DETAILED SOIL DESCRIPTION DATA BASE

MANUAL FOR DESCRIBING SOILS IN THE FIELD

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PREFACE

The Manitoba Detailed Soil Description Database is used for the recording, analysis, and output of detailed soil site observations.

The basic approach to the design and documentation of the database is modelled after the Soil Description File, developed as part of the Canadian Soil Information System (CanSIS) by the Land Resource Research Centre, Research Branch, Agriculture Canada. The CanSIS Soil Data file ("Detail" file) was initially developed, in the early 1970's, as the primary data base used for the capture, archive, and output of detailed soil site descriptions in Canada. Several modifications to the software and documentation were made over the years. LRRC support for this database was discontinued in 1985, largely due to the complexity of continued software support, and the decision to concentrate resources on the development of GIS databases.

The new Detailed Soil Description Database was developed to fulfill the continuing need for a database of detailed soil site information for Manitoba. The dBASE database and input form design was done with both ergonomic and computer considerations in mind, in particular, the desire for a similar format to the existing routine soil inspection database (Manitoba "Daily Site" file). Wherever possible, data fields values and their definitions in this manual were taken from the CanSIS Manual for Describing Soils in the Field (Working Group on Soil Survey Data, 1982, revised). The management and interogation of these databases is handled by a menu based system developed and programmed in DBase IV Version 2.0.

The new Detailed Soil Description Database ("Detail3" file) is intended to fulfill the role of the previous CanSIS Soil Data ("Detail2") file. Adaptation and use of the program to serve a similar need by other federal and provincial soil survey units in Canada is encouraged.

The preparation and design of the form and this manual was a cooperative effort by the following individuals;

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OVERVIEW

Complete descriptions of soils are essential in any soil survey. The descriptions serve as a basis for soil identification, classification, correlation, mapping, and interpretation. A complete description also documents the conditions at the site of any soil-related research (Manual for Describing Soils in the Field, 1982, revised).

The use of standardized soil data definitions, input documents, and data bases is an important aspect in the detailed study of soils. The purpose of this manual is to provide a description of the various data fields in the Manitoba Detailed Soil Site Database. This will serve the following functions;

a). As a guide to the input of field and laboratory data on manual forms by Pedologists.

b). As an explanation of the soil attributes for Pedologists and researchers who want to interpret the information in the database for various purposes.

Form Design

The new Detail soil database is defined in dBASE, a relational database management system run on personal computer systems. The detail site data is stored in four separate relational files, linked by a common header key. These files contain Field site data, Horizon data, Special Notes, and Analytical data. Previous versions of the Detail file used mainframe computer systems, and separate data cards with an 80 character column card input formats. Some of these concepts have been retained, although their main function is to enhance the organization of the database and manual, and to ensure legibility of the input forms. The data card concept is therefore conceptual, as all data is stored in the 4 relational data tables.

Data for each new detailed soil site is entered by coding a 4 page field form (Appendix III) and a 2 page lab form (Appendix IV). These are 8.5" x 11" forms, with holes punched to permit storage in standard ring binders. Each field form "booklet" consists of a single folded sheet of 11" x 16" paper. Digital version of the forms have also been developed, for direct entry of the field and lab information into personal computers.

All data is entered in a sequence of fixed format fields, on a sequence of (virtual) data cards. The first 2 positions on any card identify the card type. Positions 3 to 17 are called Header fields; these are the key fields which uniquely identify the soil site in the database. All data cards for a given site must have identical Header field information.

Certain card types (03,05,06,07,10,11,12,13) can have multiple cards per site, one for each soil layer. In these cards, positions 18 and 19 identify the soil horizon (layer) number.

The form itself is modular in its design; compact and complete. Additional soil or landscape attributes can be accommodated in the future by defining new card types and data fields.

In some cases, additional data associated, but not part of the actual detailed soil site database, may be collected. This may be specialized vegetation data, for example, or long term soil temperature or water table measurements stored in separate databases. Provision is made to identify the key fields of these data bases on the Soil Data form (Card 01), so that a link between the databases may be established in the future.

The card types currently defined for the Soil Data file are as follows;

Field Form

Card 01 - Header, Date, Location and Characterization Studies

Card 02 - Special Notes

Card 03 - Landscape features, Taxonomic Characteristics and Vegetation

Card 04 - Parent Material and Water Status

Card 05 - Soil Morphology description

Card 06 - Soil Morphology description (Continued)

Card 07 - Soil Morphology description (Continued)

Card 08 - Soil Drainage, Erosion, Soil Temperature and other parameters.

Laboratory Form

Card 10 - Analytical data

Card 11 - Analytical data

Card 12 - Analytical data

Card 13 - Analytical data

For ease of data entry, valid data entry codes for many of the commonly used data fields are provided directly on the field form. Nonetheless, the manual should be continually referred to in the field to ensure that the codes used are consistent with the definitions provided.

The manual is organized by Sections and subsections to correspond with the Card Type and Data fields numbers as used on the field form. This provides a quick, convenient reference for Pedologists recording detailed site information under field conditions.

Variable names are assigned unique variable codes. All codes which are shown in the form are described in this manual. The unique codes are shown preceding the variable name.

Terminologies used in the manual are further defined in each subsection and usually following the list of choices of variables.

Coding conventions

When completed, the Detailed Soil Description Forms may be input by the Pedologist or by data entry personnel who are unfamiliar with the original data. Care should be exercised at all times to ensure accuracy of the data; clarity and legibility in order to minimize errors in keying of data. In a computer vocabulary, **alphabetic entries are always left justified and numeric entries are right justified**, as shown in the following examples.

Left justified entry (ie: Subgroup Code)

O B L
^

Right justified entry (ie: Slope length)

- - - - 7|5
^

The starting point for data entry for fields with variable length are indicated by a small black triangle (^). The location of a decimal place in a numeric field is indicated by a broken vertical line. Do not use a period (.) to indicated the decimal place. If numeric data is given to these fields with no decimal value, zero's must be inserted at the decimal position. Keeping that in mind, below is a list of characters that must be written in a certain style or form:

a. The letter "O" must be barred (Ø). This will prevent it from being keyed as a zero.

b. The letter "I" must be clearly barred on top and bottom. It could be mistaken as the numeric "1".

c. The letter "Z" must be also be barred ("Ƶ") so that it will not be punched as the numeric "2".

d. Do not use "+" , "-" or ">", "/", "<" and special symbols in any numeric field (including depth fields).

e. When choosing a code from the DO NOT KEYPUNCH section, ensure that the code is inserted exactly as displayed in the correct field.

f. A horizontal bar "-" is used to indicate presence or absence of characteristics in the Soil Phases, Horizon Characteristics, Ice Characteristics and Sampled fields only. No other symbol can be used or permitted in these fields.

g. Print legibly and neatly using uppercase letters, and write only one character per space allotted. Use an H or HB pencil so that data entry personnel can read the data easily.

Data processing

Manitoba Soil Data File records input on manual forms should be collated by the Pedologist to verify consistency between field and lab data before computer input. They should also be checked with soil legends to ensure that the soil series and Soil Taxonomy information is correct.

Forms may then be submitted to the data base manager for final inspection and keying. The digital data is then loaded to the Manitoba Detail Soil Site Database.

Data summaries and retrievals for any detailed site data can be made as required. Consult the Appendices for examples of the various Profile Generator outputs that are currently available.

CARD TYPE 01

HEADER KEY

All Header fields must be filled in, and all data fields in the Header must be completed. Insert leading zeroes in all numeric header fields (i.e. for month, July is '07' not '7').

1a. Project code - is a unique code that identifies the name of the project and all data forms relating to that specific project. A maximum of four alphanumeric symbols are allowed, left justified.

1b. Year - This field allows entry of the year on which the data on the form was gathered in the field.

1c. Surveyor - Is a 2-letter symbol (initials) unique to each surveyor.

1d. Profile ID - Each site must have a unique number that distinguishes it from other sites in the sampling area. Profile identification numbers are to be assigned only by the data base coordinator.

1e. Series code - A three-letter character code equivalent of the Soil Name that identifies the soil at the sample site. The series code can be found as a separate column in a Soil Name File(SNF).

1f. Series variants - Variants are those properties that are believed to be sufficiently different from other known or defined properties.

Series Variants codes are:

T	Texture
C	Classification
D	Drained
P	Parent Material
R	Depth < 20cm
K	Climate
X	> 1 Variant

1g. Month/Day - Fill in the month and day in a numeric form. Leading zeroes must be inserted. ie: June 5 is coded as 06 for month and 05 for day.

1h. Military Grid Reference (Universal Transverse Mercator) - Consists of:

- Zone number, a two-digit code identifying the zone.
- An alpha letter identifying an area north or south of the equator, in 8E bands.
- Two letters that identify the 100,000m square.
- Easting reading to the nearest 100 or 10 m (left justified).
- Northing reading to the nearest 100 or 10 m (left justified).

1i. NTS Map System - This area is used to identify the map sheet on which the site being characterized is located using the National Topographic System.

- Map sheet (Primary quadrangle)
- Alphabetic division
- Numerical divisions

DLS Map System - These data fields are used to specify the location according to the Dominion Land Survey System.

- Quarter Section - Values are NE,SE,NW, and SW. If it is not possible to pinpoint the quarter section, leave blank.
- Section number - A two-digit section number from 01 to 36. This is recorded right justified. Leave this blank if the survey system does not apply.
- Township - The actual township number is recorded, right justified, leaving leading zeroes blank. If the survey system does not apply, leave blank.
- Range or Concession - A two-digit range or concession number, right justified, is recorded, depending on the survey system that is used. Leave blank if not applicable.
- Range Modifier - In some instances on a boundary between two different survey systems, a Range such as 27 A can exist. The A is recorded in column 51. Leave blank if not applicable.
- Heading - The East (E) or West (W) heading from the meridian.
- Meridian - The actual number of the meridian.
- Municipal code - Depending on existing legal survey, each municipality, county, or district must be assigned a provincially unique numerical, three-digit code. The unique three-digit code is recorded in this field.

1j. Site Elevation - The elevation of the site above mean sea level, in metres.

1k. Photo - If a photograph of the area was taken during the course of sampling, this space allows entry of the kind of photography taken, they are;

1 Landscape
2 Profile
3 Both

1l. Characterization Studies - If the site is designated as a benchmark for further investigation, indicate the type of study to be undertaken and reference site ID. The Type is a single digit numeric code as indicated below. A reference site ID is any unique connotative identification or record key assigned by the surveyor for that particular database type. For example, if the soil sampling site is also part of a long term soil temperature monitoring study, it can be assigned a Type of "1" and a Site ID of "62G16". In the Soil Temperature database, 62G16 is the key record identifier, with 62G as the NTS map sheet code, and 16 indicating the 16th soil temperature monitoring site in that map sheet.

Types

1 Soil Temperature
2 Wells
3 Soil Physical Prop.
4 Temperature & Wells
5 Vegetation
6 Salinity
7
8

CARD TYPE 02

2a. Special Notes

Five cards are provided for recording information that cannot be accommodated in any other part of the coding form. The information is entered in a free format. Up to 4 more additional cards maybe coded by inserting a page and incrementing the number by 1, starting from 6 up to 9. All notes should be printed clearly using a combination of lower and upper case, one letter per space.

On output, all information recorded in special notes is printed exactly as recorded. To achieve good output, careful and proper attention must be paid to clear and correct input.

CARD TYPE 03

3a. Land Use -- A modified CLI classification is used to record present land use. This classification was developed for purposes of mapping from aerial photographs at a scale of 1:50 000, but it can also be used for site recording. Below is a list of Land Use codes.

01 Built up areas
02 Mines, quarries
03 Outdoor recreation
04 Horticulture
05 Cropland
06 Improved pasture/forage
07 Natural grazing
08 Woodland grazing
09 Abandoned farmland
10 Productive woodland
11 Unproductive woodland
12 Swamp
13 Marsh
14 Bog
15 Fen
16 Sand
17 Rockland
18 Rough,broken, eroded
19 Rubble land
21 Arctic tundra
22 Cryoturbated land

DEFINITIONS

Built-up areas *-- All residential and commercial settlements, including parks and other urban open spaces.*

Mines, quarries, pits *-- Open excavations and land held in reserve therefore.*

Outdoor recreation *-- Land used for the outdoor recreational purposes such as: cottages, golf courses, parks, beaches, game preserves, and so forth.*

Horticulture *-- Land use for intensive cultivation of vegetables and small fruits. Includes market gardens, nurseries, flower and bulb farms, sod farms, and large-scale fur and poultry operations.*

Cropland *-- Land used or being cleared for annual field crops: grain, oilseeds, sugar beets, tobacco, potatoes, field vegetables, and associated fallow.*

Improved pasture and forage crops *-- Land used or being cleared for the production of hay and other cultivated fodder crops.*

Natural grazing *-- Area with natural vegetation of grasses, sedges, and herbaceous plants, with or without intermittent wet hay lands (sloughs or meadows). Bushes and trees may cover up to 25% of the area.*

Woodland grazing *-- Grassy, open woodland, where bushes and trees cover more than 25% of the area, and grazing is the dominant use.*

Abandoned farmland *-- Land once used for agriculture but abandoned to natural revegetation. This does not include land used for grazing or wood production.*

Productive woodland *-- Wooded land with trees presenting more than 25% crown cover and growing more than about 6 m high. Plantation and artificially reforested areas are included regardless of age.*

Unproductive woodland *-- Land with trees or bushes presenting more that 25% crown cover and growing less than about 6 m high. This includes cutover and burned over land that has not been reforested.*

Swamp *-- An area saturated with water (usually slightly acidic) throughout much of the year but with the surface of the soil usually not deeply submerged. Usually characterized by tree or shrub vegetation.*

Marsh *-- Periodically wet or continually flooded areas with the surface not deeply submerged. Usually not acidic. Covered dominantly with sedges, cattails, rushes, or other hydrophytic plants.*

Bog *-- A peat-covered or peat-filled area, generally nutrient-poor, in which mosses and especially sphagnum are dominant. The water table is at the surface for most of the year.*

Fen *-- A peat-covered or peat-filled area, generally not acidic, in which grasses, sedges, or reeds are dominant. The water table is at the surface for most of the year.*

Sand *-- Land which in its present state does not and cannot support vegetation. Includes sand bars, sand flats, dunes, beaches, and similar landforms.*

Rockland *-- Area containing frequent rock outcrops (25-90%) and shallow soils.*

Rough broken (eroded) land *-- Land with very steep topography and numerous intermittent drainage channels.*

Rubble *-- Land area with 90% or more of the surface covered with stones and boulders.*

Arctic tundra *-- Treeless area characteristic of arctic regions.*

Cryoturbated land *-- Area of arctic and subarctic soils that have been intensely disturbed by frost action.*

3b. Landform Classification

Mineral - This section is based on the landform classification system as described in The System of Soil Classification for Canada (1978). In this system Landforms are described on the basis of genetic composition and modifiers, surface expression and modifying process, and qualifying descriptors. Attempts should be made to use all categories, relating landform only to the site being described. Do not attempt to record multiple or intergrade landforms on the forms.

Mineral Landforms
101 Apron
102 Blanket
103 Fan
104 Hummocky
105 Level
106 Pitted
107 Ridged
108 Rolling
109 Terrace
110 Undulating
111 Veneer
112 Inclined
113 Steep

Organic Landform Bog
201 Palsa bog
202 Peat mound bog
203 Mound bog
204 Domed bog
205 Polygonal peat plateau
206 Lowland polygonal bog
207 Peat plateau bog
208 Northern plateau bog
209 Collapse bog
210 Floating bog
211 Shore bog
212 Basin bog
213 Flat bog
214 String bog
215 Blanket bog
216 Bowl bog
217 Sloping bog
218 Veneer bog

Fen
219 Northern ribbed fen
220 Ladder fen
221 Net fen
222 Floating fen
223 Stream fen
224 Shore fen
225 Collapse fen
226 Palsa fen
227 Spring fen
228 Sloping fen
229 Lowland polygonal fen
230 Horizontal fen
231 Channel fen
232 Stream swamp
233 Shore swamp
234 Peat margin swamp
235 Basin swamp
236 Flat swamp
237 Spring swamp

Marsh
330 Estuarine high
331 Estuarine low
332 Coastal high
333 Coastal low
334 Floodplain
335 Stream
336 Channel
337 Active delta
338 Inactive delta
339 Terminal basin
340 Shallow basin
341 Kettle
342 Seepage track
343 Shore

Shallow Water
440 Stream
441 Channel
442 Oxbow
443 Delta
444 Terminal basin
445 Shallow basin
446 Kettle
447 Shore
448 Nontidal
449 Estuarine
450 Tidal

Landform Modifier
1 Bevelled
2 Cryoturbated
3 Eroded
4 Failing
5 Kettled
6 Karst mod.
7 Soliflucted
8 Washed
9 Gullied

DEFINITIONS

Mineral Landforms

Apron *-- A relatively gentle slope at the foot of a steeper slope and formed by materials from the steeper, upper slope.*

Blanket *-- A mantle of unconsolidated materials that is thick enough to mask minor irregularities in the underlying unit but still conforms to the general underlying topography.*

Fan *-- A fan-shaped form similar to the segment of a cone and possessing a perceptible gradient from the apex to the toe.*

Hummocky *-- A very complex sequence of slopes extending from somewhat rounded depression or kettles of various sizes to irregular to conical knolls or knobs. There is a general lack of concordance between knolls and depressions. Slopes are generally 5-70% (3-35E).*

Level *-- A flat or very gently sloping, unidirectional surface with a generally constant slope not broken by marked elevations and depressions. Slopes are generally less than 2% (1E).*

Ridged *-- A long, narrow elevation of the surface, usually sharp-crested with steep sides. The ridges may be parallel, subparallel, or intersecting.*

Pitted *-- A level to gently undulating surface containing a number of pits or hollows.*

Rolling *-- A very regular sequence of moderate slopes extending from rounded, sometime confined, concave depressions to broad, rounded convexities producing a wavelike pattern of moderate relief. Slope length is often 1.6 km or greater and gradients greater that 5% (3E).*

Terraced *-- Scarp face and the horizontal; or gently inclined surface (tread) above it.*

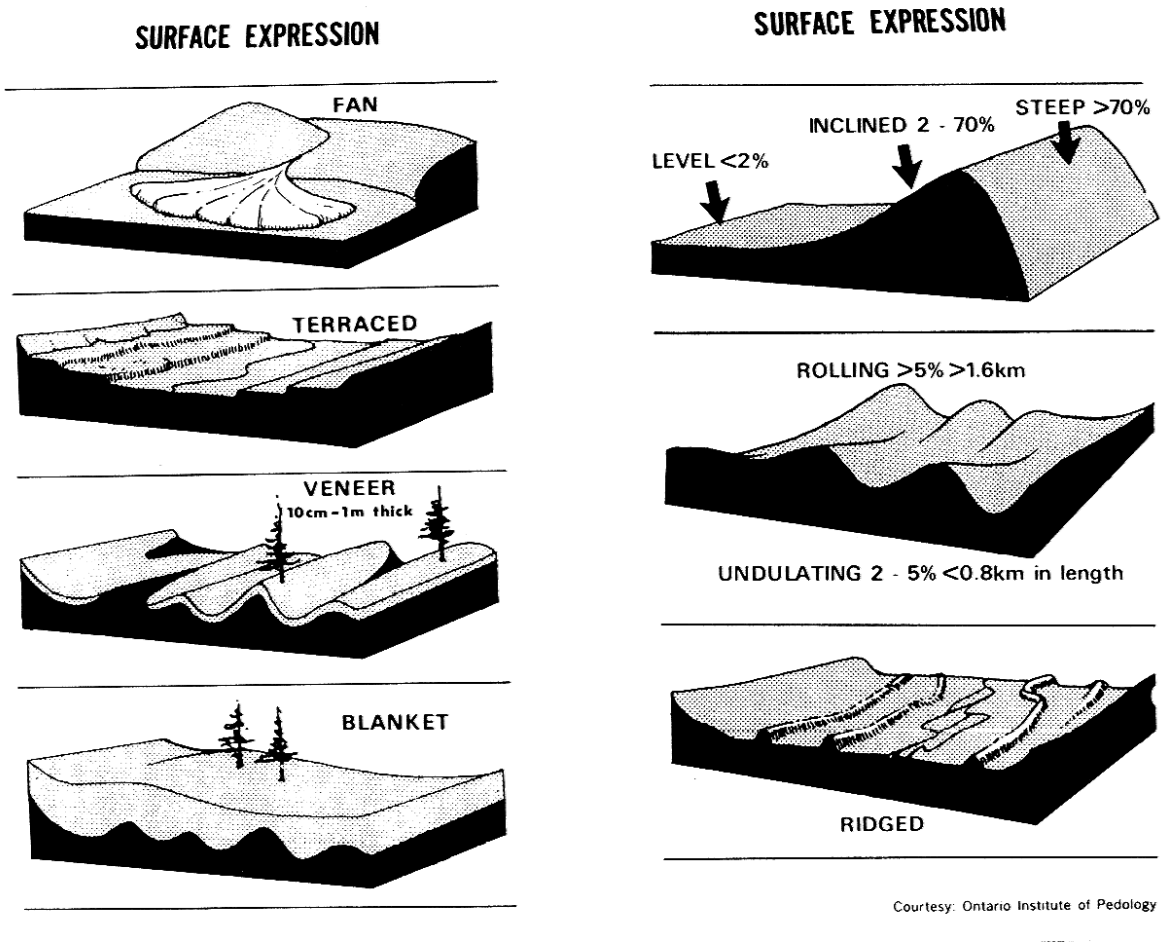
Undulating *-- A very regular sequence of gentle slopes that extend from rounded, sometimes confined concavities to broad, rounded convexities producing a wavelike pattern of low local relief. Slope length is generally less than 0.8 km and the dominant slope gradient is 2-5% (1-3E).*

Veneer *-- Unconsolidated materials too thin to mask the minor irregularities of the underlying unit surface. A veneer ranges from 10 cm to 1 m in thickness and possesses no form typical of the materials' genesis.*

Inclined *-- A sloping, unidirectional surface with a generally constant slope not broken by marked irregularities. Slopes are 2-70% (1-35E). The form of inclined slopes is not related to the initial mode of origin of the underlying material.*

Steep *-- Erosional slopes, greater that 70% (35E), on both consolidated and unconsolidated materials. The form of steep erosional slope on unconsolidated materials is not related to the initial mode of origin of the underlying material.*

Figure 1. Surface expression



Organic Landforms

Bog Wetland Class

A bog is a peatland, generally with the water table at or near the surface. The bog surface, which may be raised or level with the surrounding terrain, is virtually unaffected by the nutrient-rich groundwaters from the surrounding mineral soils and is thus generally acid and low in nutrients. The dominant materials are weakly to moderately decomposed ***Sphagnum*** *and woody peat, underlain at times by sedge peat. The soils are mainly Fibrisols, Mesisols, and Organic Cryosols (permafrost soils). Bogs may be treed or treeless, and they are usually covered with* ***Sphagnum spp.*** *and ericaceous shrubs.*

Bog Wetland Forms

All bog wetland forms are bogs as defined by the wetland classes, differing from one another in surface for, relief, or proximity to water bodies.

Palsa Bog *-- A bog composed of individual or coalesced palsas, occurring in an unfrozen peatland. Palsas are mounds of perennially frozen peat and mineral soil, up to 5 m high, with a maximum diameter of 100 m. The surface is highly uneven, often containing collapse scar bogs.*

Peat mound Bog *-- A bog with small (less than 3 m in diameter) mounds of frozen peat, rising less than 1 m above the surrounding perennially frozen fen. These bogs are found in arctic areas.*

Mound Bog *-- A bog with small (up to 3 m in diameter and 0.5-1 m in height), isolated mounds occurring in fens. Mound bogs are sometimes referred to as "fen hummocks". The rooting environment is above the fen surface and is not affected by the mineral-rich waters of the fen. Several mounds may coalesce into larger bog "islands" in fens.*

Domed Bog *-- A large (usually more that 500 m in diameter) bog with a convex surface, rising several metres above the surrounding terrain. The centre is usually draining in all directions. Small crescentic pools often form around the highest point. If the highest point is in the centre, the pools from a concentric pattern, or eccentric if the pattern is off-centre. Peat development is usually in excess of 3 m.*

Polygonal peat plateau Bog *-- A perennially frozen bog, rising about 1 m above the surrounding fen. The surface is relatively flat, scored by a polygonal pattern of trenches that developed over ice wedges. The permafrost and ice wedges developed in peat originally deposited in a non-permafrost environment.*

Lowland polygonal Bog *-- A bog with flat-topped or convex peat surfaces (often referred to as "high-centre polygons") separated by trenches over ice wedges that form a polygonal pattern when viewed from above. The peat was deposited in a permafrost environment, as shown by internal structures.*

Peat plateau Bog *-- A bog composed of perennially frozen peat, rising abruptly about 1 m from the surrounding unfrozen fen. The surface is relatively flat and even, and often covers very large areas. The peat was originally deposited in a non-permafrost environment and is often associated with collapse scar bogs or fens.*
Northern plateau Bog *-- A raised bog elevated 0.5-1 m above the surrounding fen. The surface is generally even, characterized only by small wet depressions. The plateau bog is usually teardrop-shaped, with the pointed end oriented in the down-slope direction.*

Collapse scar Bog *-- A circular or oval-shaped wet depression in a perennially frozen peatland. The collapse scar bog was once part of the perennially frozen peatland, but the permafrost thawed, causing the surface to subside. The depression is poor in nutrients, as it is not connected to the minerotrophic fens in which the palsa or peat plateau occurs.*

Floating Bog *-- A bog which occurs as a floating mat on or adjacent to ponds, and which is underlain by water or by fluid, loose peat. The surface of the floating bog is sufficiently elevated for the rooting zone to be free from contact with mineral-enriched lake water.*

Shore Bog *-- A non-floating bog forming at the shore of a pond or lake. The bog surface is elevated at least 0.5 m above the level of the lake and its rooting zone is not affected by lake water. The bog often encroaches over the lake as shown by underlying lacustrine peat sediments.*

Basin Bog *-- A bog situated in a basin that has an essentially closed drainage, receiving water from precipitation and from runoff from the immediate surroundings. The surface of the bog is flat, but the peat is generally deepest at the centre.*

Flat Bog *-- A bog having a flat, featureless surface. It occurs in broad, poorly defined depressions. The depth of peat is generally uniform.*

String Bog *-- A pattern of narrow (2-3 m wide), low (less than 1 m deep) ridges oriented at right angles to the direction of drainage. Wet depressions or pools occur between the ridges. The water and peat are very low in nutrients, as the water has been derived from other ombrotrophic wetlands. Peat thickness exceeds 1 m.*

Blanket Bog *-- A bog consisting of extensive peat deposits that occur more or less uniformly over gently sloping hills and valleys. The peat thickness seldom exceeds 2 m.*

Bowl Bog *-- A bog or fen occupying concave depressions.*

Sloping Bog *-- A bog occurring in areas of high rainfall on appreciably sloping land surfaces, fed by rainwater and by water draining from other nutrient-poor peatlands. The peat may exceed 1 m in thickness.*

Veneer Bog *-- A bog occurring in gently sloping terrain underlain by generally discontinuous permafrost. Although drainage is predominantly below the surface, overland flow occurs in poorly defined drainage-ways during peak runoff. Peat thickness is usually less than 1.5 m.*

Fen Wetland Class

A Fen is a peatland with the water table usually at or just above the surface. The waters are mainly nutrient-rich and minerotrophic from mineral soils. The dominant materials are moderately to well decomposed sedge and/or brown moss peat of variable thickness. The soils are mainly Mesisols, Humisols, and Organic Cryosols. The vegetation consists predominantly of sedges, grasses, reeds and brown mosses with some shrubs and, at times, a sparse tree layer.

Fen Wetland Forms

All fen wetland forms are fens as defined in the wetland classes, differing from one another in surface form, relief, proximity to water bodies, or basin topography.

Northern Ribbed Fen *-- A fen with parallel, low peat ridges ("strings") alternating with wet hollows or shallow pools, oriented across the major slope at right angles to water movement. The depth of peat exceeds 1 m.*

Ladder Fen *-- A fen composed of parallel, low peat ridges and shallow pools oriented at right angles to the direction of drainage. It occurs as a narrow fen strip along the edges of domed bogs. The peat is usually 1-2 m deep.*

Net Fen *-- A fen with a broad net pattern of low, interconnected peat ridges ("strings"), enclosing wet hollows or shallow pools. The wetland surface is almost completely level; greater slopes result in the formation of northern ribbed fens*

Floating Fen *-- A fen occurring adjacent to ponds or lakes, forming a floating mat, underlain by water or fluid, loose peat. The fen surface is less than 0.5 m above the level of the lake and the rooting zone is affected by lake water.*

Stream Fen *-- A fen located in the main channel or along the banks of permanent or semi-permanent streams. This fen is affected by the water of the stream at normal and flood stages.*

Shore Fen *-- A fen with an anchored surface mat that forms the shore of a pond or lake. The rooting zone is affected by the water of the lake at both normal and flood levels.*

Collapse Fen *-- (Collapse Scar Fen -- A fen with circular or oval depressions, up to 100 m in diameter, occurring in larger fens, marking the subsidence of thawed permafrost peatlands. Dead trees, remnants of the subsided vegetation of permafrost peatlands, are often evident.*

Palsa Fen *-- A fen with mounds of perennially frozen peat (sedge and brown moss peat) and mineral soil, up to 5 m high and 100 m in diameter although they can be much smaller. Palsa fens generally occur in unfrozen peatlands and are frequently associated with collapse scar fens.*

Spring Fen *-- A fen nourished by a continuous discharge of groundwater. The surface is marked by pools, drainage tracks, and occasionally, somewhat elevated "islands". The nutrient level of water is highly variable between locations.*

Sloping Fen *-- A fen occurring mainly on slowly draining, nutrient-enriched seepage slopes. Pools are usually absent, but wet seepage tracks may occur. Peat thickness seldom exceeds 2 m.*

Lowland Polygon(al) Fen *-- A fen developed on perennially frozen lowland where the intense winter cold causes the formation of polygonal cracks and ice wedges. The polygons consist of somewhat better-drained ridges which enclose very wet, low centres (hence the frequently used name "low-centre polygon"). Peat deposits are generally less than 1 m thick.*

Horizontal Fen *-- A fen with a very gently sloping featureless surface. The fen occupies broad, often ill-defined depressions, and may be interconnected with other fens. Peat accumulation is generally uniform.*

Channel Fen *-- A fen occurring in a topographically well-defined channel which at present does not contain a continuously flowing stream. The depth of peat is usually uniform.*

Swamp Wetland Class

A ***swamp*** *is a mineral wetland or a peatland with standing water or water gently flowing through pools or channels. The water table is usually at or near the surface. There is pronounced internal water movement from the margin or other mineral sources; hence the waters are rich in nutrients. If peat is present, it is mainly well-decomposed wood, underlain at times by sedge peat. The associated soils are Mesisols, Humisols, and Gleysols. The vegetation is characterized by a dense cover of deciduous or coniferous trees or shrubs, herbs, and some mosses.*

Swamp Wetland Forms

All swamp wetland forms are swamps as defined in the wetland classes, differing from one another in surface form, basin topography, or proximity to water bodies.

Stream Swamp *-- A swamp occurring along the banks of permanent or semi-permanent streams. The high water table is maintained by the level of water in the stream. The swamp is seasonally inundated, with subsequent sediment deposition.*

Shore Swamp *-- A swamp occurring along the shores of permanent ponds or lakes. The high water table is maintained by the water level in the lakes, but seasonal flooding may take place. Peat development is possible.*

Peat Margin Swamp *-- A swamp occurring in a relatively narrow (up to 25 m wide) zone between the mineral uplands and the peatland. The high water table is maintained by the peatland, but drainage from the upland adds nutrients-enriched water to the swamp. Peat deposition (less than 1 m) is common.*

Basin Swamp *-- A swamp developed in a topographically defined basin where the water is derived locally by may be augmented by drainage from other parts of the watershed. Accumulation of well-decomposed peat is hallow (less than 0.5 m) at the edge, and may reach 2 m at the centre.*

Flat Swamp *-- Flat swamp occurring in broad areas of poorly drained lowlands. The outer edges of the swamp usually merge gradually into the upland, without sharp boundaries. Peat build-up is generally thin (less than 0.5 m), but may exceed 2 m.*

Spring Swamp *-- A swamp nourished by the discharge of groundwater. The surface is characterized by low hummocks, small pools, and drainage tracks. The amounts of dissolved solids in the spring water vary regionally.*

Marsh Wetland Class

A marsh is a mineral wetland or a peatland that is periodically inundated by standing or slowly moving water. Surface water levels may fluctuate seasonally, with declining levels exposing drawdown zones of matted vegetation or mudflats. The waters are rich in nutrients, varying from fresh to highly saline. The substratum usually consists of mineral material, although occasionally it consists of well decomposed peat. The soils are predominantly Gleysols, with some Humisols and Mesisols. Marshes characteristically show zonal or mosaic surface patterns composed of pools or channels interspersed with clumps of emergent sedges, grasses, rushes, and reeds, bordering grassy meadows and peripheral bands of shrubs or trees. Submerged and floating aquatics flourish where open water areas occur.

Marsh Wetland Forms

All marsh wetland forms are marshes as defined in the wetland classes, differing from one another in source of water or basin topography.

Estuarine High Marsh *-- A marsh influenced by water of varying salinity and of tidal marine origin. It is located above mean high-water and is inundated only at highest tides and/or storm surges. It occurs in river estuaries or in connecting bays.*

Estuarine Low Marsh *-- A marsh influenced by waters of varying salinity and of tidal marine origin. It is located below mean high-water levels and is frequently inundated. It occurs in river estuaries or in connecting bays.*

Coastal High Marsh *-- A marsh influenced by brackish or saline waters of tidal marine origin. It is located above mean high-water levels and is inundated only by flood tides. It occurs on marine terraces, flats, embayments, or lagoons.*

Coastal Low Marsh *-- A marsh influenced by brackish or saline waters of tidal marine origin. It is located above mean high-water levels and is inundated only by flood tides. It occurs on marine terraces, flats, embayments, or lagoons.*

Floodplain Marsh *-- A marsh occurring on fluvial floodplains adjacent to river channels. The marsh is subject to annual flooding and sedimentation for various lengths of time, with possibly some water impounded on the marsh following flooding.*

Stream Marsh *-- A marsh occupying shorelines, bars, streambeds, or islands in continuously flowing water courses. The marsh is subject to prolonged annual flooding and is often covered by thick layers of sediments.*

Channel Marsh *-- A marsh occurring in well-defined, abandoned channels where stream flow in discontinuous or blocked. Spring freshets or groundwater inflows may flood large portions of the channel, inducing marsh development.*

Active Delta Marsh *-- A marsh occupying lowlands on deltas, usually with drainage connections to active river channels. The marsh is subject to inundation at least once during a season, followed by a slow drawdown of the water levels. A high rate of sedimentation may occur in many parts of the marsh.*

Inactive Delta Marsh *-- A marsh occupying higher portions of delta, usually some distance from active river channels. The Marsh is inundated only during very high flood stages or by wind-driven waves. Shallow water may be impounded for long periods of time.*

Terminal Basin Marsh *-- A marsh occurring in a topographically low catch basin situated at the terminal end of internal drainage systems receiving a variable water supply from surface runoff, channel wetlands, streams, or groundwater. The marsh has no overflow or drainage outlets and most water loss is due to evaporation.*

Shallow Basin Marsh *-- A marsh occurring in a uniformly shallow depression or swale, having a gradual gradient from the edge to the deepest portion. The marsh edge may be poorly defined due to rapidly receding water levels.*

Kettle Marsh *-- A marsh usually occupying well-defined elliptical catch basins located in moraines and glacio-fluvial or glacio-lacustrine landscapes. The kettles are moderately deep bowls with moderately to steeply sloping sides. The water sources are chiefly surface runoff from a local catchment area and some interbasin flow or groundwater inflow.*

Seepage Track Marsh *-- A marsh occupying spring or water discharge sites on or at the base of slopes. This marsh features saturated, quaking ground, flowage or drainage tracks, and occasional open pools where drainage is impeded.*

Shore Marsh *-- A marsh occupying the contact zone between high and low water marks bordering semi-permanent or permanent lakes. The marsh is usually found along protected shorelines, in lagoons behind barrier beaches, on islands, or in embayments. The marsh is subject to flooding by rises in lake levels, wind waves, or surface runoff.*

Shallow Water Wetland Class

Shallow water is characteristic of intermittently or permanently flooded or seasonally stable water regimes, featuring open expanses of standing or flowing water which are variously called ponds, pools, shallow lakes, oxbows, reaches, channels or impoundments. Shallow water is distinguished from deep water by mid-summer water depths of less than 2 m, and from other wetlands by summer open water zones occupying 75% or more of the wetland surface area.

Large open water areas (greater than 8 ha), located within wetland complexes, should be classified separately as shallow water units, despite the area or extent of bordering vegetation zones. Periodic flooding may increase water depths, but during droughts, low flows, drainage, or intertidal periods drawdown flats may be exposed.

Shallow water is distinguished from uplands and bordering wetland complexes by water-eroded shoreline, or by the landward margins of mudflats, floating mats, emergents, or shrubs. In the open water zone, living vegetation, if present, is confined to submerged and floating aquatic plant forms.

Shallow Water Wetland Forms

All shallow water wetland forms are shallow water wetland classes, differing from one another in basin topography or proximity to various kinds of open water.

Stream Water *-- Inland, shallow, fresh to saline flowing water which flows continuously and in confined to a main water course. Seasonal periods of flood stages may occur.*

Channel Water *-- Shallow, intermittently flowing water in abandoned, eroded glacio-fluvial spillways. Periods of flowing water occur mainly in the spring following snowmelt, and after exceptionally high precipitation.*

Oxbow Water *-- Shallow ponds or lakes in old, abandoned channels of rivers impounded behind natural levees on river floodplains. Periodic flooding by the river usually inundates the oxbow water body.*

Delta Water *-- Shallow ponds occurring on deltas that have been impounded by the shifting of river channels and the deposition of sediments.*

Terminal Basin Water *-- Shallow ponds in topographically defined basins where incoming water is supplied by drainage of the upper catchment area, as well as from the immediate surroundings. Outlet channels are lacking.*

Shallow Basin Water *-- Shallow ponds located in gently sloping depressions, receiving water from the catchment area. The basin edges are usually poorly defined. Surplus water is drained by open outlets or by seepage.*

Kettle Water *-- Predominantly shallow ponds with deep central portions, occupying basins with moderately sloping sides. The water sources are surface runoff from the local catchment area and seepage inflow. Drainage is limited to subsurface seepage, or overflow during flooding.*

Shore Water *-- Shallow water confined to the upper littoral or near-shore zone of permanent open water bodies. Shore water may occupy large portion of shallow bays or shoals, merging with deep water zones.*

Non-tidal Water *-- Brackish water bodies mainly in pools and ponds located above the mean high-tide zone. The water is less than 2 m deep.*

Estuarine Water *-- Estuarine channels or bay periodically inundated by water of varying salinity. The water is less than 2 m deep.*

Tidal Water *-- Coastal lagoons or bays influenced by tidal action and salt water of marine origin. The normal mean tide-water level is less 2 m deep.*

Landform modifiers

Bevelled *-- Surface cut or placed by running water but not underlain by fluvial materials.*

Cryoturbated *-- Surface modified by process of frost action.*

Eroded (channelled) *-- Surface crossed by a series of abandoned channels.*

Failing *-- Modification of surface by the formation of tension fractures or by large consolidated or unconsolidated masses moving slowly down slope.*

Gullied *-- The modification of surface by fluvial erosion, resulting in the development of parallel and subparallel, steep-sided, narrow ravines in both consolidated and unconsolidated materials.*

Kettled *-- Deposits or features modified by depression left by melting ice blocks.*

Karst modified *-- Modification of carbonate and other rocks by processes of solution, and of overlying unconsolidated material by collapse resulting from that solution.*

Soliflucted *-- Surface modified by the process of slow gravitational down slope movement of saturated, non frozen earth material behaving apparently as a viscous mass over a surface of frozen ground.*

Washed *-- Modification of a deposit or features by wave action in a body or standing water, resulting in lag deposits, beaches of lag materials, and wave-cut platforms.*

3c. Rockiness -- Rockiness of the pedon is recorded as classes based on the percentage of surface occupied by exposed bedrock.

Surface occupied by bedrock (%)
0 Nonrocky (< 2%)
1 Slightly rocky (2-10%)
2 Mod. rocky (10-25%)
3 Very rocky (25-50%)
4 Exceedingly (50-90%)
5 Excessively (>90%)

DEFINITIONS

Rockiness 0. *Nonrocky land -- Bedrock exposure covers less than 2% of the surface and are more than 100m apart. There maybe some interference with tillage, but to a small extent.*

Rockiness 1. *Slightly rocky land -- Sufficient bedrock exposure to interfere with tillage, but not to make intertilled crops impracticable. Depending upon how the pattern affects tillage, rock exposures are roughly 35-100m apart and cover 2-10% of the surface.*

Rockiness 2. *Moderately rocky land -- Sufficient bedrock exposure to make tillage of intertilled crops impracticable, but soil can be worked for hay crops or improved pasture if other soil characteristic are favourable. Rock exposures are roughly 10-35m apart and cover 10-25% of the surface, depending upon the pattern.*

Rockiness 3. *Very rocky land -- Sufficient rock outcrop to make use of machinery impracticable, except for light machinery where other soil characteristics are especially favourable for improve pasture. The land may have some use for wild pasture or forest, depending on other soil characteristics. Rock exposure, or patches or soil too thin over rock for use, are roughly 3.5-10m apart and cover 25-50% of the surface, depending on the pattern.*

Rockiness 4. *Exceedingly rocky land -- Sufficient rock outcrops (or very thin soil over rock) to make all use of machinery impracticable. The land may have some value for poor pasture or for forestry. Rock outcrops are 3.5m or less apart and cover 50-90% of the area.*

Rockiness 5. *Excessively rocky land -- Land on which over 90% of the surface is exposed bedrock.*

3d. Erosion - The wearing away of the land surface by detachment and transport of soil and rock materials through the action of moving water, wind or other geological processes. The presence of erosion is recorded by noting the agent and amount of erosion that has occurred. Gully erosion is a subdivision of general water erosion. If erosion is not a factor in the soil described, leave blank.

Water/Wind Erosion Classes

0 None
1 Slight
2 Moderate
3 Severe
4 Overwash
5 Overblown

DEFINITIONS

Erosion 0 *No erosion -- Complete absence of evidence of erosion by wind or water.*

Erosion 1 *Slight erosion -- The soil has a few rills or places with thin A horizons that give evidence of accelerated erosion, but not to an extent to alter greatly the thickness and character of the A Horizon. Except for soils having very thin A horizons (less that 20 cm), the surface soil consists entirely of A horizon throughout nearly all of the delineated area. Up to about 25% of the original A horizon, or original plow layer in soils with A horizons, may have been removed from most of the area. In most soils, areas with this class of erosion are not significantly different in use capabilities and management requirements from uneroded soil. In a few soils having very shallow solum over a nonconforming layer, or in a few having a shallow A horizon over a claypan or hardpan, a significant difference may exist.*

Erosion *2 Moderate erosion -- The soil has been eroded to the extent that ordinary tillage implements reach through the remaining A horizon, or well below the depth of the original plow layer in soils usually with a thin A horizon. Generally, the plow layer consists of a mixture of the original A horizons and underlying horizons. Mapped areas of eroded soil usually have patches in which the plow layer consists wholly of underlying horizons. Shallow gullies may be present. Approximately 25-75% of the original A horizon or surface soil may have been lost from most of the area.*

Erosion 3 *Severe erosion -- The soil has been eroded to the extent that all or practically all of the original surface soil, or A horizon, has been removed. The plow layer consists essentially of materials from the B or other underlying horizons. Patches in which the plow layer is a mixture of the original A horizon and the B horizon or other underlying horizons may be included within mapped areas. Shallow gullies, or a few deep ones are common on some soil types. More that 75% of the original surface soil, or A horizon, and commonly part or all of the B horizon or other underlying horizons, have been lost from most of the area.*

Erosion 4 *Overwash -- (Check if definition apply- page 128,CSSC) Deposits from water erosion lie thick enough on the soil to influence management requirements significantly, but are not deep enough to destroy the essential characteristics of the soil series.*

Erosion 5 *Overblown -- (Check if definition apply - page 128,CSSC). The deposit of wind-removed materials, on the soil is great enough to influence management, but is not great enough to destroy the essential characteristics of the soil series.*

3e. Slope -- The percent slope gradient of the land is recorded and measured at the site using a Clinometer or Abney level, accurate to one decimal place if applicable. Refer to Table 1 for the percent classes and approximate degrees.

Slope Type -- indicate if simple (regular surface) or complex (irregular surface) slope prevails on the pedon.

S Simple slope
C Complex slope

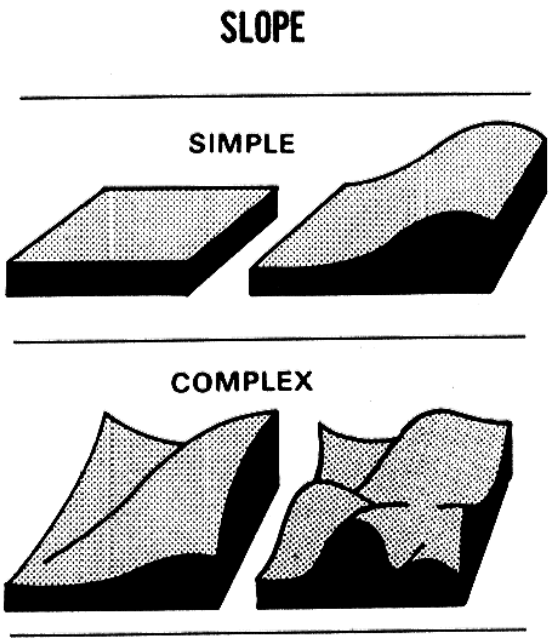
Slope Class -- an alphabetical class representing a certain range in percent slope. Values are A to J.

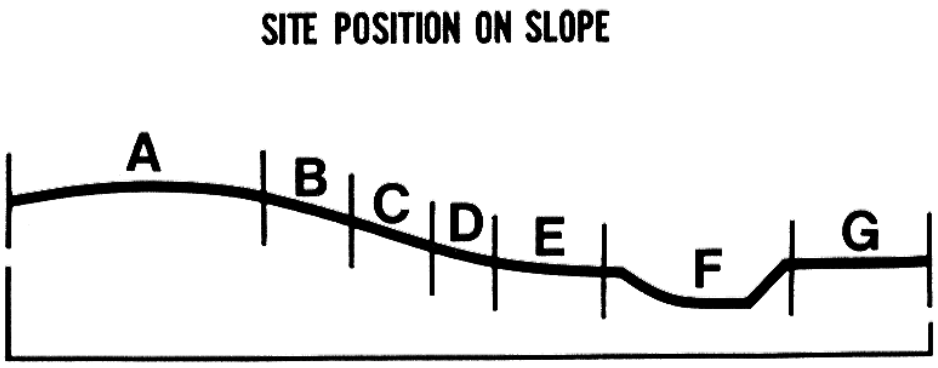
Slope percent -- indicate actual measurement of the percent slope up to one digit decimal position.

Table 1. Percent slope classes and approximate degrees

Class	Approximate		
	Slope (%)	**Degrees**	**Terminology**
A	0-0.5 %	0	Level
B	0.5-2 %	0.3-1.1	Nearly level
C	2-5 %	1.1-3	Very gentle slopes
D	5-9 %	3-5	Gentle slopes
E	9-15 %	5-8.5	Moderate slopes
F	15-30 %	8.5-16.5	Strong slopes
G	30-45 %	16.5-24	Very strong slopes
H	45-70 %	24-35	Extreme slopes
I	70-100 %	35-45	Steep slopes
J	> 100 %	> 45	Very steep slopes

Figure 2. Guide to slope type and site position





A. CREST - the generally convex upper most portion of a hill (meso scale) - it is usually convex in all directions, no distinct aspect.

B. UPPER SLOPE - the generally convex upper portion of the slope of a hill (meso scale) immediately below the crest - it has a convex surface profile with a specific aspect

C MIDDLE SLOPE - the area of the slope of a hill between the upper slope and the lower slope, where the slope profile is not generally concave or convex - it has a straight or somewhat sigmoid surface profile with a specific aspect

D LOWER SLOPE - the area toward the base of the slope of the hill, it generally has a concave surface profile with a specific aspect.

E. TOE - the lower part of the slope. Area defined by extent of homogenous site of slight slope and/or sometimes clearly demarcated by an abrupt levelling of the slope Often characterized by seepage

F DEPRESSION - at the foot of a meso scale mound or in generally level area, any area that is concave in all directions

G LEVEL - any level meso scale area not immediately adjacent to a meso scale mound Surface profile generally horizontal No aspect

Courtesy: Ontario Institute of Pedology

Site Position on slope

C Crest
U Upper
M Middle
L Lower
T Toe
D Depression

Aspect - Aspect of a pedon is measured subjectively, using one of the following classes:

N North
NE Northeast
E East
SE Southeast
S South
SW Southwest
W West
NW Northwest
L Level

DEFINITIONS

Position

Crest *- the generally convex upper most portion of a hill (meso scale). It is usually convex in all directions, no distinct aspect.*

Upper slope *- The generally convex upper portion of the slope of a hill (meso scale) immediately below the crest - it has a convex surface profile with a specific aspect.*

Middle slope *- The area of the slope of a hill between the upper slope and the lower slope, where the slope profile is not generally concave or convex - it has a straight or somewhat signoid surface profile with specific aspect.*

Lower slope *- The area toward the base of the slope of the hill. It generally has a concave surface profile with a specific aspect.*

Toe *- The lower part of the slope. Area defined by extent of homogenous site of slight slope and/or sometimes clearly demarcated by an abrupt levelling of the slope.*

Depression *- At the foot of a meso scale mound or in generally level area, any area that is concave in all directions.*

Level *- Any level meso scale area not immediately adjacent to a meso scale mound. Surface profile generally horizontal. No aspect.*

3f. Microrelief - Small scale, local difference in relief including mounds, swales and hallows.

1 Plane
2 Convex
3 Concave
4 Microridge
5 Hummocky
6 Undulating
7 Other

3g. Stoniness (% of surface covered) - Rock fragments on the surface of a soil or those protruding above ground have important effects on soil use and management. The limitations they impose are related to their number, size and spacing at the surface.

The class limits that follow are defined in terms of the approximate amount of stones (25 to 60 cm in diameter or if flat 38 to 60 cm long) and of boulders (more than 60 cm in diameter or if flat more than 60 cm long); and of their spacing.

Table 2. Stoniness classes

Classes of stoniness and boulderiness in relation to surface coverage and spacing between fragments					
Class	Name	Percent of surface covered	Distance (meters) between stones or surface covered boulders if their diameter is…		
			25 cm	60 cm	120 cm
Stones 0	Nonstony	<0.01	>25	>60	>120
Stones 1	Slightly stony	0.01-0.1	8-25	20-60	37-120
Stones 2	Moderately stony	0.1-3	1-8	3-20	6-37
Stones 3	Very stony	3-15	0.5-1	1-3	2-6
Stones 4	Exceedingly stony	15-50	0.1-0.5	0.2-1	0.5-2
Stones 5	Excessively stony	>50	<0.1	<0.2	<0.5

DEFINITIONS

Stones 0 Nonstony *- Land having less than 0.01% of surface occupied by stones.*

Stones 1 Slightly stony *- Land having 0.01-0.1% of surface occupied by stones. Stones 15-30 cm in diameter, 10-30 m apart. The stones offer only slight to no hindrance to cultivation.*

Stones 2 Moderately stony *- Land having 0.1-3% of surface occupied by stones. Stones 15-30 cm in diameter, 2-10 m apart. Stones cause some interference with cultivation.*

Stones 3 Very stony *- Land having 3-15% of surface occupied by stones. Stones 15-30 cm in diameter, 1-2 m apart. There are sufficient stones to constitute a serious handicap to cultivation.*

Stones 4 Exceedingly stony *- Land having 15-50% of surface occupied by stones. Stones 15-30 cm in diameter, 0.7-1.5 m apart. There are sufficient stones to prevent cultivation until considerable clearing has been done.*

Stones 5 Excessively stony *- Land having more than 50% of surface occupied by stones. Stones 15-30 cm in diameter, less than 0.7 apart. The land is too stony to permit cultivation.*

3h. Cobbliness - Rock fragments 8-25 cm in diameter. Determine the cobbliness classes by the percentage of surface cover.

Classes (% of surface covered)
0 Noncobbly (<0.01)
1 Slightly cobbly (0.01-0.1%)
2 Moderately cobbly (0.1-3%)
3 Very cobbly (3-15%)
4 Exceedingly cobbly (15-50%)
5 Excessively cobbly (>50%)

DEFINITIONS

Cobbliness 0 Noncobbly *- Land having less than 0.01% of surface occupied by cobbles.*

Cobbliness 1 Slightly cobbly *- Land having 0.01-0.1% of surface occupied by cobbles.*

Cobbliness 2 Moderately cobbly *- Land having 0.1-3% of surface occupied by cobbles.*

Cobbliness 3 Very cobbly *- Land having 3-15% of surface occupied by cobbles.*

Cobbliness 4 Exceedingly cobbly *- Land having 15-50% of surface occupied by cobbles.*

Cobbliness 5 Excessively cobbly *- Land having more than 50% of surface occupied by cobbles.*

3i. Salinity - The presence of soluble salts in the soil and parent material is an important characteristic for evaluations of biological and nonbiological use. Salts may occur as crystals or veins, or as surface crusts of salt crystals. Inhibited crop growth and the presence of salt-tolerant plants are indications of salts in the soil.

Salinity is evaluated on the basis of the following classes*:

1 Nonsaline (0-2mS/cm)
2 Slightly Saline (2-4mS/cm)
3 Weakly saline (4-8mS/cm)
4 Moderately saline (8-15mS/cm)
5 Strongly saline(>15mS/cm)

DEFINITIONS

Salinity 1 Nonsaline *- Salinity effects mostly neglible. Conductivity is 0-2mS/cm.*

Salinity 2 Slightly saline *- Yields of very sensitive crops may be restricted. Conductivity is 2-4 mS/cm.*

Salinity 3 Weakly saline *- Soils are weakly affected by salt. The growth of sensitive crops is inhibited, but that of salt-tolerant crops may not be. The salt content is 0.15-0.35% and the conductivity 4-8 mS/cm.*

Salinity 4 Moderately saline *- Soils are moderately affected by salt. Crop growth is inhibited and no crop does well. The salt content is 0.35-0.65% and the conductivity is 8-15 mS/cm.*

Salinity 5 Strongly saline *- Soils are strongly affected by salt. Only salt tolerant plants survive. The salt content is greater than 0.65% and the conductivity is greater than 15mS/cm. * Adopted from the Guidelines and Criteria for describing, classifying and mapping Saline Soils - ECSS Working Group on Soil Salinity, Revised January 1985.*

3j. Soil taxonomy -- Classification of soil at the site being described is recorded using The System of Soil Classification of Canada (CSSC, 1987, Second Edition). Soil order and subgroup codes are included below. A complete list of subgroups and description is in the Canadian System of Soil Classification, Second edition, 1987, Agriculture Canada.

Order B = BRUNISOLIC

Subgroups	
OEB	GLSB
EEB	ODYB
GLEB	EDYB
GLEEB	DUDYB
OSB	GLDYB
ESB	GLEDYB

Order C = CHERNOZEMIC

Subgroups	
OBL	GLSZBL
RBL	ODG
CABL	RDG
EBL	CADG
SZBL	SZDG
GLBL	GLDG
GLRBL	GLRDG
GLCABL	GLCADG
GLEBL	GLSZDG

Order G = GLEYSOLIC

Subgroups	
OHG	FEG
RHG	OLG
FEHG	HULG
OG	FELG
RG	

Order L = LUVISOLIC

Subgroups	
OGL	GLGL
DGL	GLDGL
BRGL	GLBRGL
SZGL	GLSZGL

Order O = ORGANIC

Subgroups	
TYF	THUM
MEF	LMM
HUF	CUM
TF	HUM
TMEF	TYH
THUF	FIH
LMF	MEH
CUF	TH
TYM	TFIH
FIM	TMEH
HUM	LMH
TM	CUH
TFIM	TYFO

Order R = REGOSOLIC

Subgroups	
OR	OHR
CUR	CUHR
GLR	GLHR
GLCUR	GLCUHR

Order S = SOLONETZIC

Subgroups	
BLSZ	GLGSS
GLBLSZ	GSS
GLBLSS	GSO
GLDGSS	

Order Z = CRYOSOLIC

Subgroups	
OTC	FIOC
BRTC	MEOC
RTC	HUOC
GLTC	TFIOC
OSC	TMEOC
BRSC	THUOC
RSC	GCOC
GLSC	

3k. Soil phases -- A soil phase is used to characterize soil and landscape properties that are not used as a criteria in soil taxonomy. Phases for both mineral and organic soils are recorded according to criteria described in the System for Soil Classification for Canada (1978). Phase categories are outlined below, but definitions are found in other similar sections of this manual.

Grumic
Turbic
Saline
Carbonated
Cryic
Lithic
Peaty
Drained

The absence or presence of the above phase are indicated by blank for absence or '-' for presence.

' ' Absent
'-' Present

3l. Vegetation - Data on vegetation are recorded as fixed field entries using codes where required.

General vegetation - The general vegetation of the area from which the profile is obtained is identified here. Enter the appropriate two-digit numerical code and its modifier.

General vegetation	**Vegetation modifier**
01 Crops-fields(managed)	01 Cropped
02 Crops-hort (managed)	02 Summerfallow
03 Grasses and forbes	03 Clear-cut
04 Grasses,forbes & shrubs	04 Select-cut
05 Tall shrubs	05 Burnt
06 Low shrubs	06 Plantation
07 Forest, unspec.	07 Regenerating
08 Forest, softwood	08 Mature
09 Forest, hardwood	09 Overmature
10 Forest, mixed	10 Undisturbed
11 None,(or nearly barren)	11 Inundated
12 Heath	12 Overgrazed
13 Arctic willow	13 Immature
14 Krummholz	
15 Rush	
16 Sedge	
17 Moss	
18 Lichen	
19 Floating aquatic	
20 Submerged aquatic	

CARD TYPE 04

Parent materials

The unaltered or essentially unaltered mineral or organic material from which the soil profile develops by pedogenic processes.

Report the predominant weathering process as an evaluation of the kind and degree of weathering undergone by the material since the inception of soil formation at the site.

Parent material I - Codes are found below.

Parent material II - Codes used here are identical to the ones in Parent Material I.

Parent material III - Codes used here are identical to the ones in Parent Material I.

4a. Physical component

UD Undifferentiated
FR Fragmental (stones,cobbles, and gravel)
SK Skeletal (more that 35% of particles larger than 2mm.
CL Coarse, loamy and silty (<than 18% clay)
FL Fine, loamy and silty (18-35% clay)
CY Clayey (more than 35% clay)
SM Stratified (mineral)
SU Stratified (mineral and organic)
SY Sandy
OG Organic
LY Loamy
SO Stratified (organic)
WY Woody
FI Fibric
ME Mesic
HU Humic
RK Bedrock

4b. Chemical composition

UD Undifferentiated
EA Extremely to Strongly Acidic (pH less than 5.5)
AN Medium acidic to neutral (pH 5.5-7.4)
WC Weakly calcareous (1-6% $CaCO_3$)
VC Moderate to very calcareous (6-40% $CaCO_3$)
EC Extremely calcareous (more than 40% $CaCO_3$)
SA Saline

4c. Mode of deposition

F Fluvial
C Colluvial
E Eolian
FL Fluviolacustrine
GF Glaciofluvial
GL Glaciolacustrine
L Lacustrine

LT Lacustro till
M Marine
T Morainal till
O Organic
B Bog
FN Fen
SW Swamp
R Residual

4d. Material modifier

UD Undifferentiated
MX Mixed
IG Igneous
SH Shale
SS Sandstone
MC Marl and Chalk
LS Limestone
DM Dolomite
MM Metamorphic
OU Organic, undiff.
SP Sphagnum peat
FO Forest peat
FN Fen peat
AQ Aquatic peat

DEFINITIONS

Physical component

Undifferentiated (UD) *- A layered sequence of more than three types of genetic material outcropping on a steep erosional escarpment.*

Fragmental (FR) *- Stones, cobbles, and gravel, with too little fine earth to fill interstices larger than 1 mm.*

Skeletal (SK) *- Particles coarser than 2 mm occupy 35% or more by volume with enough fine earth to fill interstices larger than 1 mm; the fraction finer than 2 mm is that defined for the sandy particle-size-class.*

Coarse loamy (CL) *- A loamy particle size that has 15% or more by weight of fine sand (0.25-0.1) mm) or coarser particles, including fragments up to 7.5 cm, and has less than 18% clay in the fine earth fraction.*

Fine loamy (FL) *- A loamy particle size that has 15% or more by weight of fine sand (0.25-0.1 mm) or coarser particles, including fragments up to 7.5 cm, and has 18-35% clay in the fine earth fraction.*

Clayey (CY) *- The fine earth contains 35% or more clay by weight and particles 2mm-25cm occupy less than 35% by volume.*

Stratified (Mineral) (SM) *-*

Stratified (Mineral and Organic) *-*

Sandy (SY) *- The texture of the fine earth includes sands and loamy sands, exclusively of loamy very fine sand and very fine sand textures; particles 2 mm-25 cm occupy less than 35% by volume.*

Organic (OG) *-*

Loamy (LY) *- The texture of the fine earth includes loamy very sand, very fine sand, and finer textures with less than 35% clay; particles 2 mm-25 cm occupy less than 35% by volume.*

Stratified (organic) *-*

Fibre classes for organic materials

The amount of fibre and its durability are important characterizing features of organic deposits in that they reflect on the degree of decomposition of the material. The prevalence of woody materials in peats is also of prime importance.

Fibric *-- The least decomposed of all organic materials; there is a large amount of well preserved fibre that is readily identifiable as to botanical origin. Fibres retain their character upon rubbing.*

Mesic *--- Organic material in an intermediate stage of decomposition; intermediate amounts of fibre are present that can be identified as to their botanical origin.*

Humic *--- Highly decomposed organic material; small amounts of fibre are present that can be identified as to their botanical origin. Fibres can be easily destroyed by rubbing.*

Woody *--- Organic material containing more than 50% of woody fibres.*

Bedrock (RK)

Chemical composition

Undifferentiated (UD)	*Undetermined*
Extremely to Strongly Acidic (EA)	*pH less than 5.0*
Medium acidic to neutral (AN)	*pH 7.6-7.3*
Weakly calcareous (WC)	*1-6% $CaCO_3$*
Moderate to very calcareous (VC)	*6-40% $CaCO_3$*
Extremely calcareous (EC)	*more than 40% $CaCO_3$*
Saline (SA)	

Mode of deposition

Fluvial *- Sediment generally consisting of gravel and sand with a minor fraction of silt and clay. The gravels are typically rounded and contain interstitial sand. Fluvial sediments are commonly moderately to well sorted and display stratification, but massive, nonsorted fluvial gravels do occur. These materials have been transported and deposited by streams and rivers. Finer textured fluvial deposits of modern rivers are termed alluvium.*

Colluvial *- Massive to moderately well stratified, nonsorted to poorly sorted sediments with any range of particle sizes from clay to boulders and blocks that have reached their present position by direct, gravity-induced movement. They are restricted to products of mass-wasting whereby the debris is not carried by wind, water, or ice (excepting snow avalanches).*

Eolian *- Sediment, generally consisting of medium to fine sand and coarse silt particle sizes, that is well sorted, poorly compacted, and may show internal structures such as cross bedding or ripple laminae, or may be massive. Individual grains may be rounded and show signs of frosting. These materials have been transported and deposited by wind action.*

Fluviolacustrine *-*

Glaciofluvial *- Fluvial materials showing clear evidence of having been deposited either directly in front of or in contact with glacier ice.*

Glaciolacustrine *- Lacustrine materials deposited in contact with glacial ice.*

Lacustrine *- Sediment generally consisting of either stratified fine sand, silt, and clay deposited on the lake bed; or moderately well sorted and stratified sand and coarser materials that are beach and other nearshore sediments transported and deposited by wave action. These are materials that either have settled from suspension in bodies of standing fresh water or have accumulated at their margins through wave action.*

Lacustro till *-*

Marine *- Unconsolidated deposits of clay, silt, sand, or gravel that are well to moderately well sorted and well stratified to moderately stratified (in some places containing shells). They have settled from suspension in salt or brackish water bodies or have accumulated at their margins through shoreline processes such as wave action and longshore drift.*

Morainal *- Sediment generally consisting of well compacted material that is nonstratified and contains a heterogeneous mixture of particle sizes, often in a mixture of sand, silt, and clay that has been transported beneath, beside, on, within and in front of a glacier and not modified by any intermediate agent.*

Organic *-*

Organic component *- The organic component consists of peat deposits containing >30% organic matter by weight that may be as thin as 10 cm if they overlie bedrock but are otherwise greater than 40 cm and generally greater than 60 cm thick.*

The classes and their definitions follow.

B Bog
N Fen
S Swamp

Bog *- A bog is a peat-covered or peat-filled area, generally with a high water table. Since the surface of the peatland is slightly elevated, bogs are either unaffected or partly affected by nutrient-rich groundwaters from the surrounding mineral soils. The groundwater is generally acidic and low in nutrients (ombotrophic). The dominant peat materials are sphagnum and forest peat, underlain, at times, by fen peat.*

Fen *- A fen is a peat-covered or peat-filled area with a high water table, which is usually at the surface. The dominant materials are shallow to deep, well to moderately decomposed fen peat. The waters are mainly rich in nutrients (minerotrophic) and are derived from mineral soils. The peat materials are therefore higher in both nutrients and pH than the peats associated with bogs.*

Swamp *- A swamp is a peat-covered or peat-filled area. The peat surface is level or slightly concave in cross section. The water table is frequently at or above the peat surface. There is strong water movement from margins or other mineral sources. The microrelief is hummocky, with many pools present. The waters are neutral or slightly acid. The dominant peat materials are shallow to deep mesic to humic forest and fen peat.*

Residual *-*

MATERIAL MODIFIERS

Material modifiers are used to qualify unconsolidated mineral and organic deposits. Particle-size classes serve to indicate the size, roundness, and sorting of unconsolidated mineral deposits. Fibre classes indicate the degree of decomposition and fibre size of organic materials.

4e. Water status

1 Origin of water
2 Associated water body
3 Both associated water body and origin

4f. Climate station - Climatic information is that which can be obtained at a specific soil sampling site, as well as that necessary to refer to climatic data banks stored by other agencies. Record the name of the Climate station, left justified.

4g. Relevance of climate station

1 Very good
2 Good
3 Moderate
4 Poor

DEFINITIONS

Very good *-- Site of the weather station is identical to the soil site; macro, intermediate, and micro level of climatic interpretation as can be made.*

Good *-- Site of weather station is not identical to the soil site, but sufficiently similar to allow for macro and intermediate levels of climatic interpretation.*

Moderate *-- Site of the weather station is not identical to the soil site, but sufficiently similar to allow for macro climatic interpretations.*

Poor *-- Site of the weather station resembles the soil site so little that any climatic interpretations would be suspect. However, there is not a better station.*

CARD TYPE 05

5a. Horizon number - Pre-numbered horizon allowing entry up to a maximum of 12 layers of horizons.

5b. Layer/Horizon designation - Designations for all organic layers and mineral soil horizons are noted in the allotted spaces. The uppermost layer or horizon is noted in row 0501; all subsequent layers or horizons are entered in order, proceeding downward through the profile. A maximum of 12 layers or horizons can be accommodated. Definitions for layers or horizons are found in Appendix I..

Lithological discontinuity - Roman numerals indicating discontinuities are converted to arabic numerals.

For example; II is 2
III is 3

Master layer/Horizon - A code of up to three characters (left justified) is used for the identification of master layers and horizons. They include A, B, C, L, F, G, H, O, AB, BC and others.

Suffixes - Standard CSSC suffixes of layers and horizons are recorded in lowercase, left justified. Up to five suffixes can be noted.

Modifier(numerical suffix modifier) - Numerical suffix modifiers are used to identify vertical subdivisions, 1, 2, and so on, such as 1 in IIBtgj1, are recorded as follows:

|2|B|T |g|j| | |

5c. Depths - The top of the mineral soil is considered as zero depth both for organic litter (less than 40 cm thick) and for mineral soils; zero depth for Organic soils (more than 40 cm thick) is the top of the organic material. Organic layers (except those that are buried) are listed in descending order of depth; mineral horizons and layers in organic soils are listed in ascending order of depth.

Average horizon depths

Upper limit (cm)
Lower limit (cm)

5d. Range - Absolute thickness range.

Maximum (cm)
Minimum (cm)

Example: A soil horizon may have a modal depths of 0-10 cm with a thickness range of 2-10 cm.

5e. Horizon Boundaries - The lower boundary of each horizon is described by indicating its distinctness and form. The distinctness depends on the abruptness of vertical change (thickness). The form refers to the variation of the boundary plane.

Distinctness

A	Abrupt	- less than 2 cm
C	Clear	- 2 to 5 cm
G	Gradual	- 5 to 15 cm
D	Diffuse	- more than 15 cm

Form

S	Smooth	- horizon surface is nearly plain
W	Wavy	- horizon surface has pockets are wider than deep
I	Irregular	- pockets are deeper than wide, broken parts of the horizon are unconnected

5f. Texture Modifier - Indicate presence of the following modifiers by entering the codes from the following choices. Leave blank to indicate the absence of texture modifiers. Modifiers are used only if the particle size distribution (textural class) is noticeably bimodal or unusually enriched with extraneous material.

Texture modifiers

GR	Gravelly
VG	Very Gravelly
MU	Mucky
GY	Gritty
AY	Ashy
WY	Woody
TX	Thixotropic

DEFINITIONS

Gravelly *- Presence of rock fragments (size of 2-7.5 cm) 20-50% gravel.*

Very gravelly *- > 50% gravel*

Mucky *- 9-17% organic matter*

Gritty *-*

Ashy *- At least 60% of the whole soil by weight consists of volcanic ash and cinders; less than 35% by volume has a diameter of 2mm and larger.*

Woody *-*

Thixotropic *- Less than 35 % by volume has a diameter of 2 mm or larger; the fine earth is thixotropic and the exchange complex is dominated by amorphous materials.*

5g. Texture - Soil texture class is estimated on the basis of size and the distribution of primary particles (2 mm or less) as determined by sieve or sedimentation analysis. Figure 1 is the textural triangle showing the proportion of % clay and the % sand fractions with corresponding texture class. Figure 2 shows three method of assessing textural class by conducting series of tests. However, where the field determinations differ from that of the laboratory test, the entries on the field form must be changed to reflect the result of the laboratory analysis.

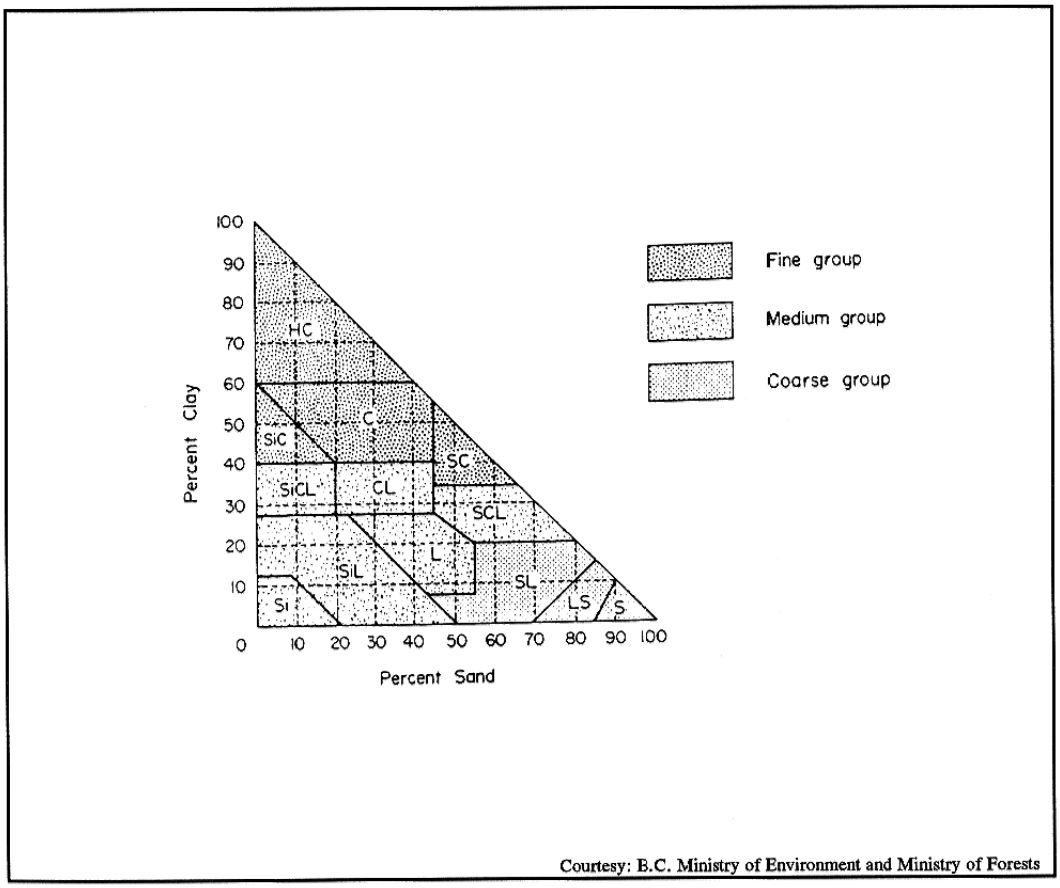
Texture classes

VCS	- Very coarse sand	L	- Loam
CS	- Coarse sand	SIL	- Silt loam
LCS	- Loamy coarse sand	SCL	- Sandy clay loam
S	- Sand	SICL	- Silty clay loam
FS	- Fine sand	CL	- Clay loam
LS	- Loamy sand	SC	- Sandy clay
LFS	- Loamy fine sand	SIC	- Silty clay
VFS	- Very fine sand	C	- Clay
LVFS	- Loamy very fine sand	HC	- Heavy clay
CSL	- Coarse Sandy Loam	O	- Organic
SL	- Sandy loam	F	- Fibric
FSL	- Fine sandy loam	M	- Mesic
VFSL	- Very fine sandy loam	H	- Humic
SI	- Silt		

Organic texture

F1 Non decomposed
F2 Very Slightly decomposed
F3 Slightly decomposed
M1 Moderately decomposed
M2 Moderately-strongly decomposed
H1 Strongly decomposed
H2 Very strongly decomposed

Figure 3. Soil textural triangle



Courtesy: B.C. Ministry of Environment and Ministry of Forests

Table 3. Field test characteristics of soil texture classes

Texture Class	Feel Test	Moist Cast Test	Ribbon Test	Taste Test	Shine Test
SAND	grainy with little floury material	no cast	none	unnecessary	unnecessary
LOAMY SAND	grainy with slight amount of floury material	very weak cast, no handling	none	unnecessary	unnecessary
SILTY SAND	grainy with moderate amount of floury material	weak cast, no handling	none	unnecessary	unnecessary
SANDY LOAM	grainy with considerable amount of floury material	weak cast, allows careful handling	none	unnecessary	unnecessary
LOAM	fairly soft and smooth with evident graininess	good cast, readily handled	barely begins to ribbon	unnecessary	unnecessary
SILT LOAM	floury with slight graininess	weak cast, allows careful handling	flakes, rather than ribbons	silt grittiness, some sand graininess	unnecessary
SILT	very floury	weak cast, allows careful handling	flakes, rather than ribbons	silt grittiness	unnecessary
SANDY CLAY LOAM	very substantial graininess	moderate cast	short and thick (<3cm)	sand graininess clearly evident	slight shiny
CLAY LOAM	moderate graininess	strong cast	fairly thin breaks readily, barely supports own weight	sand graininess clearly evident	slight shiny
SILTY CLAY LOAM	smooth and floury	strong cast	fairly thin breaks readily, barely supports own weight	silt grittiness	slight shiny
SAND CLAY	substantial graininess	strong cast	thin, fairly long (5-7.5cm) holds own weight	sand graininess clearly evident	moderately shiny
SILTY CLAY	smooth	very strong cast	thin, fairly long (5-7.5 cm) holds own weight	silt grittiness	moderately shine
CLAY	smooth	very strong cast	very thin, long (7.5cm)	smooth	very shiny

Soil texture field test

Feel tests **Graininess test** - Soils is rubbed between thumb and fingers to assess the % sand. Sand feels grainy.

Dry feel test - Soils with > 50% sand. Soil is rubbed in the palm of the hand to dry it and to separate and estimate the size of the individual sand particles. The sand particles are then allowed to fall out of the hand and the amount of the finer material (silt and clay) remaining is noted.

Stickiness test - Soil is wetted and compressed between the thumb and forefinger. Degree of stickiness is determined by noting how strongly it adheres to the thumb and forefinger upon release of pressure and how much it stretches.

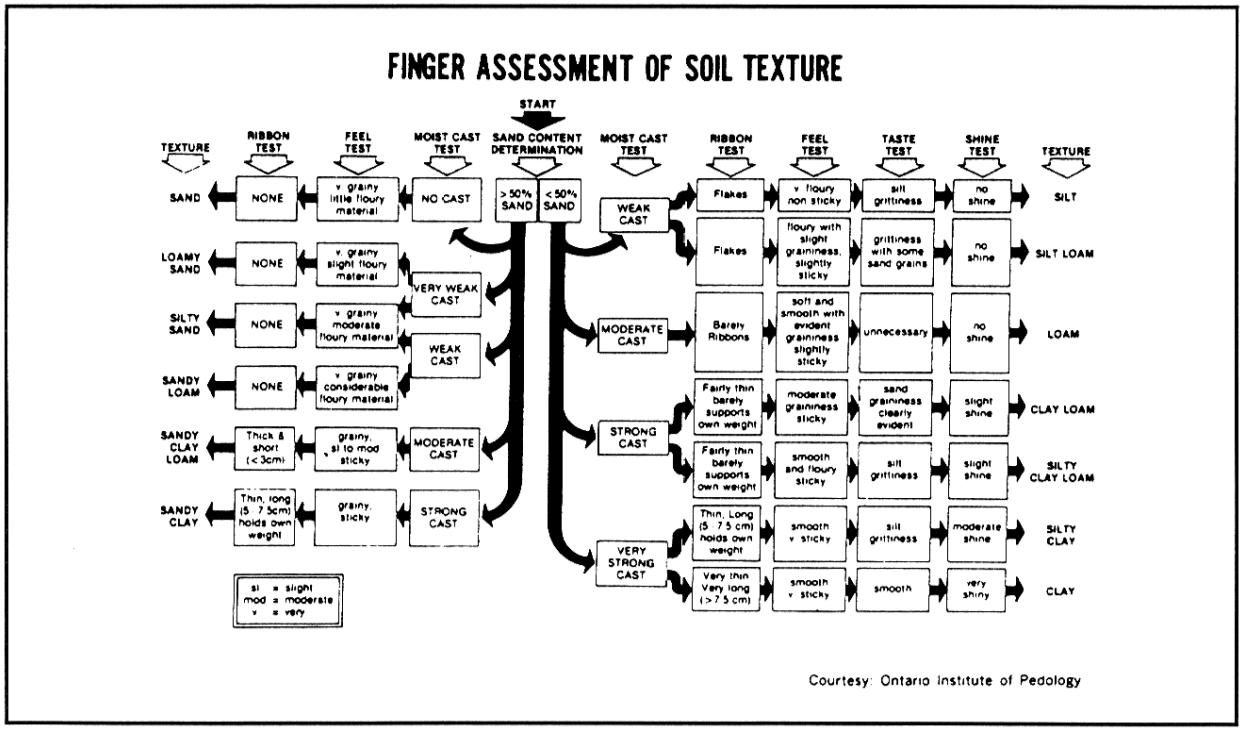
Moist cast test Compress some moist soil by clenching it in your hand. If the soil holds together (i.e forms a cast), then test the strength of the cast by tossing it from hand to hand. The more durable it is, the more clay is present.

Ribbon test Moist soil is rolled into a cigarette shape and then squeezed out between the thumb and forefinger to form the longest and thinnest ribbon possible.

Taste test A small amount of soil is worked between the front teeth. Sand is distinguished as individual grains which grit sharply against the teeth. Silt particles are identified as a general fine grittiness, but individual grains cannot be identified. Clay particles have no grittiness.

Shine test A small amount of moderately dry soil is rolled into ball and rubbed once or twice across a hard, smooth object such as a knife blade or thumb nail. A shine on the ball indicates clay in the soil.

Figure 4. Finger assessment of soil texture



DEFINITIONS

Primary Particles *(See also coarse fragments, section 5o).*

Name of separate	*Diameter (mm)*
Very coarse sand	*2.0-1.0*
Coarse sand	*1.0-0.5*
Medium sand	*0.5-0.25*
Fine sand	*0.25-0.10*
Very fine sand	*0.10-0.05*
Silt	*0.05-0.002*
Clay	*<0.002*
Fine clay	*<0.0002*

Textural Classes

Sands

Sand is a soil material that contains 85% or more sand; the percentage of silt, plus 1.5 times the percentage of clay, does not exceed 15.

Coarse sand *- 25% or more very coarse and coarse sand, and less than 50% any other one grade of sand.*

Sand *- 25% or more very coarse, coarse, and medium sand (but less that 25% very coarse and coarse sand), and less that 50% of either fine or very fine sand.*

Find sand *- 50% or more fine sand, or less than 25% very coarse, coarse, and medium sand and less that 50% very fine sand.*

Very fine sand *- 50% or more very fine sand.*

Loamy sands

Loamy sand is a soil material that contains at the upper limit 85-90% sand, and the percentage of silt plus 1.5 times the percentage of clay is not less than 15; at the lower limit it contains not less than 70-85% sand, and the percentage of silt plus twice the percentage of clay does not exceed 30.

Loamy coarse sand *- 25% or more very coarse and coarse sand, and less that 50% any other one grade of sand.*

Loamy sand *- 25% or more very coarse, coarse, and medium sand (but less that 25% very coarse and coarse sand), and less that 50% fine or very fine sand.*

Loamy fine sand *- 50% or more find sand, or less than 50% very fine sand and less than 25% very coarse, coarse, and medium sand.*

Loamy very fine sand *- 50% or more very fine sand.*

Sandy loams

Sandy loam is a soil material that contains either 20% clay or less, with the percentage of silt plus twice the percentage of clay exceeding 30, and 52% or more sand; or less than 7% clay, less that 50% silt, and 43-52% sand.

Coarse sandy loam *- 25% or more very coarse and coarse sand and less than 50% any other one grade of sand.*

Sandy loam *- 30% or more very coarse, coarse, and medium sand (but less than 25% very coarse and coarse sand), and less than 30% of either very fine or fine sand.*

Fine sandy loam *- 30% or more fine sand and less than 30% very fine sand; or between 15-30% very coarse, coarse, and medium sand; or more than 40% fine and very fine sand, at least half of which is fine sand, and less that 15% very coarse, coarse and medium sand.*

Very fine sandy loam *- 30% or more very fine sand, or more than 40% fine and very find sand, at least half of which is very fine sand, and less that 15% very coarse, coarse, and medium sand.*

Loam *- Loam is a soil material that contains 7-27% clay, 28-50% silt, and less than 52% sand.*

Silt loam *- Silt is a soil material that contains 50% or more silt and 12-27% clay, or 50-80% silt and less than 12% clay.*

Silt *- Silt is a soil material that contains 80% or more silt and less than 12% clay.*

Sandy clay loam *- Sandy clay loam is a soil material that contains 20-35% clay, less than 28% silt, and 45% or more sand.*

Clay loam *- Clay loam is a soil material that contains 27-40% clay and 20-45% sand.*

Silty clay loam *- Silty clay loam is a soil material that contain 27-40% clay and less than 20% sand.*

Sandy clay *- Sandy clay is a soil material that contains 35% or more clay and 45% or more sand.*

Silty clay *- Silty clay is a soil material that contains 40% or more clay and 40% or more silt.*

Clay *- Clay is a soil material that contains 40% or more clay, less that 45% sand, and less that 40% silt.*

Heavy clay *- Heavy clay is a soil material that contains more that 60% clay.*

In addition to these thirteen basic soil textural classes, three of which are modified according to the predominant sand fraction, other modifiers are added. The word "mucky" is used as an adjective modifying the textural class name for horizons of mineral soils, especially of Humic Gleysols, that contain 15-30% organic matter (9-17% organic carbon).

Rock fragments in the soil are also used to modify the textural class name. These are gravel, cobbles, stones, boulders, channers and flags (see section 5o for a description of size classes). The adjectival form of the rock fragment class name is used as a modifier according to the following rules:

Less than 15% by volume: No special term is used; or "nongravelly" and "nonstony" are used in writing for contrast with soils having more that 15% pebbles, cobbles, stones, or boulders.

15 to 35% by volume: The adjectival term of the dominant kind of rock fragment is used as a modifier of the textural terms: "gravelly loam", "stony loam", "bouldery loam".

35 to 60% by volume: The adjectival term of the dominant kind of rock fragment is used with the word "very" as a modifier to the textural terms: "very gravelly loam", "very bouldery loam".

More than 60% by volume: If enough fine earth is present to determine the texture class (approximately 5 percent or more by volume) the adjectival term of the dominant kind of rock fragment is used with the word "extremely" as a modifier of the textural terms: "extremely gravelly loam", "extremely bouldery loam". If there is too little fine earth to determine the texture class (less than about 5% by volume) the terms "gravel", "cobbles", "stones", and "boulders" are used in the place of fine earth texture.

The class limits apply to the volume of the layer occupied by all pieces of rock larger than 2mm. Total volume of rock fragments in each layer is estimated, and the size class that makes up the greatest volume is used as the modifier. Usually the soil also contains fragments smaller or larger than those identified in the term. For example, a stony loam usually contains pebbles, but "gravelly" is not mentioned in the name. Use of a term for larger pieces or rock, such as boulders, does not imply that the pieces are entirely within a given soil layer. A single boulder may extend through several layers.

More precise estimates of the amount of rock fragments than are provided by the defined classes are needed for some purposes. If the more precise information is needed, estimates of percentages of each size class or a combination of size classes are included in the description: "very cobbly loam; 5% stones, 30% cobbles, and 15% gravel" or "silt loam; about 10% gravel".

If loose pieces of rock are significant in use and management of a soil they are bases of phase distinctions among map units. Exposed bedrock is not soil and is separately identified in mapping.

5h. Structure 1

5i. Structure 2

Soil Structure refers to the aggregation of primary soil particles into compound particles, which are separated from adjoining aggregates by planes of weakness. The exteriors of some aggregates have thin, often dark surface films that may serve to keep aggregates apart. Other aggregates have surfaces and interiors of similar colour, and the forces holding the aggregates together appear to be wholly internal.

An individual natural soil aggregate is called a ped and should not be confused with a clod, formed as a result of some disturbance, such as plowing or digging, which has molded the soil to a transient mass that changes with alternating wetting and drying; a fragment, formed by rupture of a soil mass across natural surfaces of weakness; or a concretion, formed by local concentrations of compounds that irreversibly cement the soil grains together.

By convention an aggregate is described in the order of grade, class and type, e.g. strong, medium, blocky. In the parent material of soils the material with structural shapes may be designated as pseudo-blocky, pseudo-platy, etc.

The classification of structure involves consideration of the shape and arrangement, the size, and the distinctness of the visible aggregates or peds. The terminology of structure consists of separate sets of terms designating each of these categories, which by combination form the names of the soil structure. Shape and arrangement of peds are designated as the type of soil structure; the type in turn is subdivided into kinds, on the basis of the character of the faces and edges of the aggregates. The size of the peds is considered with the class of soil structure whereas the degree of distinctness is expressed in the grades.

Table 3 indicates four main types of structure: structureless, in which there is no observable aggregation or definite orderly arrangement around natural line of weakness; blocklike, in which the soil particles are arranged around a point and bounded by flat or rounded surfaces; platelike, in which the soil particles are arranged around a horizontal place and generally bounded by relatively flat horizontal surfaces; and prismlike, in which the soil particles are arranged around a vertical axis and bounded by relatively flat vertical surfaces. Most such types are subdivided into kinds or subtypes. Thus under structureless, the single grain kind consists of an incoherent mass of individual particles, whereas amorphous (massive) consists of an incoherent mass showing no evidence of any distinct arrangement along natural lines of weakness. The blocklike type includes three kinds; angular blocky, whose faces are rectangular and flattened, bounded by planes intersecting at relatively sharp angles; subangular blocky, whose faces are subrectangular, or consist of mixed rounded forms; and granular, which are spheroidal, characterized by rounded vertices. Each type of structure includes peds that vary in shape, and detailed soil descriptions require supplemental statements about the shape of the individual peds.

The classes recognized are indicated by their name and their size limits, which vary with the shape and arrangement. The oblique dimension is inferred for the blocklike type, the vertical dimension for the platelike, and the horizontal dimension for the prismlike.

Grade of structure is the degree of distinctness of aggregation; it expresses the differential between cohesion within the aggregates and adhesion between aggregates, and is determined

mainly by noting the durability of the aggregates and the proportions of aggregated and disaggregated material when the aggregates are displaced or gently crushed.

The grade of structure varies with the moistening of the soil and should be described at the most frequently occurring soil moisture content of the soil horizon. The principal description of the structure of soil horizon should refer to its normal moisture content, although attention should be given to any striking contrasts in structure under other moisture conditions to which the soil is subjected. If grade is designated at an unstated moisture content, it is assumed that the soil nearly dry or slightly moist, which is the part of the range in soil moisture at which soil structure is most strongly expressed.

The sequence to be followed in combining the terms to characterize the structure is grade (distinctness), class (size), and then kind (shape). Thus, the designation for the soil structure in which the peds are loosely packed and roundish, dominantly less than 2 mm in diameter, and quite distinct is strong fine granular. Types, kinds, and classes of structure illustrated in Figure 3 and Table 3.

Many soil horizons have structure consisting of large peds that break down to smaller ones; some have structures that assume one form when in place and another when disturbed. This is referred to as compound, or primary and secondary structure. In all cases, the larger peds are referred to as primary structure and smaller ones are secondary structure. If a soil has only one structural form, this is referred to as primary structure.

Sometimes soil parent materials have structural shapes or soil horizon materials have structures that are other than pedological. This is a modification of kind of structure (kind modifier) and generally indicates a structure inherited from the process of deposition.

Grade		**Kind**	
SL	Structureless	PL	Platy
VW	Very weak	PR	Prismatic
W	Weak	CO	Columnar
WM	Weak to Moderate	AB	Angular Blocky
		SB	Subangular Blocky
M	Moderate	GR	Granular
MS	Mod. to strong	MA	Massive
S	Strong	SG	Single Grained
		CL	Cloddy
Class		FI	Fibred
VF	Very fine	MT	Matted
FF	Very fine to fine	LA	Layered
F	Fine	**Kind Modifier**	
FM	Fine to Medium	PS	Pseudo
		ST	Stratified
M	Medium	BD	Bedded
MC	Medium to Coarse	LM	Laminated
C	Coarse		
VC	Very coarse		

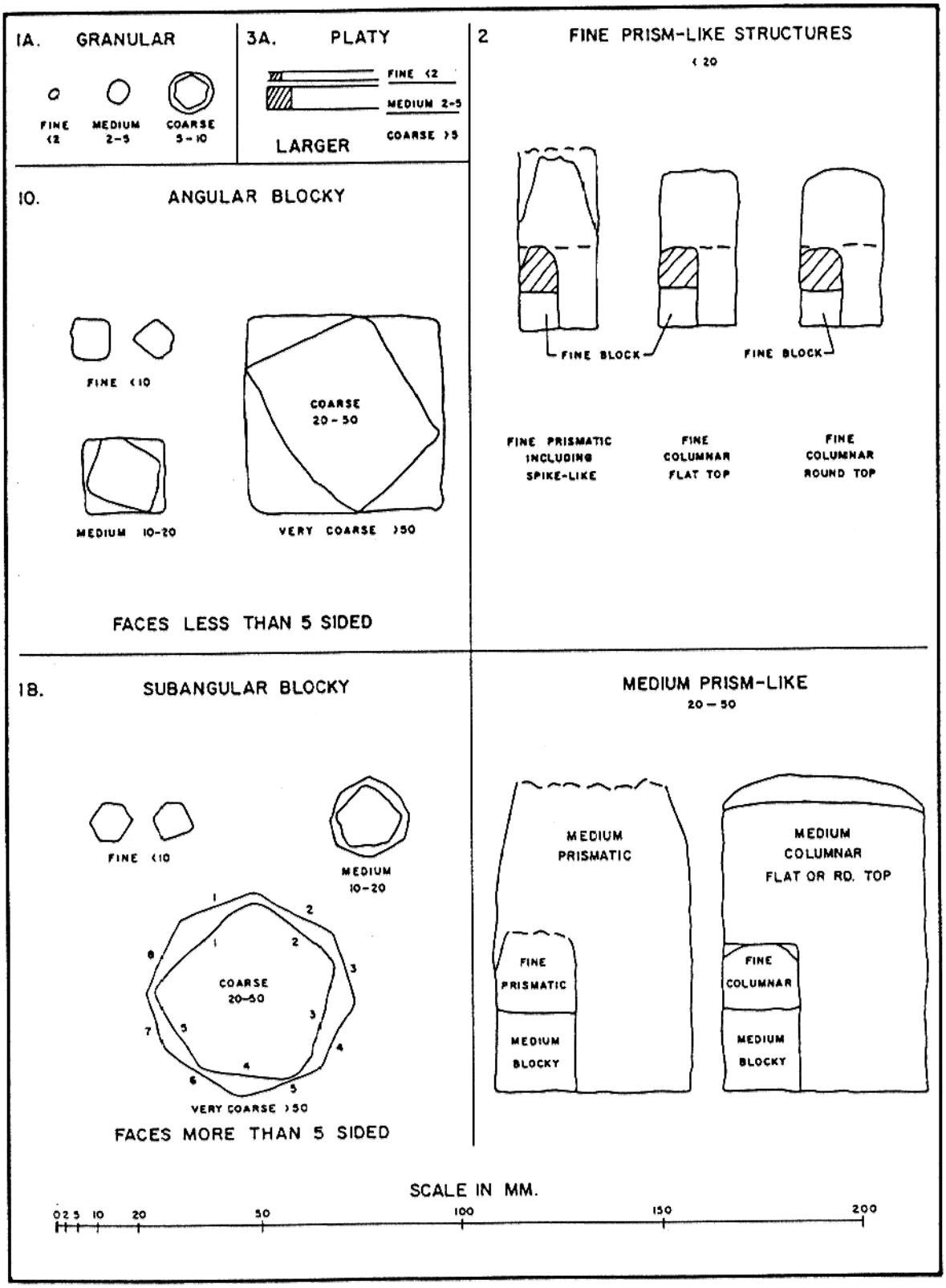
Table 4. Types, kinds, and classes of soil structure

Type	Kind	Class	Size[1] (mm)
Blocklike - Soil particles arranged around a point and bounded by flat or rounded surfaces	**Angular blocky** - ped bounded by flattened, rectangular faces intersecting at relatively sharp angles	Very fine angular blocky Fine angular blocky Medium angular blocky Coarse angular blocky Very coarse angular blocky	< 5 5-10 10-20 20-50 >50
	Subangular blocky - ped bounded by slightly rounded, subrectangular faces with vertices[2] of their intersections mostly subrounded	Very fine subangular blocky Fine subangular blocky medium subangular blocky Very coarse subangular blocky	<5 5-10 10-20 20-50 > 50
	Granular - Spheroidal peds bounded by curved or very irregular faces that do not adjoin those of adjacent peds	Very fine granular Fine granular Medium granular Coarse granular Very coarse granular	<1 1-2 2-5 5-10 >10
Platelike - Soil particles arranged around a horizontal plane and generally bounded by relatively flat horizontal surfaces	**Platy** - Peds flat or platelike; horizontal planes more or less well developed	Very fine platy Fine platy Medium plate Coarse platy Very coarse platy	< 1 1-2 2-5 5-10 >10
Prismlike - Soil particles arranged around a vertical axis and bounded by relatively flat surfaces	**Platy** - Peds flat or platelike; horizontal planes more or less well developed	Very fine platy Fine platy Medium platy Coarse platy Very coarse platy	<1 1-2 2-5 5-10 >10
	Columnar - Vertical edges near top of columns not sharp (vertices[2]-subrounded); column tops flat, rounded, or irregular	Very fine columnar Fine columnar Medium columnar Coarse columnar Very coarse columnar	<10 10-20 20-50 50-100 >100
Structureless - No observable aggregation of primary particles or no definite orderly arrangement around natural lines of weakness	**Single grained**	Loose, incoherent mass of individual primary particles	
	Massive	Amorphous; coherent mass showing no evidence of any distinct arrangement of soil particles; separates into cluster of particles, not peds	
Cloddy - Not a structure; used to indicate the condition of some ploughed surface; grade, class, and shape too varied to be describe in standard terms.			

[1] The size limits refer to measurements in the smallest dimension of platy, prismatic, and columnar peds and to the largest of the nearly equal dimension of blocky and granular peds.

[2] Definition of vertex (plural, vertices): the intersection of two planes of geometrical figure.

Figure 5. Diagrammatic representation of soil structure



DEFINITIONS

Grade of Structure

Weak *-- Weakly formed peds that are barely observable in place.*

Moderate *-- Moderately well formed peds that are moderately evident in place. Soil material of this grade, when disturbed, breaks down into a mixture of many distinct entire peds, some broken peds, and little disaggregated material.*

Strong *-- The peds are clearly evident in undisplaced soil. They adhere only weakly to one another and the peds separate from each other and remain largely intact when the soil is disturbed. When displaced, soil material of this grade consists very largely of entire peds and includes few broken peds and little disaggregated material.*

Kind Modifier

Pseudo (PS) *-- A kind of soil structure inherited from the parent material; for example, pseudoplaty, pseudoblocky.*

Stratified (ST) *-- A stratum is a layer with certain unifying characteristics, properties, or attributes that distinguish it from adjacent layers.*

Bedded (BD) *-- A bed is a unit layer in a stratified sequence that is visually or physically more or less distinctly separate from other layers above and below and is 1 cm or more thick.*

Laminated (LM) *-- A lamina is a unit layer similar to a bed but less than 1 cm thick.*

5j. Profile Moisture - Indicate the field moisture status of horizons at the time of description.

Condition

D	Dry
M	Moist
W	Wet
U	Unspecified

5k. Effervescence

Effervescence is the bubbling, hissing or foaming noticed when a chemical reagent is added to a sample of soil. It is caused mainly by carbonates and manganese oxides, or sometimes by organic matter. It is recorded by noting the type and strength of reagent (usually tested with 10% HCl) used and the degree of effervescence.

Special care must be exercised on soils where dolomite is present. The reaction usually is slower, less visible and less audible.

Degree of effervescence

N	Noneffervescent	- no bubbles observed
V	Very weak	- few bubbles
W	Weak	- bubbles readily observed
M	Moderate	- bubbles form low foam
S	Strong	- bubbles form thick foam

5l. Calcareousness

Calcareous classes are estimated in the field on the amount of carbonates present expressed as $CaCO_3$ equivalent. An approximation of the class can be made by noting the effervescence obtained with 10% HC1. These approximations should be confirmed by measurements in the laboratory. Terms use to express the carbonate contents of soils area:

Calcareous classes		$CaCO_3$ equivalent(%)
N	Noncalcareous	<1%
W	Weakly calcareous	1-5%
M	Moderate calcareous	6-15%
S	Strong calcareous	16-25%
V	Very strong	26-40%
E	Extremely	>40%

5m.Field pH

Field-determined pH is recorded by noting the method of determination and the reaction class. The reaction class rather than the determined pH is reported on the assumption that field determined pH is at best a close approximation.

Reaction Classes		pH values
EA	Extremely Acid	< 4.5
VS	Very strongly Acid	4.6 - 5.0
ST	Strongly acid	5.1 - 5.5
MA	Medium acid	5.6 - 6.0
SL	Slightly acid	6.1 - 6.5
NA	Neutral	6.6 - 7.3
ML	Mildly alkaline	7.4 - 7.8
MD	Moderately alkaline	7.9 - 8.4
SA	Strongly alkaline	>8.5

Method

1 Hellige-Truog
2 pHydrion
3 pH meter

5n. Consistence

Soil consistence is the property of soil materials that relates to the degree and kind of cohesion and adhesion or to the resistance to deformation and rupture (soil strength). Every soil material has consistence irrespective of whether the mass is large or small, in a natural condition or greatly disturbed, aggregated or structureless, or moist or dry. Although consistence and structure are interrelated, structure deals with the shape, size, and definition of natural aggregates that result from variation in the forces of attraction within a soil mass, whereas consistence deals with the strength and nature of the forces themselves.
Soil consistence is described in terms of the resistance of soil material to failure under stress, the behaviour of soil material when it fails or deforms under stress, the capacity of soil material to change shape under stress and to regain the original shape after removal of the stress, and the capacity of the soil material to adhere to foreign objects.

Terminology for consistence includes separate terms for description at three standard moisture contents, dry, moist, and wet; plasticity is described always in the wet state, cementation usually in the wet state. If moisture conditions are not stated in using any consistence term, the moisture condition is that under which the particular term is defined. Thus friable, used without a statement of the moisture content, indicates friable when moist; hard, used alone, means hard when dry; and sticky means sticky when wet. Usually it is desirable to describe consistence at several standard moisture conditions.

Soil consistence for moist and dry soil moisture states is estimated under field conditions by estimating the soil strength (resistance to crushing offered by an unconfined volume of soil in the field state). As soil strength often depends on the size of the test specimen, its shape, the way in which force is applied and other factors, an empirical system of testing must be used if results are to be comparable. If the soil is sufficiently coherent, a cube of 25 mm on each side is removed. In some places the material is so loose that it will not hold together in a cube. Where peds are less than 25 mm across a ped of common size is used. Such a specimen can be used to test moist and dry consistence, and cementation; wet consistence and plasticity require other procedures. The test specimen is shaped to give two roughly parallel upper and lower bearing surfaces, and stress is applied slowly for no longer than five seconds, using the thumb and forefinger, parallel to the vertical axis. The amount of force required to produce failure is the criterion for moist and dry consistence classes (judgement of the amount of force exerted can be developed after practice in compressing various mechanical devices). Ped strength, the force required to produce failure of natural soil structural units, is not accommodated separately and can be reported as soil consistence.

Consistence when wet is determined at moisture levels at or slightly above field capacity, and is referred to as stickiness. Stickiness is the quality or degree of adhesion to other objects or materials. It changes as soil structure is destroyed and as the soil moisture state changes. Stickiness in the field is determined on the fine earth fraction, and at the soil moisture state at which it is expressed <u>most strongly</u>. The sample is crushed in the hand, water is added if necessary to bring it to the wet state and the sample is thoroughly puddled. The puddled soil is pressed between the thumb and forefinger, and its adherence to the digits is noted. Water content is adjusted by working the sample in the hand to remove water, or by adding water as necessary to achieve the maximum stickiness.

Plasticity is the property of changing shape continuously under the influence of an applied stress, and of retaining the new shape after removal of the stress. As for stickiness, the maximum expression of the property is reported. The sample is crushed in the hand and water is added if necessary to bring the sample to the wet state. The material is thoroughly puddled and moisture content is adjusted by rolling in the hand to reduce moisture or by adding more water.

Moisture content at maximum plasticity is above the point where a roll of material 4 mm in diameter crumbles, but below the water content at which stickiness, if it is exhibited, exceeds slightly sticky. The material is rolled between the palms of the hands, or on a flat surface, and the minimum thickness of a roll 4 cm long that can support its own mass when dangled from the thumb and forefinger is used as the criterion of maximum plasticity classes.

Wet Consistence

N	Nonsticky
S	Slightly Sticky
T	Sticky
V	Very sticky

Moist Consistence		Force under which specimen fails N(kg m/s^2)
LO	Loose	-
VF	Very friable	< 8
F	Friable	8-20
FR	Firm	20-40
VM	Very firm	40-80

Dry Consistence		Force N (kg m/s^2)
LO	Loose	-
SO	Soft	< 8
SH	Sl. hard	8-40
HD	Hard	40-80
VH	Very hard	80-160
EH	Ext. hard	160-800
RG	Rigid	> 800

Plasticity		Ability to change shape
N	Nonplastic	A roll 4 mm thick cannot be formed
S	Sl. plastic	A roll 4 mm thick cannot support its mass
P	Plastic	A roll 2 mm thick cannot support its mass
V	Very plastic	A roll 2 mm thick can support its mass

DEFINITIONS

Wet consistence (stickiness)

Nonsticky *-- After the release of pressure, practically no soil material adheres to the thumb and finger.*

Slightly sticky *-- After pressure has been applied, the soil material adheres to both the thumb and finger, but comes off one or the other rather cleanly. The soil is not appreciably stretched when the digits are separated.*

Sticky *-- After pressure has been applied, the soil material adheres strongly to both the thumb and forefinger and tends to stretch somewhat and pulls apart rather than pulling free from either digit.*

Very sticky *-- after pressure has been applied, the soil material adheres strongly to both the thumb and forefinger and is decidedly stretched when they are separated.*

Moist consistence

Loose *-- The soil material is noncoherent.*

Very friable *-- The soil material is crushed under very gentle pressure, but coheres when pressed together; the specimen fails under less than 8N of force (very gentle pressure).*

Friable *-- The soil material is easily crushed under gentle to moderate pressure between the thumb and forefinger and coheres when pressed together; the specimen withstand 8N, but fails under 20N (gentle pressure).*

Firm *-- The soil material is crushed under moderate pressure between the thumb and forefinger, but resistance is distinctly noticeable; the specimen withstands 20N but fails under 40N (40N of force corresponds to firms pressure between the extended thumb and forefinger of many people, but it is considerably less than the maximum force that can be exerted slowly).*

Very firm *-- The soil material can be crushed between the thumb and forefinger, but strong pressure is required; the specimen withstands 40N but fails under 80N (80N of force is near the maximum force that can be exerted between the extended thumb and forefinger for many people).*

Dry consistence

Loose *-- The soil material is noncoherent.*

Soft *-- The soil material is weakly coherent and fragile, and breaks to a powder or individual grains under very slight pressure; the specimen fails under less than 8N of force (very gentle pressure).*

Slightly hard *-- The soil material is weakly resistant to pressure and easily broken between thumb and forefinger; the specimen withstands 8N of force but fails under 40N (40N of force corresponds to firm pressure between the extended thumb and forefinger of many people, but is significantly less than the maximum force that can be exerted slowly).*

Hard *-- The soil material is moderately resistant to pressure; it can be broken in the hands without difficulty, but considerable pressure is necessary to break it between the thumb and forefinger; the specimen withstands 40N of force but fails under 80N (80N of force is near the maximum force that can be exerted between the extended thumb and forefinger of most people).*

Very hard *-- The soil material is very resistant to pressure; it can be broken in the hands only with difficulty, and is not breakable between thumb and forefinger; the specimen withstands 80N of force but fails under 160N (160N of force corresponds approximately to the force that can be applied slowly with a foot or by compression between two hands).*

Extremely hard *-- The soil material is extremely resistant to pressure and cannot be broken in the hands; the specimen withstands 160N of force but fails under 800N (800N of force is near the pressure of full body mass for many people).*

Rigid *-- The soil material cannot be broken except by extreme pressure; the specimen withstands 800N of force.*

Plasticity

Nonplastic *-- A roll 4 cm long and 4 mm thick cannot be formed.*

Slightly plastic *-- A roll 4 cm long and 4 mm thick can be formed but cannot support its own mass.*

Plastic *-- A roll 4 cm long and 2 mm thick can be formed but cannot support its own mass.*

Very plastic *-- A roll 4 cm long and 2 mm thick can be formed and can support its own mass.*

5o. Coarse fragments

Rock fragments are described by recording the kind and amount present on a horizon basis. See Table 4 below for **terms used for rock fragments**. Refer to section 5g for guidelines on application of rock fragment content to texture class names.

Type
GR Gravelly
AG Angular gravelly
CH Cherty
CN Channery
SL Slaty
SH Shaly
CB Cobbly
AC Angular cobbly
CC Coarse Cherty
FG Flaggy
ST Stony

% Volume -- Indicate percentage by volume using single digit designation. Example: 30 percent by volume is entered as 3, while 46 percent is rounded to the nearest single whole number which is 5.

Table 5. Terms for rock fragments

Shape[1] and size	Noun	Adjective
Rounded, subrounded, angular, or irregular		
2-7.5 cm diameter	Gravel[2]	Gravelly
0.2-0.5 cm diameter	Fine gravel	Fine gravelly
0.5-2 cm diameter	Medium gravel	Medium gravelly
2-7.5 cm diameter	Coarse gravel	Coarse gravelly
7.5-25 cm diameter	Cobble	Cobbly
25-60 cm diameter	Stone	Stony
>60 cm diameter	Boulder	Bouldery
Flat:		
0.2-15 cm long	Channer	Channery
15-38 cm long	Flagstone	Flaggy
38-60 cm long	Stone	Stony
>60 cm long	Boulder	Bouldery

[1] If significant to classification or interpretation, the shape of the fragments is indicated: "angular gravel", "irregular boulders".
[2] A single fragment is called a "pebble".

CARD TYPE 06

6a. Horizon number

6b. Colour 1

6c. Colour 2

Colour of mineral and soil material is recorded, using Munsell notations, on the basis of the colour aspect (what the colour represents) and the moisture condition of the soil at the time of recording. Note that intergrade values can be accommodated for subdividing hue, value, and chroma; for example, 7.5YR 4.3/2.2. Decimal positions are reported in shaded spaces. If whole numbers are reported the decimal positions are filled with zeros; for example, 10YR 5/4 is reported as 100YR 5040. Hue symbols are right justified.

Differences between the colour of the soil material in place and that of the crushed mass, or between ped faces and interiors, and so forth, are noted by selecting the appropriate aspect code.

Aspect Codes(colour)

01 Matrix moist
02 Matrix dry
03 Exped moist
04 Exped dry
05 Inped moist
06 Inped dry
07 Crushed moist
08 Crushed dry
09 Natural wet/reduced
10 Natural wet/oxidized
11 Pressed wet/reduced
12 Pressed wet/oxidized
13 Rubbed wet/oxidized
14 Rubbed dry
15 Clay film moist
16 Clay film dry
17 Nodules moist
18 Mottle moist

6d. Mottles 1

6e. Mottles 2

Mottling in soils is described by examining the colouration of surfaces and interiors of peds. Frequently, marked differences of colour are attributable to the method of preparing the specimen, and description of the difference usually is important. For example, peds may have common, fine, yellowish brown mottles on the broken interior. If, however, the ped is cut with smearing the interior mottles often appear more abundant or of higher contrast. It is thought that the smearing caused by cutting with knife or shovel exaggerates the colour mottling.

It is recommended that colour mottles be described on a freshly picked soil surface and that both ped surfaces and interiors be described. The area percentage charts here included can facilitate visual estimates.

Mottling in soils is described by recording the pattern of the mottling and the colour or colours of the principal mottles. Pattern and size of mottles are described using abundance, size, and contrast. Colour is estimated according to standard Munsell colour notation. Enter the appropriate mottle colours by using Aspect code 18 (mottles moist), followed by the standard Hue, Symbol, Colour, and Chroma values in any of the colour fields (6b, 6c, 7b, or 7c). Make sure that the mottle description and colour are coded for the correct horizon number.

Abundance		Proportion of Exposed Surface (%)
F	Few	<2
C	Common	2-20
M	Many	>20

Size		Dimension (mm)
F	Fine	<5
M	Medium	5-15
C	Coarse	>15

Contrast (detailed description to follow)

	Difference from the matrix in		
	Hue pages	Value units	Chroma units
F Faint	0	≤2	≤1 or
	1	0	0
D Distinct	0	3-4	2-4 or
	1	≤2	≤1
P Prominent	2+	0	0 or
	0	≥4	≥4 or
	1	≥2	>1

DEFINITIONS

Abundance of Mottles

Few *-- Mottles occupy less than 2% of the exposed surface.*

Common *-- Mottles occupy 2-20% of the exposed surface.*

Many *-- Mottles occupy more than 20% of the exposed surface.*

Size of Mottles

If the length of a mottle is not more than 2 or 3 times the width, the dimension recorded is the greater one. If the mottle is long and narrow, describe the width.

Fine *-- Less than 5 mm in dimension.*

Medium *-- 5-15 mm in dimension.*

Coarse *-- > 15 mm in dimension*

Contrast of Mottles

Contrast *refers to the degree of visual distinction that is evident between associated colours. Contrast may be described as faint, distinct, or prominent:*

Faint *-- Evident only on close examination. Faint mottles commonly have the same hue as the colour to which they are compared and differ by no more that 1 unit of chroma or 2 units of value. Some faint mottles or similar but low chroma and value differ by 2.5 units (one page) of hue.*

Distinct *-- Mottles contrast only moderately with the colour to which they are compared. Distinct mottles commonly have the same hue as the colour to which they are compared but differ by 2 to 4 units of chroma or 3 to 4 units of value; or differ from the colour to which they are compared by 2.5 units (one page) of hue but by no more that 1 unit of chroma or 2 units of value.*

Prominent *-- Contrast strongly with the colour to which they are compared. Prominent mottles are commonly the most obvious colour feature of the section described. Prominent mottles that have medium chroma and value commonly differ from the colour to which they are compared by at least 5 units (two pages) of hue if chroma and value are the same; at least 4 units of value or chroma if the hue is the same; or at least 1 unit of chroma or 2 units of value if hue differs by 2.5 units (one page).*

6f. Concretions

Concretions, nodules, and casts are units within the soil matrix that differ from the surrounding material because of the concentration of some constituent or a change in fabric. Concretions and nodules are used interchangeably in this section, although the term concretion is sometimes restricted to concentrations having concentric fabric; casts are units in the soil of biological origin.

Concretions, nodules, and casts are described by noting the kind, abundance, size, location, shape, and colour of the units. Space is allocated for recording up to two kinds of units; these should represent the most common units, the pedologically most significant units, or a combination of the two.

Kind

G	Gypsum
L	Lime
I	Iron-Manganese
W	Worm cast
P	Pedotubule
S	Salt
O	Others

Abundance

F	Few (<2%)
C	Common (2-20%)
M	Many (>20%)

Size(mm)

F	Fine (<5)
M	Medium (5-15)
C	Coarse (>15)

Distribution

C	Channel
L	Localized
M	Through matrix

Shape

S	Spherical
O	Oblong
I	Irregular
P	Plate-like

6g. Clay Films

Clay films are described by recording frequency of occurrence, estimated thickness, locations and colour of the films in relation to other morphological features. Descriptions of other properties of clay films, such as continuity (whether existing as patches or a continuous network), may be needed for adequate characterization of the morphology of some soils, but space for these has not been provided in the present format; mention of such features can be accommodated in the special notes. Because clay films of more than one type may occur within a given horizon, space is provided for two descriptions if such are needed.

The objective of the frequency classes is to indicate the estimated percentage of the natural soil surfaces that are coated with clay films. The description may refer to the total surface of ped faces, or to the total surface of tubular and interstitial pores, or to the combined surfaces of peds and pores in the soil material. The description of frequency of clay films is not intended to reflect the total volume of clay films, but simply the percentage of clay faces or pore surfaces, or both, that are coated.

Thickness of clay films often varies appreciably within distances of a few millimetres. In such cases, estimate the average thickness and report one of the thickness classes. If appropriate variations in thickness occur over distances of a centimetre or more, or are related to other morphological features, and the variations are judged to be significant to description of the morphology, report the most appropriate thickness class but note the variation in special notes.

Location categories attempt to group areas where clay films are most commonly observed to accumulate, based on present knowledge. Deviations from this can be accommodated in the special notes.

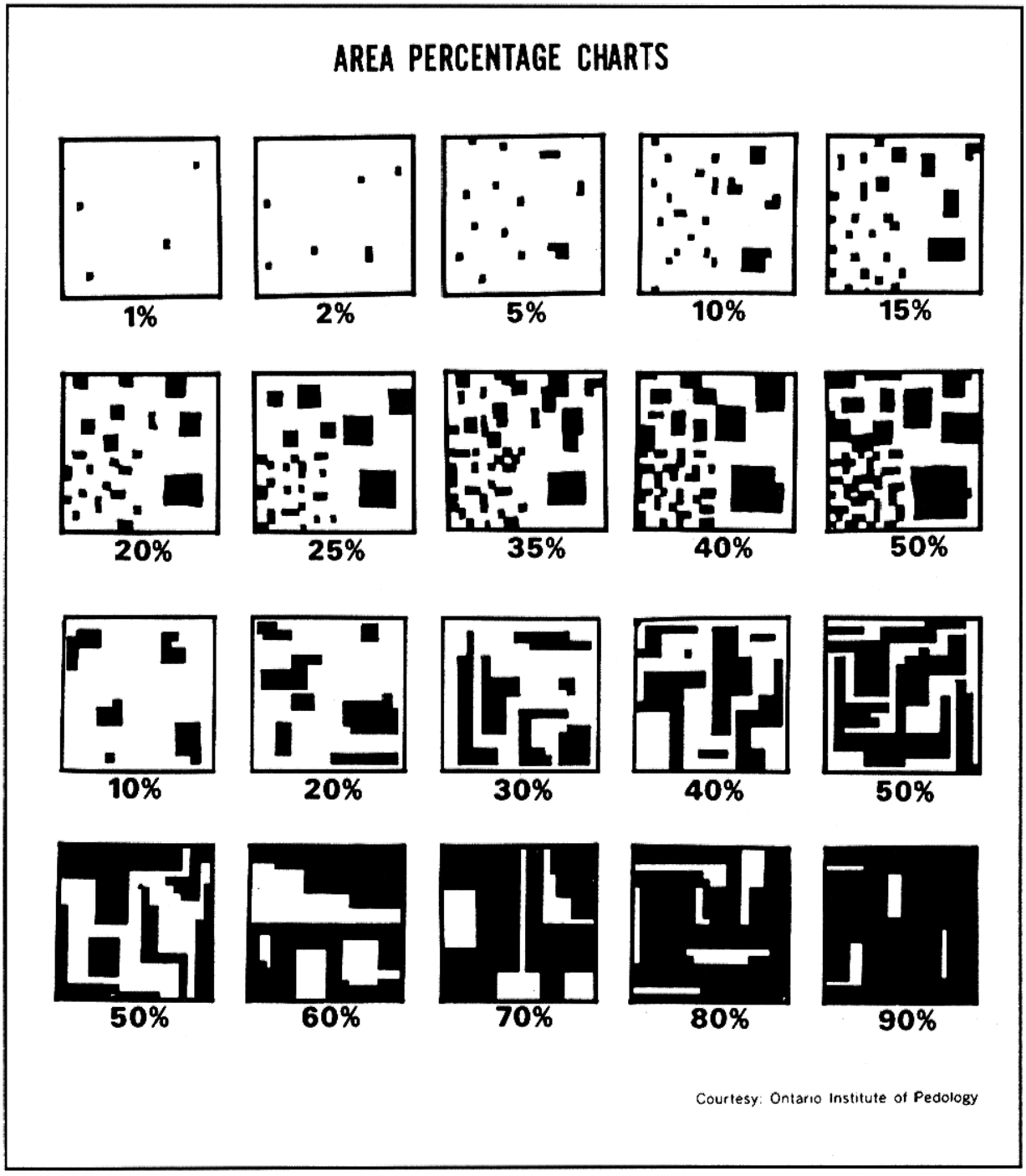
Frequency		Proportion of surface covered (%)
F	Few	<2
C	Common	2-20
M	Many	>20

Thickness		mm
VT	Very thin	<0.005
TH	Thin	0.005-0.05
MT	Mod. thick	0.05-0.5
TK	Thick	0.5-1.0
VK	Very thick	>1.0

Location

VC	Voids & channels
PF	Ped faces
VP	Some voids
PV	All voids
BR	Visible bridges

Figure 6. Area percentage chart



DEFINITIONS

Clay films *-- Clay films present on less than 2% of surface. Patches of film can be identified, but their frequency is so low that the significance of their presence may be nil or doubtful. The class includes occasional small patches of clay film not regularly associated with other morphological features.*

Common *-- Clay films present on 2-20% of surface. Patches of film are regularly associated with other morphological features. Most of the surface of peds or pores, or both, are not coated with clay film.*

Many *-- Clay films present on 20-80% of surface. Clay films are regularly associated with other morphological features. Many occur as discrete patches or as a continuous network.*

Continuous *-- Clay films present on more than 80% of surface. Most or all ped or pore surfaces, or both, are covered with films. Patches of natural surfaces may be free from clay films, but the films are essentially continuous.*

Thickness Classes

Very thin *-- Thickness less than 0.005 mm. Films visible only when viewed normal to surface; hand lens needed for identification; not visible in cross section with 10X hand lens; if present, very fine sand grains protrude through the film and are readily apparent.*

Thin *-- Thickness 0.005-0.05 mm. Hand lens usually needed for identification; visible in cross section with 10X lends but not to unaided eye; if present, very fine sand grains are enveloped by the film or their outlines are indistinct; fine sand grains protrude through the film or are only thinly coated and are readily apparent.*

Moderately thick *-- Thickness 0.05-0.5 mm. Clay films visible in cross section to unaided eye; fine sand grains are enveloped by the film or other outline are indistinct; film surfaces are relatively smooth.*

Thick *-- Thickness 0.5-1.0 mm. Clay films and their broken edges are readily visible without magnification; film surfaces are smooth; sand grains are enveloped by the film or their outlines are indistinct.*

Very thick *-- Thickness greater than 1.0 mm. Clay films are a striking feature of the morphology.*

6h. Roots - Roots are described by noting the depth of root penetration as well as the abundance, size, orientation, and distribution of roots. Although a variety of roots of varying sizes are commonly present in a horizon, space is provided for recording only the most usual and visible case.

Abundance

Size(mm)		**Orientation**		**Distribution**	
U	Micro	V	Vertical	I	Inped
V	Very fine	H	Horizontal	E	Exped
F	Fine	O	Oblique	B	Both
M	Medium	R	Random		
C	Coarse				

Table 6. Abundance of roots by number and size

Abundance of roots by number and size					
Class	Micro <.075mm	Very fine < 1 mm	Fine 1-2 mm	Medium 2-5 mm	Coarse > 5 mm
	Average number per square decimeter				
V Very few	N/A	N/A	N/A	N/A	N/A
F Few	N/A	10	10	1	1
P Plentiful	N/A	10-100	10-100	1-10	1-5
A Abundant	N/A	>100	>100	>10	>5

6i. Porosity - Porosity is the proportion of the soil volume unoccupied by soil particles, and the shapes, sizes and arrangements of the pores. In soil descriptions, useful estimates can be made of the total porosity (from estimated bulk density) and of the volume of pores that drain at low negative pressures (air porosity). In addition, the abundance, size, shape and orientation of pores larger than approximately 0.5 mm (diameter or width) can be recorded.

General
- S Slightly porous (<40% pore spaces)
- M Moderately porous (40-60%)
- H Highly porous (>60% pore spaces)

Type
- V Vesicular
- I Interstitial
- T Tubular

Abundance
- V Very few
- F Few
- C Common
- M Many

Size
- U Micro
- V Very fine
- F Fine
- M Medium
- C Coarse

Orientation
- V Vertical
- H Horizontal
- O Oblique
- R Random

Distribution
- I Inped
- E Exped
- B Both

Continuity
- C Continuous
- D Discontinuous

Morphology
- S Simple
- D Dendritic
- C Closed

Total porosity

Total porosity class for mineral soil and the associated approximate bulk densities (g/cm^3) are defined as follows:

Slightly porous - less than 40% pore space by volume; bulk density >1.6

Moderately porous - 40 to 60% pore space by volume; bulk density approximately 1.1 to 1.6

Highly porous - more than 60% pore space by volume; bulk density < 1.1
For **organic soils**, total porosity ranges from approximately 80% for humic horizons to more than 90% for fibric horizons.

Table 7. Abundance of pores by number and size

Abundance of pores by number and size[1]					
Class	Micro < .1 mm	Very fine 0.1-0.5mm	Fine 0.5-2 mm	Medium 2-5 mm	Coarse 5-10 mm
	Average number per square decimeter				
V Very few	N/A	N/A	N/A	N/A	N/A
F Few	N/A	<25	<10	<1	<1
P Plentiful	N/A	25-200	10-50	1-5	1-5
A Abundant	N/A	≥200	≥50	≥5	≥3

[1]Voids or channels larger than 10 mm in the smallest dimension are counted individually and recorded in special notes by number and proportions of the unit cross-section rather than by number class.

DEFINITIONS

Pore Orientation Classes (for roots and tubular pores)

Vertical *-- Orientation mainly vertical.*

Horizontal *-- Orientation mainly horizontal.*

Oblique *-- Orientation mainly oblique.*

Random *-- Orientation in all directions.*

Pore distribution Classes (within horizons)

Inped *-- Most roots and pores are within peds.*

Exped *-- Most roots and pores follow ped interfaces.*

Pore Morphology Classes (for individual pores)

Simple *-- Tubular pores not branched*

Dendritic *-- Tubular pores branched; pores are open at least at the upper end or at one horizontal end.*

Closed *-- Both ends of the pores are sealed from access to air and water by organic or organomineral particles or clay flows.*

Pore Continuity Classes (for tubular pores)
Continuous *-- Individual pores extend throughout the horizon.*

Discontinuous *-- Individual pores extend only partway through the horizon.*

Types of Pores

Vesicular *-- Roughly spherical or ellipsoidal in shape, not appreciably elongated in any direction.*

Interstitial *-- Irregular in shape with faces that are curved inward; formed by curved or angular faces of adjacent mineral grains or peds, or both.*

Tubular *-- More or less cylindrical in shape, elongated in one direction.*

6j. Von Post

01 Living moss layer
02 Peat not living
03 Plant material distinguishable
04 Plant material not distinguishable
05 Plant material reaching stage of decomposition
06 Plant material has decomposed
07 Original plant material is practically undistinguishable
08 Only distinguishable plant remains are roots
09 Very homogenous, amorphous sample
10 Very rare to non-existent in sedimentary peat

Von Post Scale of Decomposition

The amount of decomposition is gauged in the field by assessing the distinctness of the structure of plant remains and the colour of soil solutions as wet peat is squeezed in the hand. A scale 01-10 is used.

01 Living moss layer. Usually the surface 2-4 cm. Cannot be considered "peat" as such as it is not yet dead.

02 The structure and form of the plant material is complete. The only difference between 01 and 02 is that a 02 peat is not living. When squeezing, clear to slightly yellowish water is emitted. The peat sample in the hand is normally bright yellowish orange in colour, especially after squeezing. The sample is spongy, or elastic; upon squeezing, the compressed sample springs back, and will take little or no shape.

03 The plant material is still very easily distinguishable, but the individual sphagnum "stalks" are breaking up into pieces, as opposed to continuous lengths of stems, etc. When squeezing, yellow water with some plant debris (mostly individual leaves is emitted. The colour of the sample is somewhat darker that a 02 peat. The sample is still spongy, but less than 02; after squeezing, the peat will spring back to a point where a vague to fairly definite form of the handprint is distinguishable.

04 The plant material is not as easily distinguishable as in 03 because the pieces of peat, as mentioned above, are now disintegrating, therefor one is often dealing with individual stems, branches, and leaves. When squeezing, light brown to brown water with a lot of debris is emitted. The sample is not spongy, and upon rubbing, a slightly soapy or humic texture is detected. Upon squeezing, the sample makes a perfect replica of the handprint, commonly called "brass knuckles". It should be noted that after squeezing a peat sample, the difference in shape between a 03 and a 04, is that a 03 is "rounded off" whereas a 04 peat has definite "sharp" ridges left by the fingers. No peat escapes the fingers.

05 The plant material is reaching a stage of decomposition where the individual components (branches, leaves, stem) are starting to breakup, such that some amorphous or unstructured material is present. When squeezing, definitely brown water is emitted. This water is reaching the point where it can no longer be termed "water", but is a solution. The sample has a more definite soapy or humic texture, yet roughness is still present. Upon squeezing a very small amount of the sample escapes between the fingers.

06 The plant material has decomposed to the extent where almost half of the sample is in an amorphous or unstructured state. Plant constituents are still distinguishable upon close examination in the hand. upon squeezing, brown to dark brown water is emitted. The sample is pasty and very malleable. Upon squeezing, approximately one-third of the peat escapes between the fingers as a paste.

07 The original plant material is practically undistinguishable and a very close examination in the hand is needed to see that there are still vague structures present. If the sample is "worked" in the hand, this structure will disappear. It should be noted that such things as weed, sedge roots, and ***Eriophorum*** fibres are often very resistant to decomposition, and can be present in their "original" state in humified peats up to 07. Upon gentle squeezing, a small amount of very dark water is emitted. When the final squeeze is performed, over half of the material escapes the hand.

08 The only distinguishable plant remains are roots or ***Eriophorum*** fibres, when present. If appreciable amounts of roots or fibres are present, the peat cannot be considered to be a 08, even though the remaining material is such. The "appreciable amount" of these materials occur when they interfere with the squeezing out of the remaining amorphous material. If pieces or chips of weed are present in the sample, regardless of the amount, this alone classifies the peat as a 07. Little or no water is emitted upon gentle squeezing. The final squeeze results in over two thirds of the peat escaping the hand.

09 A very homogenous, amorphous sample containing no roots or fibres. There is no free water emitted upon squeezing, and almost all of the sample escapes the hand.

10 Very rare to non-existent in non-sedimentary peats. In sedimentary peats, the particle size can be extremely small resulting in "pudding-like" homogenous material. Upon squeezing, all of the sample escapes the hand.

6k. Ice characteristics

'-' Present
' ' Absent

Definitions

Crystals

Coatings

Random

Stratified

CARD TYPE 07

7a. Horizon number

7b. Colour 3

7c. Colour 4

Colour3 and Colour4 are similar to Colour1 and Colour2 fields (see 6b,c for an explanation). These fields can be used to record additional soil colours for a soil horizon if required, for example, to record the colour of mottles, clay films, or concretions. Ensure that the appropriate aspect codes are used as part of each colour record.

7d. Rubbed fibre (%)

This 2 digit numeric field is used to record field estimates of rubbed fibre content of organic soil layers.

7e. Botanical Composition (%)

This is a set of 15, 2-digit numeric fields used to record the estimated percentage of specific materials in organic soil layers. The individual data fields are;

Sphagnum moss	Grass
Sedge	Wood
Moss	Other
Brown moss	Sedge-peat
Leaves	Amorphous
Needles	Seeds
Herbaceous	Charcoal
Lichen	

7f. Wood

Diameter(cm)

Hardness

1 Hard
2 Soft
3 Very soft

7g. Limnic material

1 Marl
2 Coprogenous
3 Diatamaceous

7h. C14 - Indicate whether material sampled is for carbon dating.

'-' Sampled for C14
' ' Not sampled

CARD TYPE 08

8a. Depths to (m)

Bedrock - Bedrock is the solid rock that underlies soil regolith or that is exposed at the surface.

Water table - (groundwater surface; free water surface; groundwater elevation). Elevation at which the pressure in the water is zero with respect to the atmospheric pressure.

Impermeable Layer - The depth of the first layer that is significantly impermeable to root penetration is encountered.

Frost - the depth to which seasonal frost was encountered, recorded in meters.

8b. Thaw layer (m)

8c. Soil drainage parameters -

The Soil Water Regime classification utilizes the factors soil drainage aridity, hydraulic conductivity, impeding layers for both reduced and increased porosity, least and greatest depth of saturated zone and its duration, seepage, and man-made modifiers such as underdrainage. For a complete discussion of the Soil Water Regime classification see the proceedings cited above.

Soil drainage(SWIG)
VR Very rapid
R Rapid
W Well
MW Moderately well
I Imperfect
P Poor
VP Very poor

DEFINITIONS

Drainage (soil) - *(1) The rapidity and extent of the removal of water from the soil by run off and flow through the soil to underground spaces. (2) As a condition of the soil, it refers to the frequency and duration of periods when the soil is free of saturation.*

Drainage in soil reports is described on the basis of actual moisture content in excess of field capacity and length of the saturation period within the plant root zone. The terms are as follows:

Very rapidly drained - *Water is removed from the soil very rapidly in relation to supply. Excess water flows downward very rapidly if underlying material is pervious. There may be very rapid subsurface flow during heavy rainfall provided there is a steep gradient. Soils have very low available water storage capacity (usually less than 2.5 cm) within the control section and are usually coarse in texture, or shallow, or both. Water source is precipitation.*

Rapidly drained - *Water is removed from the soil rapidly in relation to supply. Excess water flows downward if underlying material is pervious. Subsurface flow may occur on steep gradients during heavy rainfall. Soils have low available water storage capacity (2.5-4 cm) within the control section, and are usually coarse in texture, or shallow, or both. Water source is precipitation.*

Well drained *- Water is removed from the soil readily but not rapidly. Excess water flows downward readily into underlying pervious material or laterally as subsurface flow. Soils have intermediate available water storage capacity (4-5 cm) within the control section, and are generally intermediate in texture and depth. Water source is precipitation. On slopes subsurface flow may occur for short durations but additions are equalled by losses. These soils are usually free of mottles within 100 cm of the surface but may be mottled below this depth. Soil horizons are usually bright coloured.*

Moderately well drained *- Water is removed from the soil somewhat slowly in relation to supply. Excess water is removed somewhat slowly due to low perviousness, shallow water table, lack of gradient, or some combination of these. Soils have intermediate to high water storage capacity (5-6cm) within the control section and are usually medium to fine in texture. Soils are commonly mottled in the 50 to 100 cm depth. Colours are dull brown in the subsoil with stains and mottles.*

Imperfectly drained *- Water is removed from the soil sufficiently slowly in relation to supply to keep the soil wet for a significant part of the growing season. Excess water moves slowly downward if precipitation is major supply. If subsurface water or groundwater, or both, is the main source, flow rate may vary but the soil remains wet for a significant part of the growing season. Precipitation is the main source if available water storage capacity is high; contribution by subsurface flow or groundwater flow, or both, increases as available water storage capacity decreases. Soils have a wide range in available water supply, texture, and depth, and are gleyed phases of well drained subgroups. These soils generally have mottling below the surface layers and generally have duller colours with depth, generally brownish grey with mottles of yellow and grey.*

Poorly drained *- Water is removed so slowly in relation to supply that the soil remains wet for a comparatively large part of the time the soil is not frozen. Excess water is evident in the soil for a large part of the time. Subsurface flow or groundwater flow, or both, in addition to precipitation are main water sources; there may also be a perched water table, with precipitation exceeding evapotranspiration. Poorly drained soils have a wide range in available water storage capacity, texture, and depth, and are gleyed subgroups, Gleysols, and Organic soils.*

Very poorly drained *- Water is removed from the soil so slowly that the water table remains at or on the surface for the greater part of the time the soil is not frozen. Excess water is present in the soil for the greater part of the time. Groundwater flow and subsurface flow are major water sources. Precipitation is less important except where there is a perched water table with precipitation exceeding evapotranspiration. These soils have a wide range in available water storage capacity, texture, and depth, and are either Gleysolic or Organic.*

Hydraulic Conductivity *- Refers to the effective flow velocity or discharge velocity in soil at unit hydraulic gradient. It is an approximation of the permeability of the soil and is expressed in cm per hour. The classes are described in general or specific terms as:*

High	*>15*	*Very rapid*	*>50*
		Rapid	*15-50*
Medium	*0.5-15*	*Mod. rapid*	*5.0-15*
		Moderate	*1.5-5.0*
		Mod. slow	*0.5-1.5*
Low	*<0.5*	*Slow*	*0.15-0.5*
		Very slow	*0.015-0.15*
		Extremely slow	*<.015*

Hydraulic conductivity classes (cm/hr)

H	*High (>15)*
H1	*Rapid (>50)*
H2	*Very rapid (15-50)*
M	*Medium (0.5-15)*
M3	*Moderately rapid (5-15)*
M2	*Moderate (1.5-5)*
M1	*Moderate-slow (0.5-1.5)*
L	*Low (<0.5)*
L3	*Slow (0.15-0.5)*
L2	*Very slow (0.05-0.15)*
L1	*Extremely slow (<0.05)*

Permeability reduced

A1	*20-50 cm*
A2	*50-100cm*
A3	*100-150cm*
A4	*150-200cm*

Permeability increased

B1	*20-50cm*
B2	*50-100cm*
B3	*100-150cm*
B4	*150-200cm*

Saturated zone (Least and Greatest) Average Annual depth(cm)

M2	*Generally low*
H	*High*
L	*Low*
M1	*Medium to high*
M3	*Medium to low*
M	*Medium*
H2	*Moderately high*
L1	*Moderately low*
H1	*Very high*
L2	*Very low*

Duration

M	*Medium*
P	*Prolonged*
S	*Short*

Seepage *- is the flow of water through the soil.*

D	*Deleterious*
E	*Enriching*
N	*Neutral*

Man made modifiers

DD	*Ditched, major effect*
D	*Ditched, minor effect*
II	*Irrigated major*
I	*Irrigated minor*
MM	*Mole drained, major*
M	*Mole drained, minor*
X	*Raised water minor*
XX	*Raised water major*
RR	*Ridged listed major*
R	*Ridged listed minor*
SS	*Subsoiled major*
S	*Subsoiled minor*
TT	*Tube drained major*
T	*Tube drained minor*

8d. Erosion - The presence of erosion is recorded by noting the agent and amount of erosion that has occurred. Gully erosion is a subdivision of general water erosion. If erosion is not a factor in the soil described, leave blank.

S-value - Structure (surface horizon)

1	Very fine granular
2	Fine granular
3	Med-Coarse granular
4	Blocky,platy,massive
5	Organic surface

K-value - permeability (soil profile)

1	Rapid
2	Mod to rapid
3	Moderate
4	Slow to mod.
5	Slow
6	Very slow

Est. site size (ha)

8e. Soil temperature (°C)

Temperature @20cm
Temperature @50cm
Temperature @100cm

8f. Rooting depth(cm)

8g. Thickness(cm) Enter the total thickness of the following in centimetres.

A horizon Solum Organic deposit

REFERENCES

Agriculture Canada, 1987 Second Edition, The Canadian System of Soil Classification

Expert Committee on Soil Survey, 1982 Revised, The Canadian Soil Information System CanSIS), Manual for describing soil in the field.

ECSS Working Group on Soil Salinity, Revised January 1985, Guidelines and Criteria for describing, Classifying and Mapping of Saline Soils.

Expert Committee on Soil Survey, 1981, Soil Water Regime Classification, Proceeding of the 3rd Annual Meeting of ECSS.

The Canadian Wetland Classification System, Ecological Land Classification, Series No. 21, Lands Conservation Branch, Canadian Wildlife Services.

APPENDIX I - SOIL HORIZON DESIGNATIONS

ORGANIC HORIZONS

Organic horizons are found in Organic soils, and commonly at the surface of mineral soils. They may occur at any depth beneath the surface in buried soils, or overlying geologic deposits. They contain more than 17% organic carbon (approximately 30% organic matter) by weight. Two groups of these horizons are recognized, O horizons and the L, F, and H horizons.

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

Of The fibric horizon is the least decomposed of all the organic soil materials. It has large amounts of well- preserved fibre that are readily identifiable as to botanical origin. A fibric horizon has 40% or more of rubbed fibre by volume and a pyrophosphate index of 5 or more. If the rubbed fibre volume is 75% or more, the pyrophosphate criterion does not apply.

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

Oh The humic horizon is the most highly decomposed of the organic soil materials. It has the least amount of fibre, the highest bulk density, and the lowest saturated water-holding capacity. It is very stable and changes very little physically or chemically with time unless it is drained. The humic horizon has less than 10% rubbed fibre by volume and a pyrophosphate index of 3 or less.

LFH These organic horizons developed primarily from leaves, twigs, woody materials and a minor component of mosses under imperfectly to well drained forest conditions.

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

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

H This is an organic horizon characterized by an accumulation of decomposed organic matter in which the original structures are indiscernible. This material differs from the F horizon by its greater humification chiefly through the action of organisms. It is frequently intermixed with mineral grains, especially near the junction with the mineral horizon.

MASTER MINERAL HORIZONS

Mineral horizons are those that contain less than 30% organic matter by weight as specified for organic horizon.

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

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

2. horizons that have been eluviated of clay, iron, aluminium, or organic matter, or all of them (Ae);

3. horizons having characteristics of 1) and 2) above but transitional to underlying B or C (AB or A and B);

4. horizons markedly disturbed by cultivation or pasture (Ap).

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

1. an enrichment in silicate clay, iron, aluminum, or humus, alone or in combination (Bt,Bf,Bfh,Bhf, and Bh);

2. a prismatic or columnar structure that exhibits pronounced coatings or stainings and significant amount of exchangeable Na (Bn);

3. an alteration by hydrolysis, reduction, or oxidation to give a change in colour or structure from horizons above or below, or both, and does not meet the requirements of 1) and 2) above (Bm,Bg).

C This is a mineral horizon or horizons comparatively unaffected by the pedogenic processes operative in A and B, excepting (i) the process of gleying, and (ii) the accumulation of calcium and magnesium carbonates and more soluble salts (Cca,Csa,Cg, and C). Marl and diatomaceous earth are considered to be C horizons.

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

W This is a layer of water in Gleysolic, Organic, or Cryosolic soils. It is called a hydric layer in Organic soils.

LOWER-CASE SUFFIXES

b Buried soil horizon.

c A cemented (irreversible) pedogenic horizon. The ortstein of a Podzol, and a layer cemented by calcium carbonate and a duripan are examples.

ca A horizon with secondary carbonate enrichment where the concentration of lime exceeds that present in the unenriched parent material. It is more than 10 cm thick, and if it has a CaCO3 equivalent of less than 15 percent it should have at least 5 percent more CaCO3 equivalent than the parent material (IC). If it has more than 15 percent CaCO3 equivalent it should have 1/3 more CaCO3 equivalent than the IC. If no IC is present, this horizon is more than 10 cm thick and contains more than 5 percent by volume of secondary carbonates in concretions or soft, powdery forms.

cc Cemented (irreversible) pedogenic concretions.

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

f A horizon enriched with amorphous material, principally Al and Fe combined with organic matter. It usually has a hue of 7.5YR or redder or its hue is 10YR near the upper boundary and becomes yellower with depth. When moist, the chroma is higher than 3 or the value is 3 or less. It contains 0.6% or more pyrophosphate-extractable Al+Fe in textures finer than sand and 0.4% ore in sands (coarse sand, sand, fine sand, and very fine sand). The ratio of pyrophosphate-extractable Al+Fe to clay (less than 0.002mm) is more than 0.05 and organic C exceeds 0.5%. Pyrophosphate-extractable Fe is at least 0.3%, or the ratio of organic C to pyrophosphate-extractable Fe is less than 20, or both are true. It is used with B alone (Bf), with B and h (Bhf), with B and g (Bfg), and with other suffixes. The criteria for "f" do not apply to Bgf horizons. The following horizons are differentiated on the basis of organic carbon content: Bf - 0.5% to 5% organic carbon. Bhf-more than 5% organic carbon.

g A horizon characterized by grey colours, or prominent mottling, or both, indicative of permanent or periodic intense reduction. Chromas of the matrix are generally 1 or less. It is used with A and e (Aeg); with B alone (Bg); with B and f (Bfg); with B, h, and f (Bhfg); with B and t (Btg); with C alone (Cg); with C and k (Ckg); and several others. In some reddish parent materials, matrix colours of reddish hues and high chromas may persist despite long periods of reduction. In these soils, horizons are designated as g if there is grey mottling or if there is marked bleaching on ped faces or along cracks.

Aeg This horizon must meet the definitions of A,e, and g.

Bg These horizons are analogous to Bm horizons but they have colours indicative of poor drainage and periodic reduction. They include horizons occurring between A and C horizons in which the main features are (i) colours of low chroma, that is: chromas of 1 or less, without mottles on ped surfaces or in the matrix if peds are lacking; or chromas of 2 or less in hues of 10YR or redder, on ped surfaces or in the matrix if peds are lacking, accompanied by more prominent mottles than those in the C horizon; or hues bluer than 10Y, with or without mottles on ped surfaces or in the matrix if peds are lacking. (ii) colours indicated in (i) and a change in structure from that of the C horizons. (iii) colour indicated in (i) and illuviation of clay too slight to meet the requirements of Bt; or accumulation or iron oxide too slight to meet the limits of Bgf. (iv) colours indicated in (i) and removal of carbonates. Bg horizons occur in some Orthic Humic Gleysols and some Orthic Gleysols.

Bfg, Bhfg, Btg, and others. When used in any of these combinations the limits set for f, hf, t, and others must be met.

Bgf The dithionite-extractable Fe of this horizon exceeds that of the IC by 1% or more. Pyrophosphate-extractable Al + Fe is less than the minimum limit specified for 'f' horizons. This horizon occurs in Fera Gleysols and Fera Humic Gleysols, and possibly below the Bfg of gleyed Podzols. It is distinguished from the Bfg of gleyed Podzols on the basis of the extractability of the Fe and Al. The Fe in the Bgf horizon is thought to have accumulated as a result of the oxidation of ferrous iron. The iron oxide formed is not associated intimately with organic matter or with Al, and it is sometimes crystalline. The Bgf horizons are usually prominently mottled, with more than half of the soil material occurring as mottles of high chroma.

Cg Ckg, Ccag, Csg, Csag. When g is used with C alone, or with C and one of the lowercase suffixes k, ca, s, or sa, it must meet the definition for C and for the particular suffix.

h A horizon enriched with organic matter. It is used with A alone (Ah); or with A and e (Ahe); or with B alone (Bh); or with B and f (Bhf).

Ah A horizon enriched with organic matter that either has a colour value at least one unit lower than the underlying horizon or contains 0.5% more organic carbon than the IC, or both. It contains less than 17% organic carbon by weight.

Ahe An Ah horizon that has undergone eluviation as evidenced, under natural conditions, by streaks and splotches of differing shades of grey and often by platy structure. It may be overlain by a darker-coloured Ah and underlain by a lighter colored Ae.

Bh This horizon contains more than 1% organic carbon, less than 0.3% pyrophosphate-extractable Fe, and has a ratio of organic carbon to pyrophosphate-extractable Fe of 20 or more. Generally the colour value and chroma are less than 3 when moist.

Bhf Defined under 'f'.

j Used as a modifier of the suffixes e, f, g, n, and t to denote an expression of, but failure to meet, the specified limits of the suffix it modifies. It must be placed to the right and adjacent to the suffix it modifies. For example Bfgj means a Bf horizon with weak expression of gleying; Bfjgj means a B horizon with weak expression of both 'f' and 'g' features.

Aej It denotes an eluvial horizon that is thin, discontinuous or slightly discernible.

Btj It is a horizon with some illuviation of clay, but not enough to meet the limits of Bt.

Btgj, Bmgj, Horizons that are mottled but do not meet the criteria of Bg.

Bfj It is a horizon with some accumulation of pyrophosphate-extractable Al and Fe but not enough to meet the limits of Bf.

Bntj or Bnj. Horizons in which development of solonetzic B properties is evident but insufficient to meet the limits for Bn or Bnt.

k Denotes the presence of carbonate, as indicated by visible effervescence when dilute HCl is added. Most often it is used with B and m (Bmk) or C (Ck), and occasionally with Ah or Ap (Ahk, Apk), or organic horizons (Ofk, Omk).

m A horizon slightly altered by hydrolysis, oxidation, or solution, or all three, to give a change in colour or structure, or both. It has:

1. Evidence of alteration in one of the following forms:

   a) Higher chromas and redder hues than the underlying horizons.

   b) Removal of carbonates, either partially (Bmk) or completely (Bm).

2. Illuviation, if evident, too slight to meet the requirements of a Bt or a podzolic B.

3. Some weatherable minerals.

4. No cementation or induration and lacks a brittle consistence when moist. This suffix can be used as Bm, Bmgj, Bmk, and Bms.

n A horizon in which the ratio of exchangeable Ca to exchangeable Na is 10 or less. It must also have the following distinctive morphological characteristics: prismatic or columnar structure, dark coatings on ped surfaces, and hard to very hard consistence when dry. It is used with B, as Bn or Bnt.

p A horizon disturbed by man's activities, such as cultivation, logging, habitation, etc. It is used with A and O.

s A horizon with salts, including gypsum, which may be detected as crystals or veins, as surface crusts of salt crystals, by depressed crop growth, or by the presence of salt-tolerant plants. It is commonly used with C and k (Csk), but can be used with any horizon or combination of horizon and lowercase suffix.

sa A horizon with secondary enrichment of salts more soluble than calcium and magnesium carbonates, in which the concentration of salts exceeds that present in the unenriched parent material. The horizon is 10 cm or more thick. The conductivity of the saturation extract must be at least 4 ms/cm and must exceed that of the C horizon by at least one-third.

t An illuvial horizon enriched with silicate clay. It is used with B alone (Bt), with B and g (Btg), with B and n (Bnt), etc.

Bt A Bt horizon is one that contains illuvial layer-lattice clays. It forms below an eluvial horizon, but may occur at the surface of a soil that has been partially truncated. It usually has a higher ratio of fine clay to total clay than IC. It has the following properties:

1. If any part of an eluvial horizon remains and there is no lithologic discontinuity between it and the Bt horizon, the Bt horizon contains more total and fine clay than the eluvial horizons, as follows:

    a) If any part of the eluvial horizon has less than 15% total clay in the fine earth fraction (2mm) the Bt horizon must contain at least 3% more clay, e.g.,Ae 10% clay-Bt minimum 13% clay.

    b) If the eluvial horizon has more than 15% and less than 40% total clay in the fine earth fraction, the ratio of the clay in the Bt horizon to that in the eluvial horizon must be 1.2 or more, e.g., 20% clay increase in the Bt over Ae.

    c) If the eluvial horizon has more than 40% total clay in the fine earth fraction, the Bt horizon must contain at least 8% more clay than the eluvial horizon, e.g. Ae 50% clay; Bt at least 58% clay.

2. A Bt horizon must be at least 5 cm thick. In some sandy soils where clay accumulation occurs in the lamellae, the total thickness of the lamellae should be more than 10 cm in the upper 150 cm of the profile.

3. In massive soils the Bt horizon should have oriented clays in some pores and also as bridges between the sand grains.

4. If peds are present, a Bt horizon shows clay skins on some of the vertical and horizontal ped surfaces and in the fine pores, or shows oriented clays in 1% or more of the cross section, as viewed in thin section.

5. If a soil shows a lithologic discontinuity between the eluvial horizon and the Bt horizon, or if only a plow layer overlies the Bt horizon, the Bt horizon need show only clay skins in some part, either in some fine pores or on some vertical and horizontal ped surfaces. Thin sections should show that some part of the horizon has about 1% or more of oriented clay bodies.

Btj,Btj, and Btg are defined under j and g.

u A horizon that is markedly disrupted by physical or faunal processes other than cryoturbation. Evidence of marked disruption such as the inclusion of material from other horizons, absence of the horizon, etc. must be evident in at least half of the cross section of the pedon. Such turbation can result from blowdown of trees, mass movement of soil on slopes, and burrowing animals. It can be used with any horizon or subhorizon with the exception of A or B alone; e.g. Aeu, Bfu, BCu.

x A horizon of fragipan character. A fragipan is a loamy subsurface horizon of high bulk density and very low organic matter content. When dry, it has a hard consistence and seems to be cemented. When moist, it has moderate to weak brittleness. It frequently has bleached fracture planes and is overlain by a friable B horizon. Air dry clods of fragic horizons slake in water.

y A horizon affected by cryoturbation as manifested by disrupted and broken horizons, incorporation of materials from other horizons and mechanical sorting in at least half of the cross section of the pedon. It is used with A, B, and C alone or in combination with other subscripts, e.g. Ahy, Ahgy, Bmy, Cy, Cgy, Cygj, etc.

z A frozen layer. It may be used with any horizon or layer, e.g. Ohz, Bmz, Cz, Wz.

APPENDIX II - SUMMARY OF CARD TYPE CODES

CARD TYPE 01

1f. Series Variant
T Texture
C Classification
F Parent Material
R Depth < 20cm
K Climate
X > 1 Variant

1k. Photo
1 Landscape
2 Profile
3 Both

1l. Characterization Studies - Types
1 Soil Temperature
2 Wells
3 Soil Physical Prop.
4 Temperature & Wells
5 Vegetation
6 Salinity
7 _____
8 _____

CARD TYPE 02

2a. Special notes (free format)
Use back page for more space

CARD TYPE 03

3a. Land Use
01 Builtup areas
02 Mines, quarries
03 Outdoor recreation
04 Horticulture
05 Cropland
06 Improved pasture/forage
07 Natural grazing
08 Woodland grazing
09 Abandoned farmland
10 Productive woodland
11 Unproductive woodland
12 Swamp
13 Marsh
14 Bog
15 Fen
16 Sand
17 Rockland
18 Rough,broken,eroded
19 Rubble land
21 Arctic tundra
22 Cryoturbated land

3b. Landform Classification

Mineral
101 Apron
102 Blanket
103 Fan
104 Hummocky
105 Level
106 Pitted
107 Ridged
108 Rolling
109 Terrace
110 Undulating
111 Veneer
112 Inclined
113 Steep

Organic
201 Palsa bog
202 Peat mound bog
203 Mound bog
204 Domed bog
205 Polygonal Peat plateau
206 Lowland polygonal bog
207 Peat plateau bog
208 Northern plateau bog
209 Collapse scar bog
210 Floating bog
211 Shore bog
212 Basin bog
213 Flat bog
214 String bog
215 Blanket bog
216 Bowl bog
217 Sloping bog
218 Veneer bog
219 Northern ribbed fen
220 Ladder fen
221 Net fen
222 Floating fen
223 Stream fen
224 Shore fen
225 Collapse fen
226 Palsa fen
227 Spring fen
228 Sloping fen
229 Lowland polygonal fen
230 Horizontal fen
231 Channel fen
232 Stream swamp
233 Shore swamp
234 Peat margin swamp
235 Basin swamp
236 Flat swamp
237 Spring swamp

Marsh
330 Estuarine high
331 Estuarine low
332 Coastal high
333 Coastal low
334 Floodplain
335 Stream
336 Channel
337 Active delta
338 Inactive delta
339 Terminal basin
340 Shallow basin
341 Kettle
342 Seepage track
343 Shore

Shallow Water
440 Stream
441 Channel
442 Oxbow
443 Delta
444 Terminal basin
445 Shallow basin
446 Kettle
447 Shore
448 Nontidal
449 Estuarine
450 Tidal

Landform Modifier
1 Bevelled
2 Cryoturbated
3 Eroded
4 Failing
5 Kettled
6 Karst mod.
7 Soliflucted
8 Washed

3c. Rockiness
(% of surface occupied)
0 Nonrocky (< 2%)
1 Slightly rocky (2-10%)
2 Mod. rocky (10-25%)
3 Very rocky (25-50%)
4 Exceedingly (50-90%)
5 Execessively (>90%)

3d. Erosion

Water/Wind
0 Noneroded
1 Slight
2 Moderate
3 Severe
4 Overwash
5 Overblown

3e. Slope

S Simple slope
C Complex slope

Class

A 0-0.5%
B 0.5-2%
C 2-5%
D 5-9%
E 9-15%
F 15-30%
G 30-45%
H 45-70%
I 70-100%
J >100%

Position

C Crest
U Upper
M Middle
L Lower
T Toe
D Depression

Aspect

N	North
NE	Northeast
E	East
SE	Southeast
S	South
SW	Southwest
W	West
NW	Northwest
L	Level

3f. Microrelief

1 Plane
2 Convex
3 Concave
4 Microridge
5 Hummocky
6 Undulating
7 Other

3g. Stoniness(size 25-60cm)

(% of surface covered)

0 Nonstony (<0.01)
1 Slightly stony (0.01-0.1%)
2 Moderately stony (0.1-3%)
3 Very stony (3-15%)
4 Exceedingly stony (15-50%)
5 Excessively stony (>50%)

3h. Cobbliness(size 7.5-25cm)

(% of surface covered)

0 Noncobbly (<0.01)
1 Slightly cobbly (0.01-0.1%)
2 Moderately cobbly (0.1-3%)
3 Very cobbly (3-15%)
4 Exceedingly cobbly (15-50%)
5 Excessively cobbly (>50%)

3i. Salinity

1 Nonsaline (0-2mS/cm)
2 Slightly Saline (2-4mS/cm)
3 Weakly saline (4-8mS/cm)
4 Moderately saline (8-15mS/cm)
5 Strongly saline(>15mS/cm)

3j. Soil taxonomy

Order B = BRUNISOLIC

Subgroups

OEB	GLSB
EEB	ODYB
GLEB	EDYB
GLEEB	DUDYB
OSB	GLDYB
ESB	GLEDYB

Order C = CHERNOZEMIC

Subgroups

OBL	GLSZBL
RBL	ODG
CABL	RDG
EBL	CADG
SZBL	SZDG
GLBL	GLDG
GLRBL	GLRDG
GLCABL	GLCADG
GLEBL	GLSZDG

Order G = GLEYSOLIC

Subgroups

OHG	FEG
RHG	OLG
FEHG	HULG
OG	FELG
RG	

Order L = LUVISOLIC

Subgroups

OGL	GLGL
DGL	GLDGL
BRGL	GLBRGL
SZGL	GLSZGL

Order O = ORGANIC

Subgroups

TYF	THUM
MEF	LMM
HUF	CUM
TF	HUM
TMEF	TYH
THUF	FIH
LMF	MEH
CUF	TH
TYM	TFIH
FIM	TMEH
HUM	LMH
TM	CUH
TFIM	TYFO

Order R = REGOSOLIC

Subgroups

OR	OHR
CUR	CUHR
GLR	GLHR
GLCUR	GLCUHR

Order S = SOLONETZIC

Subgroups

BLSZ	GLGSS
GLBLSZ	GSS
GLBLSS	GSO
GLDGSS	

Order Z = CRYOSOLIC

Subgroups

OTC	FIOC
BRTC	MEOC
RTC	HUOC
GLTC	TFIOC
OSC	TMEOC
BRSC	THUOC
RSC	GCOC
GLSC	

3k. Soil phases

' ' Absent
'-' Present

3l. Vegetation

General vegetation

01 Crops-fields (managed)
02 Crops-hort (managed)
03 Grasses and forbes
04 Grasses,forbes and shrubs
05 Tall shrubs
06 Low shrubs
07 Forest, unspec.
08 Forest, softwood
09 Forest, hardwood
10 Forest, mixed
11 None,(or nearly barren)
12 Heath
13 Arctic willow
14 Krummholz
15 Rush
16 Sedge
17 Moss
18 Lichen
19 Floating aquatic
20 Submerged aquatic

Vegetation modifier

01 Cropped
02 Summerfallow
03 Clear-cut
04 Select-cut
05 Burnt
06 Plantation
07 Regenerating
08 Mature
09 Overmature
10 Undisturbed
11 Inundated
12 Overgrazed
13 Immature

CARD TYPE 04

4a. Parent materials

Physical component

UD	Undifferentiated
FR	Fragmental
SK	Skeletal
CL	Coarse, loamy and silty
FL	Fine, loamy and silty
CY	Clayey
SM	Stratified (mineral)
SU	Stratified (mineral & organic)
SY	Sandy
OG	Organic
LY	Loamy
SO	Stratified (organic)
WY	Woody
FI	Fibric
ME	Mesic
HU	Humic
RK	Bedrock

4b. Chemical composition

UD	Undifferentiated
EA	Extremely to strongly acidic
AN	Medium acidic to neutral
WC	Weakly calcareous
VC	Moderate to very calcareous
EC	Extremely calcareous
SA	Saline

4c. Mode of deposition

F	Fluvial
C	Colluvial
E	Eolian
FL	Fluviolacustrine
GF	Glaciofluvial
GL	Glaciolacustrine
L	Lacustrine
LT	Lacustro till
M	Marine
T	Morainal till
O	Organic
B	Bog
FN	Fen
SW	Swamp
R	Residual

4d. Material modifier

UD	Undifferentiated
MX	Mixed
IG	Igneous
SH	Shale
SS	Sandstone
MC	Marl and Chalk
LS	Limestone
DM	Dolomite
MM	Metamorphic
OU	Organic, undiff.
SP	Sphagnum peat
FO	Forest peat
FN	Fen peat
AQ	Aquatic peat

4e. Water status

1 Origin of water
2 Associated water body
3 Both associated water body and origin

4f. Climate station

4g. Relevance of climate station

1 Very good
2 Good
3 Moderate
4 Poor

CARD TYPE 05

5a. Horizon number

5b. Horizon designation

5c. Depths

5d. Range

5e. Horizon Boundaries

Distinctness

D	Diffuse
G	Gradual
C	Clear
A	Abrupt

Form

S	Smooth
W	Wavy
I	Irregular
B	Broken

5f. Texture Modifier

GR	Gravelly
VG	Very Gravelly
MU	Mucky
GY	Gritty
AY	Ashy
WY	Woody
TX	Thixotropic

5g. Texture

VCS	L
CS	SIL
LCS	SCL
S	SICL
FS	CL
LS	SC
LFS	SIC
VFS	C
LVFS	HC
CSL	O
SL	F
FSL	M
VFSL	H
Si	

Organic texture

F1	Non decomposed
F2	Very Sl.decomposed
F3	Slightly decomposed
M1	Mod. decomposed
M2	Mod.-strongly decomp.
H1	Strongly decomposed
H2	Very strongly decomp.

5h. Structure

Grade

SL	Structureless
VW	Very weak
W	Weak
WM	Weak to Moderate
M	Moderate
MS	Mod. to strong
S	Strong

Class

VF	Very fine
FF	Very fine to fine
F	Fine
FM	Fine to Medium
M	Medium
MC	Medium to Coarse
C	Coarse
VC	Very coarse

Kind

PL	Platy
PR	Prismatic
CO	Columnar
AB	Angular Blocky
SB	Subangular Blocky
GR	Granular
MA	Massive
SG	Single Grained
CL	Cloddy
FI	Fibered
MT	Matted
LA	Layered

Kind Modifier

PS	Pseudo
ST	Stratified
BD	Bedded
LM	Laminated

5i. Structure (use codes in 5h.)

5j. Profile Moisture Condition

D	Dry
M	Moist
W	Wet
U	Unspecified

5k. Effervescence

N	Noneffervescent
V	Very weak
W	Weak
M	Moderate
S	Strong

5l. Calcareousness

N	Noncalcareous
W	Weakly
M	Moderate
S	Strong
V	Very strong
E	Extremely

5m. Field pH

Class

EA	Extremely acid (< 4.5)
VS	Very strongly acid (4.6-5.0)
ST	Strongly acid (5.1-5.5)
MA	Medium acid (5.6-6.0)
SLS	lightly acid (6.1-6.5)
NA	Neutral (6.6-7.3)
ML	Mildly alkaline (7.4-7.8)
MD	Moderately alkaline(7.9-8.4)
SA	Strongly alkaline (>8.5)

Method

1	Hellige-Truog
2	pHydrion
3	pH meter

5n. Consistence

Wet

N	Nonsticky
S	Slightly Sticky
T	Sticky
V	Very sticky

Moist

LO	Loose
VF	Very friable
FB	Friable
FR	Firm
VM	Very firm

Dry

LO	Loose
SO	Soft
SH	Sl. hard
HD	Hard
VH	Very hard
EH	Ext. hard
RG	Rigid

Plasticity

N	Nonplastic
S	Slightly plastic
P	Plastic
V	Very plastic

5o. Coarse fragments

Type

GR	Gravelly
AG	Angular gravelly
CH	Cherty
CN	Channery
SL	Slaty
SH	Shaly
CB	Cobbly
AC	Angular cobbly
CC	Coarse Cherty
FG	Flaggy
ST	Stony

CARD TYPE 06

6a. Horizon number

6b. Color1 -see Munsel chart

6c. Color2 -see Munsel chart

Aspect Codes(color)

01	Matrix moist
02	Matrix dry
03	Exped moist
04	Exped dry
05	Inped moist
06	Inped dry
07	Crushed moist
08	Crushed dry
09	Natural wet/reduced
10	Natural wet/oxidized
11	Pressed wet/reduced
12	Pressed wet/oxidized
13	Rubbed wet/oxidized
14	Rubbed dry
15	Clay film moist
16	Clay film dry
17	Nodules moist
18	Mottle moist

6d,e. Mottles 1,2

Abundance

F	Few
C	Common
M	Many

Size

F	Fine
M	Medium
C	Coarse

Contrast

F	Faint
D	Distinct
P	Prominent

6f. Concretions

Kind

G	Gypsum
L	Lime
I	Iron-Manganese
W	Worm cast
P	Pedotubule
S	Salt
O	Others

Abundance

F	Few (<2%)
C	Common (2-20%)
M	Many (>20%)

Size(mm)

F	Fine (<5)
M	Medium
C	Coarse (>15)

Distribution

C	Channel
L	Localized
M	Thru matrix

Shape

S	Spherical
O	Oblong
I	Irregular
P	Plate-like

6g. Clay Films

Frequency

F	Few
C	Common
M	Many
S	Continuous

Thickness

VT	Very thin
TH	Thin
MT	Mod. thick
TK	Thick
VK	Very thick

Location

VC	Voids & Channels
PF	Ped faces
VP	Some voids
PV	All voids
BR	Visible bridges

6h. Roots

Abundance

V	Very few
F	Few
P	Plentiful
A	Abundant

Size(mm)

U	Micro
V	Very fine
F	Fine
M	Medium
C	Coarse

Orientation
V Vertical
H Horizontal
O Oblique
R Random
Distribution
I Inped
E Exped
B Both

6i. Porosity
General
S Slightly porous (<40% pore spaces)
M Moderately porous (40-60% pore spaces)
H Highly porous (>60% pore spaces)
Type
V Vesicular
I Interstitial
T Tubular
Abundance
V Very few
F Few
C Common
M Many
Size
U Micro
V Very fine
F Fine
M Medium
C Coarse
Orientation
V Vertical
H Horizontal
O Oblique
R Random
Distribution
I Inped
E Exped
B Both
Continuity
C Continuous
D Discontinuous
Morphology
S Simple
D Dendritic
C Closed

6j. Von post
(See manual for explanation)
01 Living moss layer
02 Peat not living
03 Plant material distinguishable
04 Plant material not distinguishable
05 Plant material reaching stage of decomposition
06 Plant material has decomposed
07 Original plant material is practically undistinguishable
08 Only distinguishable plant remains are roots
09 Very homogenous, amorphous sample
10 Very rare to non-existent in sedimentary peat

6k. Ice characteristics
'-' Present
' ' Absent

CARD TYPE 07

7a. Horizon number

7b,c. Color3 and color4
(See Munsel chart)

7d. Rubbed fibre (%)

7e. Botanical Composition (%)

7f. Wood
Diameter(cm)

Hardness
1 Hard
2 Soft
3 Very soft

7g. Limnic material
1 Marl
2 Coprogenous
3 Diatamaceous

7h. C14
'-' Sampled for C14
' ' Not sampled

CARD TYPE 08

8a. Depths to (m)
Bedrock
Water table
Impermeable Layer
Frost

8b. Thaw layer (m)

8c. Soil drainage parameters (SWIG)
Soil drainage
VR Very rapid
R Rapid
W Well
MW Moderately well
I Imperfect
P Poor
VP Very poor
Hydraulic conductivity (cm/hr)
H High (15)
H1 Rapid (>50)
H2 Very rapid (15-50)
M Medium (0.5-15)
M3 Moderately rapid (5-15)
M2 Moderate (1.5-5)
M1 Moderate-slow (0.5-1.5)
L Low (<0.5)
L3 Slow (0.15-0.5)
L2 Very slow (0.05-0.15)
L1 Extremely slow (<0.05)
Permeability reduced
A1 20-50 cm
A2 50-100cm
A3 100-150cm
A4 150-200cm
Permeability increased
B1 20-50cm
B2 50-100cm
B3 100-150cm
B4 150-200cm
Saturated zone (Least and Greatest)
Average Annual depth(cm)
M2 Generally low
H High
L Low
M1 Medium to high
M3 Medium to low
M Medium
H2 Moderately high
L1 Moderately low
H1 Very high
L2 Very low

Duration Least depth
M Medium
P Prolonged
S Short
Seepage
D Deleterious
E Enriching
N Neutral
Man made modifiers
DD Ditched, major effect
D Ditched, minor effect
II Irrigated major
I Irrigated minor
MM Mole drained, major
M Mole drained, minor
X Raised water minor
XX Raised water major
RR Ridged listed major
R Ridged listed minor
SS Subsoiled major

S	Subsoiled minor
TT	Tube drained major
T	Tube drained minor

8d. Erosion

S-value

1	Very fine granular
2	Fine granular
3	Med-Coarse granular
4	Blocky,platy,massive
5	Organic surface

K-value

1	Rapid
2	Mod to rapid
3	Moderate
4	Slow to mod.
5	Slow
6	Very slow

Est. site size (ha)

8e. Soil temperature (°C)

Temperature @20cm
Temperature @50cm
Temperature @100cm

8f. Rooting depth(cm)

8g. Thickness(cm)

A horizon
Solum
Organic deposit

APPENDIX III - DETAIL3 FIELD INPUT FORM

APPENDIX IV - ANALYTICAL (LABORATORY) FORM

APPENDIX V - PROFILE GENERATED OUTPUT

CANADA MANITOBA SOIL SURVEY UNIT - Detail Site Database Date Printed: 05/28/97

PROJECT: NCY YEAR: 1992 SURVEYOR: GM SITE: 12 SERIES: WWD VARIANT: c NAME: Wellwood

SOIL CLASSIFICATION ORDER: Chernozemic SUBGROUP: EBL

LOCATION: DLS: SE 33 TP: 11 RGE: 14 W UTM: 14U ML
NTS MAP AREA: 62J MUNICIPALITY:

VEGETATION GENERAL: Crops-fields (managed) MODIFIER: Cropped

LAND USE: Cropland LANDFORM: ELEVATION (m):

SOIL SITE
SOIL MODIFIERS ROCKINESS : WATER EROSION: SALINITY: Nonsaline (0-2mS/cm)
STONINESS : Nonstony (<0.01) WIND EROSION:
COBBLINESS: Noncobbly (<0.01)

SLOPE 0.5% Complex CLASS: B (.5-2%) ASPECT: Northwest POSITION: MICRORELIEF:

EROSION S-VALUE: Med-Coarse granular K-VALUE: Moderate EST. SIZE(ha):

SOIL MOISTURE REGIME DRAINAGE: Well HYD. COND. CLASS (cm/hr): Moderate (1.5-5)
PERMEABILITY-REDUCED: PERMEABILITY-INCREASED: B3 100-150cm
SATURATED ZONE LEAST: GREATEST:
DURATION AT LEAST DEPTH:
SEEPAGE: DRAINAGE MODIFIER:

PARENT MATERIAL I Fine,loamy and silty, Moderate to very calcareous, Lacustrine, Mixed
II Sandy, Moderate to very calcareous, Lacustrine,Mixed

DEPTH TO BEDROCK (m): DEPTH TO IMPERMEABLE LAYER (m):
DEPTH TO WATERTABLE (m): ROOTING DEPTH (cm): 90
DEPTH TO FROST (m): THICKNESS OF THAW LAYER (m):

SOLUM THICKNESS:A Horizon (cm): 25 Solum (cm): 80 Organic Deposit (cm):

SOIL TEMP.(oC): At 20 cm: 6. At 50 cm: 7.0 At 100 cm:

SAMPLING DATE (MONTH/DAY/YEAR): 10/01/92

SPECIAL NOTES: GOOD SITE FOR SOIL MOISTURE STUDY. SAMPLED TO VERIFY SOIL DEVELOPMENT OF LEACHED PROFILES IN STRATIFIED WELLWOOD MATERIALS.

CHARACTERIZATION STUDIES:

CANADA MANITOBA SOIL SURVEY UNIT - Detail Site Database Date Printed: 05/28/97

PROJECT: NCY YEAR: 1992 SURVEYOR: GM SITE: 12 SERIES: WWD VARIANT: c NAME: Wellwood

SOIL MORPHOLOGY - TABLE 1

HORIZON	DEPTH (cm)	COLOUR Aspect 1 Value1 Aspect2 Value2	TEXTURE Class Modifier	PRIMARY SOIL STRUCTURE Grade Class Kind	SECONDARY SOIL STRUCTURE Grade Class Kind	MOTTLES Abundance Size Contrast Colour	CALCAREOUS CLASS	PH CLASS
Ap	0 to 15	Matrix moist 10.0YR2010	L	Moderate Fine to Medium Granular			Noncalc.	
Ahe	15 to 25	Matrix moist 10.0YR3030 Matrix moist 10.0TR3020	L	Moderate Fine Granular			Noncalc.	
Bt1	25 to 40	Matrix moist 10.0TR3020	CL	Moderate Medium to Coarse Angular blocky	Moderate Fine Granular		Noncalc.	
Bt2	40 to 80	Matrix moist 10.0YR4020	C	Moderate Medium Prismatic	Moderate Fine Angular blocky		Noncalc.	
Ck	80 to 10	Matrix moist 10.0YR4030 Matrix moist 10.0TR5030	SICL	Moderate Medium Angular blocky			Moderate	
2Ck	105 to 15	Matrix moist 10.0YR6030	VFS	Structureless Single grained			Weakly	

CANADA MANITOBA SOIL SURVEY UNIT - Detail Site Database Date Printed: 05/28/97

PROJECT: NCY YEAR: 1992 SURVEYOR: GM SITE: 12 SERIES: WWD VARIANT: c NAME: Wellwood

SOIL MORPHOLOGY - TABLE 2

HORIZON	DEPTH (cm)	CONSISTENCE Dry / Moist / Wet / Plastic	ROOTS Abundance / Size / Orientation / Distribution	PORES Abundance / Size / Orientation / Distribution	BOTANICAL COMPOSITION % Type	WOOD Diameter (cm) / Hardness	COARSE FRAGMENTS % Vol. Type	HORIZON BOUNDARY Distinct / Form
Ap	0 to 15	Slightly Friable / Sl. plastic	Abundant / Fine / Random / Inped	Many / Fine / Random / Exped				Abrupt Smooth
Ahe	15 to 25	Slightly Friable / Sl. plastic	Plentiful / Fine / Random / Inped	Common / Very fine / Random / Exped				Abrupt Wavy
Bt1	25 to 40	Hard Firm / Plastic	Few / Very fine / Vertical / Inped	Common / Fine / Vertical / Inped				Clear Smooth
Bt2	40 to 80	Hard Very firm / Plastic	Few / Very fine / Vertical / Exped	Common / Fine / Vertical / Inped				Abrupt Smooth
Ck	80 to 10	Hard Firm / Plastic		Common / Fine / Horizontal / Exped				Abrupt Smooth
2Ck	105 to 15	Loose Loose / Nonplastic						

CANADA MANITOBA SOIL SURVEY UNIT - Detail Site Database Date Printed: 05/28/97

PROJECT: NCY YEAR: 1992 SURVEYOR: GM SITE: 12 SERIES: WWD VARIANT: c NAME: Wellwood

SOIL ANALYSIS - CHEMICAL DATA

HORIZON	DEPTH (cm)	PH 0.01M CaC12	COND. ms/cm	CaCO3 EQUIV %	CAL-CITE %	DOLO-MITE %	ORG. C %	TOTAL N %	EXCH. CAP me/100g	EXTRACTABLE CATIONS m.e./100 gm. soil Ca	Mg	K	Na	H	FIBRE CONTENT UNRUBBED/RUBBED %	%	PYROPHOS EXTRACT. CARBON%	ASH %
Ap	0 to 15	5.4	1.2	.0	.0	.0	3.73		32.0	15.9	4.8	1.0	.4	10.6				
Ahe	15 to 25	6.5	1.2	.0	.0	.0	1.47		30.2	16.7	6.8	1.1	.5	5.0				
Bt1	25 to 40	6.9	0.7	.0	.0	.0	1.38		25.7	14.6	7.0	0.3	.1	4.4				
Bt2	40 to 80	6.8	0.5	.0	.0	.0	0.79		31.7	16.8	10.4	0.6	.2	4.4				
Ck	80 to 10	7.9	0.6	15.3	9.5	5.3	0.48		20.5	22.9	10.3	0.5	.3	.0				
2Ck	105 to 15	7.9	0.3	7.5	3.5	3.7	0.13		6.4	12.0	3.9	0.4	.1	.0				

SOIL ANALYSIS - PHYSICAL DATA

HORIZON	DEPTH (cm)	COARSE FRAG. >2mm %	PARTICLE SIZE ANALYSIS V.C. SAND %	CO. SAND %	MED. SAND %	FINE SAND %	V.F. SAND %	TOT. SAND %	TOT. SILT %	TOT CLAY %	TEXT CLASS	WATER RETENTION (%) 1/10 ATM.	1/3 ATM.	1/2 ATM.	3/4 ATM.	1 ATM.	15 ATM	BULK DENSITY (g/cm3)	FIELD MOISTURE CAPACITY %
Ap	0 to 15		0	0	1	17	21	39	35	26	L						12.8		
Ahe	15 to 25		0	0	0	4	13	17	50	33	SICL						11.7		
Bt1	25 to 40	100	0	0	0	5	13	18	49	33	SICL						11.9		
Bt2	40 to 80		0	0	0	3	9	12	44	44	SICL						14.0		
Ck	80 to 10	100	0	0	0	3	5	8	51	41	SIC						12.7		
2Ck	105 to 15		0	0	1	36	42	79	12	9	LFS						3.7		

SOIL ANALYSIS - ENGINEERING DATA

HORIZON	DEPTH (cm)	ATTERBURG LIMITS PLASTIC %	LIQUID %	SHRINKAGE MOISTURE LIMIT %	SHRINK -AGE %	ENGINEERING CLASSIFICATION AASHO Class	Indx	UNIFIED	%WATER SAT PASTE	WATER EXTRACT DETERMINATIONS me/litre Ca	Mg	Na	K	HCO3	Cl	SO4
Ap	0 to 15								51.2							
Ahe	15 to 25								51.4							
Bt1	25 to 40	23.0	39.0	16.0	18	A6	10	CL	48.4							
Bt2	40 to 80								52.2							
Ck	80 to 10	23.0	45.0	10.0	22	7-6	14	CL	51.4							
2Ck	105 to 15								33.5							

APPENDIX VI - DATA FILE STRUCTURES

SITE DATABASE FILE STRUCTURE

Field Name	Field Type	Original Width	Extended Width	Card type Reference	Field Description
PROJECT	C	4	4	1a	Project
YEAR	C	2	2	1b	Year
SURV	C	2	2	1c	Surveyor
SITENUM	C	3	3	1d	Sitenum or Profile I.D.
SOIL_CODE	C	3	3	1e	Soil Series code
VAR	C	1	1	1f	Soil Series variant
SOILNAME			15		Soil series name
MONTH	C	2	2	1g	Month
DAY	C	2	2	1g	Day of the month
ZONE	C	2	2	1h	Zone number
ALPHA	C	1	1	1h	Alpha letter
K100METER	C	2	2	1h	100,000m quadrangle
EASTING	C	5	5	1h	Easting
NORTHING	C	5	5	1h	Northing
NTSMAP	C	3	3	1i	National Topographic Map System - Primary quadrangle
NO_DIV	C	2	2	1i	Numerical divisions
QTRSECT	C	2	2	1i	Quarter Section
SECTION	C	2	2	1i	Section Number
TWP	C	3	3	1i	Township
RGE	C	2	2	1i	Range or Concession
MOD	C	1	1	1i	Range Modifier
HEADING	C	1	1	1i	Heading
MER	C	1	1	1i	Meridian
MUNC_CODE	C	3	3	1i	Municipal Code
ELEVATION	C	4	4	1j	Site Elevation
PHOTO	C	1	9	1k	Photo
TYPE1	C	1	20	1k	First types (landscape, profile, or both)
SITE_ID1	C	5	5	1l	Site ID - Characterization Studies
TYPE2	C	1	20	1l	Second type
SITE_ID2	C	5	5	1l	Site ID - Characterization Studies
TYPE3	C	1	20	1l	Third type
SITE_ID3	C	5	5	1l	Site ID - Characterization Studies
LANDUSE	C	2	23	3a	Landuse
LANDFORM	C	3	20	3b	Landform Classification
LANDMOD	C	1	12	3b	Landform Modifier
ROCKINESS	C	1	22	3c	Rockiness
ERO_WATER	C	1	9	3d	Erosion - Water
ERO_WIND	C	1	9	3d	Erosion - Wind
SLOPETYPE	C	1	7	3e	Slope Type
SLOPECLAS	C	1	10	3e	Slope Class
SLOPEPERC	C	4	4	3e	Slope Percent
SLOPELENG	C	4	4	3e	Slope Length
SLOPEPOSI	C	1	10	3e	Slope position
SLOPEASPE	C	2	9	3e	Slope Aspect
MICRO_REL	C	1	10	3f	Microrelief
STONINESS	C	1	26	3g	Stoniness Class

COBBLINESS	C	1	27	3h	Cobbliness Class
SALINITY	C	1	26	3i	Salinity Class
ORDER	C	1	11	3j	Soil Taxonomy - Order
SUBGROUP	C	6	6	3j	Soil Taxonomy - Subgroup code
GRUMIC	C	1	7	3k	Soil Phase - Grumic
TURBIC	C	1	7	3k	Soil Phase - Turbic
SALINE	C	1	7	3k	Soil Phase - Saline
CARB	C	1	7	3k	Soil Phase - Carbonates
CRYIC	C	1	7	3k	Soil Phase - Cryic
LITHIC	C	1	7	3k	Soil Phase - Lithic
PEATY	C	1	7	3k	Soil Phase - Peaty
DRAINED	C	1	7	3k	Soil Phase - Drained
VEG_GENERL	C	2	25	3l	Vegetation - General
VEG_MOD	C	2	12	3l	Vegetation - Modifier
PM1_PC1	C	2	22	4a	Parent Material 1 - Physical Component 1
PM1_PC2	C	2	22	4a	Parent Material 1 - Physical Component 2
PM1_CC1	C	2	28	4b	Parent Material 1 - Chemical Component
PM1_MD1	C	2	16	4c	Parent Material 1 - Mode of Deposition
PM1_MM1	C	2	16	4d	Parent Material 1 Material Modifier
PM2_PC1	C	2	22	4a	Parent Material 2 - Physical Component 1
PM2_PC2	C	2	22	4a	Parent Material 2 - Physical Component 2
PM2_CC2	C	2	28	4b	Parent Material 2 - Chemical Component
PM2_MD2	C	2	16	4c	Parent Material 2 - Mode of Deposition
PM2_MM2	C	2	16	4d	Parent Material 2 Material Modifier
PM3_PC1	C	2	22	4a	Parent Material 3 - Physical Component 1
PM3_PC2	C	2	22	4a	Parent Material 3 - Physical Component 2
PM3_CC3	C	2	28	4b	Parent Material 3 - Chemical Component
PM3_MD3	C	2	16	4c	Parent Material 3 - Mode of Deposition
PM3_MM3	C	2	16	4d	Parent Material 3 Material Modifier
WS_PRECIP	C	1	1	4e	Water Status - Precipitation
WS_GROUND	C	1	1	4e	Water Status - Ground
WS_STREAM	C	1	1	4e	Water Status - Stream
WS_LAKE	C	1	1	4e	Water Status - Lake
WS_BRACKS	C	1	1	4e	Water Status - Brackish
WS_SALT	C	1	1	4e	Water Status - Salt
WS_RUNOFF	C	1	1	4e	Water Status - Runoff
WS_SHPOND	C	1	1	4e	Water Status - Shallow Pond
WS_SHLAKE	C	1	1	4e	Water Status - Shallow Lake
WS_WTRACK	C	1	1	4e	Water Status - Water Track
WS_TIDAL	C	1	1	4e	Water Status - Tidal
WS_NOASSO	C	1	1	4e	Water Status - No Associated Water Body
CLIM_STA	C	16	16	4f	Climatic Station
CLIM_REL	C	1	9	4g	Climatic Station - Relevance
BEDROCK	C	3	3	8a	Depth to (m) - Bedrock
WTRTABLE	C	4	4	8a	Depth to (m) - Water table
IMPLAYER	C	4	4	8a	Depth to (m) - Impermeable layer
FROST	C	3	3	8a	Depth to (m) - Frost
ACTIVELAY	C	3	3	8b	Thaw layer (m)
DRAINAGE	C	2	15	8c	SWIG - Drainage
HYD_COND	C	2	21	8c	SWIG - Hydraulic Conductivity
RED_PERM	C	2	12	8c	SWIG - Reduced Permeability
INC_PERM	C	2	12	8c	SWIG - Increase Permeability
SAT_LEAST	C	2	13	8c	SWIG - Saturation Zone, Least
SAT_GREAT	C	2	13	8c	SWIG - Saturation Zone, Great
DURATION	C	1	9	8c	SWIG - Duration

SEEPAGE	C	1	11	8c	SWIG - Seepage
MAN_MMOD	C	2	21	8c	SWIG - Manmade modifier
EROS_S	C	1	20	8d	Erosion - S-Value
EROS_K	C	1	20	8d	Erosion - K-Value
EST_SIZE	C	3	3	8d	Erosion - Estimated site size (ha)
STEMP20CM	C	4	4	8e	Soil Temperature - at 20 cm
STEMP50CM	C	4	4	8e	Soil Temperature - at 50 cm
STEMP100CM	C	4	4	8e	Soil Temperature - at 100 cm
ROOTDEPTH	C	3	3	8f	Rooting depth (cm)
AHOR	C	3	3	8g	Thickness - A horizon
SOLUM	C	3	3	8g	Thickness - Solum
ORG_DEP	C	3	3	8g	Thickness - Organic deposit

MORPHOLOGY (HORIZON) DATA FILE STRUCTURE

Field Name	Field Type	Original Width	Width	Extended Reference	Card type Field Description
PROJECT	C	4	4	1a	Project
YEAR	C	2	2	1b	Year
SURV	C	2	2	1c	Surveyor
SITENUM	C	3	3	1d	Sitenum or Profile I.D.
SOIL_CODE	C	3	3	1e	Soil Series code
VAR	C	1	1	1f	Soil Series Variant
HORZNUM	C	2	2	5a	Horizon number
LITH_DIS	C	1	1	5b	Lithological dicontinuity
MSTR_HORZ	C	3	3	5b	Master layer/Horizon
SUFFIXES	C	5	5	5b	Suffixes
MODIF	C	1	1	5b	Numerical Suffix Modifier
DEPTHUP	C	3	3	5c	Depth - Upper limit
DEPTHLO	C	3	3	5c	Depth - Lower limit
RANG_MIN	C	3	3	5d	Range - Minimum
RANG_MAX	C	3	3	5d	Range - Maximum
DISTINCTNS	C	1	7	5e	Horizon boundaries - Distinctness
FORM	C	1	9	5e	Horizon boundaries - Form
TEXT_MOD	C	2	13	5f	Soil Texture modifier
TEXTURE	C	4	4	5g	Soil Texture
STR1_GRADE	C	2	17	5h	Structure 1 - Grade
STR1_CLASS	C	2	17	5h	Structure 1 - Class
STR1_KIND	C	2	17	5h	Structure 1 - Kind
STR1_KMOD	C	2	10	5h	Structure 1 - Kind modifier
STR2_GRADE	C	2	17	5i	Structure 2 - Grade
STR2_CLASS	C	2	17	5i	Structure 2 - Class
STR2_KIND	C	2	17	5i	Structure 2 - Kind
STR2_KMOD	C	2	10	5i	Structure 2 - Kind modifier
MOISTURE	C	1	11	5j	Profile moisture
EFFERV	C	1	16	5k	Degree of Effervescence
CALCAR	C	1	14	5l	Calcariousness class
PH_CLASS	C	2	28	5m	Field pH - Reaction Class
PH_METHOD	C	1	13	5m	Field pH - Method
CON_WET	C	1	15	5n	Consistence - Wet
CON_MOIST	C	2	12	5n	Consistence - Moist
CON_DRY	C	2	9	5n	Consistence - Dry
CON_PLAST	C	1	16	5n	Consistence - Plasticity
CF_TYPE	C	2	16	5o	Coarse Fragments - Type
CF_VOL	C	1	1	5o	Coarse Fragments - Volume
C1_ASPECT	C	2	20	6b	Colour 1 - Aspect
C1_HUE	C	4	4	6b	Colour 1 - Hue
C1_SYMB	C	2	2	6b	Colour 1 - Symbol
C1_VALUE	C	2	2	6b	Colour 1 - Value
C1_CHROMA	C	2	2	6b	Colour 1 - Chroma
C2_ASPECT	C	2	20	6c	Colour 2 - Aspect
C2_HUE	C	4	4	6c	Colour 2 - Hue
C2_SYMB	C	2	2	6c	Colour 2 - Symbol
C2_VALUE	C	2	2	6c	Colour 2 - Value
C2_CHROMA	C	2	2	6c	Colour 2 - Chroma
MOT1_ABUN	C	1	6	6d	Mottles 1 - Abundance
MOT1_SIZE	C	1	6	6d	Mottles 1 - Size

MOT1_CONT	C	1	9	6d	Mottles 1 - Contrast
MOT2_ABUN	C	1	6	6e	Mottles 2 - Abundance
MOT2_SIZE	C	1	6	6e	Mottles 2 - Size
MOT2_CONT	C	1	9	6e	Mottles 2 - Contrast
CONC_KIND	C	1	14	6f	Concretions - Kind
CONC_ABUN	C	1	14	6f	Concretions - Abundance
CONC_SIZE	C	1	12	6f	Concretions - Size
CONC_DISTR	C	1	11	6f	Concretions - Distribution
CONC_SHAPE	C	1	9	6f	Concretions - Shape
CLAY_FREQ	C	1	10	6g	Clay Films - Frequency
CLAY_THICK	C	2	10	6g	Clay Films - Thickness
CLAY_LOC	C	2	16	6g	Clay Films - Location
ROOT_ABUN	C	1	10	6h	Roots - Abundance
ROOT_SIZE	C	1	9	6h	Roots - Size
ROOT_ORIEN	C	1	10	6h	Roots - Orientation
ROOT_DIST	C	1	5	6h	Roots - Distribution
POR_GEN	C	1	17	6i	Porosity - General
POR_TYPE	C	1	12	6i	Porosity - Type
POR_ABUN	C	1	8	6i	Porosity - Abundance
POR_SIZE	C	1	9	6i	Porosity - Size
POR_ORIEN	C	1	10	6i	Porosity - Orientation
POR_DIST	C	1	5	6i	Porosity - Distribution
POR_CONT	C	1	13	6i	Porosity - Continuity
POR_MORPH	C	1	9	6i	Porosity - Morphology
VON_POST	C	2	45	6j	Von Post Scale of Decomposition
ICE_CRYST	C	1	7	6k	Ice Characteristics - Crystal
ICE_COATN	C	1	7	6k	Ice Characteristics - Coatings
ICE_RANDOM	C	1	7	6k	Ice Characteristics - Random
ICE_STRAT	C	1	7	6k	Ice Characteristics - Stratified
CO1_ASPECT	C	2	20	7b	Colour 1 - Aspect
CO1_HUE	C	4	4	7b	Colour 1 - Hue
CO1_SYMBOL	C	2	2	7b	Colour 1 - Symbol
CO1_VALUE	C	2	2	7b	Colour 1 - Value
CO1_CHROMA	C	2	2	7b	Colour 1 - Chroma
CO2_ASPECT	C	2	20	7c	Colour 2 - Aspect
CO2_HUE	C	4	4	7c	Colour 2 - Hue
CO2_SYMBOL	C	2	2	7c	Colour 2 - Symbol
CO2_VALUE	C	2	2	7c	Colour 2 - Value
CO2_CHROMA	C	2	2	7c	Colour 2 - Chroma
RUB_FIBRE	C	2	2	7d	Rubbed Fibre (%)
SPHAGNUM	C	2	2	7e	Botanical Composition - Sphagnum
SEDGE	C	2	2	7e	Botanical Composition - Sedge
MOSS	C	2	2	7e	Botanical Composition - Moss
BROWN_MOSS	C	2	2	7e	Botanical Composition - Brown moss
LEAVES	C	2	2	7e	Botanical Composition - Leaves
NEEDLES	C	2	2	7e	Botanical Composition - Needles
HERBACEOUS	C	2	2	7e	Botanical Composition - Herbaceous
LICHENS	C	2	2	7e	Botanical Composition - Lichen
GRASS	C	2	2	7e	Botanical Composition - Grass
WOOD	C	2	2	7e	Botanical Composition - Wood
OTHER	C	2	2	7e	Botanical Composition - Other
SED_PEAT	C	2	2	7e	Botanical Composition - Sedge-peat
AMORPH	C	2	2	7e	Botanical Composition - Amorphous
SEEDS	C	2	2	7e	Botanical Composition - Seeds
CHARCOAL	C	2	2	7e	Botanical Composition - Charcoal

WOOD_DIAM	C	2	2	7f	Wood - Diameter (cm)
HARDNESS	C	1	9	7f	Wood - Hardness
LIMNIC_MAT	C	1	12	7g	Limnic Material
C14	C	1	15	7h	Carbon 14

SPECIAL NOTES DATA FILE STRUCTURE

Field Name	Field Type	Original Width	Extended Width	Card type Reference	Field Description
PROJECT	C	4	4	1a	Project
YEAR	C	2	2	1b	Year
SURV	C	2	2	1c	Surveyor
SITENUM	C	3	3	1d	Sitenum or Profile I.D.
SOIL_CODE	C	3	3	1e	Soil Series code
VAR	C	1	1	1f	Soil Series Variant
NOTE1	C	62	62	2a	Free Format - Note 1
NOTE2	C	62	62	2a	Free Format - Note 2
NOTE3	C	62	62	2a	Free Format - Note 3
NOTE4	C	62	62	2a	Free Format - Note 4
NOTE5	C	62	62	2a	Free Format - Note 5
NOTE6	C	62	62	2a	Free Format - Note 6
NOTE7	C	62	62	2a	Free Format - Note 7
NOTE8	C	62	62	2a	Free Format - Note 8
NOTE9	C	62	62	2a	Free Format - Note 9
NOTE10	C	62	62	2a	Free Format - Note 10

LABORATORY ANALYSIS DATA FILE STRUCTURE

Field Name	Field Type	Original Width	Extended Width	Card type Reference	Field Description
PROJECT	C	4	4	10(1a)	Project
YEAR	C	2	2	10(1b)	Year
SURV	C	2	2	10(1c)	Surveyor
SITENUM	C	3	3	10(1d)	Sitenum or Profile I.D.
SOIL_CODE	C	3	3	10(1e)	Soil Series code
VAR	C	1	1	10(1f)	Soil Series Variant
HORZNUM	C	2	2	10	Horizon number
LABNUM	C	4	4	10	Laboratory number
PP_80MM	C	3	3	10	Percent Passing - 80 mm sieve
PP_20MM	C	3	3	10	Percent Passing - 20 mm sieve
PP_5MM	C	3	3	10	Percent Passing - 5 mm sieve
PP_2MM	C	3	3	10	Percent Passing - 2 mm sieve
PP_42MM	C	2	2	10	Percent Passing - .42 mm sieve
PP_074MM	C	2	2	10	Percent Passing - .0074 mm sieve
PP_05MM	C	2	2	10	Percent Passing - .05 mm sieve
PP_002MM	C	2	2	10	Percent Passing - .002 mm sieve
PER_SATPAS	C	3	3	10	40 Mesh - Percent water at saturated paste
VCS	C	2	2	10	Particle Size Analysis - Very Coarse Sand
CS	C	2	2	10	Particle Size Analysis - Coarse Sand
MS	C	2	2	10	Particle Size Analysis - Medium Sand
FS	C	2	2	10	Particle Size Analysis - Fine Sand
VFS	C	2	2	10	Particle Size Analysis - Very Fine Sand
TOT_SAND	C	2	2	10	Particle Size Analysis - Total Sand
TOT_SILT	C	2	2	10	Particle Size Analysis - Total Silt
TOT_CLAY	C	2	2	10	Particle Size Analysis - Total Clay
TEXT_CLASS	C	4	4	10	Particle Size Analysis - Textural Class
RUB_FIBRE	C	2	2	10	Organic - Rubbed Fibre (%)
UNRUB_FIBR	C	2	2	10	Organic - Unrubbed Fibre (%)
ASH	C	2	2	10	Organic - Ash Content (%)
CLASS	C	1	1	10	Organic - Class
ORG_CARB	C	4	5	10	Organic Carbon (%)
PYRO_EXT	C	3	4	10	Pyrophosphate Extractable Carbon (%)
PH	C	3	4	11	pH
TOTAL_N	C	4	5	11	Total Nitrogen (%)
CALC_CARB	C	3	4	11	Calcium Carbonate Equivalent (%)
CALCITE	C	3	4	11	Calcite (%)
DOLOMITE	C	3	4	11	Dolomite (%)
CEC	C	4	5	11	Cation Exchange Capacity (me/100g) Buffered
EC_CA	C	4	5	11	Exchangeable Cations Buffered (me/100g) - Calcium
EC_MG	C	3	4	11	Exchangeable Cations Buffered (me/100g) - Magnesium
EC_NA	C	3	4	11	Exchangeable Cations Buffered (me/100g) - Sodium
EC_K	C	3	4	11	Exchangeable Cations Buffered (me/100g) - Potasium
EXT_ACID	C	4	5	11	Extractable Acidity (me/100g)
ELEC_COND	C	4	5	11	Electrical Conductivity (mS/cm)
PLAST_LIM	C	3	4	11	Atterburg Limits (%) - Plastic limit
LIQUID_LIM	C	3	4	11	Atterburg Limits (%) - Liquid limit
SHRINK_LIM	C	3	4	11	Shrinkage Limit (%)
SHR_UNIF	C	11	11	11	%Shrink./ASSHO(Class & Index)/Unified Class
WE_SATPAST	C	4	5	12	Water Extract Determination(me/l) - %Water Saturated Paste

WE_CA	C	4	5	12	Water Extract Determination(me/l) - Calcium
WE_MG	C	4	5	12	Water Extract Determination(me/l) - Magnesium
WE_NA	C	4	5	12	Water Extract Determination(me/l) - Sodium
WE_K	C	3	4	12	Water Extract Determination(me/l) - Potasium
WE_CO3	C	3	4	12	Water Extract Determination(me/l) - Calcium Carbonate
WE_HCO3	C	3	4	12	Water Extract Determination(me/l) - HCO3
WE_CL	C	4	5	12	Water Extract Determination(me/l) - Chlorine
WE_SO4	C	4	5	12	Water Extract Determination(me/l) - Sulphate
WE_NO3	C	3	4	12	Water Extract Determination(me/l) - Nitrate (ppm)
WE_B	C	3	4	12	Water Extract Determination(me/l) - Boron (ppm)
DE_FE	C	2	3	12	Dithionite Extract (%) - Iron
DE_AL	C	2	3	12	Dithionite Extract (%) - Aluminum
DE_MN	C	2	3	12	Dithionite Extract (%) - Manganese
PE_FE	C	2	3	12	Pyrophosphate Extract (%) - Iron
PE_AL	C	2	3	12	Pyrophosphate Extract (%) - Aluminum
PE_MN	C	2	3	12	Pyrophosphate Extract (%) - Manganese
DPTA_FE	C	3	4	12	DPTA Extract (ppm) - Iron
DPTA_AL	C	3	4	12	DPTA Extract (ppm) - Aluminum
DPTA_MN	C	3	4	12	DPTA Extract (ppm) - Manganese
TOT_POROS	C	4	5	13	Total Porosity (%)
BD	C	3	4	13	Bulk Density (g/cc)
FIELD_MOIS	C	4	5	13	Field Moisture Capacity (%)
WR_1_10ATM	C	4	5	13	Water Retention (%) - 1/10 Atmosphere
WR_1_3ATM	C	4	5	13	Water Retention (%) - 1/3 Atmosphere
WR_1_2ATM	C	3	4	13	Water Retention (%) - 1/2 Atmosphere
WR_3_4ATM	C	3	4	13	Water Retention (%) - 3/4 Atmosphere
WR_1ATM	C	3	4	13	Water Retention (%) - 1 Atmosphere
WR_15ATM	C	3	4	13	Water Retention (%) - 15 Atmosphere
INF_5MIN	C	4	5	13	Infiltration (cm) - 5 minutes
INF_10MIN	C	4	5	13	Infiltration (cm) - 10 minutes
INF_15MIN	C	4	5	13	Infiltration (cm) - 15 minutes
INF_60MIN	C	4	5	13	Infiltration (cm) - 60 minutes
INF_RATE	C	4	5	13	Infiltration Rate-Steady State (cm/hr)
SAT_HC_FLD	C	4	5	13	Saturated Hydraulic Conductivity (cm/hr) Field
SAT_HC_LAB	C	4	5	13	Saturated Hydraulic Conductivity (cm/hr) Lab
CA_WATER_K	C	2	2	13	Calculated Water Erosion-K

Notes: