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Soil Mapping and Advisory Services

Botswana

REVISED GENERAL SOIL LEGEND OF BOTSWANA

FOOD & AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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REPUBLIC OF BOTSWANA

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REVISED GENERAL SOIL LEGEND OF BOTSWANA

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based on the work of

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Food and Agriculture Organization of the United Nations

United Nations Development Programme

Republic of Botswana

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The conclusions given in this report are those considered appropriate at the time of its preparation.
They may be modified in the light of further knowledge gained at subsequent stages of this project.

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1. INTRODUCTION

This report is a revised and updated version of the General Soil Legend of Botswana, Field Document 11 (Remmelzwaal 1988). It provides a comprehensive classification system for the soils of Botswana and has been followed for classifying and mapping soils at the reconnaissance scale. The report accompanies the 1:250 000 soil map series issued by the Soil Mapping Section of the Ministry of Agriculture[1].

The General Soil Legend is based on a primary categorization of soils according to parent material and lithology, followed by a numerical subdivision based on soil classification according to the FAO/UNESCO Soil Map of the World (FAO/UNESCO, 1974) and on site conditions and profile morphological characteristics. The FAO/UNESCO classification system has been extended and slightly modified to cater more adequately for the range of soil types present in Botswana. This amended system in fact forms the basis of the General Soil Legend of Botswana.

When the Revised Legend of the Soil Map of the World (FAO/Unesco/ISRIC, 1988) was issued, most 1:250 000 soil maps of Botswana had been completed. Soil classification units defined in this report are correlated to the Revised FAO Legend and to the subgroups in the USDA Soil Taxonomy (Soil Survey Staff, 1987). These correlations are summarised in Appendix 2 of the present report. The Revised Legend of the Soil Map of the World was used for the National Soil Map of Botswana at 1:1 000 000 scale (De Wit and Nachtergaele, 1990).

Field Document 11, containing the first edition of the General Soil Legend, was finalised in 1988 when only half of the national 1:250 000 scale soil mapping programme had been completed. The present revision became necessary after the finalization of the reconnaissance mapping programme. The main reasons for updating the legend are:

- a considerable number of units had been added to the legend during the last stage of the mapping programme

- inexperienced users had problems with the key to the legend due to incomplete or unclear definitions of certain units.

- during the production of the 1:1 000 000 soil map of Botswana, the interpretation of certain concepts of the Revised FAO Legend changed and the correlation had to be updated.

- Field Document 11 was almost out of print and a reprint was envisaged.

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1. A list of published 1:250 000 soil maps is given in Appendix 5

In this revision, extra explanations were added, dubious items removed and the key to the legend and the soil unit correlation table were corrected. No changes were made to the basic concept of the General Soil Legend of Botswana.

Although providing a comprehensive classification system for the soils of Botswana, the General Soil Legend was developed and used for reconnaissance soil mapping. The range of soil characteristics contained in the definitions of individual soil units is often broad, and the Legend would require further adaptation to satisfy the precision needed at more detailed levels of soil investigation.

1.1 BACKGROUND

The development of a comprehensive, standard legend of soils in Botswana started in 1981 as one of the activities of the Soil Mapping and Advisory Services Project BOT/80/003.

The legend construction took place simultaneously with the reconnaissance soil mapping programme at scale 1:250 000, initiated in the eastern part of the country, from the centres Serowe, Francistown and Gaborone.

The completion of the first series of standard map sheets in 1983 and the subsequent printing in the following years necessitated the finalization of major parts of the legend. As a consequence the numbering system and organization of the legend is not as logical and systematic as it should be. Decisions taken on definitions and classification were not always based on sufficient laboratory data for the simple reason that reliable analytical results were only produced from 1983 onwards.

During the completion and printing of the map sheets of North-East and Central Districts, the first edition of the general soil legend was printed in 1985, serving as the legend for the sheets: Basutos, Nata, Ramokgwebana, Francistown, Serowe, Palapye, Lephephe and Mahalapye.

From 1984 onwards surveys were shifted to the northern regions of Ngamiland and Chobe, with Maun as a new centre of mapping. Large numbers of new soil legend units were added, especially to the alluvial and lacustrine main units. In the south and east of the country, the Gaborone, Lobatse and Tuli sheets were completed while the Ghanzi sheet, in the west, was also surveyed. Additional units identified in these recent surveys have provided the principal reason for the present revision.

1.2 GENERAL PRINCIPLES

Although the physiographic approach was applied in the soil survey, it was decided not to use a physiographic subdivision in the legend, as this would have required a subdivision of the whole country in the early stages of mapping. Early tests in several areas showed that it would not be easy to

achieve a satisfactory physiographic classification, also for reasons that large parts of Botswana are rather featureless and difficult to describe morphologically. Instead a related approach was followed of using main units of parent material groupings, which show a strong relationship with both soils and landscapes.

When defining the soil units, the following principles were observed:

1. The legend was developed simultaneously with the 1:250 000 reconnaissance mapping. New soil units were added to the legend as they were described in the field, therefore the units have not been hierarchically arranged. New classifications received a new number in the legend; subdivisions of these units were made, for soils with different characteristics or similar soils with different classifications, by adding an extra symbol. The legend has also been used for 1:50 000 semi-detailed surveys but it became obvious that the system is not flexible enough to distinguish more detail than originally introduced in the primary unit description.

2. The soil units have been defined to be easily understood, using only standard terminology. Existing units in the legend were finalised as the maps were printed and therefore could no longer be changed. No attempt was made to develop soil series.

3. Originally, an attempt was made to define the soil units as narrowly as possible, in order to emphasize the central concept of the unit. During later stages of the legend construction, it could not be avoided that certain unit definitions became broad, as characteristics e.g. texture range, had to be expanded for the sake of completeness. Also, as new parts of the country were surveyed, it was difficult to keep the legend comprehensive for all recognised soils. Because the legend has to cover the whole country and the major soil characteristics differ depending on the area, soils with slight deviations from the description of the existing units e.g in colour, texture, or drainage are therefore allowed to be included within a soil unit. These variations from the central concept of the soil definition, are discussed and described in the reports accompanying the soil maps.

4. Soil types with a rare occurrence in Botswana and therefore not represented on the produced maps, were normally not included in the legend. These soils may be transitional or occur marginally. It should be noted that it could not be avoided that a few soil units, which later appeared to be quite obscure, were incorporated in the legend.

5. The small scale of reconnaissance mapping rarely allows single soil units as mapping units. A mapping symbol consists mostly of an association or a complex of 2-3 soil units, in rare cases even more. Soils covering <20% of the area are not included in the mapping symbol. The hierarchy of occurrence of individual soil units only depends on their position in the mapping unit, the first soil always being the dominant one. The extent of occurrence was not visualised but estimates were normally given in the reports. For a mapping unit with 3 soils, the distribution may vary between 30% each and 60%-20%-20%.

Associations are the dominant type of mapping unit and have been mapped where soils occur in distinct topographical positions in the catena; separation of the soils is possible on a larger mapping scale.
Complexes occur where soils merge into one another; separation of individual soils is impossible at any scale.
The difference between the two types of mapping units is generally not indicated on the soil maps but has been described in the accompanying reports.

2. LEGEND CONSTRUCTION

The mapping symbol consists of a maximum of three elements. At the first level a distinction is made in main units according to the parent material, the second level consists of a subdivision into soil units. The third level makes a distinction between specific soil characteristics where necessary.

2.1 MAIN UNITS

The first level distinction is based on parent material and rock. In the mapping symbol it is presented as a capital letter. The definitions of the units read as a key:

C : soils which are highly calcareous, having a calcium carbonate content of 40% or more equivalent, within a depth of 50cm from the surface.
This unit includes soils on shallow calcrete, nodular calcareous materials as well as limestone and dolomites.

AC-units are C-unit soils developed in alluvium or colluvium (A-unit material).
LC-units are C-unit soils developed in lacustrine deposits, pans and interdunes (L-unit material).

L : other soils that have developed in lacustrine deposits, pans and interdunes.

AL-units are L-unit soils developed in fossil alluvial systems; present conditions have no relation with water flow; often pans are found as remnants of the channels.

A : other soils developed in alluvial deposits or alluvially reworked materials. The unit also includes soils formed in colluvium of mixed origin, provided that the substratum clearly consists of colluvially reworked material and is distinguishable from in situ weathered parent rock.

LA-units are A-unit soils developed in fluvial reworked lacustrine deposits.

G : other soils on acid and intermediate igneous and metamorphic rocks. This unit consists mainly of soils formed on granites, gneisses, diorites and quartzites of the Basement Complex.

B : other soils on basic igneous and metamorphic rocks. This unit comprises soils developed on Karoo basalts, various dolerite/diabase intrusions and ultrabasic rocks.

S : other soils developed in unconsolidated sand deposits or coarse grained sedimentary rocks. The texture of the soils is loamy fine sand or coarser to a depth of at least 50cm from the surface and not finer than fine sandy loam at a depth of 100cm.

LS-units are S-unit soils developed in aeolian reworked lacustrine deposits.
KS-units are S-unit soils developed in Kalahari sands, which are well sorted and have a texture finer than fine sand.

D : other soils developed on fine grained sedimentary rocks. These soils have a texture of sandy loam or finer at a depth of 50cm from the surface. This unit contains soils on shales, siltstones, grits, feldspatic sandstones, conglomerates, etc.

R : all other very shallow soils and rock outcrops. This unit occurs on steep hills, ridges and escarpments and consists partly of Lithosols; this unit is not further subdivided into soil units.

2.2 SOIL UNITS

The soil units are defined according to a standard format. In the mapping symbol they are presented by a number, following the main unit capital letter. The main diagnostic criterion is the classification according to the FAO/UNESCO Legend of the Soil Map of the World (FAO 1974) with authorised changes to fit Botswana conditions (see section 3.1). Further subdivision of the soil units is made by adding a suffix to the number, to separate similar soils on their different characteristics. It is unavoidable that some soils mapped in a certain area deviate slightly from the soil unit descriptions.

The soil unit description consists of elements connected with:
- soil characteristics: colour, depth, texture;
- site characteristics: topography, drainage;
- phases: e.g. lithic, petric, saline, sodic, petrocalcic etc.;
- soil moisture regime: e.g. Luvisols versus Xerosols.

- **Soil depth.** The range is indicated using soil depth classes; the lower limit in the unit description indicates the depth to which roots of grasses and crops can penetrate. The soil depth is limited by the occurrence of hard rock or cemented layers.

0- 25cm	very shallow
25- 50cm	shallow
50-100cm	moderately deep
100-150cm	deep
>150cm	very deep

- **Drainage.** The classes are defined according to the FAO guidelines for soil profile description and the Soil Survey Manual (1951). The range given in the soil unit definition varies between two or three classes.

- **Colour.** The colours are described according to the Munsell Soil Color charts (Munsell, 1975). The colours refer to the B horizon or the C horizon, (if no B is present) in moist state. The indicated range lies within a square formed by the diagonal between the two value/chroma units either across one hue sheet or crossing several pages, comprising all colours in between.

- **Texture.** Textural classes are described following the revised subdivision by Remmelzwaal and Van Waveren (1988). The texture generally refers to the maximum expression of the B horizon within the profile, or to the texture at a depth of 100cm or immediately above a lithic/paralithic contact or a cemented horizon (whichever is shallower). If diagnostic for the soil classification the texture may refer to a depth of 125-150cm. Normally the texture range covers two to three classes.

- **Phases.** Phases are derived from the Legend of the Soil Map of the World (FAO/UNESCO, 1974) with amendments to fit Botswana conditions (see section 3.1.3). The indication "partly" stands for the occurrence of the phase in 30-70% of the soil unit. Often two phases were included in the soil unit description.

- **Topography.** The topography classes are described by Remmelzwaal and Van Waveren (1988). A general indication of the topography is given, often extending over a larger area (e.g. the landform) than covered by the individual soil unit. Where relevant the description of the physiography was added.

- **Site characteristics.** A general description of the hydrological conditions of the site was added to the unit description after the development of the "Land evaluation system for arable farming in Botswana" (Rhebergen 1988). The following classes are distinguished: water receiving, slightly water receiving, normal to (slightly) water receiving, normal, normal to (slightly) water shedding, slightly water shedding, water shedding.

3. SOIL CLASSIFICATION

3.1 SOIL LEGEND (FAO, 1974)

The Legend of the Soil Map of the World (FAO/UNESCO, 1974) is used as the basis for the classification system. With growing knowledge of the soils in Botswana, it became clear that certain described soils could not easily be classified with that system. Amendments to the FAO/UNESCO legend were defined for Botswana and authorized by FAO. The classification problems, with proposals for improvements, were previously discussed by Remmelzwaal (1989). Some of these changes were incorporated in the Revised Legend of the Soil Map of the World (FAO/UNESCO/ISRIC 1988). The modifications predominantly deal with minor changes to diagnostic horizons and properties. The main amendment was the new key for the Arenosols with the aim to group all sandy soils in one major unit.

The most relevant interpretations of diagnostic horizons and properties, the modifications to the standard legend and comparison with Soil Taxonomy will be discussed in the following paragraphs.

3.1.1 Diagnostic horizons

For the definitions of the diagnostic horizons and properties, where misinterpretation of the FAO 1974 definitions was possible, Soil Taxonomy (1975, 1987) has been largely followed because of more extensive descriptions of the properties; the basic concepts of the two classification systems being very similar.

Mollic Horizon

The part of the definition "Soil structure is strong enough that the major part of the horizon is not both massive and hard, or very hard when dry", is interpreted as such that epipedons having a very hard consistency and coarse blocky structure are excluded from mollic horizons, considering the general concept as given in Soil Taxonomy (Soil Survey Staff, 1975). Provided the organic matter, colour and structure requirements are met, it is assumed that the mollic horizon may continue into a designated B horizon (e.g. Bt).

Ochric Horizon

The concept of 'weak and very weak ochric horizons' was not considered useful and was never applied.

Argillic Horizon

Difficulties with the recognition of argillic horizons are usually related to the lack of clear evidence of translocation of clay in weakly structured or coarse textured soils which have low activity clays. From the definition it can be read that recognizing an argillic horizon in structureless soils should not be very problematic. Apart from the requirement of clay increase with depth, the only further condition is clay bridging or the occurrence of some cutans in pores, which means that macroscopically (also with a hand lens) hardly anything will be visible. For some poorly structured soils evidence of oriented translocated clay was obtained from thin sections, but generally it is not possible to have micromorphological analysis. It should also be realized that orientation and birefringence of ferri-argillans is gradually lost with time. The conclusion is therefore that for massive or very weakly structured soils the requirements can be interpreted as such that most evidence for translocation in the field can be waived, except for the clay increase.

Natric Horizon

The natric horizon is basically an argillic horizon, with two additional properties: (1) columnar or prismatic structure, or blocky with eluvial tongues and (2) ESP > 15. The higher sodium content should occur within 40 cm from the upper boundary of the horizon, which apparently refers to the top of the natric B horizon.

Cambic Horizon

In most cases the key properties in the identification of a cambic horizon are structure and evidence of alteration. Structure means that there must be some evidence of natural ped faces. Property **2** for a cambic horizon says that there is "soil structure **or** absence of rock structure ....", which means that the horizon may be massive, as is also stated in Soil Taxonomy (p.35, 7th line from below). The presence of soil structure becomes crucial if there is no evidence of alteration as listed under **4** (a)-(d).

Calcic Horizon

According to the definition, the calcic horizon has two forms. In the first the underlying material has less carbonates than the calcic, and in the second the calcic horizon rests on highly calcareous material, and the percentage of carbonates need not decrease with depth. In the most common case of calcareous soils in Botswana, the content of carbonates increases with depth, from a non or slightly calcareous topsoil, via moderate levels at medium depth, to high levels in the subsoil. Another case is that the topsoil is already highly calcareous, which makes it difficult to identify a calcic horizon if there is no decrease within the depth of the exposure. In cases of doubt, however it is preferred to recognize a calcic, for reasons of morphology, properties and correlation. The calcic horizon alone is not used as diagnostic in the key of

the FAO Main Soil Units. This also applies to the petrocalcic horizon, which is only used as a phase but is diagnostic in Soil Taxonomy. Soils in Botswana may have a calcic horizon but no other diagnostic horizons (apart from an ochric), and these soils can not be accommodated in the FAO system (unless in combination with a weak or very weak ochric horizon and an aridic moisture regime), and therefore calcic and petrocalcic horizons were given diagnostic value to enter Soil Units such as Arenosols and Cambisols.

Until 1989 carbonate content was not included in the standard soil analyses in Botswana. In the field calcic horizons were recognised when the matrix was strongly to extremely effervescent with 10% HCl and contained few or more by volume soft nodules or soft powdery lime. After comparison with the analyses it appeared that the correlation was good and that only for some sandy soils the calcic horizon had been over estimated. For sandy soils with less than 18% clay, the 15% $CaCO_3$ content is waived but the soil must contain more than 5% by volume of soft powdery secondary lime (USDA 1975).

Oxic Horizon

There is no clear evidence for the occurrence of oxic horizons in Botswana. Apparent CEC values per 100g clay (NH4OAc) must be 16meq or less. There are occasional indications that this may be the case, but these soils are considered as transitions and are usually classified as Ferric Luvisols or Acrisols.

Gypsic Horizon

Gypsic horizons do occur in Botswana, but only in specific environments as pans or playas. They occur usually in highly saline soils (Solonchaks) and are not frequently found. Analysis of gypsum content has never been carried out.

Albic Horizon

As compared to the Soil Taxonomy definition, the FAO definition is incomplete, missing the third sentence of the colour requirement: "If the value, dry, is 5 or 6, or the value, moist, is 4 or 5, the chroma is closer to 2 than to 3". Without this sentence the FAO definition does not make sense, and therefore this sentence has been restored. Albic horizons do occur in Botswana in a variety of soils. They may be underlain by an argillic or an other B horizon with an abrupt textural change, or there may be a gradual boundary with underlying material without a diagnostic horizon.

3.1.2 Diagnostic Properties

Abrupt Textural Change

The abrupt textural change is only used in connection with Planosols, but not as a requirement. Using Soil Taxonomy, Planosols may be classified as Albaqualfs, but no abrupt textural change is required. However, if the soil moisture regime is not aquic, Planosols may be classified as e.g. Paleustalfs, but then there is a textural requirement different from the FAO abrupt textural change (at least 20% clay increase absolute over 8 cm, or at least double when the clay percentage in A or E horizons is less than 20%). In Soil Taxonomy the increase of clay is also defined as 20% over 7.5 cm, for a clayey particle-size in the upper B (more than 35% clay), which is a comparable definition. However, for less clayey soils a different and more strict criterion than in FAO is used: 15% clay increase (absolute) over 2.5 cm. This complicates correlation, and it is thought that the Soil Taxonomy definition is too rigid, and also difficult to measure.

Albic Material

The definition of albic material was not considered appropriate and useful in Botswana. This diagnostic property was replaced by the albic E horizon.

Ferralic and Ferric Properties

There are three possibilities to qualify for ferric properties. The third one is identical to the only requirement for ferralic properties.

(1) many coarse mottles, with hues redder than 7.5YR or chromas more than 5, or both;
(2) discrete nodules, up to 2 cm in diameter, the exteriors of the nodules being enriched and weakly cemented or indurated with iron and having redder hues or stronger chromas than the interiors;
(3) a cation exchange capacity (by NH4OAc, NH4Cl being an error) of less than 24meq per 100g clay in at least some subhorizons of the argillic B horizon.

Normally the CEC clay is calculated from the CEC fine earth, apparently without corrections. As the CEC is also influenced by the organic matter content, a correction for organic carbon will result in more realistic and better comparable data. Also the silt and sand fractions will have an influence. For classification purposes in Botswana the calculated CEC clay is corrected for organic carbon, 400meq per 100g C (for the non corrected and actually digested org. C; when total org. C, using recovery factor 1.15, is given, CEC of 350meq should be used). In sandy soils the corrected CEC clay values usually appear to be too high. Obviously, when clay percentages are low, the calculated CEC clay is strongly influenced by other components. For sandy soils therefore the calculated CEC clay is not used but replaced by the total CEC, with the value of 4meq per 100g as boundary for ferralic properties. For sandy soils the CEC

of clay separates could be used for defining ferric and ferralic properties, but this is rather impractical. The petroferric horizon is considered as an advanced stage of nodular development and therefore soils having a petroferric horizon are classified as ferric, if applicable.

Hydromorphic properties

As there are some obvious errors in the text (e.g. under 4.3 in soils having an argillic horizon...), the comparable definitions in Soil Taxonomy are followed.

Plinthite
The identification of plinthite is a controversial subject. The definition in Soil Taxonomy seems not precise enough to make a clear distinction. There are some soils in Botswana, notably on granite or gneiss in water receiving positions, where plinthite was suspected.

Vertic properties

The definition is replaced by the Soil Taxonomy definition as used for subgroups: "having cracks at some period in most years, that are 1 cm or more wide, at a depth of 50 cm; that are at least 30 cm long in some part and that extend upwards to the surface or to the base of an Ap (A) horizon, if not irrigated.

3.1.3 Phases

The following FAO phases were recognized:

Stoney phase applies where the presence of gravel, stones, boulders or rock outcrops in the surface layer or at the surface makes the use of agricultural equipment impracticable. The occurrence is limited in Botswana, mostly as a gradual transition to the shallow petric phase.

Lithic phase is used when continuous coherent and hard rock occurs within 50 cm of the surface. A lithic phase is quite common in the hilly parts of Botswana.

Petric phase in the original concept indicates layers consisting of 40% or more of oxidic concretions or hardened plinthite nodules, but the phase is also applied when other coarse fragments, including weathered and fragmented rock, occur, being at least 25 cm thick and occurring within 100 cm of the surface. If such a layer occurs within 50 cm of the surface, it is indicated as a **shallow petric phase**. The 40% boundary of nodules or rock fragments coincides with the description of the occurrence as very frequent.

Petrocalcic phase marks soils in which the upper part of a petrocalcic horizon occurs within 100 cm of the surface. The petrocalcic horizon is continuously cemented or indurated. If occurring as a massive horizon of at least 20 cm thick within 50 cm of the surface, it is indicated as a **shallow petrocalcic phase**. Occurrence within 10 cm of the surface corresponds with classification as a Lithosol. For classification purposes the petrocalcic horizon is considered a diagnostic horizon as it is in Soil Taxonomy.

Petroferric phase marks soils in which the upper part of the petroferric horizon occurs within 100 cm of the surface. In Soil Taxonomy it is named ironstone. If occurring within 50 cm of the surface, it is indicated as a **shallow petroferric phase**.

Duripan phase marks soils in which the upper level of a duripan occurs within 100 cm of the surface. Duripans occur in Botswana in a variety of form and thickness, and at various depth. Often it is found associated with calcrete, silica replacing calcium carbonate. In Soil Taxonomy the duripan is a diagnostic horizon. The **shallow duripan phase** has only been separated on one occasion in lacustrine environments.

Saline phase is used when the EC is higher than 4mS/cm within 100 cm of the surface. The diagnostic property 'high salinity' is used for higher levels of soluble salts.

Sodic phase is used when the ESP (exchangeable sodium percentage) is more than 6 within 100 cm of the surface.

In addition the following two phases are recognized (Remmelzwaal and Van Waveren, 1988):

Clayey phase is applied to soils with a 10 - 30 cm thick loam to clay sedimentary surface layer over sand or loamy sand.

Sandy phase is applied to soils with a 5 - 50 cm thick sand or loamy sand sedimentary surface layer over clay loam to clay.

If several phases are recognised in one soil, a ranking has been set up according to the importance of the limiting effect on plant growth:

saline, sodic,
shallow petrocalcic, shallow petroferric, shallow duripan, lithic
shallow petric
petrocalcic, petroferric, duripan
petric

3.1.4 The FAO Soil Units

The Soil Units are defined in the Legend of the Soil Map of the World (FAO, 1974). Out of the total of 26 Soil Units, 19 were recognized in Botswana.

J	FLUVISOLS	E	RENDZINAS	K	KASTANOZEMS	W	PLANOSOLS
G	GLEYSOLS	V	VERTISOLS	C	CHERNOZEMS	A	ACRISOLS
R	REGOSOLS	Z	SOLONCHAKS	H	PHAEOZEMS	N	NITOSOLS
I	LITHOSOLS	S	SOLONETZ	B	CAMBISOLS	O	HISTOSOLS
Q	ARENOSOLS	X	XEROSOLS	L	LUVISOLS		

Additionally, Yermosols (or transitions between Xerosols and Yermosols) are likely to occur in the most arid parts of the country. They have not yet been described.

With the exception of Lithosols, these Soil Units are subdivided at second level and some at third level. The Soil Units at third level have the additional characteristics of another Soil Unit at second level. The only exception is the third level addition **Arenic**, defined as having a texture of loamy fine sand or coarser in the upper 50 cm from the surface.

The following third level connotatives have been used:

- Gleyic: showing hydromorphic properties within 50 cm of the surface

- Vertic: showing vertic properties

- Calcic: having a calcic or gypsic horizon or concentrations of soft powdery lime within 125 cm of the surface

- Arenic calcic: having a calcic or gypsic horizon or concentrations of soft powdery lime within 125 cm of the surface, and having a texture of loamy fine sand or coarser throughout the upper 50 cm of soil.

- Arenic: having a texture of loamy fine sand or coarser throughout the upper 50 cm of soil.

- Chromic: having a strong brown to red B horizon (rubbed soil has a hue of 7.5YR and a chroma of more than 4, or a hue redder than 7.5YR.

The Soil Units have their upper boundary at the surface or at less than 30 - 50 cm below the surface. When covered with a thicker layer of new material, the diagnostic horizons have no longer diagnostic value for classification. The variable thickness of 30 - 50 cm is following the concept of buried soils in Soil Taxonomy (Soil Survey Staff, 1987). In practice this means that clay covers on sandy soils may not be thicker than 30 cm, as the sand normally

does have diagnostic subsurface horizons. Sand covers on loam or clay may be up to 50 cm thick if the diagnostic horizons in the buried soil are 1 m or more in thickness.

Diagnostic subsurface horizons are diagnostic if they occur within 125 cm of the surface, unless otherwise stated.

The requirement for 'Calcic' at second level is standardized within a depth of 125 cm, without the subdivision for texture.

Of the above Soil Units, the concept of Fluvisols, Gleysols, Arenosols, Cambisols, Planosols and Nitosols is further discussed.

Fluvisols

Fluvisols are permitted to have high salinity. In the Makgadikgadi salt pans it may be difficult to distinguish between Fluvisols and Solonchaks. Areas such as the Okavango and Makgadikgadi are regularly flooded, but receive hardly or no fresh material, as all sediment has already been filtered out. Many of these soils do not show fine stratification and organic carbon levels are usually low. Depending on the deposition of fresh material they are classified as Fluvisols or otherwise.

There are differences between the definitions of Fluvisols and Fluvents (Soil Taxonomy). Fluvents are not allowed to be sandy and must have high levels of organic carbon. Fluvisols may be sandy and do not necessarily have high organic carbon levels, but instead receive fresh material or show fine stratification.

Gleysols

Hydromorphic properties are applied following full Soil Taxonomy definitions. Calcaric Gleysols were renamed **Calcic Gleysols**, having in Botswana always a calcic horizon or soft powdery lime.

Arenosols

The definition of Arenosols was not considered useful in the mapping of Botswana soils and was changed for the following reasons:

1. All deep sandy soils should be grouped together.

2. The present boundary of coarse texture allows soils with a high clay percentage of up to 18 percent and in addition silt. The boundary used in Soil Taxonomy, basically between loamy sand and sandy loam is considered more appropriate.

3. Gravelly soils should be excluded.

4. Redistribution or enrichment of carbonates, even in the form of a calcic or petrocalcic horizon, should be permitted.

5. For reasons of correlation with Soil Taxonomy and other practical reasons as to include soils on non-gravelly sandstone, lithic and petroferric contacts (phases) should be permitted.

6. There should be no restriction as to the soil moisture regime.

The revised key reads as follows:

Other soils which are coarser than sandy loam and having less than 35 percent of rock fragments or other coarse fragments in all sub-horizons to a depth of at least 100 cm from the surface or to a lithic or petroferric contact, having no diagnostic horizons other than an ochric A horizon, an albic E horizon, a calcic or petrocalcic horizon.

Arenosols having an albic E horizon to a depth of at least 50 cm below the surface.

Albic Arenosols

Other Arenosols having a petrocalcic horizon within 125 cm of the surface.

Petrocalcic Arenosol

Other Arenosols having a calcic horizon or soft powdery lime within 125 cm of the surface.

Calcic Arenosols

Other Arenosols which are calcareous at least between 20 and 50 cm below the surface.

Calcaric Arenosols

Other Arenosols showing lamellae of clay accumulation within 125 cm of the surface.

Luvic Arenosols

Other Arenosols showing colouring and ferralic properties within 125 cm of the surface (CEC <4 me/100g soil).

Ferralic Arenosols

Other Arenosols showing colouring (CEC >4me/100g soil).

Cambic Arenosols

Other Arenosols having a base saturation (by NH4OAc) of less than 50 percent, at least in some part of the soil between 20 and 50 cm below the surface.

Dystric Arenosols

Other Arenosols.

Eutric Arenosols

Notes

- Ferralic should include colouring in order to distinguish from recent sands (beach, dune) which may have ferralic properties.

- To be diagnostic, moist colours have the following limits:
  hue of 10YR and chroma of 5 or more,
  hue of 7.5YR and chroma of 4 or more
  or hue redder than 7.5YR

- Cambic should exclude other alteration than colouring. This could only be structure (or decalcification), which often is a questionable property.

- Some very weak structure alone should not lead to classification as Cambic Arenosol or Ferralic Arenosol.

Planosols

The abrupt textural change is recognized as a unique property of Planosols, and is an essential diagnostic criterion. The word 'abruptly' was added to the text of definition and key between "E horizon" and "overlying". The requirements of hydromorphic properties in at least part of the E horizons is interpreted with some liberty, as mottling or other evidence does hardly or not appear in deferrated material (see also FAO, 1988).

Nitosols

Nitosols are very deep soils, having an argillic horizon with a very uniform clay distribution. They lack ferric and vertic properties, as well as plinthite and strongly gravelly subsoils. The original concept of Nitosols was more narrowly defined than in the 1974 FAO definition, as is again reflected in the Revised FAO Legend. Nitosols with shiny pedfaces do occur in Botswana, but only subordinately. Sandy soils are permitted in Nitosols, which fits sandy soils in Botswana that have very deep argillic horizons with very gradual textural changes.

Due to the unreliability of the calculated CEC clay values of sandy soils, it is not always possible to make a clear distinction between ferric and non-ferric soils and the related classification of Ferric Luvisols and Ferric Acrisols on one side and Nitosols on the other.

Nitosols correlate with Paleustalfs in Soil Taxonomy. In Soil Taxonomy three subgroups for sandy varieties of Paleustalfs are recognized: arenic, grossarenic and psammentic, but for Botswana Nitosols (and also Luvisols, Acrisols and Xerosols) only arenic is used at third level for soils having a texture of

loamy fine sand or coarser in the upper 50 cm from the surface. For Nitosols the same colour requirements as for Paleustalfs are used. If not redder than 10YR they are generally classified as Orthic Luvisols.

Cambisols

With the recognition of the calcic and petrocalcic horizons as key horizons to enter Cambisols (see under calcic horizon, section 3.1.1), a useful distinction can be made between Cambisols that have a calcic or petrocalcic horizon (and in addition also may have a cambic horizon) and Cambisols that are only calcareous. The existing group of Calcic Cambisols was split up into **Calcic Cambisols**, which have a calcic or petrocalcic horizon, or an appreciable amount of soft powdery lime within 125 cm from the surface, and **Calcaric Cambisols**, which are calcareous at least between 20 and 50 cm below the surface.

3.2 REVISED SOIL LEGEND (FAO, 1988)

All soil descriptions, entered in the Botswana Soil Database, have been correlated according to the Revised Legend of the Soil Map of the World (FAO/UNESCO/ISRIC 1988). Most amendments to the Revised Legend, proposed by Remmelzwaal in the "General Soil Legend of Botswana" (1988), have been removed. The consensus between all soil surveyors was to follow exactly the Revised FAO Legend and to use it as such for the 1:1 000 000 soil map of Botswana. Differentiation of the soil units to fit the local conditions has been made by using appropriate third level subunit definitions. A general correlation between the different systems is given in Appendix 2. The most important implications for the classification of soils in Botswana are discussed below.

Argic horizon

The argic horizon replaces the argillic horizon but is similar to it except for the texture requirement of sandy loam or finer and needing at least 8% clay in the fine earth fraction. In Botswana soils are in general poor in silt and therefore need approximately 12-13% clay in the fine earth fraction to have a sandy loam. This means that quite a few soils with a sandy argillic horizon (loamy sand) do not satisfy the requirements for an argic horizon and therefore can no longer be classified as Luvisols but key out as Arenosols (see below).

Gleyic and Stagnic properties

Both properties occur in Botswana but previously these soils have been classified in the FAO 1974 classifications as Gleysols or as gleyic subgroups. Especially for previously analysed profiles the distinction is not always easy to make. In Botswana stagnic properties are the most dominant, also for the

major soil groupings the Luvisols, Calcisols, and Cambisols where stagnic subgroups do not exist. For these soils the distinction is made on the third level by adding Stagni- to the soil name. High groundwater levels and gleyic properties are only found in the Okavango Delta, the Kwando-Linyanti-Chobe system and in some rivers in the east and the south of the country.

Soft powdery lime

As a diagnostic property it should be present in a significant accumulation. Concentrations of soft powdery lime, if present as coatings, cover 50% or more of the structural faces and are thick enough to be visible when moist. If present as soft nodules, the volume is 5% or more.

Vertic properties

The definition in the suggested amendments to the revised soil legend (FAO, 1990) follows the one used in Section 3.1.2

Leptosols

Highly calcareous material ($CaCO_3$ equivalent of 40% or more) within 30 cm, now includes calcic and petrocalcic horizons . The distinction is made again on the third level by adding Calci- or Petrocalci- to the soil name.

Vertisols

Pelli- and Chromi- are used on the third level. Most Vertisols in Botswana are Eutric Vertisols, only a minor percentage become Calcic Vertisols.

Arenosols

The key from the revised legend (FAO/Unesco/ISRIC, 1988) is followed:

Luvic Arenosols have to contain clay lamellae or show a clay increase of 3% or more within 125 cm of the surface. The connotation Luvi- is used for Gleyic, Albic and Calcaric Arenosols having these characteristics.
Soils with an argillic horizon but not an argic horizon become Argi-Luvic Arenosols.

Ferralic Arenosols need colouring as well as Ferralic properties.

Cambic Arenosols need colouring.

Calcisols

The distinction between Luvi-Petric/Luvic Calcisols and (Petrocalci-)Calcic Luvisols is:

- both need an argic horizon

- both need a calcic or a petrocalcic horizon or a concentration of soft powdery lime (5% or more soft nodules by volume)

- Luvic Calcisols need to have a matrix that is calcareous at least between the full range of 20-50cm from the surface. (>2% $CaCO_3$ equivalent)

- Calcic Luvisols have a non calcareous matrix between 20-50cm from the surface.

Soil subunits

The third level was introduced to indicate intergrades between major soil groupings at the first or second level, or to further characterise the second level soil groupings. Third level connotations as in use in Botswana are defined in Appendix 4 with rules for priority.

Third level definitions do not represent weaker expressions of the soil characteristic. A stronger or weaker development can be indicated by prefixes such as hyper-, hypo-, epi-, whereas orthi- can be used to indicate the typical occurrence.

3.3 SOIL TAXONOMY

Soil Taxonomy (Soil Survey Staff, 1975, 1987) is used as an additional classification system and applied to all standard routine soil descriptions. Soil Taxonomy definitions are normally followed when FAO uses identical diagnostic criteria, but defined in abbreviated form. For remarks on interpretation of diagnostic horizons and criteria see Section 3.1.

The subdivision of certain great groups appears to be insufficient. Therefore a number of subgroups has been introduced, defined as identical subgroups already identified in comparable other great groups (e.g. petrocalcic, petroferric, ustalfic, calciorthidic, arenic). Also some new compound subgroups were added, e.g. Arenic Kandic Rhodic, Arenic Petrocalcic. Completely new soil units were not defined. A correlation with both FAO classifications is found in Appendix 2.

4. SOIL UNIT DEFINITIONS

To determine the soil unit in the legend, the parent material has to be decided on, following the key on page 4. The soil has to be classified according to the FAO system adapted to Botswana conditions described in Section 3.1. In the list of soil units, a certain classification can have several unit descriptions; the most appropriate has to be selected. The key to the general soil legend in appendix 1, can be used to choose the mapping symbol; the key gives abbreviated descriptions of the units, organised according to the classification.

In the description of the soil units: texture "sands, loamy sands and sandy loams" stand for the whole range of sand textural classes as described in Remmelzwaal and Van Waveren (1988). The terms "shedding" and "receiving" refer to water depletion or accumulation resulting from topographic location.

A (and LA) Soils on Alluvial Deposits

A1	Deep to very deep poorly to imperfectly drained very dark gray to dark grayish brown clay Flat to almost flat, normal to receiving	Pellic Vertisol partly sodic
A2	Deep to very deep imperfectly drained dark grayish brown to reddish brown clay loam to clay Flat to gently undulating, normal to receiving	Chromic Vertisol
A3	Deep to very deep imperfectly drained dark grayish brown sandy clay loam to clay Flat to gently undulating, normal to receiving	Vertic Cambisol
A4	Moderately deep to very deep imperfectly to moderately well drained dark grayish brown to brown sandy loams to sandy clay Flat to gently undulating, normal to receiving	Calcaric Cambisol
A4a	Deep to very deep imperfectly drained massive gray to grayish brown sandy clay loam to clay, strongly calcareous within 50cm Flat to almost flat, normal to receiving	Calcic Cambisol
A4b	Moderately deep to very deep imperfectly to moderately well drained dark grayish brown to brown clay loam to clay Flat to gently undulating, normal to receiving	Calcic Cambisol
A4c	Moderately deep to very deep moderately well drained grayish brown to brown sandy loams to sandy clay loam Flat to gently undulating, normal to receiving	Calcic Cambisol

A4d	Moderately deep imperfectly to moderately well drained gray to brown sandy loams to clay Flat to gently undulating, normal to receiving	Calcic Cambisol petrocalcic
A5	Deep to very deep poorly to imperfectly drained very dark gray to grayish brown sandy clay loam to clay Flat, (slightly) receiving	Gleyic Solonetz partly saline
A5b	Deep to very deep imperfectly to moderately well drained dark grayish brown to strong brown sandy clay loam to clay Flat to gently undulating, (slightly) receiving	Orthic Solonetz partly saline
A6	Deep to very deep poorly to imperfectly drained dark grayish brown to dark yellowish brown sandy clay to clay Flat to almost flat, (slightly) receiving	Solodic Planosol
A7	Deep to very deep poorly to imperfectly drained dark gray to grayish brown sandy clay loam to clay Flat, (slightly) receiving	Gleyic Luvisol partly sodic
A7a	Deep to very deep imperfectly drained dark gray to grayish brown sandy loams Flat, (slightly) receiving	Gleyic Luvisol partly sodic
A7b	Deep to very deep poorly to imperfectly drained dark gray to grayish brown sandy loams to sandy clay Flat, (slightly) receiving	Calcic Gleyic Luvisol partly sodic
A8	Deep to very deep imperfectly to moderately well drained dark grayish brown to reddish brown sandy clay loam to clay Flat to gently undulating, normal to receiving	Vertic Luvisol
A9	Deep to very deep imperfectly to moderately well drained dark grayish brown to yellowish brown sandy loam to clay Flat to gently undulating, normal to slightly receiving	Calcic Luvisol
A9a	Moderately deep to very deep imperfectly to moderately well drained dark grayish brown to strong brown loamy sands to sandy clay loam Flat to gently undulating, normal to slightly receiving	Arenic Calcic Luvisol
A9b	Moderately deep imperfectly to moderately well drained dark grayish brown to strong brown sandy loams to clay Flat to gently undulating, normal to slightly receiving	Calcic Luvisol petrocalcic

A9c	Deep to very deep imperfectly drained dark grayish brown to yellowish brown sandy clay loam to clay Flat, normal to slightly receiving	Calcic Luvisol sodic,saline
A10	Moderately deep to very deep moderately well drained strong brown to yellowish red sandy loam to sandy clay loam. Flat to gently undulating, normal to slightly receiving	Chromic Calcic Luvisol partly petrocalcic
A11	Moderately deep to very deep moderately well to well drained strong brown to red sandy clay loam to sandy clay Flat to gently undulating , normal to slightly receiving	Ferric Luvisol
A11a	Moderately deep to deep moderately well drained brown to red sandy loams to sandy clay loam Flat to gently undulating, normal	Ferric Luvisol petric/petroferric
A12	Moderately deep to very deep well drained brown to yellowish red sandy loams. Almost flat to gently undulating, normal to slightly receiving	Arenic Ferric Luvisol
A13	Moderately deep to deep moderately well to well drained strong brown to dark red sandy loam to sandy clay loam Almost flat to gently undulating, normal to slightly receiving	Chromic Luvisol
A13a	Moderately deep to deep moderately well drained strong brown to dark red massive sandy clay loam to sandy clay Flat to gently undulating, normal to slightly receiving	Chromic Luvisol
A13b	Moderately deep to deep well drained strong brown to red sandy loam to sandy clay loam Flat to gently undulating, normal	Chromic Luvisol petric
A14	Moderately deep to very deep moderately well to well drained dark brown to yellowish brown sandy loam to sandy clay Flat to gently undulating, normal to slightly receiving	Orthic Luvisol
A14a	Moderately deep to very deep imperfectly to moderately well drained very dark gray to grayish brown sandy loam to sandy clay Flat to gently undulating, (slightly) receiving	Orthic Luvisol

A15	Moderately deep to very deep well drained pale brown to yellowish brown loamy sands to sandy clay loam Flat to gently undulating, normal to slightly receiving	Arenic Orthic Luvisol
A15a	Moderately deep to very deep imperfectly to moderately well drained very dark gray to grayish brown loamy sands to sandy clay loam Flat to gently undulating, normal to slightly receiving	Arenic Orthic Luvisol
A16	Very deep moderately well to well drained strong brown to dark red sandy loams to sandy clay loam Almost flat to gently undulating, normal to slightly receiving	Eutric Nitosol
A16a	Very deep imperfectly to moderately well drained dark brown to dark red sandy clay loam to sandy clay Flat to almost flat, normal to slightly receiving	Calcic Eutric Nitosol
A16b	Very deep well drained reddish yellow to red loamy sands to sandy loams and silt loam Gently undulating (terraces), normal	Arenic Eutric Nitosol
A17	Very deep well drained reddish yellow to red sandy loams Almost flat to gently undulating, normal	Arenic Dystric Nitosol
A18	Moderately deep to deep moderately well to well drained strong brown to red sandy loams to sandy clay loam Gently undulating, normal	Ferric Acrisol
A19	Deep to very deep well to somewhat excessively drained yellowish brown to dark red sands to loamy sands Flat to gently undulating, normal	Ferralic Arenosol
A20	Deep to very deep moderately well to well drained dark grayish brown to yellowish brown sands to loamy sands Flat to gently undulating, normal	Calcaric Arenosol
A21	Deep to very deep moderately well to well drained dark grayish brown to yellowish brown sands to loamy sands Flat to gently undulating, normal	Calcic Arenosol
A21a	Moderately deep to deep moderately well to well drained dark grayish brown to yellowish brown sands to loamy sands Flat to gently undulating, normal	Petrocalcic Arenosol

A22	Deep to very deep well to somewhat excessively drained very dark grayish brown to yellowish brown sands to loamy sands Flat to gently undulating (levees), normal	Eutric Arenosol
A22a	Deep to very deep well to somewhat excessively drained dark brown to yellowish red sands to loamy sands Flat to gently undulating (levees), normal	Cambic Arenosol
A23	Deep to very deep poorly to imperfectly drained dark gray to dark grayish brown loam to clay Flat, receiving	Calcaric Fluvisol partly sodic
A23a	Deep to very deep poorly to imperfectly drained dark gray to white sands to loamy sands Flat, receiving	Arenic Calcaric Fluvisol
A24	Very deep very poorly to imperfectly drained black to dark grayish brown sandy loams to clay Flat, receiving	Eutric Fluvisol
A24a	Very deep poorly to imperfectly drained dark grayish brown to white sands to loamy sands Flat (channels, floodplains), receiving	Arenic Eutric Fluvisol
A24b	Very deep very poorly to imperfectly drained black to dark grayish brown sands to loamy sands Flat, receiving	Arenic Eutric Fluvisol
A24c	Very deep poorly to imperfectly drained gray to white sand over black to grayish brown sandy loams to sandy clay Flat, receiving	Arenic Eutric Fluvisol
A24d	Very deep poorly to imperfectly drained black to dark grayish brown silt loam to silty clay, often overlying sands to loamy sands Flat, receiving	Eutric Fluvisol partly saline
A24e	Very deep poorly to imperfectly drained black to white sands to loamy sands Flat, receiving	Arenic Eutric Fluvisol clayey

A25	Very deep poorly drained black to dark grayish brown sandy loams to silty clay loam, often overlying (loamy) sands Flat, receiving	Dystric Fluvisol
A25a	Very deep poorly drained black to dark grayish brown sands to loamy sands Flat, receiving	Arenic Dystric Fluvisol
A25b	Very deep very poorly drained black to dark gray sandy loams to sandy clay loam, usually having a Histic horizon within 50cm and overlying sandy subsoil Flat (swamps), receiving	Dystric Fluvisol
A26	Very deep very poorly drained stratified humus to peaty black sandy (clay)loam to silt loam, over sandy subsoil Flat, receiving	Dystric Histosol
A27	Very deep very poorly drained stratified humus to peaty black sandy (clay)loam to silt loam, over sandy subsoil Flat, receiving	Eutric Histosol
A28	Very deep poorly to imperfectly drained grayish brown loam to silty clay loam Flat to almost flat, (slightly) receiving	Orthic Solonchak
A29	Very deep poorly to imperfectly drained light brownish gray fine sands to loams Flat to almost flat, (slightly) receiving	Gleyic Solonchak
A30	Deep to very deep poorly to imperfectly drained very dark gray sandy clay to clay Flat, (slightly) receiving	Calcic Gleysol
A31	Deep to very deep poorly to imperfectly drained very dark gray sandy clay to clay Flat, (slightly) receiving	Eutric Gleysol sodic
A31a	Very deep poorly to imperfectly drained black to dark grayish brown sandy clay loam to clay Flat, (slightly) receiving	Eutric Gleysol
A31b	Very deep poorly to imperfectly drained black to dark grayish brown sandy loams Flat, (slightly) receiving	Eutric Gleysol partly sodic

A32	Very deep imperfectly drained very dark grayish brown sandy loams to silt loam to sandy clay, often overlying (loamy) fine sand Flat, (slightly) receiving	Gleyic Cambisol
A33	Very deep well drained dark brown to brown sandy loams. Gently undulating (natural levees), normal	Eutric Cambisol
A33a	Deep to very deep imperfectly drained dark grayish brown clay loam to clay Flat, normal	Eutric Cambisol sodic,saline
A34	Moderately deep to deep well to somewhat excessively drained dark brown to reddish brown loamy sand to sandy loams Flat to gently undulating, normal	Eutric Regosol shallow petric
A35	Deep to very deep moderately well to well drained dark grayish brown to yellowish brown (fine) sandy loam Flat to gently undulating, normal	Calcaric Regosol
A36	Deep to very deep moderately well to well drained dark yellowish brown to dark reddish brown sandy loams to sandy clay loam, aridic moisture regime. Flat to gently undulating, normal	Luvic Xerosol
A37	Deep to very deep imperfectly to moderately well drained dark brown to strong brown sandy clay loam to clay, aridic moisture regime. Flat to gently undulating, normal	Calcic Luvic Xerosol
A37a	Deep to very deep moderately well to well drained yellowish brown to yellowish red sandy loams to sandy clay loam, aridic moisture regime. Gently undulating (terraces), normal	Calcic Luvic Xerosol
A37b	Deep to very deep moderately well to well drained yellowish brown to yellowish red sandy loams to sandy clay loam, aridic moisture regime. Gently undulating (natural levees), normal	Arenic Calcic Luvic Xerosol
A37c	Moderately deep moderately well to well drained yellowish brown to yellowish red sandy loams to sandy clay loam, aridic moisture regime. Gently undulating, normal	Calcic Luvic Xerosol petrocalcic
A37d	Moderately deep moderately well to well drained yellowish brown to yellowish red sandy loams to sandy clay loam, aridic moisture regime. Gently undulating (natural levees), normal	Arenic Calcic Luvic Xerosol petrocalcic

A38	Deep to very deep imperfectly to moderately well drained dark brown to strong brown sandy clay loam to clay, aridic moisture regime. Flat to gently undulating, normal	Cálcic Xerosol
A39	Deep moderately well to well drained brown to reddish yellow sandy loams to sandy clay, aridic moisture regime. Flat to gently undulating, normal	Haplic Xerosol
A40	Deep to very deep moderately well to somewhat excessively drained very dark grayish brown to white sands to loamy sands Flat to gently undulating, normal	Eutric Arenosol
A40a	Deep to very deep moderately well to somewhat excessively drained massive very dark grayish brown to white sands to loamy sands Flat to gently undulating, normal	Eutric Arenosol
A40b	Deep to very deep moderately well to somewhat excessively drained very dark grayish brown to white sands to loamy sands Gently undulating to undulating (ridges), normal	Eutric Arenosol
A40c	Deep to very deep moderately well to somewhat excessively drained very dark grayish brown to white sands to loamy sands Flat to gently undulating, normal to slightly receiving	Eutric Arenosol clayey
A41	Very deep moderately well to well drained massive very dark grayish brown to brown (fine) sands to loamy sands Flat to almost flat, normal	Luvic Arenosol
A42	Deep to very deep poorly to imperfectly drained black to gray loam to clay Flat, (slightly) receiving	Mollic Gleysol
A42a	Deep to very deep poorly to imperfectly drained black to gray loam to clay, overlying grayish brown to white fine sand within 100cm Flat, (slightly) receiving	Mollic Gleysol
A42b	Deep to very deep poorly to imperfectly drained black to gray loam to clay, overlying diatomaceous earth within 100cm Flat, (slightly) receiving	Mollic Gleysol

A42c	Deep to very deep poorly to imperfectly drained black to gray loam to clay Flat, (slightly) receiving	Calcic Mollic Gleysol
A43	Moderately deep to very deep imperfectly drained very dark gray to dark grayish brown sandy clay loam to sandy clay Almost flat, normal to slightly receiving	Calcic Chernozem
A44	Deep to very deep imperfectly to moderately well drained dark grayish brown to pale brown massive loamy sands to sandy loams Flat to gently undulating, normal to (slightly) receiving	Albic Luvisol partly arenic
A45	Moderately deep to very deep moderately well to well drained brown to yellowish red sandy loams to sandy clay Flat, normal	Luvic Phaeozem
A45a	Moderately deep to very deep imperfectly drained very dark grayish brown sandy loams to clay overlying sands to loamy sands Almost flat, normal to slightly receiving	Luvic Phaeozem
A46	Moderately deep to very deep moderately well to well drained brown to yellowish red sandy loams to sandy clay Flat to gently undulating, normal	Haplic Phaeozem
A47	Deep to very deep poorly to imperfectly drained black to grayish brown clay loam to clay over sands to loamy sands Flat to almost flat, slightly receiving	Gleyic Phaeozem
A48	Deep to very deep imperfectly drained black to dark grayish brown clay loam to clay Flat, slightly receiving	Gleyic Luvic Chernozem
A49	Deep to very deep poorly to imperfectly drained very dark gray to brown sandy clay loam to clay Flat to almost flat, (slightly) receiving	Eutric Planosol
A49a	Deep to very deep poorly to imperfectly drained very dark gray to brown sandy loams to sandy clay loam Flat to almost flat, (slightly) receiving	Arenic Eutric Planosol

B Soils on Basic Igneous and Metamorphic Rocks

B1	Very shallow to shallow well to somewhat excessively drained very dark greyish brown to reddish brown sandy loams to clay loam Undulating to hilly, shedding	Eutric Regosol lithic
B1a	Very shallow to shallow well to somewhat excessively drained very dark grayish brown to reddish brown sandy loams to clay loam Almost flat to gently undulating, shedding	Eutric Regosol lithic/ shallow petric
B1b	Very shallow to shallow well to somewhat excessively drained very dark grayish brown to reddish brown sandy loams to clay loam Undulating to hilly, shedding	Calcaric Regosol lithic/ shallow petric
B2	Shallow to moderately deep well drained red to strong brown sandy loams to clay loam (dolerite/ diabase mainly) Almost flat to rolling, (slightly) shedding	Chromic Luvisol partly lithic/petric
B3	Deep moderately well to well drained red to strong brown sandy loams to clay loam (dolerite/diabase mainly) Almost flat to undulating, normal to slightly shedding	Chromic Luvisol
B4	Moderately deep to deep moderately well to well drained reddish brown to red sandy clay loam (dolerite/diabase mainly) Almost flat to undulating, normal to slightly shedding	Chromic Calcic Luvisol partly petric
B5	Deep moderately well to well drained reddish brown to strong brown sandy clay loam to clay (basalt) Undulating to rolling, (slightly) shedding	Chromic Luvisol
B5a	Shallow to moderately deep well drained reddish brown to strong brown sandy clay loam to sandy clay (basalt). Undulating to rolling, (slightly) shedding	Chromic Luvisol partly lithic/petric
B5b	Shallow to moderately deep well drained reddish brown to strong brown sandy clay loam to sandy clay (basalt). Undulating to rolling, (slightly) shedding	Chromic Cambisol partly lithic/petric
B5c	Shallow to moderately deep well drained reddish brown to strong brown sandy clay loam to sandy clay (basalt), aridic moisture regime. Undulating to rolling, (slightly) shedding	Luvic Xerosol partly lithic/petric

B5d	Shallow to moderately deep well drained reddish brown to strong brown sandy clay loam to sandy clay (basalt), aridic moisture regime. Undulating to rolling, (slightly) shedding	Haplic Xerosol partly lithic/petric
B6	Deep moderately well to well drained dark brown to reddish brown sandy clay loam to clay (basalt) Undulating to rolling, (slightly) shedding	Calcic Luvisol
B6a	Shallow to moderately deep well drained dark brown to reddish brown clay loam to clay (basalt) Undulating to rolling, (slightly) shedding	Calcic Luvisol partly lithic/petric
B6b	Shallow to moderately deep well drained dark brown to reddish brown clay loam to clay (basalt) Undulating to rolling, (slightly) shedding	Calcic Cambisol partly lithic/petric
B6c	Shallow to moderately deep well drained dark brown to reddish brown clay loam to clay (basalt), aridic moisture regime, Undulating to rolling, (slightly) shedding	Calcic Luvic Xerosol partly lithic/petric
B6d	Shallow to moderately deep well drained dark brown to reddish brown clay loam to clay (basalt) aridic moisture regime, Undulating to rolling, (slightly) shedding	Calcic Xerosol partly lithic/petric
B7	Very deep moderately well to well drained red to yellowish red sandy clay loam Almost flat to undulating, normal to slightly shedding	Eutric Nitosol
B8	Moderately deep to deep imperfectly drained dark brown to dark reddish brown sandy clay to clay Almost flat, normal	Chromic Vertisol partly petric
B9	Moderately deep to deep poorly to imperfectly drained black to very dark grayish brown clay Almost flat, normal	Pellic Vertisol partly sodic,petric
B10	Shallow to moderately deep moderately well to well well drained dark grayish brown to dark brown sandy clay to clay Almost flat, normal to receiving	Orthic Luvisol partly lithic/petric
B11	Very deep well drained dark brown to strong brown sandy clay loam to sandy clay (gabbro mainly) Almost flat to undulating, normal	Ferric Luvisol

C (AC and LC) Soils on Highly Calcareous Materials

C1	Very shallow (less than 10cm) moderately well to well drained dark grayish brown to brown loamy sands to clay loam Flat to gently undulating, normal to shedding	Lithosol
C1a	Very shallow imperfectly to well drained very dark gray to brown loamy sands to clay loam Flat to gently undulating, normal to shedding	Rendzina shallow-petrocalcic
C2	Very shallow to shallow imperfectly to well drained very dark gray to brown sandy loams to clay loam Flat to gently undulating, normal to shedding	Calcaric Regosol shallow-petrocalcic
C3	Very shallow to shallow imperfectly to moderately well drained dark grayish brown to reddish brown sands to loamy sands Flat to gently undulating, normal to slightly receiving	Petrocalcic Arenosol shallow-petrocalcic
C3b	Moderately deep moderately well to well drained light brownish gray to dark yellowish brown sands to loamy sands Flat to gently undulating, normal	Calcic Arenosol
C4	Shallow to moderately deep imperfectly to well drained very dark gray to reddish brown sandy loams to clay loam Flat to gently undulating, (slightly) receiving	Calcic Cambisol partly petrocalcic
C4a	Shallow to moderately deep imperfectly to well drained very dark gray to reddish brown sandy loams to clay loam, aridic moisture regime Flat to gently undulating, (slightly) receiving	Calcic Xerosol partly petrocalcic
C5	Shallow to moderately deep moderately well to well drained dark yellowish brown to yellowish red sandy loams to clay loam Flat to gently undulating, (slightly) receiving	Calcic Luvisol partly petrocalcic
C5a	Shallow to moderately deep moderately well to well drained dark yellowish brown to yellowish red sandy loams to clay loam, aridic moisture regime Flat to gently undulating, (slightly) receiving	Calcic Luvic Xerosol partly petrocalcic
C5b	Shallow to moderately deep imperfectly drained very dark grayish brown to brown sandy loams to sandy clay Flat, (slightly) receiving	Calcic Luvisol partly petrocalcic

C5c	Shallow to moderately deep imperfectly drained very dark grayish brown to brown sandy loams to sandy clay, aridic moisture regime. Flat, (slightly) receiving	Calcic Luvic Xerosol partly petrocalcic
C6	Shallow to moderately deep poorly to imperfectly drained very dark gray to brown sandy clay loam to clay Flat, (slightly) receiving	Calcic Gleyic Luvisol partly petrocalcic
C7	Shallow to moderately deep imperfectly drained very dark grayish brown to grayish brown sandy loams to sandy clay Flat, normal to slightly receiving	Calcic Luvic Chernozem partly petrocalcic
C8	Shallow to moderately deep poorly to imperfectly drained very dark gray to gray sandy clay to clay Flat, (slightly) receiving	Gleyic Luvic Chernozem partly petrocalcic
C9	Shallow to moderately deep imperfectly drained very dark grayish brown to brown sandy clay loam to clay Flat, normal to slightly receiving	Calcic Chernozem partly petrocalcic
C10	Shallow to moderately deep imperfectly to moderately well drained very dark gray to brown loamy sands to clay loam Flat, normal to slightly receiving	Rendzina partly petrocalcic
C11	Shallow to moderately deep imperfectly drained dark grayish brown to brown sandy loams to clay Flat to almost flat, slightly receiving	Gleyic Cambisol partly lithic/ shallow petric

D Soils on Fine-Grained Sedimentary Rocks

D1	Very shallow to moderately deep well drained yellowish brown to reddish brown sandy loams to clay loam. Undulating to hilly, shedding	Dystric Regosol partly lithic/ shallow petric
D1a	Very shallow to moderately deep well drained yellowish brown to reddish brown sandy loams to clay loam Undulating to hilly, shedding	Eutric Regosol partly lithic/ shallow petric
D1b	Very shallow to moderately deep well drained yellowish brown to reddish brown sandy loams to clay loam Undulating to hilly, shedding	Calcaric Regosol partly lithic/ shallow petric
D1c	Very shallow to moderately deep moderately well to well drained yellowish brown to reddish brown sandy clay to clay Almost flat to undulating, normal to shedding	Eutric Regosol partly lithic/petric
D2	Moderately deep well drained yellowish red to brown sandy loams Flat to undulating, normal to slightly shedding	Ferric Luvisol petric/petroferric
D3	Deep to very deep well drained yellowish red sandy loams Flat to undulating, normal to slightly shedding	Ferric Acrisol
D4	Moderately deep to deep moderately well to well drained pale brown to yellowish red sandy loams to sandy clay loam Flat to undulating, normal to slightly shedding	Ferric Acrisol partly petric
D5	Moderately deep to deep moderately well to well drained reddish brown to strong brown sandy loams to sandy clay loam Flat to gently undulating, normal to slightly shedding	Ferric Luvisol partly petric
D5a	Deep to very deep moderately well to well drained reddish yellow to yellowish red sandy loams to sandy clay loam Flat to gently undulating, normal to slightly shedding	Chromic Luvisol
D5b	Deep to very deep moderately well to well drained reddish yellow to yellowish red sandy loams to sandy clay loam Flat to gently undulating, normal to slightly shedding	Ferric Luvisol
D6	Moderately deep to deep moderately well to well drained reddish brown to yellowish red sandy loams	Ferric Luvisol petric

	to sandy clay loam Undulating to hilly, shedding	
D7	Moderately deep to very deep moderately well drained massive dark brown to yellowish red sandy clay loam to sandy clay Flat to gently undulating, normal	Ferric Luvisol partly petric/ petroferric
D7a	Deep imperfectly to moderately well drained massive dark brown to yellowish brown clay loam to sandy clay Flat to almost flat, normal	Orthic Luvisol partly petric
D7b	Deep moderately well drained massive yellowish red to red clay loam to sandy clay Flat to gently undulating, normal	Chromic Luvisol
D7c	Moderately deep to very deep moderately well drained massive brown to red sandy clay loam to sandy clay Flat to gently undulating, normal	Ferric Acrisol partly petroferric
D8	Deep moderately well drained yellowish red to red sandy clay loam to sandy clay Flat to gently undulating, normal to slightly shedding	Chromic Luvisol
D9	Deep moderately well drained reddish brown to dark yellowish brown sandy clay loam to sandy clay Flat to gently undulating, normal to slightly shedding	Calcic Luvisol
D9a	Moderately deep moderately well drained reddish brown to dark yellowish brown sandy clay loam to sandy clay Flat to gently undulating, normal to slightly shedding	Calcic Luvisol petrocalcic
D10	Very deep moderately well to well drained red sandy loams to sandy clay loam Flat to gently undulating, normal to slightly shedding	Eutric Nitosol

G Soils on Acid Igneous and Metamorphic Rocks

G1	Very shallow to shallow moderately well to somewhat excessively drained grayish brown to yellowish red coarse sand to coarse sandy loam Undulating to hilly, shedding	Dystric Regosol lithic
G1a	Very shallow to shallow moderately well to somewhat excessively drained grayish brown to yellowish red coarse sand to coarse sandy loam Undulating to hilly, shedding	Eutric Regosol lithic
G1b	Moderately deep moderately well to well drained dark grayish brown to reddish brown coarse sand to loamy coarse sand Almost flat to rolling, (slightly) shedding	Dystric Regosol shallow petric
G1c	Moderately deep moderately well to well drained dark grayish brown to reddish brown coarse sand to loamy coarse sand Almost flat to rolling, (slightly) shedding	Eutric Regosol shallow petric
G1d	Moderately deep moderately well to well drained dark grayish brown to reddish brown coarse sand to loamy coarse sand Almost flat to rolling, (slightly) shedding	Calcaric Regosol shallow petric
G1e	Very shallow well to somewhat excessively drained grayish brown to brown coarse sand to loamy coarse sand Undulating, shedding	Lithosol
G2	Moderately deep to deep moderately well to well drained dark grayish brown to reddish brown loamy coarse sands. Petric or petroferric within 75 cm. Almost flat to undulating, shedding to normal	Dystric Regosol petric, partly petroferric
G2a	Moderately deep to deep moderately well to well drained dark grayish brown to reddish brown loamy coarse sand. Petric within 75cm Almost flat to undulating, shedding to normal	Eutric Regosol petric
G2b	Moderately deep to deep moderately well to well drained brown to yellowish red coarse sandy loam Petric within 75cm Almost flat to undulating, shedding to normal	Ferralic Cambisol petric

G2c	Moderately deep moderately well to well drained strong brown to red coarse sandy loam to sandy clay loam. Petric within 75cm Almost flat to undulating, shedding to normal	Chromic Luvisol shallow petric/ petric
G2d	Moderately deep moderately well to well drained grayish brown to red coarse sandy loam to sandy clay loam. Petric or petroferric within 75cm. Almost flat to undulating, shedding to normal	Ferric Luvisol shallow petric/ petric,petroferric
G2e	Moderately deep moderately well to well drained grayish brown to red coarse sandy loam to sandy clay loam. Petric or petroferric within 75cm. Aridic moisture regime. Almost flat to undulating, shedding to normal	Luvic Xerosol shallow petric/ petric,petroferric
G2f	Moderately deep moderately well drained grayish brown to red sandy clay to clay Petric or petroferric within 75cm. Almost flat to undulating, shedding to normal	Ferric Luvisol shallow petric/ petric,petroferric
G3	Moderately deep to deep moderately well drained, brown to light gray massive coarse sand to loamy coarse sand Flat to gently undulating, normal to shedding	Albic Arenosol partly petroferric
G3a	Moderately deep to deep moderately well drained brown to light gray coarse sandy loam or gravelly loamy coarse sand. Flat to gently undulating, normal to shedding	Eutric Regosol partly petric/ partly petroferric
G4	Moderately deep to very deep well to somewhat excessively drained strong brown to yellowish red coarse sand to loamy coarse sand Almost flat to gently undulating, normal to shedding	Ferralic Arenosol partly petroferric
G5	Moderately deep to deep moderately well to well drained yellowish red to dark yellowish brown coarse sandy loam to sandy clay Almost flat to undulating, normal to shedding	Ferric Acrisol partly petric, partly petroferric
G6	Moderately deep to deep moderately well to well drained reddish yellow to red loamy coarse sand to coarse sandy loam. No petric/petroferric within 75cm Almost flat to undulating, normal to shedding	Arenic Ferric Luvisol partly petric, partly petroferric
G6a	Moderately deep to deep moderately well drained yellowish red to red sandy clay loam to clay No petric/petroferric within 75cm Almost flat to undulating, normal to slightly shedding	Ferric Luvisol partly petric/ partly petroferric

G6b	Moderately deep to deep moderately well to well drained yellowish red to red coarse sandy loam to clay. No petric/petroferric within 75cm. Aridic moisture regime. Almost flat to undulating, normal to slightly shedding	Luvic Xerosol partly petric/ partly petroferric
G7	Moderately deep to deep imperfectly to moderately well drained brown to dark grayish brown massive coarse sandy loam to sandy clay loam Flat to gently undulating, normal to slightly receiving	Orthic Luvisol petric
G7a	Moderately deep to deep imperfectly to moderately well drained brown to dark grayish brown massive coarse sandy loam to sandy clay loam Flat to gently undulating, normal to slightly receiving	Ferric Luvisol petroferric
G8	Moderately deep to deep moderately well to well drained yellowish red to red coarse sandy loam to sandy clay loam. No petric within 75cm Almost flat to undulating, normal to slightly shedding	Chromic Luvisol petric
G8a	Moderately deep to very deep moderately well to well drained yellowish red to red coarse sandy loam to sandy clay Almost flat to undulating, normal to slightly shedding	Luvic Xerosol partly petric
G9	Deep to very deep moderately well to well drained yellowish red to dark red sandy clay loam to sandy clay Almost flat to undulating	Chromic Luvisol
G10	Deep to very deep moderately well drained yellowish red to strong brown sandy clay loam to clay Almost flat, normal to slightly receiving	Chromic Luvisol
G10a	Deep to very deep imperfectly drained dark brown sandy clay loam to clay Almost flat, normal to receiving	Orthic Luvisol
G10b	Deep to very deep imperfectly to moderately well drained dark brown to yellowish red sandy clay loam to clay Almost flat, normal to receiving	Ferric Luvisol
G11	Deep imperfectly to moderately well drained gray and red to yellowish red mottled coarse sandy loam to sandy clay loam Flat to gently undulating, (slightly) receiving	Plinthic Luvisol

G12	Moderately deep to deep poorly to imperfectly drained dark grayish brown to dark gray coarse sandy loam to clay Flat, (slightly) receiving	Gleyic Luvisol
G13	Moderately deep to deep imperfectly to well drained dark grayish brown to dark reddish brown sandy loams to sandy clay Flat to undulating, normal to (slightly) receiving	Calcic Luvisol
G13a	Moderately deep imperfectly to well drained dark grayish brown to dark reddish brown coarse sandy loam to sandy clay. Flat to undulating, normal to (slightly) receiving	Calcic Luvisol petrocalcic
G13b	Moderately deep to deep imperfectly to well drained dark grayish brown to dark reddish brown coarse sandy loam to sandy clay, aridic moisture regime. Flat to undulating, normal to (slightly) receiving	Calcic Luvic Xerosol
G14	Very deep moderately well to well drained yellowish red to dark red sandy clay loam to sandy clay Almost flat to gently undulating (pediments mainly), normal	Eutric Nitosol
G14a	Very deep moderately well to well drained yellowish red to dark red sandy clay loam to sandy clay, aridic moisture regime. Almost flat to gently undulating (pediments mainly), normal	Arenic Luvic Xerosol
G15	Deep to very deep imperfectly drained yellowish brown to strong brown sandy clay to clay Flat to gently undulating, slightly receiving	Solodic Planosol
G16	Deep to very deep poorly to imperfectly drained dark gray to grayish brown sandy clay loam to sandy clay Flat to almost flat, (slightly) receiving	Gleyic Solonetz

L (and AL) Soils on Lacustrine Deposits

L1	Very deep very poorly to poorly drained very dark grayish brown to olive silt loam to silty clay loam Flat, receiving	Gleyic Solonchak sodic
L2	Very deep very poorly to poorly drained greenish gray silty clay to clay Flat, receiving	Gleyic Solonchak sodic
L2a	Moderately deep very poorly to poorly drained very dark grayish brown to greenish gray silt loam to clay Flat, receiving	Gleyic Solonchak duripan, sodic
L3	Very deep poorly drained very dark grayish brown to light olive gray loam to clay Flat, receiving	Takyric Solonchak sodic
L4	Deep to very deep poorly drained light gray to light yellowish brown to dark grayish brown silt loam to silty clay loam Almost flat, (slightly) receiving	Orthic Solonchak sodic
L5	Deep to very deep poorly to moderately well drained light olive brown to pale yellow fine sand to loamy fine sand, highly calcareous Flat to gently undulating, normal	Arenic Orthic Solonchak sodic
L6	Very deep poorly to imperfectly drained very dark gray to gray sandy clay to clay Flat, receiving	Calcic Gleysol partly sodic
L6a	Deep to very deep poorly to imperfectly drained very dark gray to gray loam to clay, overlying grayish brown to white fine sand within 100cm Flat, receiving	Calcic Gleysol partly sodic
L6b	Deep to very deep poorly to imperfectly drained very dark gray to gray loam to clay, overlying diatomaceous earth within 50cm Flat, receiving	Calcic Gleysol partly sodic
L7	Very deep poorly to imperfectly drained very dark gray to gray sandy clay to clay Flat, receiving	Eutric Gleysol partly sodic
L8	Very deep very poorly to poorly drained olive gray to light yellowish brown stratified complexes of sands, silt and clay Flat, receiving	Calcaric Fluvisol partly saline,sodic

L8a	Very deep very poorly to poorly drained olive gray to light yellowish brown stratified complexes of sands, silt and clay. Highly saline. Flat, receiving	Calcaric Fluvisol saline
L9	Very deep very poorly to poorly drained light yellowish brown to olive gray to black stratified complexes of sands, silt and clay Flat, receiving	Eutric Fluvisol
L10	Deep to very deep moderately well to well drained dark gray to pale brown fine sand to loamy fine sand Almost flat to gently undulating, normal	Calcaric Arenosol
L11	Deep to very deep moderately well to well drained dark gray to pale brown fine sand to loamy fine sand Calcareous between 0-50cm Almost flat to gently undulating, normal	Calcic Arenosol partly sodic
L11a	Deep to very deep moderately well to well drained dark gray to pale brown fine sand to loamy fine sand, non calcareous between 0-50cm. Almost flat to gently undulating, normal	Calcic Arenosol
L11b	Deep to very deep moderately well to well drained dark gray to pale brown fine sand to loamy fine sand. Calcareous between 0-50cm Flat to almost flat, normal to slightly receiving	Calcic Arenosol clayey
L12	Moderately deep to deep moderately well to somewhat excessively drained very dark grayish brown to very pale brown fine sand to loamy fine sand, calcareous between 0-50cm Flat to gently undulating, normal	Petrocalcic Arenosol
L12a	Moderately deep to deep moderately well to somewhat excessively drained very dark grayish brown to very pale brown fine sand to loamy fine sand, thin intercalated calcrete, calcareous between 0-50cm Flat to gently undulating, normal	Petrocalcic Arenosol
L12b	Moderately deep to deep moderately well to somewhat excessively drained very dark grayish brown to very pale brown fine sand to loamy fine sand, non calcareous between 0-50cm Flat to gently undulating, normal	Petrocalcic Arenosol
L13	Deep to very deep moderately well to well drained grayish brown fine sandy loam to silty clay loam Flat to gently undulating, normal	Calcaric Regosol

L13a	Shallow to moderately deep moderately well to well drained grayish brown fine sandy loam to silty clay loam. Flat to gently undulating, normal	Calcaric Regosol duripan
L14	Deep to very deep moderately well to well drained grayish brown fine sandy loam to clay loam, aridic moisture regime. Flat, normal	Calcic Xerosol
L14a	Shallow to moderately deep moderately well to well drained grayish brown fine sandy loam to clay loam, aridic moisture regime. Flat, normal	Calcic Xerosol duripan
L15	Moderately deep moderately well to well drained grayish brown to pale brown fine sandy loam to silt loam Flat, normal	Calcic Cambisol petrocalcic
L15a	Moderately deep moderately well to well drained grayish brown to pale brown fine sandy loam to silt loam, aridic moisture regime. Flat, normal	Calcic Xerosol petrocalcic
L16	Very deep well to somewhat excessively drained dark gray to pale brown fine sand to loamy fine sand, non calcareous between 0-100cm Flat to gently undulating, normal	Eutric Arenosol
L16a	Very deep well to somewhat excessively drained dark gray to pale brown fine sand to loamy fine sand, calcareous between 50-100cm Flat to gently undulating, normal	Eutric Arenosol
L16b	Deep to very deep moderately well to well drained very dark grayish brown sands to loamy sands over cemented loamy sands to sandy loams Flat to gently undulating, normal	Eutric Arenosol
L16c	Moderately deep well to somewhat excessively drained dark gray to pale brown fine sand to loamy fine sand Flat, normal to slightly receiving	Eutric Arenosol duripan
L16d	Very shallow to shallow well to somewhat excessively drained dark gray to pale brown fine sand to loamy fine sand Flat, normal to slightly receiving	Eutric Arenosol shallow duripan
L17	Deep to very deep imperfectly to well drained	Eutric Regosol

	very dark grayish brown to brown fine sandy loam Flat to gently undulating, normal	
L18	Very deep imperfectly drained very dark gray to to grayish brown sandy clay loam to clay Flat, normal to slightly receiving	Gleyic Cambisol
L19	Deep to very deep imperfectly to moderately well drained very dark grayish brown to brown sandy clay loam to clay Flat, normal	Calcaric Cambisol
L20	Deep to very deep imperfectly to moderately well drained very dark grayish brown to brown sandy clay loam to clay Flat, normal	Calcic Cambisol
L21	Very deep poorly to imperfectly drained pale brown to olive silty clay loam to clay Flat, (slightly) receiving	Orthic Solonetz saline
L22	Deep to very deep imperfectly drained dark grayish brown to olive brown sandy clay loam to clay Flat to almost flat, normal to (slightly) receiving	Orthic Luvisol
L22a	Deep to very deep imperfectly to moderately well drained dark grayish brown to brown loamy sands to sandy clay loam Flat to almost flat, normal to (slightly) receiving	Arenic Orthic Luvisol
L22b	Moderately deep to deep imperfectly drained dark grayish brown to olive brown sandy clay loam to clay Flat to almost flat, normal to (slightly) receiving	Orthic Luvisol petric/ shallow petric
L22c	Deep to very deep imperfectly to moderately well drained dark grayish brown to brown loamy sands to sandy clay loam, aridic moisture regime Flat to almost flat, normal to (slightly) receiving	Arenic Luvic Xerosol
L22d	Deep to very deep imperfectly drained dark grayish brown to olive brown sandy clay loam to clay, aridic moisture regime. Flat to almost flat, normal to (slightly) receiving	Luvic Xerosol
L22e	Shallow to moderately deep imperfectly to moderately well drained dark grayish brown to brown loamy sands to sandy clay loam Flat, normal to slightly receiving	Orthic Luvisol duripan/lithic
L23	Deep to very deep poorly to imperfectly drained dark gray to grayish brown sandy clay loam to clay Flat, (slightly) receiving	Gleyic Luvisol partly sodic/saline

L23a	Moderately deep to deep poorly to imperfectly drained dark gray to grayish brown sandy clay loam to clay Flat, (slightly) receiving	Gleyic Luvisol petric, partly sodic/saline
L24	Moderately deep to very deep imperfectly drained very dark grayish brown to brown sandy loams to clay Flat to gently undulating, normal to receiving	Calcic Luvisol
L24a	Moderately deep to very deep imperfectly drained very dark grayish brown to brown sandy clay loam to clay Flat to gently undulating, normal to receiving	Calcic Luvisol sodic,partly saline
L24b	Moderately deep imperfectly drained very dark grayish brown to brown sandy loams to clay Flat to gently undulating, normal to receiving	Calcic Luvisol partly sodic, petrocalcic
L24c	Moderately deep to very deep imperfectly to moderately well drained dark grayish brown to brown sandy loams to sandy clay loam Flat to gently undulating, normal to receiving	Arenic Calcic Luvisol partly petrocalcic, partly sodic
L24d	Moderately deep to very deep imperfectly to moderately well drained dark grayish brown to brown sandy loams to sandy clay loam, aridic moisture regime. Flat to gently undulating, normal to receiving	Arenic Calcic Luvic Xerosol sodic, partly petrocalcic
L24e	Moderately deep imperfectly drained very dark grayish brown to brown sandy loams to clay, aridic moisture regime. Flat to gently undulating, normal to receiving	Calcic Luvic Xerosol partly sodic, petrocalcic
L24f	Moderately deep to very deep imperfectly drained very dark grayish brown to brown sandy clay loam to clay, aridic moisture regime. Flat to gently undulating, normal to receiving	Calcic Luvic Xerosol partly saline, sodic
L24g	Moderately deep to very deep imperfectly drained very dark grayish brown to brown sandy loams to clay, aridic moisture regime. Flat to gently undulating, normal to receiving	Calcic Luvic Xerosol
L25	Deep to very deep imperfectly drained very dark gray to dark grayish brown clay Flat, normal	Pellic Vertisol
L25a	Deep to very deep poorly to imperfectly drained very dark gray to dark grayish brown clay	Pellic Vertisol partly sodic

	Flat, normal to slightly receiving	
L25b	Deep to very deep poorly drained very dark gray to dark grayish brown clay Flat (drainage ways), receiving	Pellic Vertisol partly sodic
L25c	Moderately deep to deep poorly to imperfectly drained very dark gray to dark grayish brown clay Flat, normal to slightly receiving	Pellic Vertisol petric, partly sodic
L26	Moderately deep to deep poorly to imperfectly drained very dark gray to dark gray clay Flat, (slightly) receiving	Vertic Calcic Gleysol partly petrocalcic
L27	Deep to very deep poorly to imperfectly drained very dark gray to dark gray clay Flat, (slightly) receiving	Vertic Eutric Gleysol
L28	Moderately deep to very deep poorly to imperfectly drained dark gray to grayish brown sandy clay loam to clay. Flat, (slightly) receiving	Calcic Gleyic Luvisol partly petrocalcic
L28a	Deep to very deep poorly to imperfectly drained dark gray to grayish brown sandy clay loam to clay Flat, (slightly) receiving	Calcic Gleyic Luvisol sodic
L29	Moderately deep to deep imperfectly drained dark gray to grayish brown sandy clay to clay Flat, (slightly) receiving	Vertic Gleyic Luvisol partly petric
L30	Deep to very deep imperfectly drained dark gray to grayish brown sandy clay loam to clay Flat, (slightly) receiving	Arenic Gleyic Luvisol
L31	Very deep imperfectly to moderately well drained yellowish brown to yellowish red loamy sands to sandy clay loam Flat to gently undulating, normal	Arenic Eutric Nitosol
L32	Very deep moderately well to well drained brown to yellowish red loamy sands to sandy clay loam Gently undulating, normal	Arenic Ferric Luvisol
L33	Very deep moderately well to well drained brown to yellowish red loamy sands to sandy clay loam Gently undulating, normal	Arenic Ferric Acrisol
L34	Moderately deep to deep imperfectly to moderately well drained brown to yellowish red sandy clay loam to clay Flat to gently undulating,normal	Ferric Luvisol partly petroferric

L35	Deep to very deep imperfectly to moderately well drained dark gray to grayish brown sandy loams to clay Flat, normal	Luvic Chernozem
L35a	Deep to very deep poorly to imperfectly drained very dark gray to dark gray sandy clay loam to clay Flat, normal to slightly receiving	Gleyic Luvic Chernozem partly sodic
L35b	Moderately deep to deep imperfectly to moderately well drained grayish brown to pale brown sandy loams to clay Flat, normal to receiving	Luvic Chernozem sodic,petric
L36	Deep to very deep poorly to imperfectly drained very dark gray to grayish brown sandy clay loam to clay Flat, normal	Calcic Chernozem partly sodic
L37	Deep to very deep poorly to imperfectly drained black to very dark gray loam to clay, with base saturation >50% in all parts of subsoil. Flat, (slightly) receiving	Mollic Gleysol
L37a	Deep to very deep poorly to imperfectly drained black to very dark gray loam to clay, base saturation <50% in some part of the subsoil Flat, (slightly) receiving	Mollic Gleysol
L37b	Deep to very deep poorly to imperfectly drained black to very dark gray loam to clay Flat, (slightly) receiving	Calcic Mollic Gleysol
L37c	Deep to very deep very poorly to imperfectly drained black to very dark gray clay Flat, receiving	Vertic Mollic Gleysol
L37d	Deep to very deep very poorly to imperfectly drained black to very dark gray clay Flat, receiving	Vertic Mollic Gleysol petric
L38	Deep to very deep poorly to imperfectly drained black to very dark gray loam to clay Flat, (slightly) receiving	Dystric Gleysol
L39	Very deep well to somewhat excessively drained light gray to pale brown sands to loamy sands, often showing lamellae of clay accumulation Gently undulating, normal	Albic Arenosol
L40	Very deep moderately well to well drained very dark grayish brown to brown fine sand to loamy fine sand Flat to gently undulating, normal	Luvic Arenosol

L41	Deep to very deep imperfectly drained dark yellowish brown to brown sandy clay loam to clay Flat to gently undulating, normal to slightly receiving	Eutric Planosol
L42	Deep to very deep poorly to imperfectly drained very dark gray to dark grayish brown sandy clay loam to clay. Flat to almost flat, slightly receiving	Solodic Planosol partly saline
L43	Deep to very deep imperfectly to moderately well drained dark grayish brown to pale brown massive loamy sands to sandy loams Flat to gently undulating, normal to receiving	Albic Luvisol partly arenic
L43a	Deep to very deep imperfectly to moderately well drained dark grayish brown to pale brown massive loamy sands to sandy loams Flat to gently undulating, normal to receiving	Calcic Albic Luvisol partly sodic
L44	Deep to very deep well to somewhat excessively drained dark yellowish brown to red sands to loamy sands. Almost flat to gently undulating, normal.	Ferralic Arenosol
L44a	Shallow to moderately deep well drained dark grayish brown to pale brown sands to loamy sands, overlying petroferric material within 125cm, as such regarded as having ferralic properties without the color criteria Almost flat, normal	Ferralic Arenosol (shallow) petroferric
L45	Shallow imperfectly to moderately well drained very dark grayish brown to yellowish brown sandy loams to clay Almost flat, normal	Eutric Regosol shallow petroferric/ shallow petric
L46	Deep to very deep moderately well to well drained strong brown to red loamy sands to sandy clay loam Flat to almost flat, normal	Arenic Chromic Luvisol

S (and KS, LS) Soils on Coarse-grained Sedimentary Rocks and on Unconsolidated Sands

S1	Very shallow to shallow excessively drained yellowish brown to yellowish red sands and loamy sands Undulating to hilly, shedding	Ferralic Arenosol lithic
S1a	Moderately deep somewhat excessively drained dark yellowish brown to yellowish red or dark reddish brown sands and loamy sands (lithic contact between 50-100 cm) Undulating to hilly, shedding	Ferralic Arenosol
S1b	Shallow to moderately deep somewhat excessively drained brownish yellow to yellowish red sands and loamy sands Undulating to hilly, shedding	Arenic Eutric Regosol petric
S1c	Shallow to moderately deep somewhat excessively drained dark grayish brown to yellowish red sands and loamy sands Flat to gently undulating, normal	Arenic Eutric Regosol (shallow) petric
S2	Deep to very deep well to somewhat excessively drained pale brown to yellowish brown sands and loamy sands Flat to undulating, Normal to slightly receiving	Albic Arenosol
S3	Deep to very deep well to somewhat excessively drained yellowish brown to yellowish red fine and fine-medium sand Flat to gently undulating, normal	Ferralic Arenosol
S3a	Deep to very deep well to somewhat excessively drained red (3.5YR or redder) fine and fine-medium sands Flat to gently undulating, normal	Ferralic Arenosol
S4	Deep to very deep somewhat excessively drained brownish yellow to reddish brown medium to coarse sand and loamy sands Flat to gently undulating, normal	Ferralic Arenosol
S5	Deep to very deep well to somewhat excessively drained yellowish brown to red fine and fine-medium sand to loamy fine sand, showing a gradual clay increase with depth (minimum 3% over 125 cm). Flat to gently undulating, normal	Ferralic Arenosol

S5a	Deep to very deep well to somewhat excessively drained yellowish brown (chroma of 5 or more) to red fine and fine-medium sands to loamy fine sand, with lamellae of clay illuviation. Flat to gently undulating, normal	Luvic Arenosol
S5b	Deep to very deep well to somewhat excessively drained dark grayish brown to brown fine and fine-medium sands to loamy fine sand, with lamellae of clay illuviation Flat to gently undulating, normal	Luvic Arenosol
S6	Deep to very deep somewhat excessively to excessively drained yellowish brown to red fine and fine-medium sands to loamy fine sand Undulating to rolling (dunes, hills), shedding to normal	Ferralic Arenosol
S6a	Deep to very deep somewhat excessively to excessively drained yellowish brown (chroma of 5 or more) to red fine and fine-medium sands to loamy fine sand, with lamellae of clay illuviation. Undulating to rolling (dunes, hills), shedding to normal	Luvic Arenosol
S6b	Deep to very deep somewhat excessively to excessively drained dark grayish brown to brown fine and fine-medium sands to loamy fine sand, with lamellae of clay illuviation. Undulating to rolling (dunes, hills), shedding to normal	Luvic Arenosol
S7	Deep to very deep well to somewhat excessively drained strong brown to red loamy fine and fine-medium sands Flat to gently undulating, normal to shedding	Arenic Ferric Luvisol
S7a	Deep to very deep well to somewhat excessively drained strong brown to red loamy fine and fine-medium sands, aridic moisture regime Flat to gently undulating, normal to shedding	Arenic Luvic Xerosol
S7b	Deep to very deep well to somewhat excessively drained dark yellowish brown to brown loamy fine and fine-medium sands Flat to gently undulating, normal to shedding	Arenic Ferric Luvisol
S8	Deep to very deep somewhat excessively to excessively drained yellowish red to red loamy fine and fine-medium sands Undulating to rolling (dunes,hills), shedding to normal	Arenic Ferric Luvisol

S8a	Deep to very deep somewhat excessively to excessively drained yellowish red to red loamy fine and fine-medium sands, aridic moisture regime. Undulating to rolling (dunes, hills), shedding to normal	Arenic Luvic Xerosol
S9	Deep to very deep somewhat excessively drained strong brown to red loamy sands Flat to undulating, normal	Arenic Ferric Acrisol
S9a	Deep to very deep well to somewhat excessively drained strong brown to red sandy loams Flat to undulating, normal	Arenic Ferric Acrisol
S10	Deep to very deep well to somewhat excessively drained yellowish red to red loamy fine and fine-medium sands to fine sandy loam Flat to undulating, normal to slightly receiving	Arenic Ferric Luvisol
S10a	Deep to very deep well to somewhat excessively drained yellowish red to red loamy fine and fine-medium sands to fine sandy loam, aridic moisture regime. Flat to undulating, normal to slightly receiving	Arenic Luvic Xerosol
S11	Very deep well to somewhat excessively drained red to brown loamy fine and fine-medium sands to fine sandy loam Flat to undulating, normal to slightly receiving	Arenic Eutric Nitosol
S11a	Very deep well to somewhat excessively drained red to brown loamy fine and fine-medium sands to fine sandy loam, aridic moisture regime. Flat to undulating, normal to slightly receiving	Arenic Luvic Xerosol
S12	Deep to very deep moderately well to well drained dark grayish brown to yellowish red loamy sands to sandy loams Flat to undulating, normal	Arenic Calcic Luvisol
S12a	Deep to very deep moderately well to well drained dark grayish brown to yellowish red loamy sands to sandy loams, aridic moisture regime. Flat to undulating, normal	Arenic Calcic Luvic Xerosol
S13	Moderately deep to very deep well to somewhat excessively drained grayish brown to yellowish red sands and loamy sands Flat to undulating, normal	Calcic Arenosol

S13a	Moderately deep to deep well to somewhat excessively drained grayish brown to yellowish red sands and loamy sands Flat to undulating, normal	Petrocalcic Arenosol
S14	Very deep well to somewhat excessively drained yellowish red to red fine and fine-medium loamy sands over sandy clay loam Undulating (dunes), normal to shedding	Arenic Eutric Nitosol
S14a	Very deep well to somewhat excessively drained yellowish red to red fine and fine-medium loamy sands over sandy clay loam, aridic moisture regime. Undulating (dunes), normal	Arenic Luvic Xerosol
S15	Deep to very deep well to somewhat excessively drained yellowish brown to reddish yellow fine and fine-medium sands to loamy fine sand Flat to undulating, normal	Calcaric Arenosol
S16	Deep to very deep somewhat excessively drained dark grayish brown to light yellowish brown fine and fine-medium sands to loamy fine sand Flat to undulating, normal	Dystric Arenosol
S17	Deep to very deep well to somewhat excessively drained dark grayish brown to light yellowish brown fine and fine-medium sands to loamy fine sand, non calcareous between 50-100cm Flat to gently undulating, normal	Eutric Arenosol
S17a	Deep to very deep well to somewhat excessively drained dark grayish brown to light yellowish brown fine and fine-medium sands to loamy fine sand, calcareous between 50-100cm Flat to gently undulating, normal	Eutric Arenosol
S17b	Shallow to moderately deep well to somewhat excessively drained dark grayish brown to light yellowish brown fine and fine-medium sands to loamy fine sand Flat to gently undulating, normal	Eutric Arenosol duripan
S17c	Deep to very deep well to somewhat excessively drained dark grayish brown to light yellowish brown medium to coarse sands to loamy sands Undulating to rolling (dunes and beachridges), normal	Eutric Arenosol

S17d	Deep to very deep well to somewhat excessively drained dark grayish brown to light yellowish brown fine and fine-medium sands to loamy fine sand Undulating to rolling (dunes and beachridges), normal	Eutric Arenosol
S18	Deep to very deep well to somewhat excessively drained strong brown to red fine and fine-medium sands to loamy fine sands Flat to gently undulating, normal	Cambic Arenosol

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APPENDIX 1. KEY TO THE GENERAL SOIL LEGEND OF BOTSWANA

Note: This key contains abridged soil unit descriptions only, full descriptions are given in chapter 4.
S-LS connotation for the texture: means all sands and loamy sands.

A Soils on Alluvial Deposits

	DEPTH	DRAIN	TEXT	COLOUR	TOPO	UNIT	REMARKS
HISTOSOLS							
Dystric	> 150	V	SCL-SIL	10YR 2/0 -10YR 2/1	F	A26	overl.sandy subsoil
Eutric	> 150	V	SCL-SIL	10YR 2/0 -10YR 2/1	F	A27	overl. sandy subsoil
VERTISOLS							
Pellic, partly sodic	> 100	P-I	C	10YR 3/1 -2.5Y4/1.5	F-A	A1	
Chromic	> 100	I	CL-C	10YR 4/2 -2.5YR 5/4	F-G	A2	
FLUVISOLS							
Calcaric, partly sodic	>100	P-I	L-C	2.5Y 4/1 -10YR 4/2	F	A23	
Arenic Calcaric, partly sodic	>100	P-I	S-LS	2.5Y 4/1 -10YR 8/2	F	A23a	
Dystric	>150	P	SL-SICL	2.5Y 2/0 -10YR 4/2	F	A25	often overlying (L)S
Dystric	>150	V	SL-SCL	2.5Y 2/0 -10YR 4/1	F	A25b	mostly with Histic <50cm,overlying sand
Arenic Dystric	>150	P	S-LS	2.5Y 2/0 -10YR 4/2		A25a	
Eutric	>150	V-I	SL-C	2.5Y 2/0 -10YR 4/2	F	A24	
Eutric, partly saline	>150	P-I	SIL-SIC	2.5Y 2/0 -10YR 4/2	F	A24d	often overlying (L)S
Eutric, clayey	>150	P-I	S-LS	2.5Y 2/0 -10YR 8/1	F	A24e	
Arenic Eutric	>150	P-I	S-LS	10YR 4/2 -10YR 8/1	F	A24a	in channels, flood plains
Arenic Eutric	>150	V-I	S-LS	2.5Y 2/0 -10YR 4/2	F	A24b	
Arenic Eutric	>150	P-I	SL-SC	2.5Y 2/0 -10YR 5/2	F	A24c	
SOLONCHAKS							
Gleyic	> 150	P-I	FS-L	2.5Y 6/2 -10YR 6/2	F-A	A29	
Orthic	> 150	P-I	L-SICL	10YR 5/2 -10YR 6/2	F-A	A28	
GLEYSOLS							
Mollic	>100	P-I	L-C	2.5Y 2/0 -10YR 5/1	F	A42b	Diatom.earth <100cm
Calcic Mollic	>100	P-I	L-C	2.5Y 2/0 -10YR 5/1	F	A42c	
Mollic	>100	P-I	L-C	2.5Y 2/0 -10YR 5/1	F	A42	
Mollic	>100	P-I	L-C	2.5Y 2/0 -10YR 5/1	F	A42a	overlying white fine sand < 100cm
Calcic	>100	P-I	SC-C	10YR 3/1 -2.5Y 3/1	F	A30	
Eutric	>150	P-I	SCL-C	2.5Y 2/0 -10YR 4/2	F	A31a	
Eutric, sodic	>100	P-I	SC-C	2.5Y 3/1 -10YR 3/1	F	A31	
Eutric, partly sodic	>100	P-I	SL	2.5Y 3/1 -10YR 3/1	F	A31b	
ARENOSOLS							
Luvic	> 150	M-W	S-LS	10YR 3/2 -7.5YR 5/3	F-A	A41	
Petrocalcic	50-125	M-W	S-LS	10YR 4/2 -10YR 5/8	F-G	A21a	
Calcic	> 100	M-W	S-LS	10YR 4/2 -10YR 5/8	F-G	A21	
Calcaric	> 100	M-W	S-LS	10YR 4/2 -10YR 5/8	F-G	A20	
Ferralic	> 100	W-S	S-LS	10YR 5/5 -2.5YR 3/6	F-G	A19	
Cambic	> 100	W-S	S-LS	10YR 3/3 -5YR 5/8	F-G	A22a	on natural levees
Eutric	> 100	W-S	S-LS	10YR 3/2 -10YR 5/4	F-G	A22	on natural levees
Eutric	> 100	M-S	S-LS	10YR 3/2 -7.5YR 8/1	F-G	A40	
Eutric	> 100	M-S	S-LS	10YR 3/2 -7.5YR 8/1	F-G	A40a	massive
Eutric	> 100	M-S	S-LS	10YR 3/2 -7.5YR 8/1	G-U	A40b	on ridges
Eutric,clayey	> 100	M-W	S-LS	10YR 3/2 -7.5YR 8/1	F-G	A40c	
REGOSOLS							
Calcaric	> 100	M-W	SL-FSL	10YR 4/2 -10YR 5/8	F-G	A35	
Eutric, shallow petric	50-150	W-S	LS-SL	10YR 3/3 -2.5YR 5/4	F-G	A34	

PLANOSOLS							
Solodic	> 100	P-I	SC-C	10YR 4/2 -10YR 4/6	F-A	A6	
Eutric	> 100	P-I	SCL-C	2.5Y 3/1 -10YR 5/3	F-A	A49	
Arenic Eutric	> 100	P-I	SL-SCL	2.5Y 3/1 -10YR 5/3	F-A	A49a	
SOLONETZ							
Gleyic, partly saline	> 100	P-I	SCL-C	10YR 3/1 -2.5Y 5/2	F	A5	
Orthic, partly saline	> 100	I-M	SCL-C	10YR 4/2 -7.5YR 5/8	F-G	A5b	
CHERNOZEMS							
Gleyic Luvic	>100	I	CL-C	2.5Y 2/0 -10YR 4/2	F	A48	
Calcic	> 50	I	SCL-SC	2.5Y 3/1 -10YR 4/2	A	A43	
PHAEOZEMS							
Gleyic	>100	P-I	CL-C	2.5Y 2/0 -10YR 5/2	F-A	A47	
Luvic	> 50	M-W	SL-SC	10YR 5/3 - 5YR 5/8	F	A45	
Luvic	> 50	I	SL-C	10YR 3/2 - 2.5Y 3/2	A	A45a	Overlying sands
Haplic	> 50	M-W	SL-SC	10YR 5/3 - 5YR 5/8	F-G	A46	
XEROSOLS							
Luvic	> 100	M-W	SL-SCL	10YR 3/4 -2.5YR 3/4	F-G	A36	
Calcic Luvic	> 100	I-M	SCL-C	10YR 3/3 -7.5YR 5/8	F-G	A37	
Calcic Luvic	> 100	M-W	SL-SCL	10YR 5/4 -5YR 5/8	G	A37a	terraces
Calcic Luvic,petrocalcic	50- 100	M-W	SL-SCL	10YR 5/4 -5YR 5/8	G	A37c	
Arenic Calcic Luvic	> 100	M-W	SL-SCL	10YR 5/4 -5YR 5/8	G	A37b	on natural levees
Arenic Calcic Luvic,petrocalcic	50-100	M-W	SL-SCL	10YR 5/4 -5YR 5/8	G	A37d	on natural levees
Calcic	> 100	I-M	SCL-C	10YR 3/3 -7.5YR 5/8	F-G	A38	
Haplic	100-150	M-W	SL-SC	10YR 5/3 -5YR 7/8	F-G	A39	
NITOSOLS							
Arenic Dystric	> 150	W	SL	7.5YR 6/6-2.5YR 5/8	A-G	A17	
Eutric	> 150	M-W	SL-SCL	7.5YR 4/6-2.5YR 3/6	A-G	A16	
Arenic Eutric	> 150	W	LS-SIL	7.5YR 6/6-2.5YR 5/8	G	A16b	gently sloping terraces
Calcic Eutric	> 150	I-M	SCL-SC	7.5YR 3/2-2.5YR 3/6	F-A	A16a	
ACRISOLS							
Ferric	50-150	M-W	SL-SCL	7.5YR 4/6-2.5YR 5/8	G	A18	
LUVISOLS							
Gleyic, partly sodic	> 100	P-I	SCL-C	2.5Y 4/1 -10YR 5/2	F	A7	
Gleyic, partly sodic	> 100	I	SL	2.5Y 4/1 -10YR 5/2	F	A7a	
Calcic Gleyic, partly sodic	> 100	P-I	SL-SC	2.5Y 4/1 -10YR 5/2	F	A7b	
Albic, partly arenic	>100	I-M	LS-SL	10YR 4/2 -10YR 6/3	F-G	A44	massive
Vertic	> 100	I-M	SCL-C	10YR 4/2 -5YR 5/4	F-G	A8	
Calcic	> 100	I-M	SL-C	2.5Y 4/2 -10YR 5/8	F-G	A9	
Calcic, petrocalcic	50-100	I-M	SL-C	2.5Y 4/2 -10YR 5/8	F-G	A9b	
Calcic, sodic/saline	> 100	I	SCL-C	2.5Y 4/2 -10YR 5/8	F	A9c	partly strongly sodic
Arenic Calcic	>100	I-M	LS-SCL	2.5Y 4/2-7.5YR 5/8	F-G	A9a	
Chromic Calcic,partly petrocalcic	> 50	M	SL-SCL	7.5YR 4/6 -5YR 5/8	F-G	A10	
Chromic	50-150	M-W	SL-SCL	7.5YR 4/6-2.5YR 3/6	A-G	A13	
Chromic	50-150	M	SCL-SC	7.5YR 4/6-2.5YR 3/6	F-G	A13a	massive
Chromic, petric	50-150	W	SL-SCL	7.5YR 4/6-2.5YR 5/8	F-G	A13b	
Ferric	> 50	M-W	SCL-SC	7.5YR 4/6-2.5YR 5/8	F-G	A11	
Ferric, petric/petroferric	50-100	M	SL-SCL	10YR 5/3 -2.5YR 5/8	F-G	A11a	
Arenic Ferric	> 50	W	SL	10YR 5/3 -5YR 5/8	A-G	A12	
Orthic	> 50	M-W	SL-SC	10YR 3/3 -10YR 5/8	F-G	A14	
Orthic	> 50	I-M	SL-SC	10YR 3/1 -10YR 5/2	F-G	A14a	
Arenic Orthic	> 50	W	LS-SCL	10YR 6/3 -10YR 5/8	F-G	A15	
Arenic Orthic	> 50	I-M	LS-SCL	10YR 3/1 -10YR 5/2	F-G	A15a	
CAMBISOLS							
Gleyic	>150	I	SL-SC	10YR 3/2 - 2.5Y 3/2	F	A32	incl. SIL; often overlying (L)FS
Vertic	> 100	I	SCL-C	10YR 4/2 -2.5Y 4/2	F-G	A3	

Calcaric	>50	I-M	SL-SC	2.5Y 4/2 -7.5YR 5/4	F-G	A4	
Calcic	>100	I	SCL-C	2.5Y 5/1 -10YR 5/2	F-A	A4a	massive, strongly calcareous <50cm
Calcic	>50	I-M	CL-C	2.5Y 4/2 -7.5YR 5/4	F-G	A4b	
Calcic	>50	M	SL-SCL	2.5Y 4/2 -7.5YR 5/4	F-G	A4c	
Calcic, petrocalcic	50-100	I-M	SL-C	2.5YR 4/2-7.5YR 5/4	F-G	A4d	
Eutric	>150	W	SL	10YR 3/3 -7.5YR 5/4	G	A33	on natural levees
Eutric, partly sodic	>100	I	CL-C	10YR 4/2 - 2.5Y 4/2	F	A33a	

B Soils on Basic Igneous and Metamorphic Rocks

	DEPTH	DRAIN	TEXT	COLOUR	TOPO	UNIT	REMARKS
VERTISOLS							
Pellic,partly sodic/petric	50-150	P-I	C	2.5Y 2/0-10YR 3/1.5	A	B9	
Chromic,partly petric	50-150	I	SC-C	10YR 3/3 -5YR 3/4	A	B8	
REGOSOLS							
Calcaric, lithic/shallow petric	<50	W-S	SL-CL	10YR 3/2-2.5YR 5/4	U-H	B1b	
Eutric,lithic	<50	W-S	SL-CL	10YR 3/2-2.5YR 5/4	U-H	B1	
Eutric,lithic/shallow petric	<50	W-S	SL-CL	10YR 3/2-2.5YR 5/4	A-G	B1a	
XEROSOLS							
Luvic,petric/partly lithic	25-100	W	SCL-SC	2.5YR 4/3-7.5YR 5/8	U-R	B5c	
Calcic Luvic,petric/partly lithic	25-100	W	CL-C	10YR 3/3 -2.5YR 5/4	U-R	B6c	
Calcic,petric/partly lithic	25-100	W	CL-C	10YR 3/3 -2.5YR 5/4	U-R	B6d	
Haplic,petric/partly lithic	25-100	W	SCL-SC	2.5YR 4/3-7.5YR 5/8	U-R	B5d	
NITOSOLS							
Eutric	> 150	M-W	SCL	5YR 4/6 -2.5YR 5/8	A-U	B7	
LUVISOLS							
Calcic	100-150	M-W	SCL-C	10YR 3/3-2.5YR 5/4	U-R	B6	on basalt
Calcic,petric/partly lithic	25-100	W	CL-C	10YR 3/3-2.5YR 5/4	U-R	B6a	on basalt
Chromic Calcic,partly petric	50-150	M-W	SCL	5YR 4/3 -2.5YR 5/8	A-U	B4	on dolerite/diabase
Ferric	>150	W	SCL-SC	10YR 3/3 - 7.YR 5/8	A-U	B11	on gabbro mainly
Chromic	100-150	M-W	SL-CL	2.5YR 4/6-7.5YR 5/8	A-U	B3	on dolerite/diabase
Chromic	100-150	M-W	SCL-C	2.5YR 4/3-7.5YR 5/8	U-R	B5	on basalt
Chromic,petric/partly lithic	25-100	W	SL-CL	2.5YR 4/6-7.5YR 5/8	A-R	B2	on dolerite/diabase
Chromic,petric/partly lithic	25-100	W	SCL-SC	2.5YR 4/3-7.5YR 5/8	U-R	B5a	on basalt
Orthic,petric/partly lithic	25-100	M-W	SC-C	10YR 4/2 -7.5YR 4/4	A	B10	
CAMBISOLS							
Calcic, petric/partly lithic	25-100	W	CL-C	10YR 3/3 -2.5YR 5/4	U-R	B6b	
Chromic, petric/partly lithic	25-100	W	SCL-SC	2.5YR 4/3-7.5YR 5/8	U-R	B5b	

C (or LC) Soils on Highly Calcareous Materials

	DEPTH	DRAIN	TEXT	COLOUR	TOPO	UNIT	REMARKS
LITHOSOL	0- 10	M-W	LS-CL	2.5Y 4/2 -7.5YR 5/4	F-G	C1	
ARENOSOLS							
Petrocalcic, shallow petrocalcic	10-50	I-M	S-LS	2.5Y 4/2- 2.5YR 5/4	F-G	C3	
Calcic	50-100	M-W	S-LS	2.5Y 6/2 - 10YR 4/6	F-G	C3b	
REGOSOLS							
Calcaric,shallow petrocalcic	10-50	I-W	SL-CL	2.5Y 3/1 -7.5YR 5/4	F-G	C2	
RENDZINA shallow petrocalcic	10-25	I-W	LS-CL	2.5Y 3/1 -7.5YR 5/4	F-G	C1a	
partly petrocalcic	25-100	I-M	LS-CL	2.5Y 3/1 -7.5YR 5/4	F	C10	
CHERNOZEMS							
Calcic Luvic,partly petrocalcic	25-100	I	SL-SC	2.5Y 3/2 - 10YR 5/2	F	C7	
Gleyic Luvic,partly petro-	25-100	P-I	SC- C	2.5Y 3/0 - 10YR 5/1	F	C8	

calcic						
Calcic, partly petrocalcic	25-100	I	SCL-C	2.5Y 3/2 -7.5YR 5/4	F	C9
XEROSOLS						
Calcic Luvic,partly petro-calcic	25-100	M-W	SL-CL	10YR 3/4 - 5YR 5/8	F-G	C5a
Calcic Luvic,partly petro-calcic	25-100	I	SL-SC	2.5Y 3/2 -7.5YR 5/4	F	C5c
Calcic,partly petrocalcic	25-100	I-W	SL-CL	2.5Y 3/1 -2.5YR 5/4	F-G	C4a
LUVISOLS						
Calcic, partly petrocalcic	25-100	M-W	SL-CL	10YR 3/4 -5YR 5/8	F-G	C5
Calcic,partly petrocalcic	25-100	I	SL-SC	2.5Y 3/2 -7.5YR 5/4	F	C5b
Calcic Gleyic,partly petro-calcic	25-100	P-I	SCL-C	2.5Y 3/0 -7.5YR 5/4	F	C6
CAMBISOLS						
Calcic, partly petrocalcic	25-100	I-W	SL-CL	2.5Y 3/1 -2.5YR 5/4	F-G	C4
Gleyic, shallow petric, partly lithic	25-100	I	SL-C	2.5Y 4/2 - 10YR 5/3	F-A	C11

D Soils on Fine Grained Sedimentary Rocks

	DEPTH	DRAIN	TEXT	COLOUR	TOPO	UNIT	REMARKS
REGOSOLS							
Calcaric,shallow petric/ partly lithic	10-100	W	SL-CL	2.5YR 4/4-10YR 5/8	U-H	D1b	
Dystric, shallow petric/ partly lithic	10-100	W	SL-CL	2.5YR 4/4 -10YR 5/8	U-H	D1	
Eutric,petric/partly lithic	10-100	M-W	SC-C	2.5YR 4/4-10YR 5/8	A-U	D1c	
Eutric,shallow petric/partly lithic	10-100	W	SL-CL	2.5YR 4/4-10YR 5/8	U-H	D1a	
NITOSOLS							
Eutric	>150	M-W	SL-SCL	2.5YR 4/6-2.5YR 5/8	F-G	D10	
ACRISOLS							
Ferric	>100	W	SL	5YR 4/6 - 5YR 5/8	F-U	D3	
Ferric, partly petric	50-150	M-W	SL-SCL	10YR 6/3 - 5YR 5/8	F-U	D4	
Ferric, partly petroferric	> 50	M	SCL-SC	10YR 5/3-2.5YR 5/8	F-G	D7c	massive
LUVISOLS							
Calcic	100-150	M	SCL-SC	5YR 4/3 -10YR 4/6	F-G	D9	
Calcic,petrocalcic	50-125	M	SCL-SC	5YR 4/3 -10YR 4/6	F-G	D9a	
Ferric	> 100	M-W	SL-SCL	7.5YR 6/6 -5YR 7/8	F-G	D5b	
Ferric,petric/petroferric	50-100	W	SL	10YR 5/3 - 5YR 5/8	F-U	D2	
Ferric,petric	50-150	M-W	SL-SCL	2.5YR 4/4- 5YR 5/8	U-H	D6	
Ferric,partly petric	50-150	M-W	SL-SCL	2.5YR 4/4-7.5YR 5/8	F-G	D5	
Ferric,partly petric/petro-ferric	> 50	M	SCL-SC	7.5YR 3/2 -5YR 5/8	F-G	D7	massive
Chromic	> 100	M-W	SL-SCL	7.5YR 6/6 - 5YR 7/8	F-G	D5a	
Chromic	100-150	M	CL-SC	5YR 4/6 - 2.5YR 5/8	F-G	D7b	massive
Chromic	100-150	M	SCL-SC	5YR 4/6 - 2.5YR 5/8	F-G	D8	
Orthic,partly petric	100-150	I-M	CL-SC	7.5YR 3/2-10YR 5/8	F-A	D7a	massive

G Soils on Acid Igneous and Metamorphic Rocks

	DEPTH	DRAIN	TEXT	COLOUR	TOPO	UNIT	REMARKS
LITHOSOLS	0-10	W-S	CS-LCS	10YR 5/2-7.5YR 5/4	U	G1e	
ARENOSOLS							
Albic,partly petroferric	50-150	M	CS-LCS	10YR 7/1 -10YR 4/3	F-G	G3	massive
Ferralic,partly petroferric	>50	W-S	CS-LCS	7.5YR 4/5 -5YR 5/8	A-G	G4	
REGOSOLS							
Calcaric,shallow petric	50-100	M-W	CS-LCS	10YR 4/2 -2.5YR 5/4	A-R	G1d	
Dystric,lithic	10-50	M-S	CS-LCS	10YR 5/2 -5YR 5/8	U-H	G1	
Dystric,petric partly petroferric	50-150	M-W	CLS	10YR 4/2 -2.5YR 5/4	A-U	G2	petric/petroferric within 75cm
Dystric,shallow petric	50-100	M-W	CS-LCS	10YR 4/2 -2.5YR 5/4	A-R	G1b	

Eutric,lithic	10-50	M-S	CS-LCS	10YR 5/2 -5YR 5/8	U-H	G1a	
Eutric,petric	50-150	M-W	CLS	10YR 4/2 -2.5YR 5/4	A-U	G2a	petric within 75cm
Eutric,partly petric/ petroferric	50-150	M	CSL	10YR 7.1 -10YR 4/3	F-G	G3a	
Eutric,shallow petric	50-100	M-W	CS-LCS	10YR 4/2 -2.5YR 5/4	A-R	G1c	
PLANOSOLS							
Solodic	>100	I	SC-C	7.5YR 4/6-10YR 5/8	F-G	G15	
SOLONETZ							
Gleyic	>100	P-I	SCL-SC	2.5Y 4/0 -10YR 5/2	F-A	G16	
XEROSOLS							
Luvic,partly petric	> 50	M-W	SL-SC	5YR 4/6 - 2.5YR 5/8	A-U	G8a	petric deeper 75cm
Luvic,partly petric/ petroferric	50-150	M-W	CSL-C	7.5YR 6/6-2.5YR 5/8	A-U	G6b	ferric;petric/petro ferric deeper 75cm
Luvic,shallow petric/ petroferric	50-100	M-W	CSL-SCL	7.5YR 4/6 -2.5YR 5/8	A-U	G2e	petric/petroferric within 75cm
Calcic Luvic	50-150	I-W	SL-SC	10YR 4/2 -2.5YR 3/4	F-U	G13b	
Arenic Luvic	>150	M-W	SCL-SC	2.5YR 3/6 -5YR 5/8	A-G	G14a	
NITOSOLS							
Eutric	> 150	M-W	SCL-SC	2.5YR 3/6-5YR 5/8	A-G	G14	on pediments mainly
ACRISOLS							
Ferric,partly petric/ petroferric	50-150	M-W	CSL-SC	10YR 3/4-5YR 5/8	A-U	G5	
LUVISOLS							
Plinthic	100-150	I-M	SL-SCL	mottled	F-G	G11	
Gleyic	50-150	P-I	CSL-C	2.5Y 4/1 -10YR 5/2	F	G12	
Calcic	50-150	I-W	SL-SC	10YR 4/2 -2.5YR 3/4	F-U	G13	
Calcic,petrocalcic	50-100	I-W	SL-SC	10YR 4/2 -2.5YR 3/4	F-U	G13a	
Ferric	>100	I-M	SCL-C	10YR 3/3 - 5YR 5/8	A	G10b	
Ferric,partly petric/ petroferric	50-150	M	SCL-C	5YR 4/6 -2.5YR 5/8	A-U	G6a	petric/petroferric deeper than 75cm
Ferric,petroferric	50-100	I-M	CSL-SCL	10YR 4/2 -7.5YR 5/4	F-G	G7a	massive
Ferric,shallow petric/petric/ petroferric	50-100	M-W	CSL-SCL	10YR 5/2 -2.5YR 5/8	A-U	G2d	petric/petroferric within 75cm
Ferric,shallow petric/petric/ petroferric	50-100	M	SC-C	10YR 5/2 -2.5YR 5/8	A-U	G2f	petric/petroferric within 75cm
Arenic Ferric,partly petric/ petroferric	50-150	M-W	LCS-CSL	7.5YR 6/6-2.5YR 5/8	A-U	G6	petric/petroferric deeper than 75cm
Chromic	>100	M-W	SCL-SC	5YR 4/6-2.5YR 3/6	A-U	G9	
Chromic	>100	M	SCL-C	5YR 4/6-7.5YR 5/8	A	G10	
Chromic, petric	50-150	M-W	CSL-SCL	5YR 4/6-2.5YR 5/8	A-U	G8	petric deeper 75cm
Chromic,shallow petric/petric	50-100	M-W	CSL-SCL	7.5YR 4/6-2.5YR 5/8	A-U	G2c	petric within 75cm
Orthic	>100	I	SCL-C	10YR 3/3-7.5YR 4/4	A	G10a	
Orthic, petric	50-150	I-M	CSL-SCL	10YR 4.2 -7.5YR 5/4	F-G	G7	massive
CAMBISOLS							
Ferralic,petric	50-150	M-W	CSL	10YR 4/3-5YR 5/8	A-U	G2b	petric within 75cm

L (and AL) Soils on Lacustrine Deposits

	DEPTH	DRAIN	TEXT	COLOUR	TOPO	UNIT	REMARKS
VERTISOLS							
Pellic	> 100	I	C	2.5Y 3/0-10YR 4/1.5	F	L25	
Pellic, partly sodic	> 100	P-I	C	2.5Y 3/0-10YR 4/1.5	F	L25a	
Pellic, partly sodic	> 100	P	C	2.5Y 3/0-10YR 4/1.5	F	L25b	
Pellic, petric/partly sodic	> 100	P-I	C	2.5Y 3/0-10YR 4/1.5	F	L25c	
FLUVISOLS							
Calcaric,saline	> 150	V-P	S-C	5Y 4/2 -10YR 6/4	F	L8a	high salinity, stratified complex
Calcaric,partly saline/sodic	> 150	V-P	S-C	5Y 4/2 -10YR 6/4	F	L8	stratified sands, silts, clays
Eutric	> 150	V-P	S-C	5Y 2/0 -10YR 6/4	F	L9	stratified sands, silts, clays

SOLONCHAKS

Gleyic	> 150	V-P	SIL-SICL	10YR 3/2 - 5Y 5/6	F	L1	
Gleyic	> 150	V-P	SIC-C	7.5GY 5/1- 10G 6/1	F	L2	
Gleyic, duripan	50-100	V-P	SIL-C	10YR 3/2 - 10G 6/1	F	L2a	
Takyric sodic	> 150	P	L-C	10YR 3/2 - 5Y 6/2	F	L3	
Orthic sodic	> 100	P	SIL-SICL	2.5Y 4/2- 10YR 7/1	A	L4	
Arenic Orthic sodic	> 100	P-M	FS-LFS	2.5Y 5/4 - 5Y 8/4	F-G	L5	highly calcareous

GLEYSOLS

Dystric	> 100	P-I	L-C	2.5Y 2/0-10YR 3/1	F	L38	
Eutric,partly sodic	> 150	P-I	SC-C	2.5Y 3/0-10YR 6/1	F	L7	
Vertic Eutric	> 100	P-I	C	2.5Y 3/0-10YR 4/1	F	L27	
Calcic,partly sodic	> 150	P-I	SC-C	2.5Y 3/0-10YR 6/1	F	L6	
Calcic,partly sodic	> 100	P-I	L-C	2.5Y 3/0-10YR 6/1	F	L6a	overlying white fine sands <100cm
Calcic,partly sodic	> 100	P-I	L-C	2.5Y 3/0-10YR 6/1	F	L6b	overlying diatom. earth <50cm
Vertic Calcic,partly petrocalcic	50-150	P-I	C	2.5Y 3/0-10YR 4/1	F	L26	
Mollic	> 100	P-I	L-C	2.5Y 2/0-10YR 3/1	F	L37	B.S. >50%
Mollic	> 100	P-I	L-C	2.5Y 2/0-10YR 3/1	F	L37a	B.S. <50% in some part of subsoil
Calcic Mollic	> 100	P-I	L-C	2.5Y 2/0-10YR 3/1	F	L37b	
Vertic Mollic	> 100	V-I	C	2.5Y 2/0-10YR 3/1	F	L37c	
Vertic Molic,petric	> 100	V-I	C	2.5Y 2/0-10YR 3/1	F	L37d	

ARENOSOLS

Albic	> 150	W-S	S-LS	10YR 7/1-10YR 6/3	G	L39	
Luvic	> 150	M-W	FS-LFS	10YR 3/2-10YR 5/3	F-G	L40	
Petrocalcic	50-125	M-S	FS-LFS	10YR 3/2-10YR 8/4	F-G	L12	calcareous 0-50cm
Petrocalcic	50-125	M-S	FS-LFS	10YR 3/2-10YR 8/4	F-G	L12a	calcareous 0-50cm intercalated calcr.
Petrocalcic	50-125	M-S	FS-LFS	10YR 3/2-10YR 8/4	F-G	L12b	noncalc.0-50cm
Calcic,partly sodic	> 100	M-W	FS-LFS	10YR 4/1-10YR 6/3	A-G	L11	calcareous 0-50cm
Calcic,partly sodic	> 100	M-W	FS-LFS	10YR 4/1-10YR 6/3	A-G	L11a	non calc. 0-50cm
Calcic,clayey	> 100	M-W	FS-LFS	10YR 4/1-10YR 6/3	F	L11b	
Calcaric	> 100	M-W	FS-LFS	10YR 4/1-10YR 6/3	A-G	L10	
Ferralic	> 100	W-S	S-LS	10YR 3/5-2.5YR 5/8	A-G	L44	
Ferralic,petroferric/shallow petroferric	25-100	W	S-LS	10YR 4/2-10YR 6/3	A	L44a	
Eutric	> 150	W-S	FS-LFS	2.5Y 4/0-10YR 6/3	F-G	L16	non calc. 0-100cm
Eutric	> 150	W-S	FS-LFS	2.5Y4/0 -10YR 6/3	F-G	L16a	calcareous 50-100cm
Eutric	>100	M-W	S-LS	2.5Y 3/2-10YR 3/2	F-G	L16b	cemented LS-SL within 125cm
Eutric,duripan	50-100	W-S	FS-LFS	2.5Y 4/0-10YR 6/3	F-G	L16c	
Eutric, shallow duripan	10-50	W-S	FS-LFS	2.5Y 4/0-10YR 6/3	F-G	L16d	

REGOSOLS

Calcaric	> 100	M-W	SL-SICL	10YR 5/2-2.5Y 5/2	F-G	L13	
Calcaric, duripan	25-100	M-W	SL-SICL	10YR 5/2-2.5Y 5/2	F-G	L13a	
Eutric	> 100	I-W	FSL	2.5Y 3/2-7.5YR 5/4	F-G	L17	
Eutric,shallow petric/ petroferric	25-50	I-M	SL-C	10YR 3/2-10YR 5/8	A	L45	

PLANOSOLS

Eutric	> 100	I	SCL-C	10YR 5/3-10YR 3/6	F-G	L41	
Solodic,partly saline	> 100	P-I	SCL-C	2.5Y 3/1-10YR 4/2	F-A	L42	

SOLONETZ

Orthic, saline	> 150	P-I	SICL-C	10YR 6/3-5Y 5/6	F	L21	

CHERNOZEMS

Luvic	> 100	I-M	SL-C	2.5Y 4/0-10YR 5/2	F	L35	
Luvic, sodic, petric	> 50	I-M	SL-C	2.5Y 5/2-10YR 6/3	F	L35b	
Gleyic Luvic,partly sodic	> 100	P-I	SCL-C	2.5Y 3/0-10YR 4/1	F	L35a	
Calcic,partly sodic	> 100	P-I	SCL-C	10YR 3/1-10YR 5/2	F	L36	

XEROSOLS

Luvic	> 100	I	SCL-C	10YR 4/2-2.5Y 4/4	F-A	L22d	
Arenic Luvic	> 100	I-M	LS-SCL	2.5Y 4/2-10YR 5/3	F-A	L22c	
Calcic Luvic	> 50	I	SL-C	2.5Y 3/2-10YR 5/3	F-G	L24g	
Calcic Luvic,petrocalcic/ partly sodic	50-100	I	SL-C	2.5Y 3/2-10YR 5/3	F-G	L24e	
Calcic Luvic, sodic partly saline	> 50	I	SCL-C	2.5Y 3/2-10YR 5/3	F-G	L24f	
Arenic Calcic Luvic,partly petrocalcic/sodic	> 50	I-M	SL-SCL	2.5Y 4/2-10YR 5/3	F-G	L24d	
Calcic	> 100	M-W	FSL-CL	10YR 5/2-2.5Y 5/2	F	L14	
Calcic,duripan	25-100	M-W	FSL-CL	10YR 5/2-2.5Y 5/2	F	L14a	
Calcic,petrocalcic	50-100	M-W	FSL-SIL	2.5Y 5/2-10YR 6/3	F	L15a	

NITOSOLS

Arenic Eutric	> 150	I-M	LS-SCL	5YR 4/6-10YR 5/8	F-G	L31	

ACRISOLS

Arenic Ferric	> 150	M-W	LS-SCL	10YR 4/3- 5YR 5/8	G	L33	

LUVISOLS

Gleyic,partly saline/sodic	> 100	P-I	SCL-C	2.5Y 4/0-10YR 5/2	F	L23	
Gleyic,petric partly sodic/ saline	50-150	P-I	SCL-C	2.5Y 4/0-10YR 5/2	F	L23a	
Arenic Gleyic	> 100	I	SCL-C	2.5 4/0 -10YR 5/2	F	L30	
Calcic Gleyic,partly petro- calcic	> 50	P-I	SCL-C	2.5 4/0 -10YR 5/2	F	L28	
Vertic Gleyic,partly petric	50-100	I	SC-C	2.5Y 4/0-10YR 5/2	F	L29	
Albic,partly arenic	> 100	I-M	LS-SL	2.5Y 4/2-10YR 6/3	F-G	L43	massive
Calcic Albic,partly sodic	> 100	I-M	LS-SL	2.5Y 3/2-10YR 6/3	F-G	L43a	
Calcic	> 50	I	SL-C	2.5Y 3/2-10YR 5/3	F-G	L24	
Calcic,petrocalcic/partly sodic	50-100	I	SL-C	2.5 3/2 -10YR 5/3	F-G	L24b	
Calcic,partly saline/sodic	> 50	I	SCL-C	2.5Y 3/2-10YR 5/3	F-G	L24a	
Arenic Calcic,partly petro- calcic/sodic	> 50	I-M	SL-SCL	2.5Y 4/2-10YR 5/3	F-G	L24c	
Ferric,partly petroferric	50-150	I-M	SCL-C	10YR 4/3-5YR 5/8	F-G	L34	
Arenic Ferric	> 150	M-W	LS-SCL	10YR 4/3-5YR 5/8	G	L32	
Orthic	> 100	I	SCL-C	10YR 4/2-2.5Y 4/4	F-A	L22	
Orthic,shallow petric/petric	50-150	I	SCL-C	10YR 4/2-2.5Y 4/4	F-A	L22b	
Orthic, duripan, lithic	25-100	I-M	LS-SCL	2.5Y 4/2-10YR 5/3	F	L22e	
Arenic Orthic	> 100	I-M	LS-SCL	2.5Y 4/2-10YR 5/3	F-A	L22a	
Arenic chromic	> 100	M-W	LS-SCL	7.5YR 4/6-2.5YR 5/8	F-A	L46	

CAMBISOLS

Gleyic	> 150	I	SCL-C	2.5Y 3/1-10YR 5/2	F	L18	
Calcaric	> 100	I-M	SCL-C	2.5Y 3/2-7.5YR 5/4	F	L19	
Calcic	> 100	I-M	SCL-C	2.5Y 3/2-7.5YR 5/4	F	L20	
Calcic,petrocalcic	50-100	M-W	FSL-SIL	2.5Y 5/2-10YR 6/3	F	L15	

S (and KS,LS) Soils on Coarse Grained Sedimentary Rocks

	DEPTH	DRAIN	TEXT	COLOUR	TOPO	UNIT	REMARKS
ARENOSOLS							
Albic	>100	W-S	S-LS	10YR 6/3 -10YR 5/8	F-U	S2	
Luvic	>100	W-S	FMS-LFS	10YR 5/4 -10R 5/8	F-G	S5a	
Luvic	>100	W-S	FMS-LFS	2.5Y 4/2 -7.5YR 5/4	F-G	S5b	
Luvic	>100	S-E	FMS-LFS	10YR 5/4 -10R 5/8	U-R	S6a	dunes,hills
Luvic	>100	S-E	FMS-LFS	2.5Y 4/2 -7.5YR 5/4	U-R	S6b	dunes,hills
Petrocalcic	50-125	W-S	S-LS	10YR 5/2 -5YR 5/8	F-U	S13a	
Calcic	> 50	W-S	S-LS	10YR 5/2 -5YR 5/8	F-U	S13	
Calcaric	>100	W-S	FMS-LFS	10YR 5/4 -5YR 7/8	F-U	S15	
Ferralic	50-100	S	S-LS	10YR 3/5 -5YR 5/8	U-H	S1a	
Ferralic	>100	W-S	FS-FMS	10YR 5/5 -5YR 5/8	F-G	S3	
Ferralic	>100	W-S	FS-FMS	3.5YR 2.5/2-10R 5/8	F-G	S3a	
Ferralic	>100	S	CS-LS	10YR 6/6 -2.5YR 5/4	F-U	S4	
Ferralic	>100	W-S	FMS-LFS	10YR 5/5 -10R 5/8	F-G	S5	clay 3% over 125cm

Ferralic	>100	S-E	FMS-LFS	10YR 5/5 -10R 5/8	U-R	S6	dunes,hills
Ferralic, lithic	0-50	E	S-LS	10YR 5/5 -5YR 5/8	U-H	S1	
Cambic	>100	W-S	S-LFS	7.5YR 5/8-10R 4/6	F-G	S18	
Dystric	>100	S	FMS-LFS	2.5Y 4/2 -10YR 6/4	F-U	S16	
Eutric	>100	W-S	FMS-LFS	2.5Y 4/2 -10YR 6/4	F-G	S17	noncalc. 50-100cm
Eutric	>100	W-S	FMS-LFS	2.5Y 4/2 -10YR 6/4	F-G	S17A	calcareous 50-100cm
Eutric	>100	W-S	CS-LS	2.5Y 4/2 -10YR 6/4	U-R	S17c	dunes,beachridges
Eutric	>100	W-S	FS-FMS	2.5Y 4/2 -10YR 6/4	U-R	S17d	dunes,beachridges
Eutric,duripan	25-100	W-S	FMS-LFS	2.5Y 4/2 -10YR 6/4	F-G	S17b	
REGOSOLS							
Arenic Eutric,petric	25-100	S	S-LS	10YR 6/6 -5YR 5/8	U-H	S1b	
Arenic Eutric, (shallow) petric	25-100	S	S-LS	2.5YR 4/2-5YR 5/8	F-G	S1c	
XEROSOLS							
Arenic Luvic	> 100	W-S	LFS-LFMS	7.5YR 4/6-2.5YR 5/8	F-G	S7a	ferric
Arenic Luvic	> 100	S-E	LFS-LFMS	5YR 4/6 -2.5YR 5/8	U-R	S8a	ferric,dunes,hills
Arenic Luvic	> 100	W-S	LFMS-FSL	5YR 4/6 -2.5YR 5/8	F-U	S10a	ferric
Arenic Luvic	> 150	W-S	LFMS-FSL	10YR 5/3 -2.5YR 5/8	F-U	S11a	
Arenic Luvic	> 150	W-S	LFMS-SCL	5YR 4/6 -2.5YR 5/8	U	S14a	dunes
Arenic Calcic Luvic	> 100	M-W	LS-SL	10YR 4/2 -5YR 5/8	F-U	S12a	
NITOSOLS							
Arenic Eutric	>150	W-S	LFMS-FSL	10YR5/3 -2.5YR 5/8	F-U	S11	
Arenic Eutric	>150	W-S	LFMS-SCL	5YR 4/6 -2.5YR 5/8	U	S14	dunes
ACRISOLS							
Arenic Ferric	>100	S	LS	7.5YR 5/8-10R 4/6	F-U	S9	
Arenic Ferric	>100	W-S	SL	7.5YR 5/8-10R 4/6	F-U	S9a	
LUVISOLS							
Arenic Calcic	>100	M-W	LS-SL	10YR 4/2-5YR 5/8	F-U	S12	
Arenic Ferric	>100	W-S	LFS-LFMS	7.5YR 4/6-2.5YR 4/8	F-G	S7	
Arenic Ferric	>100	W-S	LFS-LFMS	10YR 5/3-10YR 3/6	F-G	S7b	
Arenic Ferric	>100	S-E	LFS-LFMS	5YR 4/6 -2.5YR 5/8	U-R	S8	dunes,hills
Arenic Ferric	>100	W-S	LFMS-FSL	5YR 4/6 -2.5YR 5/8	F-U	S10	

APPENDIX 2. SOIL UNIT CORRELATION FAO 1974 - FAO 1988 - SOIL TAXONOMY 1987

NOTE: Not all possible Soil Taxonomy subgroups and FAO third level and further subdivisions are indicated, only the ones that occur most frequently. This is only the best approximation.

The use of / means: both occur (one of the two applies).
The use of ( ) means: may occur as well in addition.

Unit	FAO (1974)	FAO (1988)	Soil Taxonomy (1987)
A	**Soils on Alluvial Deposits**		
A1	Pellic Vertisols	Pelli-Eutric Vertisols Pelli-Calcic Vertisols	Typic Pellusterts
A2	Chromic Vertisols	Chromi-Eutric Vertisols Chromi-Calcic Vertisols	Entic/Typic Chromusterts
A3	Vertic Cambisols	Vertic Cambisols	Vertic Ustochrepts
A4	Calcaric Cambisols	Calcaric Cambisols	Typic Ustochrepts/Ustropepts
A4a/b/c	Calcic Cambisols	Haplic Calcisols	Typic Ustochrepts/Ustropepts
A4d	Calcic Cambisols	Petric Calcisols	Petrocalcic Ustochrepts/Ustropepts
A5	Gleyic Solonetz	Stagnic Solonetz Gleyic Solonetz	Typic/Mollic Natraqualfs
A5b	Orthic Solonetz	Haplic Solonetz	Typic/Mollic Natrustalfs
A6	Solodic Planosols	Stagnic Solonetz Eutric Planosols	Albic/Typic Natraqualfs Aeric/Arenic Albaqualfs
A7/a	Gleyic Luvisols	Stagnic Luvisols Gleyic Luvisols	Typic/Aeric/Mollic Ochraqualfs
A7b	Calcic Gleyic Luvisols	Calci-Stagnic Luvisols Calci-Gleyic Luvisols	Typic/Aeric/Mollic Ochraqualfs
A8	Vertic Luvisols	Vertic Luvisols	Vertic Haplustalfs
A9	Calcic Luvisols	Calcic Luvisols Luvic Calcisols	Typic Haplustalfs
A9a	Arenic Calcic Luvisols	Areni-Calcic Luvisols Areni-Luvic Calcisols	Arenic Psammentic Haplustalfs
A9b	Calcic Luvisols	Luvi-Petric Calcisols Petrocalci-Calcic Luvisols	Petrocalcic Paleustalfs
A9c	Calcic Luvisols	Calcic Luvisols Sodi-Calcic Luvisols Sodi-Luvic Calcisols	Typic Haplustalfs
A10	Chromic Calcic Luvisols	Chromi-Calcic Luvisols Chromi-Luvi-Petric Calcisols	Typic Haplustalfs
A11	Ferric Luvisols	Haplic/Ferric Lixisols	Kanhaplic Haplustalfs Kandic Paleustalfs Kandic Rhodustalfs
A11a	Ferric Luvisols	Ferric/Haplic Lixisols	Kanhaplic/Petroferric Haplustalfs
A12	Arenic Ferric Luvisols	Areni-Haplic/Ferric Luvisols	Arenic Haplustalfs
A13/a/b	Chromic Luvisols	Chromic Luvisols	Typic/Ultic Haplustalfs Typic Rhodustalfs
A14	Orthic Luvisols	Haplic Luvisols	Typic/Ultic Haplustalfs
A14a	Orthic Luvisols	Haplic Luvisols	Typic/Aquic Haplustalfs
A15	Arenic Orthic Luvisols	Areni-Haplic Luvisols	Arenic Haplustalfs
A15a	Arenic Orthic Luvisols	Areni-Haplic Luvisols Argi-Luvic Arenosols	Arenic Psammentic Haplustalfs
A16	Eutric Nitosols	Pale-Chromic Luvisols	Typic/Rhodic Paleustalfs
A16a	Calcic Eutric Nitosols	Chromi-Calcic Luvisols	Typic/Calciorthidic Paleustalfs
A16b	Arenic Eutric Nitosols	Pale-Areni-Chromic Luvisols	Arenic (Rhodic) Paleustalfs
A17	Arenic Dystric Nitosols	Areni-Haplic Alisols	Arenic Paleustults
A18	Ferric Acrisols	Haplic/Ferric Acrisols	Kanhaplic Haplustults Kandic Rhodustults
A19	Ferralic Arenosols	Ferralic/Luvic Arenosols	Typic Ustipsamments Ustic Quartzipsamments Ustic/Typic Torripsamments
A20	Calcaric Arenosols	Calcaric Arenosols	Typic Ustipsamments Ustic Quartzipsamments/Torripsamments
A21	Calcic Arenosols	Areni-Haplic Calcisols Calcaric Arenosols Calci-Haplic Arenosols	Grossarenic (Aridic) Ustochrepts Grossarenic (Ustollic) Calciorthids
A21a	Petrocalcic Arenosols	Areni-Petric Calcisols	Grossarenic Petrocalcic Ustochrepts Grossarenic (Ustollic) Paleorthids
A22	Eutric Arenosols	Eutri-Haplic/Luvic Arenosols	Typic Ustipsamments

A22a/b	Cambic Arenosols	Cambic/Luvic Arenosols	Ustic Quartzipsamments/Torripsamments Typic Ustipsamments Ustic Quartzipsamments/Torripsamments
A23	Calcaric Fluvisols	Calcaric Fluvisols	Aeric/Mollic Fluvaquents Aquic/Mollic Ustifluvents
A23a	Arenic Calcaric Fluvisols	Areni-Calcaric Fluvisols Calcaric/Gleyic Arenosols	Arenic Mollic/Aeric Fluvaquents Aquic Quartzipsamment/Ustipsamments
A24/c/d	Eutric Fluvisols	Eutric Gleysols Eutric Fluvisols	Mollic/Aeric Haplaquents/Fluvaquents
A24a/e	Arenic Eutric Fluvisols	Gleyic Arenosols	Typic Psammaquents
A24b	Arenic Eutric Fluvisols	Gleyic Arenosols Areni-Eutric Fluvisols	Typic/Mollic Psammaquents Arenic Mollic/Aeric Fluvaquents
A25	Dystric Fluvisols	Dystric Fluvisols	Humaqueptic/Aeric Fluvaquents
A25a	Arenic Dystric Fluvisols	Areni-Dystric Fluvisols	Arenic Humaqueptic/Aeric Fluvaquents
A25b	Dystric Fluvisols	Dystric Fluvisols	Thapto-Histic Fluvaquents
A26	Dystric Histosols	Dystri-Terric Histosols	Medisaprists/Medihemists
A27	Eutric Histosols	Eutri-Terric Histosols	Medisaprists/Medihemists
A28	Orthic Solonchaks	Calcic/Sodic/Haplic Solonchaks	Typic/Aquollic Salorthids Typic Halaquepts
A29	Gleyic Solonchaks	Gleyic Solonchaks	Typic/Aquollic Salorthids
A30	Calcic Gleysols	Calcic Gleysols Stagni-Haplic Calcisols	Mollic/Aeric Haplaquepts Typic/Aeric Haplaquepts
A31	Eutric Gleysols	Sodi-Eutric Gleysols	Typic/Mollic Halaquepts
A31a/b	Eutric Gleysols	Eutric Gleysols Stagni-Eutric Cambisols	Mollic/Aeric Haplaquepts Typic/Aeric Haplaquepts
A32	Gleyic Cambisols	Gleyic Cambisols Eutric Cambisols	Aquic/Typic Ustochrepts
A33/a	Eutric Cambisols	Eutric Cambisols	Typic Ustochrepts
A34	Eutric Regosols	Eutric Regosols Eutric Leptosols	Typic Ustorthents
A35	Calcaric Regosols	Calcaric Regosols	Typic Ustorthents
A36	Luvic Xerosols	Chromic/Orthic Luvisols	Ustalfic Haplargids
A37/a	Calcic Luvic Xerosols	Calcic Luvisols Luvic Calcisols	Ustalfic Haplargids
A37/b	Arenic Calcic Luvic Xerosols	Areni-Calcic Luvisols Arenic-Luvic Calcisols	Arenic Ustalfic Haplargids
A37/c	Calcic Luvic Xerosols	Petrocalci-Calcic Luvisols Luvi-Petric Calcisols	Petrocalcic Ustollic Paleargids
A37/d	Arenic Calcic Luvic Xerosols	Areni-Petrocalci-Calcic Luvisols Areni-Luvi-Petric Calcisols	Petrocalcic Ustollic Paleargids
A38	Calcic Xerosols	Haplic Calcisols	Ustochreptic Calciorthids
A39	Haplic Xerosols	Chromic/Eutric Cambisols Haplic Calcisols	Ustochreptic Cambiorthids
A40/a/b	Eutric Arenosols	Eutri-Haplic/Luvic Arenosols	Ustic Quartzipsamment
A40c	Eutric Arenosols	Eutri-Haplic Arenosols	Ustic Quartzipsamments
A41	Luvic Arenosols	Lamelli-Luvic Arenosols	Alfic Quartzipsamments
A42/a/b	Mollic Gleysols	Mollic Gleysols	Typic/Fluvaquentic Haplaquolls
A42c	Calcic Mollic Gleysols	Calci-Mollic Gleysols	Typic/Aeric Calciaquolls Typic Haplaquolls
A43	Calcic Chernozems	Calcic Chernozems	Typic Calciustolls Typic Haplustolls
A44	Arenic Albic Luvisols	Arenic Albic Luvisols	Arenic Haplustalfs
A45	Luvic Phaeozems	Luvic Phaeozems	Typic Argiustolls
A45a	Luvic Phaeozems	Luvi-Gleyic Phaeozems	Aquic Argiustolls
A46	Haplic Phaeozems	Haplic Phaeozems	Typic Haplustolls
A47	Gleyic Phaeozems	Luvi-Stagnic Phaeozems Luvi-Gleyic Phaeozems	Typic Argiaquolls
A48	Gleyic Luvic Chernozems	Stagni-Luvic Chernozems	Typic/Aeric Calciaquolls Typic Argiaquolls
A49	Eutric Planosols	Eutric Planosols	Typic Paleustalfs Aeric/Arenic Albaqualfs
A49a	Areni-Eutric Planosols	Areni-Eutric Planosols	Arenic Paleustalfs Arenic Albaqualfs

B Soils on Basic Igneous and Metamorphic Rocks

B1	Eutric Regosols	Eutric Leptosols Eutric Regosols	Lithic Ustorthents
B1a	Eutric Regosols	Eutric Regosols Eutric Leptosols	Lithic/Typic Ustorthents

B1b	Calcaric Regosols	Calcaric Regosols Calcari-Eutric Leptosols	Lithic/Typic Ustorthents
B2	Chromic Luvisols	Chromic Luvisols Rhodi-Chromic Luvisols	Typic/Ultic/Lithic Haplustalfs Typic/Lithic Rhodustalfs
B3	Chromic Luvisols	Chromic Luvisols Rhodi-Chromic Luvisols	Typic/Ultic Haplustalfs Typic Rhodustalfs
B4	Chromic Calcic Luvisols	Chromi-Calcic Luvisols Rhodi-Calcic Luvisols	Typic Haplustalfs Typic/Calciorthidic Rhodustalfs
B5	Chromic Luvisols	Chromic Luvisols	Typic Haplustalfs
B5a	Chromic Luvisols	Chromic Luvisols	Typic/Lithic Haplustalfs
B5b	Chromic Cambisols	Chromic Cambisols	Typic/Lithic Ustochrepts
B5c	Luvic Xerosols	Chromic Luvisols	Ustalfic/Typic/Lithic Haplargids
B5d	Haplic Xerosols	Chromic Cambisols Haplic Calcisols	Ustochreptic/Typic/Lithic Camborthids
B6	Calcic Luvisols	Calcic Luvisols	Typic Haplustalfs
B6a	Calcic Luvisols	Calcic Luvisols Luvic Calcisols	Typic/Lithic Haplustalfs
B6b	Calcic Cambisols	Haplic Calcisols	Typic/Lithic Ustochrepts
B6c	Calcic Luvic Xerosols	Calcic Luvisols Luvic Calcisols	Typic/Lithic Haplargids
B6d	Calcic Xerosols	Haplic Calcisols	Ustochreptic/Typic/Lithic Calciorthids Ustochreptic/Typic/Lithic Camborthids
B7	Eutric Nitosols	(Rhodi-)Pale-Chromic Luvisols	Rhodic/Typic Paleustalfs
B8	Chromic Vertisols	Chromi-Eutric/Calcic Vertisols	Typic Chromusterts
B9	Pellic Vertisols	Pelli-Eutric/Calcic Vertisols	Typic Pellusterts
B10	Orthic Luvisols	Haplic Luvisols	Typic/Lithic Haplustalfs
B11	Ferric Luvisols	Haplic/Ferric Lixisols	Kandic (Rhodic) Paleustalfs Kanhaplic Haplustalfs

C (or LC) Soils on Highly Calcareous Materials

C1	Lithosols	Petrocalci-Lithic Leptosols Calci-Lithic Leptosols	Lithic Ustorthents
C1a	Rendzinas	Petrocalci-Rendzic Leptosols	Petrocalcic Calciustolls
C2	Calcaric Regosols	Petrocalci-Eutric Leptosols Epi-petrocalci-Petric Calcisols	Lithic Ustorthents Petrocalcic Ustochrepts Ustochreptic/Typic Paleorthids
C3	Petrocalcic Arenosols	Petrocalci-Eutric Leptosols Epi-Petrocalci-Petric Calcisols	Petrocalcic Ustochrepts Ustochreptic/Typic Paleorthids
C3b	Calcic Arenosols	Areni-Epi-Hypercalci-Haplic Calcisols	Typic/Arenic Ustochrepts Ustochreptic/Typic Calciorthids Ustochreptic/Typic Calciorthids
C4	Calcic Cambisols	Epi-Hypercalci/Epi-Petrocalci-Eutric Leptosols Epi-Hypercalci-Haplic Calcisols Epi-Petrocalci-Petric Calcisols	Typic/Petrocalcic Ustochrepts
C4a	Calcic Xerosols	Epi-Hypercalci/Epi-Petrocalci-Eutric Leptosols Epi-Hypercalci-Haplic Calcisols Epi-Petrocalci-Petric Calcisols	Ustollic Calciorthids Ustollic Paleorthids
C5/5b	Calcic Luvisols	Epi-Hypercalci-Luvi-Petric Calcisols Epi-Hypercalci-Luvic Calcisols	Petrocalcic Paleustalfs Typic Haplustalfs
C5a/5c	Calcic Luvic Xerosols	Epi-Hypercalci-Luvi-Petric Calcisols Epi-Hypercalci-Luvic Calcisols	Petrocalcic Ustollic/-Alfic Paleargids Ustollic/Ustalfic Haplargids
C6	Calcic Gleyic Luvisols	Epi-Hypercalci-Stagni-Luvi-Petric Calcisols Epi-Hypercalci-Stagni-Luvic Calcisols	Petrocalcic Ochraqualfs Calciorthidic Ochraqualfs
C7	Calcic Luvic Chernozems	Epi-Hypercalci-Luvic Chernozems Epi-Petrocalci-Luvic Chernozems	Petrocalcic Paleustolls Typic/Aridic Argiustolls Petrocalcic Paleustolls
C8	Gleyic Luvic Chernozems	Epi-Hypercalci-Stagni-Luvic Chernozems Epi-Petrocalci-Stagni-Luvic Chernozems	Petrocalcic Argiaquolls Typic Argiaquolls
C9	Calcic Chernozems	Epi-Hypercalci-Calcic Chernozems Epi-Petrocalci-Calcic Chernozems	Typic/Entic/Aridic Haplustolls Petrocalcic Calciustolls
C10	Rendzinas	Rendzic Leptosols Petrocalci-Rendzic Leptosols Epi-Hypercalci/Epi-Petrocalci-Calcic Chernozems	Entic/Aridic Haplustolls

C11	Gleyic Cambisols	Gleyi-Hypercalci-Eutric Leptosols Gleyi-Epi-Hypercalci-Haplic Calcisols	Typic Haplaquepts

D Soils on Fine Grained Sedimentary Rocks

D1	Dystric Regosols	Dystric Regosols Dystric Leptosols	Typic/Lithic Ustorthents
D1a/c	Eutric Regosols	Eutric Regosols Eutric Leptosols	Typic/Lithic Ustorthents
D1b	Calcaric Regosols	Calcaric Regosols Calcari-Eutric Leptosols	Typic/Lithic Ustorthents
D2	Ferric Luvisols	Haplic Lixisols	Kanhaplic/Petroferric Haplustults
D3	Ferric Acrisols	Haplic Acrisols	Kanhaplic Haplustults
D4	Ferric Acrisols	Haplic/Ferric Acrisols	Kanhaplic/Petroferric Haplustults
D5	Ferric Luvisols	Haplic/Ferric Lixisols	Kanhaplic Paleustalfs
D5a	Chromic Luvisols	Chromic Luvisols	Typic/Ultic Haplustalfs
D5b	Ferric Luvisols	Haplic/Ferric Lixisols Pale-Haplic/Ferric Lixisols	Kanhaplic Haplustalfs Haplic Paleustalfs
D6	Ferric Luvisols	Haplic/Ferric Lixisols	Kanhaplic Haplustalfs
D7	Ferric Luvisols	Ferric/Haplic Lixisols	Kanhaplic/Petroferric Haplustalfs
D7a	Orthic Luvisols	Haplic Luvisols	Typic/Ultic Haplustalfs
D7b	Chromic Luvisols	Rhodi-Chromic Luvisols	Typic Rhodustalfs Typic/Ultic Haplustalfs
D7c	Ferric Acrisols	Haplic Acrisols	Kanhaplic/Petroferric Haplustalfs Kandic/Petroferric Rhodustults Kandic/Petroferric Paleustults
D8	Chromic Luvisols	(Rhodi-)Chromic Luvisols	Typic Rhodustalfs/Haplustalfs
D9	Calcic Luvisols	Calcic Luvisols	Typic Haplustalfs
D9a	Calcic Luvisols	Luvi-Petric Calcisols Petrocalci-Calcic Luvisols	Petrocalcic Paleustalfs
D10	Eutric Nitosols	Rhodi-Chromic Luvisols	Rhodic Paleustalfs

G Soils on Acid Igneous and Metamorphic Rocks

G1	Dystric Regosols	Dystric Leptosols Dystric Regosols	Lithic Ustorthents
G1a	Eutric Regosols	Eutric Leptosols Eutric Regosols	Lithic Ustorthents
G1b	Dystric Regosols	Dystric Regosols	Typic Ustorthents
G1c	Eutric Regosols	Eutric Regosols	Typic Ustorthents
G1d	Calcaric Regosols	Calcaric Regosols	Typic Ustorthents
G1e	Lithosols	Lithic Leptosols	Lithic Ustorthents
G2	Dystric Regosols	Dystric Regosols	Typic Ustorthents
G2a	Eutric Regosols	Eutric Regosols	Typic Ustorthents
G2b	Ferralic Cambisols	Ferralic Cambisols	Typic Ustochrepts
G2c	Chromic Luvisols	Chromic Luvisols Rhodi-Chromic Luvisols	Typic/Ultic Haplustalfs Typic Rhodustalfs
G2d	Ferric Luvisols	Ferric/Haplic Lixisols Rhodi-Ferric Haplustalfs	Kanhaplic/Petroferric Haplustalfs Kandic/Petroferric Rhodustalfs
G2e	Luvic Xerosols	Chromic/Haplic/Ferric Luvisols	Ustalfic Haplargids
G2f	Ferric Luvisols	Ferric/Haplic Lixisols Rhodi-Ferric/Haplic Lixisols	Kanhaplic/Petroferric Haplustalfs Haplic/Petroferric Rhodustalfs
G3	Albic Arenosols	Areni-Eutric Regosols Albic Arenosols	Typic Ustipsamments
G3a	Eutric Regosols	Eutric Regosols	Typic Ustorthents
G4	Ferralic Arenosols	Ferralic Arenosols Areni-Eutric Regosols	Typic Ustipsamments
G5	Ferric Acrisols	Ferric/Haplic Acrisols Ferric Alisols	Kanhaplic/Petroferric Haplustults Kandic/Petroferric Rhodustults
G6	Arenic Ferric Luvisols	Areni- Ferric/Haplic Lixisols Rhodi-Areni-Ferric/Haplic Lixisols	Arenic Kanhaplic/Petroferric Haplustalfs Arenic Kandic/Petroferric Rhodustalfs
G6a	Ferric Luvisols	Ferric/Haplic Lixisols Rhodi-Ferric/Haplic Lixisols (Rhodi-)Ferric Luvisols	Kanhaplic/Petroferric Haplustalfs Kandic/Petroferric Rhodustalfs Ultic Haplustalfs/Typic Rhodustalfs
G6b	Luvic Xerosols	(Areni-)Ferric/Haplic Lixisols Ferric Luvisols	(Arenic) Ustalfic/Typic Haplargids
G7	Orthic Luvisols	Haplic Luvisols	Typic/Ultic Haplustalfs
G7a	Ferric Luvisols	Ferric Lixisols Ferric Luvisols	Petroferric Haplustalfs
G8	Chromic Luvisols	Chromic Luvisols Rhodi-Chromic Luvisols	Typic/Ultic Haplustalfs Typic Rhodustalfs

G8a	Luvic Xerosols	Chromic Luvisols Rhodi-Chromic Luvisols	Ustalfic/Typic Haplargids
G9	Chromic Luvisols	Chromic Luvisols Rhodi-Chromic Luvisols	Typic/Ultic Haplustalfs Typic Rhodustalfs
G10	Chromic Luvisols	Chromic Luvisols Rhodi-Chromic Luvisols	Typic Haplustalfs
G10a	Orthic Luvisols	Haplic Luvisols	Typic Haplustalfs
G10b	Ferric Luvisols	Ferric Lixisols Ferric Luvisols	Kanhaplic Haplustalfs Typic Haplustalfs
G11	Plinthic Luvisols	Albic Plinthosols	Plinthustalfs
G12	Gleyic Luvisols	Stagnic Luvisols	Aeric Ochraqualfs
G13	Calcic Luvisols	Calcic Luvisols	Typic Haplustalfs
G13a	Calcic Luvisols	Luvi-Petric Calcisols Petrocalci-Calcic Luvisols	Petrocalcic Paleustalfs
G13b	Calcic Luvic Xerosols	Calcic Luvisols Luvic Calcisols	Ustalfic/Typic Haplargids
G14	Eutric Nitosols	Pale-Chromic Luvisols	Rhodic/Typic Paleustalfs
G14a	Arenic Luvic Xerosols	Pale-Arenic Chromic Luvisols	Arenic Ustalfic Haplargids
G15	Solodic Planosols	Albi-Abrupti-Stagnic Solonetz Eutric Planosols	Albic Natraqualfs Aeric/Arenic Albaqualfs
G16	Gleyic Solonetz	Stagnic Solonetz	Typic Natraqualfs

L (or Al) Soils on Lacustrine Deposits

L1	Gleyic Solonchaks	Gleyic Solonchaks	Typic Salorthids
L2	Gleyic Solonchaks	Gleyic Solonchaks	Typic Salorthids
L2a	Gleyic Solonchaks	Duri-Gleyic Solonchaks	Aquic Durorthids
L3	Takyric Solonchaks	Takyri-Gleyic Solonchaks	Typic Salorthids
L4	Orthic Solonchaks	Sodi-Calcic Solonchaks	Typic Salorthids
L5	Arenic Orthic Solonchaks	Areni-Calcic Solonchaks	Typic Salorthids Ustochreptic Calciorthids
L6/a/b	Calcic Gleysols	Calcic Gleysols Stagni-Haplic Calcisols	Mollic Haplaquepts Typic Halaquepts Typic Tropaquepts
L7	Eutric Gleysols	Eutric Gleysols Stagni-Eutric Cambisols	Mollic/Typic Haplaquepts Typic Halaquepts Typic Tropaquepts
L8	Calcaric Fluvisols	Calcaric Fluvisols	Typic/Tropic Fluvaquents Typic Halaquents
L8a	Calcaric Fluvisols	Salic Fluvisols	Typic Salorthids
L9	Eutric Fluvisols	Eutric Fluvisols	Typic/Tropic Fluvaquents
L10	Calcaric Arenosols	Calcaric Arenosols	Ustic Quartzipsamments Ustic Torripsamments
L11/b	Calcic Arenosols	Areni-Haplic Calcisols Calcareous Arenosols	Grossarenic (Ustollic) Calciorthids Grossarenic (Aridic) Ustochrepts
L11a	Calcic Arenosol	Areni-Haplic Arenosols Hypo-Calci-Haplic Arenosls	Grossarenic Ustropepts
L12/a/b	Petrocalcic Arenosols	Areni-Petric Calcisols	(Gross)arenic (Ustollic) Paleorthids (Gross)arenic Petrocalcic Ustochrepts (Gross)arenic Petrocalcic Ustropepts
L13	Calcaric Regosols	Calcaric Regosols	Typic Ustorthents
L13a	Calcaric Regosols	Calcaric Regosols	Typic Durochrepts
L14	Calcic Xerosols	Haplic Calcisols	Typic/Ustollic Calciorthids Typic/Ustollic Camborthids
L14a	Calcic Xerosols	Duri-Haplic Calcisols	Typic Durochrepts
L15	Calcic Cambisols	Petric Calcisols	Petrocalcic Ustochrepts
L15a	Calcic Xerosols	Petric Calcisols	Ustollic Paleorthids
L16/a	Eutric Arenosols	Eutri-Haplic Arenosols	Ustic Quartzipsamments Ustic Torripsamments
L16b	Eutric Arenosols	Eutri-Haplic Arenosols	Typic Ustorthents Ustic Quartzipsamments
L16c	Eutric Arenosols	Areni-Duri-Eutric Regosols	Arenic Durochrepts
L16d	Eutric Arenosols	Duri-Lithic/Duri-Eutric Leptosols	Ustic Durochrepts
L17	Eutric Regosols	Haplic Arenosols	Typic Ustorthents Ustic Torriorthents
L18	Gleyic Cambisols	Gleyic Cambisols Eutric Cambisols	Typic Ustorthents
L19	Calcaric Cambisols	Calcaric Cambisols	Typic Ustorthents Ustollic/Typic Camborthids
L20	Calcic Cambisols	Haplic Calcisols	Typic Ustochrepts Typic Ustropepts
L21	Orthic Solonetz	Sali-Calcic/Orthic Solonetz	Aquic/Salorthidic Natrustalfs
L22/a/b	Orthic Luvisols	Haplic Luvisols	Typic Haplustalfs
L22a	Arenic Orthic Luvisols	Areni-Haplic Luvisols	Arenic Psammentic Haplustalfs

		Argi-Luvic Arenosols	
L22c	Areni Luvic Xerosols	Areni-Haplic Luvisols	Arenic Ustalfic Haplargids
L22d	Luvic Xerosols	Haplic Luvisols	Ustalfic Haplargids
L22e	Orthic Luvisols	Duri-Haplic Luvisols	Typic Duristalfs
L23/23a	Gleyic Luvisols	Gleyic/Stagnic Luvisols	Aeric/Typic Mollic Ochraqualfs
L24	Calcic Luvisols	Calcic Luvisols Luvic Calcisols	Typic Haplustalfs
L24a	Calcic Luvisols	(Sali-)Sodi-Calcic Luvisols (Sali-)Sodi-Luvic Calcisols Calcic Luvisols	Typic Haplustalfs
L24b	Calcic Luvisols	Petrocalci-Calcic Luvisols Luvi-Petric Calcisols	Petrocalcic Paleustalfs
L24c	Arenic Calcic Luvisols	Areni-Calcic Luvisols (Sodi-)Areni-Luvic Calcisols Areni-Petrocalci-Calcic Luvisols	Arenic Psammentic Haplustalfs Arenic Petrocalcic Paleustalfs
L24d	Arenic Calcic Luvic Xerosols	Areni-Calcic Luvisols Areni-Luvic Calcisols Areni-Petrocalci-Calcic Luvisols	Arenic Ustollic Haplargids Arenic Petrocalcic/Ustollic Paleargids
L24e	Calcic Luvic Xerosols	Petrocalci-Calcic Luvisols Luvi-Petric Calcisols	Petrocalcic (Ustollic) Paleargids
L24f	Calcic Luvic Xerosols	(Sali-)Sodi-Calcic Luvisols (Sali-)Sodi-Luvic Calcisols Calcic Luvisols	Ustollic/Typic Haplargids
L24g	Calcic Luvic Xerosols	Calcic Luvisols Luvic Calcisols	Ustollic/Typic Haplargids
L25/a/c	Pellic Vertisols	Grumi-Pelli-Eutric/Calcic Vertisols	Typic Pellusterts
L25b	Pellic Vertisols	Grumi-Pelli-Eutric/Calcic Vertisols	Typic Pellusterts Typic Pelluderts
L26	Vertic Calcic Gleysols	Verti-Stagni-Haplic Calcisols	Vertic Haplaquepts
L27	Vertic Eutric Gleysols	Verti-Stagni-Eutric Cambisols	Vertic Haplaquepts
L28	Calcic Gleyic Luvisols	Calci-Stagnic Luvisols Petrocalci-Stagnic Luvisols	Typic Arenic/Mollic Ochraqualfs Petrocalcic Ochraqualfs
L28a	Calcic Gleyic Luvisols	Calci-Stagnic Luvisols Sodi-Calci-Stagnic Luvisols Petrocalci-Stagnic Luvisols	Typic Ochraqualfs Typic Ochraqualfs Petrocalcic Ochraqualfs
L29	Vertic Gleyic Luvisols	Verti-Stagnic Luvisols	Vertic Ochraqualfs
L30	Arenic Gleyic Luvisols	Areni-Stagnic Luvisols	Arenic Ochraqualfs
L31	Arenic Eutric Nitosols	Areni-Chromic Luvisols	Arenic Paleustalfs
L32	Arenic Ferric Luvisols	Areni-Haplic/Ferric Lixisols	Arenic Kandic Paleustalfs
L33	Arenic Ferric Acrisols	Areni-Haplic/Ferric Acrisols	Arenic Kandic Paleustults
L34	Ferric Luvisols	Ferric/Haplic Lixisols	Kanhaplic/Petroferric Haplustalfs
L35	Luvic Chernozems	(Calci-)Luvic Chernozems	Typic/Aridic Argiustolls
L35a	Gleyic Luvic Chernozems	Stagni-Luvic Chernozems	Aeric Calciaquolls Typic Argiaquolls
L36	Calcic Chernozems	Calcic Chernozems	Typic Argiustolls/Typic Haplustolls
L37	Mollic Gleysols	Mollic Gleysols	Fluvaquentic/Typic Haplaquolls
L37a	Mollic Gleysols	Mollic Gleysols	Fluvaquentic/Typic Humaquepts
L37b	Calcic Mollic Gleysols	Calci-Mollic Gleysols	Aeric/Typic Calciaquolls Fluvaquentic/Typic Haplaquolls
L37c	Vertic Mollic Gleysols	Verti-Mollic Gleysols	Vertic Haplaquolls
L37d	Vertic Mollic Gleysols	Verti-Mollic Gleysols	Vertic Haplaquolls
L38	Dystric Gleysols	Dystric Gleysols	Humic Haplaquepts
L39	Albic Arenosols	Albic Arenosols Lamelli-Albic Arenosols	Albic Alfic Quartzipsamments Alfic Quartzipsamments
L40	Luvic Arenosols	Lamelli-Luvic Arenosols	Alfic Quartzipsamments
L41	Eutric Planosols	Eutric Planosols	Typic Paleustalfs Aeric/Arenic Albaqualfs
L42	Solodic Planosols	Albi-Abrupti-Stagnic/Gleyic Solonetz Gleyic Planosols	Albic Natraqualfs Aeric/Arenic Albaqualfs
L43	Arenic Albic Luvisols	Abrupti-Albic Luvisols	Arenic Psammentic Haplustalfs
L43a	Calcic Albic Luvisols	Calci-Abrupti-Albic Luvisols	Arenic Psammentic Haplustalfs
L44	Ferralic Arenosols	(Ferri-)Ferralic Arenosols	Typic Quartzipsamments
L44a	Ferralic Arenosols	Areni-Eutric Regosols	Petroferric Quartzipsamments
L45	Eutric Regosols	Eutric Regosols	Typic Ustorthents
L46	Arenic Chromic Luvisols	Arenic Chromic Luvisols	Arenic Haplustalfs

S (or KS,LS) Soils on Coarse Grained Sedimentary Rocks

S1	Ferralic Arenosols	Eutric Regosols	Lithic Ustipsamments Lithic Quartzipsamments Lithic Torripsamments
S1a	Ferralic Arenosols	Areni-Eutric Regosols	Typic Ustipsamments Ustic Quartzipsamments Ustic Torripsamments
S1b/c	Arenic Eutric Regosols	Areni-Eutric Regosols	Typic Ustorthents
S2	Albic Arenosols	Albic Arenosols Luvi-Albic Arenosols	Albic Ustipsamments Albic Quartzipsamments Albic Torripsamments
S3	Ferralic Arenosols	Ferralic Arenosols	Ustic Quartzipsamments Typic Ustipsamments Ustic/Typic Torripsamments
S3a	Ferralic Arenosols	Ferralic Arenosols	Ustic Quartzipsamments Ustic/Typic Torripsamments Typic Ustipsamments
S4	Ferralic Arenosols	Ferralic Arenosols	Typic Ustipsamments Ustic Quartzipsamments/Torripsamments
S5	Ferralic Arenosols	Luvic Arenosols	Ustic Quartzipsamments Typic Ustipsamments Ustic/Typic Torripsamments
S5a/b	Luvic Arenosols	Lamelli-Luvic Arenosols	Alfic Quartzipsamments Alfic Ustipsamments Alfic Torripsamments
S6	Ferralic Arenosols	Ferralic/Luvic Arenosols	Ustic Quartzipsamments Typic Ustipsamments Ustic/Typic Torripsamments
S6a/b	Luvic Arenosols	Lamelli-Luvic Arenosols	Alfic Quartzipsamments Alfic Ustipsamments Alfic Torripsamments
S7	Arenic Ferric Luvisols	Argi-Luvic Arenosols	Psammentic Kandic (Rhodic) Paleustalfs
S7a	Arenic Luvic Xerosols	Argi-Luvic Arenosols	Psammentic Ustollic Haplargids
S8	Arenic Ferric Luvisols	Argi-Luvic Arenosols	Psammentic Kandic (Rhodic) Paleustalfs
S8a	Arenic Luvic Xerosols	Argi-Luvic Arenosols	Psammentic Ustollic Haplargids
S9	Arenic Ferric Acrisols	Dystri-Argi-Luvic Arenosols	Psammentic Kandic (Rhodic) Paleustults
S9a	Arenic Ferric Acrisols	Pale-Areni-Haplic Acrisols	Grossarenic Kandic (Rhodic) Paleustults
S10	Arenic Ferric Luvisols	Pale-Areni-Haplic Lixisols	Grossarenic Kandic (Rhodic) Paleustalfs
S10a	Arenic Luvic Xerosols	Pale-Areni-Haplic Lixisols	Grossarenic Ustollic Haplargids
S11	Arenic Eutric Nitosols	Pale-Areni-Chromic Luvisols	Grossarenic (Rhodic) Paleustalfs
S11a	Arenic Luvic Xerosols	Pale-Areni-Chromic Luvisols	Grossarenic Ustollic Haplargids
S12	Arenic Calcic Luvisols	Areni-Calcic Luvisols	(Gross)arenic Paleustalfs/Haplustalfs
S12a	Arenic Luvic Xerosols	Areni-Calcic Luvisols	(Gross)arenic (Ustollic) Haplargids
S13	Calcic Arenosols	Areni-Haplic Calcisols Calcaric Arenosols	Grossarenic (Ustollic) Calciorthids Grossarenic (Aridic) Ustochrepts Grossarenic Ustropepts
S13a	Petrocalcic Arenosols	Areni-Petric Calcisols	(Gross)arenic (Ustollic) Paleorthids (Gross)arenic Petrocalcic Ustochrepts (Gross)arenic Petrocalcic Ustropepts
S14	Arenic Eutric Nitosols	Pale-Areni-Chromic/Haplic Luvisols	(Gross)arenic (Rhodic) Paleustalfs
S14a	Arenic Luvic Xerosols	Pale-Areni-Chromic/Haplic Luvisols	(Gross)arenic Ustollic Haplargids
S15	Calcaric Arenosols	Calcaric Arenosols	Typic Ustipsamments Ustic Quartzipsamments Ustic/Typic Torripsamments
S16	Dystric Arenosols	Dystri-Haplic Arenosols	Typic Ustipsamments Ustic Quartzipsamments
S17/c /d	Eutric Arenosols	Eutri-Haplic Arenosols Eutric-Luvic Arenosols	Ustic Quartzipsamments Typic Ustipsamments Ustic/Typic Torripsamments
S17a	Eutric Arenosols	Calcari-Haplic Arenosols	Ustic Quartzipsamments Typic Ustipsamments Ustic/Typic Torripsamments
S17b	Eutric Arenosols	Areni-Eutric Calcisols	(Gross)arenic Durorthids
S18	Cambic Arenosols	Cambic Arenosols	Ustic Quartzipsamments Typic Ustipsamments Ustic/Typic Torripsamments

APPENDIX 3. GENERAL CORRELATION BOTSWANA SOIL UNITS FAO 1974 - FAO 1988

HISTOSOLS		
Dystric Histosols		Dystric-Terric Histosols (Dystri-Fibric Histosols)
Eutric Histosols		Eutric-Terric Histosols (Eutric-Fibric Histosols)
LITHOSOLS		Lithic Leptosols
VERTISOLS		
Pellic Vertisols		Pelli-Eutric/Calcic Vertisols
Chromic Vertisols		Chromi-Eutric/Calcic Vertisols
FLUVISOLS		
Calcaric Fluvisols		Calcaric Fluvisols
Dystric Fluvisols		Dystric Fluvisols
Eutric Fluvisols		Eutric Fluvisols
SOLONCHAKS		
fluvic properties	no diagnostic B horizon	Salic Fluvisols
Gleyic Solonchaks	gleyic properties stagnic properties	Gleyic Solonchaks
		Calcic/Sodic/Haplic Solonchaks
Takyric Solonchaks		Takyri-Calcic/Sodic Solonchaks
Mollic Solonchaks		Mollic Solonchaks
Orthic Solonchaks		Gypsic Solonchaks
		Calcic Solonchaks
		Sodic Solonchaks
		Haplic Solonchaks
GLEYSOLS		
gleyic properties		
Mollic Gleysols	fluvic properties, no B hor	Mollic Fluvisols
	others	Mollic Gleysols
Calcic Gleysols		Mollic Gleysols
Humic Gleysols		Umbric Gleysols
Dystric Gleysols		Dystric Gleysols
Eutric Gleysols		Eutric Gleysols

stagnic properties

Mollic Gleysols	fluvic properties, no B hor	Mollic Fluvisols
	others	Stagnic Phaeozems
Calcic Gleysols		Stagni-Haplic Calcisols
Dystric Gleysol		Stagni-Dystric Calcisols
Eutric Gleysol		Stagni-Eutric Cambisols

ARENOSOLS

Albic Arenosols		Albic Arenosols
Petrocalcic Arenosols		Areni-Petric Calcisols
Calcic Arenosols		Areni-Haplic Calcisols
Calcaric Arenosols		Calcaric Arenosols
Luvic Arenosols		Lamelli-Luvic Arenosols
Ferralic Arenosols	>3% clay increase <125cm	Luvic Arenosols
	<3% " " "	Ferralic Arenosols
Cambic Arenosols		Cambic Arenosols
Dystric Arenosols		Dystri-Haplic Arenosols
Eutric Arenosols		Eutri-Haplic Arenosols

REGOSOLS

Calcaric Regosols	<30cm soil depth or stony	Calcari-Eutric Leptosols
Dystric Regosols	" "	Dystric Leptosols
Eutric Regosols	" "	Eutric Leptosols
Calcaric Regosols	>30cm soil depth	Calcaric Regosols
Dystric Regosols	"	Dystric Regosols
Eutric Regosols	"	Eutric Regosols

RENDZINAS — Rendzic Leptosols

PLANOSOLS

Solodic Planosols	with natric	Albi-Abrupi-Stagni Solonetz
	without natric	Eutric Planosol, sodic phase
Eutric Planosol		Eutric Planosol

SOLONETZ

Gleyic Solonetz		Stagnic Solonetz
Orthic Solonetz	calcic, salic properties	Sali-Calcic Solonetz
	calcic horizon	Calcic Solonetz
	without calcic horizon	Haplic Solonetz

CHERNOZEMS

Gleyic Luvic Chernozems	Stagni-Luvic Chernozems
Luvic Chernozems	Luvic Chernozems
Calcic Chernozems	Calcic Chernozems

PHAEOZEMS

Gleyic Phaeozems	Stagnic Phaeozems
Luvic Phaeozems	Luvic Phaeozems
Haplic Phaeozems	Haplic Phaeozems

XEROSOLS

Luvic Xerosols	arenic, loamy sand 150cm	Argi-Luvic Arenosols
	non ferralic, calcareous argic hor. and petrocalcic <100cm	Luvi-Petric Calcisols
	idem but no petrocalcic	Luvic Calcisols
	non ferralic, non calcareous argic hor.	Calcic Luvisols
	non ferralic, no calcic	Haplic Luvisols
		Chromic Luvisols
	ferralic and ferric	Ferric Lixisols
	ferralic	Haplic Lixisols
Calcic Xerosols	petrocalcic < 100cm	Petric Calcisols
	non petrocalcic < 100cm	Haplic Calcisols
Haplic Xerosols	soft powdery lime	Haplic Calcisols
	without soft powdery lime	Chromic/Eutric Cambisols

NITOSOLS

Dystric Nitosols	Haplic Alisols
Eutric Nitosols	Chromic Luvisols
	(Rhodi Nitosols)

ACRISOLS

Ferric Acrisols	ferralic and ferric	Ferric Acrisols
	ferralic	Haplic Acrisols
	ferric	Ferric Alisols

LUVISOLS

Plinthic Luvisols		Albic (Eutric) Plinthosols
Gleyic Luvisols	gleyic properties	Gleyic Luvisols
	stagnic properties	Stagnic Luvisols
Albic Luvisols		Albic Luvisols
Vertic Luvisols		Vertic Luvisols
Calcic Luvisols	calcareous argic hor. petrocalcic	Luvi-Petric Calcisols
	Calcareous argic hor.	Luvic Calcisols
	non calcareous argic hor.	Calcic Luvisols
Ferric Luvisols	arenic, loamy sand 150cm	Argi-Luvic Arenosols
	ferralic and ferric	Ferric Lixisols
	ferralic	Haplic Lixisols
	ferric, non ferralic	Ferric Luvisols
Chromic Luvisols		Chromic Luvisols
Orthic Luvisols		Haplic Luvisols
	areni	Areni-Haplic Luvisols
		Argi-Luvic Arenosls

CAMBISOLS

Gleyic Cambisols	gleyic properties	Gleyic Cambisols
	stagnic properties <50cm	Stagni-Eutric Cambisols
Vertic Cambisols		Vertic Cambisols
Calcaric Cambisols		calcaric Cambisols
Calcic Cambisols	petrocalcic < 100cm	Petric Calcisols
	no petrocalcic < 100cm	Haplic Calcisols
Ferralic Cambisols		Ferralic Cambisols
Dystric Cambisols		Dystric Cambisols
Chromic Cambisols		Chromic Cambisols
Eutric Cambisols		Eutric Cambisols

APPENDIX 4. DEFINITIONS OF FAO (1988) SOIL SUBUNIT (THIRD LEVEL) CONNONATIVES

Abrupti-	- having and abrupt textural change
Albi-	- having an albic E horizon
Areni-	- having a texture of loamy fine sand or coarser in the upper 50cm of the soil
Argi-	- having a B horizon which meets the clay increase and other requirements of an argillic horizon (Soil Taxonomy, FAO 1974) (Arenosols and Calcisols)
Chromi-	- having a B horizon which in the major part has a hue of 7.5YR and a chroma of more than 4, or a hue redder than 7.5YR
Calcari-	- calcareous at least between 20 and 50cm below the surface
Calci-	- having a calcic horizon or soft powdery lime within 125cm of the surface
Duri-	- having a duripan within 100cm of the surface
Dystri-	- having a base saturation of less than 50% (by NH40Ac) in some part within 125cm of the surface
Epi-	- within 50cm of the surface
Eutri-	- having a base saturation of more than 50% (by NH40Ac) in some parts within 125cm of the surface
Ferri-	- showing ferric properties within 125cm of the surface
Ferrali-	- having ferralic properties within 125cm of the surface
Hyper-	- excessive expression of
Hypo-	- slight expression of, or occurring lower inprofile
Gleyi-	- showing gleyic properties within 100cm of the suface
Grumi-	- having strong coarse, or finer, granular structure in the suface layer, which has a thickness of 3cm or more
Gypsi-	- having a gypsic horizon within 125cm of the surface
Hypercalci-	- having a calcic horizon which has 40% or more calcium carbonate equivalent
Lamelli-	- having clay illuviation lamellae within 125cm of the surface
Luvi-	- Arenosols: having a clay increase of 3% or more within 125cm of the surface for gleyic, albic, calcaric - other soil units: having an argic B horizon
Orthic-	- right (true or typical) expression of
Pale-	- having an argic horizon which has a clay districbution such that the clay percentage does not decrease by as much as 20% of the maximum within a depth of 150cm from the soil surface, and which has a hue of 7.5YR or redder
Rhodi-	- having an argic horizon which has a hue redder than 5YR (3.5YR or redder) in all parts (apart from minor transitional horizons to A and C horizons), and has a color value moist of less than 3.5, and a color value dry no more than one unit higher than the value moist
Petrocalci-	- having a petrocalcic horizon within 125cm of the surface
Petri-	- strongly cemented or indurated
Sali-	- having slic properties within 100cm of the surface
Sodi-	- having sodic properties within 100cm of the surface
Stagni-	- having stagnic properties within 50cm of the surface
Takyri-	- showing polygonal cracking patterns at the surface and forming

	a surface crust
Verti-	- having vertic properties within 50cm of the surface
Pelli-	- vertisols only: chroma less than 1.5
Chromi-	- vertisols only: chroma more than 1.5

Priority rules for the use of third and lower level connonatives are as follows:

Abrupt	: over Albi, Calci
Albi	: over Areni (Areni not used with Albi- or Albic)
Argi	: over Lamelli, Sodi
Rhodi	: over Chromi
Pale	: over Rhodi
Areni	: over Pale, Rhodi
Epi-Hypercalci	: over Petrocalci
Petrocalci	: over Hypercalci, Calci, Areni
Luvi	: over Stagni
Calci	: over Sodi, Sali, Grumi, Argi
Sodi	: over Sali
Verti	: over Calci, Petrocalci, Sodi, Sali

APPENDIX 5. LIST OF PUBLISHED 1:250 000 SOIL MAPS

Shakawe	Ghanzi
Linyanti	Letiahau
Savuti	Orapa
Kasane	Matsitama
Gumare	Francistown
Maun	Serowe
Nxai Pan	Palapye
Basutos	Tuli
Tsau	Lephephe
Toteng	Mahalapye
Gweta	Jwaneng
Nata	Gaborone
Ramokgwebana	Lobatse

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