SHIRE OF WEST ARTHUR

LOCAL PLANNING SCHEME NO. 2

LOCAL PLANNING STRATEGY

Endorsed by the Western Australian Planning Commission
23 November 2006

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SHIRE OF WEST ARTHUR

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1.0 INTRODUCTION

The Western Australian Planning Commission (WAPC) has prepared a Model Scheme Text to guide the form and content of local planning schemes throughout Western Australia.

A criticism of local planning schemes has been that they are legal documents rather than planning documents, and often did not present a clear picture of the objectives, planning intentions, and the proposals of the local government.

The Model Scheme Text format provides for the Local Planning Strategy (LPS) and local planning policies to set the context for planning in the scheme area.

The Local Planning Strategy is expected to be a central feature of the scheme setting out the Council's general aims and intentions for future long-term growth and change. Whereas the scheme has a five-year time scale, the strategy may look ahead 10 - 15 years.

For country schemes, the Local Planning Strategy will be particularly valuable in helping to guide and control pressures for change, which could affect the rural economy and environment. The strategy will lay down guidelines for the future pattern of settlement. For example, existing townsites that are likely to expand and locations suitable for future rural-residential subdivision having regard to land characteristics and proximity to services and facilities. It may identify prime agricultural land, minerals and extractive raw materials, and water resources requiring protection; land with special management needs such as wetlands, areas prone to erosion or salinity, and areas of landscape, heritage, and amenity value.

The Local Planning Strategy will be particularly valuable in:

- setting out the framework of State and regional policies and interpreting these for the local area;
- providing the planning context and rationale for the zones, reservations and statutory provisions contained in the local planning scheme;
- explaining the Council's broad strategy for an area.

Whilst a standardised format is not proposed, by the Western Australian Planning Commission it is expected a Local Planning Strategy will contain the following elements:

- a description of the key characteristics of the municipality, its regional context, and major planning issues;
- a statement of aims explaining the strategic land use directions that the local government is seeking to pursue (these should become the aims of the scheme);
- land use or development opportunities and constraints that provide a context for local planning decisions;
- the links between strategic planning in a municipality and the State and regional planning context including the strategies of surrounding municipalities in the region;
- strategic policy statements about key issues such as housing, industry and business, open space and recreation, transport, infrastructure, environment, townsites, and rural land;
- more detailed policies and proposals for particular areas or specific issues contained in the strategy;
- an outline of how the strategy will be implemented including reference to any local planning policies and guidelines which may be required, planning scheme measures and proposals of the State and local government to facilitate development including capital works.

NOTE: Advice and assistance on the state and regional context can be obtained from the Great Southern Regional Office of the Department for Planning and Infrastructure

2.0 STATE AND REGIONAL PLANNING CONTEXT

There are no statutory region schemes or regional strategy plans, which include the Shire of West Arthur.

The Regional Vision Statements of the State Planning Strategy for the Wheatbelt Region (in which the Shire is located) are:

- Development of a range of expanded and consolidated towns linked by improved transport infrastructure.
- Encouragement of innovation in agriculture, environmental management, and downstream processing of agricultural products.
- Rehabilitation and protection of productive farmlands.
- Maintenance and enhancement of vibrant, viable inland communities.

The relevant planning strategy from the State Planning Strategy for the Shire is to:

- promote nodal urban settlement patterns in agricultural areas separated by agricultural/green belts.

The State Planning Framework has been prepared by the WAPC to unite existing State and regional policies, strategies and guidelines within a central framework, which provides a context for decision-making on land use and development. It informs the Commission, local governments, and others involved in the planning process on those aspects of State planning policy that are to be taken into account, and given effect to, in order to ensure integrated decision-making across all spheres of planning.

The State Planning Framework indicates the primary policies and strategies used by the Commission and the Department for Planning and Infrastructure in making decisions. It includes Statements of Planning Policy prepared by the Commission under Part 3 of the *Planning and Development Act 2005* as well as regional strategies, regional and sub-regional structure plans, strategic policies and operational policies prepared from time to time and endorsed by the Commission. Some of these, particularly Operational Policies, will be relevant to subdivision and development in the Shire.

3.0 LOCAL GOVERNMENT POLICY CONTEXT

The Council's mission statement is:

To preserve and enhance the life style of West Arthur Shire residents

The Shire of West Arthur Town Planning Scheme No. 1 was published in the Government Gazette on 17 August 1990. Town Planning Scheme No. 1 covers the whole of the Municipal district. It has been amended several times.

Under the provisions of Part 5 Division 5 of the *Planning & Development Act 2005,* a local planning scheme is to be examined in each fifth year following the date on which it was last published in the Government Gazette. Accordingly, Town Planning Scheme No. 1 is due for examination.

There is land use change and development in the district. The Shire wants to be able to guide this development to the best advantage of the community. For these reasons and to comply with requirements of the *Planning & Development Act*, resources have been allocated for preparation of a local planning scheme review.

The Scheme Area for Local Planning Scheme No. 2 encompasses the whole of the municipal district.

The Shire has a limited range of planning policies and these will be reviewed following final approval of this Scheme.

4.0 PROFILE AND KEY ISSUES

4.1 GENERAL

4.1.1 Location

The Shire of West Arthur covers an area of about 2,850 sq km located in the Upper Great Southern Region. The administration centre of the shire is the town of Darkan, some 204 km from Perth. Townsites also exist at Duranillin, Moodiarrup, Bowelling, Hillman, and Cordering. There is some limited development in each of the first 3 townsites. However, all that now remains of the Hillman and Cordering townsites are the designations of the townsite areas.

A small settlement centred on providing travellers' facilities and services is located at East Arthur (Arthur River) on the Albany Highway.

The location of the shire is shown in Figure 1.

4.1.2 Brief History Of European Settlement

The first settlements in what is now the Shire of West Arthur were developed along the Perth to Albany road (which was built by convict labour in the 1850s) between the Beaufort and Arthur Rivers.

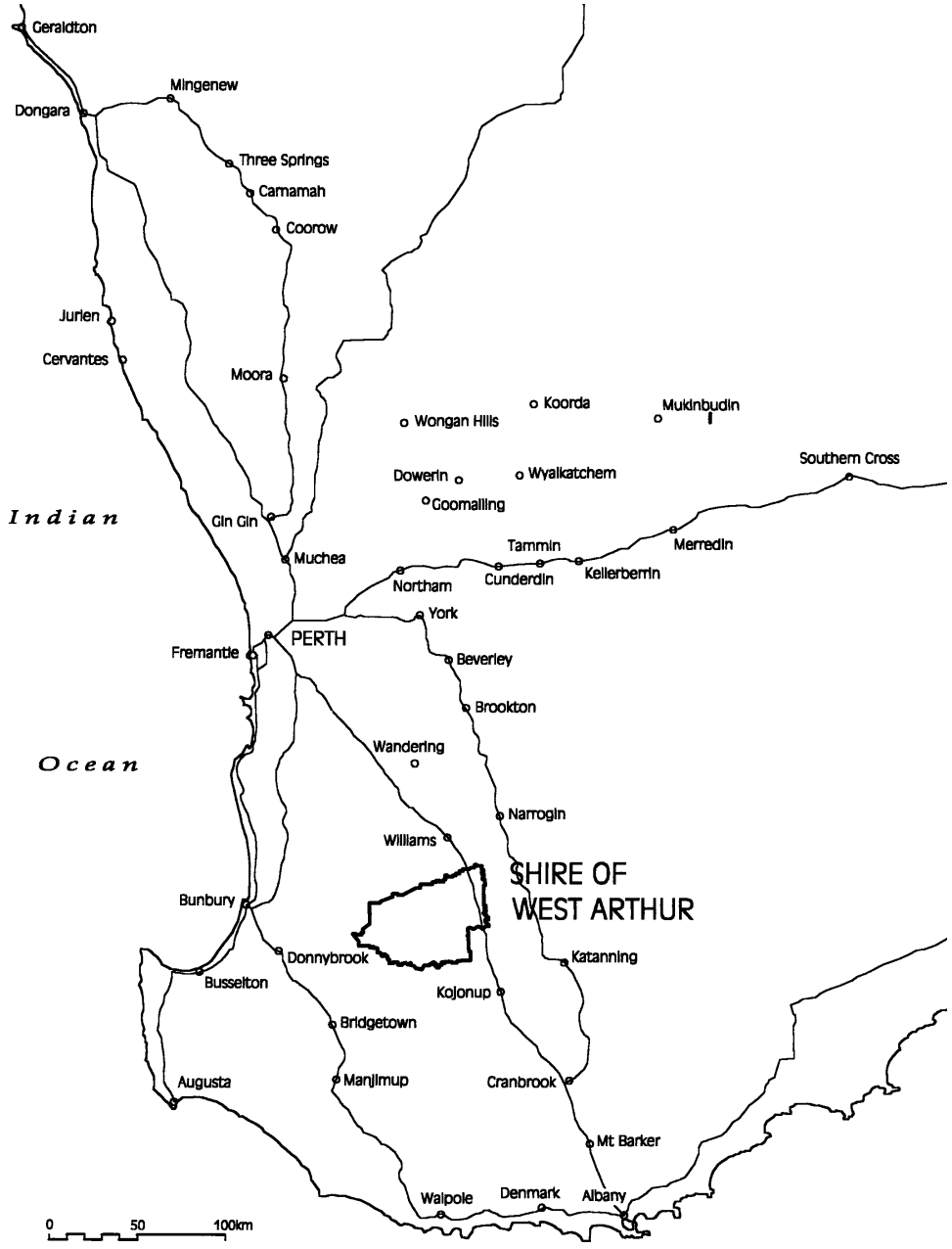
The construction of the Great Southern Railway attracted settlement away from the 'Coach Road' to the route of the railway line and Darkan was declared a townsite in 1905. The first building in the town - the hotel - was constructed in 1906 for Mrs Francis. Though modified several times during the years, this hotel still stands just north of the railway station.

The railway went through Darkan in 1907 and immediately the town began to flourish. The railway station is a charming example of a small station with wide, balanced verandahs.

By 1908, when the first Road Board office was constructed, the town boasted a store, bakehouse, cafe and boarding house, trading company, blacksmith and bootmaker. These developments were a great boon to the district's first European residents who had established themselves in the general area some 43 years earlier.

The first settlers in this town either worked on the land (usually with sheep) or in the various trading posts and stores in the general area. Some provided services at the Old Tarwonga Inn. (on the Albany Highway).

These notes are from the "Darkan Heritage Trail", developed by the Shire of West Arthur, with assistance from the: Darkan and Districts Apex Club; Darkan District High School; and West Arthur Tourist Committee



SHIRE OF WEST ARTHUR
REGIONAL LOCATION

FIGURE 1

4.2 POPULATION

The population in the Shire of West Arthur as at the 1996 census was 988 persons. Limited data is available for Darkan and separate statistics are not available for the other townsites.

The Australian Bureau of Statistics has provided information of population and total dwellings in the Shire and in Darkan for each census from 1976 to 1996, as shown in Tables 1 and 2.

TABLE 1

Population and Total Dwellings
Shire of West Arthur
1976 –1996

	Population	Total Dwellings	Persons/Dwellings
1976	1293	446	2.9
1981	1217	476	2.6
1986	1067	466	2.3
1991	976	466	2.1
1996	988	444	2.2
2001			

Source: Australian Bureau of Statistics
Prepared by: Gray & Lewis

TABLE 2

Population and Total Dwellings
Town of Darkan
1976 –1996

Census	Population No.	Total Dwellings No.	Persons/Dwellings No.
1976	266	85	3.1
1981	242	94	2.6
1986	n.a.	n.a.	n.a.
1991	201	85	2.4
1996	265	119	2.2

Source: Australian Bureau of Statistics
Prepared by: Gray & Lewis

The distribution of population between Darkan and the rest of the Shire is summarised in Table 3.

TABLE 3

Population Distribution
Shire of West Arthur

Census	Darkan %	Rest %
1976	20.5%	79.5%
1981	19.9%	80.1%
1986	n.a.	n.a.
1991	20.6%	79.4%
1996	26.8%	73.2%

Source: Australian Bureau of Statistics
Prepared by: Gray & Lewis

The population was reasonably constant in the period 1976-1991, but in the last census showed a movement towards the town. It is expected this will continue.

4.3 SETTLEMENT PATTERN AND INFRASTRUCTURE

4.3.1 Rural Land Use

The predominant land use in the district is for agricultural production. As shown in Table 6 about 211,700 ha (or 74% of the total area of the district) was in 174 agricultural establishments in 1992/93.

Agricultural production has traditionally been focussed on grazing stock, with some cropping. With greater awareness of land capability as well as changing markets, pressures of increasing land values, and pressures from persons seeking lifestyle change, different forms of agriculture are now been practiced.

Commercial tree plantations have been established, and are expanding. There is potential for this land use to expand in the district as part of farm diversification or a single crop. The Shire is not aware when the plantations may be harvested.

Olives are being cultivated in the district and appear to be well suited to local conditions.

The pattern of land use is undergoing change with the ascendance of other rural uses including tree plantations, and olive groves. Part of this change will be demand for accommodation for seasonal workers engaged on establishment, maintenance, and harvesting.

4.3.2 Darkan Townsite

Darkan is the main settlement in the district, and the centre for administration, and commercial and community services.

(a) Residential

The existing residential area in Darkan is contained on the southern side of the transport corridor, being Coalfields Road and the former railway.

Existing residential development is predominantly single houses on unsewered lots of about 1,000 m^2. A private subdivision has been initiated for land south of Burrowes Street, to the west of Gibbs Street.

There are vacant lots in the town available for new residential development.

(b) Commercial

The 'main street' commercial uses extend along the south side of Burrowes Street opposite the former railway yard. The shops provide a range of convenience goods, but customers for comparison goods must travel to centres such as Collie or Bunbury.

A hotel is located to the north of the former railway yard and the Coalfields Road.

Fuel supplies are available from service stations in the town.

(c) Industrial

A small industrial area has been developed off Horwood and King Streets, in the south eastern sector of the town. There is potential for expansion of this industrial area for light/services industries that do not impact on residential development.

The Shire supports development of an industrial area to the north east of the town for the location of those industries that cannot be accommodated within the townsite for reasons of lot size availability and/or buffer distance required to satisfy Environmental Protection Authority guidelines.

(d) Rural Residential

In the western and south-western sectors of the town there are larger lots suitable for rural-residential or hobby farm purposes. These lots that were created many years ago range in area from 2 hectares and are currently incorporated in a farming property. If they were to be made available as individual lots, they would provide variety and lifestyle choice in the town.

(e) Community Facilities

The civic and cultural facilities are mainly located along Burrowes Street with Shire office, Post Office, and Police Station. The town hall is located at the corner of Hillman and Butler Streets at the rear of the Shire office.

The Police service operates part-time in Darkan from the former medical building adjacent to the town hall. Medical services, community meeting rooms, telecentre, library, community agriculture centre, and LandCare Officer operate from the West Arthur Health and resource Centre located next to the Shire Office, and constructed in 1999 with the old Roads Board offices providing the core meeting room.

The Post Office is located off Coalfields Road, on the northern side of the railway reserve.

The major recreation facilities in the town are on land on the western side of the town. This extensive area incorporates showgrounds, recreation oval, sports club, and tennis courts. There is sufficient area available on-site for extensions to the recreation facilities to accommodate future needs.

(f) Public Purposes

There are areas of Crown Reserve in the town that have been allocated, and are being used for a particular purpose. There is limited Unallocated Crown Land available for future use.

The West Arthur cemetery is located on the western side of the town, off Moodiarrup Road.

The Department of Education and Training has advised the Darkan District High School is on Crown Reserve 10340 of 4.1608 ha. The school provides places for pre-primary, primary, and secondary school students.

Guidelines for the planning of Government schools require a primary school on a 4 ha site for every 1,250 dwellings (about 4,000 residents), and a secondary school on a site of 10 ha for every 5,500 dwellings (about 17,600 residents). A district high school on a 6 ha site is to be provided in country areas where separate high and primary schools are not warranted.

A swimming pool that is available for public use is located on the school site and is operated by the P & C.

School enrolments at the Darkan District High School in recent years are summarised in Table 4.

TABLE 4

Darkan District High School Enrolments
1994 - 1999

Year	Numbers of Students			
	Total	Pre-Primary	Primary	Secondary
1994	146	26	84	36
1995	147	26	86	35
1996	147	24	86	37
1997	152	31	83	38
1998	142	25	81	36
1999	135	21	77	37
2000				
2001				
2002				
2003				

Source: Department of Education and Training

4.3.3 Other Settlements

There is limited development in the Bowelling, Moodiarrup, and Duranillin townsites, mainly for residential purposes. And rural supply stores are located in Moodiarrup and Duranillin. The Shire provides a reticulated non-potable water supply to the Duranillin townsite.

The other townsites are undeveloped, and it is the Shire's intention they not be developed in the future.

Traveller's facilities are located at East Arthur (Arthur River) on the Albany Highway. There are 2 roadhouses, a hall, information bay, parking areas, and public toilets. Located on the coach road that was the first land transport link between Perth and Albany, Arthur River has been a much bigger settlement in the past. A few houses remain amongst reminders of earlier times.

4.3.4 Transport And Public Utilities

Darkan is located off the Coalfields Road, between Collie and the Albany Highway.

The former Collie - Narrogin railway reserve runs through the town. Railway use ceased many years ago and the district is now reliant on road transport. Rail track and infrastructure has been removed.

There is an extensive road system throughout the district, with the primary roads being Coalfields Road and Albany Highway. The extensive road system is sufficient for the current scale of agricultural development. But elements of it may require attention to accommodate traffic when tree plantations are harvested in the future. The affected authorities including the Shire will review this matter.

Main Roads WA has advised that the Coalfields Road and Albany Highway are the only roads in the district under its jurisdiction. Initial advice from Main Roads WA referred to re-alignment of the eastern and western approaches to Darkan on the Coalfields Road. However, details of any land requirements have not been made available. There are no other current planning proposals in the region that will directly impact on the use of the highways.

Telecommunication services are provided to the district, which also receives television and radio services. There is very patchy mobile phone reception, and this service is generally unreliable and poor.

The Water Corporation provides a water supply in the town of Darkan from the Great Southern Towns water supply. The Water Corporation has no plans to extend water supply services in the district.

Reticulated sewerage is not available. There is no infill sewerage works planned within the Shire in the current 10-year program of the Water Corporation. Development potential will be limited to the capacity of each development site to accommodate on-site effluent disposal. Because of the clay nature of soils, residential lot sizes must be of sufficient area to incorporate an effluent disposal area as well as building area.

Local drainage services are maintained by the Shire. The *Town Planning (Buildings) Uniform General By-laws 1989* provide that a building is not to be constructed on land defined by the Shire to be subject to flooding or inundation.

The district is connected to the Western Power state power grid for electricity supply. Electricity supplies can be readily extended to new developments within Darkan.

4.4 THE ECONOMY AND EMPLOYMENT

West Arthur is a farming community that produces wheat and coarse grains, and clover, as well as livestock including sheep, cattle, and pigs.

Commercial tree plantations have been established in the western parts of the district, but have not yet yielded a crop. The oldest plantings in the district are expected to be harvested in the next few years, and the timber carted to Bunbury for chipping.

The latest statistics available for agricultural production in the district are for 1992/93. In that year, 174 farms covered 211,700 hectares (average 1,217 ha/farm). The details of agricultural production in the West Arthur district are set out in Table 5, and are compared with the totals for the Upper Great Southern Statistical Division.[1]

It is apparent that the district is of well below average importance for wheat and cereal crops, but it contributes well above average to pasture and the stocking of sheep and cattle.

[1] The Upper Great Southern includes the Shires of Boddington, Brookton, Corrigin, Cuballing, Dumbleyung, Kondinin, Kulin, Lake Grace, Narrogin, Pingelly, Wagin, Wandering, West Arthur, Wickepin, and Williams.

TABLE 5

Agricultural Production 1992-1993

	Upper Great Southern	West Arthur	% of UGS
Agricultural establishments	1,913	174	9.1
Total area of agricultural establishments (ha)	3,397,000	211,700	6.2
Land used for crops (ha)	1,618,400	27,700	2.5
Land established under pasture (ha)	1,897,400	154,100	8.1
Wheat - Area (ha)	702,800	300	0.04
Production (t)	1,166,400	400	0.03
Cereals for grain - Area (ha)	944,800	18,500	2.0
Livestock - Sheep (No)	7,312,500	976,900	13.4
- Cattle (No)	36,800	5,600	15.2
- Pigs(No)	55,000	2,100	3.8

Statistics from Australian Bureau of Statistics
Prepared by Gray & Lewis

The 1996 Census showed a total population of 988 persons in the Shire. Of those, 23 (2.3%) were unemployed, 541 (54.8%) were employed, and 170 (17.2%) were not in the labour force.
As to be expected, the most significant industry sector was “agriculture, forestry, and fishing”. And in that grouping, 327 persons were engaged in agriculture, 14 in services to agriculture, and 3 in forestry.

The next largest industry sector is manufacturing. Almost two thirds of the total (26 out of 38 persons) is in the textile, clothing, footwear and leather grouping. This would appear to reflect the tannery plant northeast of Darkan.

The distribution of labour force to employment sectors is shown in Table 6.

TABLE 6

Employed Persons By Industry – 1996

Shire Of West Arthur

Industry	Persons			
	Male	Female	Total	%
Agriculture, Forestry and Fishing	231	113	344	62.2
Mining	7	0	7	1.3
Manufacturing	28	10	38	6.9
Electricity, Gas and Water Supply	3	0	3	0.5
Construction	8	0	8	1.4
Wholesale Trade	8	3	11	2.0
Retail Trade	10	9	19	3.4
Accommodation, Cafes and Restaurants	4	9	13	2.4
Transport and Storage	6	6	12	2.2
Communication Services	0	3	3	0.5
Finance and Insurance	3	3	6	1.1
Property and Business Services	5	3	8	1.4
Government Administration and Defence	11	9	20	3.6
Education	6	17	23	4.2
Health and Community Services	0	14	14	2.5
Cultural and Recreational Services	0	0	0	0.0
Personal and Other Services	0	5	5	0.9
Non-classifiable/not stated	12	7	19	3.4
Total	**342**	**211**	**553**	**100.0**

Source: Australian Bureau of Statistics
Prepared by: Gray & Lewis

4.5 PHYSICAL FEATURES AND THE ENVIRONMENT

4.5.1 Climate

The Bureau of Meteorology does not collect climate data for sites in the Shire. Climate averages are available for Narrogin and Collie, to the east and west of the district respectively.

Key climatic data for recording stations at Narrogin and Collie are shown in Table 7.

TABLE 7

Selected Climatic Data

	J	F	M	A	M	J	J	A	S	O	N	D	Year Ave
Narrogin													
mean max temp °C	30.9	30.1	27.2	22.9	18.1	15.1	14.3	15.2	17.8	20.5	25.6	28.8	
mean min temp °C	13.6	13.6	12.5	10.0	7.6	6.1	5.1	5.0	5.7	6.9	9.5	11.7	
mean precipitation mm	10.0	15.1	22.8	29.3	73.1	97.4	102.3	74.6	49.5	35.1	15.3	12.8	537.3
Collie													
mean max temp °C	30.5	30.1	27.3	23.2	18.9	16.3	15.5	16.3	18.1	20.7	24.8	28.3	
mean min temp °C	13.2	13.1	11.5	8.7	6.3	5.0	4.2	4.5	5.8	7.4	9.7	11.7	
mean precipitation mm	15.6	15.5	24.3	48.6	128.7	183.3	183.1	140.7	99.9	66.8	32.1	15.9	938.9

Source: Bureau of Meteorology

It would be misleading to try to interpolate climate averages as being in any particular position in the range between Narrogin and Collie. At best, the data gives an indication of climate averages at about the eastern and western extremities of the district.

4.5.2. Physical Environment

(a) Geology

West Arthur lies to the west of the Meckering Line (Mulcahy 1973) that separates the Sandplain/Salt Lake Zone of the Yilgarn shield on the east from the Dissected Zone to the west. It straddles the line separating the Dissected Zone in the east and the Zone of Rejuvenated Drainage to the west (McArthur 1991).

The Shire is underlain at depth by granitic rocks of the Yilgarn Shield, which have been subjected to widespread and prolonged weathering, and erosion that has flattened the landscape to form a massive erosion surface across much of the Yilgarn Craton. The most significant late stage of this development was in the Tertiary from perhaps 70 million years ago when large very flat palaeo-channels formed and much of the drainage was internal. Widespread deep weathering profiles formed across the erosion surfaces leading to the formation of ferricrete in the subsoils that was expressed as laterite when exposed by erosion. Underlying the ferricrete were deep kaolin clay based sub-soils over weathered basement rock.

Up-warping of the western margin resulted in down cutting by the major streams, creating the rejuvenated zones, and removal of much of the ferricrete which is now preserved as the resistant laterite/duricrust and associated pisolitic gravels that cap most of the hills in the west.

During the Tertiary broad valleys formed, filled with sandy alluvial deposits in the eastern half. These rocks have been variously exposed during Recent erosion when the eastern half of the shire was dissected.

The shire can be divided into two main land systems. The eastern half, which is a region of Tertiary broad alluvial terrace and plains, cut into the lateritic Tertiary surfaces that drain south westerly to the Blackwood River. The western region lies in the rejuvenated area where steeper valleys cut the dissected Tertiary land surface, draining west to the Collie River.

(b) Soils

Soils in the western half are dominated by well drained laterite gravels with a sandy matrix which are remnants of the Tertiary laterite soil profiles, with wetter more recent sandy soils that include gleyed clayey subsoils occupying the main valleys.

The predominant soils in the eastern region are hard setting loam soils with mottled yellow clay subsoils developed on subsoils of the Tertiary land surface and more recent soils of the granite basement.

(c) Hydrology

Water management is a key issue in the shire, whether in terms of availability or for potential to lead to increased soil salinity.

Drainage from the western portion of the shire is to the west and the Collie River, whereas drainage from the eastern half is to the Beaufort and Arthur Rivers to the Blackwood River.

In the western half the streams are generally small fast flowing tributaries draining the steeper slopes, whereas in the east gradients are gentler and flows tend to be slower.

Rainfall varies across the shire from about 800mm in the west to about 500mm in the east. But as basement rocks are relatively close to the surface over most of the shire there are no large groundwater aquifers. Precipitation is lost through surface runoff, particularly in the steeper western area where runoff is rapid. In eastern parts runoff is slower and some stream courses are quite sluggish, with water entering shallow alluvial sediments of the valley floor.

Stream salinities vary from near fresh in times of significant flow through to brackish and saline as flows reduce.

Runoff has increased following land clearing and is estimated to have increased from 1 – 12 mm prior to clearing to 20 – 60 mm per year depending on soil conditions and rainfall, (after Coles and Moore 1998). Recharge has increased from perhaps 0.2 mm to 10 – 50 mm per year and water tables are rising at between 0.05 and 0.5 m per year, (George and Bennett 1998).

Currently runoff from storms and heavy rainfall events is a major contributor of less saline and fresh water to the streams of the shire. When dams are placed across drainage lines they tend to be designed to capture a high proportion of the runoff because overflow is seen as inefficient. This reduces the downstream flows leading to potential loss of water quality through increased salinity and nutrient levels because of reduced flushing.

Flooding can be an important issue adjacent to creek lines and rivers. Storm events are able to dump large quantities of precipitation in a short time and combined with hard setting soils and loam/clays can produce flash flooding in even small catchments.

4.5.3 Land Degradation

(a) Waterlogging

Department of Agriculture Soil and Conservation Council list all the lower valley soils in the shire as being highly susceptible to waterlogging.

The best management for waterlogging is the use of deep-rooted species, agricultural species, retention of remnant vegetation, the establishment of wildlife corridors and plantation, and other deep-rooted crops in suitable locations.

(b) Salinity

In 1989 the percentage of cleared land affected by salinity was estimated at 3.34% an increase of almost 50% since the previous survey in 1979. (Grein 1994).

Surface water varies from fresh to brackish through to saline depending on the water flow and the time of the year, although in general most surface water has elevated salinity.

The worst salinity is widespread across the central and eastern parts of the shire. Further west, although the salt storage is high under the widespread plateau remnants, the increased rainfall and reduced levels of clearing means that salinity levels are lower. Salt stored on the deep soil profiles can be up to 2,000 t/ha on hilltops with 5,000 t/ha in valley soils.

Surface salinity is expressed where the shallow groundwater is forced to the surface by underlying clay soils, changes in slope, and shallow basement rocks. Surface observations including geological and/or soil mapping and stream sampling provides good data to identify the catchments at most risk, where most of the LandCare activity should be concentrated.

Shallow soils with granite near to the surface generally have lower salinity because over time recharge from precipitation has flushed out the stored salt. Left long enough a new equilibrium will be established but in the meantime significant areas of land will be made saline.

The main techniques leave the salt in the soil profile, and reduce the water loading and thus the recharge rate. This lowers the water table and allows salt stored in the surface soil horizons to gradually be displaced lower down the profile through the infiltration of precipitation. Lowering the water table is normally achieved through clearing restrictions to prevent increased recharge, the planting of vegetation and shelter belts, deep rooted pasture particularly perennial species, and establishing plantations all of which use water through evapo-transpiration. Areas of salt scar and land upstream from the scar should be planted with deep-rooted species.

Contour banks that allow surface water to flow to the streams without infiltration can also be helpful but can shift the problem from one area to create another at the disposal point.

Water harvesting in which the first flush of saline or nutrient enriched water is allowed to run off and later fresher water is retained in dams, can be beneficial in managing salinity of water supplies but may create salinity and nutrient problems downstream.

Research is continuing into actually removing the salt from evaporation basins or drainage in addition to lowering water tables.

(c) Wind Erosion

Wind erosion is a potential problem on most soils, but particularly the more sandy soils. More soil can be eroded by the wind in one day under certain conditions than through several seasons or even years. The worst times for wind erosion are potentially during strong northerly winds in autumn associated with the approach of a frontal system or cyclonic remnants when pasture cover is reduced or land has been tilled in anticipation of rains. The most productive soil is the top 50 mm, which contains most soil biota, which are able to assist with the formation of aggregates and interact with the minerals to release inorganic materials for plant uptake.

The planting of windbreaks can greatly assist in containing wind speed as well as providing shelter for stock in adverse conditions in winter.

(d) Water Erosion

Water erosion can occur potentially on all soils where the slope is greater than 1%. However it most frequently occurs on steeper slopes, particularly during storms, when adequate soil cover is not maintained. Contour channels, cultivation techniques, the strategic location of fences and firebreaks, and grazing management will all assist in containing water erosion.

(e) Acidification

Ammonium based fertilisers, and the planting of clovers and other legumes can encourage the decline in soil pH. At lower pH some elements become less available to plants and aluminium

may be mobilised, inducing aluminium toxicity and reducing soil structure. Most of the soils in the shire are rated as having a moderate to high risk of soil acidification.

The spreading of lime and gypsum, together with crop rotations, may assist.

(f) Soil Compaction

Soil compaction results from the movement of machinery and stock. Compaction increases the difficulty of root penetration, increases soils structure, and can lead to soil structure decline. Ripping and pasture management are the main means of reducing compaction.

(g) Nutrients

Nutrient export is seldom given priority in the management of broad scale farmland. However it can have a major impact on farm dams and the health of streams. The most likely export of nutrients is during storm events, particularly during summer, when soil compaction increases runoff that carries animal dung to dams and streams. The dung is high in nutrients such as phosphorous (that is a major cause of algal blooms), nitrates and organic matter, which during decomposition will deplete the oxygen of water.

If dung is washed into a dam or river pool it can potentially leach nutrients for a number of years and the only cure normally available is to empty the dam and scrape it out. The potential entry of dung into dams can be reduced through contour banks and grassed or vegetated filter traps prior to entry.

(h) Key Elements

Key land degradation elements in the shire are:

- The degree of down cutting reduces towards the east where valleys are broader and more gently sloping.
- Duricrust and gravel soils of the plateau remnants are frequently uncleared but have been grazed.
- There is increased gravel and duricrust based soils in the west.
- An increased proportion of loam over clay soils developed on granite/gneiss basement occurs in the centre and east of the shire between laterite-covered ridges.
- There is greater potential for water erosion in the steeper valleys of the west.
- Steeper sloping soils require measures such as interceptor or contour banks to reduce the potential for water erosion.
- Expanses of granite or rock outcrop increase surface run off.
- Wind erosion risks rise in the eastern half of the shire.
- Plateau remnants such as laterite/duricrust have reduced surface runoff and if cleared will lead to significant increases in the groundwater recharge.
- Hard setting loam soils are highly susceptible to increased runoff that can be exacerbated by compaction by machinery and stock.
- Runoff has increased through reduced evapo-transpiration following land clearing resulting in rising water tables particularly on valley floors.
- Flat or low lying loam/clay soils on valley floors have increased risks of water logging during wetter winters, and increased risk of salinity overall.
- The more sandy soils have increased productivity in wetter winters.
- Some clay and loam soils have hard setting characteristics that limit seedling emergence and can have poor rooting conditions.
- Some loam/clay soils in valleys may have alkaline subsoils that may restrict iron availability.
- The application of gypsum can increase the capability of clay-based soils.

- Large amounts of salt are stored under the ancient soil profiles of the laterite plateau remnants.
- Catchments containing high proportions of plateau remnants and deep ancient soils have greater salinity risk.
- The presence of or potential for saline soils exists in most valleys of the shire.
- Salinity risks and effects have increased because of land clearing.
- Salt scars develop where evaporation of shallow groundwater causes high salt levels in the surface soil horizons, even though the groundwater may have only moderate salinity levels.
- The areas and concentrations of soil salt increases in the valley soils towards the east.
- Dense planting of deep-rooted species can contain the spread of saline soils or even lead to their reduction.
- The control of salinity requires a catchment approach because a salt scar may have its origins much further up the catchment.

4.5.4 Biological Environment

(a) Vegetation

The vegetation of south-western Australia has a high species richness and endemism. Although much of the vegetation has been removed, the remnant vegetation plant communities within the shire are no exception.

Information in the *Memorandum of Understanding between Relevant Government Authorities (1997), for the Protection of Remnant Vegetation on Private Land in the Agricultural Region of Western Australia* shows that >20% of the shire is remnant vegetation. Although the distribution is uneven and most of the vegetation east from the Jarrah Forest is either cleared or significantly grazed, there are areas of remnant vegetation.

The broad original vegetation systems were studied by JS Beard and CALM and summarised by Grein, 1994.

The wetter western half, west from Darkan, is occupied by Jarrah – Marri Woodland, with the eastern half with some interfingering just west of Darkan, by Marri – Wandoo Woodland.

Within the Jarrah – Marri Woodland are a number of vegetation complexes such as the Yallanbee and Dwellingup typified by Jarrah and Marri on the laterite soils. Pindalup and Yarragil complex containing Wandoo occupy the more clayey upper valley slopes with Swamp Complex including a range of *Melaleuca* species on the valley floors.

As rainfall reduces to the east the tree layer becomes more open and the understorey becomes more typical of the warmer more northern Jarrah Forest.

Wandoo is more typical to the east with some Jarrah on gravely soils and Brown Mallet Open Forest on the laterite hills and breakaways. Flooded Gum occurs in the moist valleys with York Gum and Jam Wattle on the slopes. In the east Flat Topped Yate becomes dominant on sandy soils and together with the other eastern species forms the Beaufort System.

Grein 1994 lists 6 Declared Rare Flora species as occurring within the shire.

The vegetation of the shire was studied as part of the “Save the Bush Project No. MZ 06”, (Griffin 1995). Of the 415 remnants observed briefly by Griffin 1995, only 2% were fenced.

Approximately 29% of the original vegetation remains. Whilst large areas in the centre and west lie within Crown Land, 19% occurs on private land scattered across the shire. In the shire there are 4,710 bush remnants of which 70% or 3,314 remnants are regarded as being “remnant vegetation”, with the remainder being “scattered trees” and “modified vegetation” (Grein 1994).

Collection of seeds from reserves is to be avoided and seed orchards should be established to provide local plants for specific planting projects in the shire.

(b) Fauna

From the status of remnant vegetation across most of the shire it is obvious that mammal, amphibian, and reptile species richness and density have been greatly affected. It is also likely that foxes and cats have impacted on fauna in the remnant vegetation and Reserves whilst other species such as pigs, rabbits, goats, and gambusia fish are likely to have indirectly impacted on fauna.

The *State of Environment Report 1998* shows that up to 6-7 fauna species are regarded as threatened within the shire, but no fauna are presumed extinct. For example, the Water Rat was present in Lake Towerinning and Arthur River but disappeared in 1960. Long Necked Turtles disappeared from Lake Towerinning in the 1970s but have again been observed as the lake has undergone restoration in more recent times (Grein 1994).

Occasional species have been advantaged by clearing, for example the Sulphur Crested Cockatoo, Little and Long Billed Corellas, and Galahs utilise agricultural grains as a major component of their diet and thus their numbers are likely to increase, perhaps being limited by the availability of nesting site.

Nature reserves and remnant vegetation can be too small to be viable habitats for many of the original species. Various studies in *Role of Remnants of Native Vegetation* (Saunders et al) show that, for example, in a study at Naringal in south-western Victoria a reserve of <2 hectares accounted for only one mammal species with > 50% frequency. And even in reserves of 41 – 100 hectares only 10 species were noted. An area of 5,000 hectares was calculated to be required to provide habitat for 100 Numbats and an area of 120 hectares provided habitats for between 15 and 47 species of bird. The success really depends on linkages between remnant and habitat vegetation.

The best management of fauna is to retain and enhance where possible remnant vegetation in addition to planting clumps of trees and wildlife corridors, and controlling feral animals.

(c) Biodiversity

The flora of the shire was very diverse and in turn was linked to a diverse fauna, both large and small.

The preservation of biodiversity depends on maintaining and preserving self-sustaining remnant vegetation and habitat in all community types. This can be assisted by a policy of encouragement by the Council and assistance and education to all landholders and persons within the shire.

(d) Wetlands

Other than 2 major wetlands and pools associated with the river systems and soaks on hillsides and valley floors there are few large wetlands within the shire. The 2 major wetlands are Lake Towerinning of 179.5 hectares with 21.5 hectares vegetated, and Wildhorse swamp of 4.2 hectares which is predominantly vegetated (3.9 hectares).

As soils and lower valley areas become more saline there will be a tendency for wetlands to change in structure and function. This has occurred at Lake Towerinning. In 1955 water was diverted from the lake due to high water levels but this led to increases in salinity. Since 1989 the local LandCare group has worked to have freshwater diverted back to the lake. It also removed 40,000 tonnes of salt from the lake system. For their efforts the LandCare Catchment Group was awarded the 1993 combined Rural Traders Community LandCare Group Award at the National LandCare Awards.

Many soaks and wetter sites have been cleared for many years and do not now form natural wetlands, although moist pasture and related areas are likely to be utilised by bird and amphibian species.

Wetlands provide habitats for a wide variety and number of fauna, and small soaks may provide an oasis for frogs, fish, water birds, and small fauna. Therefore the maintenance of wetlands needs to be carefully considered before any changes are made to farm and stream plans.

Farm dams can be designed as wetlands with the construction of various depths of water, the incorporation of vegetated islands or floating platforms, the planting of fringing vegetation, and the use of logs as resting places for birds. Soaks can be deepened to provide a water source with adjoining areas fenced and planted with wetland species.

(e) Reserves and Parks

There are 10 Nature Reserves vested in various authorities within the shire. These range in size from the 40 hectare Haddelton Springs Nature Reserve, to the 294 hectare Wild Horse Swamp Nature Reserve, to the 1,161 hectare Haddelton Nature Reserve. Other Reserves include Trigwell Nature Reserve, Towerinning Nature Reserve, Boolading Nature Reserve and Dead Man's Swamp Nature Reserve. These are in addition to State Forest in the west of the Shire (Grein 1994).

These Nature Reserves are classified in the Scheme as Local Reserves for Recreation and Open Space.

In terms of providing security of habitat or sufficient habitat for fauna these reserves and Crown Land are too small and should be linked through vegetation corridors to remnant vegetation on private land and green belts. Where possible land holders should be encouraged to plant local species in vegetation buffers, windbreaks and wildlife corridors.

There should be a concerted effort within the central and eastern parts of the shire to save remnant vegetation and where possible re-establish communities. Roadsides are in some places the only component of the original plant communities remaining, and require protection.

Experience from other areas has shown that the best management for these sites is through an enthusiastic local group that will gain limited community funding and support by local government for the maintenance and restoration of remnant bushland. The Council has a good record of encouraging local groups to manage remnant vegetation and reserves as typified by the efforts expended on the restoration of Lake Towerinning.

Retention of foreshore zones along rivers, streams and drainage lines is an important part of this process.

(f) System 6 Areas

There are 3 areas identified in the System 6 report [Conservation Reserves for Western Australia as recommended by the Environmental Protection Authority October 1983 – The Darling System – System 6] that are partly or wholly in the shire.

They are:

- C29 Goonac Management Priority Area
- C93 Muja Management Priority Area
- C94 Bennelaking Management Priority Area

Each of the 3 areas comprises some State Forest, and other Crown Reserves. The portions of State Forest are to be classified in the Scheme for Local Reserve for State Forest. The Crown Reserves for other purposes are to be classified as Local Reserve for Recreation and Open Space.

Recommendations for management of the 3 areas in the System 6 report are beyond the scope of the Scheme.

4.5.5. Biological Decline

(a) Indigenous Vegetation

Remnant vegetation is under attack from weeds, dieback diseases, grazing, vermin, rural tree decline, development, and land clearing. Clear positive educative guidelines should be instituted to reduce the threat. Frequently the threat is the slow nibbling away of the vegetation instead of one act of clearing which would require approval. The end result is, however, the same.

In the shire there are 4,710 bush remnants of which 70% or 3,314 remnants are regarded as being "remnant vegetation", with the remainder being "scattered trees" and "modified vegetation". (Grein 1994). It is hoped that in the future most of these will be preserved and enhanced as opportunities present themselves.

The threats to the indigenous flora also impact on fauna that are dependant on the various plant species. In some areas the indigenous vegetation remaining on paddocks is sparse or the trees are so far apart that little habitat is available. Mature trees provide the only nesting sites for many bird species such as cockatoos.

(b) Dieback Disease

Dieback disease is normally associated with the fungus *Phytophthora Cinnamomi.* However, there are other species of Phytophthora and fungus that are implicated in the dieback of indigenous vegetation such as *Armillaria*, stem canker *Cryptodiaporthe*, and rusts. Many of the indigenous species in the shire are susceptible to these fungal species and if allowed to gain a hold, remaining indigenous vegetation will be drastically altered. The dominant plant families of the area, Proteaceae, Myrtaceae, and Epacridaceae are particularly susceptible to *Phytophthora.*

Fungal diseases are normally spread by vehicles, the movement of soil and plant materials, and members of the public.

Other forms of vegetation decline can occur, for example when populations of essential insects such as pollinators, fire regimes, predators, water availability, nutrients and grazing pressure are altered. This is often the case where trees are left in cleared land and become the focus for fauna. Predator species are forced to attack the one tree, flocks of birds are drawn to the tree and grazing under the tree prevents the development of seedlings, compacts the ground and leads to increased nutrient input, all of which lead to a decline in the health of the tree.

The protection of remnant vegetation through fencing, seeding, and replanting is to be encouraged. Often simply fencing an area can lead to a recovery of indigenous species long since thought to have been lost.

(c) Fire

Repeated inappropriate fire management of reserved vegetation has the potential to alter the species' composition by burning young plants before they have a chance to flower and set seed.

A fire management plan should be investigated for reserved land and roadsides, in the light of potential impact on the flora and fauna communities.

(d) Weeds

Weeds and other exotic species are a great threat to much of the remnant vegetation because they are normally pasture species selected for their suitability to the area. They are spread by wind and the movement of vegetation, soils, vehicles and people from pasture areas. Most roadsides have already been devastated by weed introduction and most reserves are subjected to edge impacts. The continued decline of this vegetation through the addition of weed and pasture species has the potential to damage the tourist industry and reduce the effectiveness of wildlife corridors.

(e) Honey Bees

Introduced bees are not part of the indigenous ecosystems and in order to collect nectar from some species, they bite through the base of flowers destroying the reproductive potential. Honey collection is not recommended on flora reserves because of potential structure changes to the vegetation.

The planting of honey plants as wind breaks and vegetation corridors could be investigated.

5.0 STRATEGIC PLAN

5.1 Rural Land

The Council supports the diversification of agricultural production that has the potential to expand both the economic base and the population of the district. It supports other rural uses that complement and do not have the potential to constrain established farming. Specifically the Council will be mindful of the need for buffer separation for some uses to avoid nuisance such as dust, spray drift, odour, and noise.

Water for agricultural uses is a valuable resource in the shire and intensive agricultural uses must have a sustainable water supply. This water supply is not to be based on dams which rely on catchment from other properties, or which reduce the flow of water to other properties.

More intensive agricultural uses may require a smaller land area than for broad acre farming, although lot size allowance must be made for sustainable water supply (where appropriate), a dwelling, and farm buildings.

In many cases existing farming properties are made up with a number of separate lots for which individual Title is available. Subject to land suitability and sustainable water supply, these lots may be suitable for intensive agricultural production without the need for subdivision.

However, in all probability land suitability assessment and water supply assessment will also point to larger parcels of land in which case applications for subdivision are likely. The Council's recommendations to the Commission on such applications will be based generally on land suitability and water supply, and the land requirements appropriate for the proposed form of intensive agriculture.

When dealing with subdivision applications that involve location of a new boundary parallel to a creek, the Council will seek to have the boundary offset from the creek centre line to enable more effective management of the creek.

Boundary adjustments that do not create additional lots may be approved by the Commission, but this does not extend to creation of new freehold lots. The Council proposes that there be potential for subdivision for farm adjustment, as well as for intensive uses.

When making recommendations to the Commission on applications for subdivision the Council will have regard to the relevant policies of the Commission. In the case of subdivision for intensive agriculture the Council will support subdivision in the Rural Zone where one or more of the proposed lots are for an existing or proposed intensive agriculture use and the application demonstrates that:

(i) any intensive agriculture lot would be a minimum size of 80 hectares unless the Department of Agriculture advises that a lesser lot size is adequate for a long term sustainable intensive agriculture use;
(ii) the land has high land capability for the use and all lots have a sustainable water supply for domestic, fire management, agricultural and environmental needs;
(iii) the use would not result in adverse impacts on the environment (e.g. waterways or native flora and fauna) or cause conflict with existing agricultural uses on adjoining lots;
(iv) the balance lot would be usable in the long term as a viable broad acre agricultural enterprise without the need for clearing of remnant vegetation; and
(v) the intensive agriculture use has been approved by the Council under the Scheme.

Commission policy provides for subdivision for homestead lots, and the Council will generally support subdivision in the Rural zone to create "homestead lots" where the application demonstrates the lots would:

(i) generally be in the range of 5 to 10 hectares;
(ii) be connected to electricity and telecommunications;
(iii) be provided with an adequate water supply for domestic purposes, land management and fire fighting; and

(iv) front a constructed public road.

Infrastructure throughout the rural area, specifically the road system, has been developed to provide a level of service commensurate with the intensity of agricultural use of the land.

More intensive agricultural use may highlight deficiencies with the infrastructure, particularly if there is a significant volume of heavy truck traffic such as would be associated with harvesting tree plantations. When considering applications for planning approval for tree plantations the Council will therefore have regard for factors including the adequacy of the road system.

The Council supports diversification of uses on individual properties including agroforestry, aquaculture, or farm-stay holiday accommodation. It is mindful of the beneficial effects of forestry with respect to salinity problems but must ensure adequate arrangements are made for heavy vehicle access in the event the plantations are harvested.

The Department of Conservation and Land Management together with Australian Forest Growers have produced a *Code of Practice for Timber Plantations in Western Australia.* The Council may impose conditions on an application for a timber plantation requiring compliance with the Code of Practice, and Fire Management Guidelines.

Proponents of development in the rural area may also be required to comply with the requirements of other agencies, including for example the Department of Environment in the event of a proposal that includes removal of remnant vegetation.

A tannery has been established on land off Stricklands Road and Shield Road, northeast of Darkan. The use is subject to "Additional Use" provisions in the Scheme, and Conditions relating to management of waste materials and emissions.

The tannery is an important outlet for processing hides from the district, and provides employment opportunities. However, the Council will remain mindful of the need for emissions from the plant to be managed by the operators to avoid a nuisance being created on neighbouring properties.

There are no mines currently operating in the shire. But the coalmines of the Collie Basin are located just to the west of the shire, and bauxite deposits are known in the western half of the shire.

The Department of Industry and Resources has advised that the better quality bauxite deposits in the shire are covered by Alcoa of Australia's State Agreement Mining Lease 1SA, which covers the area north of Bowelling.

The Worsley Agreement entitles Worsley Alumina to take up mining leases for bauxite and retain the rights to bauxite in situations where other companies hold Mining Act tenements, and covers most of the remaining areas of the shire.

Furthermore, the eastern section of the Shire, more specifically the northwest trending zone defined by the Darkan Fault and adjacent unnamed fault to the northeast, is prospective for gold. However there are no planning implications at this stage and no deposits of gold mineralisation have been reported from this area.

The Department of Industry and Resources has suggested the Council commission a consulting geologist to prepare a comprehensive assessment of the shire's resources of basic raw materials. Alternatively such a survey could form part of a regional survey that should be organised with support from the Department for Planning and Infrastructure and other agencies such as CALM, MRWA, and DIR.

5.2 SPECIAL CONTROL AREAS

Special Control Areas are to apply to issues affecting land uses or development that overlap Local Reserves or Zones. They are intended to apply a consistent planning response to that issue across the Local Reserves or Zones.

The Water Corporation has advised there is potential for contamination in the Wellington Reservoir Catchment as a result of undesirable land use, particularly development that may cause contamination by aerial drift. A Special Control Area is to protect the area from use and/or development which may adversely affect the quality of water supplies.

The Council will seek advice from the Water Corporation when determining applications for planning approval.

5.3 RURAL RESIDENTIAL LAND

The Council wants to promote lifestyle choice and population growth in the district. It supports development of Lot 3, of 56.7 hectares off the Quindanning – Darkan Road, just to the northwest of the town. The Scheme proposes Lot 3 be included in the Rural Residential Zone for subsequent subdivision into rural smallholdings.

A Land Capability and Suitability Assessment and a Subdivision Guide Plan for the subject land are attached in Appendix 1.

5.4 DARKAN TOWNSITE

The strategic plan for Darkan is shown on Figure 2.

(a) Residential

The existing residential lots in the town and the areas identified for residential expansion are more than adequate for possible population increases over the next 5 years.

The predominant form of residential development will be for single houses, but there may be some opportunity for the Council to approve grouped dwellings at a density of up to R20 where the land is suitable for effluent disposal. This form of development is suited to persons on short-term appointment to the town and who do not require a single-family house.

Darkan does not have reticulated sewerage and is not identified as a priority for this service. Residential development may be constrained by effluent disposal capability of sites.

(b) Commercial

The Council envisages consolidation of commercial activities within the general confines of the established town centre.

The town centre encompasses a wide range of commercial uses, civic facilities, and community uses. It is anticipated mixed-use development will continue within this area.

(c) Industrial

There is a small existing industrial area within the Darkan townsite, with very limited potential for expansion. Industries in this area must be capable of containing emissions so as not to cause a nuisance in the built-up residential areas. In this regard applicants will be required to demonstrate that a proposed industry complies with the Guidelines for Environment and Planning prepared by the Department of Environmental Protection Authority, and the recommended buffer distances for the industry.

The town industrial area is not capable of accommodating industries that require either a large land area, or a significant buffer from residential uses. Any such industries that may be located in the shire will by necessity need to be located some distance away from built-up areas, and consideration will be given to such applications on their merit.

Part of Lot 6 east of the town and north of the (disused) railway reserve has been included in the Industrial Zone. This land is close to the town, but sufficiently distant from residential

areas. The site is suitable for those industries that require a larger area than can be provided in the townsite, or which require buffer distance separation from dwellings.

(d) Rural Residential

Existing subdivided lots predominantly in the western sector of the town are included in this classification. The land is already subdivided into smallholdings and has potential for change of use predominantly for rural-residential or hobby farms. Subdivision of the larger lots in this area could occur, with a recommended minimum lot size of 2 hectares. All of the lots to be created by subdivision should be serviced with reticulated water supply for domestic consumption.

The Council anticipates rural-residential lots will offer an attractive lifestyle choice for people seeking to settle in the town.

(e) Community Facilities and Services

The established community facilities and services in the town are sufficient to meet foreseeable needs. In particular, the District High School has capacity for additional students, and the main recreation area provides for a range of recreation activities.

5.5 OTHER TOWNSITES

Gazetted townsites in the district outside Darkan are:

- Duranillin
- Moodiarrup
- Bowelling
- Cordering
- Hillman

Nothing remains of former settlements in the Cordering and Hillman townsites. There is sparse development in Duranillin, Moodiarrup, and Bowelling. Rural supplies stores are located in Duranillin and Moodiarrup and there are a few dwellings in each of the townsites. The Council will support the provision of limited services in the 3 townsites for local convenience needs. However it does not generally favour further development involving subdivision.

Traveller's services are provided at a settlement at East Arthur, off the Albany Highway. Whilst there may be some scope for enhanced services the Council does not generally favour expansion of the residential component of this settlement, or further subdivision unless directly related to provision of traveller's facilities.

6.0 STRATEGIES AND ACTIONS

6.1 ENVIRONMENTAL OPPORTUNITIES AND DIRECTIONS

The shire has a responsibility to maintain and enhance the existing physical and environmental base of the land within the district.

The role of the shire should be one of encouragement rather than one of trying to manage environmental matters through legislation and regulation. Encouragement has been most positive in the past, and fosters good community spirit whilst at the same time maximising the money available. On the other hand legislated and regulated environmental management can harbour resentment and could lead to funds and time being spent on legal arguments.

The key points to the shire's environmental management are:

- ***The identification of the state of the environment.*** This has already been commenced by various authorities and local groups such as the Native Vegetation Handbook for the Shire of West Arthur (Grein 1994, Ag. WA0).
- ***Recognition of opportunities*** as they present themselves, to maintain and enhance the environment.
- ***Encouragement for local groups,*** catchment groups, individual landholders and citizens who want to preserve or enhance the environment.
- ***Provide a forum for education*** and a forum for the exchange of LandCare and other information.
- ***Provide assistance to and work with government authorities*** where possible on environmental management.
- ***Act as a role model*** for LandCare and environmental management.

6.1.1 Catchment Management

The management of catchments is important because an activity on one property may well impact on adjoining properties. For example:

Drainage systems which direct saline water from salt affected areas may assist the recovery of soil on one property, but lead to elevated salinity at the points of discharge.

or

Reductions in deep rooted vegetation through clearing or grazing on a plateau remnant will lead to increased recharge and rising water tables lower down the catchment.

or

Placing dams across drainage lines may decrease surface flows leading to possible reductions in water tables down slope but possible increases in stream salinity through reduced flushing.

A number of catchment groups are already in place and should be encouraged. These can provide a forum for education as well as providing suggestions for catchment management.

Some past and current activities have included the Remnant Vegetation Protection Scheme that has resulted in the protection of some remnant vegetation on private property. Roadsides were surveyed for their vegetation and conservation status with assistance of the Roadside Conservation Committee. The West Arthur Conservation District Committee and the National LandCare Program have been used to assist land management and the West Arthur townscape committee has been active in landscaping urban environs.

6.1.2 Land Management

Some Land Management Actions that can be encouraged are:

(a) Soils

- Soils on steeper slopes require protection through land management such as contour ploughing, interceptor banks, and strategic planting of vegetation.
- Hard setting soils and traffic hard pans on the heavier more clayey soils can increase runoff. Periodic ripping or other management technique may be required.
- Additional trees as vegetation belts, fauna corridors, shelter zones and wind breaks can be incorporated into farm plans to assist with salinity control and reducing the risk of wind erosion on the more sandy soils.
- Alley farming with Tagasaste or *Acacia Saligna* may provide similar land management benefits but will also add to farm productivity if well planned.
- There are opportunities in the privately owned and already cleared valleys for farm diversification into agroforestry, aquaculture in some locations, forestry, floriculture, perennial horticulture, and the like.
- Basic raw materials of clay, sand, gravel products and hard rock are potentially present but may require protection for the future development of the shire. Gravel is available on the plateau remnants but this may conflict with the conservation of remnant vegetation on these sites.
- Direct drill tillage techniques will assist in the maintenance of vegetation cover and soil structure.
- The continued use of fertilisers and the growth of lupins on lighter soils may increase soil acidity and the use of lime may be required.
- Hard setting soils and areas of traffic hard pans may benefit from ripping.
- The use of contour banks and sediment settlement dams may assist in the trapping of sediment and manure, and water management.
- Wind erosion can occur on the lighter more sandy soils towards the east. Strategic planting of vegetation, windbreaks and the incorporation of alley farming techniques, will be beneficial.
- The use of lupins can lead to increased water repellence and soil acidity on lighter soils.
- Farm management and fencing should be based on soil capability and topography rather than a grid pattern to achieve better management.
- Farm practices are to be geared to maintain and improve soil quality.

(b) Water Quality

- Catchment groups can assist with co-ordination farm activities and to prevent adverse impacts lower down the drainage system.
- Further clearing is not recommended. Clearing of the upper catchments, particularly on gravel soils over deep ancient soil profiles, increases the recharge and may create a salinity problem downstream, frequently on an adjoining or nearby property.

- Monitoring of stream water quality is recommended to determine the potential for salinisation within each catchment/sub-catchment.

- Catchments/sub-catchments with the most potential for salinisation could be planted with deep-rooted species that could be agroforestry, plantation belts or alley farming.

- Salt scar areas and waterlogged areas could be fenced and planted with deep-rooted species to lower the water tables.

- Drainage lines and the banks of streams may be planted with local trees and shrubs and where possible fenced to provide sediment stripping, habitat creation and fauna linkages.

- Heavy rainfall, particularly during storms, can cause major impacts by washing soil and animal manure into watercourses and dams. The use of contour banks, settlement dams and streamside vegetation will assist in the trapping of sediment and manure.

- Drainage of water from salt affected areas to stream lines can often shift the problem further downstream; however in certain cases, through good design, drainage can be beneficial.

- Contour banks that allow fresh surface water to flow to the streams without infiltration can be helpful.

- Water harvesting in which the first flush of saline or nutrient enriched water is allowed to run off and later more fresher water retained in dams, can be beneficial in managing salinity of water supplies, but may create salinity and nutrient problems downstream.

- Runoff from heavy rainfall is to be retained where possible because it can wash soil and animal dung into watercourses and dams.

- Developments and intensive farming should be set back from streams and drainage lines to reduce the risk of flooding and nutrient loss.

- Dams should be located out of drainage lines where possible and should maintain the flow of sufficient water to streamlines.

- The size and location of dams should be designed in such a way that impacts on adjoining properties are minimised.

- River pools should be restored and protected.

- Fringing and foreshore vegetation along rivers and streams should over time be replanted with local species, and logs and other water slowing strategies introduced to restrain the flow of sediments.

- Bridle and multi-use paths can be located away from riverbanks, steeper slopes, granite outcrops and remnant vegetation to prevent erosion and the introduction of weeds.

(c) <u>Vegetation – Biodiversity</u>

- Further clearing of remnant vegetation is not recommended.

- Remnant vegetation, particularly on the rocky granite soils and steeper slopes that are subject to erosion, will benefit from being fenced and stock excluded.

- The planting of local trees is recommended to compensate for tree decline and to increase shelter for stock in exposed areas.

- The creation of vegetation belts and corridors including streamlines is encouraged to link areas of remnant vegetation.

- Land abutting reserves should be fenced where possible. Firebreaks can form a hard edge and be located on the cleared land. Chemical spraying of the fence line to prevent weeds entering the reserve is desirable.

- Replanting the plateau remnants may assist soil salinity because this will reduce recharge of groundwater under these features where large quantities of salt are stored in the sub-soils.

- Gravel resources are to be taken from cleared land where possible and not from road verges. All gravel operations should utilise the duricrust/caprock by crushing where possible to maximise the resource and minimise soil disturbance.

6.2 GUIDELINES FOR DEVELOPMENT

6.2.1 Proposed Subdivision

Not all subdivisions will need to be assessed to the same level depending on their nature and size. But for each subdivision all aspects should at least be considered even it is simply to say there is not or an insignificant potential impact, or not applicable.

The guidelines should not be used to require too much information from a proponent.

- What is the nature of the subdivision?
- Is it a logical progression that will not impede future subdivision or development?
- What are the likely future requirements and expansion potential?
- Will it require referral to the EPA?
- Is there any remnant vegetation present on site? List the nature of the vegetation and the potential impact on the vegetation. (In general there should be no clearing of remnant vegetation).
- Are there sensitive or incompatible nearby land uses such as agricultural activities?
- Will the subdivision inhibit the existing or likely future activities of adjoining property owners?
- How close are adjoining dwellings or land uses that may be impacted upon? (This will depend very much on the scale and nature of the proposed subdivision).
- Are there any heritage or potential aboriginal issues?
- Does the proposal increase the need for buffers from existing nearby developments?
- Is access available and is it suitable for the anticipated traffic?
- Will neighbours be significantly affected by traffic?
- Is there a sustainable water supply that does not rely on catchments outside the property or damming a stream that will impact on the water availability of adjoining properties?
- Are proposed dams large enough to require geotechnical input?
- What soil conditions are present; slope, soil type, amount of rock, potential water logging in winter, foundation stability? Have these factors been taken into account in the design of the subdivision?
- Does the development lie within a 1:100 year flood risk area? Or an alluvial flood plain?
- How is it proposed to dispose of storm water?

- In unsewered areas with clay soils is there sufficient permeability at the base level of the leach drain? Does the leach drain need to be inverted or is an alternative waste water system preferred?
- Can effluent disposal systems be set back 100 metres (conventional septic system) or 50 metres (alternative system) from any stream? (These buffer distances may be reduced depending on the size and nature of the stream and the soil types).
- Is the subdivision aesthetically compatible with the area? If not how can it be made acceptable with the use of preferred materials, screening trees, buffers, set backs etc?

6.2.2. Proposed Land Use

This will include larger or significant land uses that may potentially impact on adjoining residents or land. The land uses that will require assessment might be plantations, intensive live stocking, intensive agriculture, large-scale aquaculture, large-scale orchards etc.

Generally only the more significant land uses will need to be assessed and not all to the same level depending on their nature and size. But for each development all aspects should at least be considered even if it is simply to say there is not or an insignificant potential impact, or not applicable.

These guidelines should not be used to require too much information from a proponent.

- What is the nature of the land use?
- Will the proposed land use impede future requirements?
- What are the likely future requirements and expansion potential?
- Will the type of development require referral to the EPA?
- Is there any remnant vegetation present on site? List the nature of the vegetation and the potential impact of the development on vegetation. In general there should be no clearing of remnant vegetation.
- Are there sensitive or incompatible nearby land uses such as dwellings, chalets etc?
- Will the land use inhibit the existing or likely future activities of adjoining landowners?
- How close are adjoining dwellings or land uses that may be impacted upon? (This will depend very much on the scale and nature of the proposed land use such as odour, potential stray draft etc).
- Are there any heritage or potential aboriginal issues?
- Does the development increase the need for buffers for existing nearby land uses or developments?
- Is access available and is it suitable for the anticipated traffic?
- Will neighbours be significantly affected by traffic?
- Is there a sustainable water supply for the use that does not rely on catchments outside the property or damming a stream that will impact on the water availability of adjoining properties?
- Are proposed dams large enough to require geotechnical input?
- Should earthquake risk be considered in the development (depends on the number of persons, how essential the development is to the community, the construction type, foundation conditions, and location within the shire).
- What soil conditions are present; slope, soil type, amount of rock, potential water logging in winter, foundation stability? Have these factors been taken into account during the layout of the land use?
- Does the development lie within a 1:100 year flood risk area? Or an alluvial flood plain?
- Is there any waste water system proposed? If yes, what are proposals for disposal of wastewater? (Effluent disposal ponds will need to be located in impermeable ponds sunk into clay soils if nutrient levels are elevated).
- What is the potential for nutrient export?

- What setbacks are required from streams and remnant bushland? The buffer distances may be reduced depending on the size and nature of the stream and the soil types.
- Is the land use aesthetically compatible with the area? if not how can it be made acceptable with the use of preferred materials, screening trees, buffers, set backs etc?

6.2.3 Dwellings

Not all dwellings will need to be assessed to the same level, but for each development all aspects should at least be considered even if it is simply to say there is no or an insignificant potential impact, or not applicable.

These guidelines should not be used to require too much information from a proponent.

- Is suitable access available?
- Is there a sustainable self-sufficient water supply?
- What soil conditions are present; slope, soil type, amount of rock, potential water logging in winter?
- Is the development within a 1:100 year flood risk area? Or an alluvial flood plain?
- Are the proposed foundations compatible with the site conditions?
- What waste water system is proposed?
- In unsewered areas with clay soils is there sufficient permeability at the base level of the leach drain? Does the leach drain need to be inverted or is an alternative waste water system preferred?
- Can the effluent disposal system be set back 100 metres (conventional septic system) or 50 metres (alternative system) from any stream? (These buffer distances may be reduced depending on the size and nature of the stream and soil types.)
- Is the dwelling to be located in a visually sensitive location that would require restrictions on the location of the dwelling, or the use of prescribed construction materials?
- Is there any remnant vegetation that should be preserved? Is there any revegetation required? If next to a foreshore reserve, what measures are to be taken to prevent the spread of weeds in the sensitive area?

6.2.4 Industrial and Other Developments Including Rural Industries

This will include industrial developments, rural industries, may include developments such as chalets, intensive agriculture, intensive live stocking etc. Not all developments will need to be assessed to be same level depending on the nature and size of the development. But for each development all aspects should at least be considered even if it is simply to say there is no or an insignificant potential impact, or not applicable.

These guidelines should not be used to require too much information from a proponent.

- What is the nature of the development?
- What is the size, hours of operations, volumes anticipated, transport, inputs, water requirements, potential waste products, noise and impacts?
- What are the likely future requirements and expansion potential?
- Will the type of development require referral to the EPA or a licence from the DEP?
- If the development is to operate at night will noise be significant or temperature inversions affect the transmission of noise.
- Is the location acceptable?
- Are there sensitive or incompatible nearby land uses?
- Are there any heritage or potential aboriginal issues?
- Does the development increase the need for buffers for existing nearby developments?

- Is access available and is it suitable for the anticipated traffic?
- Will neighbours be significantly affected by traffic?
- How close are adjoining dwellings or land uses that may be impacted upon? (This will depend very much on the scale and nature of the proposed operation).
- Is there a sustainable water supply that does not rely on catchments outside the property or damming a stream that will impact on the water availability of adjoining properties?
- Are proposed dams to be constructed with geotechnical input for large structures?
- What soil conditions are present: slope, soil type, and amount of rock, potential water logging in winter?
- Does the development lie within a 1:100 year flood risk area? Or an alluvial flood plain.
- Are the proposed foundations compatible with the site conditions?
- Should earthquake risk be considered in the development? (Depends on the number of persons using the facility, how essential the development is to the community, the construction type, foundation conditions and location within the shire).
- How is it proposed to dispose of wastewater? (Effluent disposal will need to be in impermeable ponds sunk into clay soils if nutrient levels are elevated).
- In unsewered areas with clay soils is there sufficient permeability at the base level of the leach drain? Does the leach drain need to be inverted or is an alternative waste water system preferred?
- Can the effluent disposal system to be set back 100 metres (conventional septic system) or 50 metres (alternative system) from any stream? (These buffer distances may be reduced depending on the size and nature of the stream and the soil types.)
- Is the development aesthetically compatible with the area? If not how can it be made acceptable with the use of preferred materials, screening trees, buffers, set backs etc?
- Is there any remnant vegetation that should be preserved? Is there any revegetation required? If next to a foreshore reserve, what measures are to be taken to prevent the spread of weeds in the sensitive area.

6.3 LOCAL PLANNING SCHEME

The Local planning scheme provides the statutory basis for implementation of the Council's objectives and strategies for the district.

The Scheme proposes local reserves and zones throughout the district. It has been prepared generally in accordance with the Model Scheme Text drafted by the Western Australian Planning Commission.

Local Reserves are:	**Recreation and Open Space**
	Public Purposes
	State Forest
	Railway
	Road
Zones are:	**Residential**
	Commercial
	Industrial
	Rural Residential
	Rural
	Special Use

Generally Local Reserves will apply to Crown land. The Scheme gives very considerable flexibility for land uses on a Local Reserve, subject to the approval of the authority/agency holding a Management Order for the land.

The Scheme Text provides the basis for Council to adopt, amend, and revoke a Local Planning Policy. A Local Planning Policy adopted under the provisions of the Scheme does not bind the Council. But

when determining an application for planning approval the Council shall take into account provisions of the Policy and objectives that the Policy was designed to achieve.

The Council is taking action to stimulate population growth in the town by promoting subdivision of rural residential lots close to the town. This commitment is to provide lifestyle choice in an attractive setting close to services and facilities.

There is an on-going program to carry out townscape improvements with one objective being to encourage patronage of established businesses, and to stimulate expansion into other commercial services.

Retirees from within the district are encouraged to settle in Darkan, by the provision of a wide range of community services, including recreation facilities.

The Council supports diversification of agricultural uses, including farm-stay or holiday accommodation on established properties. Some diversification has already occurred involving relatively large parcels for forestry.

The Council is generally supportive of further forestry plantings, subject however to it being satisfied with arrangements for suitable infrastructure – such as bush fire protection and adequacy of the local road system.

Other intensive agricultural uses will be considered on their merits but in each case the Council will seek to be satisfied there is (or will be) a suitable sustainable water supply for the proposed use.

APPENDIX 1

LAND CAPABILITY AND SUITABILITY ASSESSMENT

FOR

RURAL RESIDENTIAL SUBDIVISION

LOT 3

DARKAN-QUINDANNING ROAD

DARKAN

Landform Research
Land Systems - Quarry Management - Environment
ABN 29 841 445 694

LAND CAPABILITY and ENVIRONMENTAL MANAGEMENT

Proposed subdivision, Lot 3 Darkan - Quindanning Road, Darkan

10 December 1999

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CONTENTS

Attachments

1.0 INTRODUCTION

A study of Lot 3 Darkan - Quindanning Road, Darkan, was carried out on 2 December 1999 to assess the soils, environmental status and capability for development into small rural holdings. A series of auger holes were drilled to assess the soils and in addition the geology, vegetation, hydrology and salinity were mapped and interpretations made from aerial photography.

The site lies approximately 3 km north west of the Darkan townsite. The subject and surrounding land is cleared and used for broad acre farming, with a small horse agistment/stables being developed to the north.

2.0 EXISTING ENVIRONMENT

2.1 Geology and Geomorphology

Lot 3 straddles a small creek line, with a number of tributaries entering from the east and west.

The site lies on dissected basement granite with some dolerite dykes. To the east of the creek the land rises to a ridge outside the eastern edge of Lot 3. The upper part of this slope has basement outcropping through the soils with alluvial terrace remnants on the lower slopes.

The western side consists of a flat to gently sloping terrace remnant that has been dissected in Recent times by the creek and associated tributaries with the subsequent deposition of Recent alluvium. Minor gravel formation has occurred on the older terrace.

A dolerite dyke runs east west through the central north of Lot 3.

2.2 Soils

The soils on the site are related to their position with respect to the alluvial terraces.

Soils are generally sandy loams over clay subsoils developed on the granite basement. The sand and loam appears to be of alluvial origin and commonly up to 500 mm thick. In the central west the sandy loam has been removed by erosion to leave loam soils. On the higher eastern slopes loams are developed on weathered basement.

Minor gravel is associated with the older alluvial terrace in the west.

Some of the recent alluvium is saline and salinity is expected to spread unless catchment management actions are taken.

Soil auger holes were normally stopped when basal clays were encountered because this will prove restrictive to effluent disposal. The most detailed summary of the basal clays is shown below for the Loam over Clay soil type, which provides detail on the type of basement soil horizons that can be expected as the lower horizons in all soil types.

	SOIL TYPE	DESCRIPTION
SG	Sandy Gravel Loam/clay	Dark brown sandy gravel grading to yellow brown sandy gravel over yellow brown loam and clay at 300 - 500 mm. Located on the western ridge. Possibly old alluvial terrace.
SL	Sandy Loam over Clay	Dark brown sandy loam grading to red brown or brown loam over yellow clays at 300 - 500 mm. On eastern ridge and may be related to older alluvial terraces.
L	Loam over Clay	Dark brown loam grading to yellow brown loam and mottled clays at 300 mm. Soils developed on the basement clays.
AL	Alluvial Loam	Dark yellow brown sandy loam with interbedded sand loams over basement clays at 1000 mm. Recent alluvium over basement clays. Seepages and damp soils common. Susceptible to future salinity.
SL	Saline Alluvial Loam	Alluvial loam but with saline soils.
	Granite Outcrop	Granite boulders with shallow loams between. Minor dolerite.
	Dolerite	Dolerite dyke with scattered dolerite cropping through shallow soils.

Typical soil profiles of the area are;

Sandy Loam over Clay	**North east**
0 - 180 mm	Dark brown sandy loam
180 -690 mm	Red brown loam
> 690 mm	White to red brown feldspathic sandy clay
Sandy Loam over Clay	**Central east**
0 - 330 mm	Dark brown sandy loam
330 - 540 mm	Yellow loam with coarse angular quartz sand
> 540 mm	Yellow sandy clay loam to sandy clay
Loam over Clay	**Central north west**
0 - 75 mm	Dark brown loam
75 - 320 mm	Dark yellow brown loam
320 - 780 mm	Reddish yellow loam clay with minor red mottles
780 - 1150 mm	Lighter yellow sandy clay with more distinct red and yellow mottles
1150 - 1480 mm	Yellow sandy clay with light yellow and yellow brown mottles
1480 - 1710 mm	Dusky red to red mottled sandy clay with more grit
1710 - 1850 mm	Yellow with cream sandy clay, gritty, near basement granite.
1850 End of hole	

Sandy Gravel over Loam/clay	**Central west**
0 - 130 mm	Dark brown sandy gravel
130 - 450 mm	Yellow brown gravely sand
450 - 590 mm	Yellow brown gravely loam
590 - 730 mm	Yellow brown loamy clay
730 End of hole	

2.3 Climate

Climatic data is recorded at Darkan averaging 564 mm per year. Summer maximum temperatures average about 31 ^{o}C in the hottest months of January/February down to about 15 ^{o}C in winter. Minimum temperatures range down to 4 ^{o} C in the coldest months.

Wind directions are predominantly from the east to south east on summer mornings. An afternoon sea breeze occurs on most summer days. Winds are more variable in winter.

2.4 Hydrology

Drainage is from the low eastern and western ridges. Apart from the central creek line a number of tributaries enter from the east and west. Flows in some of these are likely to be flood flows or following storm events.

At the time of the site visit in early December 1999 the water in the creeks was flowing but was saline, > 2 200 mSm, (potable water < 180 mSm).

There is one dam on site which appears to be catchment fed. Water quality was 320 mSm.

As the soils are close to basement there is not expected to be large quantities of ground water and any supplies are likely to have elevated salinity.

There is evidence that the lower eastern slopes have slight water seepages, for example where *Eucalyptus rudis* occurs.

2.5 Vegetation

The site is cleared apart from scattered trees of Wandoo *Eucalyptus wandoo*, Marri *E. calophylla*, Jarrah *E. marginata* and Jam Wattle *Acacia acuminata*. The drainage lines and lower slopes are occupied by scattered Flooded Gum *E. rudis* with occasional *Acacia saligna*.

2.6 Fauna

The amount of fauna is directly related to the proportion of remnant indigenous vegetation. As the site is cleared apart from scattered trees the indigenous fauna can be expected to be severely reduced.

3.0 LAND CAPABILITY

The opportunities of the site are;

- The predominantly gently sloping nature of the surfaces.
- The views and landscapes that can be obtained from many parts of the site.
- Proximity to Darkan townsite.
- Proximity to the Darkan-Quindanning Road.
- The remnant trees remaining on site.
- Soils with high iron/clay content that have very high phosphate retention.
- The high nutrient holding capability of the soils.
- There is no evidence of dieback disease although Flooded Gums are experiencing heavy insect predation.

The constraints of the site are;

- The small areas of granite outcrop in the east.
- The central alluvial soils that are subject to flooding and future salinity.
- The presence of saline alluvial soils.
- The central creek which will require a crossing capable of being accessed during flood.

3.1 Soil Capability - Stocking Rate

In general the ridge soils are well suited to small rural holdings although the basal clays may dictate that leach drains be semi-inverted. The same attributes of nutrient retention and drainage which makes the soils suitable for broad acre farming also allow them to be used for smaller rural holdings and effluent disposal.

Whilst the land is productive, it is dissected by the creek and saline/ potentially saline alluvial soils. East of the creek the proportion of granite outcrop and contours restrict the land to little more than grazing capability.

Stocking rate is regarded as Low, 2 - 5 DSE.

3.2 Water Availability

Potable water will be rainwater tanks. Bore water is unlikely to be available and may have elevated salinity. Catchment dam sites are restricted.

3.3 On Site Effluent Disposal - Nutrient Management

Phosphate Retention Indices (PRI) of sandy loam soils such as can be high with rates in excess of 20 being normal. Even at PRI of 10 each m^3 of soil is capable of absorbing 20 kg phosphorous without allowing for recycling. The amount of rock in the soil and the depth to clay based sub-soil will reduce the real phosphate retention in some soils so semi-inverted leach drains are recommended.

It is generally recognised that when septic tanks are used in soils of this type nutrients are removed within a few metres. See 6.5 Nutrient Management-Effluent Disposal

Gerritse 1993 found that the loam over clay soils in the hills catchment of the Swan River allowed only small amounts of phosphorous to leach. See maps for the nominated areas.

EFFLUENT DISPOSAL	MANAGEMENT
Site Capability for Effluent Disposal	• Sites suitable for conventional septic systems are available across much of the site. • See Geotechnical Issues Plan for suitable locations. • Calculations and details are covered in 6.5 Nutrient Management-Effluent Disposal.

4.0 GEOTECHNICAL CONSIDERATIONS

4.1 Foundation Stability

The whole site is underlain by relatively shallow clay soils over basement rock which provides for good slope stability.

The main issue is the exclusion of dwellings from the alluvial soils which are either saline or have high potential of becoming saline. They are subject to flooding and wet conditions which may lead to damage to footings through capillary action.

The foundation stability for developments on the more gentle slopes, where gravely and sandy loams are present, is, AS 2870 Site Class A. However sites on sloping ground with natural fill >400 mm or sand fill >800 mm will attract an AS 2870 Site Class P which will require engineering input into the design of the footings.

The use of clay fill is undesirable because it can create reduced stability through compaction difficulties and potential shrink and swell.

	GEOTECHNICAL ISSUE	**MANAGEMENT**
4.1.1	Slope stability	• Slopes less than 10% have AS 2870 Site Class A. • Developments on >10% slope using or requiring more than 400 mm natural soil fill or >800 mm sand are AS 2870 Site Class P. • The geotechnical issues map summaries the potential constraints. • Developments that require cut and fill should reduce water loading upslope of the cut. A cut off drain may be required. • Clay based fill should not be loaded with water from above as this will decrease stability. • Compaction of any clay fills is likely to be difficult when dry or may potentially expand when wetted. Clay is therefore not recommended for fill.

4.2 Drainage and Flood Risk

All sloping areas are well drained with respect to surface water. There should be no dwellings or effluent disposal on the alluvial soils.

Flood data is not known, but on geomorphological field evidence, it is assumed that the alluvial soils represent the flood plain flood and could potentially flood during storms. This can particularly apply when the soils of the catchment are hard setting as in summer, or saturated as in winter. The area of catchment for the creek is approximately 750 hectares.

See map summarising geotechnical issues.

	GEOTECHNICAL ISSUE	**MANAGEMENT**
4.2.1	Flood risk	• There should be no developments on the alluvial soils/floodplain due to potential flood risk.

4.3 Stability of Dams

There is only low potential for dams apart from the drainage lines in the east. Small catchment dams such as currently on site are stable and require no additional input.

	GEOTECHNICAL ISSUE	**MANAGEMENT**
4.3.1.	Stability of dams	• No geotechnical input required. • Dams on drainage lines are subject to normal practice and Rights in Water and Irrigation Act.

4.4 Basic Raw Materials

There are no basic raw materials of significance on the site .

4.5 Mature Trees

Large mature trees have heritage value and should be protected. However building envelopes should be located at sufficient distance to ensure dwellings are not subjected to risk associated with falling limbs or trees blown over.

	ENVIRONMENTAL ISSUE	**MANAGEMENT**
4.5.1.	Mature trees	• Dwellings should be located at sufficient distance to ensure they are not subjected to risk from falling limbs.

5.0 ENVIRONMENTAL MANAGEMENT

The following items are identified as the most likely to impact on the environment. These items can be managed by the implementation of the management recommendations. Other items are unlikely to impact or the impact is regarded as small.

5.1 Aesthetics

The majority of the site is set back from Darkan-Quindanning Road, behind a vegetated road side. The undulating nature of the site will increase the aesthetic quality of the site as well as help to reduce the impact by providing sufficient screening for lots on the eastern side of the creek.

The colour and style of dwellings and other structures should be visually compatible with the area and to this end developments should be coloured, painted or colour bond sheeting used where applicable. The use of grey galvanised or zinc/alum sheeting should be avoided unless as an integral part of a development such as a roof on a "country style" home or shielded from key sight lines.

Existing trees should be protected and a small but ongoing tree replacement program should be commenced.

	ENVIRONMENTAL ISSUE	**MANAGEMENT**
5.1.1.	Remnant vegetation	• Development should include preservation of existing trees. Some Flooded Gum *Eucalyptus rudis* have been subjected to heavy insect perdition and may require management or even removal if they eventually die. • Trees should be preserved and protected from grazing pressure. • Development should be restricted by 50 metre setbacks from the Darkan - Quindanning Road.
5.1.2	Developments	• Restrictions should be placed on the use of visually non compatible construction materials.

5.2 Preservation of Agricultural Land - Subdivision Layout

Whilst the land is productive it is dissected by the creek and saline/potentially saline alluvial soils. East of the creek the proportion of granite outcrop and contours restrict the land to little more than grazing capability.

The subdivision of Lot 3 will have little impact on agricultural land in the Darkan area.

	ENVIRONMENTAL ISSUE	**MANAGEMENT**
5.2.1.	Protection of agricultural land	• The site is small, split by a creek line with potentially saline soils and rock outcrops occurring in the east, restricting the capability of the soil for broad acre agriculture.
5.2.2	Soil Preservation	• Restrictions may be placed on stocking rates to ensure soil preservation.

5.3 Rivers and Streams

The creek will be protected by the management actions suggested below.

	ENVIRONMENTAL ISSUE	MANAGEMENT
5.3.1	Stream side vegetation	• There should be clearing bans on all stream side trees. • The number of boundaries running across the stream lines should be minimised.
5.3.2	Water Quality	• Restrictions on clearing and any further plantings will reduce the potential for salinity to increase. • There should be no development on the alluvial soils. • Catchment management is recommended to address salinity. • Salinity is addressed under 5.7 Salinity.
5.3.3	Water tables	• Water tables are elevated in the alluvial soils and are leading to a spread of salinity. They are addressed under 5.7 Salinity.

5.4 Flora and Fauna

The retention of remnant trees is important for conservation and aesthetics.

The understorey has been removed and replaced by pasture.

	ENVIRONMENTAL ISSUE	MANAGEMENT
5.4.1	Remnant vegetation	• Trees should be protected from grazing pressure. • The number of lot boundaries cutting the creek should be minimised.

5.5 Heritage

Heritage issues concern the management of flora and fauna, mature trees and potential aboriginal sites.

	ENVIRONMENTAL ISSUE	MANAGEMENT
5.5.1	Archaeological sites	• Department of Aboriginal Affairs has been contacted with respect to known sites.
5.5.2	Potential aboriginal sites	• Aboriginal sites are protected under the Aboriginal Protection Act.

5.6 Nutrient Management - Effluent Disposal

Nutrient input comes potentially from the washing of fertiliser and manure into dams and water courses and the location of effluent disposal systems. In soils such as this the impact of nutrients from effluent disposal systems is low when compared to stock. The main issue with effluent disposal is the design and placement of the system to ensure adequate microbial purification.

Phosphorous is the main nutrient implicated in algal blooms in waterways. Where waste water stays in the soils nitrates are normally removed by soil micro flora under anoxic conditions and are taken up by vegetation, denitrified by bacteria under anoxic soil conditions or lost through volatilisation of ammonia.

When there is insufficient depth to the water table or clay soils are present, microbial material has a low potential to be inactivated by soil micro-organisms, and waste water may pose a health risk. Deficiencies can be overcome by the use of semi-inverted leach drains.

Effluent Disposal

The soils of the site are generally gravely sands and sandy loams over clays. With semi-inverted leach drains and large lot sizes of 2 or more hectares, and no effluent disposal in the alluvial soils, satisfactory waste water disposal can be obtained.

Perhaps the most researched field data is shown in the following publications. Gerritse R G and J A Adeney, *Nutrient export from various land uses on the Darling Plateau in Western Australia CSIRO Report 92/41,* found that in a residential subcatchment with 2 000 m^2 lots only 5% of nitrogen is exported to stream flow and that phosphate concentrations are "low and barely affected by land use ..... and only marginally higher in streams in sub catchments dominated by orchards". Gerritse et al, found that the impact of septic systems in similar soils to be low and that nutrients were retained within a few metres, (Gerritse et al, 1995, *Retention of Nitrate and Phosphate in Soils of the Darling Plateau in Western Australia: Implications for Domestic Septic Tank Systems*, Aust. J. Soil Res. 33, 353-67.)

Nutrient Loadings and Stocking Rates

Department of Agriculture stocking rates for these soils are 2 - 4 DSE for dry pasture and where limited supplemental feed is supplied. With additional feed, for example when keeping a horse, then higher nutrient inputs occur. (DSE is Dry Sheep Equivalents; 1 horse is 10 DSE, 1 cow is 10 DSE for nutrient input).

Estimations of the actual nutrient input into the ground water can only be made based on denitrification, volatilisation of ammonia, recycling, uptake by vegetation and phosphate absorption by sesqui-oxides. Rather the best measures of nutrient impact are the current nutrient levels of input and reductions in nutrient input which can occur as a result of development.

The greatest input of phosphorous comes from the keeping of stock, i.e. a horse, and depends on the fertiliser application regime and the amount of introduced feed.

A typical conventional septic system releases 5.5 kg P year and 18 kg N/year. However allowing for six chickens, a dog and cat and a 250 m^2 area of fertilised horticulture, a further loading of 12.3 kg N/year and 5.2 kg P/year can be added for the dwelling area. (Data from Select Committee on Metropolitan Development and Groundwater Supplies, Legislative Assembly 1994 and Nitrate management in the Jandakot UWPCA, Dames and Moore, undated). One horse is estimated at 60 kg/N/year and 11 Kg/P/year.

The current input of nutrients will be predominantly from fertiliser applications, legume pasture species and introduced feed.

Typical nutrient loadings that can be expected from the various soil types

Soil type	Possible lot size and activity	Nitrogen loading per hectare	Phosphorous loading per hectare	Likely nutrient scenario
	Estimated average potential stocking rate 4 DSE per hectare	40.0 kg/N/ha/year	6.0 kg/P/ha/year	Low nutrient export, but can be significant when manure is washed to streams in storms and the first flush of winter.
	Cereal cropping 100 kg super/ha 50 kg ammonium nitrate	54.0 kg/N/ha/year	9.0 kg/P/ha/year	Low nutrient export, but can be significantly greater when fertiliser is washed to streams in the first flush of winter.
	2.0 hectare, no stock, conventional septic system	15.2 kg/N/ha/year	5.5 kg/P/ha/year	Unlikely to be any nutrient loss.
	2 hectares with an average of one horse per lot and conventional septic system.	45.2 kg/N/ha/year	10.9 kg/ha/year	Unlikely to be any nutrient loss.

	ENVIRONMENTAL ISSUE	MANAGEMENT
5.6.1	Effluent disposal	• Soil types with the exception of alluvial loams are suitable for semi-inverted conventional septic systems. • The size and design of the leach drains can be determined by permeability tests conducted at a depth of 300 mm. • Septic systems should preferably be set back set back 100 metres from the creek • There should be no more than one effluent disposal unit per lot.
5.6.2	Land use and stocking	• Intensive agricultural pursuits, such as piggeries and feed lotting should not be permitted.
5.6.4	Rubbish or waste products	• Development conditions can address the removal of waste to Shire waste disposal area.

5.7 Salinity

Part of the alluvial soils is saline and this can be expected to spread over time, although actions within the catchment may assist with slowing or reversing this trend. Salinity is a catchment problem and little can be done on this site in isolation, apart from planting deep rooted salt tolerant species on the salt affected soils to lower the water tables through evapotranspiration.

A catchment management plan should be implemented to assist the management of saline soils on the site.

	ENVIRONMENTAL ISSUE	MANAGEMENT
5.7.1	Salinity	• A catchment management scheme is supported. • Planting additional trees will assist in reducing the elevation of winter water tables and may assist with preventing the spread of saline soils. • There will be no additional water loading on the site unless scheme water is introduced at some stage in the future.

5.8 Stormwater and Erosion Potential

Water erosion is most common on the bare salt affected alluvial soils and, as salinity spreads with the consequent loss of surface vegetation, the potential for erosion could increase. Planting tree and shrub species adapted to saline soils will assist in erosion control, combined with catchment management.

Wind erosion is of minor importance on this site and relates more to dusty conditions and the isolated sand area.

Stormwater from dwellings will be used as a potable supply.

	ENVIRONMENTAL ISSUE	**MANAGEMENT**
5.8.1	Water erosion	• Stormwater from roofs will be used as a potable water source or should be retained on each lot. • Lot boundaries should where possible run along contour. • Firebreaks should be constructed such that they do not lead to erosion. • Agricultural practices should reflect the sloping nature of the land by contour ploughing and maintaining adequate vegetation through summer. • Planting additional trees will assist in reducing the elevation of winter water tables and may assist with preventing the spread of saline soils.
5.8.2	Wind erosion	• Not applicable on this site apart from dust generation from stock.

5.9 Fire Control

Fire Control falls under the Bush Fires Control Act (as amended) and the Shire of West Arthur.

The main issues with fire management are the reduction in fuel by grazing, the maintenance of firebreaks, the availability of machinery and water to fight fires and the provision of emergency escapes.

	ENVIRONMENTAL ISSUE	**MANAGEMENT**
5.9.1	Fire Risk	• Increased access and water points will assist fire reduction risk. • Location of building envelopes to allow exits in case of fire. • The use of strategic fire breaks.

5.10 Social Impact

Social impact of the proposed sub division will be minimal but will be positive by bringing additional people to Darkan and fulfilling a need for small rural lots.

	ENVIRONMENTAL ISSUE	**MANAGEMENT**
5.10.1	None noted	

6.0 CONCLUSIONS

The proposed subdivision on the edge of Darkan townsite has the potential to form a link between the town and rural areas in terms of location and lot sizes.

The creek running through the centre of the site together with the alluvial soils, some of which are saline, place some limitations on lot sizes and locations.

However the environmental and land capability issues on the site are not great and can be overcome through the subdivision guide plan. Effluent disposal can utilise conventional septic systems with the leach drains semi-inverted. The size of the system will depend on permeability test results conducted at a depth of 300 mm.

Considering the land in terms of aesthetics, remnant vegetation and land capability, this site is capable of sustaining the small rural holdings proposed with minimal initial or ongoing environmental impact. Minimum lot sizes could be as small as 1.0 or 2.0 hectares with no maximum, provided no dwelling or effluent disposal system is located within the Alluvial or Saline Alluvial Loams.

The management actions listed under Environmental Management are to provide guidance for subdivision design, and to the development of conditions to be imposed on developments.

Lindsay Stephens

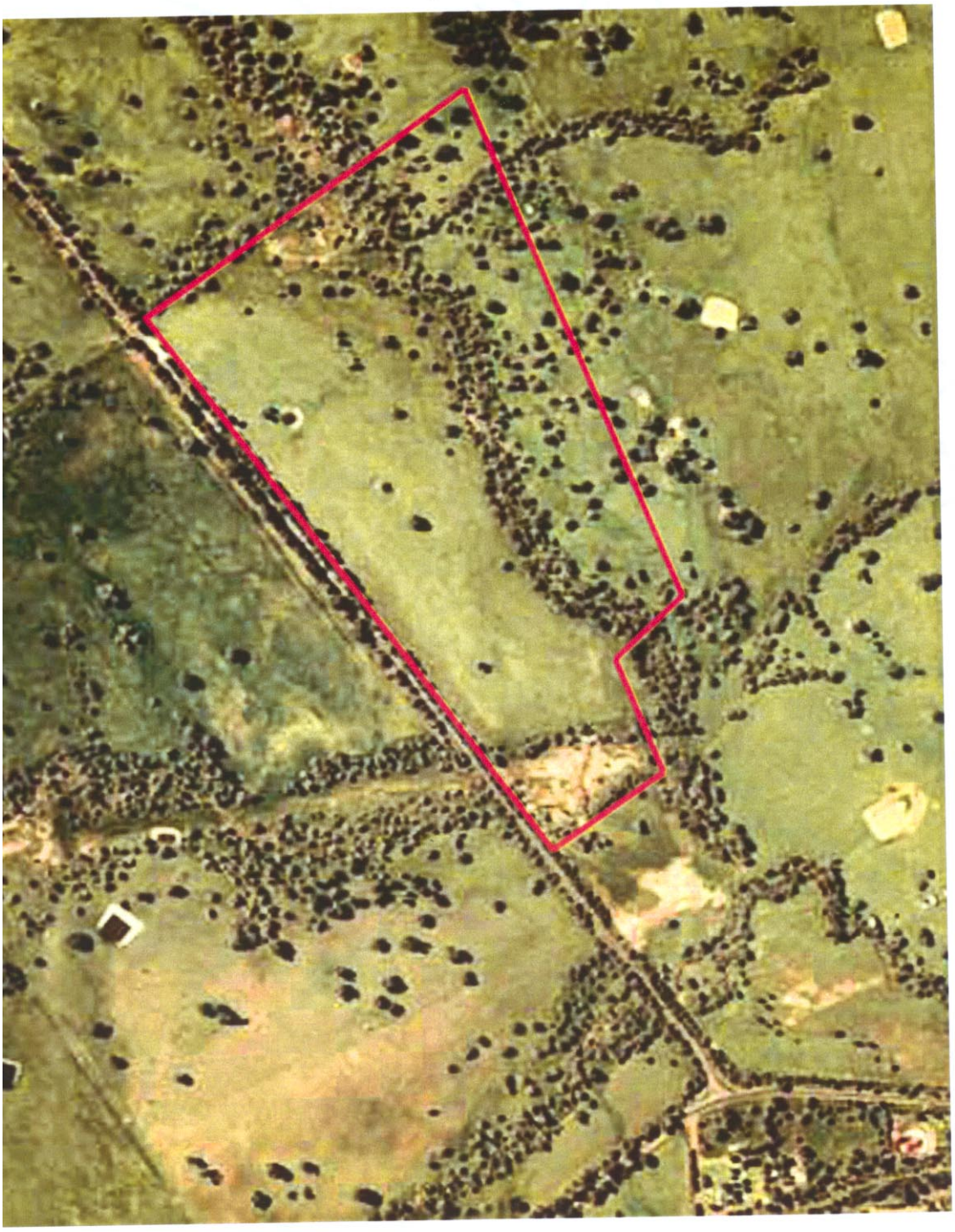
LOCAL VEGETATION SUITABLE FOR PLANTING ON THE SITE

Local and near local indigenous trees which are suitable for revegetation are listed below.

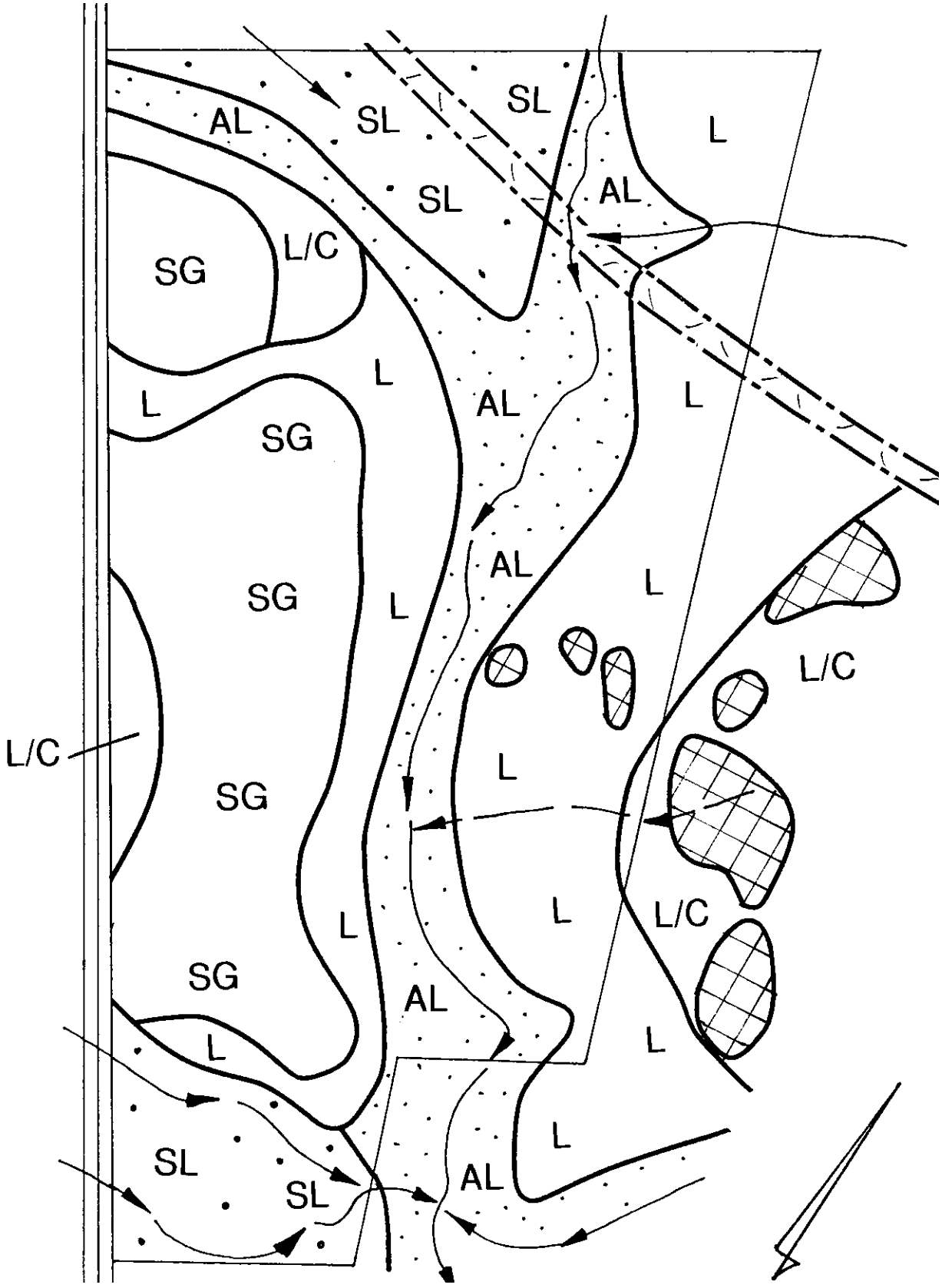
Tree			T	Shrub	S
Acacia acuminata	ST			Jam Wattle	
Acacia saligna	ST				
Allocasuarina fraseriana	ST			Sheoak	
Allocasuarina huegeliana		ST		Rock Sheoak	
Eucalyptus accedens	T			Paperbark Wandoo	
Eucalyptus astringens	T			Brown Mallet	
Eucalyptus camaldulensis	T			River Gum	
Eucalyptus calophylla	T			Marri	
Eucalyptus loxophleba	T			York Gum	
Eucalyptus marginata	T			Jarrah	
Eucalyptus occidentalis	T			Swamp Yate	
Eucalyptus rudis	T		damp sites	Flooded Gum	
Eucalyptus salmonophloia	T			Salmon Gum	
Eucalyptus sargentii	T			Salt River Gum	
Eucalyptus wandoo	T			Wandoo	

View north east across the sandy gravel/loam clay towards the central creek and the eastern ridge

Alluvial loam with creek and bare saline soils in the south



Lot 3, Darkan - Quindanning Road, Darkan Scale 1 : 10 000



SOIL MAP

Scale 1 : 5 000
See following page for key

SOIL MAP

	SOIL TYPE	DESCRIPTION
SG	Sandy Gravel Loam/clay	Dark brown sandy gravel grading to yellow brown sandy gravel over yellow brown loam and clay at 300 - 500 mm. Located on the western ridge. Possibly old alluvial terrace.
L	Sandy Loam over Clay	dark brown sandy loam grading to red brown or brown loam over yellow clays at 300 - 500 mm. Eastern ridge and may be related to older alluvial terraces.
L/C	Loam over Clay	Dark brown loam grading to yellow brown loam and mottled clays at 300 mm. Soils developed on the basement clays.
AL	Alluvial Loam	Dark yellow brown sandy loam with interbedded sand loams over basement clays at 1000 mm. Recent alluvium over basement clays. Seepages and damp soils common. Susceptible to future salinity.
SL	Saline Alluvial Loam	Alluvial loam but with saline soils.
	Granite Outcrop	Granite boulders with shallow loams between. Minor dolerite.
	Dolerite	Dolerite dyke with scattered dolerite cropping through shallow soils.

November 1999 Scale 1 : 5 000 at A4 (approx)

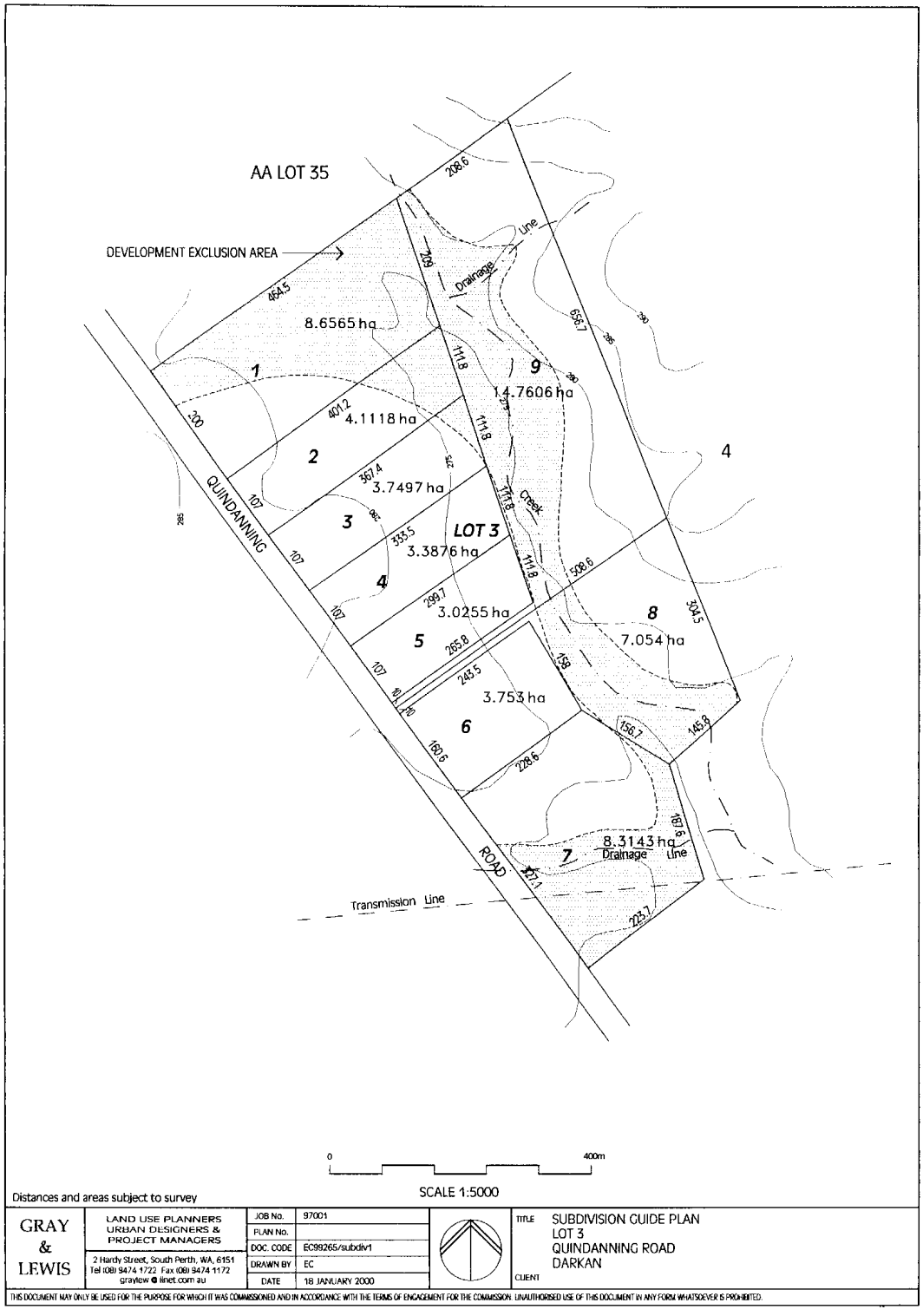
POTENTIAL LAND CAPABILITY

	LAND CLASS	ANNUAL HORTICULTURE CAPABILITY	PERENNIAL HORTICULTURE CAPABILITY	CROPPING CAPABILITY	GRAZING CAPABILITY
SG	Sandy Gravel Loam/clay	Very low Lack of water	Fair for dryland Lack of water	Fair	Fair - high
L	Sandy Loam over Clay	Very low Lack of water	Fair for dryland Lack of water	Fair - low due to small size and rock outcrop	Fair
L/C	Loam over Clay	Very low Lack of water	High for dryland Lack of water	Fair - low due to small size and rock outcrop	High
AL	Alluvial Loam	Low Lack of water	High for dryland Lack of water	Fair	High
SL	Saline Alluvial Loam	-----	Very low	Very Low	Low
	Granite Outcrop	----	----	-----	----

NOTE The land classes shown are based on the agricultural potential of the majority of the area, however in certain locations there will be minor areas with land classes above or below the major class.

GEOTECHNICAL ISSUES - CAPABILITY FOR DWELLINGS ON SMALL RURAL HOLDINGS

		FOUNDATION STABILITY	EFFLUENT DISPOSAL	COMMENTS
SG	Sandy Gravel Loam/clay	High AS 2870 Class A	Semi inverted conventional septic system	
L	Sandy Loam over Clay	High AS 2870 Class A	Semi inverted conventional septic system	
L/C	Loam over Clay	Moderate AS 2870 Class S -M	Semi inverted conventional septic system	
AL	Alluvial Loam	Moderate - low AS 2870 Class P	***Not recommended***	***Development not recommended.*** Land subject to water logging, capillary action, flooding and future increases in salinity.
SL	Saline Alluvial Loam	Low AS 2870 Class P	***Not recommended***	***Development not recommended.*** Land is saline and subject to water logging, capillary action and flooding.
	Granite Outcrop	High but requires engineering input AS 2870 Class A or	***Not recommended***	***Development not recommended.*** Not suitable for effluent disposal. Engineering input required because of differential foundation characteristics.


AA LOT 35
DEVELOPMENT EXCLUSION AREA
8.6565 ha
1
4.1118 ha
2
3.7497 ha
3
LOT 3
3.3876 ha
4
3.0255 ha
5
3.753 ha
6
8.3143 ha
7
14.7606 ha
9
7.054 ha
8
4
QUINDANNING ROAD
Transmission Line
Drainage
Creek
0
400m
SCALE 1:5000
Distances and areas subject to survey
GRAY & LEWIS
LAND USE PLANNERS
URBAN DESIGNERS &
PROJECT MANAGERS
2 Hardy Street, South Perth, WA, 6151
Tel (08) 9474 1722 Fax (08) 9474 1172
graylew @ iinet.com.au
JOB No. 97001
PLAN No.
DOC. CODE EC99265/subdiv1
DRAWN BY EC
DATE 18 JANUARY 2000
TITLE SUBDIVISION GUIDE PLAN
LOT 3
QUINDANNING ROAD
DARKAN
CLIENT
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The Shire of West Arthur Local Planning Strategy certified for advertising on 25 June 2002.

Signed for and on behalf of the Western Australian Planning Commission

_____
an officer of the Commission duly authorised by the Commission pursuant to section 24 of the Planning and Development Act 2005 for that purpose in the presence of:

_____
Witness

_____
Date 23 Nov 2006

ENDORSEMENT

Endorsement by the Western Australian Planning Commission on 21 December 2004.

_____
an officer of the Commission duly authorised by the Commission pursuant to section 24 of the Planning and Development Act 2005 for that purpose in the presence of:

_____
Witness

_____
Date 23 Nov 2006