Banksia Grove Village Shopping Centre

TRANSPORT ASSESSMENT REPORT FOR RETENTION OF EXISTING ACCESS ARRANGEMENT

Prepared for
ISPT SUPER PROPERTY

Prepared by
Uloth and Associates
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EXECUTIVE SUMMARY

The existing Banksia Grove Village Shopping centre opened to the public in December 2014, and the existing access arrangement has operated at high Levels of Service, and with no significant crash history, since that time.

The initial Transport Assessment Report (February 2013) for the existing development provided justifications for full access at each of the existing junctions. However, due to City of Wanneroo's uncertainty regarding future traffic flows generated by the centre, the JDAP approval included a condition requiring the future removal of right turn movements at each of the access driveways. It is important to note, however, that although not satisfied with this outcome, the developer agreed to the condition in order to allow the development to proceed, and City of Wanneroo provided written advice that they would be happy to reassess the removal of right-turn movements prior to any action being taken in this regard.

The objective of this current study is to identify both the existing and future traffic situations for the overall Banksia Grove Shopping Centre development, with a view to providing justification for the retention of the existing turning movement arrangements at the 2 existing access driveways serving the southern part of the site (referred to as the Coles development site).

In order to identify existing traffic flows adjacent to the site, Uloth and Associates carried out peak period intersection turning movement counts at the existing Shopping Centre access driveways, and adjacent intersections, on Thursday 4 May 2017. The data shows that the existing Coles development site (including the fast-food outlets and petrol station) currently generates 13,570 vehicle trips per day, with 48 percent of Shopping Centre traffic currently accessing the Centre from the south via the Pinjar Road - Joondalup Drive roundabout, 31 percent from the north-east via Joondalup Drive, and 21 percent to the north and west via Pinjar Road and Golf Links Drive.

When the overall site is fully developed, it is estimated that the total traffic generation will increase to 25,350 vehicle trips per day. It is also estimated that traffic flows on Joondalup Drive west of Pinjar Road will increase to 33,900 vehicles per day in 2026 and then 35,400 vehicles per day by 2031.

It is important to note that the existing access arrangement at Banksia Grove Village Shopping Centre was designed to ensure that the intersection spacing between each driveway and the adjacent major intersections satisfies the Austroads Safe Intersection Sight Distance requirements as well as the Liveable Neighbourhoods intersection spacing requirements, as discussed in Section 2.3.2.

Intersection operational analysis confirms that the existing driveways currently operate at high Levels of Service during the critical PM peak hour, and an analysis of the crash history at the site confirms that there are no issues to suggest that the right turn movements at the driveways should be removed.

Additional analysis shows that under the existing access arrangement (Access Scenario 1), the 2 existing access driveways will both continue to operate at acceptable Levels of Service during the critical future PM peak hour. However, analysis also shows that if the right turn in at Driveway 2 (off Joondalup Drive) is closed under Access Scenario 2, then the alternative right turn entry from Joondalup Drive north into Ghost Gum Boulevard will fall from high Levels of Service A and B under the existing access arrangement to an undesirable Level of Service E.

It is also important to note that the removal of the existing right turn movements at Driveways 1 and 2 would have serious implications on access to the existing petrol station, fast food developments and the Coles loading dock, as well as future developments in the southern part of the site, and will result in increased pedestrian/vehicle conflicts within the internal parking aisles, significantly reducing safety for shoppers within these areas.

- It is therefore recommended that the existing access arrangement for Banksia Grove Village Shopping Centre, at both Driveway 1 and Driveway 2, should be retained.

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1. INTRODUCTION

Banksia Grove Village Shopping Centre is located at the corner of Joondalup Drive and Pinjar Road, in Banksia Grove, as shown in the Locality Plan in Figure 1. The existing Centre forms part of the Banksia Grove District Centre Local Structure Plan No. 65, which was adopted by the Western Australian Planning Commission in October 2010.

The existing Centre (in the southern part of the overall site) was opened in December 2014 and consists of a Coles Supermarket plus Specialty retail shops, as well as freestanding take-away food outlets and a petrol station. Further development on the northern part of the site has now also commenced, with both a Woolworths Supermarket and a separate Aldi Supermarket currently under construction.

1.1 BACKGROUND INFORMATION & PREVIOUS STUDIES

Stage 1 of the Banksia Grove Village Shopping Centre was approved in May 2013 (with amendments approved in March 2014). Subsequently, a change of use from 'Take-Away Food Outlet' to 'Drive-Through Food Outlet' was approved in May 2014, and a further modification involving the Petrol Station convenience store was approved in August 2014, before the Centre was opened to the public in December 2014.

As part of the preparation for the original Development, Uloth and Associates prepared a Transport Assessment Report in February 2013, identifying the overall access requirements and internal car park layout for the Centre, including recommended intersection layouts and justifications for full turning movements at the 2 access driveways (off Joondalup Drive and Pinjar Road). However, the access arrangement off Joondalup Drive was later restricted (as part of the JDAP approval process) to left-in/left-out plus the right-turn in off Joondalup Drive, and a legal agreement was also entered into to remove the right turn movements at both access driveways once alternative access is provided as part of the development of the northern portion of the overall site.

It is important to note, however, that although not satisfied with this outcome, the developer agreed to the condition in order to allow the development to proceed, and City of Wanneroo provided written advice that they would be happy to reassess the removal of right-turn movements prior to any action being taken in this regard.

It should also be noted that an Addendum to the initial Transport Assessment Report was prepared in February 2017, for the proposed construction of a free-standing Childcare/Commercial development on the eastern side of the Shopping Centre, adjacent to Pinjar Road.

1.2 STUDY OBJECTIVE

The objective of this study is to identify both the existing and future traffic situations for the overall Banksia Grove Shopping Centre development, with a view to providing justification for the retention of the existing turning movement arrangements at the 2 existing access driveways serving the Banksia Grove Village Shopping Centre in southern part of the site (sometimes referred to as the Coles development site).

Locality Plan

BANKSIA GROVE SHOPPING CENTRE

FIG. 1

2. STUDY FINDINGS AND CONCLUSIONS

The overall study findings and conclusions are documented in this chapter, with reference to additional information and background data provided within the Technical Appendices.

2.1 BANKSIA GROVE DISTRICT CENTRE STRUCTURE PLAN

The Banksia Grove District Centre Local Structure Plan is shown in Figure A.1 in Chapter A.1 in Technical Appendix A.

- The Structure Plan identifies an east-west road connection between Pinjar Road (at Golf Links Drive) and Joondalup Drive just north of the existing Coles Supermarket site. The plan also identifies left-in/left-out access points to the Coles development site off both Pinjar Road and Joondalup Drive.

- However, it is important to note that when carrying out the initial Transport Assessment Report for the existing Centre, the specific locations of the access points to the southern part of the overall site had to be read as indicative only, particularly considering that the intersection of Joondalup Drive and Pinjar Road is shown in the plan as a signalised 4-way intersection when in fact it was constructed as a dual lane roundabout.

- It is also important to note that the Transport Planning Report prepared in conjunction with the Banksia Grove District Centre Structure Plan in February 2008 provides detailed traffic forecasts and intersection operational analysis for the District Centre, and includes comment on possible access arrangements into the Coles development site. The report suggests that although access may be limited to left turn movements only in the long term, the possibility for additional right turn movements should also be investigated.

- Future traffic forecasts in the Transport Planning Report suggest that long term traffic flows on Joondalup Drive will reach approximately 30,000 vehicles per day west of Pinjar Road and 21,000 vehicles per day east of Pinjar Road, while Pinjar Road is expected to carry approximately 21,000 vehicles per day north of Joondalup Drive and 15,000 vehicles per day north of Golf Links Drive. This forecast is based on ultimate development of the overall District Centre, with a total traffic generation of 26,700 vehicle trips per day.

2.2 INITIAL DEVELOPMENT APPLICATION

As noted above in Section 1.1, the Transport Assessment Report for the original development on the overall site was prepared by Uloth and Associates in February 2013, and included detailed analysis of the overall access requirements.

- The analysis included confirmation of acceptable intersection spacings along both Pinjar Road and Joondalup Drive (based on both Austroad's requirements and Liveable Neighbourhoods) and acceptable intersection operational characteristics even with long term traffic flows. The report therefore recommended that full-movement access could be provided at both locations.

- However, now that the existing Centre is up and running, it is possible to identify the actual traffic flows and existing intersection operational characteristics, and to utilise these as the basis for an updated long term analysis to reassess the overall access configuration.

2.3 EXISTING SITUATION

The existing situation at Banksia Grove Village Shopping Centre is presented and discussed in the following:

2.3.1 Existing Development

Figure A.2 in Technical Appendix A shows an aerial photograph of the existing situation at Banksia Grove Village Shopping Centre, together with the adjacent roads and intersections.

- It can be seen in Figure A.2 that the Coles Shopping Centre development has been constructed along with two fast-food outlets and a petrol station. The photo also shows the future development sites for Woolworths and Aldi, which are currently under construction to the immediate north of the existing Centre.

- The existing Centre currently provides a total floorspace of 7,085 square metres NLA, comprising both retail and non-retail tenancies, as follows:

- Supermarket & Specialty Shops	5,919 m²
- Fast Food Outlets	926 m²
- Petrol Station	240 m²
- Total	7,085 m²

- The existing car park comprises a total of 376 spaces, including 48 spaces adjacent to the two Fast Food outlets and 11 spaces adjacent to the Petrol Station. This translates to an overall parking provision of 5.31 spaces per 100 square metres NLA.

- It can also be seen in Figure A.2 that Joondalup Drive has been constructed as a 4-lane divided road (with a raised median), and with a dual lane roundabout at Pinjar Road at the southern tip of the site. The recent completion of Jewel Way and Ghost Gum Boulevard is also shown, with Ghost Gum Boulevard running south from Joseph Banks Boulevard and then east along the northern boundary of the existing Coles Shopping Centre to Joondalup Drive, while Jewel Way connects Ghost Gum Boulevard to Pinjar Road at Golf Links Drive.

- Figure A.2 also shows that although the roundabout at Joondalup Drive and Pinjar Road has been constructed to its ultimate configuration, Pinjar Road has only been constructed as a 2-lane road, with only the western carriageway of its ultimate dual carriageway cross section.

- On the basis of the existing layout, it is expected that once the second carriageway of Pinjar Road has been constructed adjacent to the site, the verge width will be approximately 8 metres, which will provide improved operating conditions for the existing access (Driveway 1) off Pinjar Road.

- Existing bus stops are located on Joondalup Drive immediately adjacent to the site, and on Golf Links Drive immediately west of Pinjar Road. The bus stops on Joondalup Drive are serviced by Transperth Bus Route 390, travelling between Joondalup and Banksia Grove via Tapping. The bus stops on Golf Links Drive are serviced by Route 391, travelling between Joondalup and Banksia Grove via Carramar.

- Footpaths have been constructed along the entire frontage of the Structure Plan area along Joondalup Drive, Pinjar Road, Jewel Way and Ghost Gum Boulevard, with footpath connections across the roundabouts on Pinjar Road at Joondalup Drive and Golf Links Drive / Jewel Way.

- The existing speed limit along both Joondalup Drive and Pinjar Road in the vicinity of the site is 70 kilometres per hour.

- Joondalup Drive and Pinjar Road are both identified as Distributor A roads within the Main Roads WA functional road hierarchy.

- Joondalup Drive is identified as Other Regional Road in the Metropolitan Region Scheme, with a 52 metre road reserve. Pinjar Road is also identified as Other Regional Road, with a road reserve width of 45 metres allowing for the future construction of the second carriageway.

2.3.2 Intersection Spacing

As noted above in Section 1.1, the initial Transport Assessment Report in 2013 included recommended intersection layouts and justifications for full turning movements at each of the existing access driveways (off both Joondalup Drive and Pinjar Road). This included a review of intersection spacing requirements based on sight distance requirements specified by Austroads, as well as intersection spacings for staggered intersections specified by Liveable Neighbourhoods.

- In *Guide to Road Design - Part 4A: Unsignalised and Signalised Intersections*, Austroads specifies Safe Intersection Sight Distance (SISD) as the minimum standard that should be provided on a major road at any intersection, in order to provide sufficient distance for the driver of a vehicle on the major road to observe a vehicle from the minor road moving into a collision situation, and to stop before reaching the collision point. On the basis of this definition, the SISD is often adopted as a suitable measure for the minimum acceptable separation between intersections.

- The SISD for an operating (85th percentile) speed of 80 kilometres per hour is 181 metres, while the SISD for a speed of 70 kilometres per hour is 151 metres (using a reaction time of 2.0 seconds in Table 3.2 of the Austroads Guide).

- The existing intersection spacing along Joondalup Drive, between the existing access (Driveway 2) and the Pinjar Road roundabout is 170 metres, which is suitable for a speed of approximately 75 kilometres per hour, which exceeds the posted speed of 70 kilometres per hour.

- The corresponding intersection spacing along Pinjar Road is 190 metres between the Joondalup Drive roundabout and Driveway 1, and 180 metres between Driveway 1 and Golf Links Drive, which both satisfy the requirement for 80 kilometres per hour.

- Liveable Neighbourhoods also specifies acceptable intersection spacing requirements, as follows for a 70km/hr Design Speed: Left-Right stagger - 190 metres; Right-Left stagger - 130 metres (noting that Liveable Neighbourhoods specifies the design speed as the "*legal speed limit at full build out*". Junctions on same side - 130 metres.

- The existing access driveways therefore satisfy each of the various minimum spacing requirements.

2.3.3 Existing Traffic Flows and Intersection Operational Analysis

In order to identify existing traffic flows adjacent to the site, Uloth and Associates carried out peak period intersection turning movement counts at the existing Shopping Centre access driveways, plus the Joondalup Drive - Pinjar Road roundabout and the Pinjar Road - Golf Links Drive roundabout, on Thursday 4 May 2017, together with 24-hour traffic counts on both Joondalup Drive and Pinjar Road, from Tuesday 2 May 2017 to Monday 8 May 2017.

- The existing AM and PM peak hour traffic flows at the existing Shopping Centre driveways and adjacent intersection are shown in Figures A.3 and A.4 respectively in Technical Appendix A, while corresponding daily traffic flows have been calculated as shown in Figure A.5.

- The data shows that the existing Coles development site (including the fast-food outlets and petrol station) currently generates 13,570 vehicle trips per day, with 1,199 vehicle trips in and out of the Centre during the Thursday PM peak hour, compared to just 671 vehicle trips during the AM peak hour.

- It can be seen in Figure A.5 that the busiest Shopping Centre driveway at present is Driveway 1 (off Pinjar Road), carrying 7,440 vehicles per day, with Driveway 2 (off Joondalup Drive) carrying 6,130 vehicles per day.

- It can also be seen that Pinjar Road carries 10,840 vehicles per day to the north of Driveway 1, increasing to 12,720 vehicles per day between Driveway 1 and Joondalup Drive, and to 17,280 vehicles per day south of Joondalup Drive. Joondalup Drive carries 21,200 vehicles per day north of Driveway 2, with 25,730 vehicles per day between Driveway 2 and Pinjar Road, and 24,570 vehicles per day south of Pinjar Road.

- By analysing the existing peak hour traffic flows (in Figures A.3 and A.4 in Technical Appendix A), it is estimated that 48 percent of Shopping Centre traffic currently accesses the Centre from the south via the Pinjar Road - Joondalup Drive roundabout, 31 percent from the north-east via Joondalup Drive, and 21 percent to the north and west via Pinjar Road and Golf Links Drive.

- Existing intersection operational characteristics for the Shopping Centre driveways and adjacent intersections are shown in Tables A.1 to A.4 in Chapter A.3 in Technical Appendix A.

- It can be seen in Tables A.1 and A.2 that the Shopping Centre Driveways currently operate at high Levels of Service A and B, indicating good operating conditions with short traffic delays. Tables A.3 and A.4 show that the roundabouts at Pinjar Road - Golf Links Drive - Jewel Way and Pinjar Road - Joondalup Drive also currently operate at high Levels of Service A and B.

2.3.4 Crash History

Since the shopping centre opened in December 2014, there are 2 years of crash data available.

- On Pinjar Road, there has been 2 crashes at the shopping centre driveway, both recorded as 'property damage only' and only one of these involving the right turn movements in or out of the shopping centre.

- On Joondalup Drive, there has been 3 crashes at the shopping centre driveway, with just one of these involving the right turn into the centre, also recorded as 'property damage only'.

- There is nothing out of the ordinary about these crashes, and certainly nothing to suggest that the right turn movements should be removed.

2.4 ADDITIONAL FUTURE DEVELOPMENT

Figure B.1 in Technical Appendix B is a composite plan showing the existing overall shopping centre site, overlaid with the current development plans for both the Woolworths and Aldi sites.

- The Woolworths development site is bordered by Joseph Banks Drive, Joondalup Drive and Ghost Gum Boulevard. The Centre is proposed to comprise a Shopping Centre (including the Woolworths supermarket, Specialty shops and a Recreation Centre), plus freestanding developments including a Child Care Centre and Petrol Station.

- The Aldi development site (to the west of Ghost Gum Boulevard) is proposed to comprise an Aldi Supermarket and Specialty Shops.

- Access driveways for these new developments will be provided off Joseph Banks Boulevard, Ghost Gum Boulevard and Jewel Way, while provision has also been made for connections to the existing Coles development site off both Jewel Way and Ghost Gum Boulevard.

- The Coles shopping centre is also proposed to expand towards the east as part of a Stage 2 development. Additionally, a Child Care Centre and Commercial development is proposed to the

west of the existing Centre, while future development sites (including an additional take-away food outlet) have also been identified to the south of the existing Centre in the vicinity of the Pinjar Road - Joondalup Drive roundabout.

2.5 FUTURE TRAFFIC FLOWS

2.5.1 Development Traffic Generation and Distribution

Table B.1 in Technical Appendix B shows the proposed future floorspace for the three Shopping Centre sites, together with the anticipated trip generation, calculated on the basis of the standard ITE and NSW RMS trip generation rates.

- It can be seen in Table B.1 that the trip generation of the existing Coles development site is estimated to increase to 16,140 vehicles per day, with 1,386 vehicle trips during the critical Thursday PM peak hour. It is also anticipated that the Aldi site will generate 1,700 vehicle trips per day with 166 trips during the PM peak hour, while the Woolworths site is expected to generate 7,510 vehicle trips per day with 800 trips during the PM peak hour.

- The total trip generation for the overall site is therefore estimated to be 25,350 vehicle trips per day, with 2,352 trips during the PM peak hour, noting that the trip generation for all non-Shopping Centre floorspace has been reduced by 20 percent to account for linked trips with the shopping centres.

- The distribution of the overall future traffic flows is expected to remain similar to the distribution of the existing Centre, but with a slight percentage reduction to/from the south due to increased residential development north of the Centre. It is also necessary to take into account the additional travel routes to/from the northern areas due to the new roads accessing the northern part of the Centre.

- It is therefore assumed that 45 percent of the total Shopping Centre traffic will travel to and from the south via the Joondalup Drive - Pinjar Road roundabout. A further 30 percent are assumed to travel to/from the northeast via the Joondalup Drive - Tumbleweed Drive roundabout, plus 5 percent to/from the immediate north via Ghost Gum Boulevard, leaving 20 percent to access the site to/from the northwest (with 8 percent via Golf Links Drive, 6 percent via Pinjar Road, and 6 percent via Joseph Banks Boulevard).

- Figure B.2 in Technical Appendix B therefore shows the assignment of the future daily shopping centre traffic flows into the various access driveways and adjacent intersections under the assumption that the current access arrangements are retained at both Driveway 1 and Driveway 2 (access Scenario 1), noting that the various right turn movements can be easily reassigned to the adjacent access driveways for analysis of the currently proposed removal of these right turn movements (Access Scenario 2).

2.5.2 Background Growth and Future Total Traffic

Existing 'non shopping centre' or 'Background' traffic flows adjacent to Banksia Grove Shopping Centre have been identified by distributing the existing Thursday PM peak hour shopping centre traffic through the adjacent intersections, and subtracting the shopping centre traffic from the total surveyed flows.

- On the basis of the analysis carried out for the February 2017 Transport Assessment Report Addendum, which takes into account the then existing traffic flows on Joondalup Drive and the long term traffic forecast of 30,350 vehicles per day (from the Transport Planning Report for the overall Banksia Grove District Centre Structure Plan), it is assumed, for analysis purposes, that the existing background traffic flows will continue to grow at a rate of 3 percent per annum until 2026, before flattening to a 1 percent growth rate thereafter.

- Figure B.3 in Technical Appendix B therefore shows the future daily total traffic flows following full development of the overall shopping centre, including the existing background traffic flows adjacent to the centre plus the anticipated traffic growth described above.

- It can be seen in Figure B.3 that traffic flows on Joondalup Drive are expected to increase to 33,940 vehicles per day west of Pinjar Road and 25,830 vehicles per day east of Pinjar Road, while Pinjar Road traffic is expected to carry 23,800 vehicles per day south of Joondalup Drive, 18,030 vehicles per day between Joondalup Drive and Driveway 1, and 15,280 vehicles per day between Golf Links Drive and Driveway 1.

- By carrying out the same process with PM peak hour flows, it was also possible to identify the future PM peak hour traffic flows following full development of the overall Centre, as shown in Figure B.4 in Technical Appendix B, under Access Scenario 1, while Figure B.5 shows the alternative PM peak hour flows under Access Scenario 2 (with no right turns at Driveways 1 or 2.

- By comparing Figures B.4 and B.5, it can be seen that if Driveway 2 is restricted to left-turn movements only (under Scenario 2) then the right turn in from Joondalup Drive north into Ghost Gum Boulevard will increase from 47 vehicles per hour to 259 vehicles per hour, which translates to an increase of approximately 2,300 vehicles per day. Not only does this put pressure on the operation of this unsignalised junction (as discussed below in Section 2.8), but it also means that over 2,000 vehicles per day will have to travel through the eastern car park of the Coles development site (directly in front of the new front entrance for the proposed Stage 2 development) to access the various developments within the southern part of the site.

- In order to provide a robust analysis, future traffic flows have also been identified for 2031, based on the anticipated 1 percent growth rate beyond 2026. This will further increase traffic flows on Joondalup Drive to 35,400 vehicles per day on west of Pinjar Road, and 27,000 vehicles per day east of Pinjar Road, while Pinjar Road traffic is expected to carry 24,800 vehicles per day south of Joondalup Drive, 18,600 vehicles per day between Joondalup Drive and Driveway 1, and 15,800 vehicles per day between Golf Links Drive and Driveway 1.

2.6 FUTURE INTERSECTION OPERATIONAL ANALYSIS

The future (2026) intersection operational analyses for the shopping centre access driveways and adjacent intersections are shown in Tables B.2 to B.8 in Chapter B.3 in Technical Appendix B, noting that this is consistent with the 10-year growth scenario analysis in the February 2017 Addendum Report. Additional analysis has also been carried out for 2031 to confirm ongoing intersection operational characteristics.

2.6.1 Driveways 1 and 2

Tables B.2 to B.4 show the future (2026) intersection operational analyses for the existing access driveways off Pinjar Road and Joondalup Drive.

- It can be seen in Table B.2 that the existing junction at Pinjar Road - Driveway 1 will continue to operate at an acceptable Level of Service C during the future 2026 PM peak hour, indicating satisfactory operating conditions with average traffic delays. Table B.3 then shows that with the planned future widening of Pinjar Road, the junction will operate at a high Level of Service B, indicating good operating conditions with short traffic delays. Additional analysis for 2031 confirms that the junction will also continue to operate at an acceptable Level of Service in the longer term. There is therefore no reason why the existing access arrangement cannot be retained at this location.

- The operation of the existing Joondalup Drive - Driveway 2 junction for the future 2026 PM peak hour is shown in Table B.4, confirming that the existing junction will continue to operate at an acceptable Level of Service C during the critical PM peak hour, indicating satisfactory operating conditions with average traffic delays. Additional analysis for 2031 confirms that the junction will

also continue to operate at an acceptable Level of Service in the longer term. There is therefore no reason why the existing right-turn entry from Joondalup Drive north cannot be retained, in order to maximise accessibility to the existing developments within the southern part of the site.

2.6.2 Adjacent Intersections

Tables B.5 to B.8 in Chapter B.3 show the future intersection operational analyses for the 3 intersections adjacent to Banksia Grove Shopping Centre.

- The operation of the Joondalup Drive - Ghost Gum Boulevard junction is shown in Tables B.5 and B.6 under Access Scenarios 1 and 2, respectively. Table B.5 shows that the junction will operate at an acceptable Level of Service C during the critical 2026 PM peak hour if the existing access arrangement is retained (that is under Access Scenario 1). However, if the right turn in at Driveway 2 is removed (Access Scenario 2) then the increased right turn movement at Ghost Gum Boulevard will fall to Level of Service E, as shown in Table B.6, indicating undesirable operating conditions with very long traffic delays. It is therefore clear that the retention of the existing right turn in at Joondalup Drive - Driveway 1 results in a more balanced overall traffic situation.

- Table B.7 shows that the Pinjar Road - Joondalup Drive roundabout will operate at an acceptable Level of Service C during the 2026 PM peak hour, with the existing Shopping Centre driveways remaining in their current form, but with the roundabout approaching capacity. Further analysis shows that the redistribution of traffic under Access Scenario 2 will cause the roundabout to fall to an unacceptable Level of Service F during the 2026 PM peak hour, requiring the addition of a left-turn slip lane from Pinjar Road south into Joondalup Drive south. However, it is important to note that this upgrade will be required by 2031 irrespective of which Access Scenario is applicable for the shopping centre.

- Table B.8 shows that the existing Pinjar Road - Golf Links Drive - Jewel Way roundabout will continue to operate at a high Level of Service A, indicating very good operating conditions with minimal delays, under Access Scenario 1, while additional analysis confirms that the roundabout will also operate at Level of Service A under Access Scenario 2.

2.7 IMPACTS OF CURRENTLY PROPOSED ACCESS MODIFICATIONS

In reviewing this current analysis to justify the retention of the existing access arrangement for the existing Coles Shopping centre development site, it is important to also acknowledge the various impacts that the removal of the existing right turn movements would have on the existing Centre.

- The removal of the existing right turn entry off Joondalup Drive would mean that customers of the existing Coles shopping centre would have to enter via the right turn into Ghost Gum Boulevard and then a left turn into the Coles car park. While this would still be convenient for shoppers visiting the shopping centre itself, it would have serious implications on access to the existing petrol station and Fast Foods, as well as the proposed additional developments in the southern part of the site, since to access these development vehicles would have to travel through the northern car park (directly in front of the new entrance to a future Stage 2 expansion). As well as reducing accessibility to these tenancies, this would also increase pedestrian/vehicle conflicts in front of the eastern shopping centre entrance, significantly reducing safety for shoppers within this area.

- Removal of the right turn in off Pinjar Road will similarly reduce the accessibility for development on the western side of the existing site, particularly the currently proposed childcare centre and commercial tenancies adjacent to Pinjar Road. Customers of these developments would have to continue north on Joondalup Drive to Golf Links Drive - Jewel Way to then travel back towards the south through the adjoining development site. However, since the adjoining land is under separate ownership, and with conflicting interests, it is unlikely that any signage or direction would be provided to assist accessibility to these sites.

- Access to the existing Coles loading dock would also be seriously compromised, with trucks having either carry out the same detour described above, or enter the site off Joondalup Drive and travel through the middle of the existing car park.

- The closure of the right turn out of the Centre into Pinjar Road north is perhaps less critical from an accessibility perspective. However, it would result in up to 20 percent of all vehicles exiting the site having to travel via the internal roadway (past the proposed childcare centre) to travel through the adjoining property to access Jewel Way, with significant impacts on pedestrian/vehicle conflicts along this route.

3. OVERALL CONCLUSIONS AND RECOMMENDATIONS

The overall conclusions and recommendations relating to the future access configuration at existing Access Driveways 1 and 2 at Banksia Grove Village Shopping Centre are as follows:

- The existing access arrangement at Banksia Grove Village Shopping Centre was designed to ensure that the intersection spacing between each driveway and the adjacent major intersections satisfies the Austroads Safe Intersection Sight Distance requirements as well as the Liveable Neighbourhoods intersection spacing requirements, as discussed in Section 2.3.2.
- Analysis confirms that the existing driveways currently operate at high Levels of Service during the critical PM peak hour, and an analysis of the crash history at the site confirms that there are no issues to suggest that the right turn movements at the driveways should be removed.
- The total traffic generation for the overall Banksia Grove Shopping Centre will increase from the existing 13,570 vehicles per day to an estimated 25,350 vehicles per day, following full development of the overall site. However, Access Driveway 1 (off Pinjar Road) will only increase by 350 vehicles per day (from 7,440 to 7,790 vehicles per day), while Access Driveway 2 (off Joondalup Drive) will essentially remain unchanged.
- Intersection operational analysis shows that under the existing access arrangement (Access Scenario 1), the 2 existing access driveways will both continue to operate at acceptable Levels of Service during the critical PM peak hour.
- However, analysis also shows that if the right turn in at Driveway 2 is closed (under Access Scenario 2), then the alternative right turn entry from Joondalup Drive north into Ghost Gum Boulevard will fall from high Levels of Service A and B under the existing access arrangement to an undesirable Level of Service E.
- It is also important to note that the removal of the existing right turn movements at Driveways 1 and 2 would have serious implications on access to the existing petrol station, fast food developments and the Coles loading dock, as well as future developments in the southern part of the site, and will result in increased pedestrian/vehicle conflicts within the internal parking aisles, significantly reducing safety for shoppers within these areas.
- It is therefore recommended that the existing access arrangement for Banksia Grove Village Shopping Centre, at both Driveway 1 and Driveway 2, should be retained.

TECHNICAL APPENDIX A

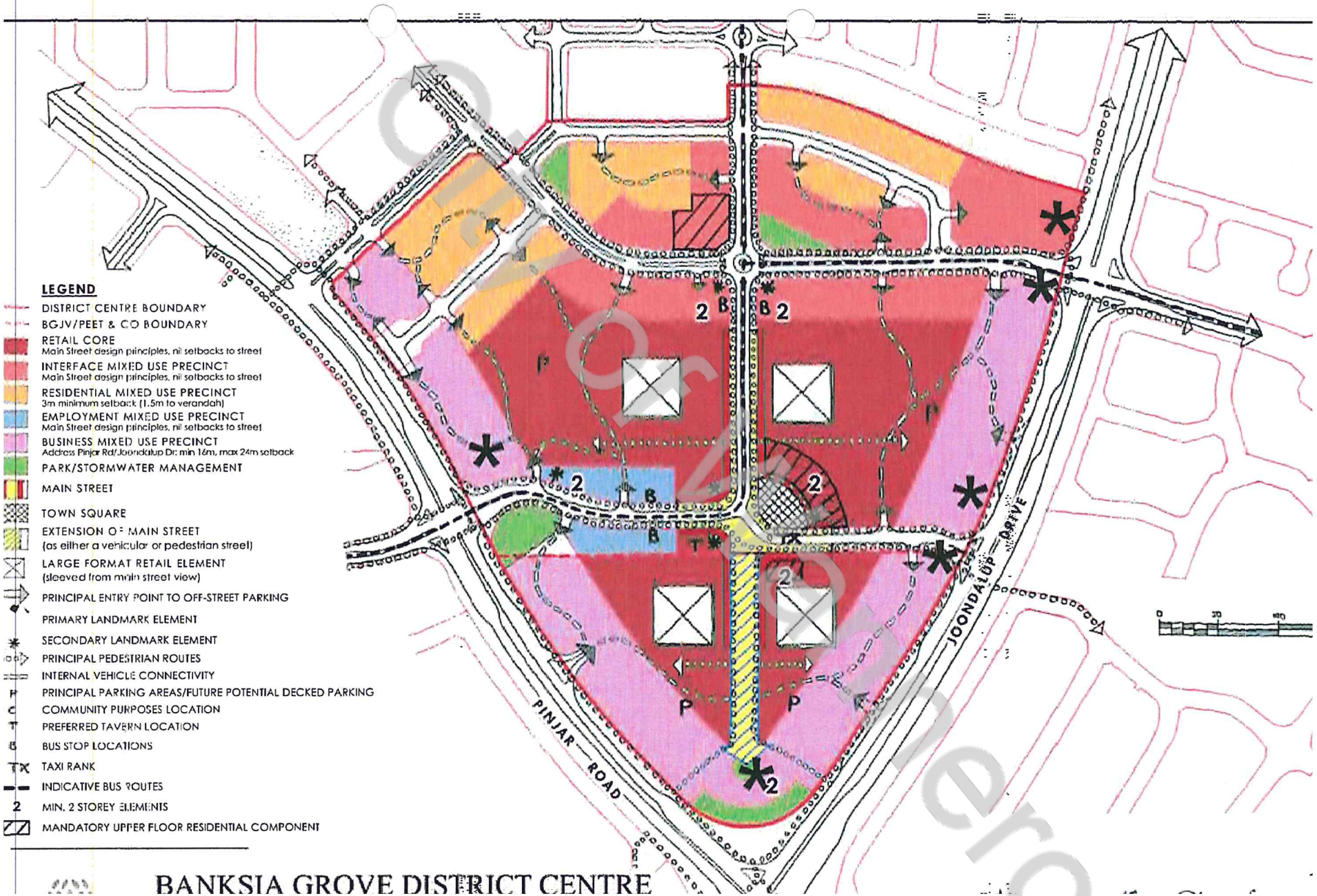
Technical Appendix A documents the District Centre Structure Plan, together with the existing traffic flows and intersection operational analyses adjacent to the Centre.

A.1 BANKSIA GROVE DISTRICT STRUCTURE PLAN

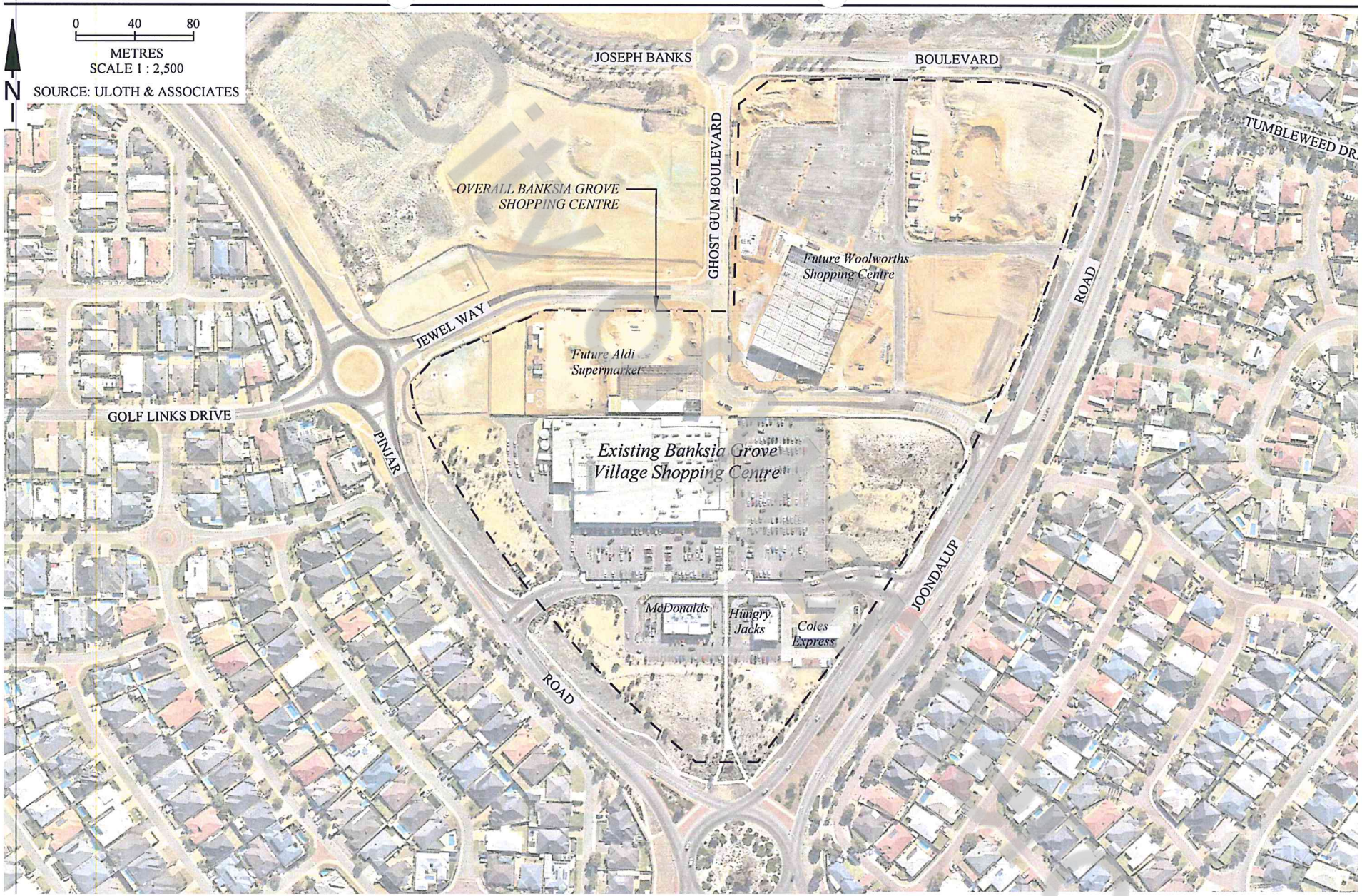
Figure A.1 shows the Banksia Grove District Centre Local Structure Plan No. 65, which was adopted by the Western Australian Planning Commission in October 2010.

A.2 EXISTING SITUATION

Figure A.2 is an aerial photograph showing the existing Banksia Grove Village Shopping Centre and the 2 new developments currently under construction, together with the adjacent roads and intersections.



BANKSIA GROVE DISTRICT CENTRE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Future Aldi Supermarket
GOLF LINKS DRIVE
PINJAR
Existing Banksia Grove Village Shopping Centre
JOONDALUP
McDonalds
Hungry Jacks
Coles Express
ROAD

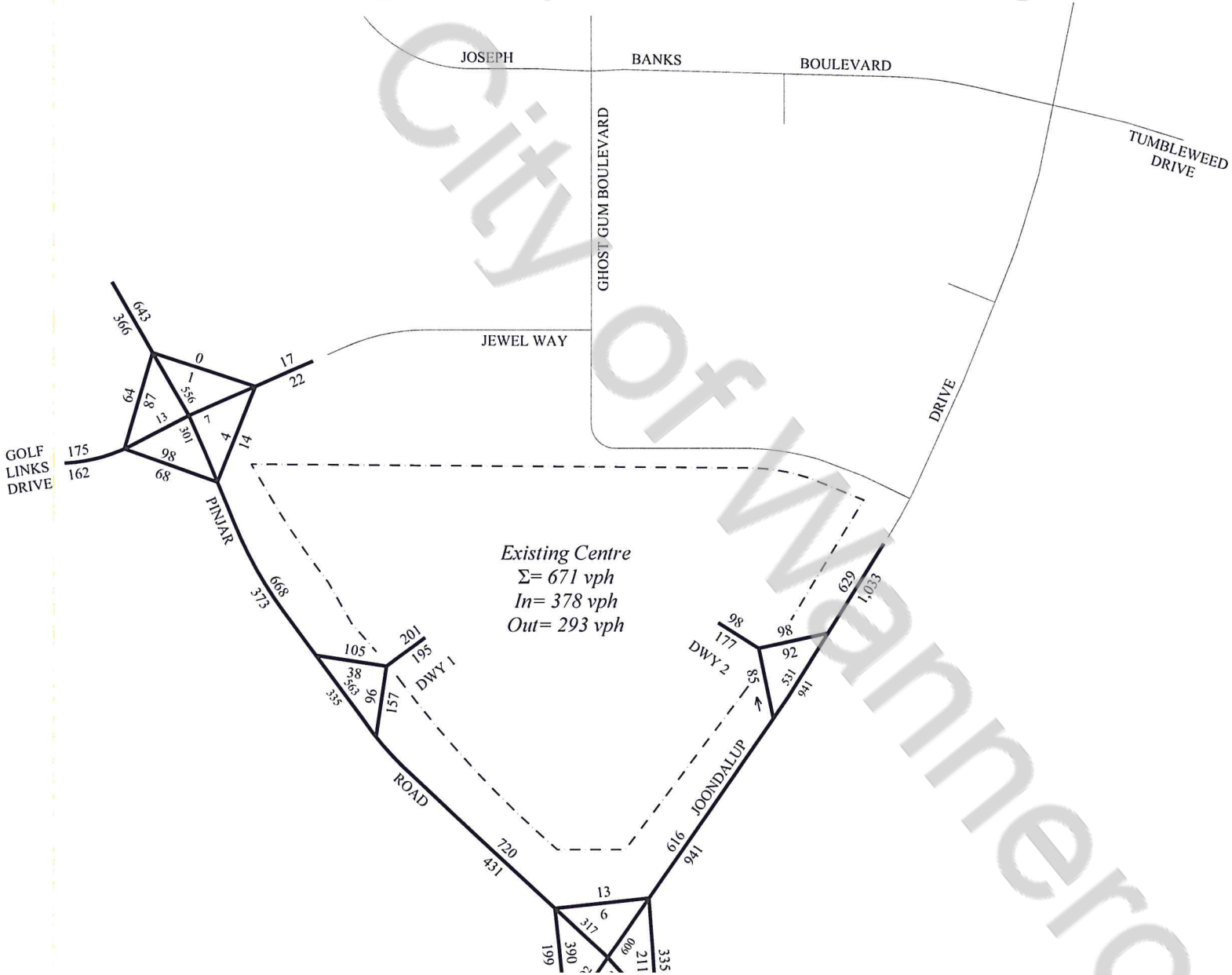
A.3 EXISTING TRAFFIC AND INTERSECTION OPERATIONAL ANALYSIS

Figures A.3 and A.4 show the existing AM and PM peak hour traffic flows at the existing Sh Centre access driveways together with the Joondalup Drive - Pinjar Road roundabout and the Pinj - Golf Links Drive roundabout as surveyed by Uloth and Associates on Thursday 4 May 2017.

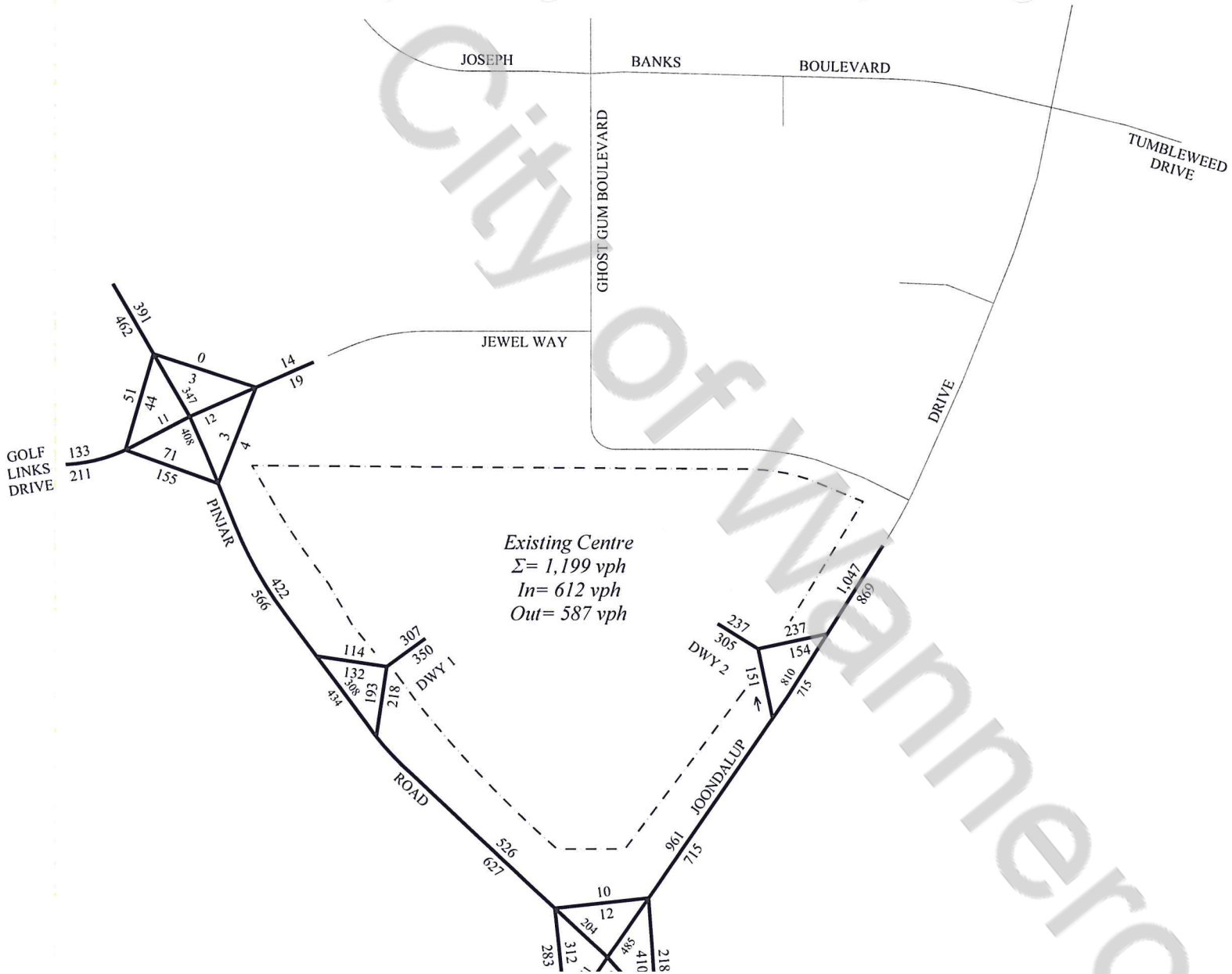
Figure A.5 shows the corresponding daily traffic flows, factored up from peak period traffic co the basis of 24-hour traffic flows obtained for both Pinjar Road and Joondalup Drive during th Tuesday 2 May 2017 to Monday 8 May 2017.

Tables A.1 and A.2 then show the existing Thursday PM peak hour intersection ope characteristics for the Shopping Centre driveways, while Tables A.3 and A.4 show the corresp intersection operational characteristics for the Pinjar Road - Golf Links Drive roundabout Joondalup Drive - Pinjar Road roundabout respectively.

SOURCE: ULOTH & ASSOCIAT



SOURCE: ULOTH & ASSOCIAT



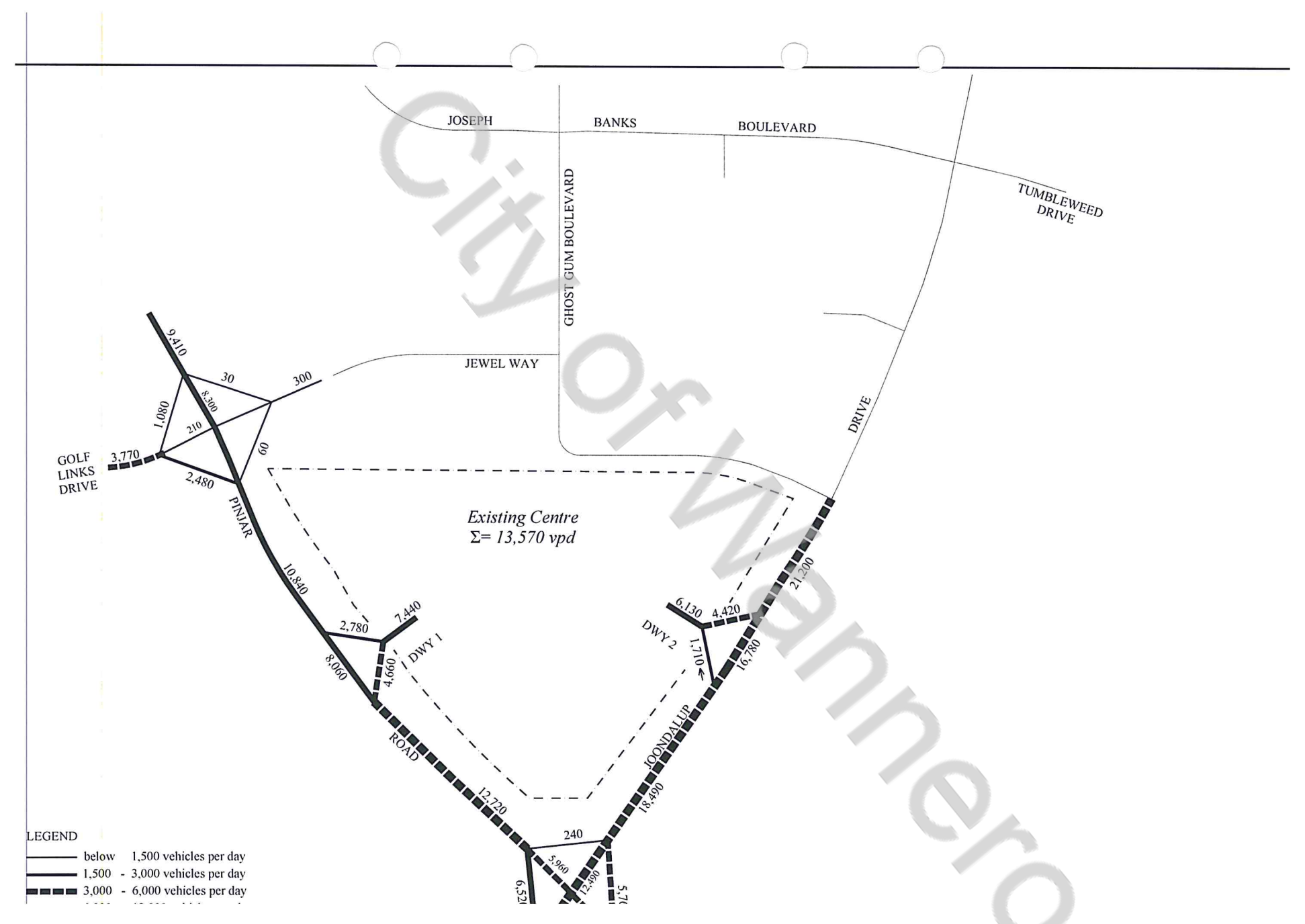


TABLE A.1
OPERATIONAL CHARACTERISTICS FOR UNSIGNALISED PINJAR ROAD - DRIVEWAY 1 JUNCTION – EXISTING THURSDAY AM AND PM PEAK HOUR BANKSIA GROVE VILLAGE SHOPPING CENTRE

ITEMS	OPERATIONAL CHARACTERISTICS										
	AM Peak Hour						PM Peak Hour				
No. of Approach Lanes: N E S W Max X Value	2 2 2 - 0.312						2 2 2 - 0.243				
Approach	Move-ment	X-Value	Max. Queue Veh.	Max. Queue m	Avrge Delay (sec)	Level of Serv.	Move-ment	X-Value	Max. Queue Veh.	Max. Queue m	Avrg Dela (sec
Pinjar Road - north	L	0.060	0.0	0	5.6	A	L	0.066	0.0	0	5
	T	0.312	0.0	0	0.0	A	T	0.169	0.0	0	0
Driveway [ ] - east	L	0.253	1.0	7	9.8	A	L	0.243	1.0	7	7
	R	0.071	0.2	2	10.5	B	R	0.242	0.9	6	11
Pinjar Road - south	T	0.142	0.0	0	0.0	A	T	0.241	0.0	0	0
	R	0.164	0.6	4	10.2	B	R	0.228	1.0	7	8

Notes: Level of Service calculations are based on Average Delay and Degree of Saturation.
Underlined X-values denote maximum values.

Source: Uloth and Associates

TABLE A.2
OPERATIONAL CHARACTERISTICS FOR UNSIGNALISED JOONDALUP DRIVE - DRIVEWAY 2 JUNCTION – EXISTING THURSDAY AM AND PM PEAK HOUR BANKSIA GROVE VILLAGE SHOPPING CENTRE

ITEMS	OPERATIONAL CHARACTERISTICS										
	AM Peak Hour						PM Peak Hour				
No. of Approach Lanes: N E S W Max X Value	3 - 3 1 0.249						3 - 3 1 0.356				
Approach	Move-ment	X-Value	Max. Queue Veh.	Max. Queue m	Avrge Delay (sec)	Level of Serv.	Move-ment	X-Value	Max. Queue Veh.	Max. Queue m	Avrg Dela (sec
Joondalup Drive - north	T	0.249	0.0	0	0.0	A	T	0.208	0.0	0	0
	T	0.249	0.0	0	0.0	A	T	0.208	0.0	0	0
	R	0.093	0.4	3	7.7	A	R	0.231	1.0	7	10
Joondalup Drive - south	L	0.081	0.2	2	5.9	A	L	0.151	0.4	3	6
	T	0.145	0.0	0	0.0	A	T	0.230	0.0	0	0
	T	0.145	0.0	0	0.0	A	T	0.230	0.0	0	0
Driveway 2 - west	L	0.118	0.4	3	7.2	A	L	0.356	1.7	12	9

Notes: Level of Service calculations are based on Average Delay and Degree of Saturation.
Underlined X-values denote maximum values.

Source: Uloth and Associates

TABLE A.3 – OPERATIONAL CHARACTERISTICS FOR PINJAR ROAD - GOLF LINKS I
JEWEL WAY ROUNDABOUT – EXISTING THURSDAY AM AND PM PEAK HOUR
BANKSIA GROVE VILLAGE SHOPPING CENTRE

ITEMS	OPERATIONAL CHARACTERISTICS										
	AM Peak Hour						PM Peak Hour				
No. of Approach Lanes: N E S W	1 1 1 1						1 1 1 1				
Max X Value	0.485						0.400				
Avrge Delay (sec)	4.9						4.4				
Level of Service	A						A				
Approach	Move-ment	X-Value	Max. Queue Veh.	Max. Queue m	Avrge Delay (sec)	Level of Serv.	Move-ment	X-Value	Max. Queue Veh.	Max. Queue m	Avr Del (se
Pinjar Road - north	LTR	0.485	4.0	29	4.7	A	LTR	0.283	1.9	14	4
Jewel Way - east	LTR	0.035	0.2	2	8.5	A	LTR	0.020	0.1	1	6
Pinjar Road - south	LTR	0.283	1.8	13	3.6	A	LTR	0.400	2.9	20	3
Golf Links Drive - west	LTR	0.161	0.9	7	8.2	A	LTR	0.133	0.8	5	8

Notes: Level of Service calculations are based on Average Delay and Degree of Saturation.
Underlined X-values denote maximum values.

Source: Uloth and Associates

TABLE A.4
OPERATIONAL CHARACTERISTICS FOR JOONDALUP DRIVE - PINJAR ROAD ROUN
EXISTING THURSDAY AM AND PM PEAK HOUR – BANKSIA GROVE VILLAGE S.C.

ITEMS	OPERATIONAL CHARACTERISTICS										
	AM Peak Hour						PM Peak Hour				
No. of Approach Lanes: N E S W	2 2 2 2						2 2 2 2				
Max X Value	0.482						0.525				
Avrge Delay (sec)	7.2						7.4				
Level of Service	A						A				
Approach	Move-ment	X-Value	Max. Queue Veh.	Max. Queue m	Avrge Delay (sec)	Level of Serv.	Move-ment	X-Value	Max. Queue Veh.	Max. Queue m	Avr Del (se
Pinjar Road - north	LT	0.358	1.8	13	5.4	A	LT	0.303	1.6	11	6
	TR	0.358	2.0	14	11.4	B	TR	0.317	1.9	14	12
Joondalup Drive - east	LT	0.482	3.3	24	5.7	A	LT	0.339	1.9	14	4
	TR	0.482	3.0	22	6.9	A	TR	0.339	1.8	13	5
Pinjar Road - south	LT	0.303	1.8	13	5.0	A	LT	0.525	3.8	27	5
	TR	0.303	1.6	12	13.5	B	TR	0.525	3.5	25	13
Joondalup Drive - west	LT	0.361	2.0	15	3.5	A	LT	0.491	3.3	23	4
	TR	0.361	1.9	14	9.0	A	TR	0.491	3.1	22	8

Notes: Level of Service calculations are based on Average Delay and Degree of Saturation.
Underlined X-values denote maximum values.

Source: Uloth and Associates

TECHNICAL APPENDIX B

Technical Appendix B documents the proposed overall development, including future traffic flows and intersection operation analyses.

B.1 PROPOSED OVERALL DEVELOPMENT

Figure B.1 shows the future overall development at Banksia Grove District Shopping Centre, wi of the proposed Woolworths Shopping Centre and Aldi Supermarket overlaid on the existin image.

Table B.1 shows the proposed floorspace for the overall development, together with anticipa generation calculated on the basis of industry-standard trip generation rates.

TABLE B.1
PROPOSED FLOORSPACE AND ANTICIPATED TRAFFIC GENERATION
BANKSIA GROVE SHOPPING CENTRE - OVERALL DEVELOPMENT

ITEM	FLOORSPACE (M^2 NLA)	TRAFFIC GENERATIO Daily (vehs/day)	PM Pea Hour (vehs/hou
• Coles Development Site			
- Shopping Centre (including Stage 2) [1]	8,889	6,930	675
- Petrol Station [2]	240	1,600	120
- Takeaway Outlets [2] (2 existing plus 1 future)	1,526	6,510	450
- Childcare/Commercial [2] (currently proposed)	1,388	640	72
- Future Commercial [2]	2,875	460	69
- Total	14,918	16,140	1,386
• Aldi Shopping Centre	2,180	1,700	166
• Woolworths Development Site			
- Shopping Centre [1]	4,985	3,890	379
- Recreation Centre [2]	454	160	33
- Commercial [2]	11,618	1,860	278
- Petrol Station [2]	200	1,600	110
- Total	17,297	7,510	800
• Overall Shopping Centre (Combined Sites)			
- Shopping Centre [1]	16,054	12,520	1,220
- Freestanding/Other [2]	18,341	12,830 [3]	1,132 [3]
• Grand Total	34,395	25,350	2,352

Notes:
1) Based on RMS rates for shopping centres 10,000 - 20,000 m² GFA.
2) Trip generation for all non-Shopping Centre floorspace has been reduced by 20 pe account for linked trips with the shopping centres.
3) Initial trip generation for freestanding/other development calculates to a total of 16,(and 1,416 vehs per PM peak, but is reduced by 20 percent for linked trips with sh centre.

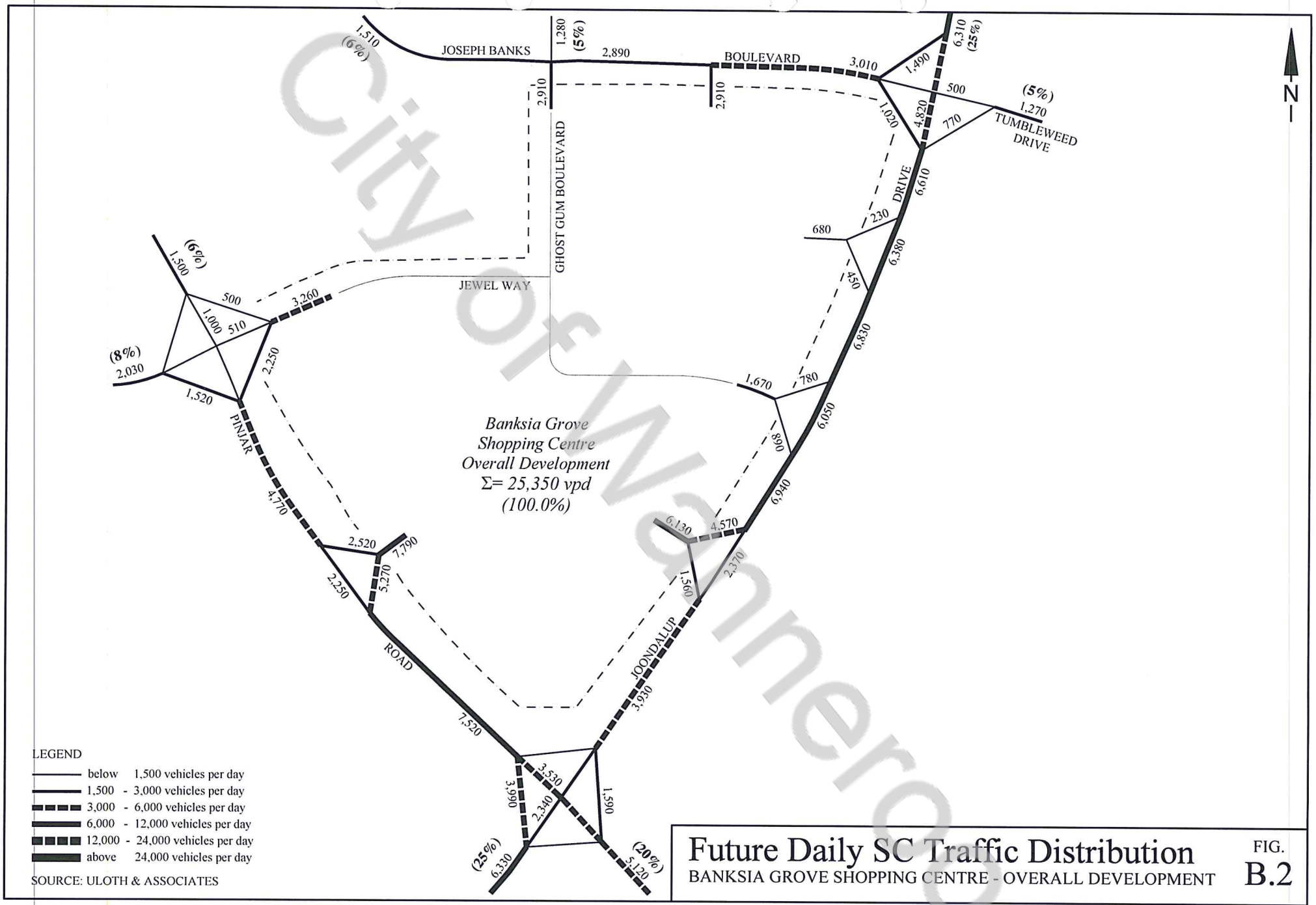
Source: Uloth and Associates


0 40 80
METRES
SCALE 1 : 2,500
SOURCE: ULOTH & ASSOCIATES
JOSEPH BANKS
BOULEVARD
GHOST GUM BOULEVARD
TUMBLEWEED DRI
Future Woolworths
Shopping Centre
JEWEL WAY
ROAD
GOLF LINKS DRIVE
PINJAR
Existing Coles
Shopping Centre
McDonalds
Hungry
Jacks
Coles
Express
JOONDALUP
ROAD

B.2 FUTURE TRAFFIC FLOWS

Figure B.2 shows the assignment of future daily traffic flows onto the various access driveways and adjacent intersections, while Figure B.3 shows the corresponding total future traffic flows, including traffic growth on both Joondalup Drive and Pinjar Road, as discussed in Section 2.7.

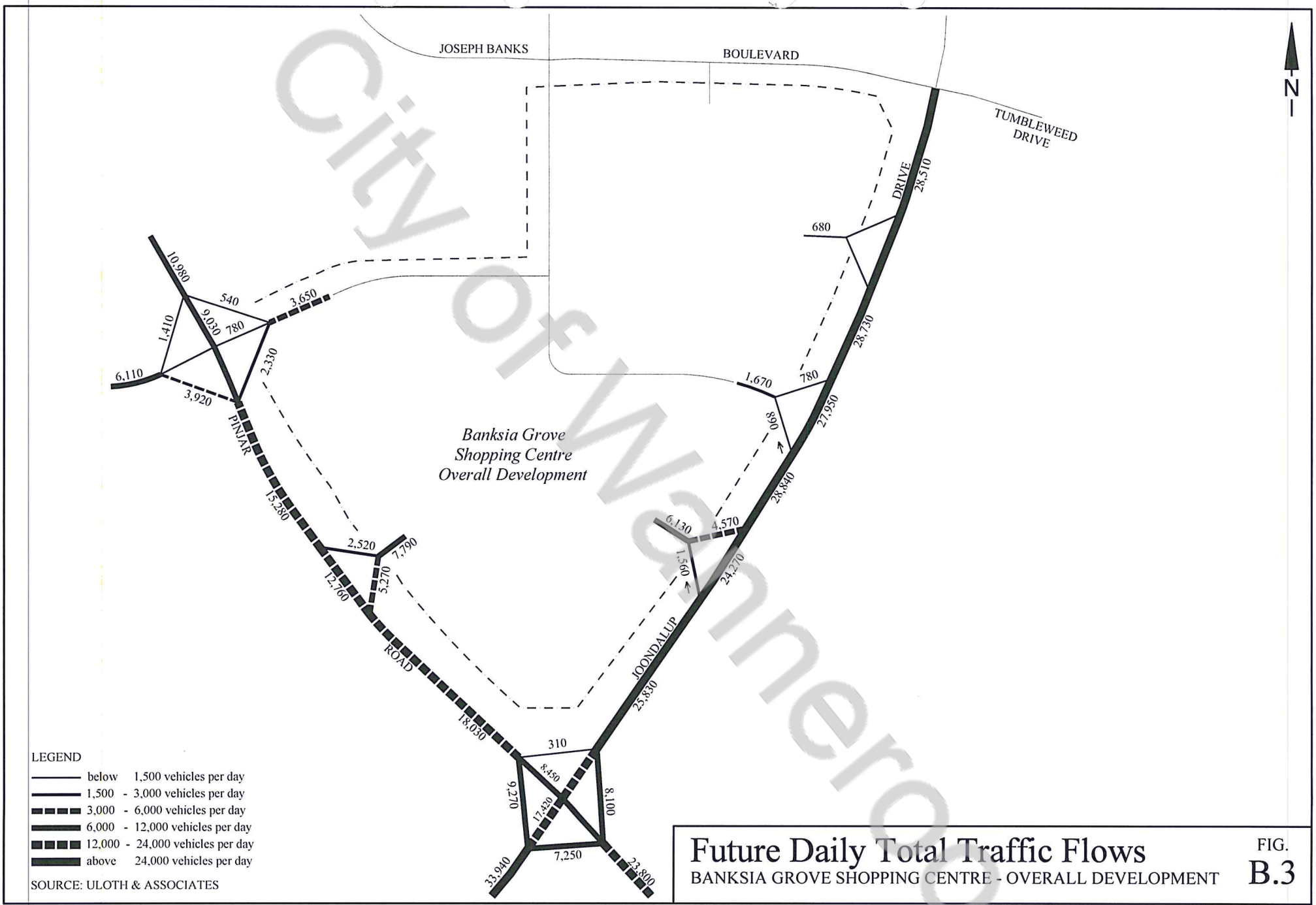
Figure B.4 then shows the future PM peak hour total traffic flows for each of the shopping centre driveways and adjacent intersections for analysis of Access Scenario 1, while Figure B.5 shows the reassigned PM peak hour traffic flows under Access Scenario 2 (with the removal of right turn movements at both Driveway 1 and Driveway 2).



Future Daily SC Traffic Distribution

BANKSIA GROVE SHOPPING CENTRE - OVERALL DEVELOPMENT

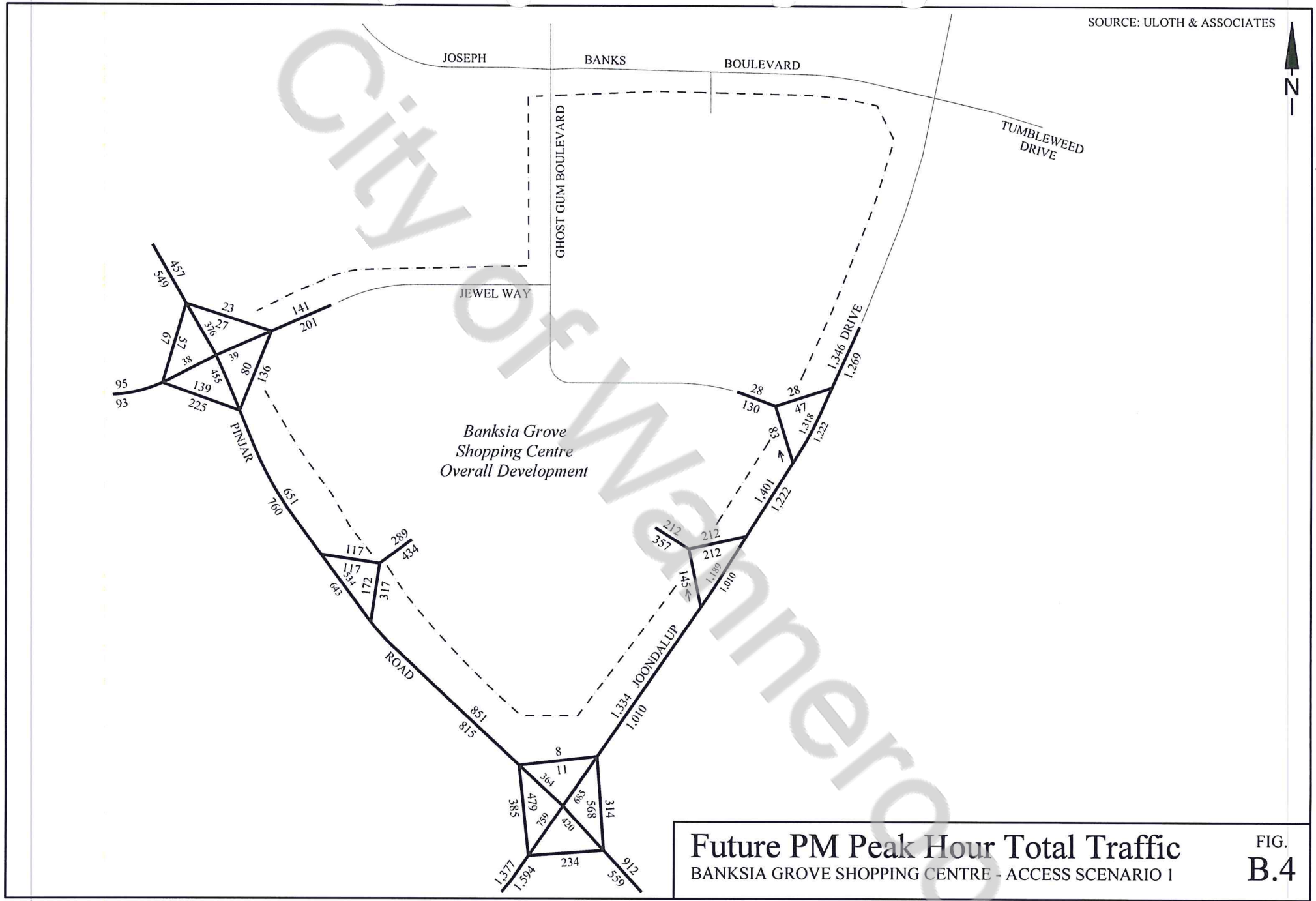
FIG. B.2



Future Daily Total Traffic Flows

BANKSIA GROVE SHOPPING CENTRE - OVERALL DEVELOPMENT

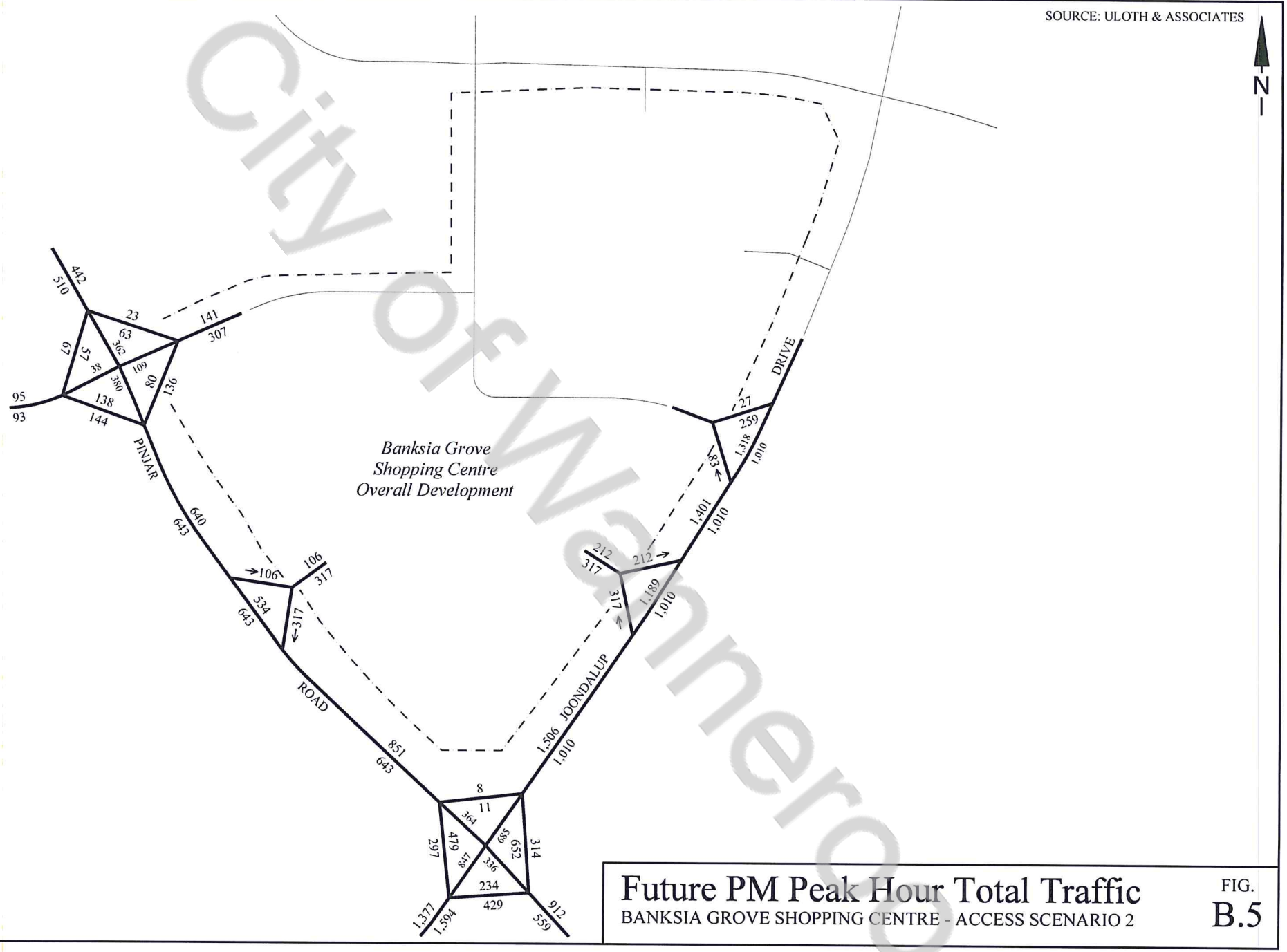
FIG. B.3



Future PM Peak Hour Total Traffic

BANKSIA GROVE SHOPPING CENTRE - ACCESS SCENARIO 1

FIG. B.4



Future PM Peak Hour Total Traffic

BANKSIA GROVE SHOPPING CENTRE - ACCESS SCENARIO 2

FIG. B.5

B.3 FUTURE INTERSECTION OPERATIONAL CHARACTERISTICS

The future intersection operational characteristics following full development of the overall Banksia Grove Shopping Centre are presented in the following, based on the 2026 PM peak hour traffic flows documented in Chapter B.2.

B.3.1 PINJAR ROAD - DRIVEWAY 1

Table B.2 shows the 2026 Thursday PM peak hour intersection operational characteristics for the Pinjar Road - Driveway 1 junction at Banksia Grove Shopping Centre under Access Scenario 1, which retains the existing all-movement operation, while Table B.3 shows the corresponding operational characteristics with Pinjar Road widened to 4 lanes divided.

TABLE B.2
OPERATIONAL CHARACTERISTICS FOR UNSIGNALISED PINJAR ROAD - DRIVEWAY 1 JUNCTION – 2026 THURSDAY PM PEAK HOUR - ACCESS SCENARIO 1
BANKSIA GROVE SHOPPING CENTRE - OVERALL DEVELOPMENT

ITEMS	OPERATIONAL CHARACTERISTICS PM Peak Hour					
No. of Approach Lanes: N E S W Max X Value	2 2 2 - 0.490					
Approach	Move-ment	X-Value	Max. Queue Veh.	Max. Queue Metres	Avrge Delay (sec)	Level of Serv.
Pinjar Road - north	L T	0.067 0.298	0.0 0.0	0 0	5.6 0.0	A A
Driveway 1 - east	L R	<u>0.490</u> 0.394	2.8 1.5	20 11	11.4 19.5	B C
Pinjar Road - south	T R	0.358 0.287	0.0 1.3	0 9	0.0 10.8	A B

Notes: Level of Service calculations are based on Average Delay and Degree of Saturation.
Underlined X-values denote maximum values.

Source: Uloth and Associates

TABLE B.3
OPERATIONAL CHARACTERISTICS FOR UNSIGNALISED PINJAR ROAD - DRIVEWAY 1 JUNCTION – 2026 THURSDAY PM PEAK HOUR – ACCESS SCENARIO 1 WITH PINJAR ROAD UPGRADED TO 4 LANES DIVIDED
BANKSIA GROVE SHOPPING CENTRE - OVERALL DEVELOPMENT

ITEMS	OPERATIONAL CHARACTERISTICS PM Peak Hour					
No. of Approach Lanes: N E S W Max X Value	2 2 3 - 0.497					
Approach	Move-ment	X-Value	Max. Queue Veh.	Max. Queue Metres	Avrge Delay (sec)	Level of Serv.
Pinjar Road - north	LT T	0.182 0.182	0.0 0.0	0 0	2.0 0.0	A A
Driveway 1 - east	L R	<u>0.497</u> 0.277	2.9 0.8	21 6	11.8 19.0	B B
Pinjar Road - south	T T R	0.179 0.179 0.273	0.0 0.0 1.2	0 0 9	0.0 0.0 10.4	A A B

Notes: Level of Service calculations are based on Average Delay and Degree of Saturation.
Underlined X-values denote maximum values.

Source: Uloth and Associates

B.3.2 JOONDALUP DRIVE - DRIVEWAY 2

Table B.4 shows the 2026 Thursday PM peak hour operational characteristics for the Joondalup Drive - Driveway 2 junction under Access Scenario 1, which retains the existing right turn in off Joondalup Drive.

TABLE B.4
OPERATIONAL CHARACTERISTICS FOR UNSIGNALISED JOONDALUP DRIVE - DRIVEWAY 2 JUNCTION – 2026 THURSDAY PM PEAK HOUR - ACCESS SCENARIO 1
BANKSIA GROVE SHOPPING CENTRE - OVERALL DEVELOPMENT

ITEMS	OPERATIONAL CHARACTERISTICS PM Peak Hour					
No. of Approach Lanes: N E S W Max X Value	3 - 3 1 0.560					
Approach	Move-ment	X-Value	Max. Queue Veh.	Max. Queue m	Avrge Delay (sec)	Level of Serv.
Joondalup Drive - north	T	0.281	0.0	0	0.0	A
	T	0.281	0.0	0	0.0	A
	R	0.560	3.0	21	20.8	C
Joondalup Drive - south	L	0.153	0.4	3	6.4	A
	T	0.331	0.0	0	0.0	A
	T	0.331	0.0	0	0.0	A
Driveway 2 - west	L	0.433	2.1	15	13.4	B

Notes: Level of Service calculations are based on Average Delay and Degree of Saturation.
Underlined X-values denote maximum values.

Source: Uloth and Associates

B.3.3 JOONDALUP DRIVE - GHOST GUM BOULEVARD

Tables B.5 and B.6 show the 2026 Thursday PM peak hour operational characteristics for the Joondalup Drive - Ghost Gum Boulevard junction under Access Scenarios 1 and 2, respectively.

TABLE B.5 – OPERATIONAL CHARACTERISTICS FOR UNSIGNALISED JOONDALUP DVE - GHOST GUM BLVD JUNCTION – 2026 THURSDAY PM PEAK HOUR - ACCESS SCENARIO 1 BANKSIA GROVE SHOPPING CENTRE - OVERALL DEVELOPMENT

ITEMS	OPERATIONAL CHARACTERISTICS PM Peak Hour					
No. of Approach Lanes: N E S W Max X Value	3 - 3 1 0.367					
Approach	Move-ment	X-Value	Max. Queue Veh.	Max. Queue m	Avrge Delay (sec)	Level of Serv.
Joondalup Drive - north	T	0.341	0.0	0	0.0	A
	T	0.341	0.0	0	0.0	A
	R	0.157	0.5	4	17.5	C
Joondalup Drive - south	L	0.076	0.2	2	5.8	A
	T	<u>0.367</u>	0.0	0	0.0	A
	T	<u>0.367</u>	0.0	0	0.0	A
Ghost Gum Blvd - west	L	0.065	0.2	2	11.7	B

Notes: Level of Service calculations are based on Average Delay and Degree of Saturation.
Underlined X-values denote maximum values.

Source: Uloth and Associates

TABLE B.6 – OPERATIONAL CHARACTERISTICS FOR UNSIGNALISED JOONDALUP DVE - GHOST GUM BLVD JUNCTION – 2026 THURSDAY PM PEAK HOUR - ACCESS SCENARIO 2 BANKSIA GROVE SHOPPING CENTRE - OVERALL DEVELOPMENT

ITEMS	OPERATIONAL CHARACTERISTICS PM Peak Hour					
No. of Approach Lanes: N E S W Max X Value	3 - 3 1 0.862					
Approach	Move-ment	X-Value	Max. Queue Veh.	Max. Queue m	Avrge Delay (sec)	Level of Serv.
Joondalup Drive - north	T	0.281	0.0	0	0.0	A
	T	0.281	0.0	0	0.0	A
	R	0.862	7.0	50	43.9	E
Joondalup Drive - south	L	0.091	0.2	2	6.6	A
	T	<u>0.367</u>	0.0	0	0.0	A
	T	<u>0.367</u>	0.0	0	0.0	A
Ghost Gum Blvd - west	L	0.062	0.2	2	11.6	B

Notes: Level of Service calculations are based on Average Delay and Degree of Saturation.
Underlined X-values denote maximum values.

Source: Uloth and Associates

B.3.4 JOONDALUP DRIVE - PINJAR ROAD

Table B.7 shows the 2026 Thursday PM peak hour operational characteristics for the Joondalup Drive - Pinjar Road roundabout under Access Scenario 1.

TABLE B.7
OPERATIONAL CHARACTERISTICS FOR JOONDALUP DRIVE -
PINJAR ROAD ROUNDABOUT – 2026 THURSDAY PM PEAK HOUR - ACCESS SCENARIO 1
BANKSIA GROVE SHOPPING CENTRE - OVERALL DEVELOPMENT

ITEMS	OPERATIONAL CHARACTERISTICS PM Peak Hour					
No. of Approach Lanes: N E S W Max X Value Avrge Delay (sec) Level of Service	2 2 2 2 0.910 17.8 B					
Approach	Move-ment	X-Value	Max. Queue Veh.	Max. Queue m	Avrge Delay (sec)	Level of Serv.
Pinjar Road - north	LT	0.728	6.5	46	19.9	B
	TR	0.728	8.2	58	23.2	C
Joondalup Drive - east	LT	0.643	5.7	41	7.6	A
	TR	0.643	5.0	36	9.4	A
Pinjar Road - south	LT	0.910	17.4	123	22.0	C
	TR	0.910	14.0	102	33.7	C
Joondalup Drive - west	LT	0.844	10.3	73	10.7	B
	TR	0.844	9.0	64	16.2	B

Notes: Level of Service calculations are based on Average Delay and Degree of Saturation.
Underlined X-values denote maximum values.

Source: Uloth and Associates

B.3.5 PINJAR ROAD - GOLF LINKS DRIVE - JEWEL WAY

Table B.8 shows the 2026 Thursday PM peak hour operational characteristics for the Pinjar Road - Golf Links Drive - Jewel Way roundabout under Access Scenario 1.

TABLE B.8
OPERATIONAL CHARACTERISTICS FOR PINJAR ROAD - GOLF LINKS DRIVE - JEWEL WAY ROUNDABOUT – 2026 THURSDAY PM PEAK HOUR - ACCESS SCENARIO 1 BANKSIA GROVE SHOPPING CENTRE - OVERALL DEVELOPMENT

ITEMS	OPERATIONAL CHARACTERISTICS PM Peak Hour					
No. of Approach Lanes: N E S W	1 1 1 1					
Max X Value	0.550					
Avrge Delay (sec)	6.2					
Level of Service	A					
Approach	Move-ment	X-Value	Max. Queue Veh.	Max. Queue m	Avrge Delay (sec)	Level of Serv.
Pinjar Road - north	LTR	0.416	3.0	22	5.7	A
Jewel Way - east	LTR	0.254	1.6	13	7.7	A
Pinjar Road - south	LTR	0.550	4.8	36	4.8	A
Golf Links Drive - west	LTR	0.275	1.8	13	9.9	A

Notes: Level of Service calculations are based on Average Delay and Degree of Saturation.
Underlined X-values denote maximum values.

Source: Uloth and Associates