SHIRE OF DENMARK

TOWN PLANNING SCHEME NO. 3

AMENDMENT NO. 106

AYTON BAESJOU
PLANNING

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June 2010

Attachment 8.1.2

MINISTER FOR PLANNING

PROPOSAL TO AMEND A PLANNING SCHEME

LOCAL AUTHORITY:	**SHIRE OF DENMARK**
DESCRIPTION OF LOCAL PLANNING SCHEME:	**TOWN PLANNING SCHEME No. 3**
TYPE OF SCHEME:	**DISTRICT SCHEME**
SERIAL No. OF AMENDMENT:	**AMENDMENT No. 106**

PROPOSAL:

1.) *Rezoning Lot 348 Kearsley Road, Denmark from the 'Rural' zone to 'Special Residential' zone, 'Residential' (R10) zone and 'Public Purpose' reserve.*

2.) *Rezoning Lots 349 Kearsley Road from the 'Rural' zone to 'Special Residential' zone and 'Residential' (R10) zone.*

3.) *Rezoning Lots 350 Kearsley Road from the 'Rural' zone to 'Residential' (R5/10) zone.*

4.) *Amending Appendix XIV of the Scheme Text to provide management provisions for the Special Residential zone on Lots 348 and 349.*

5.) *Amending the Scheme Maps accordingly.*

TOWN PLANNING SCHEME No. 3

AMENDMENT No. 106

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PLANNING AND DEVELOPMENT ACT 2005

RESOLUTION DECIDING TO AMEND A LOCAL PLANNING SCHEME

SHIRE OF DENMARK

TOWN PLANNING SCHEME No. 3
AMENDMENT No. 106

RESOLVED that the Council, in pursuance of Section 75 of the Planning & Development Act 2005, amend the above Planning Scheme by:

1.) *Rezoning Lot 348 Kearsley Road, Denmark from the 'Rural' zone to 'Special Residential' zone, 'Residential' (R10) zone and 'Public Purpose' reserve.*

2.) *Rezoning Lots 349 Kearsley Road from the 'Rural' zone to 'Special Residential' zone and 'Residential' (R10) zone.*

3.) *Rezoning Lots 350 Kearsley Road from the 'Rural' zone to 'Residential' (R5/10) zone.*

4.) *Amending Appendix XIV of the Scheme Text to provide management provisions for the Special Residential zone on Lots 348 and 349.*

5.) *Amending the Scheme Maps accordingly.*

Dated this _____day of _____ _____

_____
CHIEF EXECUTIVE OFFICER

SHIRE OF DENMARK

TOWN PLANNING SCHEME NO. 3

AMENDMENT NO. 106

PLANNING REPORT

LOTS 348, 349 & 350 KEARSLEY ROAD

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APPENDIX 1 Kearsley Road Local Structure Plan

1. INTRODUCTION

The purpose of this Amendment is to rezone Lots 348, 349 & 350 to provide for the Shire of Denmark's future water supply, protect a large area of remnant vegetation and provide for 'Special Residential' and 'Residential' lots. The proposal is generally in accordance with the Denmark Local Planning Strategy (2006) and the Kearsley Road Local Structure Plan (June 2009).

2. BACKGROUND

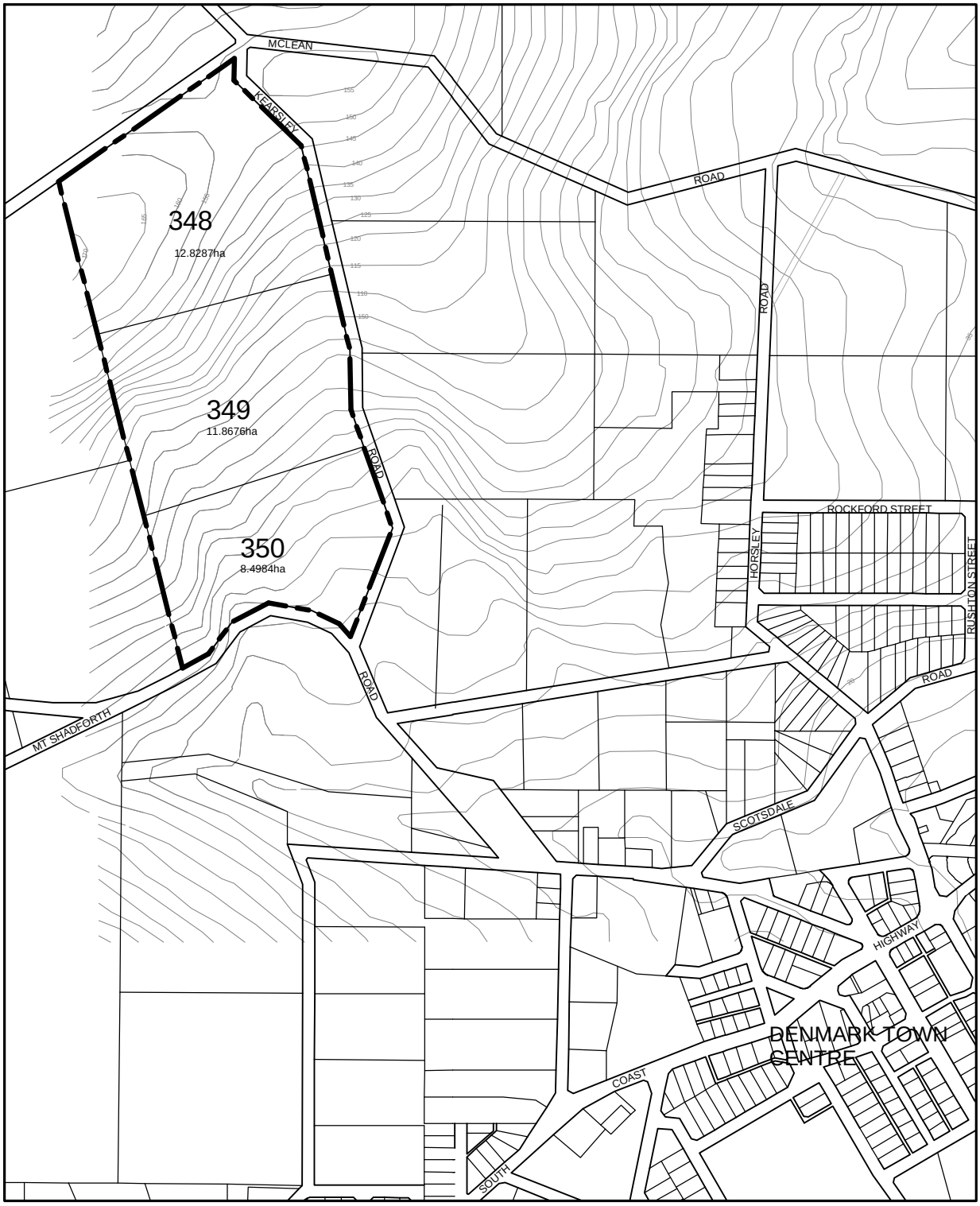
For the purposes of this document, reference will be made to the Denmark Local Planning Strategy (2006) which will supersede the Settlement Strategy. The Strategy is currently under review, but it is understood no changes will be made to Planning Unit C which incorporates the subject land. The Strategy identifies several areas as being suitable for future population growth and residential development. North Denmark was one of the areas selected as being capable of providing an opportunity to meet anticipated growth of the urban area. Planning Unit C, which contains the subject land, is the largest and most westerly cell within the North Denmark locality.

In accordance with the planning recommendations for Planning Unit C, the Kearsley Road Local Structure Plan has been prepared for this area and has been adopted for final approval by Council. The Local Structure Plan outlines how the land will be integrated with adjoining property and how roads and services will be linked and coordinated between the three respective lots within the Planning Unit.

2.1 Location, Area & Zoning

The land is located approximately 1.2 kilometres north of the Denmark town centre (refer Location Plan) and is comprised of three landholdings. Lots 348, 349 and 350 are bounded by McLean Road, Kearsley Road, Mt Shadforth Road and Reserve A35621 to the west. The subject lots have a total area of approximately 33.5ha.

Lots 348, 349 & 350 are currently zoned 'Rural' under the provisions of the Shire of Denmark Town Planning Scheme No. 3.



LOCATION PLAN

Lots 348, 349, 350
McLean, Kearsley and Mt Shadforth Road
Shire of Denmark

SCALE
1:10000
0 50 100 150 200 250
ORIG A4
05-43-LP(c)
OCTOBER 09

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2.2 Site Description

The subject land is currently used for hobby farming, rural retreat purposes and tourist accommodation. Lot 348 is mainly cleared with a small area of remnant vegetation in the southwest corner. The eastern portion of Lot 349 has been cleared and developed with a residence and holiday chalets. The western portion contains some remnant vegetation with low key access tracks and areas of fuel reduction for fire management purposes. Lot 350 is mainly cleared and pastured. It contains a house, out buildings, fences and dams.

2.3 Surrounding Landuse

The Wishart Place Local Structure Plan (refer attached plan) has been adopted for Unit B and allows for low density residential subdivision (R12.5) in the east, through to 2000 and 3000m^2 Special Residential lots adjacent to Kearsley Road.

Both rural and special rural uses, including horticultural activities (vineyards and orchards) are carried out on the land to the north east, whilst land to the southeast has been developed for residential purposes.

3. PLANNING CONTEXT

3.1 State Policies

In terms of this proposal, the most relevant State Strategic and Policy documents include:

- SPP 1 State Planning Framework Policy [Variation No 2] (2006)
- SPP 2 Environment and Natural Resources Policy (2003)
- SPP 3 Urban Growth and Settlement (2006)
- SPP 2.5 Agriculture and Rural Land Use Planning (2005)
- DC 1.1 Subdivision of Land – General principles (2004)
- DC 3.4 Subdivision of Rural Land (2002)
- DC 3.7 Fire Planning (2001)

The proposed Structure Plan and Scheme Amendment comply with the requirements of these Policies.

LOT 370

ROAD LINK TO BE PROVIDED BETWEEN McLEAN ROAD AND KEARSLEY ROAD.

POS ON LOTS 369 & 370 TO PROTECT STAND OF KARRI TREES IN SOUTH WEST CORNER OF LOT 370 AND THE NORTH - WEST CORNER OF 369.

REMNANT VEGETATION AND MATURE KARRI TREES TO BE PROTECTED IN McLEAN LEAN ROAD RESERVE.

LANDSCAPE BUFFE R (RESIDENTIAL BUILDING EXCLUSION) CLEARANCE TO VINEYARD TO SATISFACTION OF DEPARTMENT OF ENVIRONMENT

SUITABLE VEGE TATION IS TO BE PLANTED AND PROTECTED WITHIN THE BUFFER TO INTERCEPT POTENTIAL SPRAY DRIFT FROM ADJACENT LAND USES

DEVELOPMENT ENVELOPES ON NORTHERN LOTS TO ENSURE ADEQUATE SEPA RATION FROM VINEYARD ACTIVITIES

STRATEGIC FIREBREAKS TO BE DEVELOPED IN ACCORDANCE WITH AN APPROVED BUSH FIRE MANAGEMENT PLAN.

LAND CAPABILITY ASSESSMENT TO BE CONDUCTED FOR LAND.

FEATURE SURVEY OF THE LAND TO BE PROVIDED.

LOT 369

KEARSLEY ROAD ALIGNMENT TO ENSURE RETENTION OF MATURE TREES WE ST OF EXISTING SURVEYED RESE RVATION.

POS ON LO T 369 TO PROTECT THE STAND OF TREES IN THE NORTH WEST CORNER OF THE LOT

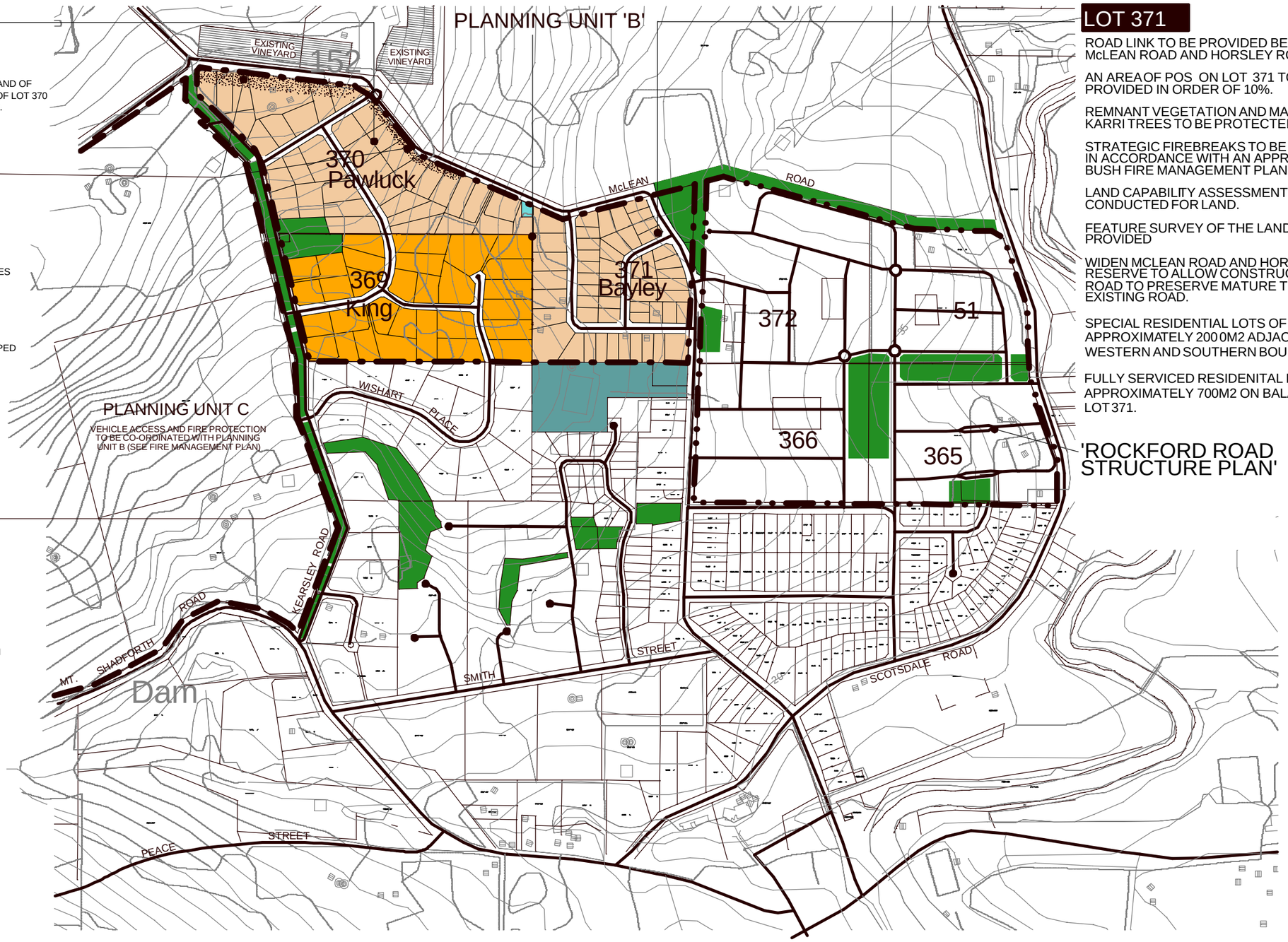
ALTERNATIVE ROAD CONNECTION TO McLEAN ROAD IF REQUIRED.

DEVELOPMENT ENVELOPES ARE REQUIRED ON SUBDIVISION GUIDE PLAN FOR LOTS AB UTTING THE EXISTING RESIDENTIAL LOTS TO THE SOUTH THAT HAVE FRONTAGE TO WISHART PLACE.

REFER TO SUBDIVISION GUIDE PLAN FOR DETAIL.

SUBDIVISION CRITERIA

- Min.lot area 3000m² unless connected to scheme sewer.
- SchemeWater.
- On site effluent disposal systems.
- Subdivision Guide Maps required with rezonings of each of lots 369, 370 & 371.



LOT 371

ROAD LINK TO BE PROVIDED BETWEEN McLEAN ROAD AND HORSLEY ROAD.

AN AREA OF POS ON LOT 371 TO BE PROVIDED IN ORDER OF 10%.

REMNANT VEGETATION AND MATURE KARRI TREES TO BE PROTECTED.

STRATEGIC FIREBREAKS TO BE DEVELOPED IN ACCORDANCE WITH AN APPROVED BUSH FIRE MANAGEMENT PLAN.

LAND CAPABILITY ASSESSMENT TO BE CONDUCTED FOR LAND.

FEATURE SURVEY OF THE LAND TO BE PROVIDED

WIDEN MCLEAN ROAD AND HORSLEY ROAD RESERVE TO ALLOW CONSTRUCTION OF ROAD TO PRESERVE MATURE TREES IN EXISTING ROAD.

SPECIAL RESIDENTIAL LOTS OF APPROXIMATELY 200 0M2 ADJACENT TO WESTERN AND SOUTHERN BOUNDARY.

FULLY SERVICED RESIDENITAL LOTS OF APPROXIMATELY 700M2 ON BALANCE OF LOT 371.

'ROCKFORD ROAD STRUCTURE PLAN'

PROJECT

SHIRE OF DENMARK - PLANNING UNIT 'B'
WISHART PLACE STRUCTURE PLAN

CLIENT

DATE	PLAN NUMBER	SCALE
SEP 2006	05-16-25.WR	1:7500

NORTH

NUMBER	ALTERATION	DATE	APPROVAL

Taylor Burrell

Town planning and design

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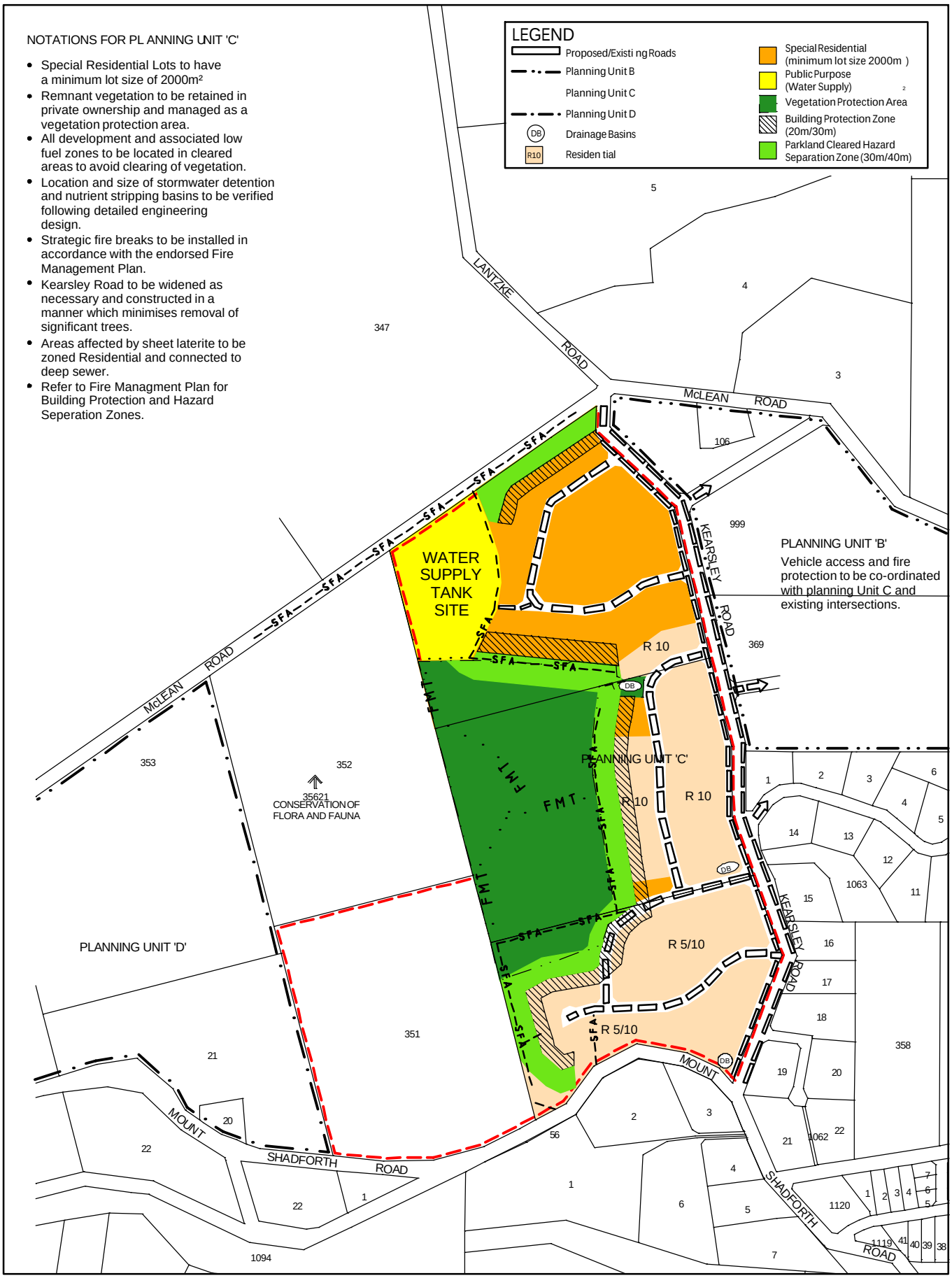

PLANNING UNIT 'C'
KEARSLEY ROAD
LOCAL STRUCTURE PLAN

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SCALE 1:7500
0 25 50 75 100 125
ORIG A4
05-43- STRUCT(k)
MARCH 10

3.2 Regional Planning Strategy - Lower Great Southern Strategy (2007)

Denmark is identified as a sub-regional centre in the Lower Great Southern Strategy (LGSS). Relevant planning issues for rural settlements generally and for Denmark in particular include:

- Managing growth in the town.
- Maintaining the attractive townscapes and rural character.
- Managing environmental qualities.
- Identification and funding of town water resources.
- Ageing infrastructure and cost of upgrades.
- Cost of extending infrastructure.
- Availability of water.
- Constraints to the supply of residential land.

One of the objectives contained in the strategy is "ensure that the identified settlements develop in a sustainable manner." Actions include identifying sufficient land for town expansion in local planning strategies and preparation of conceptual structure plans. In recognition of the lack of infrastructure the LGSS specifically advocates the following actions:

- Development of "innovative approaches to supplying country towns with water".
- Promoting water conservation strategies.
- Determine the capacity of current and potential power supply options and identify power supply requirements.

The inclusion of this land for residential use will assist in achieving the recommendations of the LGSS.

3.3 Local Planning Strategy and Schemes

As noted above the key local planning documents that provide the context and guidelines for this proposal are Council's Local Planning Strategy' (2006), Town Planning Scheme No. 3 and the Kearsley Road Local Structure Plan.

The detailed analysis of the planning unit required by the Local Planning Strategy is reproduced in Appendix A of the Kearsley Road Local Structure Plan.

Planning Issues identified in the Strategy and addressed in the structure plan include:

- Land capability assessment.
- Visual impact, in particular screening from Mount Shadforth Road.
- Retention and protection of remnant vegetation.
- Stormwater management.
- Public Open Space Provision.
- Fire protection.
- Restricted access to Mount Shadforth Road.
- Co-ordination of vehicular access and fire protection with Planning Units B and D.

The Structure Plan provides for a mix of 'Special Residential' and 'Residential' development. Refer to Plan overleaf. Key elements of the Kearsley Road Local Structure Plan are summarised and discussed below. The entire document is reproduced as Appendix 1.

4. SITE ASSESSMENT

4.1 Physical and Geotechnical Factors

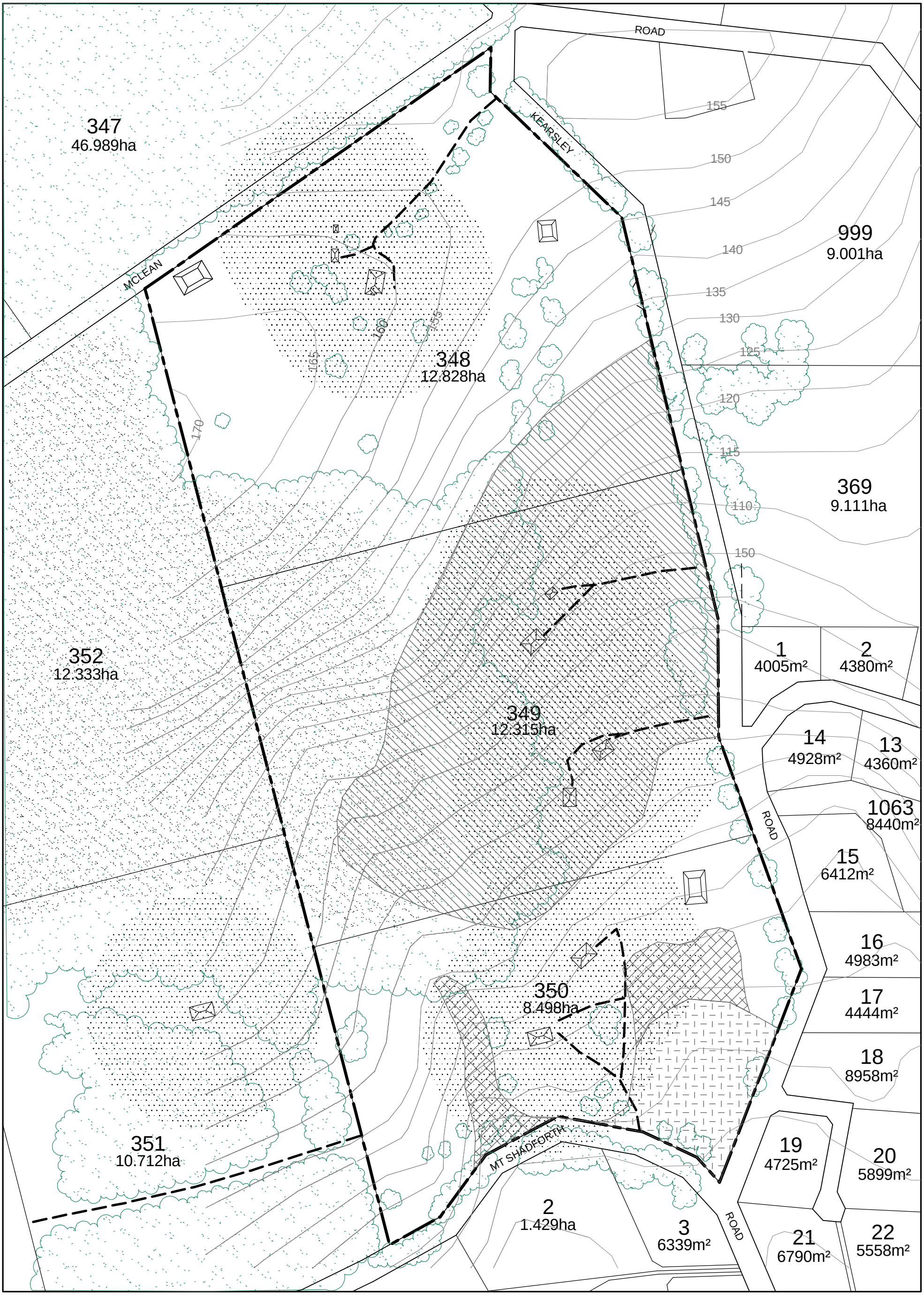
The subject land is mostly comprised of slopes at grades of 8% - 15%, flattening out along the northern ridge on Lot 348 and falling away to the south and east. The more vegetated central western sections are slightly steeper.

The large ridge forms part of the Keystone (brown) landform unit as depicted in the Shire of Denmark's Land Capability Analysis and is described as brown gravelly surface horizons over a yellow brown and red brown clay subsoil. There are small scattered outcrops of granite with localised areas of clay near the ridge top. Well drained gravely duplex soils extend over most of the upper and mid slopes. The land capability mapping provided by the Shire indicates that this soil type has a medium capability for housing, road construction and onsite effluent disposal.

Following detailed investigation conducted in September 2005, four (4) soil types were identified and mapped. An area of sheet laterite occurs between the 130m and 80m contours at depths from 500 to 700mm. The thickness of the sheet Laterite is a constraint on the installation and ongoing performance of on-site effluent disposal systems. Sandy Duplex soils occur low in the landscape on Lot 350 to a depth of 700mm over yellow sandy/clay loams. Two areas of gravel/soft laterite are found just above in the small gully. The soils are free draining and dry relatively quickly.

There are no defined drainage lines, as water tends to shed uniformly across the land in sheet form. The soils investigation prepared for the site concluded that there was no evidence of water logging and due to the elevation and slope there is no likelihood of inundation or flooding of the site. None of the test holes intersect either the permanent water table or any temporary perched water table.

The soils report is contained within the Kearsley Road Local Structure Plan, Appendix 1.



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SITE CHARACTERISTICS AND CONSTRAINTS

Lots 348, 349, 350 McLean, Kearsley and Mt Shadforth Roads, Denmark

LEGEND

- 100m Hazard Separation Zone
- Karri Conservation Area
- Sheet Laterite
- Sandy Duplex
- Gravels/Soft Laterite
- Existing Building
- Existing Dam
- Existing Vegetation
- Tracks

SCALE 1:3000

0 15 30 45 60 75

ORIG A3
05-43-SCC(b)
October 09

4.2 Vegetation

The majority of the vegetation has been cleared on Lots 348 and 350, as shown on the Site Characteristics and Constraints Plan. The western portion of Lot 349 has a significant area of remnant vegetation in a good to excellent condition. It also abuts reserve A35621 to the west which is set aside for "Conservation of Flora & Fauna".

Vegetation on the site has been broadly described in previous studies (Table 1).

Table 1: Vegetation types from previous studies

Source	Vegetation Unit	Comment
Native Vegetation Information System – Department of the Environment, Water, Heritage and the Arts	Eucalyptus Open Forest	This source contains vegetation mapped on a very broad scale and requires ground truthing at the local level
Vegetation Survey of the Albany Hinterland – Connell and ATA Environmental (2001)	Eucalyptus diversicolor Tall Forest A – Tall Eucalyptus diversicolor forest at elevations between 90 and 300m.	This study was mapped at a regional scale and requires ground truthing at the local level.
Landforms and Soils of the South Coast and Hinterland-Churchwood et. Al. (1988)	Karri-Tingle-Marri Forest	This study was mapped using air photos, and field surveys at a scale of 1:100,000
Vegetation of the Albany/Mt Barker Area-Beard (1979)	Tall Forest – Karri (Eucalyptus diversicolor)	Map unit No. 80100426. Vegetation Type No. 694

A site assessment was carried out in January 2008 by Coffey Environments. The vegetation can broadly be described as Karri-Tingle-Marri Forest.

The vegetation inspected comprises Eucalypt Open Forest (as per Department of the Environment and Water Resources, 2007) and is dominated by Eucalyptus diversicolor (Karri), E. quilfoylei (Yellow Tingle), Corymbia calophyla (Marri) and Allocasuarina decussate (Karri She-oak). The understorey is made up of Trymalium floribundum (Karri Hazel), Acacia pentadenia (Karri Whattle), Leucopogon verticillatus (Tassel Flower), Chorilaena quercifolis (Chorilaena), Lepidosperma effusum (Sword-sedge) and Pteridium esculentum (Bracken). The Karri trees are distributed fairly evenly across the assessment area, with larger trees predominantly in the southern half of the vegetation and on the pasture/vegetation interface. Yellow Tingle was most common in the northern third of the vegetation.

The condition of the vegetation ranges from 'Good' to 'Excellent' as described in Table 2 below. It is 'Good' on the forest/pasture interface (to approximately 30m into the vegetation) as there are non native pasture species such as grasses which have invaded the area. There has also been removal of understorey for fuel reduction to protect nearby dwellings. Further away from disturbing activities, the vegetation is in 'Excellent' condition and displays the attributes of vegetation that has gone for a long period without being burnt (sparse understorey with fairly high fuel loading).

Table 2: Definition of Vegetation Condition Scale Condition scale used in BUSH FOREVER VOL 2, From Keighery BJ (1994)	
Pristine (1)	Pristine or nearly so, no obvious signs of disturbance.
Excellent (2)	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good (3)	Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good (4)	Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure of ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded (5)	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded (6)	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

Reference: *Keighery, BJ (1994) Bushland Plant Survey. A Guide to Plant Community Survey for the Community. Wildflower Society of WA (inc), Nedlands, Western Australia.*

More isolated pockets of remnant vegetation are located within the unconstructed section of Kearsley Road and immediately abutting the western boundary of the road reserve. While the understorey associated with these remnants is degraded, there is an opportunity to conserve the more significant trees.

One of the key objectives of the Local Structure Plan for the area is to maximise the retention of the remnant vegetation. Approximately 30% of the area will be set aside for protection of remnant vegetation.

To achieve this, the landowner of Lot 349 is sacrificing 60% of land for vegetation protection purposes. The future owners of lots with remnant vegetation will be responsible for the maintenance of the hazard separation zone as set out in the Fire Protection Plan.

4.3 Visual Impact

The remnant vegetation within the study area, including within the Mount Shadforth and Kearsley Road reserves provide an important backdrop to the Denmark town centre and surrounding locality. They also act as a useful screen to the proposed development given the elevated nature of the site.

Roads will be sensitively located and any street tree planting will be undertaken to limit any adverse impact and to enhance the landscape qualities of the site, while at the same time retaining views to the Inlet and Ocean.

5. SITE CONTEXT

5.1 Compatibility with Adjoining Land Uses

The proposed Special Residential and Residential subdivision and development is compatible with existing and proposed adjoining land uses. Lots to the east of the lower section of Kearsley Road are zoned Residential (R2 and R 10). The adjacent lots within Planning Unit B (Wishart Place Local Structure Plan) are currently used for rural and rural living purposes. Lot 369 was the subject of Amendment 80 and has been rezoned to Special Residential.

Conditional subdivision approval has been granted for eleven (11) 2000 – 3000m^2 lots in Stage 1. Lot 999 is the subject of a current amendment which proposes rezoning to Special Residential. Remnant vegetation adjacent to Kearsley Road will be set aside as Public Open space.

The adjoining Conservation Commission of WA reserve to the west contains remnant vegetation and is shown as Parks and Recreation reserve on Town Planning Scheme No. 3 maps.

5.2 Buffers/Potential for Conflict

The horticultural activities currently conducted on land north of McLean Road will not have a significant impact on the future development of Planning Unit C. This issue was assessed during the preparation of the Wishart Place Local Structure plan which is between the subject land and the intensive agriculture. The subject land is separated from the horticultural activity by two road reserves, significant vegetation (which will be protected) and portion of Lot 370.

The generic buffer to viticulture and horticulture will be partly attenuated by the existence of a band of mature Karri trees and understorey vegetation along the unconstructed McLean Road reserve. Prevailing winds are generally southwest or southeast and therefore any overspray, noise or dust will be carried away northwards from the Planning Units B and C. The matter of an appropriate buffer to nearby viticultural and horticultural activities has been examined by the relevant authorities, (Denmark Shire Council, Department for Environment & Conservation and Department for Planning & Infrastructure).

Based upon site specific factors and having regard for spray drift, it was agreed to require the planting and protection of vegetation in the buffer within Lot 370 as part of the rezoning of that land. This is considered to be more than adequate in respect to Lot 348, particularly when combined with the existing land management and development control provisions applicable within the Lantzke Road Special Rural zone of the Town Planning Scheme No. 3.

5.3 Connectivity/Linkages

The Kearsley Road Local Structure Plan outlines how the land will be integrated with adjoining property. Kearsley Road forms a common boundary with Planning Unit B to the east and the indicative layout has been designed to take account of existing and proposed subdivisional roads, proximity of intersections and sightline requirements. McLean Road forms the northern boundary with land to the north being zoned 'Rural' and has the potential to be developed as a major east west link between Scotsdale Road and Mt Shadforth Road. Kearsley Road will also become an important north south link, connecting Mt Shadforth Road through to Lantzke Road to the north.

A significant area of bushland adjacent to the Conservation Commission of WA reserve to the west is proposed to be set aside for vegetation protection purposes, thus contributing to the visual amenity and biodiversity conservation within the locality.

6. LAND CAPABILITY

The land capability assessment of the subject land is based on work carried out by Churchward et al in 1998 and subsequent soil testing and assessment. The land is identified as falling within the keystone (Kb) – Soil Group 1. The predominant soils are generally described as brown gravely surface horizons over a yellow brown and red brown clay subsoil. Sandy duplex soils over yellow sandy/clay loams occur low in the landscape.

In terms of land capability for housing and construction, the site is predominantly medium capability, with some areas of high capability at the top of the ridge and in the south east corner of Lot 350. A small portion of the site with very low capability is within an area of remnant vegetation and is not proposed to be developed.

The other key capability rating is for on-site effluent disposal which is predominantly medium capability, with some areas of high capability at the top of the ridge in the north of the site. The gravel soils generally have a high phosphorous and nitrogen retention capacity which is important in terms of ensuring nutrients are not exported from the site.

The presence of sheet laterite on portion of Lot 348 and much of the cleared area on Lot 349, has been addressed in the Local Structure Plan in terms of its constraint on effective disposal of effluent. Conventional effluent disposal systems do not operate effectively over the sheet laterite, consequently it is proposed to deep sewer the affected area and allow for smaller residential lots.

7. SERVICES & INFRASTRUCTURE

7.1 Roads

Kearsley Road provides gazetted road frontage to lots 348, 349 & 350 as well as to Lots 369 and 999 on the eastern side of the road. The Wishart Place Structure Plan and rezoning amendments associated with Lot 369 & 999 have confirmed Kearsley Road as the main north south access road. The road has been constructed to a sealed standard from Mt Shadforth Road to Wishart Place. To the north of Wishart Place it has been constructed as a narrow gravel access for lots to the north. Consideration has previously been given to the development of Kearsley Road as a low key neighbourhood connector road for the locality with only emergency access provided to McLean Road and Lantzke Road. The Wishart Place Structure Plan endorses its connection through to McLean Road and current advice is to retain it as an important north south link connecting through to Lantzke Road and the rural area to the north.

Accordingly, it is proposed to develop the road as a dual lane carriageway with a ten metre widening on the western side in order to maximise retention of existing trees within the road reserve.

Careful design will minimise loss of mature trees located within the reserve. The majority of trees can be retained together with the landscape character of the road.

7.2 Power

Underground power will be extended to service the proposed development.

7.3 Water

The proponents have agreed to facilitate the development of a major water supply tank site for Denmark in the north west corner of Lot 348. Provision of a water supply for the proposed development is dependent on this infrastructure being completed to provide additional capacity for further growth of the townsite.

The owner of Lot 348 has agreed to sell 2.676ha of the most elevated portion of the property to the Water Corporation for the tank site. The owners of Lots 348, 349 & 999 have also agreed to provide for a 4 metre wide easement through their properties to allow for connecting water mains to be constructed outside of Kearsley Road in order to minimise clearing of trees.

It is proposed that all lots will be connected to a reticulated water supply. While the more elevated lots will require a booster pump, the facility will service the structure plan area as well as other areas in the locality.

7.4 Effluent Disposal/Sewerage

It is proposed to provide deep sewer to lots located over the sheet laterite found on the lower portion of Lot 348 and the upper portion of Lot 349. Investigation confirms that these lots, together with those proposed on Lot 350 can be accommodated by the existing sewer infrastructure currently located to the south east in Willow Creek Drive.

The balance of Lot 348 will consist of Special Residential lots with a minimum lot size of 2000m² and will be serviced by appropriate on site effluent disposal systems. The soils have a high capability to accommodate on-site effluent disposal and use of alternative treatment units will minimise the potential for nutrients to be exported from the site.

7.5 Stormwater/Drainage

Given the well drained nature of the site, and the range of lot sizes, stormwater runoff will be disposed of onsite wherever possible in accordance with water sensitive design principles. To allow for staged development a drainage site is nominated for each of the three lots to accommodate stormwater from the road system. Based on preliminary calculations the basins will be between 350m^2 and 500m^2. Most importantly, a proposed drainage basin site has been identified adjacent to the southern boundary of Lot 350.

Additional stormwater drainage may also be accommodated in the POS area/adjacent to the subdivisional roads. In the event of a higher order storm, an overland flow path is available. Appropriate nutrient stripping features will be an integral component of the basin design and access is readily available for routine maintenance.

A detailed nutrient stripping, sediment retention, drainage management plan will be provided at the subdivision stage of development in accordance with Shire of Denmark Policies and Standards.

7.6 Telecommunications

Telecommunications infrastructure can be extended to service the proposed development.

7.7 Fire Safety

A detailed fire protection plan has been prepared for the subject land and is contained in Appendix 2.

7.8 Public Open Space

Three areas of Public Open Space are shown strategically located in association with proposed detention basins. The basins will be landscaped and integrated into the surrounding area of Public Open Space to create attractive features within the subdivision within easy walking distance of the lots. The areas of POS will be of a size to accommodate additional amenities such as play equipment, subject to discussion with council at the detailed subdivision design stage.

As a 10 metre widening of Kearsley Road is provided by the landowners to minimise clearing of significant Karri and Yellow Tingle trees, a concession of 50% of the land given up is requested in terms of the requirement to provide 10% Public Open Space. The trees represent a significant landscape feature within the area and the concession will restore some equity to the landowners giving up the land. A similar consideration has been accepted in the Horsley Road Structure Plan in relation to McLean Road.

8. AMENDMENT PROPOSAL

The proposed amendment to the Shire of Denmark Town Planning Scheme No 3 will facilitate Council's strategy to provide for the future growth of the Denmark townsite by providing a mix of Special Residential and Residential lots, together with a tank site for the Denmark water supply. At the same time a significant area of remnant vegetation will be protected within a vegetation protection area which will provide a substantial buffer to an adjoining A class reserve which is designated for conservation of flora and fauna (Refer Subdivision Guide Plan).
Key elements of the plan are summarised below:

- Special Residential lots with a minimum lot size of 2000m^2 to be located on the most elevated land where land capability is suitable for on site effluent disposal systems.
- To address constraints associated with sheet laterite on the southern portion of lot 348 and the upper portion of Lot 349, smaller residential lots will be connected to deep sewer.
- While Lot 350 is not constrained by sheet laterite, the presence of the sewer line, which will run down Kearsley Road, provides the opportunity for smaller sewered residential lots. Some larger lots will be required abutting the western boundary in order to meet bush fire management requirements. A coding of R5/10 is proposed which will allow for unsewered lots with a minimum lot size of 2000m2 or sewered lots with a minimum of 875m2 and an average of 1000m2 . The potential for the larger unsewered lots to be further subdivided with sewer is shown indicatively on the Subdivision Guide Plan.
- Remnant vegetation adjacent to the Conservation of Flora and Fauna Reserve 35629 will be included in a vegetation protection area. The land will be retained in private ownership within two special residential/conservation retreat style lots. This ensures they can be appropriately managed, particularly in relation to fire, at no cost to Council.

ADOPTED BY RESOLUTION OF THE COUNCIL OF THE

_____ OF _____

AT THE _____ COUNCIL MEETING

ON THE _____ DAY OF _____ _____

CHIEF EXECUTIVE OFFICER _____

ROAD

106

46.989ha

999

KEARSLEY

SR 13

2168m²

2665m²

2043m²

2120m²

2351m²

348

12.828ha

2762m²

2017m²

2013m²

2218m²

2122m²

2239m²

DENMARK
WATER
SUPPLY
STORAGE

MCLEAN

2301m²

4686m²

2920m²

2350m²

875m²

DB

900m²

3.7227ha

900m²

883m²

1721m²

894m²

902m²

352

Reserve 35621

12.333ha

349

12.315ha

1705m²

1649m²

1003m²

916m²

POS

DB

1727m²

3.2731ha

CONSERVATION
OF
FLORA AND FAUNA

2066m²

959m²

2040m²

2173m²

2010m²

351

10.712ha

2071m²

350

8.498ha

2255m²

954m²

8171m²

910m²

2115m²

2635m²

2301m²

920m²

POS

DB

MT SHADFORTH

1
4005m²

2
4380m²

14
4928m²

8440m²

15
6412m²

16
4983m²

17
4444m²

18
8958m²

19
4725m²

21
6790m²

2
1.429ha

3
6339m²

4

ROAD

WATER

110

100

90

80

70

60

50

40

130

120

140

LEGEND

- Subject Land
- Vegetation Protection
- Strategic Fire Access
- Fire Management Track
- Building Envelopes
- Drainage Basins
- Proposed SRes 13
- Proposed R 10
- Proposed R 5/10
- Building Protection Zone (20m/30m)
- Parkland Cleared Hazard Seperation Zone (30m/40m)

Refer to Fire Management Plan for Building Protection and Hazard Separation Zon es.

N

ORIG A3
SCALE 1:3000
0 20 40 60

AYTON BAESJOU
PLANNING
11 Duke Street
Albany WA 6330
Ph 9842 2304 Fax 9842 8494

SUBDIVISION GUIDE PLAN

Lots 348, 349, 350 McLean, Kearsley and Mt Shadforth Roads.
Shire of Denmark

MAY 10
05-43-SGP(u)

- Proposed building envelopes will be located within cleared areas to avoid clearing of remnant vegetation.
- Kearsley Road to be upgraded as the main North/South access, connecting through to Mclean Road and Lantzke Road. Construction to be carried out in a manner which minimises removal of significant trees.
- Provision is made for a 2.695ha water supply site on cleared land within Lot 348. Associated water main connections to be located within an easement adjacent to Kearsley Road to avoid clearing of trees.
- Provision for storm water retention/nutrient stripping basins on site.
- Provision for a hazard separation zone between existing and proposed buildings and remnant vegetation to the west and north.

The Kearsley Road Local Structure Plan includes all three lots the subject of this Amendment. The Structure Plan provides for the co-ordination of infrastructure and services including roads, drainage, power, water, sewer, telecommunications and bush fire management. However, wherever possible provision has been made to enable each landowner to develop independently. Special outcomes associated with the proposal include:

- Provision for a water supply tank site to service future needs of Denmark townsite.
- Protection of remnant vegetation representing approximately 30% of the site to help buffer and protect high conservation value areas to the west and screen development from Mt Shadforth Road.
- Provision for the upgrading of Kearsley Road to service planning Units B and C, including the retention and protection of significant remnant vegetation in the road reserve.
- Provision of Special Residential and Residential lots which capitalise on the special views and amenities of the locality.

- Incorporation of provisions within Council's Scheme to encourage a high quality of development in keeping with the special character of Denmark.
- Incorporation of water sensitive design principles and best management practices in the management of water resources.
- Preparation of a comprehensive Fire Protection Plan to improve fire safety and on going management for the area.

8.1 Site Suitability

The subject land has a number of attributes in terms of its suitability for development into Special Residential and Residential lots. These include:

- Logical extension of the existing Special Residential and Residential areas generally in accordance with the adopted Local Planning Strategy.
- Proximity to the Denmark townsite and all the associated services and facilities such as shops, health, educational and recreational services.
- The topography of the site which provides a range of elevated, well drained house sites on gentle to moderate slopes.
- The availability of existing service infrastructure such as sewer, power, water and telecommunications which can be upgraded and extended to service the development.
- The developer has negotiated to provide a site for the new Water supply tank for Denmark.
- The availability of extensive views to the ocean, inlet and inland rural areas.
- Development of the site will not impact on creeklines or wetland areas.

8.2 Energy Efficient Design & Solar Access

The proposal has been prepared taking into account the aims of the Shire of Denmark Energy Efficient Subdivision Design (TPS Policy 33) and the climate response objectives of the Liveable Neighbourhoods Community Code. The proposal addresses efficiency and sustainability criteria.

The design and layout of lots is based on maximising passive solar access, given the terrain and natural bushland. The long boundaries are within the preferred angle range and depth. Where required, building areas provide adequate winter sun access for future house sites and yards with sufficient space for creation of microclimates. The larger Special Residential lots provide the opportunity to achieve energy efficient design objectives at the development stage. The majority of smaller residential lots are orientated east west to maximise opportunities for solar gain.

The subdivision allows for a range of lot sizes, affording variety and choice in housing styles. The Lots are aligned to the contour, thus minimising the need for retaining walls and earthworks associated with housing and access way construction.

In accordance with the adopted Policy, the subdivision layout, lot sizes and dimensions will enable dwellings to be sited to capitalise on views and protect important natural and cultural features.

Approximately 30% of the site will be set aside for protection of remnant vegetation and a significant buffer will be provided to the adjoining conservation estate. The bushland areas will perform an important ecological function providing valuable habitat for flora and fauna. The vegetated areas also provide an attractive landscape backdrop.

The lot densities, sizes and layout represent orderly and efficient development, consistent with the sustainability objectives. The road network provides safe convenient access, allows for emergency egress and affords adequate fire protection. Lots front streets such that development enhances personal safety, traffic safety, property safety and security and contributes to streetscape and park quality.

8.3 Concept Plan/Development Control

This proposal provides for a range of lot sizes ranging from Residential R10 lots (minimum 875m^2, average 1000m^2) to Special Residential lots with a minimum lot size of 2000m$^{2.}$

Lots are aligned to the contour to minimise the need for site works associated with the construction of access ways and house pads. The east west layout enables buildings to be orientated to the north to take advantage of passive solar design principles, while still capitalising on the spectacular views available from the site.

The Local Structure Plan provides for the coordination of infrastructure and services including roads, drainage, power, water, telecommunications and strategic fire breaks. Consideration has been given to the construction of Kearsley Road to enable the retention of mature native trees. Intersections have been located to take account of existing and proposed subdivisional roads in Planning Unit B (Wishart Place Local Structure Plan).

The sensitive design of future residences is considered to make a significant contribution to the visual amenity of the locality. The use of split level or stepped housing design in response to slopes and terrain is encouraged. Houses with a maximum building height of 7.5 metres, measured from natural ground level, is recommended.

Management of stormwater on site and utilisation of water sensitive design principles, including nutrient stripping, sediment retention basins will be required at the subdivision stage of development.

The proposed Amendment will utilise zoning and land use categories that already exist within the Shire of Denmark Planning Scheme. Standard mechanisms, including Special Provisions will be used to guide and control subdivision and development.

9. CONCLUSION

The subject land is identified in the Denmark Local Planning Strategy to accommodate expansion of the Denmark Townsite. It is intended that the three individual land holdings be rezoned prior to subdivision and appropriate special provisions be incorporated into the Shire of Denmark Town Planning Scheme No. 3

The attached Kearsley Road Local Structure Plan provides for the coordination of roads, infrastructure and services across the subject properties and will facilitate the expansion of the Denmark townsite. The area of vegetation will be protected and there is opportunity to improve water supply to the locality by making land available for a new tank site.

All issues identified in the policy and structure plan have been addressed, including:

- Provision of a road link between Horsley and McLean Roads;
- provision of Public Open Space;
- protection of remnant vegetation;
- provision of a land capability assessment; and
- fire management.

APPENDIX 1

Kearsley Road Local Structure Plan

SHIRE OF DENMARK

KEARSLEY ROAD - DENMARK

LOCAL STRUCTURE PLAN

AYTON BAESJOU
PLANNING

ABN: 15 061 140 172
11 Duke Street
Albany WA 6330
Ph 9842 2304 Fax 9842 8494

In association with

Coffey Environments, Cauarina Forest Services and ICS Group – Fire Protection

October 2009
Adopted March 2010
Modified May 2010

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APPENDIX A Shire of Denmark - Town Planning Policy No 28.

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APPENDIX E Local Water Management Strategies

1. INTRODUCTION

The Shire of Denmark Town Planning Scheme Policy No. 28 'A Settlement Strategy for Denmark', adopted by Council on 22 December 1998, identifies several areas as being suitable for future population growth and residential development. North Denmark was one of the areas selected as being capable of providing an opportunity to meet anticipated growth of the urban area.

Planning Issues identified in the Strategies note that inter alia:

- "Land considered suitable for special residential development, subject to detailed capability assessment.
- Remnant vegetation and particularly mature karri trees in road reserves to be protected.
- Design to maximise available views and minimise the visual impact of development with selective revegetation."

Council requires the preparation of a Local Structure Plan (LSP) for Special Residential development prior to any rezoning or development taking place. The issues to be examined include:

- Land capability assessment
- Visual impact, in particular screening from Mount Shadforth Road
- Retention and protection of remnant vegetation
- Stormwater management
- Public Open Space Provision
- Fire protection
- Restricted access to Mount Shadforth Road
- Co-ordination of vehicular access and fire protection with Planning Units B and D.

Lots 348, 349 and 350 are bounded by McLean Road, Kearsley Road and Mt Shadforth Road. This document addresses the relevant planning issues and provides the necessary framework for the rezoning of the subject land. Development of the area for Special Residential lots serves as a natural progression to the growth of Denmark.

2. LOCATION

The portion of Planning Unit C encompassed by this LSP, has an area of 33 ha and an estimated potential for approximately 95 Special Residential lots. The land is located approximately 1.2 kilometres north of the Denmark town centre and is comprised of three landholdings. It has Kearsley Road on the eastern boundary, McLean Road on the northern boundary, Mt Shadforth Road on the southern boundary and Reserve A35621 and Lot 351 to the west. Because of the extensive remnant vegetation located on Lot 351, which is a constraint on further development, it has been excluded from consideration as part of this proposal.

3. LAND AREA AND ZONING

Lot Number	Area (ha)
Lot 348	12.8287 ha
Lot 349	11.8676 ha
Lot 350	8.4984 ha
	33.1947 ha

The subject land is currently zoned Rural under the Shire of Denmark Town Planning Scheme No. 3. Land to the south east and south is zoned Residential with an R2 or R10 density coding. To the west, Lot 351 is zoned rural and Lot 352 is an A class reserve vested in the Department for Environment and Conservation and reserved Parks and Recreation in Council's Town Planning Scheme No 3. Lot 347 to the north is zoned Rural and the land north of McLean Road and east of Lantzke Road is Special Rural Area No. 10, to the east Lots 999, 106 & 369 have been rezoned to 'Special Residential' and Lot 369 was the subject of Amendment 80 and now Special Residential Zone 9.

4. PLANNING CONTEXT

The key planning document relating to the land is the Shire of Denmark Town Planning Scheme Policy No. 28, 'A Settlement Strategy for Denmark' adopted by Council on 22 December 1998. The subject land falls within Planning Unit C as identified in the Strategy. The plan and detailed analysis for the planning unit is attached in Appendix A.

The subject lots are separated from the balance of Planning Unit C to the west by substantial vegetation areas.

A key requirement of the Strategy is the preparation of a Local Structure Plan for the planning unit prior to further development and subdivision.

5. GENERAL SITE DESCRIPTION

The subject land is currently used for hobby farming, rural retreat purposes and tourist accommodation. Both rural and special rural uses, including horticultural activities (vineyards and orchards) are carried out on the land to the north east, whilst land to the southeast has been developed for Residential purposes. Land to the east is contained within Planning Unit B. A Local Structure Plan has been adopted for Unit B. To the west is the A Class reserve set aside for the conservation of flora and fauna.

Lot 348 is mainly cleared with a small area of remnant vegetation in the southwest corner. The eastern portion of Lot 349 has been cleared and developed with a residence and holiday chalets. The western portion contains remnant vegetation. Lot 350 is predominantly cleared and contains a house and out buildings.

5.1 Surrounding Land Uses

The horticultural activities currently conducted on land north of McLean Road will not have a significant impact on the future development of Planning Unit C. This issue was assessed during the preparation of the Local Planning Strategy for Unit B which abuts the subject land. The subject land is separated from the horticultural activity by two road reserves, significant vegetation (which will be protected) and portion of Lot 999.

The generic buffer to viticulture and horticulture will be partly attenuated by the existence of a mature band of Karri trees and understorey vegetation along the unconstructed McLean Road reserve. Prevailing winds are generally southwest or southeast and therefore any overspray, noise or dust will be carried away northwards from the Planning Units B and C. The matter of an appropriate buffer to nearby viticultural and horticultural activities has been examined by the relevant authorities, (Denmark Shire Council, Department for Environment and Conservation and Department for Planning & Infrastructure). Based upon site specific factors and having regard for spray drift, it was agreed to require the planting and protection of vegetation in the buffer within Lot 999 as part of the rezoning of that land. This is considered to be more than adequate in respect to Lot 348, particularly when combined with the existing land management and development control provisions applicable within the Lantzke Road Special Rural zone of the Town Planning Scheme No. 3.

The adjoining Reserve A35621 (Conservation of Flora and Fauna) to the west contains remnant vegetation and is shown as Parks and Recreation reserve on Town Planning Scheme No. 3 maps.

6. LANDFORM

6.1 Topography

Planning Unit C is mostly comprised of slopes at grades of 8% - 15%, flattening out along the northern ridge on Lot 348. Slopes in the more vegetated central western section are slightly steeper 25% - 30%, in places. The subject land is generally convex with the highest point being the well defined ridge in the northwest corner. The site falls away to the south and east.

Lot 348 ranges in elevation from approximately 170m AHD at the high point, to about 115m in the southeast corner. The cleared/developable portion of Lot 349 ranges from 120m AHD mid way along the northern boundary to 75m in the south east corner. Lot 350 ranges from 95m AHD in the north west to 50m in the southeast corner.

There are no defined drainage lines, as water tends to shed uniformly across the land in sheet form. The soils investigation prepared for the land noted that there was no evidence of water logging on the land. Due to the elevation and slope of the land there is no likelihood of inundation or flooding of the site.

6.2 Soils

A detailed investigation of the soils on the three lots was conducted in September 2005 to determine the land's capability for effective long-term disposal of effluent. A copy of the report is attached as Appendix B. The report is based upon a total of 31 augered samples obtained using a trailer mounted drilling rig. Where possible holes were dug to 2.1 metres and samples taken every 0.5 metres. Four soil types were identified and mapped.

The large ridge forms part of the Keystone (brown) landform unit and the soils are typical and similar to other hills around Denmark. There are small scattered outcrops of granite with localised areas of clay near the ridge top. Well drained gravely duplex soils extend over most of the upper and mid slopes.

An area of heavy sheet laterite occurs between the 130m and 80m contours at depths from 500 to 700mm. Sandy Duplex soils occur low in the landscape on Lot 350. They are in water gaining situations with gentle slopes to the south, to a depth of 700mm over yellow sandy/clay loams.

Two areas of gravel/soft laterite are found in the small gully on Lot 350 and just above the sandy duplex soils. Both are water gaining and drain the mid slopes. The soils are free draining and dry relatively quickly.

Given the problems associated with utilising on–site effluent disposal systems in the area where heavy sheet laterite occurs, it is proposed that smaller lots connected to a deep sewer be provided to address this issue

7. VEGETATION

The vegetation can broadly be described as Karri-Tingle-Marri forest. A site assessment was carried out by Coffey Environments on the 31 January 2008 and is attached in Appendix C. The Karri trees are distributed fairly evenly across the assessment area, with larger trees predominantly in the southern half of the vegetation and on the pasture/vegetation interface. Yellow Tingle was most common in the northern third of the vegetation.

The condition of the vegetation ranges from “Good” to “Excellent” (based on the condition scale used in Bush Forever Vol 2, from Keighery B.J. 1994). It is “Good” on the forest/pasture interface (to approximately 30m into the vegetation) as there are non native pasture species such as grasses which have invaded the area. There has also been removal of understorey for fuel reduction to protect nearby dwellings. Further away from disturbing activities, the vegetation is in “Excellent” condition and displays the attributes of vegetation that has gone for a long period without being burnt (sparse understorey with fairly high fuel loading).

8. VISUAL IMPACT

The site is moderately well screened by existing vegetation in the surrounding road reserves. Mature native trees particularly the Karri trees will be protected within the Kearsley Road Reserve.

The extensive area of vegetation on Lots 348 and 349 provides an important landscape backdrop. Remnant vegetation will be protected with special provisions precluding clearing. Controls on the location, design, height and materials of structures will ensure development does not detract from the visual amenity of the area.

Roads will be sensitively located and street tree planting will be undertaken to limit any adverse impact and to enhance the landscape qualities of the site.

9. PROPOSED DEVELOPMENT

The essential features of the structure plan are depicted and notated on the attached Local Structure Plan and the Subdivision Guide Plan. These include:

- A range of lot sizes from sewered residential lots at the R10 density Code (minimum 875m^2 - average 1000m^2) to Special Residential lots with a minimum lot size of 2000m^2. The smaller sewered lots will be located in the area where sheet laterite predominates, creating a constraint on the effective use of on-site effluent disposal systems. Areas to the south of the sheet laterite, through which the sewer line passes, have also been designated with an R10 density code. The Special Residential lots are located on land above the areas of sheet laterite which have a better capability in terms of accommodating on-site effluent disposal systems. It is estimated approximately 34 Special Residential lots can be created, together with approximately 40 Residential R10 and 19 R5 lots.
- Remnant vegetation adjacent to Reserve 35621 to the west to be retained as a vegetation protection area. This area will be incorporated within two adjoining lots so that it can be managed privately at no cost to Council, particularly in relation to fire management.
- Proposed lots to be located in cleared areas so that there will be no clearing required to construct dwellings or the low fuel areas required around the dwellings.
- Kearsley Road to be upgraded as the main access serving Planning Units B and C and linking through to Mclean and Lantzke Roads.
- Protection of significant remnant vegetation within the Kearsley Road reserve.
- Provision for a 2.695ha water supply site on cleared land within Lot 348, as opposed to within the more elevated and heavily vegetated Department of Environment and Conservation land to the west.
- Provision for storm water retention/nutrient stripping basins on site.
- Provision for a hazard separation zone between existing and proposed buildings and remnant vegetation to the west and to the north of McLean Road.

These key elements are illustrated on the Local Structure Plan. The Plan will provide for the coordination of infrastructure and services, including roads, power, water, telecommunications and bush fire management.

9.1 Kearsley Road

North of Wishart Place, Kearsley Road is well vegetated with a mix of Karri, Yellow Tingle, Red Flowering Gum, Wattie or Warren River Cedar and Marri. A gravel track has been constructed through the trees and is the main means of access for Lots 348, 349 and 999. Land abutting Kearsley Road is also vegetated on either side although there is a narrow strip immediately adjacent to the eastern and western boundary that is relatively tree free.

Kearsley road has been identified by the Shire of Denmark as the main north south access providing access to adjoining lots within both the Wishart Place Structure Plan and the Kearsley Road Structure Plan. The development of an east-west road utilizing McLean Road is also under consideration in order to help reduce traffic through the town centre. This will add further to the importance of Kearsley Road as a north-south connector. The Water Corporation also require a 4 metre strip to accommodate water mains running to and from the proposed water tank site on Lot 348. To minimise clearing, it is proposed to run a 4 metre wide easement down the western side of Kearsley Road as far as the intersection with McIlroy Bend.

A divided carriageway, consisting of approximately 3 metre wide laneways, is proposed along the heavily vegetated portion of Kearsley Road. The eastern laneway will effectively follow the existing gravel access and the western laneway will utilise the cleared strip abutting the road reserve. A ten metre wide road widening adjacent to the eastern lot boundary will be required to facilitate the western lane way.

Contributions to the upgrade of Kearsley Road will be required from developers on either side of Kearsley Road at the subdivision stage of development. As only the owners of land on the western side of Kearsley Road are providing for a 10 metre road widening, contributory arrangements will need to take this matter into account.

10. BUSH FIRE MANAGEMENT

The Local Structure Plan takes into consideration the essential elements of Planning for Bushfire Protection (2001) and the Western Australian Planning Commission Planning Policy DC3.7. It includes the following key principles:

- Low fuel areas (between 20 to 30 metres) around all dwellings.
- Appropriate separation/hazard reduction zones from the areas identified as Extreme Hazard.
- The subdivisional roads being designed as loop roads to facilitate emergency access.
- Fire hydrants to be installed within the road reserves at 200 metre intervals.
- The subdivider will be required to ensure that intending purchasers are fully aware of the fire management guidelines of the Homeowners Bushfire Survival Manual. This is required not only for initial purchasers of lots but for all subsequent transfer of lots.
- Individual lot owners will be responsible for ensuring that all buildings are constructed in accordance with Australian Standard 3559-1991 “Construction of Buildings in Bushfire Prone Areas”.

A detailed Bush Fire Protection Plan is attached in Appendix D and will be implemented at the subdivision and development stages.

11. BUILDING DESIGN

11.1 Design

The architectural design of future residences to be constructed in Planning Unit C will make a significant contribution to the visual amenity of the locality. It is therefore important for the residences and outbuildings to complement the landscape as far as possible.

Buildings should be designed and constructed of materials to be sympathetic to the existing landscape elements. The use of split-level or stepped housing design in response to slopes and terrain is encouraged. Roof and other external wall materials will be required by Council to be of materials that do not impact on the landscape amenity of the area. Reflective colours and materials such as zincalume will not be permitted.

11.2 Building Heights

Buildings shall not exceed a maximum height of 7.5m measured from natural ground level. Split level or stepped housing design will be encouraged.

12. STORMWATER & NUTRIENT MANAGEMENT

Local stormwater management strategies have been prepared for the properties and are attached in Appendix E.

The strategies have been prepared in consultation with the Department of Water and are based on best management practices for stormwater treatment and control.

Key elements of the strategy include:

- Use of rainwater tanks for stormwater attenuation of 1 in 1 year events and to reduce demand on reticulated supplies.
- Soak wells to maximise onsite infiltration for each lot for the 1 in 1 year storm water event.
- Piped drainage system to convey flows up to the 1 in 10 year event.
- Basin/swales sizes for attenuation of stormwater up to the 1 in 10 year event.
- Flood routes for safe conveyance of events up to the 100 year ARI.

Three detention/treatment basins have been designated for each of the three lots to allow for staged development and are indicatively shown on the Structure Plan and Conceptual Subdivision Plan. Basin sizes range up to 450m^2 and will require additional area to accommodate embankments and buffers. There will also be an opportunity to design the basins so that they become attractive features within the development, capable of being used for passive and active recreation.

13. PUBLIC OPEN SPACE

The majority of Lot 348 is proposed to be zoned Special Residential and has no requirement to provide Public Open Space. Approximately 5680m^2 in the south east corner is proposed to be Residential (R10) and will either provide cash in lieu or combine with Lot 349 to the south to provide a suitable local park. Such parks should be provided within 150 to 300 metres safe walking distance to all dwellings. Lot 350 has a dual coding and the requirements for Public Open Space will depend on the proportion of land designated for smaller sewered lots. Again, the option will be to provide a suitably located local park or cash in lieu.

14. SERVICING

14.1 Roads

The proposed roads forming part of the LSP will be:

- Designed and constructed to minimise impact on significant remnant vegetation within the road reserves;
- Located in a manner that is sympathetic to the topography and minimises visual impact;
- Drained underground and kerbed to satisfy the requirements and specification of the Shire of Denmark.

The proposed subdivisional roads will comply with Council's Development Standards.

14.2 Domestic Effluent Disposal

Because of the presence of sheet laterite on the southern portion of Lot 348 and northern portion of Lot 349, lots in the area will be connected to deep sewer. On the balance of Lot 348, Special Residential lots with a minimum lot size of 2000m^2 are proposed and will be serviced with on-site effluent disposal systems. Wastewater disposal will be the responsibility of individual owners who will be required to install on-site disposal systems approved by Council and the Health Department.

14.3 Water Supply

It is proposed that all lots will be connected to a reticulated water supply. Currently there is limited supply to accommodate further development in Denmark. The Water Corporation anticipates that additional supply will be made available by 2010. Planning Unit C will play an important role in facilitating the upgrade of Denmark's water supply by providing a water storage tank site in the northwest corner of Lot 348. While the more elevated lots will require a booster pump, the facility will service the structure plan area as well as other areas in the locality.

14.4 Other Services

Electricity supply will be located underground, both within the road reserve and where connection is made to the individual lots. As noted in Section 9 above, there is currently a lack of capacity to accommodate further development in Denmark. This issue will need to be addressed by Western Power in order for subdivision to occur.

Telecommunications services are available and will be extended to service the proposed subdivision. Single trenching will be encouraged.

The site is within 1.2 kilometres of the Denmark town centre. Existing community amenities including schools, library, medical services, sporting and recreation facilities are available in Denmark.

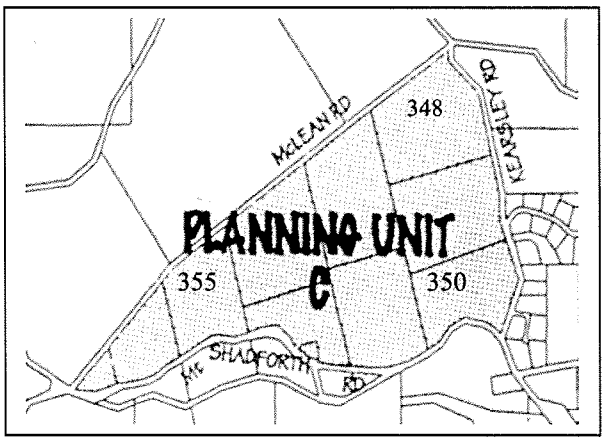
15. CONCLUSION

As required by recommendations contained with the Settlement Strategy for Denmark, this Local Structure Plan addresses a number of key issues to ensure co-ordinated development occurs within Planning Unit C. With only three lots in the planning unit, two of which are owned by the same landowner, co-ordination is relatively straight forward and each landowner can proceed independently of the other.

APPENDIX A

Shire of Denmark
Town Planning Scheme Policy No. 28
'A Settlement Strategy for Denmark'
Adopted by Council 22 December 1998
Planning Unit C

Planning Unit C



- 99 hectares
- 10 Ownerships
- 1.2 km north-west of town centre

Natural Features

- Slopes vary between 2.5 to 8% toward the north and 15 to 30% over much of the ridge flank to the south.
- The site is partially cleared with significant stands of karri remaining.
- The bulk of the vegetation comprises remnant, tall Karri forest with a generally good understorey condition.
- Some pines have been planted midway along the northern boundary.
- Comprises primary ridge wall with excellent views available over rural land to an adjacent ridge, the Denmark town centre, Wilson Inlet and Nullaki Peninsula.
- Site is visually exposed to Mt Shadforth Road and Unit D, although roadside vegetation provides some screening.
- Western portions are exposed to the Denmark townsite.

Land Use/Surrounding Uses

- The site is currently utilised for hobby farming, rural retreat purposes and includes a conservation reserve.
- Surrounding landuse includes rural, special rural and forest to the north, small rural lots including fruit trees to the south, Unit B to the east with rural (grazing) and tourist development to the west.
- Abuts Unit D

Land Capability on-site Disposal

- Comprises Kb Keystone soil unit.
- Overall medium capability.

Servicing Opportunities/Constraints

- site falls steeply to the south into the Millar Creek Catchment.
- existing sewer is approximately 750 metres to the east of this area.
- cost of extending the sewer a major constraint.
- new high level reservoir required to provide reticulated water.

Planning Issues

- fire protection requires detailed assessment given the extent of vegetation cover and steep slopes on the ridge flank.
- site may support a mix of special rural and special residential development, subject to viability of providing reticulated water, fire protection, visual impacts and retention of remnant vegetation.
- visual impact of development must be addressed.
- further development provides an opportunity for significant remnant vegetation to be protected by inclusion in public open space.
- planning needs to be coordinated with Unit B, particularly with regard to vehicular access and fire protection.
- development needs to be screened from Mt Shadforth Road.
- drainage to be managed on site with appropriately located sediment basins.
- access to Mt Shadforth Road to be restricted.
- potential yield – 75 unsewered lots

Planning Unit C Planning Recommendations/Policy

- Prior to further development/zoning, a local structure plan be prepared which provides for special residential/special rural development and addresses the following issues:

  - land capability assessment
  - visual impact
  - retention and protection of remnant vegetation
  - stormwater management
  - POS provision
  - fire protection
  - coordination of vehicular access and fire protection with Units A & B
  - screen development and restrict access to Mt Shadforth Road.

APPENDIX B

Soil Survey Report

Casuarina Forest Services

Plantation Establishment And Tending

Broadacre Spraying Licence No. 645
ABN 54 261 562 373

P.O. Box 305,
Manjimup
Western Australia.
6258

Telephone 097 712130
Facsimile 097 712130
Mobile 0418 688544

BACKSHALL, PLOUGHMAN & MENZIES. DENMARK.

On 12th September 2005 a soil survey was carried out over 3 locations off Mount Shadforth Road, Denmark. The aim was to establish broad soil types, map any areas of heavy or sheet rock and identify areas of poor drainage or severe waterlogging. Basic descriptions of soil profiles were made from interpretation of augered samples obtained using a small trailer mounted drilling rig. Where possible holes were drilled to 2.1m and samples collected every 0.5m. These were logged and described for colour, texture, structure and the presence of rock. Notes were made on soil moisture and drainage.

There are three locations involved in this survey. They extend from the ridgetop on Lot 348 at the 170m ABSL contour line in the north, south through Lot 349 to the lower slopes of the ridge and the 45m contour line in the south east corner of Lot 350. This large, well defined ridge forms part of the Keystone (brown) landform unit and the soils found here are typical to this unit and similar hills around Denmark. Near the ridgetop there are scattered small outcrops of granite with localized areas of heavy clays and lightly weathered granitic profiles. These are very localized and away from the granite outcrops are well drained, gravelly duplex soils which extend over most of the upper and midslopes. These soils extend downhill to the 130m contour line. From the 130m contour to the 80m contour is an area of heavy sheet laterite. This generally occurs at depths from 500mm to 700mm and from excavations in the area could be up to 2.0m thick. South and downslope of this shelf of rock well drained duplex soils continue until the lower slopes of the ridge around the 60m contour. Soils are sandier in this area and sandy loams and sandy clay loams extend to 1.7m over the clay base. At the time of the survey soils from 700mm to 1700mm were wet. This area is in a water gaining situation on the lower slopes or in a minor gully in the south east of Lot 350 and hence water off the hillside tends to collect in this area. Although it is wet at present there is still some slope and these soils will drain early in the spring.

The 4 soil types that have been identified and mapped are:

1. Gravelly Duplex Soils- These are found over most of the ridgetop and where there is not a cemented lateritic layer they also extend downslope onto the lower slope region. This soil type includes small granite outcrops and localized heavier clays associated with the granites. These occur mainly on the ridgetop and at the break of slope near the ridgetop on Lot 348. This soil type is part of the Keystone (brown) landform unit and it typically has a gravelly loamy sand between 500mm and 700mm deep over reddish yellow light clays. These are well structured and well drained. Red and yellow mottles are common. There can be areas with scattered lateritic boulders on the margins of the sheet laterite area but these are loose rocks and do not form a sheet or impeding layer.

2. Sheet laterite- This area occurs in the midslope of the ridge mainly in Lot 349 and in the south east corner of Lot 348. Extremely heavy laterite occurs under gravels at a depth of 500mm to 700mm. This rock layer is up to 2.0m thick in places but is more broken near the edges. Under the rock, at depths from 1.5m to 2.0m+ are the same reddish yellow clays as in Soil Type 1.

3. Sandy Duplex Soils- These soils occur low in the landscape on Lot 350. They are in watergaining situations with gentle slopes to the south. A horizons are reddish brown sandy loams extending to 700mm over yellow sandy clay loams or clay loams. These are around 1.0m thick and at the time of the

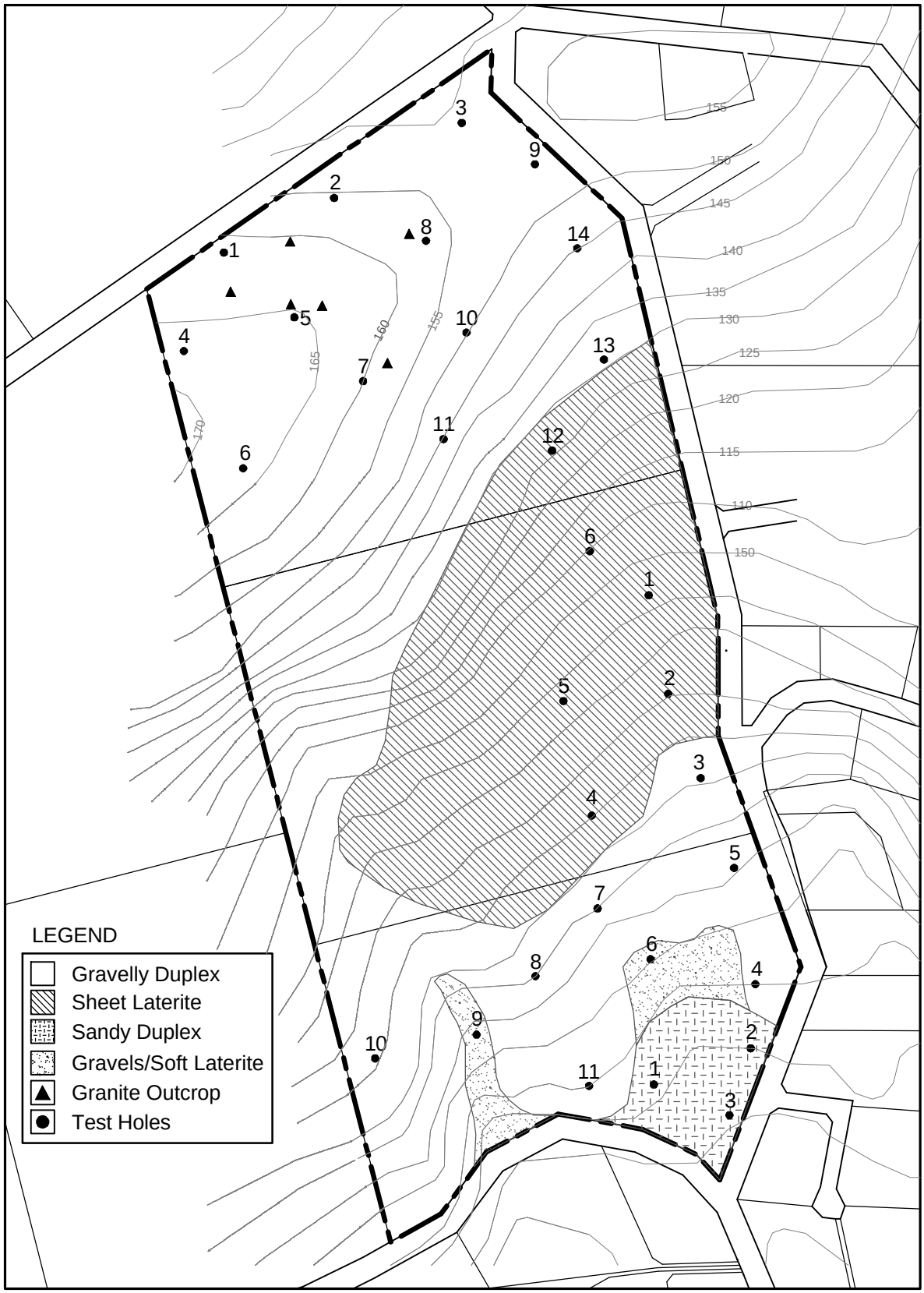
survey were very wet. Below 1.7m are reddish brown or grey, light medium clays. These have reasonable structure and can contain some lateritic gravel. They are moist but not wet.

4. Gravels/Soft laterite- This small soil type was identified in a small gully in the south of Lot 350 and in an area just above the sandy duplex soils of Soil Type 3. Both areas are in a water gaining situation and because they are freely draining gravels and soft laterite these areas are draining the water from the midslopes to the lower slopes. Both sample holes filled with water to 1.5m from the surface after drilling. Because of the free draining nature of the soils these areas will dry relatively quickly after rain events.

Duncan Brown

26th September 2005

ALL AREAS AND DIMENSIONS ARE SUBJECT TO SURVEY



SOIL MAPPING
Lots 348, 349, 350
McLean, Kearsley and Mt Shadforth Road
Shire of Denmark

Ayton Taylor Burrell
Consultants in Urban & Regional Planning
11 Duke St, Albany, Western Australia 6330
Phone: (08) 9842 2304 Fax: (08) 9842 1340

SCALE
1:5000
ORIG A4
05-43-16.WR.

Property BACKSHALL Date 12/9/05

Hole No 1 Eastings- 531101 Northings- 6132628 Salt Samples-

Landscape Features- Ridgetop

Native Vegetation- Mixed Kanuka Aspect & Slope-

Rock Type & Occurrence- granite floaters

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments
1200	Olive	HC	Massive			
1700	Red	HC				R, Olive, Y Mottles
2100+	Grey	HC				

Comments- Weathered granites

Hole No 2 Eastings- 531199 Northings- 6132685 Salt Samples-

Landscape Features- upperslope

Native Vegetation- Kanuka Aspect & Slope- 2°

Rock Type & Occurrence- very occasional granite boulders.

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments
700	Fine gravel -		90%			
1700	YR	LMC	Mod			Fine Y Mottles
2100+	Red	HC	Mod			W Mottles

Comments-

Hole No 3 Eastings- 531299 Northings- 6132756 Salt Samples-

Landscape Features- upperslope

Native Vegetation- Kanuka Aspect & Slope- 1°

Rock Type & Occurrence- Nil.

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments
200	B	LS				
800	Red	LMC	Mod			
2100+	Yellow	HC+ CL+V	Mod.			

Comments- Soft. Well drained

Property BACKSHALL Date 12/9/05

Hole No. 4 Eastings- 531070 Northings- 6132545 Salt Samples-

Landscape Features- Ridgetop

Native Vegetation- Kauri / Manuka Aspect & Slope- 1°.

Rock Type & Occurrence- /

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments
500	B	90%	Fine	gravel.		
1300	GY	LE	Occ	gravel.		
2100+	MB	LE	Mod.			Occ OG mottles

Comments-

Hole No. 5 Eastings- 531165 Northings- 6132578 Salt Samples-

Landscape Features- Ridgetop

Native Vegetation- Kauri Aspect & Slope- Flat

Rock Type & Occurrence- Occ granite in area

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments
200	dB	SL				
1700	Red	ME	Mod		Soft	
2100+	MY	LE	Weak	occ fab	-	

Comments-

Hole No. 6 Eastings- 531105 Northings- 6132480 Salt Samples-

Landscape Features- Ridgetop.

Native Vegetation- Kauri Tinigle Aspect & Slope- 1°.

Rock Type & Occurrence- Pic

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments
600	dB	CL	light	gravel.		
2100+	MY	LE	Mod			R,Y Mottles

Comments- Well drained.

Property BACKSHALL Date 12/9/05

Hole No. 7 Eastings- 531216 Northings- 6132540 Salt Samples-

Landscape Features- upperslope

Native Vegetation- Kanuka Aspect & Slope- 2°.

Rock Type & Occurrence- /

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments
600	dGB	SL	90/0	fine gravel		
2100+	rY5	LMC				fine grained.

Comments-

Hole No. 8 Eastings- 531278 Northings- 6132642 Salt Samples-

Landscape Features- Midslope

Native Vegetation- Kanuka Aspect & Slope- 2°

Rock Type & Occurrence- Occ granite outcrop.

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments
600	dGB		90/0 fine	gravel		
2100+	rY5	LC				fine R.Y Rottles

Comments-

Hole No. 9 Eastings- 531359 Northings- 6132715 Salt Samples-

Landscape Features- upperslope

Native Vegetation- Kanuka Aspect & Slope- 2°

Rock Type & Occurrence- Nil

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments
600	B	SL	light	gravel		
1200	Y	LC-	Mod			
2100+	P7	LC-	-			rB Rottles

Comments- Soft & well drained

Property BACKSHALL Date 12/9/05

Hole No. 10 Eastings- 531302 Northings- 6132574 Salt Samples-

Landscape Features- Upperslope

Native Vegetation- Kauri. Aspect & Slope- 3°

Rock Type & Occurrence- Nic.

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments
700	dgB	LS	80/0	fine gravel		
1300	~Y	LC+	Mod			Y Mottles
1400+	RG	LC	Mod			wk Mottles

Comments- Subt - well drained

Hole No. 11 Eastings- 531288 Northings- 6132483 Salt Samples-

Landscape Features- upperslope ↓

Native Vegetation- Kauri Aspect & Slope- 4°

Rock Type & Occurrence- Nic

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments
600	dgB	LS	80/0	gravel		
1200	RB	LC	Mod			Y Mottles
2100+	Red	LC+	Mod			Occ Y Mottles

Comments-

Hole No. 12 Eastings- 531385 Northings- 6132478 Salt Samples-

Landscape Features- Midslope.

Native Vegetation- K, Tingle Aspect & Slope- 3°

Rock Type & Occurrence- /

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments
	500 - 700mm	over	laterite			

Comments-

Property BACKSHALL Date 12/9/05

Hole No. 13 Eastings- 531484 Northings- 6132686 Salt Samples-

Landscape Features- Midslope

Native Vegetation- K, Tingle Aspect & Slope-

Rock Type & Occurrence- Occ latenite

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments
600	dgB	LS	20%	gravel.		
1500	Brown latenite					

Comments-

Hole No. 14 Eastings- 531408 Northings- 6132645 Salt Samples-

Landscape Features- Midslope

Native Vegetation- Aspect & Slope-

Rock Type & Occurrence-

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments
1200	Light Red	LS	60%	gravel		
2100		LMC	Mod			Occ w/ Flatties

Comments-

Hole No. Eastings- Northings- Salt Samples-

Landscape Features-

Native Vegetation- Aspect & Slope-

Rock Type & Occurrence-

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments

Comments-

Property PLOUGHMAN Date 12/9/05

Hole No. 1 Eastings- 531469 Northings- 6131955 Salt Samples-

Landscape Features- Lower Slope.

Native Vegetation- Aspect & Slope-

Rock Type & Occurrence-

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments
700	rB	SL				
1200	rY	SCL-	Massive			Wet.
1700	Y	LE-				
2100+	Blg	LME	Mod	Occ gravel		rB Mottles.

Comments-

Hole No. 2 Eastings- 531546 Northings- 6131977 Salt Samples-

Landscape Features- Lower Slope

Native Vegetation- Aspect & Slope-

Rock Type & Occurrence-

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments
700	rB	SL				
1200	rY	SCL-				Wet
1800	Y	CL-		Occ gravel		Wet.
2100+	rB	ME	Mod			Y Mottles.

Comments-

Hole No. 3 Eastings- 531524 Northings- 6131926 Salt Samples-

Landscape Features- base of hill

Native Vegetation- Aspect & Slope-

Rock Type & Occurrence-

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments
700	rB	SL		Occ gravel		
1800	Y	SCL-				Wet
2100	rB	LME	Weak	laterite		

Comments-

Property PLOUGHMAN Date 12/9/05

Hole No. 4 Eastings- 531546 Northings- 6132036 Salt Samples-

Landscape Features- Midslope ↓.

Native Vegetation- Aspect & Slope-

Rock Type & Occurrence-

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments
700	LB	LS		Occ gravel		
1100	Broken laterite					
2100+	RB	MC		Occ gravel		Y Mottles

Comments-

Hole No. 5 Eastings- 531526 Northings- 6132135 Salt Samples-

Landscape Features- Midslope. Level with dam.

Native Vegetation- Aspect & Slope-

Rock Type & Occurrence-

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments
700	RB	SL		Occ gravel		Wet
1200	Broken laterite					
1700	LB	MC		Occ gravel		
2100+	LG	MC				RB Mottles.

Comments-

Hole No. 6 Eastings- 531456 Northings- 6132048 Salt Samples-

Landscape Features- Midslope ↓

Native Vegetation- Aspect & Slope-

Rock Type & Occurrence-

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments
200	LB	LS				
1700	RY	LC	Massive	Gravel.		
2100	Salt laterite					

Comments- Water in hole.

Property Plouchman Date 12/9/05

Hole No. 7 Eastings- 531420 Northings- 6132099 Salt Samples-

Landscape Features- Midslope - W

Native Vegetation- Aspect & Slope- 3°

Rock Type & Occurrence-

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments
900	B	LS	Moderate	gravel	Soft	Occ boulders
2100+	PY	LE	Moderate			Occ rB Mottles

Comments- Well drained clays 900+.

Hole No. 8 Eastings- 531362 Northings- 6132034 Salt Samples-

Landscape Features- Midslope -

Native Vegetation- Aspect & Slope- 30

Rock Type & Occurrence- laterite boulders to 0.7m

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments
1100	B	LS	60%	gravel - heavier		700-1.1m
2100+	PY	LE	Mod			Occ rB Mottles

Comments- Well drained clays 1.1m+

Hole No. 9 Eastings- 531306 Northings- 6131981 Salt Samples-

Landscape Features- Minor gully - Midslope

Native Vegetation- Aspect & Slope- 3°

Rock Type & Occurrence- Occ gravel.

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments
700	rB	SL	Occ gravel			
2100+	rB	SL	gravelly			Wet

Comments- Water in hole

Property ROUGHMAN Date 12/9/05

Hole No. 10 Eastings- 531237 Northings- 6131964 Salt Samples-

Landscape Features- upperslope

Native Vegetation- Aspect & Slope- ~4°

Rock Type & Occurrence- Very occasional lot boulders.

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments
700	PY	SL	Occ gravel			
1300	Red	LMC	Mod	Occ grav	Occ	Y Mottles
1700	White	MHC	Mod			rb Mottles
2100+	Yellow	LMC	Mod			RB-W Mottles

Comments-

Hole No. 11. Eastings- 531410 Northings- 6131949 Salt Samples-

Landscape Features- lowerslope

Native Vegetation- Aspect & Slope- 2°.

Rock Type & Occurrence- Occ large laterite boulder

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments
700	B	SL	light	gravel		Wet.
1300	Yellow	LC	Mod			
2100+	PY	LC-	Mod			Occ Y Mottle

Comments-

Hole No. Eastings- Northings- Salt Samples-

Landscape Features-

Native Vegetation- Aspect & Slope-

Rock Type & Occurrence-

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments

Comments-

Property MENZIES Date 12/9/05

Hole No. 1 Eastings- 531456 Northings- 6132365 Salt Samples-

Landscape Features- M.dslope

Native Vegetation- K/T Aspect & Slope- 3°

Rock Type & Occurrence- /

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments
500	gravel					
1700	broken laterite	S	soft	laterite		
2100+	Rock	LMC	Mod			w Mottles.

Comments-

Hole No. 2 Eastings- 531469 Northings- 6132279 Salt Samples-

Landscape Features- M.dslope

Native Vegetation- K Aspect & Slope-

Rock Type & Occurrence- /

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments
500	laterite					
	2 holes					

Comments-

Hole No. 3 Eastings- 531498 Northings- 6132206 Salt Samples-

Landscape Features-

Native Vegetation- Aspect & Slope-

Rock Type & Occurrence-

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments
600	Yellow brown	S				
1700	Lyb	LS	80%	gravel		wet
2100+	LBg	LMC	Mod	Occ gravel		Occ R, Y Mottles

Comments-

Property MENZIES Date 12/9/05

Hole No. 4 Eastings- 531414 Northings- 6132176 Salt Samples-

Landscape Features- M.dslope

Native Vegetation- Karri Aspect & Slope-

Rock Type & Occurrence- Occ laterite boulder

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments
1000	gravel					
#	laterite					

Comments-

Hole No. 5 Eastings- 531387 Northings- 6132271 Salt Samples-

Landscape Features- M.dslope.

Native Vegetation- Aspect & Slope-

Rock Type & Occurrence- Occ laterite boulder.

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments
300						
#	laterite					

Comments-

Hole No. 6 Eastings- 531407 Northings- 6132391 Salt Samples-

Landscape Features- M.dslope.

Native Vegetation- Aspect & Slope-

Rock Type & Occurrence- Occ laterite boulder.

Pasture- Nutrition- Drainage-

Depth	Colour	Texture	Structure	Fragments	Hardness	Comments
500						
#	Laterite.					

Comments-

APPENDIX C

Vegetation Assessment

VEGETATION ASSESSMENT

KEARSLEY ROAD LOCAL STRUCTURE PLAN

Vegetation Assessment, Kearsley Road.

The majority of the vegetation has been cleared on Lots 348 and 350, as shown on the Site Characteristics and Constraints Plan. The western portion of Lot 349 has a significant area of remnant vegetation in a good to excellent condition. It also abuts reserve A35621 to the west which is set aside for "Conservation of Flora & Fauna".

Vegetation on the site has been broadly described in previous studies (Table 1).

Table 1: Vegetation types from previous studies

Source	Vegetation Unit	Comment
Native Vegetation Information System – Department of the Environment, Water, Heritage and the Arts	Eucalyptus Open Forest	This source contains vegetation mapped on a very broad scale and requires ground truthing at the local level
Vegetation Survey of the Albany Hinterland – Connell and ATA Environmental (2001)	Eucalyptus diversicolor Tall Forest A – Tall Eucalyptus diversicolor forest at elevations between 90 and 300m.	This study was mapped at a regional scale and requires ground truthing at the local level.
Landforms and Soils of the South Coast and Hinterland-Churchwood et. Al. (1988)	Karri-Tingle-Marri Forest	This study was mapped using air photos, and field surveys at a scale of 1:100,000
Vegetation of the Albany/Mt Barker Area-Beard (1979)	Tall Forest – Karri (Eucalyptus diversicolor)	Map unit No. 80100426. Vegetation Type No. 694

A site assessment was carried out in January 2008 by Coffey Environments. The vegetation can broadly be described as Karri-Tingle-Marri Forest.

The vegetation inspected comprises Eucalypt Open Forest (as per Department of the Environment and Water Resources, 2007) and is dominated by Eucalyptus diversicolor (Karri), E. quilfoylei (Yellow Tingle), Corymbia calophyla (Marri) and Allocasuarina decussate (Karri She-oak). The understorey is made up of Trymalium floribundum (Karri Hazel), Acacia pentadenia (Karri Whattle), Leucopogon verticillatus (Tassel Flower), Chorilaena quercifolis (Chorilaena), Lepidosperma effusum (Sword-sedge) and Pteridium esculentum (Bracken). The Karri trees are distributed fairly evenly across the assessment area, with larger trees predominantly in the southern half of the vegetation and on the pasture/vegetation interface. Yellow Tingle was most common in the northern third of the vegetation.

The condition of the vegetation ranges from 'Good' to 'Excellent' as described in Table 2 below. It is 'Good' on the forest/pasture interface (to approximately 30m into the vegetation) as there are non native pasture species such as grasses which have invaded the area. There has also been removal of understorey for fuel reduction to protect nearby dwellings. Further away from disturbing activities, the vegetation is in 'Excellent' condition and displays the attributes of vegetation that has gone for a long period without being burnt (sparse understorey with fairly high fuel loading).

Table 2: Definition of Vegetation Condition Scale Condition scale used in BUSH FOREVER VOL 2, From Keighery BJ (1994)	
Pristine (1)	Pristine or nearly so, no obvious signs of disturbance.
Excellent (2)	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good (3)	Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good (4)	Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure of ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded (5)	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded (6)	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

Reference: *Keighery, BJ (1994) Bushland Plant Survey. A Guide to Plant Community Survey for the Community. Wildflower Society of WA (inc), Nedlands, Western Australia.*

More isolated pockets of remnant vegetation are located within the unconstructed section of Kearsley Road and immediately abutting the western boundary of the road reserve. While the understorey associated with these remnants is degraded, there is an opportunity to conserve the more significant trees.

APPENDIX D

Fire Protection Report

ICS GROUP

Risk Management
Community Safety
Wildfire Protection
Project Management

Fire Protection

Lots 348, 349 & 350 Kearsley Road

Shire of Denmark

9 March 2010

Fire Protection

Lots 348, 349 & 350 Kearsley Road

Shire of Denmark

9 March 2010

Contact details

ICS Group
111 Mira Flores Avenue, Porongurup, Western Australia 6324
Telephone: (+61 8) 9853 2171
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Disclaimer

Representations, statements, opinions and advice expressed or implied in this document are based on information contained in Planning for Bush Fire Protection (FESA & WAPC, 2001), the draft standard for the Construction of buildings in bushfire-prone areas (Revision of AS3959-1999) DR 05060-2005, the Australian Standard for the Construction of buildings in bushfire-prone areas (AS3959-2009), advice provided by Shire of Denmark staff, and field inspections undertaken in September and October 2008.

Any representation, statement, opinion, or advice expressed or implied in this document is made in good faith, and on the basis that the ICS Group is not liable for any damage or losses whatsoever which may occur as a result of action taken or not taken (as the case may be) in respect of any representation, statement, opinion or advice referred to herein.

ICS Group

ICS Group specialises in risk and emergency management, wildfire protection and community safety. It provides consultancy services in fire preparedness and response planning, wildfire investigation, wildfire behaviour research and fire impact assessment.

Klaus Braun

Klaus Braun, the principal of ICS Group, has completed wildfire risk management and wildfire behaviour projects for State and Local Governments, as well as for corporate clients within the plantation and insurance industry. He assisted with the Council of Australian Governments National Inquiry on Bushfire Mitigation and Management (COAG, 2004), and conducted research in wildfire behaviour and impact in blue gum plantations in Australia and Portugal.

Klaus Braun presented papers on wildfire risk management at State, National and International conferences.

Prior to forming the ICS Group, Klaus has worked as Manager Wildfire Prevention and Environment Branch, Operations Manager, Regional Fire Safety Officer with the Bush Fire Service and the Fire and Emergency Services Authority of Western Australia. During this time he coordinated a number of major fire operations, developed the framework for wildfire mitigation planning in Western Australia, and undertook wildfire investigations.

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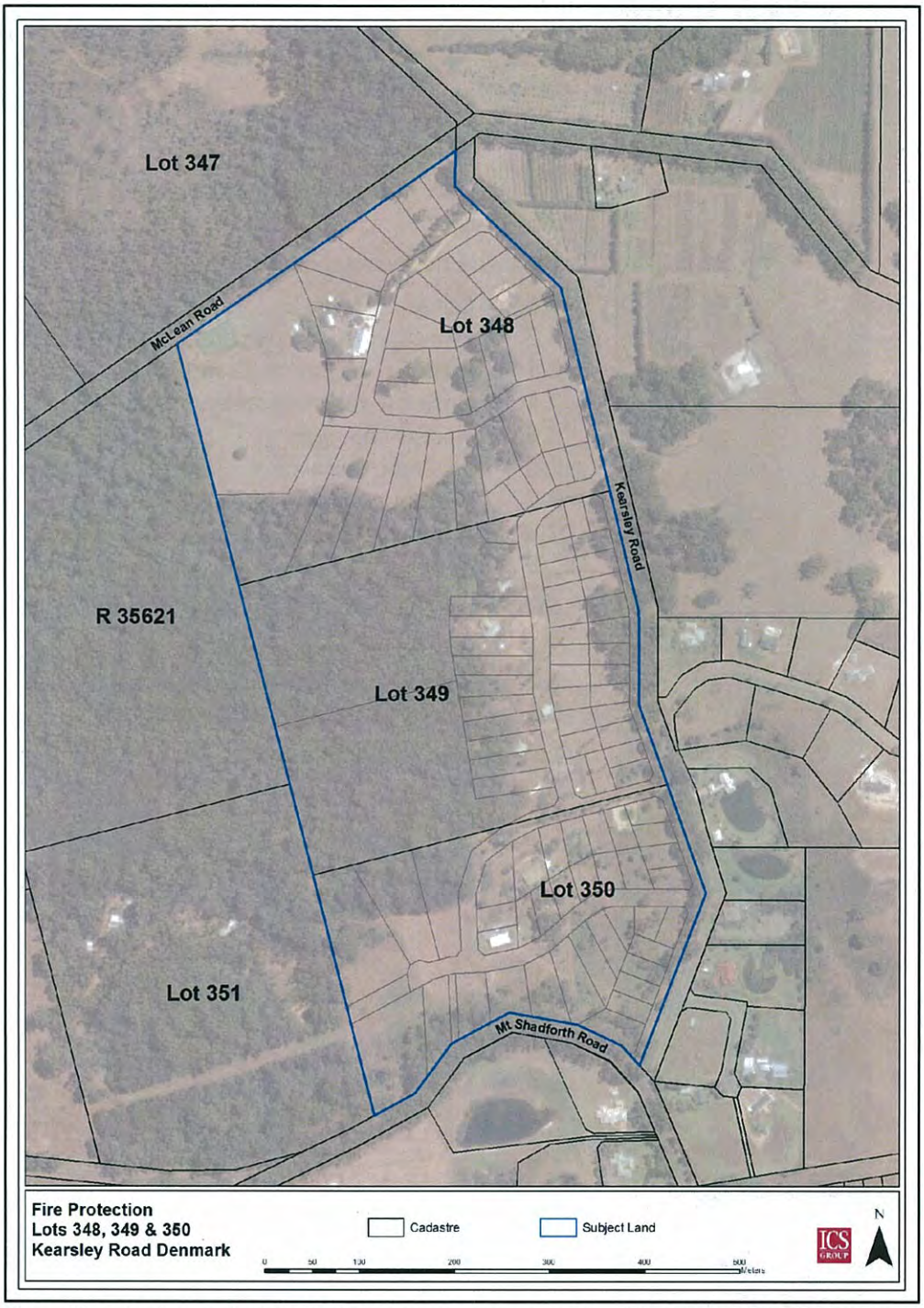
1 Introduction

1.1 Location

The proposed development is located approximately 1.5km north of the centre of the Denmark townsite. Access to the proposed development is via Kearsley Road, which connects to Mt Shadforth Road.



Above: Map showing the design of the proposed development on lots 348, 349 and 350. The structure plan for this development was prepared by Ayton Baesjou Planning.

1.2 Background information

Lots 348, 349 & 350 were zoned rural. As part of the development of the area the zoning will change from rural to special residential and residential. A local structure plan and subdivision guide plan for the proposed development were prepared by Ayton Baesjou Planning, Consultants in Urban & Regional Planning.

Site inspections were undertaken by ICS Group in September and October 2008.

1.3 Scope

This document addresses bush fire protection for lots 348, 349 & 350. It is based on requirements listed in *Planning for Bush Fire Protection* (FESA & WAPC, 2001) as well as on advice provided by the Shire of Denmark.

The fire protection document is based on the local structure and subdivision guide plans developed by Ayton Baesjou Planning. The document should be read in conjunction with the reports for the local structure and subdivision guide plans, which were also prepared by Ayton Baesjou Planning.

2 Bush fire protection

2.1 General

The preparedness and behaviour of residents before, during and after a bush fire forms an important part of bush fire risk management. This includes aspects such as being well informed about bush fire risk and risk management, leaving well before an area is affected by a bushfire or actively protecting a building, back-up water supply to deal with small spot fires, vegetation management, the maintenance of a house and its surrounds, wearing appropriate protective clothing and whether residents have prepared a suitable plan for bush fires. Building design and construction, as well as development design, contribute to bush fire safety. They cannot, however, replace adequate preparedness and the appropriate behaviour of residents in relation to bush fire risk management.

This document addresses subdivision design and building construction requirements in line with fire services, planning and local government requirements. It cannot achieve the preparedness and behaviour of residents after the development has been established. Residents who live in areas which may be exposed to bush fires must, therefore, take some responsibility to manage bush fire risk.

2.2 Fire suppression response

The development is located inside the Gazetted Fire District. The fire station of the Denmark Fire and Rescue Service is less than 2km by road from the centre of the proposed development.

The Mt Shadforth bush fire brigade adjoins the proposed development along McLean Road. The Mt Shadforth fire station is approximately 6km by road from the centre of the proposed development.

These brigades have modern urban and urban-rural appliances. This provides an adequate fire suppression response. It meets the requirements of the Shire of Denmark, Fire Services and *Planning for Bush Fire Protection*.

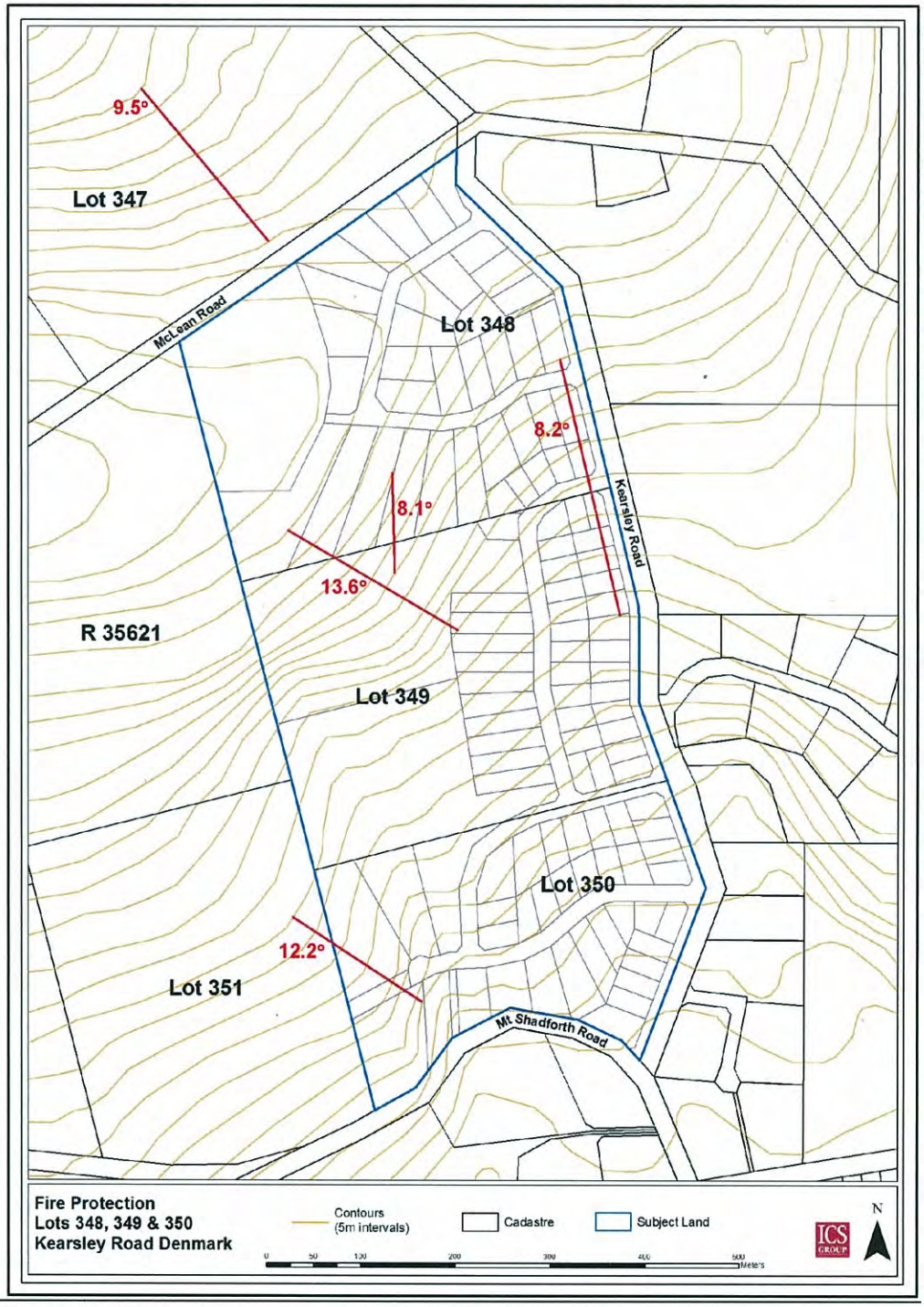
2.3 Bush fire hazard assessment

Slope

Slopes were measured in a number of different parts of the proposed development. Slope measurements are based on 5m contour data.

Slopes vary across the site but are generally below 10°. The slope in the western section of lot 350 is around 12°, but the forested area is upslope of the development. One slope measurement in the southern part of lot 348 was made diagonally rather than at right angles to the contours to provide an indication of the slope between building envelopes and the adjacent forested area.

The slope of the forested land to the north of McLean Road is approximately 10°. The slope of the forested area in the western part of lot 349 is approximately 14°.



Bush fire hazard levels

Vegetation cover varies significantly within the proposed development and on surrounding land. It includes pasture, parkland and forested areas.

Above left: The majority of the proposed development is cleared. These areas have a low to medium hazard level depending on slope.

Above right: Some parkland remains within the pasture. These areas are free of understorey fuels. They have been given a medium bush fire hazard rating.

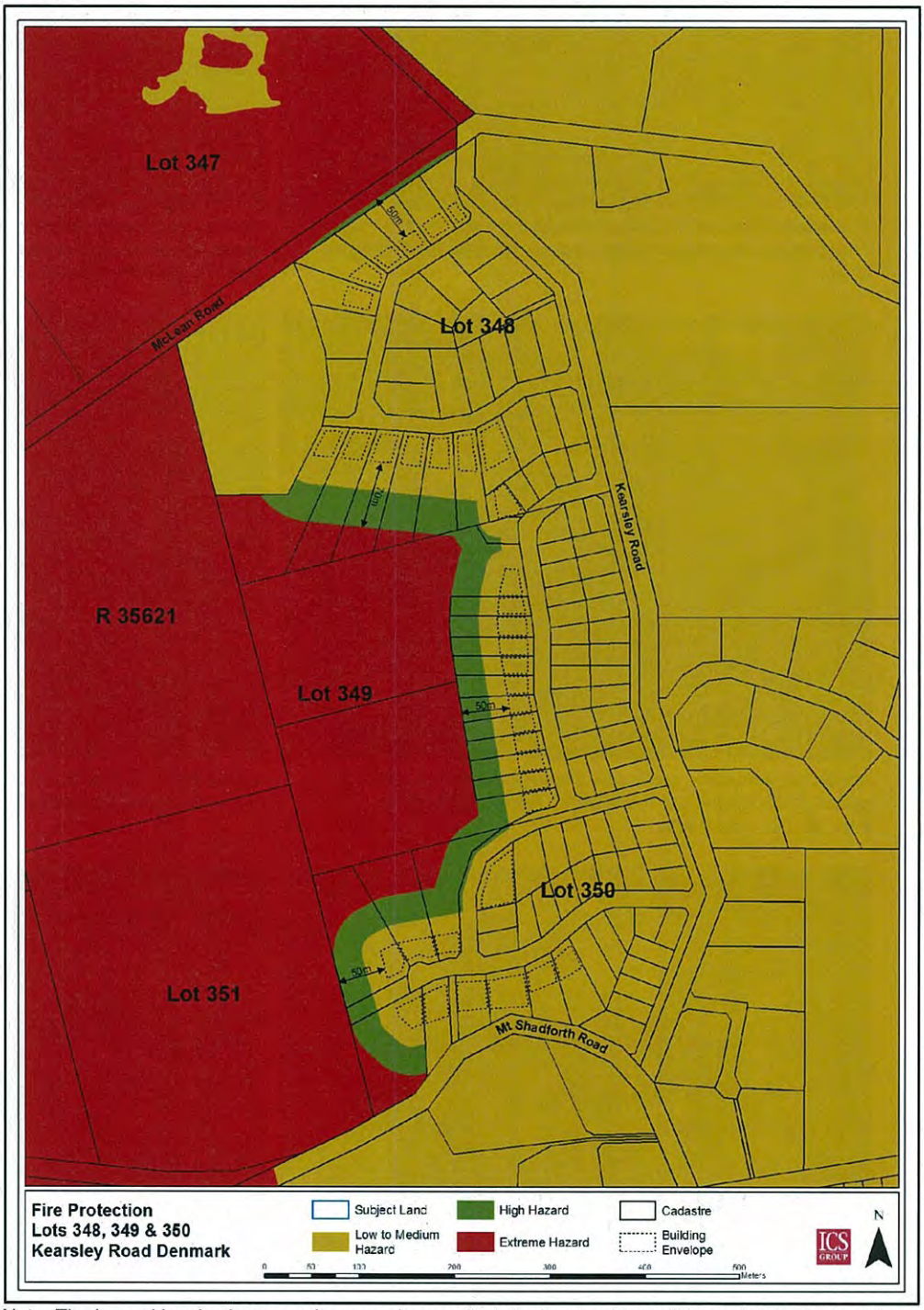
Above left: A building protection zone adjacent to an existing house. Bush fire fuels in these areas are required to be maintained at low levels.

Above right: Vegetation in an unmanaged part of the forested area. Bush fire hazard levels are high to extreme in this area.

Above left and right Vegetation cover to the north of McLean Road. Bush fire hazard levels are currently extreme.

Hazard levels were assigned in accordance with the hazard assessment model provided in *Planning for Bush Fire Protection*. A medium to low hazard level was assigned to grassed areas and to treed areas where bush fire fuels have been significantly reduced, or where they will be maintained in accordance with the requirements for building protection zones. A high hazard level was assigned to areas which will be maintained as hazard separation zones. An extreme hazard level was assigned to forested areas where bush fire fuels may not be managed.

At the time of writing hazard levels in some areas were higher than those shown on the map. Hazard levels in these areas will be reduced as part of the development. Areas where bush fire fuels are not maintained below the threshold values listed in *Planning for Bush Fire Protection* would have an extreme hazard level.



Note: The hazard levels shown on the map above reflect the levels which will be maintained when the development is in place.

2.4 Bush fire hazard management

Building protection zones

Building protection zones must be maintained around all houses in the subdivision. Bush fire fuels within building protection zones must be kept low, in accordance with the requirements listed in *Planning for Bush Fire Protection* (FESA & WAPC, 2001):

- Bush fire fuels must be maintained below 10cm in height.
- Trees and branches which may fall onto a house must be removed.
- Lower branches of the remaining trees must be trimmed.

The extent of a building protection zone depends on the slope of the land between the building and the bush fire hazard. Minimum distances of a building protection zone are:

- 0°-10° 20m;
- 10°-15° 25m; and
- 15°-20° 30m.

Where houses are located downhill from a bush fire hazard, a minimum distance of 20m is required.

In the context of the proposed development this requires that grass fuels across the whole development must be maintained below 10cm in height during the summer months. Where building envelopes are located uphill of forested areas with a slope of approximately 10°, the building protection zone must be maintained to a width of 30m, as shown on the following page.

Bush fire fuels in the building protection zone can be maintained low through slashing/mowing or mulching, but also through prescribed burning.

Hazard separation zones

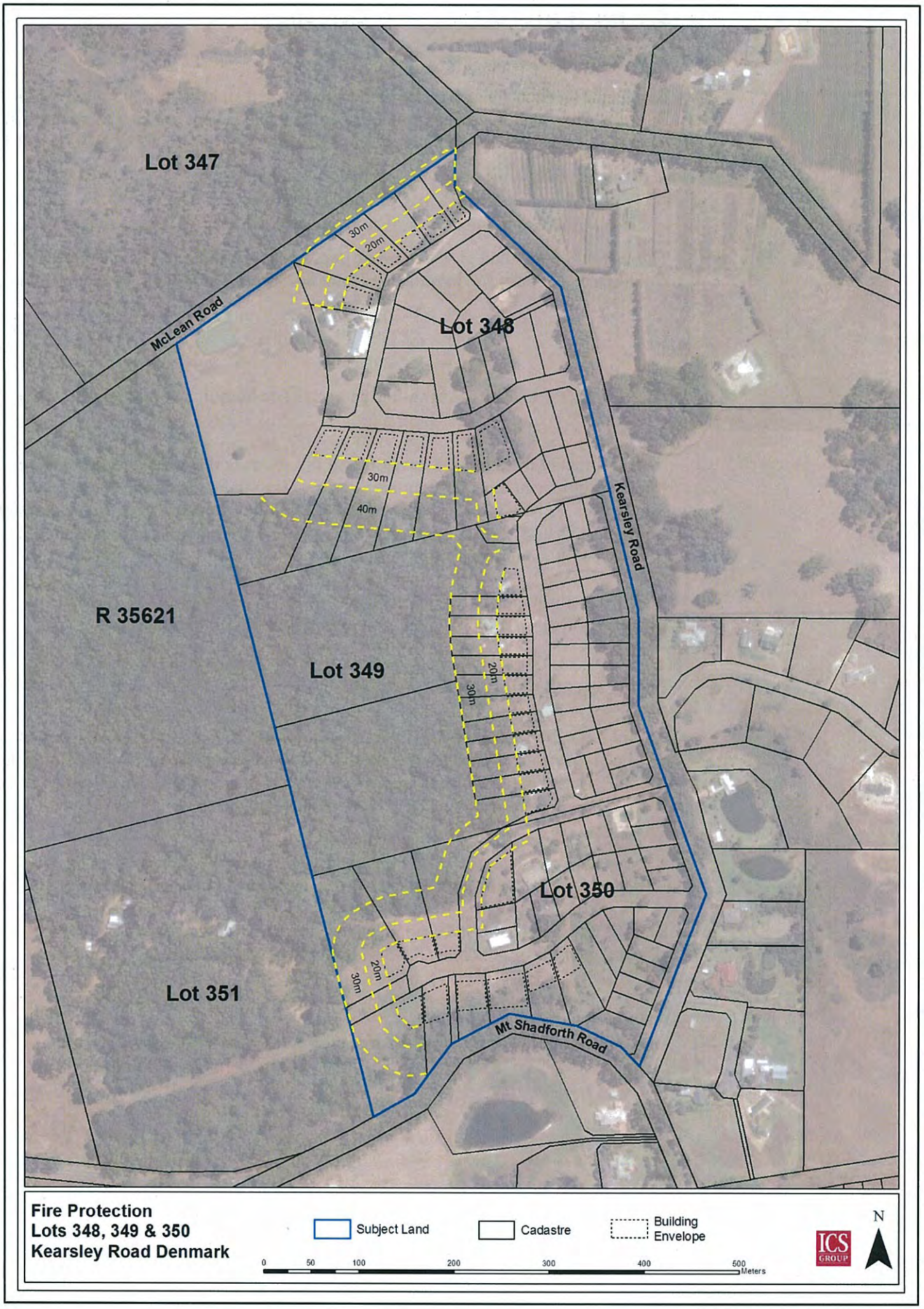
Hazard separation zones must be maintained between building protection zones and areas which may have an extreme level of bush fire hazard (see map on the following page). Hazard separation zones must be maintained in accordance with the requirements of the proposed Denmark Annual Fire Regulation Notice:

- Bush fire fuels must be maintained below 5t/ha.
- Minimum distances for hazard separation zones are 30m on level ground. The distance increases by 10m for every 10° increase in slope.

Bush fire fuels in the hazard separation zone can be maintained low through slashing/mowing or mulching, but also through prescribed burning.

Advisory note:

The Denmark Shire requested that hazard separation zones in line with the above minimum requirements are included in the design of the proposed development.


Lot 347
McLean Road
30m
20m
Lot 348
30m
40m
Kearsley Road
R 35621
Lot 349
20m
30m
Lot 350
20m
30m
Lot 351
Mt Shadforth Road
Fire Protection
Lots 348, 349 & 350
Kearsley Road Denmark
Subject Land
Cadastre
Building Envelope
0 50 100 200 300 400 500 Meters
N
ICS GROUP

Forested areas

Bush fire fuels within the forested areas which are more than 50m and 70m from building envelopes (i.e. outside hazard separation zones) have been assigned an extreme level of bush fire hazard. Bush fire fuels in these areas do not have to be maintained below certain threshold values to achieve an adequate level of protection within the proposed development. Bush fire protection within the proposed development is based on the maintenance of building protection and hazard separation zones and the construction of houses in line with the requirements of the Standard for the Construction of buildings in bushfire-prone areas, AS3959.

It may be appropriate to manage bush fire fuels in the forested areas. This can be achieved through mosaic or patch burning. The management of bush fire fuels in the forested areas is the responsibility of respective landowners. Where burning is used to manage these areas, landowners should liaise closely with and take advice from local fire brigades, Council and the Department of Environment and Conservation.

2.5 Access and egress

Access to the proposed development is via Kearsley Road, which connects to Mt Shadforth Road in the south. The upper part of Kearsley Road is currently not constructed. It will be upgraded as part of this development to form a divided carriageway with a number of linkages across a vegetated medium strip. The carriageway provides two way access and egress for residents and emergency services.

Alternative access or egress is available in the north via Lantzke Road. McLean Road can also provide alternative access/egress. McLean Road is currently not constructed to all-weather 2wd access.

Loop roads and a short cul-de-sac (approx. 50m long) will be constructed to service lots within the proposed development. An emergency access/egress way will also be established to connect the loop road on lot 350 with Mt Shadforth Road.

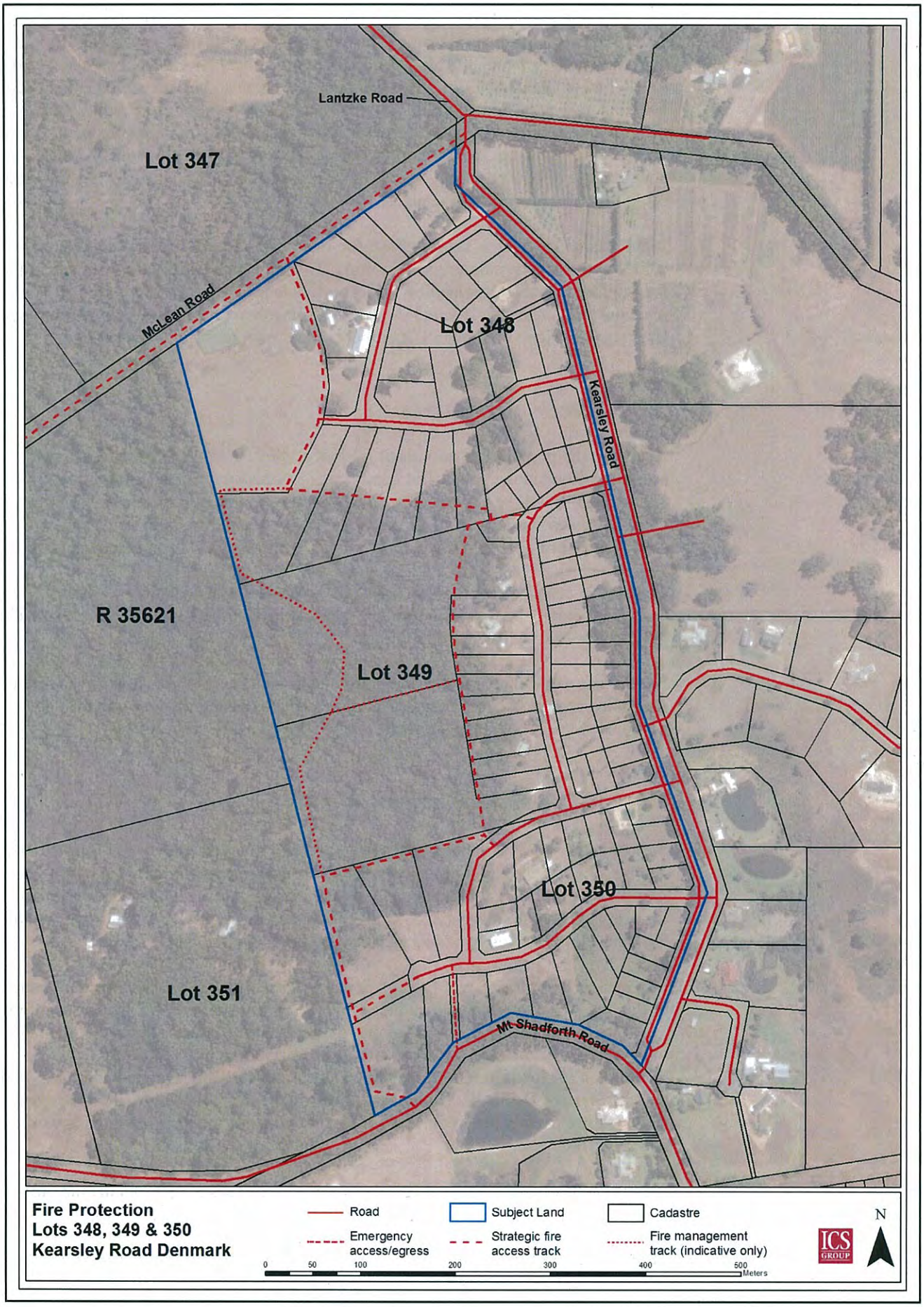
2.6 Strategic fire access

Strategic fire access tracks will be constructed and maintained between forested areas and building envelopes in accordance with the requirements listed in *Planning for Bush Fire Protection*. They will be a minimum of 6m wide, with a hard surface and 4m vertical clearance. Links between strategic fire access tracks and public roads will be established in strategic locations (see map on the following page).

Fire management tracks will be constructed and maintained near the western boundary of the forested area on lot 349 and along the boundary between the two larger forested lots. Please note that the location of the fire management tracks shown on the map is indicative only. The alignment and construction standard of these tracks will be determined in close consultation with the Department of Environment and Conservation and the Shire of Denmark. The track will be suitable for heavy duty fire appliances. A firebreak is currently not in place along the boundary of the reserve which is west of lots 348 & 349.

Gates will be installed where these tracks connect to roads to restrict unauthorised vehicle access. Gates will also be installed where tracks cross fence lines.

Property owners will be responsible for maintaining strategic fire access tracks, the fire management track and gates.


Lantzke Road
Lot 347
McLean Road
Lot 348
Kearsley Road
R 35621
Lot 349
Lot 350
Lot 351
Mt Shadforth Road
Fire Protection
Lots 348, 349 & 350
Kearsley Road Denmark
Road
Subject Land
Cadastre
Emergency access/egress
Strategic fire access track
Fire management track (indicative only)
0 50 100 200 300 400 500
Meters
N
ICS GROUP

2.7 Building construction requirements

For the purpose of the Australian Standard – Construction of buildings in bushfire-prone areas AS3959, the proposed development will be designated as a bushfire-prone area. As a minimum, buildings in this development must meet the requirements of AS3959.

Advisory notes

When the revised Standard for the *Construction of buildings in bushfire-prone areas* (AS3959-2009) was published, Australian fire agencies and the Australasian Fire and Emergency Service Authorities Council (AFAC) released a statement highlighting a number of shortfalls in the newly released standard. The Denmark Shire may, therefore, require that additional fire protection and/or construction measure are applied to the development and to buildings to provide a higher level of protection in the event of a wildfire.

It may be appropriate to apply construction requirements and the site assessment listed in the draft standard for the Construction of buildings in bushfire-prone areas (Revision of AS3959-1999) DR 05060-2005. In some parts the draft revised standard provides higher level performance based solutions for building construction and an improved model for site assessments. It should, however, be noted that the draft standard has a number of shortfalls, in particular in relation to the higher levels of fire attack, where a building is exposed to significant radiant heat loads and/or flame contact, and in relation to the assessment of the level of fire attack on steeper slopes. Nevertheless, it may be appropriate to apply those parts of the draft standard DR 05060 which provide a higher level of construction, until AS3959-2009 has been revised.

The Shire of Denmark and/or the Fire and Emergency Services Authority can provide further information in relation to fire protection and building construction.

Existing buildings

AS3959 cannot be applied retrospectively to an existing building. It is recommended, however, that owners assess the construction standard of the existing buildings with a view to improve the level of construction in line with AS3959 and DR05060.

2.8 Fire hydrants

Fire hydrants will be installed along roads at 200m intervals, in accordance with the requirements listed in *Planning for Bush Fire Protection* (FESA & WAPC, 2001).

2.9 Map

A map and GIS dataset showing final subdivision design, strategic fire access and fire management tracks, and the location of fire hydrants will be prepared and made available to the Shire of Denmark, the Denmark Fire and Rescue Service and the Mt Shadforth Bush Fire Brigade.

3 Summary of fire protection requirements

3.1 Developer's responsibility

Fire hydrants

Install fire hydrants at 200m intervals in accordance with the requirements listed in *Planning for Bush Fire Protection* (FESA & WAPC, 2001).

Strategic fire access

- Construct strategic fire access and emergency access/egress in accordance with the requirements listed in *Planning for Bush Fire Protection* (FESA & WAPC, 2001).
- Construct fire management tracks near the western boundary of lot 349 and along the boundary between the two larger forested lots. The alignment and construction standard of these tracks should be determined in close consultation with the Department of Environment and Conservation and the Shire of Denmark.
- Install gates where strategic fire access crosses fence lines and at access points with roads. Install removable barriers at the ends of the emergency access/egress way.

Map

Provide a map and GIS dataset showing final subdivision design, strategic fire access and the location of fire hydrants to the Shire of Denmark and brigades.

Information to purchasers

Provide a copy of the fire protection document to purchasers of lots.

3.2 Property owner's responsibility

- As a minimum, buildings are to be constructed in accordance with the requirements of the Australian Standard for the Construction of buildings in bushfire-prone areas AS3959. The Denmark Shire may require that additional fire protection and/or construction measure are applied to buildings to provide a higher level of protection in the event of a wildfire (please refer to the advisory note on p11 for further information).
- Building protection zones, a minimum of 20m wide on level ground and 30m wide where slopes are 10°, must be maintained around all houses in the development in accordance with the requirements listed in *Planning for Bush Fire Protection* (FESA & WAPC, 2001).
- Bushfire fuels within hazard separation zones must be maintained below 5t/ha. Hazard separation zones must be a minimum of 30m wide on level ground. The distance increases by 10m for every 10° increase in slope.
- Maintain strategic fire access tracks, the fire management track and install/maintain gates where strategic fire access crosses a fence line and at access points with roads.

3.3 Shire of Denmark's responsibility

- For the purpose of the Australian Standard AS3959 for the Construction of buildings in bushfire-prone areas, declare the development a bushfire-prone area.
- As a minimum, apply the Australian Standard for the *Construction of buildings in bushfire-prone areas* AS3959 to buildings. The level of construction which should be applied to each building should be determined through a specific site assessment as outlined in the standard. Additional fire protection and/or construction measure may be applied to buildings to provide a higher level of protection in the event of a wildfire (please refer to the advisory note on p11 for further information).

4 Information and references

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Standards Australia, 2009. *Living in bushfire-prone areas – A guide to reducing the threat and impact of bushfire attack and an explanation of the basis of AS3959* (HBB 330–2009).

Standards Australia (2009). *Australian Standard – Construction of buildings in bushfire-prone areas* (AS 3959-2009).

Standards Australia, 2005. *DR 05060 Draft for Public Comment – Construction of buildings in bushfire-prone areas (Revision of AS 3959-1999).*

Ramsay, C. & Rudolph, L., 2003. *Landscape and Building Design for Bushfire Areas.* CSIRO Publishing, Collingwood, VIC, Australia.

APPENDIX E

Local Water Management Strategies

APPENDIX E

Local Water Management Strategies

WOOD & GRIEVE ENGINEERS

Lots 348 & 349 Kearsley Road, Denmark
Local Water Management Strategy

for

Robertson Developments
Attention: Graeme Robertson

18 January 2010

Revision 1

Revision List

Rev 1 – 18/01/2010 – Initial Submission

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APPENDIX C SOIL SURVEY REPORT (CASUARINA FOREST SERVICES)
AYTON BAESJOU PLANNING, 2009

1 Summary

In support of the application for amendment of the Shire of Denmark Town Planning Scheme No. 3, for the rezoning of Lots 348 and 349 Kearsley Road, Denmark (Figure 1), we hereby submit this Local Water Management Strategy (LWMS) to the Department of Water for approval.

This Local Water Management Strategy is established by Wood & Grieve Engineers, incorporating our experience in the Great Southern Region and accepted industry best management practices for stormwater treatment and control.

Fundamental design objectives of this Local Water Management Strategy include the following:

- Treatment of stormwater runoff in low flow events
- Detention of stormwater runoff above that occurring in the natural catchment
- Identification and accommodation for flood prevention
- Enhancing coarse sediment removal and nutrient stripping from stormwater
- Encouragement of on-site use and source control of stormwater
- Minimising the potential for erosion and water-logging of downstream areas
- Maintaining or improving groundwater quality

This report refers extensively to previous work that has been undertaken as part of the rezoning process. This plan should be read in conjunction with the following reports:

- Local Structure Plan, Kearsley Road, Denmark (Ayton Taylor Burrell, September 2009)

2 Planning Approval

This LWMS relates to the majority of the land subject to rezoning under the Shire of Denmark Town Planning Scheme No. 3, adding Special Residential Zone No. 13, R10 and R5/10 areas from Lots 348, 349 and 350 Kearsley Road, Denmark (Figures 1 – 3).

The rezoning application was submitted to the Shire of Denmark on 21 October, 2009. A request from the Shire of Denmark was that a Local Water Management Strategy be prepared and approved by the Department of Water, to accompany the rezoning application, before a full assessment could be made.

Figure 2 shows the location of the proposed subdivision in the context of the Denmark TPS. The land is bounded to the south by Mt Shadforth Road, to the east by Kearsley Road, to the west by uncleared conservation reserve (Res A35621) and north by McLean Road.

The proposed subdivision guide plan (Figure 3) was prepared for Lots 348 to 350 Kearsley Rd. The development of Lot 350 is expected to occur in the future, however, this LWMS is prepared for Lots 348 and 349 in isolation from Lot 350. Please note, any proposed layouts shown for Lot 350, shown as figures in this report, may be subject to change.

Figure 3 shows 32 lots to be created from the SRes (13) portion, with minimum size of 2000m^2. 43 lots are proposed for the R10 portion (refer to Section 4.7). A 2.695 ha lot in the northwest (highest portion) of the site is to be ceded to the Water Corporation for future water reticulation infrastructure. Two nominal sites are shown for drainage basins. An internal road network will be established to service all lots, with a reserve width of 18m. The balance of the site remains as conservation reserve.

3 Design Objectives

The fundamental design objectives of this LWMS are in accordance with the Stormwater Management Manual of WA. These objectives include the following:

- Capture and treatment of stormwater in low flow (<1 in 1 year ARI (Average Recurrence Interval)) events, at source
- Conveyance of stormwater (piped and open drains) for 1 > ARI < 5 events to detention basins
- Detention of post-development stormwater for events up to 10 year ARI, above that occurring in the natural catchment
- Conceptual design of flood routes for events <100 year ARI
- Enhancing coarse sediment removal and nutrient stripping from stormwater
- Minimising the potential for erosion and water-logging of downstream areas
- Maintaining or improving groundwater quality
- Maximise reuse of runoff
- Reduce reticulated potable water use

The design objectives are discussed further in later sections of this Local Water Management Strategy. A more detailed Urban Water Management Plan will be prepared as part of the detailed design process, following approval of the rezoning application and issuing of WAPC conditions.

4 Site Characteristics

4.1 Development Location

Lots 348 and 349 Kearsley Road are approximately 12.8 ha and 12.3ha in size, respectively. The land is located approximately 2km northwest of the Denmark townsite (Figure 1). The site is located between Kearsley Road (partially constructed to seal and gravel standard) and McLean Rd (unconstructed), as shown in Figures 1-3. General access to the development is from Kearsley Rd, via Mt Shadforth Rd.

4.2 Land Use

Aerial photos of the broader, local area and of the proposed subdivision are shown in Figures 4 in Figure 5. The land is predominantly cleared of vegetation and has been utilised for hobby farming, rural retreat purposes and tourist accommodation.

4.3 Topography

Figures 3 and 4 depict the elevation across the development site and in the surrounding land. The site is elevated to approximately 165m AHD in the northwest and 150m in the north east, forming a ridge. The majority of the site slopes from the ridge in a south to southeasterly direction to approximately 70m in the south east corner, and 95m in the south west corner of the development. Grades vary from 8% to 15%. The remainder of the site to the north of the ridge slopes in a northeasterly direction to approximately 145m along the northern boundary.

4.4 Soil Types

4.4.1 Soil Units

Soil units for the subject site have been described previously within the Kearsley Rd Local Structure Plan (Ayton Taylor Burrell, 2009). The geotechnical investigation was undertaken by Casuarina Forest Services, in September 2005 to establish broad soil types, map areas of rock and to identify areas of poor drainage and/or waterlogging. Augered samples were obtained using a small trailer mounted drilling rig, with notes made on soil profile, texture, moisture and drainage. A summary map and description of the soil units is shown in Appendix C. The information was used to determine the suitability of the site for long term disposal of effluent.

The majority of Lot 348 consists of a gravelly duplex soil, typically 500mm to 700mm deep, overlaying clay. Both the gravelly soil and the underlying clays are well drained. The (cleared) area tested within Lot 349 encountered predominantly gravel overlaying sheet laterite at 500mm to 700mm. The laterite is generally thick (up to 2.0m) but becomes more broken around the edges of the unit. The laterite overlays the same clay as observed in the gravely duplex soils.

No free groundwater was recorded in the auger holes indicating that most of the site is free-draining. The sheet laterite encountered in Lot 349 is likely to cause seasonal perching of water in the overlying gravel. However, given the moderate slopes across the site and the relatively coarse soil texture, the gravels remain relatively free-draining.

Soil testing in the adjoining Lot 350 also indicated a large area of the gravely duplex soil, trending into a sandy duplex in the lower portion of the lot, where the slope decreases. The surficial sandy loam soils were observed to be wet and prone to waterlogging, indicating a water gaining soil unit.

4.4.2 Soil Permeability

As revealed in the Casuarina Forest Services report, the absence of groundwater over most of the site strongly suggests that the permeability of the upper gravel/sand soil horizon is high. This high permeability, combined with the steep topography across most of the site results in very good site drainage. No permeability testing was performed on the soil

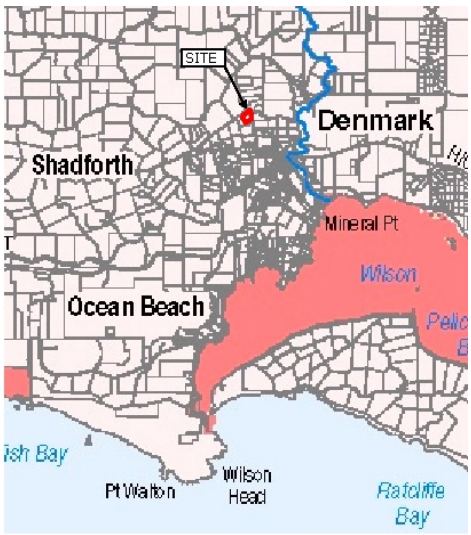
samples but would be undertaken as part of the UWMP during detailed design. The sheet laterite encountered in Lot 349 is expected to be relatively continuous over the mapped area and will prevent most vertical infiltration of groundwater, once encountered.

4.4.3 Phosphorous Retention Index

No PRI testing has been undertaken. .

4.4.4 Acid Sulfate Soils

From the WAPC Planning Bulletin #64 – Acid Sulfate Soils mapping, of the Denmark Walpole area, the site is located well outside of any known risk areas. Due to the location and very elevated nature of the proposed development, it is anticipated that there is no risk of ASS.



4.4.5 Potentially Contaminated Soils

There are no known areas, or likely sources of contamination in the area.

4.5 Surface Water

4.5.1 Catchments

As described in Section 4.3, with the topography, the majority of surface water sheds in a generally south to south easterly direction. A small ill-defined creekline extends into Lot 349, from Lot 350 (Figure 4).

4.5.2 Occurrence of Surface Water

No natural standing bodies of surface water are evident on the site. A dam exists in the northwest corner of Lot 348. As indicated in Figure 3, a large lot (2.695 ha) encompassing the dam is proposed to be ceded to the Water Corporation for future water supply infrastructure. The dam may be utilized by the Water Corporation. Another small dam in Lot 348, shown in Figure 5, has subsequently been filled in.

4.5.3 Surface Water Quality

No surface water quality testing has been undertaken. It is expected that shallow perched groundwater will generally have very low salinity and levels of nitrate and phosphate within allowable water quality guideline limits.

4.5.4 Flooding Potential

The potential of flooding on the site is negligible.

4.6 Groundwater

4.6.1 Occurrence of Groundwater

No groundwater was encountered within Lots 348 and 349 during the geotechnical investigation.

4.6.2 Groundwater Quality

None measured.

4.7 Land Capability

Given the problems associated with utilising on–site effluent disposal systems in the area where heavy sheet laterite occurs, it has been proposed that smaller lots connected to a deep sewer be provided to address this issue. It is expected that reticulated sewer will be made available to the R10 lots, with potential to also service the SRes13 area, in the future.

5 Water Sustainability Initiatives

5.1 Authority Standards and Requirements

Currently accepted Water Sensitive Urban Design principles have been utilised in establishing this management strategy. These principles can be achieved by using Best Management Practices (BMP's) as outlined in various guidelines such as the Department of Water "Stormwater Management Manual for Western Australia" and the Engineers Australia "Australian Runoff Quality – A Guide to Water Sensitive Urban Design".

The conceptual drainage plan presented herein incorporates an internal piped drainage system to manage road and lot stormwater. Raintanks and soakwells will be installed in each lot to provide at source treatment and attenuation of low flows from the impervious areas of the lots. Flow from the piped drainage network would discharge to appropriately placed detention basins, utilising existing site depressions where appropriate, with attenuated flows then discharging to the natural drainage system via available road pathways. Perimeter roads along Kearsley Rd and McLean Rd will have stormwater directed toward pervious, vegetated areas within the road reserve, with the excess water that doesn't infiltrate directed to the detention basins.

5.1.1 Department of Water

The main Department of Water objectives relevant to this rural type of development are:

- Harvesting and/or treatment of stormwater in low flow (<1 in 1 year ARI) events, at source
- Conveyance of stormwater (piped and open drains) for 1 > ARI < 5 events to detention basins
- Conceptual design of flood routes for events up to 100 year ARI
- Enhancing coarse sediment removal and nutrient stripping from stormwater
- Minimising the potential for erosion and water-logging of downstream areas
- Maintaining or improving groundwater quality
- Maintaining or improving groundwater quality

5.1.2 Local Authority

The criteria used in establishing the indicative sizes of the proposed drainage infrastructure under this management plan are in accordance with the Shire of Denmark requirements as stated in the "Guidelines for development and subdivision of land", namely: "New developments are to provide a stormwater drainage system in accordance with the "major/minor" system concept set out in the Australian Rainfall & Runoff manual, i.e., the "major" system shall provide safe, well defined overland flow paths for rare and extreme storm runoff events while the "minor" system shall be capable of carrying and controlling flows from frequent runoff events." Further detail of the Shire requirements are outlined below:

- Piped drains capable of conveying 1 in 5 yr storm events
- Open swale drains and culverts capable of conveying 1 in 10 year post-development discharge;
- Detention basins designed to attenuate the 1 in 10 year post-development storm event, while releasing to the environment at a 1 in 5 year pre-development flow rate;
- The storm events up to 100 year ARI are clearly flood routed.

5.2 Development Water Balance

Due to the size and location of the development, a detailed water balance has not been undertaken. However, an assessment of the expected post-development discharges from the development, for the various ARI events has been undertaken for this Local Water Management Strategy. We have made an assessment of:

- Raintanks – for stormwater attenuation of the 1 in 1 year event and to reduce demand on reticulated supplies
- Soakwells – to maximise the onsite infiltration for each lot to manage the 1 in 1 year storm event
- Piped drainage system – to convey flows up to the 1 in 5 year event
- Basin/Swale sizes – for attenuation of stormwater up to the 1 in 10 year event
- Flood routes – for safe conveyance events up to the 100 year ARI

The relevant discharges have been established using the Rational Method and run-off coefficients methodology as described in Australian Rainfall & Runoff (1987). All inputs (area, mainstream length, mainstream slope, time of concentration, rainfall intensity and runoff co-efficient) and the expected discharge are shown in Table 1, Appendix B, for standard ARI events. Please note, a detailed drainage assessment confirming these calculations will be required during the detailed design and documentation phase of the development, as part of the Urban Water Management Plan.

The calculated pre-development and post-development discharges were used to assess the necessary size of raintanks and soakwells for individual lots, and attenuation basins for each post-development catchment. A summary of the proposed basin and swale sizes required is presented in Table 3, Section 6.2.3, with the nominal locations shown in Figure 6. Details of the basin calculations are shown in Appendix B.

6 Stormwater & Groundwater Management

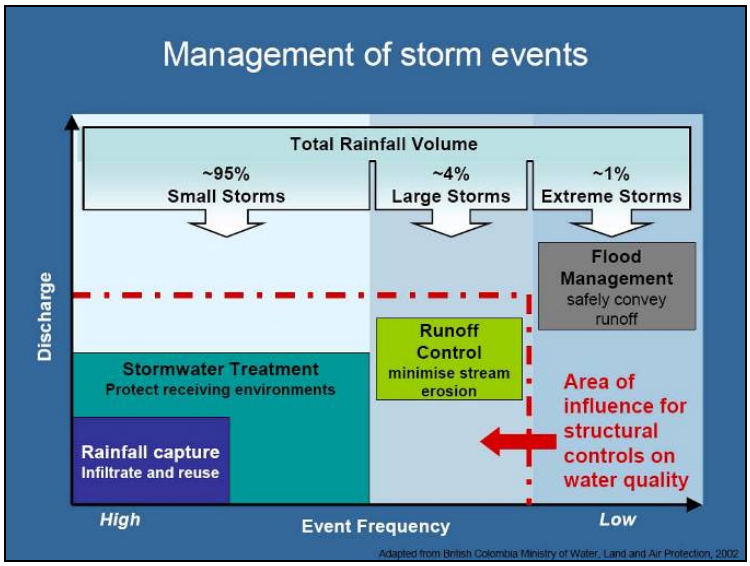
6.1 Background

Best management practices (BMP's) can be divided into two categories: structural controls and non-structural controls.

Structural controls aim to reduce the quantity and increase the quality of stormwater at or near to its source. Common structural controls include but are not limited to swales, buffer strips, rainwater tanks, soakwells, retention and/or infiltration basins and rain gardens.

Non-structural controls are preventative measures that aim to alter human behaviour to reduce the amount of pollutants that enter stormwater systems. This can include community and landowner education, management and maintenance activities and land use and planning.

The following figure represents the Department of Water's overall direction in the management of storm events.



6.2 Structural Controls

6.2.1 Individual Lot Stormwater Management

Given the expected moderate to high infiltration rates on the soils in most areas of the development, it is proposed to maximize on-site storage and treatment through the installation of raintanks and soakwells on all proposed lots. The purposes of incorporating rainwater tanks and soakwells within each lot are to:

- Detain and treat (at least) the 1 in 1 yr ARI volume from the lot impervious areas
- Reduce the demand on public water supplies

The Department of Agriculture WA raintank analysis software, "Rain Tank 2" was used to model the efficiency of different roof area, water demand and tank size combinations in order to estimate the minimum tank size required to provide a significant proportion of the required water supply to the house, and to offer attenuation of low intensity rainfall events. The program uses ~49 years of collected weekly rainfall data in assessing the predicted rainfall events and reliability. Rainfall data used in these simulations came from the BOM gauging site "Nornalup", Site number 009589 (no longer functioning). The data covered the period from 1953 to 2002. No data was available for the Denmark townsite, however we feel that the Nornalup data would be very closely representative of the coastal pattern of rainfall experienced at Denmark.

Raintank 2 reports, for a given roof area, water demand and tank size, the amount of inflow, storage, water used and outflow, plus the deficit of required demand versus water (available for) use. The reliability of the rainwater supply is not important in this case, given that a reticulated supply will provide permanent backup during drier periods.

For the purposes of this LWMS, we utilised the following input data. Water demand figures were sourced from Water Corporation published data to facilitate the assessment of various options:

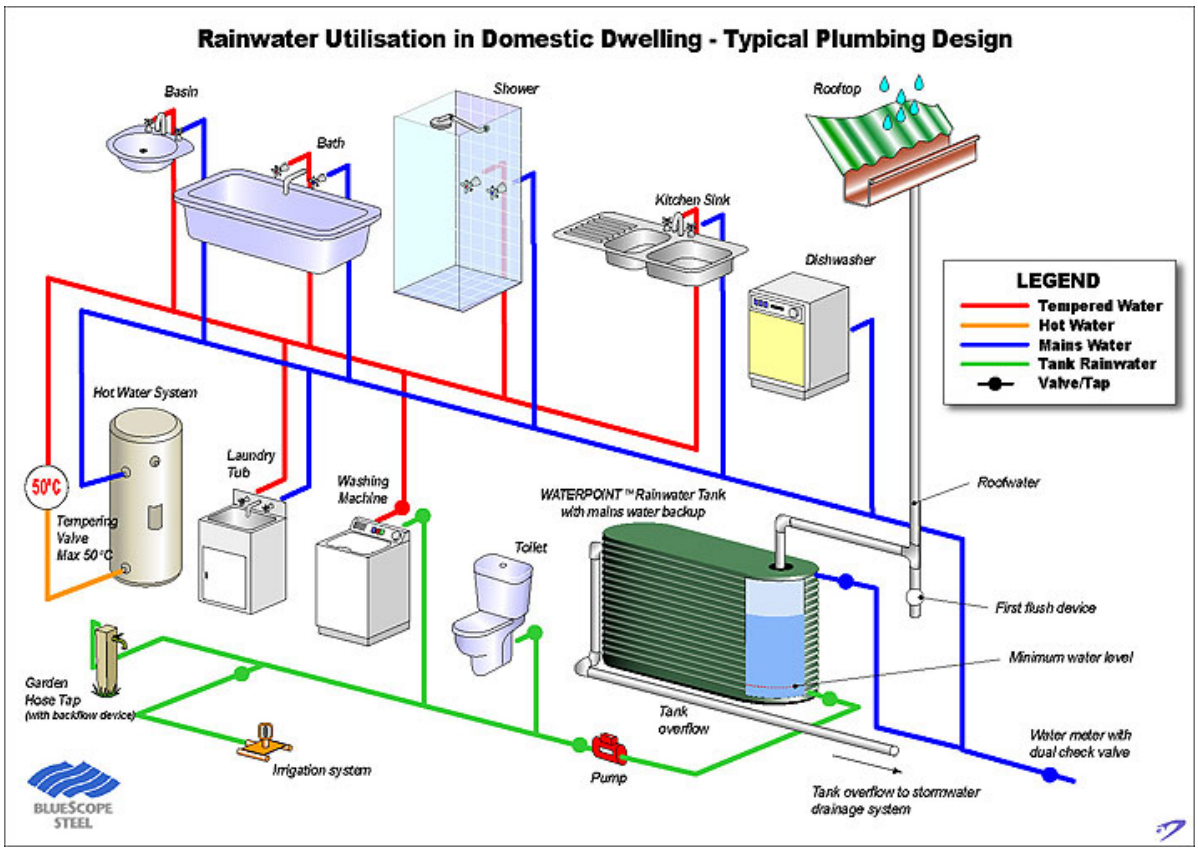
- Typical residential house/shed roof area of 400m^2
- Tank size of 5000L
- Average water efficient household demand (toilet and laundry only) of 200L/day (~128kL/yr);

- Average water efficient garden watering of 150 L/day (~55kL/yr)

Two scenarios were modelled, the first allowing just for household use (200L/day) and the second for household and garden use (350L/day).

Individual landowners will be required to incorporate a minimum 5000L rainwater tank into their dwelling design in order to provide some attenuation of the lot impervious (roof) area and to reduce demand on the reticulated supply. In the event that the tanks overflow, excess stormwater will be directed to the soakwells. This re-use and attenuation will reduce the peak outflow rate, and overall volume from the new lots thus minimising the size of the downstream infrastructure required for attenuation and furthermore, it assists in reducing the demand on public water supplies. The typical lot drainage layout for the storage and treatment of 1 in 1 year storm runoff is shown in Figure 6, along with the proposed road drainage infrastructure (Section 6.2.2) and nominal basin (Section 6.2.3) locations.

The schematic figure, below, represents a typical plumbing layout for effective re-use of harvested rainwater for domestic purposes.



The Department of Water "Stormwater Management Manual for Western Australia" indicates that individual lots should have infrastructure installed to attenuate the 1 in 1 year event. The critical storm duration relating to the maximum storage requirement will vary according to lot impervious area and critical storm duration of the impervious area. It also needs to consider the critical storm duration of the downstream, receiving infrastructure, such as a basin. Table 2 is a summary of the onsite infrastructure calculations we have made to size the raintanks and soakwells for each lot.

Table 2 – Combined Storage and Infiltration Volumes for Lot Infrastructure for 1 in 1 year event

Lot Zoning	Lot Impervious Area (m^2) (Roof and Ground Level)	Critical Duration for 1 in 1 Year Storm (mins)	Rainfall Intensity (mm/hr)	Storage and Infiltration Volume Required (m^3)	Storage Volume (Raintank) Proposed (m^3)	Infiltration Volume (Soakwell) Proposed (m^3)	Total Volume Proposed (m^3)
Special Rural	500	6	48.6	1.9	1.2m^3 (Assumes 25% of 5000L tank always available for storage)	*1.9 (2 No. x DN1500mm)	3.1
R10	400	6	48.6	1.2	1.2m^3 (Assumes 25% of 5000L tank always available for storage)	*1.2 (2 No. x DN1500mm)	2.4

* Note: Soakwells have been sized in order to fully attenuate the 1 in 1 year storm event should raintanks not have available storage capacity due to low demand periods.

6.2.2 Roads & Drainage Network

The development's stormwater network has been designed in accordance with industry standard practice and Shire of Denmark guidelines, where all piped drains (Figure 6) can convey a "minor" 1 in 5 year ARI post-development storm event over its respective catchment. All open drains and swales will have capacity for a 1 in 10 year ARI storm event.

Figure 6 shows the typical road and drainage infrastructure that will be incorporated throughout the development. The key elements of the design are:

- All roads will be sealed and fully kerbed
- Pipe size will be minimum 300mm
- Pits (manholes, gully grates and side entry pits) would be placed at strategic locations, with typical spacing of ~50m and maximum spacing of 100m
- The road surface will generally have a one-way cross-fall, to the lower side of the road, for roads that go approximately along the contour
- The road surface will be crowned for roads that have steeper longitudinal grade
- Verges will be designed such that road stormwater can extend from the road pavement onto the verge in high flow events, without entering adjoining lots
- Detention/treatment basins/swales for each post-development catchment (Section 5.2.3)

The majority of the post-development stormwater will discharge to the south and southeast, to be directed via the piped drainage system and road network to Basin A and Basin B. The discharge from Basin A will overflow to the downstream pipework and will be routed via Basin B. Basin B has been sized only to attenuate the flow generated within its own post-development catchment. The discharge from Basin A will be routed through Basin B and discharged to the downstream environment. The portion of the developed catchment to the north of the ridge line will be attenuated by shallow swale

drains contained within each lot, which will overflow to the (unmade) McLean Road reserve, when required. Where applicable, the remaining drainage infrastructure (other than the swales) constructed within the lots will have easements placed upon titles, vested to the Shire of Denmark.

6.2.3 Detention/Treatment Basins

It is anticipated that due to the relatively steep slopes within the development and subsequent steep slopes of proposed road surfaces, the conveyance of storm events will occur with relatively high velocity, leaving little opportunity for treatment between source and detention basin. Therefore, the critical infrastructure in the design for maximizing the removal of coarse sediments and associated nutrients and pollutants, particularly that derived from the road network is in the detention basins and swales.

Two detention basins and a series (12 No.) of smaller swales are proposed to form part of the treatment infrastructure to aid in stripping of coarse sediments and uptake of nutrients, prior to discharging to the downstream environment. Basins A and B (Figure 6) will be required to attenuate the majority of the developed catchment, with a series of (7 No.) swales proposed to attenuate the remainder of the catchment, north of the ridgeline.

Basins will be designed such that the maximum discharge is equivalent to the 1 in 5 year ARI pre-development peak flow (refer Table 1, Appendix B), with a storage volume large enough to detain the 1 in 10 year ARI post-development event. The swales will be sized to provide temporary storage for the 1 in 10 year event, with discharge via infiltration into the underlying soil and overflow to surrounding vegetation. Overflow from the swales, for rainfall events greater than 1 in 10 year will be directed toward the vegetated areas in the lots and into McLean Road reserve.

Table 3 is a summary of the basin calculations in Appendix B and shows the approximate sizes of the basins and swales that would be required based on this proposed subdivision layout. An allowance (reduction) in the total basin volume has been made to take into consideration the attenuation capacity of the soakwells and raintanks installed in each lot. These will need to be confirmed at the detailed design stage. Please note the basin base areas do not include the additional area required for freeboard, embankments and batters. The additional area required for basin earthworks will vary according to each basin site and will be assessed during detailed design. The base areas and water depths have been designed to maximise the treatment capability of the basins and to minimise the period of inundation of the basin vegetation.

Table 3 – Approximate Basin and Swale Volumes

Basin / Swales	Catchment Area (m^2)	Catchment Impervious Area (m^2)	Gross Volume Required for 10 year ARI Storm (m^3)	Volume Detained by 1 in 1 yr Lot Infrastructure (m^3)	Nett Volume Required (m^3)	Base Area (m^2)	Water Depth (m)	Base Area (% of Impervious Catchment)
A	66,582	18,440	230	*74	156	370	0.35	** 2%
B	105,520	22,540	317	*107	210	450	0.39	** 2%
Swales (lots)	Lot size varies	500 / lot	12.5	*3.1	9.4	19.5	0.27	** 3.9%

* From Table 2, onsite lot storage of $3.1m^3$ per Special Rural lot; $2.4m^3$ per R10 lot. Basin A - 20No. SRes lots, 5No. R10 lots. Basin B - 5No. SRes lots, 38No. R10 lots. Swales - 7No. SRes lots, 1 x Water Corp lot.

** Department of Water guidelines indicate that the basin area for effective treatment of the 1 in 1 year storm volume is ~2% of the impervious catchment area.

The conceptual layout for the basin is shown in Figure 7. The basin will incorporate a 500mm deep sediment trap at the inlet zone to assist in the removal of coarse sediment. This sediment would be periodically removed by the Shire of Denmark. As shown in Figure 7, the basins incorporate a layer of "filter media" – generally lightly compacted, fine to medium sand, through which treatment of low volume (~1 in 1 year ARI) rainfall events are treated. Discharge to the environment is via a slotted subsoil pipe system. Higher volume storm events will be discharged via a rated pipe.

Basins are to be located in separate drainage reserves and vested to the Shire of Denmark, thus ensuring access for maintenance purposes. The 12 No. swales constructed in individual lots, due to their small size and limit of serving only a single lot, would be vested in the individual lot titles. Both the basins and swales will be planted with suitable wetland vegetation (eg carex). The developer will engage a suitably qualified landscape consultant to determine the suitable species for the basin plantings, during the detailed design phase.

6.2.4 Flood Routing

As per Table 2, Appendix B, the post-development discharge is increased due to the increased impervious area, however, the overall discharge volumes will manageable with adequate infrastructure.

- In events greater than 1 in 1 year ARI, the capacity of the lot drainage infrastructure (soakwells and rainwater tanks) is exceeded
- In events greater than 1 in 5 year ARI, the capacity of the (Shire) piped drainage system is reached
- In events up to 1 in 10 year, pipe capacities may be exceeded and overland flow may occur. Basins will fill to capacity
- In major events > 1 in 10, overland flow will occur over most of the ctahcment and will be managed within road reserves

Figure 8 displays the expected drainage pattern in a major event. In major rainfall events the developed site will drain in a similar pattern to that of the pre-developed catchment. Runoff will largely occur as sheet flow over the whole site until an internal road is encountered. The internal roads will concentrate and redirect the runoff toward Kearsley Road. Kearsley Road is heavily vegetated and a meandering swale will be constructed between the two proposed paved lanes (refer Section A-A, Figure 8. Kearsley Rd approximately follows the natural flow line on the eastern (lower) side of the subdivision. Runoff will be directed down the Kearsley Road reserve, toward Mt Shadforth Rd. Road design for the Kearsley Road upgrade will include extensive earthworks to minimize the risk of stormwater leaving the road reserve and entering adjoining lots.

Major flows from the conservation reserve will behave in a similar pattern as in the pre-development state. Runoff will leave the reserve and into adjoining Lot 350. Some of the runoff from the reserve may potentially be concentrated by the fire management track (FMT) and Strategic Fire Access (SFA) track. It is proposed to construct spur drains along the tracks to disperse the water to the heavily vegetated areas of the reserve. The SFA running at the rear of lots adjoining the conservation reserve is likely to concentrate runoff to the adjoining lot 350. It is proposed to undertake significant earthworks (open drains and bunding) to direct surface flows along the internal road toward Kearsley Rd. The verges of the internal road along the Lot 349 / 350 boundary will be constructed with one way crossfall and the necessary earthworks on the lower side to maintain major flows on the road and minimize the risk of overflow to lot 350. This may be reviewed in the future if/when Lot 350 is developed. Alternate flood routes could be considered incorporating the Lot 350 layout.

6.2.5 Subsoil Drainage

The R10 zoning of the lots in Lot 349 and five lots in Lot 348, is a result of the relatively shallow, laterite sheetrock in that area, making it unsuitable for on-site effluent disposal. However, the sheetrock is overlain by gravel soils, suitable for shallow soakwells to manage the minor (1 in 1 year) events. The impermeable laterite is likely to result in perched groundwater in the gravel during wetter periods. Given the moderate slopes on the site, the perched groundwater will move downslope, as supported by the observations of the geotechnical testing.

Excavations that may be performed in order to provide level building pads, roadworks etc may therefore be prone to inundation by seepage from higher lots. Therefore is proposed to install subsoil drainage infrastructure along the lower

boundaries of R10 lots, as shown in figure 6. The subsoil drainage would connect to the house connection pit within the individual lot drainage and then to the Shire drainage system.

6.2.6 Sediment and Nutrient Stripping within the Drainage Infrastructure

Much of the nutrient loading found in typical stormwater is bound to suspended sediments. It is anticipated that the end of line attenuation basins will reduce the flow velocity of stormwater exiting the development and thus allow the removal of sediment prior to discharge to the downstream water bodies. The attenuation basins would be planted out with appropriate wetland species to assist in the uptake of the nutrients from the stormwater. The chosen plant species will need to be adaptable to both periods of inundation and periods of dry.

The planting of the basin will also ensure that during the drier summer months, the aesthetics of the basin area are still maintained for landowners.

6.2.7 Stabilisation & Erosion Control

- All earthworked areas (open drains, basins and road verges) will have a minimum of 70mm of seeded and compacted topsoil respread to prevent erosion and scour.
- The full extent of earthworks battering for the basins shall be stabilised by topsoil. This will promote vegetation regrowth and subsequently prevent erosion. All batters steeper than 1 in 6 will be stabilised by seeded hydromulching.
- Proposed culverts are expected to have higher velocity flows (e.g. at entry/exits from headwalls) due to restriction/concentration of the flow, and as such mortared rock pitching will be used to minimise the risk of scouring.
- Erosion inhibitors will be installed in swale drains where the longitudinal grade is greater than 4%, including the central swale along Kearsley Road. The spacing between inhibitors would be confirmed during the detailed design phase.

6.3 Non-Structural Controls

6.3.1 Maintenance

As with most stormwater management systems, there will be the need for some form of on-going maintenance.

The individual residents will be required to perform routine maintenance activities checking and removing any accumulated litter and sediment in their stormwater system. An annual check and clean of their gutters, rainwater tanks, soakwells and where applicable, swales, will ensure continued access to clean reusable water.

The Shire will need to ensure that the road drainage network and constructed basins are regularly inspected to assess any damage and/or preventative maintenance that can be undertaken. Any planting works within basins will require minimal on-going maintenance, and if planted at the correct time of year, should not require any further establishment work.

As previously mentioned, all drainage infrastructure located within the road reserves and lots (pipes, pits and basins) will be situated within easements vested to the Shire of Denmark.

6.3.2 Public Awareness and Education

All future landowners will receive Shire of Denmark advice in relation to encouraging the use of water-wise infrastructure. This advice is already publicly visible upon the Shire of Denmark website.

6.3.3 Garden Management & Building Application

As a part of an advice note to be issued at the time of land purchase, individual landowners will be encouraged to:

- Minimise water usage through the installation of water efficient materials during dwelling construction

- Plant native (local indigenous) vegetation species that require minimal watering
- Use low level, slow-release phosphate and nitrogen fertilisers on their gardens and time the application during periods of lower rainfall
- Direct, impervious surfaces toward vegetated garden beds to aid in the treatment of nutrients and potential contaminants.

6.4 Summary

It is our opinion that the proposed development will not have a significant effect on the existing on-site or downstream catchment and with the utilisation of the structural and non-structural controls proposed above, the surrounding environment and properties of adjoining neighbours should not be adversely affected by the proposal.

7 Managing Subdivision Works

7.1 Dust and Sediment Control

It is anticipated that dust will not negatively impact upon the surrounding areas during construction. Standard construction practices, such as mobile water carts, will aid in negating the risk of dust.

Due to the large size of the proposed lots, it is anticipated that sediment transport from the future building construction phase will be minimal. As discussed previously, it is expected that coarse sediment will drop out during open drain conveyance and furthermore at 'end of line' attenuation basins. The Shire of Denmark will be responsible for undertaking regular maintenance / cleaning of the open drain and basin network.

7.2 Dewatering

It is anticipated that construction will occur over the drier, summer months and as such, the occurrence of perched groundwater is unlikely or will be at sufficient depth below the natural surface to not require any form of dewatering.

7.3 Acid Sulfate Soils

As per Section 4.4.4, it is anticipated that acid sulfate soils (ASS) will not be encountered during the construction phase.

8 Monitoring Program

8.1 Objectives

No monitoring program is proposed for the Kearsley Road development, due to the following:

- Perched groundwater may be present during the wetter, winter months, however the proposed development is expected to have negligible impact upon groundwater quality. The R10 zoned area will have reticulated sewer supplied.
- No adverse affect is anticipated to surface water quality

9 The Next Stage - Further Information

Full detailed design documentation and an "Urban Water Management Plan" will be required prior to construction and the associated clearance of Department of Water WAPC conditions of subdivision.

10 Implementation Plan

10.1 Maintenance Arrangements

The developer will be responsible for all development maintenance during the 12 months defects period following construction. Once lapsed, the Shire of Denmark will be responsible for all maintenance and upkeep of the roads and drainage network. It should be noted that the proposed infrastructure (open drains, piped drains, kerbed roads and basins) is typically low maintenance.

Individual landowners will be required to maintain their properties as necessary to reduce sediment transport and nutrient disposal to downstream catchments.

10.2 Funding

All design, construction and handover costs for the development will be funded by the private developer.

Ongoing maintenance past the 12 months defects period will be funded by the Shire of Denmark through rated properties.

10.3 Roles and Responsibilities

The roles and responsibilities for the actions outlined in the LWMS for the proposed development are presented in the table below.

Roles and Responsibilities

Role	Responsibility	Requirement and Period
Urban Water Management Plan	Developer	Prior to subdivision approval.
Design of Drainage System	Developer	Prior to subdivision construction.
Landscaping (basins)	Developer	Prior to subdivision clearance
Maintenance of Drainage System	Developer & Shire	Drainage structures will become the responsibility of the local authority when the works are handed over at the end of construction (apart from defects)
	Shire of Denmark	Biannual evacuation of gully and manholes
	Shire of Denmark	Removal of silt from basins as needed
	Shire of Denmark	Weeding and management of the basin vegetation annually. Replacement of vegetation every 5 to 10 years.
Non-Structural Controls: Land use and Management	Developer	Sediment and erosion control during subdivision construction.
Non-Structural Controls: Public Awareness Campaign	Developer	Formal notification of stormwater storage requirements which must be included in any lot developments
Non-Structural Controls:		Information packs, including educational information

Role	Responsibility	Requirement and Period
Public Awareness Campaign	Developer & Shire of Denmark	regarding non-structural control measures, such as fertiliser application, native gardens, herbicide use, weed control and waste management, to be provided at settlement.
Non-Structural Controls: Street Sweeping and waste management	Shire of Denmark	Street sweeping to be undertaken biannually. Monitoring building controls
Water Quality Monitoring & Reporting	Developer Shire of Denmark	N/A
Building Approval	Shire of Denmark	Adoption of this LWMS as building requirements. Ensure compliance with the objectives of this LWMS; 1. On site storage volumes (via raintanks & soakwells) 2. Stormwater connections and maintenance 3. Onsite control of run-off via pavements onto roads 4. Sediment Control from building site 5. Best management for residential waste as adopted by Council 6. Waterwise landscaping 7. Waterwise internal water use

11 Conclusion

It is our opinion that the proposed special residential development will not have a significant effect on the existing on-site or downstream catchment and with the utilisation of the individual quantity and quality treatment measures proposed above, the surrounding environment and properties of adjoining neighbours should not be adversely affected by the proposal.

Appendix A

Figures 1 - 8

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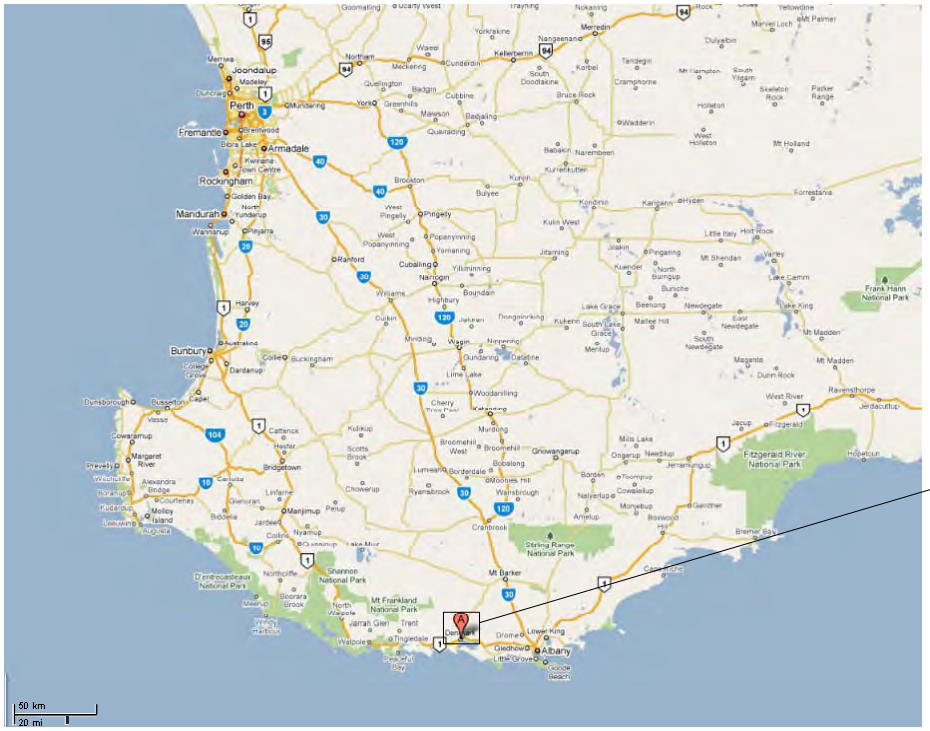
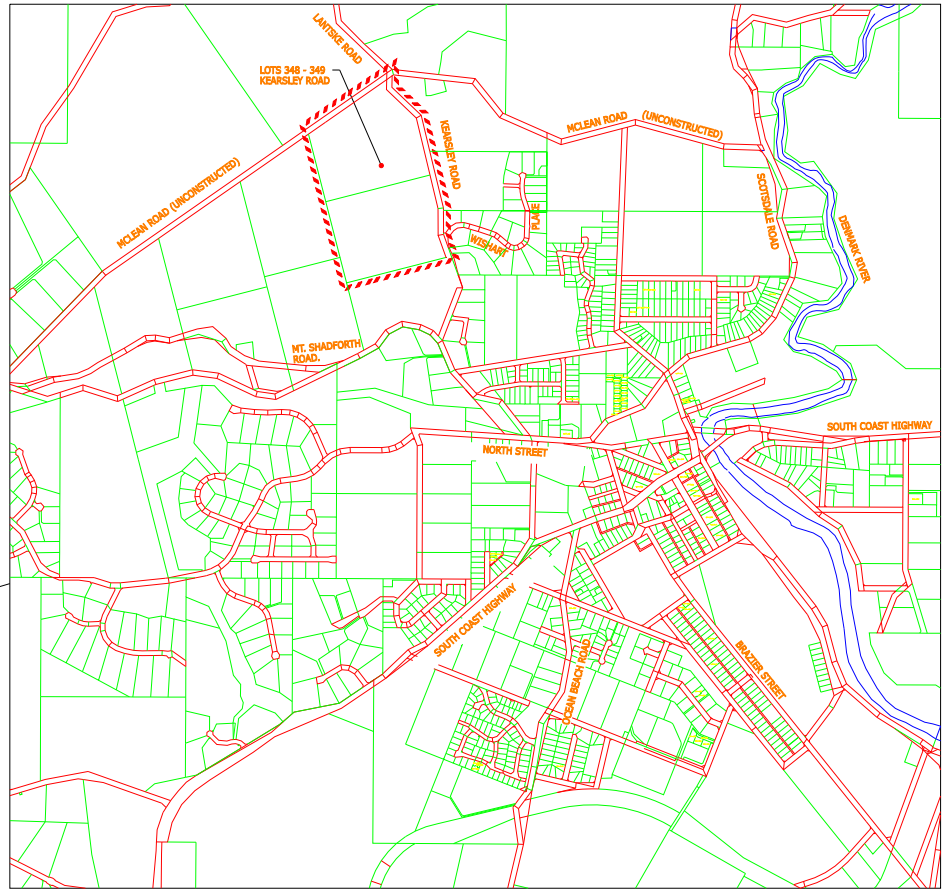


IMAGE SOURCED FROM GOOGLE MAPS 2009, INTERNET.



PLAN
SCALE 1:20000 @ A1

WOOD & GRIEVE ENGINEERS

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ALBANY
PERTH
MELBOURNE
SYDNEY
BRISBANE
BUNBURY

CLIENT:	ROBERTSON DEVELOPMENTS
PROJECT:	LOTS 348 & 349 KEARSLEY ROAD
TITLE:	FIGURE 1- LOCALITY PLAN

DESIGNED:		DRAWN: MARTIN BUCZAK	
VERIFIED: / /		WAPC No.: N/A	DATUM: N/A
APPROVED FOR TENDER: / /		DRAWING No. 19738-ALB-C-37 / F1	REV. A
APPROVED FOR CONSTRUCTION: / /			

REV.	DESCRIPTION	DRAWN	VERIFIED	APPROVED
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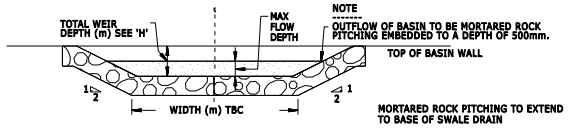
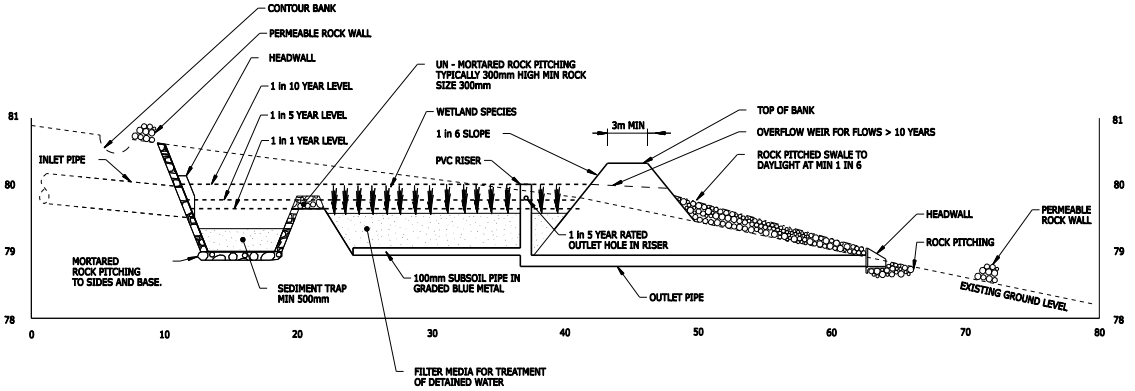


OVERFLOW WEIR DETAIL
N.T.S



SECTION A - A
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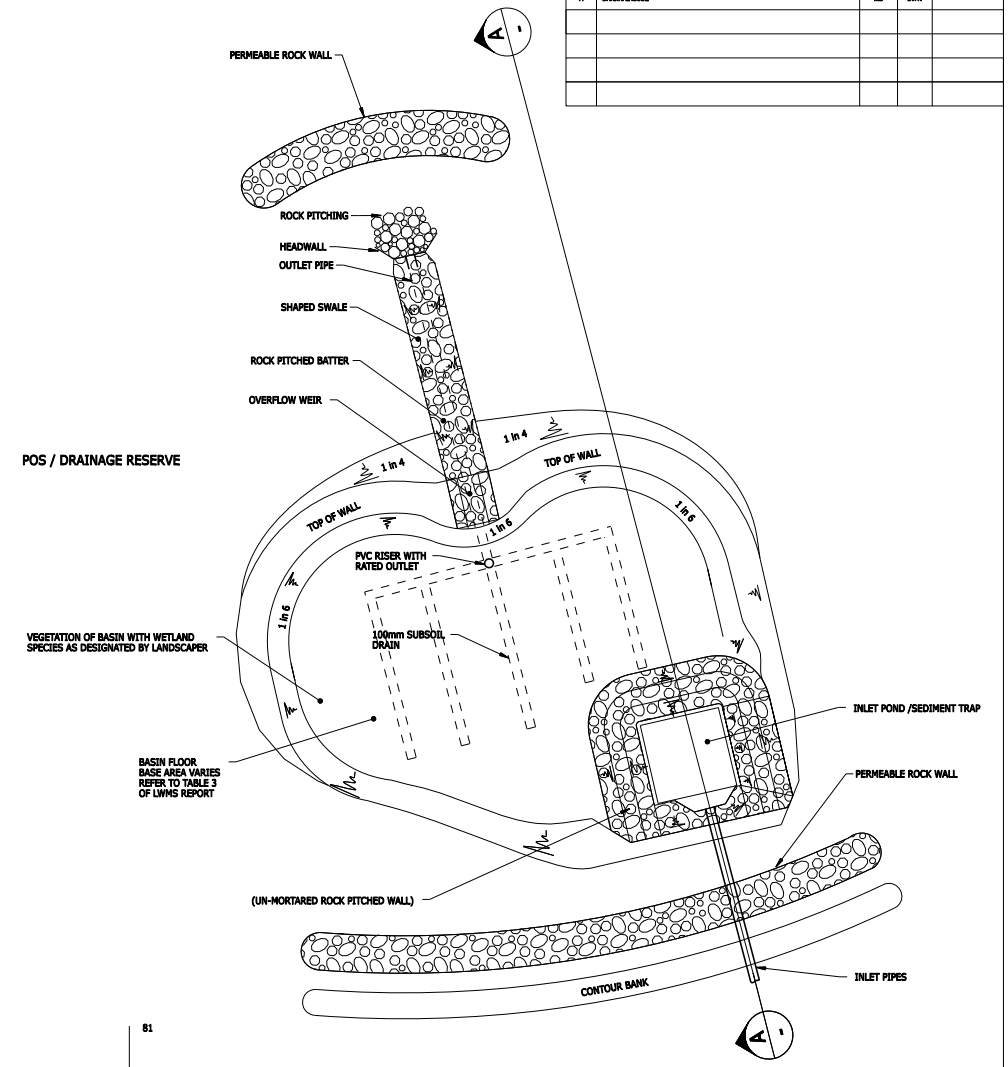

TYPICAL BASIN DETAIL

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ALBANY
PERTH
MELBOURNE
SYDNEY
BRISBANE
BUSSELTON

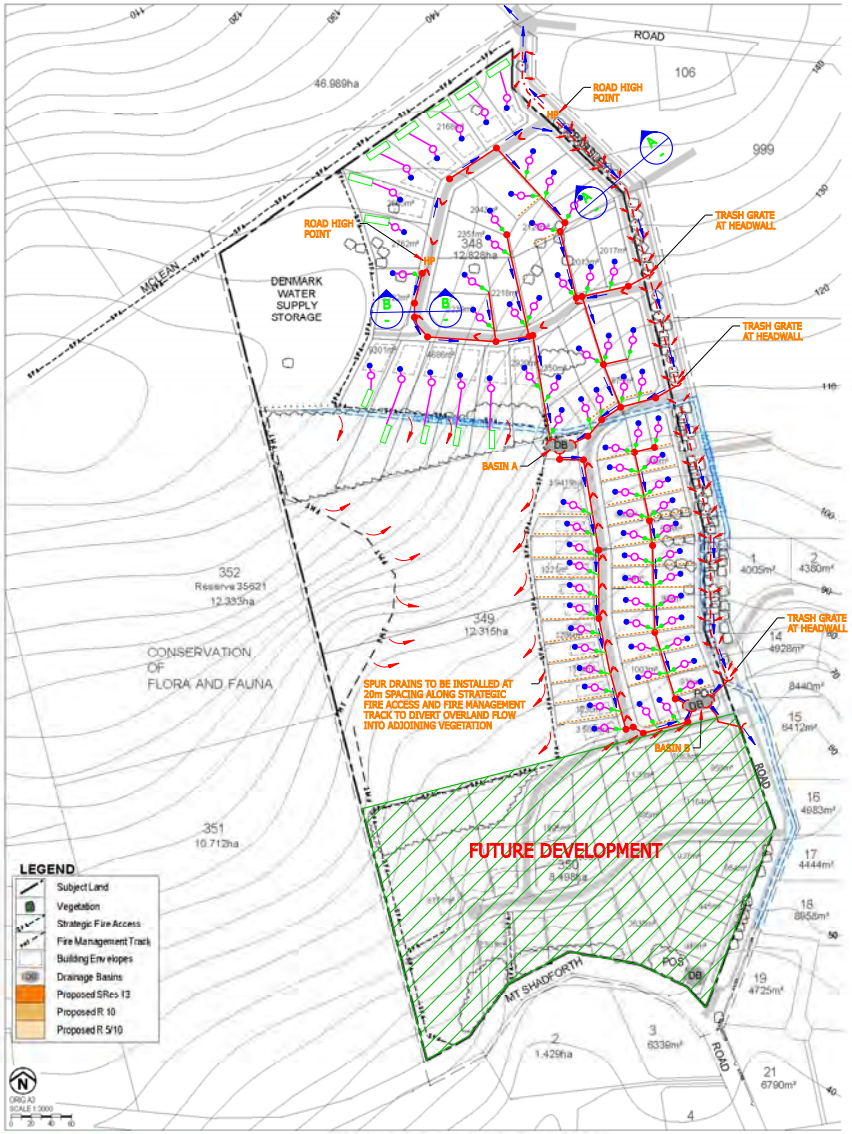
CLIENT: ROBERTSON DEVELOPMENTS

PROJECT: LOTS 348 & 349 KEARSLEY ROAD

TITLE: FIGURE 7 - TYPICAL BASIN DETAIL

DESIGNED:		DRAWN: MARTIN BUCZAK	
VERIFIED: / /		WAPC No.: N/A	DATUM: N/A
APPROVED FOR TENDER: / /		DRAWING No. 19738-ALB-C-37 / F7	REV. A
APPROVED FOR CONSTRUCTION: / /			

REV.	DESCRIPTION	DRAWN	VERIFIED	APPROVED
A	ORIGINAL ISSUE	MB	BWW	

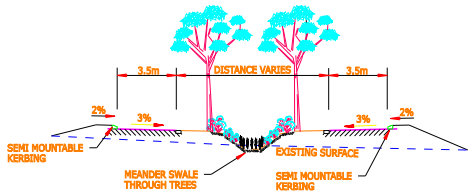


AYTON BAESJOU PLANNING

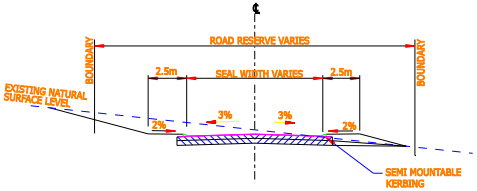
SUBDIVISION GUIDE PLAN
Lots 348, 349, 350 McLean, Kearsley and Mt Shadforth Roads.
Shire of Denmark

1 IN 1 YEAR STORMWATER TREATMENT AND DETENTION INFRASTRUCTURE
N.T.S.

MAJOR EVENT	RAINWATER TANK	SOAKWELL	PIPE	BASIN
1 in 1 YEAR	FULL	FULL	PART FULL	PART FULL
1 in 5 YEAR	FULL	FULL	PART FULL	PART FULL
1 in 10 YEAR	FULL	FULL	FULL	FULL
1 in 100 YEAR	FULL	FULL	FULL	OVER FLOW



SECTION A-A
NTS



SECTION B-B
NTS

LEGEND

- DRAINAGE PIPE AND SIDE ENTRY PIT OR MANHOLE (COUNCIL SYSTEM)
- OPEN TABLE DRAIN AND HEADWALL
- RAINWATER TANK CONNECTED TO ROOF AREA
- SOAKWELL(S) FOR ROOF AND GROUND LEVEL IMPERVIOUS AREA (MIN 2.6m²) ROOF = 2.2, G.L = 0.4
- HOUSE CONNECTION PIT(S)
- ROAD AND DRAINAGE GENERAL FLOW DIRECTION
- SUBSOIL DRAINAGE
- PROPOSED SPUR DRAIN

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CLIENT:	ROBERTSON DEVELOPMENTS
PROJECT:	LOTS 348 & 349 KEARSLEY ROAD
TITLE:	FIGURE 6 - 1 IN 1 YEAR INFRASTRUCTURE

DESIGNED:		DRAWN: MARTIN BUCZAK	
VERIFIED: / /		WAPC No.: N/A	DATUM: N/A
APPROVED FOR TENDER: / /		DRAWING No. 19738-ALB-C-37 / F6	REV. A
APPROVED FOR CONSTRUCTION: / /			

REV.	DESCRIPTION	DRAWN	VERIFIED	APPROVED
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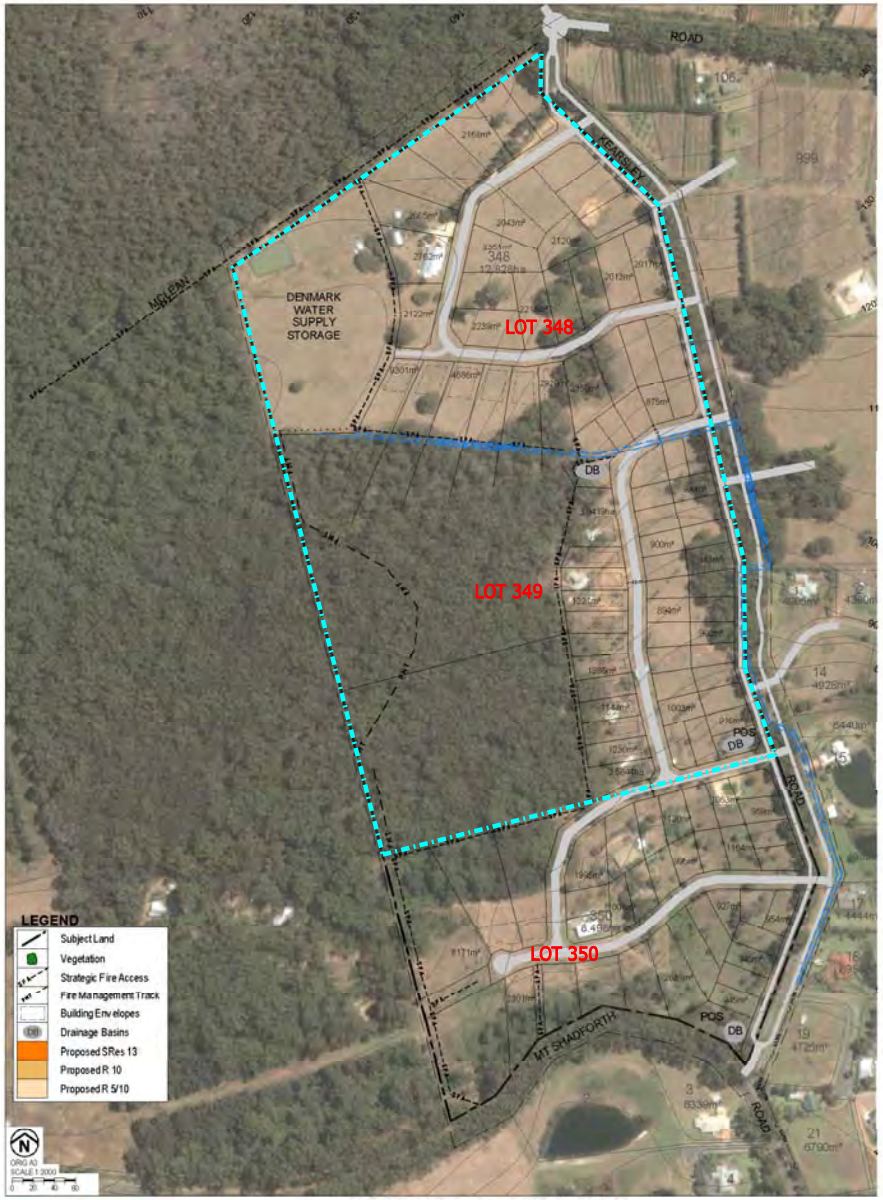

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SUBDIVISION GUIDE PLAN
Lots 348, 349, 350 McLean, Kearsley and Mt Shadforth Roads.
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LEGEND

SITE BOUNDARY

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CLIENT:	ROBERTSON DEVELOPMENTS
PROJECT:	LOTS 348 & 349 KEARSLEY ROAD
TITLE:	FIGURE 5 - AERIAL PHOTO PROPOSED SUBDIVISION

DESIGNED:		DRAWN: MARTIN BUCZAK	
VERIFIED: / /		WAPC No.: N/A	DATUM: N/A
APPROVED FOR TENDER: / /		DRAWING No. 19738-ALB-C-37 / F5	REV. A
APPROVED FOR CONSTRUCTION: / /			

REV.	DESCRIPTION	DRAWN	VERIFIED	APPROVED
A	ORIGINAL ISSUE	MB	BWW	

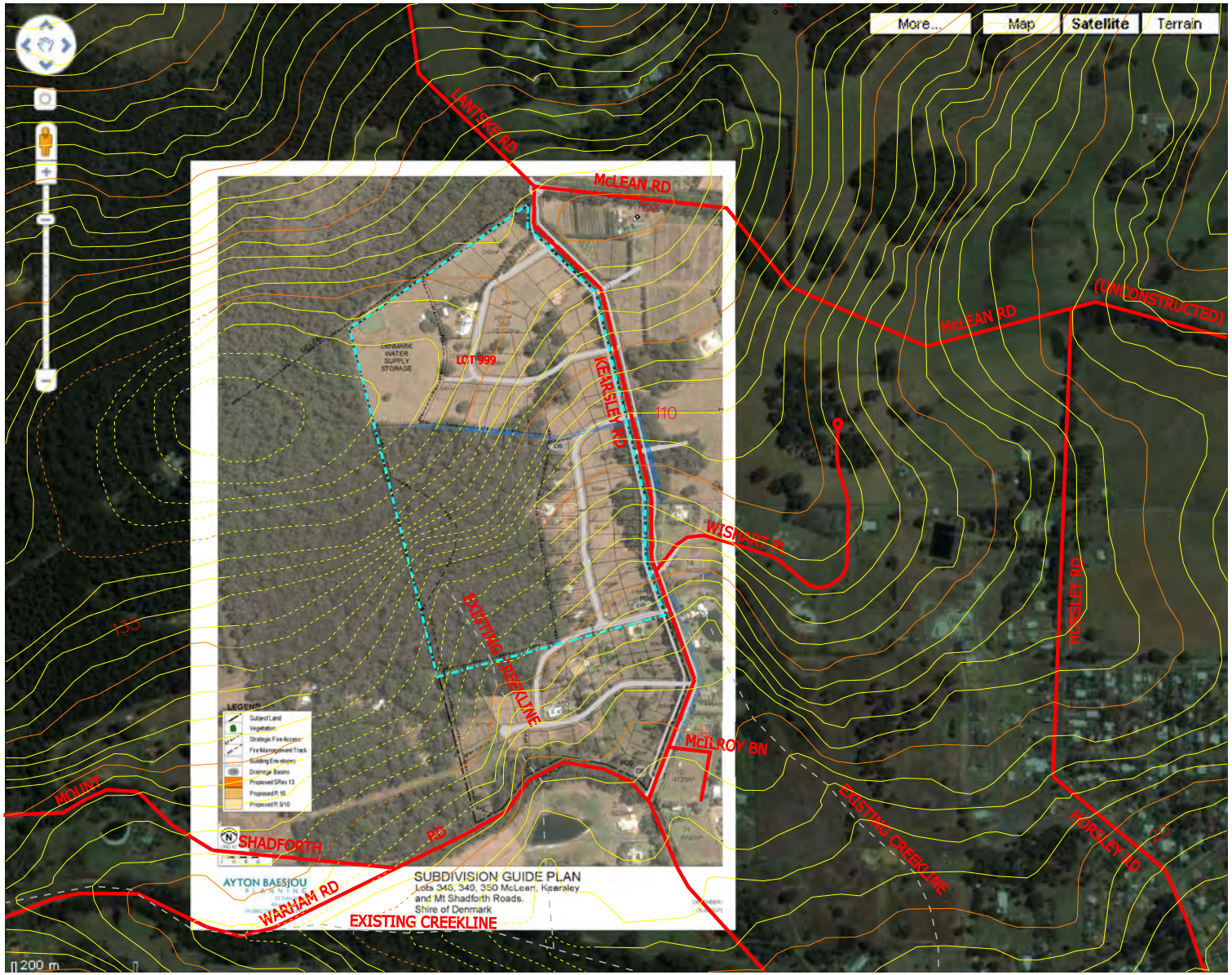

IMAGE SOURCED FROM GOOGLE MAPS 2009, INTERNET.

LEGEND

20 — EXISTING CONTOURS (5m INTERVALS)

EXISTING ROADS

EXISTING DRAINAGE LINE

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CLIENT: ROBERTSON DEVELOPMENTS

PROJECT: LOTS 348 & 349 KEARSLEY ROAD

TITLE: FIGURE 4 - AERIAL PHOTO LOCAL AREA

DESIGNED:		DRAWN: MARTIN BUCZAK	
VERIFIED: / /		WAPC No.: N/A	DATUM: N/A
APPROVED FOR TENDER: / /		DRAWING No. 19738-ALB-C-37 / F4	REV. A
APPROVED FOR CONSTRUCTION: / /			

REV.	DESCRIPTION	DRAWN	VERIFIED	APPROVED
A	ORIGINAL ISSUE	MB	BWW	

SUBDIVISION BOUNDARY

FUTURE SUBDIVISON

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SUBDIVISION GUIDE PLAN

Lots 348, 349, 350 McLean, Kearsley and Mt Shadforth Roads.
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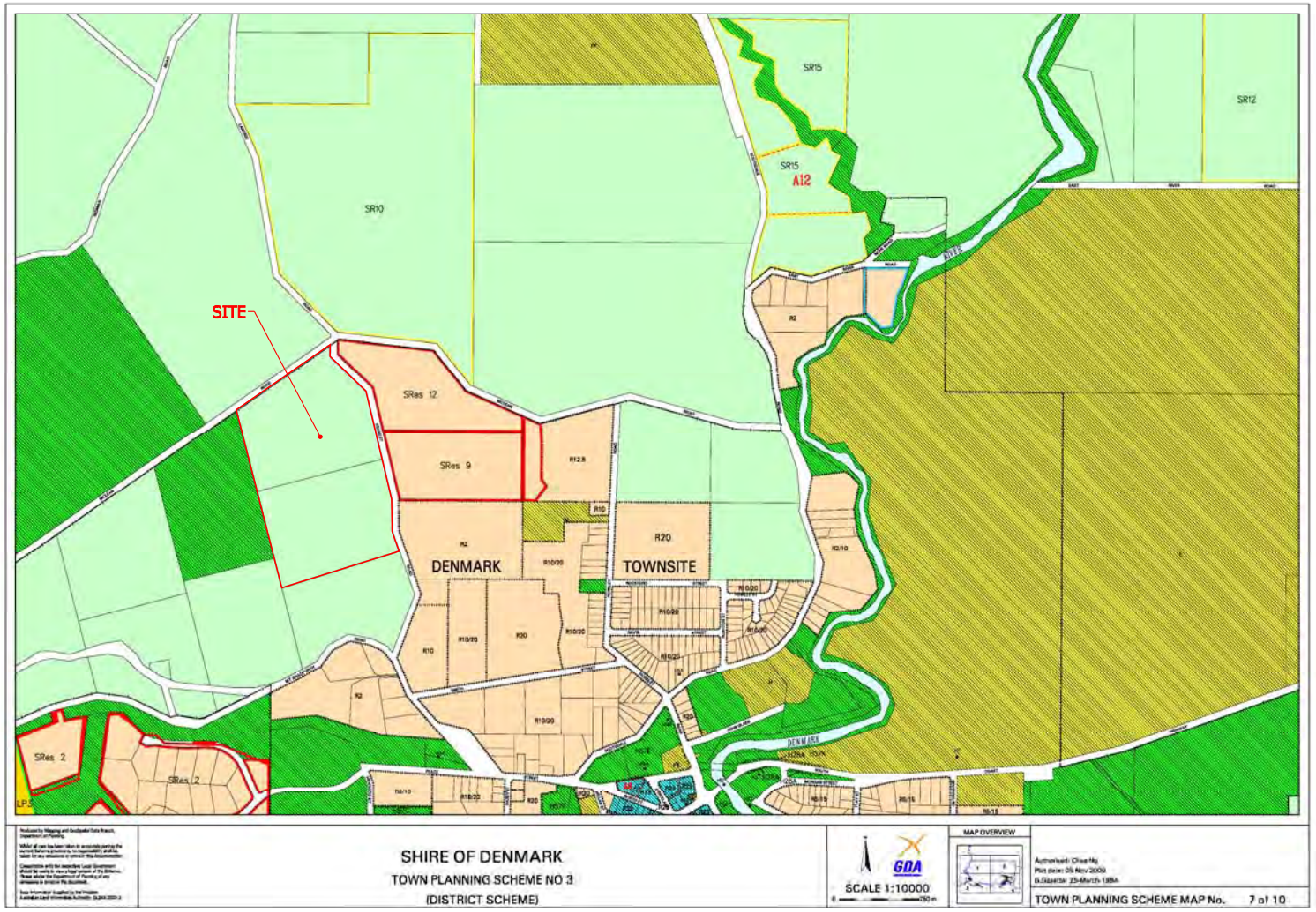
CLIENT:	ROBERTSON DEVELOPMENTS
PROJECT:	LOTS 348 & 349 KEARSLEY ROAD
TITLE:	FIGURE 3 - SUBDIVISION GUIDE PLAN

DESIGNED:		DRAWN: MARTIN BUCZAK	
VERIFIED: / /		WAPC No.: N/A	DATUM: N/A
APPROVED FOR TENDER: / /		DRAWING No. 19738-ALB-C-37 / F3	REV. A
APPROVED FOR CONSTRUCTION: / /			

REV.	DESCRIPTION	DRAWN	VERIFIED	APPROVED
A	ORIGINAL ISSUE	MB	BWW	



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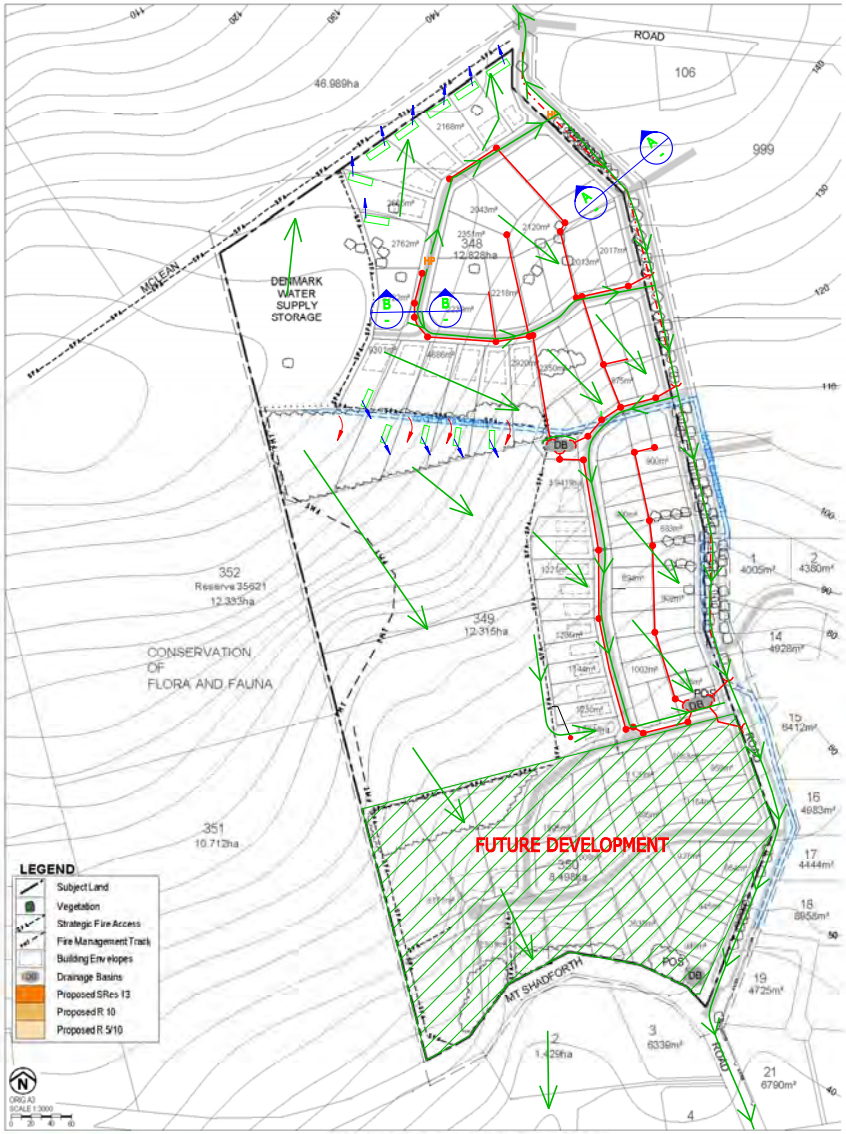
CLIENT:	ROBERTSON DEVELOPMENTS
PROJECT:	LOTS 348 & 349 KEARSLEY ROAD
TITLE:	FIGURE 2 - TOWN PLANNING SCHEME CONTEXT

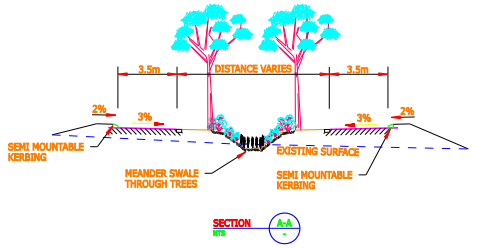
DESIGNER:		DRAWN: MARTIN BUCZAK	
VERIFIED:	/ /	WAPC No.: N/A	DATUM: N/A
APPROVED FOR TENDER:	/ /	DRAWING No. 19738-ALB-C-37 / F2	REV. A
APPROVED FOR CONSTRUCTION:	/ /		

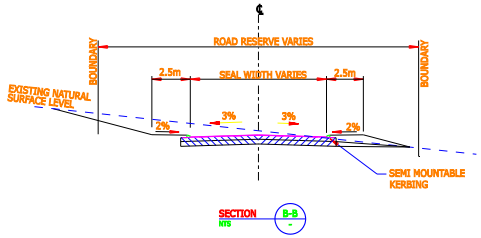
REV.	DESCRIPTION	DRAWN	VERIFIED	APPROVED
A	ORIGINAL ISSUE	MB	BWW	



AYTON BAESJOU PLANNING

SUBDIVISION GUIDE PLAN
Lots 348, 349, 350 McLean, Kearsley
and Mt Shadforth Roads.
Shire of Denmark





LEGEND

- DRAINAGE PIPE AND SIDE ENTRY PIT OR MANHOLE (COUNCIL SYSTEM)
- OPEN TABLE DRAIN AND HEADWALL
- RAINWATER TANK CONNECTED TO ROOF AREA
- SOAKWELL(S) FOR ROOF AND GROUND LEVEL IMPERVIOUS AREA (MIN 2.6m²) ROOF = 2.2, G.L = 0.4
- HOUSE CONNECTION PIT(S)
- ROAD AND DRAINAGE GENERAL FLOW DIRECTION
- MAJOR EVENT GENERAL FLOW DIRECTION

1 IN 100 YEAR STORMWATER TREATMENT AND DETENTION INFRASTRUCTURE
N.T.S.

MAJOR EVENT	RAINWATER TANK	SOAKWELL	PIPE	BASIN
1 In 1 YEAR	FULL	FULL	PART FULL	PART FULL
1 In 5 YEAR	FULL	FULL	PART FULL	PART FULL
1 In 10 YEAR	FULL	FULL	FULL	FULL
1 In 100 YEAR	FULL	FULL	FULL	OVER FLOW

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CLIENT: ROBERTSON DEVELOPMENTS

PROJECT: LOTS 348 & 349 KEARSLEY ROAD

TITLE: FIGURE 8 - MAJOR EVENT FLOW PATHS

DESIGNED:	DRAWN: MARTIN BUCZAK		
VERIFIED: / /	WAPC No.: N/A	DATUM: N/A	
APPROVED FOR TENDER: / /	DRAWING No. 19738-ALB-C-37 / F8		REV. A
APPROVED FOR CONSTRUCTION: / /			

Appendix B

Drainage Calculations

APPENDIX C

Table 1 - Catchment Runoff Calculations

Estimation by Rational Method - 1987 Australian Rainfall and Runoff

Job : Lots 348 & 349 Kearsley Rd ***Client : Robertson Developments*** ***By : Ben Whitfield***
Job # : 19738-ALB-C-37 ***Date : 12/01/10***

Location Denmark

Pre-Development Runoff Calculations

Catchment	Time of Concentration = 58.5*L / A^(0.1)*S^(0.2)						Intensity							Runoff Co-efficients							Discharge (Q) (m³/s)							Comment
	Area	Area	Length	Slope	TOC	TOC Used	1	2	5	10	20	50	100	*(Frequency Factors (Cy/C10))*							1	2	5	10	20	50	100	
	(m2)	(km2)	(km)	(m/km)	(min)	(min)	(mm/hr)	(mm/hr)	(mm/hr)	(mm/hr)	(mm/hr)	(mm/hr)	(mm/hr)	1	2	5	10	20	50	100	(m³/s)	(m³/s)	(m³/s)	(m³/s)	(m³/s)	(m³/s)	(m³/s)	
														0.8	*0.85*	*0.95*	*1*	*1.05*	*1.15*	*1.2*								
Whole Site	**251000**	0.25100	0.63	150	15.53	15	31.7	41.9	55.7	65.4	78.8	98.4	115.1	0.16	0.17	0.19	0.2	0.21	0.23	0.24	0.354	0.497	0.739	0.913	1.154	1.580	1.928	
Basin A	66582	0.06658	0.4	100	12.21	12	35.5	47.1	63.2	74.7	90.3	113.5	133.3	0.16	0.17	0.19	0.2	0.21	0.23	0.24	0.105	0.148	0.222	0.276	0.351	0.483	0.592	
Basin B	105520	0.10552	0.55	170	14.42	14	32.8	43.5	58.0	68.2	82.2	102.9	120.5	0.14	0.14	0.16	0.17	0.18	0.20	0.20	0.131	0.184	0.275	0.340	0.431	0.590	0.721	

Post-development Runoff Calculations

Catchment	Time of Concentration = 58.5*L / A^(0.1)*S^(0.2)						Intensity							Runoff Co-efficients							Discharge (Q)							Comment
	Area	Area	Length	Slope	TOC	TOC Used	1	2	5	10	20	50	100	*(Frequency Factors (Cy/C10))*							1	2	5	10	20	50	100	
	(m2)	(km2)	(km)	(m/km)	(min)	(min)	(mm/hr)	(mm/hr)	(mm/hr)	(mm/hr)	(mm/hr)	(mm/hr)	(mm/hr)	1	2	5	10	20	50	100	(m³/s)	(m³/s)	(m³/s)	(m³/s)	(m³/s)	(m³/s)	(m³/s)	
														0.8	*0.85*	*0.95*	*1*	*1.05*	*1.15*	*1.2*								
Basin A	66582	0.06658	0.51	80	16.28	16	30.6	40.5	53.6	62.9	75.6	94.3	110.2	0.33	0.35	0.40	0.42	0.44	0.48	0.50	0.189	0.266	0.394	0.486	0.614	0.838	1.022	
Basin B	105520	0.10552	0.63	150	16.94	17	29.6	39.1	51.7	60.6	72.7	90.6	105.7	0.28	0.29	0.33	0.35	0.36	0.40	0.42	0.241	0.338	0.500	0.616	0.777	1.059	1.290	
Swales (Northern)	34829	0.03483	0.07	70	2.45	8	43.0	57.4	78.2	93.2	113.6	144.1	170.4	0.26	0.27	0.30	0.32	0.34	0.37	0.38	0.107	0.152	0.231	0.289	0.370	0.514	0.635	
Uncleared Reserve	58080	0.05808	0.465	190	12.66	13	34.1	45.2	60.5	71.3	86.1	107.9	126.6	0.12	0.13	0.14	0.15	0.16	0.17	0.18	0.066	0.093	0.139	0.173	0.219	0.301	0.368	
Total	**265011**	**Note: Post-Development catchment is greater than pre-development due to inclusion of Kearsley road reserve in calculations**																			**0.430**	**0.604**	**0.894**	**1.102**	**1.390**	**1.897**	**2.312**	

Post-Development Catchment Runoff Co-efficient Calculations

	Basin A		Basin B		Swales (Northern)	
Surface Type	**Area**	**C_{10}**	**Area**	**C_{10}**	**Area**	**C_{10}**
*Road Impervious	6440	0.9	4840	0.9	0	0.9
**Road Pervious	15720	0.3	12120	0.3	0	0.3
***Lot Impervious	12000	0.9	17700	0.9	6000	0.9
Lot Pervious	32422	0.2	40573	0.2	28829	0.2
Uncleared	0	0.15	30287	0.15		0.15
Total	**66582**	**0.42**	**105520**	**0.35**	**34829**	**0.32**
		Equivalent C_{10}		**Equivalent C_{10}**		**Equivalent C_{10}**

Wood & Grieve Engineers
1st Floor, The Terrace Centre, 96-102 Stirling Terrace, Albany WA 6330

Soakwell Design

Estimation by Rational Method - 1987 Australian Rainfall and Runoff

Job : Lots 348 and 349 Kearsley Road ***Client : Robertson Developments*** ***Catchment : Lot Impervious - Roof & GL***
Job # : 19738-ALB-C-37 ***Date : 12/01/10*** ***By : Ben Whitfield***
Soakwell : Typical Special Residential Lot

Wood & Grieve ENGINEERS 11 Duke Street, ALBANY, 6330

Design Rainfall Intensity

Location	: Denmark		**Duration**	: 6 minutes	
Storm Event	: 1 year		**Intensity**	: **48.6**	**mm/hr**

Catchment Details

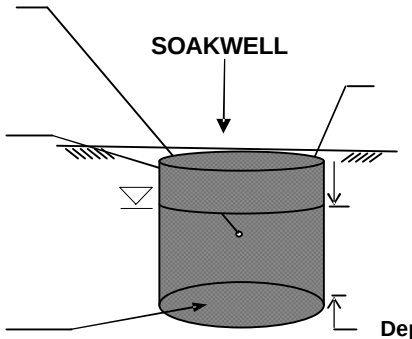
Area	: **500**	m^2	
Run-off Coefficient	: **0.90**		
Flow Rate	: **6.1**	**L/s**	

Outflow Details

(Assumed)	Medium Sand		**Tested**		
Soakage Rate	:	**0.0005**	**m/s**	**-->**	**0.0018** m^3/s (Total Soakage)
Outlet	:	**0.0**	m^3/s		

Storage Details

Max Volume Req'd *at 16 minutes*	: **1.912**	m^3	
Surface Area	: **3.677**	m^2	
inc. freeboard	***3.677***	m^2	
Base Area	: **3.677**	m^2	



Freeboard **300** mm

Batter slopes Vertical

Depth Required **0.520** m

Proposed number of soakwells is	**2**	Proposed Depth	**0.52** m
Proposed Soakwell DN	**1500** *mm*	Storage Volume Available	**1.912** m^3
		Is proposed storage enough	**Yes**

Soakwell Design

Estimation by Rational Method - 1987 Australian Rainfall and Runoff

Job : Lots 348 and 349 Kearsley Road ***Client : Robertson Developments*** ***Catchment : Lot Impervious - Roof & GL***
Job # : 19738-ALB-C-37 ***Date : 12/01/10*** ***By : Ben Whitfield***
Soakwell : Typical R10 Lot

Wood & Grieve ENGINEERS 11 Duke Street, ALBANY, 6330

Design Rainfall Intensity

Location	: Denmark		**Duration**	: 6 minutes	
Storm Event	: 1 year		**Intensity**	: **48.6**	**mm/hr**

Catchment Details

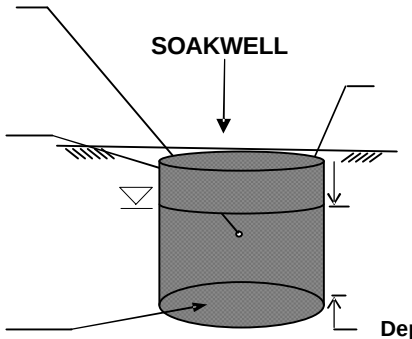
Area	: **400**	m^2	
Run-off Coefficient	: **0.90**		
Flow Rate	: **4.9**	**L/s**	

Outflow Details

(Assumed)	Medium Sand		**Tested**		
Soakage Rate	:	**0.0005**	**m/s**	**-->**	**0.0018** m^3/s
Outlet	:	**0.0**	m^3/s	(Total Soakage)	

Storage Details

Max Volume Req'd *at 12 minutes*	: **1.233**	m^3	
Surface Area	: **3.677**	m^2	
inc. freeboard	***3.677***	m^2	
Base Area	: **3.677**	m^2	



Freeboard **300** **mm**

Batter slopes Vertical

Depth Required **0.335** **m**

Proposed number of soakwells is	**2**		
Proposed Soakwell DN	**1500**	***mm***	
Proposed Depth	**0.35**	**m**	
Storage Volume Available	**1.287**	m^3	
Is proposed storage enough	**Yes**		

RAINFALL DISCHARGE / BASIN VOLUME ESTIMATE

Estimation by Rational Method - 1987 Australian Rainfall and Runoff

Job : Lot 999 Kearsley Rd ***Client : Triple Nine investments Pty Ltd*** ***Catchment : Post-Development***
Job # : 21726-ALB-C ***Date : 15/12/09*** ***By : Ben Whitfield***

Basin A - 1 in 10 Year ARI

Wood & Grieve ENGINEERS 16 Altona Street, West Perth WA 6005

Design Rainfall Intensity

Location	: Denmark		**Duration**	: 16 minutes	
Storm Event	: 10 year		**Intensity**	: **62.9**	**mm/hr**

Catchment Details

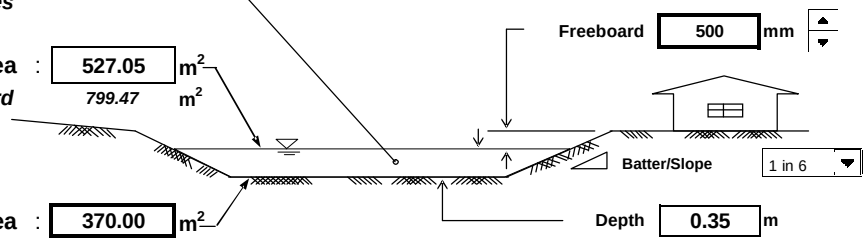
Area	: **66,582**	**m^2**
Run-off Coefficient	: **0.42**	
Flow Rate	: **489.1**	**L/s**

Outflow Details

Soil Type	: Fine Sand		
Soakage Rate	: **0.0001**	**m/s** ®	**0.037 m^3/s** (Total Soakage)
5 Yr Pre-Dev Outlet	: **0.222**	**m^3/s**	

Storage Details

Volume *at 11 minutes*	: **231.64**	**m^3**
Surface Area	: **527.05**	**m^2**
inc. freeboard	***799.47***	**m^2**
Base Area	: **370.00**	**m^2**



Current base area, depth and batter slopes can hold a Volume of :	156.18	m3
The Volume required to store a 10 year storm is :	231.64	m3
Does the proposed basin hold the design storm ? **	No	

**** Volume of 156m³ that can be stored matches volume required with allowance for individual lot storage (tanks and soakwells). Refer to Table 3 of LWMS report**

RAINFALL DISCHARGE / BASIN VOLUME ESTIMATE

Estimation by Rational Method - 1987 Australian Rainfall and Runoff

Job : Lot 999 Kearsley Rd ***Client : Triple Nine investments Pty Ltd*** ***By : Ben Whitfield***
Job # : 21726-ALB-C ***Date : 12/01/10***

Basin B - 1 in 10 Year ARI

Wood & Grieve ENGINEERS 16 Altona Street, West Perth WA 6005

Design Rainfall Intensity

Location	: Denmark		**Duration**	: 17 minutes	
Storm Event	: 10 year		**Intensity**	: **60.6**	**mm/hr**

Catchment Details

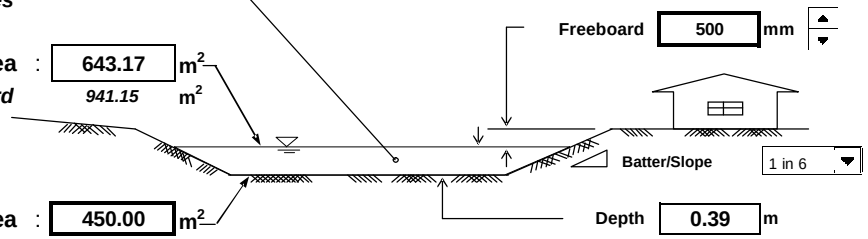
Area	: **105,520**	**m^2**
Run-off Coefficient	: **0.35**	
Flow Rate	: **622.1**	**L/s**

Outflow Details

Soil Type	: Fine Sand		
Soakage Rate	: **0.0001**	**m/s** ®	**0.045 m^3/s** (Total Soakage)
5 Yr Pre-Dev Outlet	: **0.275**	**m^3/s**	

Storage Details

Volume *at 12 minutes*	: **321.58**	**m^3**
Surface Area	: **643.17**	**m^2**
inc. freeboard	***941.15***	**m^2**
Base Area	: **450.00**	**m^2**



Current base area, depth and batter slopes can hold a Volume of :	212.05	m3
The Volume required to store a 10 year storm is :	321.58	m3
Does the proposed basin hold the design storm ? **	No	

**** Volume of 212m³ that can be stored matches volume required with allowance for individual lot storage (tanks and soakwells). Refer to Table 3 of LWMS report**

RAINFALL DISCHARGE / SWALE VOLUME ESTIMATE

Estimation by Rational Method - 1987 Australian Rainfall and Runoff

Job : Lots 348 & 349 Kearsley Rd ***Client : Robertson Developments*** ***By : Ben Whitfield***
Job # : 19738-ALB-C-37 ***Date : 12/01/10***

Swales for Individual Special Residential Lots

Wood & Grieve ENGINEERS 16 Altona Street, West Perth WA 6005

Design Rainfall Intensity

Location	: Denmark		**Duration**	: 8 minutes	
Storm Event	: 10 year		**Intensity**	: **93.2**	**mm/hr**

Catchment Details

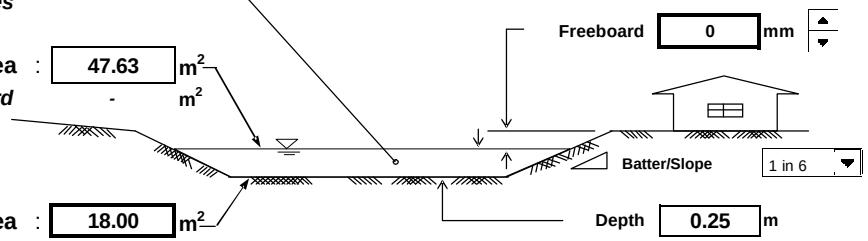
Area	: **2,001**	**m^2**
Run-off Coefficient	: **0.37**	
Flow Rate	: **19.2**	**L/s**

Outflow Details

Soil Type	: Fine Sand		
Soakage Rate	: **0.0001**	**m/s** ®	**0.0018 m^3/s** (Total Soakage)
5 Yr Pre-Dev Outlet	: **0.0**	**m^3/s**	

Storage Details

Volume *at 43 minutes*	: **12.50**	**m^3**
Surface Area	: **47.63**	**m^2**
no freeboard	**-**	**m^2**
Base Area	: **18.00**	**m^2**



Current base area, depth and batter slopes can hold a Volume of :	** 7.91	m3
The Volume required to store a 10 year storm is :	12.50	m3
Does the proposed basin hold the design storm ?	No	

**** Volume of 7.9m³ that can be stored matches volume required with allowance for rainwater tanks and soakwells. Refer to Table 3 of LWMS report**

Appendix C

WOOD & GRIEVE ENGINEERS

SOIL SURVEY REPORT (CASUARINA FOREST SERVICES)

AYTON BAESJOU PLANNING, 2009

APPENDIX B

Soil Survey Report

Casuarina Forest Services

Plantation Establishment And Tending

Broadacre Spraying Licence No. 645
ABN 54 261 562 373

P.O. Box 305,
Manjimup
Western Australia.
6258

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BACKSHALL, PLOUGHMAN & MENZIES. DENMARK.

On 12th September 2005 a soil survey was carried out over 3 locations off Mount Shadforth Road, Denmark. The aim was to establish broad soil types, map any areas of heavy or sheet rock and identify areas of poor drainage or severe waterlogging. Basic descriptions of soil profiles were made from interpretation of augered samples obtained using a small trailer mounted drilling rig. Where possible holes were drilled to 2.1m and samples collected every 0.5m. These were logged and described for colour, texture, structure and the presence of rock. Notes were made on soil moisture and drainage.

There are three locations involved in this survey. They extend from the ridgetop on Lot 348 at the 170m ABSL contour line in the north, south through Lot 349 to the lower slopes of the ridge and the 45m contour line in the south east corner of Lot 350. This large, well defined ridge forms part of the Keystone (brown) landform unit and the soils found here are typical to this unit and similar hills around Denmark. Near the ridgetop there are scattered small outcrops of granite with localized areas of heavy clays and lightly weathered granitic profiles. These are very localized and away from the granite outcrops are well drained, gravelly duplex soils which extend over most of the upper and midslopes. These soils extend downhill to the 130m contour line. From the 130m contour to the 80m contour is an area of heavy sheet laterite. This generally occurs at depths from 500mm to 700mm and from excavations in the area could be up to 2.0m thick. South and downslope of this shelf of rock well drained duplex soils continue until the lower slopes of the ridge around the 60m contour. Soils are sandier in this area and sandy loams and sandy clay loams extend to 1.7m over the clay base. At the time of the survey soils from 700mm to 1700mm were wet. This area is in a water gaining situation on the lower slopes or in a minor gully in the south east of Lot 350 and hence water off the hillside tends to collect in this area. Although it is wet at present there is still some slope and these soils will drain early in the spring.

The 4 soil types that have been identified and mapped are:

1. Gravelly Duplex Soils- These are found over most of the ridgetop and where there is not a cemented lateritic layer they also extend downslope onto the lower slope region. This soil type includes small granite outcrops and localized heavier clays associated with the granites. These occur mainly on the ridgetop and at the break of slope near the ridgetop on Lot 348. This soil type is part of the Keystone (brown) landform unit and it typically has a gravelly loamy sand between 500mm and 700mm deep over reddish yellow light clays. These are well structured and well drained. Red and yellow mottles are common. There can be areas with scattered lateritic boulders on the margins of the sheet laterite area but these are loose rocks and do not form a sheet or impeding layer.

2. Sheet laterite- This area occurs in the midslope of the ridge mainly in Lot 349 and in the south east corner of Lot 348. Extremely heavy laterite occurs under gravels at a depth of 500mm to 700mm. This rock layer is up to 2.0m thick in places but is more broken near the edges. Under the rock, at depths from 1.5m to 2.0m+ are the same reddish yellow clays as in Soil Type 1.

3. Sandy Duplex Soils- These soils occur low in the landscape on Lot 350. They are in watergaining situations with gentle slopes to the south. A horizons are reddish brown sandy loams extending to 700mm over yellow sandy clay loams or clay loams. These are around 1.0m thick and at the time of the

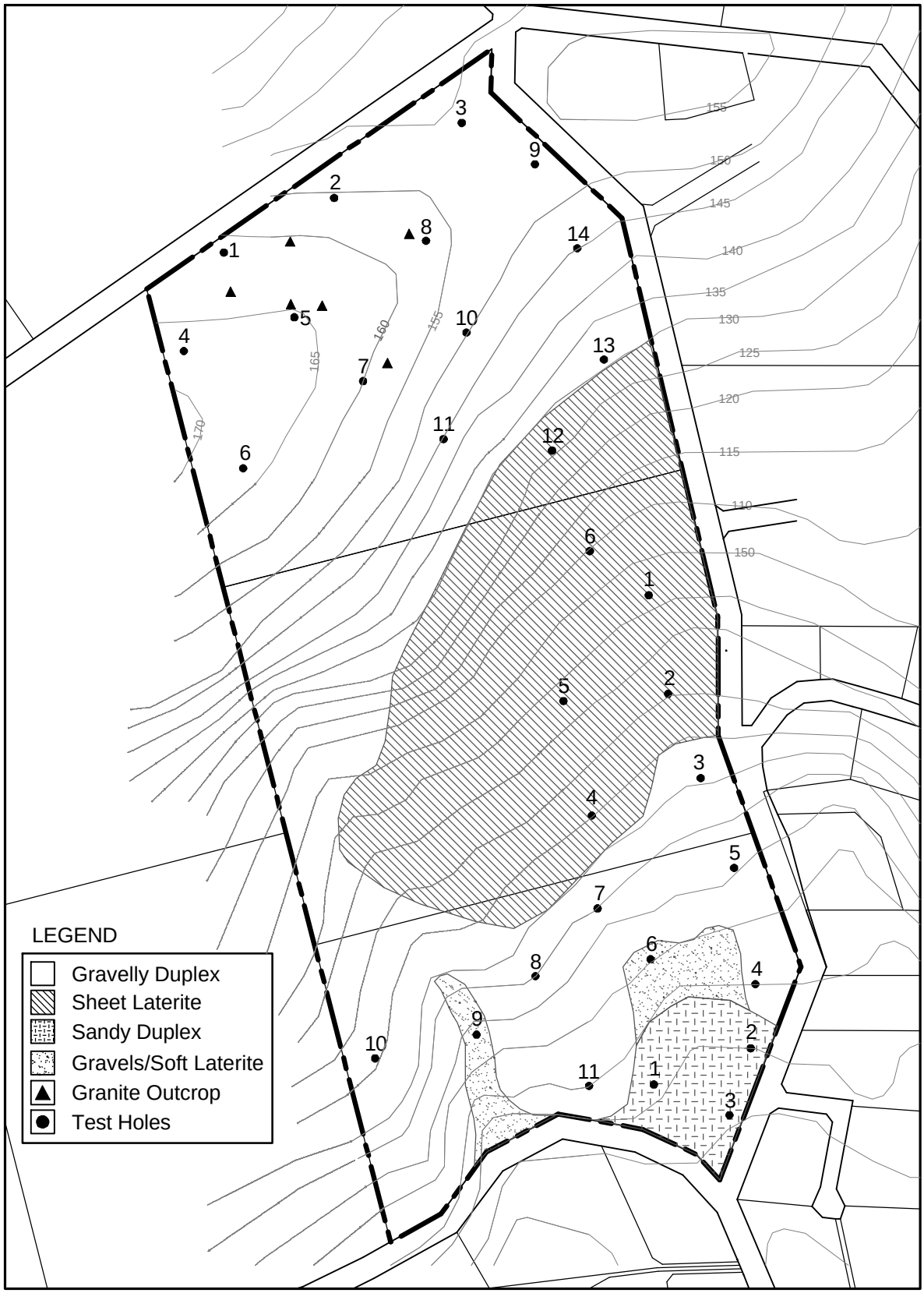
survey were very wet. Below 1.7m are reddish brown or grey, light medium clays. These have reasonable structure and can contain some lateritic gravel. They are moist but not wet.

4. Gravels/Soft laterite- This small soil type was identified in a small gully in the south of Lot 350 and in an area just above the sandy duplex soils of Soil Type 3. Both areas are in a water gaining situation and because they are freely draining gravels and soft laterite these areas are draining the water from the midslopes to the lower slopes. Both sample holes filled with water to 1.5m from the surface after drilling. Because of the free draining nature of the soils these areas will dry relatively quickly after rain events.

Duncan Brown

26th September 2005

ALL AREAS AND DIMENSIONS ARE SUBJECT TO SURVEY



SOIL MAPPING
Lots 348, 349, 350
McLean, Kearsley and Mt Shadforth Road
Shire of Denmark

Ayton Taylor Burrell
Consultants in Urban & Regional Planning
11 Duke St, Albany, Western Australia 6330
Phone: (08) 9842 2304 Fax: (08) 9842 1340

SCALE
1:5000
ORIG A4
05-43-16.WR.

Local Water Management Plan

Lot 350.
Kearsley Road
Denmark

March 2010

Local Water Management Plan

Lot 350.
Kearsley Road
Denmark

Landform Research
Land Systems - Quarries - Environment
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Lindsay Stephens Bsc (Geology), Msc (Botany) MEIANZ
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BACKGROUND

There is a proposal to subdivide Lots 348 – 350 Kearsley Road, Mt Shadforth into urban lots with areas down to 900 m^2, and some larger lots in excess of 2 000 m^2.

The subdivision is located approximately 2 km west north west of the Denmark town centre, bounded by Mt Shadforth Road in the south and Kearsley Road in the east.

A water management plan has been prepared for Lots 348 and 349 by Wood and Grieve.

This water management plan is restricted to Lot 350.

Lot 350 has an area of 8.498 hectares and is proposed to be subdivided into 10 lots of 2000 m^2 and 26 smaller lots averaging 1 000 m^2. Internal road access is generally along contour with a small downslope leg and Kearsley Road running downslope.

A detention basin is proposed for the south eastern corner of Lot 350.

It is proposed that Kearsley Road be split into a dual access way with the existing remnant vegetation and trees on the western side of Kearsley Road becoming the median strip and a new carriageway to the west of that vegetation. Figure 1.

The larger lots are to have on site waste water disposal, whereas the smaller lots will be connected to sewer.

All lots are to be connected to scheme water.

SUMMARY OF WATER MANAGEMENT AFTER SUBDIVISION

1.1 Stormwater Management

- *Calculations are based on 40 lots to provide a contingency if the subdivision changes. For 40 lots the total volume of stormwater from hard surfaces to be retained on site is calculated to be 154.8 m^3.*

- *This equates to an average of 3.87 m^3 of stormwater per lot directed to soakwells..*

- *As the size of dwellings vary, for a roof area of 250 m^2 it is recommended that two 1300 x 1200 mm soakwells be used and with a larger roof area requiring correspondingly three or more soakwells to achieve a 1 in 1 hour rainfall event.*

- *Soakwells are recommended to be placed on a 300 mm sand base and surrounded with 600 mm sand to increase the infiltration area or more soakwells used. Geofabric may be required to prevent sand from flowing into the soakwell when full. In addition to prevent collapse, an overflow to the block or road drainage is recommended.*

- *A volume of 102.6 m^3 is calculated to be directed to the local stormwater detention/retention basin in the south east of Lot 350.*

- *Using an average water depth of 1.2 m, and allowing for freeboard etc, a surface area of the detention basin is recommended to be 85.5 m^2.*

- *See Figure 4 for recommended management.*

The only other flows will relate to the bushland areas from Lots 348 to 350. The density of native vegetation on that land will reduce the stormwater flows from those areas.

Kearsley Road is proposed to be a split road with separate carriageways up and down separated by a vegetated central strip that will act as a surface drain. The stormwater from the central median strip is recommended to enter a sump at the lower end which is then to drain to the existing deep stormwater drain on Mt Shadforth Road.

The central median strip will also accept the excess flows from the subdivision of Lots 348 and 349 and the overflow from the stormwater detention basin in the south eastern corner of Lot 350.

As part of the detailed design of the stormwater drainage, a review of the stormwater drain along Mt Shadforth Road should be considered to ensure that it is capable of accepting the additional peak storm flows.

A consideration of the design of the intersection of Mt Shadforth and Kearsley Roads will also be required at the detailed design stage.

The *Shire of Denmark 2008, Guidelines for Development and Subdivision of Land* that includes stormwater management for roads, drains and detention basins can be incorporated into the detailed design of the stormwater management.

See Figure 4.

1.2 Drainage and Flood Risk

The site is no different to other nearby developed lots. There are no watercourses or defined storm flow paths.

Currently water from the bushland on Lots 348 – 350 flows down to the edge drain on Mt Shadforth Road. Figure 2.

After subdivision this water can either continue to flow in that direction or down the fire protection easement or collected by the proposed road network.

It is recommended that a contingency be maintained to allow flood storm flows to drain down the fire access easement and not across the proposed lots.

1.3 Groundwater

No evidence of the regional watertable occurs on site. There are perched winter water tables caused by lateral flows in more permeable surface soil horizons.

This surface water will be largely picked up by the road drainage. The proposed road drainage cutting off the surface water flows in sinter will also assist in reducing the winter wet soil conditions in the south of Lot 350 that were noted by Casuarina Forest Services.

There is not likely to be any change to groundwater elevations.

1.4 Water Quality

- **Salinity**

There is no evidence of salinity of soils on site.

- **Soil Acidity**

There is no evidence of acid sulfate conditions and unlikely to be any risk based on geological an regolith considerations.

- **Nutrient Impacts**

On this site waste water disposal will be sewerage on lots <1000 m^2 or nutrient adsorbing waste water systems (ATU) on lots >2000m^2.

The site complies with the Draft Country Sewerage Policy (22 September 2002, SOCWM meeting) which permits waste water disposal on any soil type on lots in excess of 2 000 m^2.

The soils on Lot 350 are capable of accepting and retaining all waste water. Site investigations were conducted by Casuarina Forest Services, who found the soils to be sufficiently free draining and of high nutrient adsorption capability.

The soils in the Denmark area are well known for the high nutrient treatment capability as “Karri Loams”.

Any fertiliser applied to gardens will similarly be strongly adsorbed onto the soil particles.

The critical issues are that the waste water should be disposed of into dry conditions and the waste water should infiltrate into the natural soils and not be able to move laterally and short circuit the disposal area. When this is undertaken good nutrient retention can be achieved.

Lindsay Stephens
Landform Research

LOCAL WATER MANAGEMENT PLAN SUMMARY

SECTION	ITEM	REFERENCE	COMMENTS
Executive Summary			
Introduction	Context	1.0 page 1	
Proposed Development	Site Context	1.2 page 2	
	Proposal Plan	Figure 1	
	Landscape Plan	Figures 1 - 5	
Design Criteria	Design Objectives	5.0 page 8 Figure 1	
Pre-Development Environment	Site Assessments	2.0 pages 3 - 8	
	Site Condition	2.0 pages 3 – 8 Figures 2 - 3	
	Geotechnical Conditions	Appedix 1	
	Environmental Issues		No wetlands, watercourses or vegetation to be disturbed
	Existing Surface Water Flows	4.2 page 7	
	Groundwater	4.3 page 8	
Water Use Sustainability Initiatives	Water efficiency	5.1 page 8	
	Water Supply	5.1 page 8	
	Wastewater Management	6.0 page 13	
Stormwater Management Strategy	Flood Parameters		No watercourses or floods
	5 Year Event		
	1 Year Event	5.0 pages 8 - 12	
	Groundwater Management		No groundwater impact
	Acid Sulfate	2.6 page 5	No acid sulfate
Future Water Management			Detailed designs will be required after approvals are gained
Implementation	Developer		This document is to support application for subdivision.
	Roles - Funding		
	Review		

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Geotechnical Assessment – Casuarina Forest Services

Figure 1 Subdivision Plan
Figure 2 Contour Plan - Catchments
Figure 3 Air Photo - Catchments
Figure 4 Water Management
Figure 5 Aerial Photograph

LOCAL WATER MANAGEMENT PLAN

1.0 Introduction

1.1 Background to a Water Management Plan

In recent years Urban Water Management has received greater attention during the design phase to ensure that water resources are maximised and that environmental flows are maintained. The considerations and design are also directed to minimising impact during storm events.

The Department of Water, 2008, *Better Urban Water Management* documents the issues.

This is also considered in Department of Planning, *Planning Bulletin 92, Urban Water Management.*

The Shire of Denmark has produced *Guidelines for Development and Subdivision of Land, 2008* which provides much information on stormwater management, planning and design. Where applicable that document is referenced.

The focus of this Local Urban Water Management Plan is to provide for surface and groundwater management at all stages of the Planning and Development process to ensure that the management of water works at a Regional and Local level and that as land is progressively developed a situation does not arise where a satisfactory solution or management cannot be found in the later stages of development.

In other words drainage and water management is to be considered up front in the broad scale and from there considered in progressively more detail until the final design at the local level is achieved.

With consideration of water issues up front and through the process there is much more potential to design better management of water. The main trends of the *Better Urban Water Management* are summarised below.

- to increase the potential for sustainability,
- maintain environmental flows,
- maintain and enhance water quality
- minimise the potential impact on the surface and groundwater hydrology both onsite and offsite,
- maintain biodiversity
- provide nutrient retention and management,
- minimise flood risk
- encourage water conservation

The key design objectives are to

- maintain the one year one hour average recurrence interval (ARI) event so that the peak post development flow rates are similar to the pre-development conditions.

- manage the catchment runoff from post development for up to the 1 in 100 year ARI event with runoff similar to the pre-development conditions.

- Try to restrict water use to 100 kL per person/year including not more than 40 – 60 kL per person per year of scheme water.

The water planning structure is;

1. ***Regional or subregional land and water planning***

   Water planning at a whole of catchment level or for the Denmark area

2. ***District water planning document***

   Water planning at the local catchment level or within a planning precinct

3. ***Local water planning strategy***

   Water planning within part of a catchment or at a subdivision level.

4. ***Detailed engineering design with technical calculations***

   This is to accompany the site specific design for the subdivision and follows subdivision approval.

At each stage of the water planning, the water balance, design and considerations would integrate both upwards and downwards. In other words the regional or district planning should not preclude development at a local level and in turn development at a local level should not place unacceptable impacts on district or regional water attributes.

In the case of the subdivision of Lot 350, a Local Water Management Plan is required. This plan should also consider the potential impact on and from the surrounding land and hydrology.

In *Better Urban Water Management* the Local Water Management Plan is submitted as part of the subdivision application process. It is not a detailed design document with complex calculations and pipe widths and the like, but rather a consideration that sufficient land and management is available to manage the water post development.

An additional stage of detailed engineering design, to accompany the site specific design for the subdivision, follows subdivision approval.

1.2 Proposed Development - Subdivision

There is a proposal to subdivide Lots 348 – 350 Kearsley Road, Mt Shadforth into urban lots with areas down to 900 m^2, with some larger lots in excess of 2 000 m^2.

The subdivision is located approximately 2 km west north west of the Denmark town centre, bounded by Mt Shadforth Road in the south and Kearsley Road in the east.

A water management plan has been prepared for Lots 348 and 349 by Wood and Grieve.

This Local Water Management Plan is restricted to Lot 350.

Lot 350 has an area of 8.498 hectares and is proposed to be subdivided into 10 lots of 2000 m2 and 26 smaller lots averaging 1 000 m2. Internal road access is generally along contour with a small downslope leg and Kearsley Road running downslope.

It is proposed that Kearsley Road be split into a dual access way with the existing remnant vegetation and trees on the western side of Kearsley Road becoming the median strip and a new carriageway to the west of that vegetation.

The larger lots of >2000 m^2 are to have on site waste water disposal, whereas the smaller lots will be connected to sewer.

All lots are to be connected to scheme water.

A site plan of the proposed subdivision is attached. Figure 1.

1.3 Current Landuse

Lot 350 has been used for rural living. It is cleared, with one dwelling and shed and a dam in the north eastern corner. There was a dam in the south eastern corner but that was filled in some years ago.

Almost all of Lot 350 is cleared although a small area of remnant Karri Forest occurs in the north west, joining a much larger area on Lots 349 and extending into Lot 348.

That vegetation is excluded from dwellings although the northern edge of some lots enter it on Lot 350.

1.4 Water Management Plan for Lot 350

This water management plan for Lot 350 is a Local Water Management Plan concentrating on Lot 350. Of necessity consideration of the potential impacts of other land within the same catchment is to ensure that integration of water management occurs.

1.5 Methodology

The site was inspected on 4 November 2009, by Lindsay Stephens, by viewing from Kearsley Road and Mt Shadforth Roads, walking on site and reviewing the contour plan, aerial photograph and subdivision guide plan. Previous work relating to soil assessment was reviewed.

The layout, landform and site features are readily obvious from these viewpoints.

2.0 Site Description

2.1 Geology and Regolith

Lot 350 lies near the base of a south facing slope dropping from 95 metres in the north western corner down to 45 metres in the south eastern corner.

The area has a granite basement at depth and is overlain by deep and permeable silty loams developed on Plantagenet Beds. The soils on Lot 348 have granite basal soil regolith, and granite is exposed in the north west of Lot 348 at the brow of the hill.

The Plantagenet Beds tend to be fine sediments, predominantly silts and fine sands with a clay component belonging to the Plantagenet Group, with dissection in more recent times and subjected to laterisation in the later Tertiary and into the Recent.

2.2 Soils

A geotechnical assessment was undertaken by Casuarina Forest Services in September 2005. A copy of the report is attached.

The soils on Lot 350 consisted mainly of Gravelly Duplex which are gravelly loamy sands to 500 – 700 mm over reddish yellow light clays. A dam is present in this soil unit in the north east corner, but according to the landholder does not hold water into summer, indicating the slow permeability of the subsoils.

In the lower parts of Lot 350, along the depressions and drainage areas, are Gravels/Soft Laterite which are described as being free draining gravels with soft laterite and water entering at 150 mm depth in September 2005.

The south eastern corner has Sandy Duplex with reddish brown loam to 700 mm over yellow sandy clay loam or clay loam. Below 1700 mm the soils are reddish grey, light medium clays. (Casuarina Forest Services). These soils are described as “very wet”. According to the existing landholder a dam was previously located in this soils unit but has been filled in recent years because “it did not hold water”.

The Gravelly Duplex soils and the Gravel/Soft Laterite are free draining. On the other hand the Sandy Duplex is wet in winter.

2.3 Implications for development

Soil types on the development areas behave in a similar manner with respect to water, site stability and nutrient retention and so are considered together; the difference being in the amount and depth of more freely draining surface sand which can affect the behaviour of soil moisture.

The soil types are well known and common in the Denmark area. The Shire of Denmark has guidelines for the installation of waste water disposal systems in these soil types that have been shown over the years to provide good levels of waste water disposal.

2.4 Soil Permeability

Casuarina Forest Services noted that the soils are free draining. They did not undertake any permeability tests.

The two dams on site, one now filled in, do not hold water into summer indicating reduced infiltration in the subsoils.

2.5 Nutrient Retention Capability

The soils on Lot 350 are capable of accepting and retaining all waste water. Site investigations were conducted by Casuarina Forest Services, who found the soils to be sufficiently free draining and of high nutrient adsorption capability.

The gravelly soils have high phosphate retention capability and are highly capable of retaining nutrients.

On this site waste water disposal will either be sewerage or nutrient adsorbing waste water systems.

Any on site wastewater disposal will be required to comply with the Draft Country Sewerage Policy (22 September 2002, SOCWM meeting) which permits waste water disposal on any soil type on lots in excess of 2 000 m^2.

Casuarina Forest Services found the majority of the site is gravel based soils. Gravel and indurated (ferricrete) in the subsoils typically have very high capability for phosphorous retention as shown by Lantzke 1997, *Phosphorous and nitrate loss from horticulture on the Swan Coastal Plain*, Department of Agriculture Miscellaneous Publication 16/97.

The soils in the Denmark area are well known for the high nutrient treatment capability as "Karri Loams".

Karri Loams are well known for their nutrient (particularly phosphorous) retaining qualities, because of the yellow goethite, iron oxides, clay and silt. The phosphate retention and thus (PRI) of all soils on site are high when considering the whole soil profile (compared to the database of type soils held by Landform Research for PRI and with Chemistry Centre data).

Karri Loams are used to form part of the amended soils used in nutrient retaining waste water disposal systems (ATU's).

For example Gerritse et al, 1995B, found that all phosphate was adsorbed within 2 metres from a 7 year old leach drain in Yarrigal loam soils that have some similarity for phosphate retention with the Karri Loams, which have better capability. The critical point is retention times within the soils.

Nutrient adsorbing waste water systems use phosphorous adsorbing amended soils in soils of lower phosphate retention capability and therefore the risk from phosphate export is from waste water systems is minimal to nil.

Nitrogen is removed by denitrification under anaerobic soil conditions and through vegetation and soil microbial uptake. For example many studies, for example Dawes and Goonetilleke, have found that all nitrogen can be lost within 1 metre in damp soil conditions which normally exist around waste water disposal areas. Gerritse R G, J A Adeney and J J Hosking, 1995, show that reductions in nitrogen to only 2% or less of the primary output concentration normally occur within 3 metres of lateral travel. Lantzke 1997, found high levels of denitrification in moist leached sands on the Swan Coastal Plain. These same moisture soil conditions will occur on site during most of the year.

Microbial purification is an important part of effluent disposal to ensure that all fine organic matter and micro-organisms are broken down. Alternative waste water systems are designed to provide efficient microbial purification (Specification for Aerobic Treatment Units Serving Single Households, Health Department of Western Australia, 1992).

Any fertiliser applied to gardens will similarly be strongly adsorbed onto the soil particles.

The critical issues are that the waste water should be disposed of into dry conditions and the waste water should infiltrate into the natural soils and not be able to move laterally and short circuit the disposal area. When this is undertaken good nutrient retention can be achieved.

2.6 Acid Sulfate Soils

Acid sulfate conditions normally only develop where saturated soil conditions occur in estuarine or peaty environments, in the presence of organic matter, sources of sulfur and under reducing conditions.

All soils observed on site are oxidised with the iron minerals being oxides. No reducing conditions were observed at the surface or at depth in the test holes. Any reducing conditions will be temporary due to waterlogging.

No organic pyritic, peat, gley or highly saline conditions were evident in any test hole. The site lies well above estuarine or saline conditions.

Draft Planning Bulletin Number 64, does not extend to this site. Clayey saline soils or gley soils, as shown in the Munsell Soil Colour Charts, were not observed by Casuarina Forest Services.

Site inspections did not identify any conditions which would suggest acid sulfate conditions. The soils exposed in the existing drains and in the soil auger holes are sufficiently yellow coloured to indicate low risk of acid sulfate conditions. No gley soils were noted.

No soils from the descriptions or the geomorphology, that have physical or compositional characteristics of acid sulfate conditions, were recorded in the soil test holes.

3.0 Climate

Rainfall at Denmark Research Station averages 1000.9 mm per year of which 83% falls from April to October inclusive. Temperatures range from maxima of 25.5 ^{o}C in January down to 16.1 ^{o}C in winter. Minima range down to 7.0 ^{o}C in the coldest months, July - August.

Annual evaporation is less than 1000 mm per year, with rainfall exceeding evaporation for almost nine months of the year.

4.0 Hydrology

4.1 Soil Moisture

Casuarina Forest Services found the soils to be free draining, with the exception of wetter soils in the south of Lot 350 associated with the depressions and low swales, particularly in the south eastern corner. The wettest part of the south eastern corner is proposed for drainage management.

As noted previously, a dam was originally located in the south eastern corner of Lot 350, but according to the landholders it was filled in because it did not hold water. A dam currently lies in the north eastern corner of Lot 350 but does not hold water into summer.

The wetter soils gain their water by lateral surface flows in the more permeable upper horizons. Into spring and summer the soil moisture seeps vertically downwards through the subsoils and continues to flow laterally through the upper soils, and so the soils dry out comparatively quickly in summer.

Trees and deep rooted species also take up much of the excess surface water. There is little runoff from the remaining vegetated areas.

In the lower elevations surface water is concentrated in the upper sand layers, filling them and then running downslope as winter wet areas. The slope of the land and the underlying silts and loams is sufficient to reduce the infiltration into those subsoils.

Surface water can be readily treated by providing cut off drains cut to the subsoils. This can remove water entering from upslope and reduce or eliminate the seepages. The two roads along contour will help reduce surface water downslope flows. Seepages such as

this are common in the Denmark area and their remediation is a normal part of local development.

4.2 Surface Water

Lots 348 – 350 largely comprise a separate small catchment. The boundaries of that catchment are shown on the attached Figure 2. Lot 350 lies at the lower part of the catchment.

The catchment drains to a west – east flowing tributary south of Mt Shadforth Road and this drains to the Denmark River to the east.

There has been some development to the east of Kearsley Road, but, as shown in the attached figures, these largely lie outside the local catchment and drain to the east. A small amount of water drains from the roads in that subdivision, to Kearsley Road.

The existing and potential surface water flows are shown on Figure 2, although little surface water flows from the forest.

Some general observations were made on 4 November 2009 in relation to surface water flows on Lot 350 and the influences on it.

1. The slope varies from moderate to steep.

2. The site drops to the south from 95 metres to 45 metres over 900 metres.

3. All water currently drains south through the cleared area and proposed subdivision.

4. The site is basically cleared.

5. All surface water drains to the creek line some 500 metres south of the subdivision, either through the dams south of Mt Shadforth Road, or along Mt Shadforth Road along a deep drain on the northern side of the road.

6. The dams on site appear to drain annually. A dam was located in the extreme south east on Lot 350, where the detention basin is proposed, but was filled in because it did not hold water.

7. The dam in the north east of Lot 350, just south of the proposed detention basin, collects water in winter from surface water seepage, which appears to be significant because the dam has a broad overflow, but the dam does not appear to hold water through summer and this was confirmed by the owner who stated that it dried up.

8. The soils appear sufficiently permeable and the lot sizes large enough for on site stormwater retention.

9. Obvious storm flows had occurred during winter 2009, running down Kearsley Road, through the vegetated trees. The water then flowed out onto Mt Shadforth Road, across the road and down the drains along the northern side of Mt Shadforth Road.

10. The subdivision to the east has piped road drainage, although it partly flows west to Kearsley Road.

11. With subdivision and development the amount and rate of runoff will increase on hard surfaces.

12. The addition of scheme water will increase water loading.

13. On steep slopes such as this water loading of the slopes requires consideration and may require management.

14. There are some steep slopes in the south west of Lot 350 that drop to Mt Shadforth Road. These slopes have already been steepened for road drainage at the road and, with cut and or additional water loading, may cause a soil instability risk in that area.

4.3 Groundwater

Water was intersected in some soil test holes by Casuarina Forest Services in the lower portions of Lot 350. It is not clear whether this is the regional groundwater or perched water. Much appears to be perched water concentrating in the more permeable upper soil horizons on the lower slopes. Certainly this water disappears in summer as indicated by the existing dam which dries up in summer.

With the elevation of the land and steepness of the slopes it is likely that the water in the soils is perched. Even in the south eastern corner which used to have a dam there are deep drains on Mt Shadforth Road which are dry, even in winter, when only a small flow drains along them.

Neither the dam in the south east corner that was filled and the existing dam hold/held water into summer further suggesting that the regional water table is significantly deeper than the elevation of the lower edge of Lot 350, and is probably closer to 35 - 40 metres AHD based on the soils, land uses and dams associated with the creekline to the south of Mt Shadforth Road.

The regional groundwater would therefore appear to be deeper and any subsurface groundwater management becomes a management of the perched soil moisture and changes in the permeability of the soil horizons, combined with the flow paths and volumes.

As much of the soil moisture results from lateral flow, subsurface cutoff drains can be used to reduce soil moisture.

5.0 Water Management Calculations

5.1 Subdivision Water Input

The proposed subdivision of Lot 350 will be connected to scheme water. The amount of scheme water used per dwelling will depend on the number of persons, the amount of water added to gardens and whether there is a swimming pool. The volume is normally in the range 250 – 350 kL per year for a family, with Denmark trending towards the lower figures because of rainfall throughout the year.

There is potential for rainwater tanks. The use of rainwater tanks will help reduce the water requirements from scheme water.

The other loading is from rainfall at 1000.9 mm per year of which 83% falls from April to October inclusive.

5.2 Water Loading from Hard Surfaces

In order to determine the effects of development, and what should be designed for and considered, an assessment of the likely recharge now and after development is considered.

For lots of 0.1 to 0.2 ha the amount of hard surface will increase with dwellings, driveways and roads.

However if the water is to soak into the ground around the dwellings and within swale drains the subdivision can be designed so that there will be no net increase in recharge apart from the small addition from scheme water.

There will also be a steep access road and steep driveways from which on site detention will be more difficult to retain.

On this proposed subdivision kerbing will be required and all stormwater from roads will therefore be directed to infiltration basins or drains.

If all the water from the roads is contained within infiltration basins then there will be no overall change in recharge on site from hard surfaces.

There will however be some increases from scheme water.

Currently rainfall which falls on the subject land either soaks into the soils or runs from the site. The landuse is pasture.

Rainfall at Denmark Research Station averages 1000.9 mm per year of which 83% falls from April to October inclusive. Details on rainfall and storm intensity is provided in *Shire of Denmark Guidelines for Development and Subdivision of Land 2008.*

For a 36 lot (say 40 lots to provide a contingency if the subdivision is changed) subdivision a hard surface area of 350 m^2 is assumed including dwelling, driveways sheds and garages.

Surface area as a result of dwellings is 350 x 40 = 14 000 m^2.

To this is added 600 metres of internal road at say 6 m^2 hard surface per metre and Kearsley Road of 300 metres at 4 plus 4 m^2 per linear metre.

The total area of road hard surface is 600 x 6 = 3 600 m^2

300 x 8 = 2 400 m^2.

The total hard surface for the subdivision is therefore estimated to be

14 000 + 6 000 = 20 000 m^2. This represents 23.5% of the surface area.

This is similar to that used by the Shire of Denmark nominal value of 500 m^2 per residential lot.

5.3 Design Criteria - Volumes

Department of Water seek to retain on site rainfall from a 1 in 1 year ARI 1 hour event. For the south coast this figure is 14 mm per one hour event (Department of Water) (14.3 mm Shire of Denmark).

As the surface area is 20 000 m^2, and the rainfall criteria is 14.3 mm with a 0.9 runoff coefficient, then a volume of 257.4 m^3 is required for detention on site for all land, roads and hard surface from developments.

It is likely that on any particular lot only 300 m^2 of water from hard surfaces will be able to be retained because of the slopes and driveways to roads. This is the likely maximum volume that will be able to be captured on sloping land such as this and directed to soakwells.

At 300 m^2 per lot and using an impervious ratio of 0.9, and a design rainfall event of 14.3 mm a volume of 300 m^2 x 14.3/1000 mm x 4.3 m^3 or 4.3 kL (4 300 litres) x 0.9 = 3.87 m^3.

Therefore a minimum of 3.87 m^3 of soakwells is recommended to be provided for on each lot.

For 40 lots this equates 257.4 – 154.8 m^3 = 102.6 m^3 directed to local stormwater detention/retention.

5.4 Treatment of Stormwater on each Lot

The volume of water directed to soak wells can be reduced correspondingly for dwellings with rainwater tanks in excess of say 5 000 litres.

The installation of rainwater tanks with a minimum volume is recommended to further reduce the potential storage on site and increase the margins.

A minimum 5 000 litre rainwater tank is recommended provided it is plumbed into a system that is used all year round, such as potable water, washing, toilet use or a combination. For toilet use alone, at say a volume of 2.5 L per average flush with 6 flushes per person, the daily use will be 2.5 x 7 = 17.5 L per person per day.

For an average 2.5 person family over a month this amounts to 1 300 L per month or 1.3 m^3 per month. To place this in comparison the wettest month of July has 158.9 mm rainfall and the driest month 22.3 mm rain. The volumes of water generated from 300 m^2 hard surface is 47.67m^3 and 6.69 m^3 respectively. Therefore it can be seen that even piping rainwater for toilet use represents a water saving, but is not sufficient alone in any month to effectively attenuate a storm event. The use of the rainwater tank to attenuate stormwater flows is therefore not included in the calculations because at this stage the actions of individual owners cannot be anticipated.

Typical soakwells of 1300 mm diameter x 1200 mm depth hold a volume of 1.59 m^3. With two such soakwells a total storage volume will be 3.18 m3 or 82% of the 300 m2 roof area used. Therefore to round the figure off. A roof area of 250 m2 will require two 1300 x 1200 mm soakwells with a larger roof area requiring correspondingly more or three soakwells to achieve a 1 in 1 hour rainfall event.

Bearing in mind the permeability of soils in the Denmark area and on site it is preferable that the infiltration surface area of the soak wells be increased. This can be achieved through by placing the soakwells on a 300 mm sand base and surrounding each soakwell with 600 mm sand or by using more soakwells. Geofabric may be required to prevent sand from flowing into the soakwell when full.

Also to prevent collapse an overflow to the block or road drainage is recommended.

As noted above it is recognised that not all water from hard surfaces may not be able to be retained on each lot, for example some paved areas. There should be an attempt to retain as much as possible by directing such water to the block.

5.5 Excess Water Treatment

The Shire of Denmark has guidelines on stormwater management for roads and drains which can be incorporated into the detailed design of the stormwater management (*Guidelines for Development and Subdivision of Land*) for the detention of stormwater.

As noted previously the volume of water coming from roads and driveways that will not be able to be treated on individual lots is 102.6 m^3. This will be directed to a detention/retention basin.

The volume of the detention basin needs to be 102.6 m^3 to accept all runoff from a 1 in 1 year ARI 1 hour event (that is 14.3 mm).

For comparison Department of Water nominally uses a basin area of 2% of the impervious area. From above, 6 000 m^2 road plus 2 000 m^2 of area from lots that is likely to run to the street is 8 000 m^2 area. A basin nominally needs to be 80m^2.

The Shire of Denmark has guidelines on stormwater treatment (Guidelines for Development and Subdivision of Land) for the detention of stormwater. The guidelines suggest an ideal depth of 1.2 metres for a 20 year ARI storm event. Slopes are recommended to be 1 : 6 to allow for easy egress. There are also design features relating to signage and spillways.

The nature of the location of the detention basin in the south eastern corner is such that slopes of 1 : 6 are not possible, There can be a more gently slope to the west to enable cleaning, or the wall of the basin could be constructed in a manner that will enable an excavator to clean out the basin if required.

From the calculations of the volume of stormwater a 1 in 1 year ARI hourly event as nominated by the Department of Water is 102.6 m^3. This represents an hourly storm rainfall of 14.3 mm. If this is to be increased to a 20 year event, which in this case seems unreasonable, the volume required to be dealt with would be 30.5 mm or 218.8 m^3.

The reason that this volume seems unreasonable is that it will lead to reduced environmental flows reaching the creek to the south of Mt Shadforth Road and ultimately the Denmark River.

A better representation of maintaining environmental flows would appear to be the 1 in 1 year hourly return event which relates to a volume of 102.6 m^3. Using that figure, with *an average water depth of 1.2 m and allowing for freeboard etc, a surface area of basin is recommended to be 85.5 m^2.*

5.6 Stormwater Design

The Shire of Denmark guidelines on stormwater management for roads and drains can be incorporated into the detailed design of the stormwater management (in relation to pipe diameters, construction guidelines and the other stormwater management parameters. They are well covered in that document and are not therefore repeated here. See *Shire of Denmark 2008, Guidelines for Development and Subdivision of Land.*

The current situation of stormwater running down Kearsley Road and out onto Mt Shadforth Road is unacceptable.

This can be minimised by the design used for the subdivision. Kearsley Road is proposed to be a split road with separate carriageways up and down separated by a vegetated central strip.

The vegetation is already in place and can be seen on the aerial photograph. That vegetation already forms a drainage function and, with the existing trees, groundcovers and rough surface, already helps to reduce the speed of flow down the slope.

The best way to provide a detention basin for the stormwater is to direct the water from the internal roads, independently of Kearsley Road to the basin in the south east corner of Lot 350. This can only be achieved via a pipe and easement across two lots or as a piped drain along the western side of Kearsley Road. This is recommended.

Stormwater from the internal roads on Lot 350 is recommended to a sump with a volume set at the stormwater flow rates for a 1 : 1 ARI one hour event with excess for contingencies. From the sump drainage is recommended t be piped along the road

reserve to the detention basin on Lot 350. This allows easy maintenance. Overflow in times of storm or blockage of the drain can be directed to the median strip drain along Kearsley Road.

Flood and water flows in Kearsley Road also derive from upslope and from excess from Lots 348 and 349. If the internal road surface water is directed to Kearsley Road and then to the detention basin on Lot 350, the size of the basin will have to be larger and there will be uncertainty with the volume required.

The central median strip will also accept the excess flows from the subdivision of Lots 348 and 349 which are the subject of a separate Local Water Management Plan prepared by Wood and Grieve. There is also a small amount of flow from the road to the east that can be dealt with in a similar manner.

The centre vegetated drainage swale on Keasrley Road effectively remains as dealing only with surface water from Kearsley Road and as a flood bypass for which it appears well suited.

The stormwater from the central median strip is recommended to enter a sump at the lower end which will then to drain to the existing deep stormwater drain on Mt Shadforth Road.

The overflow from the stormwater detention basin in the south eastern corner of Lot 350 would similarly either flow to the sump in the base of Kearsley Road or directed to the Mt Shadforth road drain.

As part of the detailed design of the stormwater drainage, a review of the stormwater drain along Mt Shadforth Road should be considered to ensure that it is capable of accepting the additional peak storm flows. If necessary that drain may have to be enlarged.

The design of the intersection of Mt Shadforth and Kearsley Roads will also be required at the detailed design stage.

5.7 Scheme Water

Scheme water is likely to add in the order of 250 – 350 kL per lot.

This can be reduced further by the provision of water tanks, depending on the manner in which the rainwater is used as discussed previously.

A small tank for gardens will effectively attenuate rainfall for summer but not in winter when the tank will be full. On the other hand a small tank used for potable water will help attenuate rainfall throughout the year, but will still depend on the amount of water used daily.

As rainwater use is dependant on individual residents its attenuation is not included in these calculations.

Similarly the additional water loading per lot is also not considered. For a 2 000 m^2 lot with a scheme water use of say 250 kL per year this additional loading represents approximately 1 000 kL per hectare after allowing for roads or equivalent to an additional 100 mm rainfall.

Lots smaller than 2 000 m^2 will be connected to sewerage and therefore portion of the additional water loading from smaller lots from scheme water will be offset by export of waste water. Greywater disposal on site will potentially offset some scheme water use by replacing the need for scheme water for gardens.

6.0 Waste Water Management

Nutrient retention is high on this site. See 2.5 Nutrient retention capability and soil assessments by Casuarina Forest Services.

On this site waste water disposal will be sewerage on lots <1000 m^2 or nutrient adsorbing waste water systems (ATU) on lots >2000m^2.

The site complies with the Draft Country Sewerage Policy (22 September 2002, SOCWM meeting) which permits waste water disposal on any soil type on lots in excess of 2 000 m^2.

The soils on Lot 350 are capable of accepting and retaining all waste water. Site investigations were conducted by Casuarina Forest Services, who found the soils to be sufficiently free draining and of high nutrient adsorption capability.

The soils in the Denmark area are well known for the high nutrient treatment capability as “Karri Loams”.

Any fertiliser applied to gardens will similarly be strongly adsorbed onto the soil particles.

The critical issues are that the waste water should be disposed of into dry conditions and the waste water should infiltrate into the natural soils and not be able to move laterally and short circuit the disposal area.

The Government Country Sewerage Policy permits site modification to achieve onsite waste water disposal. On sloping sites such as this a terraced waste water disposal area is likely to be required, with an upslope cutoff drain. This is capable of achieving a dry suitable waste water disposal area. Volume can be reduced using greywater reuse systems.

When this is undertaken good nutrient retention can be achieved.

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Casuarina Forest Services

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BACKSHALL, PLOUGHMAN & MENZIES. DENMARK.

On 12th September 2005 a soil survey was carried out over 3 locations off Mount Shadforth Road, Denmark. The aim was to establish broad soil types, map any areas of heavy or sheet rock and identify areas of poor drainage or severe waterlogging. Basic descriptions of soil profiles were made from interpretation of augered samples obtained using a small trailer mounted drilling rig. Where possible holes were drilled to 2.1m and samples collected every 0.5m. These were logged and described for colour, texture, structure and the presence of rock. Notes were made on soil moisture and drainage.

There are three locations involved in this survey. They extend from the ridgetop on Lot 348 at the 170m ABSL contour line in the north, south through Lot 349 to the lower slopes of the ridge and the 45m contour line in the south east corner of Lot 350. This large, well defined ridge forms part of the Keystone (brown) landform unit and the soils found here are typical to this unit and similar hills around Denmark. Near the ridgetop there are scattered small outcrops of granite with localized areas of heavy clays and lightly weathered granitic profiles. These are very localized and away from the granite outcrops are well drained, gravelly duplex soils which extend over most of the upper and midslopes. These soils extend downhill to the 130m contour line. From the 130m contour to the 80m contour is an area of heavy sheet laterite. This generally occurs at depths from 500mm to 700mm and from excavations in the area could be up to 2.0m thick. South and downslope of this shelf of rock well drained duplex soils continue until the lower slopes of the ridge around the 60m contour. Soils are sandier in this area and sandy loams and sandy clay loams extend to 1.7m over the clay base. At the time of the survey soils from 700mm to 1700mm were wet. This area is in a water gaining situation on the lower slopes or in a minor gully in the south east of Lot 350 and hence water off the hillside tends to collect in this area. Although it is wet at present there is still some slope and these soils will drain early in the spring.

The 4 soil types that have been identified and mapped are:

1. **Gravelly Duplex Soils-** These are found over most of the ridgetop and where there is not a cemented lateritic layer they also extend downslope onto the lower slope region. This soil type includes small granite outcrops and localized heavier clays associated with the granites. These occur mainly on the ridgetop and at the break of slope near the ridgetop on Lot 348. This soil type is part of the Keystone (brown) landform unit and it typically has a gravelly loamy sand between 500mm and 700mm deep over reddish yellow light clays. These are well structured and well drained. Red and yellow mottles are common. There can be areas with scattered lateritic boulders on the margins of the sheet laterite area but these are loose rocks and do not form a sheet or impeding layer.

2. **Sheet laterite-** This area occurs in the midslope of the ridge mainly in Lot 349 and in the south east corner of Lot 348. Extremely heavy laterite occurs under gravels at a depth of 500mm to 700mm. This rock layer is up to 2.0m thick in places but is more broken near the edges. Under the rock, at depths from 1.5m to 2.0m+ are the same reddish yellow clays as in Soil Type 1.

3. **Sandy Duplex Soils-** These soils occur low in the landscape on Lot 350. They are in watergaining situations with gentle slopes to the south. A horizons are reddish brown sandy loams extending to 700mm over yellow sandy clay loams or clay loams. These are around 1.0m thick and at the time of the

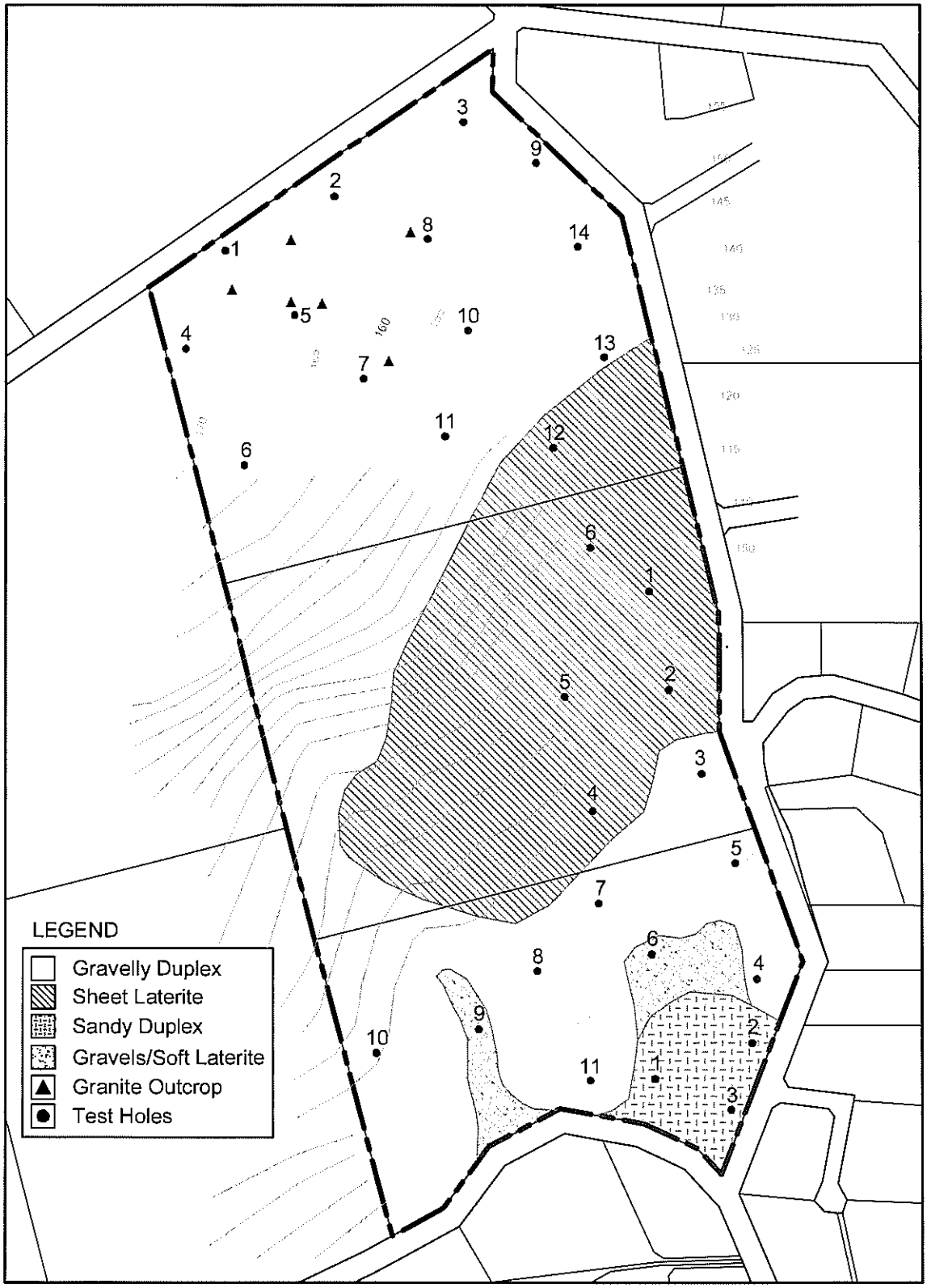
survey were very wet. Below 1.7m are reddish brown or grey, light medium clays. These have reasonable structure and can contain some lateritic gravel. They are moist but not wet.

4. Gravels/Soft laterite- This small soil type was identified in a small gully in the south of Lot 350 and in an area just above the sandy duplex soils of Soil Type 3. Both areas are in a water gaining situation and because they are freely draining gravels and soft laterite these areas are draining the water from the midslopes to the lower slopes. Both sample holes filled with water to 1.5m from the surface after drilling. Because of the free draining nature of the soils these areas will dry relatively quickly after rain events.

Duncan Brown

26th September 2005.

ALL AREAS AND DIMENSIONS ARE SUBJECT TO SURVEY



SOIL MAPPING
Lots 348, 349, 350
McLean, Kearsley and Mt Shadforth Road
Shire of Denmark

Ayton Taylor Burrell
Consultants in Urban & Regional Planning
11 Duke St Albany Western Australia 6330
Phone (08) 9842 2304 Fax (08) 9842 1340

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ADOPTED BY RESOLUTION OF THE COUNCIL OF THE

_____ OF _____

AT THE _____ COUNCIL MEETING

ON THE _____ DAY OF _____ _____

CHIEF EXECUTIVE OFFICER _____

ROAD

106

46.989ha

999

KEARSLEY

2168m²

SR 13

2665m²

2043m²

2120m²

2351m²

348

12.828ha

2762m²

2017m²

2013m²

2218m²

2122m²

2239m²

DENMARK WATER SUPPLY STORAGE

MCLEAN

9301m²

4686m²

2920m²

2350m²

875m²

WATER EASEMENT

DB

900m²

3.7227ha

900m²

883m²

1721m²

894m²

902m²

352

Reserve 35621

12.333ha

349

12.315ha

1705m²

1649m²

1003m²

916m²

POS

DB

1727m²

3.2731ha

CONSERVATION OF FLORA AND FAUNA

1063m²

959m²

1120m²

1164m²

995m²

1995m²

351

10.712ha

350

8.498ha

1008m²

927m²

954m²

8171m²

945m²

2635m²

945m²

2301m²

POS

DB

MT SHADFORTH

ROAD

1

4005m²

2

4380m²

14

4928m²

8440m²

15

6412m²

16

4983m²

17

4444m²

18

8958m²

19

4725m²

21

6790m²

2

1.429ha

3

6339m²

4

140

130

120

110

100

90

80

70

60

50

40

LEGEND

- Subject Land
- Vegetation Protection
- SFA — Strategic Fire Access
- FMT — Fire Management Track
- Building Envelopes
- DB — Drainage Basins
- Proposed SRes 13
- Proposed R 10
- Proposed R 5/10
- Building Protection Zone (20m/30m)
- Parkland Cleared Hazard Seperation Zone (30m/40m)

Refer to Fire Management Plan for Building Protection and Hazard Separation Zones.

N

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SCALE 1:3000

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AYTON BAESJOU
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SUBDIVISION GUIDE PLAN

Lots 348, 349, 350 McLean, Kearsley and Mt Shadforth Roads.
Shire of Denmark

Figure 1

MARCH 10

05-43-SGP(t)

Figure 2

LOCAL WATER MANAGEMENT PLAN	
LOT 350 KEARSLEY ROAD, DENMARK	
LOCAL CATCHMENTS	
Landform R esearch	March 2010
Basemap LAND GATE	Scale 1 : 6 000

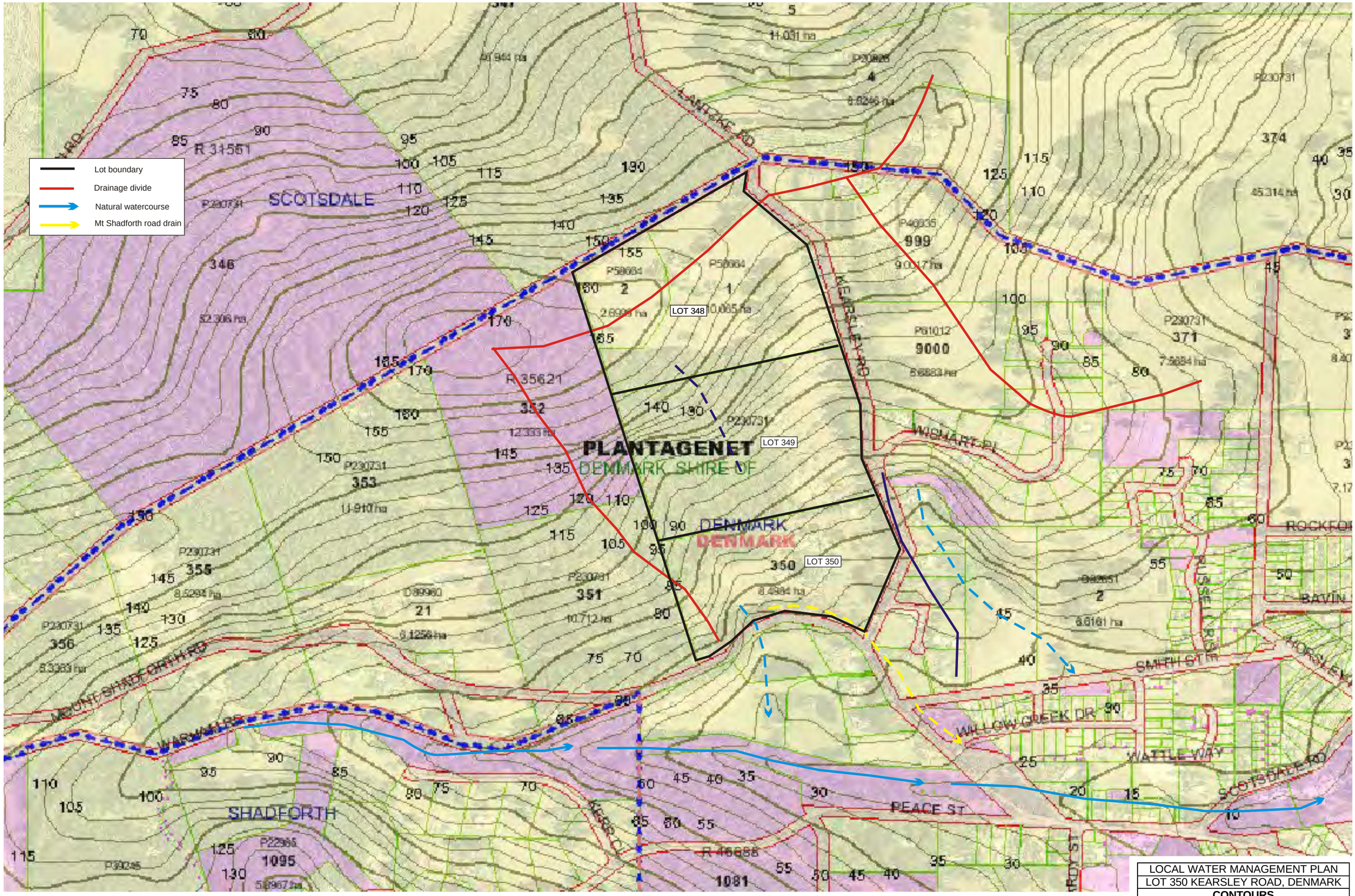


Figure 3

LOCAL WATER MANAGEMENT PLAN	
LOT 350 KEARSLEY ROAD, DENMARK	
CONTOURS	
Landform Research	March 2010
Basemap LANDGATE	Scale 1 : 6 000

ADOPTED BY RESOLUTION OF THE COUNCIL OF THE

_____ OF _____

AT THE _____ COUNCIL MEETING

ON THE _____ DAY OF _____ _____

CHIEF EXECUTIVE OFFICER _____

LEGEND - WATER MANAGEMENT

- Flow in excess of 1 in 1 ARI one hour event and flood flows. Flow down vegetated centre of Kearsley Road.
- Sump in centre of Kearsley Road to collect storm flows, and excess from sump on Lot 350.
- Direction of excess surface water runoff from individual lots. Collected by road drains.
- Road drains to Shire of Denmark Guidelines for Development and Subdivision of Land 2008.
- Detention basin to collect road drainage in Position
- Sump to collect road stormwater. Flood excess directed to Kearsley Road.
- Existing stormwater drain along upslope side of Mt Shadforth Road.

LEGEND

- Subject Land
- Vegetation Protection
- SFA — Strategic Fire Access
- FMT — Fire Management Track
- Building Envelopes
- DB — Drainage Basins
- Proposed SRes 13
- Proposed R 10
- Proposed R 5/10
- Building Protection Zone (20m/30m)
- Parkland Cleared Hazard Seperation Zone (30m/40m)

Refer to Fire Management Plan for Building Protection and Hazard Separation Zones.

ROAD
106
46.989ha
999
MCLEAN
KEARSLEY
SR 13
2168m²
2665m²
2043m²
2120m²
2351m²
348
12.828ha
2762m²
2017m²
2013m²
2218m²
2122m²
2239m²
DENMARK WATER SUPPLY STORAGE
9301m²
4686m²
2920m²
2350m²
875m²
DB
900m²
3.7227ha
900m²
883m²
1721m²
894m²
902m²
1
4005m²
2
4380m²
352
Reserve 35621
12.333ha
Flood excess to Kearsley Road median strip drain.
Flood excess flow and runoff from Kearsley Road.
349
12.315ha
1705m²
4928m²
CONSERVATION OF FLORA AND FAUNA
Detention basin collecting runoff from Lots 348 and 349.
1003m²
916m²
POS
8440m²
1727m²
3.2731ha
15
6412m²
1063m²
959m²
1120m²
1164m²
16
4983m²
995m²
1995m²
351
10.712ha
927m²
350
8.498ha
954m²
17
4444m²
8171m²
945m²
18
8958m²
2635m²
2301m²
945m²
POS
MT SHADFORTH
19
Potential for large storm overflow down emergency access.
Detention basin for stormwater from Lot 350.
Flood excess directed to sump at base of Kearsley Road.
Basin design volume 102.6 m3.
Separate piped road drainage from internal drains.
Flood overflow directed down Kearsley Road.
Stormwater and flood flows from Kearsley Road, directed to Mt Shadforth drain.
21
6790m²
ROAD
WATER EASEMENT
110
100
90
80
70
60
50
40
140
130
120

N

ORIG A3
SCALE 1:3000
0 20 40 60

AYTON BAESJOU PLANNING
11 Duke Street
Albany WA 6330
Ph 9842 2304 Fax 9842 8494

SUBDIVISION GUIDE PLAN

Lots 348, 349, 350 McLean, Kearsley and Mt Shadforth Roads.
Shire of Denmark

WATER MANAGEMENT OVERLAY

20 March 2010

Figure 4

MARCH 10
05-43-SGP(t)

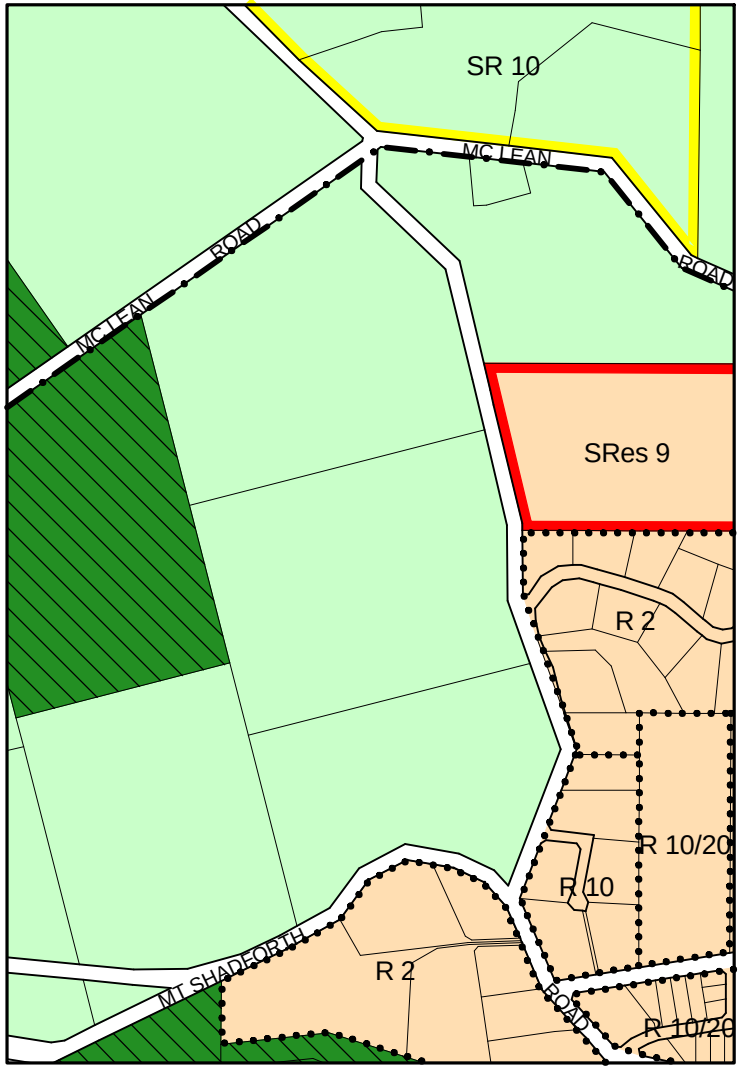
0 30m

Figure 5

LOCAL WATER MANAGEMENT PLAN	
LOT 350 KEARSLEY ROAD, DENMARK	
AERIAL PHOTOGRAPH	
Landform Research	March 2010
Basemap LANDGATE	Scale 1 : 1 5 00

SHIRE OF DENMARK
TOWN PLANNING SCHEME No. 3
AMENDMENT No. 106

Existing Zoning



LOCAL SCHEME RESERVES

- PARKS AND RECREATION
- PUBLIC USE (Denoted as Follows)
- W — WATER SUPPLY

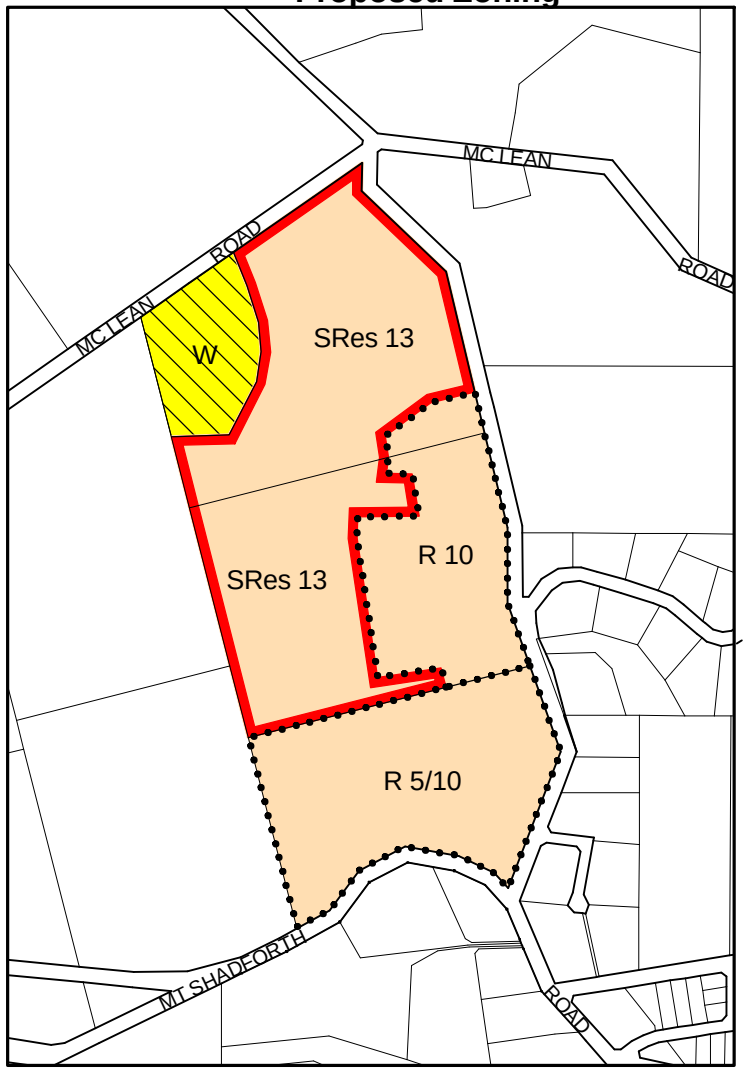
ZONES

- RESIDENTIAL
- SPECIAL RESIDENTIAL
- RURAL
- SPECIAL RURAL

OTHER

- R 2 — R CODE
- SRes 9 — SPECIAL RESIDENTIAL AREA (See Scheme Text)
- SR 10 — SPECIAL RURAL AREA (See Scheme Text)
- TOWNSITE - LAND ACT

Proposed Zoning



SCALE 1:10000

0 50 100 150 200 250

ORIG A4
05-43-ZM(h)
MARCH 10

AYTON BAESJOU PLANNING
11 Duke Street
Albany WA 6330
Ph 9842 2304 Fax 9842 8494

PLANNING AND DEVELOPMENT ACT 2005

SHIRE OF DENMARK

TOWN PLANNING SCHEME No. 3
AMENDMENT No. 106

The Denmark Council under and by virtue of the powers conferred upon it in that behalf by the Planning and Development Act 2005 hereby amends the above Local Planning Scheme by:

1.) *Rezoning Lot 348 Kearsley Road, Denmark from the 'Rural' zone to 'Special Residential' zone, 'Residential' (R10) zone and 'Public Purpose' reserve.*
2.) *Rezoning Lots 349 Kearsley Road from the 'Rural' zone to 'Special Residential' zone and 'Residential' (R10) zone.*
3.) *Rezoning Lots 350 Kearsley Road from the 'Rural' zone to 'Residential' (R5/10) zone.*
4.) *Amending Appendix XIV of the Scheme Text to provide management provisions for the Special Residential zone on Lots 348 & 349 as follows:.*

APPENDIX NO. XIV - SPECIAL RESIDENTIAL ZONES

PROVISIONS RELATING TO SPECIFIED AREAS

PARTICULARS OF THE LAND	PROPOSED USES	SPECIAL PROVISIONS
***SRes* 13 . KEARSLEY ROAD SPECIAL RESIDENTIAL ZONE** Pt Lot 348 & 349 Kearsley Road, Denmark.	Residential Permitted Use (P): Single House Permitted at Council's Discretion (AA): Home Occupation Holiday Accommodation *- On the basis that it is limited to accommodation solely within the approved single house and accommodates a maximum of 6 guests (excluding owners).*	(i) (a) The minimum lot size shall be 2000m^2. (b) Subdivision shall generally be in accordance with the endorsed Subdivision Guide Plan. The Western Australian Planning Commission may consider minor variations to the lot layout to take account of topography, vegetation and road widening. (ii) All buildings shall be set back from the lot boundaries as follows: • 8m from the front of the lot, • 8m from the rear of the lot, and • 5m from the side of the lot. (iii) Council may request the Commission to impose a condition at the time of subdivision for the provision of underground power to the lots. (iv) Roads within the zone shall: a) be located in a manner to retain remnant vegetation which is sympathetic to the topography and minimises visual impact b) be drained underground and kerbed to meet the requirements and specification of Council. (v) Council may request the Commission impose a condition at the subdivision stage of development requiring a contribution to the upgrading of Kearsley Road. (vi) (a) No clearing of remnant vegetation shall occur except for: • clearing to comply with the requirements of the Shire of Denmark Fire Break Notice; • trees that are diseased or dangerous; • clearing required to establish/maintain a low fuel buffer / hazard separation area; • clearing to gain vehicular access to an approved dwelling or any other clearing which may be approved by the Council. (b) Additional tree/shrub planting may be required as a condition of development approval. (vii) (a) Reflective colours and materials such as zincalume, will not be permitted (b) All residential buildings shall be a maximum height of 7.5m. (viii) Council may request the Commission to impose a condition at the time of subdivision for the provision of reticulated water to the lots and fire hydrants at intervals of 200 metres along the subdivisional water mains. (ix) If boundary fencing is utilised, it shall be of rural construction such as pine posts/ steel posts and 7 strand ringlock to the satisfaction of Council.

		(x)	On-site effluent disposal shall be the responsibility of the individual landowner and shall involve the use of on-site disposal systems approved by Council in accordance with Health Department of WA and Department of Environment guidelines.
		(xi)	Council may request the Commission to impose a condition at the time of subdivision for the preparation and implementation of a nutrient stripping and sediment retention Stormwater Management Plan compliant with the principles of Water Sensitive Urban Design to the satisfaction of Council and the Department of Environment.
		(xii)	(a) Council may request the Commission to impose a condition at the subdivision stage requiring the implementation of the Fire Protection Plan. (b) Council shall require that individual landowners are responsible for the maintenance of any strategic firebreak where it crosses the landowner's lot. (c) The clearing of firebreaks other than for strategic firebreak purposes will not be permitted unless for safety reasons to comply with Council and FESA requirements. (d) Council may request the Commission to impose a condition at the subdivision stage requiring the subdivider to advise prospective purchasers of the lots of the fire management guidelines of the Homeowners Bushfire Survival Manual and that driveways will need to comply with level 2 of AS3959 Construction of Buildings in Bushfire Prone Areas. (e) On those lots adjoining or adjacent to the POS or remnant vegetation, Council shall require all buildings to be constructed in accordance with Australian Standard 3959 "Construction of Buildings in Bushfire Prone Areas". (f) In cases where only part of the zone is developed, an interim firebreak system shall be prepared and put in place to the satisfaction of Council and the Fire & Emergency Services Authority.
		(xiii)	Provision shall be made to Council's satisfaction to ensure prospective purchasers of land within Special Residential Zone Area No 13: • acknowledge and accept these Special Provisions.

5.) Amending the Scheme Maps accordingly.

PLANNING AND DEVELOPMENT ACT 2005

SHIRE OF DENMARK

TOWN PLANNING SCHEME No. 3
AMENDMENT No. 106

ADOPTION

Adopted by resolution of the Shire of Denmark at the meeting of the Council held on the _____day of _____ _____

_____
Shire President

_____
Chief Executive Officer

FINAL APPROVAL

Adopted for final approval by resolution of the Shire of Denmark at the Meeting of the Council held on the _____day of _____ _____ and the Common Seal of the Shire of Denmark was hereunto affixed by the authority of a resolution of the Council in the presence of:

_____
Shire President

_____
Chief Executive Officer

Recommended/Submitted for Final Approval

_____
Delegated Under S 16
of the PD Act 2005

_____
Date

Final Approval Granted

_____
Minister for Planning

_____
Date

GOVERNMENT OF WESTERN AUSTRALIA

Environmental Protection Authority

The Atrium,
Level 8, 168 St Georges Terrace,
Perth, Western Australia 6000.
Telephone: (08) 6467 5000.
Facsimile: (08) 6467 5557.

Postal Address: Locked Bag 33,
Cloisters Square, Perth, Western Australia 6850.
Website: www.epa.wa.gov.au

Chief Executive Officer
Shire of Denmark
PO Box 183
DENMARK WA 6333

Attn: Sam Williams

Your Ref TPS3/A106 SW/KR
Our Ref A298204
Enquiries Mike Pengelly 6467 5428

Dear Sir/Madam

DECISION UNDER SECTION 48A(1)(a)
Environmental Protection Act 1986

SCHEME AMENDMENT TITLE:	**Shire of Denmark TPS 3 Amendment 106 Rezoning from Rural to combination of Special Residential and Residential and Public Purpose**
SCHEME AMENDMENT LOCATION:	**Lots 348, 348 & 350 Kearsley Road**
LOCALITY:	**Denmark**
RESPONSIBLE AUTHORITY:	**Shire of Denmark**
DECISION:	**Scheme Amendment Not Assessed - Advice Given (no appeals)**

Thank you for your letter of referring the above proposed scheme amendment.

After consideration of the information provided by you, the Environmental Protection Authority (EPA) considers that the proposed scheme amendment should not be assessed under Part IV Division 3 of the *Environmental Protection Act 1986* (EP Act) but nevertheless provides the following advice and recommendations.

ADVICE AND RECOMMENDATIONS

1. Environmental Issues

- Native Vegetation and Fauna
- Buffers to sensitive Landuse
- Onsite effluent disposal

2. Advice and recommendations regarding Environmental Issues

Native Vegetation and Fauna

The amendment contains a potentially significant area of vegetation which will be rezoned to Special Rural 13. In considering the amendment the EPA notes that the subdivision guide plan (05-43-SGP(t) March 10) provided in support of the amendment, and endorsed by Council at its meeting on 23 March 2010, provides for all building envelopes to be located in existing cleared areas, and provisions will prevent clearing of the vegetation.

The EPA also notes that Council, at the time of subdivision, will place an appropriate notification on the titles of the two special residential lots containing the bulk of the native vegetation advising that the lots cannot be further subdivided.

The amendment area is immediately adjacent to Conservation of Flora and Fauna Reserve 35621. The EPA recommends that at the time of subdivision that an appropriate notification be placed on

the title, on the advice of the Department of Environment and Conservation (DEC) to advise future land owners of the existence of the reserve and the possible DEC operations that may occur.

Buffers to sensitive Landuse

The EPA notes that horticultural land use is located in proximity to the amendment area. The EPA recommends that generic separation distances, as outlined in EPA's Guidance Statement No. 3 *Separation Distances between Industrial and Sensitive Land Uses*, are maintained unless adequate site-specific studies have been carried out that demonstrate that a lesser distance will not cause unacceptable impacts. Council should ensure that this Guidance is adequately considered during the implementation of the proposed zoning. A copy of the Guidance Statement can be found on the EPA website (www.epa.wa.gov.au).

Onsite effluent disposal

In the absence of a reticulated sewerage system the installation an alternative waste treatment unit is preferred to prevent pollution of the groundwater. The EPA supports connection to deep sewer within areas identified unsuitable for onsite effluent disposal.

3. General Advice

- For the purposes of Part IV of the EP Act, the scheme amendment is defined as an assessed scheme amendment. In relation to the implementation of the scheme amendment, please note the requirements of Part IV Division 4 of the EP Act.
- There is no appeal right in respect of the EPA's decision on the level of assessment of scheme amendments.
- A copy of this advice will be sent to relevant authorities and made available to the public on request.

Yours faithfully

Colin Murray
Director
Assessment and Compliance Services

28 June 2010

Your Ref: TPS3 A106
Our Ref: Grange 5345762
Enquiries: G Wright
Telephone: 98424230

August 9, 2010

Shire of Denmark
PO Box 183
DENMARK WA 6333

Attention: Sam Williams

Shire of Denmark
ICR1082401
11 AUG 2010
TPS3/SA106
DATE
FILE REF
COUNCILLORS
CEO
DIR of FINANCE
DIR of PLANNING ✓
DIR of INFRASTRUCTURE
DIR of COMMUNITY
OTHER

WATER CORPORATION

Great Southern Regional Office
215 Lower Stirling Terrace
ALBANY WA 6330

PO Box 915
ALBANY WA 6331

Tel (08) 9842 4211
Fax (08) 9842 4255

www.watercorporation.com.au

TPS 3 A106 RE-ZONING PROPOSAL
LOTS 348 – 350 KEARSLEY ROAD, DENMARK

Dear Sam,

Thank you for your letter dated July 21, 2010 regarding the above.

The documentation provided makes reference to the provision of reticulated water and wastewater services to the R5 and R10 parcels of land and the provision of reticulated water to the balance of the land [excluding the water tank site] being the Special Residential parcel of the three lots. You are advised that the Water Corporation has no objection to this proposal however it is strongly recommended that the proponent be advised to make early application to the Corporation to extend its Wastewater Operating Licence Area [WW OLA] to include the three lots under consideration. Until such time as the land is included in the WW OLA, the Water Corporation will not be able to provide a reticulated wastewater service to this area.

Provision of reticulated water to this land will only be considered after commissioning of the new storage tank and booster system on McLean Road, Denmark which is scheduled for completion at the end of 2010 subject to funding being available.

Yours sincerely

Graham Wright
Senior Capability Planner
Regional Customer Services Group
Great Southern

mainroads
WESTERN AUSTRALIA

ABN: 50 860 676 021

Shire of Denmark
ICR10823 65
10 AUG 2010
TPS3/SA106

DATE	LPP
FILE REF	
COUNCILLORS	
CEO	
DIR of FINANCE	
DIR of PLANNING	✓
DIR INFRASTRUCTURE	
DIR COMMUNITY	
OTHER	

Enquiries: Chris Grant on (08) 9892 0524
Our Ref: 04/13075-04 D10#168591
Your Ref: TPS3/A106 SW/RH

4 August 2010

Chief Executive Officer
Shire of Denmark
PO Box 183
DENMARK WA 6333

ATTENTION: SAM WILLIAMS

TOWN PLANNING SCHEME NO 3 - AMMENDMENT NO 106 - LOTS 348, 349 AND 350 KEARSLEY ROAD, DENMARK

I refer to your letter dated 21 July 2010 seeking Main Roads consideration concerning Town Planning Scheme No 3 Amendment No 106 as above.

Main Roads raises no objection to the proposed Scheme Amendment.

If you require any further information please contact Chris Grant on (08) 9892 0524.

Yours sincerely

Andrew Duffield
REGIONAL MANAGER

Australian Business Excellence Awards
Bronze Award 2007

Great Southern Region, Chester Pass Road, Albany or PO Box 503, Albany Western Australia 6330
Telephone: (08) 9892 0555 Facsimile: (08) 9841 8213
Email: gsreg@mainroads.wa.gov.au Website: www.mainroads.wa.gov.au

Government of **Western Australia**
Department of **Water**

Shire of Denmark
ICR1082279
4 AUG 2010
TPS3/SA106

DATE	LPM
FILE REF	
COUNCILLORS	
CEO	
DIR of FINANCE	
DIR of PLANNING	✓
DIR of INFRASTRUCTURE	
DIR of COMMUNITY	
OTHER	

[redacted]

File ref: RF1082-02

Enquiries: Brad Rimmer

Tel: 9841-0102

Shire of Denmark
PO Box 183
DENMARK WA 6333

Attention: Sam Williams

RE: Shire of Denmark Town Planning Scheme No. 3 - Amendment No. 106 - Lots 348, 349 and 350 Kearsley Road, Denmark

The Department of Water (DoW) has reviewed the above submission dated 21 July 2010. The Department is has reviewed the associated Local Water Management Plan and is satisfied with this document. The DoW has no further comment at this stage of the process.

If you wish to discuss the matter further, please contact Brad Rimmer on 9841-0102.

Yours sincerely,

Chris Gunby
Acting Regional Manager
South West Region

2 August 2010

South Coast Region
5 Bevan Street Albany Western Australia 6330
PO Box 525 Albany Western Australia 6331
Telephone (08) 9842 5760 Facsimile (08) 9842 1204
www.water.wa.gov.au
wa.gov.au

SCANNED

Peta Leiper

From: Lynn Walker [lynn.walker@westernpower.com.au] on behalf of Works Admin General [works.admin.general@westernpower.com.au]
Sent: Wednesday, 28 July 2010 11:44 AM
To: Denmark Shire Enquiries
Subject: Sam Williams - Ref TPS3/A106 - Proposed Amendment No 106 to Town Planning Scheme No 3 for Lots 348 - 350 Kearsley Road, Denmark SoD FILE REF: TPS3/SA106

Categories: FORWARDED TO DIR OF PLANNING

Shire of Denmark
ICR10721 98
29 JUL 2010

DATE	LPH
FILE REF	
COUNCILLORS	
CEO	
DIR of FINANCE	
DIR of PLANNING	✓
DIR of INFRASTRUCTURE	
DIR of COMMUNITY	
OTHER	

Locked Bag 2520, Perth WA 6001 | T: 13 10 87 | F: (08) 9225 2073 | E: works.admin.general@westernpower.com.au

To:	Sam Williams	**From:**	Lynn Walker
Organisation:	Shire of Denmark	**Section:**	Connections Administration
Email / Fax:	enquiries@denmark.wa.gov.au		
Your Ref:	TPS3/A106		
Date:	28/07/2010		

Re: Proposed Amendment No 106 to Town Planning Scheme No 3 for Lots 348 - 350 Kearsley Road, Denmark

Dear Sam,

To the best of my knowledge, we have no objections, but Western Power also wishes to advise the following, in respect to any future development due to the above-mentioned proposal.

Working in proximity to Western Power Distribution Lines
All work must comply with Worksafe Regulation 3.64 - Guidelines for Work in the Vicinity of Overhead Power Lines. If any work is to breach the minimum safe working distances a Request to Work Near Underground and Overhead Power Lines form must be submitted. For more information on this please visit the Western Power Website:

http://www.westernpower.com.au/mainContent/workingWithPower/WorkingAroundPowerLines/ProtectingWorkersAroundPowerLines.html

Please note:

A) Perth One Call Service (Freecall 1100 or visit dialbeforeyoudig.com.au) must be contacted and location details (of Western Power underground cabling) obtained prior to any excavation commencing.

B) Work Safe requirements must also be observed when excavation work is being undertaken in the vicinity of any Western Power assets.

Western Power is obliged to point out that any change to the existing(power) system, if required, is the responsibility of the individual developer.

Regards,

Customer Service Officer
Connections Administration
Western Power - 363 Wellington Street Perth WA 6000 [map]

T: 13 10 87 | **F:** (08) 9225 2073
E: works.admin.general@westernpower.com.au
W: http://www.westernpower.com.au/

Please consider the environment before you print this email.

S.W.

SCANNED

Peta Leiper

From: Walkerden, Norm F [Norman.F.Walkerden@team.telstra.com]
Sent: Thursday, 22 July 2010 11:12 AM
To: Denmark Shire Enquiries
Subject: DENMARK Town Planning Scheme 3 - Amendment Number 106 TPS3/SA106

Categories: FORWARDED TO DIR OF PLANNING

Ref: TPS3/A106 SW/RH

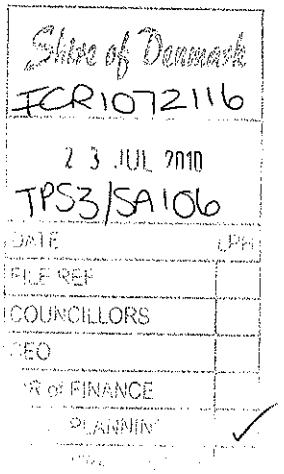
Attn: Sam Williams

Re TOWN PLANNING SCHEME 3 - AMENDMENT NUMBER 106 – Lots 348,349 and 350 Kearsley Road, Denmark

Thank you for your early correspondence re above. At present Telstra has no objection to make regarding the proposed amendment.
We look forward to further documentation as the development progresses

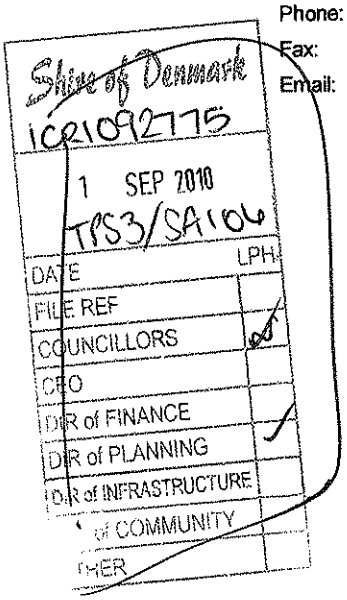
Regards,

Norm Walkerden
Forecasting & Area Planning Western,
Integrated Network Planning, Network and Technology
Postal: Locked Bag 2525 Perth WA 6001
Phone: 08 9491 6272 **Fax:** 08 9221 5730
Email Norman.F.Walkerden@team.telstra.com



Government of **Western Australia**
Department of **Environment and Conservation**

Your ref:
Our ref: srs28509
Enquiries: Peter Keppel
Phone: 97 717 943
Fax: 97 771 363
Email: Peter.Keppel@dec.wa.gov.au



Mr Sam Williams
Director, Planning & Sustainability
Shire of Denmark
PO Box 183
DENMARK WA 6333

Dear Mr Williams

Subject:: Shire of Denmark Town Planning Scheme No. 3 – Amendment No. 106 – Lots 348, 349 and 350 Kearsley Road, Denmark.

Thank you for the letter received in this office on 23 July 2010 seeking comment on the above mentioned Town Planning Scheme Amendment. The Department of Environment and Conservation (DEC) provide the following comments.

- The remnant vegetation on the lots contain habitat for a number of fauna species of conservation significance including Forest Red-tailed and the endangered Baudins Black Cockatoo. There are also a number of rare and priority listed flora species found in the local area, and it is likely that some may occur amongst the remnant vegetation on the lots. A special provision regarding the planting of indigenous native species may also help to provide habitat for fauna species.

- There are known populations of blackberry occurring within 2km of the subject land. DEC recommend that a special provision be added to the scheme along the lines that, it is the responsibility of the landholder to preclude the establishment of invasive weed species on the individual allotments.

- A vegetation management plan should be provided on how the remnant vegetation is to be protected and maintained so that any potential negative impact on conservation values is kept to a minimum.

- DEC would like to advise that under the *Environmental Protection Act 1986* that clearing of native vegetation can only be done under the authority of a permit, unless the clearing is for a purpose exempt in accordance with Schedule 6 or regulation 5 (Clearing of Native Vegetation Regulations 2006).

The proposed development area is in close proximity to lands managed by the DEC and that some or all of the following management activities may occur from time to time.

- Prescribed burning for the enhancement and conservation of biodiversity and/or fire hazard reduction purposes.

Warren Region
Brain Street, Manjimup
Phone: (08) 97 717 988 Fax: (08) 97 771 363
Postal Address: Locked Bag 2, Manjimup, Western Australia 6258
www.dec.wa.gov.au

- Application of herbicides and other chemicals for weed and plant disease control.
- Road construction and maintenance.

Planning for Bushfire Protection Guidelines Edition 2 (FESA and WA Planning Commission May 2010) requires rezoning, subdivision and development proposals be accompanied by information on how the proposal will meet the requirements of this publication. This information should include bushfire hazard and land suitability assessment, subdivision and development design in terms of access, fire services access, hazard separation and building protection zones, water supply, building envelope location and size. The plan should outline fire protection measures.

DEC has no objection to the scheme amendment providing due consideration is given to the above comments.

If you have any further queries please contact Mr Peter Barness on 97 717 929.

Yours sincerely

Peter Keppel
Regional Manager
Warren Region

27 August 2010

Sam Williams

From: willowleigh@westnet.com.au
Sent: Friday, 13 August 2010 4:30 PM
To: Sam Williams
Subject: Amendment No. 106 to TPS 3

Hi Sam re the above Scheme Amendment for Lots 348, 349 & 350 Kearsley Rd. Please be advised that I support the Amendment as detailed in the Plan, conditional upon the proponent/developer providing a dual use path way from the crn Kearsley Rd and Mt Shadforth Rd to connect to the Path way at Hardy Rd and Mt Shadforth Rd.
Regards ken Richardson - Newton

A. & L. DOSEN
LOT 19 KEARSLEY RD.
DENMARK 6333
P.O. BOX 432

AUGUST 4 2010

TO
SHIRE OF DENMARK
SAM WILLIAMS REF: TPS/A106

RE: SHIRE OF DENMARK TOWN PLANNING No. 3 AMENDMENT No. 106

AS a nearby/ADJOINING OWNERS OF LOTS 348 349 AND 350 KEARSLEY RD DENMARK, WE ARE IN full SUPPORT OF IMPLEMENTATION OF AMENDMENT No 106 TO LOTS 348 349 350 KEARSLEY RD. REASON BEING BRINGING OF RETICULATED SEWERAGE TO AREA THAT WILL BENEFIT ALL OWNERS OF PROPERTY IN THAT AREA AS IS KNOWN THAT THERE ARE PROBLEMS WITH SOME SEPTIC SYSTEMS IN THIS AREA IN WINTER TIME

YOURS FAITHFULLY

ANTHONY DOSEN IRENE L DOSEN

The submissions received relating to Scheme Amendment 106 (for Lots 348, 349 and 350 Kearsley Road) are summarised and discussed in the following table:

Shire of Denmark **Town Planning Scheme No. 3 – Amendment No. 106** **Schedule of Submissions**			
No	**Submitter / Summary of Submission**	**Officer Comment**	**Submission Recommendation**
1	**Environmental Protection Authority** **Level 8, 168 St Georges Terrace** **Perth WA 6000** States the amendment document does not need to be formally assessed under Part IV of the *Environmental Protection Act 1986* and provides the following comments: • Notes significant vegetation as shown on the Subdivision Guide Plan will be protected as building envelopes are required to be located within defined building envelopes on existing cleared land. • EPA notes at time of subdivision a section 70A notice on title will be drawn up to prevent further subdivision of the two large lots in which the majority of the vegetation is located. • Recommends the lots adjacent to Conservation of Flora and Fauna Reserve 35621 at time of subdivision have a notice be placed on title to ensure prospective purchasers are aware of the reserve and future DEC management activities. • Notes the proposed amendment area is located in close proximity to horticultural land uses. The amendment should give due consideration to the EPA's guidance statement No. 3 *Separation Distances between Industrial and Sensitive Land Uses.* • Supports connection to deep sewer where available; however alternative treatment units are recommended where deep sewer is not provided.	Building envelopes are shown to achieve protection of existing remnant vegetation and fire protection requirements. To reinforce the importance of the large remnant vegetation area on the two larger lots, the inclusion of notice on title precluding subdivision and advising of Reserve 35621 and the Department of Environment and Conservation future activities is appropriate given the importance of the reserve in this area. The horticultural area identified by the EPA represents a small area on Lantske Road and does not affect the proposal to rezone this land. The horticultural activities are small-scale in nature are largely run on organic principles with no major uses of pesticides evident and no complaints being received by the Shire from any of their activities in the past. Ideally all lots would be provided with deep sewer connection. As agreed by the EPA, the use of alternative treatment units in the upper portions of the development has been proven and is acceptable in this instance.	The submission be upheld and the following modifications be undertaken: 1. A new provision (xiv) to state: *(xiv) Council may request the Commission to impose a condition at the subdivision stage requiring a notice in the form of a Section 70A Notification pursuant to the Transfer of Lands Act 1893 is to be placed on the Certificates of Title of the proposed lots as follows:* • *For the two 3ha lots: That no further subdivision will be supported.* • *For all lots adjoining Reserve 35621: The lots adjoin Reserve 35621 which is managed by the Department of Environment and Conservation for conservation of flora and fauna purposes and may undertake management activities such as spraying, baiting and other practices accordingly.* 2. Provision (x) be reworded to require alternative treatment units (ATU's) be required to service all unsewered lots as follows: *(x) On-site effluent disposal shall be the responsibility of the individual land owner and shall involve the use of alternative treatment units (ATU's) approved by Council in accordance with Health Department of WA and Department of Environment guidelines.*
2	**Water Corporation** **215 Lower Stirling Terrace** **ALBANY WA 6330**	The proponent should be advised of the Water Corporation's comments for their action.	The submission be noted and the proponent be provided with a copy of the WC submission for their action.

Shire of Denmark Town Planning Scheme No. 3 – Amendment No. 106 Schedule of Submissions			
No	**Submitter / Summary of Submission**	**Officer Comment**	**Submission Recommendation**
	The Water Corporation has no objection to the proposal however advises that it is strongly recommended the proponent be advised to make an early application to the Water Corporation to extend its wastewater Operating Licence Area (WWOLA) to include the three lots under consideration. Advise that until such time as the land is included in the WWOLA, the Water Corporation will not be able to provide a reticulated wastewater (sewer) service to this area.		
3	**Main Roads WA** **Chester Pass Road** **Albany WA 6330** No objection to the proposed scheme amendment.	No Main Road controlled roads are affected by the proposal. Concerning the local road network, all new subdivisional roads and upgrading to existing roads resulting from this development will be funded by the subdivider and designed and constructed to the specifications and satisfaction of the Shire of Denmark.	The submission be noted.
4	**Department of Water** **5 Bevan Street** **Albany WA 6330** Have reviewed the Local Water Management Plan associated with the Scheme Amendment and has advised the document is satisfactory and no further comments are provided at this stage.	The scheme provisions require the subdivider to implement appropriate drainage measures to control stormwater and drainage on the site at the subdivision stage.	The submission be noted.
5	**Western Power** **Locked Bag 2520** **Perth 6001** No objections to the proposal and provide advice regarding any works affecting Western Power infrastructure and assets. Advises that any changes to the existing (power) network are the responsibility of the individual	The scheme provisions require the subdivider to provide underground power to the lots at the subdivision stage.	The submission be noted.

Shire of Denmark Town Planning Scheme No. 3 – Amendment No. 106 Schedule of Submissions			
No	**Submitter / Summary of Submission**	**Officer Comment**	**Submission Recommendation**
	developer.		
6	**Telstra** **Locked Bag 2525** **Perth WA 6001** No objection to the proposed scheme amendment at this time.	Nil.	The submission be noted.
7	**Department of Environment and Conservation** **Locked Bag 2** **Manjimup WA 6258** Provides the following comments: • Existing vegetation on the lots provides a habitat for a number of fauna species, including some with endangered status. In addition rare and priority listed fauna species are located in the local area. It is likely some may exist within the remnant vegetation and as such a provision relating to the planting of indigenous native species may help to provide habitat for fauna species. • There are known populations of blackberry within 2km of the subject lots. It is recommended weed management be the responsibility of the landowner to preclude the establishment of weed species on individual allotments. • A vegetation management plan should be provided detailing protection measures to minimise adverse impacts on conservation values. • DEC provides advice in terms of current clearing requirements, being that this can only be undertaken in accordance with the necessary permit in accordance with the *Environmental Protection Act 1986*. • In addition it is noted the lots are in close proximity to lands managed by the DEC, and some of the following activities, including	See previous comments regarding the adjoining Reserve 35621 above. The control of weeds and planting of indigenous native species to support the existing remnant vegetation and fauna in the area is supported.	The submission be upheld and the following modification be undertaken: 1. A new provision (xv) to state: *(xv) Council may request the Commission to impose a condition at the subdivision stage requiring the preparation and implementation of a Vegetation Management Plan for the subdivision, in consultation with the Department of Environment and Conservation.* 2. Provision (vi)(b) be reworded to require removal of environmental weeds and preference for indigenous native species in landscaping of the lots as follows: *(vi)(b) Additional tree/shrub planting utilising indigenous native species and the removal of any identified plant weed species may be required as a condition of development approval.*

Shire of Denmark Town Planning Scheme No. 3 – Amendment No. 106 Schedule of Submissions			
No	**Submitter / Summary of Submission**	**Officer Comment**	**Submission Recommendation**
	aerial spraying may occur from time to time.		
8	**Ken Richardson-Newton** **1 McIlroy Bend** **Denmark WA 6333** Supports the amendment as detailed in the application subject to the proponent/developer providing a dual use path from the corner of Kearsley/Mt Shadforth Road to connect to the existing pathway at the intersection corner of Hardy/Mt Shadforth Road.	Given the close proximity to the Denmark town centre (1.2km), it is appropriate that the subdivision contribute to the development of a dual-use-path to connect to the existing path network that connects to schools, library, shopping, sporting and recreational facilities. The Shire can request that the WA Planning Commission place a condition on the subdivision approval accordingly.	The submission be upheld and the following modification be undertaken: 1. A new provision (xvi) to state: *(xvi) Council may request the Commission to impose a condition at the subdivision stage requiring the construction and/or financial contribution towards the construction of a dual use path to connect to the existing Shire path network.*
9	**Anthony & Irene Dosen** **Lot 19 Kearsley Road** **Denmark WA 6333** Supports the proposal as it will result in reticulated sewer being present in the vicinity, rectifying existing septic system issues associated with some surrounding properties	Nil.	The submission be noted.
10	**West Australian Planning Commission** **178 Stirling Terrace** **Albany WA 6331** Notes the density coding associated with the land at the south of the subject lot (Lot 350) has changed in relation to that shown on the approved Local Structure Plan. The LSP showed R10 density coding, whilst the amendment documentation shows this as being R5/10, effectively resulting in larger lots that negate the need for a deep sewer connection.	Comments provided by the WAPC in relation to the modified density coding on the SGP and within the amendment text should changed to be consistent with the density coding in the adopted Local Structure Plan.	The submission be upheld and the following modifications undertaken as follows: 1. The Subdivision Guide Plan being modified on Lot 350 to refer to a density coding of R10 only. 2. Any reference to the R5/10 density coding on Lot 350 within the amendment document text being modified to reflect the desired R10 density coding only.

AYTON BAESJOU
PLANNING

ABN: 15 061 140 172

11 Duke Street
Albany WA 6330
Ph 9842 2304 Fax 9842 8494

Our Ref: 05-43

2 November 2010

Shire of Denmark
PO Box 183
DENMARK WA 6333

Attn: Duncan Ross

Dear Duncan,

RE: Fire Management Plan for Special Residential Lots on Lot 349 Kearsley Road, Denmark.

I refer to our discussion regarding Council's resolution at its March 2010 meeting (Item 9.1.4), requiring a fire management plan to be prepared for the two proposed 3ha lots.

It appears that there was some confusion regarding this requirement as the Fire Plan prepared by ICS Group dated 9 March 2010, incorporates these two lots.

The building envelopes, Low Fuel zones and Hazard Separation zones for these two larger lots are exactly the same as that shown for the abutting residential lots. No additional fuel management is required within the forest abutting the Hazard Separation zone. This is in accordance with Council's resolution at its January 2008 meeting, see 2(b), which requires "The retention free of disturbance and development of the area of Tingle and Karri forest that adjoins A35621 and Lot 351." Only fire management tracks are proposed within this area and will not require removal of trees.

Attached is an email from Klaus Braun from the ICS Group which confirms that further reduction of fuel loads on the larger lots is not required to meet Council's requirements.

Please do not hesitate to call me if you need to discuss the matter further.

Yours sincerely

Nick Ayton
AYTON BAESJOU PLANNING

Nick Ayton

From: Klaus Braun [kbraun@icsgroup.com.au]
Sent: Wednesday, 10 March 2010 8:26 AM
To: 'Nick Ayton'
Subject: Updated fire protection document - Kearsley Road Denmark
Attachments: Kearsley Rd 09-03-10_pr.pdf

Nick

Attached is the electronic copy of the updated fire document for the proposed development in Kearsley Road, Denmark. Please note that the attached print resolution pdf may exceed the maximum file size the Shire's e-mail system will allow through.

Bert Quayle advised last week that the Shire requested that we develop a management strategy which ensures that fuel reduction of the forested areas on the two large blocks is undertaken by the landowners. Please note that Council specifically requested that fire protection measures (building protection and hazard separation zones) must be contained within a certain distance from the edge of the remnant vegetation (refer to item 2 in the letter from the Shire of Denmark dated 14th December 2009), to protect conservation values in this area.

The fire document covers this issue on page 9, which highlights that hazard reduction in the forested areas outside the hazard separation and building protection zones is not required to achieve an adequate level of protection within the proposed development. I have added a little to this section of the fire document to clarify this issue a bit further. It would, however, be inappropriate to develop a management strategy which ensures that fuels are regularly reduced in the forested areas.

Please note that Graeme Robertson initially requested that we show 100m hazard separation zones in which bushfire fuels would be maintained below certain threshold values. This covered a large part of the forested area adjacent to the reserve. We included these 100m wide hazard separation zones in the 1st plans which were submitted to Council. As mentioned above, Council requested that we change this so that fire protection can be achieved through the 20/30m and 30/40m building protection and hazard separation zones, and the construction of houses in accordance with AS3959.

Please do not hesitate to give me a call if you have any queries or if you require further information.

Kind regards

Klaus

Klaus Braun

ICS Group

111 Mira Flores Ave
Porongurup WA 6324

Phone 08 9853 2171
Mobile 0427 100 898
Fax 08 9853 2473

Graeme Robertson
Graeme Robertson Group
PO Box 140
CLAREMONT WA 6910

21 October 2010

Shire of Denmark
PO Box 183
DENMARK WA 6333

Attention: Duncan Ross

Dear Duncan,

TOWN PLANNING SCHEME NO. 3, AMENDMENT NO. 106
LOT 348, 349 & 350 KEARSLEY ROAD, DENMARK.

I refer to your email regarding the above amendment and in particular Council's resolution which required a Fire Management Plan to be prepared for the proposed 3ha lots and legal agreements to ensure these lots cannot be further subdivided and that the proponent will contribute to the upgrading/widening of Kearsley Road and Mount Shadforth Road intersection and portion of Kearsley Road and Wishart Place.

With regard to the Fire Plan, the final version dated 9th March 2010 addresses the two 3ha lots and is in accordance with Council's Fire Management requirements. A copy of the Fire Plan is attached for your information.

In relation to the legal agreements, it is suggested that these should be prepared at the subdivision stage of development for the following reasons:

1) As the scheme amendment has yet to receive final approval, preparation of legal agreements is premature and would result in a waste of resources in the event that the amendment failed to be finalized;
2) The two 3ha lots in question have yet to be created, consequently there is no mechanism to place the caveats on the lots at this time. At such time as subdivision proceeds, a condition can be placed on the subdivision approval requiring the caveats to be placed on the titles. Council is then in a position to ensure this is done prior to the condition being cleared; and
3) In relation to the upgrading/road widening, details in relation to the extent, cost and apportionment of those costs are not yet available. Again it is considered more appropriate for a condition to be placed on the subdivision approval when more information is available. Contributions will then be required prior to clearance of the condition.

Please accept this letter as confirmation that I will agree to ensure that:

1) Caveats are placed on the 3ha lots on Lot 349 Kearsley Road to ensure further subdivision does not occur; and
2) an appropriate agreement is put into place to contribute to the upgrading /widening of Kearsley Road and Mount Shadforth Road intersection and portion of Kearsley Road and Wishart Place.

Yours sincerely

Graeme Robertson