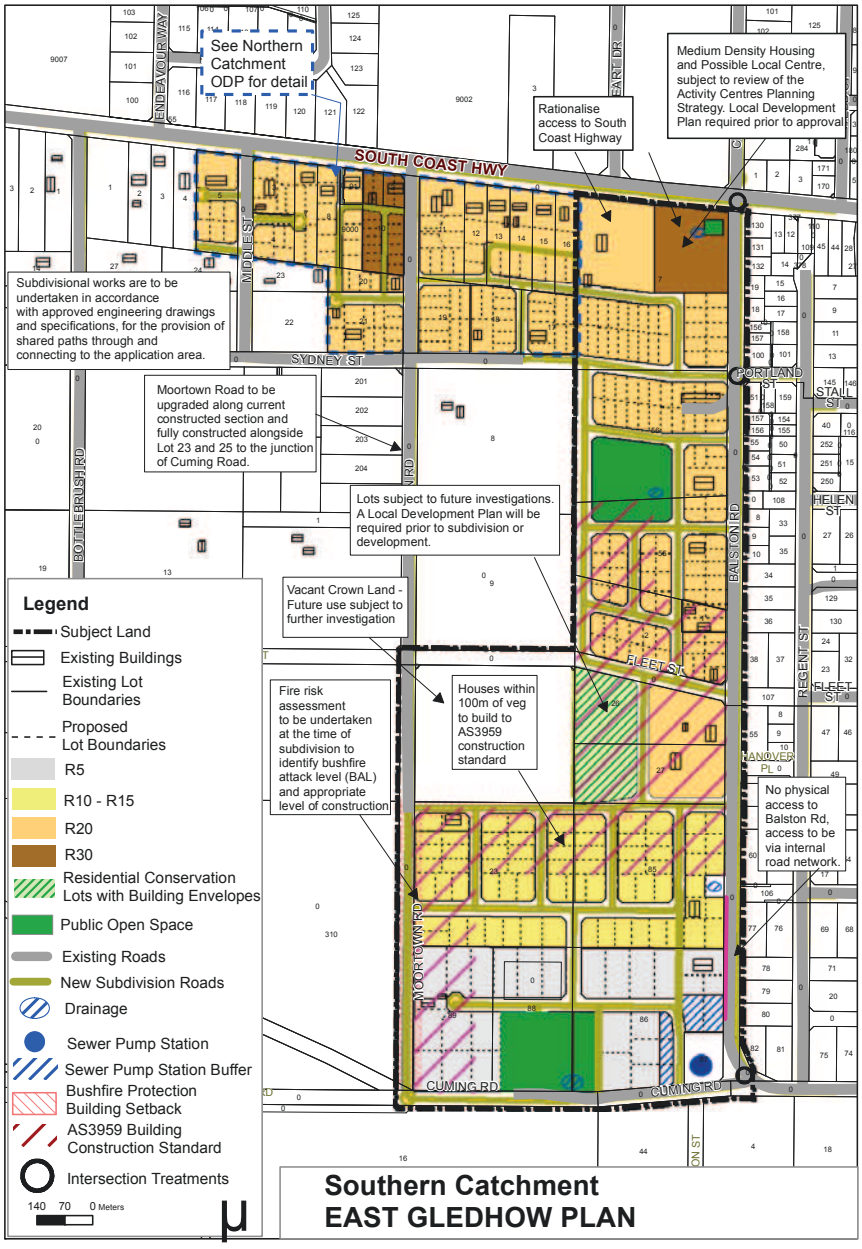
EAST GLEDHOW
OUTLINE DEVELOPMENT PLAN
(SOUTHERN CATCHMENT)



Prepared by

August 2017

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ENDORSEMENT PAGE

This structure plan is prepared under the provisions of the City of Albany Local Planning Scheme No.1

IT IS CERTIFIED THAT THIS STRUCTURE PLAN WAS APPROVED BY RESOLUTION OF THE WESTERN AUSTRALIAN PLANNING COMMISSION ON:

DATE: 31 August 2017

Signed for and on behalf of the Western Australian Planning Commission:

an officer of the Commission duly authorised by the Commission pursuant to section 16 of the Planning and Development Act 2005 for that purpose, in the presence of:

Witness

31 August 2017 Date

31 August 2027 Date of Expiry

Contents

1. INTRODUCTION

Following rezoning of the East Gledhow locality from 'Rural' to 'Residential Development' zone in 2010, the Outline Development Plan (ODP) has been prepared by Ayton Baesjou Planning on behalf of the owners of Lots 25 and 86 Cuming and Balston Road. Lots 2, 5, 6, 7, 26, 27 and 85 Balston Road and 23 Moortown Road also form part of the ODP.

The ODP is being prepared in association with Dykstra Planning who are responsible for preparing a plan for the small lot area in the northern catchment, with Ayton Baesjou Planning preparing the plan for the balance of the area which predominantly falls within the southern catchment. The study areas are illustrated below.

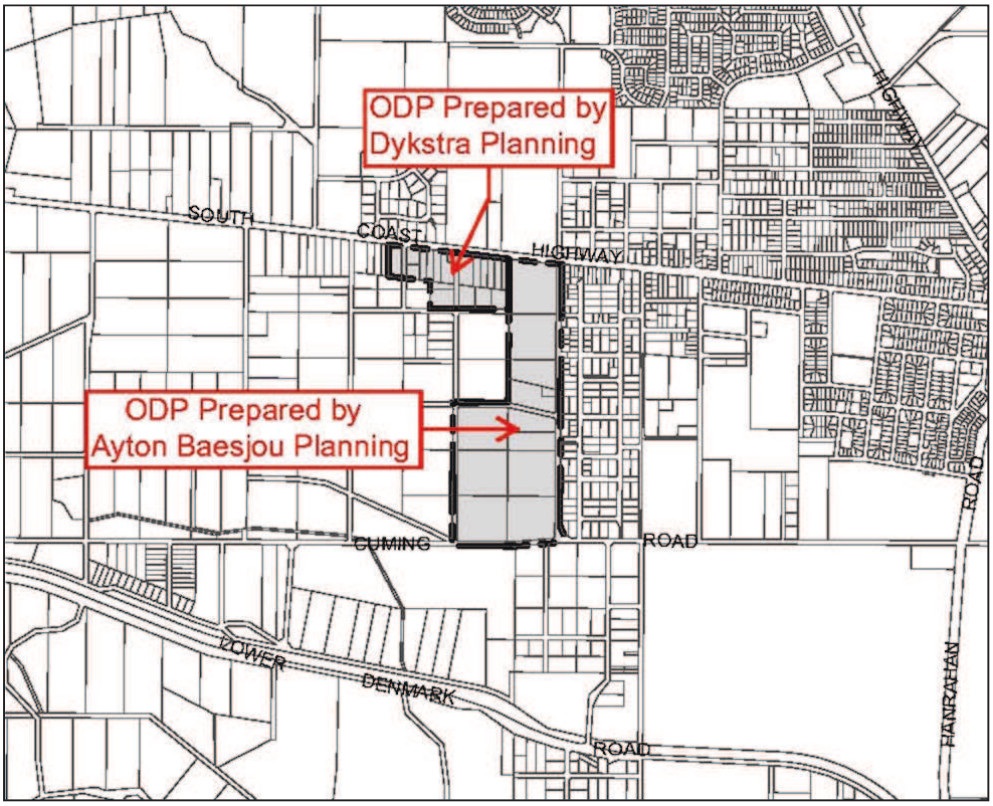

Figure 1: Study Areas

A Local Water Management Strategy and Transport Statement has been prepared for the overall study area.

2. LAND OWNERSHIP & DESCRIPTION

The southern catchment area of the ODP comprises 13 green title lots ranging in area from 4.4339ha to 2152m². Lot 87 in the south east corner of the study area is owned by the Water Corporation and has been set aside as a site for a sewerage pump station. It is 3500m² in area. The only other non privately owned land is lot 10 Moortown Road which is 3.8512ha in area and is vacant crown land. The overall area of the southern catchment area including the government owned land is 31.3334 ha. Table 1 below outlines the ownership, lot size and description of land within the Study Area.

Table 1: Land Ownership and Description

Lot Address	Owner	Lot Area
Lot 1 Balston Road	J Trigg	2152m²
Lot 2 Balston Road	A.A Trigg	1.8163ha
Lot 7 Balston Road	S & B Mastalerz	4.4340ha
Lot 26 Balston Road	J.M & P.R Williamson	1.6086ha
Lot 27 Balston Road	C & T Mohoney	1.5884ha
Lot 55 Balston Road	H. Carr	2.4948ha
Lot 56 Balston Road	H. Adams	3.4380ha
Lot 85 Balston Road	R. M Potter	3.8661ha
Lot 86 Balston Road	Trivalley Corporation Pty Ltd	3.3879ha
Lot 87 Balston Road	Water Corporation	3500m²
Lot 25 Cuming Road	M & V Gibson	4.0750ha
Lot 10 Moortown Road	Vacant Crown Land	3.8512ha
Lot 23 Moortown Road	H & W Milisavljevic	4.0731ha
		35.1986ha

3. LOCATION

East Gledhow is located 5km north west from the Albany City Centre on the southern side of South Coast Highway. The study area is bounded by Balston Road to the east, Cuming Road to the south and portion of Moortown Road to the west.

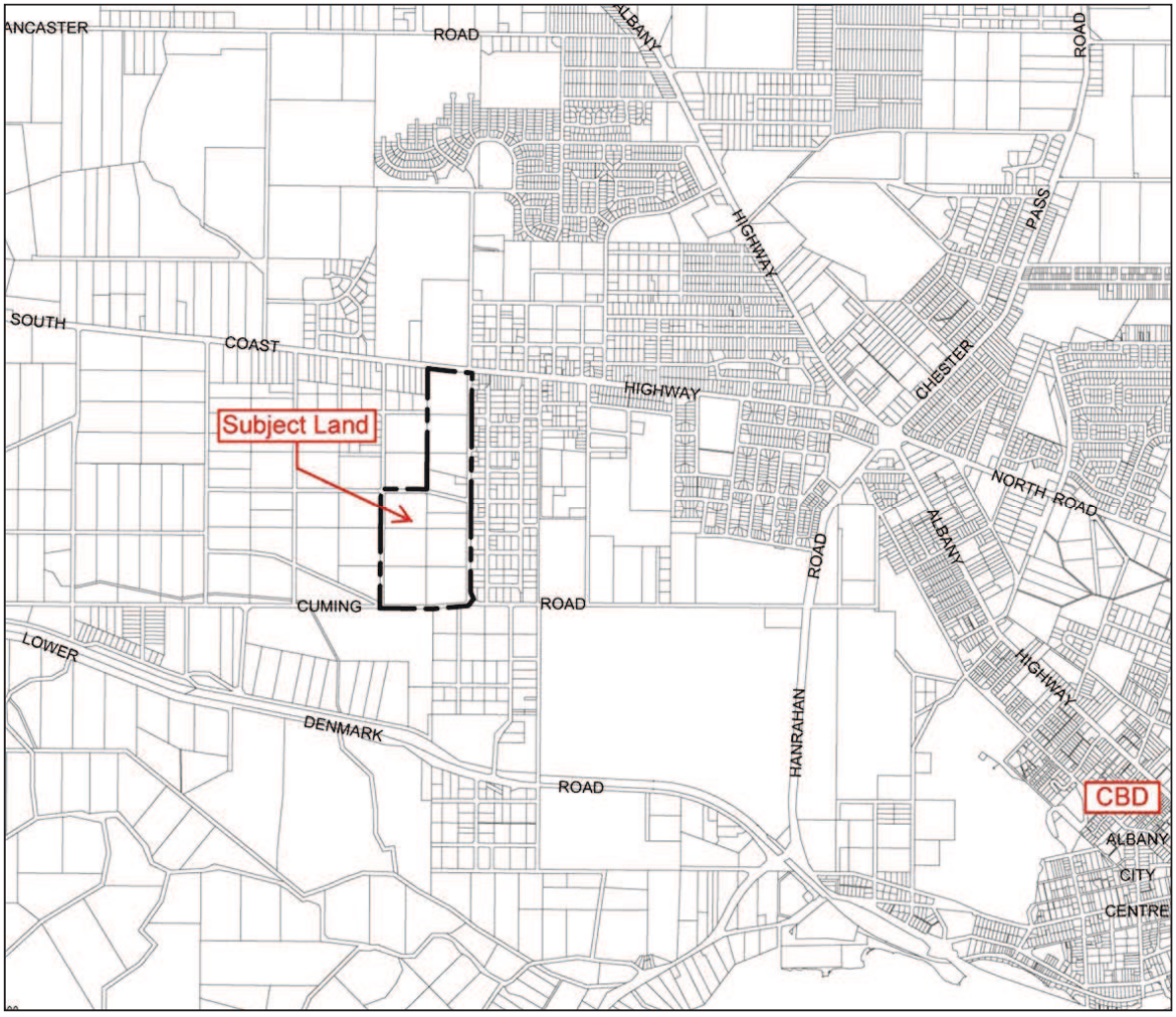

Figure 2: Location Plan

4. PLANNING CONTEXT

4.1 Town Planning Scheme No. 3

The City of Albany Town Planning Scheme No 3 is the key statutory mechanism issued to guide land use and development within the City boundaries.

The Outline Development Plan area is zoned 'Residential Development' under the provisions of the Town Planning Scheme No. 3. Prior to further development or subdivision occurring in this zone, an Outline Development Plan (ODP) must be prepared and submitted to the Western Australian Planning Commission. ODPs are required to show the principles under which it is proposed to develop or subdivide land and as a minimum requirement shall show:

a) the location and width of the distributor road system proposed;
b) the approximate location and quantity of shopping, civic and public facilities proposed together with an analysis of the factors used in determination of such facilities;
c) the distribution of the recreation and open space areas proposed;
d) the population and residential densities proposed;
e) the physical condition of the land having regard to the need for deep sewerage and/or main drainage.

4.2 Local Planning Scheme No. 1

Local Government's new Town Planning Scheme is currently being advertised for public comment and will consolidate the former Town of Albany Town Planning Scheme No. 1A with the former Shire of Albany Town planning Scheme No. 3. The draft scheme proposes that the subject land be zoned 'Future Urban'. A structure plan will need to be prepared prior to subdivision and development much in the same way as the requirements of the current scheme.

4.3 Local Planning Strategy

The Albany Local Planning Strategy (ALPS) was adopted by the Local Government on the 15 June 2010 and by the Western Australian Planning Commission on the 26 August 2010. The Strategy outlines the future use and development of land within the City of Albany.

Key ALPS aims include:

- Provision of an adequate supply and range of lot sizes and encourage a greater diversity in the housing stock.
- Infill and consolidation of development within existing urban areas.
- Integrating settlement nodes within the natural environment.

The ALPS seeks to contain the spread of fragmented urban and rural living areas in the City to:

- Minimise the development footprint on the landscape to help protect biodiversity and the environment.
- Promote energy conservation
- Provide greater housing choice.
- Minimise journey length from home to work/school/services and encourage the use of public transport, cycling and walking.
- Reduce government expenditure on servicing current and future populations.

ALPS has identified five categories of Priority Development Areas to encourage the incremental creation of fully serviced urban development nodes ranging from Priority 1 areas now being developed to a Priority 5 classification to protect long term future urban areas.

The subject land falls within the Priority 3 area which includes parts of McKail, Gledhow, Warrenup, Walmsley and Big Grove. Priority 3 areas are expected to be rezoned with local structure planning undertaken in the near future. The land is located to the west of Balston Road and effectively forms the development front as land to the east of Balston Road has already been developed with the exception of some areas of infill.

5. SITE ANALYSIS

The subject land comprises approximately 31ha of land which was previously subdivided into 4ha lots. Of the 12 lots currently within the study area, 6 retain their original lot size of around 3 to 4ha with another 4 lots having been subdivided into half and range from 1.5 to 2ha in area. One lot of 2152m² has been created and 3500m² lot has recently been created for a sewer pump station.

Compared to the lots within the northern catchment the southern catchment has largely retained its original form of subdivision and are effectively "de facto" rural residential lots.

With the exception of Lot 10 Moortown Road, which is vacant crown land, all the lots have been developed with a single residence and associated outbuildings.

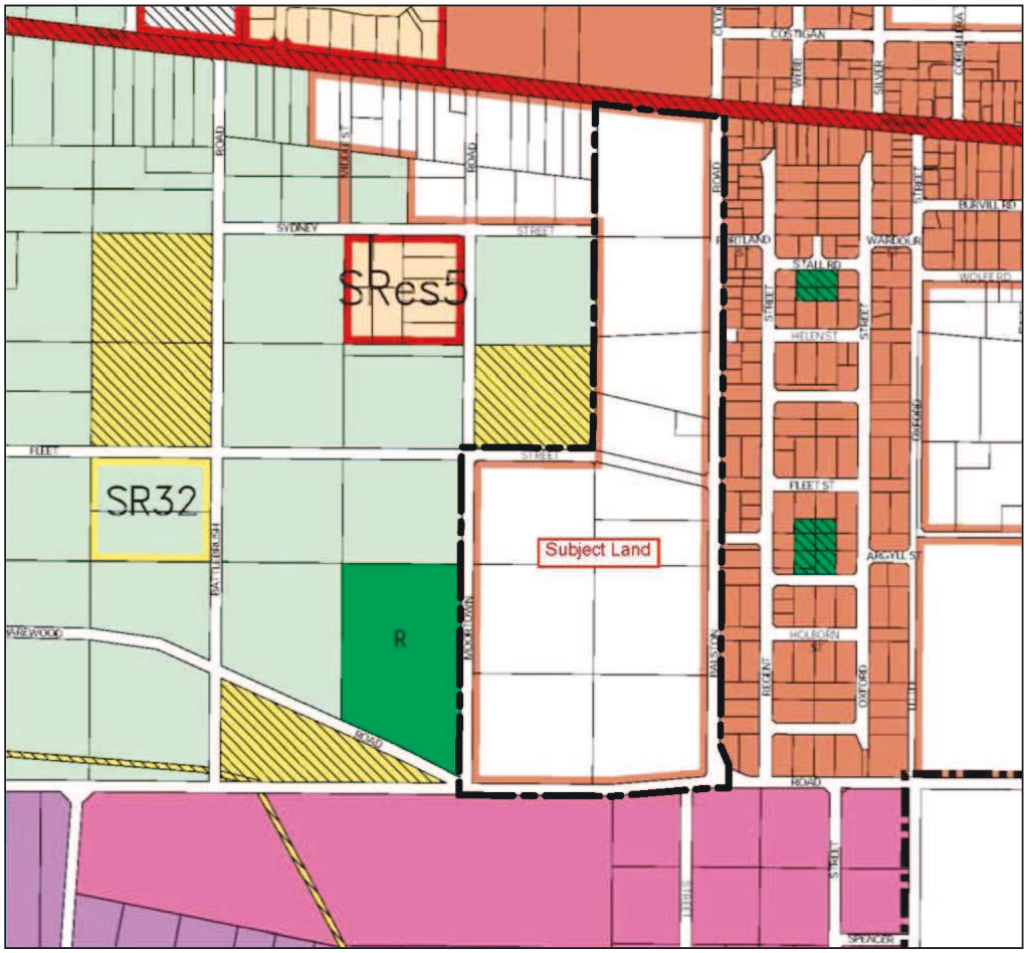

Figure 3: City of Albany, Town Planning Scheme No. 3. Existing Zoning: East Gledhow Development Area

In terms of surrounding land use, land to the east on the opposite side of Balston Road has already been developed for residential purposes with smaller sewered lots generally concentrated on the flatter land to the north near the South Coast Highway and larger unsewered lots located on the steeper land to the south. To the west the land is predominantly zoned 'Rural' apart from a pocket of 'Special Residential' development, two 'Public Purpose' reserves and one 'Parks and Recreation' reserve. To the south of Cuming Road, the land is zoned 'Light Industry'', but remains undeveloped. Refer existing zoning plan.

5.1 Topography

The majority of the site (approximately two thirds), consists of a relatively flat plateau with a high point of approximately 55m AHD. The plateau slopes gently to the north, west and south and then drops more steeply to the south forming a distinctive ridgeline which runs east - west through Gledhow. Slopes range from almost flat to 1:8 to the south.

5.2 Soils

The soil type is generally uniform across the majority of the site consisting of yellow clay and loam silt with gravel to a depth of one metre, overlying deep yellow clay silt. The lower lying area abutting Cuming Road consists of grey topsoils over leached white and yellow sands to a depth of one to two metres, overlying yellow clay silt sub soils. These soils have an inherently high phosphate retention and good ability for nitrogen management. The risk of acid sulphate conditions occurring in the development area is assessed as being minimal to nil.

5.3 Vegetation

Apart from the vacant crown land and portions of Lots 26 & 27 Balston Road immediately to the east, the majority of the site has been cleared for pastoral grazing/hobby farm activities. Remnant vegetation on the above properties ranges from degraded to excellent condition and consists of Jarrah-Marri Low Forest. Further discussion in relation to vegetation is provided in the Local Water Management Strategy provided by Opus in Appendix A.

At this stage the intentions of the Crown are unknown in terms of the future of the vacant crown land. Flora and fauna investigations will be required by the EPA should the Crown wish to identify future use/conservation of the land.

6. SERVICE INFRASTRUCTURE

6.1 Road Network

South Coast Highway provides the main access to and from the locality by connecting to Albany Highway to the east and from there through to the CBD. Balston Road which runs north - south from South Coast Highway and forms the eastern boundary of the ODP, provides an alternative access to the CBD via Cuming Road, Roundhay Street, Lower Denmark Road and Princess Royal Drive.

South Coast Highway is classified as an Integrator Arterial and Balston Road as a Neighbourhood Connector. Clydesdale Road has recently been cul-de-saced at South Coast Highway, which effectively reduces the significance of Balston Road and Clydesdale Road as a major north-south route. All other roads within the ODP are classed as local access roads. Of these, Moortown Road, Middle Street and portion of Sydney Street between Middle Street and Moortown Road have also been sealed. The balance of Sydney Street and eastern most portion of Cuming Road have been constructed to a gravel standard only. An un-named road reserve running east-west between lots 9, 10, 2 & 26 is unconstructed. A Transport Statement for the ODP area has been prepared by Opus and is attached in Appendix B.

6.2 Power

All lots are currently connected to power and preliminary advice from Western Power indicates that no network reinforcement or upgrades will be required to service the proposed development.

6.3 Telstra

Existing lots are connected to the telecommunication network which can be extended to service further development in the area.

6.4 Water Reticulation

A reticulated water supply is currently available in the area and can be extended and if necessary, upgraded, to service future developments.

6.5 Sewer Reticulation

Currently there is no reticulated sewer within the project area, however, the area is within the Water Corporation's overall sewer scheme. The existing Infrastructure Plan indicates the current sewer catchment boundary together with the existing infrastructure and proposed extensions. The project area is divided into two minor catchment areas which can be serviced relatively easily by extending existing gravity sewer infrastructure from the adjacent area. All lots located within the ODP area will be required to be connected to reticulated sewerage, including lots with an R5 density code.

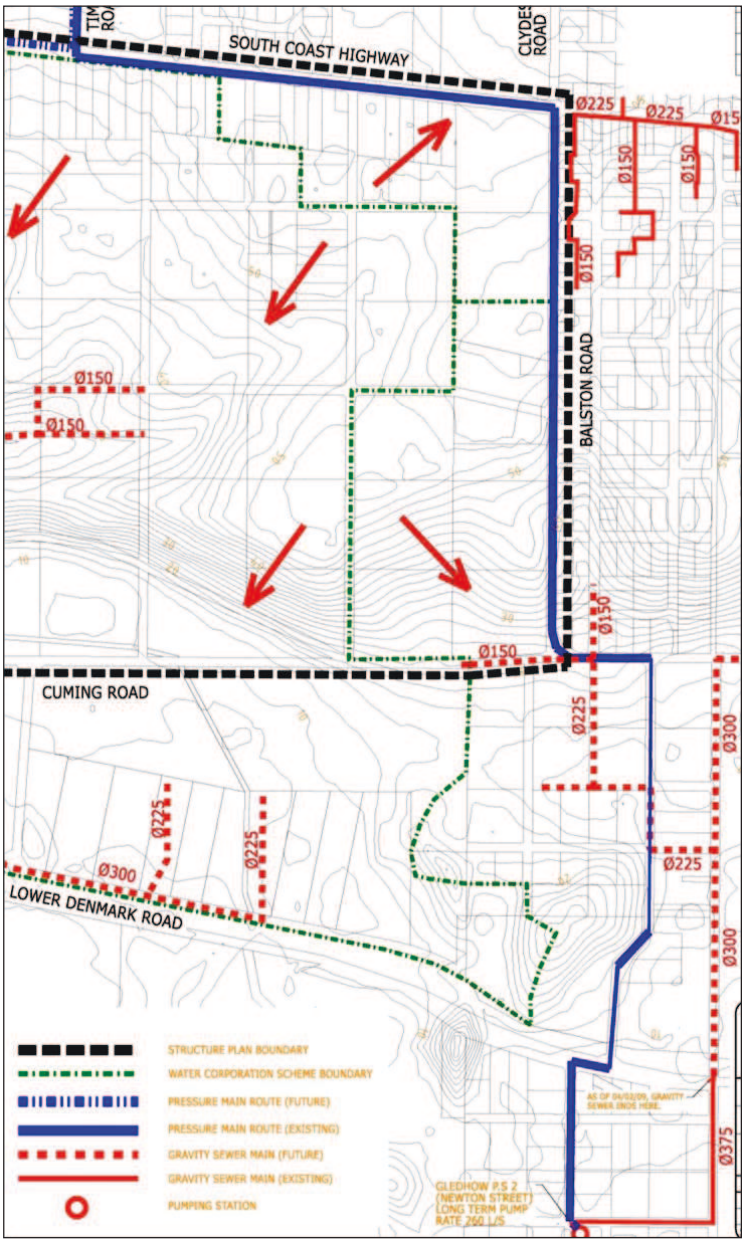

Figure 4: Existing Infrastructure Plan

6.6 Drainage

The bulk of the subject land falls within the Robinson Drainage Catchment and Munster Hill catchment and to a lesser extent, the Parker Brook Catchment to the north. While there are no wetlands or creek lines within the study area, further development will require stormwater to be managed and utilisation of these drainage catchments forms the basis of the Local Water Management Strategy attached in Appendix "A".

6.7 Community and Commercial Facilities

Currently there are no community, educational or commercial facilities located within the study area. The nearest primary school is the Lockyer school which is located between 1.2 and 2.2 kilometres to the east along South Coast Highway. A new primary school is proposed as part of the McKail residential development area and is located approximately 500m directly to the north. A future school site is proposed further to the west to serve the Gledhow Locality.

With regard to commercial facilities, the nearest shop is a small deli opposite the Lockyer Primary School and a small super market on the north east corner of Barrett Street and South Coast Highway, some 1.8km to the east. A local centre with a maximum of 600m^2 of retail floor space is proposed within the McKail development area approximately 800 metres to the north on the western side of Clydesdale Road.

Approximately 2km to the north east, the Orana Neighbourhood Shopping centre is proposed on the south west corner of Le Grande Avenue and Albany Highway. This will be the nearest centre to provide a comprehensive range of day to day convenience shopping. The nearest existing centre is the North Road Neighbourhood Shopping Centre, some 3km to the east.

7. OPPORTUNITIES AND CONSTRAINTS

The opportunities and constraints identified in relation to the study area are illustrated on the Opportunities and Constraints plan overleaf.

These are summarised as follows:

- The study area effectively forms the development front for the Gledhow locality with land to the east of Balston Road having been developed for residential purposes.
- Compared to other development areas, the area is within easy access of the Albany CBD and all the associated health, community, educational and recreation services.
- It is located close to the developing industrial area to the south east, providing ready access to employment opportunities in the area.
- In terms of its physical and environmental attributes, the land is relatively unconstrained. There are no wetlands or creeks and the majority of the land is relatively flat and has been cleared.
- Vegetation on the site varies from excellent to degraded, with the largest and best area being protected on reserved land immediately to the south west of the subject land.
- Consideration will need to be given to retaining other pockets of remnant vegetation within the Study Area. As recommended in Liveable Neighbourhoods, a balance will need to be achieved by ensuring all the Public Open Space is not given over to retaining remnant vegetation and that the objective of providing compact walkable neighbourhoods is met.
- The Balston Road / South Coast Highway intersection will become increasingly significant as the McKail and Gledhow localities develop. There is an opportunity to look at a mixed use node on the south west corner of this important intersection. Provision of employment generating activities and adjacent medium density housing should be considered.
- The ridge line to the south provides attractive views to Princess Royal Harbour and slopes are not excessive in terms of development for residential purposes.

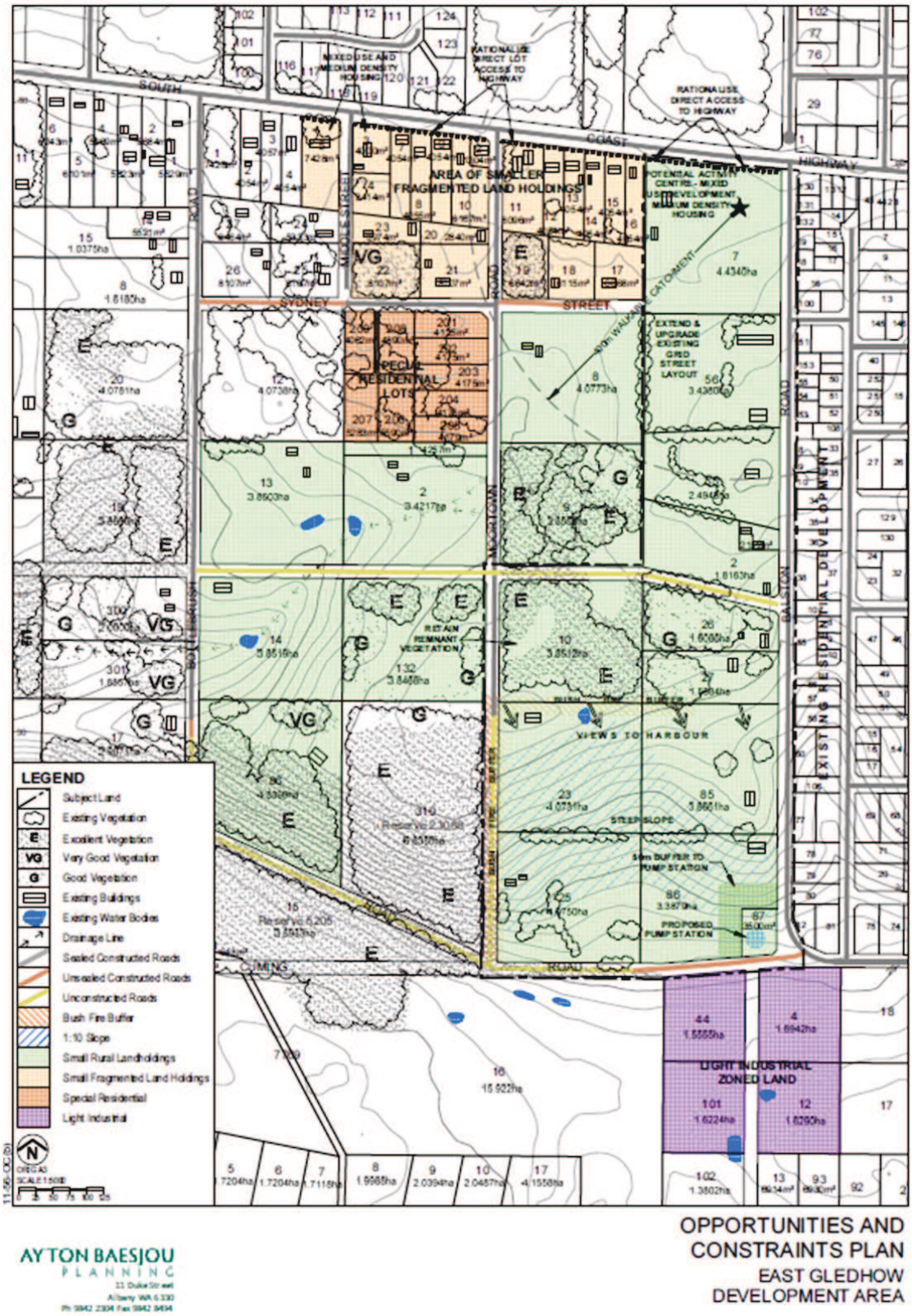

Figure 5: Opportunities and Constraints Plan

- Appropriate setbacks will need to be provided to remnant vegetation where they constitute a bush fire threat.
- A 50 metre wide buffer is required around the sewerage pumping station on Lot 87.
- Access to and from South Coast Highway will need to be restricted in accordance with Main Roads WA requirements and improvements to key intersections along Balston Road may be required as the area develops.
- The existing grid street layout of roads in the area lends itself to the interconnected street network recommended in Liveable Neighbourhoods.

8. OUTLINE DEVELOPMENT PLAN

The proposed Outline Development Plan (ODP) addresses the opportunities and constraints identified in the preceding section and follows the guidelines provided by the WAPC's Liveable Neighbourhoods Community Design Code. The ODP is illustrated overleaf.

Key elements of the design include;

- An urban structure that encourages a more walkable, mixed use neighbourhood by designating an activity node adjacent to the Balston Road/South Coast Highway intersection.
- Extension of the existing grid street layout to provide an interconnected street system with strong links to the activity node and surrounding residential area.
- Provision of a site responsive plan which responds to the opportunities and constraints and strengthens local character and identity.
- In accordance with the Local Government's preferred approach, provision of public open space is consolidated in larger areas which can accommodate a range of activities, both active and passive, as well as necessary drainage functions.
- Provision of a range of density codes ranging from R30/40 around the activity node to R10/15 on the more steeply sloping land and limited R5 lots abutting Cuming Road to the south.
- Protection of remnant vegetation so that it can be managed in a sustainable manner and provision for appropriate management of bush fire risk.
- Incorporation of best practice urban water management in relation to storm water disposal and re-use.

- Design of the urban structure/street system so that it facilitates an efficient public transport system.

These key elements are outlined in further detail below;

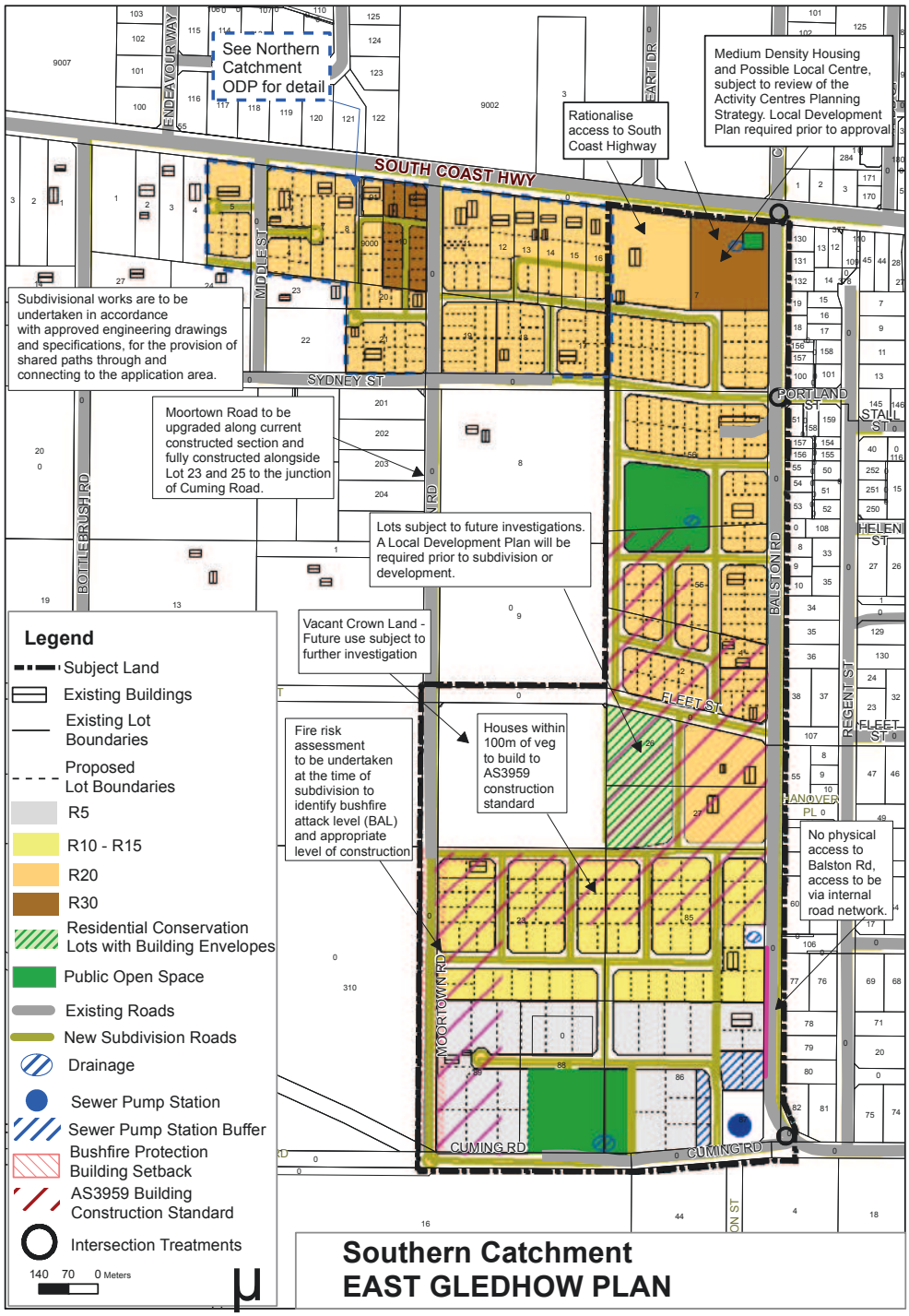

Figure 6: East Gledhow Outline Development Plan

8.1 Activity Node

In accordance with the guidelines provided by "Liveable Neighbourhoods – Element 7", designation of an activity node is an important component of neighbourhood design, providing a focal point for the local community and creation of local employment opportunities. Such centres need to be located on busier streets, not hidden away in residential cells.

In this regard, the South Coast Highway/ Balston Road intersection may support a possible activity node subject to a review of the City of Albany 'Activity Centres Planning Strategy'. The review will consider the viability of the site as a Local Centre.

Local centres, as described in the 'Activity Centres Planning Strategy' are to develop Shop/Retail floorspace up to 600m² and may include such uses as local offices, fuel station as well as R30/40 residential development within a 100m radius. Provision for a bus stop is encouraged. The quality of the public realm is particularly important with a village square/area of POS being an important component of a local centre.

8.2 Lot Layout

As required by Liveable Neighbourhoods, a range of lot sizes are provided ranging from R30 around the activity node, R20 on the flatter land and R10/15 and R5 over the more steeply sloping land to the south. The southern section also has a number of constraints such as buffer requirements to the sewer pump station and bush fire management setbacks to remnant vegetation.

Existing roads in the area generally run in a north-south east-west alignment which helps with the development of grid street layout. This in turn facilitates the creation of lots orientated either east-west or north south which enables the lots to maximise their orientation for passive solar energy gain.

Table 2, below, summarises the lot yield from the ODP.

Table 2: Lot Yield

Density	Net Residential Area	Average Lot Size	No. of Lots
R 5	5.6823 ha	$2000m^2$	26
R 10/15	5.1870 ha	$666m^2$ - $1000m^2$	69
R 20	7.8766 ha	$500m^2$	125
R 30	2.2743 ha	$300m^2$	75
Conservation Lots	1.2714 ha	$2000m^2$	6
TOTAL	22.2916 ha		301

8.3 Public Open Space

A range of open space is proposed with easy access to parts of the study area. Sites range from the proposed 'village square', located within the activity node, to the larger local parks which are located within easy walking distance of surrounding residents.

The 'Village Square' can also be associated with a 'community purpose' site which could accommodate a community hall, branch library, kindergarten etc.

In accordance with the Local Government's guidance, public open space has been consolidated into two large areas and potential for a small community village park/square which would be integrated with the higher density coding associated with the activity node located on the corner of Balston Road and South Coast Highway.

Local Government preference is to consolidate public open space into large areas which can be used for a variety of purposes rather than a series of smaller parks which also have less scope to accommodate drainage functions in a way which does not affect their usability. The larger areas also have the potential to reduce on-going maintenance cost.

Access to the larger parks is reasonable with the majority of lots being within 300 meters distance from the POS.

The larger northern area of POS is approximately one hectare in area and is centrally located within the area designated for R20 density coding. The site is flat and is well suited for active

recreation. The southern POS is approximately 8000m^2 and is located on gently sloping land at the foot of the main east-west ridge.

While the designation of public open space is usually dealt with at the subdivision stage of development the nominated sites represent potential locations and thus are not considered reserves as per Clause 5.9.1.8.5 of the scheme. The two main areas of potential POS are approximately 1.8ha in area. This is below the overall 10% provision for the ODP area which requires approximately 3.1ha as per Appendix C Table 1: Public Open Space Schedule. An additional area of POS may be required within the proposed Activity Node, subject to further investigation. It is recommended that should there be an outstanding balance of POS required that it be provided as cash-in-lieu. Cash-in-lieu can be used for the purchase of additional POS or used to offset those landholders which provide more than 10% of their land for POS. The schedule of Public Open Space is contained in Table 3 in Schedule C.

8.4 Conservation Lots

The western section of Lots 26 & 27 have remnant vegetation considered to be of either 'Good Condition' or 'Excellent Condition'. Priority flora, chorizema reticulatem (P3) is recorded along the western boundaries of the lots.

The EPA has advised that investigations and spring surveys, as well as provision of information relating to management of conservation values, be addressed. Should the owners of Lots 26 & 27 wish to subdivide their land it will be necessary for them to address the issue raised by the EPA.

As the City of Albany is not prepared to incorporate such land within its public open space, the options are either for the DEC to acquire the land for conservation purposes or for consideration to be given to the creation of conservation lots whereby the conservation values can be managed privately.

8.5 Stormwater Management

A stormwater management strategy has been prepared for the study area and has been included in Appendix A.

The study area is composed of 6 small catchments as illustrated on the Catchment Plan. The areas of land required to treat the 1:1 year and 1:10 ARI stormwater events consist of approximately 5227m^2 and can readily be accommodated within local public open space and will occupy less than 2% of the POS. The indicative layout of POS within the study area has been located so that it can accommodate the stormwater drainage. Liveable Neighbourhoods encourages integration of stormwater treatment within Public Open Space and allows for up to 2% of the 10% POS being used for restricted use such as compensating/detention basins. One of the provisions is that the water management function does not compromise the principle function of the public open space.

8.6 Bushfire Management

The remnant vegetation on Reserve 23088 to the west of the south west corner of the ODP and the remnant vegetation on Lot 10 represents a bush fire threat to adjacent housing. A preliminary assessment indicates a 20 metre wide Building Protection Zone around future housing will be required, together with a 9 metre wide Hazard Separation Zone. Housing will need to be constructed to a BAL 29 standard. These setbacks can be accommodated within the 20 metre wide road reserve abutting the vegetation together with a nine metre wide building setback on the adjacent lots. At the subdivision stage of development, a detailed fire management plan will be required to be prepared in accordance with Planning for Bush Fire Protection, Edition 2.

9. IMPLEMENTATION

The purpose of the East Gledhow ODP (ODP) is to co-ordinate the future subdivision and development of the 'Residential Development' zoned land, as required by the provisions of the City of Albany's Town Planning Scheme No 3.

With the exception of the proposed activity node, which may include a small retail outlet and small businesses such as professional offices, medical and health practitioners, the predominant land use is residential.

9.1 Objectives

The objectives of the ODP are:

- To provide for fully serviced residential development with a range of lot sizes to suit the opportunities and constraints of the site and provide for a choice of housing.
- To support the development of an activity node adjacent to the South Coast Highway/Balston Road intersection.
- To allow for a range of employment opportunities and community uses within the activity node.
- To provide a range of passive and active public open space within easy walking distance of the residential areas.
- To protect and integrate where possible, areas of remnant vegetation located within the ODP.
- To provide safe and convenient vehicle and pedestrian access.
- To build on the existing grid street system and orientate streets in a north-south or east-west alignment in order to maximise opportunities for passive solar gain.
- To provide an integrated urban water management system based on water sensitive design principles.

9.2 Subdivision and Development Requirements

In order to achieve the above objectives, all subdivision and development proposals are required to have regard to the adopted Outline Development Plan and the following requirements:

General

a) A portion of Lot 7 South Coast Highway may be considered for development as a Local Centre, subject to a review of the City of Albany 'Activity Centres Planning Strategy'.

b) Local Development Plans (LDPs) are to be prepared for all R30, Local Centre locations and for lots that front POS. A Local Centre LDP is to identify parking, drainage, POS, community purpose site, and housing density.

c) All new dwellings within the ODP be encouraged to give due consideration to solar access, local breezes, views, existing remnant vegetation, location of pedestrian and dual use pathways, orientation to POS for surveillance, and dwelling and garage footprints.

d) Density on the ODP map is indicative only and final road network, lot layout and achievement of maximum density will be dependent on resolution of individual site constraints, including location of drainage basins.

e) A contribution toward a future school site may be required as a condition of subdivision.

f) Elsewhere within the ODP, the Local Government may require an LDP to be prepared in order to define the positioning of building envelopes in relation to public open space/remnant vegetation/bushfire management and sewer pump station buffers.

g) The Local Government may also require the submission of a wider subdivision plan, which is to be referred to the landowners affected, in order to ensure the subdivision development will not adversely affect the subdivision/development of adjacent parcels of land.

Land Use

h) Uses within a proposed Local Centre are to be consistent with the Local Centre zone of the scheme and have regard to the 'Activity Centres Planning Strategy'.

Within all other areas of the ODP, the local government will give consideration to the following discretionary uses:

- Single House;
- Ancillary Accommodation;
- Bed and Breakfast;
- Grouped Dwelling;
- Home Business;
- Home Occupation;

- Home Office;
- Telecommunications Infrastructure; and
- Public Utility.

Density

i) The Local Government will support lots within the ODP being subdivided and/or developed into lot sizes in accord with the residential densities shown on the ODP.

j) Consideration will be given to special purpose dwellings within the ODP in accordance with the Residential Design Codes, with preference given to their location on Lot 7 in proximity to the activity node.

k) Within the area indicated as R15, lower density lot sizes may be required in order to address the relatively steep land and setbacks required from POS and remnant vegetation for bushfire protection.

Vegetation

l) Subdivision and development of lots that contain remnant vegetation are to retain that vegetation which will not be impacted by the development footprint and/or reserve such vegetation within POS where applicable.

m) Lots will be prohibited from clearing vegetation along their Balston Road boundary. This vegetation and the vegetation within road reserve of Balston Road are indicated for retention as a vegetation corridor.

n) Flora and fauna surveys are to accompany subdivision and development applications within all lots that contain areas of remnant vegetation.

o) Any future use of Lot 10 Moortown Rd (Vacant Crown Land) is subject to further investigation including a spring flora study, and a targeted fauna study. Any development within the lot will be subsequent to EPA and DPaW consultation and agreement and will require the preparation of a Local Development Plan.

p) The local government will give consideration to residential conservation lots on Lots 26 and 27 Balston Road, subject to a detailed Local Development Plan, which addresses, but is not limited to, retention of vegetation, bushfire management, drainage, and translocation of Priority and Declared Rare flora.

q) A vegetated buffer is to be planted around the Sewer Pump station, to the specifications of the local government.

Public Open Space

r) A minimum of 10% of the development or subdivision area is to be provided as either land or cash-in-lieu for the purpose of POS.

s) The location of land for POS is indicatively shown on the ODP. Variations to the plan may be considered by the Local Government providing the objective of providing a variety of passive and active areas of POS within convenient walking distance of surrounding residences is met. The Local Government is however opposed to the proliferation of small areas of POS that are restricted in their use and expensive to maintain.

t) Land ceded as Public Open Space shall be developed at the time of subdivision in accordance with a prepared Landscape Plan that is approved by the City of Albany, and shall include paths, landscaping, play equipment, lawn and reticulation. Landscaped areas are to be maintained for a minimum of 2 summers. Where a Landscape Plan is prepared over a POS area which is greater than 10% of the area being developed, a proportion of the cost to prepare and implement the Landscape Plan shall be reimbursed to the proponent.

u) Ceding of a portion of Lot 7 South Coast Highway for a community purpose site would be able to be considered within the 10% contribution required for POS.

Drainage

v) An Urban Water Management Plan (UWMP) is to accompany subdivision and development applications.

w) Implementation of the recommendations of the UWMP will be a condition of subdivision or development approval.

x) The Local Government will support the integration of stormwater treatment within areas of public open space in accordance with the guidelines provided in Liveable Neighbourhoods.

Development on Sloping Land

y) Development of land which has a slope greater than 1:10 shall have regard to the Local Government's Local Planning Policy 6D – Sloping Land.

Access

z) Road alignments are to be developed in accordance with the ODP, Local Development Plans and wider subdivision concept plans (refer clauses a) – g) above).

aa) Variations to the local road design may be considered by the Local Government providing they meet the objectives outlined in 9.1 above. Any variation that affects adjoining landowners will need to be referred to them for comment to ensure it does not adversely affect the subdivision/development of their land.

bb) Local Government will require a contribution toward upgrading transport infrastructure in accordance with a Transport Impact Assessment (TIA) of the ODP area at the time of subdivision and development.

cc) At the time of subdivision and development, a restrictive covenant will be placed on the title of lots that front South Coast Highway, advising that direct vehicle access to South Coast Highway is not permitted. Vehicle access shall be via the rear internal local road network only.

dd) Road upgrades to Balston Road will be to the local government's specifications.

ee) Shared crossovers are to be provided to adjoining lots along Balston Road.

ff) The TIA is to include a final engineering study of the intersection treatments and upgrade of Balston Road that will be required prior to subdivision and development.

gg) At the time of subdivision or development, the landowner shall cede, free of charge and without payment of compensation, that land identified as future road/s within the ODP or enter into an agreement with the local government for the future ceding, free of charge, of that land when required by the local government.

Reticulated Sewerage, Potable Water and Underground Power

hh) All lots are to be connected to reticulated sewer, scheme water and underground power as conditions of subdivision.

ii) Subdivision and development should be generally in accordance with this ODP adopted by the City of Albany and endorsed by the WAPC.

jj) Existing lots which do not have access to reticulated water and sewer may be considered for subdivision to create one additional lot only where the subdivision is for the excision of a single house which existed on the lot at the time of endorsement of the ODP by the

Western Australian Planning Commission. The proposed subdivision must not compromise the road and lot layout of the ODP, the existing dwelling must have access to sufficient potable water, the new lot must have access to reticulated water and both lots must qualify for appropriate effluent disposal. Notifications on title on both lots will alert landowners to the provisions of the ODP.

Contribution Planning

kk) A Developer Contribution Plan and Cost Apportionment Schedule is to be prepared prior to subdivision and development. Further detail of the plan is provided within Appendix C: Developer Contributions.

Fire Management

ll) Any buildings to be erected pursuant to this structure plan that are within 100m of vegetation shall comply with the requirements of the Australian Standard 3959 under the Building Code of Australia. A bushfire management assessment is to be conducted within Lots 2, 26, 27, 55, 56 and 85 Balston Road, Lot 23 Moortown Road and Lot 25 Cuming Road to identify the appropriate AS3959 construction standard to be applied.

Appendix A

Local Water Management Strategy

Opus International Consultants

April 2012 (as modified 2017)

(Note: Plans may not reflect the final layout).

Appendix A

Local Water Management Strategy

Opus International Consultants

June 2017

Local Water Management Strategy

East Gledhow Outline (Draft) Development Plan South Lockyer, Albany

Prepared on behalf of

Dykstra Planning & Ayton Baesjou Planning

OPUS

Local Water Management Strategy

East Gledhow Outline Development Plan
South Lockyer, Albany

Prepared on behalf of

Dykstra Planning & Ayton Baesjou Planning

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Reference: W-A1166.00
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DOCUMENT REVISION RECORD

Revision	Date	Details	Opus Approval / Signoff	Comment	
				DoW	City of Albany
DRAFT	April 2012	Local Water Management Strategy	Evan Chadfield Albany Business Manager		
FINAL	April 2012	Local Water Management Strategy	Evan Chadfield Albany Business Manager		
1	June 2017	Modifications completed by City of Albany			
2					
3					

After the document is reviewed, any changes that are made shall be forwarded to the City of Albany and Department of Water for review and comment.

CONTENTS

APPENDICES

1 | Summary

Table 1: Design Elements and Requirements for Best Management Practices (BMPs) and Critical Control Points

The Western Australian Department of Water (DoW) Stormwater Management Objectives have been addressed for this site:

Design Objectives	Compliance with Design Objectives Via Development Design Elements	Section or Appendices
Water Quality: *To maintain or improve the surface and groundwater quality within the development areas relative to pre-development conditions*	1:1 year Annual Recurrence Interval (ARI) post development events will be treated as per the Faculty for Advancing Water Biofiltration (FAWB) guideline of a treatment area based on 2% of constructed impervious area within each catchment or sub-catchment.	Appendix C Section 3.1 Water Quality Management
Water Quantity: *To maintain the total water cycle balance within development areas relative to the pre development conditions*	1:10 year post development ARI events will be attenuated within each catchment or sub-catchment and released from the site as per predevelopment stormwater flows as per City of Albany (CoA), Department of Water (DoW) and Main Roads WA requirements, to control velocity and reduce incidence of scouring, sedimentation and point loading.	Appendix C Section 3.2 Water Quantity Management Section 4.2.3 100 Year ARI Event Flood Ways
Water Conservation: *To maximise the reuse of stormwater*	Recommend rainwater tanks plumbed to buildings for non-potable water use. However rainwater tanks have not, for the purpose of this Local Water Management Strategy (LWMS) been included as attenuation within the drainage calculations.	Section 3.3 Water Conservation Section 5 Water Use Sustainability Issues
Ecosystem Health: *To retain natural drainage systems and protect ecosystem health*	1:1 year and 1:10 year post development ARI events proposed to be released from the site as per predevelopment stormwater flows.	Appendix C Section 3.4 Ecosystem Health Management
Economic Viability: *To implement stormwater management systems that are economically viable in the long term*	The stormwater system is recommended to be designed to allow for ease of maintenance – grassed batters will be gentle sloping with rock riffles for reduced incidence of scouring.	Section 3.5 Economic Viability
Public Health: *To minimise the public risk, including risk of injury or loss of life, to the community*	To ensure stormwater structural controls meet public health and safety standards the swales and basin are recommended to be designed to be relatively shallow with vegetated slopes with rock riffles to provide erosion control and stability.	Section 3.6 Public Health

Design Objectives	Compliance with Design Objectives Via Development Design Elements	Section or Appendices
Protection of Property: *To protect the built environment from flooding and waterlogging*	Road reserve within the subdivision is proposed to be utilised as a conveyance system for 1:100 year ARI events. Where required final surface level of buildings should allow finished floor levels to be 300mm above the 100 year flood level as per City of Albany Subdivision Guidelines (2009).	Appendix C Section 3.7 Protection of Property Section 4.2.3 100 Year ARI Event Flood Ways
Social Values: *To ensure that social, aesthetic and cultural values are recognised and maintained when managing stormwater*	It is recommended that any landscape areas within the Structure Plan area are revegetated with local native flora species to improve amenity at the site.	Section 3.8 Social Values
Development: *To ensure the delivery of best practice stormwater management through planning and development of high quality developed areas in accordance with sustainability and precautionary principles*	It is recommended at the detailed design stage of the development that best practice stormwater management principles are incorporated as per DoW guidelines.	To be addressed by the developer at the detailed design stage.

2 | Introduction

This Local Water Management Strategy (LWMS) has been developed by Opus International Consultants (Opus) on behalf of Dykstra Planning and Ayton Baesjou Planning as supporting information for the East Gledhow Structure Plan, Albany. This document outlines stormwater management measures and strategies to be implemented and incorporates comment from the City of Albany (CoA) and Department of Water (DoW).

This LWMS has been developed, as per the Better Urban Water Management Guidelines (WAPC, 2008) to outline best practice Water Sensitive Urban Design (WSUD) strategies that may be considered in the future staged development of the site. The 'best practice' approach to stormwater management is guided by the *Stormwater Management Manual for Western Australia* (DoW, 2007a) and provides co-ordinated guidance for developers on the current best management principles for stormwater management. Opus has recommended these principles on behalf of the client for the planning and overall commitment to sustainability and minimising its ecological footprint.

Water management objectives for this site as per the WA Stormwater Management Manual, are:

- ***Water Quality:*** *To maintain or improve the surface and groundwater quality with the development areas relative to pre-development conditions;*
- ***Water Quantity:*** *To maintain the total water cycle balance within the development areas relative to the pre-development conditions by maintaining 1:1 year ARI event on site and to attenuation the 1:10 year ARI events to match pre-development flows;*
- ***Water Conservation:*** *To maximise the reuse of stormwater;*
- ***Ecosystem Health:*** *To retain natural drainage systems and protect ecosystem health;*
- ***Economic viability:*** *To implement stormwater management systems that are economically viable in the long term;*
- ***Public Health:*** *To minimise the public risk, including risk of injury or loss of life, to the community;*
- ***Protection of Property:*** *To protect the built environment from flooding and water logging by providing overland flow path for 1:100 year ARI events;*
- ***Social Values:*** *To ensure that social, aesthetic and cultural values are recognised and maintained when managing stormwater; and*
- ***Development:*** *To ensure the delivery of best practice stormwater management through planning and development of high quality developed areas in accordance with sustainability and precautionary principles.*

2.1 | Current Land Use and Location

The subject site is located approximately 4.5 km west of the CBD of the City of Albany and encompasses an approximate area of 52 ha as shown on Figure 1.

The northern boundary of the site is adjacent to South Coast Highway and lots to the north of South Coast Highway are zoned as Residential and Special Residential. The southern end of the site is bounded by Cumming Road and to the south lies Light Industry zoned land. The western boundary is bordered by Balston Road and to the west lie Residential zoned lots. To the east are lots zoned Parks and Recreation (Restricted), Rural and Special Residential.

Figure 1: Site Context Plan: Location of East Gledhow Outline Development Plan, Gledhow, Albany.

2.2 | Development Proposal

The subject site is an area of land that has been subject to a "Residential Development" rezoning pursuant to Scheme Amendment No. 296 – City of Albany Town Planning Scheme No. 3 (District Scheme).

Ayton Baesjou and Dykstra Planning intend to prepare the East Gledhow Structure Plan over this area. Dykstra Planning propose to develop an Outline Development Plan (ODP) representing the portion of proposed Structure Plan in the north-west covering the fragmented landholdings. Ayton Baesjou proposed to design and ODP representing the remainder of the area (Appendix A – East Gledhow Concept Structure Plan).

The East Gledhow Concept Structure Plan proposes a composite residential subdivision design including the following:

a) R30 residential housing lots of an average of 300m^2 adjacent to South Coast Highway;

b) R20 residential housing lots of an average of 500 m^2 within the northern half of the site;

c) R5, R10 and R15 residential housing lots with an average of 2000m^2, 1000m^2 and 666m^2 respectively;

d) Existing Lot 19 Sydney Street is proposed to be divided into 4 private Residential/ Conservation lots with designated building envelopes. These lots will be subject to special management controls under conservation covenants applied to title; and

e) Existing Lot 26 and 27 Balston Road are also proposed to be divided into private Residential/ Conservation lots with designated building envelopes, however at time of writing is unknown how many lots are proposed to be developed.

2.3 | Legislation and Policies Applicable to the Site

This report has been prepared to comply with the following legislation, policy and guidelines:

- *Environmental Protection Act* 1986;
- Department of Water, *Interim: Developing a Local Water Management Strategy*, December 2008; and
- Department of Water (2007) WA Stormwater Management Manual.

2.4 | Consultation Prior to Preparation of this Plan

Consultation prior to the preparation of this plan has occurred with:

- Karen McKeough, Environmental Officer, Department of Water (DoW);
- Paul Camins, Planning and Development Engineer, City of Albany (CoA); and
- Don Parker, Asset Management Officer, Main Roads WA (Great Southern Regional Office – Albany); and
- Peter Stringer, Network Manager, Main Roads WA (Great Southern Regional Office – Albany).

Opus Consultants met with the DoW representative Karen McKeough representative and CoA representative Paul Camins on 19 March 2012.

Issues that have been identified by CoA and DoW during the consultation process include the following:

- City of Albany would prefer to see 1:10 year attenuation in centralised POS/ drainage areas rather than in road reserves as swales so that there is reduced maintenance and swales are not too deep. The R20 areas were considered to be too dense for swales in the in-road reserve with cross overs through the swales.
- The soil type on the top of the hill is likely to be laterite cap rock over clay so it is considered unlikely that onsite infiltration for 1:1 year ARI events is an option however this would need to be confirmed prior to detailed design.
- Within all the catchments, if each landowner goes ahead with their developments at separate times, and there isn't a central attenuation/ treatment area, they would have to accommodate this on each lot and overland flow would need to have an easement to ensure a flood route.
- Flood routes will be required to be accommodated in road reserves or as easements across properties.
- There are likely to be issues with discharging stormwater to South Coast Highway due to Main Roads policy.

- Opus Consultants me with Main Roads WA representatives Don Parker and Peter Stringer on 13 April 2012 with regard to issues relating to potential stormwater discharge from properties adjacent to the South Coast Highway road reserve.

Issues that have been identified by Main Roads WA during the consultation process include the following:

- There is an existing swale drain on the southern side of South Coast Highway adjacent to properties within the Structure Plan area.

- There is an existing culvert at the corner of South Coast Highway and Balston Road which allows downstream stormwater runoff flow to the north of the highway.

- Main Roads WA generally do not accept stormwater discharge to their road reserves from new developments however for the proposed development of Catchment D it is likely that Main Roads would accept discharge (as per predevelopment flows) to the swale in the South Coast Highway reserve if it was upgraded to accommodate a 1:50 year ARI event.

- Due to the proximity of the existing footpath located between the existing swale and the boundary of the road reserve to the south of South Coast Highway, upgrade of this swale to accommodate flows for a 1:50 year ARI event would be required to be designed to achieve safety requirements as per Main Roads WA standard design for swales (such as scour protection, crossovers to existing residential properties and slope of batters). This swale would also have to be graded so that it allows flow along South Coast Highway to the low point at the corner of Balston Road.

- In the event that a swale with the capacity to accommodate a 1:50 year ARI event cannot be designed to meet Main Roads WA safety requirements, as an alternative, a pipe system will be required to be designed to the satisfaction of Main Roads WA.

- The existing culvert located at the corner of South Coast Highway and Balston Road will be required to be designed to accommodate 1:50 year ARI event flows from Catchment D, however this will also be required to accommodate flows from existing residential properties within this catchment to the east of Balston Road.

Further consultation with Main Roads WA is recommended at the detailed design stage as each landowner develops their property to allow appropriate design of stormwater control structures required within the South Coast Highway road reserve.

3 | Design Criteria

3.1 | Water Quality Management

The following design criteria are proposed for the development of this site:

Objective

To maintain or improve the surface and groundwater quality within the development areas relative to pre-development conditions.

Design Criteria

The 1:1 year ARI post development events are proposed to be treated as per the Faculty for Advancing Water Biofiltration (FAWB, 2008) guideline of a treatment area based on 2% of constructed impervious area within the proposed lots and road reserve.

To allow for a 2% treatment area, a form of Bioretention System will be required. This may include a conventional grassed/ vegetated swale or pipe network flowing to a Bioretention System or a Bioretention Swale taking up nutrients, controlling sediment and conveying stormwater offsite as per predevelopment rates.

As per the Water by Design (2009) guidelines Conventional Swales are *"drainage depressions covered in turf or vegetation. They have an invert and batters to move stormwater in a shallow, slow flow as shown in Figure 2. Conventional swales 'pre-treat' sediments and nutrients before the stormwater enters wetlands or bioretention systems".*

Bioretention Swales *"can be combined with a bioretention trench to provide more 'treatment' for fine sediments. Bioretention swales also help to remove more phosphorous and nitrogen before stormwater enters wetlands and other systems, also as shown in Figure 2. There are a number of ways to incorporate a bioretention component into swales:*

- *By allowing the swale to direct stormwater flows into a flat bioretention trench*
- *By constructing a swale with a bioretention soil profile with local 'check dams' to extend the time water is detained in the swale before it enters other waterways*
- *By incorporating bioretention into the swale with a gentle slope".*

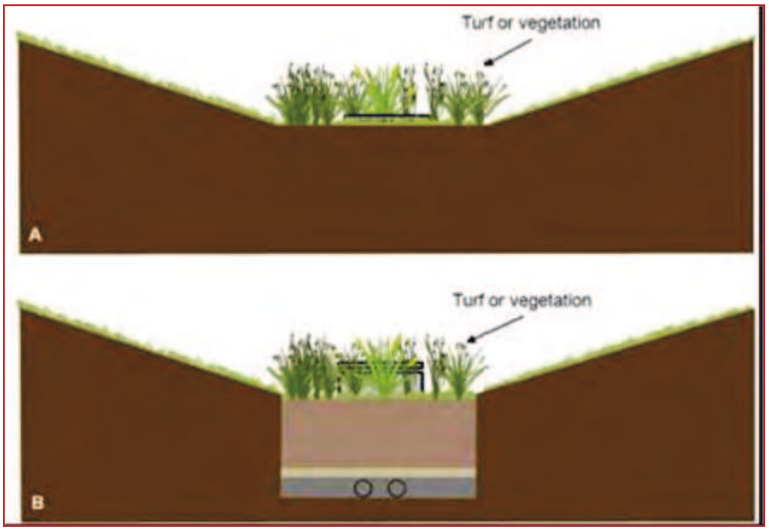


Figure 2: Typical Cross-section through a Conventional Swale (A) and a Bioretention Swale (B) [Source Water by Design, 2009]

Bioretention systems, as per Water by Design (2009) guidelines, may be used to "*treat stormwater by filtering runoff through densely planted vegetation and percolating the runoff through a filter media, such as loamy sand. As the water is percolated through the soil, pollutants are captured by fine filtration, adsorption and biological uptake. Figure 3 shows that bioretention systems have a number of elements:*

- ***Extended detention:*** *When stormwater enters the bioretention system, it temporarily ponds to a depth of 200–400 mm over the surface of the filter media. This ponding depth, or the 'extended detention', is created by raised field inlet pits (overflow pits). Extended detention helps to manage flow velocities over the surface of the filter media as well as increasing the overall volume of stormwater runoff that can be treated by the bioretention system.*
- ***Filter media:*** *The layer of 'filter media' provides the most treatment of the pollutants through fine filtration and supporting the vegetation. The vegetation improves filtration, keeps the filter media porous, provides substrate for biofilm to form and takes up some nutrients and pollutants. The filter media should be deep enough to support vegetation. The typical depth for filter media is between 600–1000 mm with a minimum depth of 400 mm. The surface of the filter media is generally flat.*
- ***Transition and drainage layers:*** *Under the filter media, a 'transition layer' of coarse sand is used to prevent the filter media moving into the drainage layer and the perforated under-drains. The transition layer is typically 100 mm deep. The 'drainage layer' is made up of fine aggregate (2–4 mm) and is typically 200 mm deep. The drainage layer collects treated water from the base of the bioretention system and delivers it into the perforated under-drains. The under-drains are perforated and typically slotted PVC (preferred) or ag-pipe".*
- ***Hydraulic structures*** *(overflow pit): During flood events that are 'above design' of the bioretention system, stormwater flows are conveyed through overflow pits or bypass paths rather than over the filter media. Hydraulic structures protect the surface of the filter media from high-flow velocities that can dislodge collected pollutants or scour vegetation.*
- ***Vegetation:*** *Vegetation is critical for bioretention function. It supports treatment of stormwater by providing a substrate layer for biofilm growth, helps to transport oxygen to the soil and enhances microbial communities that transform pollutants. The roots of the vegetation continuously break up the surface of the filter media, which prevents the surface from clogging. Wind agitating the vegetation can also help to break up the surface.*

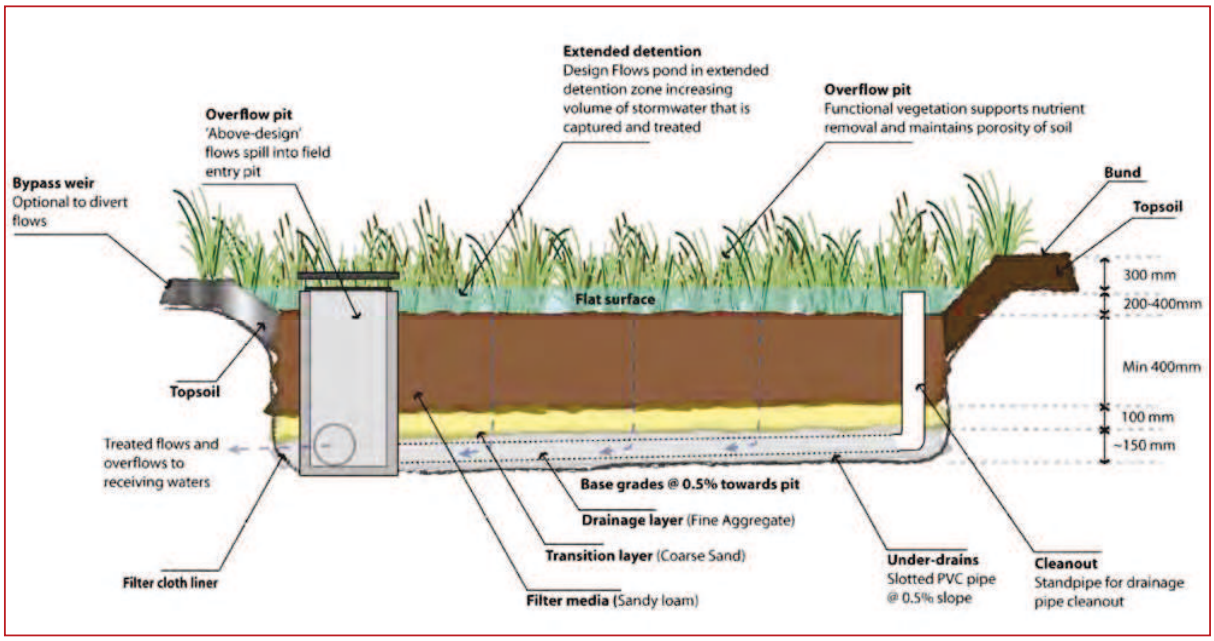


Figure 3: Typical cross-section through a bioretention system [Source Water by Design, 2009]

3.2 | Water Quantity Management

Objective

To maintain the total water cycle balance within development areas relative to the pre development conditions.

Design Criteria

The 1:1 year ARI events are required to be attenuated and treated as per CoA Subdivision and Development Guidelines (CoA) and DoW guidelines for treatment of stormwater prior to release off site (Section 3.1 Water Quality Management).

As a CoA requirement for subdivisions for the 1:10 year post development ARI events are proposed to be attenuated within the development area and released from the site as per predevelopment stormwater flows (CoA, 2009), the 1:10 year ARI events are to be attenuated on site in accordance with DoW best practice.

Consideration should be made at the detailed design stage to include either small detention basins or swales if appropriate on each site or a single larger basin on the downstream allotment which could include underground storage.

3.3 | Water Conservation

Objective

To maximise the reuse of stormwater.

Design Criteria

It is recommended that, at the time of development, rainwater tanks are installed on each lot by individual lot owners and plumbed to buildings for non-potable water use (e.g., toilets and irrigation). An option for control of this would be to stipulate rainwater tank installation on lot titles.

Rainwater tanks have not, for the purpose of this LWMS been included as attenuation within the drainage calculations.

3.4 | Ecosystem Health Management

Objective

To retain natural drainage systems and protect ecosystem health

Design Criteria

All 1:1 year and 1:10 year post development ARI events are to be released from the site as per predevelopment stormwater flows. Calculations have been made for pre and post development flows across the site (Appendix D – Drainage Calculations). Volumes and the area that is required to be attenuated have been indicated on the Water Management Strategy and Catchment Plan (Appendix C) however these will be required to be confirmed at the detailed design stage for this development.

Natural drainage lines have been proposed to be retained where possible for stormwater drainage and point loading of stormwater at exit points across the proposed subdivision are proposed to be reduced where practical (Appendix C).

3.5 | Economic Viability

Objective

To implement stormwater management systems that are economically viable in the long term.

Design Criteria

Consideration should be made at the detailed design stage for the stormwater conveyance system to allow for ease of maintenance – any batters are recommended to be gentle sloping for reduced incidence of scouring (1:6 or less). Best practice erosion control measures are recommended to be implemented during the development of the site for long term protection of the site.

All swales are recommended to be grassed or vegetated, with rock riffles at designated intervals (dependent on swale grade) to slow stormwater runoff velocity and reduce incidence of erosion.

3.6 | Public Health

Objective

To minimise the public risk, including risk of injury or loss of life, to the community.

Design Criteria

To allow stormwater structural controls to meet public health and safety standards, swale and basin designs are recommended to be relatively shallow with grassed slopes with erosion control such as rock riffles to provide stability.

3.7 | Protection of Property

Objective

To protect the built environment from flooding and waterlogging.

Design Criteria

Road reserves within the subdivision are proposed to be utilised as a conveyance system for the 1:100 year ARI events. At time of writing the lot and road layout for the subdivision has been proposed however this will need to be confirmed at the detailed design stage (Appendix A: Draft Plan)

Drainage calculations for the site have been determined for a 1:100 year ARI by adopting the assumption that the site is 100% impervious as during such an event, all pervious soils are considered to become water logged (Appendix D – Drainage Calculations).

Final surface level of buildings should allow finished floor levels to be 300mm above the 100 year flood level as per City of Albany Subdivision Guidelines (2009).

3.8 | Social Values

Objective

To ensure that social, aesthetic and cultural values are recognised and maintained when managing stormwater.

Design Criteria

It is recommended that any buffer zones within the proposed subdivision are revegetated with local native flora species to improve amenity at the site.

3.9 | Development

Objective

To ensure the delivery of best practice stormwater management through planning and development of high quality developed areas in accordance with sustainability and precautionary principles.

Design Criteria

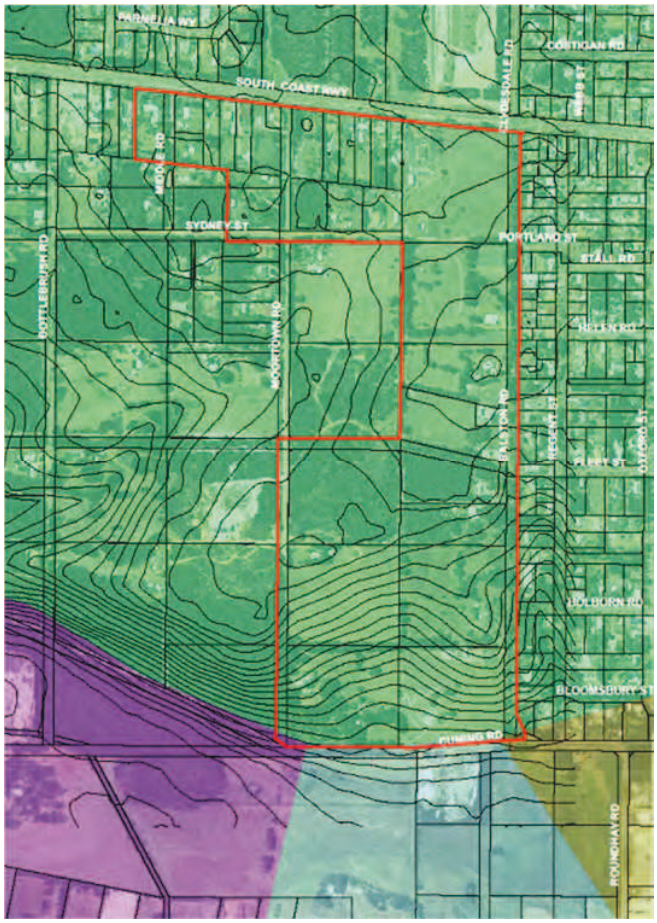
It is recommended at the detailed design stage of the development that best practice stormwater management is incorporated as per DoW guidelines.

4 | Pre-development Environment

4.1 | Site Conditions

4.1.1 | Geology

The Geological Survey of Australia Geological Map Series 1:250,000 describes the majority of the site as "*Czs Sand Plain – Sand or gravel plains; quartz sand sheets commonly with ferruginous pisoliths or pebbles, minor clay; local calcrete, laterite, silcrete, silt, clay, alluvium, colluvium, aeolian sand"* (Figure 2). This soil types are indicative only and actual soil found on site may vary.



Czs Sand Plain – Sand or gravel plains; quartz sand sheets commonly with ferruginous pisoliths or pebbles, minor clay; local calcrete, laterite, silcrete, silt, clay, alluvium, colluvium, aeolian sand

Qrc Colluvium – Colluvial sediment, sheetwash, talus; gravel piedmonts and aprons over and around bedrock; clay-silt-sand with sheet and nodular kankar; alluvial and aeolian sand-silt-gravel in depressions and broad valleys in Canning Basin; local calcrete, reworked laterite

Qe Estuarine deposits – Coastal silt and evaporite deposits; estuarine, lagoonal, and lacustrine deposits

Mg Granite, pegmatite – Granite, metagranite, Equigranular to porphyritic granite; leucocratic granite; biotite granite with potassium feldspar phenocrysts in places; foliated adamellite; mixed granitic rocks; dioritic rocks

Figure 2: Desktop assessment of geomorphology of the subject site [Adapted from Geological Survey of Australia Map Series 1:250,000, 2008

The desktop assessment of the Landscape Mapping of South-Western Australia dataset (DAFWA. 1987) indicates that there are three soil types present on the subject site (Table 2 and Appendix B).

- *Dempster Crest Phase* (Map unit 242KgDMc) - approximately 70% of the site;
- *Dempster Slope Phase* (Map unit 242KgDMs) - approximately 28% of the site; and
- *Owingup Subsystem* (Map unit 242TbOW) - approximately 2% of the site.

Table 2: Map Units with Soil Types and Predicted Vegetation (adapted from Soil Landscape Mapping of South-Western Australia 1: 20,000-1: 250,000; DAFWA, 1987)

Code	242KgDMc	242KgDMs	242TbOW
Name	Dempster Crest Phase	Dempster Slope Phase	Owingup Subsystem
Summary Description	Sands and laterite on elongate crests; Jarrah-Albany Blackbutt-Marri forest	Sands and gravels on smooth slopes; Albany blackbutt-sheoak low forest	Plains with swamps, lunettes and dunes. Yellow solonetzic soils, organic loams and diatomaceous earth; Wattle-Paperbark thickets, Teatree heath and reeds. Podzols on dunes; Banksia-Sheoak woodland
Land-form	Broad convex crests of sandy and lateritic spurs and ridges	Gentle slopes	Plains and dunes
Geology	Deeply weathered siltstone	Sandy deposits deeply weathered siltstone	
Soil	Duplex sandy gravels, Grey deep sandy duplexes, Pale deep sands and Shallow gravels	Duplex sandy gravels, pale deep sand and deep sandy gravels	Yellow solonetzic soils, organic loams and diatomaceous earth
Vegetation	Heath with scattered jarrah	Jarrah-Albany blackbutt-she oak-banksia woodland with heath	Wattle-Paperbark thickets, Teatree heath and reeds. Banksia-Sheoak woodland

Please note that the desktop investigation of soil types is indicative only and actual soil found on site may vary.

4.1.2 | Topography

The highest point of elevation within the Structure Plan area is located along a ridge that lies in a north-south direction at approximately 55mAHD. The site slopes away to the north, east and west to approximately 50mAHD on the boundaries of the site. The lowest point is at 20mAHD on the southern boundary at Cuming Road. There is a 5 – 7% slope from the top of the ridge to Cuming Road.

4.1.3 | Acid Sulfate Soils

The proposed Structure Plan area is located in an area of Low to No Risk of Actual Acid Sulfate Soil (AASS) or Potential Acid Sulfate Soils (PASS), however there is an area of High Risk of AASS and PASS the south of Cuming Road (WAPC, Planning Bulletin 64 Figure 11 Albany-Torbay Acid Sulfate Soils) (Appendix B – Acid Sulfate Soil Risk Map).

As the subject site is located with 500m of a High Risk of AASS and PASS it is recommended that an ASS Preliminary Investigation undertaken as per DEC standards for the area on the northern side of Cuming Road. If ASS is identified an ASS Management and subsequent Closure Report to Department of Environment and Conservation (DEC) should be completed prior to soil and groundwater disturbance works on site.

4.1.4 | Contaminated Sites

A search of the DEC's Contaminated Sites Database, 29th March 2012, found there are no contaminated sites pursuant to the *Environmental Protection Act* 1986 in the subject site. However this database does not include those sites which are currently in the process of being classified.

4.2 | Environmental Assets

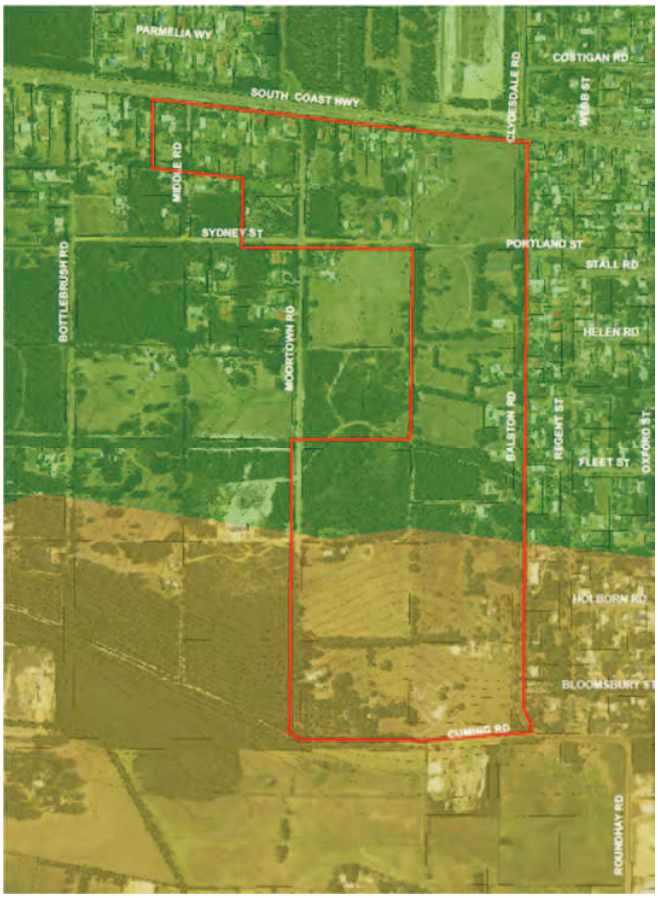
4.2.1 | Flora

The subject site lies within the Southern Jarrah Forrest IBRA subregion (Hearn *et al.*, 2002). The pre-European Vegetation Classification dataset classifies the remaining native vegetation within the subject site as the Albany System Association. A full onsite vegetation survey was not completed for the purpose of this LWMS. The two Vegetation Associations identified include the following:

- Albany System Association – 3: Medium forest; jarrah-marri; and
- Albany System Association – 978: Low forest; jarrah, *Eucalyptus staeri* and *Allocasuarina fraseriana.*

The Albany 3 Vegetation Association is listed by Shepherd *et al*. (2002) as "*Medium forest; Jarrah-Marri*." The pre-European extent of this vegetation is 3,046,385ha, the current extent being 2,197,837ha, with the estimated remaining extent being 72.1%. The extent of this vegetation type in IUCN reserves is 10.1%, with 67.9% listed in other reserves.

The Albany 978 Vegetation Association is listed by Shepherd *et al.* (2002) as Low forest; jarrah, *Eucalyptus staeri* and *Allocasuarina fraseriana.* The pre-European extent of this vegetation is 66,468ha, the current extent being 26,010ha, with the estimated remaining extent being 39.1%. The extent of this vegetation type in IUCN reserves is 14.0%, with 0.1% listed in other reserves.



Albany 978 – Low forest; jarrah, *Eucalyptus staeri* and *Allocasuarina fraseriana*

Albany 3 – Medium forest; jarrah-marri

Figure 4: Pre-European Vegetation Communities

The majority of the vegetation within the subject site has previously been cleared for the purpose of residential and rural development however Lot 19 Sydney Street, Lots 9 and 10 Moortown Road and Lots 26 and 27 Balston Road are predominantly covered of remnant native vegetation (Appendix B – ARVS Vegetation Units).

The Albany Regional Vegetation Survey (ARVS) (Sandiford and Barrett, 2010) further delineates this vegetation as the following:

- Hakea spp Shrubland/ Woodland Complex;
- *Pericalymma spongicaule* Low Heath;
- Jarrah/ Marri/ Sheaok Laterite Forest; and
- Mosaic of Jarrah/ Marri/ Sheaok Laterite Forest and Jarrah/ Sheoak/ E staeri Sandy Woodland.

Table 3: Albany Regional Vegetation Survey – Vegetation Units (Sandiford and Barrett, 2010)

ARVS (2010) Vegetation Unit	Unit Description	Total Area of Unit within ARVS Survey Area ha	% Area of Remnant Vegetation within ARVS Survey Area
Hakea spp Shrubland/ Woodland Complex	A floristically diverse and very complex group that occurs in areas of impeded drainage on a variety of soils overlying laterite or spongelite. It varies in structure from a tall open scrub over heath/ shrubland on shallow soil on crests and plains to low woodland on gentle slopes.	2,366	5.4%
Pericalymma spongicaule Low Heath	Typically found at the edges of drainage depressions on grey sandy soil when drainage is impeded by an impervious subsurface layer. It also occurs mid slope or on crests where there is localised impeded drainage.	880	2.0%
Jarrah/ Marri/ Sheaok Laterite Forest	Found on well drained shallow loamy/ sandy soil, with outcropping laterite, usually occurring on the crests and middle slopes of low relief hills and plateaus with occasional occurrences on lower slopes	13,144	29.8%
Jarrah/ Sheoak/ *E staeri* Sandy Woodland	Usually found on gentle middle to lower slopes on sandy soil overlying laterite.	5,148	11.7%

The ARVS survey describes condition of the vegetation units located within Lot 19 Sydney Street and Lot 26 Balston Road as "*Residual – Native vegetation community structure, composition, and regenerative capacity intact – no significant perturbation form landuse/ land management practice*". The corresponding Keighery (1994) condition scale is '*Very good/ Excellent/ Pristine"* (Appendix B – Bushland Condition Rating).

The condition of the remainder of the mosaic of vegetation units' onsite is described as "*Modified*" and "*Transformed*". These are described as:

- "*Modified – Native vegetation community structure, composition and regenerative capacity intact – perturbed by land use/ land management practice*". The corresponding Keighery (1994) condition scale is 'Good/ Very Good';
- "*Transformed – Native vegetation community structure, composition and regenerative capacity significantly altered by land use/ land management practice"*. The corresponding Keighery (1994) condition scale is 'Very Degraded to Degraded/ Good' (Appendix E – Bushland Condition Rating).

4.2.2 | Wetlands and Water Ways

The subject site is located in the South West Division within the Albany Coast Basin and the majority of the subject area drains within the Princess Royal Harbour Catchment to the south. However the north east portion of the site drains to the Oyster Harbour/ Kalgan River/ King River Catchment (DoW, 2008).

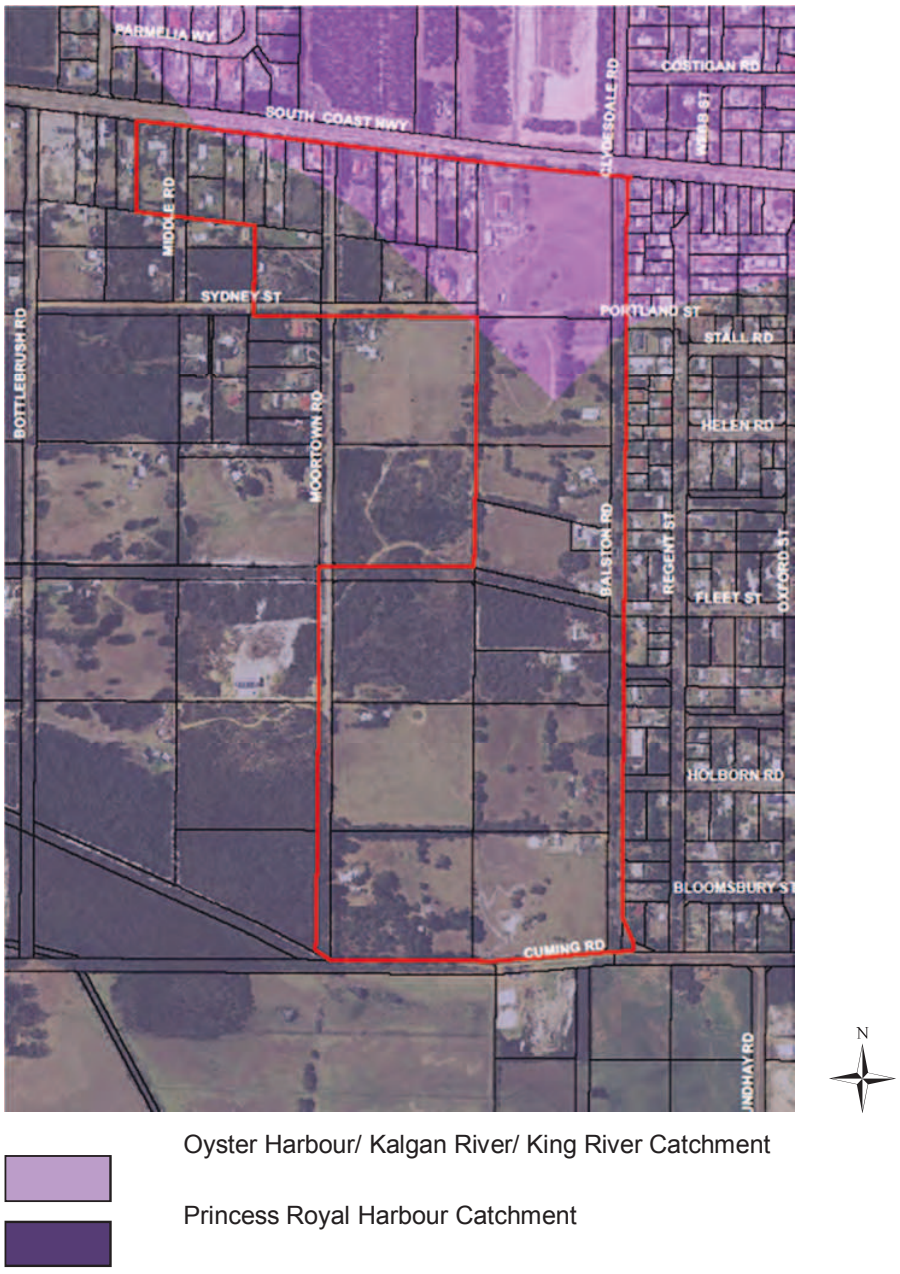


Figure 5: Catchments Located Within the Structure Plan Area (DoW, 2008)

The site does not contain any RAMSAR listed wetlands, or any regionally significant wetlands. However the following wetlands are located in close proximity to the subject area:

- Multiple Use Category wetland lies directly to the south of Cuming Road;
- Conservation Category Gledhow Nature Reserve Paluslope lies to the south east;
- Resource Enhancement Category Cuming Road Paluslope lies to the south west;
- Conservation Category Harrogate Road Paluslope lies to the south east.

Such wetland categories include the following, as per DoW (2007):

- *Conservation (C) – Wetlands which support a high level of ecological attributes and functions. The objective of management for these wetlands is primarily for conservation purposes;*

- *Resource Enhancement (R) – Wetlands which may have been partially modified but still support substantial ecological attributes and functions. The wetland can be restored to a state which could be managed for conservation purposes; and*
- *Multiple Use (M) – Wetlands with few important ecological attributes and functions remaining. The wetland can be used for a variety of purposes.*

Paluslope wetlands "*are seasonally waterlogged slope areas. These most often occur at the break of slope between a hill and a flat, or sometimes appear at a random point along a slope where an underground intrusion or hydraulic head pressure may have forced groundwater to the surface*" (DoW, 2007).

Wetland mapping (DoW, 2007) has been overlayed on the Plan of Subdivision in Appendix B.

4.2.3 | Public Drinking Water Supply and Rights in Water and Irrigation Act Areas

Desktop investigations indicate that the subject site does not lie within a Public Drinking Water Supply Area (PDWSA) as proclaimed under the *Country Areas Water Supply Act 1947* or within a *Rights in Water and Irrigation Act (RIWI) 1914* area. However to the south of Lower Denmark Road, approximately 700m from Cuming Road, lays the South Coast Water Reserve PDWSA and the Albany Groundwater Area (DoW, 2008).

4.2.4 | 100 Year ARI Event Floodways

Due to the elevated nature of the majority of the site it is not expected that there is a high risk of flooding across the site.

Flood paths for 1:100 year ARI events have been illustrated in Appendix C - Stormwater Management Strategy and Catchment Plan for each catchment.

4.2.5 | Groundwater

Groundwater investigations have not been undertaken as part of this LWMS and it is recommended that late winter water table levels are determined prior to the detailed design stage of this development, however should be undertaken at the Urban Water Management Plan (UWMP) stage.

5 | Water Use Sustainability Initiatives

5.1 | Water Efficiency Measures

It is recommended that this subdivision is designed with a commitment to sustainable water management which includes the conservation of water resources. The water conservation goal at should be to enhance the productivity and efficiency of water use by:

- Using less water;
- Encouraging use of stormwater (water harvesting in rainwater tanks) on each lot for non-potable use;
- Using native plants in waterwise landscaping; and
- Fitting water quality to its purpose.

By incorporating these measures associated with lower water use and wastewater discharge it presents the community with environmental and financial benefits.

5.2 | Water Supply

The available water sources and their proposed use within the subdivision are presented in the table below.

Table 4: Water Sources and Their Use

Source	Use	Summary
Scheme Water	Mains water – fire protection	Scheme water will provide the mains supply and fire protection water.
Groundwater	Nil	It is not proposed at this point in time to use groundwater on site.
Rainwater	Non potable in facilities (plumbed)	Non-potable use recommended on each lot.
Stormwater	Recharge	Stormwater is proposed to be attenuated within POS and drainage basins.
Black Water	Sewer or septic tanks	No Black Water recycling will be implemented. The wastewater from buildings will be disposed of via reticulated sewer.
Grey Water	Irrigation	Grey water may be utilised as part of localised irrigation for each site

5.3 | Wastewater Management

Where possible, for future subdivision of existing lots with the Structure Plan area, newly created lots are proposed to be connected to Water Corporation sewer system.

6 | Stormwater Management Strategy

Some of the water management strategies aligned to current DoW Best Practice which should been applied to this development include:

1. Maintain and where possible enhance water quality by:
   - Minimise waterborne sediment loading;
   - Minimise export of pollutants to surface or ground water;
   - Minimise post development flows across the site; and
   - Apply point source water management.
2. Encourage water conservation by:
   - Minimise the export and use of scheme water;
   - Promote the use of rainwater;
   - Promote ground water recharge (where appropriate); and
   - Reduce irrigation requirements.
3. Management of the water regime by:
   - Prevent flood damage in existing and proposed development areas;
   - Prevent erosion of adjacent wetlands, waterways and slopes; and
   - Ensure pollutants do not enter into adjacent waterways.

As discussed with the CoA and Department of Water representatives, the overall philosophy of runoff management proposed for this subdivision is avoidance of erosion within the Concept Structure Plan area and attenuation of storm flows and nutrient stripping from the proposed urban environment

The Concept Structure Plan area will be zoned 'Residential, with individual lot sizes between 300m^2 and 2000m^2, group dwelling lots and conservation lots. The lot surfaces, particularly in the northern half of the site, will vary significantly from the pre-development state. Lot surfaces are expected to be 80%-85% impervious in line with the City of Albany Subdivision guidelines.

The Concept Structure Plan area includes proposed subdivision of Lot 19 Sydney Street and Lot 26 and 27 Balston Road as privately owned and managed conservation blocks with building envelopes. Whilst the surfaces in these lots will not vary much from the pre-development state, they have still been included in the runoff calculations for the area.

At the time of writing, the exact road and lot layout for the entire Structure Plan had not be developed therefore the calculations for post development percentage impervious/ pervious within the Structure Plan area have been estimated based on the proposed density of lots as per R-Codes (average lot sizes) within each catchment. Areas and volumes for the 1:1 year ARI event treatment and the 1:10 year ARI event attenuation will be required to be confirmed at the detailed design stage as each existing lot is subdivided in the future.

The drainage calculations have been based on the Rational Method as per CoA requirement for subdivisions (Appendix D – Drainage Calculations).

Catchment Description

The pre-development catchment area includes existing residential, rural and remnant native vegetation (Appendix A – Site Plan).

Post-development characteristics will be typical urban (R5 – R30), private conservation lots and Public Open Space (POS) (Appendix A – East Gledhow Concept Structure Plan).

The site is comprised of five catchments (Catchment A – E) and includes the following details as per Table 5. Catchments A, C and D have been further divided into sub-catchments based on the proposed road layout and flood routing to enable separation of stormwater treatment and attenuation areas for various lot owners (Appendix C – Stormwater Management Strategy and Catchment Plan).

Table 5: Catchments (Post-development) within the East Gledhow Structure Plan Area

Catchment	Total Area (m^2)	Percentage impervious of total area % (Impervious area m^2)	Percentage pervious of total area % (Pervious area m^2)	FAWB 2% area of impermeable areas (m^2)
A1	94,789	22% (21,084)	78% (73,705)	420
A2	58,314	24% (14,405)	76% (44,269)	280
B	62,101	28% (17,494)	72% (44,607)	350
C1	20,000	48% (9,540)	52% (10,460)	190
C2	70,000	31% (22,000)	69% (48,000)	440
D1	36,109	51% (18,570)	49% (17,539)	370
D2	39,454	40% (15,730)	60% (23,725)	315
D3	44,315	54% (23,803)	46% (20,512)	475
D4	24,229	47% (11,429)	53% (12,800)	230
E	7,422	46% (3,393)	54% (4,029)	70
Totals:	**567,216**			

6.1 | Flood Protection

The road drainage system and road reserves within the Structure Plan area are proposed as a conveyance system for the 1:100 year ARI event overland flow. However, based on the current lot layout proposed, there will need to be a number of dedicated flood route easements, within lots, in addition to the road drainage system and road reserves.

Swales and bulk earthworks may be required to be constructed within easements to prevent flooding on 'downstream' lots. Swales will be required to be designed to allow for the 1:100yr ARI

event flow rates, with erosion protection which may include the use of rock-riffles to reduce velocity to 2m/s or less.

Final surface level of buildings should allow finished floor levels to be 300mm above the 100 year flood level as per City of Albany Subdivision Guidelines (2009).

6.2 | Manage Serviceability

1:1 Year ARI Event

Consideration should be made for infiltration at source, or as close as possible, within the road reserves where practical as per DoW best practice methods. No soil testing has been completed on site at time of writing. Desktop investigation of the subject area indicates that there is likely to be sand and gravel present.

Other sites to the north and east, which have previously been investigated by Opus, have identified variable soils including sand, gravel and clay. It is anticipated the elevated areas with the site are likely to have gravel over clay and there may be limited opportunity for onsite infiltration due to low permeability of soils onsite. Therefore the 1:1 year ARI event treatment and conveyance off site is likely to be required rather than treatment and onsite infiltration.

Conservation, Resource Enhancement and Multiple Use Category Paluslope wetland areas have been identified to the south of the site. It is recommended that soil profile and late winter water table levels are determined at the time of development of an Urban Water Management Plan for the site.

Due to the proximity of the wetland vegetation to the south and west of the site, high groundwater levels and seepage may be a problem within some areas of the Structure Plan area. If so, possible 1:1 year ARI events soakage in the upper layer may not be achievable if this leads to saturation of the upper layer and possible damage to foundations of roads and buildings. Subsoil drainage for retaining walls and roads may be required within the site to accommodate these.

Reuse of stormwater via storage through rainwater tanks at the building development application stage for each lot should be encouraged. However this has not been included in the drainage calculations as a form of stormwater attenuation.

To allow for a 2% treatment area as per FAWB guidelines, indicative areas and locations for treatment areas within each catchment/ sub-catchment have been provided within Appendix C. These however will be required to be confirmed at the detailed design stage based on the type and staging of development proposed within each catchment.

1:5 Year ARI Event

In accordance with s12.1.3.2 of the CoA Subdivision and Development Guidelines (2009), the stormwater infrastructure must accommodate the 1:5 year ARI event. As stated earlier, swales and bulk earthworks are needed to cater for the 1:100 year ARI events and is recommended that these same areas and routes are utilised for the underground pipe work through and across the proposed development. Specific details of this system will require confirmation at the detailed design stage for the overall development.

1:10 Year ARI Event

The 1:10 year ARI events are to be attenuated on site as per DoW best practice and CoA Subdivision and Development Guidelines (2009).

The calculations for post development percentage impervious/ pervious within the Structure Plan area have been estimated based on the proposed density of lots as per R-Codes (average lot sizes) within each catchment. Volumes for required for the 1:10yr ARI events have been calculated

based on the difference between pre-development surface characteristic and post-development surface characteristic (Appendix D – Drainage Calculations).

Areas and volumes for the 1:10 year ARI event attenuation, within each catchment, that will be required have been indicated (approximately) within the lowest point of each catchment/ sub-catchment. However these will be required to be confirmed at the detailed design stage as each existing lot is subdivided in the future (Appendix C – Stormwater Management Strategy and Catchment Plan).

1:50 Year ARI Event – South Coast Highway Main Roads WA Road Reserve

Main Roads WA have indicated, based on consultation undertaken for the purpose of this LWMS that if stormwater discharge, as per predevelopment flows, is proposed within the South Coast Highway reserve that the existing swale drain, associated stormwater infrastructure for crossovers and the culvert at the corner of Balston Road and South Coast Highway will be required to be upgraded to accommodate 1:50 year ARI event stormwater flow and designed to the satisfaction of Main Roads WA.

The culvert at the corner of Balston Road and South Coast Highway will also have to be designed in consideration of stormwater flows from properties to the east of Balston Road.

If a swale cannot be designed to accommodate a 1:50 year ARI event, whilst meeting Main Roads WA standards for safety, due to the proximity of the footpath within the road reserve, then a pipe system will be required to be designed to their satisfaction.

Further consultation will be required to be undertaken with Main Roads at the time of development of properties within Catchment D and E.

6.3 | Treatment of Stormwater

The treatment for stormwater has been proposed during the planning stages of this subdivision development using DoW Best Practice as in the *Stormwater Management Manual for Western Australia*. It is recommended that stormwater treatment will be undertaken utilising the following:

1. Infiltration Systems;
2. Stormwater Storage and Use; and
3. Conveyance Systems.

The 1:1year ARI post development events are proposed to be treated as per FAWB guideline (FAWB, 2008) of a treatment area based on 2% of constructed impervious area within the proposed road reserve area.

The final form and locations of the 1:1 year ARI event treatment areas/ drainage structures will be required to be determined at the detailed design stage. Drainage volume calculations have, however, been undertaken for the purpose of this LWMS to determine approximate area required for the 1:1 year ARI treatment of stormwater (Appendix C – Drainage Calculations).

The 1:1 year ARI event treatment should be undertaken as per best practice DoW recommendations at the time of development. This may include (but is not limited to):

- Rain gardens;
- Vegetated swales;
- Biofiltration basins; and
- Mechanical treatment methods.

7 | The Next Stage – Subdivision and Urban Water Management Plans

Two options for future subdivision of existing lots with the Concept Structure Plan area include the following:

Option 1

- All landowners within a catchment/ sub-catchment combine and contribute to the drainage infrastructure for the required stormwater treatment and attenuation areas in a drainage system throughout the catchment/ sub-catchment or within a centralised location at the lowest point on site.

  If development is proposed to follow Option 1 the stormwater treatment and attenuation system including associated drainage infrastructure, drainage easements and overland flood routes will be required to be developed as the first landowner progresses their development.

  However, if the CoA approves, development may be staged with temporary attenuation areas which would require drainage calculations to be completed at the detailed design stage to ensure adequate attenuation.

Option 2

- Landowners within each catchment/ sub-catchment develop and subdivide their existing lots separately and accommodate all stormwater treatment and attenuation within their lot.

  Option 2 will involve construction of all drainage infrastructure within each lot, however drainage easements and overland flood routing will need to be confirmed at the detailed design to ensure adequate flood routing for 'upstream' stormwater runoff with each catchment/ sub-catchment.

  With this option, drainage infrastructure will be spread throughout each catchment/ sub-catchment and may be integrated into each development using best practice methods solutions at the time of development. For example this may include pipe or swale conveyance, underground or above ground attenuation/ storage and integration of treatment areas/ rain gardens within lots and landscaped POS/ drainage areas.

No matter whether Option 1 or 2 are followed, as each existing lot is subject to subdivision, an Urban Water Management Plan (UWMP) will be required for the development, outlining the detailed design elements and any objectives for stormwater attenuation, control and treatment as per the Better Urban Water Management Guidelines (WAPC, 2008). An UWMP will identify specific best practice Water Sensitive Urban Design (WSUD) infrastructure and design techniques, based on strategies identified within this document, that will be implemented in the future development of the site.

Specific issues that require consideration in the development of an UWMP for the site may include (but not limited to) the following:

- Confirmation of drainage calculations and detailed design of drainage structures and layout;
- Confirmation of location, type, size and depth of attenuation swale and structures for the 1:10 year ARI events across the site;
- Design of best practice stormwater treatment methods for the 1:1 year ARI events as per DoW recommendations;
- Confirmation of the form of stormwater conveyance system within road reserves, and design of appropriate erosion control measures;
- Soil profiles and late winter water table testing information to be determined; and
- Staging of development (if required).

The future UWMP shall indicate how design criteria outlined within this LWMS will be met to satisfy water management objectives as per the WA Stormwater Management Manual.

8 | Environmental Monitoring

Environmental controls to be checked using the project activities table during and for a 12 month period after practical completion is issued for development of each existing lot. The following monitoring activities should be undertaken:

Table 5: Environmental Monitoring Activities during Development

Frequency	Monitoring activity	Person responsible
Daily	Check all sediment control	Appointed Contractor
	Check waste materials are correctly sorted and stored	Appointed Contractor
	Check personal safety equipment before each use	Appointed Contractor
	Check dust filters on equipment	Appointed Contractor
	Check noise suppression devices on equipment	Appointed Contractor
Twice weekly	Check containers of hazardous materials are properly stored and not damaged	Appointed Contractor
	Ensure dust suppression controls in place	Appointed Contractor
Weekly	Visually check vehicles and equipment for leaks or potential oil spills	Appointed Contractor
After rain	Inspect all sediment control structures	Appointed Contractor
	Check all drains are free from debris or chemicals	Appointed Contractor
	Ensure drainage structures are working as per design	Appointed Contractor

Table 6: Environmental Monitoring Activities Post Practical Completion of the Development

Frequency	Monitoring activity	Person responsible
Monthly & after rain	Inspect all sediment control structures	Appointed Contractor
	Check all drains are free from debris	Appointed Contractor
	Ensure drainage structures are working as per design	Appointed Contractor

8.1 | Control of Environmental Incidents

An important aspect in any proposed environmental program is management of non-conformance or incidents (Department of Environment Regulation). An environmental incident is an event which could result in pollution to the local environment. The planning of site works and methodology as outlined within this management plan limits the risk and harm of construction works impacting on-site or off-site.

If an incident or event occurs during construction, it should be emphasised to all personnel working on site that all incidents are documented. Investigations should be conducted and action plans established in order to ensure the event does not happen again.

8.2 | Corrective and Preventative Actions

An Environmental Investigation should include the following basic elements:

- Identify the cause of the incident;
- Identifying and implementing the necessary corrective action;
- Identifying the personnel responsible for carrying out corrective action;
- Implementing or modifying controls necessary to avoid repetition; and
- Recording changes in written procedures required.

8.3 | Contingency Procedures

Contingency measures should be included within the appointed contractor's Construction Management Plan. These protocols would be designed to reduce adverse environmental impacts and provide an early detection of non-conformance and subsequent corrective action. Any modifications to the outlined strategies and methodologies to meet unexpected conditions shall be agreed to by the appointed contractor. Monitoring is recommended to be used to confirm the effectiveness of any changes.

Should it be identified by any personnel involved in the project there is a non-conformance to acceptable methodology or there is reason to cause environmental harm, in consultation with the appointed contractor, activities should cease during resolution of the required change in methodology.

The appointed contractor should be notified of any environmental non-conformances and undertake site investigation (Refer also to Department of Environment Regulation).

9 | LWMS Review and Implementation

It is the conclusion of this LWMS that:

- Treatment of the 1:1 year ARI post development stormwater events is required as per the Faculty for Advancing Water Biofiltration (FAWB, 2008) guideline of a treatment area based on 2% of constructed impervious area within each catchment/ sub-catchment. Confirmation of locations and sizing of treatment areas (within attenuation swale) and DoW best practice methods for stormwater treatment within the site will be determined at the detailed design phase of each lot proposed to be subdivided.
- As per the CoA requirement for subdivisions, the 1:10 year post development ARI events are proposed to be attenuated within development area and released from the site as per pre-development stormwater flows using both attenuation basins, erosion control methods and strategies to reduce point loading as stormwater exits the site (DoW, 2008). Confirmation of location of attenuation areas and drainage structures, within the Structure Plan area, are to be determined at the detailed design phase of each lot proposed to be subdivided.
- Main Roads WA have indicated, based on consultation undertaken for the purpose of this LWMS that if stormwater discharge, as per predevelopment flows, is proposed within the South Coast Highway reserve that the existing swale drain (or alternative pipe system), associated stormwater infrastructure for crossovers and the culvert at the corner of Balston Road and South Coast Highway will be required to be upgraded to accommodate 1:50 year ARI event stormwater flow and designed to the satisfaction of Main Roads WA.
- It is recommended that at the detailed design stage consideration is made for drainage easements required within each existing lot as per the Stormwater Management Strategy and Catchment Plan for directional release of 1:100year ARI event flood routes.
- Soil profiles and late winter water table testing is to be completed for each lot at time of development of the Urban Water Management Plan stage.

After the document is reviewed, any changes that are made shall be forwarded to the City of Albany and Department of Water for review and comment. Please refer to Document Revision Record at the beginning of this report.

It is the responsibility of each lot owner to implement this LWMS and any future UWMP.

10 | References

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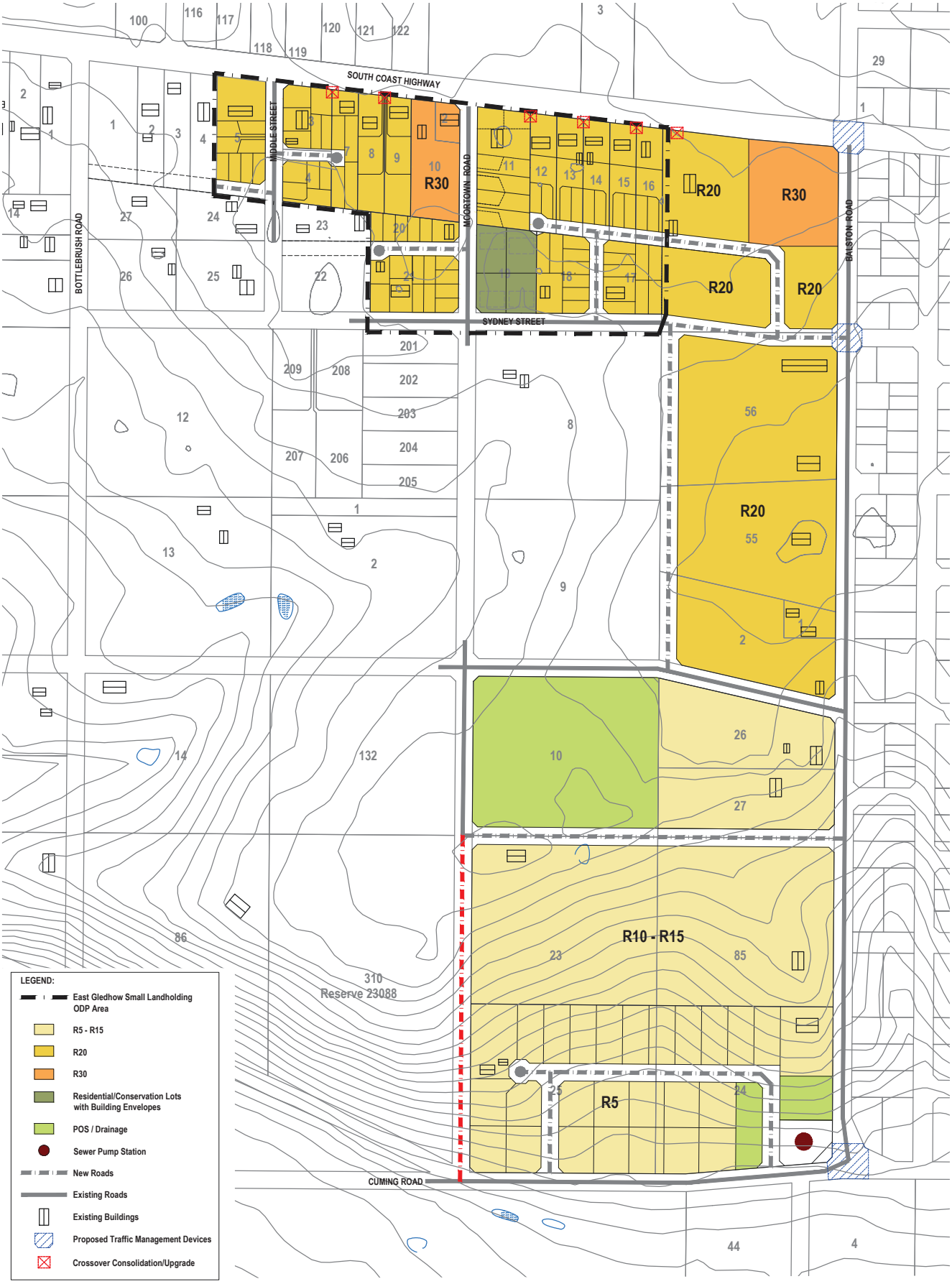
APPENDICES

APPENDIX A

Draft Plan

This plan may not reflect the final layout



Draft Plan

City of Albany - Local Planning Scheme No. 3

DYKSTRA PLANNING

19 April 2012

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Figure 3

Notes:

- This document may only be used for the purpose for which it was commissioned and in accordance with the Terms of Engagement.
- The dimensions, areas and number of lots are subject to survey and also the requirements of all authorities.

06475-SP-F4-120103-A

APPENDIX B

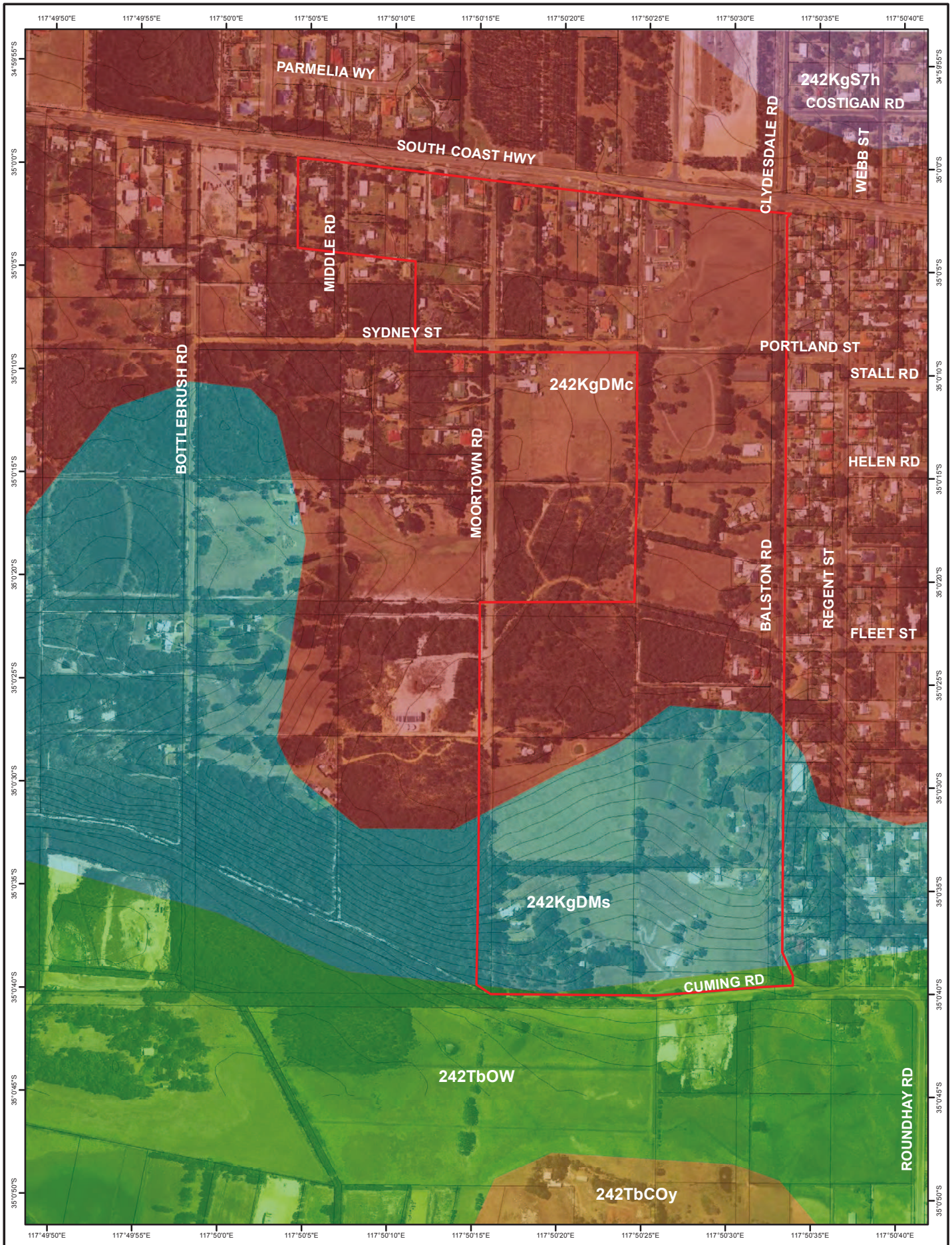
Landscape Mapping of SW Australia Dataset

Acid Sulfate Soil Risk

ARVS Vegetation Units

Wetland Evaluation Albany Urban Area

Bushland Condition Rating



SCALE AND LEGEND

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0 50 100 200 Meters

Legend

Subject Site

DAFWA subsystems clip

<all other values>

MAPPING_UN

242KgDMc

242KgDMs

242KgS7h

242TbCOy

242TbOW

Albany Office

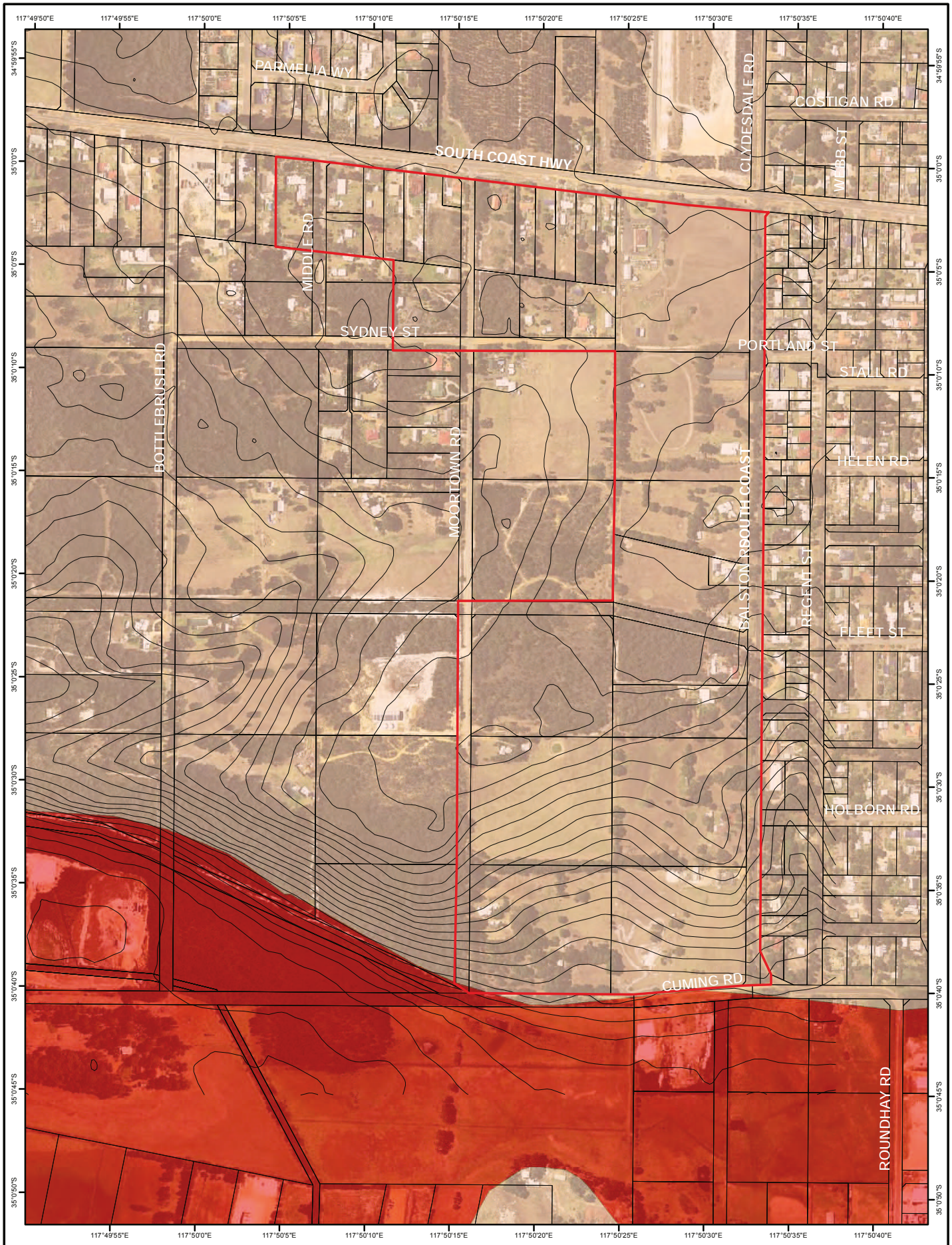
PO Box 5236
Albany, WA 6330, Australia

Tel: +61 8 9842 6155
Fax: +61 8 9842 6055

TITLE: **East Gledhow Concept Structure Plan**
Local Water Management Strategy

Landscape Mapping of SW Australia dataset

STATUS	FILE
FINAL	W-A1166.00
SCALE	PLOT DATE
1:5,000	27/03/12



SCALE AND LEGEND

N

0 50 100 200 Meters

Legend

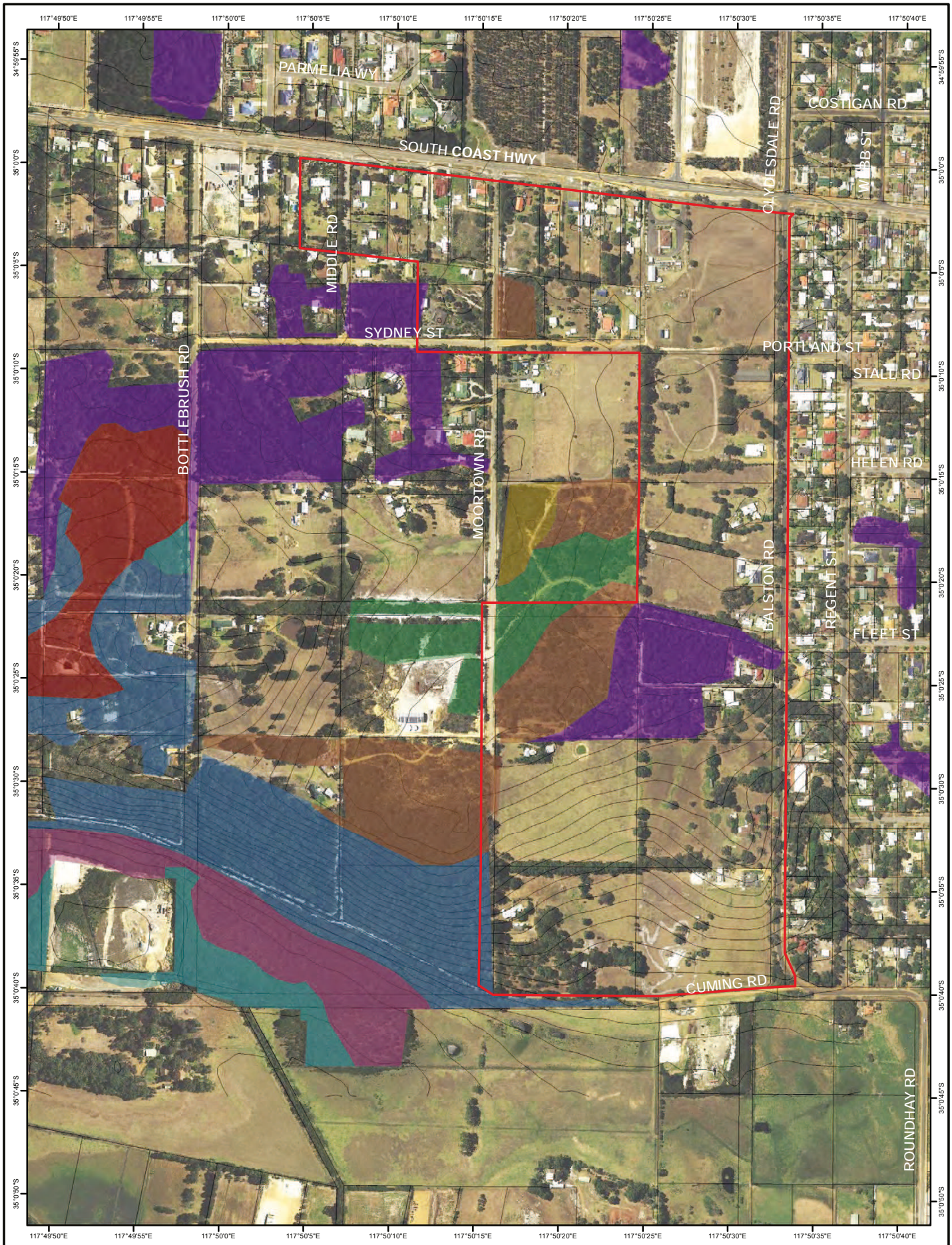
- High Risk of AASS & PASS
- Moderate to Low Risk of AASS & PASS
- Low to No Risk of AASS & PASS
- Subject Site

Albany Office
PO Box 5236
Albany, WA 6330, Australia
Tel: +61 8 9842 6155
Fax: +61 8 9842 6055

TITLE: East Gledhow Concept Structure Plan
Local Water Management Strategy

Acid Sulfate Soil Risk

STATUS	FILE
FINAL	W-A1166.00
SCALE	PLOT DATE
1:5,000	27/03/12



SCALE AND LEGEND

N

0 50 100 200 Meters

Legend

- Subject Site
- AVRS Vegetation Units Clip
- <all other values>
- VegNameA, VegNameB, VegNameC
- Evandra aristata Sedgeland, ,
- Evandra aristata Sedgeland, Taxandria juniperina Closed Forest, ,
- Hakea spp Shrubland/Woodland Complex, ,
- Homalospermum firmum/Callistemon glaucus Peat Thicket, ,
- Jarrah/Marri/Sheoak Laterite Forest, ,
- Jarrah/Marri/Sheoak Laterite Forest, Jarrah/Sheoak/E.staeri Sandy Woodland,
- Jarrah/Sheoak/E.staeri Sandy Woodland, ,
- Marri/Jarrah Forest/Peppermint Woodland, ,
- Pericalymma spongiocaule Low Heath, ,
- Taxandria juniperina Closed Forest, ,

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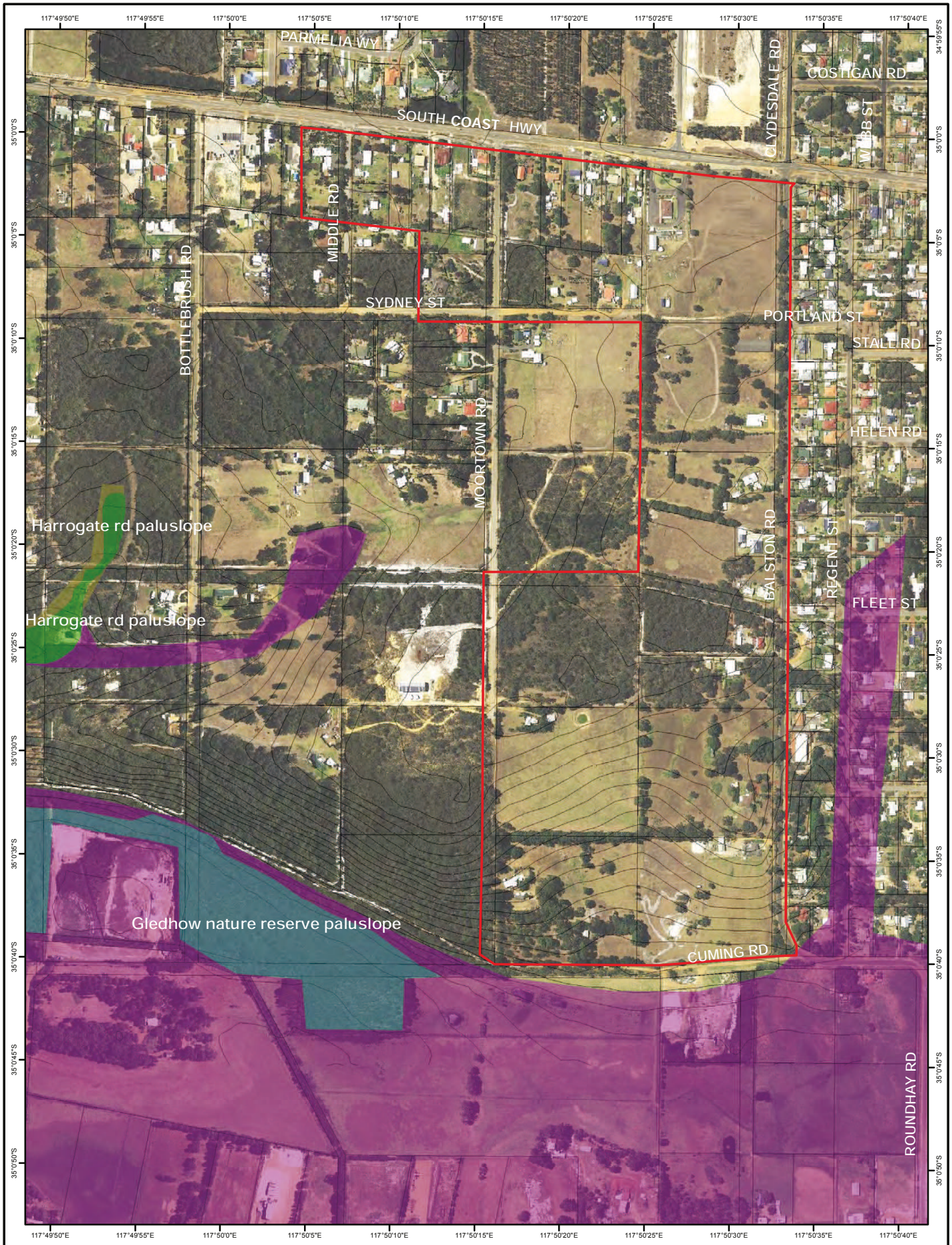
TITLE: East Gledhow Concept Structure Plan
Local Water Management Strategy

ARVS Vegetation Units

STATUS	FILE
FINAL	W-A1166.00
SCALE	PLOT DATE
1:5,000	27/03/12



SCALE AND LEGEND

N

0 35 70 140 Meters

Legend

Subject Site

Wetland Evaluation Albany Urban Area

<all other values>

FID_WETLAN, DI_W_NAME, ER_CAT

-1, , M

47, Harrogate rd paluslope, C

48, Gledhow nature reserve paluslope, C

62, Cuming rd paluslope west, R

68, , M

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TITLE: East Gledhow Concept Structure Plan
Local Water Management Strategy

Wetland Evaluation Albany Urban Area

STATUS	FILE
FINAL	W-A1166.00
SCALE	PLOT DATE
1:5,000	13/03/12

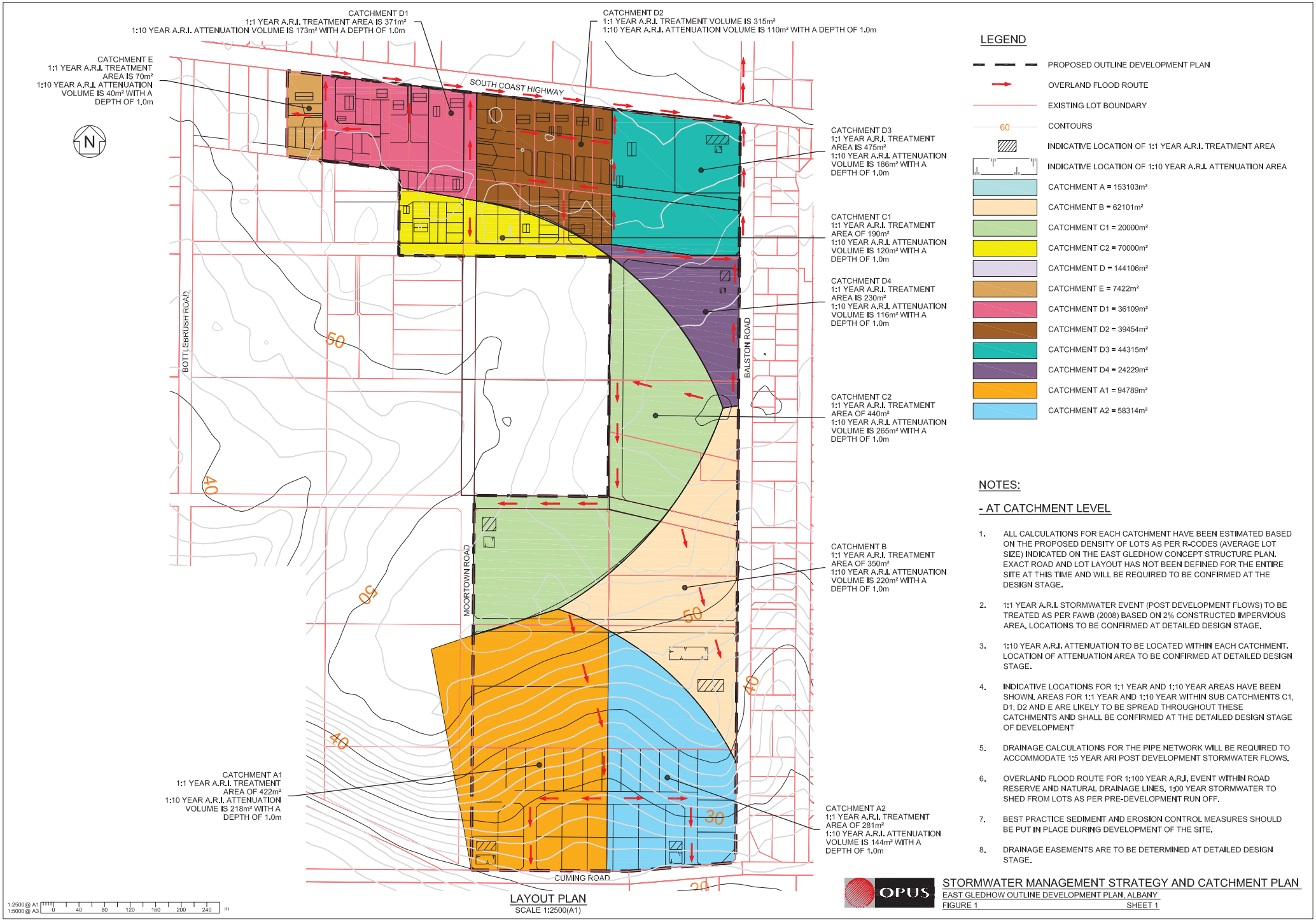
Bushland Condition Rating

Vegetation Condition Scale
(Modified from Trudgen, 1991 by B.J. Keighery for the Swan Coastal Plain Survey, 1993)

Index	Descriptor	Explanation
1	Pristine	Pristine or nearly so, so no obvious signs disturbance.
2	Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
3	Very Good	Vegetation structure altered, obvious signs of disturbance.
4	Good	Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate to it.
5	Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management.
6	Completely Degraded	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 composing weed or crop species with isolated native trees or shrubs.

APPENDIX C

Stormwater Management Strategy and Catchment Plan



LAYOUT PLAN
SCALE 1:2500(A1)

NOTES:

- AT CATCHMENT LEVEL

1. ALL CALCULATIONS FOR EACH CATCHMENT HAVE BEEN ESTIMATED BASED ON THE PROPOSED DENSITY OF LOTS AS PER R-CODES (AVERAGE LOT SIZE) INDICATED ON THE EAST GLEDHOW CONCEPT STRUCTURE PLAN. EXACT ROAD AND LOT LAYOUT HAS NOT BEEN DEFINED FOR THE ENTIRE SITE AT THIS TIME AND WILL BE REQUIRED TO BE CONFIRMED AT THE DESIGN STAGE.
2. 1:1 YEAR A.R.I. STORMWATER EVENT (POST DEVELOPMENT FLOWS) TO BE TREATED AS PER FAWB (2008) BASED ON 2% CONSTRUCTED IMPERVIOUS AREA. LOCATIONS TO BE CONFIRMED AT DETAILED DESIGN STAGE.
3. 1:10 YEAR A.R.I. ATTENUATION TO BE LOCATED WITHIN EACH CATCHMENT. LOCATION OF ATTENUATION AREA TO BE CONFIRMED AT DETAILED DESIGN STAGE.
4. INDICATIVE LOCATIONS FOR 1:1 YEAR AND 1:10 YEAR AREAS HAVE BEEN SHOWN. AREAS FOR 1:1 YEAR AND 1:10 YEAR WITHIN SUB CATCHMENTS C1, D1, D2 AND E ARE LIKELY TO BE SPREAD THROUGHOUT THESE CATCHMENTS AND SHALL BE CONFIRMED AT THE DETAILED DESIGN STAGE OF DEVELOPMENT
5. DRAINAGE CALCULATIONS FOR THE PIPE NETWORK WILL BE REQUIRED TO ACCOMMODATE 1:5 YEAR ARI POST DEVELOPMENT STORMWATER FLOWS.
6. OVERLAND FLOOD ROUTE FOR 1:100 YEAR A.R.I. EVENT WITHIN ROAD RESERVE AND NATURAL DRAINAGE LINES. 1:00 YEAR STORMWATER TO SHED FROM LOTS AS PER PRE-DEVELOPMENT RUN OFF.
7. BEST PRACTICE SEDIMENT AND EROSION CONTROL MEASURES SHOULD BE PUT IN PLACE DURING DEVELOPMENT OF THE SITE.
8. DRAINAGE EASEMENTS ARE TO BE DETERMINED AT DETAILED DESIGN STAGE.

OPUS

STORMWATER MANAGEMENT STRATEGY AND CATCHMENT PLAN

EAST GLEDHOW OUTLINE DEVELOPMENT PLAN, ALBANY

FIGURE 1 SHEET 1

APPENDIX D

Drainage Calculations

Summary table Drainage Calcs
East Gledhow - Catchment A1

Catchment Area

PreDevelopment

Subcatchmen (m^2)	Runoff C	% of Area (%)	Weighted "C"	Surface Characteristics
600	0.95	1	0.01	Roof & Sealed Surface
0	0.95	0	0.00	Roads / Driveways
0	0.50	0	0.00	Unsealed Roads
0	0.70	0	0.00	Bare Impervious Soil
0	0.10	0	0.00	Bare Pervious Soil
0	0.25	0	0.00	Urban Gardens
94189	0.30	99	0.30	Grassed Parkland
0	0.25	0	0.00	Partly Bush Parkland
0	0.20	0	0.00	Heavy native type bush
94789				

Weighted Runoff Coefficient = **0.30**

Post Development

Subcatchmen (m^2)	Runoff Coe	ercentage (Area (%)	Weighted "C"	Surface Characteristics	
17886	0.95	18.9	0.18	Lots - Roof & Sealed Surface	
4471	0.30	4.7	0.01	Lots - landscaped areas	
3198	0.95	3.4	0.03	Road Reserve Roads / Driveways	
4796	0.70	5.1	0.04	Road reserve Verges	
0	0.95	0.0	0.00	Roof & Sealed Surface	
0	0.95	0.0	0.00	Roads / Driveways	
0	0.50	0.0	0.00	Unsealed Roads	
0	0.70	0.0	0.00	Bare Impervious Soil	
0	0.10	0.0	0.00	Bare Pervious Soil	
64438	0.25	68.0	0.17	Urban Gardens	
0	0.30	0.0	0.00	Grassed Parkland	Total undeveloped a
0	0.25	0.0	0.00	Partly Bush Parkland	
0	0.20	0.0	0.00	Heavy native type bush	
94789		100.00			

Weighted Runoff Coefficient = **0.43**

Runoff critical ARI events

1:1yrs ARI		
Predevelopment flow rate	180	L/s
Post development flow rate	255	L/s
Attenuation Volume 1:1yr $V_{post} - V_{pre}$	123	m^3
Area to be used for Nutrient treatment 2% of impervic	**422**	m^2

1:10yrs ARI		
Predevelopment flow rate	465	L/s
Post development flow rate	658	L/s
Attenuation Volume 1:10y $V_{post} - V_{pre}$	218	m^3
Required basin area if depth is 1m average	**218**	m^2

1:100yrs ARI		
Predevelopment flow rate	1018	L/s
Post development flow rate	1442	L/s
Attenuation Volume 1:10($V_{post} - V_{pre}$	348	m^3
Required basin area if depth is 1m average	**348**	m^2
Notes		
> Assuming runoff coefficient=1, Full Saturation.		

Summary table Drainage Calcs
East Gledhow - Catchment A2

Catchment Area

PreDevelopment

Subcatchmen (m^2)	Runoff C	% of Area (%)	Weighted "C"	Surface Characteristics
600	0.95	1	0.01	Roof & Sealed Surface
0	0.95	0	0.00	Roads / Driveways
0	0.50	0	0.00	Unsealed Roads
0	0.70	0	0.00	Bare Impervious Soil
0	0.10	0	0.00	Bare Pervious Soil
0	0.25	0	0.00	Urban Gardens
57714	0.30	99	0.30	Grassed Parkland
0	0.25	0	0.00	Partly Bush Parkland
0	0.20	0	0.00	Heavy native type bush
58314				

Weighted Runoff Coefficient = **0.31**

Post Development

Subcatchmen (m^2)	Runoff Coe	ercentage (Area (%)	Weighted "C"	Surface Characteristics
12134	0.95	20.8	0.20	Lots - Roof & Sealed Surface
3034	0.30	5.2	0.02	Lots - landscaped areas
1911	0.95	3.3	0.03	Road Reserve Roads / Driveways
2866	0.70	4.9	0.03	Road reserve Verges
0	0.95	0.0	0.00	Roof & Sealed Surface
0	0.95	0.0	0.00	Roads / Driveways
0	0.50	0.0	0.00	Unsealed Roads
0	0.70	0.0	0.00	Bare Impervious Soil
0	0.10	0.0	0.00	Bare Pervious Soil
2977	0.25	5.1	0.01	Urban Gardens
35392	0.30	60.7	0.18	Grassed Parkland
0	0.25	0.0	0.00	Partly Bush Parkland
0	0.20	0.0	0.00	Heavy native type bush
58314		100.00		

Weighted Runoff Coefficient = **0.47**

Runoff critical ARI events

1:1yrs ARI		
Predevelopment flow rate	155	L/s
Post development flow rate	240	L/s
Attenuation Volume 1:1yr $V_{post} - V_{pre}$	81	m^3
Area to be used for Nutrient treatment 2% of impervic	**281**	m^2

1:10yrs ARI		
Predevelopment flow rate	408	L/s
Post development flow rate	630	L/s
Attenuation Volume 1:10y $V_{post} - V_{pre}$	144	m^3
Required basin area if depth is 1m average	**144**	m^2

1:100yrs ARI		
Predevelopment flow rate	880	L/s
Post development flow rate	1359	L/s
Attenuation Volume 1:10($V_{post} - V_{pre}$	228	m^3
Required basin area if depth is 1m average	**228**	m^2
Notes		
> Assuming runoff coefficient=1, Full Saturation.		

Summary table Drainage Calcs
East Gledhow - Catchment B

Catchment Area

PreDevelopment

Subcatchment Area (m^2)		Runoff C	% of Area (%)	Weighted "C"	Surface Characteristics
2400		0.95	4	0.04	Roof & Sealed Surface
0		0.95	0	0.00	Roads / Driveways
0		0.50	0	0.00	Unsealed Roads
0		0.70	0	0.00	Bare Impervious Soil
0		0.10	0	0.00	Bare Pervious Soil
0		0.25	0	0.00	Urban Gardens
21691		0.30	35	0.10	Grassed Parkland
0		0.25	0	0.00	Partly Bush Parkland
38010		0.20	61	0.12	Heavy native type bush
62101	m^2				

Weighted Runoff Coefficient = **0.26**

Post Development

Subcatchment Brea (m^2)		Runoff Coe	ercentage (Area (%)	Weighted "C"	Surface Characteristics
15715	80%	0.95	25.3	0.24	Lots - Roof & Sealed Surface
3929	20%	0.30	6.3	0.02	Lots - landscaped areas
1779	40%	0.95	2.9	0.03	Road Reserve Roads / Driveways
2668	60%	0.70	4.3	0.03	Road reserve Verges
0		0.95	0.0	0.00	Roof & Sealed Surface
0		0.95	0.0	0.00	Roads / Driveways
0		0.50	0.0	0.00	Unsealed Roads
0		0.70	0.0	0.00	Bare Impervious Soil
0		0.10	0.0	0.00	Bare Pervious Soil
0		0.25	0.0	0.00	Urban Gardens
38010		0.30	61.2	0.18	Grassed Parkland
0		0.25	0.0	0.00	Partly Bush Parkland
0		0.20	0.0	0.00	Heavy native type bush
62101			100.00		

Weighted Runoff Coefficient = **0.50**

Runoff critical ARI events

1:1yrs ARI			
Predevelopment flow rate		107	L/s
Post development flow rate		203	L/s
Attenuation Volume 1:1yr ARI	$V_{post} - V_{pre}$	126	m^3
Area to be used for Nutrient treatment 2% of impervious		**350**	m^2

1:10yrs ARI			
Predevelopment flow rate		273	L/s
Post development flow rate		518	L/s
Attenuation Volume 1:10yr ARI	$V_{post} - V_{pre}$	221	m^3
Required basin area if depth is 1m average		**221**	m^2

1:100yrs ARI			
Predevelopment flow rate		611	L/s
Post development flow rate		1157	L/s
Attenuation Volume 1:100yr ARI	$V_{post} - V_{pre}$	357	m^3
Required basin area if depth is 1m average		**357**	m^2
Notes			
> Assuming runoff coefficient=1, Full Saturation.			

Summary table Drainage Calcs
East Gledhow - Catchment C1

Catchment Area

PreDevelopment

Subcatchmen (m^2)	Runoff C	% of Area (%)	Weighted "C"	Surface Characteristics
1600	0.95	0	0.00	Roof & Sealed Surface
0	0.95	0	0.00	Roads / Driveways
0	0.50	0	0.00	Unsealed Roads
0	0.70	0	0.00	Bare Impervious Soil
0	0.10	0	0.00	Bare Pervious Soil
0	0.25	0	0.00	Urban Gardens
13400	0.30	49	0.15	Grassed Parkland
0	0.25	0	0.00	Partly Bush Parkland
5000	0.20	50	0.10	Heavy native type bush
20000				

Weighted Runoff Coefficient = **0.33**

Post Development

Subcatchmen (m^2)	Runoff Coe	ercentage (Area (%)	Weighted "C"	Surface Characteristics
6400	0.95	21.4	0.20	Lots - Roof & Sealed Surface
4200	0.30	13.9	0.04	Lots - landscaped areas
3140	0.95	10.0	0.10	Road Reserve Roads / Driveways
1260	0.70	4.3	0.03	Road reserve Verges
0	0.95	0.0	0.00	Roof & Sealed Surface
0	0.95	0.0	0.00	Roads / Driveways
0	0.50	0.0	0.00	Unsealed Roads
0	0.70	0.0	0.00	Bare Impervious Soil
0	0.10	0.0	0.00	Bare Pervious Soil
0	0.25	0.0	0.00	Urban Gardens
0	0.30	0.0	0.00	Grassed Parkland
0	0.25	0.0	0.00	Partly Bush Parkland
5000	0.20	50.4	0.10	Heavy native type bush
20000		100.00		

Weighted Runoff Coefficient = **0.61**

Runoff critical ARI events

1:1yrs ARI		
Predevelopment flow rate	45	L/s
Post development flow rate	84	L/s
Attenuation Volume 1:1yr $V_{post} - V_{pre}$	55	m^3
Area to be used for Nutrient treatment 2% of impervic	**191**	m^2

1:10yrs ARI		
Predevelopment flow rate	79	L/s
Post development flow rate	148	L/s
Attenuation Volume 1:10y $V_{post} - V_{pre}$	117	m^3
Required basin area if depth is 1m average	**117**	m^2

1:100yrs ARI		
Predevelopment flow rate	173	L/s
Post development flow rate	322	L/s
Attenuation Volume 1:100 $V_{post} - V_{pre}$	187	m^3
Required basin area if depth is 1m average	**187**	m^2
Notes		
> Assuming runoff coefficient=1, Full Saturation.		

Summary table Drainage Calcs
East Gledhow - Catchment C2

Catchment Area

PreDevelopment

Subcatchmen (m^2)	Runoff C	% of Area (%)	Weighted "C"	Surface Characteristics
200	0.95	0	0.00	Roof & Sealed Surface
0	0.95	0	0.00	Roads / Driveways
0	0.50	0	0.00	Unsealed Roads
0	0.70	0	0.00	Bare Impervious Soil
0	0.10	0	0.00	Bare Pervious Soil
0	0.25	0	0.00	Urban Gardens
34500	0.30	49	0.15	Grassed Parkland
0	0.25	0	0.00	Partly Bush Parkland
35300	0.20	50	0.10	Heavy native type bush
70000				

Weighted Runoff Coefficient = **0.25**

Post Development

Subcatchmen (m^2)	Runoff Coe	ercentage (Area (%)	Weighted "C"	Surface Characteristics
15000	0.95	21.4	0.20	Lots - Roof & Sealed Surface
9700	0.30	13.9	0.04	Lots - landscaped areas
7000	0.95	10.0	0.10	Road Reserve Roads / Driveways
3000	0.70	4.3	0.03	Road reserve Verges
0	0.95	0.0	0.00	Roof & Sealed Surface
0	0.95	0.0	0.00	Roads / Driveways
0	0.50	0.0	0.00	Unsealed Roads
0	0.70	0.0	0.00	Bare Impervious Soil
0	0.10	0.0	0.00	Bare Pervious Soil
0	0.25	0.0	0.00	Urban Gardens
0	0.30	0.0	0.00	Grassed Parkland
0	0.25	0.0	0.00	Partly Bush Parkland
35300	0.20	50.4	0.10	Heavy native type bush
70000		100.00		

Weighted Runoff Coefficient = **0.47**

Runoff critical ARI events

1:1yrs ARI		
Predevelopment flow rate	121	L/s
Post development flow rate	226	L/s
Attenuation Volume 1:1yr $V_{post} - V_{pre}$	151	m^3
Area to be used for Nutrient treatment 2% of impervic	**440**	m^2

1:10yrs ARI		
Predevelopment flow rate	308	L/s
Post development flow rate	577	L/s
Attenuation Volume 1:10y $V_{post} - V_{pre}$	266	m^3
Required basin area if depth is 1m average	**266**	m^2

1:100yrs ARI		
Predevelopment flow rate	690	L/s
Post development flow rate	1292	L/s
Attenuation Volume 1:10($V_{post} - V_{pre}$	431	m^3
Required basin area if depth is 1m average	**431**	m^2
Notes		
> Assuming runoff coefficient=1, Full Saturation.		

Summary table Drainage Calcs
East Gledhow - Catchment D1

Catchment Area

PreDevelopment

Subcatchmen (m^2)	Runoff C	% of Area (%)	Weighted "C"	Surface Characteristics
1500	0.95	4	0.04	Roof & Sealed Surface
0	0.95	0	0.00	Roads / Driveways
0	0.50	0	0.00	Unsealed Roads
0	0.70	0	0.00	Bare Impervious Soil
0	0.10	0	0.00	Bare Pervious Soil
0	0.25	0	0.00	Urban Gardens
34609	0.30	96	0.29	Grassed Parkland
0	0.25	0	0.00	Partly Bush Parkland
0	0.20	0	0.00	Heavy native type bush
36109				

Weighted Runoff Coefficient = **0.33**

Post Development

Subcatchmen (m^2)	Runoff Coe	ercentage (Area (%)	Weighted "C"	Surface Characteristics
15555	0.95	43.1	0.41	Lots - Roof & Sealed Surface
3888	0.30	10.8	0.03	Lots - landscaped areas
3015	0.95	8.3	0.08	Road Reserve Roads / Driveways
4522	0.70	12.5	0.09	Road reserve Verges
0	0.95	0.0	0.00	Roof & Sealed Surface
0	0.95	0.0	0.00	Roads / Driveways
0	0.50	0.0	0.00	Unsealed Roads
0	0.70	0.0	0.00	Bare Impervious Soil
0	0.10	0.0	0.00	Bare Pervious Soil
9129	0.25	25.3	0.06	Urban Gardens
0	0.30	0.0	0.00	Grassed Parkland
0	0.25	0.0	0.00	Partly Bush Parkland
0	0.20	0.0	0.00	Heavy native type bush
36109		100.00		

Weighted Runoff Coefficient = **0.67**

Runoff critical ARI events

1:1yrs ARI		
Predevelopment flow rate	106	L/s
Post development flow rate	218	L/s
Attenuation Volume 1:1yr $V_{post} - V_{pre}$	99	m^3
Area to be used for Nutrient treatment 2% of impervic	**371**	m^2

1:10yrs ARI		
Predevelopment flow rate	269	L/s
Post development flow rate	553	L/s
Attenuation Volume 1:10y $V_{post} - V_{pre}$	173	m^3
Required basin area if depth is 1m average	**173**	m^2

1:100yrs ARI		
Predevelopment flow rate	604	L/s
Post development flow rate	1241	L/s
Attenuation Volume 1:10($V_{post} - V_{pre}$	282	m^3
Required basin area if depth is 1m average	**282**	m^2
Notes		
> Assuming runoff coefficient=1, Full Saturation.		

Summary table Drainage Calcs
East Gledhow - Catchment D2

Catchment Area

PreDevelopment

Subcatchmen (m^2)	Runoff C	% of Area (%)	Weighted "C"	Surface Characteristics
2400	0.95	6	0.06	Roof & Sealed Surface
0	0.95	0	0.00	Roads / Driveways
0	0.50	0	0.00	Unsealed Roads
0	0.70	0	0.00	Bare Impervious Soil
0	0.10	0	0.00	Bare Pervious Soil
0	0.25	0	0.00	Urban Gardens
37054	0.30	94	0.28	Grassed Parkland
0	0.25	0	0.00	Partly Bush Parkland
0	0.20	0	0.00	Heavy native type bush
39454				

Weighted Runoff Coefficient = **0.34**

Post Development

Subcatchmen (m^2)	Runoff Coe	ercentage (Area (%)	Weighted "C"	Surface Characteristics
14182	0.95	35.9	0.34	Lots - Roof & Sealed Surface
3546	0.30	9.0	0.03	Lots - landscaped areas
1547	0.95	3.9	0.04	Road Reserve Roads / Driveways
2322	0.70	5.9	0.04	Road reserve Verges
0	0.95	0.0	0.00	Roof & Sealed Surface
0	0.95	0.0	0.00	Roads / Driveways
0	0.50	0.0	0.00	Unsealed Roads
0	0.70	0.0	0.00	Bare Impervious Soil
0	0.10	0.0	0.00	Bare Pervious Soil
17857	0.25	45.3	0.11	Urban Gardens
0	0.30	0.0	0.00	Grassed Parkland
0	0.25	0.0	0.00	Partly Bush Parkland
0	0.20	0.0	0.00	Heavy native type bush
39454		100.00		

Weighted Runoff Coefficient = **0.56**

Runoff critical ARI events

1:1yrs ARI		
Predevelopment flow rate	112	L/s
Post development flow rate	185	L/s
Attenuation Volume 1:1yr $V_{post} - V_{pre}$	61	m^3
Area to be used for Nutrient treatment 2% of impervic	**315**	m^2

1:10yrs ARI		
Predevelopment flow rate	290	L/s
Post development flow rate	479	L/s
Attenuation Volume 1:10y $V_{post} - V_{pre}$	108	m^3
Required basin area if depth is 1m average	**108**	m^2

1:100yrs ARI		
Predevelopment flow rate	637	L/s
Post development flow rate	1050	L/s
Attenuation Volume 1:10($V_{post} - V_{pre}$	172	m^3
Required basin area if depth is 1m average	**172**	m^2
Notes		
> Assuming runoff coefficient=1, Full Saturation.		

Summary table Drainage Calcs
East Gledhow - Catchment D3

Catchment Area

PreDevelopment

Subcatchmen (m^2)	Runoff C	% of Area (%)	Weighted "C"	Surface Characteristics
300	0.95	1	0.01	Roof & Sealed Surface
0	0.95	0	0.00	Roads / Driveways
0	0.50	0	0.00	Unsealed Roads
0	0.70	0	0.00	Bare Impervious Soil
0	0.10	0	0.00	Bare Pervious Soil
0	0.25	0	0.00	Urban Gardens
44015	0.30	99	0.30	Grassed Parkland
0	0.25	0	0.00	Partly Bush Parkland
0	0.20	0	0.00	Heavy native type bush
44315				

Weighted Runoff Coefficient = **0.30**

Post Development

Subcatchmen (m^2)	Runoff Coe	ercentage (Area (%)	Weighted "C"	Surface Characteristics
22506	0.95	50.8	0.48	Lots - Roof & Sealed Surface
5626	0.30	12.7	0.04	Lots - landscaped areas
1297	0.95	2.9	0.03	Road Reserve Roads / Driveways
1947	0.70	4.4	0.03	Road reserve Verges
0	0.95	0.0	0.00	Roof & Sealed Surface
0	0.95	0.0	0.00	Roads / Driveways
0	0.50	0.0	0.00	Unsealed Roads
0	0.70	0.0	0.00	Bare Impervious Soil
0	0.10	0.0	0.00	Bare Pervious Soil
12939	0.25	29.2	0.07	Urban Gardens
0	0.30	0.0	0.00	Grassed Parkland
0	0.25	0.0	0.00	Partly Bush Parkland
0	0.20	0.0	0.00	Heavy native type bush
		100.00		
44315				

Weighted Runoff Coefficient = **0.65**

Runoff critical ARI events

1:1yrs ARI		
Predevelopment flow rate	121	L/s
Post development flow rate	259	L/s
Attenuation Volume 1:1yr $V_{post} - V_{pre}$	104	m^3
Area to be used for Nutrient treatment 2% of impervic	**476**	m^2

1:10yrs ARI		
Predevelopment flow rate	319	L/s
Post development flow rate	683	L/s
Attenuation Volume 1:10y $V_{post} - V_{pre}$	186	m^3
Required basin area if depth is 1m average	**186**	m^2

1:100yrs ARI		
Predevelopment flow rate	690	L/s
Post development flow rate	1478	L/s
Attenuation Volume 1:100 $V_{post} - V_{pre}$	296	m^3
Required basin area if depth is 1m average	**296**	m^2
Notes		
> Assuming runoff coefficient=1, Full Saturation.		

Summary table Drainage Calcs
East Gledhow - Catchment D4

Catchment Area

PreDevelopment

Subcatchmen (m^2)	Runoff C	% of Area (%)	Weighted "C"	Surface Characteristics
300	0.95	1	0.01	Roof & Sealed Surface
0	0.95	0	0.00	Roads / Driveways
0	0.50	0	0.00	Unsealed Roads
0	0.70	0	0.00	Bare Impervious Soil
0	0.10	0	0.00	Bare Pervious Soil
0	0.25	0	0.00	Urban Gardens
23928	0.30	99	0.30	Grassed Parkland
0	0.25	0	0.00	Partly Bush Parkland
0	0.20	0	0.00	Heavy native type bush
24228				

Weighted Runoff Coefficient = **0.31**

Post Development

Subcatchmen (m^2)	Runoff Coe	ercentage (Area (%)	Weighted "C"	Surface Characteristics
9600	0.95	39.6	0.38	Lots - Roof & Sealed Surface
2400	0.30	9.9	0.03	Lots - landscaped areas
1828	0.95	7.5	0.07	Road Reserve Roads / Driveways
2743	0.70	11.3	0.08	Road reserve Verges
0	0.95	0.0	0.00	Roof & Sealed Surface
0	0.95	0.0	0.00	Roads / Driveways
0	0.50	0.0	0.00	Unsealed Roads
0	0.70	0.0	0.00	Bare Impervious Soil
0	0.10	0.0	0.00	Bare Pervious Soil
7657	0.25	31.6	0.08	Urban Gardens
0	0.30	0.0	0.00	Grassed Parkland
0	0.25	0.0	0.00	Partly Bush Parkland
0	0.20	0.0	0.00	Heavy native type bush
24228		100.00		

Weighted Runoff Coefficient = **0.64**

Runoff critical ARI events

1:1yrs ARI		
Predevelopment flow rate	54	L/s
Post development flow rate	111	L/s
Attenuation Volume 1:1yr $V_{post} - V_{pre}$	65	m^3
Area to be used for Nutrient treatment 2% of impervic	**229**	m^2

1:10yrs ARI		
Predevelopment flow rate	141	L/s
Post development flow rate	291	L/s
Attenuation Volume 1:10y $V_{post} - V_{pre}$	116	m^3
Required basin area if depth is 1m average	**116**	m^2

1:100yrs ARI		
Predevelopment flow rate	311	L/s
Post development flow rate	643	L/s
Attenuation Volume 1:100 $V_{post} - V_{pre}$	187	m^3
Required basin area if depth is 1m average	**187**	m^2
Notes		
> Assuming runoff coefficient=1, Full Saturation.		

Summary table Drainage Calcs
East Gledhow - Catchment E

Catchment Area

PreDevelopment

Subcatchment Area (m^2)	Runoff C	% of Area (%)	Weighted "C"	Surface Characteristics
300	0.95	4	0.04	Roof & Sealed Surface
0	0.95	0	0.00	Roads / Driveways
0	0.50	0	0.00	Unsealed Roads
0	0.70	0	0.00	Bare Impervious Soil
0	0.10	0	0.00	Bare Pervious Soil
0	0.25	0	0.00	Urban Gardens
7122	0.30	96	0.29	Grassed Parkland
0	0.25	0	0.00	Partly Bush Parkland
0	0.20	0	0.00	Heavy native type bush
7,422 m^2				

Weighted Runoff Coefficient = **0.33**

Post Development

Subcatchment Area (m^2)		Runoff Coe	ercentage (Area (%)	Weighted "C"	Surface Characteristics
2545	80%	0.95	34.3	0.33	Lots - Roof & Sealed Surface
636	20%	0.30	8.6	0.03	Lots - landscaped areas
848	40%	0.95	11.4	0.11	Road Reserve Roads / Driveways
1272	60%	0.70	17.1	0.12	Road reserve Verges
0		0.95	0.0	0.00	Roof & Sealed Surface
0		0.95	0.0	0.00	Roads / Driveways
0		0.50	0.0	0.00	Unsealed Roads
0		0.70	0.0	0.00	Bare Impervious Soil
0		0.10	0.0	0.00	Bare Pervious Soil
0		0.25	0.0	0.00	Urban Gardens
2121		0.30	28.6	0.09	Grassed Parkland
0		0.25	0.0	0.00	Partly Bush Parkland
0		0.20	0.0	0.00	Heavy native type bush
7422			100.00		

Weighted Runoff Coefficient = **0.67**

Runoff critical ARI events

1:1yrs ARI		
Predevelopment flow rate		23 L/s
Post development flow rate		46 L/s
Attenuation Volume 1:1yr ARI	$V_{post} - V_{pre}$	9 m^3
Area to be used for Nutrient treatment 2% of impervious		**68** m^2

1:10yrs ARI		
Predevelopment flow rate		59 L/s
Post development flow rate		119 L/s
Attenuation Volume 1:10yr ARI	$V_{post} - V_{pre}$	37 m^3
Required basin area if depth is 1m average		**37** m^2

1:100yrs ARI		
Predevelopment flow rate		129 L/s
Post development flow rate		264 L/s
Attenuation Volume 1:100yr ARI	$V_{post} - V_{pre}$	55 m^3
Required basin area if depth is 1m average		**55** m^2
Notes		
> Assuming runoff coefficient=1, Full Saturation.		

Appendix B

Transport Statement

Opus International Consultants

April 2012

(Note: Plans may not reflect the final layout).

Appendix B

Transport Statement

Opus International Consultants

April 2012

Transport Statement

East Gledhow Outline Development Plan
South Lockyer, Albany

Prepared on behalf of

Dykstra Planning & Ayton Baesjou Planning

OPUS

Transport Statement

East Gledhow Outline Development Plan
South Lockyer, Albany

Prepared on behalf of

Dykstra Planning & Ayton Baesjou Planning

Reviewed by

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Date: APRIL 2012
Reference: W-A1166.00
Status: FINAL

CONSULT AUSTRALIA
Business | Engineering | Design
Member Firm

CONTENTS

1 | Introduction

This report has been prepared to support the proposed East Gledhow Concept Structure Plan toward development approval in respect to a proposal by Dykstra Planning and Ayton Baesjou Planning for a new residential Development.

This report addresses the traffic and parking related aspects of the proposed development, namely:

(i) Existing traffic flows of surrounding roads;
(ii) Estimated Traffic Generation and development site parking;
(iii) Non-Technical assessment of the impact the traffic generation will have on the surrounding road network and key intersections;
(iv) Assessment of existing crash data for roads surrounding the site; and
(v) Site sustainable transport links.

Subsequent sections of this report describe the following aspects of the proposal:

Section 2 describes the existing transportation situation vicinity of the proposed development;

Section 3 discusses the proposed development traffic generation;

Section 4 summaries the stakeholder meetings;

Section 5 summaries the issues identified; and

Section 6 concludes the main findings.

1.1 | What is a Transport Statement?

A Transport Statement is a brief assessment outlining the transport aspects of the proposed development. The intent of the statement is to provide the approving authority with sufficient transport information to confirm that the proponent has adequately considered the transport aspects of the development and that it would not have an adverse transport impact on the surrounding area.

This Transport Statement is a desktop assessment only and does not include detailed assessment of traffic impact on the surrounding road network or land uses. Comment has been provided on traffic impact and surrounding land uses based on consultation with Main Roads WA and City of Albany only.

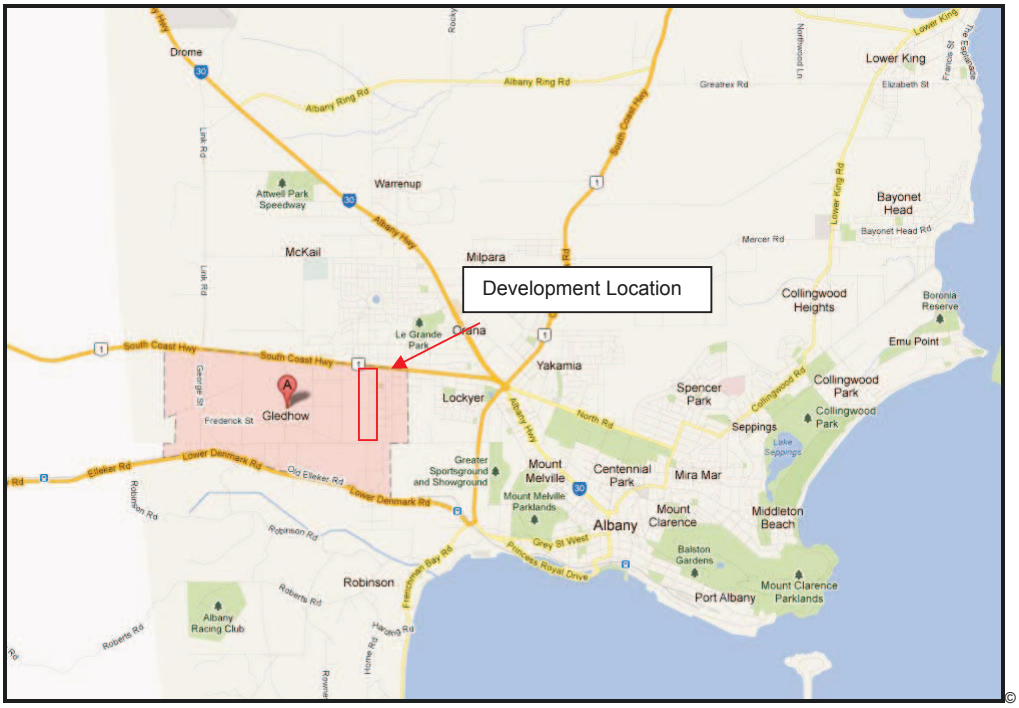
The Transport Statement has broadly followed the WAPC '*Transport Assessment Guidelines for Developments Volume 4* (2006)' and in accordance with the guidelines, a Transport Statement does not replace the need to complete a Traffic Impact Assessment in the later stages of a development, if required by approving authorities.

Of particular relevance is the accessibility of the development by non-car modes, with regard to the Governments sustainable development objectives.

2 | Existing Transport Situation

2.1 | Site Location

The development site is located in East Gledhow, Albany, with the boarding roads of South Coast Highway, Balston Road and Cuming Road. The development site is shown in Figure 1 below:



© Map by Google

Figure 1 - Development Site, East Gledhow, Albany

2.2 | Road Hierarchy

The status of a particular road is generally classified according to a road hierarchy. The hierarchy defines the functional role of each road within the road network.

The City of Albany and Main Roads WA classifies roads in the following decreasing hierarchical order of importance (refer Table 1)

Table 1 - Road Hierarchy

Road Name	City of Albany	Main Roads WA
	Ring Road	Primary Distributor
South Coast Highway	Integrator Arterial (4 lane)	Regional Distributor
Lower Denmark Road		
	Integrator Arterial (2 lane)	Distributor A
		Distributor B
Balston Road	Neighbourhood Connector	Local Distributer
Cuming Road	Local Road	Access Road
Moortown Road		
Middle Street		
Sydney Street		

South Coast Highway, which has a single lane in each direction, is classified as an Integrator Arterial, connecting through to Albany City Centre. Clydesdale Road and Balston Road running in a north-south direction adjacent to the site are classified as Neighbourhood Connector roads. All other roads surrounding the development site are classed as local access roads and are also single lanes in each direction.

Not directly accessible from the site, but within 1.5km of the site is Lower Denmark Road which is classed as an Integrator Arterial and Le Grande Avenue which is classed as a Neighbourhood Connector. Both of these roads may need to accommodate a proportion of development traffic. The road hierarchy has been determined from the City of Albany Draft Transport Network and the Main Roads Road Information Mapping System.

2.3 | Existing Speed Limits

The posted speed limit on the South Coast Highway is 60km/h adjacent to the site, increasing to 80km/h approximately 500m west of the site. There is also a school speed zone reducing the speed to 40km/h (during am and pm peak school times) approximately 1km east of the site. Balston Road is signed as a 50km/h road, leading into Cuming Road that also is a 50km/h road. The other local residential streets within or surrounding the development have a speed limit of 50 km/h.

2.4 | Existing Traffic Flows

The traffic flows for the surrounding roads, as received from the Main Roads WA and the City of Albany are as follows:

- South Coast Highway: 7 day average 2652vpd (2010);
- Balston Road: 7 day average - 907vpd (2009);
- Cuming Road 7 day average – 79vpd (2004);

For the remaining smaller internal and surrounding roads the traffic count data indicate below 100 vehicles per day with traffic using these roads mostly related to residential housing.

From discussions with the City of Albany and through on-site observations a proportion of the traffic utilising Balston Road and Cuming road are using these roads as links between the South Coast Highway and Lower Denmark Road.

Based on discussions with Main Roads WA it is also noted that South Coast Highway is a Road Train route.

No speed data could be obtained for the roads within the vicinity of the development site with the exception of Balston Road, which has a recorded 85th percentile speed of 61km/h.

2.5 | Existing Crash History

An initial review of crashes on roads surrounding the development site has resulted in no crashes being located. This either means no crashes have occurred within the last 5 years, or the Main Roads WA crash ranking system database does not hold this information.

2.6 | Existing Intersection Operation

It can be expected that nearly all the development traffic will travel through the following key intersections (all of which are priority intersections):

- South Coast Highway / Balston Road;
- Balston Road / proposed Sydney Street extension;
- Balston Road / Cuming Road.

The key intersections are shown in Figure 2 highlighted in Red (solid line) overleaf.

As can be seen in Figure 2 there have also been 4 intersections identified that may also have an impact on the surrounding network, however, these would be minor in nature (illustrated as a dashed red line on the plan).

No traffic surveys have been undertaken to ascertain intersection movements or queuing issues, however, on site observations did note that there appears to be no relating intersection issues existing.

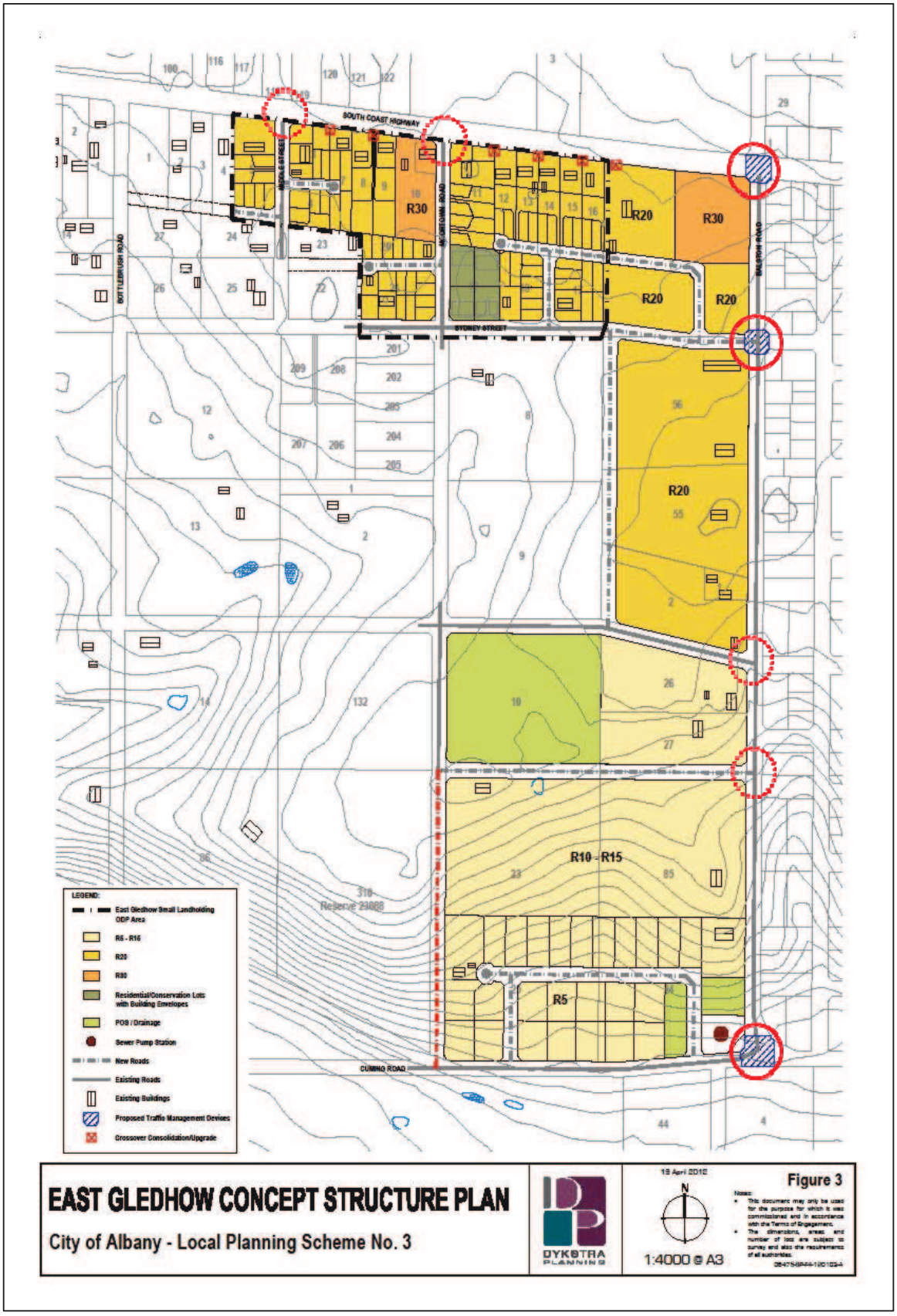


Figure 2 - Development Concept Design - Affected Intersections

2.7 | Existing Parking Provision

As the north of the development is residential in nature, with large single dwelling plots, and the remaining development to the south (running parallel with Balston Road) is bushland, all parking is off-road in private residential dwellings. There was no on-street parking evidenced on-site.

2.8 | Existing Sustainable Transport Access

The existing developments on the site are large rural/ residential lots, with the majority accessing directly onto South Coast Highway. Along South Coast Highway directly adjacent to the development site is a bi-directional cycle route, providing off-road pedestrian and cycle facilities linking through to Albany City Centre. See Figure 3.

Figure 3 - Off Road Route along South Coast Highway

There is one bus route within the vicinity of the development which is run by local operator Loves Bus Services. This service however, only operates along South Coast Highway within the vicinity of the primary school (Cull Road to Albany Highway).

2.9 | Surrounding Developments and Trip Attractors

2.9.1 | Clydesdale Park

Opposite this proposed development is a new large residential development, known as Clydesdale Park. The Clydesdale Park subdivision is expected to generate 1,672 vehicle movements per day and the overall structure plan area approximately 3,360 vehicle movements per day based on the Riley Consulting Traffic Study, February 2007.

As a result of the Clydesdale Park development and its access arrangements, the existing intersection of Clydesdale Road / South Coast Highway has been relocated to approximately 180 metres west of its present location, with the former location closed to South Coast Highway. This will remove the existing four-way priority controlled intersection with Balston Road and is considered to be a major road safety improvement for the highway.

Within this development, there is a proposed school and local activity centre that will serve the Clydesdale Park development and is assumed may also serve the proposed East Gledhow development. The Clydesdale Park development would therefore be expected to mitigate the impact of any trips attracted across South Coast Highway from the East Gledhow Development.

2.9.2 | Proposed Supermarket (intersection of Le Grande Avenue / Albany Highway)

Through discussions with the City of Albany officers there is a supermarket development proposed at the Le Grande Avenue / Albany Highway intersection. It appears that this proposed supermarket will be the closest to the East Gledhow development and there is likelihood that there will be an increase in traffic demand along Le Grande Avenue and specifically at the South Coast Highway / Le Grande Avenue intersection, this will have to be addressed and mitigated by the supermarket and not developments within the East Gledhow Structure Plan area.

3 | Proposed Development

3.1 | Description of the Proposed Development

The development site comprises of residential lots, mainly low to medium density, see Figure 2. The site is initially proposed to be split into 12 zones, ranging from R5 to R30 in the residential density codes. Further to the proposed zoning, there are also proposed road links and new intersections.

The total area proposed for development is approximately 34 hectares, split as follows:

- One R5 zone – approx 26 dwellings;
- Two R10 – R15 zones – approx 105 to 130 dwellings;
- Four R20 zones – approx 250 to 290 dwellings; and
- Two R30 zones – approx 40 to 50 dwellings, as depicted in Figure 2.

At the time of writing this statement, discussions with Dykstra Planning and Ayton Baesjou Planning with regard to the staging of the structure plan area have indicated that as the Structure Plan are is comprised of a number of small fragmented parcels of land with varying ownership, the development timeframe is likely to be variable and based on individual landowners decision to subdivide their properties in the future.

3.2 | Traffic Generation

The number of traffic movements generated by the residential development is influenced by the number of proposed dwellings. The City of Albany planning requirements does not have specific traffic generation figures for residential uses, hence the RTA Guide to traffic generating developments (October 2002) and the Western Australian Planning Commission (WAPC) has been consulted.

A Traffic Study report was produced for the Clydesdale Park Residential Development in 2007 by Riley Consulting. This report states that the development of residential land uses in Albany can be expected to have a lower traffic generation rate than would be found in the metropolitan region of Perth. The metropolitan average vehicle trip rate is 7.6 trips per household per day and reflects a population to household ratio of 2.4 persons per dwelling. Reference to the Australian Bureau of Statistics website indicates a population of 22,256 persons and 9,887 households in Albany. This indicates an average household of 2.25 persons and is similar to Perth metropolitan average.

3.2.1 | RTA Residential Trip Estimation

Daily vehicle trips = 9.0 per dwelling

Weekday peak hour vehicle trips = 0.85 per dwelling.

3.2.2 | WAPC Residential Trip Estimation

The trip rate estimation for WAPC is similar to RTA (weekday peak hour = 0.8 per dwelling), however, it also provides the AM/PM directional split:

- AM Peak: 25% IN / 75% OUT
- PM Peak 67% IN / 33% OUT

3.2.3 | Whole Structure Plan Area Traffic Generation

Table 2 below sets out the estimated trip generation of the Structure Plan area based on the trip rates as set out by RTA and WAPC.

Table 2 – Whole Structure Plan Trip Generation

	Minimum number of Dwellings (423 dwellings)	Maximum number of dwellings (498 dwellings)
Daily Trip Rate (based on 9.0 trips per dwelling)	3,807	4,482
Peak Hour Trip Rate (based on 0.85 trips per dwelling)	360	423
Peak Hour Directional Split	AM (90 IN / 270 OUT) PM (241 IN / 119 OUT)	AM (106 IN / 317 OUT) PM (283 IN / 140 OUT)

The traffic generation for the entire Structure Plan area indicates that based on the minimum or maximum number of proposed dwellings there is likely to be a high traffic impact from this development (over 100 vehicles in the peak hour) and therefore triggers the requirement for a Traffic Impact Assessment in the subdivision stages of this development, in accordance with WAPC 2006 guidance.

With limited Public Transport access directly to/from the site it is expected that the above trip rates would not reduce by any significant amount, however it may reduce slightly with a small percentage of car born trips transferring to cycle trips.

Further to this, the traffic generated by the proposed development be assessed for two distinct sections of the development, these can be identified in Figure 2 with the black dashed line distinguishing between the two assessment sections (for the purpose of this Statement referred to as Sub-Section A and Sub-Section B) with Figure 4 depicting Sub-Section A to the north of the site.

Table 3 sets out the estimated trip generation for Sub-Section A and Sub-Section B based on the trip rates as set out by RTA and WAPC.

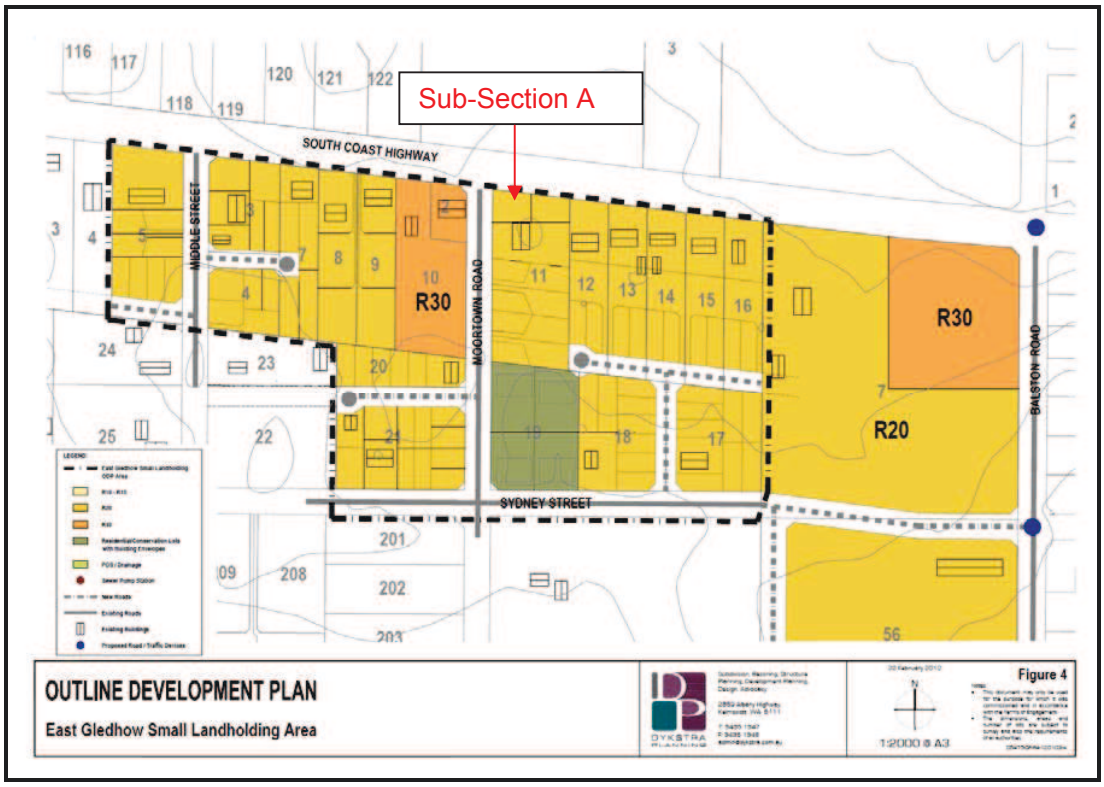


Figure 4 – Sub-Section A of Structure Plan

Table 3 - Trip Generation for Sub-Section A and Sub-Section B

	Sub-Section A Minimum number of Dwellings (122 dwellings)	Sub-Section B Minimum Number of Dwellings (301 dwellings)
Daily Trip Rate (based on 9.0 trips per dwelling)	1,098	2,709
Peak Hour Trip Rate (based on 0.85 trips per dwelling)	104	256
Peak Hour Directional Split	AM (26 IN / 78 OUT) PM (70 IN / 34 OUT)	AM (64 IN / 192 OUT) PM (172 IN / 84 OUT)

The traffic generation for either Sub-Section A or Sub-Section B indicates that there will be a high traffic impact from each sub-section of the development (over 100 vehicles in the peak hour) which therefore triggers the requirement for a Traffic Impact Assessment in the subdivision stages of this development (as with the Structure Plan area as a whole), in accordance with WAPC guidance.

3.3 | Traffic Distribution

It is expected that all traffic generated by the site will utilise the existing and/or proposed local access roads which all lead to Balston Road, Cuming Road and South Coast Highway.

3.4 | Traffic Generation Impacts of the Whole Structure Plan site

A detailed impact study has not been undertaken for this Transport Statement and the modelling and design of key intersections and mid-block links is not included within this report.

However, with background traffic flows of 2652 vpd along South Coast Highway, and assuming a conservative 60% of vehicles generated from the development (2,689) it is likely there will be an impact on South Coast Highway with the majority utilising Balston Road to access the highway. As such it may be assumed that the South Coast Highway / Balston Road intersection will require further assessment, at the subdivision stage of development, to ensure opposing traffic flows, from Balston Road and from South Coast Highway are accommodated safely.

Further to this the intersections of Balston Road / Cuming Road and Roundhay Road / Lower Denmark Road may also require further investigation to assess what improvements maybe required to accommodate the increasing traffic demand along this route between South Coast Highway and Lower Denmark Road.

The width of Balston Road is approximately 6m wide and is considered to be adequate (with some road shoulder and edge line treatment) and with the assumption that the Balston Road / South Coast Highway is improved to accommodate the extra traffic (as stated above).

However, it is advised further consultation is undertaken during a Traffic Impact Assessment, with the City of Albany as the City of Albany Subdivision and Development Guidelines (2009) refer to the WAPC Liveable Neighbourhoods Documents for urban road standards. Within Liveable Neighbourhoods, the requirements for a Neighbourhood Connector Road are such that when carrying traffic volumes above 3000 vpd the indicative road pavement width should be 11.2m including any on-street parking, plus a shared path on one verge.

3.4.1 | Traffic Generation Impact – Sub-Section A Development

The location of the Sub-Section A in the north of the development site, with the current lot orientation, results in dwellings accessing onto the access roads of Middle Street, Moortown Road and Sydney Street as well as directly onto the South Coast Highway.

Consultation with Dykstra Planning with regard to residential crossovers within Sub-Section A, has indicated that it is proposed that there will be no additional direct accesses onto South Coast Highway and where possible the number of accesses will be reduced by providing access to the internal road network.

With minimal traffic likely to exit from Middle Street and Moortown Road the intersection of these roads with South Coast Highway is not anticipated to be an issue. The majority of traffic, not accessing the South Coast Highway directly from their property is expected to utilise Sydney Street along its proposed extension and Balston Road.

3.4.2 | Trip Generation Impacts – Further Considerations

Main Road WA and the City of Albany have indicated that there is a likelihood that traffic generated by the proposed development will utilise Balston Road and Cuming Road through to Lower Denmark Road, therefore developer contributions toward mitigating this impact (for intersection upgrades as described previously) will need to be sort at the subdivision stage of development and apportioned between Sub-Section A and Sub-Section B based on their estimated impact at each intersection.

It is noted from Figure 2 that as a result of the proposed extension of Sydney Street into Balston Road, a 4-way priority cross road is created opposite Portland Street. Due to the possible high demand at the intersection for traffic to access Balston Road, through to South Coast Highway, one option for mitigation may be the realignment of the Sydney Street extension to create a staggered T-intersection arrangement. Other traffic management device options may be available, based on consultation with the City of Albany, at the subdivision stage of development and designed to their satisfaction.

Ayton Baesjou Planning and Dykstra Planning have proposed that the development within the Structure Plan area may take place over a possible 20 year period. At the subdivision stage of development, a Traffic Impact Assessment will enable assessment of the proposed staging and the development rate can be determined to calculate the gradual increase in traffic and its impact on the surrounding road network and intersections.

4 | Stakeholder Consultation

During the initial stages of this Transport Statement, meetings were held with Main Roads WA and the City of Albany. A phone call discussion has also been undertaken with Uloth Consulting.

4.1 | Main Roads WA Meeting with Peter Stringer, Network Manager

The following are a summary of Main Roads WA preferences and issues associated with the proposed Structure Plan:

- All driveways accessing directly onto South Coast Highway closed;
- The majority of driveways are low-lying with drainage issues;
- If accesses onto South Coast Highway are required then driveways should be 'uplifted' with concrete culverts;
- The amount of traffic likely to be generated by the development they would expect to see an upgrade of the South Coast Highway / Balston Road intersection and any other improvements necessary; and
- There is likely to be an increase noise impact as a result of the development.

4.2 | City of Albany Meeting with Paul Camins, Planning and Development Engineer

The following are a summary of the key points discussed:

- Uloth Consulting have recently completed a Traffic Impact Assessment for a Coles Supermarket on the corner of Le Grande Avenue and Albany Highway, this maybe a trip attractor for the development;
- Clydesdale Road is to be closed off, thus creating a T-intersection with South Coast Highway and Balston Road; and
- The existing trips that travel along Balston Road into Cuming Road and through to Lower Denmark Road as a route to access the town centre are likely to increase along this route as a result of the development and increase the usage of the associated intersections.

Comments made by Main Roads WA and the City of Albany have been incorporated into this Transport Statement where considered appropriate.

5 | Summary

The traffic related issues discussed in this Transport Statement can be summarised as follows:

- The traffic generation calculation for the Structure Plan area as a whole (3,807 – 4,482 vpd) and for the individual Sub-Section's (A and B), based on the minimum number of lots within the proposed Structure Plan area triggers the requirement for a Traffic Impact Assessment (more than 100 trips in the peak hour based on WAPC Guidance, 2006).

- It is assumed that a high proportion of traffic generated from the structure plan area likely to have an impact on South Coast Highway via the Balston Road intersection. The proportion of this impact associated with each Sub-Section (A and B) will require calculating at the subdivision stage of development to assist in adequately apportioning developer contributions to a possible intersection upgrade.

- It is assumed that there will also be a significant proportion of traffic generated by the development that will utilise Balston Road and Cumming Road to access Lower Denmark Road. The proportion of this impact associated with each Sub-Section (A and B) will require calculating at the subdivision stage of development to assist in adequately apportioning developer contributions to a possible intersection upgrade.

- As a result of the proposed extension of Sydney Street into Balston Road, a 4-way priority cross road will be created opposite Portland Street. Due to the possible high demand at the intersection for traffic to access Balston Road, through to South Coast Highway, one option for mitigation may be the realignment of the Sydney Street extension to create a staggered T- intersection arrangement. Other traffic management device options may be available, based on consultation with the City of Albany, at the subdivision stage of development and designed to their satisfaction.

- Initial assessment indicates that, with adequate road shoulder treatment, edge line treatment, appropriate road markings and intersection upgrades as required at Balston Road / South Coast Highway, Balston Road / Cuming Road and Cuming Road / Lower Denmark Road, Balston Road is unlikely to require widening.

6 | Recommendations

The following conclusions have been derived regarding the possible traffic related impacts of the proposed development:

- Detailed analysis of the development impact on the following intersections will be required:
  - South Coast Highway / Balston Road;
  - Proposed 4-way intersection of Balston Road / Sydney Street extension and Portland Street; and
  - Balston Road / Cumming Road / Lower Denmark Road;
- With appropriate road treatment and intersection upgrades, Balston Road is considered unlikely to require widening.
- A Traffic Impact Assessment, at the subdivision stage of development, will provide detailed investigations as to the development impact (as a whole and for each separate sub-section) on the three above intersections and Balston Road and provide specific design detail as per the City of Albany and Main Roads WA standards for any proposed road or intersection upgrades.

Appendix C

Developer Contributions

(Note: Plans may not reflect the final layout).

Contribution Plan

The majority of service infrastructure required to develop the ODP will be provided by the developer at the subdivision stage of development, including;

- Connection to deep sewer.
- Connection to scheme water.
- Connection to underground power.
- Connection to telecommunications.
- Construction of subdivisional roads.
- Upgrading of existing roads.
- Construction of foot paths / dual use paths.
- Construction of storm water drainage and management.
- Provision of POS and/or cash in lieu.
- Provision of drainage reserves.
- Construction of strategic fire breaks.

A Developer Contribution Plan and Cost Apportionment Schedule is an accepted means to ensure costs are evenly shared between landholders. The onus will be on individual landholders to coordinate their timing and development with adjoining landholders or to recoup applicable development costs in accordance with Section 159 of the Planning and Development Act 2005.

The preparation of a Developer Contribution Plan and Cost Apportionment Schedule will be required prior to subdivision and development, in consultation with the City of Albany and Main Roads WA. The plan will include, but not be limited to, contributions for:

- cost of preparation of the contribution plan;
- upgrades to all existing roads, including upgrades to South Coast Highway;
- intersections treatments, including any upgrades required to Lower Denmark Road intersection;
- paths;
- drainage works;

- planting of street trees; and street lighting.

Existing Road Upgrade

The only existing roads within the ODP are Balston, Cuming and portion of Moortown Road.

With regard to Balston Road, as it carries more than just local traffic, it is recommended that at the time lots fronting the road are subdivided, that they be required to upgraded based on local government specifications.

Cuming Road will need to be fully constructed to the Council's satisfaction by the owners of Lots 25 and 86. At such time as the owners of the land on the south side of Cuming Road wish to subdivide, the owners of Lots 25 and 86 will be able to recoup half the cost of construction in accordance with the provisions of the Planning and Development Act 2005.

Intersection Upgrade

Moortown Road is currently unconstructed to the west of Lot 23 Moortown Road and Lot 25 Cuming Road. At such time as these lots are subdivided they will be required to contribute to the construction of the road to local government's specifications.

Stormwater Drainage

The ODP area consists of a number of small catchment areas (6) which have been defined by OPUS in their preparation of the Stormwater Management Plan. As recommended in Liveable Neighbourhoods, it is proposed to integrate drainage basins within public open space areas where possible. Rather than multiple small areas of POS which could be overly restricted by also accommodating drainage functions, Council's preference is for larger consolidated areas of POS which can provide for a variety of active and passive activities as well as accommodating drainage facilities. Only 2% of the 10% public open space provision can be utilised for restricted use such as drainage facilities.

Where drainage functions exceed 2% of the POS contribution, additional land or cash-in-lieu will need to be provided to cover the shortfall.

Public Open Space

The ODP provides an indicative layout for POS which consolidates provision in two large areas within a walkable distance of all proposed lots within the area.

As the POS is concentrated, the majority of landowners will be required to provide cash-in-lieu instead of giving up land. Where a landowner gives up more than 10% of his land for POS, he will be compensated with the cash-in-lieu provided by other landowners.

Both areas of POS are considered suitable for accommodating drainage in a manner which will not compromise useability of the area. Detailed design at the subdivision stage of development will determine whether the drainage functions can be accommodated within the 2% restricted use allowance.

Some variation to the POS layout may be acceptable providing the objectives of the ODP are met. The schedule of Public Open Space is contained in Table 3 below.

Table 3: Public Open Space Schedule

Lot Address	Lot Area	10% POS requirement	Provision	
Lot 1 Balston Road	0.2152	215.2m²	Cash-in-lieu	10%
Lot 2 Balston Road	1.8163	1816.3m²	Cash-in-lieu	10%
Lot 7 Balston Road	4.4340	4434.0m²	Subject to LDP [1.]	Subject toLDPP [1]
Lot 26 Balston Road	1.6086	1608.6m²	Cash-in-lieu	NA
Lot 27 Balston Road	1.5884	1588.4m²	Cash-in-lieu	NA
Lot 55 Balston Road	2.4948	2494.8m²	2960m²	40.2%
Lot 56 Balston Road	3.4380	3438.0m²	8345m²	7.7%
Lot 85 Balston Road	3.8661	3866m²	Cash-in-lieu	10%
Lot 86 Balston Road	3.3879	3388m²	3388m²	10%
Lot 87 Balston Road	0.3500	NA	Nil	NA
Lot 25 Cuming Road	4.0750	4075m²	4075m²	10%
Lot 10 Moortown Road	3.8512	*	*	*
Lot 23 Moortown Road	4.0731	4073.1m²	Cash-in-lieu	10%
TOTALS	**35.1986 ha**	**3.09974ha**		

1. Provision of POS and/or cash-in –lieu subject to preparation of a Local DevelopmentPlan (LDP).

***** Crown land – subject to assessment at such time as development/conservation is considered.

NB: The public open space schedule is indicative and subject to detailed design at the subdivision stage of development.

Primary School

Given the proximity of the existing Mount Lockyer Primary School and the proposed school site on Clydesdale Road to the north, a future primary school for Gledhow is not required within the East Gledhow ODP. In the future, a site may be required further to the west. To provide for this, a per lot contribution, as determined by the Department of Education and Training, may be required at the subdivision stage of development.