Anstey-Keane Urban Development Precinct East Structure Plan

Part One - Implementation

DOCUMENT CONTROL

DESCRIPTION	DATE
230309 22-086 LSP amendment - Anstey Keane East (rev0).docx	9 March 2023
240722 22-086 LSP amendment - Anstey Keane East (rev1).docx (WAPC modifications)	22 July 2024

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

05-Nov-2020
..... Date

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

09-Nov-2020
..... Date

05-Nov-2030
..... Date of Expiry

TABLE OF AMENDMENTS

AMENDMENT NO.	SUMMARY OF THE AMENDMENT	AMENDMENT TYPE	DATE APPROVED BY WAPC
1	Change zoning of Lot 500 (16) Anstey Road from 'Residential R25' to Local Centre, and amend structure plan map by introducing the Local Centre zone	Minor	13 September 2024

EXECUTIVE SUMMARY

The Anstey-Keane Urban Development Precinct East Structure Plan comprises approximately 48ha of land, generally bound by Armadale Road, Anstey Road and Keane Road, Forrestdale. The structure plan area is zoned Urban under the Metropolitan Region Scheme and Urban Development under the City of Armadale Local Planning Scheme No.4.

The Structure Plan (originally produced by CLE Town Planning & Design) allows for the creation of a residential neighbourhood that responds to the surrounding land use context, as well as drawing on key elements of the Southern River / Forrestdale / Brookdale / Wungong District Structure Plan which provides a high level framework for future land use and development in the area.

The Structure Plan is also consistent with the strategic planning for the area as set out by Perth and Peel @ 3.5 million, the South Metropolitan Peel Sub-regional Framework and the City of Armadale Local Planning Strategy which all identify the Structure Plan area for urbanisation and residential development.

Amendment 1 incorporates the following modification to the existing approved Anstey-Keane Urban Development Precinct East Structure Plan:

- Zoning change for Lot 500 (16) Anstey Road from 'Residential R25' to 'Local Centre'.

The amendment to the approved structure plan provides for the future establishment of a 'local centre' on the amendment site to provide a local shopping facility for the residents of the Anstey-Keane Urban Development Precinct.

The proposed change in zoning would facilitate the future development a local shopping facility of maximum 1,500sqm shop-retail floorspace and additional non-retail uses on the site, which would build upon the provision of local urban support services for the Anstey-Keane Urban Development Precinct.

The following table is an updated summary of the Anstey-Keane Urban Development precinct East Structure Plan which incorporates Amendment 1.

TABLE 1: LAND USE SUMMARY

ITEM	STRUCTURE PLAN	SECTION NUMBER REFERENCED IN EXPLANATORY REPORT
Total area covered by the structure plan	48.03 hectares	1
Area of each land use proposed: Zones (as per LPS4) - Residential - Industrial Business - Local Centre Reserves (as per LPS4 and the MRS) - Road reserves - Parks and Recreation - Public Purpose (Primary School) - Public Purpose (Drainage)	 - 24.3ha - 1.7ha - 0.88ha - 12.2ha - 4.6ha - 4.0ha - 0.35ha	3
Total estimated lot yield	650 lots	3
Estimated number of dwellings	675 dwellings	3
Estimated residential site density - Dwellings per gross urban zoned hectare (as per Perth & Peel @ 3.5 million and Liveable Neighbourhoods)	27.5 dwellings per residential site hectare	3
Estimated population	1,890 people @ 2.8 people per household	3
Number of Primary Schools	1	3
Number of Secondary Schools	None	3
Public Open Space	4.1ha (gross) 2.2ha (unrestricted) 88% 0.8ha (restricted) 12%	3

CONTENTS

PART ONE

IMPLEMENTATION

1 STRUCTURE PLAN AREA

This Structure Plan applies to the land within the inner edge of the line denoting the structure plan boundary on the Structure Plan Map.

The Structure Plan is identified as the Anstey-Keane Urban Development Precinct East Structure Plan.

2 STRUCTURE PLAN CONTENT

This Structure Plan comprises:

- Part One – Implementation Section.
- Part Two – Explanatory Report.
- Appendices – Technical Reports.
- Addendum to Part Two forming the justification for Amendment 1.

Part One of the Structure Plan comprises the structure plan map and planning provisions. Part Two of the Structure Plan is the planning report component which can be used to interpret and implement the requirements of Part One. The addendum to Part Two is a report setting out the justification / explanation for Amendment 1.

3 OPERATION

The Anstey-Keane Urban Development Precinct East Structure Plan comes into effect on the date that it is endorsed by the Western Australian Planning Commission.

4 INTERPRETATION AND RELATIONSHIP WITH STATUTORY PLANNING FRAMEWORK

The Anstey-Keane Urban Development Precinct East Structure Plan constitutes a Local Structure Plan pursuant to Part 4E of the City of Armadale Town Planning Scheme 4 and the *Planning and Development (Local Planning Schemes) Regulations 2015 Schedule 2 - Deemed provisions for local planning schemes.* The Structure Plan Map outlines future land use, zones and reserves applicable within the structure plan area.

Pursuant to the *Planning and Development (Local Planning Schemes) Regulations 2015 Schedule 2 - Deemed provisions for local planning schemes*, a decision maker of an application for development approval or subdivision approval is to have due regard to the provisions of this Structure Plan, including the Structure Plan Map, Implementation Report, Explanatory Report and Technical Appendices.

5 STAGING

Development staging will follow an orderly sequence and shall not exceed the extension of essential service infrastructure or constructed road access.

6 LAND USE AND SUBDIVISION

6.1 LAND USE AND ZONES

The subdivision and development of land is to generally be in accordance with the Structure Plan. Land use permissibility within the Structure Plan area shall be in accordance with the corresponding zone or reserve under the Scheme.

The following land uses are not compatible with adjacent residential uses and should not be located within the structure plan area:

- Bulky Goods Showroom.
- Motor Vehicle, Boat and Caravan Sales.
- Light Industry.
- Restricted Premise.
- Storage.
- Transport Depot.
- Warehouse.

6.2 RESIDENTIAL

6.2.1 DWELLING TARGET

Subdivision and development within the structure plan is to achieve a dwelling target of 22 dwellings per site hectare.

6.2.2 DENSITY

Residential densities applicable to the Structure Plan shall be those residential densities shown on the Structure Plan map.

6.3 PUBLIC OPEN SPACE

The provision of public open space being provided generally in accordance with the Structure Plan Map.

6.4 ENVIRONMENTAL

Prior to the lodgement of a subdivision application a Botanical and Fauna survey is to be undertaken for the lots subject to the application. Where a survey has been conducted to support the structure plan, those lots already surveyed would not be subject to a further survey.

6.5 MOVEMENT NETWORK

(i) The Allen Road/Keane Road roundabout is subject to further detailed design at subdivision stage accounting for industrial traffic and the 132kv transmission line alignment.

(ii) Detailed cross sections for Allen Road are to be determined in consultation with the City of Armadale and Western Power prior to the lodgement of a subdivision application abutting Allen Road.

6.6 PRIMARY SCHOOL

(i) Development of the primary school is to ensure that school buildings and classrooms are located outside of the 200m buffer to the Dampier to Bunbury Natural Gas Pipeline.

(ii) A Notification on the Certificate of Title of the primary school site advising that the school is within 200m of the Dampier to Bunbury Natural Gas Pipeline is required at the subdivision stage.

6.7 LOCAL CENTRE

The development of the Local Centre site shall provide for:

(i) The connection and construction of Rathbone Drive through to Anstey Road.

(ii) An active frontage to Anstey Road with no more than 2 rows of parking between the local centre and Anstey Road setback.

(iii) An aesthetically pleasing frontage to Rathbone Drive with all servicing areas along Rathbone Drive being suitably screened to mitigate visual impact.

(iv) High quality landscaping along both Rathbone Drive and Anstey Road frontages.

(v) An outdoor plaza at or adjacent to the main entrance containing soft and hard landscaping and seating with a minimum size of 25sqm and a minimum dimension of 5 metres.

(vi) Screening of bin storage and mechanical plant.

(vii) A Traffic Impact Assessment prepared in accordance with the WAPC Transport Impact Assessment Guidelines relating to the local centre development is to be provided at the development application stage.

7 DEVELOPMENT

7.1 LOCAL DEVELOPMENT PLANS

A Local Development Plan to be required by the Western Australian Planning Commission (**WAPC**), on the advice of the City of Armadale, as a condition of subdivision approval where deemed necessary for land comprising, but not limited to:

(i) Lots abutting areas of Public Open Space.

(ii) Lots subject to 'Quiet House Design' requirements as identified in the Road Traffic Acoustic Assessment.

(iii) Prior to the lodgement of a development application and/or as a condition of subdivision approval, a Local Development Plan is to be prepared for all lots located within the Industrial Business zone to address the following:

- Reciprocal rights of access between lots;
- Design and interface with residential areas.

(iv) Lots affected by the 132Kv powerlines along Allen Road.

7.2 NOTIFICATIONS ON TITLE

In respect of applications for the subdivision of land the Council shall recommend to the WAPC that a condition be imposed as part of a subdivision approval for a notification to be placed on the Certificate(s) of Title(s) to advise of the following: -

(i) Land or lots deemed to be affected by road traffic noise as identified in the Road Traffic Acoustic Assessment prepared for the Structure Plan.

7.3 BUSHFIRE MANAGEMENT

This Structure Plan is supported by a Bushfire Management Plan. Regardless of whether the land has been formally designated as bushfire prone, any building to be erected on land identified as falling within 100 metres of a bushfire hazard is designated as bushfire prone land and shall comply with the requirements of Australian Standard 3959 under the Building Code of Australia.

8 OTHER REQUIREMENTS

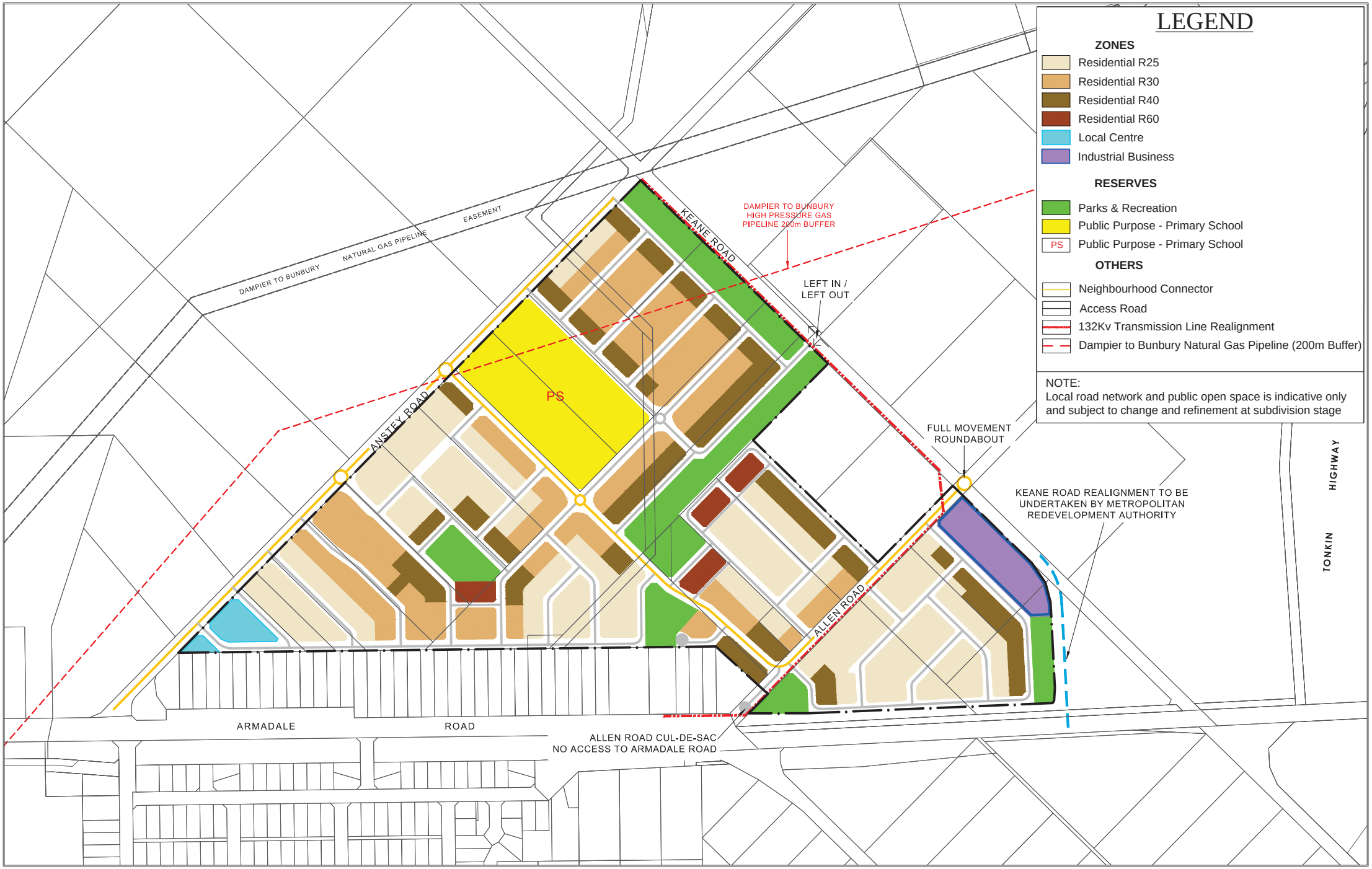
8.1 CONDITIONS OF SUBDIVISION APPROVAL

The following technical reports / strategies are to be prepared and submitted as a condition of subdivision approval (where applicable):

- Urban Water Management Plan.
- Bushfire Management Plan.
- Acid Sulphate Soils Management Plan.
- Environmental Management Plan for subdivision abutting Lots 43 and 44 Keane Road.
- Fauna Management Plan.

8.2 DEVELOPMENT CONTRIBUTIONS

The LSP is subject to contribution to the costs of common infrastructure in accordance with a Development Contribution Plan and Cost Apportionment Schedule prepared pursuant to Part 5A and Schedule 9B Development Contribution Plans.



ANSTEY KEANE URBAN DEVELOPMENT PRECINCT EAST STRUCTURE PLAN (WITH AMENDMENT 1)

ISSUE	DATE	INFORMATION INCORPORATED INTO ISSUE
1	21/12/20	Initial Version
2	15/07/24	Amendment 1

SCALE : Not to Scale

Base plan source City of Armadale

Anstey-Keane Urban Development Precinct East Structure Plan

Justification report (addendum to Part Two)

ANSTEY-KEANE URBAN DEVELOPMENT PRECINCT EAST STRUCTURE PLAN
(ADDENDUM TO PART TWO)

CONTENTS

APPENDICES

1 PLANNING BACKGROUND

1.1 INTRODUCTION AND PURPOSE

Apex Planning has formulated this structure plan amendment on behalf of Cedarville Pty Ltd, the landowner of Lot 500 (16) Anstey Road, Forrestdale (hereafter referred to as the **amendment site**).

It is proposed to amend the Anstey-Keane Urban Development Precinct East Structure Plan by changing the zoning of the amendment site from Residential R25 to Local Centre. No other changes are proposed to the structure plan, except for this change in zoning to the amendment site.

The purpose of the amendment is to facilitate the establishment of a local centre (maximum 1,500sqm shop-retail floorspace) on land which is appropriately sized and suitably located to cater for the daily shopping needs of the growing population of the Anstey-Keane Urban Development Precinct in the City of Armadale.

The site forms part of a rapidly growing urban area and adjoins land undergoing development for service commercial purposes (local fast food and fuel/convenience services) and a local childcare facility, and will build upon the provision of essential urban support services for the emerging residential estates in the locality.

This structure plan amendment is supported by an expert retail needs analysis, hydrological assessment, and traffic impact assessment.

1.2 LAND DESCRIPTION

1.2.1 LOCATION

The structure plan area is in the City of Armadale, located approximately 6km west of the Armadale Strategic Centre and 8km east of the Cockburn Strategic Centre.

The structure plan area is generally bound by Keane Road to the north-east, Anstey Road to the north-west, and Armadale Road to the south.

The structure plan area comprises approximately 48ha. The area pertaining to this amendment comprises Lot 500 (16) Anstey Road, a lot of approximately 8,797sqm.

Refer to **Figure 1 – Regional Context** and **Figure 2 – Local Context**.

1.2.2 DESCRIPTION OF CONTEXTUAL CONSIDERATIONS

The amendment site has frontage to Anstey Road, currently identified as a Distributor B road under the Main Roads hierarchy. Anstey Road currently links to Ranford Road further north-east, where it provides vehicular connectivity with the Crossroads Industrial Estate. This linkage will be terminated once the ultimate movement network of the structure plan is realised.

Anstey Road connects to Armadale Road via a full movement roundabout intersection located approximately 120m south-west of the subject site.

Armadale Road is a key regional transport route which offers a link between Armadale (east) and Cockburn Central (west), connecting the key suburbs of Treeby, Forrestdale, Haynes, and Piara Waters in between.

The amendment site forms part of the Anstey-Keane Urban Development Precinct, which is divided into three separate structure planning areas (east, north-west and south-west). The Anstey-Keane area contains the following emerging residential estates:

- Mahala Estate
- Solaris Estate
- Anstey Grove Estate

The planning framework for the area is fully established, with each local structure plan guiding the urbanisation of what was formerly rural land. The area is currently in a state of transition, with significant residential subdivision and urbanisation occurring in accordance with the established structure plans. A vision plan depicting the site in context of the nearby structure plans is provided as **Appendix 1** of this report.

The local structure plans encompassing the above estates allocate predominantly residential zoning at densities ranging from R25 to R60, with associated parks & recreation and public purpose reserves. None of the structure plans make allowance for local activity centres or shopping facilities.

The amendment site forms part of the Anstey Keane East structure plan, which currently allocates a Residential R25 zoning to the lot, as well as two local road reserves with independent access points to Anstey Road. The two local roads planned within the lot converge to a single local road leading eastward into the Mahala Estate.

The amendment site adjoins land which will be developed for non-residential purposes, depicted on the vision plan provided at **Appendix 1**. These include:

- Adjoining Lot 700 (30) Anstey Road, which is approved for a 92-place childcare facility. The landowner of this lot is actively progressing the delivery of the childcare facility.
- Adjoining Lot 400 (12) Anstey Road & Lot 800 (799) Armadale Road, which are approved for a service commercial development comprising a drive-through fast food outlet and service station. The landowner of these lots is actively progressing the delivery of this development.

The Anstey Keane East structure plan includes a designated public purposes reserve catering for a future primary school along Anstey Road, approximately 500m north-east of the site.

On the northern side of Anstey Road adjacent the subject site, land is allocated residential zoning with densities of R25-R30 under the Anstey Keane South-West structure plan. A large Public Open Space (**POS**) reserve is also planned fronting Anstey Road, with that structure plan indicating it would ultimately contain an "active senior sized playing field and community facility".

Anstey Road is in the process of upgrade from rural standard to urban standard in accordance with Development Contribution Plan No.4 (**DCP4**). At the time of preparing this report, land acquisition associated with road widening for Anstey Road has been completed for numerous sites in the area (including the subject site). As part of the Anstey Road upgrade, it will terminate at Solaris Estate to create separation between the Anstey Keane Urban Development Precinct and the industrial areas further north-east.

In terms of existing local conditions, the Mahala Estate, Anstey Grove Estate and Solaris Estate are all well underway with urbanisation at the time of preparing this report. Site works, subdivision works, dwelling construction and local road construction is substantially progressed. The subject lot is still semi-rural in nature, containing an existing dwelling, outbuildings and large open space with existing trees/vegetation.

1.2.3 LEGAL DESCRIPTION AND OWNERSHIP

The amendment site comprises a single landholding of approximately 8,797sqm, identified as Lot 500 (16) Anstey Road, Forrestdale. Lot 500 is legally described as follows:

Lot	Deposited Plan	Volume	Folio	Lot area	Ownership
500	421600	4021	400	8,797sqm	Cedarville Pty Ltd

The Certificate of Title (**CT**) is provided at **Appendix 2**.

Figure 1: Regional Context

Figure 2: Local Context

1.3 PLANNING FRAMEWORK

1.3.1 ZONING AND RESERVATIONS

The structure plan area and amendment site are zoned Urban under the Metropolitan Region Scheme. Refer to **Figure 3 – MRS Zoning.**

The structure plan area and amendment site are zoned Urban Development and located within Development Area 51 (**DA51**) and Development Contribution Area 4 (**DCA4**) under Local Planning Scheme No. 4. Refer to **Figure 4 – LPS4 zoning**.

1.3.2 DISTRICT STRUCTURE PLAN

The structure plan area and amendment site are located within the Southern River / Forrestdale / Brookdale / Wungong District Structure Plan (**DSP**), which was endorsed by the WAPC in 2001.

The DSP set out the broad district-level planning arrangements throughout the Southern River, Forrestdale, Brookdale, Wungong areas, indicating key features such as high-level land use, major roads, commercial and community infrastructure and public open space.

The DSP included provision of a local activity centre within the structure plan area, shown at the rear of the amendment site (based on a formerly planned alignment of Anstey Road which never eventuated).

The proposed amendment is broadly consistent with the DSP, noting it proposes a smaller scale local centre in roughly the same location.

The DSP is illustrated on Page 8 of the original structure plan report prepared by CLE, shown as Figure 4 in that document.

1.3.3 PERTH AND PEEL @ 3.5 MILLION AND SOUTH METROPOLITAN PEEL SUB-REGIONAL PLANNING FRAMEWORK

Perth and Peel @ 3.5 million is a high level strategic plan which sets a framework for the Metropolitan and Peel regions to manage population growth through density targets and the identification of areas suitable to sustain growth through housing, infrastructure and key services.

The suite of documents includes four sub-regional planning frameworks. The structure plan area and amendment site are located within the South Metropolitan Peel region.

The structure plan area is zoned Urban, broadly consistent with the ‘urban expansion’ area allocated to it under the framework.

A key element of Perth and Peel @ 3.5 million was a residential density target of 26 dwellings per site hectare, which was achieved by the original structure plan and is maintained by Amendment 1.

1.3.4 CITY OF ARMADALE LOCAL PLANNING STRATEGY

The City's local planning strategy was endorsed in 2016 and is currently under review. Preparation of a draft local planning strategy occurred between May-November 2022, with Council consideration of the new draft strategy set to occur in the first half of 2023.

The strategy identified the structure plan area as an urban development area, in recognition of its strategic location and capability to support population growth through urbanisation. The structure plan is consistent with the strategy. The amendment would further support population growth by delivering essential support services on land which is suitably located and of an appropriate size.

The local planning strategy contains a retail needs assessment for the municipality, which was reviewed and updated as part of the Armadale Retail (Commercial) Centres Strategy in 2020. The updated retail strategy is addressed in the subsequent section of this amendment report.

1.3.5 ARMADALE RETAIL (COMMERCIAL) CENTRES STRATEGY 2020

The City's Retail (Commercial) Centres Strategy was prepared in 2019 and adopted in 2020, and outlines the City's framework for activity centres within the municipality.

The strategy identifies a local centre on Anstey Road (38 – Anstey Road), associated with land which is now approved for the development of a drive-through fast food outlet and service station at Lot 400 (12) Anstey Road & Lot 800 (799) Armadale Road which adjoin the subject site. The strategy provides an upper limit of 500sqm for shop-retail floorspace for this local centre.

The objectives outlined in Section 4.1 of the strategy have been given due consideration in formulating this amendment, with the most important objectives being *4.1.1 Retail Hierarchy* and *4.1.2 Activity*, which are extracted below:

4.1.1 Retail Hierarchy - Ensure centres are appropriately distributed to meet community needs.

1. Distribute activity centres to meet different levels of community need and enable employment, goods and services to be accessed efficiently and equitably by the community.
2. Apply the activity centre hierarchy as part of a long-term and integrated approach by public authorities and private stakeholders to the development of economic and social infrastructure.
3. Plan activity centres to support a wide range of retail and commercial premises and promote a sustainable retail and commercial market.

4.1.2 Activity - Support centres to transition from a transactive platform to an experienced one.

4. Increase the range of employment in activity centres and contribute to the achievement of sub-regional employment self-sufficiency targets.
5. Increase the density and diversity of housing in and around activity centres to improve land efficiency, housing variety and support centre facilities.
6. Ensure activity centres provide sufficient development intensity and land use mix to support high-frequency public transport.

A comparison between the strategy and the retail analysis prepared as part of this amendment (**Appendix 5**) shows some key differences which are likely a result of:

- The strategy providing a broader City-wide evaluation of demographic data which informed the resultant outcomes of activity centre performance.
- The point in time that the strategy was prepared (pre-March 2020), which may not have been able to consider the transitional nature of the Anstey-Keane

Urban Development precinct (noting most of the structure planning was endorsed shortly after the strategy).

- The localised examination provided by the RNA and Impact Test for this amendment, which also had the benefit of completed structure plans and more up-to-date data which may have been influenced by changes in economic activity since early 2020.

The strategy characterises the area surrounding Centre 38 – Anstey Road as being surrounded by *"Residential R12.5/25, Rural Living 1 and 4 and large areas of Parks and Recreation Regional"*, which was likely indicative of the situation at the time the strategy was prepared. However, the three structure plans encompassing the Anstey-Keane Urban Development Precinct were endorsed by the WAPC in 2020, and have set greater densities ranging from R25-R60 affording more urbanised and concentrated population growth throughout the area.

The RNA and Impact Test provides an examination which is more localised with detailed consideration of the characteristics of the defined trade area, and is based on some data which was from after 2020 (referring to the source citations throughout the RNA and Impact Test report). The results of the RNA and Impact Test determine that a local centre of up to 1,500sqm shop-retail floorspace on the subject site is supportable both in the immediate term, and after 2027 when other centres in the trade area are either expanded or fully developed. Key observations as part of the retail assessment which underpin retail demand projections include:

- An age profile encompassing a noticeably higher concentration of working-age adults with young children within the trade area, compared to the Greater Perth average. The difference is considerable, with 0-4 year olds at 12% versus 6.5% and 29-34 year olds at 13% versus 8%.
- A significant increase in house sales within Forrestdale at 170% in 2021, with the median sales price of houses decreasing by 20%.
- Dwelling delivery projections for Forrestdale showing continued delivery of housing after 2023, with forecast development peaking in 2031. The total number of dwellings within the defined trade area is expected to increase steadily between 2022 and 2037, from 10,314 to 17,000.
- Trade area income demographics indicating 14% higher 'fourth quintile' income than the Greater Perth average.

The RNA and Impact Test included consideration of impacts to other centres in the defined 5km trade area, and included the small mixed commercial development at Lot 400 (12) Anstey Road & Lot 800 (799) Armadale Road. The assessment demonstrates that the amendment site is entirely capable of supporting 1,500sqm of shop-retail floorspace independent of the adjoining land. At 1,500sqm of shop-retail floorspace, the proposed local centre at the site was shown to be viable over the 15 year horizon with centre productivity remaining above benchmarks between 2022 and 2037.

The proposed amendment meets the key objectives outlined in Section 4.1 of the strategy.

1.3.6 STATE PLANNING POLICY 3.7 PLANNING IN BUSHFIRE PRONE AREAS

State Planning Policy 3.7 Planning in Bushfire Prone Areas seeks to implement risk-based land use planning and development practices to preserve life and reduce the impact of bushfire on property and infrastructure.

The structure plan area is identified as 'bushfire prone'. A bushfire management plan was prepared as part of the original structure plan for the area which remains relevant/applicable. The proposed change in zoning does not affect the implementation of asset protection zones, interface treatments or create additional bushfire risk for the construction of dwellings within 100m of bushfire prone vegetation.

A more detailed bushfire management plan will be prepared at development application stage when the development layout is formalised, which further addresses SPP3.7 and the associated guidelines.

1.3.7 STATE PLANNING POLICY 4.2 ACTIVITY CENTRES

SPP4.2 aims to ensure planning and development adequately considers the distribution, function and broad land use options for activity centres to meet local community needs, and provide social, economic and environmental benefits to the community.

The WAPC undertook a review of SPP4.2 in 2020. A key change resulting from the updated policy is guidance on the preparation and assessment of Needs Assessments and Impact Tests.

In accordance with the policy measures of SPP4.2, a proposal to amend a structure plan involving an increase of shop-retail floorspace should be assessed against policy objectives and ensure it delivers *"net community benefit and does not lead to a loss of service to the community"*.

As the proposal seeks to change the zoning of the amendment site to Local Centre with a maximum shop-retail floorspace allocation of 1,500sqm, Needs Assessment and Impact Test assessments are required in accordance with Section 7.8 and 7.9 of SPP4.2.

The Needs Assessment and Impact Test prepared by Pracsys addresses the key requirements of SPP4.2 and associated implementation guidelines, demonstrating the viability and supportability of a local centre on the site with 1,500sqm shop-retail floorspace.

A range of policy measures associated with land-use mix, employment, urban form, movement and access are also set out within Section 7 of the policy. These measures appear to be focused on larger scale activity centres, though the key principles can be applied to a local centre. In this regard:

- Land uses - the land use mix for the subject site is likely to be comprised of an anchoring shopping facility with associated non-retail uses complementing the anchor use. An example of such a mix could be a small shopping facility with

speciality stores, café and medical uses. The land use mix will be confirmed once the development vision is properly formulated.

- Employment – the establishment of a local centre on the site will create a local employment hub for local residents, complementing the approved childcare facility and other non-residential uses approved near the site and this would be strengthened by the fact the site is within convenient walking distance of the surrounding communities.
- Urban form – the urban form of the proposed local centre aligns with the local road network originally formulated as part of the local structure plan for the area. The layout, development typology, and built form approach for the ultimate development on the site will give due consideration to the neighbouring properties, the public realm, and the ten principles set out by *State Planning Policy 7.0 Design of the Built Environment*.
- Movement and access – the positioning of the proposed local centre and its co-location with other approved urban support services is likely to create multi-use trips on the surrounding road network and reduce vehicle dependence by establishing a local facility for the residents of the Anstey-Keane Urban Development Precinct in a highly accessible and well-connected setting.

In view of the above, the proposed change in zoning to facilitate a local centre on the site is consistent with the policy measures of SPP4.2.

1.3.8 OTHER APPROVALS AND DECISIONS

The amendment site adjoins land which is approved and will be developed for non-residential purposes, depicted on the vision plan provided at **Appendix 1**. These include:

- Adjoining Lot 700 (30) Anstey Road, which is approved for a 92-place childcare facility. The landowner of this lot is actively progressing the delivery of the childcare facility.
- Adjoining Lot 400 (12) Anstey Road & Lot 800 (799) Armadale Road, which are approved for a service commercial development comprising a drive-through fast food outlet and service station. The development approval process followed a scheme amendment process, whereby the zoning of the land was changed to Local Centre. The landowner of these lots is actively progressing the delivery of this development.

The co-location of a local centre on the amendment site with the approved developments explained above is appropriate, as the uses are complementary and can offer an integrated/vibrant urban setting for local residents.

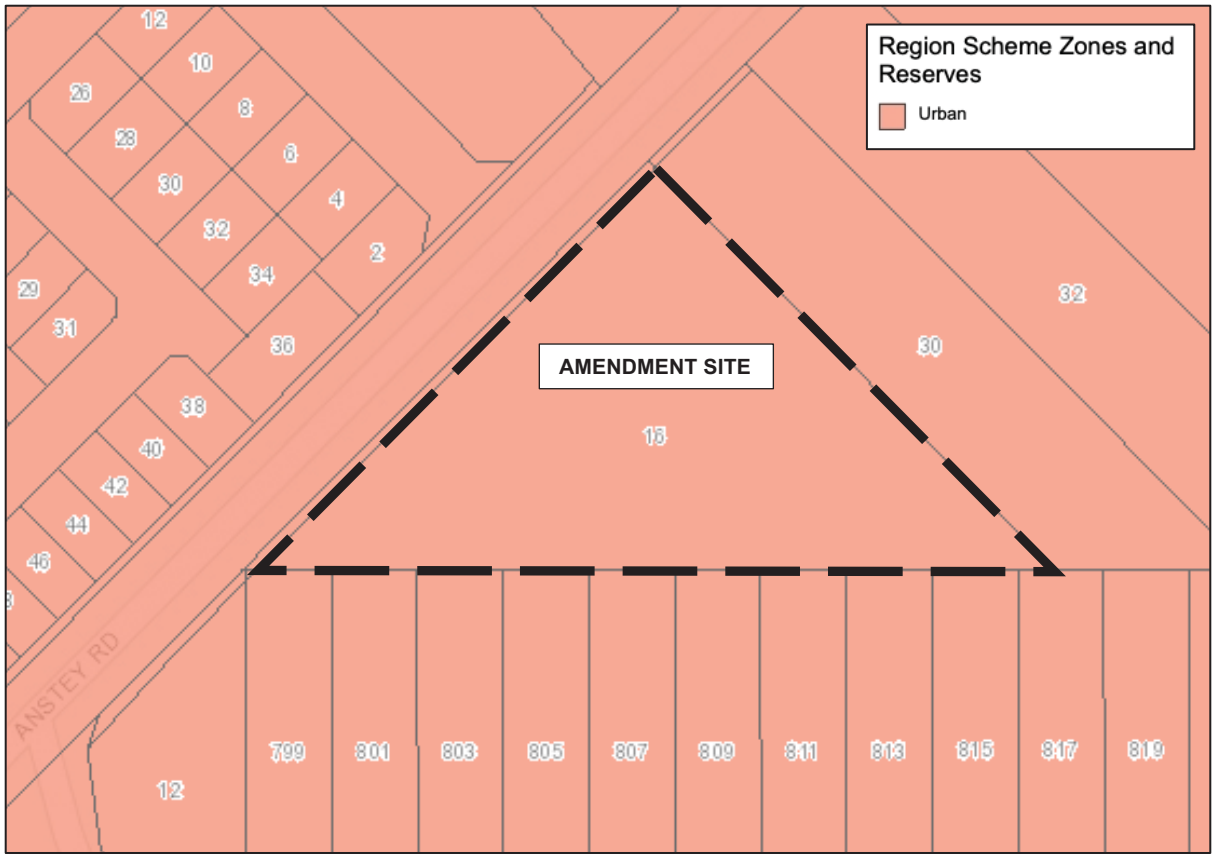


Figure 3: MRS zoning

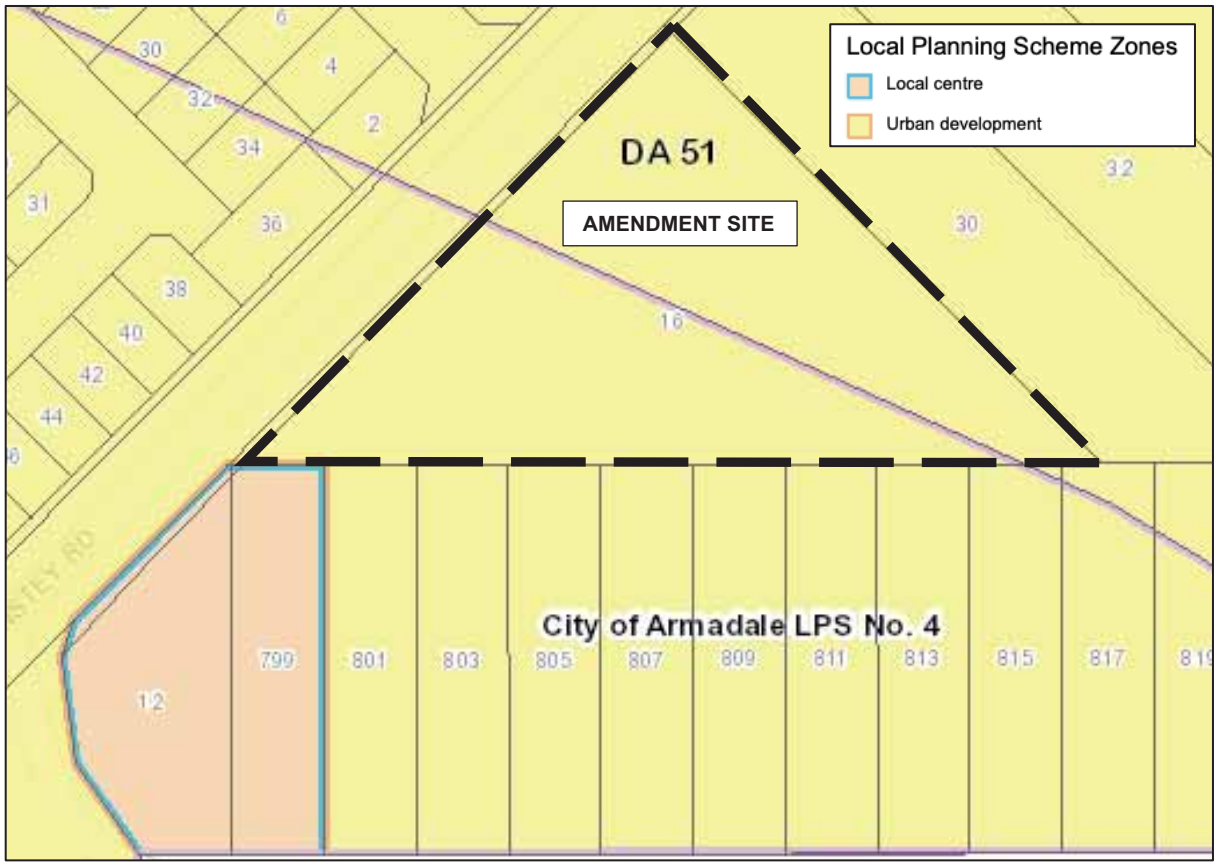


Figure 2: LPS4 zoning

2 SITE CONDITIONS AND CONSTRAINTS

The information presented in relation to site conditions and constraints within Section 2 of the explanatory report of the original structure plan remain relevant/applicable, demonstrating the structure plan area and amendment site are suitable for urban development.

Additional information is provided in the following sections as relevant to Amendment 1 and its relationship to the structure plan.

2.1 HYDROLOGY

The management of ground and surface water was addressed within a Local Water Management Strategy (**LWMS**) as part of the original structure plan. The LWMS demonstrated that hydrology is not a constraint to urban development.

Pentium Water was engaged to consider any changes to hydrology/drainage as a result of a local centre on the site, and to document this in an addendum to LWMS previously prepared for the Anstey-Keane East area. The addendum is provided at **Appendix 3**.

The addendum demonstrates that rainfall runoff, drainage, and treatment of runoff associated with the local centre will be consistent with the Residential R25 scenario originally considered for the amendment site. As a result, the stormwater management detailed in the original LWMS will not be impacted by the proposed amendment.

2.2 BUSHFIRE

A bushfire management plan was prepared for the structure plan, in accordance with the requirements of *State Planning Policy 3.7 Planning in Bushfire Prone Areas* and its guidelines.

The proposed change in zoning does not affect the implementation of asset protection zones, interface treatments or create additional bushfire risk for the construction of dwellings within 100m of bushfire prone vegetation.

A more detailed bushfire management plan will be prepared at development application stage when the development layout is formalised, which further addresses SPP3.7 and the associated guidelines.

3 LAND USE AND SUBDIVISION REQUIREMENTS

3.1 LAND USE

The original structure plan report sets out the land use, residential densities, POS, public and private transport provision, environmental considerations, and servicing requirements.

The structure plan comprises primarily Residential development with density codes ranging from R25 to R60, with a projected yield of approximately 650-670 dwellings across the structure plan area. The structure plan also comprised various Parks & Recreation reserves, a Public Purposes reserve (Primary School), and land at the eastern end of the area allocated as Industrial Business.

The amendment site (a single landholding identified as Lot 500 of approximately 8,797sqm) is proposed to be rezoned from Residential R25 to Local Centre with a maximum shop-retail floorspace allocation of 1,500sqm. A vision plan is provided at **Appendix 1** of this report which illustrates the proposed amendment in relation to the planned surroundings of the amendment site.

The rezoning of the amendment site to Local Centre is intended to facilitate the establishment of a small shopping facility with maximum 1,500sqm of shop-retail floorspace and some non-retail support uses to meet the day-to-day needs of the local area, consistent with those uses contemplated in the Local Centre zone under LPS4.

The Local Centre zone is appropriate for the site, noting it is a zone which is intended to be integrated within an urban neighbourhood setting to ensure it has strong links with the community it is intended to serve.

3.2 LOCAL CENTRE ZONE

The purpose of this structure plan amendment is to facilitate a future local centre development on the amendment site. The objectives of the Local Centre zone as set out by Clause 3.2.5 of LPS4 are extracted below for reference:

> 3.2.5 *Local Centre*
>
> a) To provide for a limited range of shopping and community services to meet the day-to-day needs of individual neighbourhoods.
>
> b) To ensure the design and landscaping of development provides a high standard of safety and amenity and contributes towards a sense of place and community within the local neighbourhood.

The proposed rezoning of the site to Local Centre is intended to facilitate the establishment of a small shopping facility with 1,500sqm of shop-retail floorspace and some non-retail support uses to meet the day-to-day needs of the local area. The ultimate design, landscaping and built form approach of the local centre will give regard to the Local Centre zone objectives and strengthen the fabric of the Anstey-Keane Precinct.

The establishment of a local centre on the site will provide residents of the Anstey-Keane area with a local shopping facility, preventing the need to drive out of the precinct to access daily shopping needs in other areas. The locality will contain district dual use paths and footpaths throughout the local road network, enhancing opportunities for residents to walk to the local centre. The amendment site is appropriately located to accommodate a local centre, noting it is:

- Located along a planned Neighbourhood Connector A/B road with good connectivity to the wider Anstey Keane area via a network of neighbourhood connector and local access streets. In this regard, the subject site has the advantage of containing future local roads connecting eastward into the Mahala Estate.
- Approximately 120m from the roundabout intersection of Anstey Road and Armadale Road, with good accessibility to the regional road network.
- Co-located with approved non-residential developments on both sides of the site, building upon the provision of key urban support services for the growing community.
- Adjacent to a large, planned POS area on the northern side of Anstey Road.
- Within convenient walking distance of the Mahala Estate, Anstey Grove Estate, and Solaris Estate.

3.3 RESIDENTIAL

Based on the range of densities (R25-R60) and the extent of residential land allocated throughout the structure plan area, the original structure plan had the potential to create approximately 650-670 residential lots.

The estimated lot yield resulted in approximately 26.6 dwellings per residential site hectare, which exceeds the minimum required by Perth and Peel @ 3.5 million (being 26 dwellings per residential site hectare).

The change in zoning from Residential R25 to Local Centre as part of this amendment would only marginally change the estimated yields under the original structure plan, originally estimated as 650-670 lots and 675-695 dwellings.

The resulting estimated residential site density is approximately 27.5 dwellings per residential site hectare.

3.4 PUBLIC OPEN SPACE

The structure plan creates a framework for the delivery of public open space serving a range of functions within the structure plan, balancing active and passive recreational pursuits and delivering key drainage objectives. The public open space areas for the structure plan are depicted on Plan 1. No changes are proposed to the public open space arrangements under the structure plan as part of this amendment.

With the proposed change in zoning from Residential R25 to Local Centre in relation to a 0.88ha site, the total public open space provision of 4.4ha represents 10.8% of gross subdivisible area (if the Local Centre zone is taken as being 'commercial land'). **Table 2** below contains a public open space schedule with the slightly adjusted figures.

Gross site area (within structure plan boundary)			**48.03**
Less			
Commercial land	2.07		
Primary school site	4.00		
Drainage reserve (Keane Road)	0.35		
1 year storm event (district flows – Bailey Brance Drain)	0.70		
Total		**7.12**	
Net Site Area			**40.91**
Deductions			
Total drainage area up to 1:1 year event	0.23		
Total		0.23	
Gross subdividable area			**40.68**
POS @ 10%		**4.068**	
POS contribution			
Minimum 80% unrestricted POS	3.25		
Maximum 20% restricted POS able to be credited	0.82		
Unrestricted open space			
Local park 1	0.34		
Local park 2	0.52		
Living stream corridor	2.74		
Total unrestricted use		**3.58**	
Restricted open space			
Drainage area between 1:1 and 1:5 year events not exceeding 20% of total open space area	0.82		
Total restricted use open space		**0.82**	
Summary of POS			
Minimum unrestricted open space required	3.25		
Unrestricted open space provided	3.55		
Maximum restricted open space required	0.82		
Restricted open space provided	0.82		
Total POS provision			**4.40**
Total POS provision as % of gross subdividable area			**10.8%**

3.5 BUSHFIRE MANAGEMENT

The structure plan was supported by a bushfire management plan which included a post-development bushfire hazard assessment. The original structure plan report provided a description of the bushfire risk reduction strategies for the area.

The proposed change in zoning from Residential R25 to Local Centre does not change the outcomes of the bushfire assessment, and does not prevent the ability for any of the risk reduction measures to be completed or adhered to on an ongoing basis.

A more detailed bushfire management plan will be prepared at the development application stage, once a development proposal is formulated for the local centre site.

3.6 MOVEMENT NETWORK

The structure plan was supported by a Traffic Impact Assessment, which forecast traffic volumes and set out a recommended road network hierarchy to support the growth of the structure plan area.

Insofar as relevant to the amendment site, Anstey Road is proposed to operate as a Neighbourhood Connector A offering a linkage to Armadale Road, transitioning to a Neighbourhood Connector B and creating connectivity through the structure plan area via an internal spine road (also Neighbourhood Connector B) which leads to Allen Road. The planned local road network includes two future local roads connecting eastward into the Mahala Estate to ensure strong linkages to the wider structure plan area. A district dual use path and series of footpaths throughout the road network will create pedestrian connectivity to the site, allowing inhabitants of the Anstey-Keane area to walk to the local centre site.

The proposed change in zoning for the amendment site has been considered in a revised TIA, which is provided at **Appendix 4.**

No changes are proposed to the movement network set out by the structure plan as part of this amendment. The revised TIA considers the proposed rezoning in context of the ultimate road network conditions for the locality and assesses the estimated change in traffic generation from what was formerly Residential R25 to a local centre with a conservative assumption of 1,500sqm shop-retail and 500sqm of non-retail commercial.

The traffic generation assessment contained in the TIA indicates the expected future total traffic volumes are expected to:

- Remain the same on Armadale Road (west of Anstey Road).
- Decrease by 300vpd on Armadale Road (east of Keane Road).
- Decrease by 200vpd on Keane Road (south).
- Increase by 100vpd on Anstey Road (north of the site).
- Decrease by 600vpd on Anstey Road (south of the site).

The TIA therefore demonstrates an improved outcome on the road network as a result of the proposed change in zoning from Residential R25 to Local Centre for the amendment site.

3.7 WATER MANAGEMENT

The structure plan was designed to accommodate the principles of best practice urban water management through the integration of stormwater detention and infiltration within areas of POS, as well as converting the existing Baileys Branch Drain to a living stream within a multiple use corridor as a feature of the locality.

A LWMS was prepared for the structure plan, which has been reviewed based on the proposed change in zoning from Residential R25 to Local Centre for the amendment site.

An addendum to the LWMS has been prepared by Pentium Water (provided at **Appendix 3**), which confirms no change to the LWMS strategies would result from the change in zoning.

3.8 ACTIVITY CENTRES

The change of zoning from Residential R25 to Local Centre would facilitate the establishment a small local activity centre on the amendment site, with a shop-retail floorspace allocation of 1,500sqm.

It is noted that the Southern River / Forrestdale / Brookdale / Wungong District Structure Plan provided for a local activity centre within the Anstey Road precinct (located roughly in the same location as the amendment site), and noted that the amount of retail floorspace would require definition at the detailed planning stage.

A Retail Needs Assessment (**RNA**) and Impact Test has been produced by Pracsys, provided at **Appendix 5**.

The RNA and Impact Test was prepared in accordance with the requirements of draft *State Planning Policy 4.2 Activity Centres* to consider whether there is sufficient demand for a local centre at the subject site, and the level of shop-retail floorspace which would be supportable based on surrounding activity centre distribution and future population growth.

The local population is likely to expand significantly within the catchment around the proposed local centre over the 10 year horizon due to the ongoing urbanisation of these areas. The trade area population was found to have relatively high incomes that are likely to support increased disposable expenditure.

The RNA conservatively considers planned expansions of existing centres and new retail developments within the defined trade area which would also contribute toward meeting the demand of the trade area population, although this particular local centre is strategically positioned to cater for the daily shopping needs of the Anstey-Keane area.

The RNA identified that up to 1,500sqm of shop-retail floorspace would be supportable at the site in the immediate term, with this level of floorspace remaining viable once competing centres are either expanded or developed by 2027. This assessment included the fast food and service station development on the land immediately to the west.

The Impact Test has shown that estimated impacts are well below the "significant impact" thresholds set out by draft *State Planning Policy 4.2*, and that the sustainability of the centre hierarchy will be preserved.

3.9 SERVICING

The structure plan is supported by an engineering servicing report which outlined the servicing arrangements associated with earthworks, sewer, water, gas, and telecommunications. This included servicing for the amendment site.

The delivery of essential services infrastructure is a key component of the development contribution framework for the structure plan area, which is addressed in the subsequent section of this amendment report.

3.10 DEVELOPMENT CONTRIBUTION PLAN 4 (**DCP4**)

In accordance with the City of Armadale LPS4, the structure plan area is within Development Contribution Area No.4 (**DCA4**).

Development Contribution Plan 4 (**DCP4**) was incorporated into the Scheme by virtue of Amendment 102 which was gazetted in February 2021, which sets out the development contribution arrangements for the structure plan area for various infrastructure items, including:

- Community infrastructure (sporting and community)
- Movement network items (Anstey Road, Keane Road, shared path network)
- Baileys Branch Drain and surrounds
- Wastewater pump station
- ATCO high pressure gas pipeline

The proposed amendment does not alter or change the arrangements under DCP4.

APPENDIX 1

VISION PLAN

Vision Plan (Amendment – Anstey-Keane Urban Development Precinct East Structure Plan)	NORTH	**Drawn:** Alessandro Stagno **Rev:** 0
Lot 500 (16) Anstey Road, Forrestdale		**Source:** MNG Access **Date:** 9 March 2023 apex planning

APPENDIX 2

CERTIFICATE OF TITLE

WESTERN AUSTRALIA

REGISTER NUMBER	
500/DP421600	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
1	**22/6/2022**

VOLUME **4021** FOLIO **400**

RECORD OF CERTIFICATE OF TITLE

UNDER THE TRANSFER OF LAND ACT 1893

The person described in the first schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the second schedule.

BGRoberts

REGISTRAR OF TITLES

LAND DESCRIPTION:

LOT 500 ON DEPOSITED PLAN 421600

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

CEDARVILLE PTY LTD OF 19 EZE TERRACE HILLARYS WA 6025

(AF P175738) REGISTERED 9/6/2022

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.
Lot as described in the land description may be a lot or location.

----------END OF CERTIFICATE OF TITLE----------

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND:	DP421600
PREVIOUS TITLE:	513-141A
PROPERTY STREET ADDRESS:	16 ANSTEY RD, FORRESTDALE.
LOCAL GOVERNMENT AUTHORITY:	CITY OF ARMADALE

APPENDIX 3

ADDENDUM TO LOCAL WATER MANAGEMENT STRATEGY

PENTIUM WATER

ANSTEY-KEANE EAST, FORRESTDALE

Local Water Management Strategy Addendum

CEDANST_01

09/12/2022

Document Status

Version	Purpose of document	Authored by	Reviewed by	Review Date
Rev 0	Final	GerEdw	ShaMcS	1/11/2022
Rev 1	Final	GerEdw	ShaMcS	9/12/2022

Approval for Issue

Name	Signature	Date
Shane McSweeney		9/12/2022

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Version: Rev 1

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(Compiled within report)

1. Introduction

Cedarville Pty Ltd are the current landowners of Lot 500, 16 Anstey Road, Forrestdale ("the site") (Figure 1 and Appendix A).

The site is 0.88 ha in size, located within the Anstey-Keane East Structure Plan (SP) and the nominated landuse zoning is Residential R25 and road reserve (Figure 2).

Cedarville seek an amendment to the SP to support a change in landuse zoning within the site from Residential R25 to Local Centre. The intent of the amendment is to facilitate a small-scale shopping centre development. A vision plan which shows the new zoning allocation of the site and includes information from the other surrounding structure plans in the locality is attached as Appendix C.

To support the SP amendment the City of Armadale have requested a high-level drainage assessment be undertaken to evaluate any change or impact to the approved Local Water Management Strategy (LWMS) that the proposed change in landuse zoning may have.

This LWMS addendum was prepared to support the SP amendment application and demonstrates that the proposed change in landuse zoning will not have any impact to the stormwater management that is proposed in the LWMS.

Figure 1: Site location

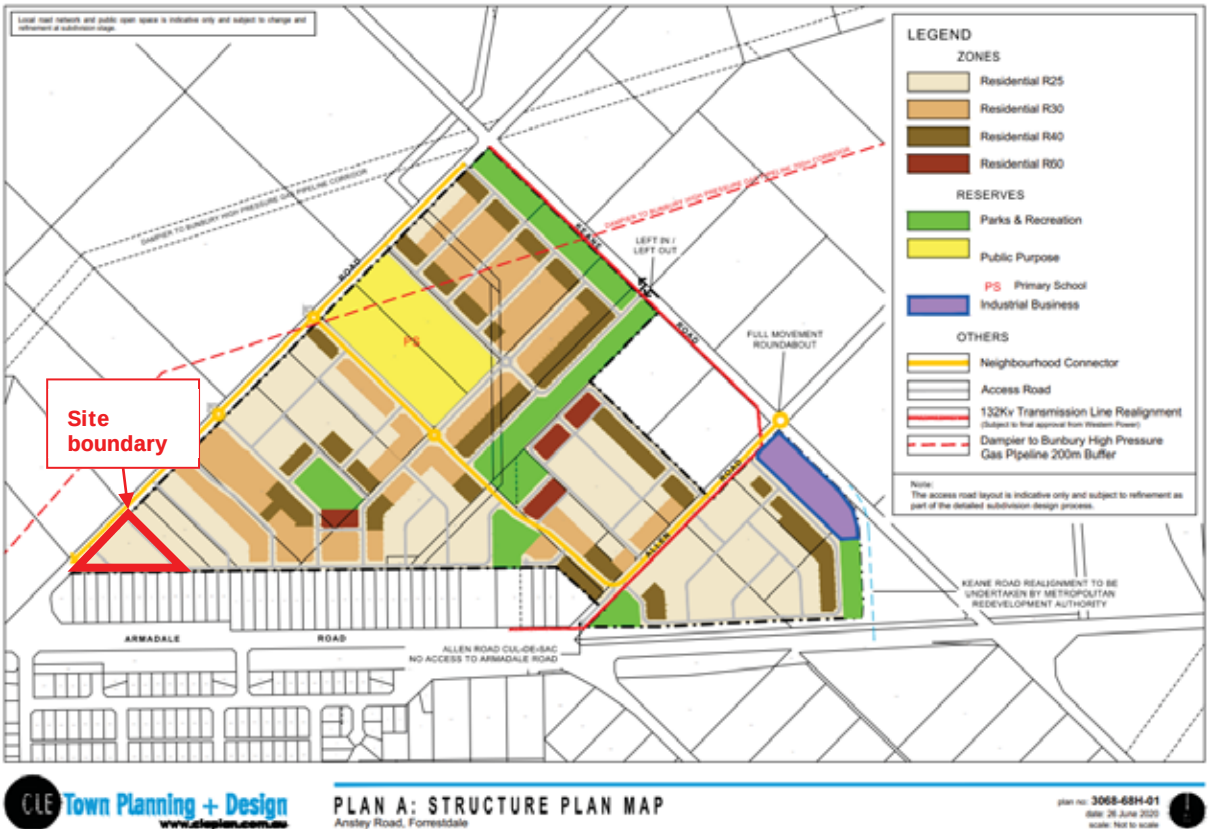


Figure 2: Approved structure plan

2. Local Water Management Strategy

The *Anstey Road East, Forrestdale, Local Water Management Strategy* was prepared by Hyd2o (2019) on behalf of PRM Property Group to support the SP application (Appendix B).

The site is located within subcatchment 1a, which is 2.61 ha in size and consists of 0.79 ha of road reserve, 1.51 ha of R25 residential lots and 0.31 ha of Public Open Space (POS) (Figure 3).

The LWMS detailed stormwater management aspects including subcatchment areas, stormwater management and bioretention treatment. Key stormwater management proposed in the LWMS are summarised below.

First 15 mm of rainfall

The first 15 mm of rainfall runoff generated from road reserve areas located within subcatchment 1a is proposed to drain into the bioretention basin located in the POS. The location of the bioretention area is shown to be in the east of subcatchment 1a and not within the site (Figure 3).

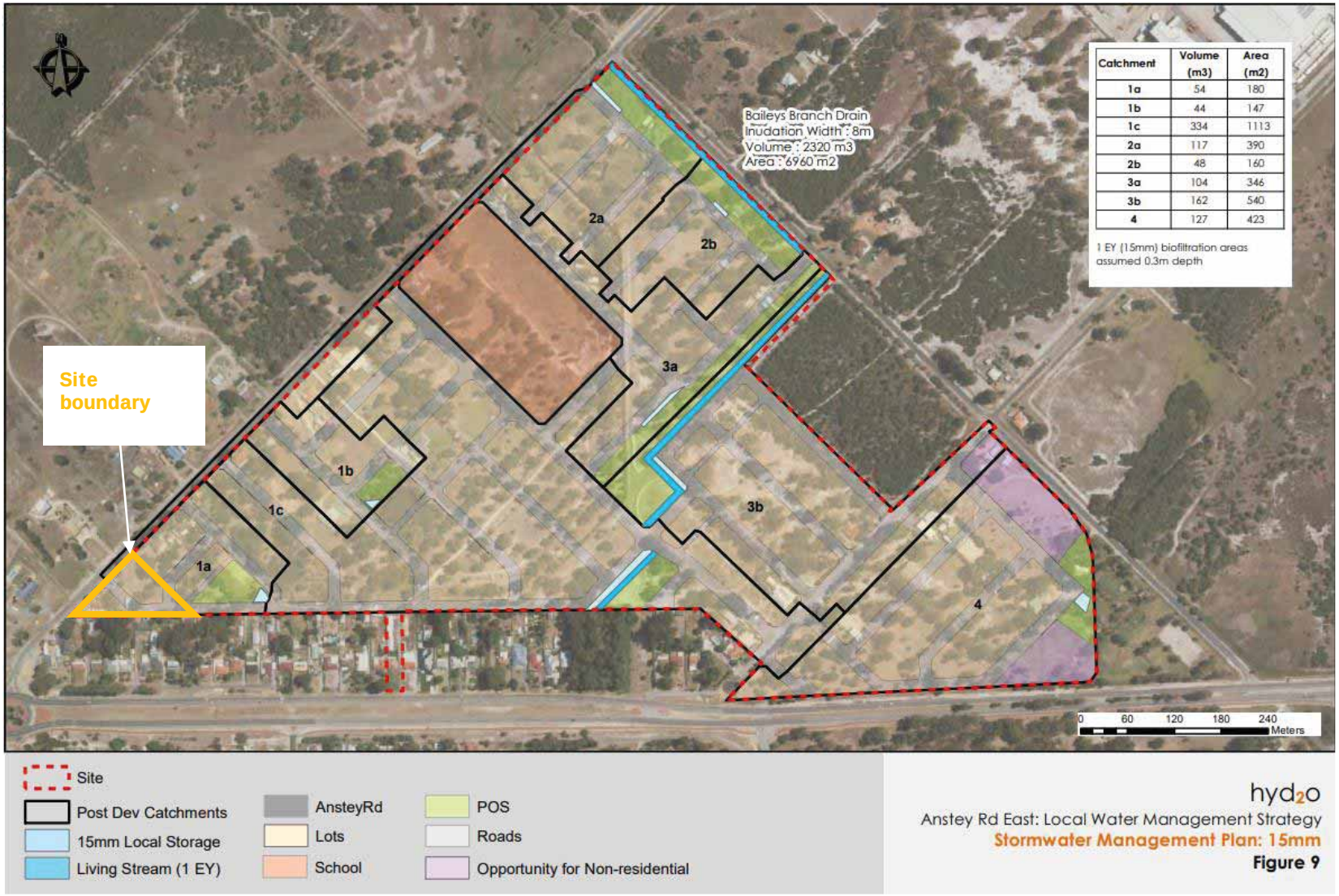
The first 15 mm or rainfall runoff generated within R25 residential lots within the site is proposed to be infiltrated via soakwells within each lot.

20% AEP event

In larger storm events, up to the 20% Annual Exceedance Probability (AEP) event, runoff from road reserve areas and R25 residential lots is proposed to be conveyed via the roadside pipe and pit network, and discharge directly into Baileys Branch Drain (Figure 4).

1% AEP event

In the 1% AEP storm event, additional runoff from road reserve and R25 residential lots is proposed to be conveyed within the road reserves and discharge directly into Baileys Branch Drain (Figure 5).



Catchment	Volume (m3)	Area (m2)
1a	54	180
1b	44	147
1c	334	1113
2a	117	390
2b	48	160
3a	104	346
3b	162	540
4	127	423

1 EY (15mm) biofiltration areas assumed 0.3m depth

Figure 3: First 15 mm of rainfall runoff to local storage area detailed in the LWMS (Hyd2o 2019)

Figure 4: 20% AEP pipe and pit drainage detailed in the LWMS (Hyd2o 2019)

Figure 5: 1% AEP overland flow detailed in the LWMS (Hyd2o 2019)

3. Amendment to the SP and LWMS

The proposed amendment to the SP seeks to change the zoning of R25 residential lots within the site to Local Centre. No change is proposed to road reserve zoned landuse types within the site.

Rainfall runoff generated within Local Centre areas will be managed consistent with that proposed for R25 residential areas as detailed in the LWMS, and is summarised below:

- Soakwells will be installed within each lot that are sized to infiltrate the first 15 mm of rainfall runoff.
- In larger storm events, up to the 20% AEP event, runoff will be conveyed via the roadside piped drainage network and discharge directly into the Baileys Branch Drain.
- In the 1% AEP event, additional runoff will be conveyed within the road reserves and discharge directly into Baileys Branch Drain.

Drainage and treatment of runoff generated within road reserve zoned landuse areas will be consistent with the LWMS and will not be impacted by the proposed SP amendment.

Similarly, drainage and treatment of runoff generated within Local Centre zoned areas will be consistent with that proposed for R25 residential lots, and therefore the stormwater management detailed in the LWMS will not be impacted by the proposed SP amendment.

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Appendix A: Structure Plan Map (CLE Town Planning and Design 2020)

CLE Town Planning + Design
www.cleplan.com.au

PLAN A: STRUCTURE PLAN MAP

Anstey Road, Forrestdale

plan no: **3068-68H-01**
date: 26 June 2020
scale: Not to scale

N

Appendix B: Local Water Management Strategy (Hyd2o 2019)

Anstey Rd East, Forrestdale

Local Water Management Strategy

October 2019

Client: PRM Property Group

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Disclaimer

Executive Summary

Hyd2o was commissioned by PRM Property Group to compile this Local Water Management Strategy (LWMS) to support the Metropolitan Region Scheme and Town Planning Scheme amendment and development concept plan proposed for 26 landholdings along Anstey Road and Keane Road in the suburb of Forrestdale (the site).

The site is approximately 49 ha in size and located approximately 21 km south east of the Perth CBD in the City of Armadale (Figure 1).

The conceptual subdivision plan for the site has been prepared by CLE Town Planning & Design. The proposed development of the site has considered the predevelopment environment, and this information has been used to inform and guide concept planning.

A key element of water management post development will be the realignment and establishment of Baileys Branch Drain as a living stream within a multiple use corridor.

This document has been prepared in accordance with the principles and objectives of Better Urban Water Management (Western Australian Planning Commission, 2008) and the Department of Water's Forrestdale Main Drain Arterial Drainage Strategy (DoW, 2009b).

Implementation of the strategy will be undertaken in accordance with Better Urban Water Management through the development and implementation of urban water management plans for individual stages of development within the site.

1. Introduction

Hyd2o was commissioned by PRM Property Group to prepare this Local Water Management Strategy (LWMS) to support the Metropolitan Region Scheme and Town Planning Scheme amendment and development concept plan proposed for the following lots (herein referred to as the site):

- Lots 48-55, 84, 86 and 87 Anstey Rd,
- Lots 10, 43, 44, 47, 60, 80 and 81 Keane Rd,
- Lots 5-8, 39, 41, 42 and 57 Allen Rd,
- Lot 58 Armadale Rd.

The site is approximately 49 ha in size and located approximately 21 km south east of the Perth CBD in the City of Armadale (Figure 1). The site is bordered by Keane Rd to the north east, Anstey Rd to the north west and a number of small residential lots fronting Armadale Rd to the south.

The development concept plan for the site has been prepared by CLE Town Planning & Design and is included as Figure 2. The proposed development is predominately urban residential consisting of residential lots, associated roads, public open space and stormwater management areas. The plan also provides some areas to the east for non-residential opportunities.

The proposed development of the site has considered the predevelopment environment and used this information to inform the development of the concept subdivision plan.

This LWMS provides an integrated total water cycle management approach to the development of the subdivision guide plan, with an assessment of the pre-development environment, development of water use sustainability initiatives, a stormwater management strategy, a groundwater management strategy and a plan for implementation.

A copy of the Better Urban Water Management (WAPC, 2008) LWMS Checklist for Developers is included as Appendix A to assist the Department of Water and Environmental Regulation (DWER) and City of Armadale (CoA) in review of this document.

1.1 Planning Context

The site is currently zoned 'Urban' under the Metropolitan Region Scheme and zoned as 'Rural Living' under the City of Armadale Town Planning Scheme Number 4 (Department of Planning, 2005).

The site is located with the Southern River District Structure Plan (DSP) area. The DSP covers a 6,500 ha area and proposes residential, industrial and neighbourhood centre development, as well as retention of existing rural and conservation areas.

The urban water management planning process for the site is shown in Table 1. This LWMS supports the proposed application for a City of Armadale Town Planning Scheme amendment to 'Urban'.

Table 1: Urban Water Management Process

Planning Phase	Planning Document	Urban Water Management Documents
District	MRS Scheme Amendment	Anstey/Keane Rd Forrestdale District Water Management Strategy (Hyd2o, 2017) **APPROVED**
Local	Town Planning Scheme Amendment	Anstey/Keane Rd Forrestdale Local Water Management Strategy **THIS DOCUMENT**
Subdivision	Subdivision Application	Urban Water Management Plan **FUTURE PREPARATION**

1.2 Key Documents

This LWMS uses the following key documents to define its principles, criteria, objectives, and implementation responsibilities:

- Anstey/Keane Road District Water Management Strategy (Hyd2o, 2017)
- Decision Process for Stormwater Management in WA (DWER, 2017)
- Draft Perth-Peel Green Growth Plan (Department of Planning, 2016)
- Forrestdale Main Drain Arterial Drainage Strategy (DoW, 2009b)
- Southern River Integrated Land & Water Management Plan (DoW, 2009a)
- Developing a Local Water Management Strategy (DoW, 2008)
- Better Urban Water Management (WAPC, 2008)
- Stormwater Management Manual for WA (DoW, 2007)
- Liveable Neighbourhoods Edition 4 (WAPC, 2007)
- Southern River/Forrestdale/Brookdale/Wungong Structure Plan – Urban Water Management Strategy (JDA, 2002)
- Southern River/Forrestdale/Brookdale/Wungong District Structure Plan (WAPC, 2001)

2. Proposed Development

The proposed development concept plan is shown in Figure 2.

The proposed development is predominately urban residential consisting of residential lots, associated roads, public open space (POS) and stormwater management areas. The site also contains a proposed primary school along Anstey Rd.

The plan also provides some areas to the east for non-residential opportunities.

The majority of POS has been proposed as a linear multiple use corridor to facilitate the redevelopment of the Water Corporation's Baileys Branch Drain as a living stream and provide regional flood storage requirements as specified as being required within the site in the Forrestdale Main Drain Arterial Drainage Strategy (DoW, 2009b).

The proposed realignment of the drain from its current location has been established with regard to other services constraints within the site, and to assist in providing a buffer between the site and the Forrestdale Business Park West to be located north of Keane Rd.

Discussions with agencies (CoA, DWER) and the downstream landowner (Cedar Woods) with regard to the realignment have been constructive and supportive, and will ensure the redeveloped drain will become a future community asset within the site. Further discussions regarding land matters for the drain and its transition from a rural drain to a living stream are discussed in Section 10 Implementation.

It is acknowledged and appreciated the drain will need to function without loss of performance across staged development. An indicative stage plan showing all stages of development is included with engineering drawings in Appendix Q. Specific details of any temporary measures will be provided at the relevant UWMP stage.

3. Design Criteria

Key design criteria for the site are shown in Table 2 and have been established consistent with criteria specified in the key reference documents previously detailed in Section 1.2. These design criteria are used to formulate the water management strategy for the site within the identified constraints and opportunities of the pre-development environment.

Table 2: Design Criteria

Strategy Elements	LWMS Method & Approach
Water Use Sustainability	
Water Efficiency	• 6 Star Building Standards (water efficient fixtures and fittings). • Maximising infiltration of stormwater where possible. • Use of superficial groundwater for POS irrigation.
Water Supply	• Rainwater tanks and Water Corporation IWSS for lots. • Irrigation bore for POS.
Wastewater	• Water Corporation reticulated sewerage.
Stormwater	
Flood Protection	• Post development flows and flood levels within Baileys Branch Drain to be consistent with Forrestdale Main Drain Arterial Drainage strategy (DoW, 2009b) for events up to 1% AEP event. • Provision of regional flood storage within Baileys Branch Drain as per Forrestdale Main Drain Arterial Drainage strategy (DoW, 2009b). • Flood storage to be integrated within POS. • Establish minimum habitable floor levels at 0.5m above the 1% AEP flood levels. • Overland flow paths within road reserves identified for safe conveyance of flows exceeding pipe drainage system capacity.
Serviceability	• Road drainage system to be designed so that roads will be passable in the 0.2 EY event. Opportunities for modified serviceability of piped drainage infrastructure to be assessed during civil design in consultation with CoA.
Ecological Protection	• Use of soak wells at lot scale to infiltrate the first 15 mm rainfall event. • Bioretention storages to retain first 15mm of road runoff. • Establishment of storage invert levels above seasonal maximum groundwater levels.
Nuisance Insect Management	• To reduce health risks from mosquitos, retention and detention treatments should be designed to ensure that immobile stormwater is fully infiltrated within a 96 hour time period.
Groundwater	
Fill Requirement & Subsoil Drainage	• Habitable floor levels to have clearance to groundwater and flood levels to be achieved by imported fill for building pads. • Subsoil drainage to manage groundwater post development. • Treatment for subsoil discharge to be provided either in situ or at the outlet prior to discharge.
Acid Sulphate Soils & Contamination	• If required, management of Acid Sulphate Soils to be handled as a separate process to LWMS consistent with DoE (2004) requirements.

4. Pre-Development Environment

4.1 Site Conditions

Figure 3 shows an aerial photograph with existing land use and topography.

The 49 ha site is located approximately 21 km south east of the Perth CBD. The site is largely cleared and used as rural lifestyle landholdings. There are two blocks characterised by native vegetation along Keane Rd, however both of these lots are excluded from the site.

There are small remaining patches of vegetation, a number of homes, sheds and small farm structures present across the site (Figure 3).

The site is traversed from south to north by Water Corporation's Baileys Branch Drain which forms part of the Forrestdale Main Drain Arterial Drainage System (DoW, 2009b). The drain's easement is approximately 15 m wide and 730 m in length.

The site is flat with topographic mapping for the site showing elevations ranging from 22 mAHD in the north of the site near the corner of Anstey Rd and Keane Rd to 24 mAHD in the south (Figure 3).

4.2 Geotechnical

Environmental geology mapping on the Armadale Part Sheet 2033 I and 2133 IV (Jordan, 1986) indicates the site is characterised by:

- S10 – SAND : white to pale grey at surface, yellow at depth, fine to medium-grained, moderately sorted, subangular to subrounded, minor heavy minerals of eolian origin. Over sandy clay to clayey sand of the Guildford Formation.
- Sp1 – PEATY SAND : grey to black, fine to medium-grained, moderately sorted quartz sand, slightly peaty, of lacustrine origin.

The majority of the site is mapped as sand, with some localised patches of peaty sand in the north of the site (correlated with multiple use wetland mapping) and in the south east of the site.

A geotechnical investigation was undertaken by JDSi Ground Engineering in May 2018 and is included as Appendix B. On 19 & 20 April, 2018 JDSi undertook a site investigation within the site. The investigation consisted of the excavation of 20 test pits, 20 sand penetrometer tests, four permeability tests and collection of soil samples for laboratory testing.

The test pits were excavated to a depth of 0.8m to 2.5 m below existing ground level. The location of the test pits are shown in Figure 4. Groundwater was only encountered in TP12, at approximately 1.9 m below ground surface. The subsurface conditions encountered in the test pits can generally be described as follows from natural surface to increasing depth:

- TOPSOIL : Ground surface to 0.3 m- A layer of topsoil or fill.
- SAND : 0.2m - >2m- Comprising of fine to medium grained, sub- rounded quartz. This layer was found in all locations.

- COFFEE ROCK : 0.8m-2.2m- This layer was encountered at test pits: TP6, TP8, TP14, TP15, TP16, and TP18. Test pits were refused above target depths.
- SILTY SAND : 0.5m- 1.8m- A silty sand layer interpreted as the Guildford Formation and comprising fine to medium grained sand and low plasticity clay fines and/or silt fines and traces of lateritic gravels. This was encountered in test pits TP1-TP4, TP7-TP10, TP13, and TP20.

Infiltration testing was undertaken using a falling head permeameter at four sites at a depth of 0.9m. Estimated minimum permeability was measured between 1.7 m/day and >10m/day across the site.

The preliminary classification of the site was "Class A" on sites where sand was present and "Class S" where sands were over Guildford Formation soils, alluvial soils or coffee rock.

In addition to geotechnical testing, Hyd2o installed seven groundwater monitoring bores on 5 April, 2016 across the site (Figure 4). Bores were installed to a depth of 4-5m below ground surface with the subsurface profile generally consistent with Jordan 1986.

Hyd2o lithological logs are included in Appendix C. The profile of all bores was sand with a fine to coarse texture, with the exception of AK4, which exhibited a number of layers of coffee rock, and bore AK2, which had sand to 1m, clayey sand to 1.5m and sandy clay to the end of hole at 3m depth.

4.3 Acid Sulphate Soils

Acid Sulphate Soil (ASS) is the common name given to naturally occurring soil and sediment containing iron sulfides. These naturally occurring iron sulfides are generally found in a layer of waterlogged soil or sediment, and are benign in their natural state.

When disturbed and exposed to air, however, they oxidise and produce sulfuric acid, iron precipitates, and concentrations of dissolved heavy metals such as aluminium, iron and arsenic. Release of acid and metals as a result of the disturbance of ASS can cause significant harm to the environment and infrastructure.

The presence of ASS has been a recognised issue of concern in Western Australia since 2003. The Department of Environment and Conservation (now DBCA) and the WAPC have released guidance notes on ASS, covering the requirement for assessing sites and the management of sites where ASS are identified.

ASS mapping is shown in Figure 4. Western Australian Planning Commission mapping identifies the site as having a moderate to low risk of ASS occurring within 3m of natural soil surface, with the exception of a portion in the northern corner and eastern portion of the site which have a high to moderate risk of ASS occurring within 3m of natural surface.

Should an ASS investigation be required to be undertaken at the site, this will be prepared separately to this LWMS.

4.4 Contaminated Sites

A search of the Department of Water and Environmental Regulation's Contaminated Sites database (accessed September 2018) indicates no known contaminated sites within the site.

4.5 Aboriginal Heritage Sites

A search of the Aboriginal Heritage Inquiry System (accessed September 2018) indicates that no Registered Aboriginal Heritage Sites are located within the site.

4.6 Wetlands

The Department of Biodiversity, Conservation and Attractions' mapping of Geomorphic Wetlands of the Swan Coastal Plain indicates that a portion of the site is classified as multiple use wetland (MUW) (Figure 5).

There are no Resource Enhancement Wetlands (REW) or conservation category wetlands (CCW) within the site.

Forrestdale Lake is located approximately 400 m south of the site. Forrestdale Lake a conservation category wetland and a Ramsar listed wetland, however both surface water and groundwater flow in a northerly direction away from the lake.

4.7 Surface Water

The major surface water feature of the site is the Water Corporation's Baileys Branch Drain which flows from north the south across the site (Figure 6). The drain is a tributary of the Forrestdale Main Drain which it joins approximately 2.3 km downstream of the site.

The Baileys Branch Drain is a steep sided trapezoidal drain located within a 15m wide strip of land owned by the Water Corporation. The drain is very flat with little grade and is inundated with groundwater during the winter period. Flow velocities within the drain are very low even during storm events (< 0.2 m/s).

The construction of the drain occurred sometime between 1965 and 1974, coinciding with the development of the Forrestdale townsite on the northern boundary of Lake Forrestdale. The drain conveyed stormwater from the urban developed area away from the lake and through rural land to Forrestdale Main Drain. The Baileys Branch Drain also currently acts as a groundwater control and will continue to do so post development. This is reflected in the site groundwater contours as detailed in Section 4.8.

By June 1977, the Dumsday Compensating Basin on the southern side of Armadale Rd was constructed, and some realignment of the Bailey Branch Drain to its current alignment also occurred at that time.

The Dumsday Compensating Basin then moved to its current location in 2005 to accommodate the widening of Armadale Rd. At the time of its relocation, its capacity was reduced despite an increase in the impervious catchment area contributing to the basin due to the Armadale Rd widening.

The Dumsday Compensating Basin has a contributing catchment of approximately 58 ha, including Armadale Rd and the Forrestdale town site urban area. The area of the Dumsday Compensating Basin is 0.2 ha, representing only 0.3% of its total catchment area, an order of magnitude less in size than would be normally be expected for a catchment of this size.

DoW (2009b) identifies Dumsday Basin as a Water Corporation asset, therefore it is understood maintenance is and will continue to be a Water Corporation responsibility.

This results in regional flood storage being required within the site post development. The requirements for stormwater management of the site post development are outlined in the Forrestdale Main Drain Arterial Drainage Strategy (DoW, 2009b).

4.7.1 Forrestdale Main Drain Arterial Drainage Strategy

The Forrestdale Main Drain Arterial Drainage Strategy (DoW, 2009b) provides modelling of the Baileys Branch Drain for both existing and ultimate development scenarios, and identifies drainage upgrade requirements in the vicinity of Anstey Rd.

Although the document is 10 year old, DoW (2009b) still represents the overarching strategy document governing design of stormwater in the area. Key extracts from the strategy relevant to this report are included in Appendix D.

Water levels within the drain at key locations during storm events as modelled in DoW (2009b) are summarised in Table 3. These levels are used by Hyd2o to develop and calibrate an XP-Storm stormwater model of the area in Section 6.

It should be noted that recent updates to Australian Rainfall and Runoff (Ball et al, 2016) have resulted in changes in terminology being recommended to describe design rainfalls. Generally, Exceedance per Year (EY) terminology is recommended to be used for very frequent design rainfalls, Annual Exceedance Probability (AEP, %) terminology used for frequent and infrequent design rainfalls, and AEP (1 in x) terminology used for rare design rainfalls. For the purpose of this report, Average Rainfall Interval (ARI) terminology used in DoW (2009b) has therefore been replaced with the updated terminology as follows:

- 1 Year ARI – replaced with 1 EY
- 5 Year ARI – replaced with 0.2 EY
- 10 Year ARI – replaced with 10% AEP
  (note this is approximate only as 10% AEP is equivalent to a 9.49 Year ARI)
- 100 Year ARI – replaced with 1% AEP

For ultimate development DoW (2009b) specifies a widening of the Baileys Branch Drain from its current 5.5m width to 50m within the site for approximately 490m. These requirements are largely due to the shortfall in storage at the Dumsday Compensating Basin as detailed in Section 4.7.

Hyd2o note that the water levels within the Baileys Branch Drain for ultimate development shown in Table 3 at most locations are slightly lower than the existing system, which is a result of the additional storage provided in the 50m widening of the drain.

It is not clear why the Dumsday compensating basin levels are increased at ultimate development, as this appears to be counterintuitive on the basis that levels downstream are reduced and its outflow has increased.

The DoW (2009b) strategy was based on individual developments all providing separate offline local stormwater storages to attenuate flows from developed areas to specified allowable flow rates prior to discharging to the drain. This is further discussed in Section 6.

Table 3: Baileys Branch Drain Flood Levels and Flows at Key Locations

Location	Invert mAHD	10% AEP Flow m^3/s	10% AEP HGL mAHD	1% AEP Flow m^3/s	1% AEP HGL mAHD	Natural Surface mAHD
Keane Rd Culvert Upstream Existing System Ultimate Development	21.06	1.00 0.65	22.41 22.28	1.29 0.81	22.84 22.70	22.88
Anstey Rd Culvert Upstream Existing System Ultimate Development	21.19	0.65 0.81	22.50 22.30	0.75 1.02	23.04 22.76	23.10
Armadale Rd Culvert Downstream Existing System Ultimate Development	21.57	0.86 1.00	22.53 22.32	1.11 1.34	23.05 22.77	23.65
Dumsday Compensating Basin Existing System Ultimate Development	21.65	0.81 0.94	23.09 23.32	1.08 1.27	23.74 24.16	23.65

4.7.2 Surface Water Quality

Surface water quality samples were taken from Baileys Branch Drain from the upstream site entry (Armadale Rd, SW1) and downstream site exit locations (Anstey Rd, SW2).

Samples were taken over winter when the drain was observed to be flowing resulting in samples collected in June, July and August 2016 and July, August and October 2017.

Each sample was analysed in situ for physical parameters (temperature, electrical conductivity (EC) and pH), with samples sent to a NATA approved laboratory for analysis of nutrients and heavy metals.

Detailed surface water quality results are included in Appendix F with laboratory reports contained in Appendix G. Surface water quality results are summarised in Table 4 and below, with comparison to ANZECC (2000) guidelines:

- Mean pH at SW1 and SW2 were 6.46 and 6.63, respectively. Results are close to within the ANZECC guideline range of 6.5 to 8.0 pH.
- Mean EC at SW1and SW2 were 0.50 mS/cm and 0.74 mS/cm, respectively. Results are slightly above the ANZECC guideline range of 0.12 mS/cm to 0.30 mS/cm.
- Mean TN at SW1 and SW2 were 2.68 mg/L and 3.90 mg/L, respectively. These values exceed the ANZECC guideline concentration of 1.2 mg/L.
- Mean TP at SW1 and SW2 were 0.46 mg/L and 1.54 gl/L. These values also exceed the ANZECC guideline concentration of 0.065 mg/L.

Given the semi-rural land use across the site, including horse agistment and sheep grazing, it is not unusual that the downstream TN and TP concentrations are higher than upstream.

The mean results for all heavy metals were within the 99% trigger levels of protection for freshwater species at both monitoring sites.

Table 4: Predevelopment Surface Water Quality

Parameter	ANZECC	SW1 (upstream)	SW2 downstream)
EC (mS/cm)	0.12 – 0.30	0.50	0.74
pH	6.5 – 8.0	6.46	6.63
TN (mg/L)	1.2	2.68	3.90
TP (mg/L)	0.065	0.46	1.54
TKN (mg/L)	-	1.88	3.73
Ammonia (mg/L)	0.08	0.09	0.06
Nitrite as N (mg/L)	-	0.01	0.04
Nitrate as N (mg/L)	-	0.80	0.19

4.8 Groundwater

4.8.1 Groundwater Levels

Seven groundwater monitoring bores were installed at the site on 5th April 2016 (Figure 7). The bores were installed by Edrill Environmental via a drill rig, overseen by Hyd2o. The bores were constructed suitable for water level and water quality monitoring.

The monitoring program was undertaken over an 18 month period, commencing in April 2016, with the final monitoring occasion in October 2017 – capturing two winters. Water level monitoring was undertaken monthly at the onsite bores and an additional three nearby DWER bores (T115, T80 (O), 602). A summary of water levels recorded during the monitoring program are presented in Table 5 and Appendix E.

Minimum groundwater levels for the site bores were recorded in April 2016 and ranged from 19.77 mAHD at AK2 to 21.63 mAHD at AK5. Maximum groundwater levels over the monitoring period were recorded in September 2016 ranging from 22.16 mAHD at AK2 to 23.25 mAHD at AK7. Groundwater flow is generally north towards the intersection of Anstey Rd and Keane Rd.

All three DWER bores monitored show a historical annual variation of between 1.5 m – 2.5 m between winter and summer levels with long-term hydrographs showing a general decline in groundwater levels since the 1970s.

The recorded groundwater levels were broadly consistent with the Perth Groundwater Map. The online DWER Perth Groundwater Map shows May 2003 groundwater levels across the site ranging from 21 mAHD and 22 mAHD, which represent a typical minimum groundwater level at the end of summer. The Map also provides groundwater contours showing the historical maximum groundwater levels across the site being between 23 mAHD and 24 mAHD, approximately 2 m above the May 2003 levels.

The monitoring of long term DWER bores allowed for onsite groundwater measurements to be referenced to long term local groundwater records for consistency and the calculation of an average annual maximum groundwater level (AAMGL) and maximum groundwater level (MGL) for the site.

It is important to note the LWMS only uses the terminology AAMGL to represent a valid statistical property of groundwater in the area, and not as a concept as per previous DWER policies. This LWMS presents details of the groundwater's seasonal variation, AAMGL, and MGL all as measures of its seasonal, annual, and interannual behaviour. Simply presenting an MGL is not considered adequate to represent the groundwater characteristics and behaviour of the site.

Tables 6 and 7 detail the calculation of the AAMGL and MGL for the site based on long term DWER records correlated against readings from the September 2016 peak groundwater levels (the highest site groundwater levels recorded). The calculation also considers the proximity of some of the bores to the Baileys Branch Drain in limiting the groundwater rise in these bores.

AAMGL mapping is shown in Figure 7. Note that bore AK4 was not used in mapping due to the potential impact of coffee rock layers on recorded water levels at this location.

Goundwater mapping shows the impact of Baileys Branch Drain, with groundwater broadly flowing toward Baileys Branch Drain from either side of the drain. A small area of the site near the corner of Anstey and Armadale Rd is considered likely to flow toward the Forrestdale Main Drain located east of the site.

The AAMGL is estimated to range between a maximum of 23.8 mAHD in the south western corner, and a minimum of 21.9 mAHD in Baileys Branch Drain adjacent to Anstey Rd. The MGL for the site is estimated to range between 22.4 mAHD and 24.4 mAHD.

Recent maintenance undertaken by Water Corporation in July 2019 within the Baileys Branch Drain downstream of the site removed a considerable 1m deep blockage in the drain which has resulted in reductions in groundwater levels in the drain at the site.

An overall 0.3 m reduction in peak groundwater levels at Anstey Rd as a result of the blockage removal is expected based on monitoring outcomes to date. This impact is currently continuing to be monitored by both Hyd2o and Water Corporation, and will be factored into future planning and design for the site.

Table 5: Predevelopment Groundwater Levels

	Site Groundwater Bores							DWER Bores		
	AK1	**AK2**	**AK3**	**AK4**	**AK5**	**AK6**	**AK7**	**T115**	**T80(O)**	**602**
Top of Casing (mAHD)	24.83	23.02	24.46	25.02	24.27	24.22	24.21	24.91	27.60	25.26
Natural Surface (mAHD)	24.23	22.42	23.96	24.47	23.67	23.62	23.61	24.32	27.16	24.68
Groundwater Levels (mAHD)										
07/04/16	20.82	19.77	20.79	20.58	21.63	20.53	20.81	21.39	23.69	20.57
13/05/16	20.94	19.92	21.87	20.72	21.87	20.57	20.62	21.51	24.19	21.26
26/06/16	21.56	20.91	22.35	21.12	22.26	21.13	22.64	22.04	24.87	22.14
29/07/16	22.47	21.65	22.72	21.97	22.65	21.96	22.89	22.90	25.41	22.88
22/08/16	22.63	21.79	22.79	22.17	22.79	22.10	23.06	23.16	25.37	23.03
30/09/16	23.09	22.16	23.06	22.63	23.07	22.61	23.25	23.72	25.50	23.11
20/10/16	22.93	22.04	22.97	22.57	23.02	22.50	23.07	23.53	25.13	22.97
21/11/16	22.58	21.47	22.70	22.13	22.72	22.12	22.78	22.94	24.59	22.69
20/12/16	22.21	20.91	22.52	21.69	22.52	21.80	22.52	22.39	24.15	22.22
02/02/17	21.66	20.24	22.26	21.20	22.18	21.17	22.02	21.86	23.90	21.24
28/02/17	21.98	20.73	22.50	21.41	22.40	21.51	22.51	21.97	24.89	22.24
22/03/17	21.98	20.72	22.39	21.52	22.27	21.52	22.42	21.99	24.28	21.73
20/04/17	21.56	20.34	22.22	21.23	22.22	21.42	22.29	21.81	Not accessible	21.42
24/05/17	21.51	20.45	22.27	21.21	22.13	21.31	22.46	21.87	24.37	22.04
26/06/17	21.67	20.67	22.33	21.32	22.26	21.28	22.58	21.95	24.42	22.37
17/07/17	22.11	21.27	22.58	21.68	22.50	21.68	22.80	22.30	24.70	22.82
18/08/17	23.00	22.01	23.04	22.40	22.97	22.42	23.13	23.43	25.23	23.16
29/09/17	22.99	22.04	23.07	22.49	23.00	22.41	23.11	23.36	25.03	23.14

Table 6: AAMGL and MGL – DWER Bores

Bore	Period of Record	Groundwater Leve (mAHD) 30/09/16	AAMGL (mAHD)	Correction Factor (m)	MGL (mAHD)	Correction Factor (m)
T115	1975-2004, 2013-2016	23.72	23.90	0.18	24.72	1.00
T80 (O)	1973-2016	25.50	25.96	0.46	26.47	0.97
602	1996-2016	23.11	23.19	0.08	23.59	0.48
Correction Factors for Site Bores				**0.24**		**0.81**

Table 7: AAMGL and MGL - Site Bores

Bore	Natural Surface (mAHD)	Groundwater Level (mAHD) 30/09/16	Applied Correction Factor (m)	AAMGL (mAHD)	Depth Below Natural Surface (m)	Applied Correction Factor (m)	MGL (mAHD)	Depth Below Natural Surface (m)
AK1	24.23	23.09	0.24	23.33	0.90	0.81	23.90	0.33
AK2	22.42	22.16	0.14 [1]	22.30	0.12	0.71 [1]	22.42 [2]	0.00
AK3	23.96	23.06	0.24	23.30	0.66	0.81	23.87	0.09
AK4	24.47	22.63	0.24	22.87	1.60	0.81	23.44	1.03
AK5	23.67	23.07	0.24	23.31	0.36	0.81	23.67 [2]	0.00
AK6	23.62	22.61	0.14 [1]	22.75	0.87	0.71 [1]	23.32	0.30
AK7	23.61	23.25	0.14 [1]	23.39	0.22	0.71 [1]	23.61 [2]	0.00

1. Reduced correction factor applied for these bores due to proximity to Baileys Branch Drain
2. Corrected to natural surface

4.8.2 Groundwater Quality

Groundwater quality samples were taken from all site bores quarterly, commencing in May 2016 with the last samples collected in August 2017. A total of six groundwater quality sampling occasions were undertaken. Detailed groundwater quality results are included in Appendix F with laboratory reports contained in Appendix G.

Groundwater quality results are summarised in Table 7 and below, with comparison to ANZECC (2000) guidelines for lowland rivers in the southwest of Australia:

- Mean pH ranged from 4.05 at AK5 to 6.66 at AK1, being below to within the ANZECC guideline range of 6.5 to 8.0 pH.
- Mean EC ranged from 0.33 mS/cm at AK4 to 23.3 mS/cm at AK2, above the ANZECC guideline range of 0.12 mS/cm to 0.30 mS/cm. This ranges from fresh to relatively saline across the site.
- Mean TN ranged from 2.9 mg/L at AK2 to 24.7 mg/L at AK5, above the ANZECC guideline concentration of 1.2 mg/L.
- Mean TP ranged from 0.05 mg/L at AK2 to 13.5 mg/L at AK5. These values range from within to exceeding the ANZECC guideline of 0.065 mg/L.

Whilst TN and TP concentrations are above the ANZECC guidelines, they represent typical groundwater nutrient values for the Swan Coastal Plain for land that has been historically used for farming purposes.

Across all bores, the mean results for all metals were within the 99% trigger level of protection for freshwater species (see Appendix F).

Table 8: Predevelopment Groundwater Quality

		Mean Groundwater Quality Results						
Parameter	**ANZECC**	**AK1**	**AK2**	**AK3**	**AK4**	**AK5**	**AK6**	**AK7**
EC (mS/cm)	0.12 – 0.30	1.79	23.33	5.49	0.33	3.50	0.94	4.90
pH	6.5 – 8.0	6.66	5.61	4.98	5.68	4.05	5.27	6.33
TN (mg/L)	1.2	23	2.9	12.1	3.5	24.7	7.9	9.5
TP (mg/L)	0.065	0.66	0.05	0.20	0.27	13.5	0.13	1.04
TKN (mg/L)	-	12.1	2.8	12.1	1.6	25.2	7.9	9.5
Ammonia (mg/L)	0.08	0.33	0.31	0.24	0.36	2.87	0.82	0.28
Nitrite as N (mg/L)	-	0.05	0.11	0.03	0.005	<0.005	0.03	0.01
Nitrate as N (mg/L)	-	11.02	0.04	0.11	0.43	0.03	0.10	0.02

5. Water Use Sustainability Initiatives

5.1 Water Efficiency Measures

Water conservation measures will be implemented within the development and will be consistent with Water Corporation's Waterwise land development criteria, and include:

- Promotion of use of waterwise practices including water efficient fixtures and fittings (taps, showerheads, toilets and appliances, rainwater tanks, waterwise landscaping).
- All houses to be built to 6 star building standards.
- Use of water wise plantings, including native plants, in POS areas.
- Use of groundwater bores for irrigation of POS.
- Maximising on site retention of stormwater.
- Use of higher density residential zonings and smaller lots to reduce garden (ex-house) use of water and nutrient application areas.

5.2 Water Supply

Domestic water supply will be provided via extension of the Water Corporation's Integrated Water Supply System (IWSS). Rainwater tanks will not be implemented/mandated at estate scale to supplement the domestic water supply scheme. Residents who wish to supplement scheme water supply with rainwater tanks will be provided for by individual builders during the building application process.

Landscape concept plans for the site prepared by Emerge Associates are shown in Appendix H. Landscaping has been designed with recognition of the generally low availability of water in the area, with local species incorporated to minimise water use.

DWER have issued two groundwater licences with allocation from the superficial aquifer – GWL 201253 (50,558 kL) and GWL 153126 (7,500 kL). These licence allocations have been granted for use for irrigation of up to 8.49 ha of public open space and also cover use for construction purposes. The water use allocation for the GWL was determined by DWER via POS areas provided and application by DWER of standard irrigation rates. An indicative irrigation schedule prepared by Emerge Associates is included in Appendix H.

Copies of licences are included as Appendix I and summarised in Table 9.

Table 9: Groundwater Resource and Existing Licence Allocation

GW Area	Subarea	Aquifer	Licence No.	Allocation	Expiry
Perth	City of Armadale	Superficial	201253	50,558	3/5/2028
			152126	7,500	26/4/2028

5.3 Wastewater Management

Wastewater will be reticulated sewerage with management by the Water Corporation.

6. Stormwater Management Strategy

Stormwater management will be undertaken consistent with DWER water sensitive design practices. The system will consist of lot soakwells, subsoil drainage, piped road drainage system, biofiltration areas, and Baileys Branch Drain realigned and reconfigured as a living stream to provide water quantity and quality treatment for stormwater generated from the proposed development. Given the size of the site, the LWMS has focussed on providing detail associated with modelling of the arterial drainage system and ensuring space requirements for drainage are adequately provided in POS. There will be opportunities for median swales and other WSUD measures in wider road reserves and these measures will be appropriately investigated at UWMP stage as detailed engineering progresses.

The proposed system refines the strategy detailed in DoW (2009b) as follows :

- Within the site it is proposed to provide online storage and attenuation of flows within the living stream without separate offline storages. No local storages will therefore be provided other than biofiltration areas for water quality treatment of the first 15mm of runoff. This is possible by increasing the length (and hence storage capacity) of the Baileys Branch Drain and using this capacity to provide combined regional and local storage requirements. The combination of regional and local flood storage within the living stream is proposed to minimise the overall stormwater imprint on POS and improve MUC characteristics and the living stream configuration. Given the low gradient of the Bailey Branch Drain (and flow velocities), this configuration is also considered to enable better flushing of the system during storm events.
- With respect to the DoW (2009b) proposed 1.0 ha compensating basin (Baileys CB) in Cedar Woods land (Appendix D), it is considered problematic in that location to efficiently achieve the required storage due to excavation restrictions within the Dampier to Bunbury Natural Gas Pipeline Corridor. This is proposed to be replaced by a living stream within a 40m multiple use corridor (MUC) adjacent to the Keane Rd road reserve as a continuation of the living stream from the site. Any loss of storage as a result of the change will effectively be accommodated within the sites MUC south of Anstey Rd.
- With respect to the Baileys Branch Drain configuration, DoW (2009b) specifies a living stream of 50 m top width, 1:8 side slopes, and 1.9m deep (implying a 20m base width). Given the high groundwater conditions in the area a narrower base channel is preferred to minimise the extent of open water within the MUC and maximise amenity and useable POS. A ~12m wide main channel for events up to the 0.2 EY is proposed, with larger event permitted to flood into the wider MUC corridor. The proposed design is consistent with the Water Corporations Drainage for Liveability Fact Sheet, Living Streams in Water Corporation Assets (Water Corporation 2016).

This stormwater management concept and post development catchment mapping for the site is shown in Figure 8. Eight main stormwater catchments have been identified in consultation with project engineers JDSi, seven of which will drain to the Baileys Branch Drain. The eighth catchment east of Allen Rd (Catchment 4) is part of the Forrestdale Main Drain catchment as identified in DoW (2009b), and will continue to drain in this direction post development in accordance with DoW (2009b).

This approach is considered the most efficient for the site in terms of maximising usable POS within the established multiple use corridors within the site and has been agreed in principle with Water Corporation.

For Baileys Branch Drain, relocation of the drain will require a new crossing at Anstey Rd and this relocation is supported by the downstream developer Cedar Woods. Advice from project engineers JDSi and Water Corporation plans (Appendix J) indicate this proposed alignment will not clash with existing services.

It is important to note the multiple use corridor width varies from approximately 30m to 70m within the site along its 800 m length. DoW (2009b) previously recommended a 50m living stream of 490m length in the site post development. The realignment of the drain, extending its length through the site, and adopting a variable width in different areas have been implemented as a result of a site responsive design. It is important to note the variable widths still maintain DoW(2009b) requirements for flood storage.

DWER and Water Corporation living stream guidelines do not prescribe designated widths for MUC's and recommend site responsive design, however the narrower 30m section is compliant with City of Armadale minimum width requirements for multiple use corridors (City of Armdale Local Planning Policy PLN 2.6).

The Water Corporation have indicated they are committed to working collaboratively with local government and DWER regarding responsibilities and establishing partnership agreements for management of drainage assets for areas where multiple use characteristics apply and rural drains are transitioned to living streams. Correspondence with the Water Corporation to date is attached as Appendix K.

With respect to the catchment draining to Forrestdale Main Drain (Catchment 4), Hyd2o have had previous discussions with Calibre, who are responsible for undertaking the design of the Keane Rd upgrade for Forrestdale Business Park West, to ensure a discharge from the site is accommodated within any stormwater upgrades in this area. Correspondence with Calibre on this matter is included as Appendix L. While the Calibre design is being assessed as a separate process to this LWMS this information has been included in this report is to demonstrate the designers of that infrastructure are aware of the requirements to accept drainage from the site.

It is important to note the outfall from this catchment is not depended on the development of Forrestdale Business Park, only the Keane Rd upgrade in this area. While the development the catchment draining to Forrestdale Main Drain is the final stage of development (refer Appendix Q staging), ilf the Keane Rd upgrade has not occurred by this time, as a contingency the area can continue to discharge via the existing culvert under Keane Rd which currently drains flow from this area into the adjacent resource enhancement wetland. Some additional temporary storage may be required to be provided depending on the existing culvert capacity. Other alternative temporary open drain connections to Forrestdale Main Drain may also be possible is required.

Opportunities for modified serviceability in piped drainage infrastructure for minor events will be assessed during civil design and UWMP development in consultation with the City of Armadale. This will consider allowing lesser design events to increase pit spacing and reduce infrastructure whilst still maintaining required gutter flows.

With respect to the living stream configuration this has been designed to account for a range of factors including high and variable groundwater table, Water Corporation desire to minimise baseflow channel, maintaining POS usability, providing major flood storage, and other infrastructure considerations (powerlines etc). The final configuration of the living stream will be subject to further refinement during detailed design of the POS corridor within the key parameters of the LWMS, and will consider opportunities for tree retention within this space via the establishment of appropriate levels.

Anstey Rd runoff is proposed to be managed by both LWP (eastern portion) and by CWP (western portion) and accommodated within subdivisional stormwater areas. This is likely be managed via piped drainage, subject to detail design of Anstey Rd.

6.1 Stormwater Modelling

Stormwater modelling for the site was performed using XP-Storm to determine flood storage requirements and provide an assessment of areas required for drainage purposes.

It should be noted Australian Rainfall and Runoff 1987 (IEAust, 1987) was used in the stormwater modelling for this report rather than the recently released Australian Rainfall and Runoff 2016 (Ball et al., 2016). This approach has been adopted as flows and levels from the Forrestdale Main Drain Arterial Drainage Strategy (DoW, 2009b) were based on Australian Rainfall and Runoff 1987 (IEAust, 1987) in its preparation.

The design storms modelled by XP-Storm were based on methodology in Australian Rainfall & Runoff (Institution of Engineers Australia, 1987) and the Bureau of Meteorology Computerised Design IFD Rainfall System. The rainfall temporal pattern was assumed to be spatially uniform, and storm durations modelled ranged from 1 to 72 hours.

6.1.1 Model Establishment & Validation

An initial model of the ultimate stormwater system was established in XP-Storm based on DoW (2009b) parameters for validation purposes.

The model was based on all hydrology and hydraulic parameters as specified in DoW (2009b) for the adopted strategy. This included all catchment areas, storage configurations, land use, runoff rates and parameters. The model was extended downstream of Baileys Wetland approximately 1.7 km downstream of the site to ensure modelling results were not adversely affected by assumed tailwater conditions.

With respect to groundwater, an initial groundwater level of 21.9 mAHD within the drain was adopted at the commencement of the storm for modelling purposes. This water level is approximately equivalent to the culvert obvert under Anstey Rd, and was selected as representative of a maximum winter condition in the drain for modelling purposes based on Hyd2o (2018). It should be noted that this is a conservative assumption, given recent maintenance works on the drain downstream of the site by Water Corporation (as discussed in Section 4.8.1) have removed a considerable blockage, and an overall 0.3 m reduction in peak groundwater levels at Anstey Rd has been observed. Once confirmed this change will factor into the future planning and design.

Calibration results are summarised at key locations in Table 10, demonstrating a good agreement with DoW (2009b) modelling, and providing confidence in the model to then

assess changes in land use and the stormwater management approach since the original DoW (2009b) modelling was performed using the Infoworks model.

It should be noted that the Dumsday Basin top water level was lower in Hyd2o modelling than DoW (2009b), however the peak outflow was the similar. Storage characteristics for this basin were provided via the City of Armadale based on design drawings. The design drawing for the Dumsday Bain is contained in Appendix K.

Table 10: XP-Storm Model Validation Results

Location	1% AEP HGL DoW(2009) via Infoworks Model mAHD	1% AEP HGL Calibrated Hyd2o XP-STORM Model mAHD
Keane Rd Culvert Upstream Ultimate Development	22.70	22.73
Anstey Rd Culvert Upstream Ultimate Development	22.76	22.79
Armadale Rd Culvert Downstream Ultimate Development	22.77	22.79
Dumsday Compensating Basin Ultimate Development	24.16 (1.27 m^3/s peak outflow)	23.95 (1.26 m^3/s peak outflow)

6.2 Flood Protection (1% AEP Event)

Based on the development concept plan (Figure 2), the calibrated XP-Storm model of the site was then modified to reflect refinements in land use and changes to the stormwater management strategy as previously detailed in Section 6 and Figure 8.

Key stormwater modelling parameters are shown in Table 11, with the runoff coefficients adopted for modelling purposes for various events and durations calculated in detail in Appendix M using Hyd2o's CURRV runoff rate estimator based on various individual land use characteristics. Note all land use area breakdowns used to estimate runoff rates detailed in Appendix M are based on CoA's Water Resource Management for Land Development position paper (Essential Environmental, 2015).

With respect to the adopted runoff rates for design, Hyd2o understand the City requires drainage for lots less than 350m^2 to be managed by provision of interconnected soak wells linked to a grated pit installed in the driveway of the lot. The grated pit will provide a "bubble out" function allowing an indirect connection to City's drainage system via overland flow down the driveway. Lots larger than 350 m^2 are required to control water on-site via interconnected soak wells.

Appendix N details the standard living stream section applied for post development modelling purposes, comprising a main channel and wider floodplain for major event storage. A Mannings n of 0.035 was assumed. It is important to note that given the low velocity of flow due to the very low grades and the considerable influence of groundwater, the living stream behaviour within the site is not that of a typical stream. For example, the depth of water due to groundwater each year will be a higher level than a 50% AEP event when groundwater is low. Further iteration of the living stream design will

be undertaken as detailed planning of the MUC corridor progresses in consultation with key agencies. This design refinement will include consideration of providing a gentle downward slope towards the main channel enough to generate overland flow and avoid water ponding on the wider floodplain area.

Schematics of the XP–Storm model are contained as Appendix O. Modelled flood protection storage volumes and areas are detailed in Table 11 and Figures 9 to 11 show the extent of inundation of POS area for various flood management events. Note that impact of the TWL is shown accurately and to scale in all figures relative to the total POS area and plans based on the cross sections of the living stream provided in the LWMS.

Figure 11 shows the extent of inundation for the 1% AEP event, with modelled long sections of the Baileys Branch Drain contained in Appendix P. The total area within the site required for flood storage up to the 1% AEP event is approximately 3.98 ha of the total site area, with a total detention storage volume of approximately 27,172 m^3.

Modelling results for the 1% AEP event are summarised in Tables 12 and 13 in comparison to DoW (2009b) results. While the proposed stormwater management strategy changes results in minor increases in water levels in the 1% AEP event at all locations, all levels remain below the existing natural surface at these locations and these surface levels will rise post development (by up to 1.5m). It is also important to note that the revised modelling ultimate levels are below the levels detailed in Table 1 as modelled in DoW (2009b) for the existing system performance.

Note that storage shapes shown in Figures 9 to 11 are indicative only for determination of area requirements and representation of storage areas required in relation to POS areas allocated in the development concept plan. It is not the intent to construct a linear trapezoidal drain within this space, and it is intended the final form will represent a meandering living stream. The final flood attenuation area configuration, location, and elevations will be documented in future UWMPs and will be dependent on final earthworks, drainage, and road design levels for the development.

The developer is aware of the requirement for the Baileys Branch Drain to maintain an uninterrupted drainage function during the realignment process. To this end a preliminary strategy sketch for the upgrade of the drain has also been developed by project engineers JDSi and included in Appendix Q. Further refinement of this strategy will be reported during the UWMP process.

Refinements to catchment areas in this report are likely to occur as detailed design proceeds, and modelling will be updated accordingly during the UWMP process.

The minimum building floor levels will comply with DWER and City of Armadale requirements for a 0.5m clearance above estimated 1% AEP flood levels.

6.3 Serviceability (0.2 EY Event)

Modelled storage volumes, areas, flood rise and inverts are detailed in Table 11 and Figure 10 for the 0.2 EY flood event, showing the extent of inundation of POS area. The total area required for the 0.2 EY event is approximately 1.58 ha of the total site area with a total detention storage volume of approximately 8182 m^3.

6.4 Ecological Protection (1 EY Event, 15 mm)

Storm volumes for ecological protection based on the first 15 mm event are provided in Table 11 to provide a guide for storage requirements. Volumes will be refined at UWMP stage on the basis of more detailed modelling in parallel with engineering design, with final adopted batters and ultimate configurations to be determined in consultation with CoA.

The total estimated area required for management of the first 15mm of site runoff (excluding Baileys Branch Drain) is 0.33 ha (990 m^3 at 0.3m assumed depth). The Baileys Branch Drain 1 EY Area of Inundation is estimated as 0.70 ha (based on 8.0m channel inundation width) with a storage volume of 2320 m^3.

Note that Hyd2o's current estimate of what would be termed the base flow channel is based on the area which would be expected to be inundated every year (ie effectively a 1 EY inundation level) - which given the depth of the drain post development, allowable batter slopes, and acknowledging the significant influence of groundwater inundation in winter, is estimated at 8 m. If ultimately a lower groundwater level can be adopted within the drain for design purposes (for example due to blockages or lack of downstream maintenance) this will be a positive outcome for the development and likely reduce drainage land take and constraints within the POS corridor. As none of the early stages of development will include works on the drain, this issue is not considered a critical path issue for progressing structure planning approvals and will be assessed as the project progresses.

All biofiltration systems will be designed consistent with the Adoption Guidelines for Stormwater Biofiltration Systems (CRC for Water Sensitive Cities, 2015). Note that in some instances alternative technologies such as stormtech cells and amended soils may be used for treatment rather than surface based biofiltration systems, to maximum POS useability outcomes. The detailed design of treatment areas will be undertaken compliant with CoA requirement at UWMP stage, and designs of these areas provided in the relevant UWMP's for CoA approval.

Note that the sizing and depth presented in this LWMS is for 15mm storage has been performed without considering further distributed opportunities for infiltration and treatment at local scale (eg road reserves), and are therefore likely to be conservative. Further detailed modelling at UWMP stage will refine these requirements for use in engineering design.

Table 14 details a summary from the Stormwater Management Manual for Western Australia (DoW, 2007) of expected pollutant removal efficiencies for various WSUD measures in relation to water quality design criteria contained in WAPC (2008). While DoW (2007) does not provide expected pollutant removal efficiencies for all best management practices (BMPs), application of a treatment train approach using a combination of the non-structural and structural measures will therefore clearly achieve the design objectives for water quality for the site.

Table 11: Stormwater Management Sizing

Sub Catchments	1a	1b	1c	2a	2b	3a	3b	4
Residential (ha)	1.51	1.25	9.35	2.56	1.41	1.93	4.10	3.98
Road Reserve (ha)	0.79	0.61	4.61	1.62	0.66	1.43	2.24	1.75
POS (ha)	0.31	0.21	0.46	0.67	0.70	0.73	1.08	0.43
Non Res Opportunity (ha)	0.00	0.00	0.00	0.00	0.00	0.00	0.18	1.59
Total Area (ha)	2.61	2.07	14.43	4.85	2.77	4.09	7.60	7.74
1 EY (15mm) EIA (ha)	0.54	0.42	3.18	1.12	0.45	0.98	1.55	1.21
0.2 EY EIA (ha)	1.05	0.83	6.20	2.00	0.95	1.67	3.03	3.26
1% AEP EIA (ha)	1.37	1.08	7.97	2.57	1.28	2.15	3.94	4.22
1 EY Event (15mm) Biofiltration Areas for Local Stormwater								
AAMGL (m AHD)	23.5	23.4	22.3	22.2	22.6	22.6	22.4	23.2
Nominal Invert (mAHD)	23.8	23.7	22.6	22.5	22.9	22.9	22.7	23.2
Volume Runoff (m^3)	82	63	477	168	68	148	232	181
Storage Reqd (m^3) (considering infiltration/subsoil)	54	44	334	117	48	104	162	127
Top Water Level (mAHD)	24.1	24.0	22.9	22.7	23.2	23.2	23.0	23.5
Flood Rise (m)	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
TWL Area (m^2)	180	147	1113	390	160	346	540	423
0.2 EY Event – All Catchments to Baileys Branch Drain (except Catchment 4) [1]								
Invert (mAHD)	21.19 at Anstey Rd 21.38 at u/s end of Living Stream Living Stream length : 870 m							23.50 (above bioretention)
Configuration	Refer Indicative Section, Appendix N							2,500 m^2 base area 1:6 side slopes
AAMGL (mAHD)	21.9 conservatively assumed in drain at Anstey Rd (at storm commencement) – actual of 21.6 mAHD TBC							23.2 (Calibre CGL @ 22.9)
Top Water Level (mAHD)	22.30 at Anstey Rd 22.36 at u/s end of Living Stream							23.80
Flood Rise (m)	1.11 at Anstey Rd 0.98 at u/s end of Living Stream							0.30
TWL Area (m^2)	10,440 (12m wide main channel)							2,880
Volume (m^3)	5,960							800 (above 1 yr)
Flow (m^3/s)	1.13 at Anstey Rd 1.74 at u/s end of Living Stream							0.019
Velocity (m/s)	0.15 at Anstey Rd 0.22 at u/s end of Living Stream							1.06
Critical Storm (hr)	6							24
1% AEP Event								
Top Water Level (mAHD)	22.89 at Anstey Rd 22.91at top of Living Stream							24.27
Flood Rise (m)	1.70 at Anstey Rd 1.53 at u/s end of Living Stream							0.77
TWL Area (m^2)	33,800 (variable 30-50 wide floodplain)							3,510
Volume (m^3)	23,470							2,280 (above 1 yr)
Flow (m^3/s)	0.94 at Anstey Rd 1.09 at u/s end of Living Stream							0.036
Velocity (m/s)	0.13 at Anstey Rd 0.18 at u/s end of Living Stream							1.98
Critical Storm (hr)	6							24

1. Bailey Branch Drain 1 EY Area of Inundation (21.9mAHD at Anstey Rd) estimated as 6960 m^2 (8.0m channel inundation width) with a storage volume of 2320 m^3

Table 12: Comparison to DoW(2009b) : Levels & Flows

Location	1% AEP HGL DoW(2009) mAHD	1% AEP HGL Calibrated Hyd2o XP-Storm Model mAHD	1% AEP HGL Proposed Strategy XP-Storm Model mAHD
Keane Rd Culvert Upstream Ultimate Development	22.70	22.73	22.79
Anstey Rd Culvert Upstream Ultimate Development	22.76	22.79	22.89
Armadale Rd Culvert Downstream Ultimate Development	22.77	22.79	22.94
Dumsday Compensating Basin Ultimate Development	24.16 (1.27m/s peak outflow)	23.95 (1.26 m3/s peak outflow)	24.19 (1.17 m3/s peak outflow)

Table 13: Comparison to DoW(2009b) : Baileys Catchments Volumes & Areas

	Area (m^2)		Volume (m^3)	
Event	**DoW(2009)**	**Proposed Strategy XP-Storm Mode**	**DoW(2009)**	**Proposed Strategy XP-Storm Mode**
1 EY	na	2876 : Local 6960 : Baileys	na	863 : Biofilter 2320 : Baileys
0.2 EY	na	2876 : Local 10440 : Baileys	na : Local 4550 : Baileys	863 : Biofilter 5960 : Baileys
10% AEP	na	na	8660 : Local 5150 : Baileys	na
1% AEP	12700: Local 28080: Baileys	2876 : Local 33800 : Baileys	10920: Local 12100 : Baileys	863 : Biofilter 23470 : Baileys

Note : "Local Drainage" specified in the table above for DoW (2009) refers to the combined storage for the Keane Road South Compensation Basin and Anstey Road Compensation Basin.
Catchment 4 excluded in above table to enable direct comparison of results.
na : modelling result not available

Table 14: BMP Water Quality Performance in Relation to Design Criteria

Water Quality Parameter	WAPC (2008) Design Criteria (required removal as compared to a development with no WSUD)	Structural Controls Nutrient Output Reduction [1]		
		Bioretention Systems	Vegetated Swales	Living Streams
Total Suspended Solids	80%	80%	60-80%	90%
Total Phosphorus	60%	60%	30-50%	50-100%
Total Nitrogen	45%	50%	25-40%	50-100%
Gross Pollutants	70%	-	>90%	-

1. Typical Performance Efficiencies via DoW (2007)

7. Groundwater Management Strategy

7.1 Fill and Subsoil Drainage

Groundwater management within the site will be undertaken consistent with the Department of Water publication Water Resource Considerations when Controlling Groundwater Levels in Urban Development (DoW, 2013a).

Development levels in the site will be largely dominated by fill requirements to achieve adequate separation to groundwater, given the proximity of groundwater levels to natural surface. Current available engineering earthworks drawings are included as Appendix Q.

Minimum separation between building floor levels for development and groundwater will be achieved by a combination of fill and subsoil drainage to provide protection against any post development groundwater rise. It is important to note development staging will be done over many years and ongoing post development groundwater monitoring will be undertaken and outcomes used will inform the engineering design of future stages as they develop.

All subsoil drainage is proposed to be located at a controlled groundwater level (CGL) set at the AAMGL. Lots will achieve an adequate clearance above the invert of the subsoil drains through the use of imported fill. Ongoing management of subsoil drainage will be required to ensure its ongoing performance in accordance with design.

All subsoil drainage will be free draining in accordance with DWER requirements and treated for water quality prior to discharge. The intent is that subsoil drainage will be treated within 1 EY bioretention areas whose locations are shown in Figure 9. Opportunities for insitu treatment of subsoil flow via use of special media around the subsoil will also being examined as an alternative to minimise fill. Subsoil drainage design will be undertaken at UWMP stage.

Finished lot levels and fill requirements are a detailed design issue to be addressed during the preparation of detailed engineering design drawings and preparation of the UWMP and will be ultimately submitted for council approval at that stage. Future POS levels will be also be established at this time compliant with CoA requirements for clearance to groundwater.

Groundwater/subsoil modelling will be performed at UWMP stage in accordance with the IPWEA (2016) Draft Specification on Separation Distances for Groundwater Controlled Urban Development. This guideline recommends the establishment of development levels on the basis of detailed modelling of subsoil drainage utilising a 30 year daily rainfall record obtained from DWER based on a future median rainfall scenario as outlined in Selection of Future Climate Projections for Western Australia (DoW, 2015).

IPWEA (2016) requires the provision of a minimum 0.3m of coarse sand in the rear of lots above the 50% AEP phreatic surface for residential lots of size 400-800m^2, and a 0.15m clearance for lots <400 m^2. This criteria will be used as the basis for establishing fill requirements for the site, in consultation with CoA.

This LWMS recognised that the CoA has previous experiences with poor infiltration of imported fill, and permeability rates suggested within water management documents

have not been met. As a result some recent developments in Forrestdale and Wungong have encountered groundwater management issues. As requested by CoA, on-site confirmation via testing of permeability rates will therefore be undertaken, with a minimum three tests per stage. Further specific details of this testing will be appropriately defined at UWMP stage.

With respect to POS areas, the separation from phreatic crest to finished surface level will be undertaken based on CoA requirements for clearance to groundwater in these areas.

7.2 Acid Sulphate Soils

As discussed in Section 4.3, a detailed soil and groundwater study is recommended to be undertaken in accordance with the Department of Environment Regulation guidelines to fully characterise the nature and extent of ASS across the site.

This will be conducted appropriately as a separate process to this LWMS.

All assessment and management of ASS will be conducted in accordance with the Acid Sulphate Soil Guideline Series Identification and Investigation of Acid Sulphate Soils (DoE, 2004).

8. Monitoring

8.1 Pre Development Monitoring

No need is anticipated need for additional predevelopment monitoring for the purpose of informing the UWMP and subdivision process.

If any further monitoring is required this will serve to inform engineering design rather than to satisfy government agency requirements.

8.2 Post Development Monitoring

Post development groundwater monitoring locations and parameters are detailed in Figure 12 and Table 15.

Department of Water (2012) indicates a minimum of 3 years post development monitoring is required, and defines post development as "*from completion of first subdivision to five years after 80 per cent of the development (by land area) has been completed*".

The program is therefore designed to operate over a three year post development period, with the timing for commencement of the program to be negotiated at UWMP stage with DWER and the City of Armadale with consideration of development staging.

The program may need to be modified as data is collected to increase or decrease the monitoring effort in a particular area, or to alter the scope of the program itself. Any modification to the program would be identified through review of the collected data and would require the agreement of all parties (DWER, City of Armadale, and developer).

All water quality testing will be conducted by a NATA approved laboratory.

Based on monitoring outcomes, a contingency action plan is shown in Table 16. Specific monitoring target values and contingency trigger values will be based on predevelopment monitoring data and defined as development proceeds based on staging and additional data collected prior to the commencement of development.

Table 15: Post Development Monitoring Program

Monitoring	Parameter	Location	Method	Frequency and Timing
Groundwater	Water Level (m AHD)	4 bore within the site + nearby DWER bores	Electrical depth probe or similar	Quarterly
	pH, EC, Nitrogen, Phosphorus	4 bores within the site	Pumped bore sample	Quarterly (Jan, Apr, Jul & Oct)
Surface water	pH, EC, TSS Nitrogen Phosphorus	2 location in Baileys Branch Drain (upstream & downstream)	Collected grab sample	Nominally 4 times per year when/if water present, typically June to October.

Table 16: Contingency Planning

Monitoring Type	Criteria for Assessment	Criteria Assessment Frequency	Contingency Action
			1. Assess if an isolated, development area or regional occurrence. 2. Determine if due to the development or other external factors. 3. Perform appropriate contingency action as required (examples provided below) 4. Record and report any breach and action taken. 5. If necessary, inform residents of any required works and their purpose. 6. Inform and provide monitoring data to DoW and CoA upon breach of any trigger value(s).
Surface Water and Groundwater Quality	**Water Quality** Water quality from the Study Area compared to : a) predevelopment surface water and groundwater quality monitoring results b) typical urban stormwater quality on the Swan Coastal Plain (Martens et al 2004) TN : 1.1 mg/l TP : 0.21 mg/l with reference to ANZECC guidelines [1]	annual review and reporting	1. Identify and remove any point sources of pollution. 2. Review operational and maintenance (eg fertilising) practices. 3. Consider alterations to POS areas including landscape regimes and soil amendment. 4. Consider modifications to the stormwater system. 5. Consider initiation of community based projects.

1. ANZECC guidelines to be used as a reference point only. ANZECC guidelines state that guidelines values are not intended to be directly applied to stormwater quality, however are applicable where the stormwater system are regarded as having conservation value. ANZECC guideline values are derived for unmodified or slightly modified ecosystems. ANZECC recommends the values only be applied where site specific values do not exist, or site specific targets cannot be derived.

9. Urban Water Management Plans

Consistent with processes defined in WAPC (2008), an Urban Water Management Plan (UWMP) will be developed and submitted to support subdivision applications for various stages of development within the site. UWMPs will address:

- Demonstrated compliance with LWMS criteria and objectives to the satisfaction of CoA and DWER.
- Agreed/approved measures to achieve water conservation and efficiencies of water use.
- Detailed stormwater management design including refining stormwater modelling detailed in the LWMS.
- Specific structural and non-structural BMPs and treatment trains to be implemented including their function, location, maintenance requirements, expected performance and agreed on going management arrangements.
- Management of groundwater levels including proposed fill levels.
- Management of subdivision works including development of a strategy for sediment control during construction, and insitu permeability testing.
- Implementation plan including roles, responsibilities, funding and maintenance arrangements.
- Specific monitoring and reporting to be undertaken post development.
- Contingency plans (where necessary).

More detail of the POS and stormwater storage integration will be provided during the development of the UWMP, including refinement of stormwater modelling, preparation of landscape plans (species selection and treatments), and detailed design drawings.

Preparation of the UWMP will be the responsibility of the developer.

10. Implementation

Table 17 details the roles, responsibilities and funding to implement the LWMS for this site. This LWMS will be implemented by the developer, CoA, and DWER based on the roles, responsibilities and funding as detailed in Table 17. Any modification required to the LWMS would be identified through the UWMP process and require the agreement of all parties.

Monitoring outcomes will be used in a continual improvement capacity to review the implemented WSUD within the site with outcomes used to inform future planning and design approaches for subsequent developments in the area.

Specific maintenance responsibilities will be detailed at UWMP stage. It is envisaged that the schedule for maintenance works will be consistent with typical requirements of CoA, and include the need for ongoing management of subsoil drainage to ensure its ongoing performance in accordance with design.

With respect to construction, the contractor will be responsible for preparing and implementing appropriate best management practices during construction. Construction management will be undertaken consistent with the Local Government Guidelines for Subdivision Development (Institute of Public Works Engineering Australia 2011).

These actions will be further refined, where appropriate, at UWMP stage.

With respect to the Baileys Branch Drain, negotiations between the CoA and Water Corporation with regard to a maintenance agreement are ongoing. A transition process framework has been established (identifying processes, sequencing and responsibilities) and the developer has provided associated documentation to the Water Corporation to assist in the resolution of land matters for the drains reconfiguration (Appendix K).

Both Water Corporation and CoA will need to share responsibility for maintaining the multiple use corridor and a maintenance agreement will need to be established between the agencies for this purpose, similar to other transitioning drains in the Forrestdale area.

Table 17: Implementation Responsibilities

	Responsibility & Funding			
Implementation Action	**Developer**	**CoA**	**DWER**	**W Corp**
Finalise maintenance agreement	☑	☑		☑
Urban Water Management Plans				
Preparation of a UWMP for individual development stages	☑			
Review & approval of UWMPs		☑	☑	
Stormwater System				
Construction within the site	☑			
Post development monitoring program	☑			
Operation & Maintenance				
a) Prior to Handover	☑			
b) Following Handover		☑		☑

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FIGURES

Date:1/10/2018 Job No. H17064

Site

hyd2o

Anstey Rd East: Local Water Management Strategy

Location Plan

Figure 1

Date: 1/11/2018 Job No H17064

Source : CLE Town Planning + Design (2018)

hyd2o

Anstey Road East : Local Water Management Strategy

Development Concept Plan

Figure 2

Date: 1/10/2018 Job No. H17064Av1

Site

Topography (mAHD)

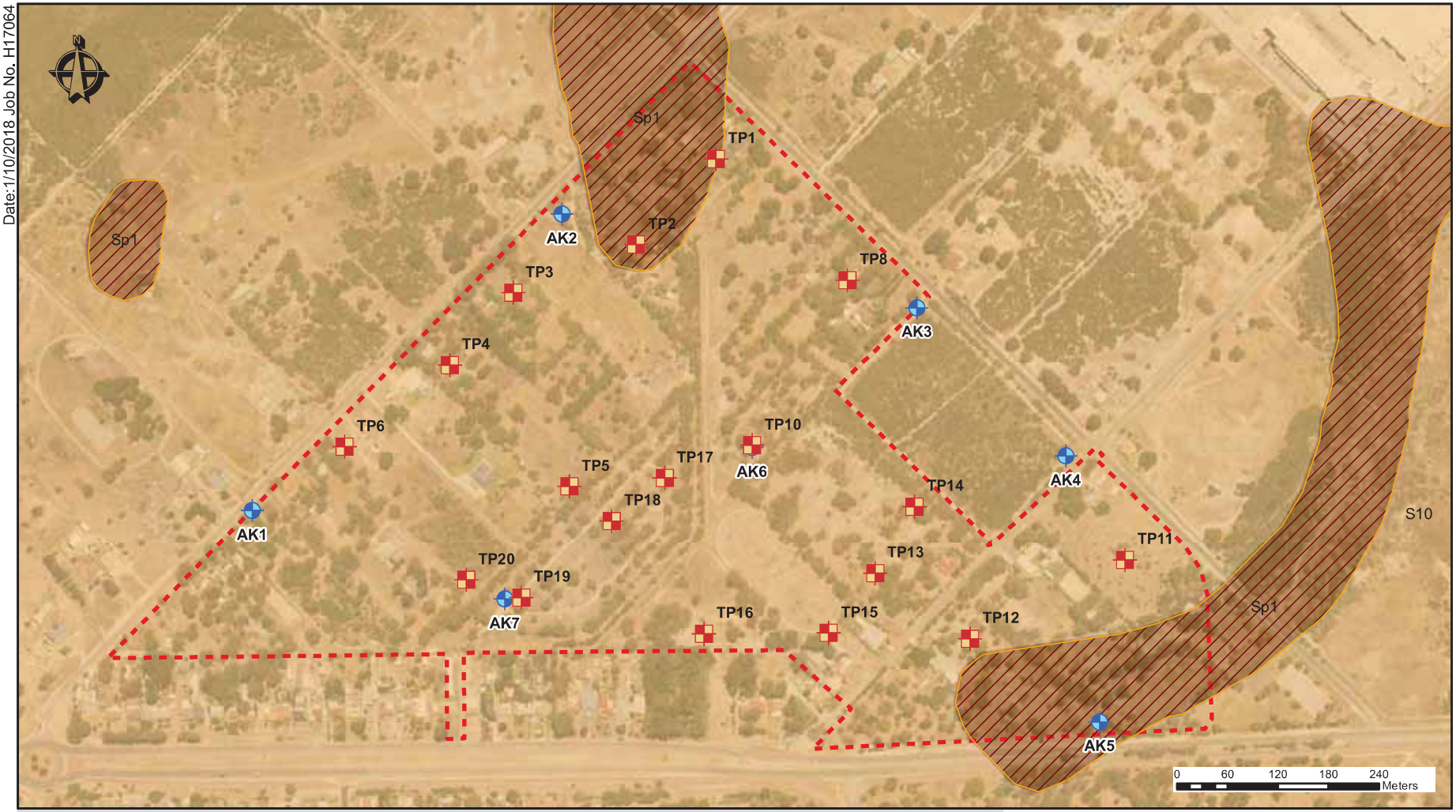
hyd2o

Anstey Rd East: Local Water Management Strategy

Site Conditions Plan

Figure 3

Date:1/10/2018 Job No. H17064



Site

Environmental Geology

S10-Sand

Sp1-Peaty Sand

High to moderate risk of ASS

Test Pits (JDSI, 2018)

Groundwater Bores

hyd2o

Anstey Rd East: Local Water Management Strategy

Geotechnical Plan

Figure 4

Date: 1/10/2018 Job No. H17064

Site

Baileys Branch Drain

Wetlands

Conservation

Multiple Use

Resource Enhancement

hyd2o

Anstey Rd East: Local Water Management Strategy

Wetlands Plan

Figure 5

Date: 1/10/2018 Job No. H17064

Site

Baileys Branch Drain

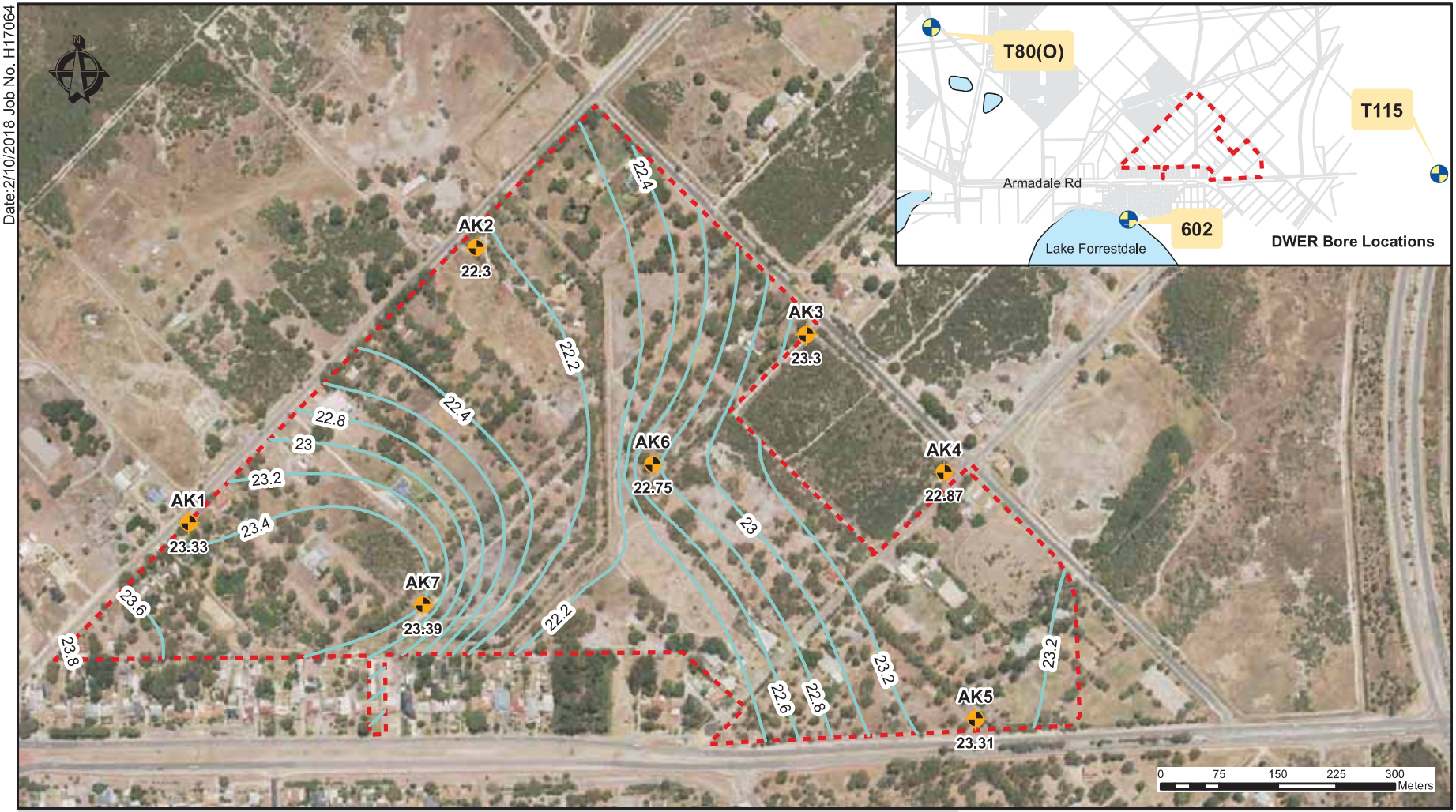
hyd2o

Anstey Rd East: Local Water Management Strategy

Surface Water Plan

Figure 6

Date:2/10/2018 Job No. H17064



Site

Groundwater Monitoring Bores (AAMGL, mAHD)

DWER Groundwater Monitoring Bore

hyd2o

Anstey Rd East: Local Water Management Strategy

Groundwater Plan

Figure 7

Date: 1/11/2018 Job No. H17064

AnsteyRd
Lots
Opportunity for Non Residential
POS
Roads
School
Post Development Catchments
Realigned Baileys Branch Drain as a Living Stream

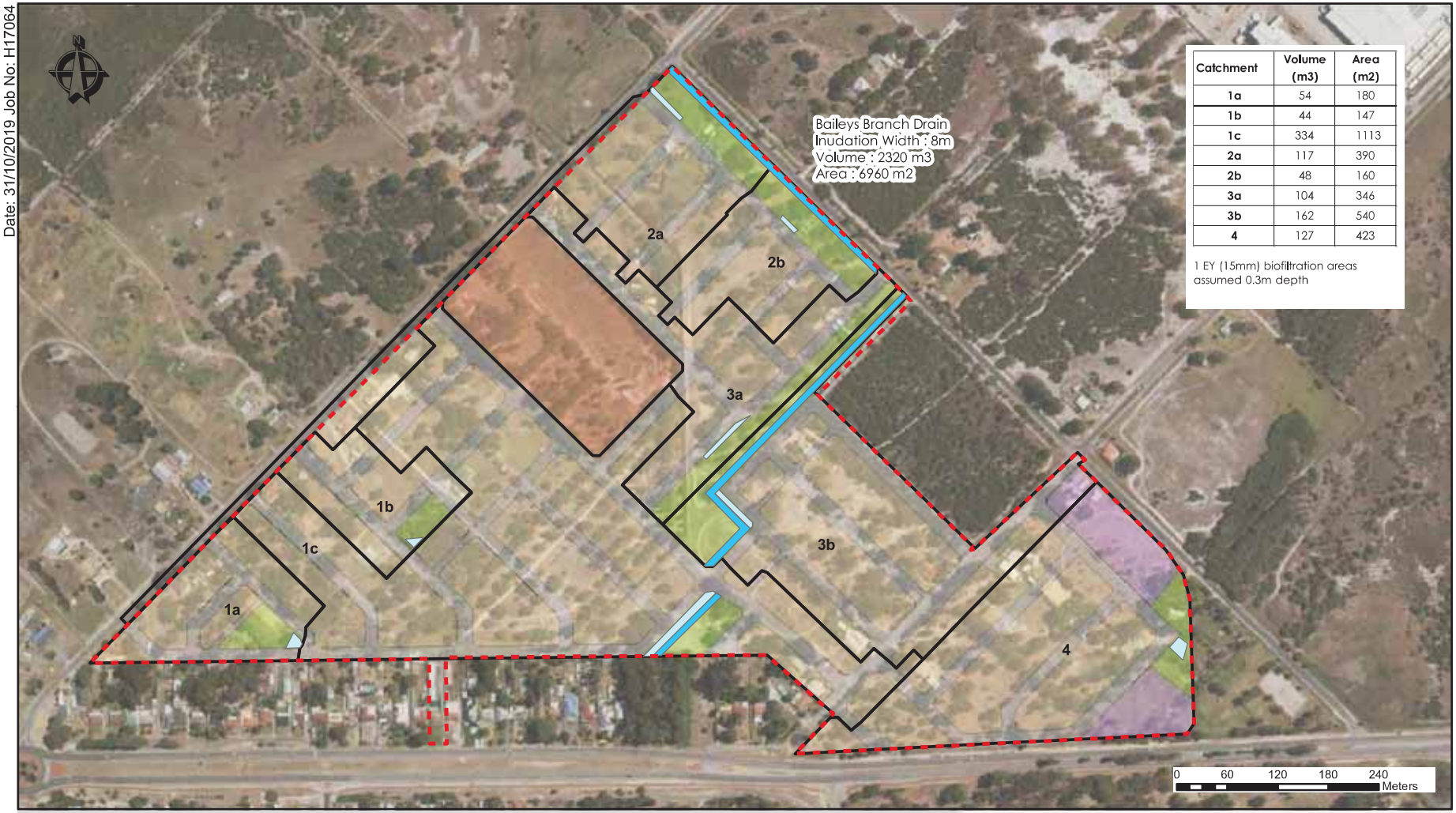
hyd2o

Anstey Rd East: Local Water Management Strategy

Stormwater Concept Plan and Catchments

Figure 8

Date: 31/10/2019 Job No: H17064



Catchment	Volume (m3)	Area (m2)
1a	54	180
1b	44	147
1c	334	1113
2a	117	390
2b	48	160
3a	104	346
3b	162	540
4	127	423

1 EY (15mm) biofiltration areas assumed 0.3m depth

Site
Post Dev Catchments
15mm Local Storage
Living Stream (1 EY)
AnsteyRd
Lots
School
POS
Roads
Opportunity for Non-residential

hyd2o

Anstey Rd East: Local Water Management Strategy

Stormwater Management Plan: 15mm

Figure 9

Date: 03/07/2019 Job No. H17064

AnsteyRd
Lots
Opportunity for Non Residential
POS
Roads
School
Post Development Catchments
0.2 EY Inundation Area

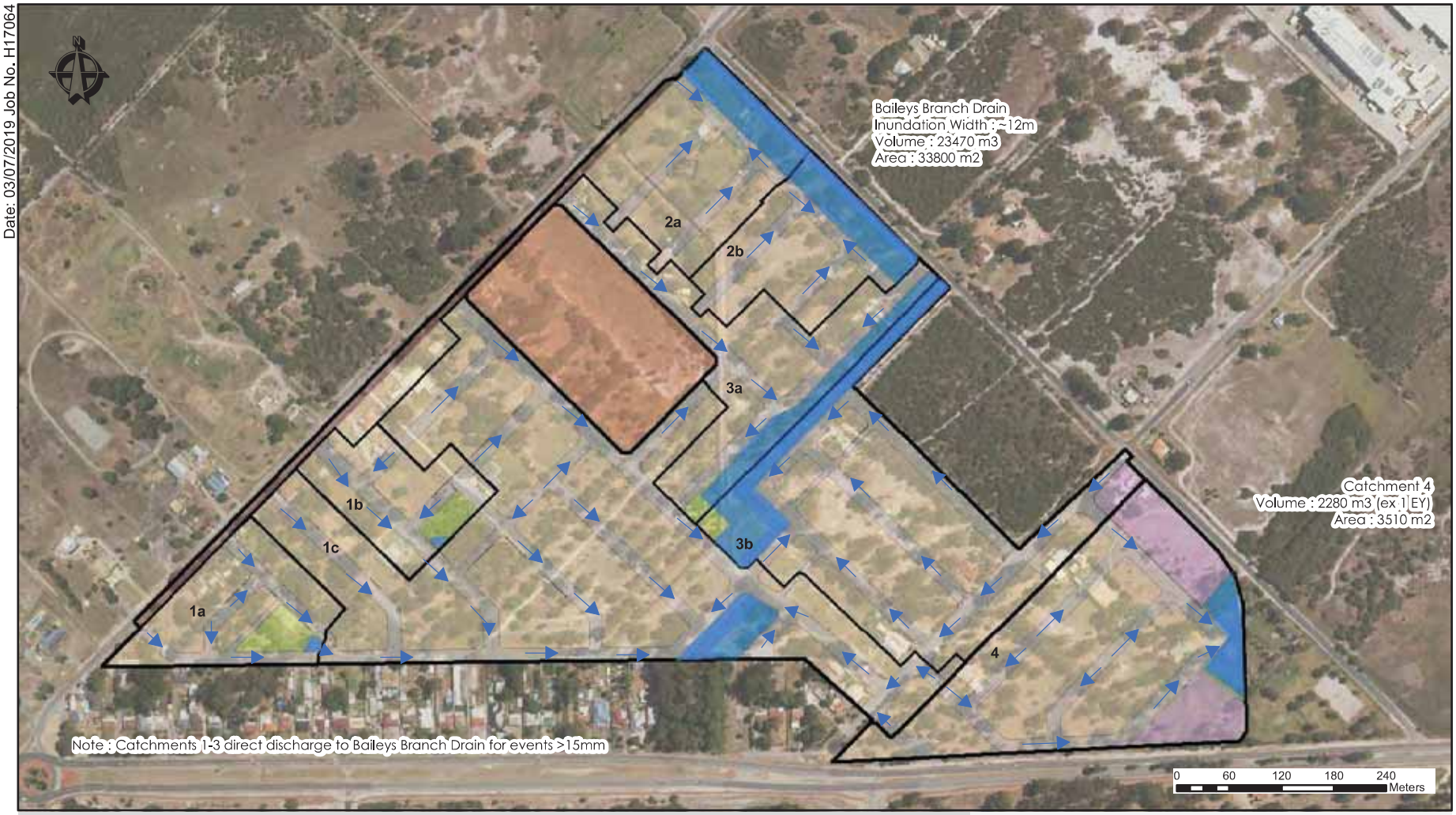
hyd2o

Anstey Rd East: Local Water Management Strategy

Stormwater Management Plan: 0.2 EY

Figure 10

Date: 03/07/2019 Job No. H17064



AnsteyRd
Lots
Opportunity for Non Residential
POS
Roads
School
Post Development Catchments
1% AEP Inundation Area

hyd2o

Anstey Rd East: Local Water Management Strategy

Stormwater Management Plan: 1% AEP

Figure 11

Date: 2/10/2018 Job No. H17064

Site
Groundwater Site
Surface Water Site

AnsteyRd
Lots
Roads
POS

Non Residential Opportunity
School
Post Development Catchments

hyd2o

Anstey Rd East: Local Water Management Strategy

Post-Development Monitoring Sites

Figure 12

Appendix C: Vision Plan (Apex Planning 2022)

Vision Plan (Amendment 1 – Anstey-Keane Urban Development Precinct East Structure Plan)	NORTH	**Drawn:** Alessandro Stagno **Rev:** 0
Lot 500 (16) Anstey Road, Forrestdale		**Source:** MNG Access **Date:** 7 November 2022 apex planning

APPENDIX 4

REVISED TRAFFIC IMPACT ASSESSMENT

transcore
20 years anniversary

transport planning
traffic engineering
modelling

Proposed LSP Amendment

Lot 500 (16) Anstey Road, Forrestdale

Transport Impact Assessment

PREPARED FOR:
Cedarville Pty Ltd

December 2022

Document history and status

Author	Revision	Approved by	Date approved	Revision type
Roger Bajwa	r01	R White	08/12/2022	Draft
Roger Bajwa	r01a	R White	09/12/2022	Final

File name: t22.217.rb.r01a

Author: Roger Bajwa

Project manager: Behnam Bordbar

Client: Cedarville Pty Ltd

Project: Lot 500 (16) Anstey Road, Forrestdale

Document revision: r01a

Project number: t22.217

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REPORT FIGURES

REPORT TABLES

1 Introduction

This Transport Impact Assessment has been prepared by Transcore on behalf of Cedarville Pty Ltd with regard to a proposed amendment to the Anstey Keane Urban Development Precinct - East Structure Plan (LSP) for land at Anstey Road, Forrestdale in the City of Armadale.

As part of the proposed amendment to the Anstey-Keane East Precinct LSP, the zoning of Lot 500 (16) Anstey Road, Forrestdale is proposed to be changed from Residential (R25) to Local Centre (commercial).

The subject site is located on the southeastern side of Anstey Road in Forrestdale. It is occupied by Anstey Road to the northwest, and existing residential developments to the northeast as well as to the south as shown in **Figure 1**.

Figure 1: Site location

Transcore prepared a Transport Impact Assessment for Anstey-Keane East Precinct LSP in July 2020.

It should also be noted that in separate development applications a service station with fast food outlets has been approved and a childcare facility has been proposed in the vicinity of the proposed local centre. However, these developments have not

been constructed yet. The service station with fast food outlets is located to the southwest of the proposed local centre and the childcare centre is located to the northeast of the proposed local centre as shown in **Figure 2**.

Figure 2: Location of the subject site, proposed childcare centre and approved service station and fast-food outlets

This Transport Impact Assessment report focuses on the impact of the proposed Amendment rather than revising the assessment of the whole Anstey Keane Urban Development Precinct - East Structure Plan. Accordingly, this report should be read in conjunction with the 2020 Transport Impact Assessment for Anstey-Keane East Precinct LSP.

2 Proposed Amendment To Local Structure Plan

Transcore prepared a Transport Impact Assessment for Anstey-Keane East Precinct LSP in July 2020. In that previous TIA report, the Anstey-Keane East Precinct area was proposed to be subdivided for residential development, a primary school site and potential non-residential development sites along the western side of Keane Road opposite Forrestdale Business Park West. It was anticipated to yield approximately 650-670 residential lots and two group housing sites. A total dwelling yield of approximately 675-695 dwellings was assumed.

The draft concept plan for the previous LSP is shown in **Figure 5**. For further details please refer to the TIA prepared by Transcore for Anstey-Keane East Precinct.

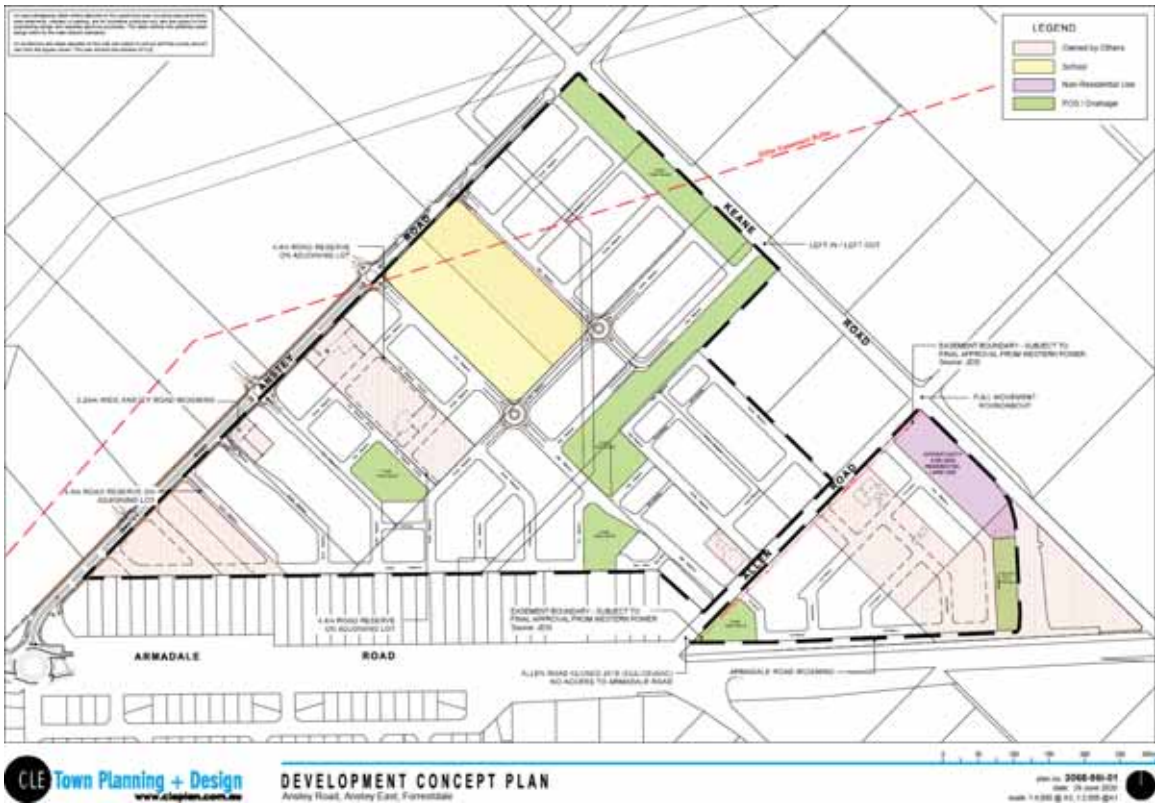


Figure 3: Concept plan for previous LSP

As part of the proposed amendment to the Anstey Keane Urban Development Precinct - East Structure Plan, the zoning of Lot 500 (16) Anstey Road, Forrestdale is proposed to be changed from Residential (R25) to Local Centre (commercial) as shown in **Appendix A**. The area of the lot is 8,797m^2 and considering an average lot area of 300m^2 for a residential dwelling, it was anticipated to yield 29 residential dwellings. These dwellings are proposed to be replaced by a local centre with a floor area of 2,000m^2 including 1,500m^2 for retail shops and an additional 500m^2 for non-retail.

3 Existing Situation

3.1 Existing Land Use

The subject site is currently a rural-residential property with one house, as shown in **Figure 4**.

Figure 4: Existing land use

In the City of Armadale Local Planning Scheme No 4, the site is currently zoned as 'Urban Development' as shown in **Figure 5**. As shown in **Appendix B,** the site is currently indicated as Residential (R25) in the structure plan.

Figure 5: Existing zoning

3.2 Existing Road Network

Armadale Road is a Primary Distributor road under the care and control of Main Roads WA and is covered by a Primary Regional Roads reservation in the Metropolitan Region Scheme (MRS), as shown in **Figure 5**. It is currently constructed as a dual carriageway 2-lane divided rural road (two 3.5m traffic lanes and approximately 1.2m of the shoulder sealed on each side of the road) in the vicinity of the subject site. An 80km/h speed limit applies on Armadale Road in this area. Existing weekday traffic volumes on Armadale Road (east of Nicholson Road) were around 19,400 vehicles per day (vpd) in 2017/18 with heavy vehicles forming 11.3% of this traffic. At the eastern end of the LSP area, Armadale Road (east of Forrest Road) carried around 29,700vpd in 2021/2022 with heavy vehicles forming 9.3% of this traffic.

The proportion of average weekday traffic (AWT) flows that occur during morning and afternoon peak hours on Armadale Road is illustrated in **Table 1** based on the information obtained from the Main Roads WA website.

Table 1: Existing Peak Period Traffic Flows

Road	Date	7-8AM	8-9AM	3-4PM	4-5PM	5-6PM	AWT
Armadale Rd (E of Nicholson Rd)	2017/18	1455	1366	1424	1499	1366	19,377
		7.5%	7.0%	7.3%	7.7%	7.0%	
Armadale Rd (W of Forrest Rd)	2017/18	950	949	1048	1082	961	13,185
		7.2%	7.2%	7.9%	8.2%	7.3%	
Armadale Rd (E of Forrest Rd)	2017/18	1351	1363	1405	1451	1298	18,747
		7.2%	7.3%	7.5%	7.7%	6.9%	
Armadale Rd (W of Forrest Rd)	2021/22	1928	1959	2085	2078	1837	23,901
		8.1%	8.2%	8.7%	8.7%	7.7%	
Armadale Rd (E of Forrest Rd)	2021/22	2411	2577	2644	2496	2120	29,733
		8.1%	8.7%	8.9%	8.4%	7.1%	

Anstey Road is currently classified as a *District Distributor B* in the Main Roads WA functional road hierarchy, providing local access within this area. It is constructed as a single-carriageway, two-lane rural road. Anstey Road currently links through from Armadale Road to Ranford Road. It has a posted speed limit of 60km/h from Armadale Road to Keane Road (adjacent to this site) and 80km/h from Keane Road to Ranford Road. Anstey Road carried 1,708vpd north of Armadale Road in 2017/18 with 13.1% of this traffic being heavy vehicles.

The Armadale Rd / Anstey Rd / Weld St intersection is constructed as a 4-arm roundabout accommodating two through lanes in each direction on Armadale Road.

3.3 Public Transport

Bus Route No. 519 runs on Armadale Rd and Nicholson Rd from Murdoch Train Station to Armadale Train Station, as shown in **Figure 6**.

This route provides an hourly service Monday to Friday with more frequent service (4 per hour) in the AM and PM peak periods. There is currently no service on weekends or public holidays.

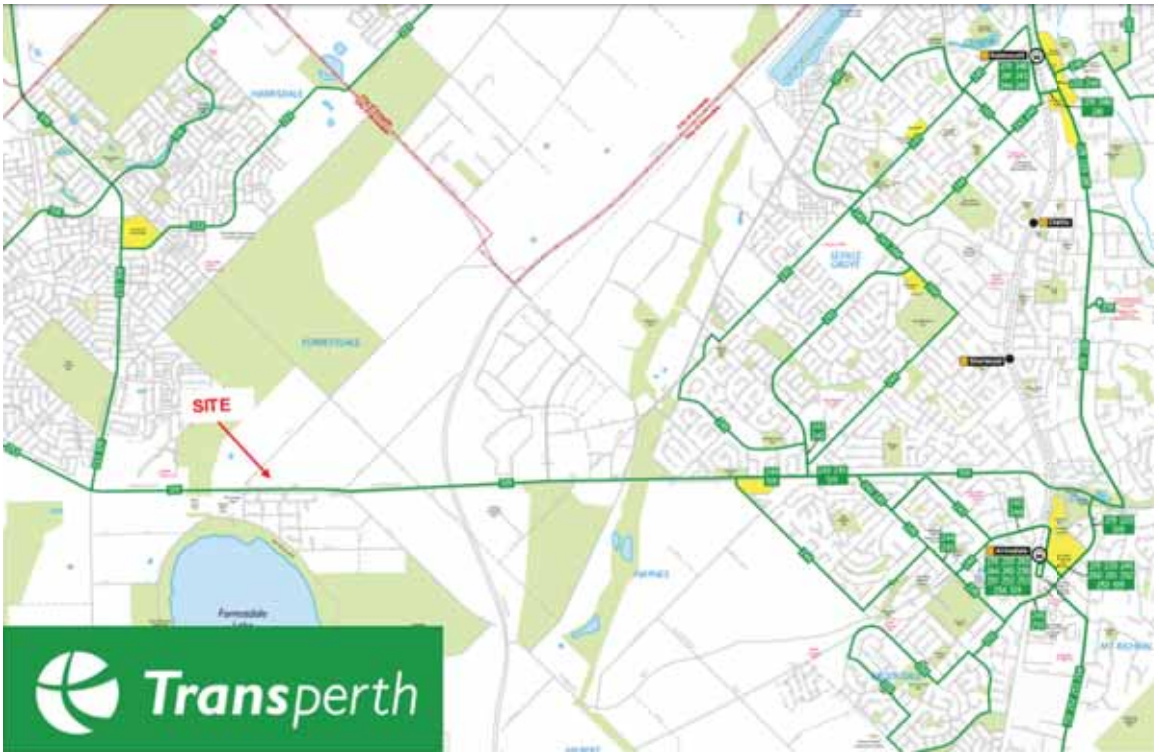


Figure 6: Existing bus routes

3.4 Pedestrian and Cyclist Facilities

There is a 1.5m wide footpath on the southern side of Armadale Road from Nicholson Road to Weld Street. East of Weld Street there is a 3m shared path instead.

The Department of Transport's Perth Bike Map series (see **Figure 7**) shows that Anstey Road, Allen Road and Keane Road are considered good road riding environments.

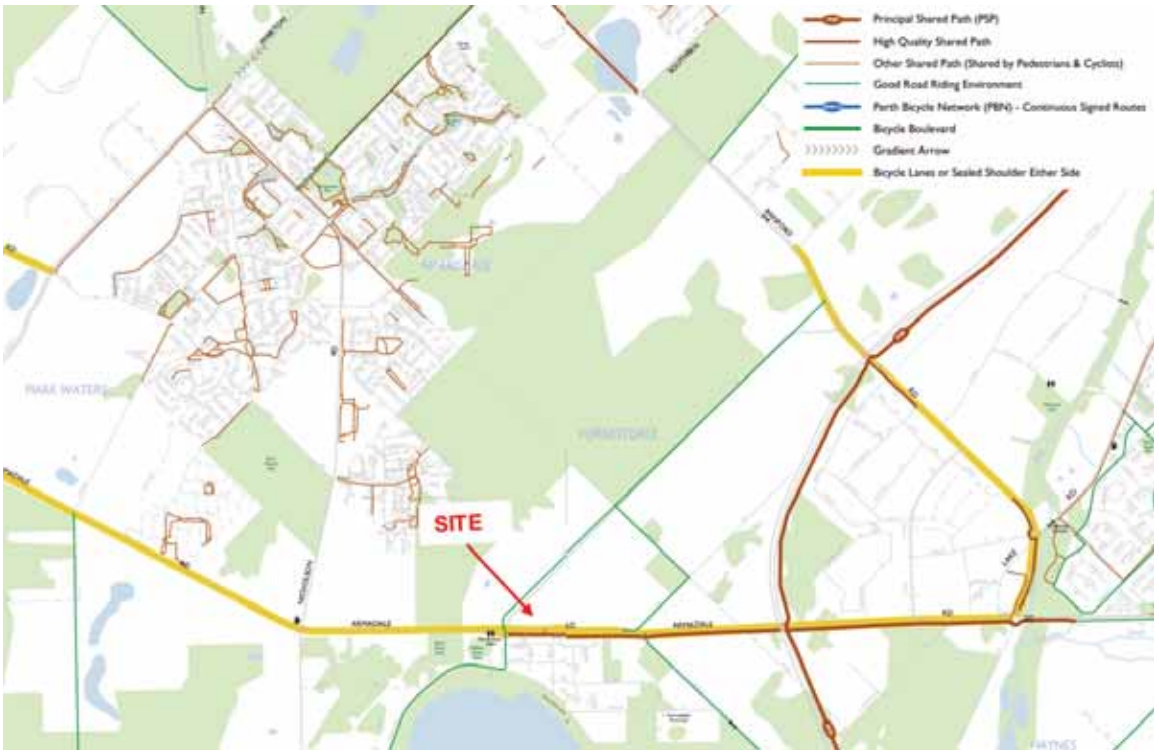


Figure 7: Bike map

3.5 Changes to Surrounding Road Network

Refer to the 2020 Transport Impact Assessment for Anstey-Keane East Precinct LSP. The main change to the existing road network that is relevant to the subject site is the treatment of Anstey Road as already planned in the Anstey Keane Urban Development Precinct - East Structure Plan, is that Anstey Road will be closed off on the southwest side of Keane Road to avoid industrial traffic travelling through this the Anstey Keane Urban Development Precinct.

3.6 Public Transport Network Planning

The Department of Transport plan, *Public Transport for Perth in 2031*, envisages a future bus rapid transit route from Armadale to Cockburn Central providing a cross-suburban link between the Mandurah and Armadale railway lines. However, this is part of the ultimate network for a city of 3.5 million people and is indicated as beyond 2031.

4 Proposed Transport Network

4.1 Road Hierarchy

The proposed hierarchy of roads in and around the LSP area is illustrated in **Figure 8** using the road hierarchy defined in the Western Australian Planning Commission *Liveable Neighbourhoods* (LN) policy.

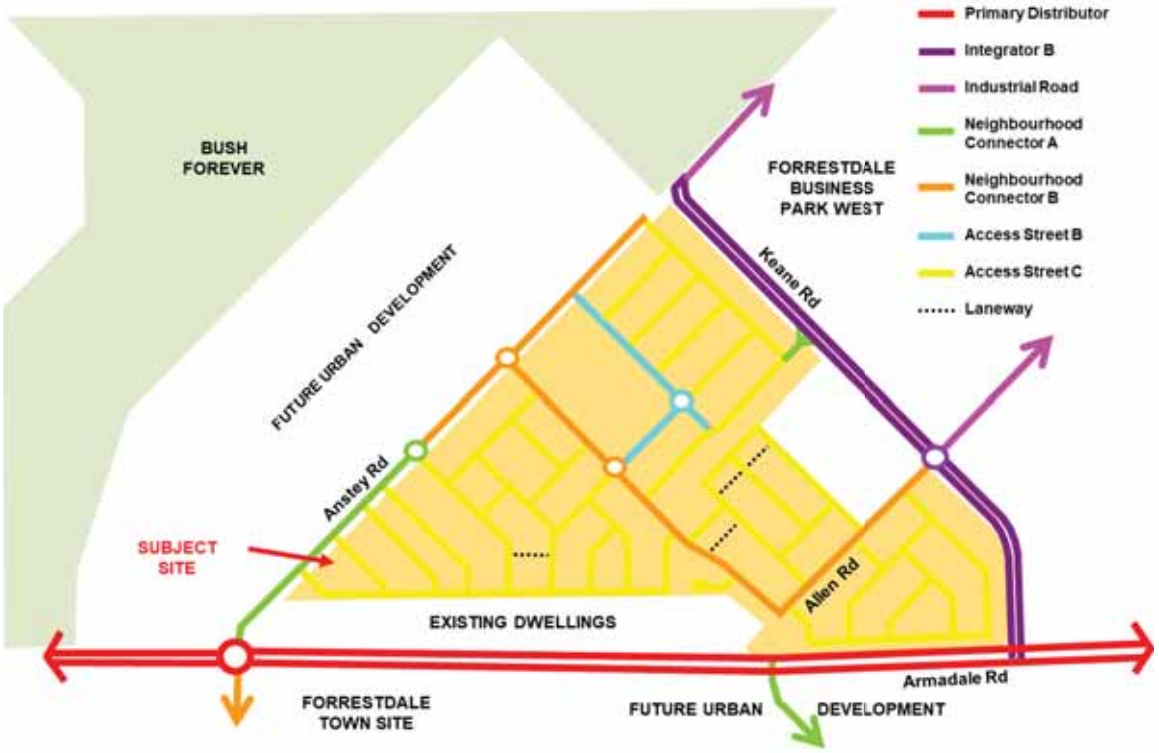


Figure 8: Road hierarchy

Some key characteristics of the relevant road classifications for neighbourhood connectors and access streets have been summarised in **Table 2** below. These are generally based on Liveable Neighbourhoods guidelines although the proposed widths do vary slightly from the standard Liveable Neighbourhoods cross-section diagrams.

Table 2: Road hierarchy

Road Classification	Indicative upper volume	Indicative road reserve width	Indicative road pavement width
Neighbourhood Connector A	7,000 vpd	24.4m	2 x 5m (incl. cycle lanes), 2m median & embayed parking
Neighbourhood Connector B	3,000 vpd	19.4m to 20m (18m min)	7m (plus embayed parking)
Access Street A	3,000 vpd	24m typical	2 x 3.5m, 6m median & embayed parking
Access Street B	3,000 vpd	18m typical	6m (plus embayed parking)
Access Street C	3,000 vpd	15.4m to 16m	7.2m
Access Street D	1,000 vpd	14.2m to 15m	6m
Laneway	300 vpd	6m typical	6m

4.1.1 Neighbourhood Connector Roads

The Anstey Keane Urban Development Precinct - East Structure Plan plans for Anstey Road to be closed off on the southwest side of Keane Road to avoid industrial traffic travelling through this Anstey Keane Urban Development Precinct.

The future traffic flows in **Section 6.3** of this report indicate that about half the length of Anstey Road north of Armadale Road would be likely to carry more than 3,000vpd, so it would be appropriate for that section to be constructed to Neighbourhood Connector A road standard. Current planning for that section of Anstey Road (as agreed with the City of Armadale) is based on a 24.6m Neighbourhood Connector road reserve width including a 3.6m median.

The future neighbourhood connector from Anstey Road to Allen Road and the section of Allen Road through to Keane Road would carry traffic volumes of less than 3,000vpd, so it would be appropriate for the rest of Anstey Rd and the neighbourhood connector route including Allen Road to Keane Road) to be constructed to a Neighbourhood Connector B road standard, as indicated in **Figure 8**. Therefore the section of Anstey Road adjacent to the northern half of the LSP area can be designed as a Neighbourhood Connector B within the existing 20.1m road reserve. The same applies to Allen Road within the LSP area.

4.1.2 Access Streets

The basic access street width required by the City of Armadale is the 15.4m Access Street C of *Liveable Neighbourhoods.* This standard is able to accommodate traffic volumes of up to 3,000vpd.

Two roads within the LSP area adjacent to the primary school site are proposed to have 18m widths and will include embayed parking for the primary school. The road servicing the Industrial Business zone is also proposed to have an 18m width. They are indicated as Access Street B in **Figure 8**.

4.1.3 Laneways

In Liveable Neighbourhoods, the standard road reserve width of laneways is 6.0 metres. These would typically be designed with flush kerbing (i.e. at the same level as the laneway pavement) and central drainage, and can accommodate two-way vehicle movement and rubbish collection. Visitor car parking is typically constructed in the road reserve adjacent to proposed lots serviced by laneways at a typical rate of one bay per every two dwellings.

However, for laneways that provide the only public road frontage for lots abutting public open space in the proposed concept plan a 9.0m wide road reserve is proposed for these laneways to accommodate services as well. This width is able to accommodate a 6m carriageway and parking on one side, where required. The only laneway of this type in the proposed concept plan is the southwestern one shown in **Figure 8**.

4.2 Public Transport

The existing bus service along Armadale Road adjacent to the site is noted in **Section 3.3** and long-term potential upgrade of bus services along Armadale Road is noted in **Section 3.6**.

Previous advice from the Public Transport Authority (PTA) indicates any potential bus service through Forrestdale Business Park West would be in the longer term and would be related to the level of development of the surrounding areas. A likely alignment for a potential bus service would be along Ranford Road, to provide a strategic connection to Armadale. Anstey Road and Keane Road are also possibilities due to connections to adjacent areas, although a Ranford Road service would likely be of a higher priority.

The potential future link road east of Anstey Road to Allen Road to connect to Keane Road (shown in orange in **Figure 8** as a Neighbourhood Connector B road) would provide a suitable route for future bus service through this area if and when the PTA decides to provide a bus service through this area.

4.3 Pedestrian and Cyclist Facilities

The proposed pedestrian and cyclist network within and adjacent to the LSP area is outlined in **Figure 9**.

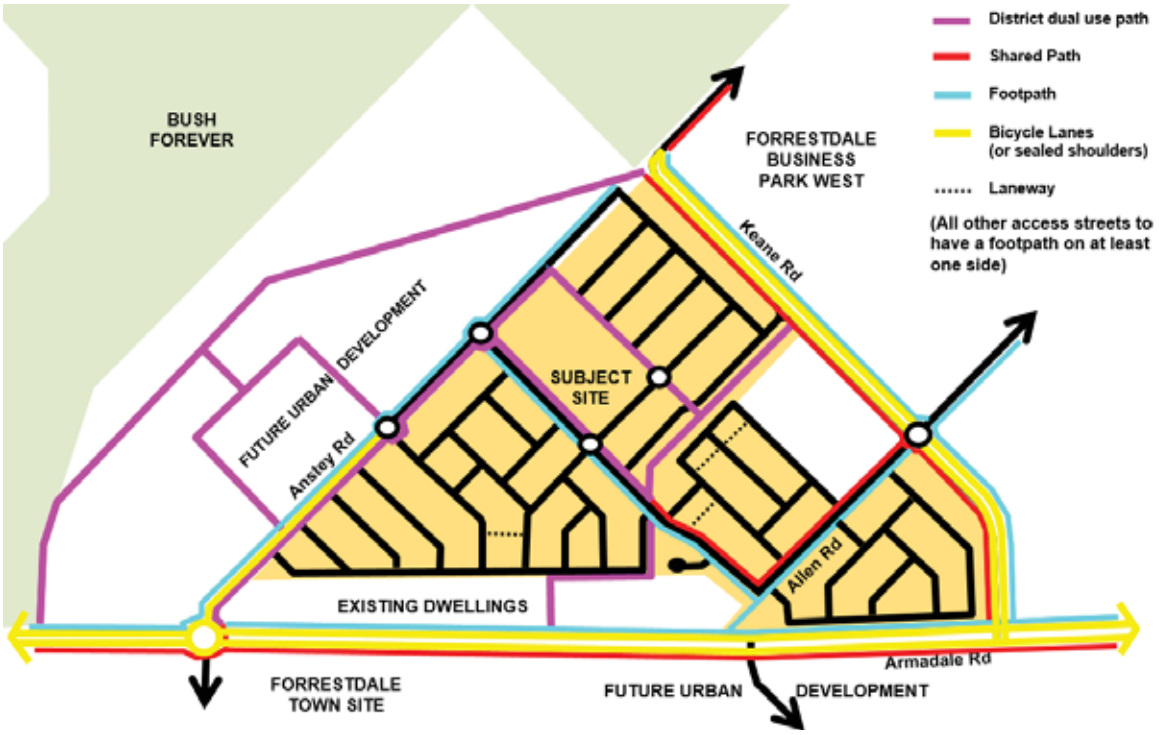


Figure 9: Pedestrian and cyclist facilities

In accordance with Liveable Neighbourhoods guidelines paths will be provided on at least one side of all roads. There would be paths on both sides on all Neighbourhood Connector roads, including a shared path at least 2m wide on one side of Anstey Road, Allen Road and the proposed neighbourhood connector road link between them.

A network of district dual use paths has been identified as part of the development contribution plan for this precinct and those paths are also shown on **Figure 9**.

On-street cycle lanes are normally included only on Neighbourhood Connector A roads and above, as indicated in the details of the road hierarchy listed in **Table 1**. This principle is reflected in **Figure 9**.

Note that the paths shown in **Figure 9** have not changed from what was shown in the 2020 TIA report. Exact details of internal road and path networks within the future local centre are currently unknown but it is assumed that the path network connectivity through the subject site to Anstey Road would be maintained through this future local centre site.

5 Integration with Surrounding Area

Refer to the 2020 Transport Impact Assessment for Anstey-Keane East Precinct LSP.

The proposed amendment to rezone the subject site for a local centre does not have any significant impact on the surrounding areas.

6 Analysis of the Transport Network

6.1 Assessment Period

The traffic assessment previously undertaken for the Anstey Keane Urban Development Precinct - East Structure Plan nominally indicated an assessment year of 2031 but actually reflects the full development of this precinct and surrounding areas. The actual timeframe for the full development of this precinct and surrounding areas is currently not known but it is anticipated to be at least 10 years into the future.

6.2 Traffic generation

Transcore prepared the Transport Impact Assessment for Anstey-Keane East Precinct LSP in July 2020. In that previous TIA report, the LSP area was proposed to be subdivided for residential development, a primary school site and potential non-residential development sites along the western side of Keane Road opposite Forrestdale Business Park West. It was anticipated to yield approximately 650-670 residential lots and two group housing sites. A total dwelling yield of approximately 675-695 dwellings was assumed.

Some of this traffic was expected to remain internal within the site with trips between the local facilities, primary school and residential areas.

As part of the proposed amendment to the Anstey Keane Urban Development Precinct - East Structure Plan, the zoning of Lot 500 (16) Anstey Road, Forrestdale is proposed to be changed from Residential (R25) to Local Centre (commercial). The area of the lot is 8,797m^2 and considering an average lot area of 300m^2 for a residential dwelling, the residential yield of this site is estimated as 29 residential dwellings.

The daily traffic generation rate used in the subject site for this transport report is 10 vehicle trips per day (vpd) per dwelling, which is consistent with the traffic generation of the previous report and as generally required by the City of Armadale for structure planning in this area.

The anticipated 29 residential lots of the Amendment area were therefore estimated to generate approximately 290vpd. Since these residential lots will now be replaced by the local centre the traffic generation for these residential lots is replaced by the traffic generation for the local centre.

Traffic generation from nearby areas that are also anticipated to be subdivided in future has also been included in the traffic modelling undertaken for this transport report.

The distribution of these trips in the previous LSP report was determined by the traffic model in proportion to the location of trip productions and attractors for work trips,

education trips and other trips (shopping, social, recreational, etc.) among all the land uses in the traffic model. The distribution of trips to and from the LSP area is summarised in **Table 3**.

Table 3: External trip distribution in the previous LSP report

Approach Road	Percentage of Trips
Armadale Road (west)	42%
Armadale Road (east)	24%
Anstey Road (northeast)	12%
Allen Road (northeast)	18%
Weld Street (south)	2%
Forrest Road (south)	2%
Total	**100%**

Transcore prepared a Transport Impact Assessment for the nearby service station and fast food outlets development in February 2021. The distribution of trips to and from the service station is summarised in **Table 4**. For further information please refer to the TIA prepared by Trasncore.

Table 4: Trip distribution for service station

Approach Road	Percentage of Trips
Armadale Road (west)	25%
Armadale Road (east)	25%
Anstey Road (northeast)	30%
Weld Street (south)	20%
Total	**100%**

Transcore prepared a Transport Impact Statement for the nearby childcare centre on Anstey Road in June 2021. It is assumed that the traffic generated by the childcare centre will consist of all local traffic from the Anstey Keane Urban Development Precinct. The distribution of trips to and from the childcare centre is summarised in **Table 5**. For further information please refer to the TIS prepared by Trasncore.

Table 5: Trip distribution for the childcare centre

Approach Road/Area	Percentage of Trips
Anstey Keane Urban Development Precinct	100%
Total	**100%**

The traffic volumes likely to be generated by the proposed local centre (commercial) were estimated in accordance with the *ITE Trip Generation Manual (11th Edition)*.

The trip rates which were used to estimate the proposed development traffic generation are as follows:

Strip Retail Plaza (822) – 1000 Sq. Ft. GFA

- Weekday daily: 54.45vpd per 1000sqft GFA/ 0.929 = 58.61vpd/ 100m^2 GFA;
- Weekday AM peak hour: 2.36vph per 1000sqft GFA/ 0.929 = 2.54vph/ 100m^2 GFA; and,
- Weekday PM peak hour: 6.59vph per 1000sqft GFA/ 0.929 = 7.09vph/ 100m^2 GFA.

Accordingly, it is estimated that the traffic generations for the proposed local centre (2000m^2 GFA) are:

- Weekday daily: [58.61 x 2,000/100] = 1,172vpd; and,
- Weekday AM peak hour: [2.54 x 2,000/100] = 51vph; and,
- Weekday PM peak hour: [6.59 x 2,000/100] = 132vph.

Further, the distribution of trips to and from the local centre is summarised in **Table 6**. As shown in the table, 30 percent of the traffic is anticipated to be generated from future urban development to the west of Anstey Road and 50 percent of the traffic is anticipated to be generated from the Anstey Keane East LSP area. The local centre is anticipated to generate 20 percent of the external traffic from Armadale Road and Weld Street.

Table 6: Trip distribution for the proposed local centre

Approach Road/Area	Percentage of Trips
Future Urban Development	30%
Anstey Keane Residental Precinct	50%
Armadale Road (west)	5%
Armadale Road (east)	5%
Weld Street (south)	10%
Total	**100%**

6.3 Traffic Flow Forecasts

The future total daily traffic flows on the road network around the subject site have been modelled for the future scenario of full development of this area as discussed above.

Figure 10 illustrates future total weekday anticipated traffic flows for the previous 2020 TIA report for Anstey-Keane East Precinct LSP.

These figures show the total future traffic flows on the major roads within this LSP area and surrounding area and also, in brackets, the component of these future traffic flows that would be generated by the future urban development of the LSP area. The figure of 43,00vpd on Armadale Road west of Anstey Road was obtained from Main Roads WA transport model results provided for the City of Armadale in 2016. Main Roads WA has also previously advised that traffic flows on Armadale Road may be significantly higher in the long term and these volumes are shown in **Figure 10** in square brackets on Armadale Road.

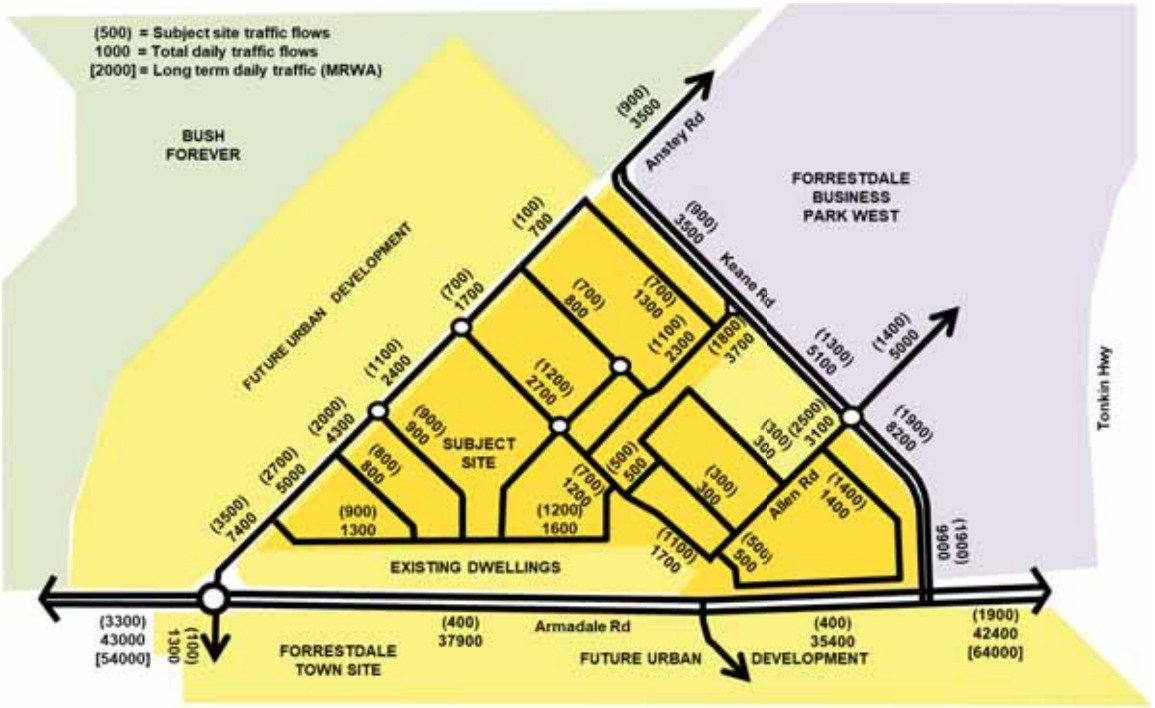


Figure 10: Daily traffic volumes from the previous LSP report

The daily traffic flows were adjusted to include the approved service station with fast food outlets and the proposed childcare facility and updated traffic volumes are shown in **Figure 11**.

Almost all the childcare facility traffic is expected to be generated with the Anstey Keane Urban Development Precinct. The net effect of the childcare centre on the LSP traffic is expected to be negligible because residential trip generation of 10vpd already accounts for these trips and people would have to travel outside this area to another childcare centre if there was no childcare facility in the precinct.

The service station and fast food development is expected to generate 2,500vpd per day which includes 1,400vpd passing-trade and 1,100vpd non-passing trade trips. The service station and fast food development will generate approximately 300vpd from both east and west on Armadale Road. Further, it will generate approximately 200vpd on Weld Street. The traffic volume will increase by 1,500vpd on the section of Anstey Road between Armadale Road and the service station crossover on Anstey Road. However, the traffic flow from Anstey East LSP area will decrease by 100vpd on Armadale Road (west) as the service station / fast food trips that were supposed to go out of LSP area will now finish within the area.

However, it must be noted that there won't be any increase in the traffic flow within the Anstey Keane Urban Development Precinct because residential trip generation of 10vpd already accounts for these trips and people would have to travel outside if there was no service station /fast food development in the precinct.

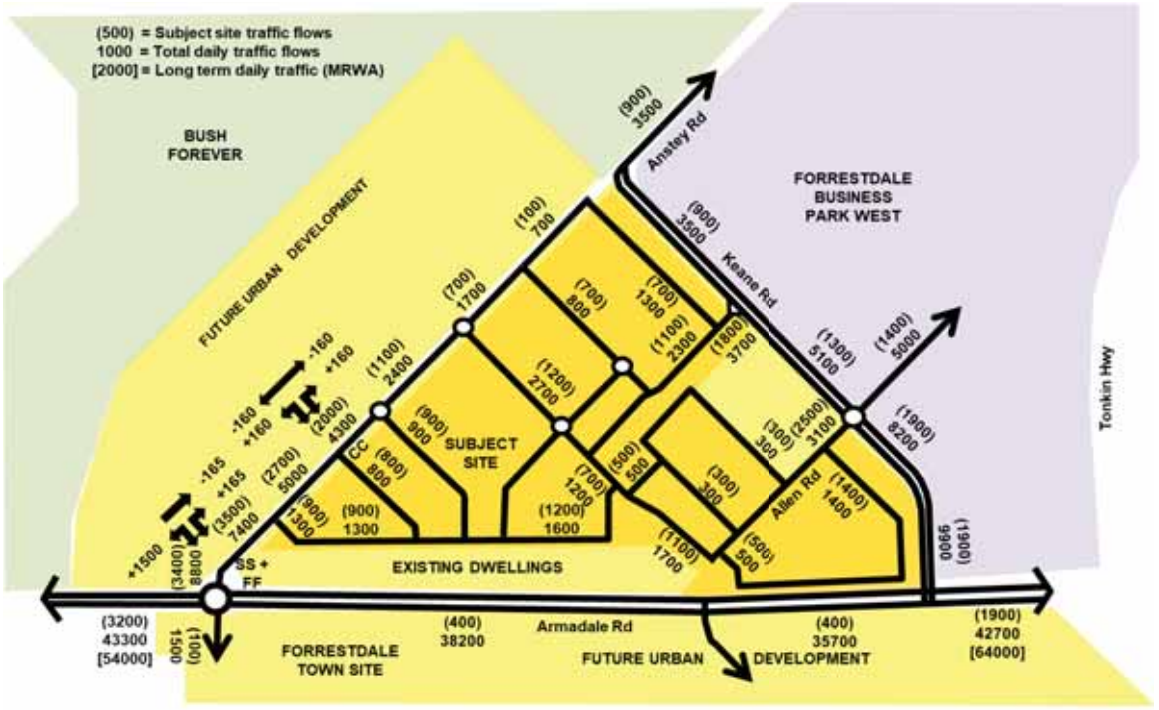


Figure 11: Daily traffic volumes including the service station and childcare traffic

As part of the proposed amendment to the Anstey-Keane East Precinct LSP, the zoning of Lot 500 (16) Anstey Road, Forrestdale is proposed to be changed from Residential (R25) to Local Centre(commercial). The area of the lot is 8,797m^2 and considering an average lot area of 300m^2 for a residential dwelling, it was supposed to occupy 29 residential dwellings.

The daily traffic generation rate used in the subject site for this transport report is 10 vehicle trips per day (vpd) per dwelling, which is consistent with the traffic generation of the previous report and as generally required by the City of Armadale for structure planning in the North Forrestdale area.

The anticipated 29 residential lots of the LSP area were therefore supposed to generate approximately 290vpd. Since these residential lots will now be replaced by the local centre, the traffic volumes in **Figure 12** are adjusted to discount the traffic generation for 29 residential lots.

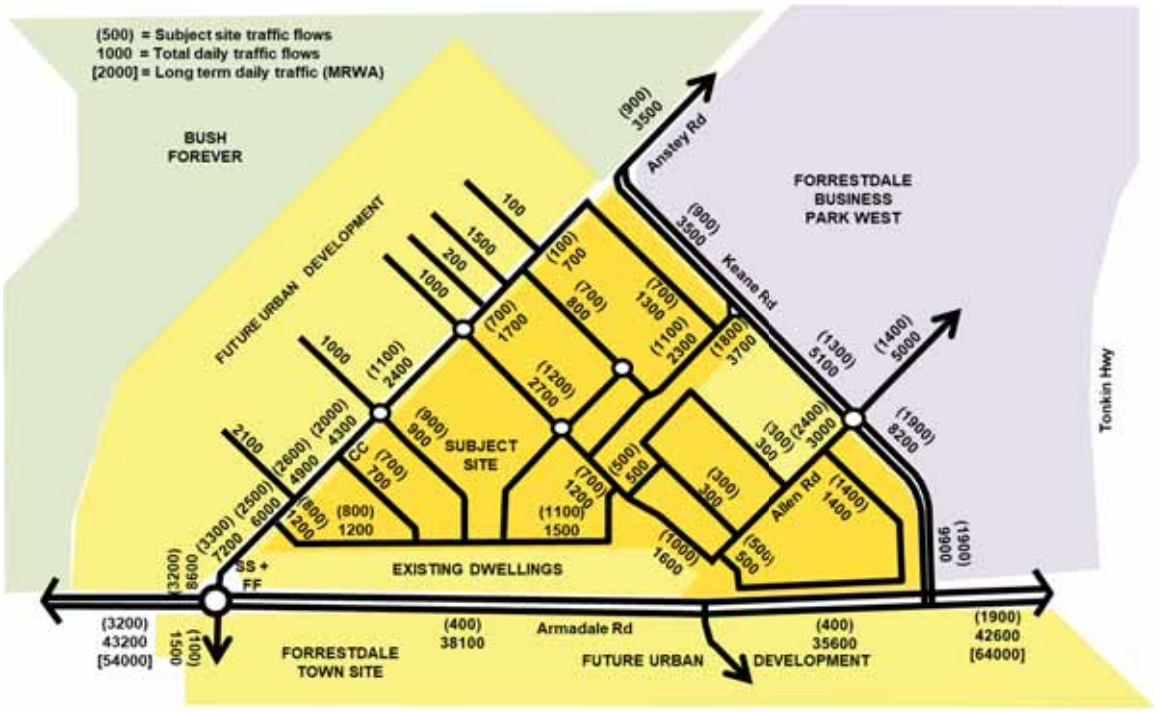


Figure 12: Daily traffic volumes including the service station and childcare traffic and subtracting the residential traffic for the subject site

Further, as detailed in **Section 6.2**, the local centre is expected to generate 1,172 trips per day. These trips are distributed on the surrounding road network in **Figure 13** as per the traffic distribution assumed in **Table 6**.

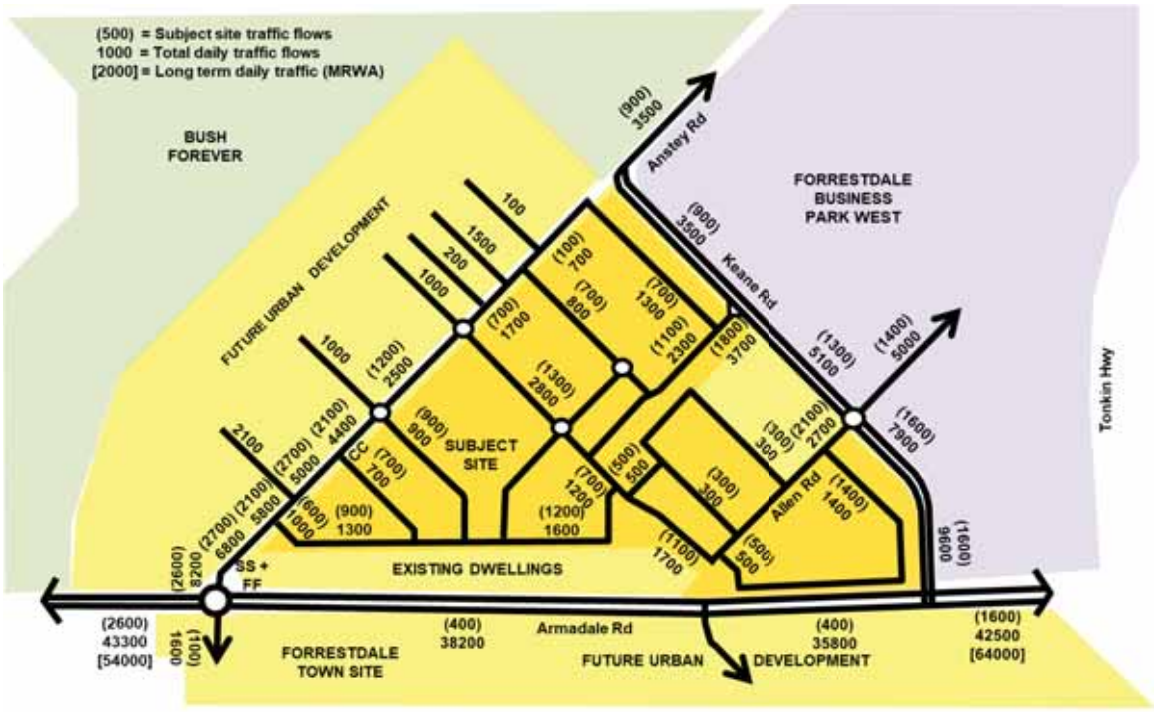


Figure 13: Daily traffic volumes including the service station and childcare traffic and replacing the residential traffic for the subject site with the local centre traffic

Overall, comparing the existing expected total traffic volumes (including the expected traffic of the approved service station / fast food development and proposed childcare centre) (i.e. **Figure 11**) with the total traffic volumes after the amendment (**Figure 13**), traffic volumes are expected to remain the same on Armadale Road (west of Anstey Road), decrease by 300vpd on Armadale (east of Keane Road), and decrease by 200vpd on Keane Road (south). Traffic volumes will increase by 100vpd on Anstey Road (north of the local centre) but decrease by 600vpd on Anstey Road (south of the local centre) because of shopping trips by residents in the Anstey Keane Urban Development Precinct that would be able to be done locally instead of having to drive out of the Precinct.

6.4 Traffic on Surrounding Roads

The WAPC Transport Impact Assessment Guidelines (2016) provides the following guidance on the assessment of traffic impacts:

"As a general guide, an increase in traffic of less than 10 percent of capacity would not normally be likely to have a material impact on any particular section of road, but increases over 10 percent may. All sections of the road with an increase greater than 10 percent of capacity should therefore be included in the analysis. For ease of assessment, an increase of 100 vehicles per hour for any lane can be considered as equating to around 10 percent of capacity. Therefore, any section of road where development traffic would increase flows by more than 100 vehicles per hour for any lane should be included in the analysis."

The proposed amendment in LSP will not increase traffic flows on any roads adjacent to the subject site by the quoted WAPC threshold of +100vph to warrant further analysis. Therefore, the impact of development traffic on the surrounding road network will not be significant.

6.5 Intersection Analysis

Intersection analysis has not been undertaken as part of this TIA. The intersection analysis was previously undertaken for TIA issued for the approved service station / fast food development and the previous TIA for the LSP report. As noted in **Section 6.4** the small change in peak-hour traffic flows as a result of the proposed Amendment does not warrant further detailed analysis.

It is understood that intersection analysis of the driveways for the proposed local centre would be required as part of the traffic impact report for the development application of the local centre.

6.6 Access to Frontage Properties

Refer to the 2020 Transport Impact Assessment for Anstey-Keane East Precinct LSP. There are no changes as a result of the proposed LSP Amendment.

6.7 Pedestrian / Cycle Networks

Refer to the 2020 Transport Impact Assessment for Anstey-Keane East Precinct LSP. There are no significant changes as a result of the proposed LSP Amendment. Exact details of internal road and path networks within the future local centre are currently unknown but it is assumed that the path network connectivity through the subject site to Anstey Road would be maintained through this future local centre site.

6.8 Access to Public Transport

Refer to the 2020 Transport Impact Assessment for Anstey-Keane East Precinct LSP. There are no changes as a result of the proposed LSP Amendment.

7 Conclusions

This Transport Impact Assessment has been prepared by Transcore on behalf of Cedarville Pty Ltd with regard to a proposed amendment to the Anstey Keane Urban Development Precinct - East Structure Plan for land at Anstey Road, Forrestdale in the City of Armadale.

The LSP area is located on the southeast side of Anstey Road in Forrestdale and extends from Keane Road in the northeast to Armadale Road in the south, excluding existing dwellings fronting Armadale Road.

The Amendment area (Lot 500 (16) Anstey Road, Forrestdale) is located on the southeastern side of Anstey Road in Forrestdale. at the southwest corner of the LSP area.

In separate development applications, a service station with fast food outlets has been approved and a childcare facility has been proposed along Anstey Road adjacent to the proposed local centre. However, these developments have not been constructed yet. The service station with fast food outlets is located to the southwest of the proposed local centre and the childcare centre is located to the northeast of the proposed local centre. The changes in future daily traffic flows as a result of these planned developments have been taken into account in this transport impact assessment to establish the future traffic flows that would exist in this area without the proposed LSP Amendment.

As part of the proposed amendment to the Anstey Keane Urban Development Precinct - East Structure Plan, the zoning of Lot 500 (16) Anstey Road, Forrestdale is proposed to be changed from Residential (R25) to Local Centre(commercial). The net yield of this Amendment area is estimated to be 29 residential dwellings within the current structure plan. These dwellings are proposed to be replaced by a local centre with a floor area of 2000m^2 including 1500m^2 for retail shops and an additional 500m^2 for non-retail.

The local centre is expected to generate 1,172 trips per day with approximately 80% of these trips are expected to be from within the Anstey Keane Urban Development Precinct and 20 percent expected to be external trips from Armadale Road and Weld Street.

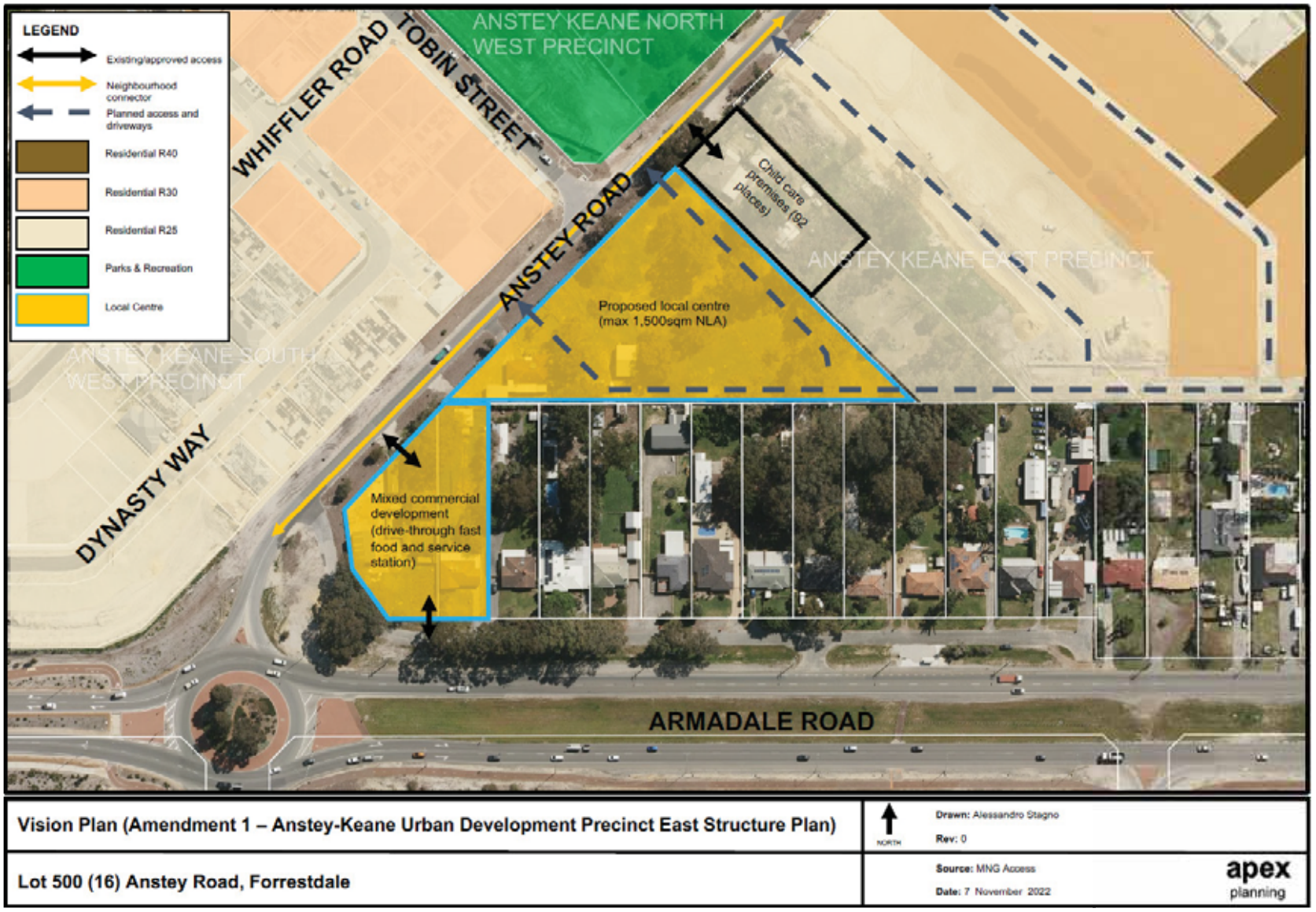
Overall, comparing the expected future total traffic volumes (including the expected traffic approved service station and proposed childcare) with the total future traffic volumes after the amendment, traffic volumes are expected to remain the same on Armadale Road (west of Anstey Road), decrease by 300vpd on Armadale (east of Keane Road), and decrease by 200vpd on Keane Road (south). Traffic volumes will increase by 100vpd on Anstey Road (north of the local centre) but decrease by 600vpd on Anstey Road (south of the local centre) because of shopping trips by residents in the Anstey Keane Urban Development Precinct that would be able to be done locally instead of having to drive out of the Precinct.

Thus, the proposed LSP amendment will not result in significant increases in traffic flows on any roads adjacent to the site. Any increases on individual roads will be less than 100vph and do not warrant further detailed analysis.

It is therefore concluded that the impact of the proposed LSP Amendment on the surrounding road network will not be significant.

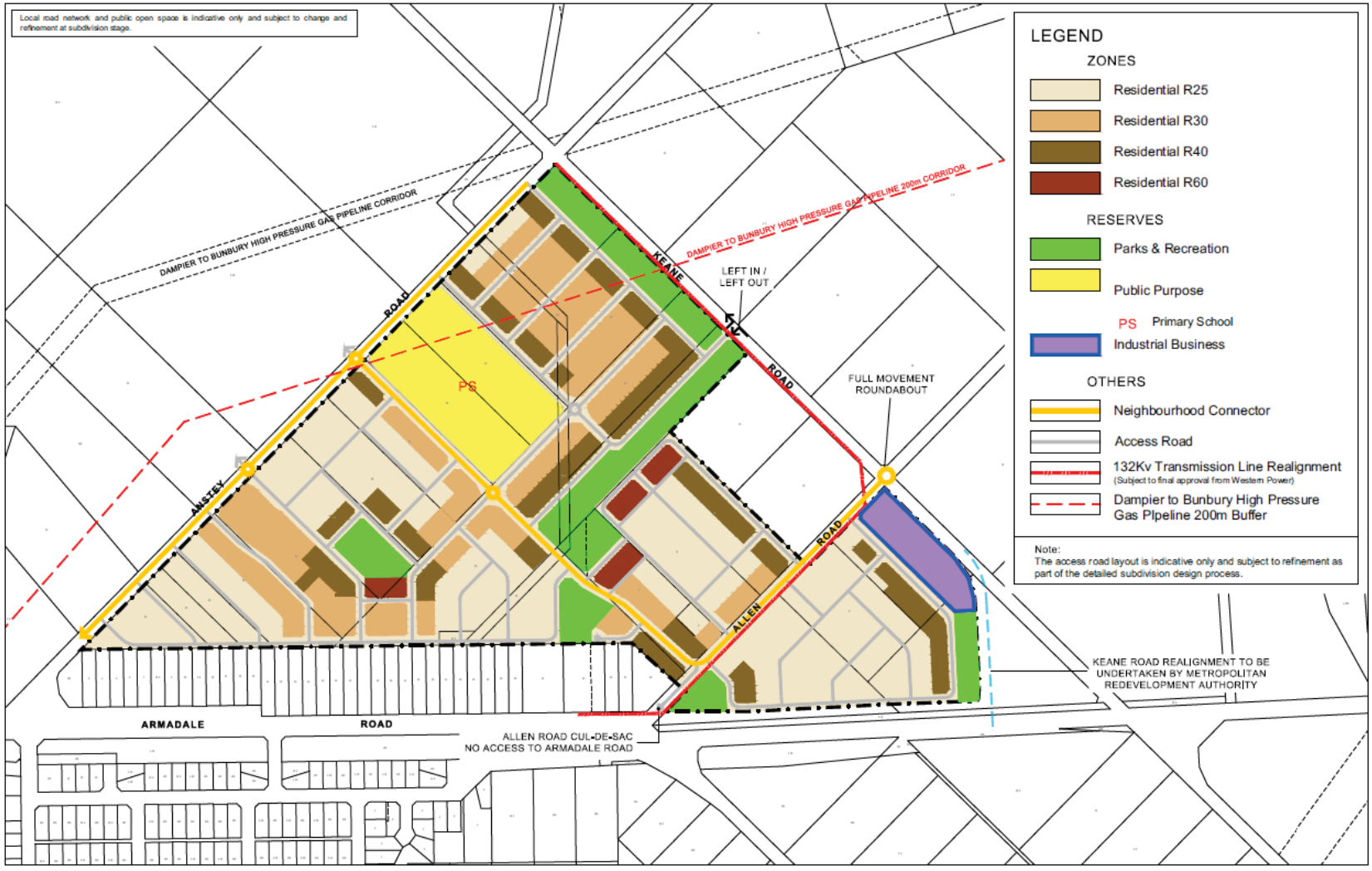
Appendix A

VISION PLAN


LEGEND
Existing/approved access
Neighbourhood connector
Planned access and driveways
Residential R40
Residential R30
Residential R25
Parks & Recreation
Local Centre
ANSTEY KEANE NORTH WEST PRECINCT
WHIFFLER ROAD
TOBIN STREET
ANSTEY ROAD
Child care premises (92 places)
ANSTEY KEANE EAST PRECINCT
Proposed local centre (max 1,500sqm NLA)
ANSTEY KEANE SOUTH WEST PRECINCT
DYNASTY WAY
Mixed commercial development (drive-through fast food and service station)
ARMADALE ROAD
Vision Plan (Amendment 1 – Anstey-Keane Urban Development Precinct East Structure Plan)
Lot 500 (16) Anstey Road, Forrestdale
NORTH
Drawn: Alessandro Stagno
Rev: 0
Source: MNG Access
Date: 7 November 2022
apex planning

Appendix B

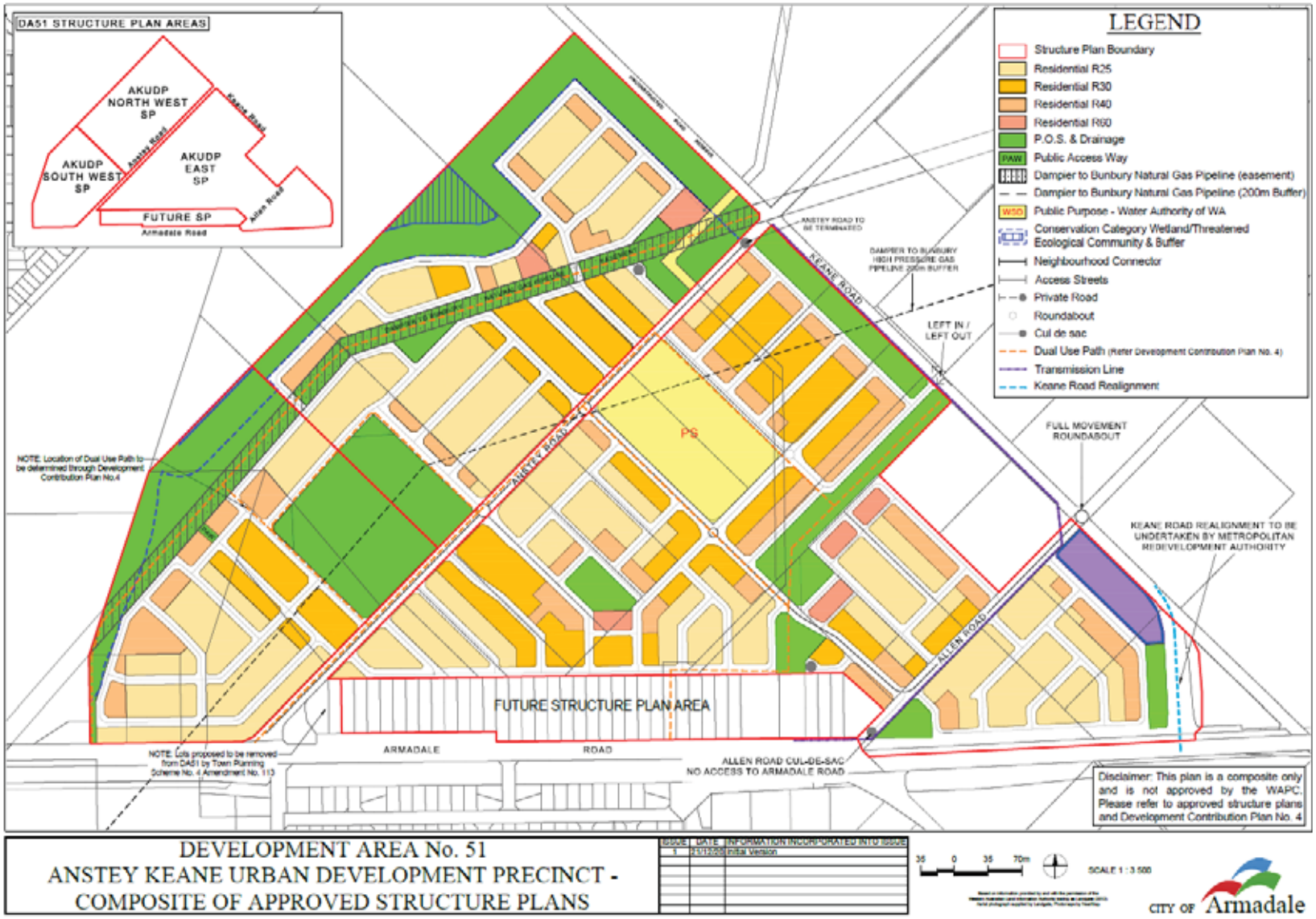
Approved Structure Plans



CLE Town Planning + Design
www.cleplan.com.au

PLAN A: STRUCTURE PLAN MAP
Anstey Road, Forrestdale

plan no: 3068-68H-01
date: 26 June 2020
scale: Not to scale


DA51 STRUCTURE PLAN AREAS
AKUDP NORTH WEST SP
AKUDP SOUTH WEST SP
AKUDP EAST SP
FUTURE SP
Armadale Road
Keane Road
Anstey Road
Allen Road
LEGEND
Structure Plan Boundary
Residential R25
Residential R30
Residential R40
Residential R60
P.O.S. & Drainage
PAW Public Access Way
Dampier to Bunbury Natural Gas Pipeline (easement)
Dampier to Bunbury Natural Gas Pipeline (200m Buffer)
WSO Public Purpose - Water Authority of WA
Conservation Category Wetland/Threatened Ecological Community & Buffer
Neighbourhood Connector
Access Streets
Private Road
Roundabout
Cul de sac
Dual Use Path (Refer Development Contribution Plan No. 4)
Transmission Line
Keane Road Realignment
ANSTEY ROAD TO BE TERMINATED
DAMPIER TO BUNBURY HIGH PRESSURE GAS PIPELINE 200m BUFFER
LEFT IN / LEFT OUT
FULL MOVEMENT ROUNDABOUT
KEANE ROAD REALIGNMENT TO BE UNDERTAKEN BY METROPOLITAN REDEVELOPMENT AUTHORITY
PS
NOTE: Location of Dual Use Path to be determined through Development Contribution Plan No.4
FUTURE STRUCTURE PLAN AREA
ARMADALE ROAD
ALLEN ROAD CUL-DE-SAC NO ACCESS TO ARMADALE ROAD
NOTE: Lots proposed to be removed from DA51 by Town Planning Scheme No. 4 Amendment No. 113
Disclaimer: This plan is a composite only and is not approved by the WAPC. Please refer to approved structure plans and Development Contribution Plan No. 4
DEVELOPMENT AREA No. 51
ANSTEY KEANE URBAN DEVELOPMENT PRECINCT -
COMPOSITE OF APPROVED STRUCTURE PLANS
ISSUE DATE INFORMATION INCORPORATED INTO ISSUE
1 21/12/05 Initial Version
35 0 35 70m
SCALE 1 : 3 500
CITY OF Armadale

APPENDIX 5

RETAIL NEEDS ASSESSMENT AND IMPACT TEST

pracsys.

Cedarville Pty Ltd

Retail Needs Assessment and Impact Test for Lot 84, 16 Anstey Road Forrestdale

Final Report

September 2023

Document Control				
Document Version	**Description**	**Prepared By**	**Approved By**	**Date Approved**
v1.0	Retail Needs Assessment	Reid Quekett	Dawson Demassiet-Huning	31 March 2022
v2.0	Retail Needs Assessment	Reid Quekett	Dawson Demassiet-Huning	30 May 2022
v3.0	Edits & Impact Test	Atle Edgar	Dawson Demassiet-Huning	24 November 2022
v4.0	Final Needs Assessment and Impact Test	Atle Edgar	Dawson Demassiet-Huning	14 December 2022
V5.0	Final Needs Assessment and Impact Test – Updates	Sudhara Weerakoon	Dawson Demassiet-Huning	09 September 2023

CONTENTS

1 INTRODUCTION

1.1 Background

This report provides a Needs Assessment to consider whether there is sufficient demand for a Shop/Retail (SHP) development at Lot 84, 16 Anstey Road Forrestdale, in the City of Armadale. Cedarville Pty Ltd has identified the need for an independent Retail Needs Assessment to assess the level of demand for SHP uses at the planned centre. Pracsys has been engaged to undertake the Needs Assessment and estimate the level of SHP floorspace which would be supportable at the centre, with consideration of the surrounding activity centre distribution and future population growth.

1.2 Retail Needs Assessment and Impact Test Purpose and Objectives

The draft State Planning Policy 4.2 (draft SPP4.2) states the following relating to needs assessments: *'The need for activity centre uses refers to the scale and mix of residential and non-residential uses likely to be needed within a catchment area over the plan period (10 years for Precinct Structure Plans).'*

The needs assessment should measure demand for the area and identify the scale of supply necessary to appropriately accommodate this demand in square metres Net Lettable Area (NLA).

The draft SPP 4.2 also provides guidance regarding Impact Tests: *'Specifically, the Impact Test will ensure major development proposals will not unreasonably impact upon the activity centre hierarchy, result in loss of services to the community and/or impact upon existing, committed and planned public and private infrastructure investment.'* It states further that *'Competition between businesses in and of itself is not considered a relevant planning consideration.'* This means that decisions should not be based on the impact on, or viability of, individual tenants. Only the potential impact on the centres and the effects on the catchment community should be considered under an impact test.

This needs assessment and impact test follows the requirements of draft SPP 4.2 Implementation Guidelines to consider and assess demand for activity centres uses and measure the impact on the activity centre hierarchy. The assessment should be based on facts and unbiased evidence[1].

The key objectives of the report are to:

- Define the catchment area of the proposed scheme amendment request
- Review drivers of floorspace, including forecast population growth and socio-economic characteristics, employment, changing expenditure patters, and property market profile
- Evaluate the competitive environment including existing and planned floorspace supply (including expansions and new developments)

[1] Draft SPP 4.2 Implementation Guidelines

- Develop a net demand assessment
- Assess the level of Shop/Retail floorspace supportable at the site
- Assess the impact of the proposed development on the viability of the activity centre hierarchy

1.3 Gravity Model Methodology

Pracsys uses a proven retail gravity model methodology to examine the supply of and demand for retail floorspace within a defined catchment and estimate the potential impact of proposed retail developments. The Retail Gravity Model (also known as Huff's Gravity Model) is a modified version of Sir Isaac Newton's Law of Gravitation. The Gravity Model is a popular model widely used in international trade modelling, transport modelling and regional planning. Retail Gravity modelling studies retail supply, and the probability of a customer (demand) visiting a particular centre. The model accounts for the distribution and attractiveness of competing centres, along with the distance a customer will have to travel to each centre. Floorspace quantum (m^2) is used to represent the attractiveness of retail centres. Customers are willing to travel farther to shop at large centres, representing a higher level of attraction (they can generally satisfy multiple needs in one trip to a larger centre, which also contains a higher proportion of comparison goods).

The model provides an objective method of distributing expenditure among centres. Calibration is used to match the calculated distribution of expenditure to actual published turnover levels, optimising the model outputs. Having established a benchmarked current distribution of expenditure, new floorspace can be introduced and changes in expenditure distribution across time can be examined, allowing for various retail centre transformations such as planned expansions and new developments. This comprehensive approach creates a distribution of expenditure that is fundamentally unbiased, as it is based on mathematical rules. It is a widely used approach that has been accepted by the Department of Planning, Lands and Heritage and Western Australian Planning Commission (WAPC) through the review of a wide range of Structure Plans, Local Commercial Strategies and Retail Sustainability Assessments.[2] For more information on the gravity modelling methodology, please see **Appendix 1: Gravity Modelling Methodology.**

1.4 Shop Uses

The "shop" land use is an "A" classification land use that can be approved in the Industrial Business zone. It should be noted the City would aim to only approve "shop" uses in the Industrial Business zone that are considered incidental to the predominant/primary use on a property or where they are considered to be logical and complementary to an industrial area (e.g. shops selling work wear or safety clothing, small convenience stores, etc.). Shops such as supermarkets or liquor stores, etc. would be unlikely to be approved in an Industrial Business zone and it is not expected that any future Shop uses on this type of land within the catchment would affect the demand for the proposed uses.

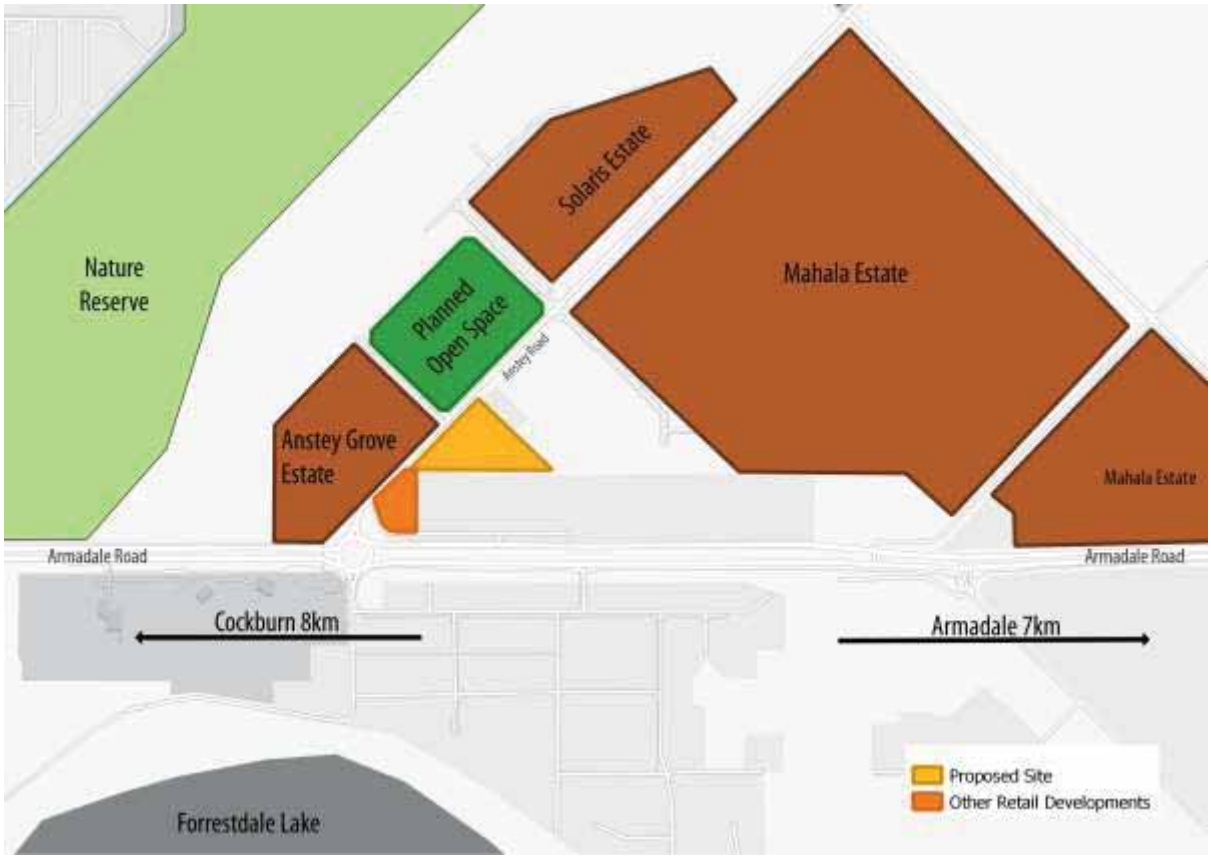
[2] For example, in April 2014, the West Australian Planning Commission approved the Melville City Centre Structure Plan, which proposed the expansion of the Garden City shopping centre. The RSA prepared by Pracsys in support of the application was based on gravity modelling. Please see Melville City Structure Plan 2015.

2 DEVELOPMENT CONTEXT

2.1 Site Location

The subject site is located proximate to the intersection of Anstey Road and Armadale Road. The lot is bordered by multiple current residential developments to the north, east and west, and proximate to many large nature reserves and a planned district open space. Armadale Road serves as the connecting route between Armadale to the east and Cockburn to the west. The following map identifies the approximate location of the proposed development (Figure 1).

Figure 1. Subject Site Context



Source: Google Maps 2022, Yolk Property Group 2022, LWP Property 2022

The site is located within an area which is predominantly residential in nature. A number of residential developments (Anstey Grove Estate, Solaris Estate and Mahala Estate) have been identified and accounted for in modelling based on the Urban Land Development Outlook 2020/21 (ULDO). The ULDO identifies a total development potential of approximately 1,156 additional dwellings by 2030 for the three estates, equating to approximately 3,468 residents if an average 3 person per dwelling estimate is applied. The inclusion of these developments provides an understanding of the demand for a local centre from population directly adjacent to the centre. The additional dwellings have been removed from the broader dwelling forecasts used in the modelling to ensure there is no double counting of dwellings.

2.2 Trade Area Definition

A trade area is the spatial boundary from which a commercial floorspace generates the majority of its customers. The trade area definition allows for the measurement of the number of potential customers, their demographics and expenditure potential, as well as an assessment of the competitive environment.

SPP 4.2 states that local centres provide for the day to day needs of local communities, playing an important role in the activity centre hierarchy by providing walkable access to services and facilities for local communities. The modelled trade area of the prospective centre is comprised of a five-kilometre catchment area. The 5km catchment is used in the gravity model and ensures that all centres which could reasonably influence the viability of the prospective centre are included in the RNA (Figure 2).

Figure 2. Modelled Trade Area of Prospective Development

Source: Positron 2022

The modelled trade area encompasses Haynes to the west, Forrestdale and Hilbert to the south, Harrisdale and Piara Waters to the north, and Banjup to the east. The supply catchment extends up to five kilometres from the centre and includes shopping centres such as Harrisdale District Centre and ERADE Village Local Centre (see Figure 9. Trade Area Current & Future **Retail Supply Network** for an illustration of the trade area's competitive environment). The site's location at the corner of Armadale Road and Anstey provides high levels of passing traffic that will increase the level of supportable floorspace, particularly once the nearby estate developments are completed (see Figure 1).

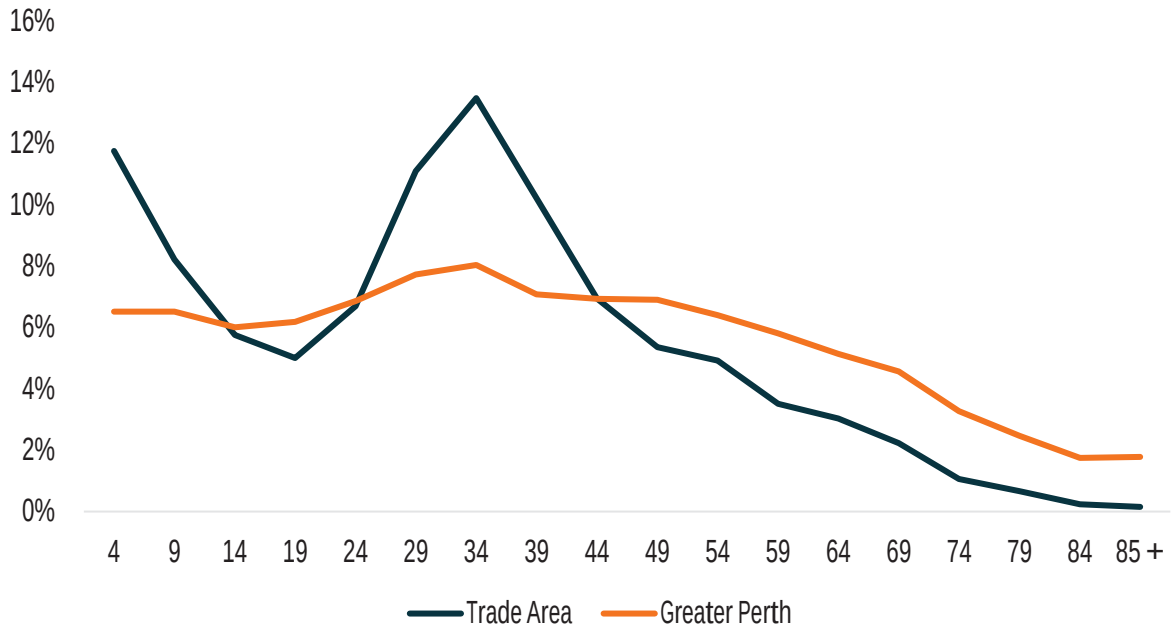
3 RETAIL DEMAND

Understanding local demographics and expected market growth is key in the assessment of the need for retail floorspace in the defined trade area. This section provides an overview of demographics, current and future dwellings and the expenditure profile of the trade area.

3.1 Age Profile

The trade area exhibits a noticeably different demographic profile to the Greater Perth benchmark (Figure 3), with a slightly lower proportion of people aged 15 to 19 (5% versus 6%) and a higher proportion of both 0- to 4-year-olds (12% versus 6.5%) and 29- to 34-year-olds (13% versus 8%) than in Greater Perth. This reflects that the trade area is comprised of a higher concentration of working-age adults with young children than the Greater Perth average. This may indicate increased expenditure on childcare and certain convenience retail goods and services.

Figure 3. Trade Area Demographic Profile

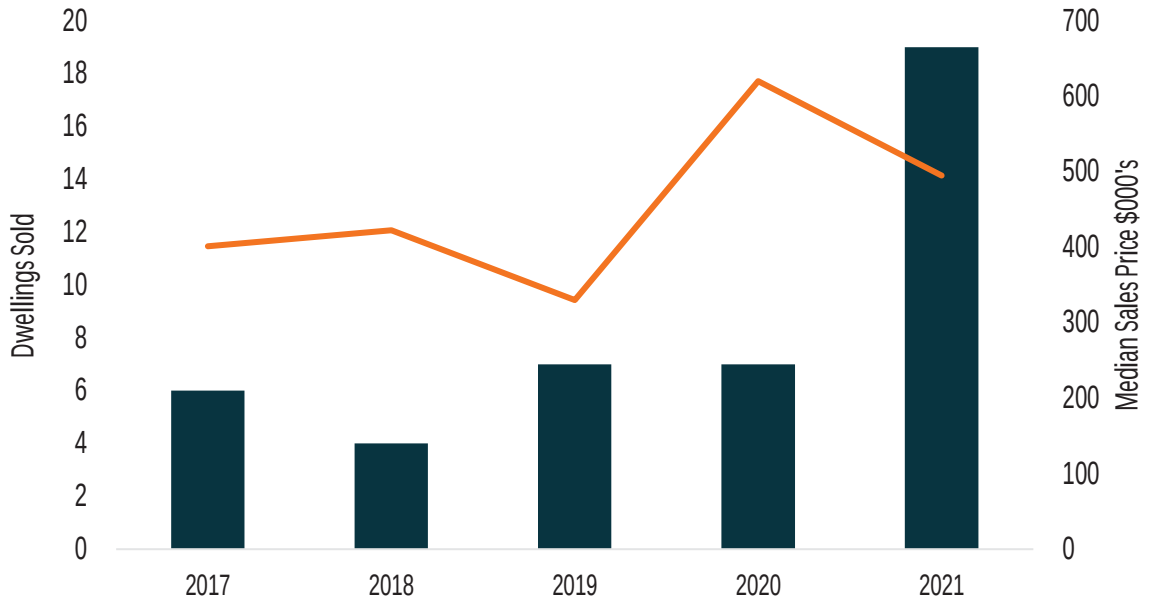


Source: ABS 2016, Pracsys 2022

3.2 Property Market

Property market data helps to create an understanding of current property and development trends. In 2021, the number of house sales in Forrestdale increased by approximately 170% and the median sales price of houses decreased by 20% (Figure 4).[3]

Figure 4. Dwelling Sales Trends Forrestdale



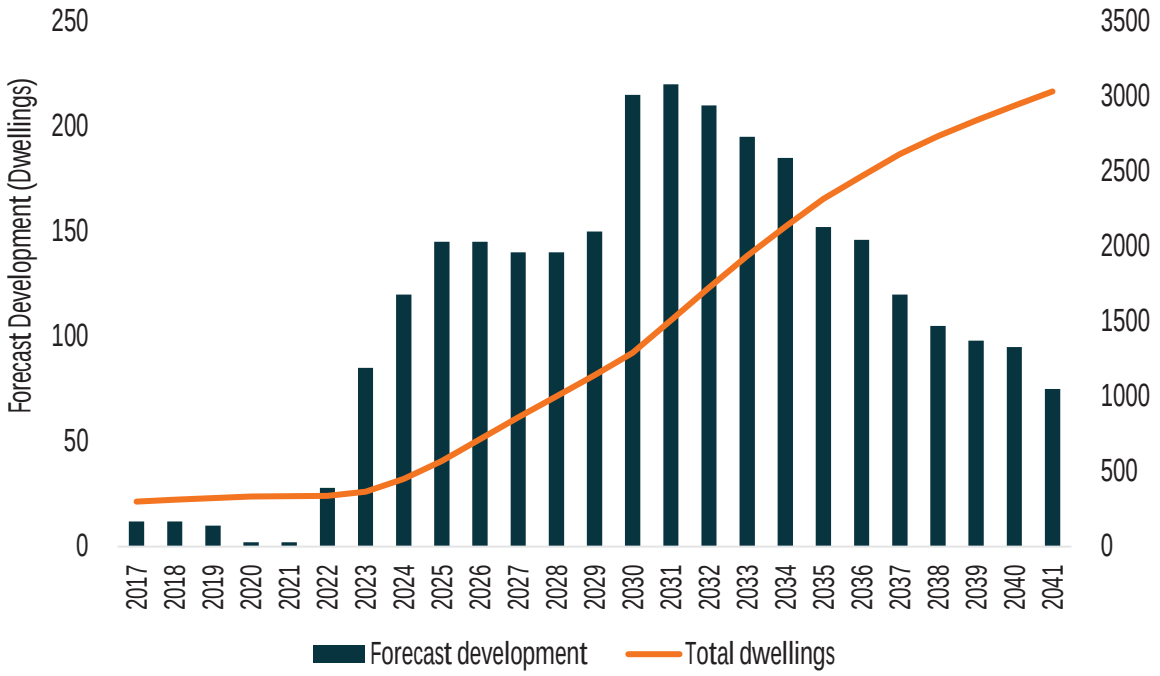
Source: REIWA 2022

This demonstrates a large increase in the supply of dwellings, which will likely increase the need for retail and other population driven goods and services in the area. This increase in supply has been generated by an increase in residential estate developments in the Forrestdale area, which is likely to continue for the near future.

Dwelling projections show that the supply of new housing developments in Forrestdale is expected to rise after 2023 (Figure 5); however, sales data from Figure 4 suggests that the projected dwelling developments begun slightly earlier than expected, with a large increase in dwellings expected to occur over the next few years.

[3] REIWA 2021, Suburb Profile Forrestdale. Available from: https://reiwa.com.au/suburb/forrestdale/

Figure 5. Forecast Residential Development in Forrestdale



Source: Forecast ID 2021, Pracsys 2022

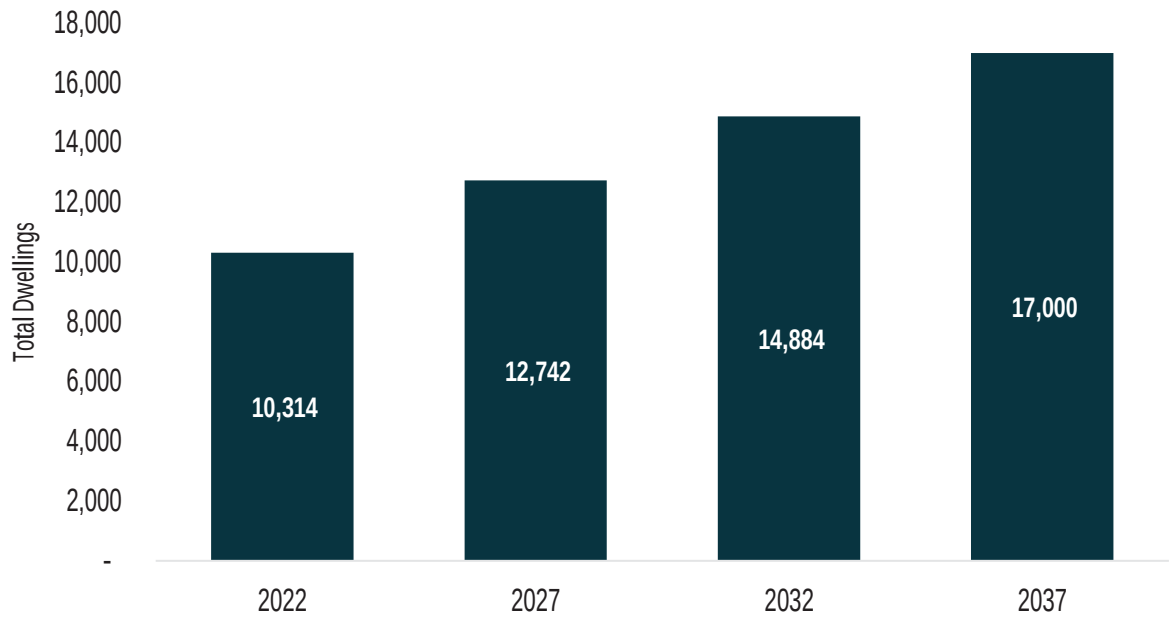
The development of a Local Centre at Anstey Road would support the development of the suburb through increased liveability and access to employment. Providing an appropriate scale of amenity will ensure the liveability is maintained as new population moves into the area.

3.3 Trade Area Dwellings

The trade area of the proposed development is estimated to contain 10,314 dwellings in 2022 (Figure 6).[4] Based on dwelling growth forecasts, the number of dwellings in the trade area is expected to grow to 14,884 by 2032, reflecting a forecast increase in dwellings of 44 per cent. By 2037, the number of dwellings in the trade area is projected to reach 17,000 reflecting a 65 per cent increase from the current level.

[4] The ABS Census 2016 dwelling count by SA1 areas was used to estimate the 2016 number of dwellings in the catchment. *WA Tomorrow* population projections (median band) were used to forecast dwellings beyond 2016 (Department of Planning, Lands and Heritage 2018).

Figure 6. Trade Area Dwelling Growth Forecast

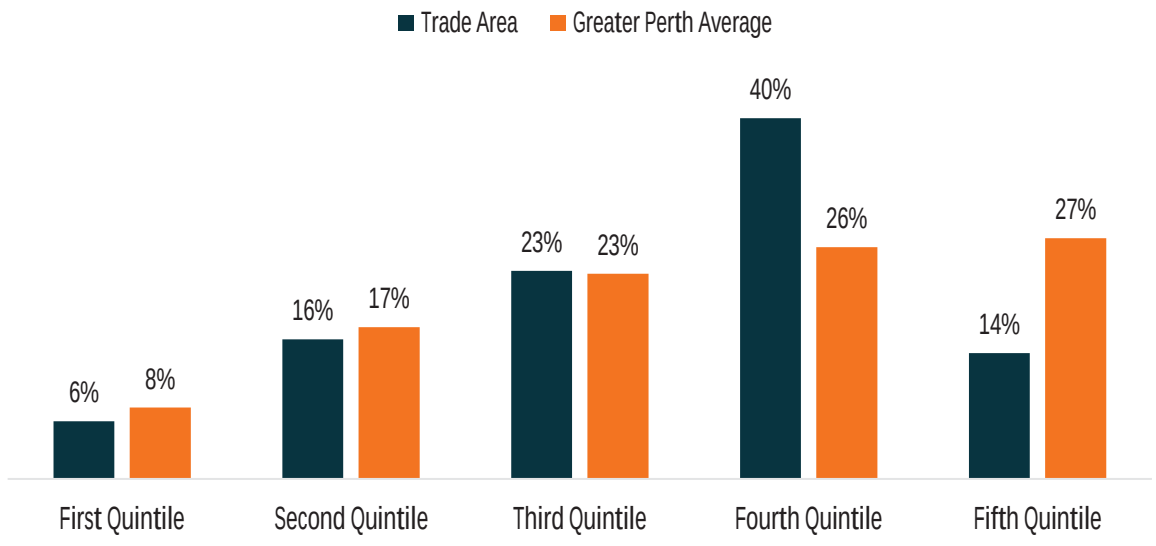


Source: ABS 2016, DPLH WA Tomorrow 2018, Forecast.id 2020, Pracsys 2022

3.4 Trade Area Income

Trade area income demographics play an important role in the success of retail developments, as the level of spending on retail goods and services is primarily determined by household income. Generally, lower income quintiles spend a higher proportion of their income on basic goods and services; upper income quintiles have more disposable income available to spend on non-essential retail items. ABS Census data has been used to assess the distribution of household income within the trade area (Figure 7).

Figure 7. Trade Area Population Weekly Income Profile



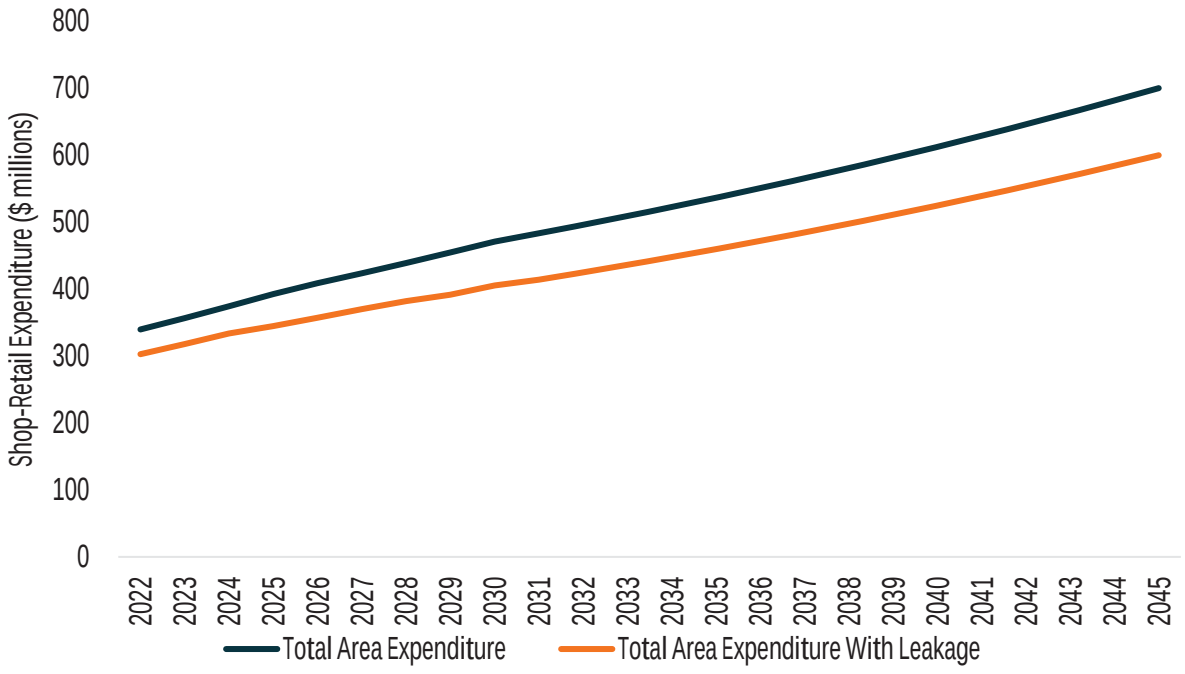
Source: ABS 2016, ABS HHES Survey 2015/2016, Pracsys 2022

Incomes in the trade area are on similar to the Greater Perth benchmark across the three lowest quintiles, with a higher proportion of households in the fourth quintile (40% versus 26%) and a lower proportion in the fifth (14% versus 27%). This is likely reflective of the higher proportion of residents in the 29-34 age bracket compared to Greater Perth and the prevalence of young families in the area who have not yet achieved their highest earning potential. However, the relatively high number of fourth quintile income households in the catchment indicates that there remains a strong potential for high levels of discretionary spend within the catchment, which will support greater levels of goods and service provision.

3.5 Retail Expenditure

ABS Household Expenditure Survey data was used to estimate the average spend per household by income quintile, from which the total expenditure pool of the catchment has been derived. The model combines propensity to spend on commodities based on household income quintiles to derive the total Shop/Retail expenditure in the area. Given projected household growth, Shop/Retail expenditure is estimated to increase from $339 million in 2022 to $495 million in 2032, reflecting growth of 46 per cent (Figure 8). By 2037, trade area shop-retail expenditure is predicted to reach $565 million – an increase of 66 per cent from current levels. This large increase in catchment expenditure reflects the significant expansion in residential dwellings expected to occur in Forrestdale over the next 10 years. Some of this turnover is projected to be lost to online leakage; however, this is expected to be less prominent in respect to convenience retail than other types, such as comparison retailing. The effect of online leakage on the viability of the proposed development is expected to be minimal.

Figure 8. Catchment Area Shop/Retail Expenditure Pool, 2022 to 2045



Source: ABS Census 2016, ABS HHES Survey 2015/2016, Pracsys 2022

4 RETAIL SUPPLY

4.1 Current Supply

This section provides an overview of the competitive environment facing the proposed development at Anstey Road. Being a local centre, the proposed centre is likely to compete principally with those centres in close proximity.

Existing retail floorspace supply within the trade area has been derived through data from multiple sources, including:

- The Department of Planning Land Use Survey (2015/17)
- Property Council Shopping Centre Directory (2018)
- Secondary Research (various structure plans, property manager websites etc.)

A total of six developments containing Shop/Retail floorspace within five kilometres of the proposed development were included in the analysis to ensure a comprehensive assessment of current local retail supply. Two additional large centres with a wider catchment located outside of the 5km area were included in the gravity modelling to ensure the retail supply is accurately represented. A selection of centres within the supply network are illustrated below (Figure 9). The trade area and surrounding area includes a wide range of retail offerings, from Strategic and Secondary centres such as Armadale and Cockburn Gateway, to mixed-used industrial business areas, and various neighbourhood and local level centres. Most centres within the 5km trade area are neighbourhood and local centres that provide for daily and weekly household shopping needs.

Figure 9. Trade Area Current & Future Retail Supply Network

Source: DPLH Land Use and Employment Survey 2015/17, Armadale Retail (Commercial) Centres Strategy 2020

The total current Shop/Retail offering within the 5km trade area and surrounds has been estimated at 137,214m^2 (Figure 10).

Figure 10. Trade Area Shop-Retail Floorspace Supply 2021

Centre	Shop-Retail Floorspace (m^2)
On the Map	
Wright Road / Ranford Road Neighbourhood Centre (City of Armadale Component)	1,438
Harrisdale District Centre	12,200
Wright Road / Ranford Road Neighbourhood Centre (City of Gosnells Component)	6,192
Piara Waters Neighbourhood Centre	550
ERADE Village Local Centre	370
Strawberry Drive	100
Cockburn Gateway	51,322
Armadale T Centre	60,261
Haynes Neighbourhood Centre	4,781
Total Floorspace	**137,214**

Source: Armadale Local Commercial Strategy 2020, DPLH Land Use and Employment Survey 2015/17

4.2 Expansions and Planned Developments

There has been an increase in the number and scale of planned retail expansions since the State government has relaxed its restrictions on retail floorspace development in 2010. A desktop analysis and review of planning documentation within the City of Armadale and City of Gosnells local government areas was undertaken to identify any planned future Shop-Retail floorspace developments within the trade area and surrounds (Figure 9. Trade **Area Current & Future Retail Supply Network**. This review identified 10 future retail developments or expansions in the region (Figure 11). A conservatively high estimate of additional Shop/Retail and Other Retail floorspace owing to these expansions has been used to consider the long-term ability of the catchment to support the proposed centre size.

Figure 11. Trade Area Shop-Retail Floorspace Expansions and Developments

Centre	Previous NLA (m^2)	Expanded NLA (m^2)	Additional NLA (m^2)	Year of Expansion
Piara Waters Neighbourhood Centre	550	5,709	5,159	4,298 in 2026 5,709 in 2026
Harrisdale District Centre	12,200	25,000	12,800	22,000 in 2026 25,000 in 2031
ERADE Village Local Centre	370	2,170	1,800	2,170 in 2025
Forrestdale	0	500	500	2026
Haynes Southwest	0	200	200	2026
Haynes Neighbourhood Centre	4,781	6,200	2,538	2026
Haynes North	0	400	400	2026
Hilbert	0	20,000	20,000	5,000 in 2026 20,000 in 2031
Hilbert North	0	700	700	2026
Cockburn Gateway	51,322	90,000	38,668	72,300 in 2026 90,000 in 2036
Armadale T Centre	60,261	100,000	39,739	70,000 in 2026 90,000 in 2036 100,000 in 2041
Anstey Rd (Lot 3 and 301)	0	180	180	2025

Source: Armadale Retail (Commercial) Strategy 2020, element 2020

5 RETAIL NEEDS ASSESSMENT AND IMPACT TEST

This section identifies the potential supportable retail floorspace at the proposed site and then measures the potential impact of the proposed uses on the activity centre hierarchy.

5.1 Gravity Modelling and Model Calibration

The retail needs assessment uses gravity modelling to estimate the quantity of Shop/Retail floorspace supportable at the project site. The retail gravity model incorporates the most up to date data on household expenditure from the ABS, retail floorspace supply from the Department of Planning, Lands and Heritage and retail floorspace from secondary sources to identify recent expansions and planned centres.

Gravity model estimates of centre turnover were calibrated against known or modelled turnover data where possible. Key centres used to calibrate the model are listed below, with their respective turnover levels (Figure 12. Centres with Available Turnover Data or Published Productivity Estimates). Where centres were near the border or outside of the trade area, the approximate proportion of their expenditure expected to be derived from the trade area was used to adjust their turnover.

Figure 12. Centres with Available Turnover Data or Published Productivity Estimates

Centre	Turnover ($)	% Turnover from Catchment
Cockburn Gateway[5]	431,790,000	12%
Armadale T Centre	404,170,527	15%
Harrisdale[6] District Centre	109,600,000	90%
Wright Road / Ranford Road Neighbourhood Centre (City of Armadale Component)	9,347,000	50%
Piara Waters Neighbourhood Centre	4,275,700	90%
ERADE Village Local Centre	2,665,590	75%
Haynes Neighbourhood Centre	36,950,000	40%

Source: Cockburn Gateway 2019, Stockland 2019-20, Armadale Retail (Commercial) Centres Strategy 2020

Retail productivity benchmarks or modelled productivity estimates from the Armadale Retail (Commercial) Centres Strategy were used to calibrate centre turnover where actual data was not available (Figure 14).

5.2 Supportable Turnover

Shop/Retail Assessment

The Anstey Rd centre is planned as a local centre; SPP4.2 (2010) identified local centres as supporting approximately 1,500m^2 Shop/Retail floorspace Net Lettable Area (NLA).[7] The supportable Shop/Retail

[5] Cockburn Gateway Shopping Centre 2019, 'Asset Profile Flyer' Available from: https://specialtymallleasing.com.au/ctrpdf/30/PCG316_Asset_Profile_Flyer-SML_COCKBURN.pdf
[6] Stockland 2019, 'Property Portfolio'. Available from: https://www.stockland.com.au/investor-centre/our-portfolio
[7] All floorspace estimates are in Net Lettable Area terms

floorspace at the site was therefore tested by assessing whether the turnover available at 500m^2, 1,000m^2 and 1,500m^2 of Shop/Retail floorspace was sufficient for the centre to be viable over the next 15 years (Figure 13). All testing included the Fast food and Service station developments on lot 3 and 301 Anstey Rd (180m^2 retail NLA proposed) that could be viewed as an extension of the Anstey Rd local centre; although the uses are more likely to cater for the needs of passing traffic rather than local residents. The expected floorspace productivity of each development size in five-year increments was then compared to benchmark floorspace productivity levels for a range of uses and productivity estimates for similar developments from the Armadale Retail (Commercial) Centres Strategy 2020 (the ARC Strategy) (Figure 14 and Figure 15).

Figure 13. Proposed Centre Productivity ($/m^2)

Floorspace m^2	2022	2027	2032	2037
680 (500m^2 proposed site)	9,663	8,047	8,468	8,573
1,180 (1,000m^2 proposed site)	9,397	7,903	8,336	8,453
1,680 (1,500m^2 proposed site)	9,152	7,765	8,209	8,338

Source: Pracsys 2022

Figure 14. Retail Benchmark Productivity

Retail Category	Productivity ($/m^2)	Note
Take Home Food	10,749	Grocery
Take Home Liquor	9,674	Bottle shop
Convenience Retail	7,524	Deli / pharmacy
Dine Out Food	6,987	Restaurant
Clothing/Footwear	5,374	Comparison

Source: Colliers 2017

Figure 15. Retail Centre Productivity Benchmarks

Local Centres	2021	2026	2031	2036
Forrestdale	$7,497	$7,395	$7,614	$7,890
Haynes South West	-	$7,097	$7,282	$7,642
Hilbert North	-	$6,796	$7,030	$7,393

Source: Armadale Retail (Commercial) Centres Strategy 2020

Note: A productivity estimate for the Anstey Road centre was not identified in the Armadale Retail (Commercial) Centres Strategy 2020.

The floorspace productivity of a Shop/Retail development at Anstey Road is predicted to be very high in 2022, reaching almost $9,700m^2 for a 500m^2 development and $9,200m^2 for a 1,500m^2 development. It is assumed that several centres in the trade area will be developed or expand by 2026 and onwards. With these centres considered, the expected floorspace productivity of Lot 84 is reduced, particularly in 2027; the proposed centre still achieves higher turnover than most benchmarks even at 1,500m^2. As the catchment

population continues to grow after 2027, the centre's performance improves and performs better than benchmarks at all sizes tested. This means the proposed centre is expected to be viable at up to 1,500m^2, even when the fuel station and takeaway food uses proposed at Lot 3 and 301 Anstey Rd are included to make a total of 1,680m^2.

The predicted floorspace productivity of Lot 84 in 2032 is high enough to support a mix of floorspace types that could include Take Home Food (e.g. supermarket), Dining Out Food (e.g. restaurant) and / or Clothing/Footwear (e.g. comparison) retail, up to the identified 1,500m^2. It could also support a total of 1,300m^2 supermarket only floorspace (front of house)[8] based on the identified viable floorspace productivity level. While the model identifies a dip in productivity in 2027 due to the significant assumed floorspace expansions, it is temporary, with strong recovery regardless of the size of the proposed centre.

It is recommended that the Lot 84 development is supportable at 1,500m^2 of Shop/Retail floorspace (excluding the Lot 3 and 301 Anstey Road uses). It is also likely that the demand addressed by Lot 3 and 301 Anstey Road uses will come from outside the local area and the supportable floorspace required to meet community need will be greater than 1,500m^2 (excluding the 180m^2 of retail NLA at Lot 3 and 301 Anstey Road).

The results should be seen as complementary to the ARC Strategy. The findings of this assessment provide a more granular investigation of the population growth being proposed in close proximity to the Anstey Rd local centre and the demand that this population creates locally. The smaller model and specific timing and quantum of development provided by the ULDO indicate that the supportable floorspace at the location is greater than what was identified in the ARC Strategy. It should be noted that the proposed centre on its own is within the size expected of a local centre under the State Planning Framework. The proposed 180m^2 of retail uses at Lots 3 and 301 Anstey Rd are uses that derive expenditure from passing traffic (fuel and takeaway food). The analysis has conservatively included these as part of the centre for modelling purposes. While these are technically within the same centre according to the City's Strategy, they do not address the role of a local centre in providing walkable access to daily shopping needs.

5.3 Modelling Impacts

Market Share

The impact is calculated using the estimated floorspace productivity of the development in 2025. All new centres and centre expansions included in 2027 have been included in 2025 to provide a complete assessment of impact. In 2025 the proposed development is expected to turnover approximately $5 million at 680m^2, up to $12 million at 1,680m^2. Turnover relative to the catchment's total Shop/Retail expenditure is insignificant, making up approximately 1% of total catchment turnover at 680m^2 and 3% at 1,680m^2.

[8] Back of house floorspace is additional to the Net Lettable Area

Impact Assessment

Turnover impact represents the reduction in a centre's turnover resulting from new competition. Two scenarios are modelled, one with the proposed development and one without. The two levels of turnover across relevant centres are then compared to estimate the impact the proposed development is expected to have.

Impact Assessment Steps[9]

- Define first year of proposed development operation; estimated to be 2025
- Model shop-retail turnover for all centres, including expansions and new centres, in 2025 (to be conservative all expansions by 2027 were included)
- Include proposed development shop-retail floorspace in model for years 2025, 2027 & 2032
- Model shop-retail turnover for all centres including proposed development in 2025, 2027 & 2032
- Calculate the change in shop-retail turnover for all centres in 2025 and analyse change by 2027 & 2032
- Estimate % change in shop-retail turnover for each centre and compare to draft SPP4.2 impact levels and how they change over time

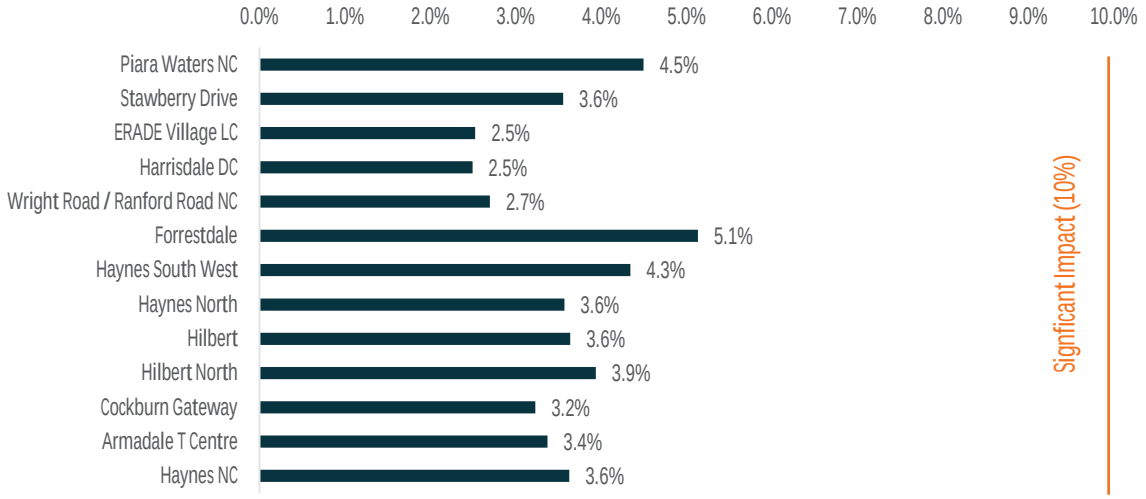
The impact on individual centres will depend on many factors, including current performance levels, the degree of dependence of one store on another and the competitive response. The impact assessment is therefore representative and an indication of likely turnover declines.

The sustainability of a centre is typically considered significantly impacted when its turnover is reduced by more than 10%.[10] Figure 16. Selected Centres – displays the results of the impact test for the proposed development at Anstey Road using a gravity model approach. The results reveal the difference in retail turnover owing to the development of the Anstey Road local centre at different floorspace amounts.

The impact test has been conducted at a proposed size of 1,680m^2 in 2025, against turnovers of the same centre's in 2025 with the proposed 180m^2 retail floorspace at the Anstey centre (Figure 16).

[9] For more details on Gravity Modelling specifically, please see Section 8, Appendix 1: Gravity Modelling Methodology
[10] As defined by the draft SPP4.2 Implementation Guidelines

Figure 16. Selected Centres – Impact Test Results



Source: Pracsys 2022

The impacts should be interpreted as the change in turnover at a centre based on the turnover drawn from the identified study area. For instance it is assumed that the Armadale Town Centre draws 15% of its turnover from the trade area; this is the impact on that 15% of turnover, not the total turnover of the Armadale Town Centre.

The impact on all centres is below the 10% significant impact and moderate impact thresholds identified in the draft SPP4.2 guidelines (and the revised SPP4.2 (2023) Impact Guidelines). This reflects the small scale of the development. Over time the identified impacts are wholly mitigated by population growth and additional expenditure in the trade area and all centres achieve increases in turnover to baseline by 2027 and significant increases in turnover compared to the baseline by 2032. This reflects the increase expenditure at the proposed development drawing largely from the significant population increase from surrounding residential developments (Figure 17).

Figure 17. Turnover Impact in 2025, 2027 and 2032

Centre	Change in Turnover from 2025 Baseline (%)		
	2025	2027	2032
Piara Waters NC	-4.5%	3.3%	42.5%[11]
Strawberry Drive	-3.6%	3.9%	3.9%
ERADE NC	-2.5%	2.9%	10.1%
Harrisdale DC	-2.5%	3.3%	11.2%
Wright Road / Ranford Road NC	-2.7%	3.2%	10.2%
Forrestdale	-5.1%	3.9%	8.9%
Haynes South West	-4.3%	5.1%	6.3%
Haynes North	-3.6%	4.4%	1.6%

[11] Large jump due to assumed stage 2 expansion in 2031

Centre	Change in Turnover from 2025 Baseline (%)		
Hilbert	-3.6%	4.5%	308.1%[12]
Hilbert North	-3.9%	4.7%	2.3%
Cockburn Gateway	-3.2%	3.2%	9.3%
Armadale T Centre	-3.4%	3.9%	3.3%
Haynes NC	-3.6%	5.5%	11.0%

Source: Pracsys 2022

The impacts show that the proposed uses will not affect the viability of surrounding centres, both current and planned.

5.4 Competitive Response

Whether actual impacts on retail centres are similar to estimated impacts largely depends on the competitive response. The competitive response is usually targeted at improving the foot traffic and therefore turnover of a centre and can be affected at a centre level or an individual tenant level. At the centre level, the response can include but is not limited to: centre refurbishment and redevelopment, tenancy re-mixing and marketing events. At the tenant level, the response may involve store refurbishment, improving the level of customer service, improving in-store management, advertising and pricing. How competitors respond will naturally affect the level of impact that is experienced as a result of the proposed development. All these factors have a potential to significantly reduce the impact of the proposed development at Anstey Road.

[12] Centre now assumed to expand from 5,000m^2 to 20,000m^2 in 2031

6 IMPACT ON COMMUNITY

6.1 Economic Benefits

The proposed development at Anstey Rd will provide ongoing employment benefits resulting from operations of the proposed retail offerings. It is estimated that by 2032 the proposed development will support 90 Full Time Equivalent jobs based on an additional 1,500m^2. Some of this employment will be a transfer from within the trade area while some will reflect new employment opportunities for locals.

6.2 Community Benefits

The proposed development will support walkable access to Shop/Retail uses for the significant population being supported by neighbouring residential developments. The proposed development will offer a variety of different retail offerings and encourage healthy competition in the area, all of which will benefit customers. This creates balance and equity of access as larger numbers of people are able to access the goods and services they desire in a timelier fashion.

The proposed development aligns with objectives in the draft SPP4.2 and the ARC Strategy. Specifically, it provides access to daily shopping needs for future residents within a walkable catchment, addresses community need efficiently and equitably and reduces the need for private car trips. The additional 3,470 persons directly adjacent to the centre will create significant demand for daily shopping trips. The proposed centre is located centrally to all of the surrounding residential developments with approximately 50% of the proposed developable area within 400m of the centre, providing high levels of walkability.

Without the proposed development the objectives identified above could not be met, specifically: the current uses proposed at Lot 3 and 301 Anstey would not address daily shopping needs; the Forrestdale local centre has not progressed with any planning and is not of sufficient scale to meet daily shopping demand (particularly as it shares a boundary with residential dwellings); and, the nearest offering to provide for daily shopping needs is over 1.4 km to the west (the future Nicholson Road North centre) and almost 5km to the east (Haynes Neighbourhood Centre). The proposed development will provide appropriate activity centre uses to create a liveable community and address Local and State planning objectives.

The benefits associated with the proposed development are likely to be a welcome addition from both and economic and community benefit perspective by providing employment, reducing travel time, providing variety, encouraging healthy competition and creating a case for equitable access.

7 CONCLUSION

This report assesses the proposed development at Lot 84, 16 Anstey Road Forrestdale, in the City of Armadale, its trade area and competition to estimate the need for and potential impacts of the development on the retail network.

Retail Needs Assessment

Population is likely to expand significantly in the 5km catchment around the proposed site over the next 10 years and beyond due to significant residential developments, and the trade area population has relatively high incomes that are likely to support increased disposable expenditure for retail items.

There are also many proposed expansions and developments to be completed in the trade area over the next 10 years which will meet the demand of the Trade Area population. Anstey Rd local centre is strategically positioned to address the daily shopping needs of directly adjacent residential developments.

Retail demand was assessed through gravity modelling, accounting for all centres identified in the trade area, as well as new developments and expansions. The analysis identified that up to an additional 1,500m^2 of Shop/Retail floorspace would be supportable at the site currently with this level of floorspace remaining viable once competing centres are completed by 2027. This accounted for the nearby fast food and service station developments on lot 3 and 301 Anstey Road, which amounts to 180m^2 of retail floorspace. Population-driven demand will continue to expand in the trade area, supporting the viability of the site through the fifteen-year timeframe of the analysis.

Impact Test

Modelling has shown that the estimated impacts are less than the moderate (5%, apart from Forrestdale at 5.1%) and well below the 10% significant impact threshold identified by the draft SPP4.2 (2020) and current SPP4.2 (2023); the sustainability of the centre hierarchy will be preserved. A number of factors contribute to this finding, including:

- The development is small and would not achieve a concentration that would draw customers away from larger surrounding centres, relying predominantly on local expenditure
- The development is in an expanding residential area that will have high population levels mitigating the impact on nearby centres
- There are few centres in immediate proximity to the proposed development
- A profitable competitive environment

Overall, the development is expected to be a positive contribution to the retail network as it will create significant economic and community benefit. Local residents will benefit through walkable access to daily shopping amenity, reduced travel times for daily shopping trips, increased variety and healthy competition that will not undermine the activity centre hierarchy. This benefits all households and allows a larger share of income to be directed to other activities.

The Proposed Development aligns with draft SPP4.2 and ARC Strategy objectives and can be recommended for approval.

8 APPENDIX 1: GRAVITY MODELLING METHODOLOGY

Gravity models allow for the measurement of spatial interaction as a function of distance to determine the probability of a given customer shopping at a centre and provide an approximation of trade area and sales potential for a development. This modelling technique uses the distance between a household and each centre, and a measure of 'attractiveness' to define the probability model. The 'attractiveness' of a centre has been defined by total floorspace and the distance has been calculated by measuring straight-line distances between each centre and population. The gravity model probability formula is shown in Figure 18.

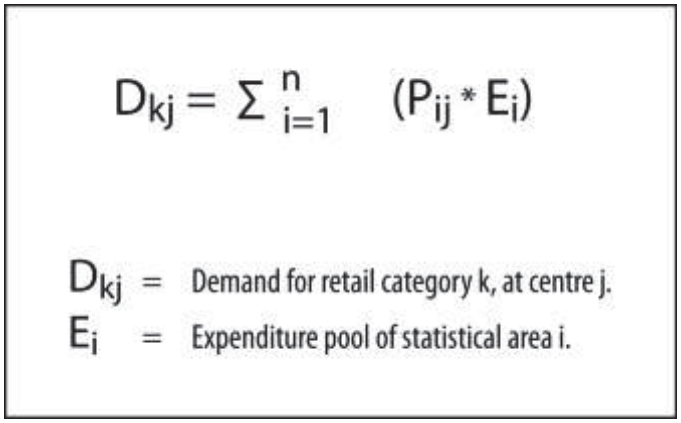
Figure 18. Gravity Model Probability Formula

$$P_{ij} = \frac{\frac{A_{jk}^{a}}{D_{ij}^{ß}}}{\sum_{j=1}^{m} \frac{A_{jk}^{a}}{D_{ij}^{ß}}}$$

P_{ij}	=	Probability of customer living/working in statistical area i shopping at complex j.
A_i	=	Area of floorspace in centre, j in square metres, according to the type of supply, k.
D_{ij}	=	Distance between statistical area of households, i and complex j.
a	=	Area exponent
ß	=	Distance exponent
k	=	Type of supply or expenditure, either Convenience or Comparison
i	=	Statistical area (i=1,...,n)
j	=	Complexes (j=1,...,m)

Source: Carter, C (1993) 'Assumptions Underlying the Retail Gravity Model', *Appraisal Journal,* Vol 61, No 4, pp510; Pracsys (2020)

Figure 19. Gravity Model Demand Formula



Source: Carter, C (1993) 'Assumptions Underlying the Retail Gravity Model', *Appraisal Journal,* Vol 61, No 4, pp510; Pracsys (2020)

Figure 19 shows that the demand for retail category k[13], at centre j, is equal to the sum of the probabilities of customers living in statistical areas i to n, multiplied by the expenditure pool of statistical area i. In other words, the demand for retail is a function of the probability of customer from particular statistical area attending the centre multiplied by the expenditure pool of that statistical area. The expenditure is pool is derived through the population multiplied by its income distribution.

In its core form gravity modelling provides a clearer, reproducible outcome that can be easily assessed. However, it does not consider local factors, including:

- The comparative value proposition of centres (e.g. the presence of an 'anchor' attractor that draws significant market share);
- The brand preference of users; or
- The efficiency of transport networks, as well as geographical barriers (e.g. in some cases it may be easier for customers to access a centre that lies physically further away).

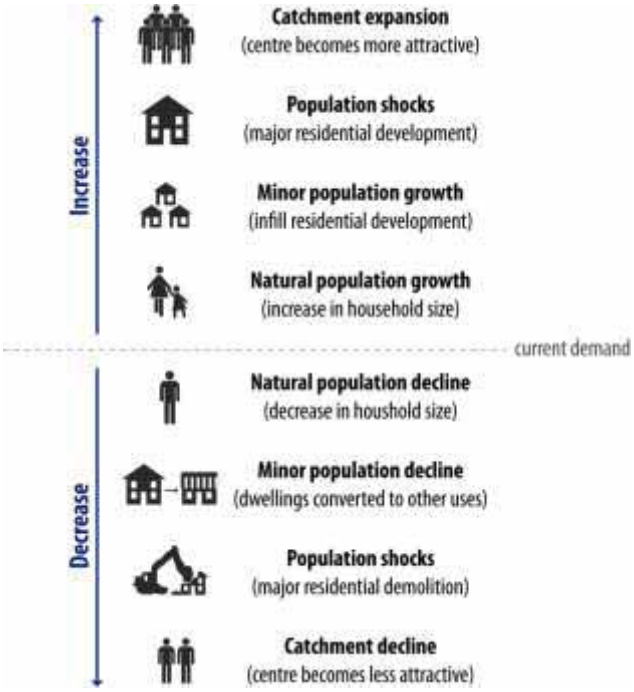
8.1 Drivers of Retail Floorspace Supply and Demand

Demand changes can result in increased or decreased expenditure. The potential causes of demand changes are shown in Figure 20. These largely show that an increasing population increases demand, and vice versa. There are significant amounts of commercial floorspace, especially office floorspace, flagged for the central sub-region of Perth and beyond. There will also be significant numbers of new dwellings provided across Perth. This increase in residents has the potential to boost demand for goods and services in the area.

[13] Retail categories are determined by their PLUC code and whether they are convenience or comparison goods. Convenience goods are day-to-day items such as groceries, pharmaceuticals and fast food. Comparison goods are items where consumers are willing to travel further distances, and are bought less frequently such as clothing, furniture, electronics, or other household items.

Demand can also increase from rising incomes, or wealth, because people have more disposable income to spend on retail. Demand can also be increased by reducing leakage. Leakage for retail is largely caused by online retail, as well as travelling.

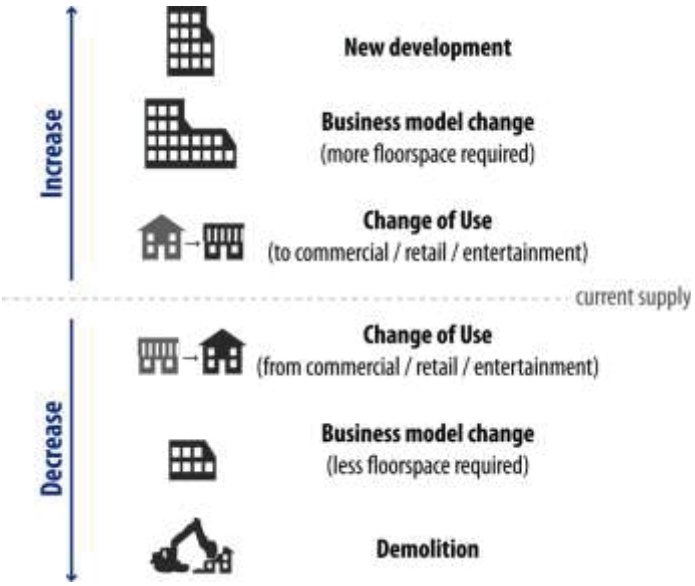
Figure 20. Drivers of Retail Floorspace Demand



Source: Pracsys 2020

Supply changes can result in increased or decreased retail floorspace. The potential causes of supply changes are shown in Figure 19.

Figure 21. Drivers of Retail Floorspace Supply



Source: Pracsys 2020