GRN Grainger Land System

This system is a dissected plateau, consisting of plateau surfaces separated by slopes and creek lines. The system is bordered to the west by the very highly dissected plateau areas in Flinders Chase National Park; to the north by plateau surfaces; and to the south by a lower elevation dissected plateau area. Named after Grainger Lagoon which is situated in the western section of this land system.

Area: 202.0 km^2

Annual rainfall: 640 – 815 mm average

Geology: Pliocene age regolith, with thick ironstone gravel capping mottled clays, dominates the remnant plateau surfaces; while related Pliocene-Quaternary age mottled clayey colluvium, often with an ironstone gravel capping, is common on many slopes adjacent to plateau surfaces. The underlying early Cambrian age Kanmantoo Group meta-sandstones have near surface to surface expression on many creek gully slopes, on a number of slopes adjacent to plateau surfaces (especially mid and lower slopes), and on a few crests. These stony and rocky areas occur where much of the previously overlying clayey sediments have been stripped off by water action (and possibly by glacial action in a few valleys?). Deposits of loamy and sandy alluvium, derived from plateau surface topsoils, are common on low lying plateau areas, headwater soaks, the sluggishly drained upper reaches of drainage depressions, and along drainage lines.

Topography/ Elevation: This land area has a dissected plateau topography, consisting of plateau surfaces separated by slopes and creek lines. Over this system slopes typically vary from 0 to 12%, but can be up to 60% in a few deep creek gullies. Drainage is from north to south. The land system is separated into four sections. The western section includes relatively large plateau surfaces which are dissected by the upper South West River and the upper reaches of a few other creeks. This section also includes the one large lagoonal depression in this land system: Grainger Lagoon. Elevation varies from near 240 m in the north to around 50 m at the bottom of the slopes adjacent to the lower elevation plateau area in the south. The central section is separated from the western section by the deep gorge of the North West River, and includes some of the upper tributaries of the North East and North West Rivers. Elevation varies from about 170 m in the north to 50 m in the south. The largest section is the eastern one, which is separated from the central section by the deep gorge of the North East River, and includes the upper Harriet River and tributaries, the upper tributaries of Two Wheel Creek and Rainy Creek, and some of the upper tributaries of Wittow Creek. Elevations vary from about 240 m in the northwest to about 50 m in the southwest. The final section is the northern one, which is separated from the eastern section by a remnant plateau ridge. This section includes the upper tributaries of the North East River and has elevations near 260 m in the north to 170 m in the creek valleys in the south.

Relief: Typically from 20 to 40 m, but up to 80 m in the deepest creek gullies: eg, the upper Harriet River gorge.

Main soils:

J2	Ironstone soil
K4-**K2**	Sandy loam over brown clay on rock
F1-**F2**-**G3**	Sandy loam to sand over brown clay

Minor soils: **J3** Shallow soil on ferricrete
I2 Highly leached sand
L1 Shallow soil on rock

Main features: Arable plateau surfaces and slopes with non-arable creek areas. Topsoils are mostly sandy loams and loams, while a few sandy areas occur. Topsoil textures typically sandier in the west, and smoother loams in the east. The main soils are loamy over clay with ironstone gravel, and loamy over clay, often stony over weathered rock. Areas of stony and rocky soils occur. The clayey subsoils are usually sodic and relatively impermeable, resulting in seasonal waterlogging in many soils over winter and spring: waterlogging is particularly bad in the western section of this land system. Water erosion is a risk on sloping land. Fertility is reduced by ironstone gravel due to the 'fixation' of phosphorus. Acidic and strongly acidic conditions regularly occur in topsoils and subsoils. Minor patches of saline seepage occur along drainage depressions.

Most of the patches of saline land presently visible along drainage lines were mapped in the late 1940s by Northcote. Therefore, it seems that the post war clearing of native vegetation has not resulted in a significant increase of saline seepage along drainage lines: and it follows that there probably has not been a significant rise in the saline groundwater level over this land system area in this time?

Soil Landscape Unit summary: Grainger Land System (GRN)

SLU	% of area	Main features #
AOm	1.6	Steep rocky creek gully slopes; or creek gully slopes including creek lines (upper Harriet River gorge – possibly an old glacial area). Main soils: stony texture contrast soils on weathered rock **K4**-**K2** (*Brown Chromosol-Kurosol-Sodosol on weathered rock*) and shallow rocky soils **L1** (*rocky Tenosol*). Deeper soils occur on side arms and drainage lines where these occur. **AOm** – creek gully slopes or creek gully (including slopes, side arms, and drainage line) (slopes 20-60%, 5-6e, 3-4w) Summary: non arable steep and rocky creek gully slopes.
CBB CBBw CBC CBCw CBD CBZ	4.7 0.4 29.1 1.4 0.4 0.4	Slopes mostly with texture contrast soils formed on weathered rock. Main soils: mostly sandy loam texture contrast soils formed on weathered rock (at less than one metre depth) usually containing quartz fragments, ironstone fragments, and often rock fragments or ferruginized rock fragments **K4**-**K2** (*Chromosol-Kurosol-Sodosol on weathered rock*). With areas of ironstone soil and alluvial ironstone soil **J2** (*Ferric Brown Chromosol-Kurosol-Sodosol*) especially on crests and upper slopes. Possibly with some deeper texture contrast soils **F1**-**F2** (*Brown Sodosol*) on lower slopes, slight depressions or drainage lows. **CBB** – slopes (1-4%, 2e, 3-4w) **CBBw** – wetter slopes (1-3.5%, 2-1e, 4-3w) **CBC** – slopes (2.5-10%, 3e, 3-4w) **CBCw** – wetter slopes (3-8%, 3e, 4-3w). Ironstone soils are likely to be the alluvial variant. **CBD** – steeper slopes (8-20%, 4-3e, 4-3w) **CBZ** – plateau surface (slopes 0-2%, 1e, 3-4w) Summary: mostly arable slopes which are often stony, and including some ironstone areas. Seasonal waterlogging is a problem, however, the problem is eased somewhat on sloping land. Fertility problems due to acidity and phosphorous fixation on ironstone soils are also limitations.
CCE CCO CCT	8.9 8.2 1.2	Drainage depressions: consisting of texture contrast soils formed on weathered rock on slopes, and deeper soils along drainage lines. Often with sluggishly drained upper reaches.

		Main soils: sandy loam to loamy sand on clay, very often with weathered rock at less than one metre depth: **K4** and **F1**-**F2**-**G3** (*Sodosol on weathered rock* and *Brown Sodosol*) and shallow rocky soils **L1** (*rocky Tenosol*) on slopes; and deep sands and sandy loams **I2**-**H3**-**M1** (*Podosol* and/or sandy Tenosol) and sandy loam to sand on clay **F1**-**F2** (*Brown Sodosol*) along drainage lines. Podosols especially occur in the sluggishly drained side arms and upper reaches of drainage depressions. **CCE** – drainage depressions (slopes 0-20%, 4-3e, 7-5w, 2-1s) **CCO** – drainage depressions with some saline seepage (slopes 0-20%, 4-3e, 7-5w, 3-2^{o}s) **CCT** – drainage depressions with greater saline seepage salinity (slopes 0-10%, 3e, 7-5w, 3-4^{+}s) Summary: wet non-arable drainage depressions.
CFA CFBw CFC CFCw CFD	0.1 0.1 5.4 0.5 0.3	Slopes and plateau surfaces dominated by stony texture contrast soils formed on weathered rock. Main soils: mostly stony or rocky sandy loam texture contrast soil on weathered rock (meta-sandstone) **K4**-**K2** (*Chromosol-Kurosol-Sodosol on weathered rock*). With minor to limited areas of ironstone soil **J2** (*Ferric Brown Chromosol-Kurosol-Sodosol*) especially on crests and upper slopes. Possibly with some areas of shallow sandy loams on rock **L1** (*rocky Tenosol*); or non stony texture contrast soils **F2**-**F1** (*Brown Sodosol*) on lower slopes. **CFA** – elevated plain (slopes 0-1.5%, 1e, 3w) **CFBw** – wetter slopes (1-3%, 2-1e, 4w) **CFC** – slopes (2-12%, 3-4e, 3-4w) **CFCw** – wetter lower slopes (4-12%, 3-4e, 4-5w) **CFD** – steeper slopes (slopes 8-20%, 4e, 3-4w) Summary: usually very stony, and often steep, slopes.
FPA FPB	7.5 0.9	Wetter low lying plateau areas dominated by ironstone soils. Main soils: alluvial/wash areas with usually light sandy loam ironstone soil typically with very thick topsoils and often with the ironstone gravel incorporated in the upper clayey subsoil or a transitional clay loamy layer between topsoil and subsoil **J2** (*Ferric Brown Chromosol-Kurosol-Sodosol*), found in lows/slight depressions. And some non alluvial ironstone soil often with minor amounts of small quartz fragments **J2** (*Ferric Brown Chromosol-Kurosol-Sodosol*). Some soils without ironstone gravel may occur in the very wettest areas: sandy loam to sand over brown clay **F1**-**G3** (*Brown Sodosol*), highly leached sand **I2** (*Podosol*), or bleached sand **H3** (sandy Tenosol). **FPA** – wetter low lying plateau areas (slopes 0-2%, 1-2e, 4-5w) **FPB** – slight slopes (slopes 1-3.5%, 2-1e, 4w) Summary: wet low lying plateau areas, usually with relatively deep and infertile topsoils.
FVA FVB FVBa FVC FVZ FVZr	<0.1 3.2 0.2 1.1 5.4 1.5	Slopes and plateau surfaces mostly with texture contrast soils with ironstone gravel. Main soils: sandy loam ironstone soil and alluvial ironstone soil **J2** (*Ferric Brown Chromosol-Kurosol-Sodosol*) usually with thick or very thick topsoils and many with minor amounts of small quartz fragments; with sandy loam texture contrast soils formed on weathered rock (at less than one metre depth) usually containing quartz fragments, ironstone fragments, and often some ferruginized rock fragments **K4**-**K2** (*Chromosol-Kurosol-Sodosol on weathered rock*). Minor to limited areas of sandy loam texture contrast soil may occur in slight depressions or drainage lows **F1**-**F2** (*Brown Sodosol*). **FVA** – elevated plain (slopes 0-1%, 1e, 3w) **FVB** – slopes (1-4%, 2-3e, 3-4w) **FVBa** – slopes with lighter textured topsoils: mostly loamy sands (slopes 1-6%, 2e, 3-4w, 2a) **FVC** – slopes (2-8%, 3e, 3-4w) **FVZ** – level plateau surface (slopes 0-1%, 1e, 3-4w) **FVZr** – gently undulating plateau surfaces/crests (slopes 0-3%, 2-1e, 3-4w) Summary: ironstone areas with some stony soils. Seasonal waterlogging and fertility problems due to acidity and phosphorous fixation are the biggest limitations.
FXB	0.8	Plateau surfaces and slopes dominated by texture contrast soils with ironstone gravel.

FXZ	11.2	Main soils: sandy loam ironstone soil often with very thick topsoils, and some alluvial ironstone soil **J2** (*Ferric Brown Chromosol-Kurosol-Sodosol*); with some areas of sandy loam shallow soil on ferricrete **J3** (*Petroferric Tenosol*). Minor to limited areas of sandy loam texture contrast soil may occur in slight depressions **F1**-**F2** (*Brown Sodosol*), and these usually contain some ironstone nodules. **FXB** – slopes (1-4%, 2e, 3-4w) **FXZ** – plateau surfaces (slopes 0-1.5%, 1e, 3-4w) Summary: ironstone areas with some boulder nodular ironstone. Seasonal waterlogging and fertility problems due to acidity and phosphorous fixation are the biggest limitations.
FtC	0.1	Slopes with mostly sandy soils with ferricrete or ironstone gravel. Main soils: sandy shallow soil on ferricrete **J3** (*Petroferric Tenosol*) and sandy ironstone soil **J2** (*Ferric Brown Sodosol*). Some sands over clay **G3** (*Brown Sodosol*) may occur, especially in the very wettest areas. And some patches of highly leached sand and/or bleached sand **I2**-**H3** (*Podosol* and/or sandy Tenosol) may occur. **FtC** – slopes (3-12%, 3-2e, 4-3w) with very thick to thick topsoils. Summary: the main limitations are infertility due to the sandy and strongly acidic nature of soils, phosphorous fixation on ironstone soils, shallow soils, wetness, and wind erosion risk.
FvA FvZ	0.6 0.3	Plateau surfaces with sandy loam soils with ferricrete or ironstone gravel. Main soils: sandy loam shallow soil on ferricrete **J3** (*Petroferric Tenosol*), ironstone soil, and probably alluvial ironstone soil **J2** (*Ferric Brown Sodosol-Chromosol*). Minor to limited areas of sandy loam to sandy texture contrast soil may occur in the very wettest areas **F1**-**G3** (*Brown Sodosol*), but still often contain some ironstone nodules. **FvA** – low lying areas on plateau surfaces (slopes 0-1.5%, 1e, 4w) **FvZ** – plateau surfaces (slopes 0-2%, 1e, 3-4w) Summary: the main limitations are seasonal waterlogging, phosphorous fixation on ironstone soils, and stoniness and shallow soils.
PiE PiB	1.7 0.2	Low lying and wet alluvial plateau areas and slopes mostly with highly leached sands. Main soils: highly leached sand **I2** (*Podosol*) with some sandy loam to sand over brown clay **F1**-**G3** (*Brown Sodosol*) and possibly some alluvial ironstone soil **J2** (*Ferric Brown Sodosol*) with ironstone gravel incorporated in the upper clayey subsoil or a clay loamy transitional horizon between topsoil and subsoil. **PiE** – level to sloping headwater depression/soak areas (slopes 0-3%, 1-2e, 5w) **PiB** – slope (slopes 2-5%, 2e, 4-5w) Summary: wet and infertile sands.
PjA	0.3	Low lying plateau surfaces mostly with very thick light sandy loams over clay. Main soils: mostly very thick bleached light sandy loams over clay **F1**-**G3** (*Brown Sodosol*), and possibly some highly leached sand **I2** (*Podosol*), bleached sand **H3** (sandy Tenosol), and/or alluvial ironstone soil with very thick topsoils **J2** (*Ferric Brown Sodosol*). **PjA** – quite wet and low lying plateau areas (slopes 0-2%, 1e, 4-5w) Summary: wet low lying plateau areas, usually with relatively deep and infertile sandy loam topsoils.
XnC	0.1	Lagoons. Including Grainger Lagoon which is covered in water reeds(?). Main soils: mostly wet sandy loam to sandy texture contrast soils **N3** (Sodosolic Hydrosol); possibly with some clay loamy gradational soils where topsoils have been lost due to past wind erosion events when lagoon has been dry **N3** (Dermosolic Hydrosol). **XnC** – non saline or slightly saline seasonal lagoon (7w, 1-2s)
Xo-	<0.1	Small non arable waterlogged depressions on plateau surfaces. Main soils: sandy loam to sand over brown clay **F1**-**G3** (*Brown Sodosol*), and often alluvial ironstone soil **J2** (*Ferric Brown Sodosol*). **Xo-** – waterlogged depression (slopes <0%, 1e, 5w)

Xu- XuU XuV	0.1 1.8 0.3	Swampy non arable depressions. Wetter version of 'Pi' land units. Main soils: highly leached sand **I2** (*Podosol*) and some sand to sandy loam over brown clay **G3**-**F1** (*Brown Sodosol*). **Xu-** – swampy depression in headwater area (slopes 0-1%, 1e, 7w) **XuU** – swampy headwater soaks/drainage depressions, often with some slight gullying (slopes 0-3%, 2-1e, 7w, 2-1g) **XuV** – slightly saline headwater drainage depressions (slopes 0-3%, 2e, 7w, 2-3s, 2-1g)

Classes in the 'Soil Landscape Unit summary' table (eg. 2-1e, 3w, 2y, etc) describe the predominant soil and land conditions, and their range, found in Soil Landscape Units. The number '1' reflects minimal limitation, while increasing numbers reflect increasing limitation. Letters correspond to the type of attribute:

a - wind erosion	e - water erosion	f - flooding	g - gullying
r - surface rockiness	s - salinity	w - waterlogging	y - exposure

Detailed soil profile descriptions:

Main soils:

J2 Ironstone soil (*Ferric Brown Chromosol-Kurosol-Sodosol*). Two variants of this soil occur. The first is an ironstone soil with medium to thick sandy loam or loam topsoil with ironstone gravel, over yellow-brown or olive-brown clay with mottles: especially found on remnant plateau surfaces and upper slopes.

The second is an alluvial ironstone soil with medium to very thick sandy loam or loam topsoil, then a transitional clay loamy layer usually with ironstone gravel, over olive-brown, olive, yellow-brown or yellow clay with mottles and often with ironstone gravel in the upper part: especially found on low lying parts of plateaux where alluvium from higher levels has deposited. The thicker, sandier topsoils often have a bleached subsurface layer. Soil pHs vary from acidic to strongly acidic. Underlying these soils is usually a deeply weathered and deeply mottled, grey, red, and yellow-brown clayey substrate, which is typically strongly acidic.

K4-**K2** Sandy loam over brown clay on rock (*Brown Chromosol-Kurosol-Sodosol on weathered rock*). Medium thickness to thick sandy loam, or sometimes loam, usually with meta-sandstone fragments, quartz fragments, and/or ironstone fragments/nodules; over a yellow-brown, olive-brown or red-brown clay with some mottles; which overlies weathered meta-sandstone rock at less than one metres depth. Soil pHs vary from acidic to strongly acidic. Mostly found on slopes (especially mid and lower slopes), slopes along creek lines, and some crests.

F1-**F2**-**G3** Sandy loam to sand over brown clay (*Brown Sodosol*). Medium thickness to very thick sandy loam, loam, or sometimes loamy sand overlying orange-brown, olive-brown, olive, or even red-brown clayey subsoil with mottles. The clayey subsoil is often dispersive. Some of the sandier topsoils have a bleached subsurface layer. Soil pHs are acidic to strongly acidic. These soils sometimes have very thick bleached sandy topsoils, and could be defined as 'sandy Tenosols' on a clayey substrate. Mostly found on wet lower slopes, in drainage depressions, and can occur on wet and low lying plateau areas where the ironstone gravel has been 'dissolved'.

Minor soils:

J3 Shallow soil on ferricrete (*Petroferric Tenosol*). Two variants of this soil occur: a loamy and a sandy one. The sandy variant is only found in one small part of the system while the loamy variant is much more common. The loamy variant consists of medium thickness to thick sandy loam soil overlying ferricrete. The ferricrete can be a cemented sheet of nodular ironstone, cemented boulders of nodular ironstone, or just a very dense layer of ironstone gravel. Mostly found on remnant plateau surfaces.

I2 Highly leached sand (*Podosol*). Very thick infertile sands with a bleached subsurface layer, and a dark and firm fine loamy sand or fine sandy loam subsoil layer of accumulated iron, aluminium and organic compounds. Usually a dispersive clayey substrate, or sometimes ironstone gravel or ferricrete underlies these soils. Soil pHs are usually strongly acidic, especially in upper soil layers. Found in the sluggishly drained upper reaches of drainage depressions, in headwater soak areas, and in wet low lying areas on plateau surfaces which are typically adjacent to headwater soaks and upper drainage depressions.

L1 Shallow soil on rock (*rocky Tenosol*). Stony and rocky sandy loams or loams grading into weathered rock, which overlie hard meta-sandstone rock. There may be pockets of mottled brown clay incorporated within the upper layer of weathered rock. Mostly found on steeper slopes, and along creek lines.

Further information: DEWNR Soil and Land Program