SUSTAINABLE RURAL DEVELOPMENT PLANNING GUIDELINES No 2

STOCKING RATE GUIDELINES FOR SMALL RURAL HOLDINGS

SWAN COASTAL PLAIN AND DARLING SCARP WESTERN AUSTRALIA

AGWEST LOGO

1.0 INTRODUCTION

Why produce this document on stocking rates?

This document provides guidance for planners, developers, local authorities and land owners seeking to determine the stocking rates for small rural holdings on the Swan Coastal Plain and Darling Scarp Agriculture WA receives numerous requests for stocking rates which can be competently answered by other authorities with the appropriate information This document provides that information and guidance on how to interpret it

Within the last decade or so a number of factors have come together, increasing the need for the guidelines on stocking rates to be updated These include the rapid spread of urbanisation, increased community desire for small rural holdings and hobby farms, recognition of nutrient problems in waterways, identification and reservation of shallow groundwater reserves and the introduction of non traditional types of stock

Small rural holdings are often owned by people who want to pursue a semi rural lifestyle but who are inexperienced in land management issues Subsequently small land holders stock their properties with animals at rates higher than the land resources can sustain, leading to degradation of the resource

It is hoped that over time stocking rates will form the basis for small rural and hobby farm developments, with lot sizes selected to match the desired land uses to the soil type This should occur during the planning process

Aims of the document

- Encourage greater community understanding of the concept of stocking rate
- Provide base guidelines on the stocking rate most suited to particular soil types
- Encourage planners, developers and land capability assessors to consider stocking rates during the planning process
- Provide information to local authorities and community members to enable decisions on stocking rates to be made

What is a Small Rural Holding?

A small rural holding is any block of rural land that is generally too small to be agriculturally viable.

These blocks are normally used for recreation or lifestyle purposes but do not exclude viable lots used for more intensive purposes such as a 20 hectare emu farm or a 5 hectare alpaca stud. Small rural holdings fill a market need, particularly for the keeping of horses in a rural setting close to an urban area. However in the push for lot yields, some existing lots may not be large enough to sustain stock in some situations. The most common lot size is 2 hectares but it can vary from 0.5 to 40 hectares.

Small rural lots are frequently used as buffers, for example between rural and urban land uses or to increase the set back of more intense developments from a natural resource such as a wetland. They are also used for residential development on land covered by indigenous bush, where restrictions on clearing and the keeping of stock are normally applied.

The most common land uses are "conservation" with minimal clearing, the keeping of horses or a lifestyle block with no stock. Although little research has been undertaken, it would appear that in areas where stock is permitted, only half the properties actually carry stock mostly horses kept for recreational purposes. Also there appears to be a trend in the keeping of horses which are more commonly owned when children are in their teenage years. Prior to and after that period the number of horses is less. Thus in a group of small rural holdings there is likely to be a period of perhaps 10 to 20 years when the numbers of horses or other stock are at their peak.

In some areas such as Byford, up to 70% of owners irrigate a portion of their holding although in other areas such as Gidgegannup, irrigation of pasture is much less common. Bore water is usually available on small rural holdings but the annual allocations in many areas are restricted to 1 500 kL from a bore licensed through the Water and Rivers Commission.

Small rural lot holders are normally enthusiastic but inexperienced in stock and pasture management and rarely have the equipment to complete farming activities themselves. Contractors are commonly used for land management such as fencing, the construction of firebreaks and cultivation. Lot holders also plant significant numbers of trees to provide screening, shade and other functions, often in response to local authority guidelines.

What are Stocking Rates?

Stocking rates are the number of stock be they sheep, cattle, horses, emus or any other type of animal that can consistently be kept on a particular piece of average pasture year in and out without additional feed and without causing environmental degradation Degradation could include soil erosion, tree decline, increasing levels of nutrients in groundwater and waterways, the spread of weeds into adjoining bushland and soil structure decline

The stocking rate is most usually associated with broad acre farming practices and thus gives a baseline value for the management of land on small rural holdings By suggesting a baseline stocking rate for various soil types, and provided related land management issues are addressed, the soil system will be protected and the land use can be sustainable

Stocking rate is normally equated to Dry Sheep Equivalents (DSE), based on the amount of pasture that each particular type of animal will consume This works well for traditional animals but does not take into account the reduced impact on the pasture of the newer types of stock such as alpacas or emus which have a different foot structure and feeding patterns Alpacas with their soft pads are more gentle to the soil structure and could in theory be stocked at higher rates than sheep, based on soil management However the rate of consumption of pasture by alpacas, in terms of body weight, will be similar to sheep, and stocking at higher rates could denude the pasture and expose the soil to erosion On the basis of pasture consumption there will be little difference in the stocking rate of sheep or alpacas However if feed is introduced, higher stocking rates may be possible for alpacas

Emus may also be stocked at higher rates that hard hoofed stock On deep sands 16 emus of similar body weight to sheep may be sustainable per hectare provided they have extra feed, with low impact on the soil apart from tracks along the fence lines A similar number of sheep on the same pasture would destroy the soil structure leading to erosion through damage by their hard hoofs Feeding patterns of the two animals are also different, whilst sheep will pull grass such as couch from the ground, emus will just nip the tops of the leaves, maintaining a better vegetation cover The other consideration is that whilst more emus can be stocked, the increased stocking rate may result in nutrient losses

Stock on the Swan Coastal Plain and Darling Scarp

The Swan Coastal Plain and near area is unlike most other areas of the south west It is underlain in many places by porous sands and sediments with low water and nutrient holding capabilities In places the land is poorly drained and it is common for the water table to lie close to the surface with numerous associated wetlands In addition the pressure of development has led to potentially high nutrient loadings on groundwater and waterways, yet at the same time has required that most of these same water resources be preserved for potable or other water sources

Much of the land is cleared with only the poorest quality land remaining as remnant bushland On the coastal plain the remnant areas are usually dry sand ridges, whereas on the scarp areas of laterite duricrust or steep slopes are the only remaining uncleared private land Stocking of this remnant bushland is not acceptable because of the poor soil quality and in the interests of bushland conservation

Dry pasture has the lowest stocking rate Stocking rates can be increased with pasture improvement through the introduction of additional pasture species such as legumes and perennial grasses, the use of fertilisers and, at the end of the scale, irrigation Pastures on commercial operations are normally improved and managed and thus have greater stocking rates It is

common practise for crops and stock to be rotated on large properties to better manage pasture and stock are also frequently bought and sold according to the quality of the growing season

In some localities on the Swan Coastal Plain, factors other than maintaining pasture will determine stocking rate Shallow ground water is often available but is normally restricted to 1500 kL per year for a small rural or hobby block of 2 to 5 hectares This will be enough to maintain a garden and some animals but will only provide enough water to irrigate 2 000 m^2 or the building envelope There are many ground water resource areas and catchments such as the Peel-Harvey Catchment and the Jandakot Mound where nutrient management is the key issue and may determine stocking rates

For example Statement of Planning Policy 2, Peel-Harvey Catchment precludes stock on lots of 1 hectare or less, the Management Strategy for the Peel Harvey Inlet (EPA Bulletin 749) has a target estuarine water quality of 0 2 mg/L, and the Draft Statement of Planning Policy No 6, Jandakot Groundwater Protection Policy, restricts nitrogen input to 25 kg per hectare or agroundwater concentration of 12 5 mg/L (25% National Health and Medical Research Council limit

Nowadays land on or near the Swan Coastal Plain that is close to towns is covered by Town Planning Schemes or other planning mechanisms that may restrict stock to dry stocking rates unless approval is given by the local authority or other regulatory body to increase the rate Approvals to increase the stocking rate are normally only granted if the land holder provides a management plan that prevents soil and vegetation decline as well as minimises nutrient export

Stocking rates may vary slightly from Gingin to Busselton even on the same soil type, because of small climatic differences At Gingin the annual evaporation is higher and rainfall lower than at Busselton, which may allow one or two additional sheep per hectare to be carried in the south of the Swan Coastal Plain compared to the areas in the north However in terms of small rural holdings this is not generally significant and an average base stocking rate is used

In many cases the stocking rate for a particular property can only be determined from field information or a detailed soil map because soils may change quickly over short distances For example, in the Pinjarra area there are dry leached sands within 100 metres of waterlogged clays or swamp

Base Stocking Rate

Therefore stocking rates are best considered as a base rate with increased rates dependant on pasture improvement, farm planning, nutrient management as well as statutory requirements In this document guidelines are provided to enable the soil type and thus base stocking rate to be determined for a particular site In addition a checklist is provided to assist in the preparation or assessment of increased stocking rates

The base stocking rate is set at a level that will allow stocking in average years In times of drought stocking rates may have to be reduced or feed introduced The rates also assume basic pasture and property management **No stock should be kept on a property no matter how large unless the owner is prepared to monitor the animals, repair fences and rotate pastures as appropriate.**

The recommended base stocking rate should;

- Provide enough feed to maintain animals in good condition

- Provide enough pasture cover to protect the soil throughout the year although some stock rotation may be necessary.
- Preserve enough drinking water through the year.
- Not lead to degradation of the existing vegetation.
- Not lead to soil erosion.
- Be sustainable through average years.

2.0 STOCKING RATES AND ANIMAL EQUIVALENTS

Stocking Rates and Animal Equivalents

Stocking rate is number of animals that is sustainable through average years without leading to any deterioration in the animals or environment. The stocking rate is normally equated to Dry Sheep Equivalents (DSE) per hectare.

The stock equivalents have been developed from the experience of competent agriculturalists, agricultural officers and site visits, rather than a detailed research documentation. Properties in different locations were chosen to provide comparisons across soil types. With the exception of horses there was close agreement between the practised stocking rates and the rates which have been used in the past. There was general agreement that horses are harder on soil structure than the usual stock equivalent, being rated at 12 DSE compared to cattle at 10 DSE. These figure have been incorporated into these guidelines.

Different stock management systems are possible, depending on the level of pasture improvement, type of animal, feeding regimes and management practices.

Dry Pasture Stocking

Dry pasture with no irrigation or supplementary feed.

This is the broad acre stocking rate that would apply to a large property or to a small rural holding with the lowest level of pasture management in an average year. This type of stocking relies on no feed being brought onto the property. Even so some pasture management is required such as, the addition of fertiliser with the appropriate levels of nutrient elements, rotational grazing, slashing of the spring flush, hay production and perhaps manure collection.

Supplemented Stocking

Dry pasture with additional feed provided.

This assumes the same pasture management as the Dry Stocking Rate but allows for additional feed to be brought onto the property. By providing additional feed, higher stocking rates are possible for stock such as emus, deer and alpacas which have less impact on the soil than hard hoofed animals. Providing additional feed and increasing stocking rates for hard hoofed animals such as sheep, cattle or horses without appropriate pasture management will lead to land degradation.

Irrigated Stocking

Irrigated pasture combined with some supplementary feed

Irrigation can maintain better summer pasture and thus stocking rates can be increased. Again some stock with softer feet structure will be able to be stocked at higher rates than the hard hoofed animals such as sheep and horses. Whilst pasture impact may be sustainable, in susceptible areas, irrigated stocking may lead to nutrient losses unless substantial management practices are used.

Intensive or Managed Stocking

Intensive stocking in stables or pens.

In this system, stock spend the majority of their time in pens or stables with only short periods on pasture. No stocking rate can be given for intensive operations but rather the stocking rate is determined by the land systems and management practices used by the land holder. Comprehensive stock and nutrient management practices are required to prevent nutrient loss and adverse environmental impact. Approval for intensive stocking rates is normally required from the local and other government authorities.

Table 1 Animal Equivalents for the calculation of Stocking Rates

Note Stocking rates are based on the potential for pasture damage which depends on feeding patterns and foot structure. They are not based on nutrient loading.

A 50 kg wether or hogget is the accepted standard for Dry Sheep Equivalents (DSE).

Type of Livestock	Dry Sheep Equivalent DSE	Dry Stocking and Supplemental Stocking Rates	Irrigated Stocking Rate Increase over Dry Stocking Rate
Sheep			
Wether, ewe, hogget, average 50 kg	1.0	Use DSE	x 2.0
Lambing ewe	1.5	Use DSE	x 2.0
Ram	2.0	Use DSE	x 2.0
Cattle			
Milking dairy cow, yearling, steer/heifer,	8.0 - 10.0	Use DSE	x 2.0
Dry cow or steer 350 - 450 kg	8.0 - 10.0	Use DSE	x 2.0
Yearling steer, fattening, 250 - 400 kg	8.0 - 10.0	Use DSE	x 2.0
Cow with calf	12.0 - 14.0	Use DSE	x 2.0
Smaller cattle (Dexter, Lowline)	5.0	Use DSE	x 2.0
Bull	14.0	Use DSE	x 2.0
Horses			
Light	12.0	Use DSE	x 2.0
Draught	16.0	Use DSE	x 2.0
Pony	7.0 - 9.5	Use DSE	x 2.0
Goats			
Dry Angora	0.7	Use DSE	x 2.0
Breeding Angora, cashmere goat	1.0	Use DSE	x 2.0
Dry milk goat	1.5	Use DSE	x 2.0
Milking goat	3.0	Use DSE	x 2.0
Deer			
Red Deer	1.2	Use DSE	x 2.0
Fallow Deer	0.7	Use DSE	x 2.0
Llama 150 - 210 kg	2.0 - 2.8	Use DSE	x 2.0
Alpaca 60 - 70 kg	0.8 - 1.0	Use DSE	x 2.0
Ostrich			
Adult average 110 - 120 kg (half introduced feed)	0.8 - 1.0	Use DSE	x 2.0
Young ostriches (half introduced feed)	0.2	Use DSE	x 2.0
Emu average 55 kg (half introduced feed)	0.65	Use DSE	x 2.0
Turkey 8 kg (free range)	0.015	Use DSE	Variable
Poultry (free range)	Variable	Variable	Variable
Layer (free range)	Variable	Variable	Variable
Broiler (free range)	Variable	Variable	Variable
Pigs			
100 kg (free range)	2.0	Use DSE	Variable
Miniature	1.0	Variable	Variable

Sources See acknowledgments and references

3.0 LAND UNITS AND SOIL TYPES

Geology of the Swan Coastal Plain

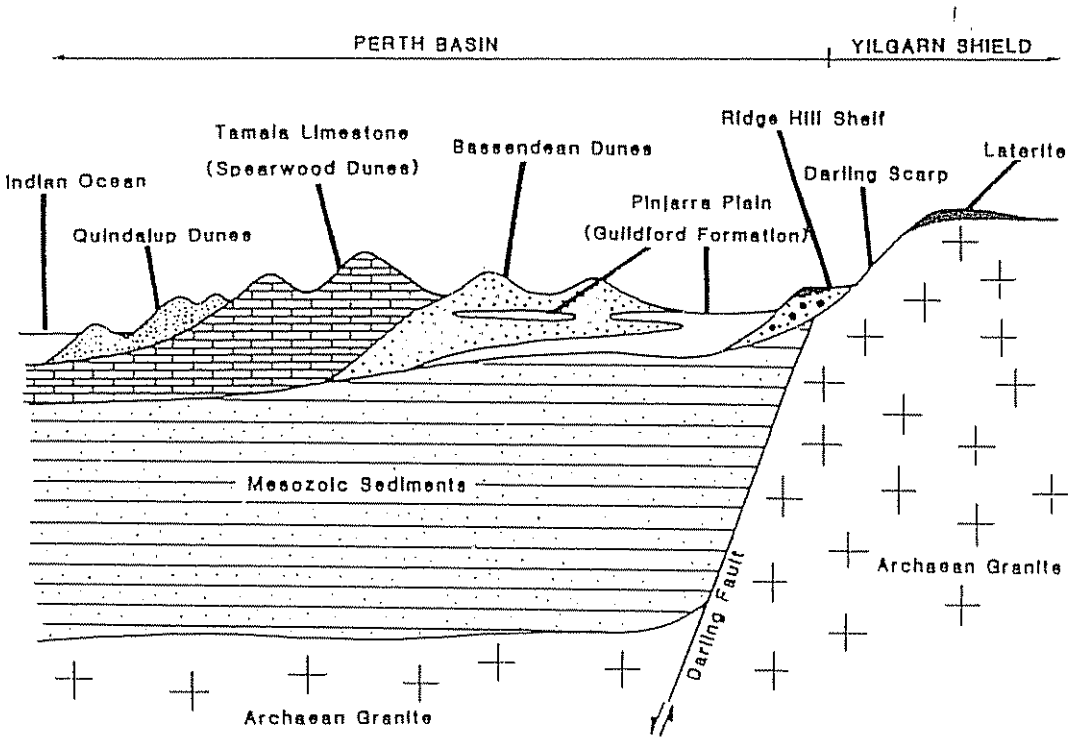
The Swan Coastal Plain was formed by the down faulting of the western edge of the Yilgarn Shield to create a deep basin. Movement on the Darling Fault commenced about 300 million years ago in the Permian Period and continued through the Mesozoic until 70 million years ago when movement ceased. As the basin deepened, sands and muds were deposited by rivers draining the shield from the east to form over 10 000 metres of sediments.

Notable among the Mesozoic sediments are formations such as the Leederville Formation, Yarragadee Formation and the South Perth Shale in which are contained huge resources for ground water that will form part of the water supply of the Swan Coastal Plain in the future

In more recent times rivers, the ocean and the wind have deposited sands and silts upon which the modern soil units are formed. Deep weathering of the basement rocks in the late Tertiary, from perhaps 15 million years ago until into the Pleistocene, produced soils containing the brown laterite gravel and duricrust that caps the hills of the Darling Plateau.

During the last one million years (Pleistocene) when the earth was subjected to ice ages, sea levels changed from approximately 120 metres below current sea level to 75 metres above current sea level. As the sea level rose and fell due to the amount of water locked up in the polar ice caps, different sediments were deposited across the Swan Coastal Plain.

At least three major dune systems were formed parallel to the coast. Quindalup the most recent on the coastal edge, the Spearwood dune system slightly inland, and further inland the Bassendean dune system. At the base of the Darling Scarp are a series of ancient beach lines formed at a time when sea level was significantly higher. These are the Yogannup Formation, Gingin Scarp and Ridge Hill Shelf at elevations of up to 75 metes above sea level. Finally there are alluvial deposits of the Pinjarra Plain and similar areas formed by rivers such as the Murray, Swan, Serpentine and Vasse



CROSS SECTION OF THE SWAN COASTAL PLAIN and DARLING SCARP

Quindalup Dune System

The Quindalup Dune System is the youngest set of dunes situated near to the current coast It consists of dunes that extend inland from the present beaches, although in some areas such as at Safety Bay the dunes are very low and only gently undulating The dunes are formed from recent cream coloured sand consisting of quartz and shell fragments They are vegetated with *Acacia* thicket and have either been cleared for development such as south of Rockingham or retained as reserved land for example the Yalgorup National Park

The geological unit of the Quindalup System is the **Safety Bay Sand** with other minor associated coastal sediments In the south the **Vasse** estuarine deposits near the coast are associated with the dune formation and are included in the Quindalup System

Spearwood Dune System

Inland from the Quindalup Dune System lies the Spearwood Dune System The cream calcareous sand of this system has been cemented to form the Tamala Limestone ridges As the Tamala Limestone weathers, yellow to brown quartz sand is released to form sandy deposits which are thickest on the eastern side of the limestone ridges This forms the **Cottesloe Sands** which are brown siliceous sands in close proximity to the limestone outcrops Away from the limestone are the **Karrakatta Sands** which are deeper and yellow, becoming darker with depth

The geological unit that results in the Spearwood soil system is the Tamala Limestone which includes the **Ludlow Plain** in the south The Ludlow Plain is a low plain developed on Tamala Limestone about 2 km inland from the present coast

Bassendean Dune System

The Bassendean Dune System is inland of the Spearwood Dunes and covers the central parts of the Swan Coastal Plain It consists of pale yellow siliceous sand which has been leached white During the leaching process the yellow iron oxide coating of the sand grains is removed to be deposited lower in the soil as weak ferricrete or coffee rock In places the Bassendean Sands has been eroded and redeposited into other dunes

The geological unit is the Bassendean Sand

Pinjarra Plain

The Pinjarra Plain is the broad flat area of land which has formed by the major river systems such as the Swan, Serpentine, Canning, Murray, Vasse and other river systems on the eastern side of the coastal plain These rivers deposited clays and sandy clay sediments which vary both laterally and vertically through the sequence On top of the clays and silts are small dunes of aeolian sands similar to the Bassendean Sands which have formed by reworking of sandy sediments

The geological unit is the Guildford Formation which includes the **Swan Valley** and **Beermullah Lake** with adjacent alluvial deposits in the north In the south the **Abba Plain** and **Yelverton Shelf** comprise the Guildford Formation

Ridge Hill Shelf

At the base of the Darling Scarp lies the ancient beach lines of the Ridge Hill Shelf In the north the beach line lies along the Gingin Scarp on the edge of the Dandaragan Plateau and in the south along the Whicher Scarp The beach deposits consist of a series of yellow sandy clay and gravel

sediments at about 75 metres AHD sloping gently to the west. It consists of alluvial fans formed by streams draining the Darling Scarp as well as a series of marine beach terraces

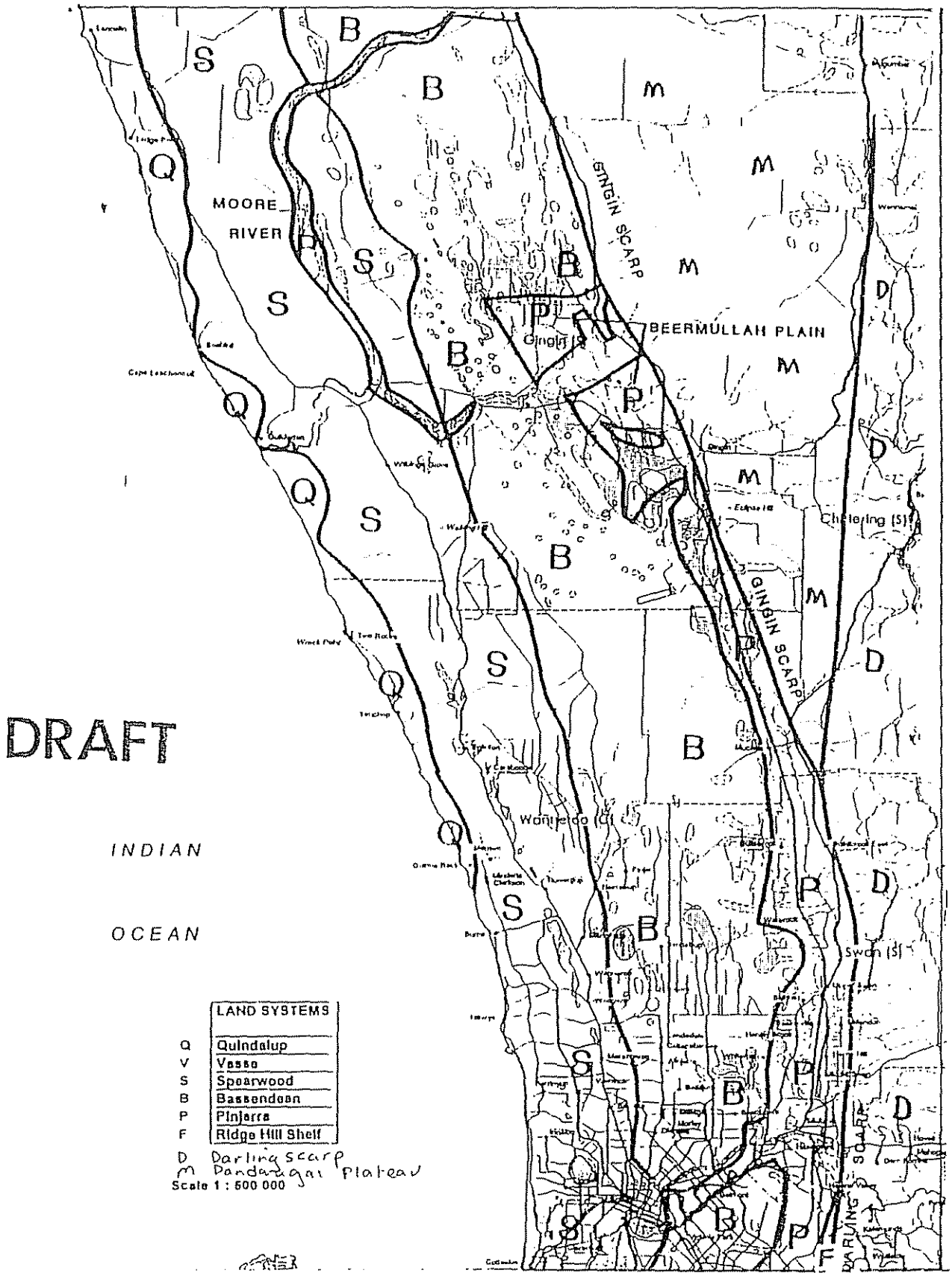
The geological units of the Ridge Hill Shelf are the Yogannup Formation and the Ridge Hill Sandstone.

Darling Scarp and Plateau

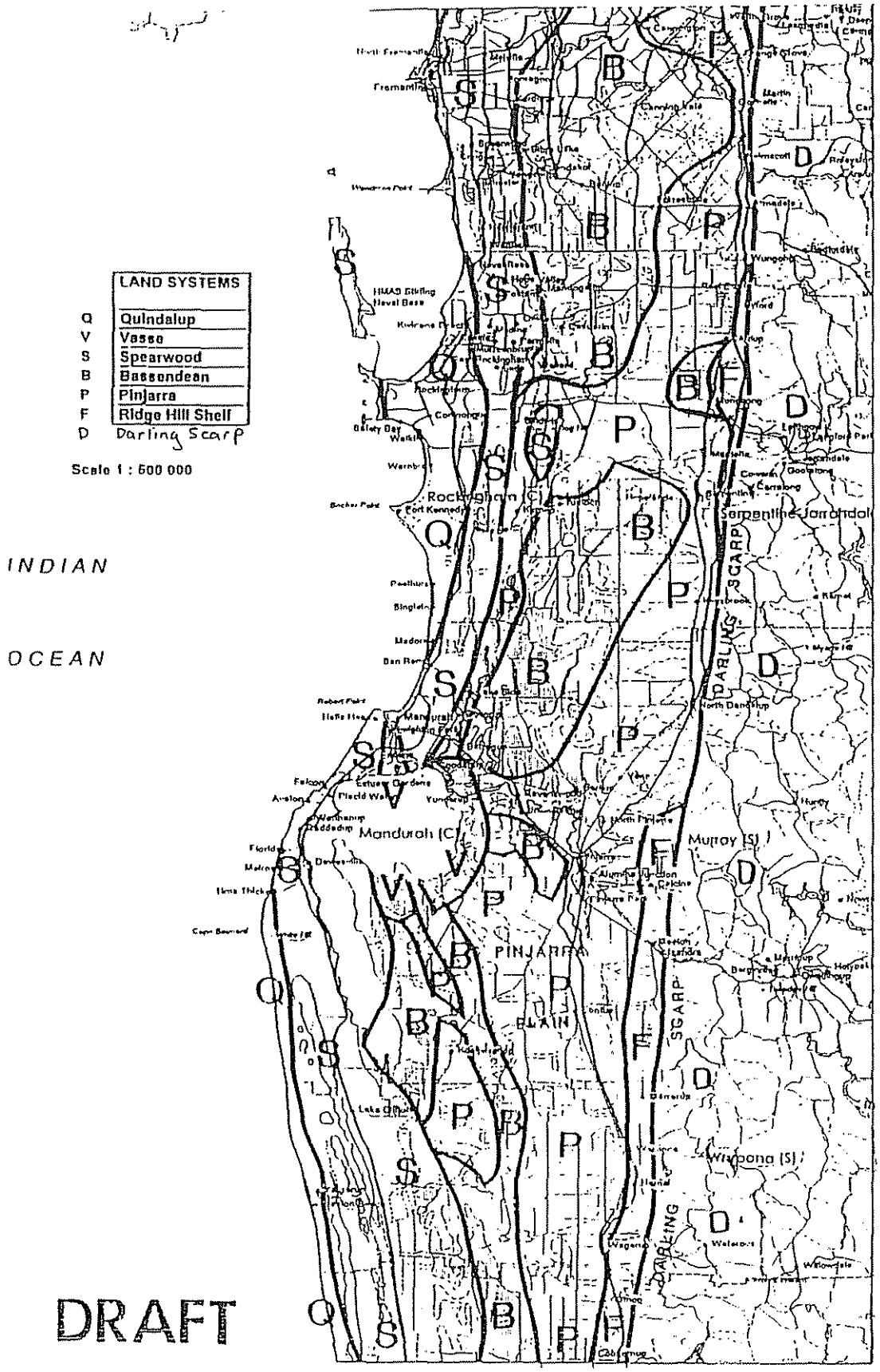
Laterite covering the flatter upper elevations of the hills of the Darling Plateau remains as remnants of ancient sub soils developed during periods of intense weathering. Gravel of variable depth overlies duricrust (caprock) over bauxite and clay rich subsoils with granite basement at depth. Streams have dissected the plateau, cutting through and removing the laterite to expose the granite basement on steep valley sides. Between the granite outcrop and the laterite further up slope are loams and clay loams over clay. These gently to steeply sloping soils have frequently been cleared for orchards. Minor areas of sand of aeolian origin occur on some valley slopes.

Other land units

In all soil units there are small areas of other soil types such as swamp soils, estuarine and alluvial flood plains and terraces along the major rivers and streams, and in several places limestone marl deposits which are formed by calcareous algae living in shallow lakes



LAND UNITS OF THE SWAN COASTAL PLAIN and DARLING SCARP



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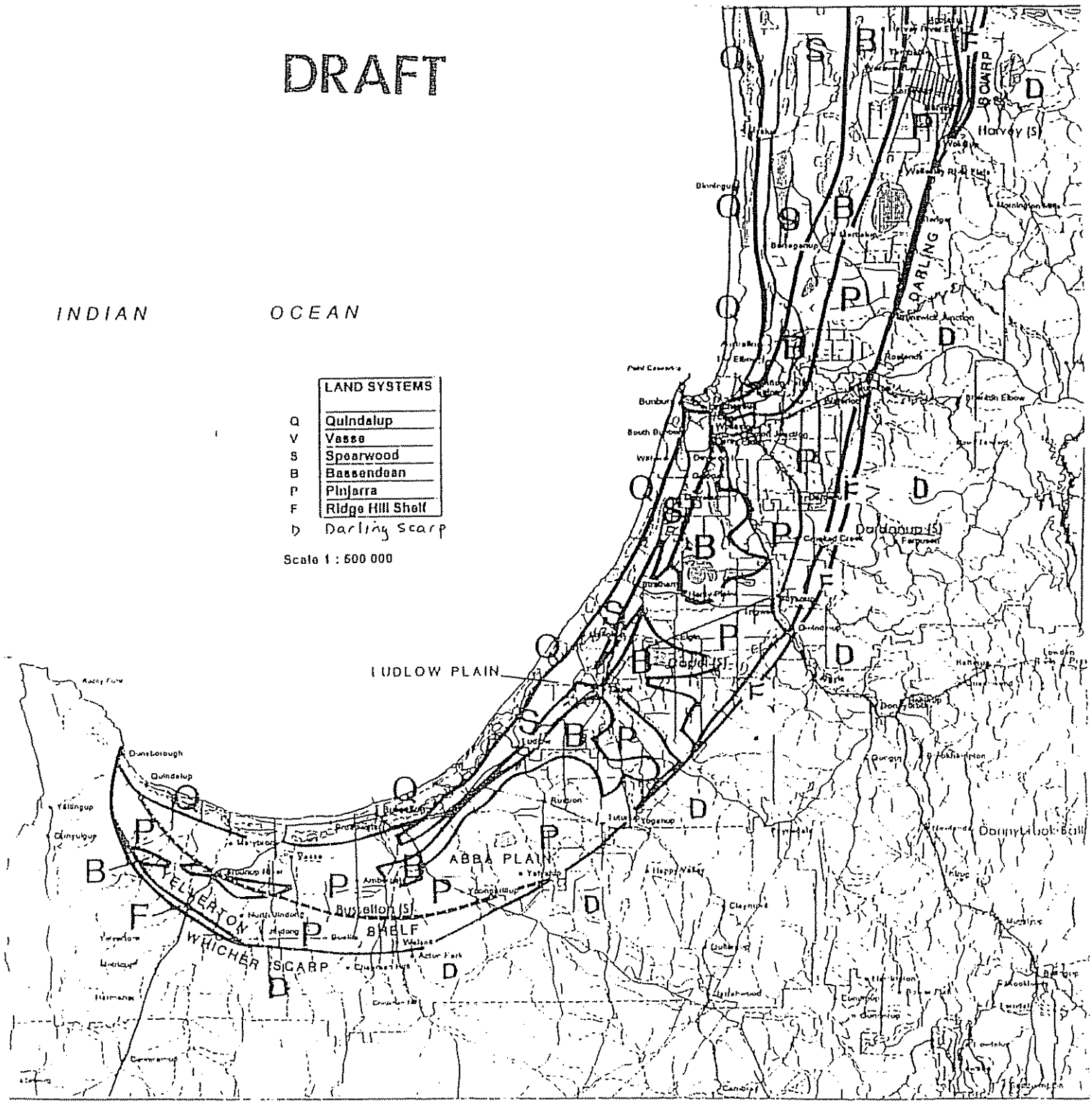
LAND UNITS OF THE SWAN COASTAL PLAIN and DARLING SCARP



LAND UNITS OF THE SWAN COASTAL PLAIN and DARLING SCARP

Land Unit and Soil Type Summary

Table 2 summarises all the land units used in previously published land resources and land capability documents In some of these publications the same soil name has been used across land units and in other cases different names have been used for the same soil type within the same land unit Land unit names sometimes vary across geological units

The Atlas of Natural Resources, Darling System, Western Australia, (Dept Cons and Land Management WA 1980), lists the main soil units and these have usually been adopted during subsequent land capability and land resource mapping Soil unit names have been included in Table and on the Soil Sheets as a cross reference Occasionally a particular soil does not readily fit one of the seven soil types used

The land unit, soil description, the soil types used in this documents and the map symbols are included in this table to assist with correlations In addition the geological unit is listed in brackets under the land unit name

Table 9 Summary of Soil Types, Land Units and Geological Formations

LAND UNIT	SOIL DESCRIPTION	SOIL TYPE SHEET	SOIL TYPES AND UNITS LISTED IN LAND CAPABILITY AND LAND RESOURCE PUBLICATIONS
Quindalup	Deep calcareous sand	2	Qf1, Qf2, Qp1, Qp2, Qp3, Qb, Q5
	Calcareous sand and limestone	1	Qd, Qd1, Qp, Vasse - V10
	Waterlogged sand	3	Qd1, Qw
	Deep leached sand	2	Vasse - V5, V6
Vasse	Foetid muds, humic sandy clay	4	V1, V2, V3, Qwy
(Quindalup)	Alkaline yellow duplex	1	V8
	Alkaline sandy clay	3	
	Deep leached grey sand	2	V5, V6, V6a
	Siliceous sand marl/limestone	3	V4, V10, Yoongarillup
	Brown cracking clays	4	V8
	Drained swamp	3	
	Brown loam	5	V7, Qw, Qwy
Spearwood (Tamala Limestone)	Yellow brown sand/limestone	1	Cottesloe - S1b, S2b, S2c, S4b, Sld, S1d, S2a
	Limestone with little soil	1	Cottesloe - S2b, S5, S6, S1a
	Deep yellow or brown sand	1	Karrakatta - S6, L, Lw Dardak
	Pale leached sand	2	Karrakatta- S1c, S2c, S3b, S4a Cowalla, Nabaroo
	Low yellow sand (swales)	1	Karrakatta - S3, S3a, S4c, Lwr Beonaddy, Waterville
Ludlow Coastal Plain (Spearwood)	Deep yellow brown sand	1	L
	Wet shallow sand/limestone	3	Lw, Lwr
	Pale yellow sand	2	Lw
	Alluvial soils	5	Lv, Lvg
	Deep clayey Sand	1	Cokelup, Yogannup, Lwg, Lvg

LAND UNIT	SOIL DESCRIPTION	SOIL TYPE SHEET	SOIL TYPES AND UNITS LISTED IN LAND CAPABILITY AND LAND RESOURCE PUBLICATIONS
Bassendean	Deep Leached white sand-weak iron hardpan	2	Gavin - B, B1, B1a, B2
	Deep leached white sand - yellow brown subsoils	2	Jandakot - B1a, B1c. B2. B2a Waterville, Cowalla
	Deep leached white sand	2	Gavin, Jandakot - B3, B3b, Battordal, Muchea, Nabaroo
	Wet leached white sand	3	Joel - B3, B3b, B4, B5. B6 Beonaddy
Ridge Hill Shelf (Yogannup Formation)	Yellow brown sand and gravel	1	Regan - Re1, Re2, Re3, Re8, Re9. Mogumber - Mb2, Mb4, Mb7, Forrestfield - F1b, Fb, F2a, F2b, Cartis, Gf4
	Yellow or leached sand	1 and 2	Gwindinup, Forrestfield - F1c, F2c, Re 2, Re3
	Gravel	6	Mogumber - Mb1
	Yellow duplex	6	Lotons, Isandra, Forrestfield - F3. F4, F5, Re8, Re9
	Alkaline sand clay	4	Mogumber - Mb5
	Wet sands	3	Re5, Re6
	Deep leached sand	2	Cartis, Mogumber - Mb3, Regan - Re4, Re7
Yelverton Shelf (Yogannup Formation)	Yellow brown gravelly duplex	1	Forest Grove - Y, Y3, Yi, Yi3 Mungite
	Poorly drained depressions	3	Yw, Ywi, Yvw
	Deep leached sand	2	Yd, Yd3
	Alluvial flats	5	Yv, Yf
	Gravel over ironstone	6	
Gingin Scarp (Yogannup Formation)	Yellow gravelly sand	1	Koorian, Regan
	Sand clay duplex	3	Gulli, Minjil, Cooper, Gingin
	Deep leached sand	2	Cowalla, Coonambidgee
	Yellow sand	1	
	Alluvial sand and loam	5	Bedamanup, Collett

LAND UNIT	SOIL DESCRIPTION	SOIL TYPE SHEET	SOIL TYPES AND UNITS LISTED IN LAND CAPABILITY AND LAND RESOURCE PUBLICATIONS
Pinjarra Plain (Guildford Formation)	White sand over clay duplex	3	P1, P2, P4a, P5a, P8, P11b, P13 Southern River
	Yellow sand over clay duplex	1 and 5	Coolup, Mayfields, Boyanup, Cruse. Fairbridge, Oakley, Mongin, Herne, Guildford Gf1, Gf2, Gf3, Swan - Sw7, Pinjarra - P3, P8. P9, P12 Cannington
	Red sand over clay duplex	3	Blythwood
	Gradational sand-clay	5	Coolup, Boyanup, Pinjarra - P2
	Massive red earths	5	Belhus, Pinjarra - P10
	Deep white leached sand	2	Pinjarra - P12, Guildford - Gf7, Gf 9
	Wet leached sand	3	Pinjarra - P7b
	Black /grey cracking clay	4	Turkey Flat, Ekersley, Wellesley, Gf8, Greenlands, Pinjarra - P4, P5, P10a
	River terraces / loams	5	Houghton, Belhus, Guildford Swan - Sw, Sw1, Sw2, Sw3, Sw4, Sw6, Pinjarra - P6b, Pa, P6c, P10 Harvey, Dardanup
	Red brown earthy sands	5	Swan, Pyrton, Swan - Sw8, Sw9
	Yellow brown sand	2	Marrinup
	Swamps	3	Benger, P7, P7a, Guildford - Gf6, Swan - Sw5
Abba Plain (Guildford Formation)	Waterlogged grey brown gradational duplex	3	Abba - A, Af, Af2, A2 Busselton
	Leached grey sands	2	Af2, Ad2
	Red brown sandy loam	5	Marybrook, Af, Afw
Beermullah (Guildford Formation)	Sandy clay duplex	3	White, Collard, Pinpin, Alp
	Deep leached sand	2	Battordal, Cowalla
	Gravelly yellow sand	1	Glencoe, Harris
	Clay and limestone	1	Moorukine, Muchea Limestone
	Alluvial	5	Jerlack, Collett, Bedmanup
Moore River Gingin Brook (Guildford Formation)	Yellow sand	1	
	Sand clay duplex	3	Burgh, White. Edwards. Alp. Gulli. Cooper. Bidaminna. Collard, Cooper
	Clay soils	4	Kadjelup. Karakin, Bookine. Mungala
	Alluvial sand and loam	5	Millbank, Collett. Neergabby, Garbanup, Bedamanup, Moore
	Wet sands	3	Waterville, Yanga
	Dry leached sands	2	Battordal

LAND UNIT	SOIL DESCRIPTION	SOIL TYPE SHEET	SOIL TYPES AND UNITS LISTED IN LAND CAPABILITY AND LAND RESOURCE PUBLICATIONS
Darling Range	Laterite gravel and duricrust	6	Dwellingup D1, D2, D3 Yallanbee Y1, Y2 Coolakin Ck1, Ck2, Ck3, Ck4
	Valley sand and sand/clay duplex (well drained)	7	Yarragil Yg1, Yg2, Yg3
	Valley sand/clay duplex (poorly drained)	3	Yarragil Yg4, Yg5
	Rocky uplands and steep valleys with basement	7	Cooke, Marbup, Helena H1 Myara Ma1
	Swampy	3	Goonaping
Dandaragan Plateau	Gravel and duricrust	6	Mogumber Mb1, Mb2
	Deep leached siliceous sand	2	Cullala, Mogumber Mb3
	Yellow gravelly sands	1	Karamal, Mb4, Mb6, Mb7
	Wet sands	3	Wannamal, Mogumber Mb5

4.0 BASE STOCKING RATES

Base Stocking Rate Guidelines

The stocking rate guidelines are developed on **Dry Stocking Rates** using **Dry Sheep Equivalents (DSE/hectare)**. The stocking rates of similar soil types are generally consistent across the Swan Coastal Plain and Darling Scarp

What does vary across the Swan Coastal Plain is the potential for nutrient losses due to factors such as soil type and depth, proximity to water bodies, slope and remnant vegetation. Whilst in some areas there are strict guidelines on the potential for nutrient exports, nutrient export should be eliminated or at the least minimised from all rural holdings. In some areas where nutrient exports are controlled, the potential loss of nutrients may restrict stocking rates to levels below the normal carrying capacity.

To simplify the calculation of stocking rates the soils of the Swan Coastal Plain and Darling Scarp have been divided into seven main groups on the basis of composition, structure and the potential for nutrient losses and soil degradation. For each soil type a dry stocking rate has been allocated at a level which is considered sustainable, provided limited pasture and stock management is practised. The base stocking rate applies for all dry pasture conditions, even if some additional feed is introduced

Full details of the soil types are included in the **Soil Fact Sheets**, (Section 6). For convenience the dry stocking rates are listed in Table 3 below. Table 1 can be used to determine the animal equivalents for alternative stock.

Table 3 Dry Stocking Rate for the various soil types (DSE/hectare)

Soil Type	Fact Sheet	Recommended Dry Stocking rate See Table 1 for animal equivalents
Deep yellow sand and gravelly sand	1	5 DSE/hectare
Deep white sand	2	0 5 - 2 0 DSE/hectare
Low wet sand and sand over clay duplex	3	8 DSE/hectare
Clay soils	4	5 DSE/hectare
Alluvial brown loam	5	10 DSE/hectare
Gravel soils	6	8 DSE/hectare
Valley clays and loams	7	10 DSE/hectare

Table 5 provides an example for the number of horses that are recommended on various soil types for different lot sizes assuming some pasture and stock management. The information is derived from Tables 1 and 3. The only way to keep stock on small holdings on some soil types is with a managed or intensive form of stocking utilising comprehensive management practices. Permission is normally required for this

Table 4 Examples of likely base stocking rates for horses on a small rural holding

See Tables 1 and 3

* Allowance has been made for household nutrients loading because of potential nutrient export in soil types 2 and 3 (conventional septic systems are rated as equivalent to 7 DSE, alternative/amended soil systems are equivalent to 4 DSE). Amended soil systems are normally mandatory in soil type 3.

\# In some areas stock are not permitted on lots of < 1 hectare.

Soil Type	Soil	1 ha dry #	1 ha irrig #	2 ha dry	1 ha dry 1 ha irrig	5 ha dry
Deep yellow sand and gravelly sand	1	5 DSE No horse	10 DSE No horse	10 DSE No horse	15 DSE 1 horse	25 DSE 2 horses
Deep white sand	2*	0* DSE No horse	0* DSE No horse	0* DSE No stock	2* DSE No horse	6 DSE No horse
Low wet sand and sand over clay duplex	3*	4* DSE No horse	12* DSE 1 horse	12* DSE 1 horse	20* DSE 1 horse	36* DSE 3 horses
Clay soils	4	5 DSE No horse	10 DSE No horse	10 DSE No horse	15 DSE 1 horses	25 DSE 2 horses
Alluvial brown loam	5	10 DSE No horse	20 DSE 1 horse	20 DSE 1 horse	30 DSE 2 horses	50 DSE 4 horses
Gravel soils	6	8 DSE No horse	16 DSE 1 horse	16 DSE 1 horse	24 DSE 2 horses	40 DSE 3 horses
Valley clays and loams	7	10 DSE No horse	20 DSE 1 horse	20 DSE 1 horse	30 DSE 2 horses	50 DSE 4 horses

Table 5 provides guidance on the capability of the seven soil types to sustain the various stocking regimes. In all cases normal pasture and stock management is assumed. It should be noted that there are some areas where local conditions will restrict stocking, such as the presence of wetlands.

Table 5 Capability of the various soil types for stocking regimes

Dry Pasture and including some Supplemental Stocking

Soil Type	Soil Fact Sheet	Sustainability	Key Management Issues
Deep yellow sand and gravelly sand	1	Acceptable	Wind erosion Potential nitrogen loss to groundwater
Deep white sand	2	Not recommended	Wind erosion Nitrogen and phosphorous loss
Low wet sand and sand over clay duplex	3	Acceptable	Water logging in winter Potential flooding Wind erosion on duplex soils Potential phosphorous loss
Clay soils	4	Acceptable	Waterlogging and puddling by stock Potential flooding Loss of nutrients through surface runoff
Alluvial brown loam	5	Acceptable	Exclusion of stock from watercourses
Gravel soils	6	Acceptable	The presence of laterite caprock will reduce pasture and stocking rates
Valley clays and loams	7	Acceptable	Surface removal of manure in storms Exclusion of stock from water courses

Irrigated Stocking

Soil Type	Soil Fact Sheet	Sustainability	Key Management Issues
Deep yellow sand and gravelly sand	1	Acceptable	Nil
Deep white sand	2	Not recommended without soil amendment	Nitrogen and phosphorous export to ground water Wind erosion
Low wet sand and sand over clay duplex	3	Acceptable with nutrient management	Water logging Phosphorous export to ground and surface water, nitrogen export to surface water
Clay soils	4	Acceptable with nutrient management	Water logging and puddling by stock Nitrogen and phosphorous export to surface water.
Alluvial brown loam	5	Acceptable	Nil
Gravel soils	6	Acceptable	Nil
Valley clays and loams	7	Acceptable	Water erosion Soil damage on steep slopes Surface runoff of manure and nutrients

Intensive or Managed Stocking

Soil Type	Soil Fact Sheet	Sustainability	Key Management Issues
Deep yellow sand and gravelly sand	1	Acceptable with manure management	Wind erosion Nitrogen export to ground water
Deep white sand	2	Not recommended without soil amendments and irrigation	Nitrogen and phosphorous export to ground water Wind erosion
Low wet sand and sand over clay duplex	3	Not recommended without comprehensive management	Water logging Phosphorous export to ground and surface water. nitrogen export to surface water
Clay soils	4	Not recommended without comprehensive management	Water logging and puddling by stock Nitrogen and phosphorous export to surface water
Alluvial brown loam	5	Acceptable with manure management	Nil
Gravel soils	6	Acceptable with manure management	Nil
Valley clays and loams	7	Not recommended on slopes > 10%	Water erosion Soil damage on steep slopes Surface runoff of manure and nutrients

5. CALCULATING STOCKING RATES

HOW TO DETERMINE STOCKING RATES

The following table (Table 6) has been developed to enable the calculation of the dry stocking rate for a particular property It utilises the soil type determined by the Soil Fact Sheets the dry stocking rate and the animal equivalents In addition, in certain areas where there are restrictions on nutrient management, particularly Soil Types 2 and 3, allowances for an effluent disposal system should be included

You should have

Stocking Rate Calculation sheet (Table 6)
Soil Fact Sheets (Section 6)
Land Unit Maps (Section 3) - may be useful
Stock Management Sheet (Section 7) - may be useful

You should know

Area of the property
The volume of water available for irrigation (1500 kL/year will irrigate 0.2 to 0.3 ha)
Town Planning restrictions and conditions

Steps to take

1 Locate the soil type on which the property lies This can be done from the map sheets provided, combined with field observations, available large scale soil maps, Agriculture WA Land Resource Series publications, indicator tree and shrub species and the Soil Fact Sheets It is not uncommon for properties to have several soil types and each of these should be taken into account

2. From field information, scheme provisions, policies and the Soil Fact Sheets and Table 5 (Capability for various stocking regimes), find out if there are any environmental issues that will restrict stock, eg; remnant vegetation, wetland, nutrient loss, waterlogging and note these in the section "Environmental Constraints"

3 From the Soil Fact Sheet or Table 3 find the **Dry Pasture Stocking Rate** (DSE/hectare) for the particular soil types Use Table 1 to find the **Irrigated Stocking Rate** (double the dry pasture stocking rate, DSE/hectare) if applicable

4 Calculate the total DSE for the area of irrigated pasture by:

Area irrigated pasture in hectares x DSE/hectare from Table 1

5 Calculate the total DSE for the area of non irrigated pasture by:

Area non-irrigated pasture in hectares x DSE/hectare from Soil Fact Sheet or Table 3

6 Note the area of any land which cannot be stocked such as wetland, remnant vegetation basement rock or laterite duricrust outcrop

7 **In areas where nutrient restrictions apply**, such as the Peel-Harvey Catchment or proclaimed ground water areas, subtract 4 DSE for dwellings where an alternative effluent treatment unit is used and 7 DSE where a conventional septic system is used

8. Find the **Total Area** and Total **Dry Pasture Stock** for the property (DSE)

9 Note any town planning restrictions that will affect the stocking rate? Such as;

- No stock on properties of less than 1 hectares,
- Limitations on stock to prevent nutrient losses,
- Restrictions on the type of stock.

Subtract any limitations on from the stocking rate and note the total DSE for the property.

10 List any **Planning Conditions** or **Environmental Constraints** that will apply to stock being held on this property

11 From Table 1 (Animal Equivalents), determine the number of each animal that can be kept on the property.

12 If planning conditions or environmental constraints apply to the property, a **Stock Management Sheet** may need to be completed (Section 7).

STOCKING RATE CALCULATION

LOT NUMBER/LOCATION		
Land unit, vegetation, soil type etc (Soil Fact Sheets)		
TO CALCULATE THE STOCKING RATE		
Land Holding	**Area - hectares**	**Stock Allowed**
Irrigated pasture	ha	DSE
Soil Type 1	ha	DSE
Soil Type 2	ha	DSE
Non irrigated pasture	ha	DSE
Soil Type 1	ha	DSE
Soil Type 2	ha	DSE
Soil Type 3		
Area of remnant bushland, basement rock or duricrust.	ha	No stock allowed
Area of wetland and associated buffers	ha	No stock allowed
In areas where nutrient limitations apply, for the building envelope subtract 4 DSE for alternative effluent treatment unit and 7 DSE for conventional septic system.	ha	Subtract 0, 4 or 7 DSE DSE
TOTAL AREA and STOCKING RATE FOR PROPERTY	ha	DSE
Town Planning Conditions / Restrictions		
Environmental Constraints		
Conditions Imposed		

6. SOIL FACT SHEETS

SOIL FACT SHEET 1

Deep Yellow Sand and Gravelly Sand — 1

LAND UNITS

Spearwood - Karrakatta and Cottesloe soils
Forrestfield - Quindalup
Ludlow Plain
Yogannup
Yoongarillup
Cottesloe
Ridge Hill Shelf
Yelverton Shelf
Gingin Scarp
Whicher Scarp

INDICATOR PLANT SPECIES

Tuart - *Eucalyptus gomphocephala*
Marri - *E. calophylla*
Jarrah - *E. marginata*
Woody Pear - *Xylomelon occidentale*
WA Peppermint - *Agonis flexuosa*
Banksia grandis
Spearwood - *Kunzea ericifolia*

Thicket vegetation on limestone ridges with Parrot Bush - *Dryandra sessilis*

SOIL DESCRIPTION

- Located on dunes inland from the coast associated with limestone, or as part of the Ridge Hill Shelf/Yogannup beach lines near the base of the Darling Scarp.
- Pale to dark yellow sand, deep, with nil to small amounts of clay
- Gravel is present in variable amounts at the base of the Darling Scarp.
- Dry in summer with maximum water table > 1.5 metres from surface
- Limestone outcrop is common in the darker sands near the coast.

CURRENT STATUS

- Often cleared for grazing although areas in the south such as the Ludlow Plain are reserved.
- Some areas of the Yogannup Formation are held under mining tenements.
- Often used for market gardens.
- Some limestone and sand lie within Resource and Priority Resource Extraction areas.

ENVIRONMENTAL ISSUES

- High wind erosion potential
- The unit has a moderate - high phosphate retention due to depth of sand and the amount of iron oxide (geothite) present
- Underground water resources
- Lake Clifton Management Plan
- Peel Harvey Catchment
- Low soil moisture
- Potential to pollute shallow ground water
- Remnant vegetation may contain poorly reserved plant communities at the base of the Darling Scarp
- Bores restricted to shallow ground water, normally licensed to 1500 kL/year

STOCKING RATES	5 DSE/ha DRY PASTURE
COMMENT	Higher stocking rates can be maintained if an alternative water source is available

SOIL FACT SHEET 2

Deep White Sand	2

LAND UNITS	INDICATOR PLANT SPECIES
Bassendean Sands - Gavin, Jandakot Leached Spearwood - Karrakatta Quindalup Dunes, Safety Bay Sands Pinjarra Plain Vasse Soils Yelverton Shelf Abba Plain	Banksia Woodland *Banksia attenuata, B. menziesii, B ilicifolia* Sheoak - *Allocasuarina fraseriana* Jarrah - *Eucalyptus marginata* Spearwood - *Kunzea ericifolia* *Acacia thicket (Quindalup)*

SOIL DESCRIPTION

- Dunes of the oldest coastal dune system, recent coastal dunes and leached sand dunes located in other land units.
- Typically the Bassendean and Quindalup dunes, but some leached sands exist in the Spearwood, Forrestfield Systems and the edge of the Darling Scarp

- Bassendean Sands are deep white to pale yellow quartz sands which may have yellow subsoils and minor ferricrete hard pans at depth
- Quindalup dunes are deep white dunes containing 20-70 % calcium carbonate
- Dry in summer with highest water table > 1.5 metres from surface in winter

CURRENT STATUS

- Often uncleared Banksia woodland (Bassendean) or coastal Acacia thicket (Quindalup)
- Proximity to reserved areas.
- Resource and Priority sand extraction areas.

ENVIRONMENTAL ISSUES

- High potential for wind erosion
- Low water retention
- Low nutrient retention particularly phosphorous and nitrogen
- Banksia Woodland remnants in some areas
- Wetlands, Peel Harvey catchment and Groundwater resource areas
- Buffers required for sand extraction areas
- Quindalup system has restricted groundwater limited to thin lens over saline water.
- Perennial grasses used to improve pasture are very invasive to remnant bushland

STOCKING RATES	2 DSE/ha DRY PASTURE (hobby farm, 0.75 - 2 broad acre)
COMMENT	Stock should not be permitted unless irrigation and soil amendments are available. Nutrient loss is a likely consequence of irrigation and higher stocking rates

SOIL FACT SHEET 3

Low Wet Leached Sand and Sand over Clay Duplex | 3

LAND UNITS

Bassendean - Joel
Swales in Quindalup and Spearwood dunes
Abba Plain, Guildford, Beermullah, Yanga
Wet areas of the Ridge Hill Shelf/Yogannup System - Lotons, Isandra
Yelverton Shelf, Swan, Cannington
Pinjarra Plain - Coolup, Mayfields, Boyanup, Fairbridge, Oakley, Blythwood
Bootine, Herdsman

INDICATOR PLANT SPECIES

Flooded Gum - *Eucalyptus rudis*
Paperbarks - *Melaleuca preissiana, M rhaphiophylla, M. Viminaria*

Spearwood - *Kunzea ericifolia*
Coojong - *Acacia saligna*

SOIL DESCRIPTION

- Lower dunes and swales, dunes of the oldest coastal dune system (Bassendean) as well as leached aeolian sands present in other land units.
- Shallow aeolian sand over alluvial clay on the eastern side of the Swan Coastal Plain.

- Poorly drained soils.
- Leached white sand which is frequently water logged for short periods in winter. May be slightly peaty.

- May also consist of low lying sand over clay or ferricrete hard pan.
- Water table rises to within < 1.5 metes in winter

CURRENT STATUS

- Mostly cleared for summer pasture

ENVIRONMENTAL ISSUES

- Often adjacent to wetlands
- Frequently poorly drained and drainage channels are a common occurrence
- Wind erosion on duplex soils.
- Waterlogged in winter.
- Some areas may be prone to flooding.
- High potential for nutrient losses particularly phosphorous. Nitrates are not normally a problem because they are denitrified under anoxic conditions in the soils.
- Peel-Harvey Catchment
- Groundwater protection areas
- Wildlife associated with swamps such as Southern Brown Bandicoots, tortoises, amphibians and bird life

STOCKING RATES	8 DSE/ha DRY PASTURE
COMMENT	Potential nutrient losses are likely to reduce stocking rates Proximity to waterbodies wetlands and remnant vegetation may restrict stocking rates. Pasture can be improved with perennial clover

SOIL FACT SHEET 4

Clay Soils — 4

LAND UNITS

Pinjarra Plain - Turkey Flat, Ekersley
Vasse
Ludlow Coastal Plain
Beermullah
Cokelup

INDICATOR PLANT SPECIES

Marri - *Eucalyptus calophylla*
Wet areas
Paperbarks - *Melaleuca preissiana, M rhaphiophylla,*
Flooded Gum - *Eucalyptus rudis*
Saline areas
Saltwater paperbark - *Melaleuca cuticularis*
rushes sedges and Samphire

SOIL DESCRIPTION

- Alluvial plains and terraces of the main rivers
- Lagoonal and estuarine sediments

- Dark brown-black clays which are frequently cracking and dispersive
- A thin layer of sand may be present over the clay on slight rises
- Alkaline-acidic, relatively impermeable
- Saline and calcareous - humic muds, clays and sands

CURRENT STATUS

- Mostly cleared and frequently drained
- Summer grazing, particularly cattle
- Irrigated pasture in the Harvey area
- Some estuarine and lagoon areas are reserved

ENVIRONMENTAL ISSUES

- Drainage channels enable nutrients fast access to watercourses
- Nutrient retention is usually reduced by fast run off and relative impermeability
- Peel Harvey catchment
- Potentially saline soils
- Groundwater is often brackish or saline and in restricted quantities
- Proximity to streams, rivers, wetlands and estuaries
- Soil amendments such as sheeting with sand or addition of gypsum will improve soil
- Waterlogging is common in winter
- Soil structure frequently declines through puddling by stock

STOCKING RATES	5 DSE/ha DRY PASTURE
COMMENT	Stocking rates will depend on soil amendments and nutrient management Site specific information may be required Often waterlogged in winter and may be unsuitable for stock Nutrient export can impact on wetlands and estuaries

SOIL FACT SHEET 5

Alluvial Brown Loam	5

LAND UNITS	INDICATOR PLANT SPECIES
Swan Valley, Belhus, Houghton, Pyrton Pinjarra Plain, Harvey, Dardanup Vasse Abba Plain Guildford Serpentine Moore	No particular indicator species Marri - *Eucalyptus calophylla* Flooded Gum - *Eucalyptus rudis* *Acacia saligna* Paperbark - *Melaleuca rhaphiophylla and M. preissiana*

SOIL DESCRIPTION

- Red brown loams of alluvial flood plains, terraces and plains associated with major rivers and streams.
- Soils vary from sandy loams to clay loams both vertically and horizontally. Normally the soils are well drained with some perched water tables on flatter areas each winter.

CURRENT STATUS

- Mostly cleared for grazing, orchards and vines.

ENVIRONMENTAL ISSUES

- Proximity to rivers and foreshore reserves
- Foreshore management plans may be required
- Generally high phosphate retention but high potential for losses unless managed
- Peel Harvey catchment
- Fertile soil which is valuable for horticulture
- Some areas may be subject to flooding

STOCKING RATES	10 DSE/ha DRY PASTURE
COMMENT	Potential nutrient losses are the main problem. Stock need to be moved away from floodwaters.

SOIL FACT SHEET 6

Gravels	6

LAND UNITS	INDICATOR PLANT SPECIES
Ridge Hill Shelf Gingin Scarp Yelverton Whicher Scarp	Marri - *Eucalyptus calophylla* Jarrah - *Eucalyptus marginata* Bull Banksia - *Banksia grandis* Parrot Bush - *Dryandra sessilis*

SOIL DESCRIPTION

- Located on the laterite soils of the ridges at the base of the Darling Scarp
- Yellow brown gravels with variable amounts of duricrust and laterite float. Duricrust is commonly present at a depth of 1 to 2 metres.

CURRENT STATUS

- Partly cleared

ENVIRONMENTAL ISSUES

- Very high phosphorous absorption
- Limited shallow groundwater
- Potential for water to run rapidly from the site with some water erosion.
- Soil depth is restricted by the presence of laterite duricrust (caprock) in some areas
- Erosion is a potential problem on steeper slopes

STOCKING RATES	8 DSE/ha DRY PASTURE
COMMENT	The presence of laterite duricrust will restrict pasture growth and stocking rates.

SOIL FACT SHEET 7

Valley Clays and Loams	7

LAND UNITS	INDICATOR PLANT SPECIES
Darling Scarp	Marri - *Eucalyptus calophylla* Wandoo - Eucalyptus wandoo Yarri - Eucalyptus patens *Hakeas* and *Grevilleas* Wet areas Paperbarks - *Melaleuca preissiana, M. rhaphiophylla,* Flooded Gum - *Eucalyptus rudis* Narrow Leaf Peppermint - *Agonis linearifolia*

SOIL DESCRIPTION

- Gentle to steep valley slopes of the Darling Plateau.
- Developed on clay subsoils and basement granite.

- Light coloured to red-brown loams, earths and clays with white kaolin clays at depth.
- Low permeability with rapid runoff.

CURRENT STATUS

- Mostly cleared and often used for orchards and lifestyle blocks.

ENVIRONMENTAL ISSUES

- Rapid drainage to stream lines.
- Although the soil is capable of retaining nutrients, low permeability reduces the potential for nutrient management.
- High risk of dung being washed into streams and dams
- Groundwater is normally of good quality.
- Proximity to streams, rivers. wetlands and estuaries.
- Frequent soaks and seepages, some of which have elevated salinity
- Small areas may be waterlogging.
- Susceptible to landslips near seepages on steeper slopes.
- Potential for saline soils in some areas.
- Steeper slopes may lead to soil erosion and land slippage
- Outcrops of basement granite may restrict the useable area.

STOCKING RATES	8 DSE/ha DRY PASTURE
COMMENT	Site specific information may be required because of proximity to water courses basement outcrop and steep slopes. Susceptible to waterlogging and landslips in some places. High water erosion potential particularly on slopes > 10%

7. STOCK MANAGEMENT CHECKLIST

Stock Management Checklist

This checklist is produced for all land holders, but in particular those with lots of a potentially commercial size who wish to apply to the relevant authorities for increased stocking rates will need to address all issues.

Lot number, road and location	
Lot size	
Soil type	
Type and number of stock	

Checklist	Not Applicable	Adequate	Required
Property management plan			
Fenced buffers, vegetation corridors and rehabilitation			
Protection of waterways			
Water erosion protection measures			
Wind erosion protection measures			
Dust management			
Management of water logged soil			
Pasture management plan, (eg hay, rotation, slashing)			
Separate stock water supply (scheme, dam, bore, tank)			
Irrigated summer pasture			
Suitable fences for the stock to be kept			
Yards or other restraining device (large stock animals)			
Fencing of remnant bushland			
Protection of trees from grazing			
Declared weeds present			
Management of environmental weeds			
Pasture management policy			
Soil tests to determine the correct nutrient application			
Fertiliser/nutrient management plan			
Collection and management of manure/dung			
Nutrient management plan			
Management of flies and other nuisance insects			
Management of odour			
Impact of noise on adjoining properties			
Satisfactory branding of stock			
Health of stock			

8. LAND MANAGEMENT AND LAND RESOURCES INFORMATION

Land Management Information

A general guide for small rural holdings is the Small Block Manual (Shire of Serpentine-Jarrahdale), available from Agriculture WA. A number of pamphlets (Farmnotes F/N) are available from Agriculture WA on particular topics;

Agriculture Western Australia
3 Baron-Hay Court
SOUTH PERTH WA 6151
Phone 08 9368 3440

Land clearing	F/N 1/93	Land Clearing Regulations Small Block Manual
Fences		Small Block Manual, Help and fact sheets from fencing suppliers and manufacturers.
Yards		
Revegetation		Small Block Manual Greening Australia Publications
Protection of trees	F/N 52/89	Preventing soil erosion and tree damage on small holdings Small Block Manual
Stock management		Small Block Manual
Pasture management	F/N 12/89 F/N 11/91 F/N 6/90 Shire Serp. Jarrahdale Agric WA Booklet	Pasture management in the south west Cropping and horticulture Sprinkler Irrigated pasture for small holdings Small Block Manual Pasture management for small landholders
Fertiliser	F/N 52/89 F/N 27/96	Preventing soil erosion and tree damage on small holdings Nitrogen fertiliser sources for crops Small Block Manual Fertiliser manufacturers/suppliers
Water logging		Small Block Manual
Property management	F/N 8/91 F/N 39/93 F/N 17/86 F/N 19/86 Agric WA Agric WA Booklet	Land use and general property management Calculating the value of rural land Development guidelines for small rural lots Site evaluations for small rural lot developments Property Care, A guide to Maintaining and Improving Your Property (T Bell) Land management issues in the Swan and Canning Catchment
Draining land	F/N 47/93 F/N 9/91 F/N 26/94	Notification of draining or pumping saline land Water and drainage Notification of intention to drain or pump water in the Peel Harvey Catchment
Weeds		Agricultural Protection Board Small Block Manual
Water	F/N73/94 F/N 46/90 F/N 11/86 F/N 69/78	Water supplies for irrigation on the small farm Water quality for farm domestic use Clearing cloudy or coloured water Water quality for WA farms Small Block Manual
Fire		Small Block Manual Bushfires Board of WA

9. FURTHER READING AND REFERENCES

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Gov of Western Australia, 1997, Draft Statement of Planning Policy No 2, **Jandakot Groundwater Protection Policy**

Lantzke N, 1997, **Phosphorous and nitrate loss from horticulture on the Swan Coastal Plain**, Agriculture WA, Miscellaneous Publication, 16/97

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National and Medical Research Council, 1996, **Australian Drinking Water Guidelines**, Canberra ACT

Poinke H B, Sharma M L and J K Hosking, undated, **Effect of Irrigated Horticultural Cropping on Groundwater Quality Swan Coastal Plain Western Australia**, CSIRO Water Resources No 2.

Land Capability and Land Resource Information

A number of land capability and land resource assessments have been completed for the Swan Coastal Plain. These are more detailed and of a more scientific level but may provide additional information Soils in the field change rapidly over very short distances and these changes cannot always be accurately shown on maps because of the scales involved Therefore even though these publications contain more detailed maps, the soils still must be checked in the field

All the publications listed below can be obtained from

AGWEST Land Management Services
Agriculture Western Australia
3 Baron-Hay Court
SOUTH PERTH WA 6151
Phone 08 9368 3440

Barnesby, B A, P D King and M E Prouix-Nixon Land resources from **Harvey to Capel** on the Swan Coastal Plain, Two Maps, Agriculture WA

Campbell-Clause J and G A Moore, 1991, Land capability study for horticulture in the **Swan Valley**, Agriculture WA.

Department of Conservation and Environment, 1980, **Atlas of Natural Resources Darling System**, Western Australia,

King P D and M R Wells, 1990, **Darling Range** rural land capability study, Agriculture WA
Smolinski H and G Scholz, 1997, Soil Assessment of the **West Gingin** area (1997), Agriculture WA.

Tille P J and N C Lantzke, 1990. **Busselton - Margaret River - Augusta** land capability study, Agriculture WA

Van Gool D and B Kipling, 1992, Land resources of the northern and southern sections of the **Peel-Harvey Catchment**, Two Maps. Agriculture WA

Wells M R, 1989, Land Capability study of the shires of **Mandurah and Murray**, Agriculture WA

Wells M R and A J Clarke, 1986, **Shire of Wanneroo** - a study of land resources and planning considerations. Technical Report 47, Agriculture WA

Wells M R and P D King, 1989, **Land capability assessment methodology** for rural residential development and associated agricultural land uses Agriculture WA

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