PCL Port Clinton Land System

Near coastal plains and pediments stretching from south of Price to just below South Hummocks

Area: 81.9 km^2

Annual rainfall: 330 – 385 mm average

Geology: The central part of this system is formed from loamy and stony colluvial sediments, which are derived from the adjacent Hummock Range escarpment. The southern and very northern parts of this system are underlain by blocky red or orange clay (Hindmarsh Clay). However, younger wind deposited calcareous sediments overlie much of these older sediments, with the thickest calcareous deposits in the southern part of the system being over two metres thick. Calcareous deposits vary from infusions of fine carbonate material into pre-existing sediments to very thick deposits of loamy calcareous material. Hard carbonate nodules, fragments and pans are usually associated with these calcareous deposits. Many broad drainage areas in the central northern part of this system have had calcareous materials removed by water movement, revealing the loamy and stony colluvial sediments. The red blocky clay probably underlies these colluvial sediments at depth. Soils have formed in this clay in the north of the system, where depositions of calcareous material has been the least significant, largely only infusing into the pre-existing clay. In particular, this clay forms an alluvial plain (which is possibly an ancient estuary) in the very north east of the system, where the subsoil clay can be gypseous. (This is a transitional area related to the saline coastal flats at the head of St Vincent Gulf). Also, in the central part of this system, footslopes with deposits of calcareous loam are underlain by weathered sandstone with red and green mottles.

Topography: This is an elongate system of plains, pediments and drainage depressions lying adjacent to the edge of the Hummock Range escarpment and rises further south. The land is mostly very gently undulating, with slopes typically from 0 - 2%. Drainage lines originating in the Hummock Range escarpment or the rises further south, cross this land system in a south easterly or easterly direction, ending at the intertidal flats and mangrove areas to the east. In the north of the system is a drainage line which originates from the plains and ranges to the north, and heads southward into the low lying saline area at the head of St Vincent Gulf ('Head of Gulf' Land System).

Elevation: From sea level or just above on the western edge of the coastal plain to 60 m along the base of the Hummock Range escarpment.

Relief: Up to 20 m adjacent to the Hummock Range escarpment; typically 10 m or less.

Main soils:

A4a-**A5**	Calcareous loam	(*Regolithic Hypercalcic-Lithocalcic Calcarosol*)
A4b	Light calcareous sandy loam	(*Regolithic Hypercalcic-Lithocalcic Calcarosol*)
A6	Calcareous clay loam	(*Pedal Hypercalcic-Lithocalcic Calcarosol*)
B2	Shallow calcareous loam on calcrete	(*Petrocalcic Calcarosol*)
C1	Stony red loam	(*stony Red Kandosol*)
A4c	Stony calcareous brown loam	(*stony Calcarosol*)
D2-**D3**	Loam over red clay	(*Red Sodosol*)

Minor soils:

A2	Calcareous loam on rock	(*Paralithic Calcarosol*)
A4d	Alluvial calcareous loam	(*well structured Calcarosol*)

Main features: This land system area is mostly arable. Soils are mostly calcareous throughout, with a build up of finely divided carbonate, and often hard carbonate rubble, in the subsoil. The presence of hard carbonate rubble reduces effective water holding capacities. Calcareous soils reduce the availability of certain nutrients: namely phosphorous, zinc, manganese, and iron. Deficiencies of the first two nutrients are common, while the latter two are more rarely deficient, but deficiency symptoms can appear temporarily in cold and wet conditions. Surface soils are usually friable, however, clayey subsoils can be poorly structured and so limit root growth.

Two broad soil groups predominate: deep loamy calcareous soils; and calcareous soils with a clayey subsoil. The former soil group is well to excessively drained, allowing water and soluble nutrients such as nitrogen to move beyond the rootzone after heavy rainfall. The latter group is moderately well to well drained but has a clayey subsoil which prevents excessive movement of water and soluble nutrients beyond the root zone. These soils have high inherent fertility, however, the clayey subsoil allows the build up of toxic elements such as boron and sodium. The relatively low annual rainfall which is typical of this area, limits leaching, and allows the accumulation of salt, especially in clayey subsoils. Moderate to moderately high levels of salinity also occur in low lying areas adjacent to saline coastal land due to the presence of saline water tables.

Soil Landscape Unit summary: Port Clinton Land System (PCL)

SLU	% of area	Main features #
KMAg KMB KMP	2.6 0.9 1.0	Low lying plains and slopes of loamy colluvium over clay, very extensively infused by calcareous deposits. Main soils: stony calcareous brown loam **A4c** (*stony Calcarosol*) and loam over red clay **D2**-**D3** (*Red Sodosol*); with minor to limited calcareous loam **A4a**-**A5** (*Regolithic Hypercalcic-Lithocalcic Calcarosol*) on very low rises. **KMAg** – low lying broad drainage plain **KMB** – footslopes (2-3%) **KMP** – low lying coastal plain with marginal salinity (4s) Summary: these alkaline soils are relatively fertile with mostly good drainage, however, the presence of stones reduces waterholding capacities and rainfall is low. Loose loamy surface soils are a wind erosion risk when bare; while water erosion is a potential risk on footslopes. Soils with clayey subsoils are affected by high boron levels. Areas adjacent to the coast are affected by saline soils due to the presence of a saline watertable.
KPG	11.7	Outwash plains formed on clay, very extensively overlain by calcareous deposits, with some south east flowing gullied drainage lines, which then spread out into broad drainage flats. Slopes 0-2%. Main soils: calcareous clay loam **A6** (*Pedal Hypercalcic-Lithocalcic Calcarosol*) on flats and low rises and calcareous loam **A5-A4a** (*Regolithic Hypercalcic-Lithocalcic Calcarosol*) on low rises. With some shallow calcareous clay loam on calcrete **B2** (*Petrocalcic Calcarosols*) on low rises; and with loam over red clay **D3**-**D2** (*Red Sodosol*) in drainage areas. Summary: these alkaline soils are quite fertile, however, they are limited by low rainfall and high boron levels in many subsoils. Effective waterholding capacities vary due to varying amounts of hard carbonate rubble and the restriction of calcrete pans in places. Water erosion and flooding may be risks in drainage areas.
KYA KYB KYJ KYT	1.5 2.4 1.4 2.5	Low lying areas and creeks of loamy and stony colluvium, extensively infused by calcareous deposits. Main soils: stony calcareous brown loam **A4c** (*stony Calcarosol*); with stony red loam **C1** (*stony Red Kandosol*) on drainage flats. Also with minor to limited areas of calcareous loam **A4a**-**A5** (*Regolithic Hypercalcic-Lithocalcic Calcarosol*) usually on low rises. Possibly with some loam over red clay **D2**-

		D3 (*Red Sodosol*) on the low lying coastal plain. **KYA** – low lying plains (slopes 0-1%). **KYB** – slopes (0-2%) **KYJ** – creek lines, often eroded. **KYT** – low lying coastal plain with marginal salinity (4s). Summary: these alkaline soils are relatively fertile with mostly good drainage, however, the presence of stones or hard carbonate rubble reduces water holding capacities and rainfall is low. Areas adjacent to the coast are affected by saline soils due to the presence of a saline watertable. Wind erosion is a risk when the loose light sandy loam surface soils are bare.
KZb	3.1	Low lying broad drainage plains of loamy and stony colluvium with some gullying. Two creeks, originating in the Hummock Range escarpment flow into this area. Slopes 0-1%. Main soils: stony red loam **C1** (*stony Red Kandosol*). Summary: these are relatively fertile soils with good drainage, however, their very stony nature limits waterholding capacities and management options and rainfall is low. Loose light sandy loam surface soils are at risk of wind erosion when bare; while many subsoils have raised salinity levels caused by a saline water table below the soil. Flooding is a risk.
SeA SeAg SeBg	4.3 1.4 1.4	Coastal plains and slight slopes: dominated by wind deposited rubbly loamy calcareous deposits. Main soils: rubbly calcareous loam **A4a**-**A5** (*Regolithic Lithocalcic Calcarosol*); with some shallow calcareous loam on calcrete **B2** (*Petrocalcic Calcarosol*). Also with minor to limited calcareous clay loam **A6** (*Pedal Hypercalcic-Lithocalcic Calcarosol*) in lows and drainage areas. **SeA** – plains **SeAg** – plains with minor waterways **SeBg** – slight slopes with minor waterways (slopes: 1-2.5%) Summary: soils well drained and calcareous. Rainfall relatively low, while the hard carbonate rubble and shallow calcrete reduce effective waterholding capacities. Wind erosion a risk when soils bare, and the results of previous events are evidenced by the roadside build up of soil. The occurrence of marginal deficiencies with a number of nutrients is likely, especially phosphorous and zinc.
SiA SiK SiLg SiQg	22.6 0.9 7.0 0.6	Coastal plains and slight slopes: dominated by wind deposited loamy to sandy calcareous deposits. These deposits are from one to more than two metres thick, and are underlain by orange/red clayey sediments (Hindmarsh Clay). Main soils: light calcareous sandy loam **A4b** (*Regolithic Hypercalcic-Lithocalcic Calcarosol*) and calcareous loam **A4a**-**A5** (*Regolithic Hypercalcic-Lithocalcic Calcarosol*), and some shallow calcareous loam on calcrete **B2** (*Petrocalcic Calcarosol*). Minor areas of calcareous clay loam **A6** (*Pedal Hypercalcic-Lithocalcic Calcarosol*) in drainage depressions (in 'SiLg' soil landscape unit). **SiA** – plains, sometimes with a few waterways (2s) **SiK** – plains with raised salinity levels (3s) **SiLg** – slight slopes with some saline seepage and many waterways with some rilling/minor gullying (slopes: 0-2.5%, 2-1e, 3s, 2-1g) **SiQg** – slight slopes with marginal salinity and some rilling (slopes: 1-3%. 2e, 4s, 2-1g) Summary: soils are excessively drained and calcareous: leaching of nitrogen and even sulphur would be significant with heavy rains. However, rainfall is relatively low, limiting production potential and making the presence of toxic levels of subsoil boron a risk, while the sandy nature and/or presence of hard carbonate rubble in many of these soils reduces effective waterholding capacity. The sandy nature of many of these soils also means that wind erosion is a significant risk. Saline seepage, caused by a saline watertable, is common, and mostly results in raised subsoil salinity levels. The occurrence of marginal deficiencies with a number of nutrients is likely, especially phosphorous and zinc.
SlBg SlH	3.3 0.4	Footslopes at the base of the Hummock Range escarpment: very extensively covered by wind deposited rubbly loamy calcareous deposits, sometimes overlying weathered sandstone. Main soils: rubbly calcareous loam **A4a** (*Regolithic Lithocalcic Calcarosol*) and shallow calcareous loam on calcrete **B2** (*Petrocalcic Calcarosol*); with calcareous loam on rock **A2** (*Paralithic Calcarosol*).

		SlBg – slopes with waterways (slopes: 1-3%, 2e, 1-2g) **SlH** – slopes with gullying/rilling (slopes: 2-4.5%, 3-2e, 2-3g) Summary: soils are relatively well drained and calcareous. Rainfall is relatively low, while hard carbonate rubble and shallow calcrete reduce effective waterholding capacities. Water erosion, especially in the form of rilling, is a risk when soils are bare. The occurrence of marginal deficiencies with a number of nutrients is likely, especially phosphorous and zinc.
SOA SOAg SOBg	1.0 10.6 2.3	Coastal plains and slight slopes: dominated by wind deposited loamy calcareous deposits, which are underlain by loamy and stony colluvium which has surface exposure in places. Main soils: calcareous loam **A4a**-**A5** (*Regolithic Hypercalcic-Lithocalcic Calcarosol*). With minor to limited stony calcareous brown loam **A4c** (*stony Calcarosol*) and loam over red clay **D2**-**D3** (*Red Sodosol*). With alluvial calcareous loam **A4d** (*well structured Calcarosol*) in drainage depressions: minor occurrence. **SOA** – plains **SOAg** – plains with minor gullying **SOBg** – slight slopes with minor gullying (slopes: 1-2.5%) Summary: soils are well drained and calcareous. Rainfall is low, and varying amounts of hard carbonate rubble give varying effective waterholding capacities. The occurrence of marginal deficiencies with a number of nutrients is likely, especially phosphorous and zinc.
SWe SWO SWT	0.2 0.2 0.3	Creek and drainage lines: dominated by wind deposited loamy calcareous deposits underlain by clayey sediments at depth. There are areas where soils have formed directly in these clays. Main soils: calcareous loam **A4a**-**A5** (*Regolithic Hypercalcic-Lithocalcic Calcarosol*. With minor to common calcareous clay loam **A6** (*Pedal Hypercalcic-Lithocalcic Calcarosol*) or a calcareous variant of loam over red clay **D3**-**D2** (Effervescent *Red Sodosol*). Slopes are typically 0-3%; minor gullied areas have greater slopes. **SWe** – eroded creek line with raised salinity levels (2-3s, 3e, 3g). Mostly non arable. **SWO** – drainage depression with raised salinity levels (3-2s, 2e, 2-1g). Mostly arable. **SWT** – drainage depression and coastal flat with marginal salinity (4-5s, 2-1e, 2-1g). Mostly non-arable. Summary: these drainage areas range from non arable to arable. Parts of these areas are subject to infrequent flooding, and defined/gullied drainage lines occur in places. Salinity is a limitation, especially in the southern most drainage depression.
VHA	16.4	Alluvial flats, possibly an ancient estuary, formed on red clayey sediments which are sometimes gypseous (Hindmarsh Clay). A defined drainage line transverses the northern extension of this land unit, but then spreads out into an ill-defined state: a drainage depression in the centre of the land unit is a former extension of this drainage line. Other drainage flats/depressions occur, especially in the south east of the land unit. Slopes are 0-1%. Main soils: calcareous clay loam **A6** (*Hypercalcic-Lithocalcic Calcarosol*): non rubbly and rubbly variants of this soil are both extensive. With limited loam over red clay **D3**-**D2** (*Red Sodosol*) in drainage areas/flats. Some moderately saline well structured red loams and clay loams with gypseous bases may occur in the lowest lying areas **D4** (Red Sodosol). Limited areas of rubbly calcareous loam **A5**-**A4a** (*Regolithic Supracalcic-Lithocalcic Calcarosol*) occur on some very low rises. Summary: this land is transitional to the saline coastal flats at the head of St Vincent Gulf ('Head of Gulf' Land System). The soils are all alkaline, but are mostly relatively fertile with moderately high nutrient retention capacities and waterholding capacities due to relatively high clay contents. Effective waterholding capacities vary, however, due to variable contents of hard carbonate rubble. The main limitations to productivity are low rainfall, high to very high subsoil boron levels, and moderate salt levels.

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:

A4a-**A5** Calcareous loam (*Regolithic Hypercalcic-Lithocalcic Calcarosol*)
Calcareous deposits: with medium thickness highly calcareous greyish brown to brown loamy topsoil, over highly calcareous greyish brown to brown clay loamy subsoil which usually contains hard carbonate rubble, overlying highly calcareous light brown to orange brown light clay or clay loamy lower subsoil. An underlying substrate can be in the place of this lower subsoil in the form of loamy colluvial sediments, clayey sediments, or weathered sandstone (at a depth of 60cm or more). Slopes and plains: especially on very low rises.

A4b Light calcareous sandy loam (*Regolithic Hypercalcic-Lithocalcic Calcarosol*)
A lighter textured variant of the above soil occurs in the southern part of this system (in 'Si' soil landscape units). Topsoils and subsoils are highly to moderately calcareous with textures ranging from loamy sands to sandy loams. Thin, dense sandy subsoil pans, with light sandy loam textures often occur: these pans are overlain by thin layers containing significant amounts of fine quartz (1-2mm). Hard carbonate rubble is often present in subsoils, with some soils underlain by calcrete at greater than 50cm. Lower subsoils (occurring at greater than 50cm depth) range from loamy to clay loamy textures, and have raised salinity levels. The quartz grains giving these soils lighter and sandier textures are likely to have originated in the quartz rich rises just to the west. Orange/red clayey sediments occur at depths of more than one metre (Hindmarsh Clay). At their extreme, these become texture contrast soils with sandy topsoils and clay loam to heavy loam subsoils (Effervescent Brown Chromosols; thick, sandy/clay loamy). Found on plains.

A6 Calcareous clay loam (*Pedal Hypercalcic-Lithocalcic Calcarosol*)
Thin to medium thickness calcareous brown to reddish brown clay loam to loamy topsoil often with good granular structure, over highly calcareous brown to reddish brown clay loam or light clay which often contains hard carbonate rubble. Underlying this is blocky red medium to heavy clay beginning somewhere between 30cm and 70cm (Hindmarsh Clay). This red clay is highly calcareous in its surface layers but non calcareous at depth. Gypsum segregations sometimes occur in this red clay. Plains: flats and slight rises.

B2 Shallow calcareous loam on calcrete (*Petrocalcic Calcarosol*)
A soil similar to the 'calcareous clay loam' or 'calcareous loam', but underlain by a calcrete pan at less than 50cm. Medium thickness highly calcareous greyish brown to brown clay loam or loamy topsoil over calcareous greyish brown to brown light clay, clay loam or loam, overlying a calcrete pan. Mostly on very low rises.

C1 Stony red loam (*stony Red Kandosol*)
Medium to thick reddish brown to brown loose light sandy loam topsoil, which may be slightly calcareous, over reddish brown to red sandy clay loam subsoil which is non calcareous to moderately calcareous, which may be underlain by a highly calcareous brown sandy clay loam lower subsoil at greater than 50cm depth. This soil is stony throughout: usually with greater than 20% hard rock fragments. Drainage flats.

A4c Stony calcareous brown loam (*stony Calcarosol*)
Related to the above soil but more highly calcareous throughout. Medium to thick moderately calcareous brown light sandy loam to sandy loam topsoil, grading into moderately calcareous brown light clay to clay loam subsoil, over a highly calcareous lower subsoil layer. This soil is stony throughout and these stones can be carbonate coated: usually with greater than 20% hard rock fragments. Flats.

D2-**D3** Loam over red clay (*Red Sodosol*)
Medium thickness to thick reddish brown to red loamy topsoil, over mostly well structured red medium clay, which overlies a highly calcareous red medium clay (Hindmarsh Clay). Some hard rock or small quartz fragments may be present. Sometimes the some is calcareous throughout. Drainage flats.

Minor soils:

A2 Calcareous loam on rock (*Paralithic Calcarosol*)
Medium thickness calcareous greyish brown loamy topsoil, over loamy to clay loamy subsoil with hard carbonate rubble, on weathered rock at about 50cm depth. These soils are found on the eastern footslopes of the Hummock Range escarpment, and were found to overlie weathered sandstone with red and green mottles.

A4d Alluvial calcareous loam (*well structured Calcarosol*)
Deep to moderate depth well structured highly calcareous greyish brown silty clay loam. Found in drainage depressions.

Further information: DEWNR Soil and Land Program