

# PLANNING PROPOSAL

52 PLUMPTON ROAD AND 108 BRINDABELLA DRIVE, TATTON

MAY 2018



## Document Verification



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52 Plumpton Road and 108 Brindabella Drive, Tatton

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## PLANNING PROPOSAL

This Planning Proposal prepared under Section 3.33 of the *Environmental Planning and Assessment Act 1979*, seeks to amend the Wagga Wagga Local Environmental Plan 2010. This Planning Proposal will be assessed by Wagga Wagga City Council and the NSW Department of Planning and Environment.

This Planning Proposal has been prepared to support the proposed rezoning of part of Lot 2 DP243027 and Lot 327 DP1178026 from E2 Environmental Conservation and R5 Large Lot Residential to R1 General Residential and to remove the prescribed minimum lot size, under the Wagga Wagga Local Environmental Plan (LEP) 2010.

The proposal is consistent with the NSW Planning and Infrastructure guidelines including circulars and practice notes, regarding the use and application of appropriate land use zones.

Wagga Wagga City Council is the relevant planning authority pursuant to section 3.32 of the *Environmental Planning and Assessment Act 1979*.

## INTRODUCTION

The land subject to this Planning Proposal is in private ownership and NGH Environmental acts on behalf of the landowners in preparing this proposal for consideration. The land is located in the suburb of Tatton, the subject holdings and landowners are listed in Table 1 below.

Table 1: Subject land and land ownership

<i>Subject land</i>	<i>Landowner</i>
Lot 2 DP243027, 52 Plumpton Road	Matt Jenkins Pty Ltd
Lot 327 DP 1178026, 108 Brindabella Drive	Vanessa & Slade Stanley

The subject land is shown in Figure 1 on the following page.



Figure 1: Subject land (Source: Base Map - WWCC online mapping)

## BACKGROUND

This proposal seeks to rezone land that was assessed as having had a higher level of environmental protection zoning applied during its transition from the Wagga Wagga Local Environmental Plan (LEP) 1985 to the Wagga Wagga LEP 2010. Historically, the western portion of the site was zoned for residential purposes, whilst the eastern portion of the land was zoned 7 Environmental Protection. The environmental protection zone stemmed from concerns in the 1980s that related to flood occurring from overland flow, salinity and shallow groundwater. However, studies were not undertaken to validate Council's concerns at the time.

To advise the process of preparing a Planning Proposal for land, the landowner Matt Jenkins, XP (Xeros Piccolo) and NGH consultants engaged in extensive consultation with representatives of the Wagga Wagga City Council to determine the most appropriate way forward.

In a meeting with Council officers in October 2017, Council advised of the necessity to undertake an extensive review of land, by preparing a Risk Analysis Assessment of all land located within the environmental protection zone. This land included holdings not subject to the proposed Planning Proposal. The purpose of the Risk Analysis Assessment would be to examine the status of flood inundation as well as the presence of salinity and potential for shallow groundwater. The land subject to the Risk Analysis Plan is indicated in the figure on the following page.

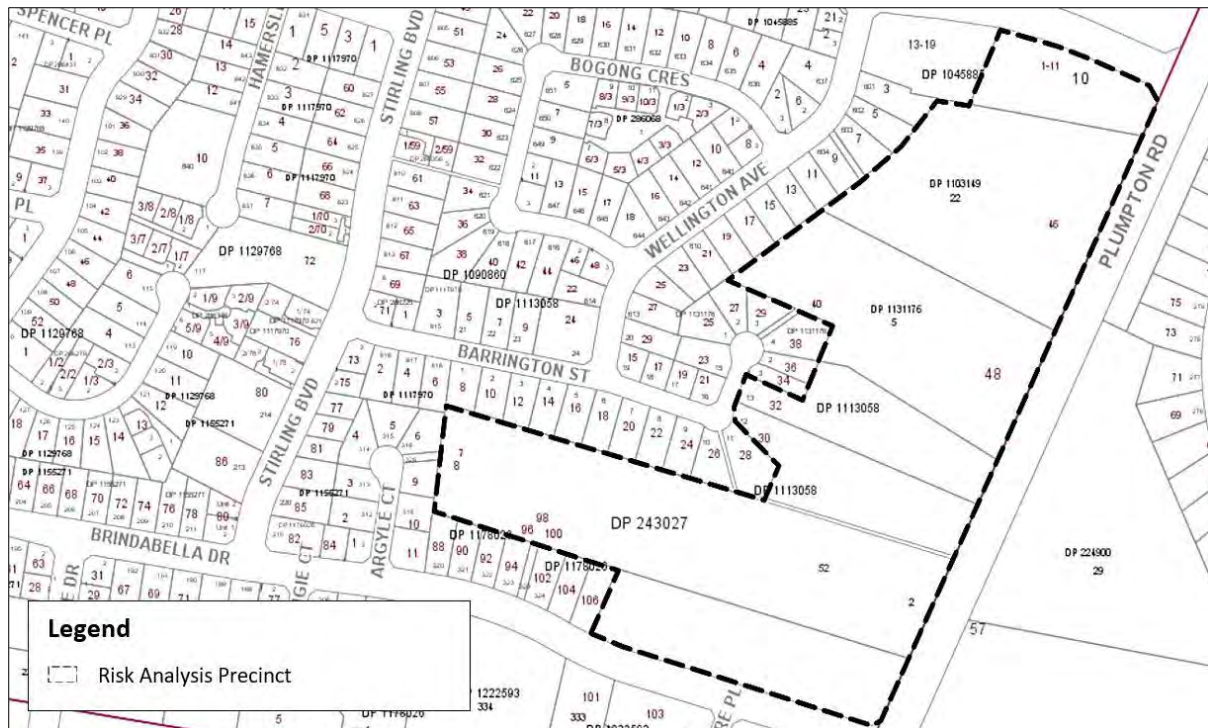


Figure 2: Land subject to Risk Analysis Assessment (Source: Base Map - WWCC online mapping)

The Risk Analysis Assessment report was submitted to Council for their reference in March 2018. The assessment provides the results of more detailed investigations of the environmental concerns held by Council and analyses the changes in environment that have occurred since the original environmental zone was applied. As part of the assessment a flood impact assessment and salinity/groundwater assessment were conducted to inform the Risk Analysis Assessment.

The findings of the Risk Analysis Report as relevant to the subject land can be summarised as follows:

#### Salinity

- According to Council's 'Urban Salinity Technical Report 2015-16', Council considers urban salinity concerns to be present where the piezometer readings reveal *both* high EC concentrations (greater than 5 deciSiemens per metre) and high SWLs (less than 5 metres below ground level)<sup>1</sup>.
- The piezometer closest to the subject land is Piezometer No. 51, which is located just off Plumpton Road opposite 48 Plumpton Road. Monthly readings, or thereabouts, since April 1997 indicate a general decline in SWLs since the establishment of the piezometer, from 6.7 metres below ground level, remaining fairly steady around 9 metres below ground level for the last 10 years. The average SWL since establishment is 8.12 metres below ground level; the median is 8.33 metres.
- The recorded electrical conductivity (EC) has ranged from 2.14 deciSiemens per metre (dS/m) in March 2011 to 6.10 in October 2007. Since establishment the average EC level is 4.76 dS/m; the median is 4.75.
- The recorded average and median SWLs and EC levels for Piezometer No. 51 do not exceed Council's identified thresholds and therefore can be considered to indicate that urban salinity is not a notable concern for this area.

<sup>1</sup> City of Wagga Wagga, 2016, 'Urban Salinity Technical Report 2015-16', p.20.



- NGH also carried out testing to determine the EC<sub>1:5</sub> and pH<sub>1:5</sub> levels present in the soil on the subject land and surrounding properties along Plumpton Road. The electrical conductivity is influenced by the concentration and composition of dissolved salts.
- The EC levels are very low, which would confirm that capillary action has not occurred, with no evidence of concentrated dissolved salts in the soil substrate. The pH levels are within a normal range for the type of soils encountered.

#### **Overland flooding**

- The modelling undertaken by WMA Water confirmed that the subject land (referred to as Scenario A site in the report) is impacted by the design flood (the 1% AEP event), generally falling within a low hazard flood storage area and the flood fringe. A minor flow path is located on the very eastern edge of the subject land but does not constitute the main floodway.
- The flood impact of development on the subject land was modelled using a preliminary development concept. The maximum off-site impact is 0.3 metres within the retention basin at 108 Brindabella Drive and 0.05 metres on the western side of the basin.
- Accordingly, the off-site flood level impact is viewed as relatively minor. Further consideration of the development concept would occur at development application stage and could include design measures to lessen the flood impact if desired.

A copy of the Risk Analysis Assessment is provided as an Attachment to this Planning Proposal for the reference of the Department of Planning and Environment.

In a meeting in March 2018, it was agreed that Council would prepare a separate Planning Proposal should they feel it necessary to consider an alternative zone for the remainder of the investigation area, based on the findings of the Risk Analysis Report and Council's own investigations.

## SUBJECT LAND AND LOCALITY

The subject land is known as 52 Plumpton Road and 108 Brindabella Drive, Tatton. The land is legally described as Lot 2, DP243027 and Lot 327, DP1178026.

The subject land is sited on the western side of Plumpton Road at the intersection of Brindabella Drive, in the locality of Tatton. Tatton is a residential neighbourhood located approximately 7km south of the Wagga Wagga CBD.

The location of the site with respect to the CBD is shown in Figure 3 below.

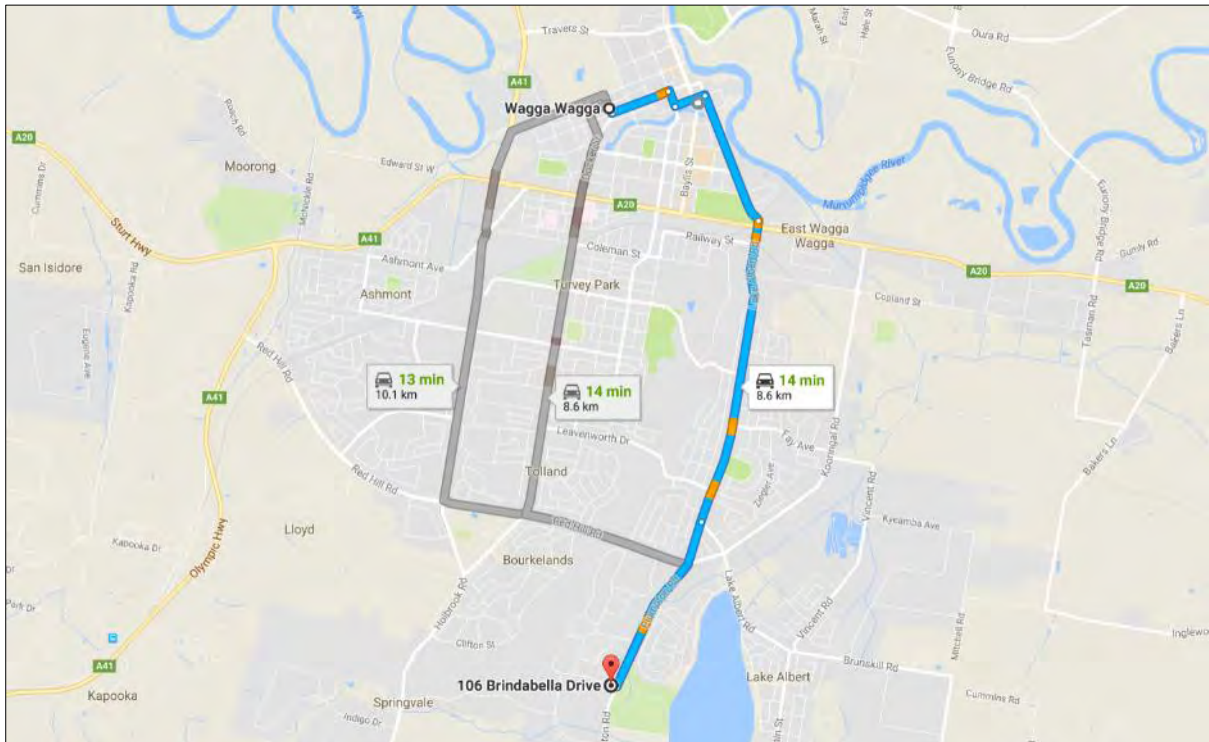


Figure 3 Location of subject land (Google maps, 2017)

# 1 PART 1 OBJECTIVES OR INTENDED OUTCOMES

The objectives of the Planning Proposal are to amend the Wagga Wagga Local Environmental Plan 2010 in order:

- To rezone a portion of the subject land from E2 Environmental Conservation to R1 General Residential, and
- To rezone a portion of the subject land from R5 Large Lot Residential to R1 General Residential, to correct a minor split zone anomaly on Lot 327 DP1178026.
- To remove the minimum lot size applicable to the area of the zone anomaly on Lot 327 DP1178026.

The above objectives are consistent with the aims of the Wagga Wagga Local Environmental Plan 2010 and the proposed rezoning would facilitate better development outcomes by enabling infill residential development on the subject land.

## 2 PART 2 EXPLANATION OF THE PROVISIONS

It is proposed to amend the Wagga Wagga Local Environmental Plan 2010 as follows:

- Amend the Land Zoning Map applicable to the land to indicate a change from E2 Environmental Conservation to R1 General Residential;
- Amend the Land Zoning Map applicable to the land from R5 Large Lot Residential to R1 General Residential; and
- Amend the Lot Size Map applicable to the land to remove the 0.2-hectare minimum lot size and indicate no prescribed minimum lot size.

Existing and proposed zones and minimum lot sizes are indicated in Figures 4-7 on the following pages.

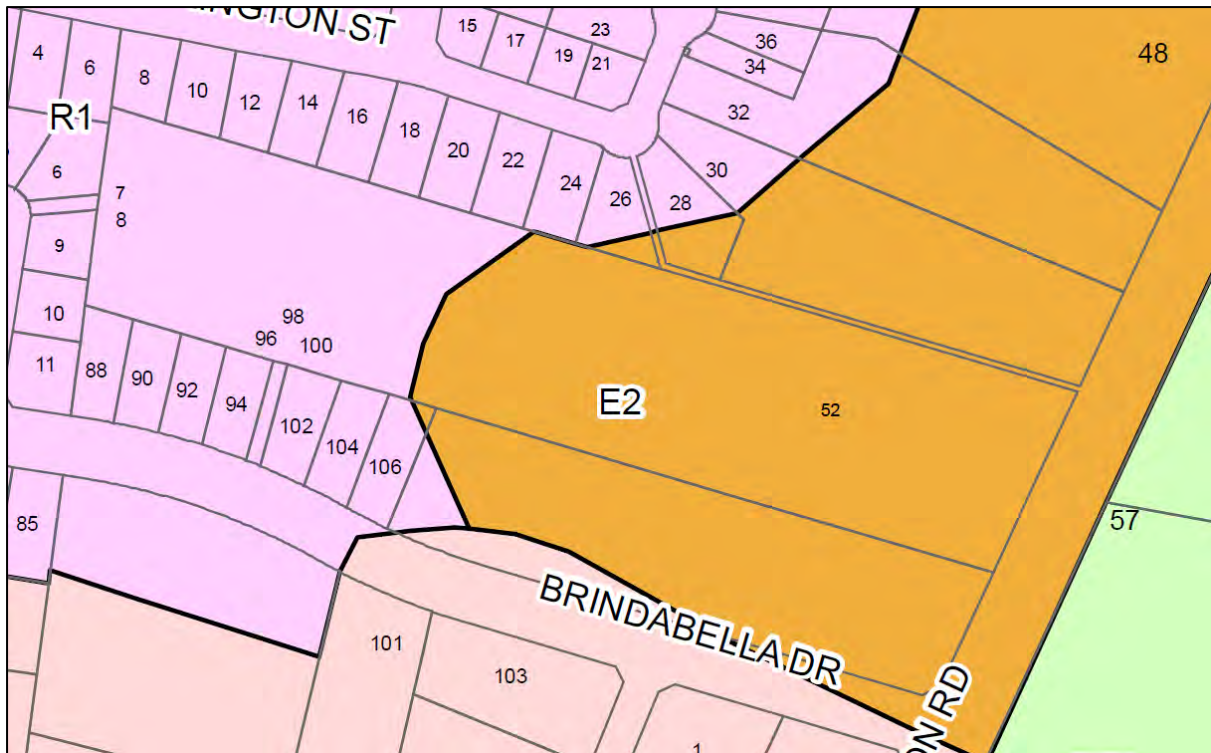


Figure 4: Existing land zoning (Source: WWCC)

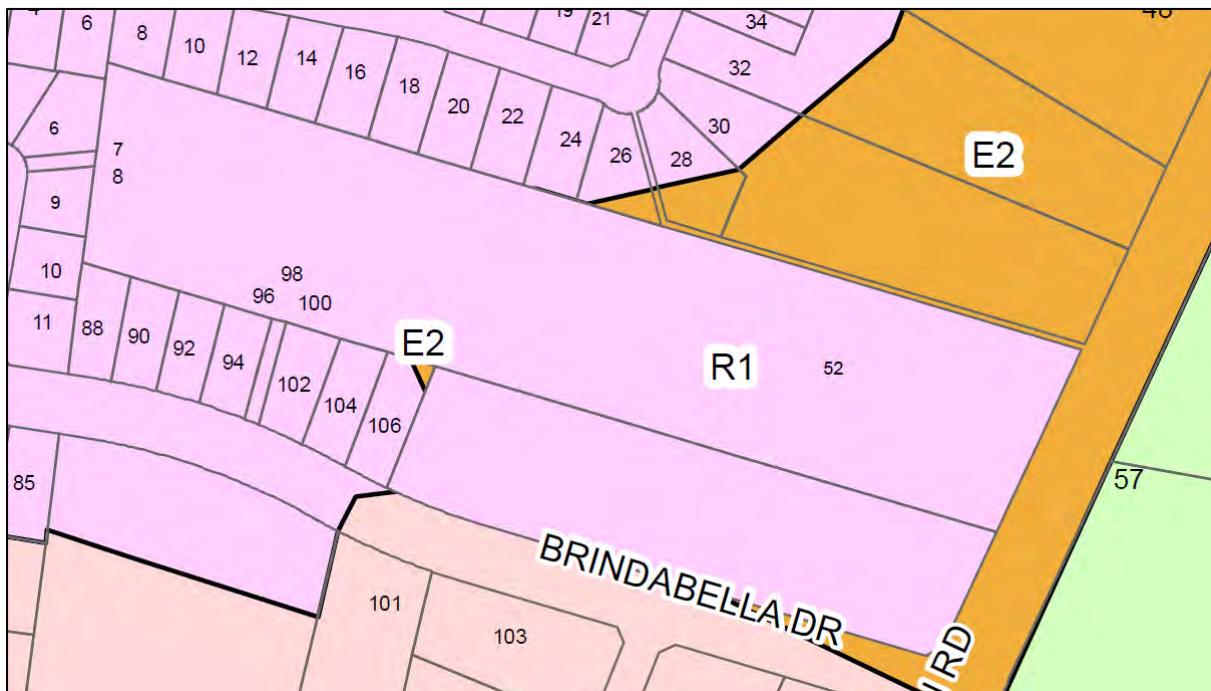


Figure 5: Proposed land zoning (Source: WWCC)



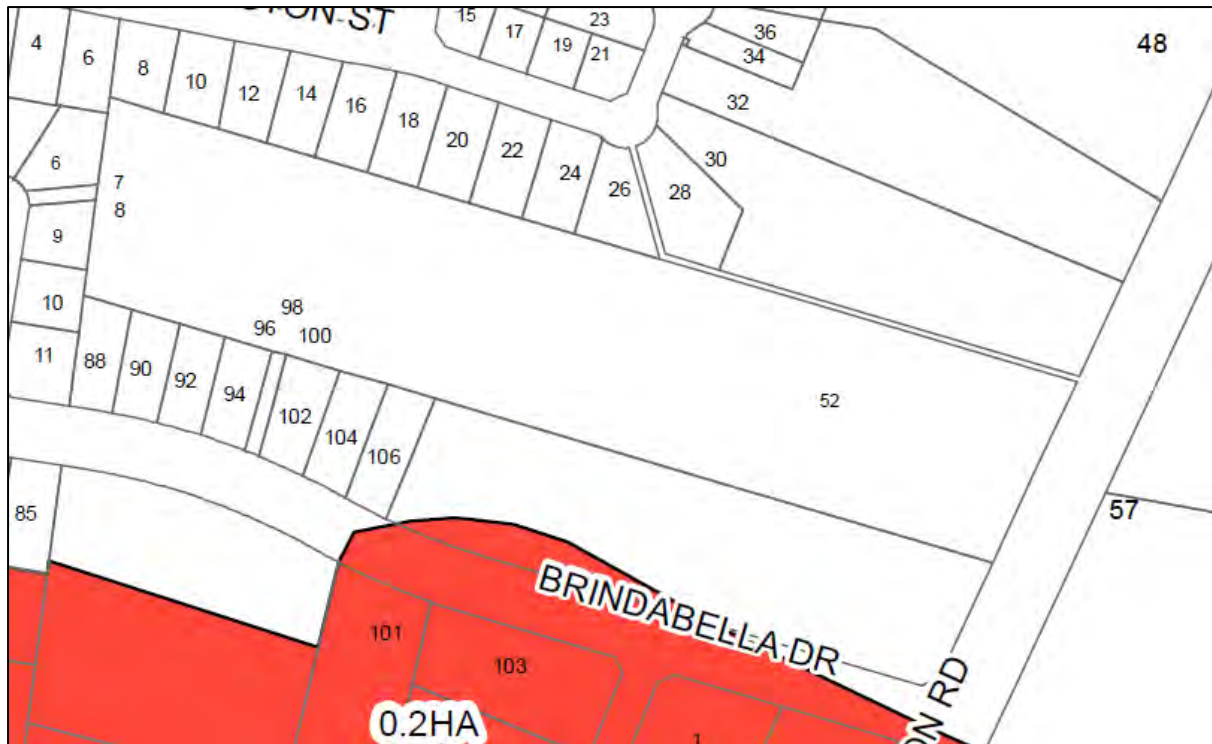


Figure 6: Existing minimum lot size map extract (Source: WWCC)

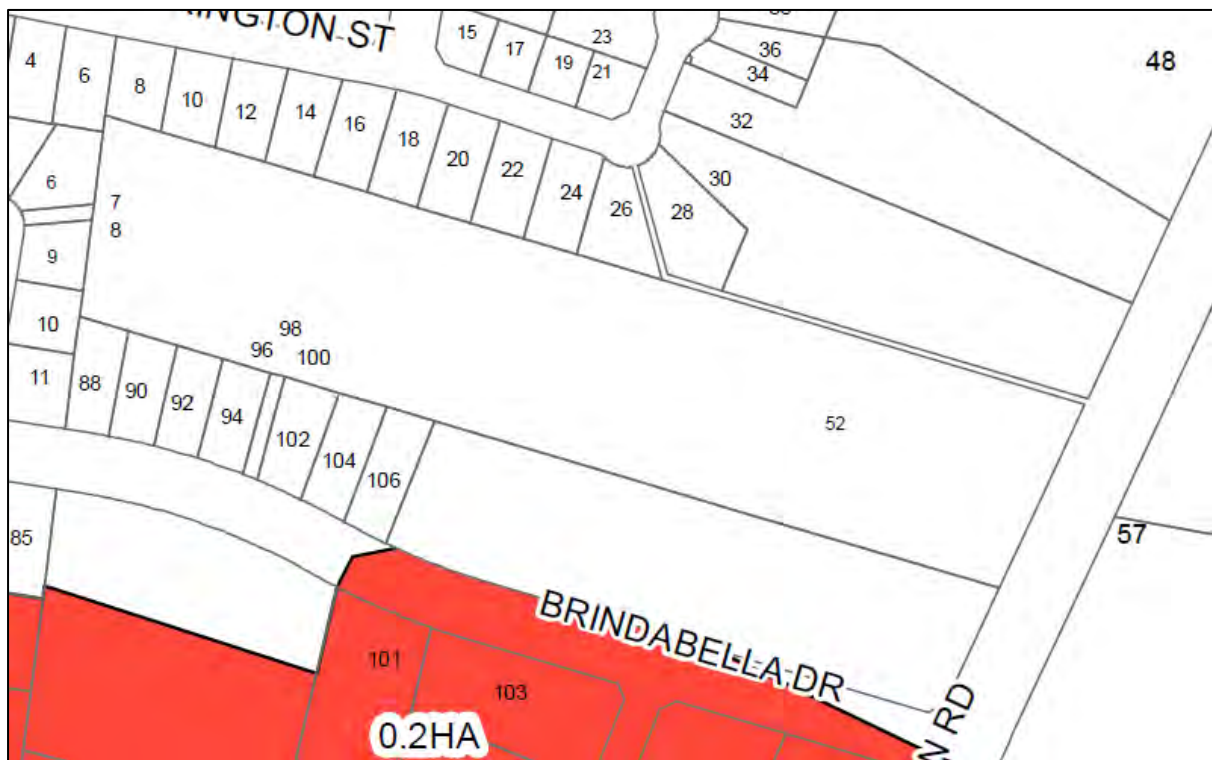


Figure 7: Proposed minimum lot size amendment (Source: WWCC)

## 3 PART 3 JUSTIFICATION

### 3.1 SECTION A NEED FOR THE PLANNING PROPOSAL

#### 3.1.1 *Is the planning proposal a result of any strategic study or report?*

Yes, the Planning Proposal is put forward in response to a report commissioned by the proponent that investigated the status of previously identified environmental hazards.

The subject land was originally considered in the preparation of the Tatton neighbourhood plan however, ultimately, Council resolved to exclude the land due to concerns regarding historic overland flooding issues. Additionally, there was a view by Council that the land was impacted by shallow groundwater and therefore susceptible to salinity.

Overland flow flooding concerns upon the subject land had been previously identified in the '*Urban Capability Study: Red Hill Road/Plumpton Road Wagga Wagga*' (Soil Conservation NSW, 1980). As stated in the document, it was intended as a guide for decision makers regarding the development potential in terms of physical limitations of the land. The document acknowledged that more specific engineering and design investigations may be required to more accurately define constraints. The study assessed the eastern portion of the subject land to have 'severe physical limitations' as it fell within the Stringybark Creek floodplain.

Potential salinity and groundwater concerns were identified as part of the '*Wagga Wagga Natural Resource Management Plan*' (Wagga Wagga City Council, 1998). It is believed the Plan remained in draft form and was never formally adopted, although some of the outcomes of the Plan were translated into Council's subsequent planning instruments and documents.

It is understood that the subject land was mapped as a potential salinity risk due to the path of Stringybark Creek through the land. The lower footslopes of Willans Hill were regarded as having a shallow groundwater presence and to therefore be also at risk of salinisation.

Since the study was completed in 1980, there has been significant alterations to the creek carriageway through the Springvale, Tatton and Lake Albert areas as urban development occurred. In the vicinity of the subject land, the creek was diverted through the Wagga Wagga Country Club golf course which is located on the eastern side of Plumpton Road.

A detailed submission was made to the exhibition of the draft Wagga Wagga Local Environmental Plan 2008 seeking Council consideration to rezone the land to R1 General Residential. The proposal was not supported given Council required further information to evaluate the flooding and groundwater concerns.

As advised previously, a precursory report to this Planning Proposal was prepared by NGH Environmental to investigate the status of the previously identified environmental concerns and determine whether these concerns were still present and persisting.

The investigation area specified by Council for the Risk Analysis Assessment was the full extent of the E2 Environmental Conservation-zoned area adjacent to Plumpton Road, between Brindabella Drive and Stirling Boulevard, as indicated in Figure 2 earlier in this report.

In further consideration of the overland flooding concerns, WMA Water was engaged by the proponents to undertake a flood impact assessment for the subject land. Best practice assessment of flood behaviour

requires an understanding of the full range of flood behaviour and consequences through a fit-for-purpose flood study<sup>2</sup>.

The modelling confirmed that the subject land (Scenario A site referred to in the WMA Water report) is impacted by the design flood (the 1% AEP event), though generally categorised as a low hazard flood storage area and flood fringe. A minor flow path is located on the very eastern edge of the subject land but does not constitute the main floodway.

The flood impact of development on the subject land was modelled using a preliminary development concept. The maximum off-site impact is 0.3 metres within the retention basin at 108 Brindabella Drive and 0.05 metres on the western side of the basin. Accordingly, the off-site flood level impact is viewed as relatively minor. Further consideration of the development concept would occur at development application stage and could include design measures to lessen the flood impact if desired.

Geotechnical investigations and a review of groundwater monitoring records were undertaken to consider the potential salinity risk present. According to Council's 'Urban Salinity Technical Report 2015-16' (USTR 15/16), urban salinity concerns are considered to be present where piezometer readings reveal *both* high EC concentrations (greater than 5 deciSiemens per metre) and high SWLs (less than 5 metres below ground level)<sup>3</sup>. These piezometers are referred to as 'critical piezometers' in Council's urban salinity literature.

The piezometer closest to the subject land is Piezometer No. 51, which is located within the Plumpton Road corridor, opposite 48 Plumpton Road. The readings indicate a general decline in SWLs (standing water levels) since the establishment of the piezometer, remaining fairly steady around 9 metres below ground level for the last 10 years. The average SWL since establishment is 8.12 metres below ground level; the median is 8.33 metres. The recorded electrical conductivity (EC) has ranged from 2.14 deciSiemens per metre (dS/m) in March 2011 to 6.10 in October 2007. Since establishment the average EC level is 4.76 dS/m; the median is 4.75. The recorded average and median SWLs and EC levels for Piezometer No. 51 do not exceed the identified thresholds in the USTR 15/16 and can be considered to indicate that urban salinity is not a notable concern for this area.

NGH also carried out testing to determine the EC<sub>1:5</sub> and pH<sub>1:5</sub> levels present in the soil on the subject land and surrounding properties along Plumpton Road. The electrical conductivity is influenced by the concentration and composition of dissolved salts. Salts increase the ability of a solution to conduct an electrical current, so a high EC value indicates a high salinity level. The target levels for productive soil are below 0.15 dS/m (equivalent to 150 microSiemens/cm) for EC<sub>1:5</sub><sup>4</sup>.

The soil sampling results did not indicate the presence of a salinity issue. The EC levels are very low, which would indicate that capillary action has not occurred, with no evidence of concentrated dissolved salts in the soil substrate. The pH levels are within a normal range for the type of soils encountered.

In a meeting held with Council officers in March 2018 and subsequent discussions, it was agreed that there appears to be no evidence of an environmental constraint that warrants the retention of the E2 Environmental Conservation zone upon the subject land. It was agreed that NGH would proceed with the preparation of a Planning Proposal to consider an alternative zoning for the subject land.

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<sup>2</sup> Smith, G. and McLuckie, D., 2015, 'Delineating hazardous flood conditions to people and property', Floodplain Management Australia National Conference 2015.

<sup>3</sup> City of Wagga Wagga, 2016, 'Urban Salinity Technical Report 2015-16', p.20.

<sup>4</sup> Department of Primary Industries, n.d., 'Salinity', <https://www.dpi.nsw.gov.au/agriculture/soils/salinity>.

### **3.1.2 Is the planning proposal the best means of achieving the objectives or intended outcomes, or is there a better way?**

Yes, the Planning Proposal is the best means of achieving the objectives.

The R5 zone was considered in the development of the Planning Proposal. However, the characteristics and location of the subject land indicate its potential would best be achieved with the R1 General Residential zone. The land is in an area that is adequately supported by social infrastructure such as a doctor's clinic, childcare centres and schools and physical infrastructure can be cost-effectively extended to the site. The land is located close to a major thoroughfare (Plumpton Road) and shared pathways as well as regional and local-scale open space areas. These factors indicate that the land would be suited to development of a similar scale as the surrounding neighbourhood.

The land is situated on the northern side of Brindabella Drive, amongst residential land zoned R1 General Residential. Land on the southern side of Brindabella Drive incorporates the very southern fringe of Tatton and transitions to Springvale, a rural residential area. It is considered more appropriate that the R1 General Residential zone would be applied to land north of Brindabella Drive.

The application of a minimum lot size was considered in the development of the Planning Proposal. Given it is intended that the land would be rezoned to R1 General Residential, it is proposed that a minimum lot size would not be applied to the land. Throughout the Wagga Wagga LGA, there is no prescribed minimum lot size under the LEP. This is instead managed under the provisions of the Wagga Wagga Development Control Plan, to provide greater flexibility where suitable. It is considered that there are no factors in this instance that would deem it necessary to apply a minimum lot size. Further, should the rezoning proceed, the land presents an opportunity to increase the variety of housing types available in the neighbourhood, which may not be realised if a minimum lot size was to be applied.

## **3.2 SECTION B RELATIONSHIP TO STRATEGIC PLANNING FRAMEWORK**

### **3.2.1 Is the planning proposal consistent with the objectives and actions of the applicable regional, sub-regional, or district plan or strategy (including any exhibited draft plans or strategies)?**

The Riverina Murray Regional Plan 2036 is applicable to the subject land. The following Directions from the Plan are relevant to the Planning Proposal:

Table 3-1 Considerations under the Riverina Murray Regional Plan 2036

<b>Objectives and actions</b>	<b>Comment</b>
<b>Direction 15 Protect and manage the region's many environmental assets</b>	Consistent. The Natural Resources Sensitivity Biodiversity LEP map does not indicate the presence of biodiversity sensitivities within the proposed area for rezoning. There are also no aquatic habitats within the proposed area for rezoning.

<b><i>Direction 16 Increase resilience to natural hazards and climate change</i></b>	Consistent. The subject land is located away from areas of known high biodiversity value, high bushfire hazard, contaminated land and designated waterways. There is a minor overland flooding risk present, however this is compatible with the type of development proposal according to the site-specific study conducted by WMA Water.
<b><i>Direction 22 Promote the growth of regional cities and local centres</i></b>	Consistent. The Riverina Murray Regional Plan 2036 reveals a need for Wagga Wagga (together with Albury and Griffith as the other major centres in the region) to shoulder a significant portion of the anticipated population growth and housing provision over the next 20 years. The proposed rezoning represents the optimal use of serviceable urban land and will contribute to meeting the projected demand for housing.
<b><i>Direction 25 Build housing capacity to meet demand</i></b>	Consistent. The proposed rezoning would facilitate infill residential development on land that has cost-effective access to public utilities. It would have the benefit of increasing the variety of housing types available as a range of lot sizes have been proposed as part of preliminary investigations.
<b><i>Direction 26 Provide greater housing choice</i></b>	Consistent. The R1 General Residential zone in the WWLEP 2010 provides for a range of permissible housing types. As indicated above, it is expected that the rezoning would facilitate a greater variety of lot sizes and housing types in the neighbourhood.
<b><i>Direction 28 Deliver healthy built environments and improved urban design</i></b>	Consistent. The proposed rezoning would facilitate infill residential development that is compatible with the local built form.

The Riverina Murray Regional Plan 2036 does not include Sustainability Criteria, as referenced in the Department's 'A Guide to Preparing Planning Proposals'. As such, the Assessment Criteria are instead referenced to establish the merit of the Planning Proposal. The merit of the Planning Proposal is site-specific and has been established by further detailed investigation of previously identified environmental hazards.

As detailed in Section 3.1.1 of this report, overland flow flooding was identified as a concern in a Soil Conservation of NSW study undertaken in 1980, whilst salinity/groundwater concerns were identified in a Wagga Wagga City Council draft natural resources management plan prepared in 1998.

Further detailed investigation has been undertaken to confirm the status of these potential constraints. There is no evidence of environmental constraints that would warrant the retention of the E2 Environmental Conservation zone upon the subject land.

Further, the subject land is similar to other properties along Plumpton Road, between the intersections with Brindabella Drive and with Springvale Drive. With the implementation of the Wagga Wagga Local Environmental Plan 2010, the minimum lot size for these properties was reduced to facilitate infill residential development. The identified properties are also impacted by overland flow flooding to a magnitude that is similar to that of the subject land.

The potential future development would be infill residential development on land that has cost-effective access to public utilities. The potential development of the land for residential purposes would have only a minor incremental demand on public infrastructure and services and would be levied with capital contributions that go towards this.

It is viewed that development of this nature on the subject land would be compatible with the pattern of surrounding development.

### **3.2.2 Is the planning proposal consistent with a council's local strategy or other local strategic plan?**

The Wagga Wagga Spatial Plan 2043 is applicable to the subject land. The following Objectives from the Spatial Plan are relevant to the Planning Proposal:

Table 3-2 Considerations under the Wagga Wagga Spatial Plan 2043

<b>Objectives</b>	<b>Comment</b>
<b><i>Protect the biodiversity of Wagga Wagga Local Government Area</i></b>	Consistent. Although the land is currently zoned E2 Environmental Conservation, Council's mapping, site inspections and the Preliminary Risk Analysis report indicate that the land has low biodiversity value. The development of the land for residential purposes would not have an adverse impact on biodiversity values present in the locality. The land is located in the Bio-certification Area.
<b><i>Manage impacts of natural systems and hazards, particularly salinity, flooding and bushfires</i></b>	Consistent. The Preliminary Risk Analysis report indicates that the land is not at risk of salinisation and that the overland flow flooding is of a low hazard that would be compatible with residential development.
<b><i>Accommodating population growth through adequate supplies of well planned residential land, providing a variety of housing options to achieve housing choice and affordability.</i></b>	Consistent. The land is within an established residential area and the R1 General Residential zone can facilitate a wide range of housing options to provide choice and affordability.  Relevant to this Planning Proposal, there are several actions identified in the Spatial Plan that would contribute to the achievement of this objective: <ul style="list-style-type: none"> <li>• Identify sites suitable for redevelopment and investigate the potential to concentrate development to infill sites to accommodate future growth,</li> <li>• Identify areas within Wagga Wagga central that cater for 'empty nesters' and community demand,</li> </ul>
<b><i>Facilitate the provision of physical infrastructure in a coordinated and cost-effective manner</i></b>	Consistent. The land is within an established urban area and has cost-effective access to public infrastructure.
<b><i>Facilitate improved efficiency of urban infrastructure such as water supply, wastewater management, stormwater management, electricity and telecommunications</i></b>	Consistent. The land is within an urban area and therefore can be efficiently serviced. Servicing of the land would not place an undue burden on the community.



***Accommodate the increasing demand for smaller homes***

Consistent. The R1 General Residential zone in the WWLEP 2010 provides for a range of permissible housing types.

Consideration has also been given to Council's **draft Wagga Wagga Activation Strategy 2040** as exhibition of the document has occurred in September 2017. However, it is intended the Activation Strategy would ultimately replace the Wagga Wagga Spatial Plan 2043.

The draft Activation Strategy identifies an aim to support urban development within the Urban Containment Line only. This will ensure infrastructure is provided in a cost-effective manner, to protect rural land from fragmentation and to protect environmental and resource lands. The subject land is well within the Urban Containment Line as indicated in the figure below.

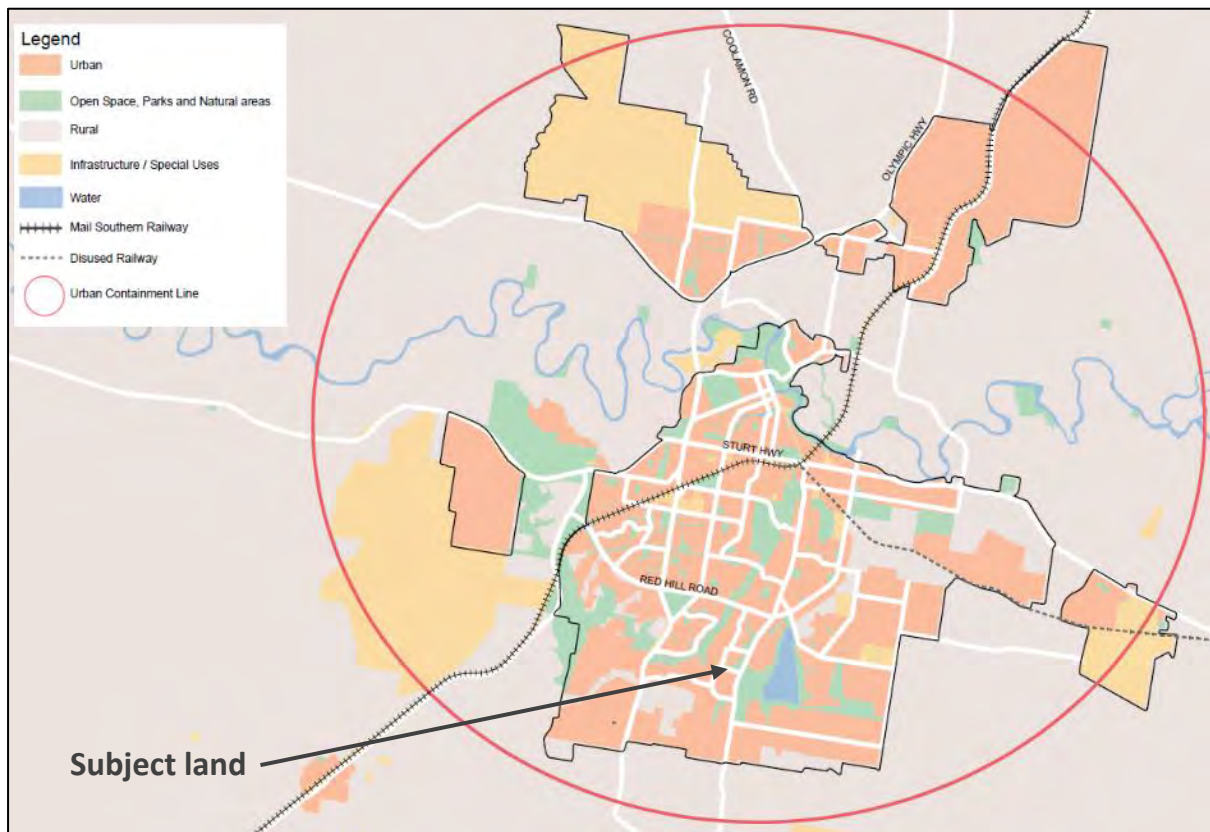


Figure 8: Urban Containment Line map extract from draft Wagga Wagga Activation Strategy 2040 (Source: Wagga Wagga City Council, 2017)

The draft Activation Strategy identifies the subject land as lying within the Lake Albert/Tatton precinct. According to the draft Strategy, it is considered by Council that the precinct is serviced and well-supported by a number of key attributes including high quality private and public recreation areas, schools, community facilities and a neighbourhood shopping centre.

The draft Strategy states that the precinct will benefit from a small amount of additional rural lifestyle lots to preserve the rural lifestyle character, better utilisation of Lake Albert and improving corridors and connectivity. The Planning Proposal is consistent with these aims as the area intended to be rezoned is proposed for larger lifestyle lots to maintain the rural visual character of Plumpton Road. The subject land is well-connected to Lake Albert, providing an area for passive and active recreation for residents.

### 3.2.3 Is the planning proposal consistent with applicable State Environmental Planning Policies?

The following State Environmental Planning Policies are applicable to the Planning Proposal:

Table 3-3 Relevant State Environmental Planning Policies

Relevant SEPPs	Comment
<b>State Environmental Planning Policy No 55—Remediation of Land</b>	<p>The subject land had been used for grazing and cropping prior to the development of the adjoining Tatton neighbourhood. There are no other known potentially contaminating uses that would have occurred on the subject land. Agricultural use is specified in Appendix 2 of Council's Contaminated Land Policy which takes reference from the SEPP 55 Planning Guidelines.</p> <p>Given that the potential for land contamination from the grazing and cropping activities is low, it is considered that the subject land is suited to residential use and the proposed rezoning could be supported in this regard.</p>

### 3.2.4 Is the planning proposal consistent with applicable Ministerial Directions (s. 9.1 directions)?

Yes. The following Ministerial Directions are applicable to the Planning Proposal:

Table 3-4 Consideration of Ministerial Directions

Ministerial Directions	Comment
<b>Direction 2.1 Environment Protection Zones</b>	<p>Consistent. The Planning Proposal is justified by a study prepared in support of the Planning Proposal which gives consideration to the objectives of the direction.</p> <p>The Planning Proposal does not intend the rezoning of land that is environmentally sensitive. The study prepared in support of the Planning Proposal illustrates that the subject land does not host any environmental concerns that warrant the retention of the E2 Environmental Conservation zone.</p>
<b>Direction 3.1 Residential Zones</b>	<p>Consistent. The Planning Proposal includes a change to R1 General Residential which provides for a wide range of dwelling types and densities and would broaden the housing choice available to the community.</p> <p>The subject land is located within the established residential neighbourhood of Tatton and its rezoning would avoid land consumption on the urban fringe. The land has cost-effective access to public utilities. Its rezoning to R1 would facilitate a more efficient use of infrastructure.</p>
<b>Direction 3.4 Integrating Land Use and Transport</b>	<p>Consistent. As indicated above, the subject land is within an established residential neighbourhood and is viewed as being an accessible location.</p> <p>The land is within an area served by public transport, and shared pathways for pedestrians and cyclists are located adjacent to the land on Plumpton Road. The rezoning would be compatible with the aims of 'Improving Transport Choice – Guidelines for planning and development' and 'The Right Place for Business and Services'.</p>



<p><b>Direction 4.3 Flood Prone Land</b></p>	<p>Justifiably inconsistent. The Planning Proposal does intend to rezone land to R1 General Residential that is affected by overland flow flooding (stormwater) in the design event.</p> <p>The provisions of the Planning Proposal that are inconsistent are minor, as the original reasons for the application of the E2 zone are now obsolete (there is no salinity risk considered to be present and the previous flooding pattern has been significantly alleviated by the re-routing of Stringybark Creek to the other side of Plumpton Road). The land would have otherwise been originally zoned R1 General Residential consistent with the surrounding neighbourhood.</p> <p>Further, the flood impact assessment report prepared by WMA Water indicates that the magnitude of the flood hazard currently present is low and compatible with the type of residential development intended (larger lifestyle lots).</p>
<p><b>Direction 5.10 Implementation of Regional Plans</b></p>	<p>Consistent; refer to Section 3.2.1 of this Planning Proposal.</p>

### 3.3 SECTION C ENVIRONMENTAL, SOCIAL AND ECONOMIC IMPACT

#### 3.3.1 *Is there any likelihood that critical habitat or threatened species, populations or ecological communities, or their habitats, will be adversely affected as a result of the proposal?*

The land subject to the proposed rezoning is not identified as sensitive land on the Terrestrial Biodiversity Map of the WWLEP. The land is considered unlikely to contain critical habitat, threatened species, populations or ecological communities or their habitats.



Figure 9: Terrestrial Biodiversity LEP map (Source: WWCC online mapping, 2018)

The existing residential-zoned parts of the subject land are subject to the Wagga Wagga Biodiversity Certification Order (2010). The E2-zoned parts of the subject land were also subject to the Biodiversity Certification Order until 24 November 2017 when the State Government issued the Biodiversity Certification of Environmental Planning Instruments Order 2017. The 2017 Order had the effect of limiting the Wagga Wagga Biodiversity Certification Order 2010 to apply only to business, industrial, residential and special infrastructure zones – meaning that all other land that falls within the Order Area now constitutes “excluded land”.

Although partially zoned E2 Environmental Conservation, the land did not form part of an identified offset area in the Wagga Wagga Biodiversity Certification Strategy prepared by EcoLogical Australia. The potential impact of development of the subject land has already been accounted for in the offset measures detailed in Wagga Wagga Biodiversity Certification Strategy.

### ***3.3.2 Are there any other likely environmental effects as a result of the planning proposal and how are they proposed to be managed?***

The subject land is not mapped as bushfire prone land or vulnerable land, according to Council records. The land is not identified as being prone to landslip.

Part of the subject land is mapped as subject to overland flow flooding. A detailed flood impact assessment report prepared by WMA Water is included with the attached Risk Analysis Report.

The modelling undertaken by WMA Water confirmed that the subject land (referred to as the Scenario A site in the WMA report) is impacted by the design flood (the 1% AEP event), generally falling within a low hazard flood storage area and the flood fringe. A minor flow path is located on the very eastern edge of the subject land but does not constitute the main floodway.

The flood impact of development on the subject land was modelled using a preliminary development concept. The maximum on-site impact is 0.3 metres within the retention basin at 108 Brindabella Drive and 0.05 metres on the western side of the basin. Accordingly, the off-site flood level impact is viewed as relatively minor.

Should the rezoning proceed, further consideration of the development concept would occur at development application stage and could include design measures to lessen the flood impact if desired.

### ***3.3.3 Has the planning proposal adequately addressed any social and economic effects?***

A search of the AHIMS register was conducted. No Aboriginal sites have been recorded and no Aboriginal places declared within 1km of the subject land. Further, the land is located within an established urban area and has been previously used for agricultural activities. In consideration of these factors, it is believed the potential to impact Aboriginal sites is low.

The rezoning of the land would facilitate additional housing opportunities in an established residential area. All public utilities can be cost-effectively extended to the site, as outlined in the following section. The land is located adjacent to public transport routes and shared pathways for cycling and walking. The neighbourhood is already supported by social infrastructure such as a doctor’s clinic, childcare centres and schools. Regional and local-scale open space areas are within close proximity to the land.

## 3.4 STATE AND COMMONWEALTH INTERESTS

### *3.4.1 Is there adequate public infrastructure for the planning proposal?*

Should the rezoning proceed, the land would be developed as infill residential development as cost-effective access to public utilities is available. Refer to Attachment 2 indicating the location of public utilities adjacent to the subject land.

In terms of access to road infrastructure, an assessment of the traffic impact of the potential development on surrounding roads found that the surrounding roads can comfortably cater for the anticipated loads. An upgrade of the Brindabella Drive and Plumpton Road intersection is not required.

The potential development of the land for residential purposes would have only a minor incremental demand on other public essential services such as health, education and emergency services.

### *3.4.2 What are the views of state and Commonwealth public authorities consulted in accordance with the Gateway determination?*

Consultation with any relevant State and Commonwealth public authorities would be conducted post-gateway determination as necessary.

It is anticipated that it would be necessary to consult with the Office of Environment & Heritage and the Department of Primary Industries (Water).

## 4 MAPPING

Refer to mapping included within this Planning Proposal.

## 5 COMMUNITY CONSULTATION

Community consultation would be undertaken in accordance with the relevant provisions of the Act and with the Gateway Determination conditions.

## 6 PROJECT TIMELINE

A project timeline will be able to be developed post-Gateway Determination.

## **ATTACHMENT 1**

## **RISK ANALYSIS ASSESSMENT**

# RISK ANALYSIS REPORT

PRECURSORY REPORT TO REZONING APPLICATION

52 PLUMPTON ROAD AND 108 BRINDABELLA DRIVE, TATTON

MAY 2018



## Document Verification



**Project Title**

Risk Analysis Report  
52 Plumpton Road and 108 Brindabella Drive, Tatton

Project Number:	17-256			
Project File Name:	\\WAGGA\Active\Projects\2017\2017 - TOWN PLANNING PROJECTS\17-256 Rezoning of Land E2 to R1 (Jenkins)\Reports			
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Draft 1.0	08/03/2018	Stephanie Anderson	Lizzie Olesen-Jensen	Lizzie Olesen-Jensen
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# 1 INTRODUCTION

## 1.1 BACKGROUND

NGH Environmental was commissioned by Matt Jenkins Builder Pty Ltd and Vanessa and Slade Stanley, being the landowners of the subject land, to prepare a Risk Analysis Report for land located at Tatton. The site comprises:

- Lot 2 DP243027, 52 Plumpton Road (Jenkins), and
- Lot 327 DP 1178026, 108 Brindabella Drive (Stanley).

The land is indicated in Figure 1-1 below.



Figure 1-1 Subject land (Source: Base Map - WWCC online mapping)

The land is zoned R1 General Residential, E2 Environmental Conservation and R5 Large Lot Residential, as shown in the figure below.



Figure 1-2 Current land zoning (Source: Base Map - WWCC online mapping)

It is intended that the site will become the subject of a future Planning Proposal that seeks approval to amend the environmental zone enabling residential development to occur. Rezoning the land for residential purposes would facilitate infill development on land that has access to full urban services and for which considerable infrastructure construction has occurred, including improvement to public services along Plumpton Road.

Land comprising Lot 2, DP243027, 52 Plumpton Road, Tatton was originally considered as part of the Tatton residential neighbourhood however due to historic overland flooding, both the 1 in 10 and the 1 in 100-year events, the land retained its environmental protection zone in the making of the LEP 2010. Additionally, there were concerns for the potential of creating a saline environment that arose from the notion that the land was impacted by shallow groundwater.

However, ongoing subdivision and continuing development works within the Tatton neighbourhood has resulted in an altered topography alleviating drainage affectations in the re-routing of overland drainage patterns.

A detailed submission was made to the exhibition of the draft Local Environmental Plan (LEP) 2008, now LEP 2010 seeking approval to rezone the land to R1 General Residential. The proposal was not supported given Council required further information to address the overland flow flooding prior to consideration.

## **1.2 PURPOSE OF THIS REPORT**

This report has been prepared as a precursory report to the intended rezoning application for land in the ownership of Jenkins and Stanley. The purpose of this report is to investigate the status of the previously identified environmental concerns and determine whether these concerns are still present and persisting.

The necessity of this report was established in consultation with Council's Strategic Planning Officers and Development and Subdivisions Engineer Coordinator.

The following scope for this report was provided in Council correspondence (Email) dated 1 November 2017. The correspondence advised:

***I can confirm that the flood study to support the re-zoning application will need to address the following issues:***

- ***Analysis of the current overland flow through the E2 zone including your site. Justification will need to be provided for allowing a re-zoning taking into consideration the overland flow and its compatibility with residential development.***
- ***The flood study will need to model both development of your site as well as the rest of the E2 zone. This will allow an overall assessment to be carried out to determine the cumulative impacts of all sites within the E2 zone. This will also allow the impact of any future development in the E2 zone on your site to be assessed.***

The outcomes of this investigation will inform the scope of the rezoning application for land in the ownership of Jenkins and Stanley.

In accordance with point number two of Council's correspondence the investigation area, for the purpose of this Risk Analysis Report, has been expanded to include the subject land as well as land comprising the rest of the E2 zone. In addition to the above points, site examination has been broadened to include groundwater investigations.

A map indicating the land comprising the risk analysis precinct in context to the land subject to a future rezoning application is shown in Figure 1-3 over page.



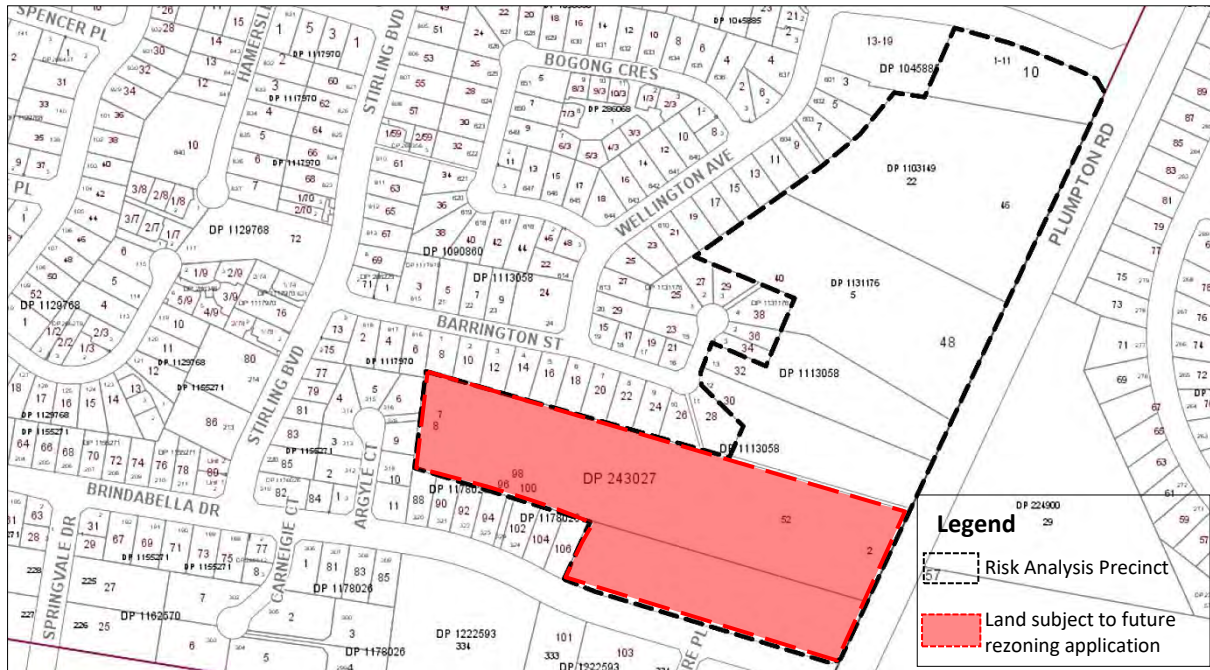


Figure 1-3 Risk analysis precinct indicating land subject to future rezoning (Source: Base Map - WWCC online mapping)

## 2 RISK ANALYSIS

Under the Wagga Wagga Local Environmental Plan 1985, the western portion of the subject land was zoned 2 Residential, whilst the eastern portion was zoned 7 Environmental Protection. This was in response to environmental concerns of overland flow flooding and salinity/shallow groundwater that were identified in the 1980s. Since this time, the area has undergone significant changes with the development that has occurred in the Tatton and Springvale suburbs.

This report considers the results of more detailed investigations of the environmental concerns and the changes in environment that have occurred since the original environmental zone was applied. A flood impact assessment (included as Attachment A) and a salinity/groundwater assessment have been conducted.

### 2.1 OVERLAND FLOW FLOODING

#### 2.1.1 Background

Overland flow concerns upon the subject land were identified as part of a study prepared by Soil Conservation Service NSW entitled '*Urban Capability Study: Red Hill Road/Plumpton Road Wagga Wagga*' (1980). The study comprised 230 hectares of land south of Red Hill Road and west of Plumpton Road; the area is now known as the neighbourhood of Tatton.

The purpose of the study was to map land slopes, terrain and drainage patterns and to assess the potential of the land for urban development and give strategic planning guidance to Council. At that time, capability studies were prepared for all potential urban development areas such as the northern suburbs of Estella, Boorooma and Cartwrights Hill and southern suburbs of Glenfield, Lloyd and Bourkelands.

The study assessed the western portion of the subject land to have only 'minor to moderate physical limitations', Class B within the Urban Capability classification framework, similar to other areas of Tatton that have been developed. The eastern portion of the subject land forms part of the lower footslopes of Willians Hill, along the eastern boundary of the Tatton suburb. This area was categorised as 'D-f'. The classification refers to Class 'D – severe physical limitations' and Subclass 'f – flooding'. The flood categorisation related to land mapped within the Stringybark Creek floodplain.

The study theorised that the development of the wider Tatton area would increase runoff to Stringybark Creek, restricting the suitability of the sensitive footslopes area for residential development. The report noted that runoff from the steep sideslopes of Willians Hill produces flooding and waterlogging on the footslopes. The survey identified that the flooding issues were exacerbated by the lack of watercourse definition on the footslopes because of the negligible slope.

The Soil Conservation NSW study acknowledged that it was a guide to development potential in terms of the physical limitations of the land and only provided a basis onto which other considerations may be imposed to inform land use planning. That study acknowledged that more specific engineering and design investigations may be required to more accurately define constraints.

The recommendations of the Soil Conservation Service of NSW study formed part of the background information that translated into the Wagga Wagga Urban Local Environmental Plan 1985.



## 2.1.2 Investigation into overland flow flooding status

Since the Soil Conservation NSW study was completed in 1980, there has been significant alterations to the carriage of Stringybark Creek flows through the Springvale, Tatton and Lake Albert areas. In the vicinity of the subject land, Stringybark Creek was diverted through the Wagga Wagga Country Club golf course which is located further east of the subject land, on the opposite side of Plumpton Road.

The present route of Stringybark Creek can be seen in Figure 2-1 and Figure 2-2 below.

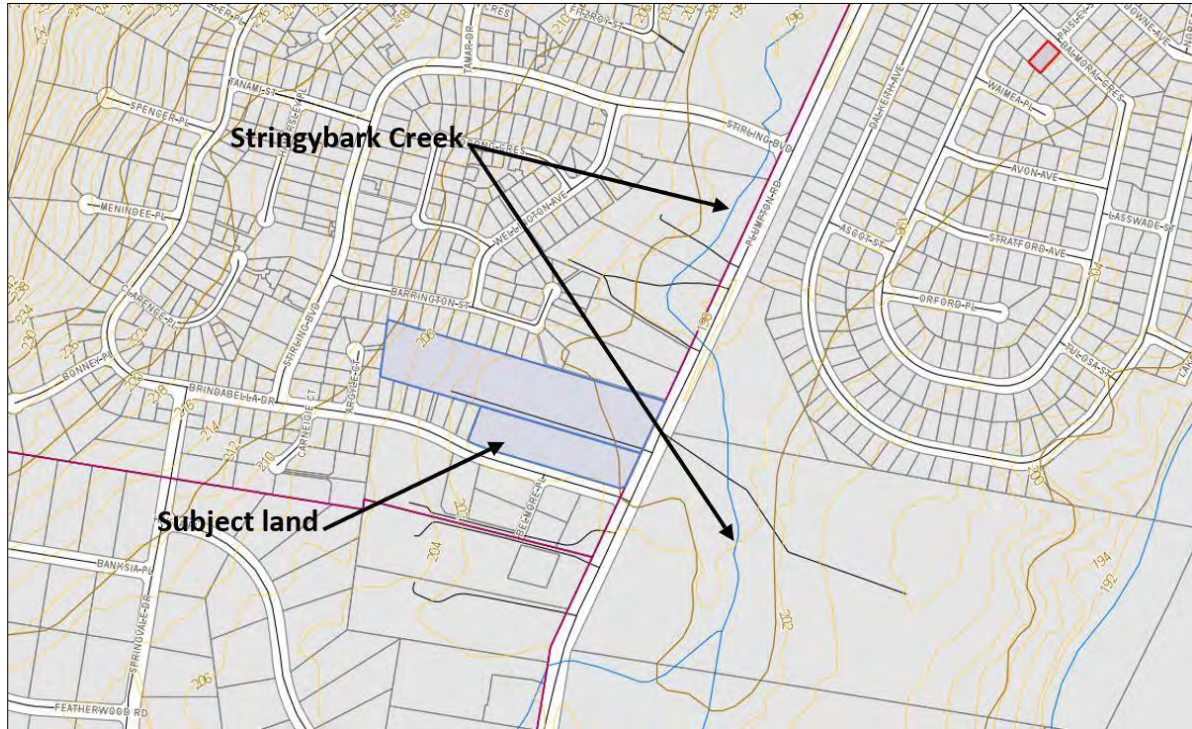


Figure 2-1 Cadastre map of area with topographic feature overlay (Source: WWCC online mapping, 2017)

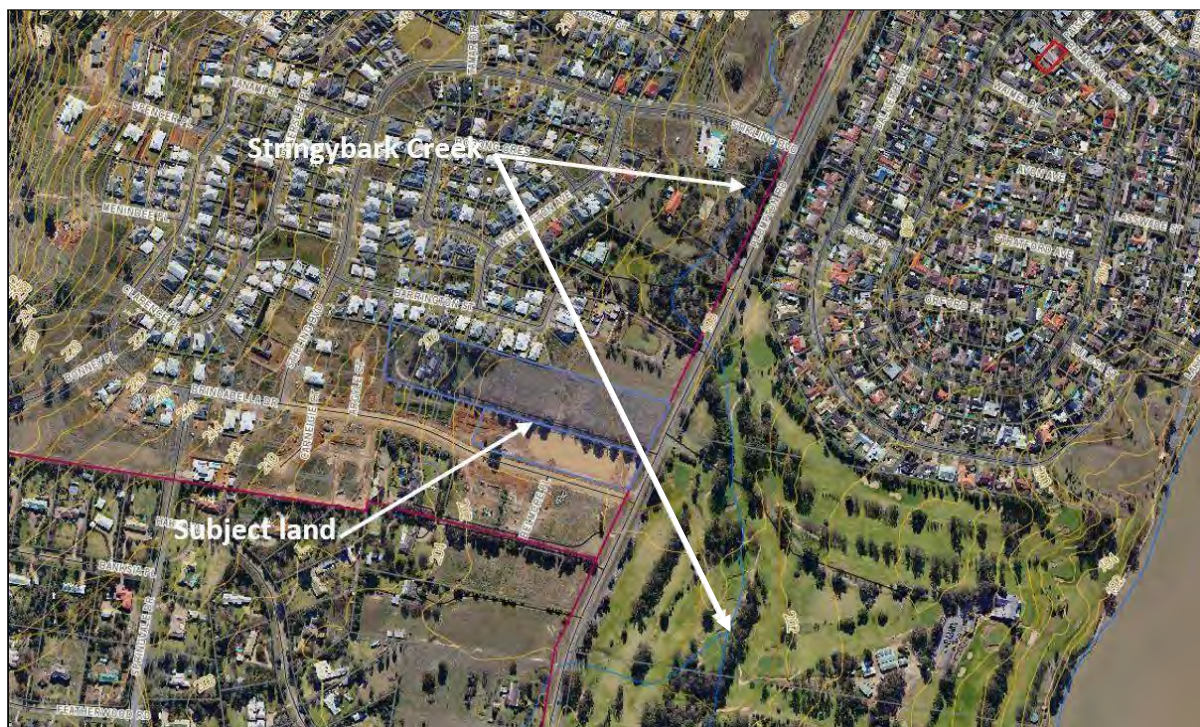


Figure 2-2 Aerial image of area with topographic feature overlay (Source: WWCC online mapping, 2017)



The Soil Conservation NSW study forecast that development of the wider Tatton area would increase runoff to Stringybark Creek, causing flooding and waterlogging on the footslopes. Indeed, development would have reduced opportunities for stormwater infiltration to groundwater and increased runoff to the creek given the increase in impervious area resulting from urban development. This may have had a beneficial impact in reducing groundwater levels in the area, as discussed further in Section 2.2 of this report.

In addition, whilst development would have increased the volume of runoff to the creek, the rate of discharge is now managed to avoid flooding. This has been achieved through Council-imposed requirements for stormwater management measures as part of the development of Tatton neighbourhood, including the construction of an underground stormwater network and detention basins that restrict the rate of stormwater discharge to no greater than pre-development levels.

In further consideration of the overland flooding concerns, WMA Water was engaged by the proponents to undertake a flood impact assessment for the subject land. Best practice assessment of flood behaviour requires an understanding of the full range of flood behaviour and consequences through a fit-for-purpose flood study<sup>1</sup>.

At Council's request, other properties north of the subject land and south of Stirling Boulevard were also included in the flood impact assessment. This was to determine the potential cumulative impacts that could occur with development in the area adjacent to Plumpton Road, should Council consider a wider area for rezoning from E2 Environmental Conservation to R1 General Residential. The wider study area is referred to a 'Scenario B: Ultimate development of entire E2 zone' in the WMA Water report.

The WMA Water flood impact assessment (2018) is included as Attachment A to this report.

The modelling undertaken by WMA confirmed that the subject land (Scenario A site) is impacted by the design flood event (the 1% AEP event), generally falling within a low hazard flood storage area and the flood fringe. A minor flow path is located on the very eastern edge of the subject land (illustrated in red in Figure 2-3 below) but does not constitute the main floodway. The floodway of Stringybark Creek is located further east of the subject land.

The Scenario B site is subject to more significant overland flow flooding in the design event. A major flood runner is evident, flowing from the dam located at 32 Barrington Street north to Stirling Boulevard. Most of the land within the scenario site is categorised as low hazard flood storage also.

Modelling by WMA also quantified and categorised the hydraulic hazard affecting the study area, as illustrated in Figure 2-4 and Figure 2-5. The hydraulic hazard is quantified by considering the depth of floodwaters and the velocity of floodwaters in combination for the design event.

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<sup>1</sup> Smith, G. and McLuckie, D., 2015, 'Delineating hazardous flood conditions to people and property', Floodplain Management Australia National Conference 2015.



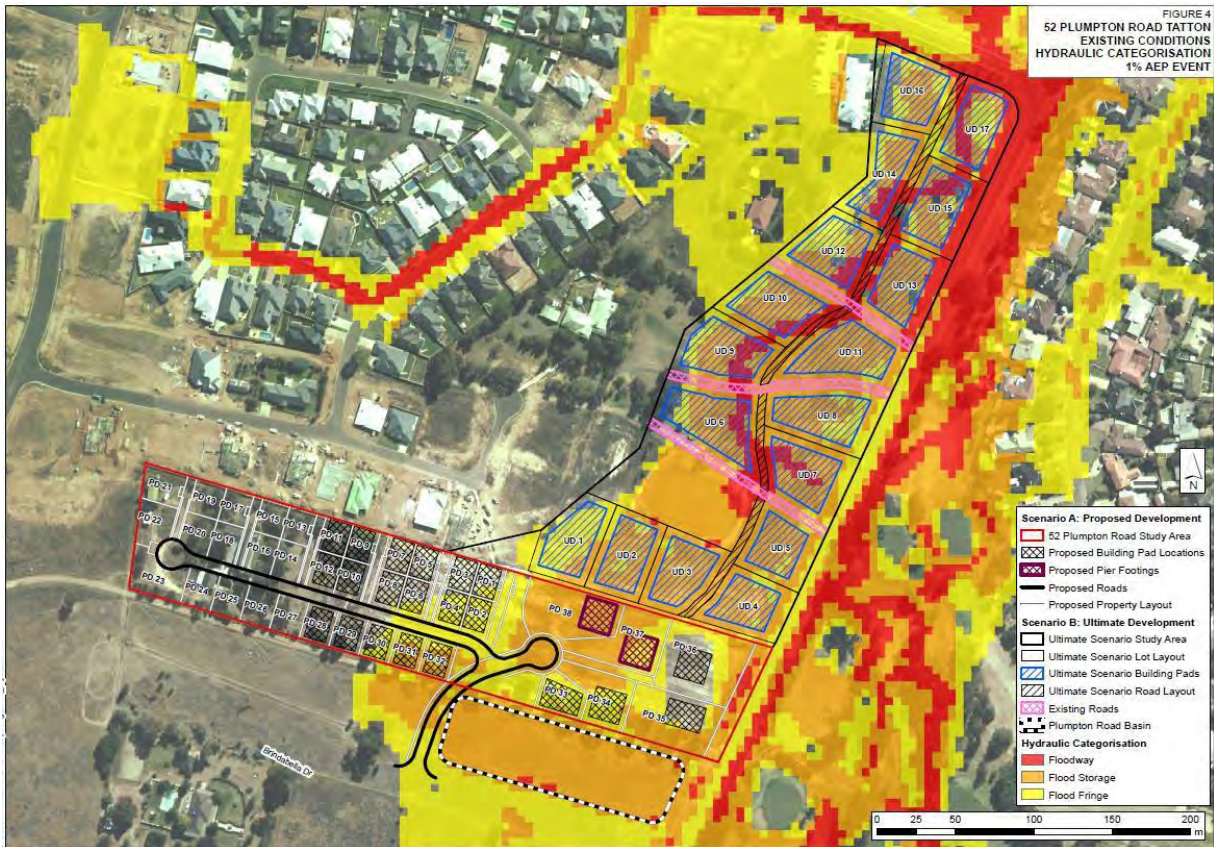


Figure 2-3 Hydraulic Categorisation Map for 1% AEP event (Source: WMA Water, 2018)

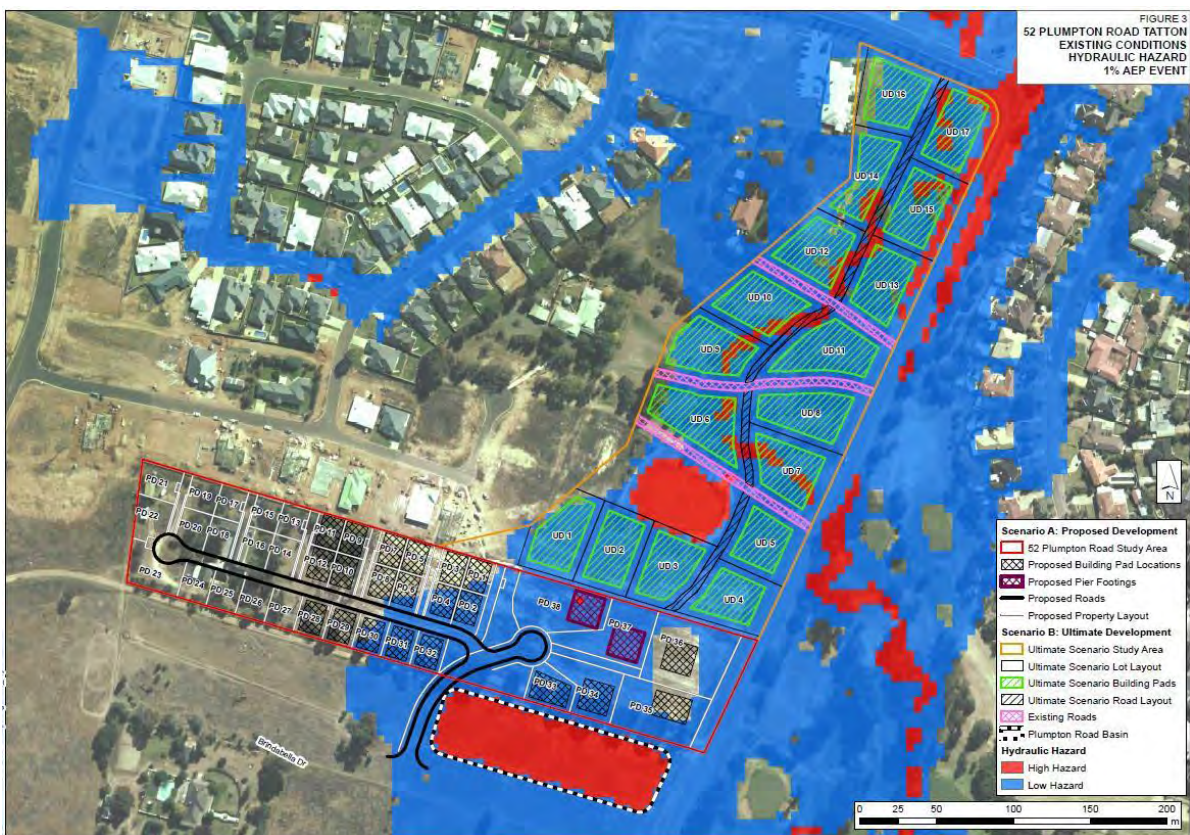


Figure 2-4 Low-High Hazard Categorisation Map for 1% AEP event (Source: WMA Water, 2018)



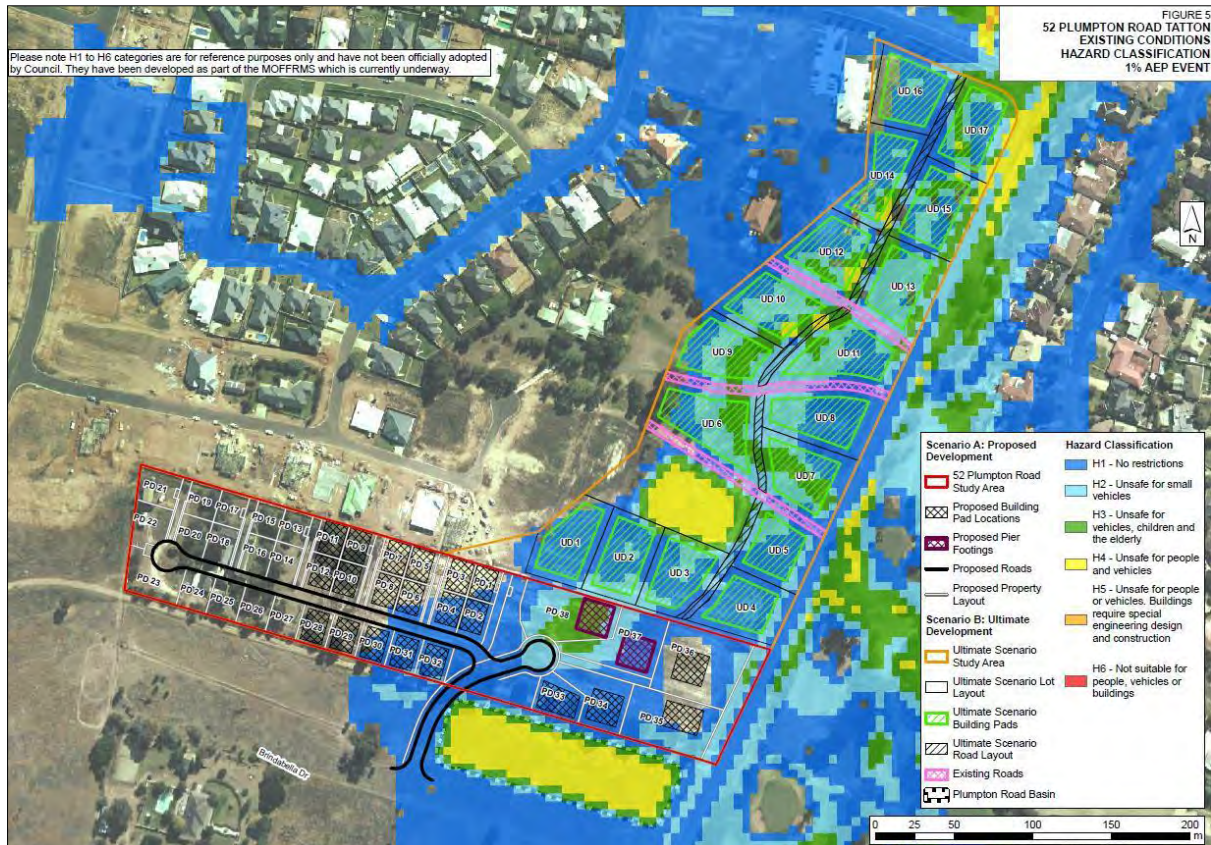


Figure 2-5 H1-6 Hazard Categorisation Map for 100yr ARI event (Source: WMA, 2017)

The modelling results were categorised by WMA according to the hydraulic hazard vulnerability curves provided in the Water Research Laboratory's 'Flood Hazard Water Research Laboratory Technical Report' (2014) and included in Figure 2-6 below. This is the best-practice method for industry and decision makers in categorising hydraulic hazard according to AIDR 'Guideline 7-3 Flood Hazard' (2017).

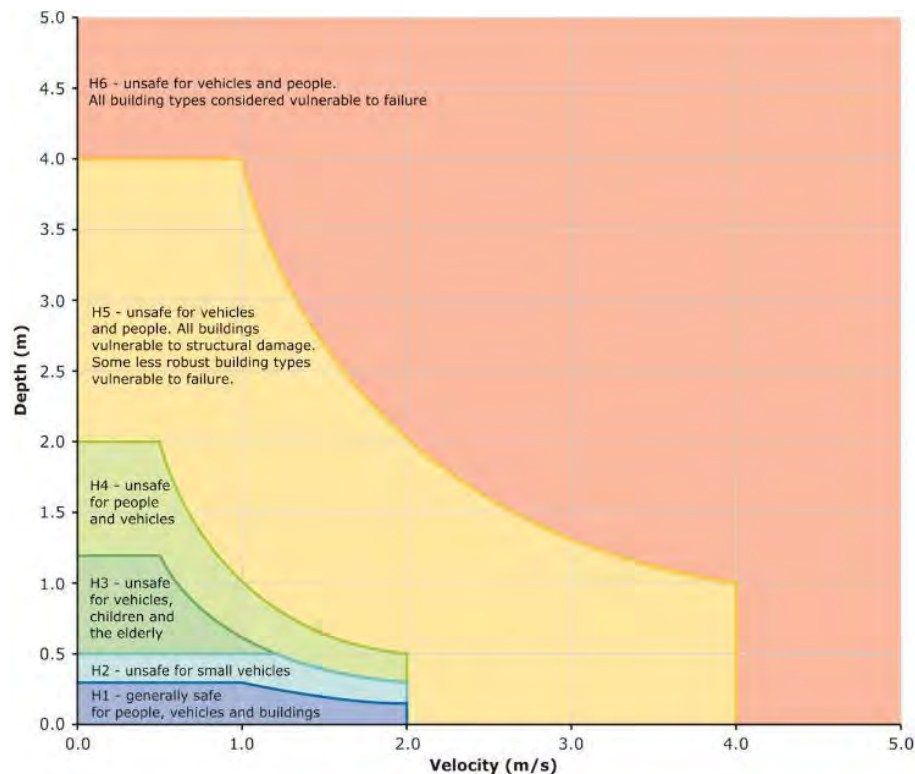


Figure 2-6 Flood Hazard Curves (Source: Water Hazard Laboratory, 2014)



The vulnerability thresholds that correspond to the hydraulic hazard vulnerability curves on the previous page are included in the table below.

Table 2-1 Vulnerability Thresholds (Source: Water Hazard Laboratory, 2014)

<b>Hazard Vulnerability Classification</b>	<b>Description</b>
H1	Generally safe for vehicles, people and buildings.
H2	Unsafe for small vehicles.
H3	Unsafe for vehicles, children and the elderly.
H4	Unsafe for vehicles and people.
H5	Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6	Unsafe for vehicles and people. All building types considered vulnerable to failure.

Most of the flood-affected area for the Scenario A site is categorised as a H1 hazard, according to the Research Laboratory's classification scale in Figure 2-6. A small area along the northern boundary can be categorised as a H2 and H3 hazard.

An area categorised as a H1 hazard is a low hazard that is generally safe for vehicles, people and buildings according to the vulnerability classification thresholds in Table 2-1 Vulnerability Thresholds (Source: Water Hazard Laboratory, 2014). Hazard levels of H2 and H3 are also low, but in the design event a H2 area is unsafe for small vehicles, whilst a H3 area is unsafe for vehicles, children and the elderly.

The Scenario B site can be seen as slightly more hazardous, with the majority of the flood-affected area categorised as a H2 hazard, according to the Research Laboratory's classification scale in Figure 2-6. An area through the centre of the site, following the path of the flood runner, can be seen as categorised as a H3 hazard. Small plots categorised as a H4 hazard are also mapped within the site.

A preliminary development concept was prepared for the subject land to model the impact development would have on overland flow flooding levels. The maximum flood level impact within the site extent is 0.1 metres. The maximum off-site impact is 0.3 metres within the retention basin at 108 Brindabella Drive and 0.05 metres on the western side of the basin.

The off-site flood level impact is viewed as relatively minor. Further consideration of the development concept would occur at development application stage and could include design measures to lessen the flood impact if desired.

The modelling undertaken for the Scenario B site was very conservative with the inputs, as no preliminary development concept had been prepared for this area. Parameters of a 'worst-case scenario' were provided by Council. The maximum flood level impact within the Scenario B site is 0.61m. The maximum off-site impact is 0.05 metres along Plumpton Road and along Dalkeith Avenue, up to 300 metres north of the site.

The off-site impact is viewed as significant, both in terms of the increase in flood level and the extent of the impact up to 300 metres away.

## 2.2 SALINITY AND GROUNDWATER CONSIDERATIONS

### 2.2.1 Background

Salinity and groundwater concerns of the subject land were identified as part of the draft Wagga Wagga Natural Resource Management Plan prepared by Council in 1998. It is believed the Plan remained in draft form and was never formally adopted, although some of the outcomes of the Plan have been translated into Council's planning instruments and documents.

The purpose of the Plan was to provide information for decision makers on the state of the natural resources and how various activities that impact on the local natural environment can be encouraged, modified, restricted or prohibited<sup>2</sup>.

It is understood that the subject land was mapped as a potential salinity risk due to the path of Stringybark Creek through the land. Further, the lower footslopes of Willans Hill were regarded as having a shallow groundwater presence and to therefore be also at risk of salinisation. Evaporation from shallow water tables can occur where groundwater is located less than 2 metres below ground level. This results in naturally-occurring salts in the groundwater becoming concentrated in the soil substrate.

### 2.2.2 Investigation into status of salinity risk and groundwater levels

In 1998, Wagga Wagga City Council established a network of piezometers across Wagga Wagga to monitor urban salinity through the collection of standing water level (SWL) and electrical conductivity (EC) readings. The network currently comprises 198 piezometers.

According to Council's 'Urban Salinity Technical Report 2015-16' the groundwater monitoring results allow the identification of areas that are susceptible to saline discharge<sup>3</sup>. Council considers urban salinity concerns to be present where the piezometer readings reveal *both* high EC concentrations (greater than 5 deciSiemens per metre) and high SWLs (less than 5 metres below ground level)<sup>4</sup>. These piezometers are referred to as 'critical piezometers' in Council's urban salinity literature.

The only piezometer in the Eastern Sub-Catchment to indicate an urban salinity concern is Piezometer No. 29, which is located off Dalkeith Avenue in Lake Albert and approximately 630 metres east of the subject land. The Urban Salinity Technical Report refers to Council's belief that the SWLs of this piezometer may be due to lateral influences of Lake Albert<sup>5</sup>.

The piezometer closest to the subject land is Piezometer No. 51, which is located just off Plumpton Road opposite 48 Plumpton Road. Readings from this piezometer have been taken monthly, or thereabouts, since April 1997. Refer to records obtained from Wagga Wagga City Council in Attachment B.

The readings indicate a general decline in SWLs since the establishment of the piezometer, from 6.7 metres below ground level, remaining fairly steady around 9 metres below ground level for the last 10 years. The average SWL since establishment is 8.12 metres below ground level; the median is 8.33 metres.

The recorded electrical conductivity (EC) has ranged from 2.14 deciSiemens per metre (dS/m) in March 2011 to 6.10 in October 2007. Since establishment the average EC level is 4.76 dS/m; the median is 4.75.

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<sup>2</sup> City of Wagga Wagga, 1998, 'Wagga Wagga draft Natural Resource Management Plan', p.1.

<sup>3</sup> City of Wagga Wagga, 2016, 'Urban Salinity Technical Report 2015-16', p.7.

<sup>4</sup> City of Wagga Wagga, 2016, 'Urban Salinity Technical Report 2015-16', p.20.

<sup>5</sup> City of Wagga Wagga, 2016, 'Urban Salinity Technical Report 2015-16', p.20.

Summarised yearly readings from Piezometer No. 15 and others in the surrounding area are included in the table below. A copy of all readings obtained from Wagga Wagga City Council is included as Attachment B.

Table 2-2 Reading summary from piezometers surrounding the subject land

	<b>Piezometer No. 51</b>		<b>Piezometer No. 163</b>		<b>Piezometer No. 180</b>		<b>Piezometer No. 181</b>		<b>Piezometer No. 182</b>	
	<i>Depth: 16.68m</i>		<i>Depth: 8.50m</i>		<i>Depth: 6.70m</i>		<i>Depth: 10.00m</i>		<i>Depth: 12.00m</i>	
	<b>SWL</b>	<b>EC<sub>w</sub></b>	<b>SWL</b>	<b>EC<sub>w</sub></b>	<b>SWL</b>	<b>EC<sub>w</sub></b>	<b>SWL</b>	<b>EC<sub>w</sub></b>	<b>SWL</b>	<b>EC<sub>w</sub></b>
<b>1997</b>	-6.54	3.30								
<b>1998</b>	-6.66	5.22								
<b>1999</b>	-6.30	5.18								
<b>2000</b>	-6.07 <sup>1</sup>	8.82								
<b>2001</b>	-6.16	4.55								
<b>2002</b>	-6.40	5.53								
<b>2003</b>	-7.02	5.26								
<b>2004</b>	-7.46	3.40								
<b>2005</b>	-8.17	5.89								
<b>2006</b>	-8.47	6.00								
<b>2007</b>	-8.99	5.37								
<b>2008</b>	-9.76	5.30	DRY	N/A						
<b>2009</b>	-10.19	5.11	DRY	N/A						
<b>2010</b>	-10.44	4.69	DRY	N/A	DRY	N/A				
<b>2011</b>	-9.79	2.18	DRY	N/A	DRY	N/A	-8.47	6.22	-2.67	0.71
<b>2012</b>	-9.35	3.97	DRY	N/A	DRY	N/A	-8.53	6.42	-2.50	1.13
<b>2013</b>	-9.32	4.01 <sup>3</sup>	DRY	N/A	DRY	N/A	-8.88	6.72 <sup>3</sup>	-3.14	1.52 <sup>3</sup>
<b>2014</b>	-9.35	4.12	DRY	N/A	DRY	N/A	-9.10	6.97	-3.19	1.45
<b>2015</b>	-9.62	5.56	DRY	N/A	DRY	N/A	-9.39	6.06	-3.56	1.50
<b>2016</b>	-9.49	5.54	DRY	N/A	DRY	N/A	-8.07	6.44	-3.26	1.24
<b>2017</b>	-9.08 <sup>2</sup>	4.84 <sup>2</sup>	DRY	N/A	DRY	N/A	-8.79 <sup>2</sup>	6.71 <sup>2</sup>	-3.83 <sup>2</sup>	1.32 <sup>2</sup>

**Note:** Readings from June each year have been reproduced in Table 2-2 except as provided for below.

<sup>1</sup> Reading from 6 July 2000

<sup>2</sup> Reading from 28 August 2017

<sup>3</sup> Reading from 29 July 2013

As stated earlier, Council deems urban salinity concerns to be present where the piezometer readings reveal *both* high EC concentrations (greater than 5 dS/m) and high SWLs (less than 5 metres below ground level)<sup>6</sup>. The recorded average and median SWLs and EC levels for Piezometer No. 51 near to the subject land do not exceed these thresholds and can therefore be considered to indicate that urban salinity is not a notable concern for this area.

Further, according to Table 2.17 of the draft Wagga Wagga Natural Resource Management Plan, the salinity risk rating is considered to be 'low' where the groundwater depth is between 5-10 metres and 'very low' where exceeding 10 metres. As stated earlier, the average SWL for Piezometer No. 51 since establishment in 1997 was 8.12 metres below ground level; the median was 8.33 metres. The readings have revealed a general decline in the SWL and has remained steady around 9 metres below ground level for the last 10 years. The piezometer was established in 1997 and readings have been taken in both severe drought conditions and periods of above average rainfall. The recorded levels substantiate the view that a shallow groundwater presence is unlikely to be a concern for this area.

NGH also carried out testing to determine the EC<sub>1:5</sub> and pH<sub>1:5</sub> levels present in the soil on the subject land and surrounding properties along Plumpton Road. The electrical conductivity is influenced by the concentration and composition of dissolved salts. Salts increase the ability of a solution to conduct an electrical current, so a high EC value indicates a high salinity level. The target levels for productive soil are below 0.15 dS/m (equivalent to 150 microSiemens/cm) for EC<sub>1:5</sub><sup>7</sup>. Readings above 1 dS/m reveal an emerging salinity concern; salt-tolerant plants will begin to thrive, and the growth of other plantings will be affected. The target pH<sub>1:5</sub> level is 5.5 to 6.0<sup>8</sup>.

Sixteen soil samples were collected from three properties as indicated in the figure on the following page. Samples were collected to a depth of approximately 150-200mm below the surface, with organic matter manually removed. Evidence of land filling was observed at 52 Plumpton Road and these areas were avoided for sampling. It was assumed that the filling was imported fill and therefore the test results would have not been representative of the natural site conditions.

The sixteen collected samples were bulked into five for testing at the CSU Environmental & Analytical Laboratory. The results are detailed in the table below with the full analysis report included as Attachment C. Consistent with the piezometer readings, the soil sampling results do not indicate the presence of a potential salinity issue. The EC levels are very low, which would confirm that capillary action has not occurred, with no evidence of concentrated dissolved salts in the soil substrate. The pH levels are within a normal range for the type of soils encountered.

Table 2-3 Soil testing results

	<i>Sample 17-256-S01</i>	<i>Sample 17-256-S02</i>	<i>Sample 17-256-S03</i>	<i>Sample 17-256-S04</i>	<i>Sample 17-256-S05</i>
<b>EC<sub>1:5</sub> (microSiemens/cm)</b>	50	59	38	71	52
<b>pH<sub>1:5</sub></b>	5.8	5.7	5.9	6.1	6.3

<sup>6</sup> City of Wagga Wagga, 2016, 'Urban Salinity Technical Report 2015-16', p.20.

<sup>7</sup> Department of Primary Industries, n.d., 'Salinity', <https://www.dpi.nsw.gov.au/agriculture/soils/salinity>.

<sup>8</sup> Department of Primary Industries, n.d., 'Result Interpretation', <https://www.dpi.nsw.gov.au/about-us/services/laboratory-services/soil-testing/interpret>





Figure 2-7 Soil sampling map (Source: Base map - WWCC online mapping / NGH, 2018)

## 3 CONCLUSION

### 3.1 FLOODING

In further consideration of the overland flooding concerns, WMA Water was engaged by the proponents to undertake a flood impact assessment for the subject land.

The modelling undertaken by WMA Water confirmed that the subject land (Scenario A site) is impacted by the design flood (the 1% AEP event), generally falling within a low hazard flood storage area and the flood fringe. A minor flow path is located on the very eastern edge of the subject land (illustrated in red in Figure 2-3 below) but does not constitute the main floodway.

The flood impact of development on the subject land was modelled using a preliminary development concept. The maximum off-site impact is 0.3 metres within the retention basin at 108 Brindabella Drive and 0.05 metres on the western side of the basin. Accordingly, the off-site flood level impact is viewed as relatively minor. Further consideration of the development concept would occur at development application stage and could include design measures to lessen the flood impact if desired.

At Council's request, other properties north of the subject land and south of Stirling Boulevard were also included in the flood impact assessment. This was to determine the potential cumulative impacts that could occur with development in the area adjacent to Plumpton Road, should Council be inclined to consider a wider area for rezoning from E2 Environmental Conservation to R1 General Residential.

The majority of the Scenario B site is also categorised as low hazard flood storage for the design event; however, a major flood runner (high hazard floodway) is present, flowing from the dam located at 32 Barrington Street north to Stirling Boulevard. However, the modelling results for the worst-case parameters provided by Council indicated the flood impact of further development in the wider study area to be significant. The maximum off-site impact is 0.05 metres along Plumpton Road and along Dalkeith Avenue, up to 300 metres north of the site.

### 3.2 SALINITY

Investigations indicated that the salinity risk rating is 'low' where the groundwater depth is between 5-10 metres and 'very low' where exceeding 10 metres. The readings have revealed a general decline in the SWL and has remained steady around 9 metres below ground level for the last 10 years. The piezometer was established in 1997 and readings have been taken in both severe drought conditions and periods of above average rainfall. The recorded levels substantiate the view that a shallow groundwater presence is unlikely to be a concern for this area.

The results of the flood and salinity assessments indicate the subject land is zoned inappropriately and the land is potentially isolated from maximising its available potential based on the findings of this Risk Analysis report. It is considered that the appropriate zone for the subject land comprising Lot 2 DP243027 and Lot 327 DP1178026 is R1 Residential, consistent with adjoining land.

This report is submitted for Council's consideration.



# ATTACHMENT A FLOOD IMPACT ASSESSMENT



Xeros Piccolo Consulting Engineers  
5 Bye Street  
Wagga Wagga. NSW 2650

P171113\_52Plumpton\_Road\_Letter.docx

21 February 2018

**Attention: Mr Nathan Fisher**

Dear Nathan,

**Re: 52 Plumpton Road – Flood Impact Assessment**

## **1. INTRODUCTION**

WMAwater has been engaged by Xeros Piccolo Consulting Engineers to provide a flood impact assessment for a proposed development at 52 Plumpton Road, Tatton. The site has been identified as flood affected, and is subject to inundation from overland flow. The flood behaviour in the vicinity of the site is defined in the Wagga Wagga Major Overland Flow Flood Study (MOFFS; WMAwater, 2015) (Reference 1), adopted by Wagga Wagga City Council (WWCC).

52 Plumpton Road is largely undeveloped except for a single building situated near the western boundary. The development proposes to subdivide the property into seven lot subdivisions, consisting of 6 large residential blocks and 1 community title allotment facilitating 32 individual dwellings. As part of the proposal, each new flood affected dwelling (within the flood extent) will be set at the 1% AEP flood level plus 0.5 m freeboard, and dwellings beyond the flood extent will be set at 300 mm above ground level. A flood impact assessment is required to determine how the proposed house pads will affect flood behaviour in this area, and to determine the offsite impacts that may be caused by the proposed development.

The area of the proposed development is currently zoned as General Residential (R1) in the western half and Environmental Conservation (E2) in the eastern half as per the Wagga Wagga Local Environmental Plan (LEP) 2010 (see Figure 1). The development proposes to rezone the E2 portion of the site to R1 to support residential development.

The E2 zone extends north to Stirling Boulevard. WWCC requires that, in addition to an impact assessment for 52 Plumpton Road, that the rezoning of the entire E2 zone is considered as an

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'Ultimate Scenario' to determine the potential cumulative impacts that could occur with ongoing development in the area. The proponent is required to provide an impact assessment that assumes the entire E2 zone is rezoned as R1, subdivided into lots and developed (i.e. housing pads constructed on each lot).

For clarity, the report will henceforth refer to the two impact assessment sites as follows:

- Scenario A: Proposed development of 52 Plumpton Road; and
- Scenario B: Ultimate development of entire E2 zone (including Proposed Development, 52 Plumpton Road).

The location of the Scenario A and Scenario B sites are shown on Figure 1.

## **2. EXISTING FLOOD ENVIRONMENT**

Both the Scenario A and Scenario B sites are subject to overland flow flooding as defined by the MOFFS (Reference 1). The existing peak flood depth and level contours for the 1% AEP event are presented on Figure 2.

The eastern half of the Scenario A site is flood affected in the 1% AEP event. A major flow path is located along Plumpton Road to the east of the Scenario A site, however outside of the Plumpton Road basin the Scenario A site is generally classed as low hazard flood storage/flood fringe. Hydraulic hazard for the two sites is shown on Figure 3 and the hydraulic categorisation on Figure 4.

The Scenario B site is subject to more significant flood affectation than the Scenario A site. A major flood runner (high hazard floodway) traverses the Scenario B site from the detention basin behind 32-36 Barrington Street to Stirling Boulevard, although the Scenario B site is generally classed as low hazard flood storage (see Figure 3 and Figure 4).

A minor flow path is located on the eastern side of the Scenario A site around the proposed location of Lots PD 37 and PD 38 with depth of up to 0.75 m as can be seen on Figure 2. It is noted that building pads in this area are likely to obstruct this flow path, and as such, pier construction has been designated for the proposed dwellings in this area (Lot PD 37 and Lot PD 38), as described in Section 3.1.

Hazard Classifications based on vulnerability thresholds (H1 to H6) are included on Figure 5. Please note these are yet to be adopted by council and are for reference purposes only.

## **3. METHODOLOGY**

The MOFFS (Reference 1) model has been modified to represent the two proposed scenarios. Lots are referred to as PD for Scenario A, and UD for Scenario B. The process undertaken is outlined below:

### **3.1. Scenario A: Proposed Development**

1. The proposed dwelling pads (except Lots PD 37 and PD 38) were incorporated into the model as impermeable obstructions to flow with no assumed flood storage capacity;
2. Lots PD 37 and PD 38 were modelled as dwellings on piers outside the flood extent (due to

the presence of a minor flow path as described in Section 2), and were thus excluded from the model;

3. The modified model was run, and the results of the pre-development and post-development cases were compared to determine the flood impact; and
4. Impact maps were produced, indicating levels of afflux due to the Scenario A: Proposed Development in the 1% AEP event.

### **3.2. Scenario B: Ultimate Development**

1. Specifications for the Scenario B: Ultimate Development layout were provided by Council and are listed below. An example road layout provided by Council to aid in the design of the ultimate development scenario is included as Appendix A. It is noted that the designed ultimate development case is a conservative estimate of likely future development in terms of both lot and dwelling pad size, and the installation of building pads in the floodway (which would likely not be allowed under WWCC policy). From WWCC:
  - a. Access off Plumpton Road will not be supported;
  - b. Minimum lot sizes of 0.2 hectares;
  - c. A 10 m setback from Plumpton Road and a 5 m setback from lot boundaries will be required for all building pads; and
  - d. Building Pads will take up the entirety of the lot minus the above setbacks.
2. The 17 dwellings (marked UD 1 – UD 17 in Figure 1) that form the Scenario B: Ultimate Development design were incorporated into the model as impermeable obstructions with no assumed flood storage capacity (in addition to the dwellings for the Scenario A proposed development);
3. The modified model was run, and the results of the pre-development and post-development cases were compared to determine the flood impact; and
4. Impact maps were produced, indicating levels of afflux due to the Scenario B: Ultimate Development in the 1% AEP event.

## **4. RESULTS**

### **4.1. Scenario A: Proposed Development**

The peak flood level impact for the 1% AEP event is shown on Figure B1. The maximum flood level impact that occurs is within the site extent and is 0.1 m.

The proposed development causes offsite impacts along the southern boundary of the lot. This includes flood level increases of approximately 0.03 m within the Plumpton Road Basin and 0.05 m to the west of the basin on Lot DP1178026 (108 Brindabella Drive, Tatton) as shown on Figure B1.

### **4.2. Scenario B: Ultimate Development**

The peak flood level impact for the 1% AEP event is shown on Figure B2. The maximum impact that occurs is within the site extent and is 0.61 m.

The ultimate development causes offsite peak flood level increases of up to 0.05 m along Plumpton Road and properties along Dalkeith Avenue. Flood level increases also occur along Dalkeith Avenue up to 300 m north of the ultimate development.

Both the high increase to onsite flood depths (up to 0.61 m), and the widespread increase to offsite depths (0.05 m up to 300 m away), are to be expected given the pre-existing flooding conditions on site and the large scale of development assumed in the ultimate development scenario.

## **5. SUMMARY**

WMAwater has undertaken a flood impact assessment for the proposed development at 52 Plumpton Road, Tatton (Scenario A) and for the Ultimate Development (Scenario B) requested by WWCC.

The assessment for the proposed development (Scenario A) showed a localised increase (0.05 m) to flood levels at an offsite location south of the development site. The assessment for the ultimate development (Scenario B) assumes the entire E2 area between Brindabella Drive to Stirling Boulevard is rezoned and subdivided to support residential development. The impact assessment shows a large increase to flood levels (0.61 m) on site as well as increases to flood levels (0.05 m) along Plumpton Road, Dalkeith Avenue and adjoining properties. The results of this assessment can be used to facilitate discussions with Council regarding the proposed development.

Should you require any further clarification, please do not hesitate to contact the undersigned.

Yours Sincerely,

**WMAwater**



**Erin Askew**

Director

## **References**

- 1 Wagga Wagga City Council  
**Wagga Wagga Major Overland Flow – Model Update Report**  
WMAwater, 2015

## **Figures**

- Figure 1: Existing Site Conditions
- Figure 2: Existing Peak Flood Depth 1% AEP Event
- Figure 3: Existing Peak Flood Hydraulic Hazard 1% AEP Event
- Figure 4: Existing Peak Flood Hydraulic Categorisation 1% AEP Event
- Figure 5: Existing Peak Hazard Classifications 1% AEP Event
- Figure B1: Proposed Development Flood Impact 1% AEP Event
- Figure B2: Ultimate Development Flood Impact 1% AEP Event

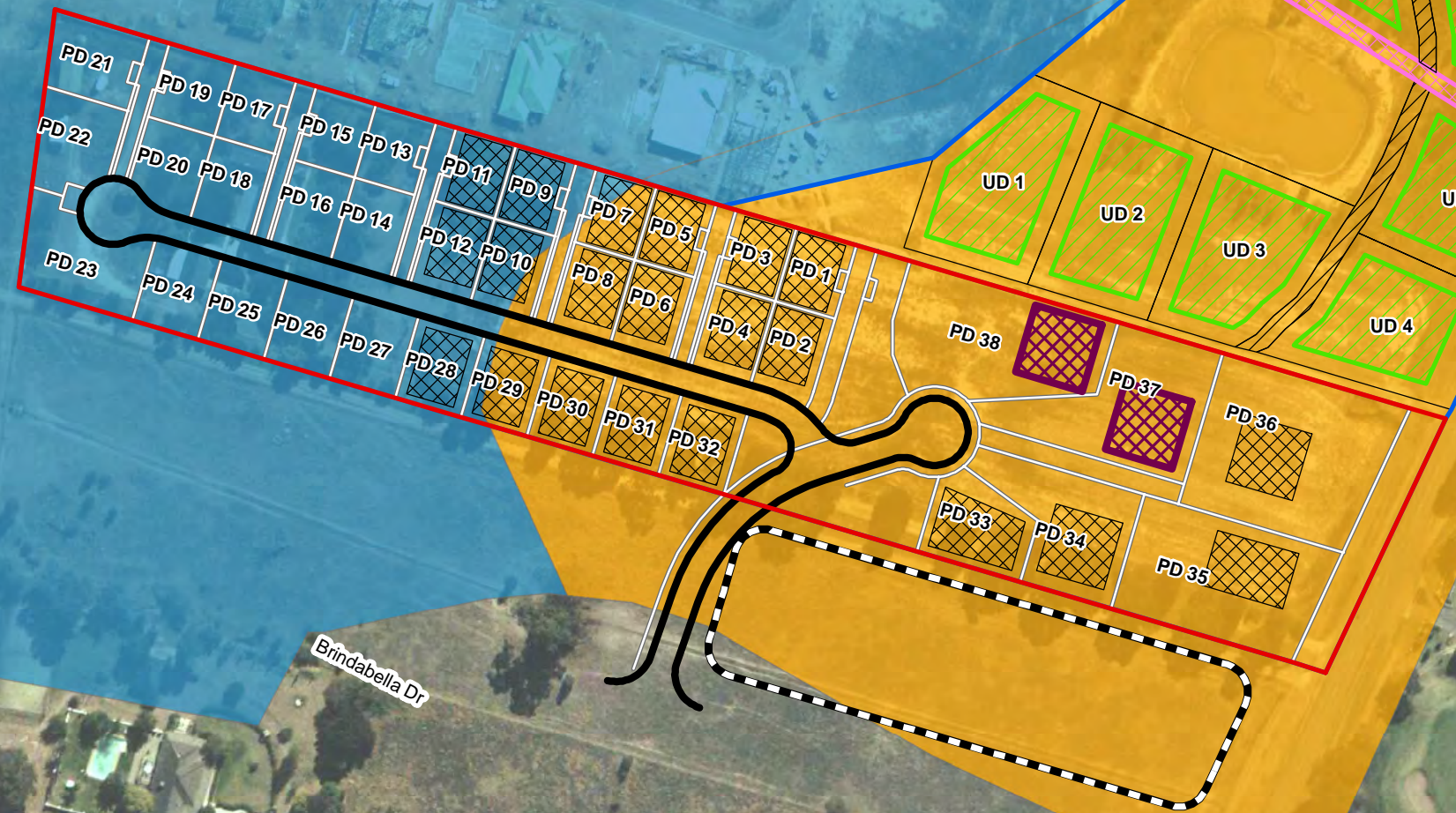
## **Attachments**

- Appendix A: Ultimate Development Scenario schematic





FIGURE 1  
52 PLUMPTON ROAD TATTON  
EXISTING CONDITIONS  
OVERVIEW



- Scenario A: Proposed Development**
- 52 Plumpton Road Study Area
  - Proposed Building Pad Locations
  - Proposed Pier Footings
  - Proposed Roads
  - Proposed Property Layout
- Scenario B: Ultimate Development**
- Ultimate Scenario Study Area
  - Ultimate Scenario Lot Layout
  - Ultimate Scenario Building Pads
  - Ultimate Scenario Road Layout
  - Existing Roads
  - Plumpton Road Basin
- Wagga Wagga LEP**
- R1 General Residential
  - E2 Environmental Conservation

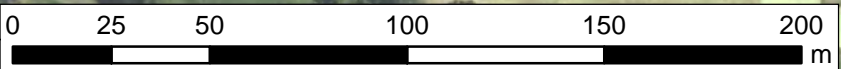




FIGURE 2  
52 PLUMPTON ROAD TATTON  
EXISTING CONDITIONS  
PEAK FLOOD LEVELS AND DEPTHS  
1% AEP EVENT

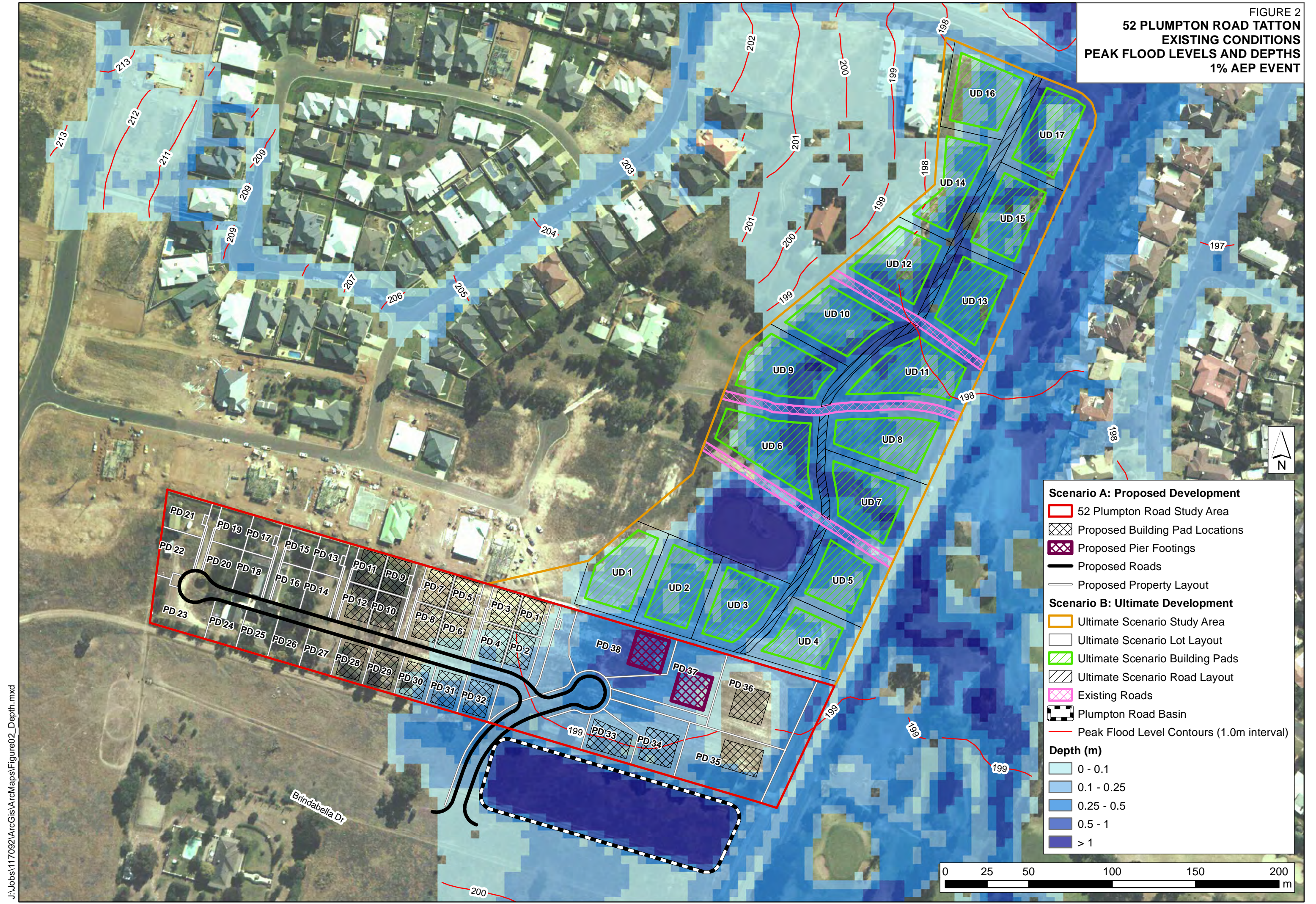
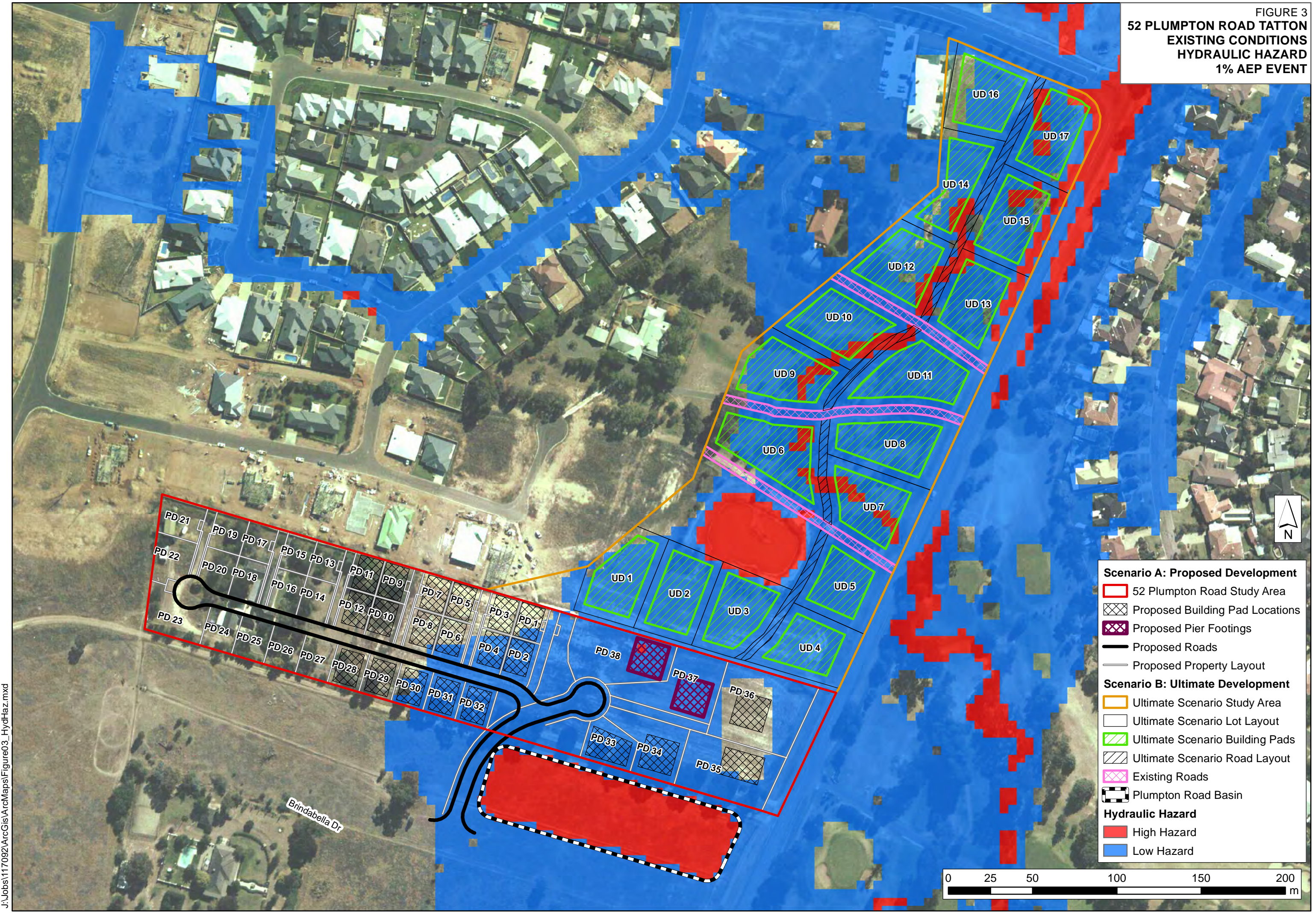




FIGURE 3  
52 PLUMPTON ROAD TATTON  
EXISTING CONDITIONS  
HYDRAULIC HAZARD  
1% AEP EVENT



**Scenario A: Proposed Development**

- 52 Plumpton Road Study Area
- Proposed Building Pad Locations
- Proposed Pier Footings
- Proposed Roads
- Proposed Property Layout

**Scenario B: Ultimate Development**

- Ultimate Scenario Study Area
- Ultimate Scenario Lot Layout
- Ultimate Scenario Building Pads
- Ultimate Scenario Road Layout
- Existing Roads
- Plumpton Road Basin

- Hydraulic Hazard**
- High Hazard
  - Low Hazard



FIGURE 4  
52 PLUMPTON ROAD TATTON  
EXISTING CONDITIONS  
HYDRAULIC CATEGORISATION  
1% AEP EVENT

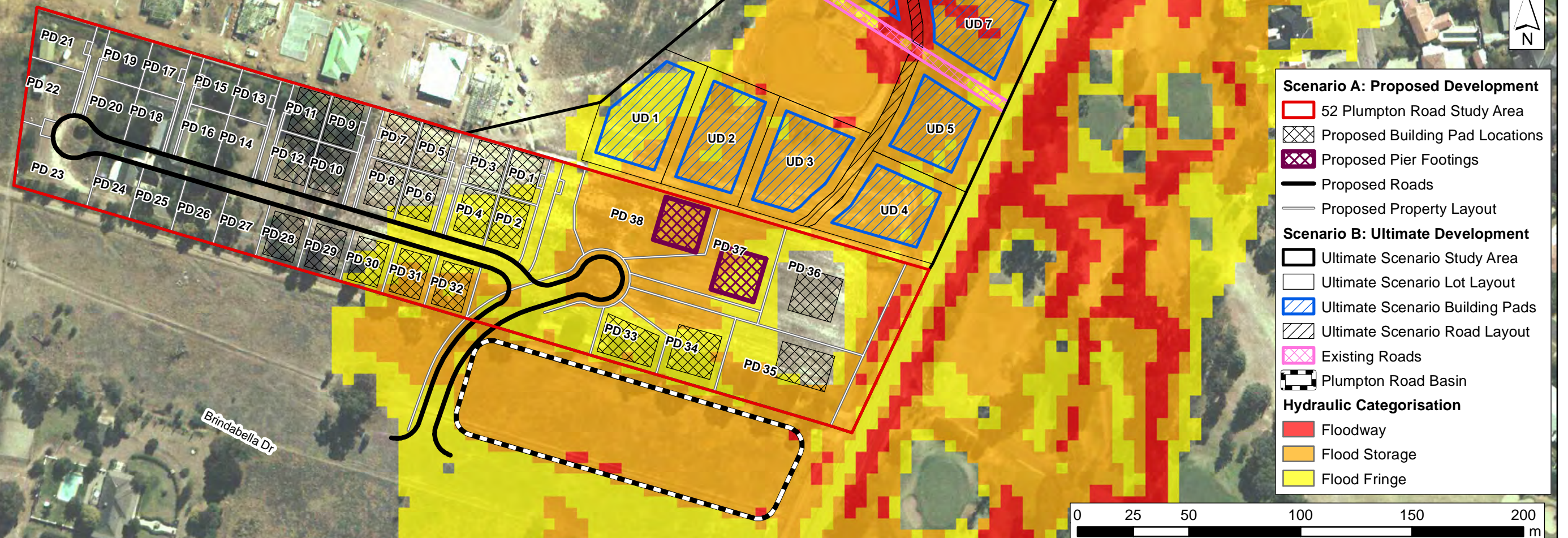




FIGURE 5  
52 PLUMPTON ROAD TATTON  
EXISTING CONDITIONS  
HAZARD CLASSIFICATION  
1% AEP EVENT

Please note H1 to H6 categories are for reference purposes only and have not been officially adopted by Council. They have been developed as part of the MOFFRMS which is currently underway.

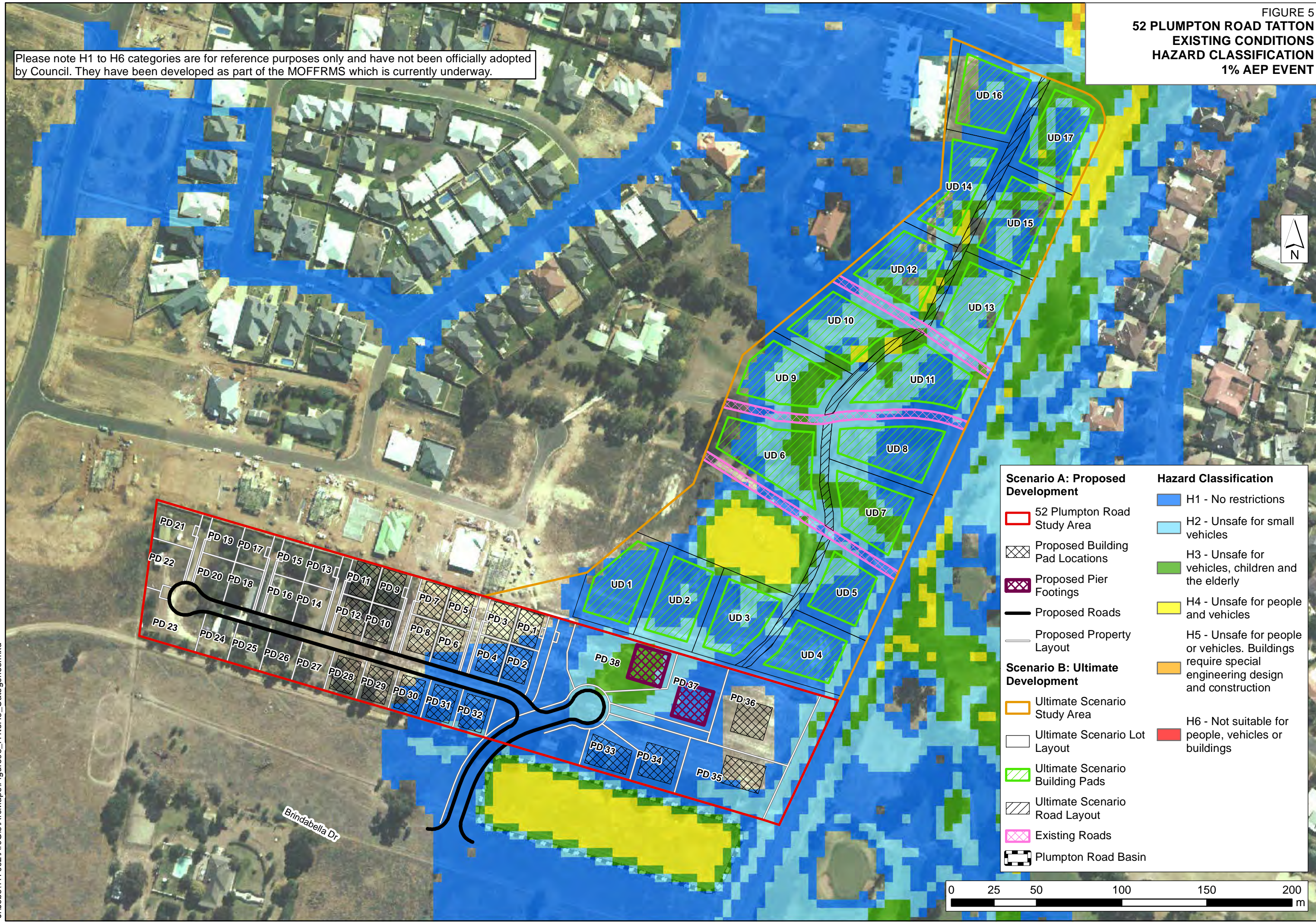
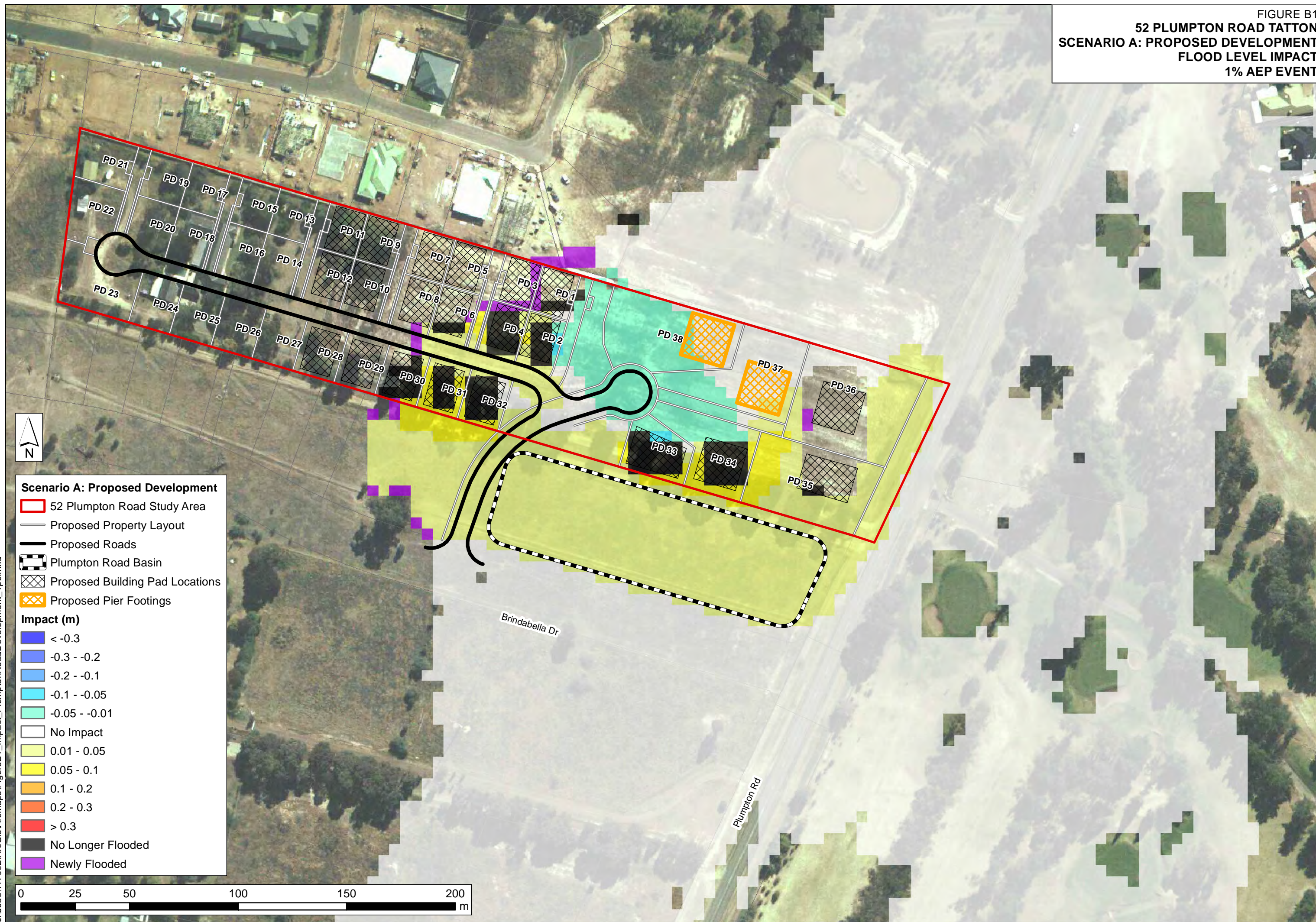




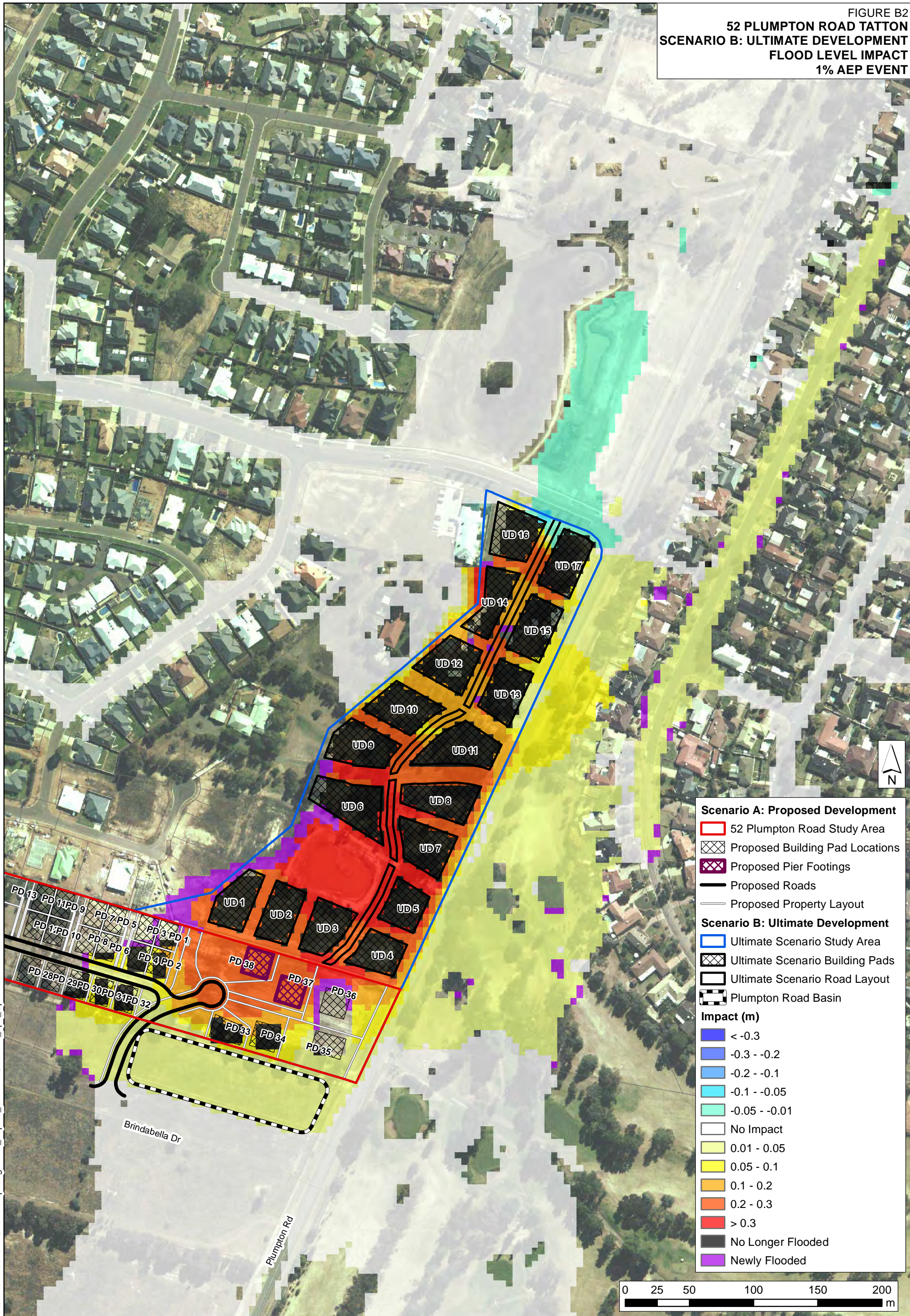
FIGURE B1  
52 PLUMPTON ROAD TATTON  
SCENARIO A: PROPOSED DEVELOPMENT  
FLOOD LEVEL IMPACT  
1% AEP EVENT



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FIGURE B2  
52 PLUMPTON ROAD TATTON  
SCENARIO B: ULTIMATE DEVELOPMENT  
FLOOD LEVEL IMPACT  
1% AEP EVENT











Sketch provided by Wagga Wagga City Council, 25/1/18



## **ATTACHMENT B      WWCC PIEZOMETER RECORDS**



## Piezometer No 51

**Location:** Plumpton Rd opp. 'Ashgrove' near golf course

**County & Parish:** Wynyard County, South Wagga Wagga Parish

**Urban Subcatchment (Golder 2007):** Eastern Subcatchment

**Bore Depth:** 16.68m

**Extension:** 0.84m

**Diameter of steel casing:**

**Zone:** 55H

**Eastings:** 533027.210

**Northings:** 6108696.539

**Altitude** (height of piezometer above sea level): 197.405

**Accuracy:** dGPS Sept 09 B. Donaldson

**FMWT:** Field measurement of water table

**TWTD:** True water table depth (depth to water table from ground level)

Field measurement of water table is measured to the nearest 0.01 of a metre

\*From January 1998 onwards the plopper height is added to the piezometer extension formula.

DATE	FMWT (m)	TWTD (m)	EC (dS/m)	COMMENTS	DATE	TWTD (m below)
22-Apr-97	7.54	6.70	4.90		22-Apr-97	-6.70
5-May-97	7.32	6.48			5-May-97	-6.48
26-May-97	7.27	6.43	5.08		26-May-97	-6.43
16-Jun-97	7.38	6.54	3.30		16-Jun-97	-6.54
16-Jul-97	7.39	6.55	5.50		16-Jul-97	-6.55
6-Aug-97	7.30	6.46	5.75		6-Aug-97	-6.46
11-Sep-97	7.38	6.54	5.34		11-Sep-97	-6.54
16-Oct-97	7.27	6.43	5.49		16-Oct-97	-6.43
27-Oct-97	7.29	6.45		*Automatic logger installed	27-Oct-97	-6.45
17-Nov-97	7.28	6.44	5.42		17-Nov-97	-6.44
22-Dec-97	7.25	6.41	4.47		22-Dec-97	-6.41
19-Jan-98	7.16	6.45	5.24	*0.13 (plopper) added to piezo height in formula	19-Jan-98	-6.45
2-Mar-98	7.30	6.59	5.36		2-Mar-98	-6.59
1-Apr-98	7.36	6.65	5.25		1-Apr-98	-6.65
11-May-98	7.39	6.68	5.45		11-May-98	-6.68
11-Jun-98	7.37	6.66	5.22		11-Jun-98	-6.66
22-Jul-98	7.39	6.68	5.71		22-Jul-98	-6.68
18-Aug-98	7.31	6.60	4.98		18-Aug-98	-6.60
10-Sep-98	7.33	6.62	5.23		10-Sep-98	-6.62
15-Oct-98	7.09	6.38	5.02		15-Oct-98	-6.38
27-Nov-98	6.92	6.21	5.19		27-Nov-98	-6.21
28-Jan-99	6.76	6.05	5.17		28-Jan-99	-6.05
23-Feb-99	6.83	6.12	5.39		23-Feb-99	-6.12
25-Mar-99	6.90	6.19	4.90		25-Mar-99	-6.19
29-Apr-99	6.91	6.20	5.30		29-Apr-99	-6.20
19-May-99	6.97	6.26	5.10		19-May-99	-6.26
25-Jun-99	7.01	6.30	5.18		25-Jun-99	-6.30
29-Jul-99	7.00	6.29	5.66		29-Jul-99	-6.29
31-Aug-99	6.97	6.26	5.37		31-Aug-99	-6.26
30-Sep-99	6.92	6.21	5.10		30-Sep-99	-6.21
4-Nov-99	6.76	6.05	4.94		4-Nov-99	-6.05
25-Nov-99	6.73	6.02	4.87		25-Nov-99	-6.02
5-Jan-99	6.62	5.91	4.58		5-Jan-99	-5.91

1-Feb-00	6.63	5.92	4.52		1-Feb-00	-5.92
23-Feb-00	6.69	5.98	5.04		23-Feb-00	-5.98
30-Mar-00	6.72	6.01	5.31		30-Mar-00	-6.01
27-Apr-00	6.81	6.10	5.31		27-Apr-00	-6.10
29-May-00	6.71	6.00	5.04		29-May-00	-6.00
6-Jul-00	6.78	6.07	8.82		6-Jul-00	-6.07
31-Jul-00	6.85	6.14	4.92		31-Jul-00	-6.14
17-Aug-00	6.78	6.07	4.95		17-Aug-00	-6.07
20-Sep-00	6.80	6.09	4.97		20-Sep-00	-6.09
24-Oct-00	6.76	6.05	4.46		24-Oct-00	-6.05
29-Nov-00	6.68	5.97	4.50		29-Nov-00	-5.97
22-Dec-00	6.62	5.78	4.45	0.13 removed	22-Dec-00	-5.78
18-Jan-01	6.67	5.83	4.58		18-Jan-01	-5.83
21-Feb-01	6.75	5.91	5.24		21-Feb-01	-5.91
20-Mar-01	6.71	5.87	5.34		20-Mar-01	-5.87
19-Apr-01	6.85	6.01	4.65		19-Apr-01	-6.01
23-May-01	6.91	6.07	4.57		23-May-01	-6.07
26-Jun-01	7.00	6.16	4.55		26-Jun-01	-6.16
26-Jul-01	6.95	6.11	4.78		26-Jul-01	-6.11
29-Aug-01	6.80	5.96	4.64		29-Aug-01	-5.96
26-Sep-01	6.99	6.15	4.74		26-Sep-01	-6.15
29-Oct-01	6.93	6.09	5.70		29-Oct-01	-6.09
27-Nov-01	6.98	6.14	5.85		27-Nov-01	-6.14
27-Dec-01	6.98	6.14	5.77		27-Dec-01	-6.14
29-Jan-02	7.05	6.21	5.56		29-Jan-02	-6.21
25-Feb-02	7.11	6.27	5.55		25-Feb-02	-6.27
29-Mar-02	7.12	6.28	5.53		29-Mar-02	-6.28
29-Apr-02	7.23	6.39	5.73		29-Apr-02	-6.39
29-May-02	7.27	6.43	5.65		29-May-02	-6.43
26-Jun-02	7.24	6.40	5.53		26-Jun-02	-6.40
28-Aug-02	7.35	6.51	5.52		28-Aug-02	-6.51
26-Sep-02	7.27	6.43	5.72		26-Sep-02	-6.43
29-Oct-02	7.31	6.47	5.41		29-Oct-02	-6.47
28-Nov-02	7.25	6.41	4.87		28-Nov-02	-6.41
31-Dec-02	7.39	6.55	4.13		31-Dec-02	-6.55
30-Jan-03	7.39	6.55	3.60		30-Jan-03	-6.55
24-Feb-03	7.58	6.74	4.45		24-Feb-03	-6.74
25-Mar-03	7.62	6.78	5.60		25-Mar-03	-6.78
28-Apr-03	7.69	6.85	4.76		28-Apr-03	-6.85
21-May-03	7.84	7.00	4.20		21-May-03	-7.00
23-Jun-03	7.86	7.02	5.26		23-Jun-03	-7.02
30-Jul-03	7.85	7.01	4.93		30-Jul-03	-7.01
25-Aug-03	7.79	6.95	4.81		25-Aug-03	-6.95
19-Sep-03	7.75	6.91	4.09		19-Sep-03	-6.91
30-Oct-03	7.65	6.86	3.78	*0.05 (plopper) added to piezo height in formula	30-Oct-03	-6.86
27-Nov-03	7.74	6.95	4.51		27-Nov-03	-6.95
5-Jan-04	7.84	7.05	5.72		5-Jan-04	-7.05
30-Jan-04	7.88	7.04	4.57	Plopper adjustment removed from formula	30-Jan-04	-7.04
26-Feb-04	8.08	7.24	4.68		26-Feb-04	-7.24
26-Mar-04	8.12	7.28	2.50		26-Mar-04	-7.28
27-Apr-04	8.27	7.43	4.77		27-Apr-04	-7.43
28-May-04	8.25	7.41	3.50		28-May-04	-7.41
30-Jun-04	8.30	7.46	3.40		30-Jun-04	-7.46
30-Jul-04	8.29	7.45	5.74		30-Jul-04	-7.45
26-Aug-04	8.41	7.57	5.82		26-Aug-04	-7.57

29-Sep-04	8.39	7.55	5.80	29-Sep-04	-7.55
31-Oct-04	8.40	7.56	5.83	31-Oct-04	-7.56
25-Nov-04	8.50	7.66	5.70	25-Nov-04	-7.66
22-Dec-04	8.46	7.62	4.78	22-Dec-04	-7.62
31-Jan-05	8.43	7.59	2.70	31-Jan-05	-7.59
28-Feb-05	8.58	7.74	2.25	28-Feb-05	-7.74
30-Mar-05	8.75	7.91	2.28	30-Mar-05	-7.91
29-Apr-05	8.90	8.06	2.68	29-Apr-05	-8.06
27-May-05	8.86	8.02	5.91	27-May-05	-8.02
30-Jun-05	9.01	8.17	5.89	30-Jun-05	-8.17
29-Jul-05	8.92	8.08	5.94	29-Jul-05	-8.08
26-Aug-05	9.01	8.17	5.94	26-Aug-05	-8.17
30-Sep-05	8.85	8.01	5.92	30-Sep-05	-8.01
28-Oct-05	8.76	7.92	5.91	28-Oct-05	-7.92
26-Nov-05	8.96	8.12	5.91	26-Nov-05	-8.12
30-Dec-05	8.90	8.06	5.82	30-Dec-05	-8.06
27-Jan-06	8.88	8.04	5.87	27-Jan-06	-8.04
28-Feb-06	9.00	8.16	5.87	28-Feb-06	-8.16
31-Mar-06	9.10	8.26	5.90	31-Mar-06	-8.26
28-Apr-06	9.16	8.32	5.91	28-Apr-06	-8.32
29-May-06	9.17	8.33	5.92	29-May-06	-8.33
1-Jun-06	9.31	8.47	6.00	1-Jun-06	-8.47
1-Jul-06	9.41	8.57	5.96	1-Jul-06	-8.57
28-Aug-06	9.35	8.51	5.38	28-Aug-06	-8.51
25-Sep-06	9.41	8.57	5.40	25-Sep-06	-8.57
30-Nov-06	9.49	8.65	5.34	30-Nov-06	-8.65
22-Dec-06	9.55	8.71	5.30	22-Dec-06	-8.71
31-Jan-07	9.63	8.79	5.29	31-Jan-07	-8.79
28-Feb-07	9.77	8.93	5.33	28-Feb-07	-8.93
30-Mar-07	9.87	9.03	5.29	30-Mar-07	-9.03
30-Apr-07	9.93	9.09	5.35	30-Apr-07	-9.09
31-May-07	9.98	9.14	5.31	31-May-07	-9.14
29-Jun-07	9.83	8.99	5.37	29-Jun-07	-8.99
31-Jul-07	10.02	9.18	5.33	31-Jul-07	-9.18
31-Aug-07	10.07	9.23	5.39	31-Aug-07	-9.23
28-Sep-07	10.04	9.20	5.41	28-Sep-07	-9.20
31-Oct-07	10.15	9.31	6.10	31-Oct-07	-9.31
30-Nov-07	10.16	9.32	5.70	30-Nov-07	-9.32
24-Dec-07	10.19	9.35	6.00	24-Dec-07	-9.35
31-Jan-08	10.26	9.42	6.01	31-Jan-08	-9.42
29-Feb-08	10.30	9.46	5.97	29-Feb-08	-9.46
28-Mar-08	10.30	9.46	5.91	28-Mar-08	-9.46
30-Apr-08	10.35	9.51	5.80	30-Apr-08	-9.51
26-May-08	10.54	9.70	5.60	26-May-08	-9.70
27-Jun-08	10.60	9.76	5.30	27-Jun-08	-9.76
30-Jul-08	10.54	9.70	5.40	30-Jul-08	-9.70
26-Sep-08	10.47	9.63	5.00	26-Sep-08	-9.63
30-Oct-08	10.60	9.76	5.58	30-Oct-08	-9.76
24-Nov-08	10.56	9.72	5.31	24-Nov-08	-9.72
23-Dec-08	10.70	9.86	5.60	23-Dec-08	-9.86
28-Jan-09	10.84	10.00	5.50	28-Jan-09	-10.00
23-Feb-09	10.82	9.98	5.63	23-Feb-09	-9.98
26-Mar-09	10.95	10.11	5.30	26-Mar-09	-10.11
27-Apr-09	10.87	10.03	4.94	27-Apr-09	-10.03
25-May-09	11.05	10.21	5.28	25-May-09	-10.21

22-Jun-09	11.03	10.19	5.11	22-Jun-09	-10.19
28-Jul-09	11.12	10.28	5.06	28-Jul-09	-10.28
26-Aug-09	11.05	10.21	5.13	26-Aug-09	-10.21
28-Sep-09	11.02	10.18	5.31	28-Sep-09	-10.18
27-Oct-09	11.15	10.31	5.55	27-Oct-09	-10.31
26-Nov-09	11.05	10.21	5.65	26-Nov-09	-10.21
21-Dec-09	11.12	10.28	4.70	21-Dec-09	-10.28
25-Jan-10	11.12	10.28	4.30	25-Jan-10	-10.28
22-Feb-10	11.22	10.38	5.67	22-Feb-10	-10.38
29-Mar-10	11.26	10.42	5.14	29-Mar-10	-10.42
28-Apr-10	11.31	10.47	4.92	28-Apr-10	-10.47
26-May-10	11.17	10.33	4.94	26-May-10	-10.33
30-Jun-10	11.28	10.44	4.69	30-Jun-10	-10.44
26-Jul-10	11.21	10.37	4.75	26-Jul-10	-10.37
30-Aug-10	11.19	10.35	4.89	30-Aug-10	-10.35
27-Sep-10	11.06	10.22	4.88	27-Sep-10	-10.22
01-Nov-10	10.97	10.13	3.38	1-Nov-10	-10.13
24-Nov-10	10.96	10.12	3.57	24-Nov-10	-10.12
24-Jan-11	10.69	9.85	2.20	24-Jan-11	-9.85
01-Mar-11	10.65	9.81	2.14	1-Mar-11	-9.81
28-Mar-11	10.75	9.91	2.23	28-Mar-11	-9.91
28-Apr-11	10.70	9.86	2.18	28-Apr-11	-9.86
27-May-11	10.58	9.74	2.22	27-May-11	-9.74
28-Jun-11	10.63	9.79	2.18	28-Jun-11	-9.79
26-Jul-11	10.54	9.70	2.21	26-Jul-11	-9.70
29-Aug-11	10.45	9.61	2.34	29-Aug-11	-9.61
26-Sep-11	10.38	9.54	2.23	26-Sep-11	-9.54
27-Oct-11	10.30	9.46	2.40	27-Oct-11	-9.46
28-Nov-11	10.20	9.36	2.58	28-Nov-11	-9.36
27-Jan-12	10.04	9.20	2.96	27-Jan-12	-9.20
27-Feb-12	10.19	9.35	4.09	27-Feb-12	-9.35
26-Mar-12	10.24	9.40	4.15	26-Mar-12	-9.40
24-Apr-12	10.14	9.30	3.98	24-Apr-12	-9.30
29-May-12	10.24	9.40	3.55	29-May-12	-9.40
26-Jun-12	10.19	9.35	3.97	26-Jun-12	-9.35
29-Aug-12	9.93	9.09	4.09	29-Aug-12	-9.09
26-Sep-12	9.95	9.11	4.18	26-Sep-12	-9.11
30-Oct-12	9.89	9.05	4.30	30-Oct-12	-9.05
29-Jan-13	9.88	9.04	4.35	29-Jan-13	-9.04
27-Feb-13	9.95	9.11	4.32	27-Feb-13	-9.11
27-Mar-13	10.11	9.27	4.39	27-Mar-13	-9.27
22-Apr-13	10.02	9.18	4.02	22-Apr-13	-9.18
26-Jun-13	10.16	9.32		26-Jun-13	-9.32
29-Jul-13	10.14	9.30	4.01	29-Jul-13	-9.30
28-Aug-13	10.13	9.29	3.98	28-Aug-13	-9.29
26-Sep-13	9.99	9.15	4.58	26-Sep-13	-9.15
28-Oct-13	10.09	9.25	4.21	28-Oct-13	-9.25
27-Nov-13	9.95	9.11	4.09	27-Nov-13	-9.11
29-Jan-14	10.04	9.20	4.17	29-Jan-14	-9.20
26-Feb-14	10.07	9.23	4.11	26-Feb-14	-9.23
26-Mar-14	10.19	9.35	4.29	26-Mar-14	-9.35
28-May-14	10.14	9.30	4.16	28-May-14	-9.30
26-Jun-14	10.19	9.35	4.12	26-Jun-14	-9.35
29-Jul-14	10.27	9.43	5.00	29-Jul-14	-9.43
25-Aug-14	10.06	9.22	5.12	25-Aug-14	-9.22



29-Sep-14	10.05	9.21	5.07
29-Oct-14	10.02	9.18	4.96
26-Nov-14	10.07	9.23	4.32
28-Jan-15	10.14	9.30	4.39
24-Feb-15	10.19	9.35	4.45
24-Mar-15	10.23	9.39	4.38
29-Apr-15	10.42	9.58	4.52
27-May-15	10.41	9.57	5.53
26-Jun-15	10.46	9.62	5.56
29-Jul-15	10.43	9.59	5.46
28-Sep-15	10.34	9.50	5.25
27-Oct-15	10.29	9.45	5.37
25-Feb-16	10.25	9.41	6.11
27-Jun-16	10.33	9.49	5.54
30-Aug-16	10.39	9.55	5.16
25-Oct-16	10.16	9.32	4.88
26-Feb-17	10.03	9.19	5.14
24-May-17	10.05	9.21	4.751
28-Aug-17	9.92	9.08	4.839

29-Sep-14	-9.21
29-Oct-14	-9.18
26-Nov-14	-9.23
28-Jan-15	-9.30
24-Feb-15	-9.35
24-Mar-15	-9.39
29-Apr-15	-9.58
27-May-15	-9.57
26-Jun-15	-9.62
29-Jul-15	-9.59
28-Sep-15	-9.50
27-Oct-15	-9.45
25-Feb-16	-9.41
27-Jun-16	-9.49
30-Aug-16	-9.55
25-Oct-16	-9.32
26-Feb-17	-9.19
24-May-17	-9.21
28-Aug-17	-9.08

**Piezometer No 163****Bi-monthly 2****Location:** Stringybark Creek wetland, Riding for the Disabled, Gregadoo Rd**County & Parish:** Wynyard County, Rowan Parish**Bore Depth:** 8.50m**Extension:** Measured September 09 at 0.40

Diameter of steel casing =

**Zone:** 55**Eastings:** 532901.036**Northings:** 6107278.157**Altitude** (height of piezometer above sea level): 205.030**Accuracy:** dGPS Nov 08 B. Donaldson

FMWT: Field measurement of water table

TWTD: True water table depth ( depth to water table from ground level)

Field measurement of water table is measured to the nearest 0.1 of a metre

DATE	FMWT (m)	TWTD (m)	EC (ds/m)	COMMENTS	DATE	TWTD (m below)
31-Aug-07	DRY	DRY	DRY		31-Aug-07	
28-Sep-07	DRY	DRY	DRY		28-Sep-07	
31-Oct-07	DRY	DRY	DRY		31-Oct-07	
24-Dec-07	DRY	DRY	DRY		24-Dec-07	
29-Feb-08	DRY	DRY	DRY		29-Feb-08	
30-Apr-08	DRY	DRY	DRY		30-Apr-08	
30-Jun-08	DRY	DRY	DRY		30-Jun-08	
30-Aug-08				Unable to locate key	30-Aug-08	
30-Oct-08				Unable to locate key	30-Oct-08	
24-Nov-08	DRY	DRY	DRY		24-Nov-08	
28-Jan-09	DRY	DRY	DRY		28-Jan-09	
23-Feb-09	DRY	DRY	DRY		23-Feb-09	
26-Mar-09	DRY	DRY	DRY		26-Mar-09	
25-May-09	DRY	DRY	DRY		25-May-09	
26-Aug-09	DRY	DRY	DRY		26-Aug-09	
28-Sep-09	DRY	DRY	DRY		28-Sep-09	
21-Dec-09	DRY	DRY	DRY		21-Dec-09	
28-Apr-10	DRY	DRY	DRY		28-Apr-10	
26-Jul-10	DRY	DRY	DRY		26-Jul-10	
1-Nov-10	DRY	DRY	DRY		1-Nov-10	
24-Jan-11	DRY	DRY	DRY		24-Jan-11	
28-Apr-11	DRY	DRY			28-Apr-11	
2-May-11	DRY	DRY			2-May-11	
27-May-11	DRY	DRY			27-May-11	
28-Jun-11	DRY	DRY			28-Jun-11	
26-Jul-11	DRY	DRY			26-Jul-11	
27-Jan-12	DRY	DRY			27-Jan-12	
24-Apr-12	DRY	DRY			24-Apr-12	
28-Jul-12	DRY	DRY			28-Jul-12	
30-Oct-12	DRY	DRY			30-Oct-12	
29-Jan-13	DRY	DRY			29-Jan-13	

22-Apr-13	DRY	DRY
29-Jul-13	DRY	DRY
28-Oct-13	DRY	DRY
29-Jan-14	DRY	DRY
28-Apr-14	DRY	DRY
26-Jun-14	DRY	DRY
29-Jul-14	DRY	DRY
29-Oct-14	DRY	DRY
28-Jan-15	DRY	DRY
29-Apr-15	DRY	DRY
29-Jul-15	DRY	DRY
27-Oct-15	DRY	DRY
24-Nov-15	DRY	DRY
27-Jan-16	DRY	DRY
25-Feb-16	DRY	DRY
25-Oct-16	DRY	DRY
26-Feb-17	DRY	DRY
24-May-17	DRY	DRY
28-Aug-17	DRY	DRY

22-Apr-13
29-Jul-13
28-Oct-13
29-Jan-14
28-Apr-14
26-Jun-14
29-Jul-14
29-Oct-14
28-Jan-15
29-Apr-15
29-Jul-15
27-Oct-15
24-Nov-15
27-Jan-16
25-Feb-16
25-Oct-16
26-Feb-17
24-May-17
28-Aug-17

## Piezometer No 180

**Location:** Kimberley Dr, off F Kimberley Dr, off Plumpton Road, opposite 47 Plumpton Road

**County & Parish:** County: Wynyard, Parish: South Wagga Wagga

**Bore Depth:** 6.7m

**Extension:** 0.54

**Diameter of steel casing:**

**Zone:** 55

**Eastings:** 533306.600

**Northings:** 6109374.076

**Altitude** (height of piezometer above sea level): 195.633

**Accuracy:**

**Status:** Active Dry

**FMWT:** Field measurement of water table

**TWTD:** True water table depth (depth to water table from ground level)

Field measurement of water table is measured to the nearest 0.01 of a metre

**Date Drilled:** 17-Jun-10

Date	FMWT (m)	TWTD (m)	EC (dS/m)	COMMENT	DATE	TWTD (m below)
26-Jul-10	DRY	DRY				
30-Aug-10	DRY	DRY				
27-Sep-10	DRY	DRY				
1-Nov-10	DRY	DRY				
24-Nov-10	DRY	DRY				
24-Jan-11	DRY	DRY				
1-Mar-11	DRY	DRY				
28-Mar-11	DRY	DRY				
28-Apr-11	DRY	DRY				
27-May-11	DRY	DRY				
28-Jun-11	DRY	DRY				
26-Sep-11	DRY	DRY				
28-Nov-11	DRY	DRY				
27-Jan-12	DRY	DRY				
27-Feb-12	DRY	DRY				
26-Mar-12	DRY	DRY				
24-Apr-12	DRY	DRY				
29-May-12	DRY	DRY				
26-Jun-12	DRY	DRY				
29-Aug-12	DRY	DRY				
26-Sep-12	DRY	DRY				
30-Oct-12	DRY	DRY				
28-Nov-12	DRY	DRY				
29-Jan-13	DRY	DRY				
27-Feb-13	DRY	DRY				
27-Mar-13	DRY	DRY				
22-Apr-13	DRY	DRY				
26-Jun-13	DRY	DRY				
29-Jul-13	DRY	DRY				
28-Aug-13	DRY	DRY				
26-Sep-13	DRY	DRY				



28-Oct-13	DRY	DRY
27-Nov-13	DRY	DRY
29-Jan-14	DRY	DRY
26-Feb-14	DRY	DRY
26-Mar-14	DRY	DRY
28-May-14	DRY	DRY
29-Oct-14	DRY	DRY
26-Nov-14	DRY	DRY
28-Jan-15	DRY	DRY
24-Mar-15	DRY	DRY
29-Apr-15	DRY	DRY
27-May-15	DRY	DRY
26-Jun-15	DRY	DRY
29-Jul-15	DRY	DRY
28-Sep-15	DRY	DRY
27-Oct-15	DRY	DRY
24-Nov-15	DRY	DRY
27-Jan-16	DRY	DRY
25-Feb-16	DRY	DRY
0-Jan-00	DRY	DRY
27-Jun-16	DRY	DRY
0-Jan-00	DRY	DRY
30-Aug-16	DRY	DRY
25-Oct-16	DRY	DRY
26-Feb-17	DRY	DRY
24-May-17	DRY	DRY
28-Aug-17	DRY	DRY

## Piezometer No 181

**Location:** Kimberley Drive, behind 1 Malebo Place

**County & Parish:** County: Wynyard, Parish: South Wagga Wagga

**Bore Depth:** 10.00m

**Extension:** Ground level

**Diameter of steel casing:**

**Zone:** 55

**Eastings:** 533097.236

**Northings:** 6109440.728

**Altitude** (height of piezometer above sea level): 205.568

**Accuracy:**

**Status:** Active

**FMWT:** Field measurement of water table

**TWTD:** True water table depth (depth to water table from ground level)

Field measurement of water table is measured to the nearest 0.01 of a metre

**Date Drilled:** 17-Jun-10

Date	FMWT (m)	TWTD (m)	EC (dS/m)	COMMENT	DATE	TWTD (m below)
26-Jul-10	8.92	8.92	5.7		26-Jul-10	-8.92
30-Aug-10	8.515	8.515	4.92		30-Aug-10	-8.515
27-Sep-10	8.42	8.42	5.72		27-Sep-10	-8.42
1-Nov-10	8.1	8.1	5.74		1-Nov-10	-8.1
24-Nov-10	8.05	8.05	6.3		24-Nov-10	-8.05
24-Jan-11	8.08	8.08	7.33		24-Jan-11	-8.08
1-Mar-11	8.08	8.08	6.24		1-Mar-11	-8.08
28-Mar-11	8.23	8.23	6.39		28-Mar-11	-8.23
28-Apr-11	8.37	8.37	6.5		28-Apr-11	-8.37
27-May-11	8.33	8.33	6.39		27-May-11	-8.33
28-Jun-11	8.47	8.47	6.22		28-Jun-11	-8.47
26-Jul-11	8.29	8.29	6.26		26-Jul-11	-8.29
29-Aug-11	8.05	8.05	6.47		29-Aug-11	-8.05
26-Sep-11	8.1	8.1	6.66		26-Sep-11	-8.1
27-Oct-11	8.29	8.29	7.04		27-Oct-11	-8.29
28-Nov-11	8.41	8.41	7.33		28-Nov-11	-8.41
27-Jan-12	8.55	8.55	6.82		27-Jan-12	-8.55
27-Feb-12	8.74	8.74	6.71		27-Feb-12	-8.74
26-Mar-12	8.46	8.46	6.69		26-Mar-12	-8.46
24-Apr-12	8.58	8.58	6.32		24-Apr-12	-8.58
29-May-12	8.72	8.72	6.54		29-May-12	-8.72
26-Jun-12	8.53	8.53	6.42		26-Jun-12	-8.53
29-Aug-12	7.78	7.78	6.12		29-Aug-12	-7.78
26-Sep-12	7.78	7.78	6.62		26-Sep-12	-7.78
30-Oct-12	8.03	8.03	6.88		30-Oct-12	-8.03
28-Nov-12	8.16	8.16	7.02		28-Nov-12	-8.16
29-Jan-13	8.41	8.41	6.81		29-Jan-13	-8.41
27-Feb-13	8.58	8.58	6.86		27-Feb-13	-8.58
22-Apr-13	8.72	8.72	7.14		22-Apr-13	-8.72
26-Jun-13	8.88	8.88			26-Jun-13	-8.88
29-Jul-13	8.87	8.87	6.72		29-Jul-13	-8.87

28-Aug-13	8.75	8.75	6.84
26-Sep-13	8.59	8.59	6.65
28-Oct-13	8.73	8.73	6.84
27-Nov-13	8.78	8.78	6.76
29-Jan-14	8.94	8.94	6.92
26-Feb-14	8.96	8.96	6.84
26-Mar-14	9.06	9.06	6.94
28-May-14	9.08	9.08	7.02
26-Jun-14	9.1	9.1	6.97
29-Jul-14	9.14	9.14	6.27
25-Aug-14	9.22	9.22	6.36
29-Sep-14	9.12	9.12	6.52
29-Oct-14	9.13	9.13	6.79
26-Nov-14	9.17	9.17	6.89
28-Jan-15	9.19	9.19	6.81
24-Feb-15	9.25	9.25	6.75
24-Mar-15	9.31	9.31	6.81
29-Apr-15	9.36	9.36	6.72
27-May-15	9.38	9.38	6.09
26-Jun-15	9.39	9.39	6.06
29-Jul-15	8.96	8.96	6.02
28-Sep-15	8.92	8.92	6.11
27-Oct-15	9.06	9.06	6.19
24-Nov-15	9.12	9.12	6.54
27-Jan-16	9.22	9.22	6.42
25-Feb-16	9.24	9.24	6.37
27-Jun-16	8.07	8.07	6.44
30-Aug-16	7.21	7.21	6.21
25-Oct-16	7.82	7.82	6.41
26-Feb-17	8.63	8.63	6.82
24-May-17	8.77	8.77	6.62
28-Aug-17	8.79	8.79	6.71

28-Aug-13	-8.75
26-Sep-13	-8.59
28-Oct-13	-8.73
27-Nov-13	-8.78
29-Jan-14	-8.94
26-Feb-14	-8.96
26-Mar-14	-9.06
28-May-14	-9.08
26-Jun-14	-9.1
29-Jul-14	-9.14
25-Aug-14	-9.22
29-Sep-14	-9.12
29-Oct-14	-9.13
26-Nov-14	-9.17
28-Jan-15	-9.19
24-Feb-15	-9.25
24-Mar-15	-9.31
29-Apr-15	-9.36
27-May-15	-9.38
26-Jun-15	-9.39
29-Jul-15	-8.96
28-Sep-15	-8.92
27-Oct-15	-9.06
24-Nov-15	-9.12
27-Jan-16	-9.22
25-Feb-16	-9.24
27-Jun-16	-8.07
30-Aug-16	-7.21
25-Oct-16	-7.82
26-Feb-17	-8.63
24-May-17	-8.77
28-Aug-17	-8.79

**Piezometer No 182****Location:** 2 Stirling Blvd, Tatton (opposite ABC Childcare)**County & Parish:** County: Wynyard, Parish: South Wagga Wagga**Bore Depth:** 12.00m**Extension:** 0.53**Diameter of steel casing:****Zone:** 55**Eastings:** 532951.853**Northings:** 6108951.542**Altitude** (height of piezometer above sea level): 198.646**Accuracy:****FMWT:** Field measurement of water table**TWTD:** True water table depth (depth to water table from ground level)

Field measurement of water table is measured to the nearest 0.01 of a metre

**Date Drilled** 18-Jun-10

Date	FMWT (m)	TWTD (m)	EC (dS/m)	COMMENT	DATE	TWTD (m below)
26-Jul-10	3.25	2.72	1.756		26-Jul-10	-2.72
30-Aug-10	3.01	2.48	1.752		30-Aug-10	-2.48
27-Sep-10	2.71	2.18	1.751		27-Sep-10	-2.18
1-Nov-10	2.46	1.93	1.396		1-Nov-10	-1.93
24-Nov-10	2.48	1.95	1.318		24-Nov-10	-1.95
24-Jan-11	2.6	2.07	0.561		24-Jan-11	-2.07
1-Mar-11	2.54	2.01	0.659		1-Mar-11	-2.01
28-Mar-11	2.82	2.29	0.607		28-Mar-11	-2.29
28-Apr-11	2.97	2.44	0.687		28-Apr-11	-2.44
27-May-11	3.04	2.51	0.686		27-May-11	-2.51
28-Jun-11	3.2	2.67	0.71		28-Jun-11	-2.67
26-Jul-11	3.22	2.69	0.797		26-Jul-11	-2.69
29-Aug-11	2.93	2.4	0.654		29-Aug-11	-2.4
26-Sep-11	3.01	2.48	0.934		26-Sep-11	-2.48
27-Oct-11	3.07	2.54	0.949		27-Oct-11	-2.54
28-Nov-11	3.05	2.52	1.07		28-Nov-11	-2.52
27-Jan-12	3.18	2.65	1.065		27-Jan-12	-2.65
27-Feb-12	3.27	2.74	1.102		27-Feb-12	-2.74
26-Mar-12	2.58	2.05	1.17		26-Mar-12	-2.05
24-Apr-12	2.73	2.2	1.09		24-Apr-12	-2.2
29-May-12	3.01	2.48	1.087		29-May-12	-2.48
26-Jun-12	3.03	2.5	1.131		26-Jun-12	-2.5
29-Aug-12	2.65	2.12	1.259		29-Aug-12	-2.12
26-Sep-12	2.85	2.32	1.299		26-Sep-12	-2.32
30-Oct-12	3.01	2.48	1.436		30-Oct-12	-2.48
28-Nov-12	3.12	2.59	1.591		28-Nov-12	-2.59
29-Jan-13	3.59	3.06	1.522		29-Jan-13	-3.06
27-Feb-13	3.76	3.23	1.592		27-Feb-13	-3.23
27-Mar-13	3.86	3.33	1.603		27-Mar-13	-3.33
22-Apr-13	3.86	3.33	1.597		22-Apr-13	-3.33

26-Jun-13	3.67	3.14	
29-Jul-13	3.55	3.02	1.522
28-Aug-13	3.48	2.95	1.472
26-Sep-13	3.36	2.83	1.481
28-Oct-13	3.63	3.1	1.535
27-Nov-13	3.63	3.1	1.567
29-Jan-14	3.98	3.45	1.612
26-Feb-14	4.03	3.5	1.648
26-Mar-14	4.14	3.61	1.662
28-May-14	4.03	3.5	1.582
26-Jun-14	3.72	3.19	1.455
29-Jul-14	3.74	3.21	1.512
25-Aug-14	3.66	3.13	1.502
29-Sep-14	3.64	3.11	1.495
29-Oct-14	3.76	3.23	1.407
26-Nov-14	3.88	3.35	1.547
28-Jan-15	3.91	3.38	1.601
24-Feb-15	4.08	3.55	1.577
24-Mar-15	4.17	3.64	1.539
29-Apr-15	4.28	3.75	1.572
27-May-15	4.32	3.79	1.513
26-Jun-15	4.09	3.56	1.509
29-Jul-15	3.77	3.24	1.486
28-Sep-15	3.35	2.82	1.477
27-Oct-15	3.57	3.04	1.492
24-Nov-15	3.63	3.1	1.511
27-Jan-16	3.94	3.41	1.402
25-Feb-16	4.24	3.71	1.312
27-Jun-16	3.79	3.26	1.235
30-Aug-16	2.87	2.34	1.211
25-Oct-16	2.5	1.97	1.281
26-Feb-17	3.96	3.43	1.453
24-May-17	4.51	3.98	1.363
28-Aug-17	4.36	3.83	1.319

26-Jun-13	-3.14
29-Jul-13	-3.02
28-Aug-13	-2.95
26-Sep-13	-2.83
28-Oct-13	-3.1
27-Nov-13	-3.1
29-Jan-14	-3.45
26-Feb-14	-3.5
26-Mar-14	-3.61
28-May-14	-3.5
26-Jun-14	-3.19
29-Jul-14	-3.21
25-Aug-14	-3.13
29-Sep-14	-3.11
29-Oct-14	-3.23
26-Nov-14	-3.35
28-Jan-15	-3.38
24-Feb-15	-3.55
24-Mar-15	-3.64
29-Apr-15	-3.75
27-May-15	-3.79
26-Jun-15	-3.56
29-Jul-15	-3.24
28-Sep-15	-2.82
27-Oct-15	-3.04
24-Nov-15	-3.1
27-Jan-16	-3.41
25-Feb-16	-3.71
27-Jun-16	-3.26
30-Aug-16	-2.34
25-Oct-16	-1.97
26-Feb-17	-3.43
24-May-17	-3.98
28-Aug-17	-3.83



# ATTACHMENT C      CSU      LABORATORY      ANALYSIS REPORT

NGH Environmental  
Suite 1/39 Fitzmaurice Street  
Wagga Wagga NSW 2650  
Attention: Nicole Isles

Friday, December 8, 2017



NATA Accredited Laboratory  
Number: 9597

Accredited for compliance with  
ISO/IEC 17025 - Testing

## LABORATORY ANALYSIS REPORT

Report Number: 1712-0004

Page 1 of 2

For all enquiries related to this report please quote document number: 1712-0004

<u>Facility:</u>		<u>Order #</u>			
<u>Sample Type</u>		<u>Collected By</u>		<u>Date Received</u>	
Soil		S. Anderson		01-December-2017	
<u>EAL ID</u>	<u>Client ID.</u> Date/Time sample taken	<u>Test</u>	<u>Result (units)</u>	<u>Method Reference</u>	<u>Limit of Reporting</u>
17Dec-0016	<b>17-256-S1</b> 30.11.17 4.30pm	Conductivity (1:5 soil/water)	50 µS/cm	LTM-S-003	1
		pH (1:5 soil/water)	5.8 pH units	LTM-S-004	
17Dec-0017	<b>17-256-S2</b> 30.11.17 4.30pm	Conductivity (1:5 soil/water)	59 µS/cm	LTM-S-003	1
		pH (1:5 soil/water)	5.7 pH units	LTM-S-004	
17Dec-0018	<b>17-256-S3</b> 30.11.17 4.30pm	Conductivity (1:5 soil/water)	38 µS/cm	LTM-S-003	1
		pH (1:5 soil/water)	5.9 pH units	LTM-S-004	
17Dec-0019	<b>17-256-S4</b> 30.11.17 4.30pm	Conductivity (1:5 soil/water)	71 µS/cm	LTM-S-003	1
		pH (1:5 soil/water)	6.1 pH units	LTM-S-004	
17Dec-0020	<b>17-256-S5</b> 30.11.17 4.30pm	Conductivity (1:5 soil/water)	52 µS/cm	LTM-S-003	1
		pH (1:5 soil/water)	6.3 pH units	LTM-S-004	

**Note:**

\* NATA Accreditation does not cover the performance of this service.

NGH Environmental  
Suite 1/39 Fitzmaurice Strret  
Wagga Wagga NSW 2650  
Attention: Nicole Isles

Friday, December 8, 2017

NATA Accredited Laboratory  
Number: 9597Accredited for compliance with  
ISO/IEC 17025 - Testing

## LABORATORY ANALYSIS REPORT

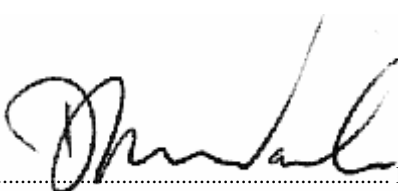
Report Number: 1712-0004

Page 2 of 2

*For all enquiries related to this report please quote document number: 1712-0004*

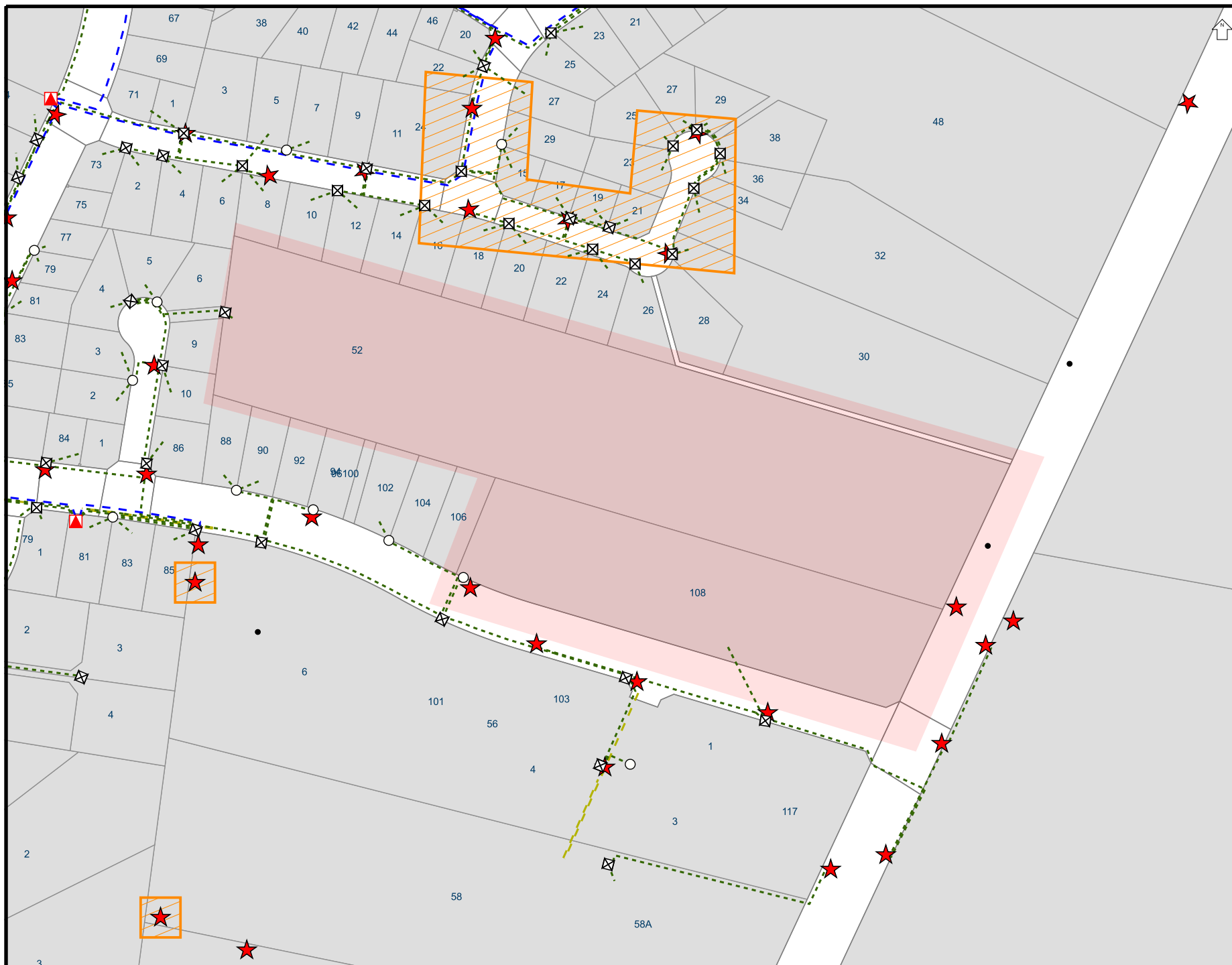
<b><u>Facility:</u></b>	<b><u>Order #</u></b>	
<b><u>Sample Type</u></b>	<b><u>Collected By</u></b>	<b><u>Date Received</u></b>
Soil	S. Anderson	01-December-2017

<b><u>EAL ID</u></b>	<b><u>Client ID.</u></b> Date/Time sample taken	<b><u>Test</u></b>	<b><u>Result (units)</u></b>	<b><u>Method Reference</u></b>	<b><u>Limit of Reporting</u></b>
----------------------	--	--------------------	------------------------------	--------------------------------	----------------------------------

Signed .....  David Wade, Laboratory Manager.

*All samples analysed as received.  
All soil results are reported on a dry basis.  
The EAL takes no responsibility for the end use of results within this report.  
This report shall not be reproduced except in full.  
This report replaces any previously issued report*

## **ATTACHMENT 2      PUBLIC UTILITIES MAPS**



Overhead wires not shown  
LOOK UP & LIVE!

## LEGEND

- LV Underground Cable
- HV Underground Cable
- Underground Pipe
- ★ Underground Earth or Wires
- ▲ Ground Substation
- Pole
- X Cubicle
- Pit
- Area of Interest

## Critical Assets

Contact Essential Energy  
on 13 23 91

- X Zone Substation
- Underground Cable
- Underground Fibre

## Proposed Works

- X Area of proposed works

Proposed assets are shown as  
orange symbols

THE INFORMATION ON THIS  
MAP MAY NOT BE  
ACCURATE.

If details are incorrect,  
please notify  
Essential Energy on  
13 23 91  
(or fax 1800 354 636)

ISSUE DATE: 25/05/2018

You must resubmit your  
request if you have not  
started work within 4 weeks  
of the 'Issue Date' above

A4 SCALE: 1:2549



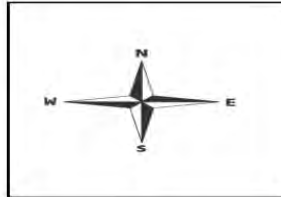
Job Number: 14284411

Sequence number: 71837382

Job location: Brindabella Drive, Tatton

Map  
Centre:





Type: Telco  
Technology: Fibre  
Assets

IN-SERVICE:  
Cable/ Duct/ Trench  
DESIGNED/CONSTRUCTED:  
Cable/ Duct/ Trench

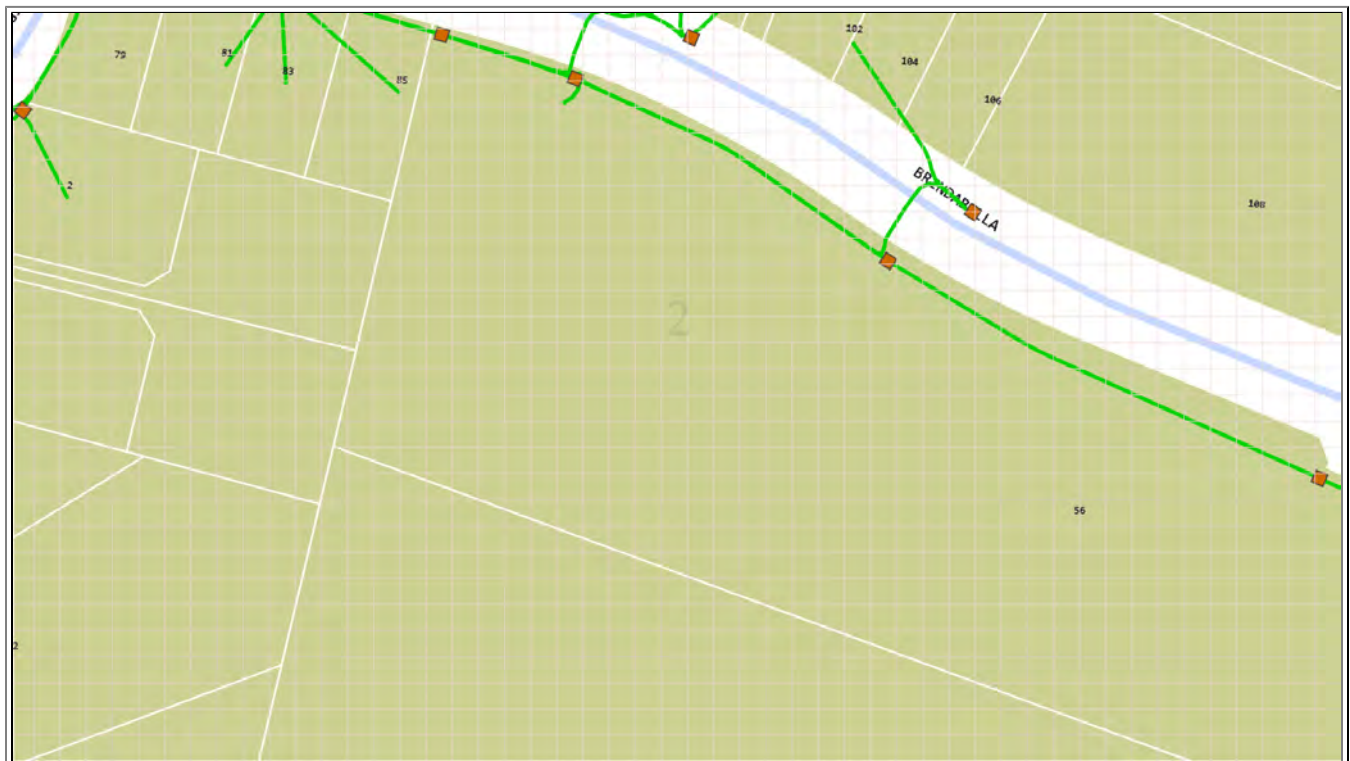
Pit/Manhole

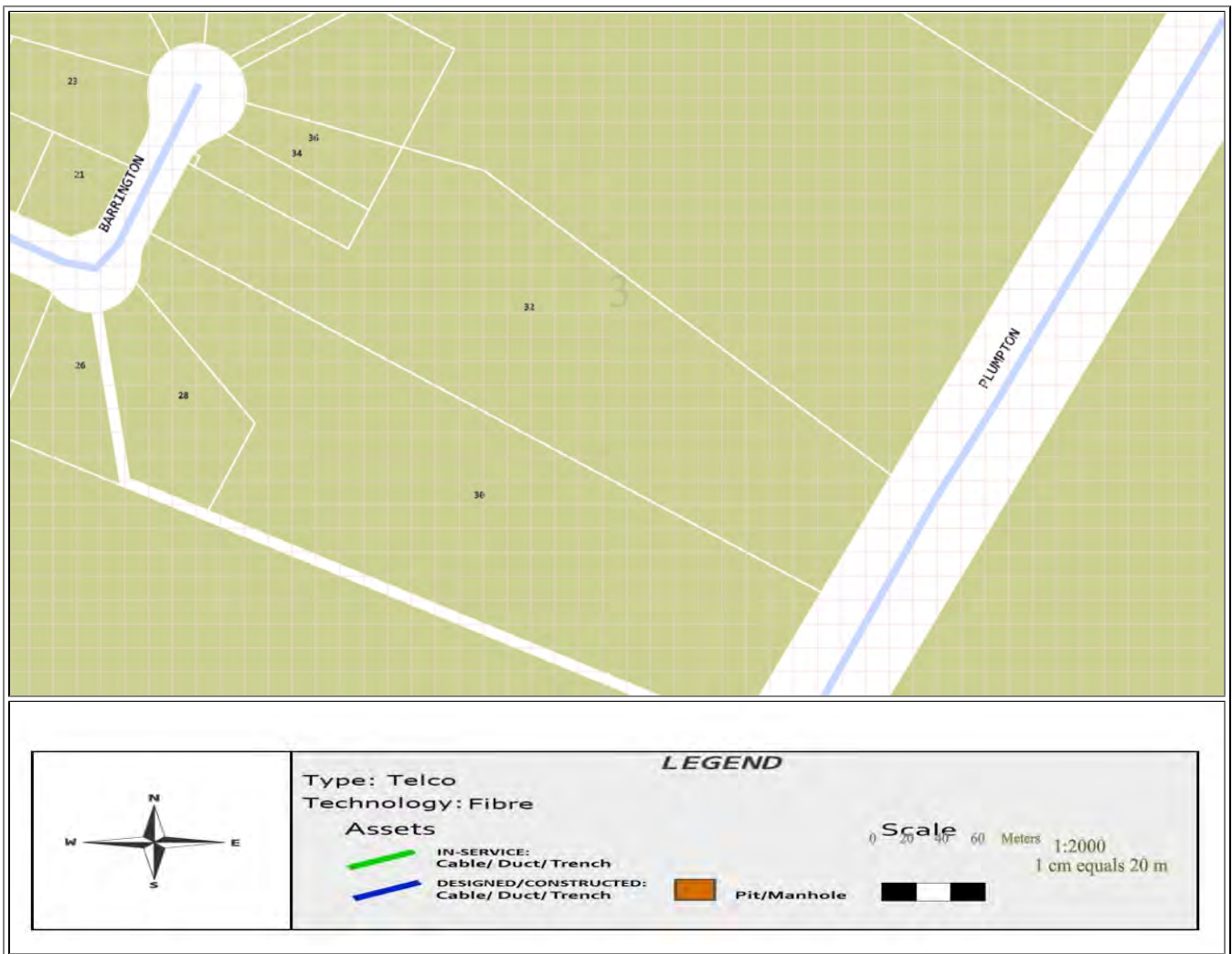


#### LEGEND

Scale  
0 20 40 60 Meters 1:2000  
1 cm equals 20 m





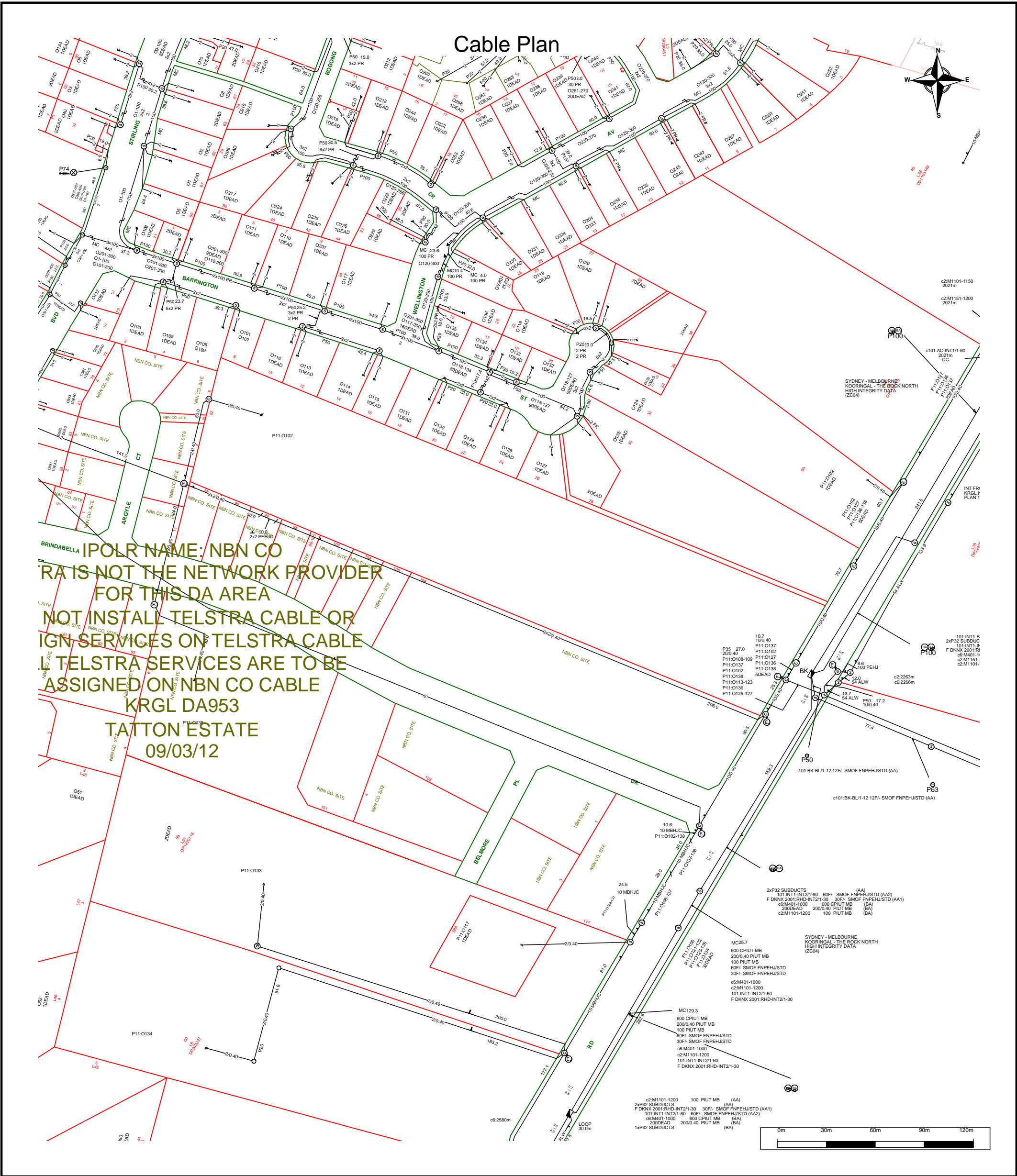






## Emergency Contacts

You must immediately report any damage to **nbn**<sup>TM</sup> network that you are/become aware of. Notification may be by telephone - 1800 626 329.



IPOLR NAME: NBN CO  
RA IS NOT THE NETWORK PROVIDER  
FOR THIS DA AREA  
NOT INSTALL TELSTRA CABLE OR  
IGN SERVICES ON TELSTRA CABLE  
TELSTRA SERVICES ARE TO BE  
ASSIGNED ON NBN CO CABLE  
KRGL DA953  
TATTON ESTATE  
09/03/12

	<p>For all Telstra DBYD plan enquiries - email - Telstra.Plans@team.telstra.com For urgent onsite contact only - ph 1800 653 935 (bus hrs)</p>	<p>Sequence Number: 71837383</p>
<p>TELSTRA CORPORATION LIMITED A.C.N. 051 775 556</p>		<p><b>CAUTION: Fibre optic and/ or major network present in plot area. Please read the Duty of Care and contact Telstra Plan Services should you require any assistance.</b></p>
<p>Generated On 25/05/2018 10:50:19</p>		

The above plan must be viewed in conjunction with the Mains Cable Plan on the following page

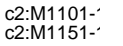
WARNING - Due to the nature of Telstra underground plant and the age of some cables and records, it is impossible to ascertain the precise location of all Telstra plant from Telstra's plans. The accuracy and/or completeness of the information supplied can not be guaranteed as property boundaries, depths and other natural landscape features may change over time, and accordingly the plans are indicative only. Telstra does not warrant or hold out that its plans are accurate and accepts no responsibility for any inaccuracy shown on the plans.

It is your responsibility to locate Telstra's underground plant by careful hand pot-holing prior to any excavation in the vicinity and to exercise due care during that excavation.

Please read and understand the information supplied in the duty of care statement attached with the Telstra plans. TELSTRA WILL SEEK COMPENSATION FOR LOSS CAUSED BY DAMAGE TO ITS PLANT.

Telstra plans and information supplied are valid for 60 days from the date of issue. If this timeframe has elapsed, please reapply for plans.

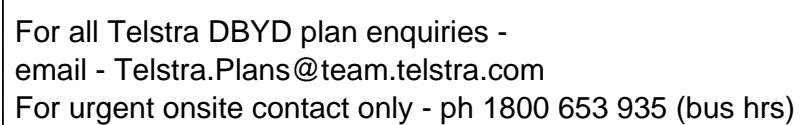
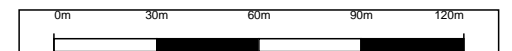




SYDNEY - MELBOURNE  
KOORINGAL - THE ROCK NORTH  
HIGH INTEGRITY DATA  
(ZC04)

INT TO CAC  
KRGL KOORINGAL  
PLAN 53

BRINDABELLA  
POLAR NAME: NBN CO  
RA IS NOT THE NETWORK PROVIDER  
FOR THIS DA AREA  
NOT INSTALL TELSTRA CABLE OR  
IGN SERVICES ON TELSTRA CABLE  
TELSTRA SERVICES ARE TO BE  
ASSIGNED ON NBN CO CABLE  
KRGL DA953  
TATTON ESTATE  
09/03/12

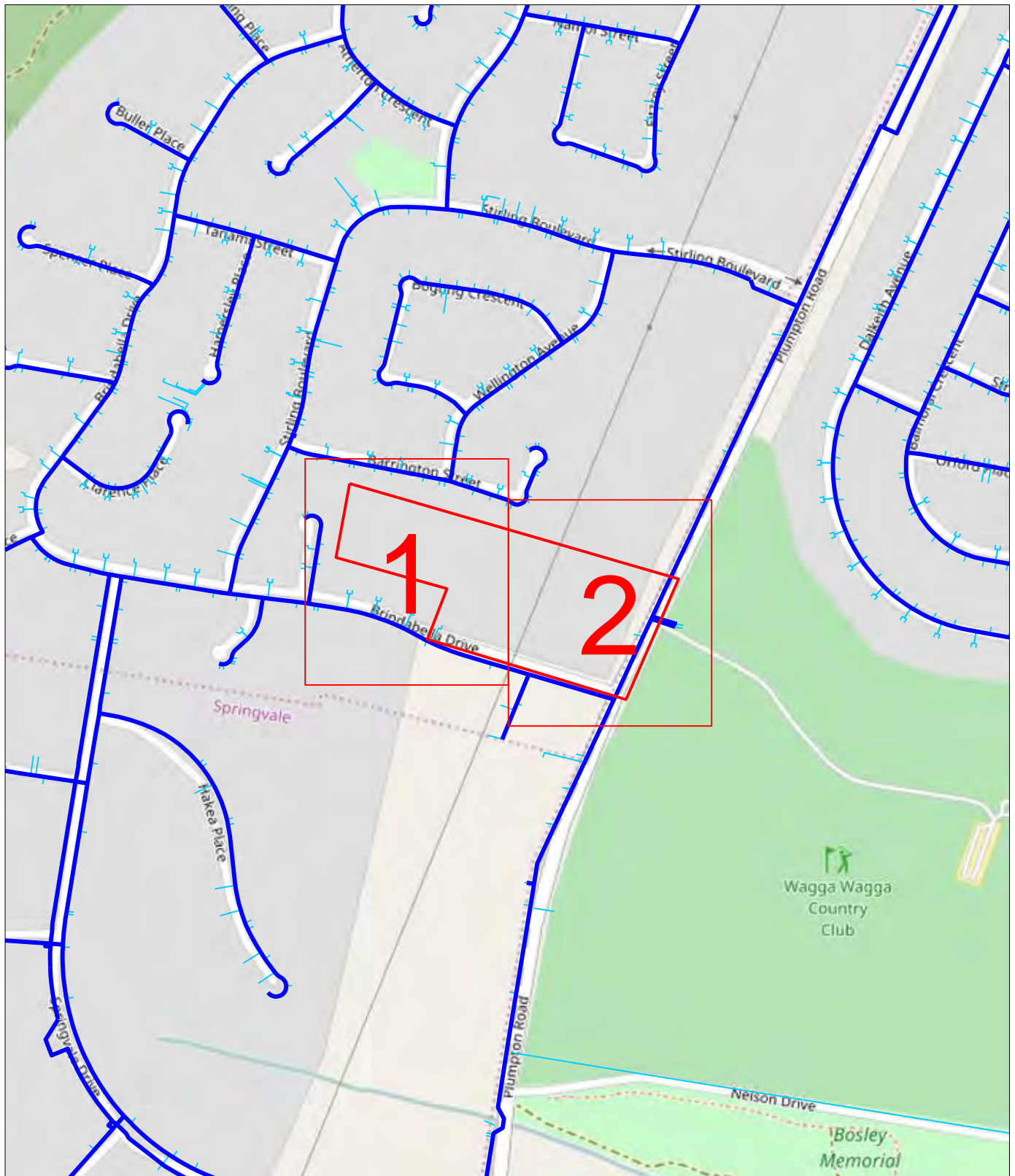








Generated On 25/05/2018 10:50:20

CAUTION: Fibre optic and/ or major network present in plot area. Please read the Duty of Care and contact Telstra Plan Services should you require any assistance.


Telstra plans and information supplied are valid for 60 days from the date of issue. If this timeframe has elapsed, please reapply for plans.

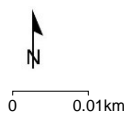
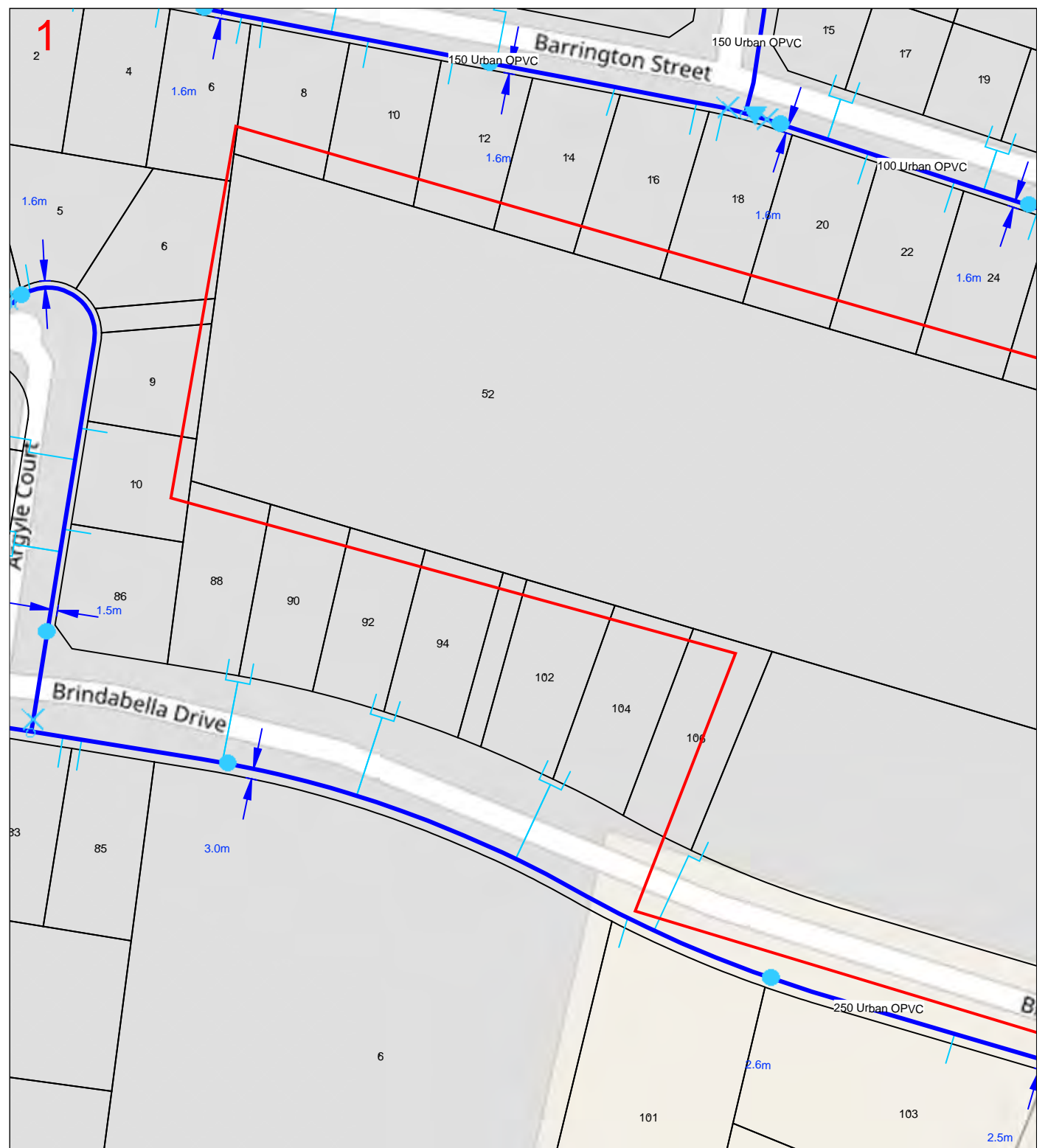
# Overview Map

**Sequence No: 71837386**
**Brindabella Drive Tatton**

**LEGEND:**

- |   |            |   |                            |
|---|------------|---|----------------------------|
|  | Detail Map |  | Water Main                 |
|   |            |  | Service Connection Pipe    |
|   |            |  |                            |
|   |            |  | Proposed Construction Area |
|   |            |  | Affected DBYD Work Area    |

Riverina Water County Council does not accept any liability for inaccuracies or any lack of information on the plans, or any damage to Riverina Water County Council assets resulting from, or in connection with the information provided.

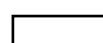


  
 0 0.06km  
 Imagery sourced from Open StreetMaps



























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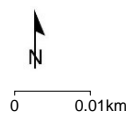
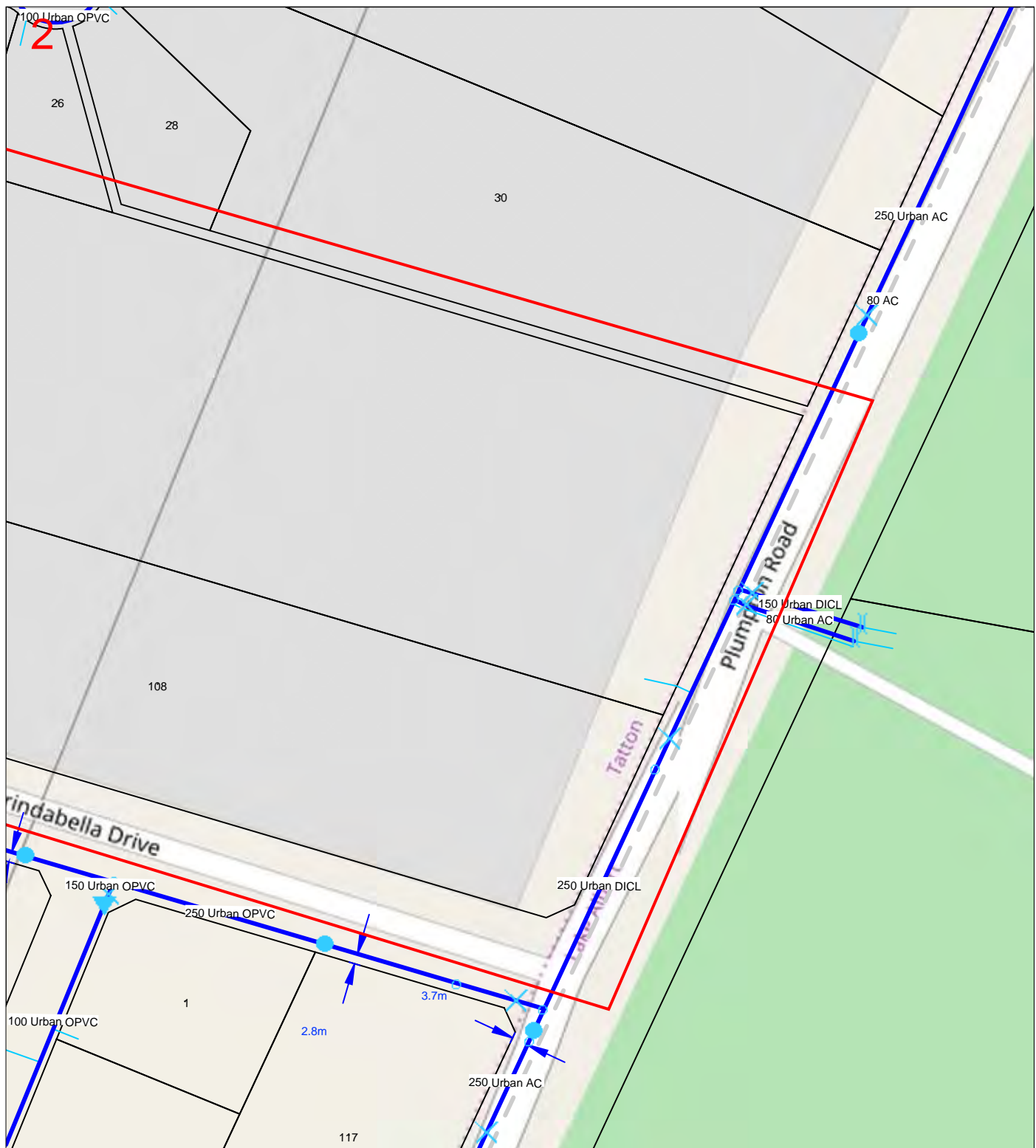
Imagery sourced from Open StreetMaps

#### LEGEND:

-  Property Boundary
-  Proposed Construction Area
-  Affected DBYD Work Area

- |   |  |
|---|--|
|  Nodes - Air_Release_Valve   |  Nodes - Pres_Sustain_Valve         |
|  Nodes - Borehole            |  Nodes - Pump                       |
|  Nodes - Butterfly_Valve     |  Nodes - Reducer                    |
|  Nodes - Check_Valve         |  Nodes - Reservoir                  |
|  Nodes - Cleaning_Port       |  Nodes - Scour_Valve                |
|  Nodes - Closed_Valve        |  Nodes - Standpipe                  |
|  Nodes - Endcap              |  Nodes - Tower                      |
|  Nodes - Gate_Valve          |  Nodes - Treatment_Plant            |
|  Nodes - Hydrant_Single      |  Pipes - Raw                        |
|  Nodes - Junction            |  Pipes - Abandoned                  |
|  Nodes - Meter               |  Pipes                              |
|  Nodes - Pres_Reducing_Valve |  Services - Service Connection Pipe |

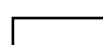




























Riverina Water County Council does not accept any liability for inaccuracies or any lack of information on the plans, or any damage to Riverina Water County Council assets resulting from, or in connection with the information provided.

Imagery sourced from Open StreetMaps

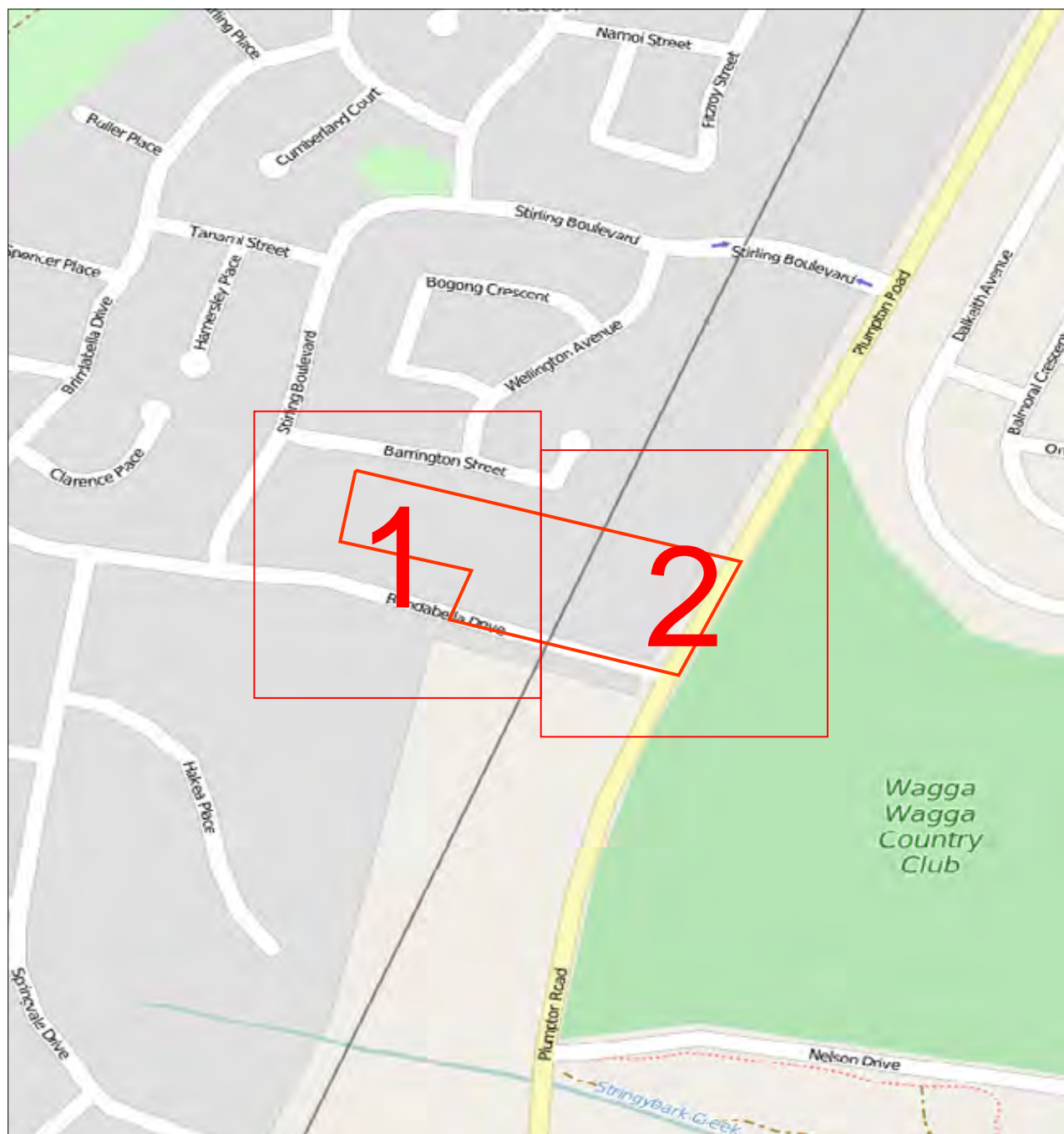
#### LEGEND:

-  Property Boundary
-  Proposed Construction Area
-  Affected DBYD Work Area

- |   |  |
|---|--|
|  Nodes - Air_Release_Valve   |  Nodes - Pres_Sustain_Valve         |
|  Nodes - Borehole            |  Nodes - Pump                       |
|  Nodes - Butterfly_Valve     |  Nodes - Reducer                    |
|  Nodes - Check_Valve         |  Nodes - Reservoir                  |
|  Nodes - Cleaning_Port       |  Nodes - Scour_Valve                |
|  Nodes - Closed_Valve        |  Nodes - Standpipe                  |
|  Nodes - Endcap              |  Nodes - Tower                      |
|  Nodes - Gate_Valve          |  Nodes - Treatment_Plant            |
|  Nodes - Hydrant_Single      |  Pipes - Raw                        |
|  Nodes - Junction            |  Pipes - Abandoned                  |
|  Nodes - Meter               |  Pipes                              |
|  Nodes - Pres_Reducing_Valve |  Services - Service Connection Pipe |



Site Address	Brindabella Drive Tatton 2650	Sequence No	71837384
Name	Miss Stephanie Anderson		
Email	steph.a@nghenvironmental.com.au		



Scale 1: 6000



Enquiry Area



Map Key Area



Site Address	Brindabella Drive Tatton 2650	Sequence No	71837384
Email	steph.a@ngnenvironmental.com.au	Map Reference	Penguin 325G17,325H17



**LEGEND**

	Service Pipe		Field Valve		Delivery Point
	Distribution Pipe		Anode Bed		Gas Regulator Site
	Critical Pipe		CP Test Point Site		Depth
	Transmission Pipe				

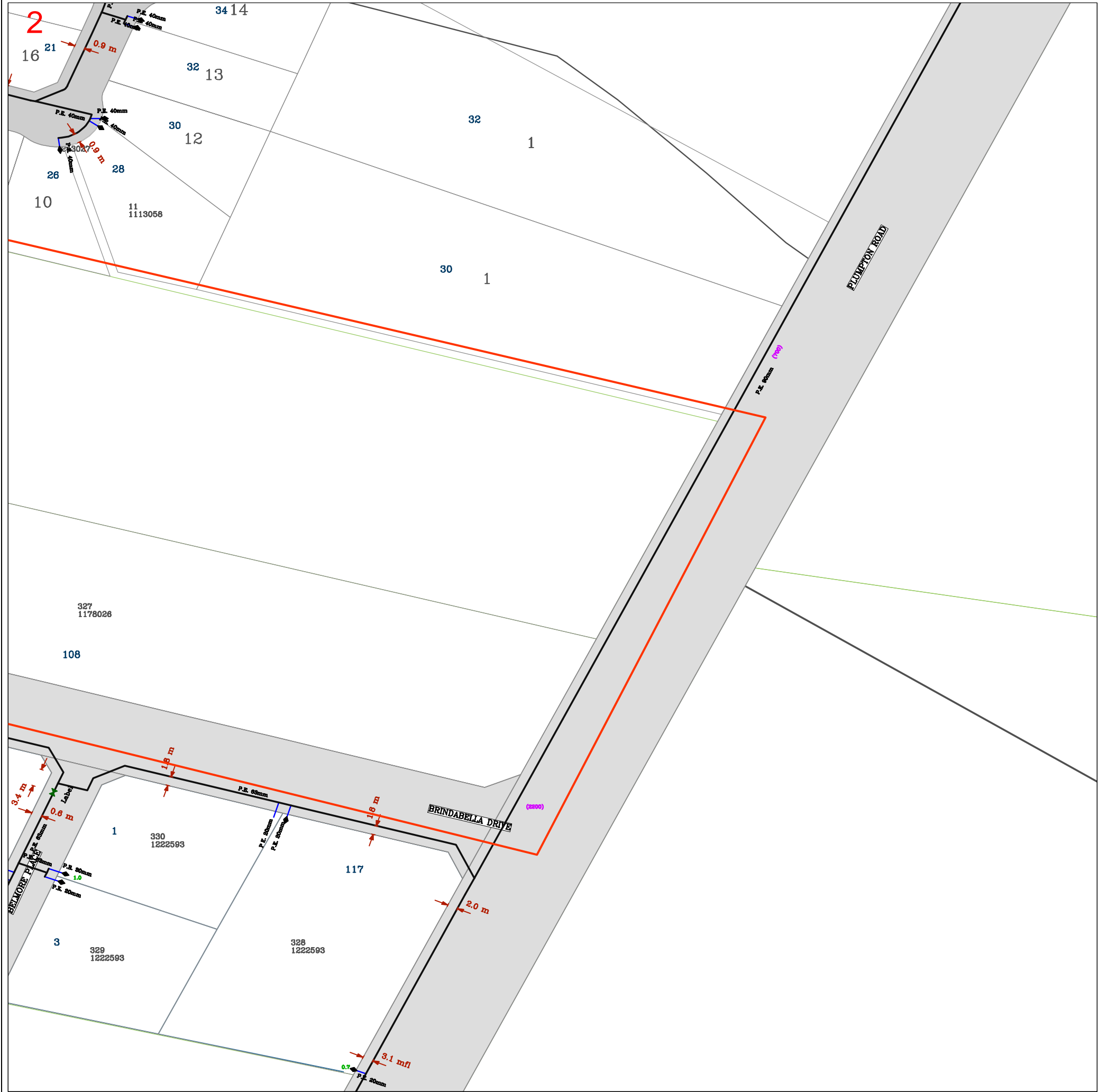
Map Key:

1	2
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Scale 1:1000

0 0.01km

Site Address	Brindabella Drive Tatton 2650	Sequence No	71837384
Email	steph.a@nghenvironmental.com.au	Map Reference	Penguin 325G17,325H17



**LEGEND**

Service Pipe	Field Valve	Delivery Point
Distribution Pipe	Anode Bed	Gas Regulator Site
Critical Pipe	CP Test Point Site	Depth
Transmission Pipe		

Map Key:

1	2
---	---

Scale 1:1000

0 0.01km

NORTH

# **ATTACHMENT 3      TRAFFIC IMPACT ASSESSMENT REPORT**



# **Traffic Impact Assessment**

## **52 Plumpton Road Proposed Residential Rezoning Wagga Wagga, NSW Report September 2017**

Prepared by  
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Lavington NSW 2641  
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### **Document Control**

<b>Version</b>	<b>Date</b>	<b>Issue</b>	<b>Author</b>	<b>Reviewed</b>	<b>Approved</b>
Draft	28/09/2017	A	PJM	PJM	

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## **1. Executive Summary**

### **Proposed residential rezoning – 52 Plumpton Road, Wagga Wagga**

This report provides an assessment of the traffic impacts to support a proposed rezoning application of 52 Plumpton Road, on the corner of Plumpton Road and Brindabella Drive, Wagga Wagga. The subject land is currently zoned R1 General Residential and E2 Environmental Conservation and it is proposed to rezone the portion of land zoned E2 to R1 to allow for residential development.

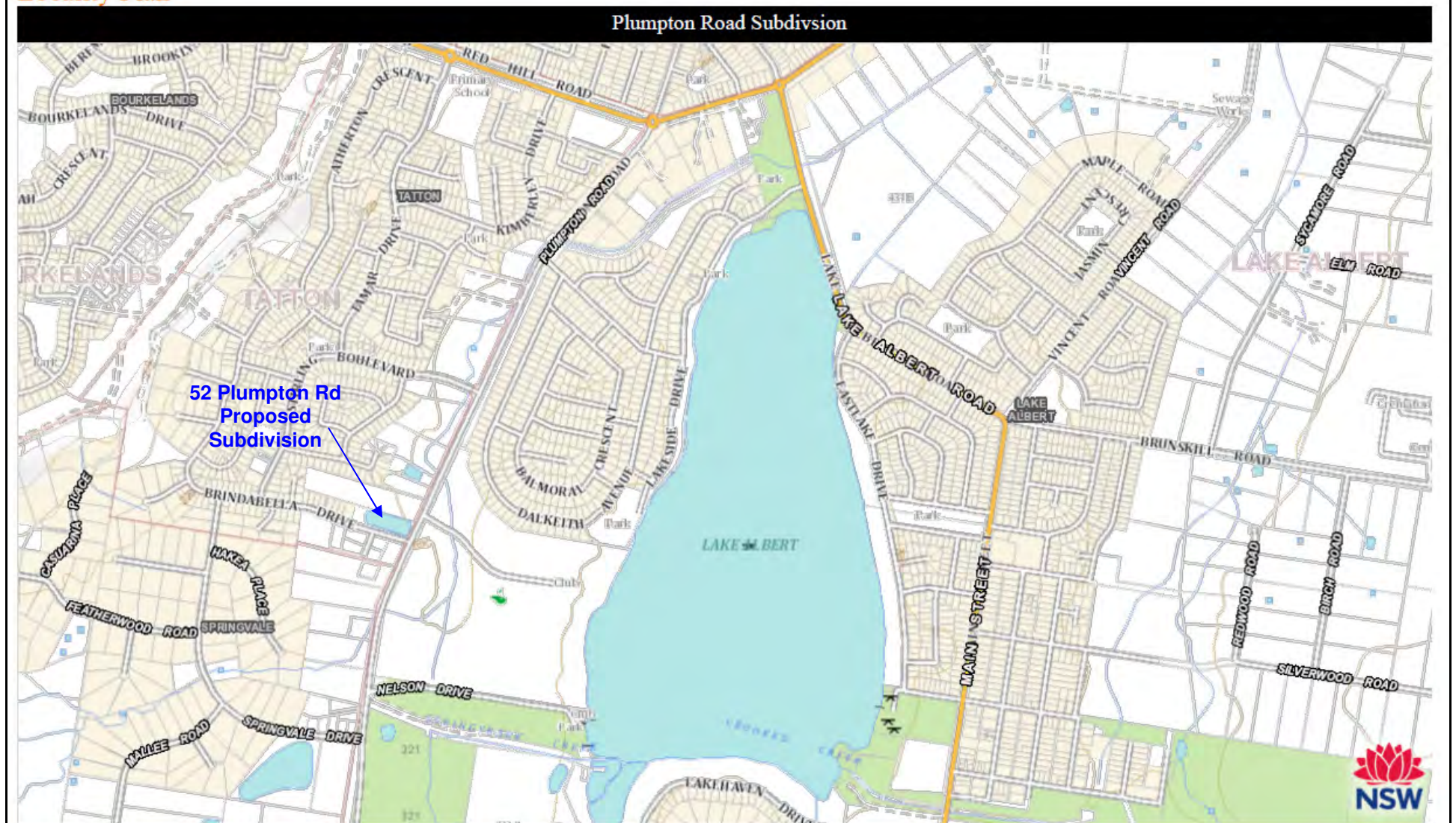
This report investigates the traffic impacts of vehicle movements through the development, Brindabella Drive (connecting road) and the wider road network arising from subdivision of the site into an indicative seven residential allotments, comprising the construction of 32 medium density dwellings on Lot 1 as a Community Title development and the construction of larger lot residential dwellings on lots 2 to 7. This includes an assessment of the key intersection of Plumpton Road and Brindabella Drive.

It is concluded that the existing intersection of Plumpton Road and Brindabella Drive operates well within capacity at a Level-of-Service of A in both the AM and PM peak periods at current 2017 traffic flows and will continue to operate within capacity at a Level-of-Service of A at 2027 with the addition of forecast and generated subdivisional traffic. It is determined that the proposed subdivision will have a minimal impact on the existing road network.



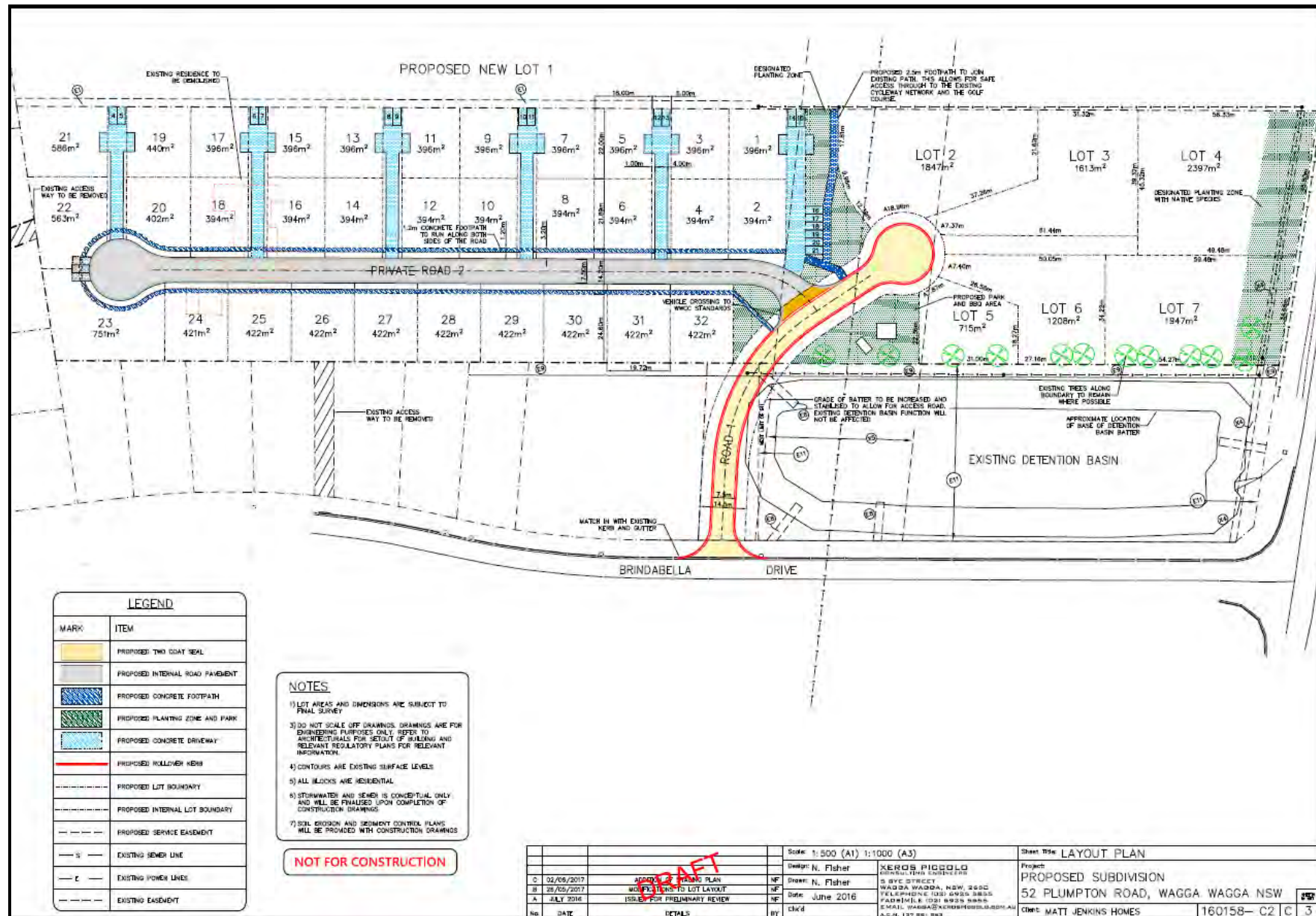
## 1.1 Locality Plan

### Locality Plan

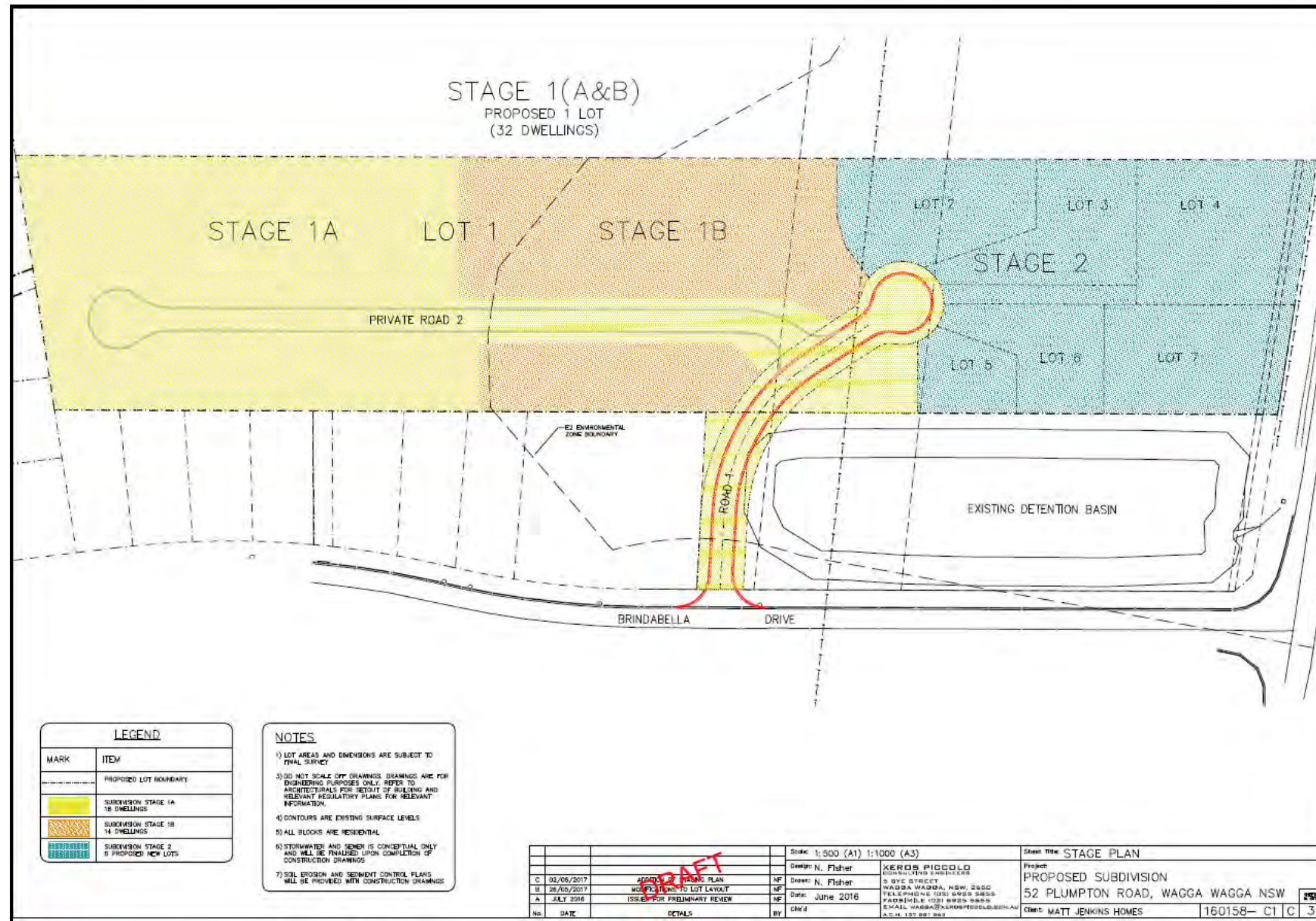




## 1.2 Proposed Indicative Subdivision Layout



## Proposed indicative Subdivision Staging Plan





### 1.3 Site Characteristics

<b>Address</b>	52 Plumpton Road Wagga Wagga NSW
<b>Road Hierarchy</b>	Plumpton Road classified as a sub-arterial road under the management of Wagga Wagga City Council. Brindabella Drive classified as a collector road under the management of Wagga Wagga City Council
<b>Proposed Use</b>	Rezoning to R1 General Residential for proposed subdivision.
<b>Access</b>	Site frontage onto Brindabella Drive
<b>Existing Traffic volumes and Speed Environment</b>	<b>Plumpton Road-Red Hill Rd to Lansdowne Ave</b> Average daily traffic 7,997vpd 85 <sup>th</sup> percentile speed 57.6km/h Speed limit 80km/h. Weekly peak hour AM 850vph and PM 786vph <b>Plumpton Road- Springvale Dr to Gregadoo Rd</b> Average daily traffic 4,523vpd 85 <sup>th</sup> percentile speed 71.3km/h Speed limit 80km/h. Weekly peak hour AM 711vph and PM 583vph
<b>Traffic Generation</b>	Information obtained from RMS Guide to Traffic Generating Developments Technical Direction TDT 2013/04a Updated Traffic Surveys and suggests daily, AM and PM peak vehicle movements generated by the subdivision of the site into 7 lots and 38 potential dwellings as 228vpd and 24vph.

### 1.4 Recommendation

- That Wagga Wagga City Council concurs with the proposed subdivision access points and layout;
- Wagga Wagga City Council carry out works to improve the layout and pavement delineation of the existing BAR at the intersection of Plumpton Road and Brindabella Drive.

## 2. Introduction

A rezoning application of 52 Plumpton Road will be submitted to Wagga Wagga City Council. The subject land is currently zoned R1 General Residential and E2 Environmental Conservation and it is proposed to rezone the portion of land zoned E2 to R1 to allow for residential development.

Peter Meredith Consulting has been engaged to prepare a report assessing the traffic impacts of a proposed residential subdivision development of 52 Plumpton Road, Wagga Wagga to support the rezoning applicant.

The Traffic Impact Assessment Report (TIAR) will discuss the traffic impacts of providing a residential subdivision road network connecting to Brindabella Drive. To obtain access to the proposed subdivision development on 52 Plumpton Road the access road (road 1) will pass through 108 Brindabella Drive. Subdivision of 108 Brindabella Drive will also be required to provide a road corridor between Brindabella Drive and 52 Plumpton Road.

The TIAR will also investigate the traffic impacts on the existing road network at the intersections of Brindabella Drive and the main subdivision access road (road 1), and Plumpton Road/Brindabella Drive (as specifically requested by Council).

The assessment uses existing traffic flow data obtained from manual peak hour traffic counts, on-site observations, traffic generating development figures, and future traffic growth predictions.

### 2.1 Documentation

The documentation and information provided for this assessment includes:

- Proposed subdivision layout and subdivision staging plans revision C 2 June 2017 by Consulting Engineers Xeros Piccolo;
- Subdivision and zoning information from NGH Environmental.

### 2.2 References

References used in the preparation of this assessment include the following:

- *Roads and Maritime Services (RMS) Guide to Traffic Generating Developments, Version 2.2 October 2002 for traffic generation predictions and Technical Direction TDT 2013/04a Updated Traffic Surveys.*
- *Austroads Guide to Road Design (AGRD) Part 4A: Unsignalised and Signalised Intersections.*
- *RMS supplement to Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections.*
- *Austroads Guide to Road Design Part 6: Roadside Design, Safety and Barriers.*
- *Signalised and Unsignalised Intersection Design and Research Aid (SIDRA). SIDRA Intersections 6.1 Plus software.*

### 3. Existing Conditions

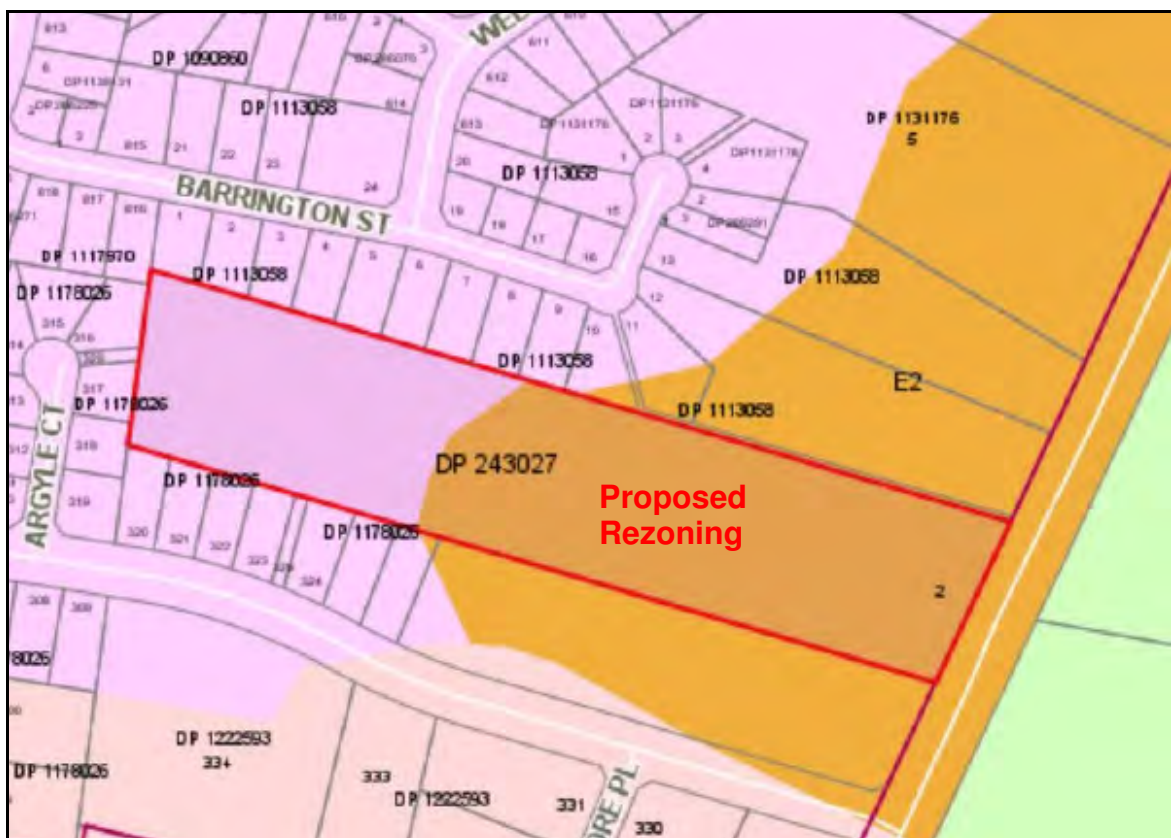
The proposed development is situated on the North West corner of Plumpton Road and Brindabella Drive, Moama. The proposed development is to be accessed from Brindabella Drive, and is described as 52 Plumpton Road.

### 3.1 Land Use

The proposed development site comprises a large vacant allotment of land described as, 52 Plumpton Road, Wagga Wagga located in the suburb of Tatton.

The development site has an approximate area of 3.0 hectares and is currently zoned R1 General Residential and E2 Environmental Conservation under the Wagga Wagga Local Environmental Plan 2010. It is proposed to rezone the portion of land zoned E2 to R1 to allow for residential development. The subject land is presently used as large lot single residence.

The surrounding land use is established residential development, as well as the Wagga Wagga Country Club golf course to the east.



**Source: NGH Environmental**



## 3.2 Road Network

### Plumpton Road

Plumpton Road forms the eastern boundary of the site. It runs south from Red Hill Road. It provides access for local traffic from nearby residential and the golf course areas, as well as rural areas further south. Plumpton Road is classified as a sub-arterial road and is under the management of the Wagga Wagga City Council.

Adjacent to the development site Plumpton Road has a road reserve width of 30.1m and consists of the following characteristics:

- An undivided two-way road with a sealed carriageway width of 8.6m;
- Two traffic lanes of 4.3m and gravel shoulders at 2.3m on the east side and 2.8 on the west side shoulder;
- Formed table drains and grass verges
- Line marked centre line with guide post delineation; and
- A shared 2.0m wide pedestrian/cyclist path on the eastern side.



**Photo 1 shows mid-block Plumpton Road looking south towards the intersection with Brindabella Drive at the start of the BAR taper.**



**Photo 2 looking north bound from Brindabella Drive along Plumpton Road showing clear sight distance**



**Photo 3 looking south bound from Brindabella Drive along Plumpton Road showing clear sight distance**



**Photo 4 looking east bound on Brindabella Drive towards intersection with Plumpton Road**

### **Brindabella Drive**

Brindabella Drive forms the southern boundary of the site. Brindabella Drive connects to Plumpton Road as a T-junction intersection and is controlled by a give-way sign and line markings. Brindabella Drive provides access to residential houses with the Tatton residential estate and runs from Plumpton road to Atherton Crescent is classified as a collector road and is under the management of the Wagga Wagga City Council.

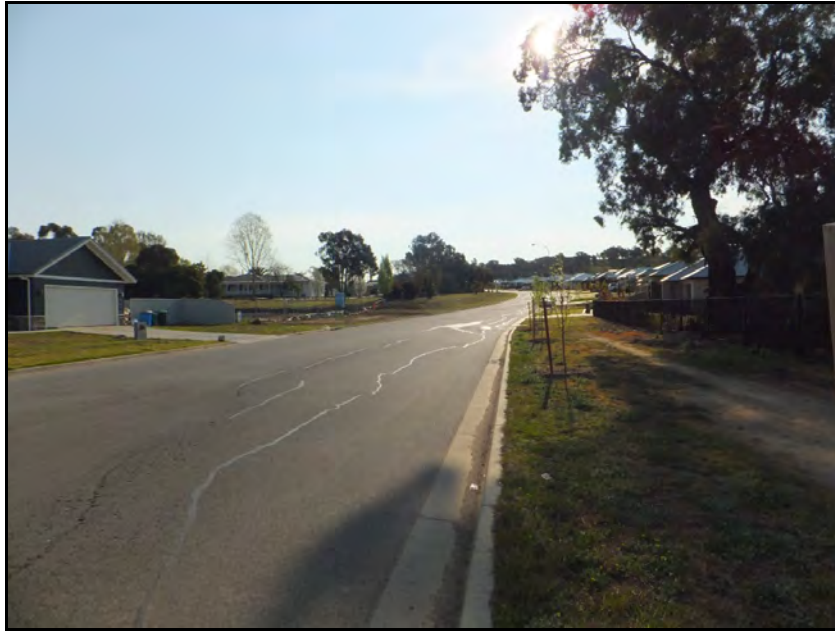
Adjacent to the development site Brindabella Drive has a road reserve width of 24m and consists of the following characteristics:

- An undivided two-way road with a sealed carriageway width of 13m between kerbs;
- Nature strips 5.5m wide on both sides; and
- Street lighting.



**Photo 5 Brindabella Drive looking east (towards Plumpton Road) from proposed connection of subdivision access road (Road 1). Shows clear sight distance along Brindabella Drive.**





**Photo 6 Brindabella Drive looking west from proposed connection of subdivision access road (Road 1). Shows clear sight distance along Brindabella Drive.**

### **Intersection of Plumpton Road and Brindabella Drive**

Brindabella Drive connects to Plumpton Road as a T-junction intersection. To provide for south bound right-turning traffic a basic auxiliary right turn treatment (BAR) configuration has been constructed as part of the intersection. The intersection consists of the following characteristics:

#### **Signs, markings and delineation**

- Give-way sign and line markings on Brindabella Drive;
- Hazard marker at the end of the intersection;
- Street lighting at on the approaches and at the intersection (Refer to Photos 2, 3 and 4);
- Large 10m radius kerb returns from Brindabella Drive.

#### **BAR configuration**

- South bound approach taper length 68m and lane width 4.3m;
- Straight passing section length 32m and width at centre line of Brindabella Drive of 7.0m;
- Departure taper length 43m and lane width 4.3m;
- Left-turn north bound out of Brindabella Drive 30m in length and lane width 5.3m to kerb.

### **3.3 Speed Environment**

In the vicinity of the development site, Plumpton Road has a posted speed limit of 80km/h. The speed limit on Brindabella Drive reduces to the 50km/h urban speed limit.

### **3.4 Existing Traffic**

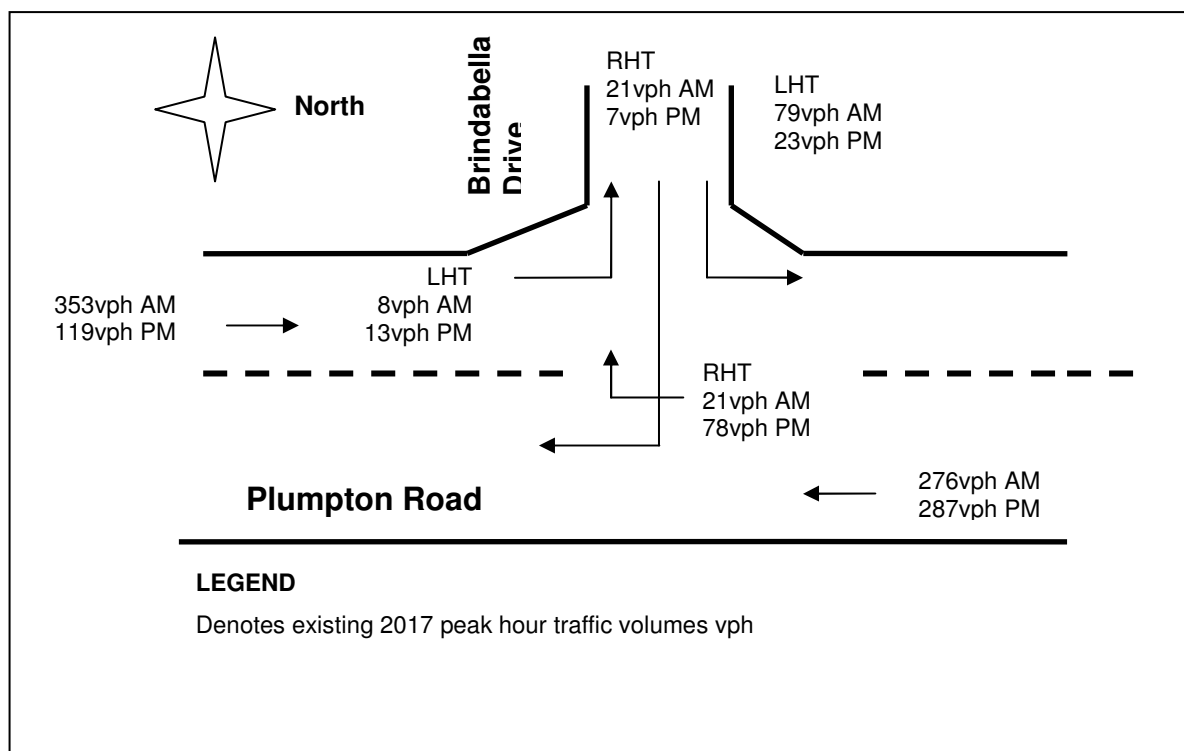
During July 2017 Wagga Wagga City Council conducted traffic counts on Plumpton Road between Red Hill Road and Lansdowne Avenue and between Springvale Drive and Gregadoo Road . The results of the traffic counts are shown in tables in Appendix A. A summary of the July 2017 ADT, AM and PM peak hour traffic volumes (vph) for Plumpton Road are shown below in the Table 1.

**Table1: ADT, AM and PM Peak hour traffic volumes for Plumpton Road July 2017**

July 2017 Location	ADT	AM	PM	85 <sup>th</sup> % speed
Plumpton Road between Red Hill Road and Lansdowne Avenue both directions	7,997	850 (8 to 9am)	786 (5 to 6pm)	57.6km/h
Plumpton Road between Springvale Drive and Gregadoo Road both directions	4,523	711 (8 to 9am)	583 (3 to 4pm)	71.3km/h

As part of this investigation, turning movement counts were undertaken at the intersection of Plumpton road and Brindabella Drive. These turning movement counts were undertaken on Thursday 20 September 2017, and covered the morning, midday and evening peak periods. A summary of the turning movements for the intersection are shown in Figure 1 below. *Manual peak hour (one day) directional traffic counts at intersections are common traffic engineering practice (refer to AGTM Part 3- Traffic Studies and Analysis, Appendix A) which gives accurate directional traffic volumes that can not be achieved with mid-block traffic counts..*

**Figure 1: Existing 2017 AM (8.00 -9.00) and PM (5.00-6.00) peak traffic flows at the intersection of the Plumpton Road and Brindabella Drive**



The intersection was modelled to determine the level-of-service (LOS) using the intersection analysis program SIDRA Intersection 6.1. Full results for the site are included in Appendix B1 and B2, however the key outcomes may be summarised as follows:

- Plumpton Road and Brindabella operate well within capacity in both the AM and PM peak periods with a LOS A for all movements. Minimal delays are experienced, with the worst

being on Brindabella Road the south bound right-turn onto Plumpton Road (average 11.0 seconds AM and 7.0 seconds PM).

### **3.5 Public Transport**

Public buses operate in the Lake Albert area on both Plumpton Road and Brindabella Drive are town and school buses routes. Busabout Wagga Wagga currently operates the Brindabella Drive route 13 times per day, Monday to Friday and 9 times a day on the weekend days.

### **3.6 Pedestrians and Cyclists**

Plumpton Road has a 2m wide shared path for pedestrians and cyclists on its eastern side opposite the development site. This provides access from Karingal Road south to the Nelson Drive and connecting to the Wagga Wagga Boat Club.

## **4. Proposed Development**

The proposal seeks to rezone the existing 3.0 hectare site into R1 General Residential and purports the following indicative staged subdivisional development.

- Subdivide the site into seven lots 1 to 7 (refer to Section 1.2 to Subdivision Layout Plan);
- Lot 1 is proposed to be developed as community title with the construction of 32 medium density residential dwellings in two stages. Stage 1A with 18 dwellings and Stage1B with 14 dwellings (refer to Section 1.3 Subdivision Staging Plan;
- The community title development will involve the construction of total of 32 dwellings and access to the dwellings fronting private 2 will be from private road 2. Access to the dwellings along the northern boundary of Lot 1 will be from a shared 4m wide concrete access driveway connecting to private road 2. Each driveway will service 2 dwellings and at the end of the driveway 2 visitor parking spaces are provided. In addition, another 9 off-street visitor parking spaces will be provided for dwellings facing private road 2;
- Stage 2 involved the development of lots 2 to 7 larger lot residential development;
- Construction of access road 1 and private road 2 both 7.5m wide as part of Stage 1A;
- Construction of concrete footpaths along each side of private road 2 with a 2.5m wide shared pathway connecting to the existing pathway on the north boundary of the development site. This allows access to the existing shared path on the eastern side of Plumpton Road;



- Construction of a concrete path around road 1 cul-de-sac and along the northern boundaries of lots 6 and 7 connecting to Plumpton Road. This allows access to the existing shared path on the eastern side of Plumpton Road;
- The timeframe for full development of the subdivision is assumed to be ten years (By 2027).

## 5. Future Traffic Growth and Analysis

### 5.1 Existing Traffic Growth

A standard 2% per annum traffic growth has been applied to the existing volumes to allow for the increase in background traffic volumes arising from general increases across the network. This has been calculated over 10 years to year 2027 (The year of full development of the proposed Subdivision).

### 5.2 Traffic Generation by Proposed Development

Traffic generation levels for the proposed residential subdivision are established using the rates suggested in the *RMS Guide to Traffic Generating Developments Technical Direction and TDT 2013/04a Updated Traffic Surveys*. Traffic generation rates for Medium Density Residential Dwellings (regional areas) for larger units and town houses will be used for the 32 dwellings on lot 1 and generation rates for Dwelling Houses (regional areas) for lots 2 to 7. Assumed generation rates are as follows:

#### Medium Density Residential Dwellings

- Daily vehicle trips (vpd) = 5 to 6.5 per dwelling
- Weekday peak hour vehicle trips (vph) = 0.50 to 6.5 per dwelling

By applying the average generation of the above rates, the proposed fully developed lot 1 section of the subdivision (by year 2027) could potentially generate:

- Daily vehicle trips =  $32 \times 5.75 = 184 \text{ vpd}$
- Weekday average peak hour vehicle trips =  $32 \times 0.58 = 18.56$

#### Residential Dwellings Houses

- Daily vehicle trips (vpd) = 7.4 per dwelling
- Weekday average peak hour vehicle trips (vph) = 0.78 per dwelling

By applying the above rates, the proposed fully developed subdivision of lots 2 to 7 (by year 2027) could potentially generate:

- Daily vehicle trips (vpd) =  $7.4 \times 6 = 44.4 \text{ vpd}$
- Weekday average peak hour vehicle trips (vph) =  $0.78 \times 6 = 4.68$

### Total Traffic Generation

The total traffic generated for the fully developed subdivision for lots 1 to 7 is shown below:

Daily vehicle trips =  $184 + 44.4 = 228.4$  say **228vpd**

Weekday average peak hour vehicle trips =  $18.56 + 4.68 = 23.24$  say **24vph**

### 5.3 Traffic Distribution and Analysis

Traffic generated by the development will be distributed throughout the network depending on origin/destination and route choices. This can be estimated by assessing likely origins and destinations based on existing traffic flows.

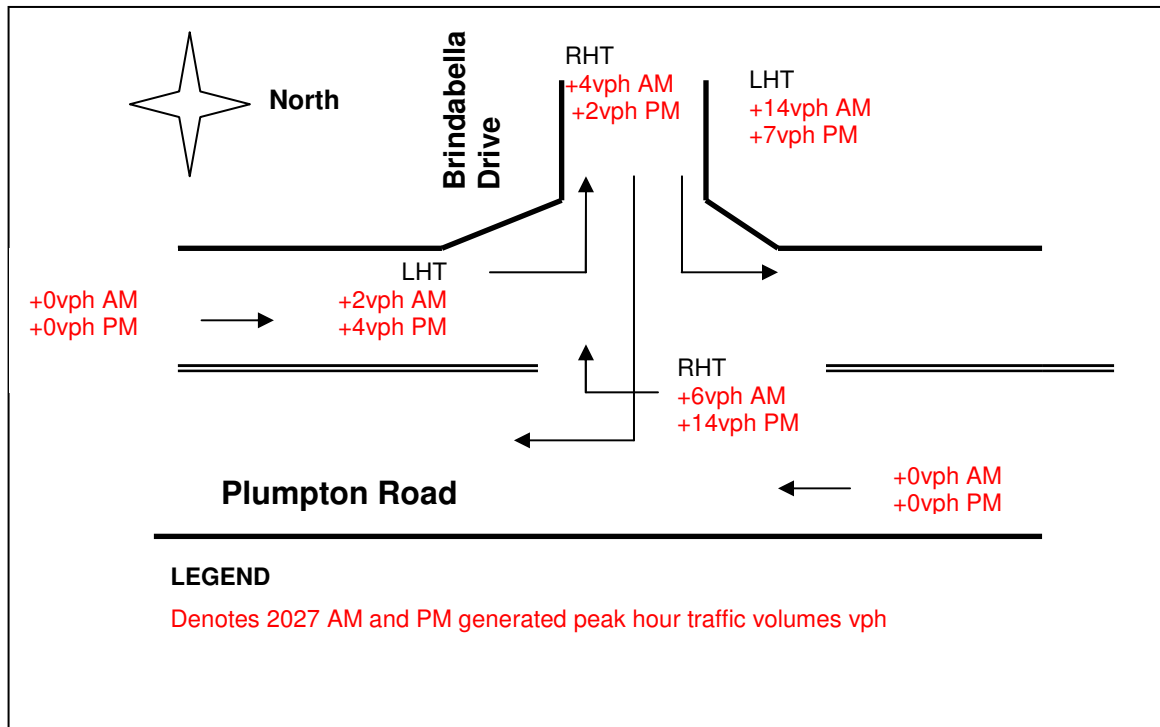
The following assumptions have been made in determining the distribution of traffic:

Assumption	Reasoning
In the AM peak, 70% of traffic generated by the subdivision will be outbound, and 30% inbound. In the PM peak, the corresponding split will be 30/70.	Industry standard based on RTA Guide to Traffic Generating Developments and also review of existing traffic movement data.
In the AM all traffic from subdivision will exit road 1 and turn left onto Brindabella Drive and in the PM all traffic will enter the subdivision turning right from Brindabella Drive.	All traffic generators are towards Plumpton Road.
80% of traffic generated by the development will utilise Brindabella Drive/Plumpton Road intersection and turn left, and 20% of traffic will turn right.	Existing percentages of AM traffic flow at Brindabella Drive/Plumpton Road intersection. Refer Figure 1.

These assumptions have been used to determine the additional traffic likely to be generated at the key intersection of the Plumpton Road with Brindabella Drive.

A summary of the additional turning movements for the intersection of Brindabella Drive and Plumpton Road are shown in Figure 2 below.

**Figure 2: Future AM and PM peak traffic flows generated by full development (2027) at the intersection of the Brindabella Drive and Plumpton Road**



## 6. Impacts & Mitigating Works

The impacts of the proposed fully-developed 7 lot subdivision on through-traffic on Brindabella Drive are primarily related to the low speed turning manoeuvres at new T-junction intersection with road 1.

The impacts of the proposed fully-developed 7 lot subdivision on the existing T-junction intersection of Plumpton Road and Brindabella Drive are primarily related to the increase turning traffic volumes generated by the subdivision.

The impacts are quantified below and appropriate mitigating works are recommended, if required.

### 6.1 Sight Distance

#### Brindabella Drive

The existing speed limit for Brindabella Drive along the frontage of the proposed development is 50km/h. The minimum safe intersection sight distance (SISD) as set out in the *Austroads Guide to Road Design Part 4A: Section 3 Sight Distance, Table 3.2* for a design speed of 50km/h is 97m for a reaction time of 2.0 seconds. This criteria is satisfied at the new access T-junction intersection in both directions with measured sight distances of over 150m in both directions. Refer to Photos 5 and 6.

#### Plumpton Road

The existing speed limit for Plumpton Road along the frontage of the proposed development is 80km/h. The minimum safe intersection sight distance (SISD) as set out in the *Austroads Guide to Road Design Part 4A: Section 3 Sight Distance, Table 3.2* for a design speed of 80km/h is 181m



for a reaction time of 2.0 seconds. This criteria is satisfied at the existing T-intersection of Plumpton Road and Brindabella Drive in both directions with measured sight distances of over 300m in both directions from Brindabella Drive. *Refer to Photos 2 and 3.*

## **6.2 Intersection of Brindabella Drive and Road 1**

The width of Brindabella Drive is 13m between kerbs (2 x 6.5m traffic lanes) and will adequately allow for the left-hand passing of any west bound vehicle turning right into road 1.

The new T-junction intersection of Brindabella Drive and Road 1 is located on the northern side of Brindabella Drive. The centre line of the proposed new intersection is located 126m to the west of the existing T-junction intersection of Brindabella Drive and Belmore Place. A minimum stagger distance of 30m is usually required (refer Figure 7.8 AGRD04A) and 126m is more than an adequate distance between T-junction intersections to allow for the deceleration and storage of turning vehicles. Given that the traffic generated from the subdivision will be very low (24vph), it is anticipated that there will be no future impacts on turning traffic at these intersections. *Refer to Photo 5.*

## **6.3 Intersection Performance Plumpton Road/Brindabella Drive**

A SIDRA analysis of the operation of the existing BAR T-Junction intersection of Plumpton Road and Brindabella Drive was undertaken for the forecast and generated subdivision future traffic flows for both AM and PM up to year 2027. The analysis determines the future capacity and operational level-of-service (LOS) of the intersection movements. *Refer to Table 1 below for the Austroads definitions of level-of-service.*

**Table 1: Level-of-service for capacity and operational analysis for all types of road facilities**

<b>Level of service A</b>	A condition of free-flow in which individual drivers are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to manoeuvre within the traffic stream is extremely high, and the general level of comfort and convenience provided is excellent.
<b>Level of service B</b>	In the zone of stable flow where drivers still have reasonable freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is a little less than with level of service A.
<b>Level of service C</b>	Also in the zone of stable flow, but most drivers are restricted to some extent in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience declines noticeably at this level.
<b>Level of service D</b>	Close to the limit of stable flow and approaching unstable flow. All drivers are severely restricted in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is poor, and small increases in traffic flow will generally cause operational problems.
<b>Level of service E</b>	Traffic volumes are at or close to capacity, and there is virtually no freedom to select desired speeds or to manoeuvre within the traffic stream. Flow is unstable and minor disturbances within the traffic stream will cause breakdown.
<b>Level of service F</b>	In the zone of forced flow, where the amount of traffic approaching the point under consideration exceeds that which can pass it. Flow breakdown occurs, and queuing and delays result.

SIDRA Movement Summary results for the intersection of Plumpton Road and Brindabella Drive are included in Appendix B3 and B4, however the key outcomes may be summarised as follows:

- Plumpton Road and Brindabella Drive continues to operate well within capacity at a Level of Service of A in both the AM and PM peak periods at 2027. Minimal delays are experienced; with the worst being still Brindabella Road south bound right-turn onto Plumpton Road (average 14.2 seconds AM and 12.0 seconds PM).

### **6.3.1 BAR Configuration at Intersection of Plumpton Road and Brindabella Drive**

The dimensions of the existing BAR configuration at the intersection of Plumpton Road and Brindabella Drive are not in accordance with the requirements of *AGRD Part 4A: Unsignalised and Signalised Intersections Figure 7.5: Basic right (BAR) turn treatment on a two-lane rural road. Refer to Section 3.2 Road Network for the existing dimension of the BAR.*

The existing storage and vehicle passing length is 32m and the AGRD requires a length of 47.5m for an 80km/h speed limit. The existing approach taper (A) is measured at 68m and the required AGRD approach taper is calculated at 39m. To meet the requirements of the AGRD the storage and vehicle passing length could be increased by reducing the length of the existing approach taper by 15.5m.

Line making and pavement delineation could also be improved to ensure safety at the intersection.

The future 2027 traffic flow from the proposed subdivision will represent less than 4% of the existing 2017 traffic flow at the intersection of Plumpton Road and Brindabella Drive and it is anticipated that Wagga Wagga City Council will be responsible for the minor improvement works at the intersection.

#### **6.4 Subdivision Planning**

The provision of access Road 1 and private Road 2 both at 7.5m wide will allow for the movement of two-way traffic. It is anticipated that there will be no requirement for vehicles to park on Road 1 which will allow for the free-flow of two-way traffic.

Private Road 2 provides access to the 21 community title medium density dwellings fronting Private Road 2 and access via a 4m wide drive to 5 pairs and one single dwelling along the northern boundary of Lot 1. It is anticipated that there may be the occasional vehicle parked on Private Road 2 for short periods of time and these might include service, trade or visitor vehicles. However, this is expected to be minimal, particularly with visitor vehicles, as there is 21 dedicated visitor parking spaces provided in the community title development.

#### **6.5 Pedestrians**

The provision of a network of footpaths and shared paths within the proposed subdivision providing connectivity to the existing path network on Plumpton Road will adequately cater for pedestrians.

### **7. Conclusions and Recommendations**

#### **It is concluded that:**

- The existing intersection of Plumpton Road and Brindabella Drive operates well within capacity at a Level-of-Service of A in both the AM and PM peak periods at current 2017 traffic flows and will continue to operate within capacity at a Level-of-Service of A at 2027 with the addition of forecast and generated subdivisional traffic. It is determined that the proposed subdivision will have a minimal impact on the existing road network;
- Minor works to the existing BAR treatment at the Plumpton Road and Brindabella Drive intersection can be easily carried out to improve the BAR layout and to meet the requirements of AGRD and that these works be the responsibility of the Wagga Wagga City Council;
- The proposed T-junction intersection of Brindabella Drive and Road 1 will adequately cater for existing thru and generated turning subdivision traffic;
- SISD criteria are met at both intersections;



- The proposed subdivisional roads will adequately cater for the two-way movement of the traffic generated by the residential developments;
- An adequate network of footpaths and shared paths will be provided.

**It is recommended that:**

- Wagga Wagga City Council concurs with the proposed subdivision access points and layout;
- Wagga Wagga City Council carry out works to improve the layout and pavement delineation of the existing BAR at the intersection of Plumpton Road and Brindabella Drive.

## Appendix A

### Plumpton Road Traffic Data (2017):

A1: Plumpton Road between Red Hill Road and Lansdowne Avenue weekly count

A2: Plumpton Road between Red Hill Road and Lansdowne Avenue speed stats

A3: Plumpton Road between Springvale Drive and Gregadoo Road weekly count

A4: Plumpton Road between Springvale Drive and Gregadoo Road speed stats

### A1: Plumpton Road between Red Hill Road and Lansdowne Avenue weekly count

WeeklyVehicle-394 Page 2

#### Weekly Vehicle Counts

##### WeeklyVehicle-394

Site: Plumpton rd.0.0N  
 Description: Between Redhill & Lansdowne  
 Filter time: 0:00 Monday, 6 June 2016 => 0:00 Monday, 13 June 2016  
 Scheme: Vehicle classification (ARX)  
 Filter: Cls(1 2 3 4 5 6 7 8 9 10 ) Dir(NESW) Sp(10,160) Headway(>0)

	Mon 06 Jun	Tue 07 Jun	Wed 08 Jun	Thu 09 Jun	Fri 10 Jun	Sat 11 Jun	Sun 12 Jun	Averages 1 - 5	1 - 7
Hour									
0000-0100	2	11	15	19	15	41	37	12.4	20.0
0100-0200	4	4	2	8	7	25	37	5.0	12.4
0200-0300	6	6	6	9	10	18	37	7.4	13.1
0300-0400	6	8	8	5	7	9	31	6.8	10.6
0400-0500	12	12	14	10	13	8	7	12.2	10.9
0500-0600	59	51	56	59	54	19	16	55.8	44.9
0600-0700	220	194	214	208	192	83	52	205.6	166.1
0700-0800	421	477	482	514	436	178	67	466.0	367.9
0800-0900	875<	960<	874<	881<	661<	335	187	850.2<	681.9<
0900-1000	539	561	522	551	535	424	350	541.6	497.4
1000-1100	427	446	474	452	472	520	426	454.2	459.6
1100-1200	478	447	466	457	498	546<	499<	469.2	484.4
1200-1300	525	427	501	461	512	544<	495<	485.2	495.0
1300-1400	464	452	458	495	480	452	446	469.8	463.9
1400-1500	485	511	493	535	555	527	460	515.8	509.4
1500-1600	832<	748	732	846<	686	465	492	768.8	685.9<
1600-1700	699	716	766	749	715	464	460	729.0	652.7
1700-1800	790	798<	821<	782	740<	460	384	786.2<	682.1
1800-1900	442	461	492	484	485	377	277	472.8	431.1
1900-2000	254	248	265	297	273	216	163	267.4	245.1
2000-2100	139	182	214	221	186	138	128	188.4	172.6
2100-2200	97	132	117	143	151	139	123	128.0	128.9
2200-2300	42	67	62	64	118	114	89	70.6	79.4
2300-2400	28	16	28	27	47	80	45	29.2	38.7
Totals									
0700-1900	6977	7004	7081	7207	6775	5292	4543	7008.8	6411.3
0600-2200	7687	7760	7891	8076	7577	5868	5009	7798.2	7124.0
0600-0000	7757	7843	7981	8167	7742	6062	5143	7898.0	7242.1
0000-0000	7846	7935	8082	8277	7848	6182	5308	7997.6	7354.0
AM Peak	0800 875	0800 960	0800 874	0800 881	0800 661	1100 546	1100 499		
PM Peak	1500 832	1700 798	1700 821	1500 846	1700 740	1200 544	1200 495		

\* - No data.

## A2: Plumpton Road between Red Hill Road and Lansdowne Avenue speed stats

SpeedStat-398 Page 2

### Speed Statistics

SpeedStat-398

Site: Plumpton rd.0.0N  
 Description: Between Redhill & Lansdowne  
 Filter time: 9:57 Tuesday, 31 May 2016 => 8:35 Wednesday, 15 June 2016  
 Scheme: Vehicle classification (ARX)  
 Filter: Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0)

Vehicles = 95970

Posted speed limit = 60 km/h, Exceeding = 7482 (7.80%), Mean Exceeding = 63.17 km/h

Maximum = 126.7 km/h, Minimum = 10.0 km/h, Mean = 50.5 km/h

85% Speed = 57.6 km/h, 95% Speed = 61.2 km/h, Median = 51.1 km/h

20 km/h Pace = 41 - 61, Number in Pace = 82084 (85.53%)

Variance = 62.97, Standard Deviation = 7.94 km/h

#### Speed Bins (Partial days)

Speed	Bin	Below	Above	Energy	vMult	n * vMult
0 - 10	0 0.0%	0 0.0%	95970 100.0%	0.00	0.00	0.00
10 - 20	765 0.8%	765 0.8%	95205 99.2%	0.00	0.00	0.00
20 - 30	1330 1.4%	2095 2.2%	93875 97.8%	0.00	0.00	0.00
30 - 40	5315 5.5%	7410 7.7%	88560 92.3%	0.00	0.00	0.00
40 - 50	33060 34.4%	40470 42.2%	55500 57.8%	0.00	0.00	0.00
50 - 60	48018 50.0%	88488 92.2%	7482 7.8%	0.00	0.00	0.00
60 - 70	7186 7.5%	95674 99.7%	296 0.3%	0.00	0.00	0.00
70 - 80	267 0.3%	95941 100.0%	29 0.0%	0.00	0.00	0.00
80 - 90	22 0.0%	95963 100.0%	7 0.0%	0.00	0.00	0.00
90 - 100	5 0.0%	95968 100.0%	2 0.0%	0.00	0.00	0.00
100 - 110	0 0.0%	95968 100.0%	2 0.0%	0.00	0.00	0.00
110 - 120	1 0.0%	95969 100.0%	1 0.0%	0.00	0.00	0.00
120 - 130	1 0.0%	95970 100.0%	0 0.0%	0.00	0.00	0.00
130 - 140	0 0.0%	95970 100.0%	0 0.0%	0.00	0.00	0.00
140 - 150	0 0.0%	95970 100.0%	0 0.0%	0.00	0.00	0.00
150 - 160	0 0.0%	95970 100.0%	0 0.0%	0.00	0.00	0.00
160 - 170	0 0.0%	95970 100.0%	0 0.0%	0.00	0.00	0.00
170 - 180	0 0.0%	95970 100.0%	0 0.0%	0.00	0.00	0.00
180 - 190	0 0.0%	95970 100.0%	0 0.0%	0.00	0.00	0.00
190 - 200	0 0.0%	95970 100.0%	0 0.0%	0.00	0.00	0.00

Total Speed Rating = 0.00

Total Moving Energy (Estimated) = 0.00

#### Speed limit fields (Partial days)

Limit	Below	Above
0   60 (PSL)	88488 92.2%	7482 7.8%



### A3: Plumpton Road between Springvale Drive and Gregadoo Road weekly count

VirtWeeklyVehicle-396 Page 2

#### Weekly Vehicle Counts (Virtual Week)

VirtWeeklyVehicle-396

Site: Plumpton rd.0.0S  
 Description: Between Gregadoo & Springvale  
 Filter time: 12:00 Thursday, 27 July 2017 => 12:00 Friday, 4 August 2017  
 Scheme: Vehicle classification (ARX)  
 Filter: Cls(1 2 3 4 5 6 7 8 9 10 ) Dir(NESW) Sp(10,160) Headway(>0)

	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Averages 1 - 5	1 - 7
<b>Hour</b>									
0000-0100	9.0	3.0	2.0	3.0	3.5	17.0	21.0	4.0	7.8
0100-0200	5.0	1.0	2.0	5.0	0.0	11.0	12.0	2.2	4.5
0200-0300	0.0	1.0	0.0	1.0	3.0	9.0	24.0	1.3	5.1
0300-0400	2.0	1.0	1.0	2.0	2.0	6.0	18.0	1.7	4.3
0400-0500	5.0	5.0	5.0	4.0	10.0	6.0	7.0	6.5	6.5
0500-0600	25.0	23.0	40.0	23.0	26.0	13.0	13.0	27.2	23.6
0600-0700	87.0	97.0	101.0	86.0	88.0	28.0	23.0	91.2	74.8
0700-0800	250.0	260.0	260.0	245.0	239.5	77.0	32.0	249.0	200.4
0800-0900	781.0<	683.0<	706.0<	697.0<	701.0<	159.0	122.0	711.5<	568.8<
0900-1000	272.0	238.0	276.0	295.0	278.0	216.0	206.0	272.8	257.4
1000-1100	242.0	203.0	238.0	231.0	244.5	307.0<	243.0	233.8	244.1
1100-1200	263.0	265.0	221.0	251.0	252.5	296.0	274.0<	250.8	259.4
1200-1300	207.0	229.0	238.0	262.5	275.0	280.0	240.0	245.7	249.3
1300-1400	192.0	208.0	246.0	227.0	224.0	297.0<	244.0	220.7	233.1
1400-1500	244.0	254.0	275.0	269.0	314.0	296.0	235.0	270.8	269.5
1500-1600	548.0<	542.0<	564.0<	597.0<	653.0<	282.0	251.0<	583.5<	504.3<
1600-1700	352.0	444.0	512.0	375.0	383.0	286.0	240.0	406.8	370.9
1700-1800	431.0	391.0	414.0	388.0	378.0	261.0	248.0	398.3	362.4
1800-1900	188.0	229.0	271.0	223.0	256.0	194.0	148.0	231.7	216.5
1900-2000	118.0	117.0	125.0	115.0	132.0	96.0	99.0	120.3	114.6
2000-2100	58.0	81.0	84.0	100.0	107.0	72.0	57.0	88.3	82.4
2100-2200	39.0	52.0	62.0	65.0	74.0	73.0	36.0	59.5	58.3
2200-2300	22.0	22.0	31.0	30.0	65.0	62.0	21.0	33.3	35.4
2300-2400	6.0	4.0	11.0	10.5	32.0	30.0	8.0	12.3	14.0
<b>Totals</b>									
0700-1900	3970.0	3946.0	4221.0	4060.5	4198.5	2951.0	2483.0	4075.5	3735.9
0600-2200	4272.0	4293.0	4593.0	4426.5	4599.5	3220.0	2698.0	4434.8	4065.9
0600-0000	4300.0	4319.0	4635.0	4467.0	4696.5	3312.0	2727.0	4480.5	4115.3
0000-0000	4346.0	4353.0	4685.0	4505.0	4741.0	3374.0	2822.0	4523.3	4167.0
<b>AM Peak</b>	0800 781.0	0800 683.0	0800 706.0	0800 697.0	0800 701.0	1000 307.0	1100 274.0		
<b>PM Peak</b>	1500 548.0	1500 542.0	1500 564.0	1500 597.0	1500 653.0	1300 297.0	1500 251.0		

\* - No data.

## A4: Plumpton Road between Springvale Drive and Gregadoo Road speed stats

SpeedStat-397 Page 2

### Speed Statistics

SpeedStat-397

Site: Plumpton rd.0.0S  
 Description: Between Gregadoo & Springvale  
 Filter time: 9:18 Thursday, 27 July 2017 => 14:32 Friday, 4 August 2017  
 Scheme: Vehicle classification (ARX)  
 Filter: Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0)

Vehicles = 33893

Posted speed limit = 60 km/h, Exceeding = 15694 (46.30%), Mean Exceeding = 69.12 km/h

Maximum = 151.2 km/h, Minimum = 13.5 km/h, Mean = 60.6 km/h

85% Speed = 71.3 km/h, 95% Speed = 79.6 km/h, Median = 59.0 km/h

20 km/h Pace = 49 - 69, Number in Pace = 24366 (71.89%)

Variance = 104.60, Standard Deviation = 10.23 km/h

### Speed Bins (Partial days)

Speed	Bin	Below	Above	Energy	vMult	n * vMult
0 - 10	0 0.0%	0 0.0%	33893 100.0%	0.00	0.00	0.00
10 - 20	13 0.0%	13 0.0%	33880 100.0%	0.00	0.00	0.00
20 - 30	93 0.3%	106 0.3%	33787 99.7%	0.00	0.00	0.00
30 - 40	311 0.9%	417 1.2%	33476 98.8%	0.00	0.00	0.00
40 - 50	3496 10.3%	3913 11.5%	29980 88.5%	0.00	0.00	0.00
50 - 60	14286 42.2%	18199 53.7%	15694 46.3%	0.00	0.00	0.00
60 - 70	9751 28.8%	27950 82.5%	5943 17.5%	0.00	0.00	0.00
70 - 80	4305 12.7%	32255 95.2%	1638 4.8%	0.00	0.00	0.00
80 - 90	1505 4.4%	33760 99.6%	133 0.4%	0.00	0.00	0.00
90 - 100	117 0.3%	33877 100.0%	16 0.0%	0.00	0.00	0.00
100 - 110	12 0.0%	33889 100.0%	4 0.0%	0.00	0.00	0.00
110 - 120	2 0.0%	33891 100.0%	2 0.0%	0.00	0.00	0.00
120 - 130	1 0.0%	33892 100.0%	1 0.0%	0.00	0.00	0.00
130 - 140	0 0.0%	33892 100.0%	1 0.0%	0.00	0.00	0.00
140 - 150	0 0.0%	33892 100.0%	1 0.0%	0.00	0.00	0.00
150 - 160	1 0.0%	33893 100.0%	0 0.0%	0.00	0.00	0.00
160 - 170	0 0.0%	33893 100.0%	0 0.0%	0.00	0.00	0.00
170 - 180	0 0.0%	33893 100.0%	0 0.0%	0.00	0.00	0.00
180 - 190	0 0.0%	33893 100.0%	0 0.0%	0.00	0.00	0.00
190 - 200	0 0.0%	33893 100.0%	0 0.0%	0.00	0.00	0.00

Total Speed Rating = 0.00

Total Moving Energy (Estimated) = 0.00

### Speed limit fields (Partial days)

Limit	Below	Above
0   60 (PSL)	18199 53.7%	15694 46.3%

## Appendix B

### SIDRA Movement Summaries:

- B1 Plumpton Road and Brindabella Drive AM 2017
- B2 Plumpton Road and Brindabella Drive PM 2017
- B3 Plumpton Road and Brindabella Drive AM with forecast and generated traffic 2027
- B4 Plumpton Road and Brindabella Drive PM with forecast and generated traffic 2027

### B1 Plumpton Road and Brindabella Drive AM 2017

#### MOVEMENT SUMMARY

▽ Site: Plumpton Rd AM 2017

Plumpton Rd Brindabella Dr  
 Giveway / Yield (Two-Way)  
 Design Life Analysis (Practical Capacity): Results for 1 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Plumpton Rd											
1	L2	9	0.0	0.183	5.6	LOS A	0.0	0.0	0.00	0.01	58.2
2	T1	379	0.0	0.183	0.0	LOS A	0.0	0.0	0.00	0.01	59.8
Approach		388	0.0	0.183	0.1	NA	0.0	0.0	0.00	0.01	59.8
North: Plumpton Rd											
8	T1	296	0.0	0.150	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
9	R2	23	0.0	0.018	6.8	LOS A	0.1	0.5	0.43	0.60	52.2
Approach		319	0.0	0.150	0.5	NA	0.1	0.5	0.03	0.04	59.3
West: Brindabella Dr											
10	L2	85	0.0	0.074	6.9	LOS A	0.3	2.0	0.41	0.64	52.3
12	R2	23	0.0	0.046	11.0	LOS A	0.2	1.1	0.60	0.79	49.3
Approach		107	0.0	0.074	7.8	LOS A	0.3	2.0	0.45	0.67	51.7
All Vehicles		814	0.0	0.183	1.3	NA	0.3	2.0	0.07	0.11	58.4

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akgelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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## B2 Plumpton Road and Brindabella Drive PM 2017

### MOVEMENT SUMMARY

 Site: Plumpton Rd PM 2017

Plumpton Rd Brindabella Dr  
 Giveway / Yield (Two-Way)  
 Design Life Analysis (Practical Capacity): Results for 1 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Plumpton Rd											
1	L2	14	0.0	0.108	5.5	LOS A	0.0	0.0	0.00	0.04	58.0
2	T1	214	0.0	0.108	0.0	LOS A	0.0	0.0	0.00	0.04	59.6
Approach		228	0.0	0.108	0.3	NA	0.0	0.0	0.00	0.04	59.5
North: Plumpton Rd											
8	T1	308	0.0	0.156	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
9	R2	84	0.0	0.057	6.2	LOS A	0.3	1.8	0.33	0.57	52.5
Approach		392	0.0	0.156	1.3	NA	0.3	1.8	0.07	0.12	58.2
West: Brindabella Dr											
10	L2	25	0.0	0.018	6.2	LOS A	0.1	0.5	0.29	0.55	52.7
12	R2	8	0.0	0.013	9.7	LOS A	0.0	0.3	0.55	0.69	50.2
Approach		32	0.0	0.018	7.0	LOS A	0.1	0.5	0.35	0.58	52.1
All Vehicles		652	0.0	0.156	1.3	NA	0.3	1.8	0.06	0.12	58.3

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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## B3 Plumpton Road and Brindabella Drive AM with forecast and generated traffic

2027

## MOVEMENT SUMMARY

 **Site: Plumpton Rd AM 2027 with generated & forecast traffic**

Plumpton Rd Brindabella Dr  
 Giveaway / Yield (Two-Way)  
 Design Life Analysis (Practical Capacity): Results for 1 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Plumpton Rd											
1	L2	13	0.0	0.232	5.6	LOS A	0.0	0.0	0.00	0.02	58.2
2	T1	479	0.0	0.232	0.0	LOS A	0.0	0.0	0.00	0.02	59.8
Approach		492	0.0	0.232	0.2	NA	0.0	0.0	0.00	0.02	59.8
North: Plumpton Rd											
8	T1	375	0.0	0.190	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
9	R2	35	0.0	0.032	7.4	LOS A	0.1	0.9	0.49	0.65	52.0
Approach		410	0.0	0.190	0.7	NA	0.1	0.9	0.04	0.06	59.2
West: Brindabella Dr											
10	L2	122	0.0	0.120	7.5	LOS A	0.5	3.3	0.48	0.70	52.1
12	R2	33	0.0	0.091	14.2	LOS A	0.3	2.2	0.72	0.88	47.3
Approach		156	0.0	0.120	8.9	LOS A	0.5	3.3	0.53	0.74	51.0
All Vehicles		1058	0.0	0.232	1.6	NA	0.5	3.3	0.09	0.14	58.1

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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## B4 Plumpton Road and Brindabella Drive PM with forecast and generated traffic

2027

## MOVEMENT SUMMARY

▽ Site: Plumpton Rd PM 2027 with generated traffic & forecast traffic

Plumpton Rd Brindabella Dr  
 Giveaway / Yield (Two-Way)  
 Design Life Analysis (Practical Capacity): Results for 1 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Plumpton Rd											
1	L2	21	0.0	0.138	5.6	LOS A	0.0	0.0	0.00	0.04	58.0
2	T1	269	0.0	0.138	0.0	LOS A	0.0	0.0	0.00	0.04	59.6
Approach		291	0.0	0.138	0.4	NA	0.0	0.0	0.00	0.04	59.5
North: Plumpton Rd											
8	T1	390	0.0	0.198	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
9	R2	121	0.0	0.088	6.5	LOS A	0.4	2.8	0.38	0.60	52.3
Approach		511	0.0	0.198	1.6	NA	0.4	2.8	0.09	0.14	57.9
West: Brindabella Dr											
10	L2	39	0.0	0.030	6.4	LOS A	0.1	0.8	0.33	0.57	52.6
12	R2	12	0.0	0.027	12.0	LOS A	0.1	0.7	0.64	0.79	48.7
Approach		50	0.0	0.030	7.7	LOS A	0.1	0.8	0.41	0.63	51.6
All Vehicles		853	0.0	0.198	1.5	NA	0.4	2.8	0.08	0.14	58.0

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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