ATTACHMENTS EXCLUDED FROM AGENDA
ORDINARY COUNCIL MEETING
22 MARCH 2021

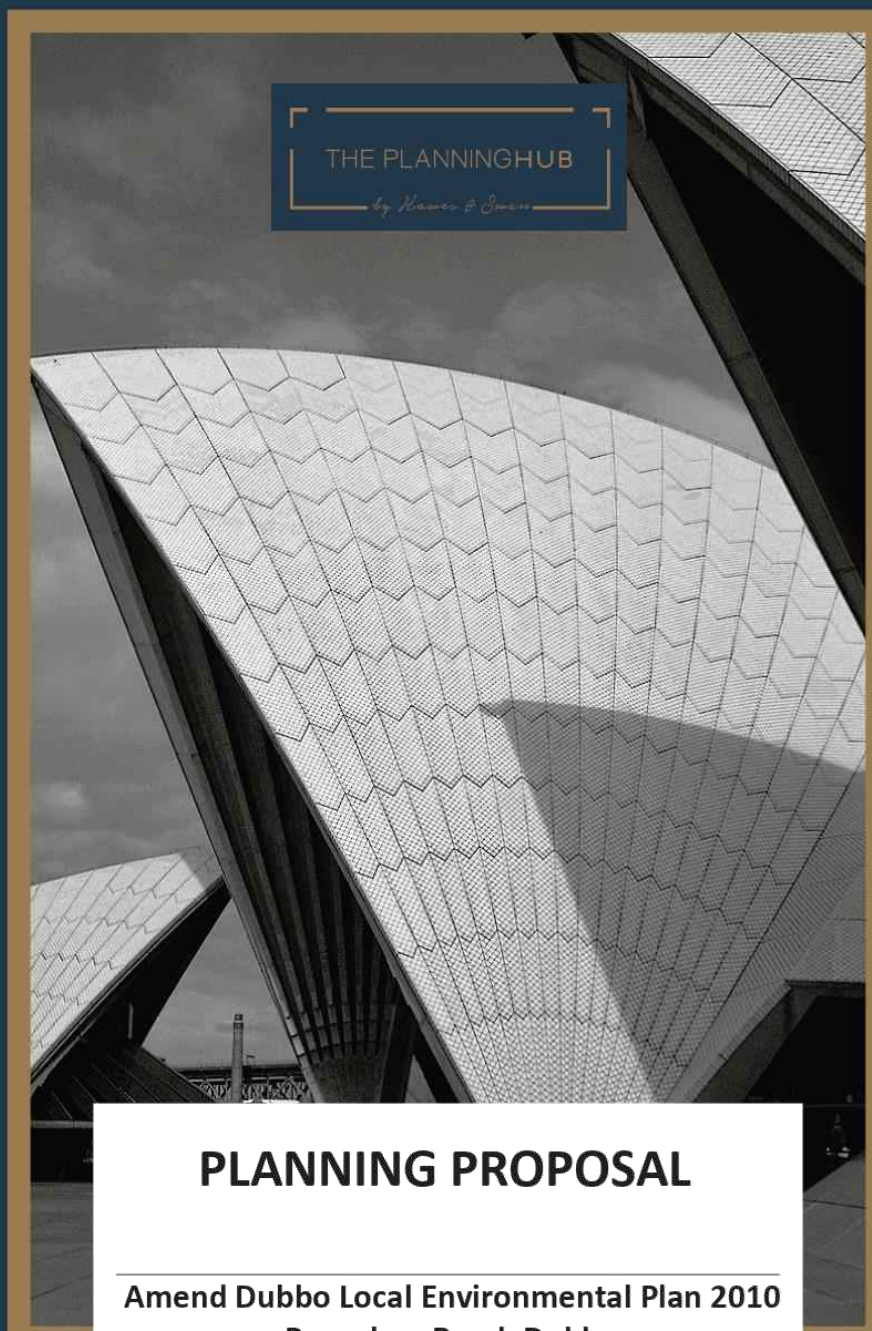
MEMBERSHIP: Councillors J Diffey, V Etheridge, D Grant, D Gumley, A Jones, S Lawrence, G Mohr, K Parker, J Ryan and B Shields.

The meeting is scheduled to commence at 5:30pm.

Page

CCL21/46 Planning Proposal Keswick RSL

Attachment 2: Dubbo RSL Planning Proposal 2



PLANNING PROPOSAL

Amend Dubbo Local Environmental Plan 2010
Boundary Road, Dubbo

Planning Proposal
Boundary Road, Dubbo

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DOCUMENT INFORMATION

Prepared For:	Dubbo RSL Club
Project Name:	Dubbo RSL Planning Proposal
Job Reference:	19-270 V.2
Date Approved:	2 October 2020

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Appendices

A Planning Proposal Consistency with SEPPs
The Planning Hub

B Planning Proposal Consistency with Ministerial Directions
The Planning Hub

C Site Aerial and Future Lot Layout
Dubbo Regional Council

D Concept Layout Plan
Curtin Architects

E Aboriginal Due Diligence Assessment
OzArk

F Preliminary Site Investigation
Envirowest

G Salinity and Groundwater Assessment
Envirowest

H Preliminary Opportunities and Constraints Noise Assessment
Muller Acoustic Consulting

I Civil Engineering Servicing Report
AT&L

J Traffic and Transport Assessment
TTM Consulting

K Social Impact Assessment
Hill PDA

1.0 Introduction

This Planning Proposal has been prepared by The Planning Hub on behalf of the Dubbo RSL and seeks to amend the Dubbo Local Environmental Plan (LEP) 2011 to rezone a parcel of land to include additional permitted uses of a registered club and recreational facilities at Part Lot 502 DP 1255115 Boundary Road, Dubbo.

The purpose of this Planning Proposal is to rezone the subject site under Dubbo LEP 2011 to facilitate future development for the purposes of a registered club and recreational facilities. This Planning Proposal outlines the intended effects of the proposed LEP amendments to Dubbo LEP 2011 and provides justification for the proposed changes.

This Planning Proposal has been prepared in accordance with:

- Section 3.33 of the *Environmental Planning and Assessment Act 1979 (EP&A Act);*
- The Department of Planning – A Guide to Preparing Planning Proposals; and
- The recommendations of Dubbo Regional Council's Pre-Application Consultation.

It is the first stage of the Planning Proposal which seeks the initial Department of Planning, Industry and Environment gateway determination to:

- Support the justification for the proposal;
- Confirm the technical investigations and consultation required; and
- Outline the process for continuing the assessment of the proposal.

As outlined in a Guide to Preparing Planning Proposals, the Planning Proposal will evolve throughout the course of preparing the amending LEP as relevant sections will be updated and amended in response to the outcomes of technical investigations and consultation.

The Planning Proposal forms part of a suite of documents that are submitted in support of the application attached as **Appendices A-K**.

1.1 Project Context

Dubbo RSL Club (the Club) is a registered club currently located at 178-188 Brisbane Street, Dubbo. The Club provides a range of community facilities and services at the existing site comprising event and conference space, gym and aquatic centre and multiple bars and food amenities.

The Club also operates a number of other community facilities and services in Dubbo comprising the Dubbo RSL Motel, the Dubbo City Bowling Club and the Rhino Lodge. In addition to the facilities the Club sponsors a range of local sports and community groups including the following:

- Dubbo RSL Colts Cricket Inner Club
- Dubbo RSL Community Swimming Inner Club
- Dubbo RSL Junior Soccer Inner Club

- Dubbo RSL Squash Inner Club
- Dubbo RSL Swimming (Ducks) Inner Club
- Dubbo RSL Tennis Inner Club
- Dubbo RSL Youth Club
- Dubbo Country Music Association
- NSW Rural Fire Service
- Lifeline Central West
- Dunedoo Pastoral Ag Association
- City of Dubbo Turf Club
- Paramount Tennis Club
- Dubbo Community Men's Shed
- Group 11 Junior and Senior Rugby League
- Aboriginal Education Consult Group
- Dubbo Specialist & Rehab Centre

The Club is always looking to expand and provide additional facilities and services to the Dubbo Community.

The intent of the subject Planning Proposal is to provide a registered club and recreational facilities in close proximity to the South-East Dubbo Urban Release Residential Area which is currently under development. The site is located within the future Keswick Estate and borders the future Southlakes and Hillview Estates which will mostly consist of residential development. The inclusion of additional permitted uses for the site will allow for the future development of a registered club and recreational facilities to provide facilities and services to the existing and future population of the area.

1.2 Pre-Lodgement Consultation

An initial pre-application meeting was held with Dubbo Council staff on the 16th of October 2019 to discuss the intent of the Planning Proposal and confirm the relevant specialist studies to be prepared in support of the Planning Proposal.

In accordance with the Department of Planning & Environment Guidelines for preparing Planning Proposals, a subsequent pre-lodgment meeting was undertaken with Dubbo Council staff on the 9th of September 2020 to discuss the proposed rezoning of the site.

The Pre-Lodgment Meeting provided the opportunity to discuss the key constraints and opportunities of the site, the work undertaken on the proposal, the specialist studies prepared in support of the proposal and the proposed amendment to the LEP to achieve the intended outcome for the site.

Council were generally supportive of the proposal and agreed with the amendment to the LEP comprising the inclusion of additional permitted uses of a registered club and recreation facilities to ensure that the site is not sterilized from future development through a full rezoning of the site.

A key point of discussion in the Pre-Lodgment meeting was in relation to the access to the site being a key constraint for future development. In previous discussions, Council had detailed that vehicular access to

the site could not be provided from Boundary Road due to the gradient of the road and the predicted future traffic volumes. Therefore, vehicular access would have to be provided from the future road on the eastern boundary of the site identified as Henty Drive. The Boundary Road extension that bounds the site to the south is currently under construction with the future roundabout and stub of Henty Drive to also be constructed.

Council have agreed to provide a temporary access road along the site's eastern boundary from the roundabout to provide access to the site until such time Henty Drive is fully constructed. The temporary access road is detailed in the Concept Layout Plan provided in **Appendix D** and the Traffic and Transport Assessment provide in **Appendix J**. The applicant would be happy to discuss the inclusion of any site-specific clauses in the Dubbo LEP relating to the interim access measures if deemed to be required.

2.0 Project Vision and Strategic Merit

2.1 Project Vision

The intent of the subject Planning Proposal is to provide a registered club and recreational facilities in close proximity to the South-East Dubbo Urban Release Residential Area which is currently under development. The proposal is deemed to have strategic merit in that it will provide a community use and infrastructure in a future residential area that will positively contribute to the economy and liveability of the neighbourhood.

The proposal aims to provide a community use and facilities that can ensure the area can develop its own neighbourhood identity. This is to be achieved through the rezoning of the subject site to provide registered club and recreation facilities as additional permitted land uses for the subject site under the Dubbo LEP.

The objectives of the Planning Proposal have been informed by a range of specialist studies provided as attachments to this report. The specialist studies have ensured the proposal recognises and considers the significant aspects of the subject site and surrounding locality and ensures the proposal is an appropriate response to the site characteristics.

The key objectives of the Planning Proposal and resulting neighbourhood are as follows:

Community and Recreational Infrastructure to Support Growth

The proposal will facilitate the future development of community and recreational facilities in an area identified for future residential growth. The future development of the site is in conjunction with the extension of Boundary Road and associated infrastructure and will ensure there is appropriate community and recreational infrastructure in the area to support residential growth and create a viable residential community with a high level of amenity.





Generation of Community Interactions

The proposal will facilitate the future development of community and recreational facilities and will ensure they are established in the early stages of the development of the wider residential area. The early establishment of the club and recreational facilities will generate community interactions and create a cohesive residential community as the wider area develops. The site will become a key social, recreational and community destination positively contributing to the liveability of the area.



Accessibility and Liveability of the Community

The proposal will ensure residents of the future residential area will have appropriate access to community and recreation facilities as the area is developed ensuring a high level of accessibility and positively contributing to the liveability of the area. The integration of the development into the neighbourhood will ensure a number of social, recreational and community can occur within the neighbourhood and reduce the need to leave the neighbourhood for social and recreational purposes.

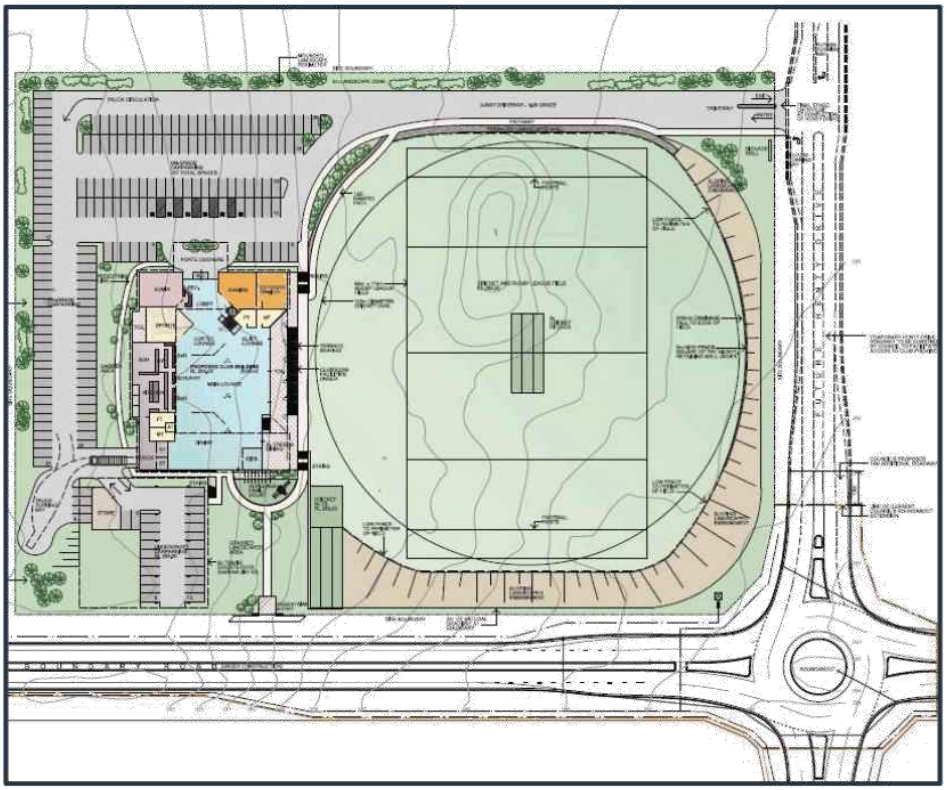

Figure 1: **Concept Layout Plan for the Subject Site (Source: Curtin Architects)**

2.2 Strategic Merit

A key consideration for any Planning Proposal is its strategic merit. The proposal is considered to have a high level of strategic merit based on the following key areas:

Removal of Restriction on Recreation Facilities in the Residential Area

The proposal will facilitate the future development of community and recreational facilities in an area where recreation facilities are currently prohibited. The subject site and surrounding area are currently zoned R2 Low Density Residential under the provisions of the Dubbo LEP, recreation facilities and registered clubs are prohibited in the R2 zone. The proposal will rezone the site to include the additional permitted uses of a registered club and recreation facilities. The inclusion of the additional permitted uses will ensure the objectives of the proposal can be achieved whilst also ensuring that the site is not sterilized from future development through a full rezoning of the site.



Generation of Community Interaction and Cohesion

The proposal will facilitate the future development of community and recreational facilities and will ensure they are established in the early stages of the development of the wider residential area. The early establishment of the club and recreational facilities will generate community interactions and create a cohesive residential community as the wider area develops. The site will become a key social, recreational and community destination positively contributing to the liveability of the area.



Co-location of Employment Lands with Future Neighbourhood Centre

The proposal will take advantage of the location of the subject site in proximity to the Boundary Road extension and the future neighbourhood centre identified for development on the opposite side of Boundary Road. The co-location of the proposal with the future neighbourhood centre will create a strategic community and retail precinct for the wider south east residential area. The proposal will ensure the key community, recreation and retail uses are provided in one central location for the wider residential area for convenience and to reduce the impact of providing commercial uses throughout the neighbourhood.

3.0 Site Analysis

3.1 Site Location and Context

The subject site currently forms part of a larger site in which the subject site will eventually be subdivided to accommodate the proposed development. The larger site is commonly known as Volta Avenue, Dubbo and legally described as Lot 502 DP 1255115. The Planning Proposal only relates to the 3.3ha portion of the site as identified below.

A site aerial of the larger site and eventual subject site is detailed in **Figure 2** and **3** below.



Figure 2: **Larger Site Containing the Subject Site (Source: Nearmap)**



Figure 3: **Subject Site as identified within the larger site (Source: Dubbo Regional Council)**

The site sits within an area identified for future residential development forming part of the existing residential estate to the west known as Keswick Estate and the wider South-East Dubbo Urban Release Residential Area. The site is currently zoned R2 Low Density Residential under the provisions of the Dubbo Local Environmental Plan (LEP) 2011.

The site sits north of Stage 1 of the South-East Dubbo Urban Release Residential Area Structure Plan which is bounded by the future extension of Boundary Road to the north, Hennessy Road and its future extension to the south, Southlakes Estate to the west and Sheraton Road to the east.

3.2 Site Description

The eventual subject site has a site area of 3.3 hectares and will have frontage to the future extension of Boundary Road to the south and Stream Avenue to the east. Construction of the Boundary Road extension between Wheelers Lane and Sheraton Road has commenced and will provide future access to the property with the construction of the roundabout and extension of Henty Drive along the site's eastern boundary.

The surrounding area is currently vacant and identified for future residential land use with a site located to the south west on the opposite side of the future roundabout identified for use as a neighbourhood centre to service the area. The site is not identified as being Bushfire prone or flood prone.

Refer to Figure 4 for a site aerial detailing the subject site and future neighbourhood centre.



Figure 4: Site Aerial with the Location of the Future Neighbourhood Centre detailed (Source: Dubbo Regional Council)

4.0 Objectives or Intended Outcomes

4.1 Project Objectives and Intended Outcomes

The primary purpose of this Planning Proposal is to amend the Dubbo Local Environmental Plan (LEP) 2011 to enable the future development of the site for the purposes of a registered club and recreation facilities.

The intent of the subject Planning Proposal is to provide a registered club and recreation facilities in close proximity to the South-East Dubbo Urban Release Residential Area which is currently under development. The proposal is deemed to have strategic merit in that it will provide a community use and infrastructure in a future residential area that will positively contribute to the economy and liveability of the neighbourhood.

5.0 Explanation of Provisions

In summary the project objectives and intended outcomes will achieved by:

- Amending the Dubbo LEP 2011 Additional Permitted Uses Map for the subject site (Sheet APU_008B) to identify the site for additional permitted uses referenced in Schedule 1 of the LEP.
- Amending Schedule 1 of the Dubbo LEP 2011 – to include a provision relating to the subject site that would permit development for the purposes of a registered club and recreation facilities.

5.1 Zoning and Additional Permitted Uses

The subject site is currently zoned R2 Low Density Residential under the provisions of the Dubbo LEP 2011. Registered clubs and recreation facilities are prohibited in the R2 Low Density Residential zone.

The proposal seeks to amend the Dubbo LEP 2011 to include registered club and recreation facilities as additional permitted land uses for the subject site as identified in Schedule 1 of the LEP. The Planning Proposal relates to specific use for the Dubbo RSL and therefore a full rezoning of the site is not sought.

6.0 Justification

6.1 Need for Planning Proposal

The intent of the subject Planning Proposal is to provide a registered club and recreational facilities in close proximity to the South-East Dubbo Urban Release Residential Area which is currently under development. The proposal is deemed to have strategic merit in that it will provide a community use and infrastructure in a future residential area that will positively contribute to the economy and liveability of the neighbourhood. The proposal aims to provide a community use and facilities that can ensure the area can develop its own neighbourhood identity.

The site and surrounding area is currently zoned R2 Low Density Residential under the provisions of the Dubbo LEP. Recreational facilities and registered clubs are prohibited in the R2 zone which restricts

opportunities for community uses to be developed to support the growing population in the area. The Club currently supports a range of sporting and youth clubs and the site represents an ideal opportunity for the club to continue to support a new community where the new population will be looking for facilities to train and sporting clubs to join in the local area. The provision of new recreational facilities may also attract additional grants and funding for the wider community and contribute to the viability and liveability of the new residential area.

Is the Planning Proposal as a result of any strategic study or report?

The Planning Proposal is not a result of any specific strategic study or report however a number of specialist studies have been undertaken in support of the proposal that demonstrate the suitability of the site for the inclusion of the additional permitted uses and future to enable the future development of the site for the purposes of a registered club and recreation facilities. The specialist studies are provided as Appendices to this report.

In addition, a comprehensive assessment of the proposal has been undertaken against the strategic planning strategies and policies relevant to the site which is provided in Section 6.2 of this report. The assessment has found that the Planning Proposal is generally consistent with the relevant objectives and actions of the key planning strategies and policies relevant to the site.

Is the Planning Proposal the best means of achieving the objectives or intended outcomes, or is there a better way?

Yes, the project objectives and intended outcomes can only be achieved through the amendment of the Dubbo Local Environmental Plan 2011.

6.2 Relationship to Strategic Planning Framework

The Planning Proposal is generally consistent with the relevant objectives and actions of the key planning strategies and policies relevant to the site. The relevant key strategic planning policies that relate to the area and the proposal are as follows:

- Central West and Orana Regional Plan;
- Dubbo Regional Council Community Strategic Plan;
- Dubbo Local Strategic Planning Statement;
- Residential Areas Development Strategy; and
- Employment Lands Strategy.

Is the Planning Proposal consistent with the objectives and actions of the applicable regional or sub-regional strategy?

6.2.1 Central West and Orana Regional Plan

The Central West and Orana is home to more than 300,000 people. People from metropolitan areas are attracted to its vibrant regional cities and centres, historic towns and villages, diverse lifestyles, and

community festivals and events. The region makes a major contribution to the State's economy, building on its proud agricultural heritage and embracing innovation. Its rich soils, mountains and vast plains form a mosaic of beautiful landscapes.

The Central West and Orana Regional Plan provides a guide for the NSW Government's land use planning priorities and decisions over the next 20 years for the region, The Plan provides an overarching framework to guide subsequent and more detailed land use plans, development proposals and infrastructure funding decisions. The Plan sets the following regionally focused goals:

- The most diverse regional economy in NSW
- A stronger, healthier environment and diverse heritage
- Quality freight, transport and infrastructure networks
- Dynamic, vibrant and healthy communities

Each goal is proposed to be achieved through a number of focused planning directions. An assessment of the proposal's consistency with the relevant key planning directions of The Central West and Orana Regional Plan is provided in the table below.

Table 2: Consistency with the Central West and Orana Regional Plan

Direction	Comment
Direction 4: Promote and diversify regional tourism markets	The proposal will facilitate a future community and recreational land use that will assist in promoting the emerging residential area and provide a use that will diversify the tourism market in Dubbo and provide a key facility that will attract people to the area.
Direction 10: Promote business and industrial activities in employment lands	The proposal will facilitate future employment generating land uses in an appropriate scale for the future residential neighbourhood.
Direction 14: Manage and conserve water resources for the environment	The proposal has been designed with consideration of the natural environment and characteristics of the site to ensure natural resources can be appropriately managed and conserved. A Salinity and Groundwater Assessment has been prepared by Envirowest in support of the proposal and is provided in **Appendix G**. The assessment concludes that no impact on groundwater including contamination and changed groundwater levels is expected from the development. The development will not impact on quantity or quality of both unconfined and confined aquifers. All future development on the site will be designed and constructed to appropriately mange and conserve water resources for the environment.

Table 2: Consistency with the Central West and Orana Regional Plan	
Direction	**Comment**
Direction 16: Respect and protect Aboriginal heritage assets	An Aboriginal Due Diligence Assessment (**Appendix E**) has been prepared by Artefact in support of the proposal. The assessment included a desktop review and site inspection. The desktop and visual inspection component for the study area follows the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (Due Diligence; DECCW 2010). The field inspection followed the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in New South Wales* (OEH 2011). The undertaking of the Due Diligence process resulted in the conclusion that the proposed works will have an impact on the ground surface, however, no Aboriginal objects or intact archaeological deposits will be harmed by the proposal. The Due Diligence Assessment concludes that no Aboriginal Heritage Impact Permit application is required and provides a number of recommendations to be implemented in future development to ensure the greatest possible protection to the area's Aboriginal cultural heritage values.
Direction 21: Coordinate utility infrastructure investment	The proposal will facilitate the future development of the site in conjunction with the current extension of Boundary Road along the southern boundary of the site which includes the provision of services for future connection.
Direction 22: Manage growth and change in regional cities and strategic and local centres	The proposal will provide a community use and infrastructure in a future residential area that will positively contribute to the economy and liveability of the neighbourhood. The proposal aims to provide a community use and facilities that can ensure the area can develop its own neighbourhood identity and provide a key strategic precinct in association with the future neighborhood centre on the opposite side of Boundary Road for the wider residential area.
Direction 25: Increase housing diversity and choice	The proposal will positively contribute to the future residential area by providing community and recreation facilities in close proximity to a range of future residential land uses. The proposal will only involve the provision of additional permitted uses to ensure that the site is not sterilized from future residential development through a full rezoning of the site.

Table 2: Consistency with the Central West and Orana Regional Plan	
Direction	**Comment**
Direction 29: Deliver healthy built environments and better urban design	The proposal will facilitate the future development of community and recreational infrastructure that will positively contribute to the built environment and liveability of the future residential area.

6.2.2 Dubbo Regional Council 2040 Community Strategic Plan

The Dubbo Regional Council 2040 Community Strategic Plan is a high-level strategy that aims to guide and influence the actions and initiatives of Dubbo Regional Council, the community, all tiers of government and community stakeholders through to 2040. The plan identifies five themes in which the plan aims to focus on within the LGA, these are as follows:

- Theme 1 – Housing;
- Theme 2 – Infrastructure;
- Theme 3 – Economy;
- Theme 4 – Community Leadership; and
- Theme 5 – Liveability.

The proposal is considered to be consistent with the themes of the Dubbo Regional Council Community Strategic Plan in that it will provide a community use and infrastructure in a future residential area that will positively contribute to the economy and liveability of the neighbourhood.

The table below details the key planning themes of the 2040 Community Strategic Plan and the proposal's consistency with the relevant planning strategies.

Table 3: Consistency with the Dubbo Regional Council 2040 Community Strategic Plan		
Theme	**Strategy**	**Comment**
Theme 1 - Housing	1.1.1 - A variety of residential housing types are located close to appropriate services and facilities	The proposal will facilitate the future development of community and recreational facilities in an area identified for future residential growth. The future development of the site is in conjunction with the extension of Boundary Road and associated infrastructure and will ensure there is appropriate community and recreational infrastructure in the area to support residential growth and create a viable

Table 3: Consistency with the Dubbo Regional Council 2040 Community Strategic Plan		
Theme	**Strategy**	**Comment**
		residential community with a high level of amenity.
	1.2.3 - New residential development is designed in accordance with Safer- By-Design principles.	Future development on the subject site will be designed in accordance with the Safer- By-Design principles. If the rezoning of the site is progressed it will facilitate the development of the site and promote enhanced neighbourhood safety and security through casual surveillance generated by the presence of a permanent new development and activity within the site.
	1.4.3 - Residential and other development is supported by the provision of a strategic and affordable infrastructure framework	The proposal will facilitate the future development of the site in conjunction with the current extension of Boundary Road along the southern boundary of the site which includes the provision of public utility infrastructure and will provide suitable future connections for the site.
Theme 2 - Infrastructure	2.2.1 - Council promotes a high level of road safety to users. 2.2.3 - Council's road network meets the transport needs of users in terms of traffic capacity, functionality and economic and social connectivity.	Traffic and road safety have been key considerations in the preparation of the proposal. A Traffic and Transport Assessment (**Appendix J**) has been prepared in support of the proposal that details that the site is suitable for the proposal and will not adversely impact the safety of the existing or future road network.
	2.5.5 - A network of cycleways and pedestrian facilities is provided and maintained.	The Boundary Road extension is currently under construction to the south of the site which includes the provision of pedestrian and bicycle facilities.

Table 3: Consistency with the Dubbo Regional Council 2040 Community Strategic Plan		
Theme	**Strategy**	**Comment**
Theme 3 - Economy	3.1.5 Events that provide for activities that foster cultural and recreational opportunities and community interaction are supported.	The proposal will facilitate the future development of community and recreational facilities and will ensure they are established in the early stages of the development of the wider residential area. The early establishment of the club and recreational facilities will generate community interactions and create a cohesive residential community as the wider area develops. The site will become a key social, recreational and community destination positively contributing to the liveability of the area.
	3.7.2 Strategic land use strategies establish a land use hierarchy for the location of employment generating activities	The proposal will take advantage of the location of the subject site in proximity to the Boundary Road extension and the future neighbourhood centre identified for development on the opposite side of Boundary Road. The co-location of the proposal with the future neighbourhood centre will create a strategic community and retail precinct for the wider south east residential area. The proposal will ensure the key community, recreation and retail uses are provided in one central location for the wider residential area for convenience and to reduce the impact of providing commercial uses throughout the neighbourhood.
	3.7.3 Planning controls ensure adequate and suitable land is available for new development opportunities.	The proposal will rezone the site to include the additional permitted uses of a registered club and recreation facilities. The inclusion of the additional permitted uses will ensure

Table 3: Consistency with the Dubbo Regional Council 2040 Community Strategic Plan		
Theme	**Strategy**	**Comment**
		the objectives of the proposal can be achieved whilst also ensuring that the site is not sterilized from future development through a full rezoning of the site.
	3.7.4 Neighbourhood shopping centres are located to provide attractive and convenient services and facilities to support new and established neighbourhoods without adversely impacting on the Dubbo Central Business District.	The proposal will take advantage of the location of the subject site in proximity to the Boundary Road extension and the future neighbourhood centre identified for development on the opposite side of Boundary Road. The co-location of the proposal with the future neighbourhood centre will create a strategic community and retail precinct for the wider south east residential area whilst not detracting from the vitality of the Dubbo CBD.
Theme 4 – Community Leadership	4.1.1 There is demonstrated unity throughout the community	The proposal will facilitate the future development of community and recreational facilities and will ensure they are established in the early stages of the development of the wider residential area. The early establishment of the club and recreational facilities will generate community interactions and create a cohesive residential community as the wider area develops. The site will become a key social, recreational and community destination positively contributing to the liveability of the area.
Theme 5 – Liveability	5.5.1 Access to recreation and cultural facilities for young people is improved. 5.5.2 Quality passive and active open space is located to	The proposal will ensure residents of the future residential area will have appropriate access to community and recreation facilities as the area is developed ensuring a high level of accessibility and positively contributing to the liveability of the

Table 3: Consistency with the Dubbo Regional Council 2040 Community Strategic Plan		
Theme	**Strategy**	**Comment**
	maximise access and use by the community 5.5.3 Unique recreational facilities and opportunity are available 5.5.4 Our sporting facilities are recognised as catering for a wide range of local, regional and state sporting events and opportunity	area. The integration of the development into the neighbourhood will ensure a number of social, recreational and community can occur within the neighbourhood and reduce the need to leave the neighbourhood for social and recreational purposes. In addition, The proposal will facilitate a future community and recreational land use that will assist in promoting the emerging residential area and provide a use that will diversify the tourism market in Dubbo and provide a key facility that will attract people to the area.

Is the Planning Proposal consistent with Council's local strategy or other local strategic plan?

6.2.3 Dubbo Local Strategic Planning Statement

The Dubbo Local Strategic Planning Statement (LSPS) plans for the economic, social and environmental land use needs of the community over the next 20 years.

It sets land use planning priorities to ensure that the Dubbo Local Government Area (LGA) can thrive both now and in the future, and that future development is appropriate for the local context. The plan is aimed at ensuring the people have a great city, towns and villages in which to live, work and play; that businesses and visitors have a great place to invest and experience; and that it continue to work towards the strategic vision articulated in the 2040 Community Strategic Plan.

The LSPS is structured around the following five key themes:

- Infrastructure;
- Economy;
- Housing;
- Liveability; and
- Sustainability.

An assessment of the proposal against the relevant key planning priorities of the Dubbo LSPS is provided in the table below.

Table 4: Consistency with the Dubbo Local Strategic Planning Statement	
Planning Priority	Comment
Planning Priority 1: Plan for the delivery of infrastructure to support growth	The proposal will facilitate the future development of community and recreational facilities in an area identified for future residential growth. The future development of the site is in conjunction with the extension of Boundary Road and associated infrastructure and will ensure there is appropriate community and recreational infrastructure in the area to support residential growth and create a viable residential community with a high level of amenity.
Planning Priority 7: Continue to support and grow our tourism industry	The proposal will facilitate a future community and recreational land use that will assist in promoting the emerging residential area and provide a use that will diversify the tourism market in Dubbo and provide a key facility that will attract people to the area.
Planning Priority 8: Ensure supply of employment generating land	The proposal will take advantage of the location of the subject site in proximity to the Boundary Road extension and the future neighbourhood centre identified for development on the opposite side of Boundary Road. The co-location of the proposal with the future neighbourhood centre will create a strategic community and retail precinct for the wider south east residential area. The proposal will ensure the key community, recreation and retail uses are provided in one central location for the wider residential area for convenience and to reduce the impact of providing commercial uses throughout the neighbourhood.
Planning Priority 12: Create sustainable and well-designed neighbourhoods	The proposal will facilitate the future development of community and recreational facilities in an area identified for future residential growth. The future development of the site is in conjunction with the extension of Boundary Road and associated infrastructure and will ensure there is appropriate community and recreational infrastructure in the area to support residential growth and create a viable residential community with a high level of amenity.

6.2.4 Residential Areas Development Strategy

The Dubbo Residential Areas Development Strategy aims to provide a spatial, servicing and development control framework that will assure the timely provision of residential development opportunities which fit the needs of Dubbo and the region it services. The Strategy was designed to protect land for future residential development and to facilitate the servicing, staging, and release of this land.

The subject site falls within the South East Precinct of the strategy. The strategy sets a goal to identify and protect the established residential neighbourhoods and ensure a sufficient supply of suitable land to meet the future residential development needs of the city.

The proposal is not inconsistent with the aims and objectives of the strategy in that it will provide a community use and infrastructure to support area identified for future residential growth. The proposal aims to provide a community use that can ensure the area can develop its own neighbourhood identity.

An assessment of the proposal against the key planning principles of the Residential Area Development Strategy is provided in the table below.

Table 5: Consistency with the Residential Areas Development Strategy

Planning Principle	Comment
Sustainability	Sustainability will be a key consideration in the design of all future development onsite.
Compatibility	The proposal is supported by a number of specialist studies that demonstrate the site's suitability for the inclusion of the additional permitted uses of a registered club and recreational facilities. The Concept Layout Plan provided in **Appendix D** details how the site can be sited and designed to ensure it is compatible with the surrounding residential area.
Amenity	The proposal will facilitate the future development of community and recreational facilities in an area identified for future residential growth. The future development of the site is in conjunction with the extension of Boundary Road and associated infrastructure and will ensure there is appropriate community and recreational infrastructure in the area to support residential growth and create a viable residential community with a high level of amenity.
Efficiency	The proposal will establish community and recreation facilities in the community which will assist in the efficient development of the surrounding area based on the provision of community and recreation infrastructure in the early stages of the development of wider residential area.

Table 5: Consistency with the Residential Areas Development Strategy	
Planning Principle	**Comment**
Economy	It is expected that the proposal and future development of the site will generate significant employment for the community during construction, providing employment for workers and economic benefits from materials and transport of goods. During operation the proposed facility would provide employment for staff required to run and service the restaurants and bars as well as maintain and run the sports facilities. In addition, the proposal will facilitate the development of the site in close proximity to the future neighborhood centre on the opposite side of Boundary Road.
Diversity	The proposal will facilitate the future development of the site for the purposes of a registered club and recreational facilities which will diversify the development envisaged for the area. The inclusion of the additional permitted uses will ensure the objectives of the proposal can be achieved whilst also ensuring that the site is not sterilized from future development through a full rezoning of the site.
Community	The proposal will facilitate the future development of community and recreational facilities and will ensure they are established in the early stages of the development of the wider residential area. The early establishment of the club and recreational facilities will generate community interactions and create a cohesive residential community as the wider area develops. The site will become a key social, recreational and community destination positively contributing to the liveability of the area.

6.2.5 Employment Lands Strategy

The Employment Lands Strategy aims to ensure the City of Dubbo has an appropriate level of commercial, industrial, institutional and tourist zoned land in the future which is situated in locations that can best meet the long-term requirements of Dubbo and the Region.

Whilst it is noted the subject site is zoned R2 Low Density Residential and is not identified within this strategy, the proposal will rezone the site to include additional permitted uses that will result in employment generating activity onsite.

Council staff have advised that as the proposal only includes additional permitted uses and not a full rezoning of the site, the Employment Lands Strategy does not need amending to accommodate the subject site.

An assessment of the proposal against the relevant planning principles of the Employment Lands Strategy is provided in the table below.

Table 6: Consistency with the Employment Lands Strategy	
Planning Principle	**Comment**
Maintain and support the CBD as Dubbo's primary service and retail centre	The proposal will take advantage of the location of the subject site in proximity to the Boundary Road extension and the future neighbourhood centre identified for development on the opposite side of Boundary Road. The co-location of the proposal with the future neighbourhood centre will create a strategic community and retail precinct for the wider south east residential area whilst not detracting from the vitality of the Dubbo CBD.
Infrastructure is appropriately planned to encourage sustainable development of employment lands.	The proposal will facilitate the future development of the site in conjunction with the current extension of Boundary Road along the southern boundary of the site which includes the provision of public utility infrastructure and will provide suitable future connections for the site allowing for the appropriate and sustainable development of the site.
Any proposals for new employment lands are adequately planned for to meet the long-term needs of Dubbo's industry and community.	The proposal will facilitate the future development of community and recreational facilities and will ensure they are established in the early stages of the development of the wider residential area. The early establishment of the club and recreational facilities will generate community interactions and create a cohesive residential community as the wider area develops. The site will become a key social, recreational and community destination positively contributing to the liveability of the area. It is expected that the proposal and future development of the site will generate significant employment for the community during construction, providing employment for workers and economic benefits from materials and transport of goods. During operation the proposed facility would provide employment for staff required to run and service the restaurants and bars as well as maintain and run the sports facilities.
Maintain the efficiency of Dubbo's key transport corridors.	The subject site will have frontage to the future extension of boundary road between Wheelers Lane and Sheraton Road. A key driver for the extension of Boundary Road was the redirection of localised traffic away from Dubbo's key

Table 6: Consistency with the Employment Lands Strategy	
Planning Principle	Comment
	transport corridors tom minimise potential for conflict and appropriately mange volumes of traffic. The proposal will ensure the key transport corridors can maintain efficiency.

Is the Planning Proposal consistent with applicable State Environmental Planning Policies?

The Planning Proposal is consistent with the relevant State Environmental Planning Policies (SEPPs) that apply to the site. A detailed list of the SEPPs and commentary is provided at **Appendix A**.

Is the Planning Proposal consistent with applicable Ministerial Directions (s9.1 directions)?

The Planning Proposal is generally consistent with the Section 9.1 directions issued by the Minister for Planning. A statement of the consistency of this Planning Proposal with these directions is provided at **Appendix B.**

6.3 Environmental, Social and Economic Impact

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?

6.3.1 Ecological Impacts

The subject site is not identified as having biodiversity value or being ecologically significant as detailed in the Natural Resource – Biodiversity Map provided in the Dubbo Local Environmental Plan (LEP) 2011. The site currently contains scattered vegetation in the form of weeds and some trees.

The site is currently zoned R2 Low Density Residential under the Dubbo LEP and it is assumed it would eventually be developed to accommodate residential dwellings. The Planning Proposal will rezone the site to include the additional permitted uses of a register club and recreation facilities.

All future development on the site will be sited and designed to best respond to the ecological value of the surrounding area and will include the provision of native landscaping to assist in the integration of the future development into the surrounding environment. It is therefore considered that the Planning Proposal will not adversely impact on critical habitat, threatened species, populations or ecological communities and their habitats.

Are there any other likely environmental effects as a result of the Planning Proposal and how are they proposed to be managed?

6.3.2 Contamination

The subject site was previously used for agricultural purposes and has introduced fill from various sources present onsite. A Preliminary Site Investigation (**Appendix F**) has been undertaken by Envirowest in support of the proposal to determine suitability of the site for the proposed rezoning. A site assessment was conducted on 19 May 2020 consisting of a site walkover, desktop study and limited soil sampling.

The preliminary contamination assessment comprised a soil sampling and laboratory analysis program. A total of sixteen locations were assessed across the site. Six boreholes were drilled to rock onsite to determine the soil profile and ten soil samples were collected from stockpiles to provide an indicator of potential contamination.

Levels of chromium (III) exceeded adopted thresholds in one stockpile sample. Additional investigations are required to delineate impacted material. The levels of all other analytes evaluated in the soil samples were below the adopted health and ecological investigation and screening levels for recreational and commercial land-use. The Investigation concluded that It is expected that the site can be made suitable for the proposed land-use following additional investigations, completion of remediation works and validation assessment where required.

The additional investigations and remediation work and validation assessment where required will be undertaken at Development Application stage when physical works are proposed onsite.

6.3.3 Salinity and Groundwater

A Salinity and Groundwater Assessment (**Appendix G**) was prepared by Envirowest to assess the existing salinity conditions of the soil and groundwater onsite and determine the potential future impact of development on the site.

An initial investigation and desktop review was undertaken to collect existing information on groundwater on and around the site and the likelihood of salinity across the site. Boreholes were drilled and soil samples collected on 19 May 2020.

The site investigation included description of the existing landscape, soil investigation, laboratory analysis and groundwater investigation. The soil profile investigation was undertaken by constructing six boreholes up to 1.7m in depth or drill refusal. Representative soil samples were collected and analysed for pH, electrical conductivity, colour, dispersion, texture, chlorides and exchangeable sodium percentage.

The investigation results and proposed development were evaluated to identify impacts and recommend management outcomes to minimise salinity risk. Water balance was modelled to estimate changes in infiltration following development. Surface water flow containing sediment, nitrogen and phosphorus were modelled.

No visual surface or sub-surface indicators of groundwater discharge areas were identified on the site. The infiltration balance indicated infiltration will reduce under the post development scenario due to an increase in impermeable areas. Rainfall on impermeable areas will drain off-site in stormwater pipes.

The investigation concluded that the risk of groundwater contamination from the proposed land uses is lower than the current land use. Nutrient contributions will decrease as a result of smaller available areas for fertilisation and a decrease in animal waste. Sediment contributions will also decrease as a result of an increase in hard cover areas and no soil disturbance from farming activities.

No impact on groundwater including contamination and changed groundwater levels is expected from the development. The development will not impact on quantity or quality of both unconfined and confined aquifers.

6.3.4 Aboriginal Heritage

An Aboriginal Due Diligence Assessment (**Appendix E**) has been prepared by Artefact in support of the proposal. The assessment included a desktop review and site inspection. The desktop and visual inspection component for the study area follows the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (Due Diligence; DECCW 2010). The field inspection followed the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in New South Wales* (OEH 2011).

The investigation identified that the study area is relatively distant to reliable water and has no specific landform features indicating archaeological sensitivity. However, the local area more generally appears to have provided good conditions for Aboriginal occupation over many previous generations.

The lack of identifiable resources in the study area (other than potentially basalt) and its distance to water indicate that habitation sites (artefact scatters, isolated finds and hearths indicating occupation of the land) may be less likely than further to the east or south. The basalt capping makes the ridge top uneven, reducing its suitability as a camp site. This is supported by the registered AHIMS sites near the study area, which show a high occurrence of artefact sites closer to Eulomogo Creek and the Macquarie River. The expected site types at the study area would be the result of resource gathering or markers associated with habitation of nearby areas, such as scarred trees and isolated finds.

The undertaking of the Due Diligence process resulted in the conclusion that the proposed works will have an impact on the ground surface, however, no Aboriginal objects or intact archaeological deposits will be harmed by the proposal. The Due Diligence Assessment concludes that no Aboriginal Heritage Impact Permit application is required and provides a number of recommendations to be implemented in future development to ensure the greatest possible protection to the area's Aboriginal cultural heritage values.

6.3.5 Acoustic Impacts

The subject site is located in an area identified for future low-density residential development and therefore acoustic amenity ad the potential impact of future development has been a key consideration in the preparation of the Planning Proposal.

A Preliminary Opportunities and Constraints Noise Assessment (**Appendix H**) has been prepared by Muller Acoustic Consulting in support of the proposal. The assessment was been undertaken to provide a summary of existing environmental noise and identifies opportunities and constraints related to the

rezoning of the site to facilitate the development of a registered club and recreation facilities. The main aspects considered in the assessment were:

- Noise emissions during the construction phase of a potential registered club;
- Independent Liquor and Gaming Authority (ILGA) noise emissions from the proposal site;
- Noise emissions associated with the internal operation including likely facilities such as restaurant, bar and function room;
- Noise emissions associated with the potential external activities including the use of the sports facilities and outdoor terrace areas;
- Operational noise from the mechanical plant associated with the development; and
- Road traffic noise from patron access and egress from the proposal site.

The surrounding locality is currently described as a rural environment with undeveloped lots located on all sides of the proposal site. The current noise environment is dominated by natural and wildlife noise sources.

It is however noted that as the wider area develops, the ambient environment surrounding the proposal site will evolve from a rural to a suburban environment, with traffic and domestic noise becoming the dominating sources.

Once the area is developed the site will be bound to the south by the Boundary Road extension and to the east by (proposed) Henty Drive. The undeveloped lots to the west and north are expected to be a range of residential land uses. To assess noise levels at the nearest potential residences, hypothetical receiver points were identified in close proximity to each side of the proposal site.

The assessment identified that the rural nature of the locality, short separation distances between the proposal site and nearby receivers, and the nature of the proposal activities would result in a moderate to high risk of noise impacts, particularly from sports/external events and road traffic noise.

The assessment does note that as Keswick Estate develops it is likely that the ambient rural noise environment will evolve into a typical suburban noise environment. The review has concluded that during the construction phase of a potential registered club, there is potential that the generated noise levels may be above the relevant criteria, however as the area is currently undergoing development, construction noise may be typical for the area for the foreseeable future. It is also noted that the lots surrounding the project site are undeveloped and that many receivers would not be completed or occupied prior to construction of the facility.

During operation of a potential registered club, there is a moderate to high risk of noise impacts within the community. The risk of potential impacts would be greater during the evening and night period as a result of the more stringent period criteria. It is therefore considered that management and mitigation measures may be required to reduce the potential impacts on the community. The management and mitigation measures will be provided in more detail in the Noise Impact Assessment report for the project.

The assessment concluded that the proposal site is considered suitable for rezoning to allow for the potential future development of a registered club and recreation facilities subject to appropriate

management and mitigation measures to be confirmed and implemented at Development Application stage.

6.3.6 Traffic and Transport

A Traffic and Transport Assessment has been prepared by TTM Consulting in support of the proposal and is provided in **Appendix J**. The report assesses the transport implications of the proposed rezoning and includes an assessment of the existing conditions including site context and the current and planned transport environment, road network assessment and traffic modelling.

Vehicular access to the site is provided via a single 11m wide divided driveway crossover on Henty Drive, in the north-east corner of the site. The preliminary design indicates an all-movements, unsignalized access with dedicated left and right turn lanes into the site from Henty Drive. The proposed access location is cognisant not only of Council restrictions, but also of the practical spatial requirements of the sports field and of the desire to minimise traffic impacts on the roundabout.

Given that the timing for the construction of Henty Drive is uncertain, and in order to facilitate access to the site, Council has advised that it will construct and maintain an interim arrangement on Henty Drive until such time as full construction takes place. TTM are advised that his interim arrangement will consist of a two-lane bitumen sealed access from the roundabout along the entire eastern frontage of the site. The applicant would be happy to discuss the inclusion of any site specific clauses in the Dubbo LEP relating to the interim access measures if deemed to be required.

The total indicative parking supply is 197 car spaces as detailed on the Concept Layout Plan provided in **Appendix D**. This satisfies the estimated maximum practical demand for the development (194 spaces), and essentially satisfies the Council requirement as outlined in the Dubbo Development Control Plan (DCP) 2011, being just 5 spaces (or 2.5%) less than the calculated requirement.= The dimensions layout and geometry of the car park design are consistent with the requirements of AS2890, and the Dubbo DCP.

Given the estimates of development generated traffic during these times are relatively low, and that the access driveway has been located as far from the adjacent intersection as possible, it is considered likely that the future road network will easily accommodate the development generated traffic.

The Traffic and Transport Assessment concludes that the Planning Proposal is supportable from a traffic engineering and safety perspective and the site is considered suitable for the future development of a registered club and recreation facilities.

Has the Planning Proposal adequately addressed any social and economic effects?

6.3.7 Social Infrastructure

A Social Impact Assessment has been prepared by Hill PDA in support of the proposal and is provided in **Appendix K**. The Social Impact Assessment provides a detailed description of the existing social environment and an assessment of the potential social impacts from the proposed development.

The assessment identified the following key areas potential social impacts resulting from the proposal:

- **Access and Connectivity** - How patrons arrive to and from a licensed premise can have a significant impact on the amenity and safety of an area. The longer a patron must wait for transport generally increases the opportunity for antisocial behaviour and risk to themselves and the community. Ensuring that the proposed development has adequate public transport and a high quality and frequent taxi service would improve safety and amenity of the area;

- **Amenity** - Unwanted noise may result in reduced residential amenity for neighbouring residents. Adopting the recommendations of the acoustic report would manage the potential noise impacts generated from the proposal. Doing so would ensure compliance with the NSW Government's Office of Liquor, Gaming and Racing (OLGR) noise limits and help mitigate potential social impacts resulting from increased noise.

- **Community Cohesion** - The review of the surrounds indicates that the proposed venue is isolated from other licensed venues and late-night venues. The proposal is likely to benefit the community both, adults and children, in the eastern Dubbo area who may use the new Dubbo RSL as an option for entertainment and recreation. The proposed development is expected to be generally publicly accessible and would act as a place for social interaction. As such, it could increase the opportunities for residents of the surrounding residential community and surrounds to interact, subsequently would be beneficial to community cohesion within the study area and provide social benefits.

- **Community Health and Safety** - Crime associated with alcohol consumption could be perceived as a risk to public safety in the local area. Alcohol related antisocial behaviour can negatively impact patrons, employees, property, neighbouring residents, police and emergency service workers, and hospitality workers in general. the area surrounding the site does not have a high incidence of alcohol-related assault or non-domestic assault crimes. The proposed venue is not located near other licensed venues which indicates that a clustering effect of alcohol-related antisocial behaviour is less of a risk. In addition, the provision of additional sporting facilities will help encourage health lifestyles for the wider area.

- **Local Economy and Employment** - It is expected that the site will generate significant employment for the community during construction, providing employment for workers and economic benefits from materials and transport of goods. During operation the proposed facility would provide employment for staff required to run and service the restaurants and bars as well as maintain and run the sports facilities.

- **Provision of Social Infrastructure and Recreation Facilities** - At current the proposal includes unique facilities that are not currently available within 2km of the site. The Club would provide facilities for the new and existing community to enjoy sports, recreation and entertainment locally. The additional facilities would have a positive impact on the community.

The assessment concludes that the potential negative impacts of the proposed development can be successfully managed with the implementation of the mitigation measures detailed throughout the report and the community will benefit from the addition of local sports, recreation and entertainment facilities.

A Plan of Management can be prepared at the DA stage to minimise the risk of antisocial behaviour at the site and ensure that ongoing operations at the site appropriately managed and monitored.

6.3.8 Services and Utilities

A Civil Engineering Servicing Report has been prepared by AT&L in support of the proposal and is provided in **Appendix I**. The report undertook a review of all the existing civil infrastructure on site and in the surrounding area to determine the ability of the site to be serviced if the rezoning progresses.

As part of Dubbo Council's investment of capital projects, the Boundary Road Extension project is proposed to provide connection between Wheelers Lane and Sheraton Road to the east. The purpose of this extension is to provide access to developing The Keswick and Southlakes housing estates and improve access for residents to Dubbo's growth areas.

Stage 1 of the Boundary Road Extension Project, between Wheelers Lane and Alexandria Avenue was completed by Council in late 2018. Stage 2, between Alexandria Avenue and Sheraton Road is currently under construction.

The Stage 2 extension is a 1.2km long two-lane sealed and fully kerbed extension with integrated bike lanes and a footpath on the southern side. The following utilities will be installed as part of the works:

- Stormwater;
- Potable Water;
- Sewer;
- Street lighting and underground electricity; and
- Telecommunications.

Stormwater Drainage

Dial Before You Dig (DBYD) records from Dubbo Regional Council indicate there is no existing piped stormwater infrastructure on the site or within the proposed street frontages to the site.

As part of the Boundary Road extension works scheduled for completion by Dubbo Council, stormwater drainage has been proposed within the road reserve. The proposed network indicates a DN525mm pipe will be installed in the south-east corner of the lot fronting Stream Ave and a DN300mm pipe will be installed in the south-east corner of the lot fronting Boundary Road. These two connection locations ultimately drain into the same trunk drainage network to the east. Council have advised it will be possible to connect the proposed lot into this system, subject to their consultation and approval.

In order to control stormwater runoff, a new stormwater drainage network will be constructed within the proposed site to service the development. Prior to discharging into Council's street trunk drainage system, on-site detention will be provided to satisfy the permissible discharge requirements for the site.

All stormwater drainage infrastructure will be designed in accordance with the requirements of the relevant engineering standards including the Dubbo Development Control Plan 2013 and AS3500.3.

Potable Water

Dial Before You Dig (DBYD) records from Dubbo Regional Council indicate there is no existing potable water infrastructure on the site or within the proposed street frontages to the site. There is however an existing potable water service at the intersection of Alexandria Avenue and Boundary Road.

As part of the Boundary Road extension works, Council have advised a DN150mm PVC potable water main will extend from the potable water service at the intersection of Alexandria Avenue and Boundary Road and be provided within the verge fronting the south east corner of the lot. Council have advised connection to this potable water service is possible, subject to their consultation and approval.

Sewer

Dial Before You Dig (DBYD) records from Dubbo Council indicate there is no existing sewer infrastructure on the site or within the proposed street frontages to the site.

As part of the Boundary Road extension works, Dubbo Council propose a HDPE DN50mm pressure sewer connection and pressure sewer boundary kit will be made available to the lot. Council have advised connection to the pressured sewer network is possible, subject to the construction of an on-site sewer pump station and their consultation and approval.

In addition to the pressurised system, a DN150mm gravity sewer connection will also be provided to the lot. Connection to this service will not be available for use until such a time the Southlakes Residential subdivision to the south of Boundary Road extends its internal sewer network. Once the gravity sewer is made live, the lot can be disconnected from the pressure sewer network and connected to the gravity sewer.

Electricity

Dial Before You Dig (DBYD) records from Essential Energy indicate there is no existing electrical infrastructure on the site or within the proposed street frontages to the site. However, Council's Boundary Road extension documentation show 2 x 11kV existing underground feeders from the Sheraton Road Solar Farm to the east of the proposed site. Connection to these feeders are not available and need to be protected during construction.

As part of the Boundary Road extension works, Dubbo Council propose the installation of underground electrical conduits located within the centre median and the southern verge of Boundary Road, and within a crossing connection on Stream Avenue. Council have not confirmed the capacity within these conduits, however, have expressed both high (11kV) and low voltage (415V) conduits are likely to be provided. Connection to this service is available, subject to the approval of the Essential Energy.

Natural Gas

Dial Before You Dig (DBYD) records indicate there is no existing gas infrastructure on the site or within the

proposed street frontages to the site.

As part of the Boundary Road extension works, Dubbo Council propose a low-pressure natural gas main in the southern verge of Boundary Road and within a crossing connection on Stream Avenue. The diameter of the gas main has not been finalised, however will likely be either DN32mm or DN50mm. Connection to this gas main will be available in the south-east corner of the site within the Stream Avenue (Henty Drive) verge.

Telecommunications

Dial Before You Dig (DBYD) results from NBN indicate there is no existing telecommunications infrastructure on the site or within the proposed street frontages to the site.

As part of the Boundary Road extension works, Dubbo Council propose NBN pit and pipe network in the southern verge of Boundary Road and within a crossing connection on Stream Avenue. The network will provide conduits only and fibres are to be provided by the proposed development in consultation with the NBN.

6.4 State and Commonwealth Interests

Is there adequate public infrastructure for the Planning Proposal?

As detailed above, the Boundary Road Extension project is proposed to provide connection between Wheelers Lane and Sheraton Road to the east. Stage 1 of the Boundary Road Extension Project, between Wheelers Lane and Alexandria Avenue was completed by Council in late 2018. Stage 2, between Alexandria Avenue and Sheraton Road is currently under construction.

The Stage 2 extension is a 1.2km long two-lane sealed and fully kerbed extension with integrated bike lanes and a footpath on the southern side. Stage 2 will construct the section of Boundary Road that bounds the subject site to the south. The following utilities will be installed as part of the works:

- Stormwater;
- Potable Water;
- Sewer;
- Street lighting and underground electricity; and
- Telecommunications.

Once the construction of Boundary Road is completed the site will have adequate access to public infrastructure to support the future development of the site subject to approval and consultation with Council and the relevant authorities at Development Application Stage.

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

Consultation with relevant State and Commonwealth public authorities will be undertaken as part of the exhibition of the Planning Proposal, as directed by the Gateway Determination. In this regard, consultation with the following public authorities is anticipated:

- Transport for NSW
- Essential Energy
- NSW Water
- NSW Environment, Energy and Science
- NSW Office of Environment and Heritage

7.0 Mapping

As discussed in Section 5 of this report the Planning Proposal seeks to amend the Dubbo LEP 2011 as follows:

- Amend the Additional Permitted Uses Map for the subject site (Sheet APU_008B) to identify the site for additional permitted uses referenced in Schedule 1 of the LEP.

The required mapping will be undertaken by Council once Gateway Determination has been issued for the proposal.

8.0 Community and Key Stakeholder Consultation

It is expected that direction as to the nature and extent of the public exhibition will be provided by Department of Planning, Industry and Environment as part of the Gateway Determination. No formal community consultation has been undertaken in relation to this Planning Proposal to date.

In accordance with the Department of Planning & Environment Guidelines for preparing Planning Proposals a pre-lodgment meeting was undertaken with Dubbo Council staff on 9 September 2020 to discuss the proposed rezoning of the site as detailed in Section 1.2 of this report.

9.0 Project Timeline

The Relevant Planning Authority (RPA) has discretion to determine the relevant project timeframe for the determination of this Planning Proposal. The information detailed within this Planning Proposal has been provided to outline any potential impacts and provide justification to support and assist the RPA's determination.

10.0 Conclusion

This Planning Proposal has been prepared by The Planning Hub on behalf of the Dubbo RSL and seeks to amend the Dubbo Local Environmental Plan (LEP) 2011 to will seek to rezone a parcel of land to include additional permitted uses of a registered club and recreational facilities at Boundary Road, Dubbo.

The Planning Proposal has been prepared in accordance with Section 3.33 of the Environmental Planning

and Assessment Act 1979 (the EP&A Act) and the relevant guidelines prepared by the NSW Department of Planning including 'A Guide to Preparing Local Environmental Plans' and *'A Guide to Preparing Planning Proposals'*.

The Planning Proposal provides a comprehensive justification of the proposed amendment to the Dubbo LEP 2011, and significant planning merit in the following respects:

- It will facilitate the future development of community and recreational facilities in an area identified for future residential growth;
- It will provide suitable access to community and recreational facilities for future residents of the wider area;
- It will allow the site to become a key social, recreational and community destination positively contributing to the liveability of the area; and
- It will allow the site to contribute to the generation of a key strategic community and retail precinct for the wider south east residential area in association with the future neighborhood centre.

Given the above significant planning merits and the absence of any adverse social, economic or environmental impacts, it is requested that the Planning Proposal be favorably considered by Council and that Council resolve to forward it to the Department of Planning, Industry & Environment to allow the Department to consider the Planning Proposal for Gateway Determination under Section 3.34 of the Environmental Planning and Assessment Act, 1979.

THE PLANNINGHUB
by Hawes & Swan

APPENDIX A

PLANNING PROPOSAL CONSISTENCY WITH STATE ENVIRONMENTAL PLANNING POLICIES (SEPPs)

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Consistency with Relevant State Environmental Planning Policies (SEPPs) Boundary Road, Dubbo			
SEPP	Aim	Comment	Complies
SEPP 55 – Remediation of Land	This Policy provides a state-wide planning approach to remediation and aims to promote the remediation of any contaminated land for the purpose of reducing the risk of harm to human health and/or the environment. A planning authority is to consider whether the land is contaminated and if so whether it is, or can be made, suitable for the proposed land uses.	A Preliminary Site Investigation has been undertaken by Envirowest in support of the proposal and is provided in **Appendix F**. The Investigation states that additional investigations are required to delineate impacted material onsite. The levels of all other analytes evaluated in the soil samples were below the adopted health and ecological investigation and screening levels for recreational and commercial land-use. The Investigation concludes that It is expected that the site can be made suitable for the proposed land-use following additional investigations, completion of remediation works and validation assessment where required. The additional investigations and remediation work and validation assessment where required will be undertaken at Development Application stage when physical works are proposed. The proposal is considered to be consistent with this SEPP as contamination has been considered as a part of the proposal and the site is expected to be able to be made suitable for its intended use at DA Stage.	✓
SEPP 64 – Advertising and Signage	The aim of this policy is to regulate signage, ensure it is of a high-quality design and finish, provides effective communication in suitable locations and is compatible with the desired visual character.	The planning proposal does not preclude future development on the site of complying with the SEPP. All future applications for signage and advertisement	✓

		on the site will need to be consistent with the relevant provisions of this SEPP.	

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APPENDIX B

PLANNING PROPOSAL CONSISTENCY WITH SECTION 9.1 MINISTERIAL DIRECTIONS

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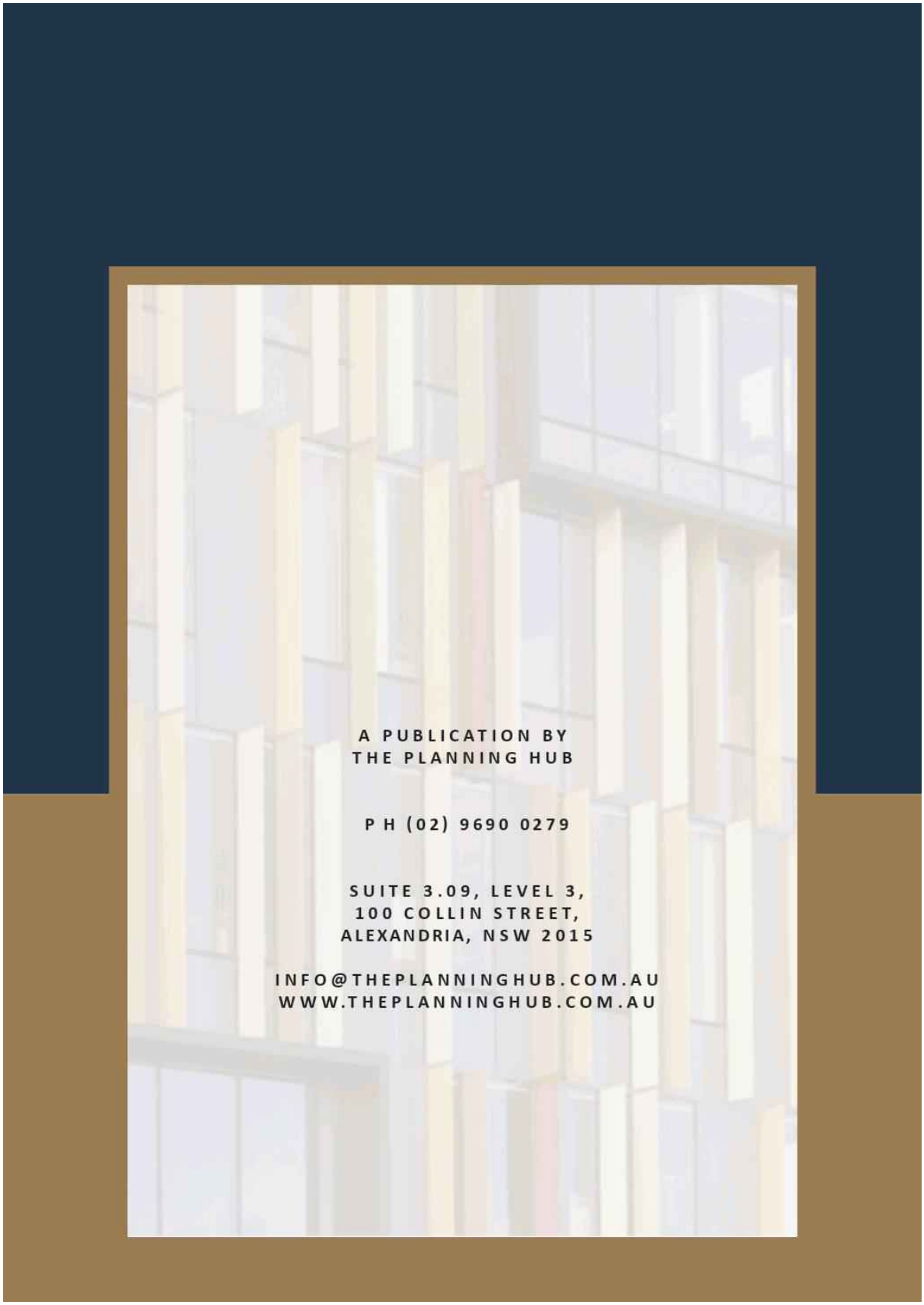
Consistency with Relevant Section 9.1 Ministerial Directions Boundary Road, Dubbo			
Direction	**Requirement**	**Comment**	**Complies**
2 – Environment and Heritage			
2.3 – Heritage Conservation	A planning proposal must contain provisions that facilitate the conservation of: (a) items, places, buildings, works, relics, moveable objects or precincts of environmental heritage significance to an area, in relation to the historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic value of the item, area, object or place, identified in a study of the environmental heritage of the area, (b) Aboriginal objects or Aboriginal places that are protected under the National Parks and Wildlife Act 1974, and (c) Aboriginal areas, Aboriginal objects, Aboriginal places or landscapes identified by an Aboriginal heritage survey prepared by or on behalf of an Aboriginal Land Council, Aboriginal body or public authority and provided to the relevant planning authority, which identifies the area, object, place or landscape as being of heritage significance to Aboriginal culture and people.	An Aboriginal Due Diligence Assessment (**Appendix E**) has been prepared by OzArk in support of the proposal and concludes that the proposal will not impact on any Aboriginal objects or intact archaeological deposits. In addition, the report provides recommendations for the construction of the proposal to ensure no further investigations will be required. The proposal is therefore considered to be consistent with this direction.	✓
2.6 – Remediation of Contaminated Land	A planning proposal authority must not include in a particular zone (within the meaning of the local environmental plan) any land specified in paragraph (2) if the inclusion of the land in that zone would permit a change of use of the land, unless: (a) the planning proposal authority has considered whether the land is contaminated, and (b) if the land is contaminated, the planning proposal authority is satisfied that the land is suitable in its contaminated state (or will be	A Preliminary Site Investigation has been undertaken by Envirowest in support of the proposal and is provided in **Appendix F**. The Investigation states that additional investigations are required to delineate impacted material onsite. The levels of all other analytes evaluated in the soil samples were below the adopted health and ecological investigation and screening levels for recreational and commercial land-use.	✓

	suitable, after remediation) for all the purposes for which land in the zone concerned is permitted to be used, and (c) if the land requires remediation to be made suitable for any purpose for which land in that zone is permitted to be used, the planning proposal authority is satisfied that the land will be so remediated before the land is used for that purpose.	The Investigation concludes that it is expected that the site can be made suitable for the proposed land-use following additional investigations, completion of remediation works and validation assessment where required. The additional investigations, remediation work and validation assessment where required will be undertaken at Development Application stage when physical works are proposed. The proposal is considered to be consistent with this direction as contamination has been considered as a part of the proposal and the site is expected to be able to be made suitable for its intended use at DA Stage.	
3 – Housing, Infrastructure and Urban Development			
3.1 – Residential Zones	A planning proposal must include provisions that encourage the provision of housing that will: (a) broaden the choice of building types and locations available in the housing market, and (b) make more efficient use of existing infrastructure and services, and (c) reduce the consumption of land for housing and associated urban development on the urban fringe, and (d) be of good design.	The proposal is inconsistent with the direction as it will facilitate additional permitted uses on land zoned for residential purposes. The proposal's inconsistency with the direction is considered reasonable as it will provide a community use and infrastructure in a future residential area that will positively contribute to the economy and liveability of the neighbourhood. The proposal only relates to the one site and is considered to be of minor significance as the surrounding land will remain zoned for residential purposes and the proposal will facilitate a community use that will positively contribute to the residential area and provide suitable access to facilities for future residents. The inclusion of the additional permitted uses will ensure the objectives of the proposal can be achieved whilst also	On Merit

		ensuring that the site is not sterilized from future development through a full rezoning of the site.	
3.4 – Integrating Land Use and Transport	The objective of this direction is to ensure that urban structures, building forms, land use locations, development designs, subdivision and street layouts achieve the following planning objectives: (a) improving access to housing, jobs and services by walking, cycling and public transport, and (b) increasing the choice of available transport and reducing dependence on cars, and (c) reducing travel demand including the number of trips generated by development and the distances travelled, especially by car; and (d) supporting the efficient and viable operation of public transport services, and (e) providing for the efficient movement of freight.	The proposal is consistent with this direction as it has been designed with consideration of the future road network and will ensure future development can facilitate the efficient movement of vehicles onsite and the surrounding road network. A Traffic and Transport Assessment (**Appendix J**) has been prepared by TTM Group in support of the proposal which concludes that the proposal is unlikely to impact the existing and future road networks and further detailed assessment will be undertaken at development application stage.	✓
5 - Regional Planning			
5.10 – Implementation of Regional Plans	Planning proposals must be consistent with a Regional Plan released by the Minister for Planning.	The proposal is consistent with this direction as it is consistent with the Central West and Orana Regional Plan as detailed in Section 6.2 of the planning report.	✓


A PUBLICATION BY
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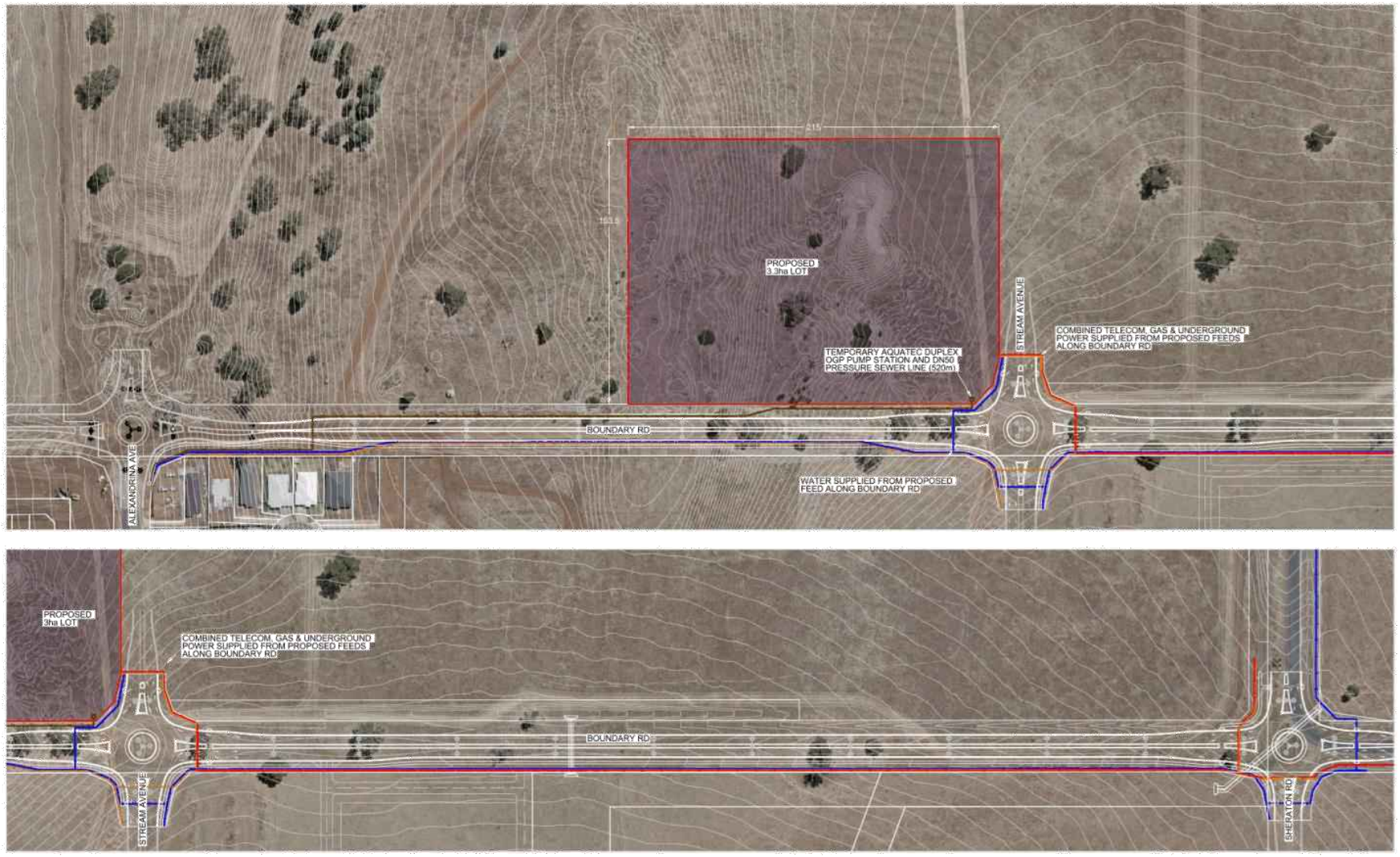
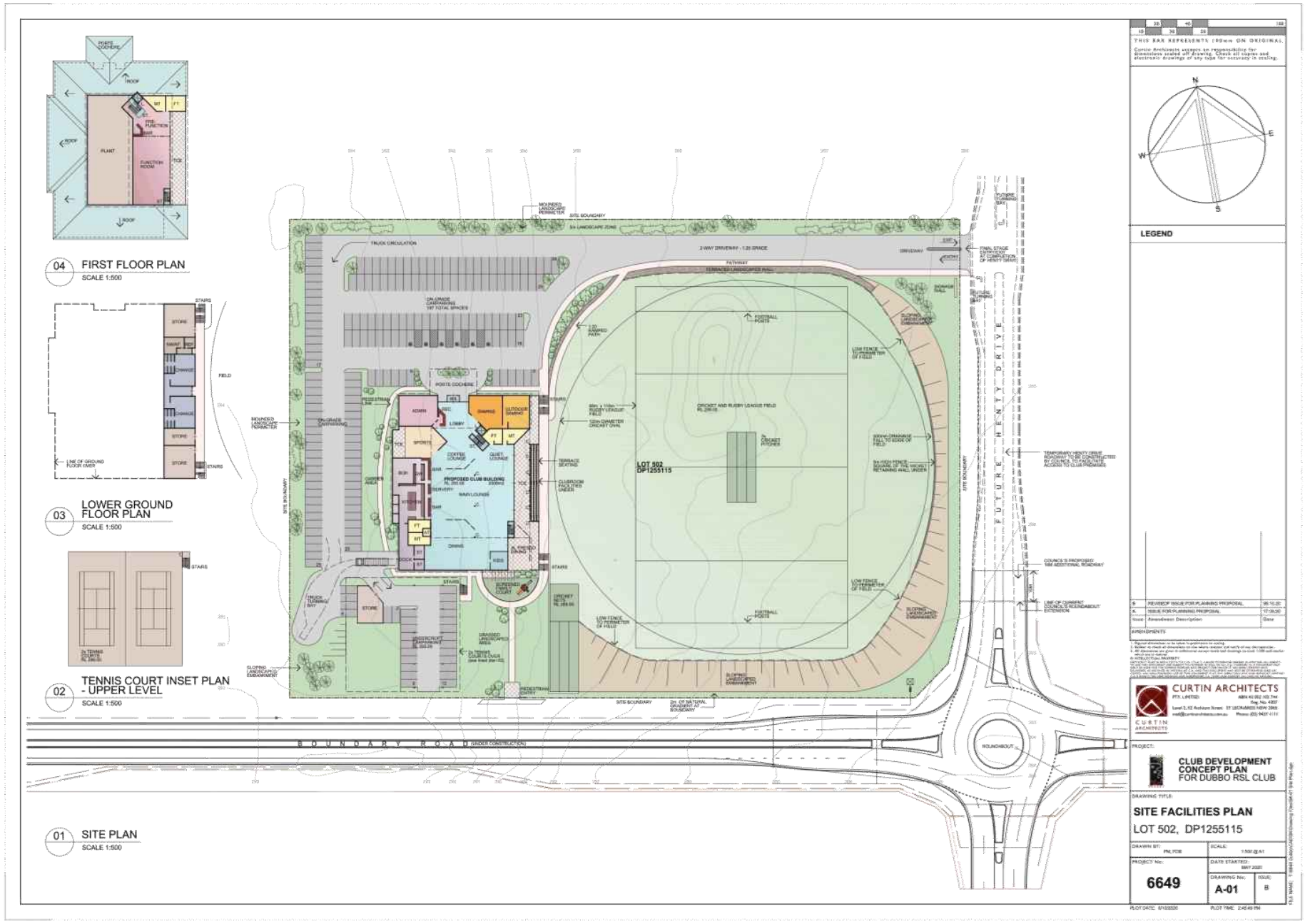
PROPOSED RSL LOT SERVICING STRATEGY



PROPOSED RSL LOT SERVICING STRATEGY




04 FIRST FLOOR PLAN
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03 LOWER GROUND FLOOR PLAN
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02 TENNIS COURT INSET PLAN - UPPER LEVEL
SCALE 1:500
01 SITE PLAN
SCALE 1:500
LOT 502 DP1255115
PROPOSED CLUB BUILDING
CRICKET AND RUGBY LEAGUE FIELD
FUTURE HENTY DRIVE
BOUNDARY ROAD (UNDER CONSTRUCTION)
LEGEND
CURTIN ARCHITECTS
CLUB DEVELOPMENT CONCEPT PLAN FOR DUBBO RSL CLUB
SITE FACILITIES PLAN
LOT 502, DP1255115
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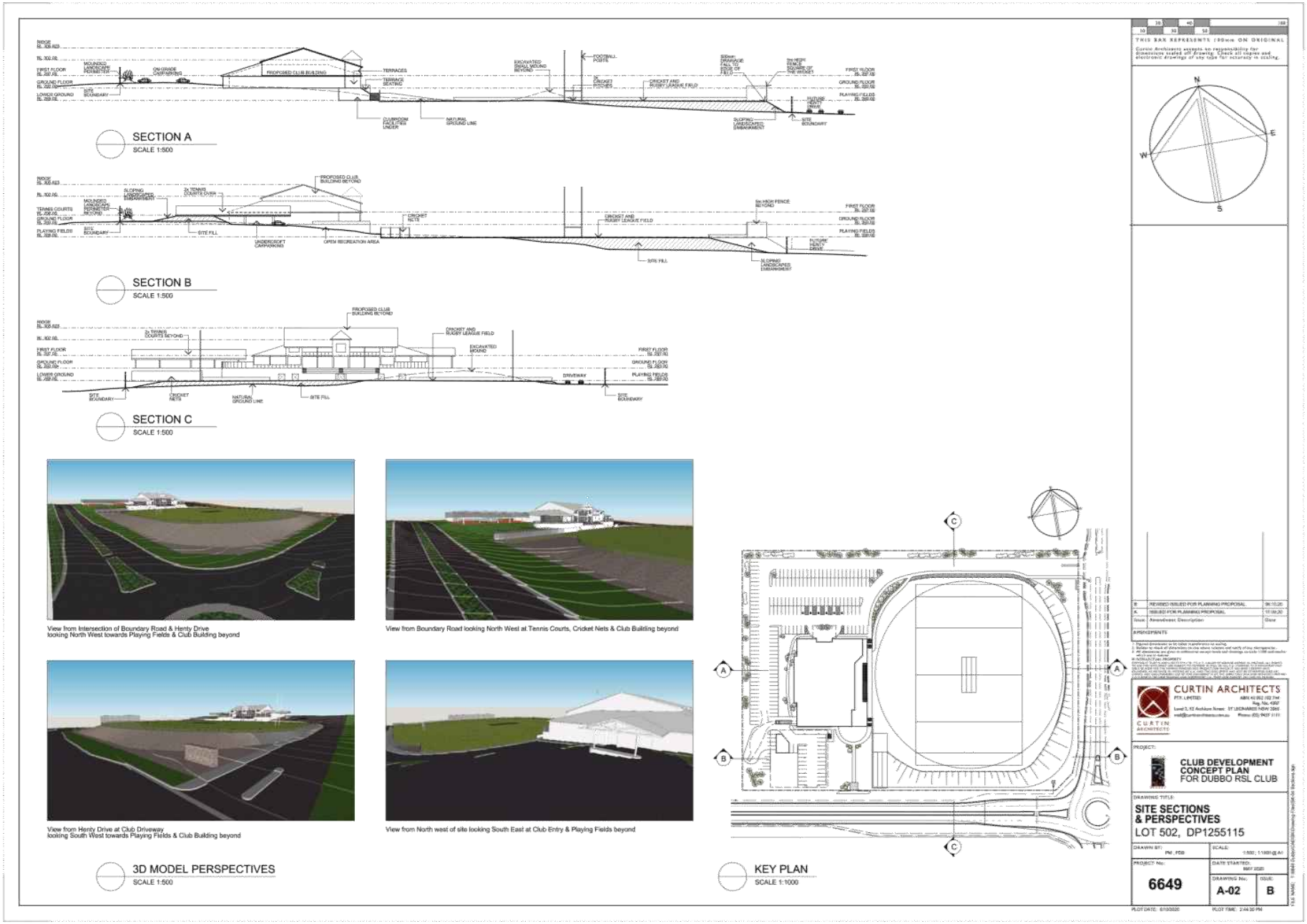
SECTION A
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SECTION C
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View from Intersection of Boundary Road & Henty Drive looking North West towards Playing Fields & Club Building beyond
View from Boundary Road looking North West at Tennis Courts, Cricket Nets & Club Building beyond
View from Henty Drive at Club Driveway looking South West towards Playing Fields & Club Building beyond
View from North west of site looking South East at Club Entry & Playing Fields beyond
3D MODEL PERSPECTIVES
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KEY PLAN
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CLUB DEVELOPMENT CONCEPT PLAN FOR DUBBO RSL CLUB
SITE SECTIONS & PERSPECTIVES
LOT 502, DP1255115
6649
A-02
B



View west through study area.

ABORIGINAL HERITAGE DUE DILIGENCE ASSESSMENT REPORT

PROPOSED RSL SPORTING FACILITY: KESWICK ESTATE

DUBBO

MAY 2020

Report prepared by

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DOCUMENT CONTROLS

Proponent	Dubbo RSL Club
Client	The Planning Hub
Document Description	Aboriginal Due Diligence Assessment Report: Keswick, Dubbo
File Location	OzArk Job No.
S:\OzArk EHM Data\Clients\The Planning Hub\Dubbo RSL Jan 2020	2545

Document Status: V3.0 Final	Date 8 May 2020
Draft V1.0 Author to editor OzArk 1st internal (Series V1 = OzArk internal edits)	V1.0 HR author 6/5/2020 V1.1 JB edit 08/05/20
Draft V2.0 Report Draft for release to client (Series V2 = OzArk and client edits)	V2.0 OzArk to The Planning Hub
FINAL V3.0 = Final report	V3.0 OzArk to The Planning Hub 17/08/2020
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Enquiries should be addressed to OzArk Environment & Heritage.

Acknowledgement

OzArk acknowledge Traditional Owners of the area on which this assessment took place and pay respect to their beliefs, cultural heritage and continuing connection with the land. We also acknowledge and pay respect to the post-contact experiences of Aboriginal people with attachment to the area and to the elders, past and present, as the next generation of role models and vessels for memories, traditions, culture and hopes of local Aboriginal people.

EXECUTIVE SUMMARY

OzArk Environment & Heritage (OzArk) has been engaged by The Planning Hub (the client), on behalf of Dubbo RSL Club (the proponent) to complete an Aboriginal heritage Due Diligence assessment for a planning proposal for the rezoning of the site to accommodate construction of an RSL club and associated recreation facilities (the proposal). The study area covers a 3.3-hectare portion of Lot 502, DP 1255115 in the Dubbo Local Government Area (LGA).

The undertaking of the Due Diligence process resulted in the conclusion that the proposed works will have an impact on the ground surface, however, no Aboriginal objects or intact archaeological deposits will be harmed by the proposal. This moves the proposal to the following outcome:

> *Aboriginal Heritage Impact Permit (AHIP) application not necessary. Proceed with caution. If any Aboriginal objects are found, stop work and notify Heritage NSW* (131 555 or info@environment.nsw.gov.au)*. If human remains are found, stop work, secure the site and notify NSW Police and Biodiversity and Conservation Division (BCD).*

To ensure the greatest possible protection to the area's Aboriginal cultural heritage values, the following recommendations are made:

1) The proposed work may proceed at the study area without further archaeological investigation under the following conditions:
    a) All land and ground disturbance activities must be confined to within the study area, as this will eliminate the risk of harm to Aboriginal objects in adjacent landforms. Should the parameters of the proposal extend beyond the assessed areas, then further archaeological assessment may be required.
    b) All staff and contractors involved in the proposed work should be made aware of the legislative protection requirements for all Aboriginal sites and objects.
2) This assessment has concluded that there is a low likelihood that the proposed work will adversely harm Aboriginal cultural heritage items or sites. However, during works, if Aboriginal artefacts or skeletal material are noted, all work should cease and the procedures in the *Unanticipated Finds Protocol* (**Appendix 2**) should be followed;
3) Although outside the study area for the RSL project, contractors should be provided with the updated location of K-ST-6 (GDA Zone 55 653765E, 6428443N) and efforts made to avoid the site, which should be feasible as it is outside the study area.
4) Work crews should undergo cultural heritage induction to ensure they recognise Aboriginal artefacts (see **Appendix 3**) and are aware of the legislative protection of

Aboriginal objects under the National Parks and Wildlife Act (NPW Act) and the contents of the *Unanticipated Finds Protocol*.

5) The information presented here meets the requirements of the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales*. It should be retained as shelf documentation for five years as it may be used to support a defence against prosecution in the event of unanticipated harm to Aboriginal objects.

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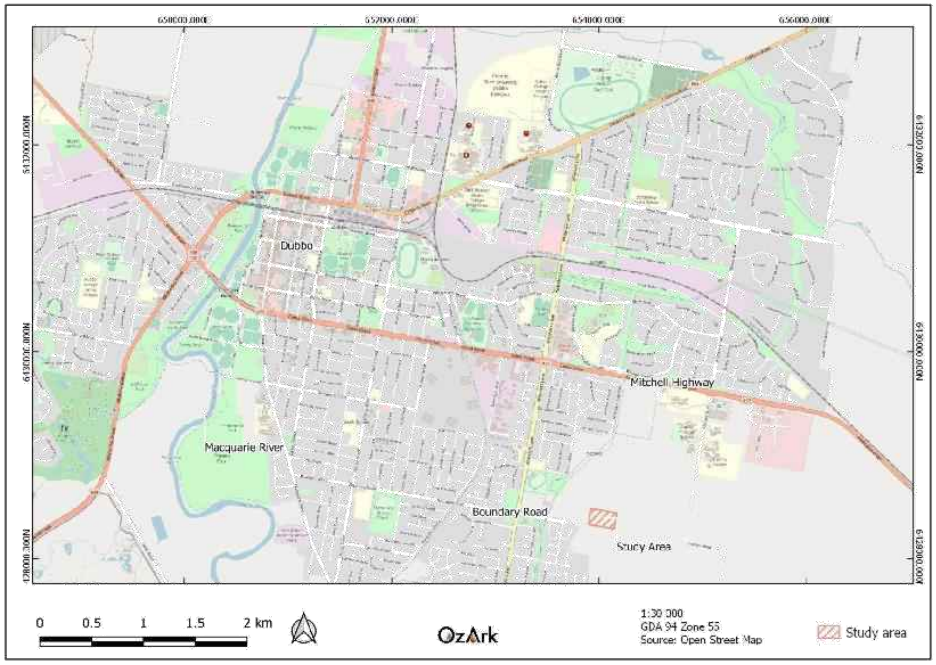
1 INTRODUCTION

1.1 BRIEF DESCRIPTION OF THE PROPOSAL

OzArk Environment & Heritage (OzArk) has been engaged by The Planning Hub (the client), on behalf of Dubbo RSL Club (the proponent) to complete an Aboriginal heritage Due Diligence assessment for a planning proposal for the rezoning of the site to accommodate construction of an RSL club and associated recreation facilities (the proposal). The proposal is in the Dubbo Local Government Area (LGA) (**Figure 1-1**).

Figure 1-1. Map showing the location of the proposal.



1.2 STUDY AREA

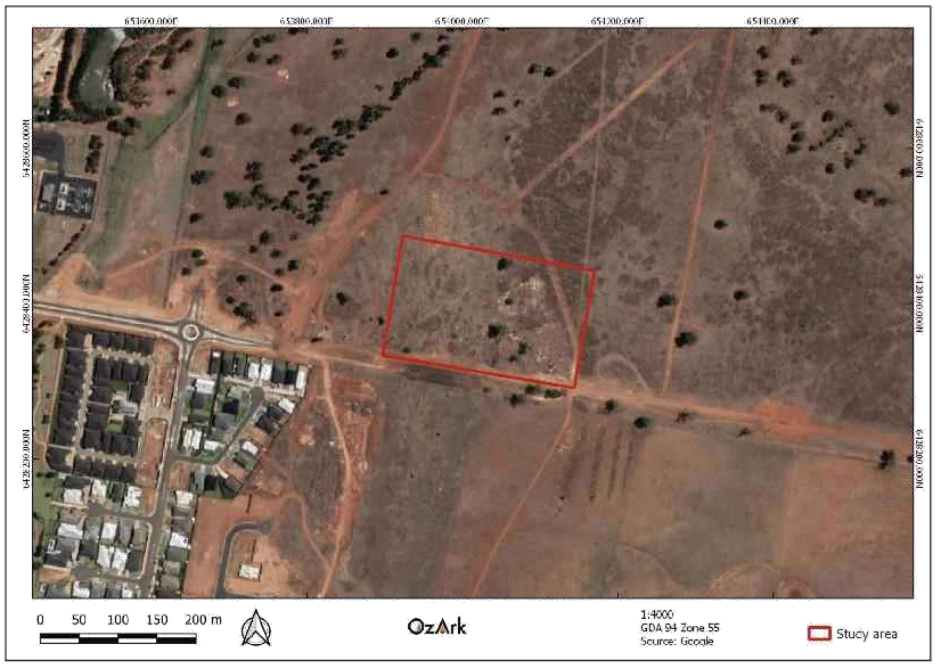
The study area covers a portion of Lot 502, DP 1255115 on Boundary Road in Dubbo, NSW. The study area consists of approximately 3.3 hectares of land and is shown on **Figure 1-2**.

1.3 ASSESSMENT APPROACH

Aboriginal cultural heritage

The desktop and visual inspection component for the study area follows the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (Due Diligence; DECCW 2010). The field inspection followed the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in New South Wales* (OEH 2011).

Figure 1-2: Aerial showing the study area.



2 ABORIGINAL DUE DILIGENCE ASSESSMENT

2.1 INTRODUCTION

The National Parks and Wildlife Regulation 2009 (NPW Regulation) made under the *National Parks and Wildlife Act 1974* (NPW Act) advocates a Due Diligence process to determining likely impacts on Aboriginal objects. Carrying out Due Diligence provides a defence to the offence of harming Aboriginal objects and is an important step in satisfying Aboriginal heritage obligations in NSW.

2.2 DEFENCES UNDER THE NPW REGULATION 2009

2.2.1 Low impact activities

The first step before application of the Due Diligence process itself is to determine whether the proposed activity is a "low impact activity" for which there is a defence in the NPW Regulation. The exemptions are listed in Section 80B (1) of the NPW Regulation (DECCW 2010: 6).

The potential construction activities of the proponent are not considered 'low impact activities'.

2.2.2 Disturbed lands

Relevant to this process is the assessed levels of previous land-use disturbance.

The NPW Regulation Section 80B (4) (DECCW 2010: 18) define disturbed land as follows:

> *Land is disturbed if it has been the subject of a human activity that has changed the land's surface, being changes that remain clear and observable.*
>
> *Examples include ploughing, construction of rural infrastructure (such as dams and fences), construction of roads, trails and tracks (including fire trails and tracks and walking tracks), clearing vegetation, construction of buildings and the erection of other structures, construction or installation of utilities and other similar services (such as above or below ground electrical infrastructure, water or sewerage pipelines, stormwater drainage and other similar infrastructure) and construction of earthworks.*

The study area has been used as a location for dumping rubbish and overburden for the two past decades. More recently it has been used as a stockpile for construction materials associated with road and housing development at the nearby Keswick and Southlakes Estates. While the majority of the study area has been disturbed in a 'clear and observable' manner under the NPW Regulation, the changes area not wholesale across the area. It is therefore determined that the proposal must be assessed under the Due Diligence Code. The reasoning for this determination is set out in **Table 2-1**.

Table 2-1: Determination of whether Due Diligence Code applies.

Item	Reasoning	Answer
Is the activity a Part 3A project declared under section 75B of the EP&A Act?	The proposal is assessed under Part 4 of the EP&A Act.	No
Is the activity exempt from the NPW Act or NPW Regulation?	The proposal is not exempt under this Act or Regulation.	No
Do either or both of these apply: Is the activity in an Aboriginal place? Have previous investigations that meet the requirements of this Code identified Aboriginal objects?	 The activity will not occur in an Aboriginal place. No previous investigations have been conducted.	No
Is the activity a low impact one for which there is a defence in the NPW Regulation?	The proposal is not a low impact activity for which there is a defence in the NPW Regulation.	No
Is the activity occurring entirely within areas that are assessed as 'disturbed lands'?	The proposal is not solely within areas of high modification.	No
Due Diligence Code of Practice assessment is required		

2.3 Application of the Due Diligence Code of Practice to the proposal

To follow the generic Due Diligence process, a series of steps in a question/answer flowchart format (DECCW 2010: 10) are applied to the proposed impacts and the study area, and the responses documented.

2.3.1 Step 1

Will the activity disturb the ground surface or any culturally modified trees?

Yes, the proposal will impact the ground surface and may impact culturally modified trees.

The proposed works will impact the ground surface through excavation, levelling, and vegetation clearing for the construction of the facility buildings and sports fields. Culturally modified trees, if present in the study area, may be impacted by the proposal.

2.3.2 Step 2a

Are there any relevant confirmed site records or other associated landscape feature information on AHIMS?

No, there are no previously recorded sites within the study area.

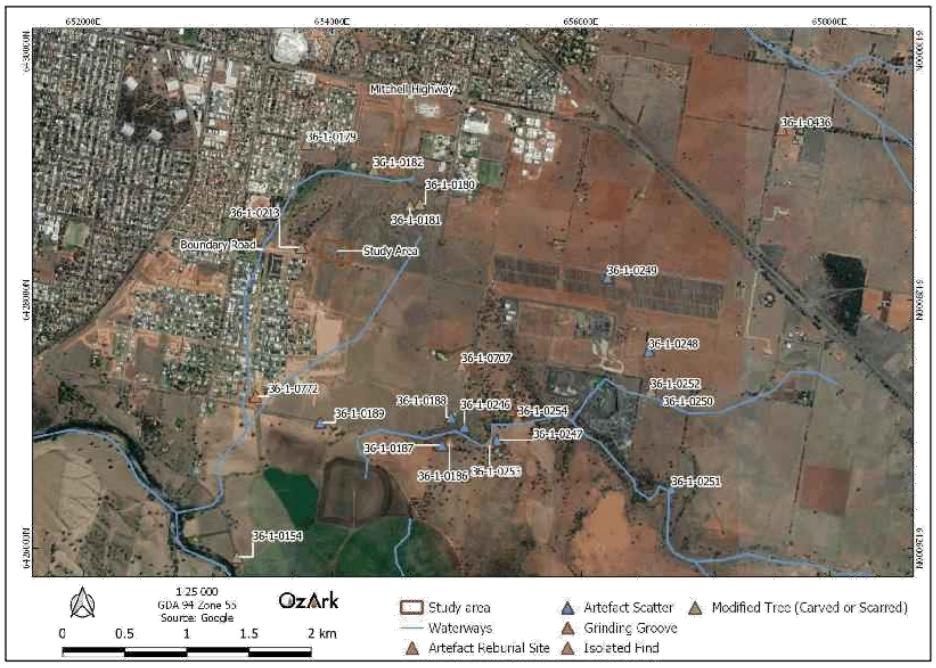
A search of the Aboriginal Heritage Information System (AHIMS) database conducted on 9 April 2020 covering a 5 km radius centred on the study area (GDA Zone 55, Eastings: 653060-657643, Northings: 6425891-6429965) returned 22 results.

Figure 2-1 shows all previously recorded sites in relation to the study area and **Table 2-2** shows the types of sites that are close to the study area.

Table 2-2: Site types and frequencies of AHIMS sites near the study area.

Site Type	Number	% Frequency
Artefact Scatter	9	40.9
Modified Tree (Carved or Scarred)	7	31.8
Isolated Find	3	13.6
Axe Grinding Grooves	2	9.1
Artefact Reburial Location	1	4.5

Figure 2-1: Previously recorded sites in relation to the study area.



Artefact scatters are the most frequent site recorded in the search area, accounting for 40.9% of results. The next most common are modified trees (31.8%) and isolated finds (13.6%). As shown in **Figure 2-1**, the five closest sites to the study area are modified trees, suggesting that they were prevalent in the local area and could be expected in the study area if trees of appropriate age and species for cultural modification are present.

2.3.3 Step 2b

Are there any other sources of information of which a person is already aware?

No, there are no other sources of information that would indicate the presence of Aboriginal objects in the study area.

2.3.3.1 Ethnographic sources of information

According to Tindale's map of tribal boundaries (1974), the Dubbo area falls within the northern limits of Wiradjuri country, as defined by the limits of the Wiradjuri language group. The Tubba-Gah and Dundullimal comprise two local sub-groups, 'clans' or mobs within the larger Wiradjuri entity. The study area falls within the territory of the Tubba-Gah, thought to lie to the east of the Macquarie River, south of the Talbragar River and north of Eulomogo creek, whereas the Dundullimal are thought to have occupied the area to the west of the Macquarie River (Kelton 1995b: 7–8; Koettig 1985: 21–22). Not all Aboriginal community representatives agree with this division, with some arguing that the Tubba-Gah mob inhabited both sides of the Macquarie River.

Early accounts of first contact between Europeans and Aboriginals in the Macquarie River area can be found in Oxley (1820) and Sturt (1833). Although interesting, these sources provide only a small window into the lifestyle and customs of the Aboriginal people of the Dubbo area. Near Whylandra Creek / Tanners Springs, one of the first encounters John Oxley had with the Indigenous inhabitants of the area was on 13 August 1817. Oxley noted that the country clearly "*…afforded them ample means of subsistence…*" when compared to the areas he had travelled further to the south.

2.3.3.2 Regional archaeological context

Throughout Australia, numerous archaeological studies in widely varying environmental zones and contexts have demonstrated a high correlation between the permanence of a water source and the permanence and/or complexity of Aboriginal occupation in the vicinity of the water source. Results of archaeological studies covering the Dubbo area, such as Koettig (1985), have conformed to this general model.

Koettig conducted an assessment for Dubbo's Local Environmental Plan, concentrating investigations in the narrow river valley corridors of the Dubbo, Geurie and Wellington regions. The study concurred with prior hypotheses, noting that river corridors provide an abundance of resources readily accessible to Aboriginal people, and that this is generally reflected in the complexity of lithic assemblages from sites close to permanent water compared to those near ephemeral water sources (Koettig 1985: 84–99). Large open camp sites or artefact scatters are most likely to occur in exposed areas close to drainage features but may also occur along ridgelines and on elevated ground overlooking water courses.

In 1995 Kelton completed an Aboriginal archaeological survey of approximately 290 ha of the Keswick land parcel, including the study area. Five scarred trees were recorded during the survey, the closest of which is 150 m west of the current study area. The lack of any stone artefact sites identified across the 1995 study area is noteworthy, but was deemed to conform with Kelton's predictions for site locations due to distance from permanent water (Kelton 1995:45). Disturbance in the form of dumped materials was noted over the study area at that time.

Kelton (1998) conducted a survey for potential industrial development near Eulomogo Creek, 300 ha of land 1.5 km southeast of the current study area. The study resulted in the identification of nine Aboriginal sites, including two axe grinding groove sites, a scarred tree, and six open camp sites / artefact scatters. Kelton noted that the location of open camp sites and axe grinding grooves along the banks and adjacent terraces of Eulomogo Creek conformed to the predictive model. It was predicted sites would occur along the banks of perennial and ephemeral creek lines. Of the nine sites recorded, seven sites (AHIMS sites 36-1-0246, 36-1-0247, 36-1-0250, 36-1-0251, 36-1-0252, 36-1-0253 and 36-1-0254) are located within 200 m of Eulomogo Creek and drainage features of Eulomogo Creek. However, the recording of the extensive artefact scatter (36-1-0248) along a low hillslope east of the "South Keswick" homestead was not expected.

In 2017 OzArk undertook a due diligence assessment for the connection between the Dubbo Solar farm and the electricity substation located near the corner of Boundary Road and Wheelers Lane. This easement followed the fence that bounds the southern edge of the study area. No Aboriginal sites were found as a result of this assessment.

In 2018 OzArk undertook a due diligence assessment for the extension of Boundary Road, from Wheelers Lane to Sheraton Road. This new road, not yet complete, forms the southern boundary of the study area. No Aboriginal sites were found as a result of this assessment.

Conclusion

The study area was assessed in 1995 by Kelton and no artefacts were identified. Further assessments by OzArk (2017 and 2018) immediately adjacent to the study area to the south, also found no sites. While this does not rule out the possibility of new sites being identified, it does reduce the likelihood.

There are no known cultural values or Aboriginal sites pertaining directly to the location of the proposed work. No Aboriginal community members accompanied the current visual inspection.

2.3.4 Step 2c

Are there any landscape features that are likely to indicate presence of Aboriginal objects?

No, the landforms of the study area have no specific indicators of archaeological sensitivity.

2.3.4.1 Topography, geology and soil profile

Low hills with long slopes characterise the locality. The study area straddles the edge of an undulating plain as it transitions to a basalt ridge above the Macquarie River floodplain at approximately 270 m Australian Height Datum. This is a tertiary basalt of the Cainozoic era, which can be found across the region, as here, as a cap on isolated hills and ridges (Holmes 1984). The surrounding area comprises mostly floodplain with low undulating basalt slopes.

Sedimentology of the landscape unit is dominated by Holocene fluvial sediments associated with the Macquarie River alluvial deposits and its distributary stream systems (Mitchell 2002: 34). Soil profiles are typified by dark yellow-brown silty clay with patches of sand and carbonate nodules deposited from suspended sediments in floodwater (Mitchell 2002: 34). On the ridge however, the soil is a red rich loam associated with the breakdown of the basalt.

2.3.4.2 Hydrology

The study area is located on a low basalt capped ridge between two unnamed drainage lines (approximately 400 m to the east and the west) that drain into Eulomogo Creek, an ephemeral waterway, which meets the Macquarie River 2.3 km south of the study area and is the permanent water source for the Dubbo region.

2.3.4.3 Vegetation

Grey Box (*Eucalytpus microcarpa*), Yellow Box (*E. melliodora*) and Rough-barked Apple (*Angophora floribunda*) occur on valley floors, while River Red Gum (*E. camaldulensis*) line the Macquarie River and River Oak (*Casuarina cunninghamiana*) tends to line the tributaries (OzArk 2015). Fuzzy Box (*E. conica*) is also known to occur along foot slopes and alluvial areas near the Macquarie River. Riverine woodland vegetation has been dramatically altered since European settlement, and few isolated native trees remain in proximity. The study area today exhibits a couple of immature exotic trees, but is predominantly cleared.

2.3.4.4 Discussion

The study area is relatively distant to reliable water and has no specific landform features indicating archaeological sensitivity. However, the local area more generally appears to have provided good conditions for Aboriginal occupation over many previous generations. The lack of identifiable resources in the study area (other than potentially basalt) and its distance to water indicate that habitation sites (artefact scatters, isolated finds and hearths indicating occupation of the land) may be less likely than further to the east or south. The basalt capping makes the ridge top uneven, reducing its suitability as a camp site.

This is supported by the registered AHIMS sites (**Figure 2-1**) near the study area, which show a high occurrence of artefact sites closer to Eulomogo Creek and the Macquarie River. The expected site types at the study area would be the result of resource gathering or markers associated with habitation of nearby areas, such as scarred trees and isolated finds. Again, this expectation is informed by the identified AHIMS sites near the study area, which are exclusively modified trees recorded by Kelton's 1995 survey.

The outcropping and boulder basalt may have been exploited / collected by Aboriginal in the past, but there is no specific evidence for this.

Although not required by the Due Diligence process, the proponent has elected to apply the precautionary principle and proceed to visual inspection of the study area (**Section 2.3.6**) in order to ground-truth the findings of the above desktop level assessment.

2.3.5 Step 3

Can harm to Aboriginal objects listed on AHIMS or identified by other sources of information and/or can the carrying out of the activity at the relevant landscape features be avoided?

No known objects or landforms with identified archaeological sensitivity will be impacted by the proposal.

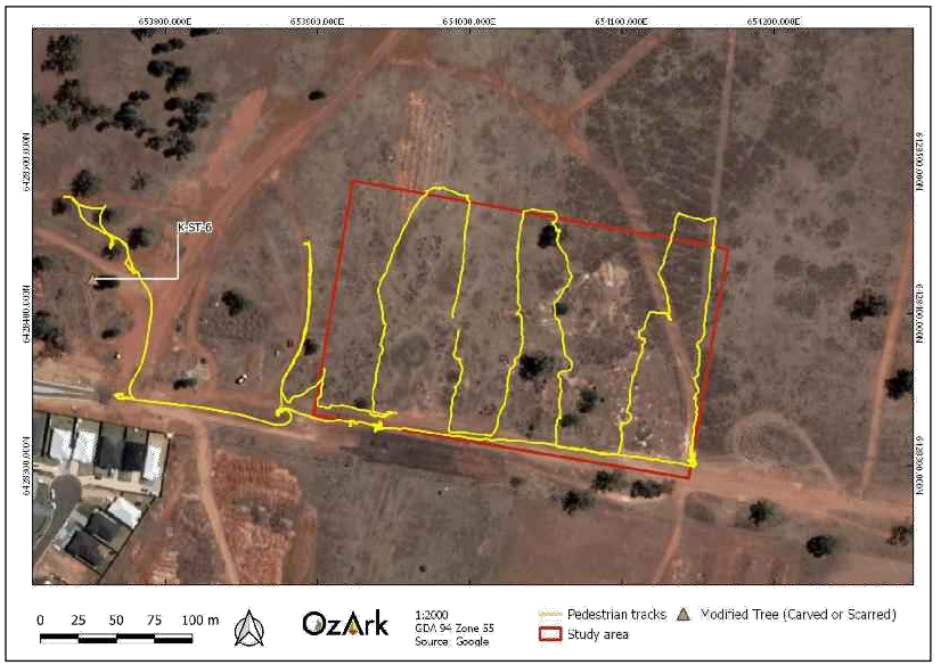
2.3.6 Step 4

Does a desktop assessment and visual inspection confirm that there are Aboriginal objects or that they are likely?

No Aboriginal objects were identified at the study area and their likelihood was assessed as low.

The visual inspection of the study area was undertaken by OzArk Director Dr Jodie Benton and Heritage Officer Harrison Rochford on 15 April 2020. No new sites were recorded. The nearest AHIMS site (K-ST-6) was located and confirmed to be approx. 160 m west of the study area.

Figure 2-2: Survey coverage within the study area.



Discussion

Dense weed cover limited Ground Surface Visibility (GSV) across the majority of the study area. Areas of Ground Surface Exposure (GSE) were largely restricted to existing vehicle tracks (**Plate 1**) or heaps of soil related to earthworks / dumping (**Plate 2**). While GSE was estimated to be only 20%, visibility within the exposures was good (60%) (**Plate 3**).

The visual inspection noted substantial disturbances to the natural ground surface across the study area, most frequently the accumulation of excess gravel associated with nearby road and housing construction (**Plate 4**). The majority of the study area has been used as a rubbish tip and evidence of this is still visible (**Plate 5**) and corresponds with previous available evidence (**Plate 6**).

The desktop modelling indicated that the study area has low archaeological potential and a history of previous land disturbance. The visual inspection results are consistent with this modelling. The most frequent site type near the study area, modified trees, were expected to be the most likely site recorded. There are very few mature native trees remaining in the study area due to widespread clearing.

The closest registered AHIMS site to the study area, K-ST-6 was located 160 m west of the study area. The coordinates on AHIMS (converted to GDA 94 Zone 55 653752E,6428423N) were found to be approximately 25 m off the location of the site, which was recorded as: GDA Zone 55 653765E,6428443. OzArk will submit a site card update with the correct coordinates.

A 'no' answer for Step 4, results in the following outcome (DECCW 2010):

> *AHIP* (Aboriginal Heritage Impact Permit) *application not necessary. Proceed with caution. If any Aboriginal objects are found, stop work and notify Heritage NSW* (131 555 or info@environment.nsw.gov.au). *If human remains are found, stop work, secure the site and notify NSW Police and Heritage NSW.*

2.4 Conclusion

The Due Diligence process has resulted in the outcome that an AHIP is not required. The reasoning behind this determination is set out in **Table 2-3**.

Table 2-3: Due Diligence Process application.

Item	Reasoning	Answer
Will the activity disturb either of the following: • the ground surface where archaeological deposits are likely • mature, native trees that may be culturally modified.	The proposed works would disturb the ground surface through excavation and construction. The likelihood of archaeological deposits being present at the study area was assessed as low. The proposal will not impact culturally modified trees.	No
Are there any relevant records of Aboriginal heritage on site (AHIMS or from other sources), or landscape features that are likely to indicate presence of Aboriginal objects?	AHIMS indicated no Aboriginal sites within the study area, however, one recorded scarred tree confirmed 160 m to the west. No landscape features in the study area indicate the likely presence of Aboriginal objects.	No
Will the activity impact Aboriginal objects or landforms with archaeological potential?	There are no known items of Aboriginal significance present in the study area, and landforms with identified archaeological sensitivity are not present.	No
Does the desktop and/or visual assessment confirm that Aboriginal objects will be harmed?	Desktop searches found no known items of Aboriginal heritage in the study area. It is assessed that there is a low likelihood of there being subsurface archaeological deposits within the study area.	No
AHIP not necessary. Proceed with caution.		

3 MANAGEMENT RECOMMENDATIONS

The undertaking of the Due Diligence process resulted in the conclusion that the proposed works will have an impact on the ground surface, however, no Aboriginal objects or intact archaeological deposits will be harmed by the proposal. This moves the proposal to the following outcome:

> *AHIP application not necessary. Proceed with caution. If any Aboriginal objects are found, stop work and notify Heritage NSW* (131 555 or info@environment.nsw.gov.au). *If human remains are found, stop work, secure the site and notify NSW Police and Heritage NSW.*

To ensure the greatest possible protection to the area's Aboriginal cultural heritage values, the following recommendations are made:

1) The proposed work may proceed at the study area without further archaeological investigation under the following conditions:
    a) All land and ground disturbance activities must be confined to within the study area, as this will eliminate the risk of harm to Aboriginal objects in adjacent landforms. Should the parameters of the proposal extend beyond the assessed areas, then further archaeological assessment may be required.
    b) All staff and contractors involved in the proposed work should be made aware of the legislative protection requirements for all Aboriginal sites and objects.
2) This assessment has concluded that there is a low likelihood that the proposed work will adversely harm Aboriginal cultural heritage items or sites. However, during works, if Aboriginal artefacts or skeletal material are noted, all work should cease and the procedures in the *Unanticipated Finds Protocol* (**Appendix 2**) should be followed;
3) Although outside the study area for the RSL project, contractors should be provided with the updated location of K-ST-6 (GDA Zone 55 653765E, 6428443N) and efforts made to avoid the site, which should be feasible as it is outside the study area.
4) Work crews should undergo cultural heritage induction to ensure they recognise Aboriginal artefacts (see **Appendix 3**) and are aware of the legislative protection of Aboriginal objects under the NPW Act and the contents of the *Unanticipated Finds Protocol*.
5) The information presented here meets the requirements of the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales*. It should be retained as shelf documentation for five years as it may be used to support a defence against prosecution in the event of unanticipated harm to Aboriginal objects.

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PLATES



Plate 1: View northeast to the study area.



Plate 2: View west through study area. Note vegetation of dense weeds.



Plate 3: View south through study area showing an exposure good Ground Surface Visibility (GSV).



Plate 4: View southwest showing mounds of imported gravel.



Plate 5: Example of rubbish remaining in the study area from previous use as a tip.

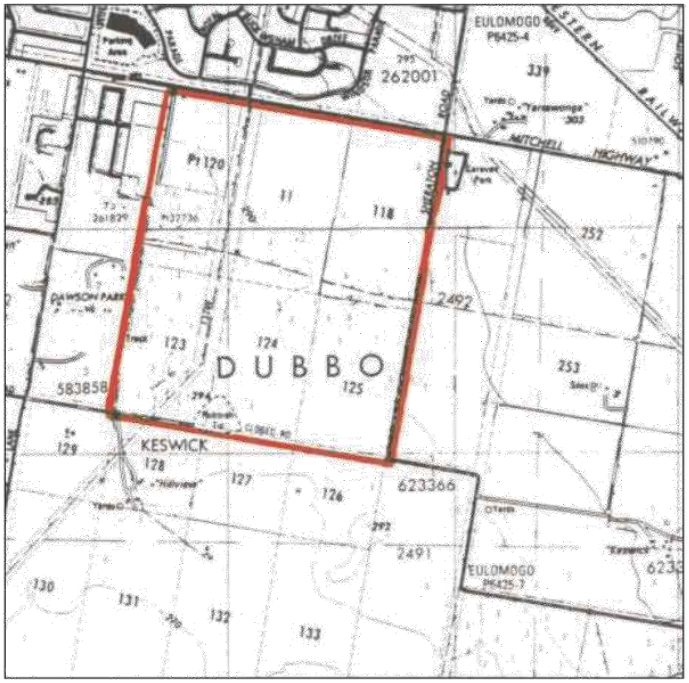


Plate 6: Figure after Kelton 1995, red indicates study area of that survey. Note area labelled 'rubbish tip' that corresponds with the majority of the current study area.

APPENDIX 1: AHIMS SEARCH RESULTS

Office of Environment & Heritage NSW

AHIMS Web Services (AWS)
Extensive search - Site list report

Your Ref/PO Number : Keswick
Client Service ID : 496784

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
36-1-0246	EC OS 1;Kalimongo Creek;	AGD	55	654950	6426800	Open site	Valid	Artefact : -	Open Camp Site	4378
	Contact	Recorders	Central West Archaeological and Heritage Services Pty Ltd					Permits	1276,1277	
36-1-0247	EC-OS-2;Kalimongo Creek;	AGD	55	655210	6425690	Open site	Valid	Artefact : -	Open Camp Site	4378
	Contact	Recorders	Central West Archaeological and Heritage Services Pty Ltd					Permits	1276,1277	
36-1-0248	Kalimongo Creek (EC-OS-3)	GDA	55	656544	6427593	Open site	Valid	Artefact : -	Open Camp Site	4378
	Contact	Recorders	Central West Archaeological and Heritage Services Pty Ltd,OzArk Environmental a					Permits	1276,1277	
36-1-0249	EC-OS-4;Keswick South (Kalimongo);	AGD	55	656100	6427000	Open site	Valid	Artefact : -	Open Camp Site	4378
	Contact	Recorders	Central West Archaeological and Heritage Services Pty Ltd					Permits	1276,1277	
36-1-0250	EC-OS-5; Keswick South (Kalomongo)	GDA	55	656662	6427183	Open site	Valid	Artefact : -	Open Camp Site	4378
	Contact	Recorders	Central West Archaeological and Heritage Services Pty Ltd,OzArk Environmental a					Permits	1276,1277	
36-1-0251	EC-OS-6; Keswick South (Kalomongo)	GDA	55	656726	6426485	Open site	Valid	Artefact : -	Open Camp Site	4378
	Contact	Recorders	Central West Archaeological and Heritage Services Pty Ltd,OzArk Environmental a					Permits	1276,1277	
36-1-0252	EC-ST-1; Keswick South (Kalomongo)	GDA	55	656559	6427271	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	4378
	Contact	Recorders	Central West Archaeological and Heritage Services Pty Ltd,OzArk Environmental a					Permits	1276,1277	
36-1-0253	EC AG 2;Kalomongo Creek;	AGD	55	655150	6425670	Open site	Valid	Grinding Groove : -	Axe Grinding Groove	4378
	Contact	Recorders	Central West Archaeological and Heritage Services Pty Ltd					Permits	1276,1277	
36-1-0254	EC AG 1;Kalomongo Creek;	AGD	55	655390	6425870	Open site	Valid	Grinding Groove : -	Axe Grinding Groove	4378
	Contact	Recorders	Central West Archaeological and Heritage Services Pty Ltd					Permits	1276,1277	
36-1-0272	K-OS-4 Reburial location	GDA	55	653381	6427225	Open site	Valid	Artefact : -		
	Contact	Recorders	OzArk Environmental and Heritage Management,Miss Stephanie Rowden					Permits		
36-1-0154	Old Dubbo Rd	AGD	55	653120	6425750	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	
	Contact	Recorders	Katrina Goering					Permits		
36-1-0213	K-ST-6	AGD	55	653640	6428240	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	3350
	Contact	Recorders	Jim Kelton					Permits		
36-1-0179	Keswick Scarred Tree-5 [K-ST-5]	GDA	55	653794	6429259	Open site	Destroyed	Modified Tree (Carved or Scarred) : -	Scarred Tree	3350
	Contact	Recorders	Central West Archaeological and Heritage Services Pty Ltd,OzArk Environmental a					Permits	3873	

Report generated by AHIMS Web Service on 09/04/2020 for Harrison Rochford for the following area at Datum :GDA, Zone : 55, Eastings : 653060 - 657643, Northings : 6425891 - 6429965 with a Buffer of 0 meters. Additional Info : DD. Number of Aboriginal sites and Aboriginal objects found is 22

Office of Environment & Heritage NSW

AHIMS Web Services (AWS)
Extensive search - Site list report

Your Ref/PO Number : Keswick
Client Service ID : 496784

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
36-1-0180	K-ST-4	AGD	55	654390	6428590	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	3350
	Contact	Recorders	Central West Archaeological and Heritage Services Pty Ltd					Permits		
36-1-0181	K-ST-3	AGD	55	654510	6428580	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	3350
	Contact	Recorders	Central West Archaeological and Heritage Services Pty Ltd					Permits		
36-1-0182	K-ST-2	AGD	55	654220	6428870	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	3350
	Contact	Recorders	Central West Archaeological and Heritage Services Pty Ltd					Permits		
36-1-0186	K-IF-2;	AGD	55	654030	6426680	Open site	Valid	Artefact : -	Isolated Find	3348,103709
	Contact	Recorders	Jim Kelton					Permits		
36-1-0187	K-OS-2;	AGD	55	654770	6426650	Open site	Valid	Artefact : -	Open Camp Site	3348,103709
	Contact	Recorders	Jim Kelton					Permits		
36-1-0188	K-OS-3;	AGD	55	654840	6426873	Open site	Valid	Artefact : -	Open Camp Site	3348,102806,103709
	Contact	Recorders	Jim Kelton					Permits		
36-1-0189	K-OS-4	GDA	55	653981	6427013	Open site	Destroyed	Artefact : -	Open Camp Site	3348,104317
	Contact	Recorders	Jim Kelton,Ozark Environmental and Heritage Management,Miss Stephanie Rowden					Permits	4471	
36-1-0436	PR-IF1	AGD	55	657498	6429191	Open site	Valid	Artefact : 1		99011
	Contact	Recorders	Doctor Jodie Benton					Permits		
36-1-0707	Hillview IF1	GDA	55	655039	6427478	Open site	Valid	Artefact : -		103709
	Contact	Recorders	Ozark Environmental and Heritage Management,Doctor Chris Lovell					Permits		

Report generated by AHIMS Web Service on 09/04/2020 for Harrison Rochford for the following area at Datum :GDA, Zone : 55, Eastings : 653060 - 657643, Northings : 6425891 - 6429965 with a Buffer of 0 meters. Additional Info : DD. Number of Aboriginal sites and Aboriginal objects found is 22

APPENDIX 2: ABORIGINAL HERITAGE: UNANTICIPATED FINDS PROTOCOL

An Aboriginal artefact is anything which is the result of past Aboriginal activity. This includes stone (artefacts, rock engravings etc.), plant (culturally scarred trees) and animal (if showing signs of modification; i.e. smoothing, use). Human bone (skeletal) remains may also be uncovered while onsite.

Cultural heritage significance is assessed by the Aboriginal community and is typically based on traditional and contemporary lore, spiritual values, and oral history, and may also take into account scientific and educational value.

Protocol to be followed in the event that previously unrecorded or unanticipated Aboriginal object(s) are encountered:

1. If any Aboriginal object is discovered and/or harmed in, or under the land, while undertaking the proposed development activities, the proponent must:
    a. Not further harm the object;
    b. Immediately cease all work at the particular location;
    c. Secure the area so as to avoid further harm to the Aboriginal object;
    d. Notify Heritage NSW as soon as practical on 131 555, providing any details of the Aboriginal object and its location; and
    e. Not recommence any work at the particular location unless authorised in writing by Heritage NSW.
2. In the event that Aboriginal burials are unexpectedly encountered during the activity, work must stop immediately, the area secured to prevent unauthorised access and NSW Police and Heritage NSW contacted.
3. Cooperate with the appropriate authorities and relevant Aboriginal community representatives to facilitate:
    a. The recording and assessment of the find(s);
    b. The fulfilment of any legal constraints arising from the find(s), including complying with Heritage NSW directions; and
    c. The development and implementation of appropriate management strategies, including consultation with stakeholders and the assessment of the significance of the find(s).
4. Where the find(s) are determined to be Aboriginal object(s), recommencement of work in the area of the find(s) can only occur in accordance with any consequential legal requirements and after gaining written approval from Heritage NSW (normally an Aboriginal Heritage Impact Permit).

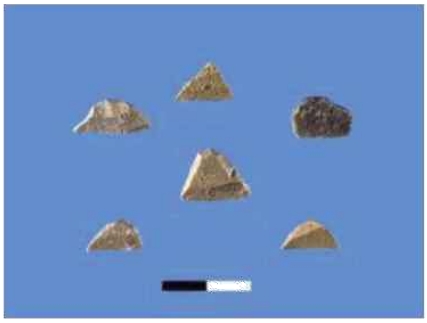
APPENDIX 3: ABORIGINAL HERITAGE: ARTEFACT IDENTIFICATION



Retouched blades (scale = 1cm)



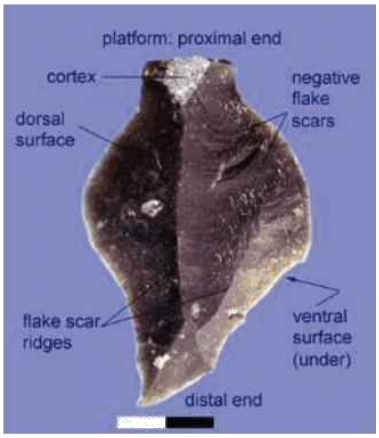
Flakes



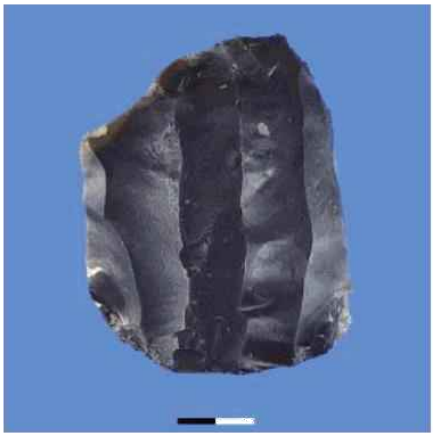
Microliths (scale = 1cm)



Scraper (scale = 1cm)



Flake characteristics (scale = 1cm)



Core from which flakes have been removed (scale = 1cm)

Preliminary contamination investigation

Proposed RSL Club, part Lot 502 DP1255115 Boundary Road, Dubbo



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Document control			
Report number	**Date**	**Author**	**Update information**
R11858c draft	23 June 2020	Leah Desborough	
R11858c Draft 1	26 June 2020	Leah Desborough	Comments as per Lachlan Rodgers
R11858c	14 July 2020	Leah Desborough	Report finalised
R11858c.1	29 July 2020	Leah Desborough	Update to reflect new concept plan

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Summary report

Background

A registered club facility and associated recreational facilities are proposed for a 3.3ha parcel of land located within Lot 502 DP1255115 Boundary Road, Dubbo NSW. The development will include the club building, kids play and family area, football/cricket field and carpark. The facility is located on former farmland and has had fill introduced from various sources. The former land-uses are potential sources of contamination. A preliminary contamination investigation is required for the site to determine requirements for additional investigations.

Objectives of investigation

The objective of the investigation was to determine suitability of the site for the proposed land-use.

Scope

The scope was to identify past potentially contaminating activities, identify potential types of contamination, discuss the site condition, provide a preliminary assessment of site contamination and assess the need for further investigation to determine suitability for recreational and commercial land use. The scope of works included site inspection, soil sampling and analysis of the soil samples for contaminants of concern.

Summary

A site assessment was conducted on 19 May 2020 consisting of a site walkover, desktop study and limited soil sampling.

The preliminary contamination assessment comprised a soil sampling and laboratory analysis program. A total of sixteen locations were assessed across the site. Six boreholes were drilled to rock, the soil profile described and indicators of potential contamination identified. Ten soil samples were collected from stockpiles to provide an indicator of potential contamination.

The site was dominated by the presence of numerous stockpiles of unknown origin. The stockpiles generally contained reddish brown sandy clay. Gravel was identified in some stockpiles. Foreign materials including concrete, timber, asphalt, bricks and car bodies were also identified on the site. Vegetated surface cover was near 100%. Bare areas were present in areas of gravel. Fill material was identified in two boreholes to depths of 900mm. Refusal due to basalt was encountered in four boreholes at depths from 0.1m.

Vegetation cover restricted inspection of the soil surface for asbestos containing materials. No asbestos containing materials were identified in the borehole cuttings.

Levels of chromium (III) exceeded adopted thresholds in one stockpile sample. Additional investigations are required to delineate impacted material. The levels of all other analytes evaluated in the soil samples were below the adopted health and ecological investigation and screening levels for recreational and commercial land-use.

Recommendations

It is expected that the site can be made suitable for the proposed land-use following additional investigations, completion of remediation works and validation assessment.

The additional investigations should be undertaken following surveying of the proposed site boundary to ensure to entire site is sampled.

Natural soils on the site should be assessed at 45 locations on a 30m systematic sampling pattern in accordance with NEPM (1999) guidelines. Soil samples should be collected using an excavator and analysed for a range of potential contaminants including heavy metals, hydrocarbons and asbestos.

Stockpiles on the site should be assessed in accordance with waste classification guidelines including the *Excavated Natural Material* (*ENM) Exemption* by use of an excavator to remove vegetation and allow inspection of the material. Stockpiles containing similar material as determined visually should be determined and soil samples collected. Number of soil samples will be based on volume of material identified. Soil samples should be analysed for electrical conductivity, pH, heavy metals, hydrocarbons, organochlorine pesticides, polychlorinated biphenyls and foreign materials. Gravimetric assessment for asbestos is also recommended.

Additional boreholes or excavator pits should be constructed to confirm a quarry or landfill is not present on the site.

Additional investigations are required to delineate chromium (III) impacted soils at sampling location C5.

A detailed investigation report should be prepared describing the results and suitability for the proposed land-use or requirements for remediation.

Remediation at the stockpile sample C5 was collected will be required to enable the proposed land-use. Remediation should be undertaken in accordance with a remediation action plan (RAP).

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1. Introduction

A registered club facility and associated recreational facilities are proposed for a 3.3ha parcel of land located within Lot 502 DP1255115 Boundary Road, Dubbo NSW. The development will include the club building, kids play and family area, football/cricket field and carpark. The facility is located on former farmland and has had fill introduced from various sources. The former land-uses are potential sources of contamination. A preliminary contamination investigation is required for the site to determine requirements for additional investigations.

2. Objectives

The objective of the investigation was to determine suitability of the site for the proposed land-use.

3. Scope of work

Envirowest Consulting Pty Ltd was commissioned by The Planning Hub to undertake a preliminary contamination investigation, in accordance with the contaminated land management planning guidelines, from the *Contaminated Land Management Act 1997* and the *State Environmental Policy No. 55 (SEPP 55)*, for a 3.3ha parcel of land located within Lot 502 DP1255115 Boundary Road, Dubbo NSW. The objective was to identify past potentially contaminating activities, identify potential contamination types, discuss the site condition, provide a preliminary assessment of site contamination and assess the need for further investigation. The scope of works included site inspection, soil sampling and analysis of the soil samples for contaminants of concern.

4. Site identification

Address	Lot 502 DP1255115 Boundary Road Dubbo NSW
Deposited plans	Lot 502 DP1255115
Latitude and longitude	-32.27° 148.64°
Geographic coordinates	55H E654111m N6428365m
Client	The Planning Hub
Owner	Dubbo Regional Council
Current occupier	Vacant
Area	Approximately 3.3 hectares
Local government area	Dubbo Regional Council
Current zoning	R2 – Low density residential (Dubbo LEP 2011)
Trigger for investigation	Change in land-use
Locality map	Figure 1

5. Site history

5.1 Land-uses

The historical land-use of the site is grazing with stockpiling of materials occurring in the 1990s.

5.2 Summary of council records

The site is mapped in a moderately high groundwater vulnerability area (Dubbo LEP 2011).

5.3 EPA contaminated sites list

The investigation area is not listed on the NSW EPA register of contaminated sites or sites notified to the EPA.

5.4 Sources of information

Site inspection 19 May 2020 by Luke Niven of Envirowest Consulting
NSW EPA records of public notices under the CLM Act 1997
Soil and geological maps
Spatial information exchange historic parish maps
Historical aerial photographs
Dubbo LEP 2011

5.5 Review of historic aerial photographs, maps and plans

5.6 Chronological list of site uses

Aerial photographs indicate the site has been used as grazing land until the late 1980's. The 1991 aerial photograph depicts disturbance on the site and is potentially the stockpiles identified on the site at the time of inspection. The fill is from various unknown sources.

The 1986 topographic map developed from 1980 aerial imagery identifies a rubbish tip on the site.

No horticultural activities, mines, sheep dips, underground storage tanks (UST), bunkers or contaminating industrial activities are known to have been located on the site from the site inspection and site history.

5.7 Buildings and infrastructure

No buildings were identified within the investigation area. The southern boundary of the investigation area has been fenced in the past. The fence has been removed to allow for construction of the Boundary Road extension.

5.8 Spills, losses or discharges

No records for spills or losses on the site were available. No records for discharges to land, water or air were available.

5.9 Relevant complaint history

Nil

5.10 Previous investigations

No previous investigations are known to have been undertaken on the site.

5.11 Historical neighbouring land-use

North – Grazing
South – Grazing
East – Grazing
West – Grazing

Historical neighbouring land-uses are not expected to impact of the site.

5.12 Contaminant sources

Numerous stockpiles containing soil located across the site is the identified source of contamination. Fill material was also present on the site at depths of up to 900mm from an unknown source. A landfill was potentially located on the site and is a source of contamination.

It is unlikely biosolids have been applied to the area. Site inspection, historical review and analytical results indicate that biosolids are unlikely to have been applied to the area.

5.13 Contaminants of concern

Based on historical activities and site inspection, potential contaminants have been identified as;

- Heavy metals (arsenic, cadmium, chromium, copper, nickel, lead, zinc, mercury)
- Total recoverable hydrocarbons (TRH C6-C40)
- Benzene, toluene, ethylbenzene, xylenes, and naphthalene (BTEXN)
- Polycyclic aromatic hydrocarbons (PAH)
- Asbestos
- Foreign materials

5.14 Integrity assessment

The site history was obtained from a site inspection and history review. The information is consistent with the current site condition and to the best of the assessor's knowledge is accurate.

6. Site condition and surrounding environment

6.1 Site inspection

The site was inspected by Luke Niven of Envirowest Consulting Pty Ltd on 19 May 2020.

6.2 Land-use

The site was a vacant lot with a historical land-use of grazing. Numerous stockpiles are located on the site.

6.3 Current neighbouring land-use

North – Vacant, former farmland
South – Boundary Road under construction
East – Vacant, former farmland
West – Vacant, former farmland

6.4 Surface cover and vegetation

Surface cover was dominated by ruderal weeds including mallow, skeleton weed, hedge mustard, paddy melon and other broadleaved weeds. An eucalypt tree and several small robinias are scattered across the site. The site was covered by vegetation.

6.5 Evidence of visible contamination

Fill material is present on the site to depths of up to 0.9m and as stockpiles.

Disturbed areas were identified in the 1991 aerial photograph.

No signs of settlement or subsidence was identified on the site.

No signs of visible contamination such as discolouration or staining was identified on the surface of the site or within borehole cuttings.

6.6 Topography

The site is predominantly located on an upper slope. Aspect is predominantly east and slopes are gently inclined and generally less than 5%. Elevation ranges between 285 and 293 metres above sea level. The lowest elevation occurs on the eastern boundary.

6.7 Soils and geology

The site is located within the Bunglegumbie Soil Landscape (Murphy *et al.* 1998).

Soil in the Bunglegumbie landscape consists of red brown earths, red earth, non-calcic brown soils and yellow podzolic/solodic soils. Parent material is weathered alluvium. Soil salinity problems are absent. Erosion hazard is low on slopes less than 3%.

Lithology of the southern section of the site is Napperby Formation comprising siltstone thinly interbedded with fine-medium grained lithic quartz sandstone with minor conglomerate. Lithology of the northern section is Cainozoic Basalt comprising tholeiite, alkali basalt and alkali ultramafic (Colquhoun *et al.*1997).

Soils on the site comprised reddish brown sandy clay over yellowish brown to light brown sandy clay. Basalt rock was encountered in all boreholes at depths between 0.1m and 1.7m. Basalt rock was encountered at 1.1m and 1.7m in the central section of the site and at 0.1m to 0.6m in the western and northern sections of the site.

No erosion was identified on the site.

6.8 Water

6.8.1 Surface water

The surface of the site is uneven as a result of numerous stockpiles on the site. Water is expected to pond between stockpiles. Surface water flows are expected to generally flow east and south. Eulomogo Creek is located approximately 2.2km south of the site.

Eulomogo Creek empties into the Macquarie River approximately 3.0km south of the site.

6.8.2 Groundwater

Two registered water abstraction bores were identified within a 500m radius of the site on the NSW Government Water NSW website (2020). One bore is a monitoring bore and has been constructed to intercept unconfined shallow water. Water-bearing zones (WBZ's) were from 7m. The second bore is licensed for public use and was constructed to 100m with water bearing zones from 30m and standing water level at 33m.

No.	Date drilled	Location	SWL (m)	Use	Status
GW802624	2005	380m NW	-	Monitoring	Current
GW803790	1988	480m SW	32.9	Public	Current

6.9 Evidence of possible naturally occurring contaminants

No natural sources of PAH were identified.

The site is not mapped as an acid sulphate soil risk (NSW SEED Portal accessed 10 June 2020).

A groundwater and salinity assessment undertaken on the site by Envirowest Consulting Pty Ltd (report number R11858s) did not identify saline soils.

The site is not mapped as a geological unit with asbestos potential (NSW SEED Portal accessed 10 June 2020).

6.10 Environmentally sensitive features or habitats

No environmentally sensitive features or habitats were identified on the site. Remnant bushland is located to the north. Eulomogo Creek is located approximately 2.2km to the south and is impacted by upstream farmland.

6.11 Integrity assessment

The site history was obtained from a site inspection and history review. The information is consistent with the current site condition and to the best of the assessor's knowledge is accurate.

7. Conceptual site model

7.1 Contaminant sources

Potential exists for contaminating activities to have been undertaken on site which may impact on the suitability for the proposed land-use. The historical land-use and placement of fill across the site may have resulted in application of contaminants.

7.2 Contaminants of concern

Based on historical activities and site inspection the contaminants of concern across the site are:

- Heavy metals (arsenic, cadmium, chromium, copper, nickel, lead, zinc and mercury)
- Total recoverable hydrocarbons (TRH)
- Benzene, toluene, ethylbenzene, xylene, naphthalene (BTEXN)
- Polycyclic aromatic hydrocarbons (PAH)
- Asbestos
- Foreign materials

7.3 Potential receptors

The proposed land-use of the site is recreational and commercial. The site has historically been used as agricultural land and stockpiling of imported material.

Human receptors include:

- Visitors (adults and children)
- Staff (adults)
- Site workers
- Construction workers
- Intrusive maintenance workers

Ecological receptors include

- Flora and fauna on the site and adjacent to the site
- Aquatic flora and fauna receptors off-site

7.4 Exposure pathways

Pathways for exposure to contaminants are:

- Dermal contact following soil disturbance
- Ingestion and inhalation after soil disturbance
- Surface water and sediment runoff into waterways
- Leaching of contaminants into the groundwater
- Direct contact of flora and fauna with the soil

7.5 Source receptor linkages

Potential source pathway receptor linkages are identified to enable evaluation of any adverse impact on human health or ecology.

The proposed land-use of the site is recreational and commercial and human receptors to the investigation area are likely. Proposed users of the site may have a risk of exposure if contaminants are present and the soil is disturbed. Construction workers, visitors, staff and intrusive maintenance workers to the site may potentially be receptors to soil contaminants through direct contact to soil which includes ingestion and dermal contact.

Inhalation may occur as a result of vaporisation, soil disturbance and dust production. Major soil disturbance before and after the development of the site is considered unlikely. Soil disturbance during construction and development of the site is expected to be accompanied by erosion control measures which will reduce the incidence of dust production.

Vegetation on the site may be potential receptors to soil contamination through direct uptake of contaminants.

The source receptor linkage to aquatic organisms and ecosystems is considered incomplete as the site is well vegetated and movement of sediments from the site is unlikely. During construction work it is expected that erosion control measures will be implemented and movement of sediment off site will be unlikely. Following development of the site it is expected that vegetation will be re-established or hard surfaces constructed which will control sediment movement from the site. The nearest waterway to the site is Eulomogo Creek which is located approximately 2.2km south and it is not expected that contaminants from the site will be transported to aquatic receptors within Eulomogo Creek.

Groundwater is not identified as a potential receptor to contamination. Groundwater bores are located greater than 250m from the site. Contaminants are expected to originate from the soil surface and groundwater levels in the area are at depths greater than 3m below the soil surface.

Source/contaminant	Transport	Potential exposure pathways	Receptors
■Use of pesticides (heavy metals) ■Fill material unknown source	□Wind ■Sedimentation ■Groundwater	■Direct contact (ingestion and absorption) (human and environment) ■Inhalation □Runoff □Leaching	■Construction workers ■Workers ■Visitors ■Intrusive maintenance workers ■Vegetation

■Potential, □unknown/unlikely

8. Data quality objectives (DQO)

8.1 State the problem

A registered club facility and associated recreational facilities is proposed for the site. Land-use will change from vacant to recreational and commercial. The property has historically been used as agricultural land and storage of imported materials which may have resulted in contaminating activities. The site requires investigation to ensure suitability for the proposed land-use.

8.2 Identify the decision

The land-use proposed is recreational and commercial and the levels of contaminants should be less than the thresholds listed in Section 11. The decision problem is, do the levels of potential contaminants exceed the assessment criteria listed in Section 11.

8.3 Identify the inputs decision

Investigations of the site is required to identify any potential contaminants from historical land-use.

8.4 Define the boundaries of the study

The investigation area is a 3.3ha parcel of land located within Lot 502 DP1255115 Boundary Road, Dubbo NSW.

8.5 Develop a decision rule

The decision rule for suitability for recreational and commercial land-use is based on the thresholds listed in Schedule B1 of the NEPM (1999) *Guideline on Investigation Levels for Soil and Groundwater*.

8.6 Specify acceptable limits on the decision errors.

The 95% upper confidence limit of average levels of samples collected is less than the threshold levels and the results are less than 250% of relevant thresholds.

8.7 Optimize the design for obtaining data

Soil samples were collected from the site on judgemental pattern from areas where indicators of contamination were identified.

Analytes included heavy metals, hydrocarbons and PAH. Asbestos was visually assessed.

9. Sampling analysis plan and sampling methodology

9.1. Sampling design

A judgemental sampling pattern was adopted to provide a preliminary assessment of the contamination status of imported material.

9.1.1 Sampling locations

Ten discrete soil samples were collected from the stockpiles across the site on judgemental sampling pattern (Figure 2). Six boreholes were constructed to enable the soil profile to be described including the presence of fill and other indicators of contamination.

A visual inspection was undertaken over the site for evidence of contamination.

9.1.2 Sampling density

The sampling density will enable a preliminary assessment of contamination resulting from importation of materials.

9.1.3 Sampling depth

Sampling depth within stockpiles was 100 to 200mm below the surface. Boreholes were drilled on the site to drill refusal and ranged from 0.1m to 1.7m.

9.2 Analytes

The discrete soil samples were evaluated for arsenic, cadmium, chromium, copper, lead, nickel, zinc and mercury, total recoverable hydrocarbons (TRH C6-C40), benzene, toluene, ethylbenzene, xylenes, naphthalene (BTEXN) and polycyclic aromatic hydrocarbons (PAH) as these were identified as the contaminants of concern possibly present as a result of previous activities and presence of fill material (Table 1). One sample was additionally analysed for chromium III and chromium VI.

The site surface, soil borings and the fill material was visually inspected for the presence of asbestos containing material (ACM).

Table 1. Schedule of samples and analyses

Sample ID	Location	Source	Analysis undertaken
C1	North western section	Fill	Arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), nickel (Ni), zinc (Zn), mercury (Hg), polycyclic aromatic hydrocarbons (PAH), total recoverable hydrocarbon (TRH) (C6-C40), benzene, ethylbenzene, toluene, xylenes and naphthalene (BETXN)
C2	South western section	Fill	As, Cd, Cr, Cu, Pb, Ni, Zn, Hg, PAH, TRH(C6-C40), BTEXN
C3	South western section	Fill	As, Cd, Cr, Cu, Pb, Ni, Zn, Hg, PAH, TRH(C6-C40), BTEXN
C4	Central section	Fill	As, Cd, Cr, Cu, Pb, Ni, Zn, Hg, PAH, TRH(C6-C40), BTEXN
C5	Central section	Fill	As, Cd, Cr, Cu, Pb, Ni, Zn, Hg, PAH, TRH(C6-C40), BTEXN, Cr III and Cr VI
C6	North eastern section	Fill	As, Cd, Cr, Cu, Pb, Ni, Zn, Hg, PAH, TRH(C6-C40), BTEXN
C7	Central southern section	Fill	As, Cd, Cr, Cu, Pb, Ni, Zn, Hg, PAH, TRH(C6-C40), BTEXN
C8	Central southern section	Fill	As, Cd, Cr, Cu, Pb, Ni, Zn, Hg, PAH, TRH(C6-C40), BTEXN
C9	South eastern section	Fill	As, Cd, Cr, Cu, Pb, Ni, Zn, Hg, PAH, TRH(C6-C40), BTEXN
C10	South eastern section	Fill	As, Cd, Cr, Cu, Pb, Ni, Zn, Hg, PAH, TRH(C6-C40), BTEXN

9.3 Sampling methods

Soil samples were taken using a stainless-steel hand shovel. Soil was taken at each individual sampling location below the vegetated and detrital layer. The soil was transferred to a solvent rinsed glass jar with a Teflon lid using clean latex gloves. The sampling jars were filled with no airspace to prevent loss of volatiles.

Tools were decontaminated between sampling locations to prevent cross contamination by brushing to remove and rinsing with clean tap water and drying with clean towel. Sampling protocols are presented in Appendix 5.

Boreholes were drilled with an EVH hydraulic drill rig with solid auger.

10. Quality assurance and quality control

10.1 Sampling design

The sampling program is intended to provide preliminary data as to the presence and levels of contaminants.

Discrete soil samples were collected on a judgemental pattern from stockpiles across the site. The sampling density is considered sufficient to provide a preliminary assessment of contamination within the stockpiles.

10.2 Field

The collection of samples was undertaken in accordance with industry accepted standard protocols (NEPC 1999). The details of the samples collected are presented in Table 1. Discrete samples were collected and analysed.

Sampling equipment was decontaminated between each sampling event. Samples were stored and transported under refrigeration and in insulated containers. Appropriate storage duration was observed. A chain of custody form tracked the samples to the laboratory (Appendix 4).

A single sampler was used to collect the samples using standard methods. Soil collected was a fresh sample from the hand shovel. After collection the samples were immediately placed in new glass sampling jars and placed in a cooler. Sample jars were filled to minimise headspace and maintain sample integrity.

One intra laboratory duplicate sample was analysed to evaluate sample integrity and data comparability. The frequency of field duplicates is greater than the NEPM (1999) recommendation of 5%. Samples from all batches did not contain contaminants which confirm the absence of cross contamination during transport and storage. A field sampling log is presented in Appendix 3.

10.3 Laboratory

Chemical analysis was conducted by SGS Laboratories, Sydney, which is NATA accredited for the tests undertaken. The laboratories have quality assurance and quality control programs in place, which include internal replication and analysis of spike samples and recoveries.

Method blanks, matrix duplicates and laboratory control samples were within acceptance criteria. The quality assurance and quality control report is presented together with the laboratory report as Appendix 4.

10.4 Data evaluation

The laboratory quality control report indicates the data variability is within acceptable industry limits. The data is considered representative and usable for the purposes of the investigation. Data quality indicators are presented in Appendix 4.

11. Assessment criteria

The proposed land-use of the site is a registered club facility which will include the club building, kids play and family area, football/cricket field and carpark. All areas of the site will be used by patrons including children intermittently. Staff members are considered adults and will access the site daily. The proposed land-use is considered to be public open space. NEPC (1999) describes public open space as parks, playgrounds, recreational areas and playing fields that are accessible to the public and where the public may spend a large amount of time. It includes areas where young children may have supervised access and use the area outside of the home for frequent short periods of time. Some areas of the site are considered commercial land-use.

The assessment criteria for the soil data in recreational and commercial sites is described in Table 1A(1) of *Guideline on Investigation Levels for Soil and Groundwater* (NEPC 1999). The criteria lists health investigation levels (HIL) for a range of land-uses. The appropriate initial comparison for the site is *Recreational (HIL C)*. The HIL C threshold is considered appropriate for the proposed land-use (Table 3). Assessment criteria for commercial sites (HIL D) has been provided as a comparison.

The NEPM (1999) provides health screening levels (HSL) for hydrocarbons in soil. The HSLs have been developed to be protective of human health for soil types, depths below surface and apply to exposure to hydrocarbons through the predominant vapour exposure pathway. The appropriate HSL for the site is listed in Table 4. TRH>16 have physical properties which make the TRH fractions non-volatiles and therefore these TRH fractions are not applicable for vapour intrusion.

Ecological investigation levels (EIL) have been developed for the protection of terrestrial ecosystems for selected metals and organic substances in the soil in the guideline (NEPC 1999). EILs vary with land-use and apply to contaminants up to 2m depth below the surface. The EIL for arsenic and lead is not dependant on soil type. The EILs were determined using the ASC NEPM Toolbox EIL calculation sheet (accessed June 2020). The EILs for recreational and commercial land-use are listed in Tables 2 and 3.

Typical CEC values for soils in the locality are 10cmol(+)/kg. pH values of between 5.5 to 6, organic carbon of 1% and clay content of 20 to 25% (Espade 2016). The contaminants have been identified in the soil for at least two years and are considered aged.

Ambient background concentrations of metals have been determined based on results obtained from investigations within the locality.

Ecological screening levels (ESL) assess the risk to terrestrial ecosystems from petroleum hydrocarbons in the soil. The EILs and ESLs consider the properties of the soil and contaminants and the capacity of the local ecosystem to accommodate increases in contaminant levels (Table 4).

Management limits have been developed to assess petroleum hydrocarbons following evaluation of human health and ecological risks (NEPC 1999). Management units are applicable as screening levels after consideration of relevant ESLs and HSLs. The appropriate management limit for the site is listed in Table 4.

Chromium is analysed as total chromium which is the sum of chromium (III) and chromium (VI). Chromium (VI) is a potential contaminant from industrial processes including ferrochrome production, electroplating, pigment production and tanning (WHO 1998). Chromium (VI) is reduced to chromium (III) when it comes into contact with organic matter in biota, soil and water. Chromium in the environment is present in the trivalent state (WHO 1998).

Asbestos was assessed visually on a presence/absence basis.

Table 2. EIL Calculation sheet, recreational land-use

Analyte	Rationale	ACL (mg/kg)		ABC (mg/kg)	EIL (mg/kg)	
		Recreational	Commercial		Recreational	Commercial
Arsenic	Aged	100	160	-	100	160
Chromium (III)	Clay content 20-25%, aged	550	910	28	578	968
Copper	pH 6.0	210	300	12	222	312
Lead	Generic	1,100	1,800	7	1,107	1,807
Nickel	CEC 10cmol/kg	170	290	19	189	309
Zinc	CEC 10cmol/kg, pH 5.5	480	700	27	507	727

Table 3. Assessment criteria for soil (mg/kg) (NEPC 1999)

Analyte	HIL Recreational	HIL Commercial /industrial	EIL Urban residential and open public space	EIL Commercial and industrial
Arsenic	300	3,000	100	160
Cadmium	90	900	-	-
Chromium	300[1]	3,600[1]	550[2]	910[2]
Copper	17,000	240,000	210	300
Lead	600	1,500	1,100	1,800
Nickel	1,200	6,000	170	290
Zinc	30,000	400,000	480	700
Mercury	80	730	-	-
PAH	300	4,000	-	-
Carcinogenic PAH	3	40	-	-
Naphthalene	-	-	170	370

[1] Threshold for Chromium (VI), [2] Threshold for Chromium (III), HIL – health investigation level, EIL – ecological investigation level

Table 4. Soil assessment criteria (mg/kg) (NEPC 1999)

Analyte	HSL Recreational / open space / clay soil	HSL Commercial / clay soil	ESL Urban residential and public open space/ fine soil	ESL Commercial / fine soil	Management limits for TRH in soil / Residential, parkland and public open space	Management limits for TRH in soil / commercial
	0m to <1m	0m to <1m				
TRH (C6-C10)	NL	310	180	215	800	800
TRH (>C10-C16)	NL	NL	120	170	1,000	1,000
TRH (>C16-C34)	NA	NA	1,300	2,500	3,500	5,000
TRH (>C34-C40)	NA	NA	5,600	6,600	10,000	10,000
Benzene	NL	4	65	95	-	-
Toluene	NL	NL	105	135	-	-
Ethylbenzene	NL	NL	125	185	-	-
Xylenes	NL	NL	45	95	-	-
Naphthalene	NL	NL	-	-	-	-
Benzo(a)pyrene	-	-	0.7	1.4	-	

HSL – health screening level, EIL – ecological investigation level, ESL – ecological screening level, NL – non limiting, NA – not applicable

The chemical assessment of soil was also made under the Excavated Natural Material (ENM) exemption (2014) under the POEO Regulation 2014. The thresholds for the excavated natural material exemptions were compared with the results (Table 4).

Table 4. ENM thresholds (mg/kg)

Analyte	Units	ENM thresholds	
		Maximum average concentration	Absolute maximum concentration
Arsenic	mg/kg	20	40
Cadmium	mg/kg	0.5	1
Chromium (total)	mg/kg	75	150
Copper	mg/kg	100	200
Lead	mg/kg	50	100
Nickel	mg/kg	30	60
Zinc	mg/kg	150	300
Mercury	mg/kg	0.5	1
Electrical conductivity	dS/m	1.5	3
pH	pH units	5 to 9	4.5 to 10
TPH (C6-C9)	mg/kg	-	-
TPH (C10-C36)	mg/kg	250	500
Benzene	mg/kg	NA	0.5
Toluene	mg/kg	NA	65
Ethylbenzene	mg/kg	NA	25
Xylenes	mg/kg	NA	15
PAH	mg/kg	20	40
Benzo(a)pyrene	mg/kg	0.5	1
Rubber, plastic, bitumen, paper, cloth, paint and wood	%	0.05	0.10

12. Results and discussion

The site was dominated by stockpiles which had been imported from an unknown source. The stockpiles were predominantly reddish brown sandy clay. Foreign materials were identified across the site and within the stockpiles including concrete, timber, asphalt, bricks and car bodies. The foreign materials are an

amenity hazard. Surface cover on the site was predominately 100% due to recent rain. Some bare areas were identified due to gravel. Boreholes drilled in the central section of the site identified fill from 0.6m to 1m. Basalt rock resulted in drill refusal from depths of 0.25m to 1.7m.

Presence of vegetation restricted visual inspection of the surface of the site and stockpiles. No odours were identified. No soil staining or asbestos containing materials were not identified in borehole cuttings.

Levels of chromium (III) in sample C5 exceeded the recreational HIL/EIL and commercial EIL (Table 5). Volume of impacted material was unable to be estimated due to the presence of vegetation. The levels of all other analytes analysed in the soil samples (Tables 5 and 6) were below the adopted health and ecological investigation levels for recreational and commercial land-use (NEPC 1999).

Maximum levels of chromium, lead and nickel and average levels of chromium exceeded the threshold for classification of ENM (Table 5). Average and maximum levels of other analytes were below the ENM thresholds (Tables 5 and 6).

Table 5. Soil analysis results for metals and PAH (mg/kg)

Sample ID	Location (Figure 2)	Arsenic	Cadmium	Total chromium	Copper	Lead	Nickel	Zinc	Mercury	PAH	Carcinogenic benzo(a)pyrene	Naphthalene
C1	North western section	4	<0.3	15	11	9	8.6	37	<0.05	<0.8	<0.3	<0.1
C2	South western section	3	<0.3	79	24	8	120	34	<0.05	<0.8	<0.3	<0.1
C3	South western section	2	<0.3	18	16	160	15	77	<0.05	5.9	0.8	<0.1
C4	Central section	1	<0.3	57	19	9	26	33	<0.05	8.2	1.4	<0.1
C5	Central section	11	<0.3	1,200[3]	17	15	16	150	<0.05	1.4	<0.3	<0.1
C6	North eastern section	2	<0.3	9.9	13	4	23	57	<0.05	<0.8	<0.3	<0.1
C7	Central southern section	1	<0.3	33	14	150	22	56	0.45	<0.8	<0.3	<0.1
C8	Central southern section	1	<0.3	49	20	28	34	38	<0.05	<0.8	<0.3	<0.1
C9	South eastern section	5	<0.3	11	12	6	11	26	<0.05	<0.8	<0.3	<0.1
C10	South eastern section	5	<0.3	14	12	7	11	27	<0.05	<0.8	<0.3	<0.1
	Max average level	3.5	<0.3	148.6	15.8	39.6	28.7	53.5	0.09	2.1	-	-
	Absolute max level	11	<0.3	1,200	24	160	120	150	0.45	8.2	-	-
Recreational land-use thresholds (NEPC 1999)												
HIL		*300*	*90*	*300[1]*	*17,000*	*600*	*1,200*	*30,000*	*80*	*300*	*3*	-
EIL		*100*	-	*578[2]*	*222*	*1,107*	*189*	*507*	-	-	-	*170*
Commercial/industrial land-use thresholds (NEPC 1999)												
HIL		*3,000*	*900*	*3,600[1]*	*240,000*	*1,500*	*6,000*	*400,000*	*730*	*4,000*	*40*	-
EIL		*160*	-	*968[2]*	*312*	*1,807*	*309*	*727*	-	-	-	*370*
ENM Exemption (2014)												
Max average level		*20*	*0.5*	*75*	*100*	*50*	*30*	*150*	*0.5*	*20*	-	-
Absolute max level		*40*	*1*	*150*	*200*	*100*	*60*	*300*	*1*	*40*	-	-

[1] Threshold for Chromium (VI), [2] Threshold for Chromium (III), [3] Chromium (III), HIL – Health investigation levels, EIL – Ecological investigation levels

Table 6. Soil analysis results for TRH and BTEXN (mg/kg)

Sample ID	Location (Figure 2)	TRH (C6-C10)	TRH (>C10-C16)	TRH (>C16-C34)	TRH (>C34-C40)	TPH (C10-C36)	Benzene	Toluene	Ethyl-benzene	Xylenes	Naphthalene	Benzo(a)pyrene
C1	North western section	<25	<25	<90	<120	<110	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1
C2	South western section	<25	<25	<90	<120	<110	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1
C3	South western section	<25	<25	<90	<120	<110	<0.1	<0.1	<0.1	<0.3	<0.1	0.5
C4	Central section	<25	<25	<90	<120	<110	<0.1	<0.1	<0.1	<0.3	<0.1	0.9
C5	Central section	<25	<25	<90	<120	<110	<0.1	<0.1	<0.1	<0.3	<0.1	0.1
C6	North eastern section	<25	<25	<90	<120	<110	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1
C7	Central southern section	<25	<25	<90	<120	<110	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1
C8	Central southern section	<25	<25	<90	<120	<110	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1
C9	South eastern section	<25	<25	<90	<120	<110	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1
C10	South eastern section	<25	<25	<90	<120	<110	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1
	Max average level	<25	<25	<90	<120	<110	<0.1	<0.1	<0.1	<0.3	<0.1	0.22
	Absolute max level	<25	<25	<90	<120	<110	<0.1	<0.1	<0.1	<0.3	<0.1	0.9
Recreational land-use thresholds (NEPC 1999)												
HSL	*0m to <1m*	*310*	*NL*	*NA*	*NA*	*-*	*4*	*NL*	*NL*	*NL*	*NL*	*-*
ESL		*215*	*170*	*2,500*	*6,600*	*-*	*9*	*135*	*185*	*95*	*-*	*0.7*
Management limits		*800*	*1,000*	*5,000*	*10,000*	*-*	*-*	*-*	*-*	*-*	*-*	*-*
Commercial land-use thresholds (NEPC 1999)												
HSL	*0m to <1m*	*310*	*NL*	*NA*	*NA*	*-*	*4*	*NL*	*NL*	*NL*	*NL*	*-*
ESL		*215*	*170*	*2,500*	*6,600*	*-*	*9*	*135*	*185*	*95*	*-*	*1.4*
Management limits		*800*	*1,000*	*5,000*	*10,000*	*-*	*-*	*-*	*-*	*-*	*-*	*-*
ENM Exemption (2014)												
Max average level		*-*				*250*	*NA*	*NA*	*NA*	*NA*	*-*	*0.5*
Absolute max level		*-*				*500*	*0.5*	*65*	*25*	*15*	*-*	*1*

HSL – health screening level, EIL – ecological investigation level, ESL – ecological screening level, NL – non limiting, NA – not applicable

13. Site characterisation

13.1 Environmental contamination

Elevated levels of Chromium (III) in one sample.

Foreign materials located within stockpiles and across the site.

13.2 Chemical degradation production

The contaminants will not degrade.

13.3 Exposed population

No human health or ecological receptors exposed.

14. Conclusions and recommendations

14.1 Summary

A site assessment was conducted on 19 May 2020 consisting of a site walkover, desktop study and limited soil sampling.

The preliminary contamination assessment comprised a soil sampling and laboratory analysis program. A total of sixteen locations were assessed across the site. Six boreholes were drilled to rock, the soil profile described and indicators of potential contamination identified. Ten soil samples were collected from stockpiles to provide an indicator of potential contamination.

The site was dominated by the presence of numerous stockpiles of unknown origin. The stockpiles generally contained reddish brown sandy clay. Gravel was identified in some stockpiles. Foreign materials including concrete, timber, asphalt, bricks and car bodies were also identified on the site. Vegetated surface cover was near 100%. Bare areas were present in areas of gravel. Fill material was identified in two boreholes to depths of 900mm. Refusal due to basalt was encountered in four boreholes at depths from 0.1m.

Vegetation cover restricted inspection of the soil surface for asbestos containing materials. No asbestos containing materials were identified in the borehole cuttings.

Levels of chromium (III) exceeded adopted thresholds in one stockpile sample. Additional investigations are required to delineate impacted material. The levels of all other analytes evaluated in the soil samples were below the adopted health and ecological investigation and screening levels for recreational and commercial land-use.

14.2 Assumptions in reaching the conclusions

It is assumed the sampling sites are representative of the site.

14.3 Extent of uncertainties

The analytical data relate only to the locations sampled. Soil conditions can vary both laterally and vertically and it cannot be excluded that unidentified contaminants may be present.

14.4 Suitability for proposed use of the site

Further investigations are required to determine suitability for the proposed land-use.

14.5 Limitations and constraints on the use of the site

Additional investigations of the site are required to determine suitability for the proposed land-use.

14.6 Recommendation for further work

It is expected that the site can be made suitable for the proposed land-use following additional investigations, completion of remediation works and validation assessment.

The investigations should be undertaken following surveying of the proposed site boundary to ensure to entire site is investigated.

Natural soils on the site should be assessed at 45 locations on a 30m systematic sampling pattern in accordance with NEPM (1999) guidelines. Soil samples should be collected using an excavator and analysed for a range of potential contaminants including heavy metals, hydrocarbons and asbestos.

Stockpiles on the site should be assessed in accordance with waste classification guidelines including the *Excavated Natural Material (ENM) Exemption* by use of an excavator to remove vegetation and allow inspection of the material. Stockpiles containing similar material as determined visually should be determined and soil samples collected. Number of soil samples will be based on volume of material identified. Soil samples should be analysed for electrical conductivity, pH, heavy metals, hydrocarbons, organochlorine pesticides, polychlorinated biphenyls and foreign materials. Gravimetric assessment for asbestos is also recommended.

Additional boreholes and excavator pits should be constructed to confirm a quarry or landfill is not present on the site.

Additional investigations are required to delineate chromium (III/VI) impacted soils at sampling location C5.

A detailed investigation report should be prepared describing the results and suitability for the proposed land-use or requirements for remediation.

Remediation at the stockpile sample C5 was collected will be required to enable the proposed land-use. Remediation should be undertaken in accordance with a remediation action plan (RAP).

15. Report limitations and intellectual property

This report has been prepared for the use of the client to achieve the objectives given the clients requirements. The level of confidence of the conclusion reached is governed by the scope of the investigation and the availability and quality of existing data. Where limitations or uncertainties are known, they are identified in the report. No liability can be accepted for failure to identify conditions or issues which arise in the future and which could not reasonably have been predicted using the scope of the investigation and the information obtained.

The investigation identifies the actual subsurface conditions only at those points where samples are taken, when they are taken. Data derived through sampling and subsequent laboratory testing is interpreted by geologists, engineers or scientists who then render an opinion about overall subsurface conditions, the nature and extent of the contamination, its likely impact on the proposed development and appropriate remediation measures. Actual conditions may differ from those inferred to exist, because no professional, no matter how well qualified, and no sub-surface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock or time. The actual interface between materials may be far more gradual or abrupt than a report indicates. Actual conditions in areas not sampled may differ from predictions. It is thus important to understand the limitations of the investigation and recognise that we are not responsible for these limitations.

This report, including data contained and its findings and conclusions, remains the intellectual property of Envirowest Consulting Pty Ltd. A licence to use the report for the specific purpose identified is granted for the persons identified in that section after full payment for the services involved in preparation of the report. This report should not be used by persons or for purposes other than those stated and should not be reproduced without the permission of Envirowest Consulting Pty Ltd.

16. References

Environment Protection Authority (1995) *Contaminated sites: Sampling Design Guidelines* (NSW Environment Protection Authority, Chatswood)

Environment Protection Authority (2020) *Consultants reporting on contaminated land* (NSW Environment Protection Authority, Chatswood)

Environment.nsw.gov.au, 'eSPADE | NSW Environment & Heritage' Version 2. N.p., 2019. Web. 15 May 2020.

Murphy BW and Lawrie JW (1998) *Soil Landscapes of the Dubbo 1:250 000 Sheet Report,* Department of Land and Water Conservation of NSW, Sydney

NEPC (1999 revised 2013) *National Environment Protection (Assessment of Site Contamination) Measure 1999* (National Environment Protection Council Service Corporation, Adelaide)

Figures

Figure 1. Locality map
Figure 2. Site plan and sampling locations
Figure 3. Photographs of the site

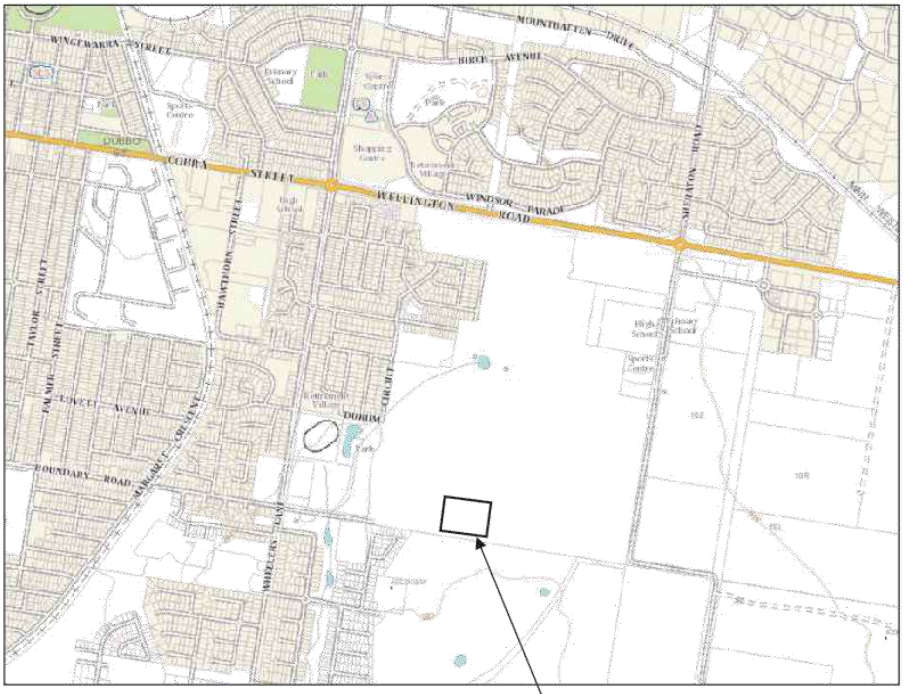

Figure 1. Site locality		
RSL Club, Part Lot 502 DP1255115, Boundary Road, Dubbo NSW		
	Envirowest Consulting Pty Ltd	
Job: R11858c .1	Drawn by: LD	Date: 16/6/2020



Legend

- Investigation area
- ⊗ Stockpile sampling location
- ☒ Borehole

Approximate Scale 1: 2,800

0 28 56 112m

Figure 2. Sampling plan and borehole locations		
RSL Club, Part Lot 502 DP1255115, Boundary Road, Dubbo NSW		
	Envirowest Consulting Pty Ltd	
Job: R11858c.1	Drawn by: LD	Date: 16/6/2020

Figure 3. Photographs of the site



Appendices

Appendix 1. Sample analysis, quality assurance and quality control (QAQC) report
Appendix 2. Borelogs
Appendix 3. Field sampling log
Appendix 4. Soil analysis results – SGS report number SE206541 and chain of custody form
Appendix 5. Soil sampling protocols

Appendix 1. Sample analysis, quality assurance and quality control (QAQC) report

1. Data quality indicators (DQI) requirements

1.1 Completeness

A measure of the amount of usable data for a data collection activity. Greater than 95% of the data must be reliable based on the quality objectives. Where greater than two quality objectives have less reliability than the acceptance criterion the data may be considered with uncertainty.

1.1.1 Field

Consideration	Requirement
Locations and depths to be sampled	Described in the sampling plan. The acceptance criterion is 95% data retrieved compared with proposed. Acceptance criterion is 100% in crucial areas.
SOP appropriate and compiled	Described in the sampling plan.
Experienced sampler	Sampler or supervisor
Documentation correct	Sampling log and chain of custody completed

1.1.2 Laboratory

Consideration	Requirement
Samples analysed	Number according to sampling and quality plan
Analytes	Number according to sampling and quality plan
Methods	EPA or other recognised methods with suitable PQL
Sample documentation	Complete including chain of custody and sample description
Sample holding times	Metals 6 months, OCP, PAH, TPH, PCB 14 days

1.2 Comparability

The confidence that data may be considered to be equivalent for each sampling and analytical event. The data must show little or no inconsistencies with results and field observations.

1.2.1 Field

Consideration	Requirement
SOP	Same sampling procedures to be used
Experienced sampler	Sampler or supervisor
Climatic conditions	Described as may influence results
Samples collected	Sample medium, size, preparation, storage, transport

1.2.2 Laboratory

Consideration	Requirement
Analytical methods	Same methods, approved methods
PQL	Same
Same laboratory	Justify if different
Same units	Justify if different

1.3 Representativeness

The confidence (expressed qualitatively) that data are representative of each media present on the site.

1.3.1 Field

Consideration	Requirement
Appropriate media sampled	Sampled according to sampling and quality plan or in accordance with the EPA (1995) sampling guidelines.
All media identified	Sampling media identified in the sampling and quality plan. Where surface water bodies on the site sampled.

1.3.2 Laboratory

Consideration	Requirement
Samples analysed	Blanks

1.4 Precision

A quantitative measure of the variability (or reproduced of the data). Is measured by standard deviation or relative percent difference (RPD). A RPD analysis is calculated and compared to the practical quantitation limit (PQL) or absolute difference AD.

- Levels greater than 10 times the PQL the RPD is 50%
- Levels between 5 and 10 times the PQL the RPD is 75%
- Levels between 2 and 5 times the PQL the RPD is 100%
- Levels less than 2 times the PQL, the AD is less than 2.5 times the PQL

Data not conforming to the acceptance criterion will be examined for determination of suitability for the purpose of site characterisation.

1.4.1 Field

Consideration	Requirement
Field duplicates	Frequency of 5%, results to be within RPD or discussion required indicate the appropriateness of SOP

1.4.2 Laboratory

Consideration	Requirement
Laboratory and inter lab duplicates	Frequency of 5%, results to be within RPD or discussion required. Inter laboratory duplicates will be one sample per batch.
Field duplicates	Frequency of 5%, results to be within RPD or discussion required
Laboratory prepared volatile trip spikes	One per sampling batch, results to be within RPD or discussion required

1.5 Accuracy

A quantitative measure of the closeness of the reported data to the true value.

1.5.1 Field

Consideration	Requirement
SOP	Complied
Inter laboratory duplicates	Frequency of 5%. Analysis criterion 60% RPD for levels greater than 10 times the PQL 85% RPD for levels between 5 to 10 times the PQL 100% RPD at levels between 2 to 5 times the PQL Absolute difference, 3.5 times the PQL where levels are, 2 times PQL

1.5.2 Laboratory

Recovery data (surrogates, laboratory control samples and matrix spikes) data subject to the following control limits:

- 60 to 140% acceptable data
- 20-60% discussion required, may be considered acceptable
- 10-20% data should considered as estimates
- 10% data should be rejected

Consideration	Requirement
Field blanks	Frequency of 5%, <5 times the PQL, PQL may be adjusted
Rinsate blanks	Frequency of 5%, <5 times the PQL, PQL may be adjusted
Method blanks	Frequency of 5%, <5 times the PQL, PQL may be adjusted
Matrix spikes	Frequency of 5%, results to be within +/-40% or discussion required
Matrix duplicates	Sample injected with a known concentration of contaminants with tested. Frequency of 5%, results to be within +/-40% or discussion required
Surrogate spikes	QC monitoring spikes to be added to samples at the extraction process in the laboratory where applicable. Surrogates are closely related to the organic target analyte and not normally found in the natural environment. Frequency of 5%, results to be within +/-40% or discussion required
Laboratory control samples	Externally prepared reference material containing representative analytes under investigation. These will be undertaken at one per batch. It is to be within +/-40% or discussion required
Laboratory prepared spikes	Frequency of 5%, results to be within +/-40% or discussion required

2. Laboratory analysis summary

One analysis batch was undertaken over the preliminary investigation program. Samples were collected on 19 May 2020. A total of ten samples were submitted for analytical testing. The samples were collected in the field by an environmental scientist from Envirowest Consulting Pty Ltd, placed into laboratory prepared receptacles as recommended in NEPM (1999). The samples preservation and storage was undertaken using standard industry practices (NEPC 1999). A chain of custody form accompanied transport of the samples to the laboratory.

The samples were analysed at the laboratories of SGS Laboratories, Alexandria NSW which is National Association of Testing Authorities (NATA) accredited for the tests undertaken. The analyses undertaken, number of samples tested and methods are presented in the following tables:

Laboratory analysis schedule

Sample id. (sampling location)	Number of samples	Duplicate	Analyses	Date collected	Substrate	Laboratory report
C1, C2, C3, C4, C5, C6, C7, C8, C9, C10	10	1	As, Cd, Cr, Cu, Pb, Ni, Zn, Hg, PAH, TRH(C6-C40), BTEXN	19/5/2020	Soil	SE206541

Analytical methods

Analyte	Extraction	Laboratory methods
Metals	USEPA 200.2 Mod	APHA USEPA SW846-6010
Chromium (III)	-	APHA 3500 CR-A&B & 3120 and USEPA SW846-3060A
Chromium (VI)	USEPA SW846-3060A	USEPA SW846-3060A
Mercury	USEPA 200.2 Mod	APHA 3112
TPH(C6-C9)	USPEA SW846-5030A	USPEA SW 846-8260B
TPH(C10-C36), PAH	Tumbler extraction of solids	USEPA SW 846-8270B
PCB	Tumbler extraction of solids	USEPA SW 846-8270B
OC Pesticides	Tumbler extraction of solids	USEPA SW 846-8270B
BTEX	Tumbler extraction of solids	USEPA SW 846-8260B

3. Field quality assurance and quality control

One intra laboratory duplicate sample was collected for the investigation. The frequency was greater than the recommended frequency of 5%. Table A5.1 outlines the samples collected and differences in replicate analyses. Relative differences were deemed to pass if they were within the acceptance limits of +/- 40% for replicate analyses or less than 5 times the detection limit.

Field duplicate frequency

Sample id.	Number of samples	Duplicate	Frequency (%)	Date collected	Substrate	Laboratory report
C1, C2, C3, C4, C5, C6, C7, C8, C9, C10	10	1	10	19/5/2020	Soil	SE206541

Table A5.1. Relative differences for intra laboratory duplicates

	C1 and DA	
	Relative difference (%)	Pass/Fail
Arsenic	0	Pass
Cadmium	NA	Pass
Chromium	7	Pass
Copper	0	Pass
Lead	0	Pass
Nickel	0	Pass
Zinc	3	Pass
Mercury	NA	-
BTEXN	NA	-
TRH	NA	-
PAH	NA	-

NA – relative difference unable to be calculated as results are less than laboratory detection limit, *Results less than 5 times laboratory detection limits, ^Variation expected to be due to non-homogenised sample. Does not impact results

No trip blanks or spikes were submitted for analysis. This is not considered to create significant uncertainty in the analysis results because of the following rationale:

- The fieldwork was completed within a short time period and consistent methods were used for soil sampling.
- Soil samples were placed in insulated cooled containers after sampling to ensure preservation during transport and storage.
- The samples were placed in single use jars using clean sampling tools and disposable gloves from material not in contact with other samples. This reduces the likelihood of cross contamination.
- Samples in the analysis batch contain analytes below the level of detection. It is considered unlikely that contamination has occurred as a result of transport and handling.

4. Laboratory quality assurance and quality control

Sample holding times are recommended in NEPC (1999). The time between collection and extraction for all samples was less than the criteria listed below:

Analyte	Maximum holding time
Metals, cyanide	6 months
OCP, TRH, PCB, BTEX, PAH	14 days

The laboratory interpretative reports are presented with individual laboratory report. Assessment is made of holding time, frequency of control samples and quality control samples. No significant outliers exist for the sampling batches. The laboratory report also contains a detailed description of preparation methods and analytical methods.

The results, quality report, interpretative report and chain of custody are presented in the attached appendices. The quality report contains the laboratory duplicates, spikes, laboratory control samples, blanks and where appropriate matrix spike recovery (surrogate).

5. Data quality indicators (DQI) analysis

5.1 Completeness

A measure of the amount of usable data for a data collection activity (total to be greater than 95%). The data set was found to be complete based on the scope of work. No critical areas of contamination were omitted from the data set.

5.1.1 Field

Consideration	Accepted	Comment
Locations to be sampled	Yes	In accordance with sampling methodology, described in the report. Sampling locations described in figures.
Depth to be sampled	Yes	In accordance with sampling methodology
SOP appropriate and compiled	Yes	In accordance with sampling methodology Sampled with stainless steel spade into lab prepared containers, decontamination between samples, latex gloves worn by sampler
Experienced sampler	Yes	Same soil sampler, environmental scientist
Documentation correct	Yes	Sampling log completed Chain of custody completed

5.1.2 Laboratory

Consideration	Accepted	Comment
Samples analysed	Yes	All critical samples analysed in accordance with chain of custody and analysis plan
Analytes	Yes	All analytes in accordance with chain of custody and analysis plan
Methods	Yes	Analysed in NATA accredited laboratory with recognised methods and suitable PQL
Sample documentation	Yes	Completed including chain of custody and sample results and quality results report for each batch
Sample holding times	Yes	Metals less than 6 months. OCP, TPH, PCB, BTEX less than 14 days

5.2 Comparability

The confidence that data may be considered to be equivalent for each sampling and analytical event.

The data sets were found to be acceptable.

5.2.1 Field

Consideration	Accepted	Comment
SOP	Yes	Same sampling procedures used and sampled on one date
Experienced sampler	Yes	Experienced scientist
Climatic conditions	Yes	Described in field sampling log
Samples collected	Yes	Suitable size, storage and transport

5.2.2 Laboratory

Consideration	Accepted	Comment
Analytical methods	Yes	Same methods all samples, in accordance with NEPC (1999) or USEPA
PQL	Yes	Suitable for analytes
Same laboratory	Yes	SGS is NATA accredited for the test
Same units	Yes	-

5.3 Representativeness

The confidence (expressed qualitatively) that data are representative of each media present on the site.

The data sets were found to be acceptable.

5.3.1 Field

Consideration	Accepted	Comment
Appropriate media sampled	Yes	Sampled according to sampling and quality plan
All media identified	Yes	Soil Sampling media identified in the sampling and quality plan

5.3.2 Laboratory

Consideration	Accepted	Comment
Samples analysed	Yes	Undertaken in NATA accredited laboratory. No blanks analysed. Samples in the analysis batch contain analytes below the level of detection. It is considered unlikely that contamination has occurred as a result of transport and handling.

5.4 Precision

A quantitative measure of the variability (or reproduced of the data).The data sets were found to be acceptable.

5.4.1 Field

Consideration	Accepted	Comment
SOP	Yes	Complied
Field duplicates	Yes	Collected

5.4.2 Laboratory

Consideration	Accepted	Comment
Laboratory and inter lab duplicates	Yes	Frequency of 5%, results to be within +/-40% or discussion required
Field duplicates	Yes	Frequency of 5%, results to be within +/-40% or discussion required
Laboratory prepared volatile trip spikes	NA	Not analysed due to preliminary nature of investigation

5.5 Accuracy

A quantitative measure of the closeness of the reported data to the true value.

The data sets were found to be acceptable.

5.5.1 Field

Consideration	Accepted	Comment
SOP	Yes	Complied
Field blanks	NA	Frequency of 5%, <5 times the PQL, PQL may be adjusted
Rinsate blanks	NA	Frequency of 5%, <5 times the PQL, PQL may be adjusted

5.5.2 Laboratory

Consideration	Accepted	Comment
Method blanks	Yes	Frequency of 5%, <5 times the PQL, PQL may be adjusted
Matrix spikes	Yes	Frequency of 5%, results to be within +/-40% or discussion required.
Matrix duplicates	Yes	Frequency of 5%, results to be within +/-40% or discussion required. RPD failed acceptance criteria due to sample heterogeneity.

Surrogate spikes	Yes	Frequency of 5%, results to be within +/-40% or discussion required. At least 2 of 3 surrogates are within acceptance criteria.
Laboratory control samples	Yes	Frequency of 5%, results to be within +/-40% or discussion required
Laboratory prepared spikes	Yes	Frequency of 5%, results to be within +/-40% or discussion required

No trip blanks, field spikes or sample rinsates were submitted for analysis. This is not considered to create significant uncertainty in the analysis results because of the following rationale:

- The fieldwork methods used for soil sampling were consistent throughout the project with all in situ samples collected from material which had not been subject to exposure.
- The fieldwork was completed within a short time period and consistent methods were used for soil sampling.
- Soil samples were placed in insulated cooled containers as quickly as possible, with the containers filled to minimize headspace. The sample containers were sealed immediately after the sample was collected and chilled in an esky containing ice.
- The samples were stored in a refrigerator and transported with ice bricks to ensure preservation during transport and storage.
- The samples were placed in single use jars using clean sampling tools and disposable gloves from material not in contact with other samples. This reduces the likelihood of cross contamination.
- Samples in the analysis batches contained analytes below the level of detection. It is considered unlikely that contamination has occurred as a result of transport and handling.

6. Conclusion

All media appropriate to the objectives of this investigation have been adequately analysed and no area of significant uncertainty exist. It is concluded the data is usable for the purposes of the investigation.

Appendix 2. Borelogs

Borelog

Job: 11858 Client: The Planning Hub Site: Dubbo RSL Boundary Road Dubbo NSW	Borehole No: BH1	Sampling method: EVH Logged by: LN Date: 19/5/2020

Depth (m)	Graphic Log	SOIL DESCRIPTION Soil type/rock, grain size, structure, colour, minor components	Unified symbol	Samples	COMMENTS
		FILL, silty sand, dark brown with gravel			No odour
		FILL, silty clay, yellowish brown			No odour
0.5		FILL, silty clay, dark brown			No odour
1.0		SILTY CLAY, reddish brown with gravel	CI		
1.5					
		End of hole, drill refusal due to basalt rock			

Slope/nature of surface: 2-4% SE *Ground water*: No free water identified in soil profile	*Remarks* (fill, odour, root holes): Fill to 0.9m

Borelog

Job: 11858 Client: The Planning Hub Site: Dubbo RSL Boundary Road Dubbo NSW	Borehole No: BH2	Sampling method: EVH Logged by: LN Date: 19/5/2020

Depth (m)	Graphic Log	SOIL DESCRIPTION Soil type/rock, grain size, structure, colour, minor components	Unified symbol	Samples	COMMENTS
		FILL, silty sand, light brown			No odour
0.5					
		SANDY CLAY, dark brown grey	CI		
1.0					
		End of hole, drill refusal due to basalt rock			
1.5					

Slope/nature of surface: 2-4% E *Ground water*: No free water identified in soil profile	*Remarks* (fill, odour, root holes): Fill to 0.6m

Borelog

Job: 11858 Client: The Planning Hub Site: Dubbo RSL Boundary Road Dubbo NSW	Borehole No: BH3	Sampling method: EVH Logged by: LN Date: 19/5/2020

Depth (m)	Graphic Log	SOIL DESCRIPTION Soil type/rock, grain size, structure, colour, minor components	Unified symbol	Samples	COMMENTS
		SILTY SAND, reddish brown	SM		No odour
0.5		End of hole, drill refusal due to basalt rock			
1.0					
1.5					

Slope/nature of surface: 2-4% E *Ground water:* No free water identified in soil profile	*Remarks* (fill, odour, root holes): Two boreholes drilled adjacent Borehole 3 with drill refusal at 0.3m.

Borelog

Job: 11858 Client: The Planning Hub Site: Dubbo RSL Boundary Road Dubbo NSW	Borehole No: BH4	Sampling method: EVH Logged by: LN Date: 19/5/2020

Depth (m)	Graphic Log	SOIL DESCRIPTION Soil type/rock, grain size, structure, colour, minor components	Unified symbol	Samples	COMMENTS
		SILTY SAND, reddish brown	SM		No odour
0.5		End of hole, drill refusal due to basalt rock			
1.0					
1.5					

Slope/nature of surface: 2-4% E *Ground water:* No free water identified in soil profile	*Remarks* (fill, odour, root holes): One borehole drilled adjacent Borehole 4 with drill refusal at 0.2m.

Borelog

Job: 11858 Client: The Planning Hub Site: Dubbo RSL Boundary Road Dubbo NSW	Borehole No: BH5	Sampling method: EVH Logged by: LN Date: 19/5/2020

Depth (m)	Graphic Log	SOIL DESCRIPTION Soil type/rock, grain size, structure, colour, minor components	Unified symbol	Samples	COMMENTS
		SILTY SAND, reddish brown	SM		No odour
0.5		End of hole, drill refusal due to basalt rock			
1.0					
1.5					

Slope/nature of surface: 2-4% E *Ground water:* No free water identified in soil profile	*Remarks* (fill, odour, root holes): Nil

Borelog

Job: 11858 Client: The Planning Hub Site: Dubbo RSL Boundary Road Dubbo NSW	Borehole No: BH6	Sampling method: EVH Logged by: LN Date: 19/5/2020

Depth (m)	Graphic Log	SOIL DESCRIPTION Soil type/rock, grain size, structure, colour, minor components	Unified symbol	Samples	COMMENTS
		SILTY CLAY, reddish brown	Cl		No odour
0.5		SILTY CLAY, grey with gravel	Ci		
1.0		End of hole, drill refusal due to basalt rock			
1.5					

Slope/nature of surface: 2-4% E *Ground water:* No free water identified in soil profile	*Remarks* (fill, odour, root holes): Nil

Appendix 3. Field sampling log

Client	The Planning Hub
Contact	Lachlan Rogers
Job number	R11858c
Location	Boundary Road, Dubbo NSW
Date	19 May 2020
Investigator(s)	Luke Niven
Weather conditions	Fine

Sample id	Matrix	Date	Analysis required	Observations/comment
C1	Soil	19/05/2020	Arsenic (As), cadmium (Ca), chromium (Cr), copper (Cu), lead (Pb), nickel (Ni), zinc (Zn), mercury (Hg), total recoverable hydrocarbons (TRHC6-C40), benzene, ethylbenzene, toluene, xylene, naphthalene (BTEXN), polycyclic aromatic hydrocarbon (PAH)	
C2	Soil	19/05/2020	As, Ca, Cr, Cu, Pb, Ni, Zn, Hg, TRH, BTEXN and PAH	
C3	Soil	19/05/2020	As, Ca, Cr, Cu, Pb, Ni, Zn, Hg, OCP, TRH, BETXN, PCB and PAH	
C4	Soil	19/05/2020	As, Ca, Cr, Cu, Pb, Ni, Zn, Hg, OCP, TRH, BETXN, PCB and PAH	
C5	Soil	19/05/2020	As, Ca, Cr, Cu, Pb, Ni, Zn, Hg, OCP, TRH, BETXN, PCB and PAH	
C6	Soil	19/05/2020	As, Ca, Cr, Cu, Pb, Ni, Zn, Hg, OCP, TRH, BETXN, PCB and PAH	
C7	Soil	19/05/2020	As, Ca, Cr, Cu, Pb, Ni, Zn, Hg, OCP, TRH, BETXN, PCB and PAH	
C8	Soil	19/05/2020	As, Ca, Cr, Cu, Pb, Ni, Zn, Hg, OCP, TRH, BETXN, PCB and PAH	
C9	Soil	19/05/2020	As, Ca, Cr, Cu, Pb, Ni, Zn, Hg, OCP, TRH, BETXN, PCB and PAH	
C10	Soil	19/05/2020	As, Ca, Cr, Cu, Pb, Ni, Zn, Hg, OCP, TRH, BETXN, PCB and PAH	
DA	Soil	19/05/2020	As, Ca, Cr, Cu, Pb, Ni, Zn, Hg, OCP, TRH, BETXN, PCB and PAH	Duplicate of C1

Appendix 4. Soil analysis results – SGS report number SE206541 and chain of custody form

ANALYTICAL REPORT

Accreditation No. 2562

CLIENT DETAILS		LABORATORY DETAILS	
Contact	Luke Niven	Manager	Huong Crawford
Client	ENVIROWEST CONSULTING PTY LIMITED	Laboratory	SGS Alexandria Environmental
Address	PO BOX 8158 ORANGE NSW 2800	Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	61 2 63614954	Telephone	+61 2 8594 0400
Facsimile	(Not specified)	Facsimile	+61 2 8594 0499
Email	luke@envirowest.net.au	Email	au.environmental.sydney@sgs.com
Project	**11858**	SGS Reference	**SE206541 R0**
Order Number	**11858**	Date Received	21/5/2020
Samples	13	Date Reported	28/5/2020

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing. NATA accredited laboratory 2562(4354).

SIGNATORIES

Dong LIANG
Metals/Inorganics Team Leader

Ly Kim HA
Organic Section Head

SGS

ANALYTICAL RESULTS SE206541 R0

VOC's in Soil [AN433] Tested: 22/5/2020

PARAMETER	UOM	LOR	C1 SOIL - 19/5/2020 SE206541.003	C2 SOIL - 19/5/2020 SE206541.004	C3 SOIL - 19/5/2020 SE206541.005	C4 SOIL - 19/5/2020 SE206541.006	C5 SOIL - 19/5/2020 SE206541.007
Benzene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Toluene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ethylbenzene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
m/p-xylene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
o-xylene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Xylenes	mg/kg	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Total BTEX	mg/kg	0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Naphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1

PARAMETER	UOM	LOR	C6 SOIL - 19/5/2020 SE206541.008	C7 SOIL - 19/5/2020 SE206541.009	C8 SOIL - 19/5/2020 SE206541.010	C9 SOIL - 19/5/2020 SE206541.011	C10 SOIL - 19/5/2020 SE206541.012
Benzene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Toluene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ethylbenzene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
m/p-xylene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
o-xylene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Xylenes	mg/kg	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Total BTEX	mg/kg	0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Naphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1

PARAMETER	UOM	LOR	DA SOIL - 19/5/2020 SE206541.013
Benzene	mg/kg	0.1	<0.1
Toluene	mg/kg	0.1	<0.1
Ethylbenzene	mg/kg	0.1	<0.1
m/p-xylene	mg/kg	0.2	<0.2
o-xylene	mg/kg	0.1	<0.1
Total Xylenes	mg/kg	0.3	<0.3
Total BTEX	mg/kg	0.6	<0.6
Naphthalene	mg/kg	0.1	<0.1

SGS

ANALYTICAL RESULTS SE206541 R0

Volatile Petroleum Hydrocarbons in Soil [AN433] Tested: 22/5/2020

PARAMETER	UOM	LOR	C1 SOIL - 19/5/2020 SE206541.003	C2 SOIL - 19/5/2020 SE206541.004	C3 SOIL - 19/5/2020 SE206541.005	C4 SOIL - 19/5/2020 SE206541.006	C5 SOIL - 19/5/2020 SE206541.007
TRH C6-C9	mg/kg	20	<20	<20	<20	<20	<20
Benzene (F0)	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TRH C6-C10	mg/kg	25	<25	<25	<25	<25	<25
TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	<25	<25	<25	<25

PARAMETER	UOM	LOR	C6 SOIL - 19/5/2020 SE206541.008	C7 SOIL - 19/5/2020 SE206541.009	C8 SOIL - 19/5/2020 SE206541.010	C9 SOIL - 19/5/2020 SE206541.011	C10 SOIL - 19/5/2020 SE206541.012
TRH C6-C9	mg/kg	20	<20	<20	<20	<20	<20
Benzene (F0)	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TRH C6-C10	mg/kg	25	<25	<25	<25	<25	<25
TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	<25	<25	<25	<25

PARAMETER	UOM	LOR	DA SOIL - 19/5/2020 SE206541.013
TRH C6-C9	mg/kg	20	<20
Benzene (F0)	mg/kg	0.1	<0.1
TRH C6-C10	mg/kg	25	<25
TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25

SGS

ANALYTICAL RESULTS SE206541 R0

TRH (Total Recoverable Hydrocarbons) in Soil [AN403] Tested: 22/5/2020

PARAMETER	UOM	LOR	C1 SOIL - 19/5/2020 SE206541.003	C2 SOIL - 19/5/2020 SE206541.004	C3 SOIL - 19/5/2020 SE206541.005	C4 SOIL - 19/5/2020 SE206541.006	C5 SOIL - 19/5/2020 SE206541.007
TRH C10-C14	mg/kg	20	<20	<20	<20	<20	<20
TRH C15-C28	mg/kg	45	<45	<45	<45	<45	<45
TRH C29-C36	mg/kg	45	<45	<45	<45	<45	<45
TRH C37-C40	mg/kg	100	<100	<100	<100	<100	<100
TRH >C10-C16	mg/kg	25	<25	<25	<25	<25	<25
TRH >C10-C16 - Naphthalene (F2)	mg/kg	25	<25	<25	<25	<25	<25
TRH >C16-C34 (F3)	mg/kg	90	<90	<90	<90	<90	<90
TRH >C34-C40 (F4)	mg/kg	120	<120	<120	<120	<120	<120
TRH C10-C36 Total	mg/kg	110	<110	<110	<110	<110	<110
TRH >C10-C40 Total (F bands)	mg/kg	210	<210	<210	<210	<210	<210

PARAMETER	UOM	LOR	C6 SOIL - 19/5/2020 SE206541.008	C7 SOIL - 19/5/2020 SE206541.009	C8 SOIL - 19/5/2020 SE206541.010	C9 SOIL - 19/5/2020 SE206541.011	C10 SOIL - 19/5/2020 SE206541.012
TRH C10-C14	mg/kg	20	<20	<20	<20	<20	<20
TRH C15-C28	mg/kg	45	<45	<45	<45	<45	<45
TRH C29-C36	mg/kg	45	<45	61	<45	<45	<45
TRH C37-C40	mg/kg	100	<100	<100	<100	<100	<100
TRH >C10-C16	mg/kg	25	<25	<25	<25	<25	<25
TRH >C10-C16 - Naphthalene (F2)	mg/kg	25	<25	<25	<25	<25	<25
TRH >C16-C34 (F3)	mg/kg	90	<90	<90	<90	<90	<90
TRH >C34-C40 (F4)	mg/kg	120	<120	<120	<120	<120	<120
TRH C10-C36 Total	mg/kg	110	<110	<110	<110	<110	<110
TRH >C10-C40 Total (F bands)	mg/kg	210	<210	<210	<210	<210	<210

PARAMETER	UOM	LOR	DA SOIL - 19/5/2020 SE206541.013
TRH C10-C14	mg/kg	20	<20
TRH C15-C28	mg/kg	45	<45
TRH C29-C36	mg/kg	45	<45
TRH C37-C40	mg/kg	100	<100
TRH >C10-C16	mg/kg	25	<25
TRH >C10-C16 - Naphthalene (F2)	mg/kg	25	<25
TRH >C16-C34 (F3)	mg/kg	90	<90
TRH >C34-C40 (F4)	mg/kg	120	<120
TRH C10-C36 Total	mg/kg	110	<110
TRH >C10-C40 Total (F bands)	mg/kg	210	<210



ANALYTICAL RESULTS SE206541 R0

PAH (Polynuclear Aromatic Hydrocarbons) in Soil [AN420] Tested: 22/5/2020

PARAMETER	UOM	LOR	C1 SOIL - 19/5/2020 SE206541.003	C2 SOIL - 19/5/2020 SE206541.004	C3 SOIL - 19/5/2020 SE206541.005	C4 SOIL - 19/5/2020 SE206541.006	C5 SOIL - 19/5/2020 SE206541.007
Naphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	0.1	<0.1	<0.1	0.1	1.1	<0.1
Acenaphthene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	0.1	<0.1	<0.1	0.3	<0.1	<0.1
Anthracene	mg/kg	0.1	<0.1	<0.1	0.2	0.4	<0.1
Fluoranthene	mg/kg	0.1	<0.1	<0.1	1.0	0.5	0.2
Pyrene	mg/kg	0.1	<0.1	<0.1	1.1	0.9	0.3
Benzo(a)anthracene	mg/kg	0.1	<0.1	<0.1	0.4	0.6	0.1
Chrysene	mg/kg	0.1	<0.1	<0.1	0.4	0.7	0.1
Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1	<0.1	0.6	1.2	0.2
Benzo(k)fluoranthene	mg/kg	0.1	<0.1	<0.1	0.3	0.5	<0.1
Benzo(a)pyrene	mg/kg	0.1	<0.1	<0.1	0.5	0.9	0.1
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1	<0.1	0.4	0.6	0.1
Dibenzo(ah)anthracene	mg/kg	0.1	<0.1	<0.1	<0.1	0.1	<0.1
Benzo(ghi)perylene	mg/kg	0.1	<0.1	<0.1	0.5	0.7	0.1
Carcinogenic PAHs, BaP TEQ <LOR=0	TEQ (mg/kg)	0.2	<0.2	<0.2	0.7	1.4	<0.2
Carcinogenic PAHs, BaP TEQ <LOR=LOR	TEQ (mg/kg)	0.3	<0.3	<0.3	0.8	1.4	<0.3
Carcinogenic PAHs, BaP TEQ <LOR=LOR/2	TEQ (mg/kg)	0.2	<0.2	<0.2	0.7	1.4	0.2
Total PAH (18)	mg/kg	0.8	<0.8	<0.8	5.9	8.2	1.4
Total PAH (NEPM/WHO 16)	mg/kg	0.8	<0.8	<0.8	5.9	8.2	1.4

PARAMETER	UOM	LOR	C6 SOIL - 19/5/2020 SE206541.008	C7 SOIL - 19/5/2020 SE206541.009	C8 SOIL - 19/5/2020 SE206541.010	C9 SOIL - 19/5/2020 SE206541.011	C10 SOIL - 19/5/2020 SE206541.012
Naphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(k)fluoranthene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(ah)anthracene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(ghi)perylene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Carcinogenic PAHs, BaP TEQ <LOR=0	TEQ (mg/kg)	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Carcinogenic PAHs, BaP TEQ <LOR=LOR	TEQ (mg/kg)	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Carcinogenic PAHs, BaP TEQ <LOR=LOR/2	TEQ (mg/kg)	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total PAH (18)	mg/kg	0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Total PAH (NEPM/WHO 16)	mg/kg	0.8	<0.8	<0.8	<0.8	<0.8	<0.8

PAH (Polynuclear Aromatic Hydrocarbons) in Soil [AN420] Tested: 22/5/2020 (continued)

PARAMETER	UOM	LOR	DA SOIL - 19/5/2020 SE206541.013
Naphthalene	mg/kg	0.1	<0.1
2-methylnaphthalene	mg/kg	0.1	<0.1
1-methylnaphthalene	mg/kg	0.1	<0.1
Acenaphthylene	mg/kg	0.1	<0.1
Acenaphthene	mg/kg	0.1	<0.1
Fluorene	mg/kg	0.1	<0.1
Phenanthrene	mg/kg	0.1	<0.1
Anthracene	mg/kg	0.1	<0.1
Fluoranthene	mg/kg	0.1	<0.1
Pyrene	mg/kg	0.1	<0.1
Benzo(a)anthracene	mg/kg	0.1	<0.1
Chrysene	mg/kg	0.1	<0.1
Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1
Benzo(k)fluoranthene	mg/kg	0.1	<0.1
Benzo(a)pyrene	mg/kg	0.1	<0.1
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1
Dibenzo(ah)anthracene	mg/kg	0.1	<0.1
Benzo(ghi)perylene	mg/kg	0.1	<0.1
Carcinogenic PAHs, BaP TEQ <LOR=0	TEQ (mg/kg)	0.2	<0.2
Carcinogenic PAHs, BaP TEQ <LOR=LOR	TEQ (mg/kg)	0.3	<0.3
Carcinogenic PAHs, BaP TEQ <LOR=LOR/2	TEQ (mg/kg)	0.2	<0.2
Total PAH (18)	mg/kg	0.8	<0.8
Total PAH (NEPM/WHO 16)	mg/kg	0.8	<0.8

SGS

ANALYTICAL RESULTS SE206541 R0

Soluble Anions (1:5) in Soil by Ion Chromatography [AN245] Tested: 27/5/2020

PARAMETER	UOM	LOR	B1-300 SOIL - 19/5/2020 SE206541.001	B1-1500 SOIL - 19/5/2020 SE206541.002
Chloride	mg/kg	0.25	9.3	35
Sulfate	mg/kg	5	15	160

SGS

ANALYTICAL RESULTS SE206541 R0

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR) [AN122] Tested: 25/5/2020

PARAMETER	UOM	LOR	B1-300 SOIL - 19/5/2020 SE206541.001	B1-1500 SOIL - 19/5/2020 SE206541.002
Exchangeable Sodium, Na	mg/kg	2	49	900
Exchangeable Sodium, Na	meq/100g	0.01	0.21	3.9
Exchangeable Sodium Percentage*	%	0.1	0.6	8.4

SGS

ANALYTICAL RESULTS SE206541 R0

Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES [AN040/AN320] Tested: 25/5/2020

PARAMETER	UOM	LOR	C1 SOIL - 19/5/2020 SE206541.003	C2 SOIL - 19/5/2020 SE206541.004	C3 SOIL - 19/5/2020 SE206541.005	C4 SOIL - 19/5/2020 SE206541.006	C5 SOIL - 19/5/2020 SE206541.007
Arsenic, As	mg/kg	1	4	3	2	1	11
Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Chromium, Cr	mg/kg	0.5	15	79	18	57	1200
Copper, Cu	mg/kg	0.5	11	24	16	19	17
Lead, Pb	mg/kg	1	9	8	160	9	15
Nickel, Ni	mg/kg	0.5	8.6	120	15	26	16
Zinc, Zn	mg/kg	2	37	34	77	33	150

PARAMETER	UOM	LOR	C6 SOIL - 19/5/2020 SE206541.008	C7 SOIL - 19/5/2020 SE206541.009	C8 SOIL - 19/5/2020 SE206541.010	C9 SOIL - 19/5/2020 SE206541.011	C10 SOIL - 19/5/2020 SE206541.012
Arsenic, As	mg/kg	1	2	1	1	5	5
Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Chromium, Cr	mg/kg	0.5	9.9	33	49	11	14
Copper, Cu	mg/kg	0.5	13	14	20	12	12
Lead, Pb	mg/kg	1	4	150	28	6	7
Nickel, Ni	mg/kg	0.5	23	22	34	11	11
Zinc, Zn	mg/kg	2	57	56	38	26	27

PARAMETER	UOM	LOR	DA SOIL - 19/5/2020 SE206541.013
Arsenic, As	mg/kg	1	4
Cadmium, Cd	mg/kg	0.3	<0.3
Chromium, Cr	mg/kg	0.5	14
Copper, Cu	mg/kg	0.5	11
Lead, Pb	mg/kg	1	9
Nickel, Ni	mg/kg	0.5	8.6
Zinc, Zn	mg/kg	2	38

SGS

ANALYTICAL RESULTS SE206541 R0

Mercury in Soil [AN312] Tested: 25/5/2020

PARAMETER	UOM	LOR	C1 SOIL - 19/5/2020 SE206541.003	C2 SOIL - 19/5/2020 SE206541.004	C3 SOIL - 19/5/2020 SE206541.005	C4 SOIL - 19/5/2020 SE206541.006	C5 SOIL - 19/5/2020 SE206541.007
Mercury	mg/kg	0.05	<0.05	<0.05	<0.05	<0.05	<0.05

PARAMETER	UOM	LOR	C6 SOIL - 19/5/2020 SE206541.008	C7 SOIL - 19/5/2020 SE206541.009	C8 SOIL - 19/5/2020 SE206541.010	C9 SOIL - 19/5/2020 SE206541.011	C10 SOIL - 19/5/2020 SE206541.012
Mercury	mg/kg	0.05	<0.05	0.45	<0.05	<0.05	<0.05

PARAMETER	UOM	LOR	DA SOIL - 19/5/2020 SE206541.013
Mercury	mg/kg	0.05	<0.05

SGS

ANALYTICAL RESULTS

SE206541 R0

Moisture Content [AN002] Tested: 22/5/2020

PARAMETER	UOM	LOR	B1-300 SOIL - 19/5/2020 SE206541.001	B1-1500 SOIL - 19/5/2020 SE206541.002	C1 SOIL - 19/5/2020 SE206541.003	C2 SOIL - 19/5/2020 SE206541.004	C3 SOIL - 19/5/2020 SE206541.005
% Moisture	%w/w	1	4.9	15.8	12.6	21.6	4.8

PARAMETER	UOM	LOR	C4 SOIL - 19/5/2020 SE206541.006	C5 SOIL - 19/5/2020 SE206541.007	C6 SOIL - 19/5/2020 SE206541.008	C7 SOIL - 19/5/2020 SE206541.009	C8 SOIL - 19/5/2020 SE206541.010
% Moisture	%w/w	1	6.8	12.2	18.7	2.1	9.0

PARAMETER	UOM	LOR	C9 SOIL - 19/5/2020 SE206541.011	C10 SOIL - 19/5/2020 SE206541.012	DA SOIL - 19/5/2020 SE206541.013
% Moisture	%w/w	1	24.5	21.1	13.1

SGS

METHOD SUMMARY

SE206541 R0

METHOD	METHODOLOGY SUMMARY
AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN040/AN320	A portion of sample is digested with nitric acid to decompose organic matter and hydrochloric acid to complete the digestion of metals. The digest is then analysed by ICP OES with metals results reported on the dried sample basis. Based on USEPA method 200.8 and 6010C.
AN040	A portion of sample is digested with Nitric acid to decompose organic matter and Hydrochloric acid to complete the digestion of metals and then filtered for analysis by ASS or ICP as per USEPA Method 200.8.
AN122	Exchangeable Cations, CEC and ESP: Soil sample is extracted in 1M Ammonium Acetate at pH=7 (or 1M Ammonium Chloride at pH=7) with cations (Na, K, Ca & Mg) then determined by ICP OES/ICP MS and reported as Exchangeable Cations. For saline soils, these results can be corrected for water soluble cations and reported as Exchangeable cations in meq/100g or soil can be pre-treated (aqueous ethanol/aqueous glycerol) prior to extraction. Cation Exchange Capacity (CEC) is the sum of the exchangeable cations in meq/100g.
AN122	The Exchangeable Sodium Percentage (ESP) is calculated as the exchangeable sodium divided by the CEC (all in meq/100g) times 100. ESP can be used to categorise the sodicity of the soil as below: ESP < 6% non-sodic ESP 6-15% sodic ESP >15% strongly sodic Method is referenced to Rayment and Lyons, 2011, sections 15D3 and 15N1.-
AN245	Anions by Ion Chromatography: A water sample is injected into an eluent stream that passes through the ion chromatographic system where the anions of interest ie Br, Cl, NO2, NO3 and SO4 are separated on their relative affinities for the active sites on the column packing material. Changes to the conductivity and the UV-visible absorbance of the eluent enable identification and quantitation of the anions based on their retention time and peak height or area. APHA 4110 B
AN312	Mercury by Cold Vapour AAS in Soils: After digestion with nitric acid, hydrogen peroxide and hydrochloric acid, mercury ions are reduced by stannous chloride reagent in acidic solution to elemental mercury. This mercury vapour is purged by nitrogen into a cold cell in an atomic absorption spectrometer or mercury analyser. Quantification is made by comparing absorbances to those of the calibration standards. Reference APHA 3112/3500
AN403	Total Recoverable Hydrocarbons: Determination of Hydrocarbons by gas chromatography after a solvent extraction. Detection is by flame ionisation detector (FID) that produces an electronic signal in proportion to the combustible matter passing through it. Total Recoverable Hydrocarbons (TRH) are routinely reported as four alkane groupings based on the carbon chain length of the compounds: C6-C9, C10-C14, C15-C28 and C29-C36 and in recognition of the NEPM 1999 (2013), >C10-C16 (F2), >C16-C34 (F3) and >C34-C40 (F4). F2 is reported directly and also corrected by subtracting Naphthalene (from VOC method AN433) where available.
AN403	Additionally, the volatile C6-C9 fraction may be determined by a purge and trap technique and GC/MS because of the potential for volatiles loss. Total Recoverable Hydrocarbons - Silica (TRH-Si) follows the same method of analysis after silica gel cleanup of the solvent extract. Aliphatic/Aromatic Speciation follows the same method of analysis after fractionation of the solvent extract over silica with differential polarity of the eluent solvents.
AN403	The GC/FID method is not well suited to the analysis of refined high boiling point materials (ie lubricating oils or greases) but is particularly suited for measuring diesel, kerosene and petrol if care to control volatility is taken. This method will detect naturally occurring hydrocarbons, lipids, animal fats, phenols and PAHs if they are present at sufficient levels, dependent on the use of specific cleanup/fractionation techniques. Reference USEPA 3510B, 8015B.
AN420	(SVOCs) including OC, OP, PCB, Herbicides, PAH, Phthalates and Speciated Phenols (etc) in soils, sediments and waters are determined by GCMS/ECD technique following appropriate solvent extraction process (Based on USEPA 3500C and 8270D).
AN420	Carcinogenic PAHs may be expressed as Benzo(a)pyrene equivalents by applying the BaP toxicity equivalence factor (NEPM 1999, June 2013, B7). These can be reported as the individual PAHs and as a sum of carcinogenic PAHs. The sum is reported three ways, the first assuming all <LOR results are zero, the second assuming all < LOR results are half the LOR and the third assuming all <LOR results are the LOR.
AN433	VOCs and C6-C9 Hydrocarbons by GC-MS P&T: VOC's are volatile organic compounds. The sample is presented to a gas chromatograph via a purge and trap (P&T) concentrator and autosampler and is detected with a Mass Spectrometer (MSD). Solid samples are initially extracted with methanol whilst liquid samples are processed directly. References: USEPA 5030B, 8020A, 8260.

FOOTNOTES SE206541 R0

FOOTNOTES

*	NATA accreditation does not cover the performance of this service.	-	Not analysed.	UOM	Unit of Measure.
		NVL	Not validated.	LOR	Limit of Reporting.
**	Indicative data, theoretical holding time exceeded.	IS	Insufficient sample for analysis.	↑↓	Raised/lowered Limit of Reporting.
		LNR	Sample listed, but not received.		

Unless it is reported that sampling has been performed by SGS, the samples have been analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calculated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the " Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.
Note that in terms of units of radioactivity:

a. 1 Bq is equivalent to 27 pCi
b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC and MU criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: www.sgs.com.au/en-gb/environment-health-and-safety.

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STATEMENT OF QA/QC PERFORMANCE

SE206541 R0

CLIENT DETAILS		LABORATORY DETAILS	
Contact	Luke Niven	Manager	Huong Crawford
Client	ENVIROWEST CONSULTING PTY LIMITED	Laboratory	SGS Alexandria Environmental
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Facsimile	(Not specified)	Facsimile	+61 2 8594 0499
Email	luke@envirowest.net.au	Email	au.environmental.sydney@sgs.com
Project	11858	SGS Reference	**SE206541 R0**
Order Number	11858	Date Received	21 May 2020
Samples	13	Date Reported	28 May 2020

COMMENTS

All the laboratory data for each environmental matrix was compared to SGS' stated Data Quality Objectives (DQO). Comments arising from the comparison were made and are reported below.

The data relating to sampling was taken from the Chain of Custody document.
This QA/QC Statement must be read in conjunction with the referenced Analytical Report.
The Statement and the Analytical Report must not be reproduced except in full.

All Data Quality Objectives were met with the exception of the following:

Extraction Date	Soluble Anions (1:5) in Soil by Ion Chromatography	2 items
Surrogate	VOC's in Soil	2 items
	Volatile Petroleum Hydrocarbons in Soil	2 items
Duplicate	Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES	1 item

SAMPLE SUMMARY

Samples clearly labelled	Yes	Complete documentation received	Yes
Sample container provider	SGS	Sample cooling method	Ice Bricks
Samples received in correct containers	Yes	Sample counts by matrix	13 Soil
Date documentation received	21/5/2020	Type of documentation received	COC
Samples received in good order	Yes	Samples received without headspace	Yes
Sample temperature upon receipt	12.7°C	Sufficient sample for analysis	Yes
Turnaround time requested	Standard		

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SGS

HOLDING TIME SUMMARY

SE206541 R0

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS "Field Sampling Guide for Containers and Holding Time" (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in Green when within suggested criteria or Red with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR) — Method: ME-(AU)-[ENV]AN122

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
B1-300	SE206541.001	LB200369	19 May 2020	21 May 2020	16 Jun 2020	25 May 2020	16 Jun 2020	28 May 2020
B1-1500	SE206541.002	LB200369	19 May 2020	21 May 2020	16 Jun 2020	25 May 2020	16 Jun 2020	28 May 2020

Mercury in Soil — Method: ME-(AU)-[ENV]AN312

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
C1	SE206541.003	LB200348	19 May 2020	21 May 2020	16 Jun 2020	25 May 2020	16 Jun 2020	28 May 2020
C2	SE206541.004	LB200348	19 May 2020	21 May 2020	16 Jun 2020	25 May 2020	16 Jun 2020	28 May 2020
C3	SE206541.005	LB200348	19 May 2020	21 May 2020	16 Jun 2020	25 May 2020	16 Jun 2020	28 May 2020
C4	SE206541.006	LB200348	19 May 2020	21 May 2020	16 Jun 2020	25 May 2020	16 Jun 2020	28 May 2020
C5	SE206541.007	LB200348	19 May 2020	21 May 2020	16 Jun 2020	25 May 2020	16 Jun 2020	28 May 2020
C6	SE206541.008	LB200348	19 May 2020	21 May 2020	16 Jun 2020	25 May 2020	16 Jun 2020	28 May 2020
C7	SE206541.009	LB200348	19 May 2020	21 May 2020	16 Jun 2020	25 May 2020	16 Jun 2020	28 May 2020
C8	SE206541.010	LB200348	19 May 2020	21 May 2020	16 Jun 2020	25 May 2020	16 Jun 2020	28 May 2020
C9	SE206541.011	LB200348	19 May 2020	21 May 2020	16 Jun 2020	25 May 2020	16 Jun 2020	28 May 2020
C10	SE206541.012	LB200348	19 May 2020	21 May 2020	16 Jun 2020	25 May 2020	16 Jun 2020	28 May 2020
DA	SE206541.013	LB200348	19 May 2020	21 May 2020	16 Jun 2020	25 May 2020	16 Jun 2020	28 May 2020

Moisture Content — Method: ME-(AU)-[ENV]AN002

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
B1-300	SE206541.001	LB200191	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	27 May 2020	27 May 2020
B1-1500	SE206541.002	LB200191	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	27 May 2020	27 May 2020
C1	SE206541.003	LB200191	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	27 May 2020	27 May 2020
C2	SE206541.004	LB200191	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	27 May 2020	27 May 2020
C3	SE206541.005	LB200191	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	27 May 2020	27 May 2020
C4	SE206541.006	LB200191	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	27 May 2020	27 May 2020
C5	SE206541.007	LB200191	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	27 May 2020	27 May 2020
C6	SE206541.008	LB200191	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	27 May 2020	27 May 2020
C7	SE206541.009	LB200191	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	27 May 2020	27 May 2020
C8	SE206541.010	LB200191	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	27 May 2020	27 May 2020
C9	SE206541.011	LB200191	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	27 May 2020	27 May 2020
C10	SE206541.012	LB200191	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	27 May 2020	27 May 2020
DA	SE206541.013	LB200191	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	27 May 2020	27 May 2020

PAH (Polynuclear Aromatic Hydrocarbons) in Soil — Method: ME-(AU)-[ENV]AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
C1	SE206541.003	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	28 May 2020
C2	SE206541.004	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	28 May 2020
C3	SE206541.005	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	28 May 2020
C4	SE206541.006	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	28 May 2020
C5	SE206541.007	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	28 May 2020
C6	SE206541.008	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	28 May 2020
C7	SE206541.009	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	28 May 2020
C8	SE206541.010	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	28 May 2020
C9	SE206541.011	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	28 May 2020
C10	SE206541.012	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	28 May 2020
DA	SE206541.013	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	28 May 2020

Soluble Anions (1:5) in Soil by Ion Chromatography — Method: ME-(AU)-[ENV]AN245

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
B1-300	SE206541.001	LB200487	19 May 2020	21 May 2020	26 May 2020	27 May 2020†	24 Jun 2020	28 May 2020
B1-1500	SE206541.002	LB200487	19 May 2020	21 May 2020	26 May 2020	27 May 2020†	24 Jun 2020	28 May 2020

Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES — Method: ME-(AU)-[ENV]AN040/AN320

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
C1	SE206541.003	LB200340	19 May 2020	21 May 2020	15 Nov 2020	25 May 2020	15 Nov 2020	28 May 2020
C2	SE206541.004	LB200340	19 May 2020	21 May 2020	15 Nov 2020	25 May 2020	15 Nov 2020	28 May 2020
C3	SE206541.005	LB200340	19 May 2020	21 May 2020	15 Nov 2020	25 May 2020	15 Nov 2020	28 May 2020
C4	SE206541.006	LB200340	19 May 2020	21 May 2020	15 Nov 2020	25 May 2020	15 Nov 2020	28 May 2020
C5	SE206541.007	LB200340	19 May 2020	21 May 2020	15 Nov 2020	25 May 2020	15 Nov 2020	28 May 2020
C6	SE206541.008	LB200340	19 May 2020	21 May 2020	15 Nov 2020	25 May 2020	15 Nov 2020	28 May 2020
C7	SE206541.009	LB200340	19 May 2020	21 May 2020	15 Nov 2020	25 May 2020	15 Nov 2020	28 May 2020
C8	SE206541.010	LB200340	19 May 2020	21 May 2020	15 Nov 2020	25 May 2020	15 Nov 2020	28 May 2020

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HOLDING TIME SUMMARY

SE206541 R0

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS "Field Sampling Guide for Containers and Holding Time" (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in Green when within suggested criteria or Red with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES (continued) — Method: ME-(AU)-[ENV]AN040/AN320

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
C9	SE206541.011	LB200340	19 May 2020	21 May 2020	15 Nov 2020	25 May 2020	15 Nov 2020	28 May 2020
C10	SE206541.012	LB200340	19 May 2020	21 May 2020	15 Nov 2020	25 May 2020	15 Nov 2020	28 May 2020
DA	SE206541.013	LB200340	19 May 2020	21 May 2020	15 Nov 2020	25 May 2020	15 Nov 2020	28 May 2020

TRH (Total Recoverable Hydrocarbons) in Soil — Method: ME-(AU)-[ENV]AN403

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
C1	SE206541.003	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C2	SE206541.004	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C3	SE206541.005	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C4	SE206541.006	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C5	SE206541.007	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C6	SE206541.008	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C7	SE206541.009	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C8	SE206541.010	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C9	SE206541.011	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C10	SE206541.012	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
DA	SE206541.013	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020

VOC's in Soil — Method: ME-(AU)-[ENV]AN433

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
C1	SE206541.003	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C2	SE206541.004	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C3	SE206541.005	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C4	SE206541.006	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C5	SE206541.007	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C6	SE206541.008	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C7	SE206541.009	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C8	SE206541.010	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C9	SE206541.011	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C10	SE206541.012	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
DA	SE206541.013	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020

Volatile Petroleum Hydrocarbons in Soil — Method: ME-(AU)-[ENV]AN433

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
C1	SE206541.003	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C2	SE206541.004	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C3	SE206541.005	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C4	SE206541.006	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C5	SE206541.007	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C6	SE206541.008	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C7	SE206541.009	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C8	SE206541.010	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C9	SE206541.011	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C10	SE206541.012	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
DA	SE206541.013	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020

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SURROGATES

SE206541 R0

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA/QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in Green when within suggested criteria or Red with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

PAH (Polynuclear Aromatic Hydrocarbons) in Soil — Method: ME-(AU)-[ENV]AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
2-fluorobiphenyl (Surrogate)	C1	SE206541.003	%	70 - 130%	92
	C2	SE206541.004	%	70 - 130%	85
	C3	SE206541.005	%	70 - 130%	91
	C4	SE206541.006	%	70 - 130%	78
	C5	SE206541.007	%	70 - 130%	93
	C6	SE206541.008	%	70 - 130%	87
	C7	SE206541.009	%	70 - 130%	94
	C8	SE206541.010	%	70 - 130%	86
	C9	SE206541.011	%	70 - 130%	88
	C10	SE206541.012	%	70 - 130%	88
	DA	SE206541.013	%	70 - 130%	89
d14-p-terphenyl (Surrogate)	C1	SE206541.003	%	70 - 130%	114
	C2	SE206541.004	%	70 - 130%	122
	C3	SE206541.005	%	70 - 130%	96
	C4	SE206541.006	%	70 - 130%	99
	C5	SE206541.007	%	70 - 130%	112
	C6	SE206541.008	%	70 - 130%	116
	C7	SE206541.009	%	70 - 130%	91
	C8	SE206541.010	%	70 - 130%	110
	C9	SE206541.011	%	70 - 130%	105
	C10	SE206541.012	%	70 - 130%	100
	DA	SE206541.013	%	70 - 130%	98
d5-nitrobenzene (Surrogate)	C1	SE206541.003	%	70 - 130%	99
	C2	SE206541.004	%	70 - 130%	98
	C3	SE206541.005	%	70 - 130%	97
	C4	SE206541.006	%	70 - 130%	97
	C5	SE206541.007	%	70 - 130%	92
	C6	SE206541.008	%	70 - 130%	96
	C7	SE206541.009	%	70 - 130%	94
	C8	SE206541.010	%	70 - 130%	96
	C9	SE206541.011	%	70 - 130%	96
	C10	SE206541.012	%	70 - 130%	93
	DA	SE206541.013	%	70 - 130%	100

VOC's in Soil — Method: ME-(AU)-[ENV]AN433

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Bromofluorobenzene (Surrogate)	C1	SE206541.003	%	60 - 130%	76
	C2	SE206541.004	%	60 - 130%	80
	C3	SE206541.005	%	60 - 130%	80
	C4	SE206541.006	%	60 - 130%	74
	C5	SE206541.007	%	60 - 130%	76
	C6	SE206541.008	%	60 - 130%	82
	C7	SE206541.009	%	60 - 130%	79
	C8	SE206541.010	%	60 - 130%	75
	C9	SE206541.011	%	60 - 130%	80
	C10	SE206541.012	%	60 - 130%	70
	DA	SE206541.013	%	60 - 130%	76
d4-1,2-dichloroethane (Surrogate)	C1	SE206541.003	%	60 - 130%	104
	C2	SE206541.004	%	60 - 130%	109
	C3	SE206541.005	%	60 - 130%	112
	C4	SE206541.006	%	60 - 130%	104
	C5	SE206541.007	%	60 - 130%	108
	C6	SE206541.008	%	60 - 130%	113
	C7	SE206541.009	%	60 - 130%	111
	C8	SE206541.010	%	60 - 130%	113
	C9	SE206541.011	%	60 - 130%	109
	C10	SE206541.012	%	60 - 130%	102
	DA	SE206541.013	%	60 - 130%	109
d8-toluene (Surrogate)	C1	SE206541.003	%	60 - 130%	117
	C2	SE206541.004	%	60 - 130%	127
	C3	SE206541.005	%	60 - 130%	131 ⓒ

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SURROGATES

SE206541 R0

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA/QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in Green when within suggested criteria or Red with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

VOC's in Soil (continued) — Method: ME-(AU)-[ENV]AN433

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
d8-toluene (Surrogate)	C4	SE206541.006	%	60 - 130%	129
	C5	SE206541.007	%	60 - 130%	124
	C6	SE206541.008	%	60 - 130%	126
	C7	SE206541.009	%	60 - 130%	127
	C8	SE206541.010	%	60 - 130%	128
	C9	SE206541.011	%	60 - 130%	132 ⓘ
	C10	SE206541.012	%	60 - 130%	119
	DA	SE206541.013	%	60 - 130%	122

Volatile Petroleum Hydrocarbons in Soil — Method: ME-(AU)-[ENV]AN433

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Bromofluorobenzene (Surrogate)	C1	SE206541.003	%	60 - 130%	76
	C2	SE206541.004	%	60 - 130%	80
	C3	SE206541.005	%	60 - 130%	80
	C4	SE206541.006	%	60 - 130%	74
	C5	SE206541.007	%	60 - 130%	76
	C6	SE206541.008	%	60 - 130%	82
	C7	SE206541.009	%	60 - 130%	79
	C8	SE206541.010	%	60 - 130%	75
	C9	SE206541.011	%	60 - 130%	80
	C10	SE206541.012	%	60 - 130%	70
	DA	SE206541.013	%	60 - 130%	76
d4-1,2-dichloroethane (Surrogate)	C1	SE206541.003	%	60 - 130%	104
	C2	SE206541.004	%	60 - 130%	109
	C3	SE206541.005	%	60 - 130%	112
	C4	SE206541.006	%	60 - 130%	104
	C5	SE206541.007	%	60 - 130%	108
	C6	SE206541.008	%	60 - 130%	113
	C7	SE206541.009	%	60 - 130%	111
	C8	SE206541.010	%	60 - 130%	113
	C9	SE206541.011	%	60 - 130%	109
	C10	SE206541.012	%	60 - 130%	102
	DA	SE206541.013	%	60 - 130%	109
d8-toluene (Surrogate)	C1	SE206541.003	%	60 - 130%	117
	C2	SE206541.004	%	60 - 130%	127
	C3	SE206541.005	%	60 - 130%	131 ⓘ
	C4	SE206541.006	%	60 - 130%	129
	C5	SE206541.007	%	60 - 130%	124
	C6	SE206541.008	%	60 - 130%	126
	C7	SE206541.009	%	60 - 130%	127
	C8	SE206541.010	%	60 - 130%	128
	C9	SE206541.011	%	60 - 130%	132 ⓘ
	C10	SE206541.012	%	60 - 130%	119
	DA	SE206541.013	%	60 - 130%	122

SGS

METHOD BLANKS

SE206541 R0

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in Green when within suggested criteria or Red with an appended dagger symbol (†) when outside suggested criteria.

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR)

Method: ME-(AU)-[ENV]AN122

Sample Number	Parameter	Units	LOR	Result
LB200369.001	Exchangeable Sodium, Na	mg/kg	2	0

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

Sample Number	Parameter	Units	LOR	Result
LB200348.001	Mercury	mg/kg	0.05	<0.05

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Sample Number		Parameter	Units	LOR	Result
LB200187.001		Naphthalene	mg/kg	0.1	<0.1
		2-methylnaphthalene	mg/kg	0.1	<0.1
		1-methylnaphthalene	mg/kg	0.1	<0.1
		Acenaphthylene	mg/kg	0.1	<0.1
		Acenaphthene	mg/kg	0.1	<0.1
		Fluorene	mg/kg	0.1	<0.1
		Phenanthrene	mg/kg	0.1	<0.1
		Anthracene	mg/kg	0.1	<0.1
		Fluoranthene	mg/kg	0.1	<0.1
		Pyrene	mg/kg	0.1	<0.1
		Benzo(a)anthracene	mg/kg	0.1	<0.1
		Chrysene	mg/kg	0.1	<0.1
		Benzo(a)pyrene	mg/kg	0.1	<0.1
		Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1
		Dibenzo(ah)anthracene	mg/kg	0.1	<0.1
		Benzo(ghi)perylene	mg/kg	0.1	<0.1
		Total PAH (18)	mg/kg	0.8	<0.8
	Surrogates	d5-nitrobenzene (Surrogate)	%	-	99
		2-fluorobiphenyl (Surrogate)	%	-	91
		d14-p-terphenyl (Surrogate)	%	-	119

Soluble Anions (1:5) in Soil by Ion Chromatography

Method: ME-(AU)-[ENV]AN245

Sample Number	Parameter	Units	LOR	Result
LB200487.001	Chloride	mg/kg	0.25	<0.25
	Sulfate	mg/kg	5	<5.0

Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES

Method: ME-(AU)-[ENV]AN040/AN320

Sample Number	Parameter	Units	LOR	Result
LB200340.001	Arsenic, As	mg/kg	1	<1
	Cadmium, Cd	mg/kg	0.3	<0.3
	Chromium, Cr	mg/kg	0.5	<0.5
	Copper, Cu	mg/kg	0.5	<0.5
	Nickel, Ni	mg/kg	0.5	<0.5
	Lead, Pb	mg/kg	1	<1
	Zinc, Zn	mg/kg	2	<2.0

TRH (Total Recoverable Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN403

Sample Number	Parameter	Units	LOR	Result
LB200187.001	TRH C10-C14	mg/kg	20	<20
	TRH C15-C28	mg/kg	45	<45
	TRH C29-C36	mg/kg	45	<45
	TRH C37-C40	mg/kg	100	<100
	TRH C10-C36 Total	mg/kg	110	<110

VOC's in Soil

Method: ME-(AU)-[ENV]AN433

Sample Number		Parameter	Units	LOR	Result
LB200182.001	Monocyclic Aromatic Hydrocarbons	Benzene	mg/kg	0.1	<0.1
		Toluene	mg/kg	0.1	<0.1
		Ethylbenzene	mg/kg	0.1	<0.1
		m/p-xylene	mg/kg	0.2	<0.2
		o-xylene	mg/kg	0.1	<0.1

SGS

METHOD BLANKS

SE206541 R0

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in Green when within suggested criteria or Red with an appended dagger symbol (†) when outside suggested criteria.

VOC's in Soil (continued) — Method: ME-(AU)-[ENV]AN433

Sample Number		Parameter	Units	LOR	Result
LB200182.001	Polycyclic VOCs	Naphthalene	mg/kg	0.1	<0.1
	Surrogates	d4-1,2-dichloroethane (Surrogate)	%	-	117
		d8-toluene (Surrogate)	%	-	112
		Bromofluorobenzene (Surrogate)	%	-	84
	Totals	Total BTEX	mg/kg	0.6	<0.6

Volatile Petroleum Hydrocarbons in Soil — Method: ME-(AU)-[ENV]AN433

Sample Number		Parameter	Units	LOR	Result
LB200182.001		TRH C6-C9	mg/kg	20	<20
	Surrogates	d4-1,2-dichloroethane (Surrogate)	%	-	117

SGS

DUPLICATES

SE206541 R0

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in Green when within suggested criteria or Red with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Mercury in Soil — Method: ME-(AU)-[ENV]AN312

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE206541.012	LB200348.014	Mercury	mg/kg	0.05	<0.05	<0.05	200	0
SE206547.005	LB200348.022	Mercury	mg/kg	0.05	<0.05	<0.05	200	0

Moisture Content — Method: ME-(AU)-[ENV]AN002

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE206541.009	LB200191.011	% Moisture	%w/w	1	2.1	2.2	76	2
SE206547.005	LB200191.021	% Moisture	%w/w	1	8.7	8.9	41	3

PAH (Polynuclear Aromatic Hydrocarbons) in Soil — Method: ME-(AU)-[ENV]AN420

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE206541.011	LB200187.014		Naphthalene	mg/kg	0.1	<0.1	<0.1	200	0
			2-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	200	0
			1-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	200	0
			Acenaphthylene	mg/kg	0.1	<0.1	<0.1	200	0
			Acenaphthene	mg/kg	0.1	<0.1	<0.1	200	0
			Fluorene	mg/kg	0.1	<0.1	<0.1	200	0
			Phenanthrene	mg/kg	0.1	<0.1	<0.1	200	0
			Anthracene	mg/kg	0.1	<0.1	<0.1	200	0
			Fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
			Pyrene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(a)anthracene	mg/kg	0.1	<0.1	<0.1	200	0
			Chrysene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(k)fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(a)pyrene	mg/kg	0.1	<0.1	<0.1	200	0
			Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1	<0.1	200	0
			Dibenzo(ah)anthracene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(ghi)perylene	mg/kg	0.1	<0.1	<0.1	200	0
			Carcinogenic PAHs, BaP TEQ <LOR=0	mg/kg	0.2	<0.2	<0.2	200	0
			Carcinogenic PAHs, BaP TEQ <LOR=LOR	mg/kg	0.3	<0.3	<0.3	134	0
			Carcinogenic PAHs, BaP TEQ <LOR=LOR/2	mg/kg	0.2	<0.2	<0.2	175	0
			Total PAH (18)	mg/kg	0.8	<0.8	<0.8	200	0
		Surrogates	d5-nitrobenzene (Surrogate)	mg/kg	-	0.5	0.5	30	2
			2-fluorobiphenyl (Surrogate)	mg/kg	-	0.4	0.4	30	1
			d14-p-terphenyl (Surrogate)	mg/kg	-	0.5	0.5	30	7
SE206547.005	LB200187.022		Naphthalene	mg/kg	0.1	<0.1	<0.1	200	0
			2-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	200	0
			1-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	200	0
			Acenaphthylene	mg/kg	0.1	<0.1	<0.1	200	0
			Acenaphthene	mg/kg	0.1	<0.1	<0.1	200	0
			Fluorene	mg/kg	0.1	<0.1	<0.1	200	0
			Phenanthrene	mg/kg	0.1	<0.1	<0.1	200	0
			Anthracene	mg/kg	0.1	<0.1	<0.1	200	0
			Fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
			Pyrene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(a)anthracene	mg/kg	0.1	<0.1	<0.1	200	0
			Chrysene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(k)fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(a)pyrene	mg/kg	0.1	<0.1	<0.1	200	0
			Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1	<0.1	200	0
			Dibenzo(ah)anthracene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(ghi)perylene	mg/kg	0.1	<0.1	<0.1	200	0
			Carcinogenic PAHs, BaP TEQ <LOR=0	mg/kg	0.2	<0.2	<0.2	200	0
			Carcinogenic PAHs, BaP TEQ <LOR=LOR	mg/kg	0.3	<0.3	<0.3	134	0
			Carcinogenic PAHs, BaP TEQ <LOR=LOR/2	mg/kg	0.2	<0.2	<0.2	175	0
			Total PAH (18)	mg/kg	0.8	<0.8	<0.8	200	0
		Surrogates	d5-nitrobenzene (Surrogate)	mg/kg	-	0.5	0.5	30	1
			2-fluorobiphenyl (Surrogate)	mg/kg	-	0.4	0.4	30	4

SGS

DUPLICATES

SE206541 R0

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in Green when within suggested criteria or Red with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

PAH (Polynuclear Aromatic Hydrocarbons) in Soil (continued) — Method: ME-(AU)-[ENV]AN420

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE206547.005	LB200187.022	Surrogates	d14-p-terphenyl (Surrogate)	mg/kg	-	0.5	0.4	30	27

Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES — Method: ME-(AU)-[ENV]AN040/AN320

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE206541.012	LB200340.014		Arsenic, As	mg/kg	1	5	5	49	1
			Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	200	0
			Chromium, Cr	mg/kg	0.5	14	12	34	14
			Copper, Cu	mg/kg	0.5	12	11	34	10
			Nickel, Ni	mg/kg	0.5	11	11	35	5
			Lead, Pb	mg/kg	1	7	6	45	14
			Zinc, Zn	mg/kg	2	27	24	38	15
SE206547.005	LB200340.022		Arsenic, As	mg/kg	1	4	4	56	17
			Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	200	0
			Chromium, Cr	mg/kg	0.5	11	11	35	1
			Copper, Cu	mg/kg	0.5	78	190	30	81 ⑤
			Nickel, Ni	mg/kg	0.5	13	14	34	6
			Lead, Pb	mg/kg	1	10	9	41	10
			Zinc, Zn	mg/kg	2	44	47	34	6

TRH (Total Recoverable Hydrocarbons) in Soil — Method: ME-(AU)-[ENV]AN403

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE206541.011	LB200187.014		TRH C10-C14	mg/kg	20	<20	<20	200	0
			TRH C15-C28	mg/kg	45	<45	<45	200	0
			TRH C29-C36	mg/kg	45	<45	<45	200	0
			TRH C37-C40	mg/kg	100	<100	<100	200	0
			TRH C10-C36 Total	mg/kg	110	<110	<110	200	0
			TRH >C10-C40 Total (F bands)	mg/kg	210	<210	<210	200	0
		TRH F Bands	TRH >C10-C16	mg/kg	25	<25	<25	200	0
			TRH >C10-C16 - Naphthalene (F2)	mg/kg	25	<25	<25	200	0
			TRH >C16-C34 (F3)	mg/kg	90	<90	<90	200	0
			TRH >C34-C40 (F4)	mg/kg	120	<120	<120	200	0
SE206547.005	LB200187.022		TRH C10-C14	mg/kg	20	<20	<20	200	0
			TRH C15-C28	mg/kg	45	<45	<45	200	0
			TRH C29-C36	mg/kg	45	<45	<45	200	0
			TRH C37-C40	mg/kg	100	<100	<100	200	0
			TRH C10-C36 Total	mg/kg	110	<110	<110	200	0
			TRH >C10-C40 Total (F bands)	mg/kg	210	<210	<210	200	0
		TRH F Bands	TRH >C10-C16	mg/kg	25	<25	<25	200	0
			TRH >C10-C16 - Naphthalene (F2)	mg/kg	25	<25	<25	200	0
			TRH >C16-C34 (F3)	mg/kg	90	<90	<90	200	0
			TRH >C34-C40 (F4)	mg/kg	120	<120	<120	200	0

VOC's in Soil — Method: ME-(AU)-[ENV]AN433

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE206541.011	LB200182.014	Monocyclic	Benzene	mg/kg	0.1	<0.1	<0.1	200	0
		Aromatic	Toluene	mg/kg	0.1	<0.1	<0.1	200	0
			Ethylbenzene	mg/kg	0.1	<0.1	<0.1	200	0
			m/p-xylene	mg/kg	0.2	<0.2	<0.2	200	0
			o-xylene	mg/kg	0.1	<0.1	<0.1	200	0
		Polycyclic	Naphthalene	mg/kg	0.1	<0.1	<0.1	200	0
		Surrogates	d4-1,2-dichloroethane (Surrogate)	mg/kg	-	10.9	13.1	50	18
			d8-toluene (Surrogate)	mg/kg	-	13.2	12.1	50	9
			Bromofluorobenzene (Surrogate)	mg/kg	-	8.0	7.8	50	3
		Totals	Total Xylenes	mg/kg	0.3	<0.3	<0.3	200	0
			Total BTEX	mg/kg	0.6	<0.6	<0.6	200	0
SE206547.005	LB200182.022	Monocyclic	Benzene	mg/kg	0.1	<0.1	<0.1	200	0
		Aromatic	Toluene	mg/kg	0.1	<0.1	<0.1	200	0
			Ethylbenzene	mg/kg	0.1	<0.1	<0.1	200	0
			m/p-xylene	mg/kg	0.2	<0.2	<0.2	200	0
			o-xylene	mg/kg	0.1	<0.1	<0.1	200	0
		Polycyclic	Naphthalene	mg/kg	0.1	<0.1	<0.1	200	0
		Surrogates	d4-1,2-dichloroethane (Surrogate)	mg/kg	-	13.5	10.9	50	21

SGS

DUPLICATES

SE206541 R0

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in Green when within suggested criteria or Red with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

VOC's in Soil (continued) — Method: ME-(AU)-[ENV]AN433

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE206547.005	LB200182.022	Surrogates	d8-toluene (Surrogate)	mg/kg	-	12.1	10.2	50	16
			Bromofluorobenzene (Surrogate)	mg/kg	-	8.7	7.7	50	12
		Totals	Total Xylenes	mg/kg	0.3	<0.3	<0.3	200	0
			Total BTEX	mg/kg	0.6	<0.6	<0.6	200	0

Volatile Petroleum Hydrocarbons in Soil — Method: ME-(AU)-[ENV]AN433

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE206541.011	LB200182.014		TRH C6-C10	mg/kg	25	<25	<25	200	0
			TRH C6-C9	mg/kg	20	<20	<20	200	0
		Surrogates	d4-1,2-dichloroethane (Surrogate)	mg/kg	-	10.9	13.1	30	18
			d8-toluene (Surrogate)	mg/kg	-	13.2	12.1	30	9
			Bromofluorobenzene (Surrogate)	mg/kg	-	8.0	7.8	30	3
		VPH F Bands	Benzene (F0)	mg/kg	0.1	<0.1	<0.1	200	0
			TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	<25	200	0
SE206547.005	LB200182.022		TRH C6-C10	mg/kg	25	<25	<25	200	0
			TRH C6-C9	mg/kg	20	<20	<20	200	0
		Surrogates	d4-1,2-dichloroethane (Surrogate)	mg/kg	-	13.5	10.9	30	21
			d8-toluene (Surrogate)	mg/kg	-	12.1	10.2	30	16
			Bromofluorobenzene (Surrogate)	mg/kg	-	8.7	7.7	30	12
		VPH F Bands	Benzene (F0)	mg/kg	0.1	<0.1	<0.1	200	0
			TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	<25	200	0

SGS

LABORATORY CONTROL SAMPLES

SE206541 R0

Laboratory Control Standard (LCS) results are evaluated against an expected result, typically the concentration of analyte spiked into the control during the sample preparation stage, producing a percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in Green when within suggested criteria or Red with an appended dagger symbol (†) when outside suggested criteria.

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB200348.002	Mercury	mg/kg	0.05	0.21	0.2	70 - 130	105

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB200187.002	Naphthalene	mg/kg	0.1	4.4	4	60 - 140	110
	Acenaphthylene	mg/kg	0.1	4.6	4	60 - 140	114
	Acenaphthene	mg/kg	0.1	4.3	4	60 - 140	107
	Phenanthrene	mg/kg	0.1	3.8	4	60 - 140	95
	Anthracene	mg/kg	0.1	4.4	4	60 - 140	109
	Fluoranthene	mg/kg	0.1	4.0	4	60 - 140	99
	Pyrene	mg/kg	0.1	4.5	4	60 - 140	112
	Benzo(a)pyrene	mg/kg	0.1	4.4	4	60 - 140	109
Surrogates	d5-nitrobenzene (Surrogate)	mg/kg	-	0.5	0.5	40 - 130	99
	2-fluorobiphenyl (Surrogate)	mg/kg	-	0.5	0.5	40 - 130	92
	d14-p-terphenyl (Surrogate)	mg/kg	-	0.4	0.5	40 - 130	86

Soluble Anions (1:5) in Soil by Ion Chromatography

Method: ME-(AU)-[ENV]AN245

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB200487.002	Chloride	mg/kg	0.25	92	100	70 - 130	92
	Sulfate	mg/kg	5	91	100	70 - 130	91

Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES

Method: ME-(AU)-[ENV]AN040/AN320

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB200340.002	Arsenic, As	mg/kg	1	350	318.22	80 - 120	109
	Cadmium, Cd	mg/kg	0.3	5.7	5.41	80 - 120	106
	Chromium, Cr	mg/kg	0.5	41	38.31	80 - 120	107
	Copper, Cu	mg/kg	0.5	320	290	80 - 120	109
	Nickel, Ni	mg/kg	0.5	200	187	80 - 120	107
	Lead, Pb	mg/kg	1	95	89.9	80 - 120	106
	Zinc, Zn	mg/kg	2	290	273	80 - 120	106

TRH (Total Recoverable Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN403

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB200187.002	TRH C10-C14	mg/kg	20	39	40	60 - 140	98
	TRH C15-C28	mg/kg	45	<45	40	60 - 140	93
	TRH C29-C36	mg/kg	45	<45	40	60 - 140	70
TRH F Bands	TRH >C10-C16	mg/kg	25	40	40	60 - 140	100
	TRH >C16-C34 (F3)	mg/kg	90	<90	40	60 - 140	85
	TRH >C34-C40 (F4)	mg/kg	120	<120	20	60 - 140	60

VOC's in Soil

Method: ME-(AU)-[ENV]AN433

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB200182.002 Monocyclic Aromatic	Benzene	mg/kg	0.1	3.5	5	60 - 140	71
	Toluene	mg/kg	0.1	3.8	5	60 - 140	75
	Ethylbenzene	mg/kg	0.1	3.7	5	60 - 140	74
	m/p-xylene	mg/kg	0.2	7.7	10	60 - 140	77
	o-xylene	mg/kg	0.1	3.6	5	60 - 140	73
Surrogates	d4-1,2-dichloroethane (Surrogate)	mg/kg	-	11.2	10	70 - 130	112
	d8-toluene (Surrogate)	mg/kg	-	10.1	10	70 - 130	101
	Bromofluorobenzene (Surrogate)	mg/kg	-	9.3	10	70 - 130	93

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB200182.002	TRH C6-C10	mg/kg	25	71	92.5	60 - 140	77
	TRH C6-C9	mg/kg	20	60	80	60 - 140	75
Surrogates	d4-1,2-dichloroethane (Surrogate)	mg/kg	-	11.2	10	70 - 130	112
	Bromofluorobenzene (Surrogate)	mg/kg	-	9.3	10	70 - 130	93
VPH F Bands	TRH C6-C10 minus BTEX (F1)	mg/kg	25	49	62.5	60 - 140	78

SGS

MATRIX SPIKES

SE206541 R0

Matrix Spike (MS) results are evaluated as the percentage recovery of an expected result, typically the concentration of analyte spiked into a field sub -sample during the sample preparation stage. The original sample's result is subtracted from the sub-sample result before determining the percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA/QC plan (ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in Green when within suggested criteria or Red with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

QC Sample	Sample Number	Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE206541.003	LB200348.004	Mercury	mg/kg	0.05	0.20	<0.05	0.2	89

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE206541.004	LB200187.023		Naphthalene	mg/kg	0.1	4.4	<0.1	4	109
			2-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	-	-
			1-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	-	-
			Acenaphthylene	mg/kg	0.1	4.4	<0.1	4	111
			Acenaphthene	mg/kg	0.1	4.3	<0.1	4	107
			Fluorene	mg/kg	0.1	<0.1	<0.1	-	-
			Phenanthrene	mg/kg	0.1	4.0	<0.1	4	100
			Anthracene	mg/kg	0.1	4.6	<0.1	4	114
			Fluoranthene	mg/kg	0.1	4.3	<0.1	4	106
			Pyrene	mg/kg	0.1	4.5	<0.1	4	112
			Benzo(a)anthracene	mg/kg	0.1	<0.1	<0.1	-	-
			Chrysene	mg/kg	0.1	<0.1	<0.1	-	-
			Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1	<0.1	-	-
			Benzo(k)fluoranthene	mg/kg	0.1	<0.1	<0.1	-	-
			Benzo(a)pyrene	mg/kg	0.1	4.4	<0.1	4	110
			Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1	<0.1	-	-
			Dibenzo(ah)anthracene	mg/kg	0.1	<0.1	<0.1	-	-
			Benzo(ghi)perylene	mg/kg	0.1	<0.1	<0.1	-	-
			Carcinogenic PAHs, BaP TEQ <LOR=0	TEQ (mg/kg)	0.2	4.4	<0.2	-	-
			Carcinogenic PAHs, BaP TEQ <LOR=LOR	TEQ (mg/kg)	0.3	4.6	<0.3	-	-
			Carcinogenic PAHs, BaP TEQ <LOR=LOR/2	TEQ (mg/kg)	0.2	4.5	<0.2	-	-
			Total PAH (18)	mg/kg	0.8	35	<0.8	-	-
		Surrogates	d5-nitrobenzene (Surrogate)	mg/kg	-	0.5	0.5	-	97
			2-fluorobiphenyl (Surrogate)	mg/kg	-	0.5	0.4	-	94
			d14-p-terphenyl (Surrogate)	mg/kg	-	0.4	0.6	-	87

Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES

Method: ME-(AU)-[ENV]AN040/AN320

QC Sample	Sample Number	Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE206541.003	LB200340.004	Arsenic, As	mg/kg	1	50	4	50	92
		Cadmium, Cd	mg/kg	0.3	43	<0.3	50	86
		Chromium, Cr	mg/kg	0.5	61	15	50	93
		Copper, Cu	mg/kg	0.5	56	11	50	90
		Nickel, Ni	mg/kg	0.5	56	8.6	50	94
		Lead, Pb	mg/kg	1	54	9	50	89
		Zinc, Zn	mg/kg	2	80	37	50	86

TRH (Total Recoverable Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN403

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE206541.004	LB200187.023		TRH C10-C14	mg/kg	20	42	<20	40	105
			TRH C15-C28	mg/kg	45	<45	<45	40	98
			TRH C29-C36	mg/kg	45	<45	<45	40	90
			TRH C37-C40	mg/kg	100	<100	<100	-	-
			TRH C10-C36 Total	mg/kg	110	<110	<110	-	-
			TRH >C10-C40 Total (F bands)	mg/kg	210	<210	<210	-	-
		TRH F Bands	TRH >C10-C16	mg/kg	25	41	<25	40	103
			TRH >C10-C16 - Naphthalene (F2)	mg/kg	25	41	<25	-	-
			TRH >C16-C34 (F3)	mg/kg	90	<90	<90	40	95
			TRH >C34-C40 (F4)	mg/kg	120	<120	<120	-	-

VOC's in Soil

Method: ME-(AU)-[ENV]AN433

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE206541.003	LB200182.024	Monocyclic	Benzene	mg/kg	0.1	3.4	<0.1	5	67
		Aromatic	Toluene	mg/kg	0.1	3.8	<0.1	5	76
			Ethylbenzene	mg/kg	0.1	3.4	<0.1	5	68
			m/p-xylene	mg/kg	0.2	6.9	<0.2	10	69
			o-xylene	mg/kg	0.1	3.3	<0.1	5	65

SGS

MATRIX SPIKES

SE206541 R0

Matrix Spike (MS) results are evaluated as the percentage recovery of an expected result, typically the concentration of analyte spiked into a field sub -sample during the sample preparation stage. The original sample's result is subtracted from the sub-sample result before determining the percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA/QC plan (ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in Green when within suggested criteria or Red with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

VOC's in Soil (continued) — Method: ME-(AU)-[ENV]AN433

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE206541.003	LB200182.024	Polycyclic	Naphthalene	mg/kg	0.1	<0.1	<0.1	-	-
		Surrogates	d4-1,2-dichloroethane (Surrogate)	mg/kg	-	10.9	10.4	10	109
			d8-toluene (Surrogate)	mg/kg	-	10.4	11.7	10	104
			Bromofluorobenzene (Surrogate)	mg/kg	-	8.4	7.6	10	84
		Totals	Total Xylenes	mg/kg	0.3	10	<0.3	-	-
			Total BTEX	mg/kg	0.6	21	<0.6	-	-

Volatile Petroleum Hydrocarbons in Soil — Method: ME-(AU)-[ENV]AN433

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE206541.003	LB200182.024		TRH C6-C10	mg/kg	25	73	<25	92.5	79
			TRH C6-C9	mg/kg	20	65	<20	80	81
		Surrogates	d4-1,2-dichloroethane (Surrogate)	mg/kg	-	10.9	10.4	10	109
			d8-toluene (Surrogate)	mg/kg	-	10.4	11.7	10	104
			Bromofluorobenzene (Surrogate)	mg/kg	-	8.4	7.6	-	84
		VPH F	Benzene (F0)	mg/kg	0.1	3.4	<0.1	-	-
		Bands	TRH C6-C10 minus BTEX (F1)	mg/kg	25	53	<25	62.5	84

MATRIX SPIKE DUPLICATES

SE206541 R0

Matrix spike duplicates are calculated as Relative Percent Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The original result is the analyte concentration of the matrix spike. The Duplicate result is the analyte concentration of the matrix spike duplicate.

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in Green when within suggested criteria or Red with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

No matrix spike duplicates were required for this job.

SGS

FOOTNOTES

SE206541 R0

id samples expressed on a dry weight basis.

criteria are subject to internal review according to the SGS QA/QC plan and may be provided on request or alternatively can be found he
s://www.sgs.com.au/~/media/Local/Australia/Documents/Technical Documents/MP-AU-ENV-QU-022 QA QC Plan.pdf

*	NATA accreditation does not cover the performance of this service.
**	Indicative data, theoretical holding time exceeded.
-	Sample not analysed for this analyte.
IS	Insufficient sample for analysis.
LNR	Sample listed, but not received.
LOR	Limit of reporting.
QFH	QC result is above the upper tolerance.
QFL	QC result is below the lower tolerance.

①	At least 2 of 3 surrogates are within acceptance criteria.
②	RPD failed acceptance criteria due to sample heterogeneity.
③	Results less than 5 times LOR preclude acceptance criteria for RPD.
④	Recovery failed acceptance criteria due to matrix interference.
⑤	Recovery failed acceptance criteria due to the presence of significant concentration of analyte (i.e. the concentration of analyte exceeds the spike level).
⑥	LOR was raised due to sample matrix interference.
⑦	LOR was raised due to dilution of significantly high concentration of analyte in sample.
⑧	Reanalysis of sample in duplicate confirmed sample heterogeneity and inconsistency of results.
⑨	Recovery failed acceptance criteria due to sample heterogeneity.
⑩	LOR was raised due to high conductivity of the sample (required dilution).
†	Refer to relevant report comments for further information.

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Chain of Custody Form – Ref 11858

Sheet 1 of 1

Ref:	11858
Investigator:	Envirowest Consulting 9 Cameron Place PO Box 8158 ORANGE NSW 2800
Telephone:	(02) 6361 4954
Email:	Luke@envirowest.net.au
Contact Person:	Luke Niven
Invoice:	accounts@envirowest.net.au
Laboratory:	SGS SYDNEY 16/33 Maddox Street ALEXANDRIA NSW 2015
Quotation #:	
Courier/CN:	

	Sample ID	Container*	Sampling Date/Time	Sample matrix: Water	Soil	Sludge	Sample preservation: Cool	HNO3/HCl	Unpreserved	Analysis: SGS Method Code: Exchangeable sodium, chloride and sulphate	CL10: TRH, BTEXN, PAH, 8 metals			
1	B1-300	A	19/05/2020		X		X		X	X				
2	B1-1500	A	19/05/2020		X		X		X	X				
3	C1	A	19/05/2020		X		X		X		X			
4	C2	A	19/05/2020		X		X		X		X			
5	C3	A	19/05/2020		X		X		X		X			
6	C4	A	19/05/2020		X		X		X		X			
7	C5	A	19/05/2020		X		X		X		X			
8	C6	A	19/05/2020		X		X		X		X			
9	C7	A	19/05/2020		X		X		X		X			
10	C8	A	19/05/2020		X		X		X		X			
11	C9	A	19/05/2020		X		X		X		X			
12	C10	A	19/05/2020		X		X		X		X			
13	DA	A	19/05/2020		X		X		X		X			

SGS EHS Sydney COC
SE206541

Investigator: I attest that the proper field sampling procedures were used during the collection of these samples.

Sampler name: Luke Niven
Date: 19/05/2020 Time: 1300-1500

Relinquished by: (print and signature)	Luke Niven	Date: 20/05/2020	Time: 16:00
Received by: (print and signature)		Date: 21/05/20	Time: @ 12.30

Please return completed form to Envirowest Consulting, *A = Solvent rinsed glass jar with Teflon lined lid and green label, B= Plastic with green label, C= Amber with green label, D= Vial with white label, E= Plastic with red label

ANALYTICAL REPORT

Accreditation No. 2562

CLIENT DETAILS		LABORATORY DETAILS	
Contact	Leah Desborough	Manager	Huong Crawford
Client	ENVIROWEST CONSULTING PTY LIMITED	Laboratory	SGS Alexandria Environmental
Address	PO BOX 8158 ORANGE NSW 2800	Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	61 2 63614954	Telephone	+61 2 8594 0400
Facsimile	(Not specified)	Facsimile	+61 2 8594 0499
Email	leah@envirowest.net.au	Email	au.environmental.sydney@sgs.com
Project	**11858 - Additional**	SGS Reference	**SE206541A R0**
Order Number	**11858**	Date Received	10/6/2020
Samples	13	Date Reported	17/6/2020

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing. NATA accredited laboratory 2562(4354).

SIGNATORIES

Shane MCDERMOTT
Inorganic/Metals Chemist

SGS

ANALYTICAL RESULTS SE206541A R0

Hexavalent Chromium in Soil UV/Vis [AN075/AN201] Tested: 16/6/2020

PARAMETER	UOM	LOR	C5 SOIL - 19/5/2020 SE206541A.007
Hexavalent Chromium, Cr6+	mg/kg	0.5	**1.3**
Trivalent Chromium, Cr3+	mg/kg	1	**1200**

SGS

ANALYTICAL RESULTS SE206541A R0

Moisture Content [AN002] Tested: 15/6/2020

PARAMETER	UOM	LOR	C5 SOIL - 19/5/2020 SE206541A.007
% Moisture	%w/w	1	**8.6**

SGS

METHOD SUMMARY

SE206541A R0

METHOD	METHODOLOGY SUMMARY
AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN075	This method uses an alkaline digestion to solubilise both water-soluble and water-insoluble forms of hexavalent chromium in solids. The solution is then pH adjusted and the hexavalent chromium concentration in solution determined colourimetrically.
AN201	Cr6+ is determined colourimetrically by reaction with diphenylcarbazide in acid solution. A red-violet colour of unknown composition is produced.

FOOTNOTES

*	NATA accreditation does not cover the performance of this service.	-	Not analysed.	UOM	Unit of Measure.
		NVL	Not validated.	LOR	Limit of Reporting.
**	Indicative data, theoretical holding time exceeded.	IS	Insufficient sample for analysis.	↑↓	Raised/lowered Limit of Reporting.
		LNR	Sample listed, but not received.		

Unless it is reported that sampling has been performed by SGS, the samples have been analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calculated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the " Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.
Note that in terms of units of radioactivity:

a. 1 Bq is equivalent to 27 pCi
b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC and MU criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: www.sgs.com.au/en-gb/environment-health-and-safety.

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STATEMENT OF QA/QC PERFORMANCE

SE206541A R0

CLIENT DETAILS

Contact	Leah Desborough
Client	ENVIROWEST CONSULTING PTY LIMITED
Address	PO BOX 8158 ORANGE NSW 2800
Telephone	61 2 63614954
Facsimile	(Not specified)
Email	leah@envirowest.net.au
Project	**11858 - Additional**
Order Number	**11858**
Samples	13

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
SGS Reference	**SE206541A R0**
Date Received	10 Jun 2020
Date Reported	17 Jun 2020

COMMENTS

All the laboratory data for each environmental matrix was compared to SGS' stated Data Quality Objectives (DQO). Comments arising from the comparison were made and are reported below.

The data relating to sampling was taken from the Chain of Custody document.
This QA/QC Statement must be read in conjunction with the referenced Analytical Report.
The Statement and the Analytical Report must not be reproduced except in full.

All Data Quality Objectives were met with the exception of the following:

Extraction Date	Moisture Content	1 item

SAMPLE SUMMARY

Samples clearly labelled	Yes	Complete documentation received	Yes
Sample container provider	SGS	Sample cooling method	Ice Bricks
Samples received in correct containers	Yes	Sample counts by matrix	1 Soil
Date documentation received	10/6/2020@3:38pm	Type of documentation received	Email
Samples received in good order	Yes	Samples received without headspace	Yes
Sample temperature upon receipt	12.7°C	Sufficient sample for analysis	Yes
Turnaround time requested	Standard		

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Member of the SGS Group

SGS

HOLDING TIME SUMMARY

SE206541A R0

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS "Field Sampling Guide for Containers and Holding Time" (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in Green when within suggested criteria or Red with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

Hexavalent Chromium in Soil UV/Vis — Method: ME-(AU)-[ENV]AN075/AN201

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
C5	SE206541A.007	LB202041	19 May 2020	10 Jun 2020	16 Jun 2020	16 Jun 2020	23 Jun 2020	17 Jun 2020

Moisture Content — Method: ME-(AU)-[ENV]AN002

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
C5	SE206541A.007	LB201912	19 May 2020	10 Jun 2020	02 Jun 2020	15 Jun 2020†	20 Jun 2020	16 Jun 2020

SGS

SURROGATES

SE206541A R0

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA/QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in Green when within suggested criteria or Red with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

No surrogates were required for this job.

SGS

METHOD BLANKS

SE206541A R0

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in Green when within suggested criteria or Red with an appended dagger symbol (†) when outside suggested criteria.

Hexavalent Chromium in Soil UV/Vis — Method: ME-(AU)-[ENV]AN075/AN201

Sample Number	Parameter	Units	LOR	Result
LB202041.001	Hexavalent Chromium, Cr6+	mg/kg	0.5	0

SGS

DUPLICATES

SE206541A R0

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in Green when within suggested criteria or Red with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Hexavalent Chromium in Soil UV/Vis — Method: ME-(AU)-[ENV]AN075/AN201

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE206541A.007	LB202041.004	Hexavalent Chromium, Cr6+	mg/kg	0.5	1.3	1.2690023201	69	1

Moisture Content — Method: ME-(AU)-[ENV]AN002

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE206541A.007	LB201912.016	% Moisture	%w/w	1	8.6	7.5	42	14
SE207466.001	LB201912.011	% Moisture	%w/w	1	16.73553719005	5.0028851702	36	11

SGS

LABORATORY CONTROL SAMPLES

SE206541A R0

Laboratory Control Standard (LCS) results are evaluated against an expected result, typically the concentration of analyte spiked into the control during the sample preparation stage, producing a percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in Green when within suggested criteria or Red with an appended dagger symbol (†) when outside suggested criteria.

Hexavalent Chromium in Soil UV/Vis — Method: ME-(AU)-[ENV]AN075/AN201

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB202041.002	Hexavalent Chromium, Cr6+	mg/kg	0.5	NA	20	70 - 130	99

MATRIX SPIKES

SE206541A R0

Matrix Spike (MS) results are evaluated as the percentage recovery of an expected result, typically the concentration of analyte spiked into a field sub -sample during the sample preparation stage. The original sample's result is subtracted from the sub-sample result before determining the percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA/QC plan (ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in Green when within suggested criteria or Red with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

No matrix spikes were required for this job.

SGS

MATRIX SPIKE DUPLICATES

SE206541A R0

Matrix spike duplicates are calculated as Relative Percent Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The original result is the analyte concentration of the matrix spike. The Duplicate result is the analyte concentration of the matrix spike duplicate.

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in Green when within suggested criteria or Red with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

No matrix spike duplicates were required for this job.

SGS

FOOTNOTES

SE206541A R0

id samples expressed on a dry weight basis.

criteria are subject to internal review according to the SGS QA/QC plan and may be provided on request or alternatively can be found he
s://www.sgs.com.au/~/media/Local/Australia/Documents/Technical Documents/MP-AU-ENV-QU-022 QA QC Plan.pdf

*	NATA accreditation does not cover the performance of this service.
**	Indicative data, theoretical holding time exceeded.
-	Sample not analysed for this analyte.
IS	Insufficient sample for analysis.
LNR	Sample listed, but not received.
LOR	Limit of reporting.
QFH	QC result is above the upper tolerance.
QFL	QC result is below the lower tolerance.

①	At least 2 of 3 surrogates are within acceptance criteria.
②	RPD failed acceptance criteria due to sample heterogeneity.
③	Results less than 5 times LOR preclude acceptance criteria for RPD.
④	Recovery failed acceptance criteria due to matrix interference.
⑤	Recovery failed acceptance criteria due to the presence of significant concentration of analyte (i.e. the concentration of analyte exceeds the spike level).
⑥	LOR was raised due to sample matrix interference.
⑦	LOR was raised due to dilution of significantly high concentration of analyte in sample.
⑧	Reanalysis of sample in duplicate confirmed sample heterogeneity and inconsistency of results.
⑨	Recovery failed acceptance criteria due to sample heterogeneity.
⑩	LOR was raised due to high conductivity of the sample (required dilution).
†	Refer to relevant report comments for further information.

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Yin, Emily (Sydney)

From: AU.Environmental.Sydney (Sydney)
Sent: Wednesday, 10 June 2020 3:38 PM
To: Leah Desborough
Cc: AU.SampleReceipt.Sydney (Sydney)
Subject: RE: [EXTERNAL] SE206541

Hi Leah,

Thanks, will report this additional job on standard TAT.
If you could cc all your future analysis requests to AU.SampleReceipt.Sydney@sgs.com as well that would be much appreciated.

Hi Emily,

Please see below additional analysis request. Thanks.

Kind Regards,

Huong Crawford
Environment, Health & Safety
Production Manager

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SGS EHS Alexandria Laboratory
SE206541A COC
Received: 10-Jun-2020

From: Leah Desborough <Leah@envirowest.net.au>
Sent: Wednesday, 10 June 2020 3:30 PM
To: AU.Environmental.Sydney (Sydney) <AU.Environmental.Sydney@sgs.com>
Subject: [EXTERNAL] SE206541

*** WARNING: this message is from an EXTERNAL SENDER. Please be cautious, particularly with links and attachments. ***

Good afternoon

Could I please request analysis for Chromium (VI) and (III) on sample C5 on job number SE206541. Standard turnaround time please.

Thanks

Leah Desborough
Senior Environmental Scientist

1

Appendix 5. Soil sampling protocols

1. Sampling

The samples will be collected from the auger tip, mattock, hand auger or excavator bucket immediately on withdrawal.

The time between retrieval of the sample and sealing of the sample container will be kept to a minimum.

The material will be collected using single use disposal gloves or a stainless-steel spade which represented material which has not been exposed to the atmosphere prior to sampling.

All sampling jars will be filled as close to the top as possible to minimise the available airspace within the jar.

2. Handling, containment and transport

Daily sampling activities will be recorded including sampling locations, numbers, observations, measurements, sampler, date and time and weather condition.

The sampling jars will be new sterile glass jars fitted with plastic lid and airtight Teflon seals, supplied by the laboratories for the purpose of collecting soil samples for analysis. Sample containers will be marked indelibly with the sample ID code to waterproof labels affixed to the body of the container.

All samples will be removed from direct sunlight as soon as possible after sampling and placed in insulated containers. Samples will be stored in a refrigerator at 4 °C prior to transportation to the laboratory in insulated containers with ice bricks in accordance with AS4482.1.

Handling and transportation to the laboratory will be accompanied with a chain of custody form to demonstrate the specimens are properly received, documents, processed and stored.

Maximum holding time for extraction (AS4482.1) are:

Analyte	Maximum holding time
Metals	6 months
Mercury	28 days
Sulfate	7 days
Organic carbon	7 days
OCP, OPP, PCB	14 days
TRH, BTEX, PAH, phenols	14 days

3. Decontamination of sampling equipment

Sampling tools will be decontaminated between sampling locations by

- Removing soil adhering to the sampling equipment by scraping, brushing or wiping
- Washing with a phosphate-free detergent
- Rinsing thoroughly with clean water
- Repeating if necessary
- Collect rinsate per sampling time and preserve according to AS 2031.1
- Dry equipment with disposable towels or air

Groundwater and salinity study

Proposed RSL Club, part Lot 502 DP1255115 Boundary Road, Dubbo NSW



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Document control			
Report number	**Date**	**Author**	**Update information**
R11858s draft	23 June 2020	Leah Desborough BNatRes (Hons)	
R11858s	14 July 2020	Leah Desborough BNatRes (Hons)	Report finalised
R11858s.1	3 August 2020	Leah Desborough BNatRes (Hons)	Update to reflect new concept plan

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Executive summary

Background

A registered club facility and associated recreational facilities are proposed for a 3.3ha parcel of land located within Lot 502 DP1255115 Boundary Road, Dubbo NSW. The development will include the club building, kids play and family area, football/cricket field and carpark. Part of the site is located in a moderately high groundwater vulnerability area. The hydrogeological landscape has moderate salinity risk. A groundwater salinity assessment is required as part of the development process.

Objectives of the investigation

A site investigation was undertaken to assess the existing salinity conditions of the soil and groundwater and determine the impact of the development on groundwater and salinity.

Investigation

A soil investigation was undertaken of the site. An initial investigation and desktop review was undertaken to collect existing information on groundwater on and around the site and the likelihood of salinity across the site. Boreholes were drilled and soil samples collected on 19 May 2020.

The site investigation included landscape description, soil investigation, laboratory analysis and groundwater investigation. The soil profile investigation was undertaken by constructing six boreholes up to 1.7m in depth or drill refusal. Representative soil samples were collected and analysed for pH, electrical conductivity, colour, dispersion, texture, chlorides and exchangeable sodium percentage.

The investigation results and proposed development were evaluated to identify impacts and recommend management outcomes to minimise salinity risk. Water balance was modelled to estimate changes in infiltration following development. Surface water flow containing sediment, nitrogen and phosphorus were modelled using Chafer (2003).

Conclusions

The site had a historical pasture grazing land-use and is currently vacant with numerous stockpiles of imported soil and debris. Vegetation cover on the site was generally 100% due to recent rainfall. No bare areas resulting from sheet erosion or salinity scalding were identified. The risk of erosion is low.

Soils on the site comprised loamy sand over silty clay and light clay. Drill refusal due to basalt was encountered from depths of 0.1 to 1.7m.

The majority of the site is located in the Dubbo Basalt Hydro-geological Landscape (HGL). Lithology of the Dubbo Basalt Hydro-geological Landscape consists of Cainozoic basalt consisting of in situ Olivine rich alkali basalt with some colluvial material and quartzite derived from the underlying sandstone and siltstone. Soil salinity in the landscape is isolated at areas along drainage lines, at the intersection with the Purlewaugh formation, depressions and footslopes which were not identified on the site. Groundwater or groundwater indicators were not encountered in the soil to a depth of 1.7m. Groundwater was not saline from drillers log descriptions of bores in the landscape.

Potable and stock supply bores have been constructed in the locality. Bores in the locality generally have water bearing zones greater than 10m in gravels and sands. Groundwater recharge within the Dubbo Basalt HGL is greatest on plateau areas. Groundwater residence times are short.

No visual surface or sub-surface indicators of groundwater discharge areas were identified on the site.

The infiltration balance indicated infiltration will reduce under the post development scenario due to an increase in impermeable areas. Rainfall on impermeable areas will drain off-site in stormwater pipes. Increased infiltration may occur as a result of irrigation of the sporting field. The increase is off-set by the reduction in permeable areas

The risk of groundwater contamination from the proposed land-use is lower than the current land-use. Nutrient contributions will decrease as a result of smaller available areas for fertilisation and a decrease in animal waste. Sediment contributions will also decrease as a result of an increase in hard cover areas and no soil disturbance from farming activities. Other activities which may increase the risk of groundwater contamination including car washing and re-use of greywater will not be undertaken on the site.

No impact on groundwater including contamination and changed groundwater levels is expected from the development. The development will not impact on quantity or quality of both unconfined and confined aquifers.

Recommendations

The development water and soil design will include:

- Drainage of water from hard surfaces in stormwater pipes
- Sediment and erosion control plans during construction
- Determination of the soil electrical conductivity at the design depth in areas to be excavated
- Ensure imported material is non-saline
- Irrigation scheduling of sports field to prevent overwatering
- No unsealed stormwater detention dams to be constructed

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1. Introduction

A registered club facility and associated recreational facilities are proposed for a 3.3ha parcel of land located within Lot 502 DP1255115 Boundary Road, Dubbo NSW. The development will include the club building, kids play and family area, football/cricket field and carpark. Part of the site is located in a moderately high groundwater vulnerability area. The hydrogeological landscape has moderate salinity risk. A groundwater salinity assessment is required as part of the development process.

2. Scope of work

Envirowest Consulting Pty Ltd was commissioned by The Planning Hub to undertake a groundwater investigation and salinity study for part Lot 502 DP1255115 Boundary Road, Dubbo NSW. The objective was to assess the existing conditions and possible future impact of the proposed development on soil, groundwater and salinity.

3. Site identification

Address	Part Lot 502 DP1255115 Boundary Road Dubbo NSW
Client	The Planning Hub
Deposited plans	Part Lot 502 DP1255115
Universal grid reference	UTM Zone 55H, 654072mE, 6428355mN
Locality map	Figure 1
Site plan	Figure 2
Photographs	Figure 16
Area	Approximately 3.3 hectares
Dates of inspection and assessment	19 May 2020

4. Proposed development

The proposed development is club facility and associated recreational facility (Figure 15). The development will include the club building, kids play and family area, football/cricket field and carpark. Approximately 1.2ha of the site will be hard surface areas comprising carpark, driveway and buildings (Table 1). Surface water on the areas are expected to be managed by a stormwater system which will discharge into the reticulated stormwater system and flow off-site. The remainder of the site is expected to comprise soft landscaping which will allow infiltration of water. Irrigation is expected to occur on the sporting field, viewing banks and other landscaped areas.

Table 1. Land-use areas

Land-use	Area (ha)
Carpark and driveway	0.9
Buildings	0.25
Sports field, soft landscaping	2.15

5. Site condition and surrounding environment

5.1 Land-use

The current land-use is vacant. Material has been imported and stockpiled across the site. Historical land-use is expected to have been dominated by grazing and may have included a basalt quarry.

5.2 Vegetation

The investigation area was dominated by ruderal weeds including mallow, skeleton weed, hedge mustard, paddy melon and other broadleaved weeds. An eucalypt tree and several small robinias are scattered across the site.

5.3 Topography

The site is predominantly located on a upper slope. Aspect is predominantly east and slopes are gently inclined and generally less than 5%. Elevation ranges between 285 and 293 metres above sea level. The lowest elevation occurs on the eastern boundary. No evidence of groundwater seepage or discharge areas were observed on the site.

5.4 Soils and geology

The site is located within the Bunglegumbie Soil Landscape (Murphy *et al.* 1998).

Soil in the Bunglegumbie landscape consists of red brown earths, red earth, non-calcic brown soils and yellow podzolic/solodic soils. Parent material is weathered alluvium. Soil salinity problems are absent. Erosion hazard is low on slopes less than 3%.

Lithology of the southern section of the site is Napperby Formation comprising siltstone thinly interbedded with fine-medium grained lithic quartz sandstone with minor conglomerate. Lithology of the northern section is Cainozoic Basalt comprising tholeiite, alkali basalt and alkali ultramafic (Colquhoun *et al.*1997).

Soils on the site comprised reddish brown sandy clay over yellowish brown to light brown sandy clay. Basalt rock was encountered in all boreholes at depths of between 0.1m and 1.7m. Basalt rock was deeper (1.1m and 1.7m) through the central section of the site and shallower (0.25m to 0.6m) in the western and northern sections of the site.

5.5 Surface water

The surface of the site is uneven as a result of numerous stockpiles on the site. Water is expected to pond between stockpiles. Surface water flows are generally east and south. Eulomogo Creek is located approximately 2.2km south of the site.

Eulomogo Creek empties into the Macquarie River approximately 3.0km south of the site.

5.6 Groundwater

The Australian Natural Resources Atlas identifies the site within the Upper Macquarie Alluvium Groundwater Management Unit. The management unit has an area of 414km^2 with approximately 17.95 GL consumed per year. Average salinity levels are greater than 1,500mg/L.

Sixteen registered water abstraction bores were identified within a 1km radius of the site on the NSW Government Water NSW website (2020). Water-bearing zones (WBZ's) and standing water levels were recorded for nine bores. The Water NSW website shows that SWL's and WBZ's in bores (for which data was recorded) were at depths greater than 5m. The water bearing zones are located in unconfined sand, gravel and clay and confined sandstone.

Five bores form part of the Dubbo Regional Council salinity network and as such have been constructed to intersect shallow unconfined groundwater. The remainder of the bores are licenced for domestic, stock, and public.

6. Groundwater and soil salinity investigation

The soil salinity investigation comprised a desktop study, field assessment and soil analysis. The desktop study included a review of soil landscape maps, hydro-geological landscapes and groundwater databases. Infiltration modelling was also undertaken.

The field assessment included an initial site investigation and detailed profile descriptions and soil analysis. The soil and landscape information collected provided an adequate description of the physical processes on the site to enable salinity issues to be identified and managed. The frequency of tests undertaken was in accordance to the frequency in Table 1 of Lillicrap and McGhie (2002) for moderately intensive construction.

6.1 Soil landscapes

Soil landscape data was reviewed for information regarding soil types in the locality, occurrence of salinity, erosion and sodic soils.

6.2 Hydro-geological landscapes

Hydro-geological landscape (HGL) data for the locality was reviewed for information regarding the groundwater aquifer including lithology, aquifer type, recharge and discharge characteristics (Figure 3).

6.3 Groundwater

An investigation of registered bores in the area was undertaken to determine the depth and salinity of the groundwater. Groundwater information was found from a review of the NSW Government Water NSW database and Dubbo Regional Council Salinity Network.

The groundwater was divided into deep and shallow groundwater. Deep groundwater is located in river gravels, sands and sandstone at depths greater than 15 metres. The shallow groundwater is expected to generally be unconfined in a local aquifer controlled by drainage lines and/or lithological contrasts within the site.

Water criteria for salinity are presented in Tables 2 to 4. The conversion from EC (dS/m) to total dissolved solids or TDS (mg/L) is undertaken by applying the conversion factor of 640 for an average concentration of salts present (Lillicrap and McGhie 2002).

Table 2. Drinking water criteria for salinity (NHMRC, NRMMC 2011)

Palatability	EC (dS/m)	Total dissolved solids -Salinity (mg/L)
Good	0.94	600
Fair	0.94-1.41	600-900
Poor	1.41-1.88	900-1,200
Unacceptable	>1.88	>1,200

Table 3. Total dissolved solids of water for agricultural use (Reid 1990)

Class	Description	Total dissolved solids -Salinity (mg/L)
1	Low salinity	0-175
2	Medium salinity	175-500
3	High salinity	500-1500
4	Very high salinity	1500-3500
5	Extremely high salinity	>3500

Table 4. Guidelines on salinity class determination (Dubbo City Council Urban Salinity Plan)

Electrical conductivity (dS/m)	Salinity class
0-2	Low
2-6	Moderate
6-15	High
>15	Extreme

6.4 DLWC groundwater vulnerability mapping

The NSW Department of Land and Water Conservation have undertaken groundwater vulnerability mapping of the Dubbo locality (Piscope and Dwyer 2001). The vulnerability mapping utilises the DRASTIC technique which is a composite description of all the major geologic and hydro-geologic factors that affect and control groundwater movement into, through and out of an area. It involves the overlaying of various hydro-geological settings via a Geographical Information System (GIS). Each hydro-geological setting describes topography, soil type, bedrock type, estimate of rainfall and net recharge depth to watertable (DTWT), aquifer yield, relative conductivity and any particular features associated with the setting that are available. Groundwater vulnerability is classified into high, moderately high, moderate, low moderate and low (Figure 4).

6.5 Dubbo LEP (2011) groundwater vulnerability map

The Dubbo LEP (2011) Natural Resource – Groundwater vulnerability map describes the areas within the Dubbo Regional Council area where groundwater is considered vulnerable to depletion and contamination as a result of development (Figure 5).

6.6 Infiltration model

A simulation model was developed to predict changes in infiltration pre and post development. The area for each land-use pre and post development was estimated from site walkover, topographical map, development concept plans and aerial photograph. The site was classified into the different land-use areas pre and post development (Table 5).

Groundwater recharge in agricultural pasture areas in the Wagga Wagga area was estimated to be 15mm/year (Cook *et al.* 2001). Wagga Wagga has a similar climate to Dubbo and the groundwater recharge data is considered representative of the investigation area.

It is expected overwatering will contribute to recharge however studies have demonstrated the recharge in agricultural grazing land-use of 15mm/year is similar to diffuse urban land-use of 14mm/year (Cook *et al.* 2001).

Infiltration on hard surfaces will be zero with surface water collected and piped off-site.

Table 5. Land-use areas pre and post development

Land-use	Pre development (ha)	%	Post development (ha)	%	Comments
Pasture	3.3	100	0	0	Not irrigated, few trees, water expected to pool in low areas between stockpiles
Urban	0	0	2.15	65	Sports field and surrounds
Hard surfaces (buildings, carpark, driveway)	0	0	1.15	35	Surface water expected to be piped off-site
Total	3.3	100	3.3	100	

6.7 Nutrient model

A simulation model was developed to predict surface runoff, sediment loss, nitrogen and phosphorus export, pre and post development. The area for each land-use pre and post development was estimated from site walkover, topographical map, subdivision plans and an aerial photograph. The site was classified into the different land-use areas pre and post development (Table 6).

Table 6. Land use areas for nutrient model

Land-use areas	Pre-development (ha)	Post development (ha)
Improved pasture	3.3	0
Urban (open space)	0	2.15
Roads (sealed)	0	0.9
Urban	0	0.25
Total	3.3	3.3

Land-use on-site are as follows;

- *Improved pasture* is the pre-development land-use.
- *Urban (open space)* refers to the irrigated sporting field and surrounds.
- *Roads (sealed)* refers to the carpark and driveway
- *Urban* refers to the developed areas on the site including building and terraced seating

Sediment, nitrogen and phosphorus export was estimated for low, median and high scenarios for each land-use class as detailed in Appendix 1 (Chafer 2003).

6.8 Initial site investigation

An initial site investigation was conducted by collecting information on vegetation, slope, bare areas and other indicators of salinity at 12 locations across the site (Figure 6). This density is in accordance with the recommendations by Lillicrap and McGhie (2002).

6.9 Detailed profile descriptions and laboratory analysis

Six boreholes were constructed with an EVH truck mounted hydraulic drilling rig with solid auger on 18 May 2020 to provide information on the soil profiles and enable sampling. The boreholes were constructed at various local elevations on the site (Figure 7). Depth of boreholes were to refusal on basalt rock. One borehole was drilled to 1.7m, one borehole to 1.1m and four boreholes to less than 1m.

The soil profile was described for colour, texture and moisture. Soil samples were collected from one borehole at 100mm, 200mm, 300mm, 500mm, and 500mm intervals to the depth of the borehole. The sampling is expected to provide an adequate description of subsoil salinity conditions. Soil samples were analysed for pH, electrical conductivity and dispersion.

Soil electrical conductivity (EC) results of the 1:5 (soil:water suspension) were converted to saturated extracts (ECe). EC values are converted to ECe by using a multiplier factor (Charman and Murphy, 1991), which is dependent on the soil texture (Table 7). Saline soils are defined as those with an electrical conductivity (ECe) greater than 4 dS/m (Charman and Murphy, 2001). Soil salinity ratings and effects on plant growth are presented in Table 8.

Table 7. ECe texture based conversion factors (Charman and Murphy 2001)

Soil texture	Conversion factor
Loamy sand, clayey sand, sand	23
Sandy loam, fine sandy loam, light sandy clay loam	14
Loam, loam fine sandy, silt loam, sandy clay loam	9.5
Clay loam, silty clay loam, fine sandy clay loam	8.6
Sandy clay, silty clay, light clay	7.5
Light medium clay, medium clay, heavy clay	5.8

Table 8. Soil salinity ratings based on ECe readings

Salinity rating	ECe (dS/m)*	Effects on Plants
Non saline (NS)	0-2	Salinity effects negligible
Slightly saline (SS)	2-4	Very salt sensitive plant growth restricted
Moderately saline (MS)	4-8	Salt sensitive plant growth restricted
Highly saline (HS)	8-16	Only salt tolerant plants unaffected
Extremely saline (ES)	>16	Only extremely tolerant plants unaffected

*ECe - Electrical conductivity of a saturated extract

Soil with ECe below 2 dS/m will have negligible effects on plant growth and soil stability. Soil with ECe of between 2 and 4 dS/m may restrict very salt sensitive plant growth. Soil with ECe between 4 and 8 dS/m will restrict the growth of salt sensitive plants.

Samples were analysed for dispersion using the Emerson aggregate test. Table 9 details the eight dispersion classes.

Table 9. Emerson dispersion classes

Class	Description
1	Highly dispersive (slakes, complete dispersion)
2	Moderately dispersive, slakes, some dispersion
3	Slightly dispersive, slakes, some dispersion after remoulding
4	Non-dispersive, slakes, carbonate or gypsum present
5	Non-dispersive, slakes, dispersion in shaken suspension
6	Non-dispersive, slakes, flocculates in shaken suspension
7	Non-dispersive, no slaking, swells in water
8	Non-dispersive, no slaking, does not swell in water

Representative soil samples were collected from the topsoil and subsoil and analysed for chloride and sodicity. Chloride criteria for corrosiveness to building material are presented in Table 10 and are an extract from AS2159-1995 Piling – design and installation.

Aggressive soils criteria for salinity and sulfate impacts on building structures are presented in Australia Standard AS2870-2011 (Appendix 2). The AS2870 standard also describes requirements to mitigate salinity and sulphate on footings.

Table 10. Chloride corrosiveness to building materials (AS2159-1995 Piling – design and installation)

Concrete piles		Steel piles	
Chlorides in water (mg/kg)	Soil conditions for low permeability soils or all soils above groundwater	Chlorides in water (mg/kg)	Soil conditions for low permeability soils or all soils above groundwater
<2,000	Non-aggressive	<1,000	Non-aggressive
2,000-6,000	Non-aggressive	1,000-10,000	Non-aggressive
6,000-12,000	Mild	10,000-20,000	Mild
12,000-30,000	Moderate	>20,000	Moderate
>30,000	Severe		

Sodicity is expressed as a percentage of the cation exchange capacity or exchangeable sodium percentage (ESP). Ranking of sodicity is presented in Table 11 (Lillicrap and McGhie 2002). An ESP of less than 5% indicates a non-sodic soil, ESP of between 5 and 15% indicates a sodic soil and an ESP of greater than 15% indicates a highly sodic soil.

Table 11. Ranking of exchangeable sodium percentage

Exchangeable sodium percentage	Ranking
<5%	Non-sodic
5-15%	Sodic
>15%	Highly sodic

7. Results and discussion

7.1 Soil landscape maps

The site is located within the Bunglegumbie Soil Landscape (Murphy *et al*. 1998). Soil in the Bunglegumbie landscape consists of red brown earths, red earth, non-calcic brown soils and yellow podzolic/solodic soils. Parent material is relatively old and weathered alluvium. Soil salinity problems are absent. Erosion hazard is low on slopes less than 3%.

Lithology of the site is Cainozoic Basalt comprising tholeiite, alkali basalt and alkali ultramafic (Colquhoun *et al*.1997).

7.2 Hydro-geological landscapes

The majority of the site is located in the Dubbo Basalt HGL. The south western section is in the Purlewaugh/Napperby HGL (eSpade 2020). The site and associated hydro-geological landscapes are depicted in Figure 3.

Lithology of the Dubbo Basalt HGL consists of Cainozoic basalt consisting of in-situ Olivine rich alkali basalt with some colluvial material and quartzite derived from the underlying sandstone and siltstone. Soil salinity is isolated at areas along drainage lines, at the intersection with the Purlewaugh formation, depressions and footslopes. Saline soils also occur due to local perching of the water table. Groundwater recharge is greatest on plateau areas. Groundwater flow is unconfined to semi-confined in consolidated fractured rock. Groundwater salinity is good. Salt sites occur at the contact of the basalt cap with the underlying geology.

The Purlewaugh/Napperby HGL landscape is characterised by low flat hills and rises with a stepped geomorphology. Lithology of the Purlewaugh/Napperby HGL consists of Purlewaugh Formation, Napperby Formation and Boulderwood Formation comprising mainly ferruginous red siltstone, carbonaceous mudstone, fine to medium grained lithic sandstone, ironstone, minor coal and minor conglomerate. Large areas of salinity occur along contours and are repeated at different topographic levels. Severe salt sites occur in the lower landscape. Salt load is very high to extreme due to water

readily mobilising salts stored within the sedimentary pile. Groundwater flow is unconfined to semi-confined flows through fractures in sandstone and sedimentary bedrock, permeable soils and saprolite. Lateral flow occurs through colluvial sediments on lower slopes. High recharge rates occur across the landscape particularly in areas where cropping is practised. Water electrical conductivity is moderate to high.

Shallow basalt was encountered in the boreholes across the site including in boreholes constructed in the south western section (BH3 and BH4) where basalt was encountered at 0.25m and 0.3m. The presence of basalt indicates that the Purlewaugh/Napperby HGL was not encountered to the drilling depth. Dubbo Basalt underlies the investigation area. The contact of the basalt cap with the underlying geology is expected to occur further downslope. Salt sites are not expected to occur on the site.

Topographical features including drainage lines, depressions and footslopes and geological features including geological contact where soil sites can develop in the Dubbo Basalt HGL were not identified on the site.

7.3 Groundwater

7.3.1 OEH registered bores

Sixteen registered water abstraction bores were identified within a 1km radius of the site on the NSW Government Water NSW database (2020) (Figure 8). Data known about each bore within 1km of the site from the Department of Primary Industries website is summarised in Appendix 3.

Five bores form part of the Dubbo Regional Council salinity network and as such have been constructed to intersect shallow unconfined groundwater. The characteristics of these bores are discussed in Section 7.3.2. The remainder of the bores are licenced for domestic, stock, public and monitoring.

Water-bearing zones (WBZ's) and standing water levels were recorded for twenty bores. The Water NSW database shows that SWL's and WBZ's in bores (for which data was recorded) were at depths greater than 5m (Figure 8 and Appendix 3). The water bearing zones are located in unconfined sand, gravel and clay and confined sandstone.

7.3.2 Dubbo Regional Council salinity network

Five Dubbo Regional Council (DRC) monitoring bores are located at less than 1km from the site (Figure 9 and Appendix 4). The bores are identified as DCC19, DCC44, DCC45, DCC115 and DCC116 (Figure 10).

Bore depths ranged from 3m to 9m with water bearing zones located in unconfined regolith comprising clay. Bores DCC19 and DCC44 have been dry since monitoring begun in March 2005 and one of the bores (DCC115) has not been monitored since February 2012. DCC45 usually contains water at the time of monitoring at depths greater than 6.5m. Salinity rating of the water is low. Water within DCC116 was variable until January 2016 and has generally contained water since this time at depths greater than 2m. Salinity rating of the water is low.

Standing water levels in Dubbo Regional Council (DRC) monitoring bores within 1km of the site in November 2018 to March 2019 were generally dry ranged between 0.30m to 8.76m and dry at times (Table 12 and Figure 9). Electrical conductivity of these bores was classed as low to moderate salinity (Appendix 4).

Table 12. Dubbo Regional Council salinity network

Sampling location (see Figure 10)	Depth (m)	Date sampled	Standing water level (m)	EC (dS/m)	Total dissolved solids (EC x 640) (mg/L)
DCC19	3	Nov-18	Dry	-	-
		Jan-19	Dry	-	-
		Mar-19	Dry	-	-
DCC44	6	Nov-18	Dry	-	-
		Jan-19	Dry	-	-
		Mar-19	Dry	-	-
DCC45	9	Nov-18	7.43	1.35	864
		Jan-19	Dry	-	-
		Mar-19	Dry	-	-
DCC115	9	Nov-18	Missing	-	-
		Jan-19	Missing	-	-
		Mar-19	Missing	-	-
DCC116	3.5	Nov-18	Missing	-	-
		Jan-19	Missing	-	-
		Mar-19	Missing	-	-

TSTB- too shallow to bail

7.3.3 On-site groundwater

No groundwater was identified on site when constructing boreholes. No indicators of seasonal groundwater was identified in the boreholes.

7.4 Groundwater vulnerability

The Department of Land and Water Conservation (Piscope and Dwyer 2001) identifies the majority of the site as having a moderate groundwater vulnerability rating (Figure 4).

Land to the south west had a moderately high groundwater vulnerability rating and to the east and north east a low groundwater vulnerability rating.

7.5 Dubbo LEP (2011) groundwater vulnerability map

The Dubbo LEP (2011) identifies the south western section of the site in a moderately high groundwater vulnerability area (Figure 5). No groundwater vulnerability rating applies to remainder of the site.

The moderately high groundwater vulnerability area is associated with the mapped Purlewaugh/Napperby HGL and the non-mapped area is associated with the Dubbo Basalt HGL. The Purlewaugh/Napperby HGL was not encountered on the site (Section 7.2) and the entire site is expected to not have a groundwater vulnerability rating.

7.6 Initial site investigation

The initial site investigation was conducted on a 50m x 50m grid across the site (Figure 6 and Appendix 5).

The site has a historical land-use of grazing with stockpiles and debris placed on the site between 1980 and 1991 and potentially more added after this time.

Several trees were located on the site. The tree species was generally non-native robinias which are garden escapees. One eucalypt tree occurs on the site.

Groundcover species were dominated by ruderal weeds including mallow and hedge mustard. Recent rain has resulted in lush vegetation on the site. Some bare areas were identified as a result of gravel.

The majority of the site was very gently inclined with slopes less than 5%.

Basalt cobbles were identified on the surface in the western section of the site.

No bare areas and indicators of salinity were observed in the assessment.

7.7 Soil characteristics

Boreholes were constructed up to depths of 1.7m and generally to depths of less than 1m due to the presence of basalt rock. Borelogs are presented in Appendix 6.

7.7.1 Texture and colour

Soils on the site comprised topsoil of dark brown loamy sand with gravel (Table 13). Subsoils were yellowish brown silty clay with gravel over reddish brown light clay with gravel. Basalt rock resulting in drill refusal was encountered from depths of 0.1m and up to depths of 1.7m.

7.7.2 Salinity (electrical conductivity)

All samples to 1.5m were determined to be non-saline with electrical conductivity of less than 2dS/m (Figure 10).

The sample collected from the base (1.7m) of Borehole 1 was slightly saline (Table 13).

7.7.3 pH

The topsoil was slightly acidic (Table 12). Subsoil was generally slightly to strongly alkaline.

7.7.4 Emerson aggregate test

Topsoil on site was non-dispersive with slightly dispersive soils identified from 0.5m (Table 13).

Table 13. Soil colour, texture, pH, EC and ECe (detailed profile descriptions)

Borehole No -depth (mm)	Soil colour	Soil texture	pH	EC1:5	ECe (dS/m)	Emerson aggregate test
1-100	Dark brown	Loamy sand with gravel	8.9	0.05	1.15	5
1-200	Yellowish brown	Silty clay with gravel	8.7	0.17	1.28	5
1-300	Yellowish brown	Silty clay with gravel	9.0	0.09	0.68	5
1-500	Dark brown	Light clay	8.9	0.16	1.20	3
1-1000	Reddish brown	Light clay	8.8	0.17	1.28	3
1-1500	Reddish brown	Light clay with gravel	8.9	0.23	1.73	3
1-1700	Reddish brown	Light clay with gravel	9.0	0.31	2.33	3

7.7.5 Chlorides

Levels of chlorides in the samples analysed were less than 2,000mg/kg and considered non-aggressive soils for concrete and steel piles (Table 14).

7.7.6 Exchangeable sodium percentage

Exchangeable sodium percentage for the topsoil sample collected from Borehole 1 was non-sodic (Table 14). The subsoil sample collected at 1.5m from Borehole 1 was sodic.

Table 14. Soil results for chlorides and exchangeable sodium percentage (ESP) (Appendix 7)

Sample ID	Borehole and depth (mm) (Figure 5)	Chlorides (mg/kg)	ESP (%)
B1-300	1-300	9.3	0.6
B1-1500	1-1500	35	8.4

ND – Not detected at the laboratory limits

7.8 Indicators of salinity

7.8.1 Bare soil

No bare soil resulting from sheet erosion or salinity were present on site.

7.8.2 Salt crystals

No salt crystals present on site.

7.8.3 Vegetation indicators

No highly salt tolerant plant species are present on site.

7.8.4 Die back

No vegetation or tree die back was observed on or surrounding the site.

7.8.5 Effects on buildings

No buildings are located on site.

7.8.6 Conditions of roads

No evidence of surface undulations or break-up of bitumen on the roads surrounding the site.

7.9 Infiltration balance

Infiltration occurs for all permeable areas. Infiltration under a pasture land-use (15mm/year) has been determined to be similar as under an irrigated lawn land-use (14mm/year). Soil moisture resulting from infiltration not used by vegetation represents potential recharge. Pre-development infiltration will occur across the whole site under the pasture land-use. Post development infiltration will occur on a portion of the site with no infiltration occurring on hard surfaces.

The infiltration balance indicates the development will reduce infiltration (Table 15).

Table 15. Infiltration from each land-use, pre and post development

Land-use areas	Infiltration (mm/year)	Area pre-development (ha)	Infiltration pre-development (mm/year)	Area post development (ha)	Infiltration post development (mm/year)	Impact
Pasture	15	3.3	49..5	0	0.00	49.5
Urban	14	0	0.00	2.15	30.1	-30.1
Hard surfaces	0	0	0.00	1.15	0	0.0
TOTAL			**49.5**		**30.1**	**19.4**

7.10 Nitrogen

Nitrogen soil levels in the grazing system are typically low with concentrated areas around animal wastes. Nitrogen fertilisers are also used in cropping operations and biological synthesis occurs in legumes. Off-site movement occurs from sediment loss. Water soluble nitrogen has potential to leach into the groundwater.

Post development sources of nitrogen are from fertilisers applied to lawns. Post development fertilisation is only expected to occur on the sporting field with minor fertiliser of garden areas. The

impact from lawn fertilisers will be less than the impact of animal wastes. The impact of nitrogen fertiliser post development will be reduced.

The nutrient balance indicates the development will reduce nitrogen export by 16 kg/year under the median scenarios (Table 16). Reduced pasture area and a greater area of hard surfaces has resulted in a decrease in nitrogen loss.

Table 16. Land-use nitrogen export pre and post development (kg/year)

Land-use areas	Pre-development	Post development	Impact
Improved pasture	29.37	0.00	29.37
Urban (open space)	0.00	6.88	-6.88
Roads (sealed)	0.00	5.40	-5.40
Urban	0.00	1.53	-1.53
TOTAL	29.37	13.81	15.57

7.11 Phosphorus

The main phosphorus sources pre-development are from animal waste and fertilisers. Stock are expected to have been regularly grazed on the site prior to development works around the site resulting in removal of fences. Off-site movement of phosphorus will occur in sediments and susceptible times are when vegetation cover is low.

Stock numbers will be zero in the post development land-use resulting in a decrease contribution of phosphorus on the site.

Phosphorus binds to soil and the primary method of movement is in sediments. Vegetation cover is expected to be higher post development resulting in filtering of runoff, reduced sediment loads exported and consequently lower phosphorus export.

The nutrient balance indicates the development will decrease phosphorus export by 2 kg/year under the median scenarios (Table 17). Reduced pasture area and a greater area of sealed surfaces have resulted in a decrease in the phosphorus loss.

Table 17. Land-use phosphorus exports pre and post development (kg/year)

Land-use areas	Pre-development	Post development	Impact
Improved pasture	4.46	0.00	4.46
Urban (open space)	0.00	0.37	-0.37
Roads (sealed)	0.00	1.62	-1.62
Urban	0.00	0.46	-0.46
TOTAL	**4.46**	**2.44**	**2.01**

7.12 Sediment

The nutrient balance indicates the development will reduce sediment by 696 kg/year under the median scenario (Table 18). Sediments are reduced due to the decrease in contribution from the pasture area.

Table 18. Land-use sediment export pre and post development (kg/year)

Land-use areas	Pre-development	Post development	Impact
Improved pasture	1,716.00	0.00	1,716.00
Urban (open space)	0.00	774.00	-774.00
Roads (sealed)	0.00	171.00	-171.00
Urban	0.00	75.00	-75.00
TOTAL	1,716.00	1,020.00	696.00

7.13 Garden fertilisers and chemicals

Minor usage of herbicides may occur post development on irrigated areas, in a controlled manner to manage weeds within the sporting field. All fertilisers and agricultural chemicals will be utilised by the vegetation or degrade rapidly in the environment. No impact on surface water or groundwater will occur.

No industrial activities including bulk storage or use of chemicals will occur in the development.

8. Soil and water impact assessment

8.1 Soil

Soil across the site was shallow ranging in depth from 0.1m to 1.7m. The soils were identified to be non-saline to 1.5m with slightly saline subsoil identified at 1.7m. Sodic subsoils were identified in the sample collected from 1.5m. Excavation works for the development are expected to be minimal due to the presence of shallow basalt bedrock and will include levelling of the central and eastern sections of the site to create a level playing field. Excavation works for the development are not expected to intercept the slightly saline and sodic subsoil. Management will be required to ensure sodic subsoil exposure is minimised.

8.2 Water

8.2.1 Surface water

Stormwater on the site will be managed by the reticulated stormwater system to be connected to the site. Majority of rainfall will be piped off-site.

8.2.2 Groundwater

8.2.2.1 Recharge

No recharge areas were identified on the site. Recharge within the Dubbo Basalt HGL is greatest on plateau areas.

The decrease in permeable areas following development of the site will result in a reduction in the amount of infiltration and therefore the potential in recharge.

Regular monitoring has been undertaken by the NSW Office of Water of the Dubbo town water supply extraction area located south west of the site. These bores have shown a long term declining trend with falls of up to 18m (Smithson 2010).

8.2.2.2 Discharge

Discharge areas were not identified on the site from surface and subsurface observations such as ponding water, water tolerant vegetation and wet soils.

8.2.2.3 Clause 7.5 of the Dubbo LEP 2011

(1) The objective of this clause is to maintain the hydrological functions of key groundwater systems and to protect vulnerable groundwater resources from depletion and contamination as a result of inappropriate development.

Response: The development and groundwater at the site is described in the Groundwater and Salinity report prepared by Envirowest Consulting Pty Ltd (Report number R11858s).

(2) This clause applies to the land identified as "Groundwater vulnerability" on the Natural Resources – Groundwater Vulnerability Map.

Response: The majority of the site is not mapped on the groundwater vulnerability map. The south western section of the site is in a moderately high groundwater vulnerability area.

(3) Before determining a development application for development on land to which this clause applies, the consent authority must consider:

(a) whether the development (including any on-site storage or disposal of solid or liquid waste chemicals) will cause any groundwater contamination or any adverse effect on groundwater dependent ecosystems.

Response:
The development has a low potential to adversely affect groundwater and groundwater dependent ecosystems. Approximately half of the site will be covered with hard surfaces which will result in a reduction in water infiltration. Irrigation of the football field and small landscaped areas is expected to occur.

Nitrogen fertiliser will not be required on the majority of the site and application rates are expected to be sufficient to provide nutrients to plants and not result in off-site movement. The impact of nitrogen inputs post development will be reduced.

The post development scenario is expected to result in a decrease in contribution of phosphorus, nitrogen and suspended sediments. Fertilizer use will be less than the agricultural land-use. Stock will not be grazed on the site in the post development land-use.

Minor usage of herbicides may occur post development to control weeds. All fertilisers and agricultural chemicals are not residual and will be utilised by the vegetation or degrade rapidly in the environment. No impact on surface water or groundwater will occur.

No industrial activities including bulk storage or use of chemicals will occur in the development.

(b) The cumulative impact (including the impact on nearby groundwater extraction for potable water supply or stock water supply) of the development and any other existing development on groundwater.

Response:
Impact on groundwater from nitrogen and phosphorus contamination is expected to be less post development compared to pre-development due to lower contributions from animals and fertilisers. The cumulative impact of the development on groundwater quality is expected to be negligible.

(4) Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that:

(a) The development is designed, sited and will be managed to avoid any significant adverse environmental impact, or
(b) If that impact cannot be avoided by adopting feasible alternatives – the development is designed, sited and will be managed to minimise that impact, or
(c) If that impact cannot be minimised – the development will be managed to mitigate that impact.

No impacts from the development are expected under the expected development works and the proposed land-use scenario.

8.3 Vegetation

The site contains annual species which are shallow rooted. No impact from saline soils and groundwater on the vegetation was observed.

Vegetation will be replaced with introduced grasses, ornamental species including native species and hard surfaces.

8.4 Infrastructure

The engineering design for the site has not been finalised. The presence of basalt rock from depths of 0.1m is expected to prevent extensive excavation works being undertaken on the site withsome cutting and filling works expected to create a level site. Imported fill should be non-saline. Impact on infrastructure from saline soils are not expected as infrastructure will be within non-saline imported material, non-saline to slightly saline natural soils or basalt rock.

8.5 Pollution risk control

Occasional fertilizer and chemical use is expected from the proposed land-use. Fertilisers will be utilised by plants. All agricultural chemicals degrade rapidly in the environment. No impact on surface water or groundwater will occur.

The site has historically been used for grazing. Waste from the animals contains significant nutrients and pathogens which has potential to move in surface water flows.

Stock will be excluded in the post development land-use decreasing contribution by animals to nutrients on the site.

The site contains numerous stockpiles of soil and other waste materials of unknown origin. If any contamination is associated with the imported material, remediation works will be undertaken to make the site suitable for the proposed land-use. The remediation works will ensure contaminants which may be currently contributing to pollution are managed.

Hard surfaces across the site will reduce sediment loads exported. Nutrient impact on surface water will be reduced post development.

The site area is considered important as it forms part of the Macquarie River catchment. ANZECC (2000) has determined water quality indicators for river systems in regard to various environmental values (Table 19). The environmental values relate to the protection of:

- aquatic ecosystems
- aquatic foods
- primary contact recreation
- secondary contact recreation
- drinking water
- visual amenity
- irrigation water supplies
- homestead water supplies
- livestock water supplies
- human consumption of fish

The irrigation water quality indicators are considered appropriate for the catchment. The potential impact of the development on each water quality indicator has been assessed (Table 19). Potential issues relate to current and future land-use and management of the site.

Table 19. Impacts of development on water quality (Environmental objectives)

Indicator	Objective	Impact of development
Nitrogen	5 mg/L	Nitrogen may be applied to areas of the site as fertilisers. Nitrogen will be used by plants, digested by microbes or volatilised into the atmosphere. Infiltration for nitrogen into the subsoil and impact on groundwater systems will not occur. Maintenance of groundcover by minimal cultivation and no grazing are important factors in reducing nitrogen export. Nutrient modelling indicates nitrogen will decrease on site.
Faecal coliform	<10 cfu/100mL to 10,000cfu/100mL	No effluent applied to the site. No impact.
Aluminium	5 mg/L	No impact.
Iron	0.2 mg/L	No impact.
Manganese	0.2 mg/L	No impact.
Dissolved oxygen	>6.5 mg/L	No effluent applied to the site. Vegetated areas are expected to be managed. No impact.
Phosphorus	0.05mg/L	Phosphorus may be applied to small areas of the site as fertilisers Phosphorus will be used by plants and absorbed in the soil. Groundcover will be enhanced in the development resulting in reduced sediment and phosphorus export. Post development fertiliser application rates will be reduced and the effect on phosphorus less. Nutrient modelling indicates phosphorous will decrease on site post development.
pH	between 6.0 and 8.5	Fertilisers have a declining influence on pH and effects off-site will be negligible.
Cyanobacteria	-	Cyanobacteria are dependent on the levels of nitrogen, phosphorus and water temperature. The development will not increase nitrogen and phosphorus therefore will have negligible impact. No cyanobacteria are present in fertilisers.
Conductivity	-	Exposure of saline soils and off-site movement will be minimised by adoption of recommendations including minimising depth of cut and implementation of erosion and sediment control plans. No impact expected.
Turbidity	-	Negligible impact due to small size of the development and the absence of any disturbed areas on site.

The impact of the development on each water quality indicators will be negligible.

8.6 Earthworks

The engineering design for the site has not been finalised. The presence of basalt rock from depths of 0.1m is expected to prevent extensive excavation works being undertaken on the site with some cutting and filling works expected to create a level site. Imported fill should be non-saline.

8.7 Other impacts of the development

Nil

9. Management recommendation

9.1 Design

The development water and soil design will include:

- Drainage of water from hard surfaces in stormwater pipes
- Sediment and erosion control plans during construction
- Determination of the soil electrical conductivity at the design depth in areas to be excavated
- Ensure imported material is non-saline
- Irrigation scheduling of sports field to prevent overwatering
- No unsealed stormwater detention dams to be constructed

9.2 Exposure classification for concrete

Soil saturated extract electrical conductivity (EC_e) was determined to be <4dS/m in the natural soil samples tested (Table 14). The soil pH was greater than 8. Exposure classification for concrete is A1. Minimum design characteristic strength for concrete is 20MPa and minimum curing requirement is continuous curing for at least 3 days (Appendix 2). Minimum reinforcement cover for concrete in soils is 40mm (Appendix 2). Exposure classification for concrete will require determination for imported fill material.

10. Conclusions

The site had a historical pasture grazing land-use and is currently vacant with numerous stockpiles of imported soil and debris. Vegetation cover on the site was generally 100% due to recent rainfall. No bare areas resulting from sheet erosion or salinity scalding were identified. The risk of erosion is low.

Soils on the site comprised loamy sand over silty clay and light clay. Drill refusal due to basalt was encountered from depths of 0.1 to 1.7m.

The majority of the site is located in the Dubbo Basalt Hydro-geological Landscape (HGL). Lithology of the Dubbo Basalt Hydro-geological Landscape consists of Cainozoic basalt consisting of in situ Olivine rich alkali basalt with some colluvial material and quartzite derived from the underlying sandstone and siltstone. Soil salinity in the landscape is isolated at areas along drainage lines, at the intersection with the Purlewaugh formation, depressions and footslopes which were not identified on the site. Groundwater or groundwater indicators were not encountered in the soil to a depth of 1.7m. Groundwater was not saline from drillers log descriptions of bores in the landscape.

Potable and stock supply bores have been constructed in the locality. Bores in the locality generally have water bearing zones greater than 10m in gravels and sands. Groundwater recharge within the Dubbo Basalt HGL is greatest on plateau areas. Groundwater residence times are short.

No visual surface or sub-surface indicators of groundwater discharge areas were identified on the site.

The infiltration balance indicated infiltration will reduce under the post development scenario due to an increase in impermeable areas. Rainfall on impermeable areas will drain off-site in stormwater pipes. Increased infiltration may occur as a result of irrigation of the sporting field. The increase is off-set by the reduction in permeable areas

The risk of groundwater contamination from the proposed land-use is lower than the current land-use. Nutrient contributions will decrease as a result of smaller available areas for fertilisation and a decrease in animal waste. Sediment contributions will also decrease as a result of an increase in hard cover areas and no soil disturbance from farming activities. Other activities which may increase the risk of groundwater contamination including car washing and re-use of greywater will not be undertaken on the site.

No impact on groundwater including contamination and changed groundwater levels is expected from the development. The development will not impact on quantity or quality of both unconfined and confined aquifers.

11. Recommendations

The development water and soil design will include:

- Drainage of water from hard surfaces in stormwater pipes
- Sediment and erosion control plans during construction
- Determination of the soil electrical conductivity at the design depth in areas to be excavated
- Ensure imported material is non-saline
- Irrigation scheduling of sports field to prevent overwatering
- No unsealed stormwater detention dams to be constructed

12. Report limitations and intellectual property

This report has been prepared for the use of the client to achieve the objectives given the clients requirements. The level of confidence of the conclusion reached is governed by the scope of the investigation and the availability and quality of existing data. Where limitations or uncertainties are known, they are identified in the report. No liability can be accepted for failure to identify conditions or issues which arise in the future and which could not reasonably have been predicted using the scope of the investigation and the information obtained.

The investigation identifies the actual subsurface conditions only at those points where samples are taken, when they are taken. Data derived through sampling and subsequent laboratory testing is interpreted by geologists, engineers or scientists who then render an opinion about overall conditions, the nature and extent of likely impacts of the proposed development, and appropriate remediation measures. Actual conditions may differ from those inferred to exist, because no professional, no matter how well qualified, and no sub surface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock or time. The actual interface between materials may be far more gradual or abrupt than a report indicates. Actual conditions in areas not sampled may differ from predictions. It is thus import to understand the limitations of the investigation and recognise that we are not responsible for these limitations.

This report, including data contained, its findings and conclusions, remain the intellectual property of Envirowest Consulting Pty Ltd. A licence to use the report for the specific purpose identified is granted for the persons identified in that section after full payment for the services involved in preparation of the report. This report should not be used by persons or for purposes other than those stated, and not reproduced without the permission of Envirowest Consulting Pty Ltd.

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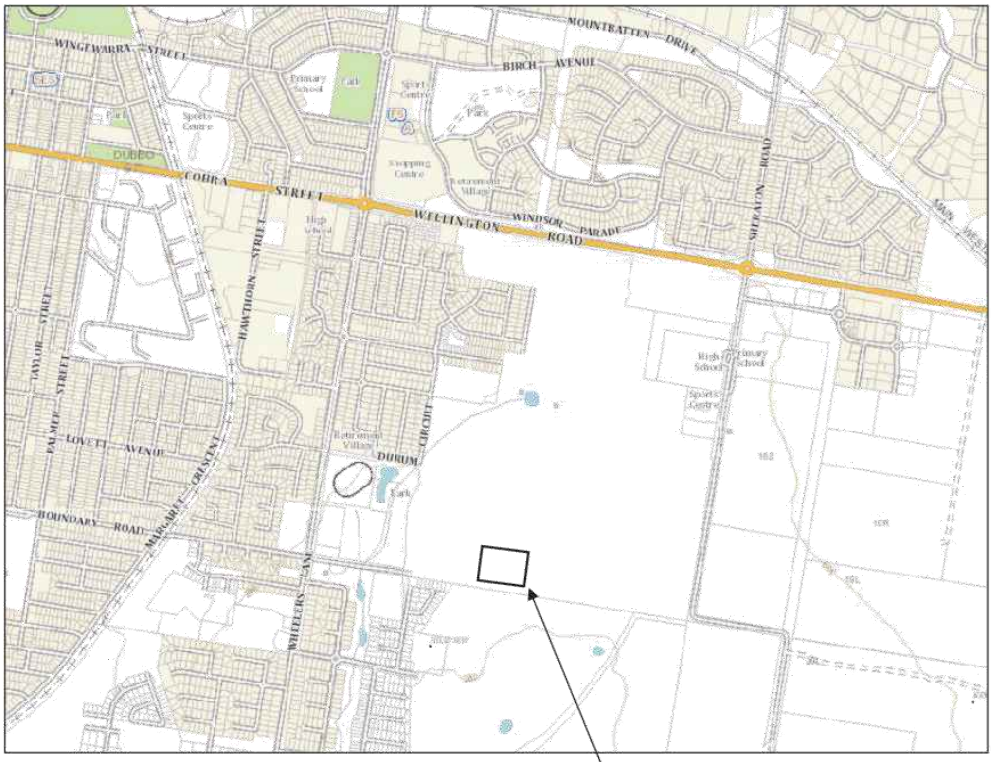

Figure 1. Locality plan		
RSL Club, Part Lot 502 DP1255115, Boundary Road, Dubbo NSW		
	Envirowest Consulting Pty Ltd	
Job: R11858s.1	Drawn by: LD	Date: 9/6/2020



Approximate Scale 1: 4,000

0 40 80 160m

Legend

Investigation area

Figure 2. Aerial photograph		
RSL Club, Part Lot 502 DP1255115, Boundary Road, Dubbo NSW		
	Envirowest Consulting Pty Ltd	
Job: R11858s.1	Drawn by: LD	Date: 10/6/2020

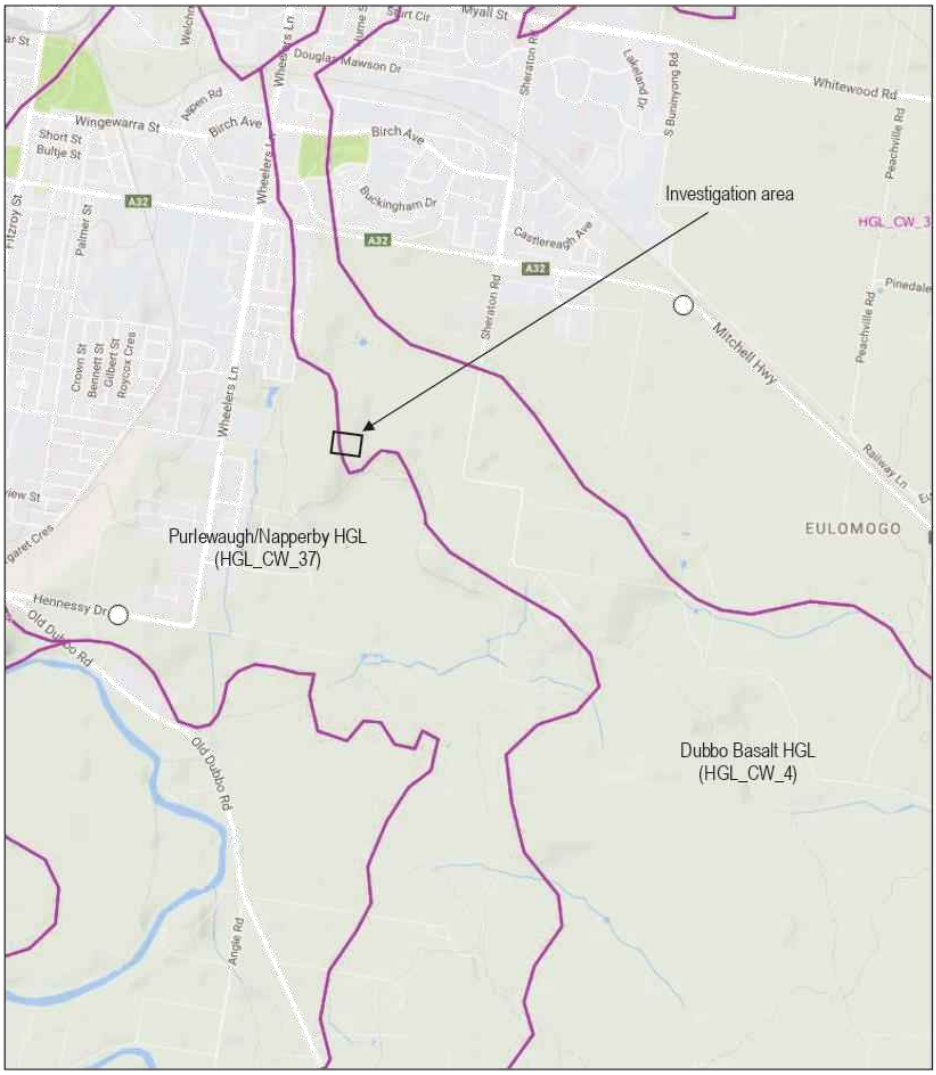

Figure 3. Hydro-geological landscapes (eSpade 2020)		
RSL Club, Part Lot 502 DP1255115, Boundary Road, Dubbo NSW		
	Envirowest Consulting Pty Ltd	
Job: R11858s.1	Drawn by: -	Date: 9/6/2020

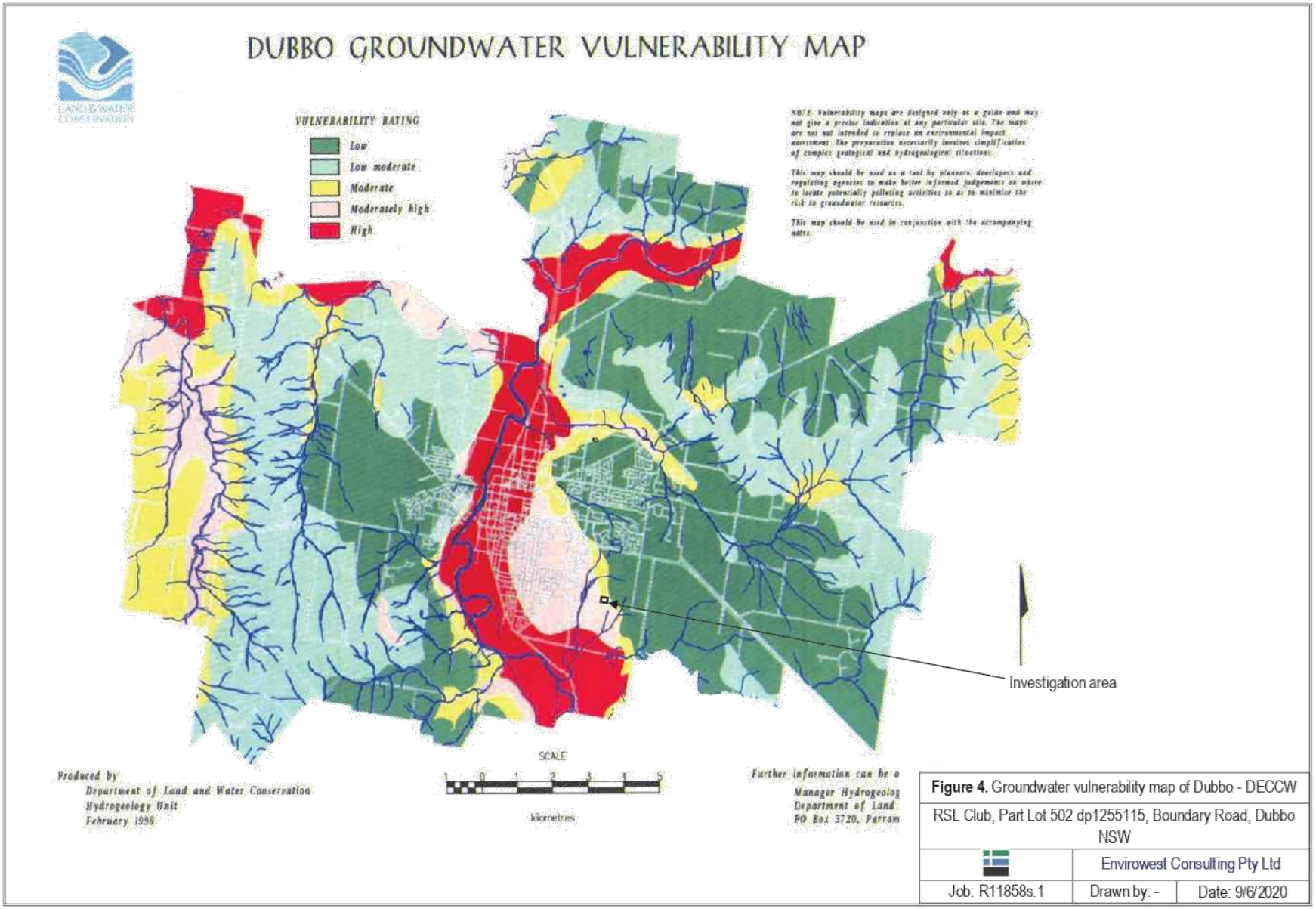

Figure 4. Groundwater vulnerability map of Dubbo - DECCW

RSL Club, Part Lot 502 dp1255115, Boundary Road, Dubbo NSW

Envirowest Consulting Pty Ltd

Job: R11858s.1	Drawn by: -	Date: 9/6/2020

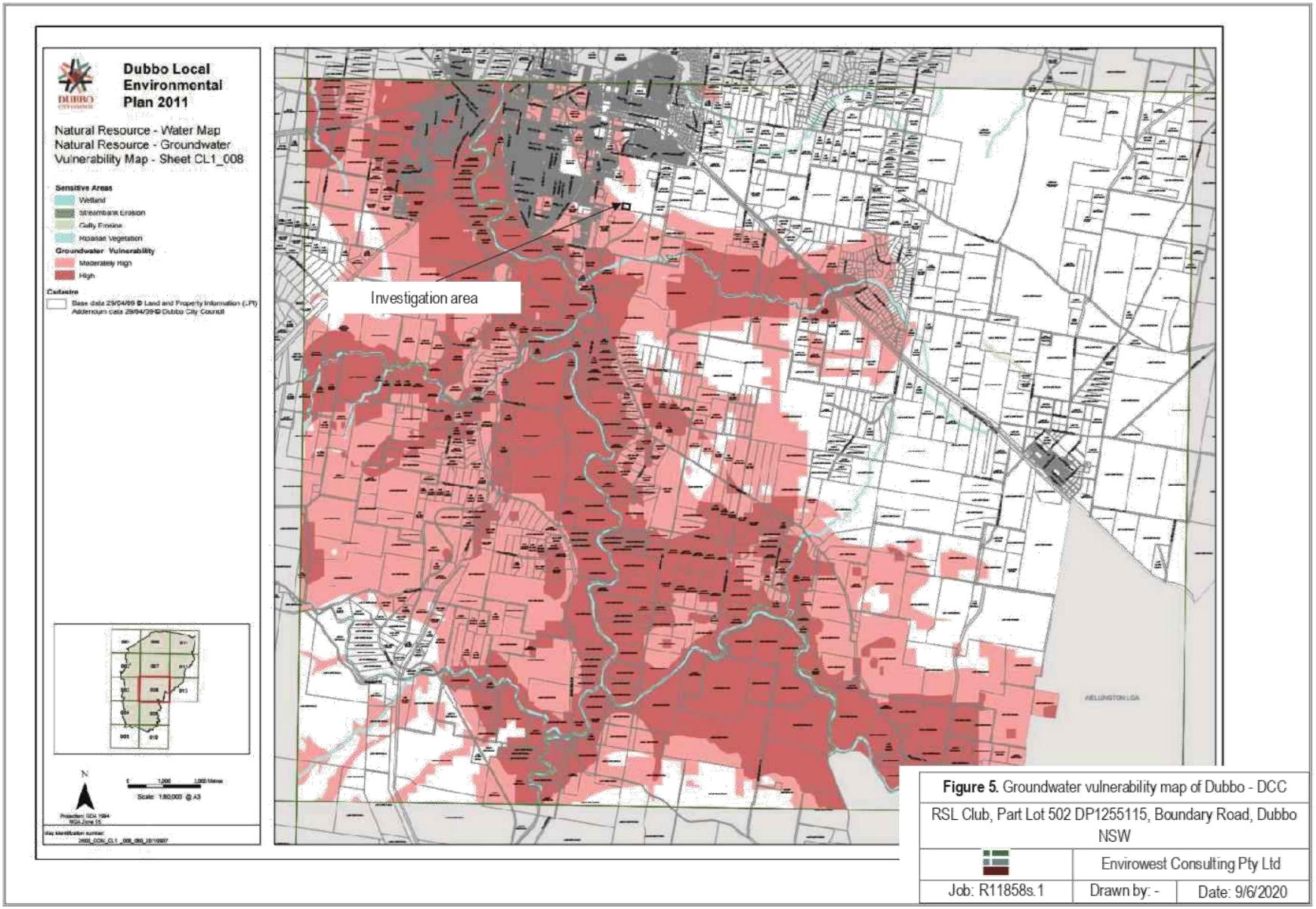

Figure 5. Groundwater vulnerability map of Dubbo - DCC

RSL Club, Part Lot 502 DP1255115, Boundary Road, Dubbo NSW

Envirowest Consulting Pty Ltd

Job: R11858s.1 | Drawn by: - | Date: 9/6/2020



Legend

Investigation area

⊗ Sampling location

Approximate Scale 1: 4,000

0 40 80 160m

Figure 6. Initial investigation locations

RSL Club, Part Lot 502 DP1255115, Boundary Road, Dubbo NSW

Envirowest Consulting Pty Ltd

Job: R11858s.1	Drawn by: LD	Date: 10/6/2020



Legend

Investigation area

⊗ Sampling location

Approximate Scale 1: 4,000

0 40 80 160m

Figure 7. Detailed investigation locations		
RSL Club, Part Lot 502 DP1255115, Boundary Road, Dubbo NSW		
	Envirowest Consulting Pty Ltd	
Job: R11858s.1	Drawn by: LD	Date: 10/6/2020



Approximate Scale 1: 19,000

0 190 360 720m

Figure 8. Location of groundwater bores within 1km of the site

RSL Club, Part Lot 502 DP1255115, Boundary Road, Dubbo NSW

Envirowest Consulting Pty Ltd

Job: R11858s.1	Drawn by: -	Date: 11/6/2020



Figure 9. Dubbo Regional Council Salinity Network

RSL Club, Part Lot 502 DP1255115, Boundary Road, Dubbo NSW

Envirowest Consulting Pty Ltd

Job: R11858s.1 | Drawn by: - | Date: 9/6/2020

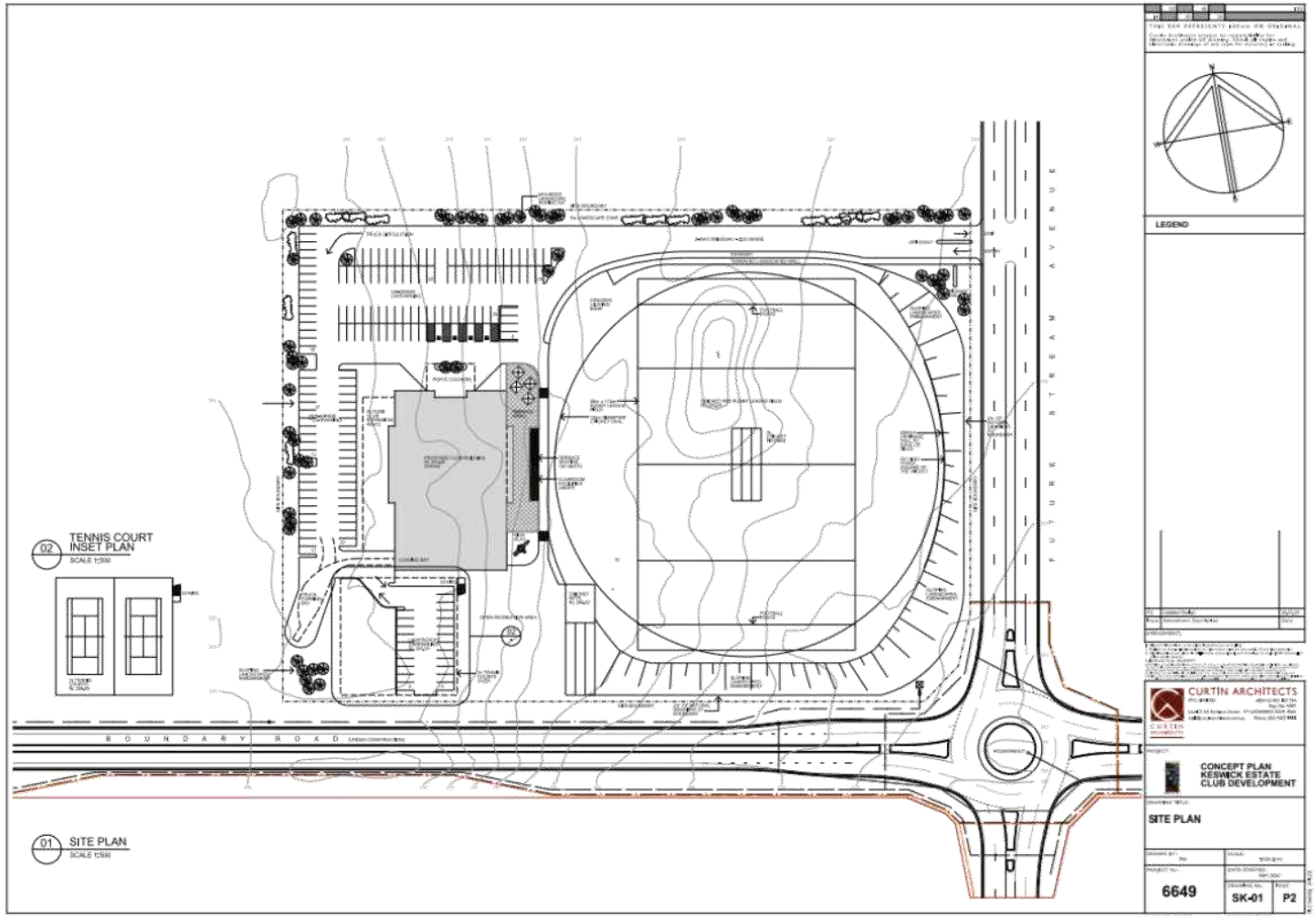

Figure 10. Site development concept plan

RSL Club, Part Lot 502 DP1255115, Boundary Road, Dubbo NSW

Envirowest Consulting Pty Ltd

Job: R11858s.1 | Drawn by: - | Date: 29/7/2020

Figure 11. Photographs of the site







Appendices

Appendix 1. Nutrient and sediment modelling
Appendix 2. Aggressive soils, extract from Australia Standards, AS 2870-2011, 2011
Appendix 3. Details of registered bores within 1km of the site – Water NSW
Appendix 4. Salinity results from the Dubbo Regional Council Salinity Network
Appendix 5. Initial site investigation characteristics
Appendix 6. Field and laboratory sheets
Appendix 7. Reference methods for soil testing
Appendix 8. SGS laboratory report and chain of custody form

Appendix 1. Nutrient and sediment modelling
Land-use export rates for sediments, nitrogen and phosphorus mg/kg/year (Chafer 2003)

	Suspended sediment (kg/ha/yr)		
Land use class	Low	Median	High
Native bushland	20	40	60
Disturbed landscapes	330	870	2290
Remediated gullies	165	435	1145
Cropped	420	570	720
Pine plantations	65	380	680
Improved pasture	140	520	870
Unimproved pasture	140	190	230
Roads (sealed)	140	190	230
Roads (earth)	25	140	500
Urban	30	300	1200
Urban (open space)	160	360	1000
Rural residential	140	190	230
Industrial	180	200	4800
Commercial	180	200	4800
Golf course	0	10	20
Orchard	490	680	870

	Total Nitrogen (kg/ha/yr)		
Land use class	Low	Median	High
Native bushland	0.9	2.4	4
Disturbed landscapes	4.2	12	20
Remediated gullies	2.1	6	10
Cropped	4.2	8.9	13.5
Pine plantations	0.8	2.9	8.3
Improved pasture	4.2	8.9	13.5
Unimproved pasture	1.3	3.2	5.1
Roads (sealed)	2	6	10
Roads (earth)	1.3	2.2	3.1
Urban	2.2	6.1	10
Urban (open space)	1.3	3.2	5.1
Rural residential	2.2	6.1	10
Industrial	4	7.4	10
Commercial	4	7.4	10
Golf course	0	3.2	5
Orchard	1.7	8.9	5

	Total Phosphorus		
Land use class	Low	Median	High
Native bushland	0.01	0.13	0.25
Disturbed landscapes	0.3	1.24	2.2
Remediated gullies	0.15	0.62	1.1
Cropped	0.5	1.35	2.2
Pine plantations	0.1	1.16	2.5
Improved pasture	0.5	1.35	2.2
Unimproved pasture	0.1	0.17	0.25
Roads (sealed)	0.3	1.8	3.4
Roads (earth)	0.3	1.72	3.2
Urban	0.2	1.82	3.6
Urban (open space)	0.1	0.17	0.25
Rural residential	0.2	1.72	3.6
Industrial	1.4	1.82	2.2
Commercial	1.4	1.8	2.2
Golf course	0	0.3	3.6
Orchard	0.1	0.3	0.5

Sediment export kg/yr

LOW	PRE	POST	IMPACT
Native bushland	0.00	0.00	0.00
Disturbed landscapes	0.00	0.00	0.00
Remediated gullies	0.00	0.00	0.00
Cropped	0.00	0.00	0.00
Pine plantations	0.00	0.00	0.00
Improved pasture	462.00	0.00	462.00
Unimproved pasture	0.00	0.00	0.00
Roads (sealed)	0.00	126.00	-126.00
Roads (earth)	0.00	0.00	0.00
Urban	0.00	7.50	-7.50
Urban (open space)	0.00	344.00	-344.00
Rural residential	0.00	0.00	0.00
Industrial	0.00	0.00	0.00
Commercial	0.00	0.00	0.00
Golf course	0.00	0.00	0.00
Orchard	0.00	0.00	0.00
TOTAL	**462.00**	**477.50**	**-15.50**

MEDIAN	PRE	POST	IMPACT
Native bushland	0.00	0.00	0.00
Disturbed landscapes	0.00	0.00	0.00
Remediated gullies	0.00	0.00	0.00
Cropped	0.00	0.00	0.00
Pine plantations	0.00	0.00	0.00
Improved pasture	1716.00	0.00	1716.00
Unimproved pasture	0.00	0.00	0.00
Roads (sealed)	0.00	171.00	-171.00
Roads (earth)	0.00	0.00	0.00
Urban	0.00	75.00	-75.00
Urban (open space)	0.00	774.00	-774.00
Rural residential	0.00	0.00	0.00
Industrial	0.00	0.00	0.00
Commercial	0.00	0.00	0.00
Golf course	0.00	0.00	0.00
Orchard	0.00	0.00	0.00
TOTAL	**1716.00**	**1020.00**	**696.00**

HIGH	PRE	POST	IMPACT
Native bushland	0.00	0.00	0.00
Disturbed landscapes	0.00	0.00	0.00
Remediated gullies	0.00	0.00	0.00
Cropped	0.00	0.00	0.00
Pine plantations	0.00	0.00	0.00
Improved pasture	2871.00	0.00	2871.00
Unimproved pasture	0.00	0.00	0.00
Roads (sealed)	0.00	207.00	-207.00
Roads (earth)	0.00	0.00	0.00
Urban	0.00	300.00	-300.00
Urban (open space)	0.00	2150.00	-2150.00
Rural residential	0.00	0.00	0.00
Industrial	0.00	0.00	0.00
Commercial	0.00	0.00	0.00
Golf course	0.00	0.00	0.00
Orchard	0.00	0.00	0.00
TOTAL	**2871.00**	**2657.00**	**214.00**

Total Nitrogen kg/yr

LOW	PRE	POST	IMPACT
Native bushland	0.00	0.00	0.00
Disturbed landscapes	0.00	0.00	0.00
Remediated gullies	0.00	0.00	0.00
Cropped	0.00	0.00	0.00
Pine plantations	0.00	0.00	0.00
Improved pasture	13.86	0.00	13.86
Unimproved pasture	0.00	0.00	0.00
Roads (sealed)	0.00	1.80	-1.80
Roads (earth)	0.00	0.00	0.00
Urban	0.00	0.55	-0.55
Urban (open space)	0.00	2.80	-2.80
Rural residential	0.00	0.00	0.00
Industrial	0.00	0.00	0.00
Commercial	0.00	0.00	0.00
Golf course	0.00	0.00	0.00
Orchard	0.00	0.00	0.00
TOTAL	**13.86**	**5.15**	**8.72**

MEDIAN	PRE	POST	IMPACT
Native bushland	0.00	0.00	0.00
Disturbed landscapes	0.00	0.00	0.00
Remediated gullies	0.00	0.00	0.00
Cropped	0.00	0.00	0.00
Pine plantations	0.00	0.00	0.00
Improved pasture	29.37	0.00	29.37
Unimproved pasture	0.00	0.00	0.00
Roads (sealed)	0.00	5.40	-5.40
Roads (earth)	0.00	0.00	0.00
Urban	0.00	1.53	-1.53
Urban (open space)	0.00	6.88	-6.88
Rural residential	0.00	0.00	0.00
Industrial	0.00	0.00	0.00
Commercial	0.00	0.00	0.00
Golf course	0.00	0.00	0.00
Orchard	0.00	0.00	0.00
TOTAL	**29.37**	**13.81**	**15.57**

HIGH	PRE	POST	IMPACT
Native bushland	0.00	0.00	0.00
Disturbed landscapes	0.00	0.00	0.00
Remediated gullies	0.00	0.00	0.00
Cropped	0.00	0.00	0.00
Pine plantations	0.00	0.00	0.00
Improved pasture	44.55	0.00	44.55
Unimproved pasture	0.00	0.00	0.00
Roads (sealed)	0.00	9.00	-9.00
Roads (earth)	0.00	0.00	0.00
Urban	0.00	2.50	-2.50
Urban (open space)	0.00	10.97	-10.97
Rural residential	0.00	0.00	0.00
Industrial	0.00	0.00	0.00
Commercial	0.00	0.00	0.00
Golf course	0.00	0.00	0.00
Orchard	0.00	0.00	0.00
TOTAL	**44.55**	**22.47**	**22.09**

Total Phosphorus kg/yr

LOW	PRE	POST	IMPACT
Native bushland	0.00	0.00	0.00
Disturbed landscapes	0.00	0.00	0.00
Remediated gullies	0.00	0.00	0.00
Cropped	0.00	0.00	0.00
Pine plantations	0.00	0.00	0.00
Improved pasture	1.65	0.00	1.65
Unimproved pasture	0.00	0.00	0.00
Roads (sealed)	0.00	0.27	-0.27
Roads (earth)	0.00	0.00	0.00
Urban	0.00	0.05	-0.05
Urban (open space)	0.00	0.22	-0.22
Rural residential	0.00	0.00	0.00
Industrial	0.00	0.00	0.00
Commercial	0.00	0.00	0.00
Golf course	0.00	0.00	0.00
Orchard	0.00	0.00	0.00
TOTAL	**1.65**	**0.54**	**1.12**

MEDIAN	PRE	POST	IMPACT
Native bushland	0.00	0.00	0.00
Disturbed landscapes	0.00	0.00	0.00
Remediated gullies	0.00	0.00	0.00
Cropped	0.00	0.00	0.00
Pine plantations	0.00	0.00	0.00
Improved pasture	4.46	0.00	4.46
Unimproved pasture	0.00	0.00	0.00
Roads (sealed)	0.00	1.62	-1.62
Roads (earth)	0.00	0.00	0.00
Urban	0.00	0.46	-0.46
Urban (open space)	0.00	0.37	-0.37
Rural residential	0.00	0.00	0.00
Industrial	0.00	0.00	0.00
Commercial	0.00	0.00	0.00
Golf course	0.00	0.00	0.00
Orchard	0.00	0.00	0.00
TOTAL	**4.46**	**2.44**	**2.01**

HIGH	PRE	POST	IMPACT
Native bushland	0.00	0.00	0.00
Disturbed landscapes	0.00	0.00	0.00
Remediated gullies	0.00	0.00	0.00
Cropped	0.00	0.00	0.00
Pine plantations	0.00	0.00	0.00
Improved pasture	7.26	0.00	7.26
Unimproved pasture	0.00	0.00	0.00
Roads (sealed)	0.00	3.06	-3.06
Roads (earth)	0.00	0.00	0.00
Urban	0.00	0.90	-0.90
Urban (open space)	0.00	0.54	-0.54
Rural residential	0.00	0.00	0.00
Industrial	0.00	0.00	0.00
Commercial	0.00	0.00	0.00
Golf course	0.00	0.00	0.00
Orchard	0.00	0.00	0.00
TOTAL	**7.26**	**4.50**	**2.76**

Appendix 2. Aggressive soils, extract from Australian Standards, *AS 2870-2011*, 2011

Exposure classification for concrete in saline soils

Saturated extract electrical conductivity (EC_e), *dS/m*	Exposure classification
<4	A1
4-8	A2
8-16	B1
>16	B2

Notes:
1. Guidance on concrete in saline soils can be found in CCAA T56
2. Exposure classifications are from AS 3600
3. The currently accepted method of determining the salinity level of the soil is by measuring the extract electrical conductivity (*EC*) of a soil and water mixture in deciSiemens per metre (dS/m) and using conversion factors that allow for the soil texture, to determine the saturated extract electrical conductivity (EC_e)
4. The division between a non-saline and saline soil is generally regarded as an EC_e value of 4dS/m, therefore no increase in the minimum concrete strength is required below this value

Exposure classification for concrete in sulfate soils

Exposure conditions			Exposure classification	
Sulfates (expressed as SO_4)*		pH	Soil conditions A**	Soil conditions B†
In soil (ppm)	In groundwater (ppm)			
<5,000	<1,000	>5.5	A2	A1
5,000-10,000	1,000-3,000	4.5-5.5	B1	A2
10,000-20,000	3,000-10,000	4-4.5	B2	B1
>20,000	>10,000	<4	C2	B2

* Approximately 100ppm SO_4 = 80ppm SO_3
** Soil conditions A – high permeability soils (e.g. sands and gravels) that are in groundwater
† Soil conditions B – low permeability soils (e.g. silts and clays) or all soils above groundwater

Minimum design characteristic strength (f_c') and curing requirements for concrete

Exposure classification	Minimum f_c' MPa	Minimum initial curing requirement
A1	20	Cure continuously for at least 3 days
A2	25	
B1	32	Cure continuously for at least 7 days
B2	40	
C1	≥50	
C2	≥50	

Minimum reinforcement cover for concrete

Exposure classification	Minimum cover in saline soils * mm	Minimum cover in sulfate soils ** (mm)
A1	See Clause 5.3.2	40
A2	45	50
B1	50	60
B2	55	65
C1	†	70
C2	†	85

* Where a damp-proofing membrane is installed, the minimum reinforcement cover in saline soils may be reduced to 30mm.
** Where a damp-proofing membrane is installed, the minimum reinforcement cover in sulfate soils may be reduced by 10mm.
† Saline soils have a maximum exposure classification of B2.

Appendix 3. Details of registered bores within 1km of the site – Water NSW

Bore record No. (Figure 8)	Eastings	Northings	Drilled / Completed depth (m)	Salinity description	Water bearing zones (m)	Standing water level (m)	Date drilled and or tested	Purpose
GW801091	653375	6428652	36	-	-	-	-	Industrial/ Irrigation
GW802624	653684	6428788	9	-	7-9	-	2005	Monitoring
GW042218	653505	6428921	18.3	-	-	18.4	1953	Stock, domestic (abandoned)
GW802625	654071	6429259	3.5	-	2.5-3.5	-	2006	Monitoring
GW802554	654491	6428905	9	-	6.5-7.5	-	2004	Monitoring
GW801343	654944	6428486	59	-	-	-	1992	Unknown (backfilled)
GW801344	655053	6428466	32	-	-	-	1992	Unknown (backfilled)
GW801345	655153	6428459	34	-	-	-	1992	Unknown (backfilled)
GW802528	654952	6428393	3	-	2-3	2.9	2004	Monitoring
GW005558	654961	6428252	57.9	-	26.2-33.8	18.3	1959	Stock
GW801338	654839	6428083	149	-	-	-	1992	Unknown (backfilled)
GW055350	653851	6427529	21.6	-	-	-	-	Stock/ Domestic
GW802620	653174	6427798	6	-	5-6	5.47	2005	Monitoring
GW803790	653138	6428168	43.9	Good	0-39.3	30	1988	Stock, domestic (Abandoned)
GW804712	653140	6428170	52	Good	42-49	32.8	2011	Domestic
GW055352	652647	6428616	99.7	Good	30.4-31.3	32.9	1973	Public

Appendix 4. Salinity and Standing Water Level (SWL) data from Dubbo Regional Council Salinity Network

Dubbo Regional Council Salinity Network site number (Figure 9)		DCC19	DCC44	DCC45	DCC115	DCC116
Sampling date	**Drilled depth (m)**	**3**	**6**	**9**	**9**	**3.5**
Mar-05	EC(dS/m)	TSTB	-	-	-	-
	SWL (m)	2.90	DRY	DRY	DRY	DRY
Apr-05	EC(dS/m)	TSTB	TSTB	0.30	-	-
	SWL (m)	2.83	6	6.80	DRY	DRY
May-05	EC(dS/m)	-	-	0.30	-	-
	SWL (m)	-	DRY	5.87	DRY	DRY
Jun-05	EC(dS/m)	-	-	1.40	-	-
	SWL (m)	-	DRY	5.95	DRY	DRY
Jul-05	EC(dS/m)	-	-	1.30	0.3	-
	SWL (m)	-	DRY	6.90	7.01	DRY
Aug-05	EC(dS/m)	-	-	1.30	0.4	-
	SWL (m)	-	DRY	7.40	8.0	DRY
Sep-05	EC(dS/m)	-	-	-	0.1	-
	SWL (m)	-	DRY	8.76	5.87	DRY
Oct-05	EC(dS/m)	TSTB	-	0.90	0.2	0.7
	SWL (m)	2.75	DRY	7.45	6.37	2.3
Nov-05	EC(dS/m)	-	-	-	0.2	-
	SWL (m)	-	DRY	7.40	6.4	DRY
Dec-05	EC(dS/m)	-	-	DRY	-	-
	SWL (m)	DRY	DRY	DRY	DRY	DRY
Jan-06	EC(dS/m)	-	-	DRY	0.3	-
	SWL (m)	DRY	DRY	DRY	8.0	DRY
Feb-06	EC(dS/m)	-	-	TSTB	TSTB	TSTB
	SWL (m)	DRY	DRY	8.75	8.5	3.26
Mar-06	EC(dS/m)	-	-	DRY	-	-
	SWL (m)	DRY	DRY	DRY	DRY	DRY
Apr-06	EC(dS/m)	-	-	0.90	-	-
	SWL (m)	DRY	DRY	4.60	DRY	DRY
May-06	EC(dS/m)	-	-	0.70	-	TSTB
	SWL (m)	DRY	DRY	3.29	DRY	3.26
Jun-06	EC(dS/m)	-	-	1.00	-	TSTB
	SWL (m)	DRY	DRY	4.25	DRY	3.3
Jul-06	EC(dS/m)	-	-	0.90	0.1	-
	SWL (m)	DRY	DRY	2.87	5.75	DRY
Aug-06	EC(dS/m)	-	-	0.80	0.3	-
	SWL (m)	DRY	DRY	7.42	7.59	DRY
Sep-06	EC(dS/m)	-	-	0.90	-	-
	SWL (m)	DRY	DRY	8.45	DRY	DRY
Oct-06	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	DRY	DRY
Nov-06	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	DRY	DRY
Dec-06	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	DRY	DRY
Jan-07	EC(dS/m)	-	-	0.80	-	TSTB
	SWL (m)	DRY	DRY	7.5	DRY	3.29
Feb-07	EC(dS/m)	-	-	0.90	-	TSTB
	SWL (m)	DRY	DRY	4.96	DRY	3.3
Mar-07	EC(dS/m)	-	-	0.80	-	-
	SWL (m)	DRY	DRY	7.43	DRY	DRY
Apr-07	EC(dS/m)	-	-	1.80	-	TSTB
	SWL (m)	DRY	DRY	7.46	DRY	3.3

TSTB – Too shallow to bail

Dubbo Regional Council Salinity Network site number (Figure 9)		DCC19	DCC44	DCC45	DCC115	DCC116
Sampling date	Drilled depth (m)	3	6	9	9	3.5
May-07	EC(dS/m)	-	-	0.80	TSTB	TSTB
	SWL (m)	DRY	DRY	7.09	6.33	3.3
Jun-07	EC(dS/m)	TSTB	-	0.70	-	TSTB
	SWL (m)	2.79	DRY	7.47	5.47	3.32
Jul-07	EC(dS/m)	-	-	0.90	-	TSTB
	SWL (m)	DRY	DRY	7.62	DRY	3.25
Aug-07	EC(dS/m)	TSTB	-	0.90	-	-
	SWL (m)	2.69	DRY	7.31	DRY	DRY
Sep-07	EC(dS/m)	TSTB	-	0.90	-	-
	SWL (m)	2.75	DRY	7.33	DRY	DRY
Oct-07	EC(dS/m)	-	-	TSTB	-	-
	SWL (m)	DRY	DRY	8.69	DRY	DRY
Nov-07	EC(dS/m)	-	-	TSTB	-	-
	SWL (m)	DRY	DRY	8.74	DRY	DRY
Dec-07	EC(dS/m)	-	-	TSTB	-	-
	SWL (m)	DRY	DRY	8.28	DRY	DRY
Jan-08	EC(dS/m)	-	-	TSTB	-	TSTB
	SWL (m)	DRY	DRY	7.79	DRY	3.29
Feb-08	EC(dS/m)	-	-	DRY	-	-
	SWL (m)	DRY	DRY	DRY	DRY	DRY
Mar-08	EC(dS/m)	-	-	0.50	-	-
	SWL (m)	-	DRY	7.30	DRY	DRY
Apr-08	EC(dS/m)	-	-	DRY	-	-
	SWL (m)	-	DRY	DRY	DRY	DRY
May-08	EC(dS/m)	-	-	DRY	-	-
	SWL (m)	-	DRY	DRY	DRY	DRY
Jun-08	EC(dS/m)	-	-	DRY	-	-
	SWL (m)	-	DRY	DRY	DRY	DRY
Jul-08	EC(dS/m)	-	-	-	-	-
	SWL (m)	-	DRY	DRY	DRY	DRY
Aug-08	EC(dS/m)	-	-	7.90	-	-
	SWL (m)	-	DRY	6.25	DRY	DRY
Sep-08	EC(dS/m)	-	-	0.90	0.2	-
	SWL (m)	-	DRY	6.56	6.2	DRY
Oct-08	EC(dS/m)	-	-	-	-	-
	SWL (m)	-	DRY	DRY	DRY	DRY
Nov-08	EC(dS/m)	-	-	0.7	0.2	-
	SWL (m)	-	DRY	7.4	6.08	DRY
Dec-08	EC(dS/m)	-	-	1.00	0.5	-
	SWL (m)	-	DRY	8.47	7.32	DRY
Jan-09	EC(dS/m)	-	-	-	-	-
	SWL (m)	-	DRY	DRY	DRY	DRY
Feb-09	EC(dS/m)	-	-	-	-	-
	SWL (m)	-	DRY	DRY	DRY	DRY
Mar-09	EC(dS/m)	-	-	1.01	-	-
	SWL (m)	-	DRY	6.6	DRY	DRY
Apr-09	EC(dS/m)	-	-	1.14	-	-
	SWL (m)	-	DRY	7.41	DRY	DRY
May-09	EC(dS/m)	-	-	-	-	-
	SWL (m)	-	DRY	DRY	DRY	DRY
Jun-09	EC(dS/m)	-	-	-	-	-
	SWL (m)	-	DRY	DRY	DRY	DRY
Jul-09	EC(dS/m)	-	-	0.96	-	-
	SWL (m)	-	DRY	7.35	DRY	DRY

TSTB – Too shallow to bail

Dubbo Regional Council Salinity Network site number (Figure 9)		DCC19	DCC44	DCC45	DCC115	DCC116
Sampling date	Drilled depth (m)	3	6	9	9	3.5
Aug-09	EC(dS/m)	-	-	1.08	-	-
	SWL (m)	DRY	DRY	7.96	DRY	DRY
Sep-09	EC(dS/m)	-	-	1.23	-	-
	SWL (m)	DRY	DRY	8.15	DRY	DRY
Oct-09	EC(dS/m)	-	-	TSTB	0.52	-
	SWL (m)	DRY	DRY	8.79	7.38	DRY
Nov-09	EC(dS/m)	-	-	1.50	-	-
	SWL (m)	DRY	DRY	8.52	DRY	DRY
Dec-09	EC(dS/m)	-	-	1.33	-	-
	SWL (m)	DRY	DRY	7.83	DRY	DRY
Jan-10	EC(dS/m)	-	-	-	-	TSTB
	SWL (m)	DRY	DRY	DRY	DRY	3.41
Feb-10	EC(dS/m)	-	-	TSTB	-	0.4
	SWL (m)	DRY	DRY	8.74	-	2.33
Mar-10	EC(dS/m)	-	-	-	0.4	-
	SWL (m)	DRY	DRY	DRY	7.47	DRY
Apr-10	EC(dS/m)	TSTB	-	TSTB	-	0.31
	SWL (m)	2.87	DRY	8.95	-	1.43
May-10	EC(dS/m)	-	-	-	DRY	0.51
	SWL (m)	DRY	DRY	DRY	DRY	1.57
Jun-10	EC(dS/m)	-	-	-	-	0.47
	SWL (m)	DRY	DRY	DRY	-	0.3
Jul-10	EC(dS/m)	-	-	-	-	0.62
	SWL (m)	DRY	DRY	DRY	-	0.59
Aug-10	EC(dS/m)	-	-	0.87	-	0.78
	SWL (m)	DRY	DRY	7.55	-	0.74
Sep-10	EC(dS/m)	-	-	0.75	-	0.67
	SWL (m)	DRY	DRY	7.36	-	1.03
Oct-10	EC(dS/m)	-	-	-	-	0.32
	SWL (m)	DRY	DRY	DRY	-	2.45
Nov-10	EC(dS/m)	-	-	0.38	-	-
	SWL (m)	DRY	DRY	3.68	-	-
Dec-10	EC(dS/m)	-	-	0.56	-	0.74
	SWL (m)	DRY	DRY	5.09	-	1.84
Jan-11	EC(dS/m)	-	-	0.75	-	-
	SWL (m)	DRY	DRY	6.50	-	DRY
Feb-11	EC(dS/m)	-	-	1.06	-	-
	SWL (m)	DRY	DRY	8.21	DRY	DRY
Mar-11	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	DRY	DRY
Apr-11	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	DRY	DRY
May-11	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	DRY	DRY
Jun-11	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	DRY	DRY
Jul-11	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	DRY	DRY
Aug-11	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	DRY	DRY
Sep-11	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	DRY	DRY
Oct-11	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	DRY	DRY

TSTB – Too shallow to bail

Dubbo Regional Council Salinity Network site number (Figure 9)		DCC19	DCC44	DCC45	DCC115	DCC116
Sampling date	Drilled depth (m)	3	6	9	9	3.5
Nov-11	EC(dS/m)	TSTB	-	-	-	2.47
	SWL (m)	2.93	DRY	DRY	DRY	1.23
Dec-11	EC(dS/m)	-	-	1.14	-	1.56
	SWL (m)	DRY	DRY	7.3	DRY	0.95
Jan-12	EC(dS/m)	-	-	1.22	-	-
	SWL (m)	DRY	DRY	7.48	DRY	DRY
Feb-12	EC(dS/m)	-	-	1.31	-	-
	SWL (m)	DRY	DRY	7.4	-	-
Mar-12	EC(dS/m)	TSTB	-	1.88	-	-
	SWL (m)	2.82	DRY	8.03	-	-
Apr-12	EC(dS/m)	-	-	2.14	-	-
	SWL (m)	DRY	DRY	8.62	-	-
May-12	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	-	-
Jun-12	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	-	-
Jul-12	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	-	-
Aug-12	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	-	-
Sep-12	EC(dS/m)	-	-	1.04	-	-
	SWL (m)	DRY	DRY	7.5	-	-
Oct-12	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	-	-
Nov-12	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	-	-
Dec-12	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	-	-
Jan-13	EC(dS/m)	-	-	1.31	-	-
	SWL (m)	DRY	DRY	7.53	-	-
Feb-13	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	-	DRY
Mar-13	EC(dS/m)	-	-	-	-	0.54
	SWL (m)	DRY	DRY	DRY	-	1.58
Apr-13	EC(dS/m)	-	-	-	-	0.3
	SWL (m)	DRY	DRY	DRY	-	1.63
May-13	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	-	DRY
Jun-13	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	-	DRY
Jul-13	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	-	DRY
Aug-13	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	-	-
Sep-13	EC(dS/m)	-	-	TSTB	-	-
	SWL (m)	DRY	DRY	8.68	-	-
Oct-13	EC(dS/m)	-	-	TSTB	-	-
	SWL (m)	DRY	DRY	8.68	-	-
Nov-13	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	-	-
Dec-13	EC(dS/m)	-	-	1.05	-	-
	SWL (m)	DRY	DRY	7.98	-	-
Jan-14	EC(dS/m)	-	-	1.24	-	-
	SWL (m)	DRY	DRY	5.60	-	-

TSTB – Too shallow to bail

Dubbo Regional Council Salinity Network site number (Figure 9)		DCC19	DCC44	DCC45	DCC115	DCC116
Sampling date	Drilled depth (m)	3	6	9	9	3.5
Feb-14	EC(dS/m)	-	-	1.09	-	-
	SWL (m)	DRY	DRY	5.42	-	-
Mar-14	EC(dS/m)	-	-	1.25	-	-
	SWL (m)	DRY	DRY	6.08	-	-
Apr-14	EC(dS/m)	-	-	1.11	-	-
	SWL (m)	DRY	DRY	6.24	-	-
May-14	EC(dS/m)	-	-	0.94	-	-
	SWL (m)	DRY	DRY	5.98	-	-
Jun-14	EC(dS/m)	-	-	0.99	-	-
	SWL (m)	DRY	DRY	6.03	-	-
Jul-14	EC(dS/m)	-	-	1.03	-	-
	SWL (m)	DRY	DRY	6.20	-	-
Aug-14	EC(dS/m)	-	-	1.19	-	-
	SWL (m)	DRY	DRY	6.89	-	-
Sep-14	EC(dS/m)	-	-	-	-	-
	SWL (m)	-	-	-	-	-
Oct-14	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	-	-
Nov-14	EC(dS/m)	TSTB	-	1.35	-	-
	SWL (m)	2.85	DRY	7.95	-	-
Dec-14	EC(dS/m)	TSTB	-	1.34	-	-
	SWL (m)	2.80	DRY	7.90	-	-
Jan-15	EC(dS/m)	0.87	-	1.25	-	-
	SWL (m)	2.51	DRY	6.61	-	-
Mar-15	EC(dS/m)	-	-	1.15	-	-
	SWL (m)	DRY	DRY	5.91	-	-
May-15	EC(dS/m)	-	-	1.19	-	-
	SWL (m)	DRY	DRY	7.02	-	-
Jul-15	EC(dS/m)	-	-	1.03	-	-
	SWL (m)	DRY	DRY	6.41	-	-
Sep-15	EC(dS/m)	-	-	1.09	-	-
	SWL (m)	DRY	DRY	7.85	-	-
Nov-15	EC(dS/m)	-	-	1.35	-	-
	SWL (m)	DRY	DRY	7.90	-	-
Jan-16	EC(dS/m)	-	0.65	2.13	-	0.15
	SWL (m)	DRY	1.29	7.50	-	2.14
Mar-16	EC(dS/m)	-	0.92	2.42	-	0.84
	SWL (m)	DRY	1.87	7.71	-	2.28
May-16	EC(dS/m)	-	1.69	1.69	-	0.94
	SWL (m)	DRY	7.31	7.31	-	2.49
Jul-16	EC(dS/m)	-	0.79	1.25	-	0.99
	SWL (m)	DRY	2.41	6.60	-	2.88
Sep-16	EC(dS/m)	-	0.58	1.17	-	0.84
	SWL (m)	DRY	2.15	6.31	-	2.69
Nov-16	EC(dS/m)	-	0.87	1.17	-	0.96
	SWL (m)	DRY	2.66	7.04	-	2.02
Jan-17	EC(dS/m)	0.81	0.76	1.51	-	0.96
	SWL (m)	2.89	1.99	7.21	-	2.02
Mar-17	EC(dS/m)	0.97	0.88	1.50	-	0.84
	SWL (m)	2.54	1.81	7.01	-	2.09
May-17	EC(dS/m)	1.03	0.85	1.84	-	0.89
	SWL (m)	2.79	2.00	7.19	-	2.24
Jul-17	EC(dS/m)	-	0.70	1.39	-	0.99
	SWL (m)	DRY	2.17	6.50	-	2.77

TSTB – Too shallow to bail

Dubbo Regional Council Salinity Network site number (Figure 9)		DCC19	DCC44	DCC45	DCC115	DCC116
Sampling date	**Drilled depth (m)**	**3**	**6**	**9**	**9**	**3.5**
Sep-17	EC(dS/m)	-	-	-	-	1.04
	SWL (m)	DRY	DRY	DRY	-	2.94
Nov-17	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	-	-
Jan-18	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	-	-
Mar-18	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	-	DRY
May-18	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	-	DRY
Jul-18	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	-	-
Sep-18	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	-	-
Nov-18	EC(dS/m)	-	-	1.35	-	-
	SWL (m)	DRY	DRY	7.43	-	-
Jan-19	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	-	-
Mar-19	EC(dS/m)	-	-	-	-	-
	SWL (m)	DRY	DRY	DRY	-	-

TSTB – Too shallow to bail

Appendix 5. Initial site investigation characteristics

Location (Figure 6)	Vegetation	Slope (%)	Bare areas	Indicators of salinity	Surface rocks	Trees (within 50m)
A1	Pasture grasses, mallow, variegated thistle, broad leaved weeds	2-4% E	Nil	Nil	Nil	Nil
A2	Hedge mustard, mallow	2-4% E	Nil	Nil	Nil	Yes, eucalypt
A3	Hedge mustard, mallow	2-4% E	Bare area from track	Nil	Nil	Nil
A4	Paddy melon, variegated thistle, broad leaved weeds	2-4% E	Nil	Nil	Nil	Nil
B1	Pasture grasses, mallow, variegated thistle, broad leaved weeds	2-4% E	Nil	Nil	Nil	Nil
B2	Hedge mustard, mallow	2-4% E	Nil	Nil	Nil	Yes, robinia
B3	Hedge mustard, mallow	2-4% E	Nil	Nil	Nil	Yes, robinia
B4	Paddy melon, variegated thistle, broad leaved weeds	2-4% E	Bare area from track	Nil	Nil	Nil
C1	Pasture grasses, mallow, variegated thistle, broad leaved weeds	2-4% E	Nil	Nil	Surface rocks	Yes, robinia
C2	Hedge mustard, mallow	2-4% E	Nil	Nil	Surface rocks	Yes, robinia
C3	Hedge mustard, mallow	2% E	Nil	Nil	Nil	Yes, robinia
C4	Paddy melon, variegated thistle, broad leaved weeds	2% E	Bare area from track	Nil	Nil	Nil

Appendix 5. Field and laboratory sheets

Salinity assessment

Client: The Planning Hub			**Job no:** 11858	**Date:**	18/5/2020
Address:	Part Lot 502 DP1255115 Boundary Road, Dubbo				
Borehole:	1	**GPS:**	55H 654074mE 6428365mN		

Surface description

Slope:	2-4%	Aspect:	South east
Morphological type:	Mid-slope		
Land-use:	Grazing/vacant/stockpiles		
Disturbance:	High		
Erosion:	Nil		
Coarse fragments:	Nil on surface		
Surface cover:	Hedge mustard, mallow, grasses		
% surface cover	98%		
Salinity:	Nil		

Sub-surface description

Sample method: EVH		Logged by: LN					
Depth (mm)	Soil description (texture, colour, coarse fragments, mottles, roots, structure)	Sample	M/D	pH (1:5 water)	EC (dS/m)	ECe	Emerson aggregate test
0 to 100	Dark brown loamy sand with gravel	X	M	8.9	0.05	1.15	5
100 to 400	Yellowish brown silty clay with gravel	X	M	8.7	0.17	1.28	5
		X		9.0	0.09	0.68	5
400 to 900	Dark brown silty clay	X		8.9	0.16	1.20	3
900 to 1700	Reddish brown light clay with gravel	X	M	8.8	0.17	1.28	3
		X		8.9	0.23	1.73	3
		X		9.0	0.31	2.33	3
1700	End of hole, refusal on basalt						
Notes: Nil							

Salinity assessment

Client: The Planning Hub		**Job no:** 11858	**Date:** 18/5/2020
Address:	Part Lot 502 DP1255115 Boundary Road, Dubbo		
Borehole:	2	**GPS:**	55H 654032mE 6428396mN

Surface description

Slope:	2-4%	Aspect:	East
Morphological type:	Mid-slope		
Land-use:	Grazing/vacant/stockpiles		
Disturbance:	High		
Erosion:	Nil		
Coarse fragments:	Nil on surface		
Surface cover:	Hedge mustard, mallow, grasses		
% surface cover	100%		
Salinity:	Nil		

Sub-surface description

Sample method: EVH		Logged by: LN					
Depth (mm)	Soil description (texture, colour, coarse fragments, mottles, roots, structure)	Sample	M/D	pH (1:5 water)	EC (dS/m)	ECe	Emerson aggregate test
0 to 600	Light brown silty sand		M				
600 to 1100	Dark brown grey sandy clay		M				
1100	End of hole on basalt						
Notes: Nil							

Salinity assessment

Client: The Planning Hub			**Job no:** 11858	**Date:**	18/5/2020
Address:	Part Lot 502 DP1255115 Boundary Road, Dubbo				
Borehole:	3	**GPS:**	55H 653976mE 6428368mN		

Surface description

Slope:	2-4%	Aspect:	East
Morphological type:	Mid-slope		
Land-use:	Grazing/vacant/stockpiles		
Disturbance:	High		
Erosion:	Nil		
Coarse fragments:	Basalt cobbles on surface		
Surface cover:	Hedge mustard, mallow, grasses		
% surface cover	100%		
Salinity:	Nil		

Sub-surface description

Sample method: EVH		Logged by: LN					
Depth (mm)	Soil description (texture, colour, coarse fragments, mottles, roots, structure)	Sample	M/D	pH (1:5 water)	EC (dS/m)	ECe	Emerson aggregate test
0 to 250 250	Reddish brown silty sand End of hole, refusal on basalt		M				
Notes: Two boreholes drilled adjacent Borehole 3 with drill refusal at 0.3m.							

Salinity assessment

Client: The Planning Hub			**Job no:** 11858	**Date:**	18/5/2020
Address:	Part Lot 502 DP1255115 Boundary Road, Dubbo				
Borehole:	4	**GPS:**	55H 653995mE 6428343mN		

Surface description

Slope:	2-4%	Aspect:	East
Morphological type:	Mid-slope		
Land-use:	Grazing/vacant/stockpiles		
Disturbance:	High		
Erosion:	Nil		
Coarse fragments:	Basalt cobbles on surface		
Surface cover:	Hedge mustard, mallow, grasses		
% surface cover	100%		
Salinity:	Nil		

Sub-surface description

Sample method: EVH		Logged by: LN					
Depth (mm)	Soil description (texture, colour, coarse fragments, mottles, roots, structure)	Sample	M/D	pH (1:5 water)	EC (dS/m)	ECe	Emerson aggregate test
0 to 200 200	Reddish brown silty clay End of hole on basalt		M				
Notes: One borehole drilled adjacent Borehole 4 with drill refusal at 0.2m.							

Salinity assessment

Client: The Planning Hub			**Job no:** 11858	**Date:**	18/5/2020
Address:	Part Lot 502 DP1255115 Boundary Road, Dubbo				
Borehole:	5	**GPS:**	55H 654008mE 6428438mN		

Surface description

Slope:	2-4%	Aspect:	East
Morphological type:	Mid-slope		
Land-use:	Grazing/vacant/stockpiles		
Disturbance:	High		
Erosion:	Nil		
Coarse fragments:	Nil on surface		
Surface cover:	Hedge mustard, mallow, grasses		
% surface cover	100%		
Salinity:	Nil		

Sub-surface description

Sample method: EVH		Logged by: LN					
Depth (mm)	Soil description (texture, colour, coarse fragments, mottles, roots, structure)	Sample	M/D	pH (1:5 water)	EC (dS/m)	ECe	Emerson aggregate test
0 to 100 100	Reddish brown silty clay End of hole on basalt		M				
Notes: Nil							

Salinity assessment

Client: The Planning Hub			**Job no:** 11858	**Date:**	18/5/2020
Address:	Part Lot 502 DP1255115 Boundary Road, Dubbo				
Borehole:	6	**GPS:**	55H 654036mE 6428428mN		

Surface description

Slope:	2-4%	Aspect:	East
Morphological type:	Mid-slope		
Land-use:	Grazing/vacant/stockpiles		
Disturbance:	High		
Erosion:	Nil		
Coarse fragments:	Nil on surface		
Surface cover:	Hedge mustard, mallow, grasses		
% surface cover	100%		
Salinity:	Nil		

Sub-surface description

Sample method: EVH		Logged by: LN					
Depth (mm)	Soil description (texture, colour, coarse fragments, mottles, roots, structure)	Sample	M/D	pH (1:5 water)	EC (dS/m)	ECe	Emerson aggregate test
0 to 400	Reddish brown silty clay		M				
400 to 600	Grey silty clay with gravel		M				
600	End of hole						
Notes:							

Appendix 7. Reference methods for soil testing

Reference Methods:

Colour: Munsell (2000) In 'Munsell Soil Colour Charts' (Gretag Macbeth: NY)

Field texture: McDonald RC, Isbell RF, Speight JG, Walker, Hopkins MS (1990) Australian Soil and Land Survey Field Handbook pp.115-124 (Inkata Press: Melbourne)

PH: AS1289.4.3.1-1997 Method of testing soil for engineering purposes – Soil Chemical Tests- Determination of the pH value of a soil – Electrometric method

Salinity: Rayment GE and Higginson FR (1992) Australian Laboratory Handbook of Soil and Water Chemical Methods (Method 3A1, pp.15-16) (Inkata Press Melbourne) Electrical conductivity of saturated extract is based on conversions of EC (1:5) and soil texture class, to give a more accurate assessment of soil salinity hazard (Salavich PG and Peterson GH (1993) Estimating the electrical conductivity of soil paste extracts from 1:5 soil water suspensions and texture. Australian Journal of Soil Research 31, 3-81)

Appendix 8. SGS laboratory report and chain of custody form

ANALYTICAL REPORT

Accreditation No. 2562

CLIENT DETAILS		LABORATORY DETAILS	
Contact	Luke Niven	Manager	Huong Crawford
Client	ENVIROWEST CONSULTING PTY LIMITED	Laboratory	SGS Alexandria Environmental
Address	PO BOX 8158 ORANGE NSW 2800	Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	61 2 63614954	Telephone	+61 2 8594 0400
Facsimile	(Not specified)	Facsimile	+61 2 8594 0499
Email	luke@envirowest.net.au	Email	au.environmental.sydney@sgs.com
Project	**11858**	SGS Reference	**SE206541 R0**
Order Number	**11858**	Date Received	21/5/2020
Samples	13	Date Reported	28/5/2020

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing. NATA accredited laboratory 2562(4354).

SIGNATORIES

Dong LIANG
Metals/Inorganics Team Leader

Ly Kim HA
Organic Section Head

SGS

ANALYTICAL RESULTS SE206541 R0

VOC's in Soil [AN433] Tested: 22/5/2020

PARAMETER	UOM	LOR	C1 SOIL - 19/5/2020 SE206541.003	C2 SOIL - 19/5/2020 SE206541.004	C3 SOIL - 19/5/2020 SE206541.005	C4 SOIL - 19/5/2020 SE206541.006	C5 SOIL - 19/5/2020 SE206541.007
Benzene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Toluene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ethylbenzene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
m/p-xylene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
o-xylene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Xylenes	mg/kg	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Total BTEX	mg/kg	0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Naphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1

PARAMETER	UOM	LOR	C6 SOIL - 19/5/2020 SE206541.008	C7 SOIL - 19/5/2020 SE206541.009	C8 SOIL - 19/5/2020 SE206541.010	C9 SOIL - 19/5/2020 SE206541.011	C10 SOIL - 19/5/2020 SE206541.012
Benzene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Toluene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ethylbenzene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
m/p-xylene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
o-xylene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Xylenes	mg/kg	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Total BTEX	mg/kg	0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Naphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1

PARAMETER	UOM	LOR	DA SOIL - 19/5/2020 SE206541.013
Benzene	mg/kg	0.1	<0.1
Toluene	mg/kg	0.1	<0.1
Ethylbenzene	mg/kg	0.1	<0.1
m/p-xylene	mg/kg	0.2	<0.2
o-xylene	mg/kg	0.1	<0.1
Total Xylenes	mg/kg	0.3	<0.3
Total BTEX	mg/kg	0.6	<0.6
Naphthalene	mg/kg	0.1	<0.1

SGS

ANALYTICAL RESULTS SE206541 R0

Volatile Petroleum Hydrocarbons in Soil [AN433] Tested: 22/5/2020

PARAMETER	UOM	LOR	C1 SOIL - 19/5/2020 SE206541.003	C2 SOIL - 19/5/2020 SE206541.004	C3 SOIL - 19/5/2020 SE206541.005	C4 SOIL - 19/5/2020 SE206541.006	C5 SOIL - 19/5/2020 SE206541.007
TRH C6-C9	mg/kg	20	<20	<20	<20	<20	<20
Benzene (F0)	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TRH C6-C10	mg/kg	25	<25	<25	<25	<25	<25
TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	<25	<25	<25	<25

PARAMETER	UOM	LOR	C6 SOIL - 19/5/2020 SE206541.008	C7 SOIL - 19/5/2020 SE206541.009	C8 SOIL - 19/5/2020 SE206541.010	C9 SOIL - 19/5/2020 SE206541.011	C10 SOIL - 19/5/2020 SE206541.012
TRH C6-C9	mg/kg	20	<20	<20	<20	<20	<20
Benzene (F0)	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TRH C6-C10	mg/kg	25	<25	<25	<25	<25	<25
TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	<25	<25	<25	<25

PARAMETER	UOM	LOR	DA SOIL - 19/5/2020 SE206541.013
TRH C6-C9	mg/kg	20	<20
Benzene (F0)	mg/kg	0.1	<0.1
TRH C6-C10	mg/kg	25	<25
TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25



ANALYTICAL RESULTS SE206541 R0

TRH (Total Recoverable Hydrocarbons) in Soil [AN403] Tested: 22/5/2020

PARAMETER	UOM	LOR	C1 SOIL - 19/5/2020 SE206541.003	C2 SOIL - 19/5/2020 SE206541.004	C3 SOIL - 19/5/2020 SE206541.005	C4 SOIL - 19/5/2020 SE206541.006	C5 SOIL - 19/5/2020 SE206541.007
TRH C10-C14	mg/kg	20	<20	<20	<20	<20	<20
TRH C15-C28	mg/kg	45	<45	<45	<45	<45	<45
TRH C29-C36	mg/kg	45	<45	<45	<45	<45	<45
TRH C37-C40	mg/kg	100	<100	<100	<100	<100	<100
TRH >C10-C16	mg/kg	25	<25	<25	<25	<25	<25
TRH >C10-C16 - Naphthalene (F2)	mg/kg	25	<25	<25	<25	<25	<25
TRH >C16-C34 (F3)	mg/kg	90	<90	<90	<90	<90	<90
TRH >C34-C40 (F4)	mg/kg	120	<120	<120	<120	<120	<120
TRH C10-C36 Total	mg/kg	110	<110	<110	<110	<110	<110
TRH >C10-C40 Total (F bands)	mg/kg	210	<210	<210	<210	<210	<210

PARAMETER	UOM	LOR	C6 SOIL - 19/5/2020 SE206541.008	C7 SOIL - 19/5/2020 SE206541.009	C8 SOIL - 19/5/2020 SE206541.010	C9 SOIL - 19/5/2020 SE206541.011	C10 SOIL - 19/5/2020 SE206541.012
TRH C10-C14	mg/kg	20	<20	<20	<20	<20	<20
TRH C15-C28	mg/kg	45	<45	<45	<45	<45	<45
TRH C29-C36	mg/kg	45	<45	61	<45	<45	<45
TRH C37-C40	mg/kg	100	<100	<100	<100	<100	<100
TRH >C10-C16	mg/kg	25	<25	<25	<25	<25	<25
TRH >C10-C16 - Naphthalene (F2)	mg/kg	25	<25	<25	<25	<25	<25
TRH >C16-C34 (F3)	mg/kg	90	<90	<90	<90	<90	<90
TRH >C34-C40 (F4)	mg/kg	120	<120	<120	<120	<120	<120
TRH C10-C36 Total	mg/kg	110	<110	<110	<110	<110	<110
TRH >C10-C40 Total (F bands)	mg/kg	210	<210	<210	<210	<210	<210

PARAMETER	UOM	LOR	DA SOIL - 19/5/2020 SE206541.013
TRH C10-C14	mg/kg	20	<20
TRH C15-C28	mg/kg	45	<45
TRH C29-C36	mg/kg	45	<45
TRH C37-C40	mg/kg	100	<100
TRH >C10-C16	mg/kg	25	<25
TRH >C10-C16 - Naphthalene (F2)	mg/kg	25	<25
TRH >C16-C34 (F3)	mg/kg	90	<90
TRH >C34-C40 (F4)	mg/kg	120	<120
TRH C10-C36 Total	mg/kg	110	<110
TRH >C10-C40 Total (F bands)	mg/kg	210	<210



ANALYTICAL RESULTS SE206541 R0

PAH (Polynuclear Aromatic Hydrocarbons) in Soil [AN420] Tested: 22/5/2020

PARAMETER	UOM	LOR	C1 SOIL - 19/5/2020 SE206541.003	C2 SOIL - 19/5/2020 SE206541.004	C3 SOIL - 19/5/2020 SE206541.005	C4 SOIL - 19/5/2020 SE206541.006	C5 SOIL - 19/5/2020 SE206541.007
Naphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	0.1	<0.1	<0.1	0.1	1.1	<0.1
Acenaphthene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	0.1	<0.1	<0.1	0.3	<0.1	<0.1
Anthracene	mg/kg	0.1	<0.1	<0.1	0.2	0.4	<0.1
Fluoranthene	mg/kg	0.1	<0.1	<0.1	1.0	0.5	0.2
Pyrene	mg/kg	0.1	<0.1	<0.1	1.1	0.9	0.3
Benzo(a)anthracene	mg/kg	0.1	<0.1	<0.1	0.4	0.6	0.1
Chrysene	mg/kg	0.1	<0.1	<0.1	0.4	0.7	0.1
Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1	<0.1	0.6	1.2	0.2
Benzo(k)fluoranthene	mg/kg	0.1	<0.1	<0.1	0.3	0.5	<0.1
Benzo(a)pyrene	mg/kg	0.1	<0.1	<0.1	0.5	0.9	0.1
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1	<0.1	0.4	0.6	0.1
Dibenzo(ah)anthracene	mg/kg	0.1	<0.1	<0.1	<0.1	0.1	<0.1
Benzo(ghi)perylene	mg/kg	0.1	<0.1	<0.1	0.5	0.7	0.1
Carcinogenic PAHs, BaP TEQ <LOR=0	TEQ (mg/kg)	0.2	<0.2	<0.2	0.7	1.4	<0.2
Carcinogenic PAHs, BaP TEQ <LOR=LOR	TEQ (mg/kg)	0.3	<0.3	<0.3	0.8	1.4	<0.3
Carcinogenic PAHs, BaP TEQ <LOR=LOR/2	TEQ (mg/kg)	0.2	<0.2	<0.2	0.7	1.4	0.2
Total PAH (18)	mg/kg	0.8	<0.8	<0.8	5.9	8.2	1.4
Total PAH (NEPM/WHO 16)	mg/kg	0.8	<0.8	<0.8	5.9	8.2	1.4

PARAMETER	UOM	LOR	C6 SOIL - 19/5/2020 SE206541.008	C7 SOIL - 19/5/2020 SE206541.009	C8 SOIL - 19/5/2020 SE206541.010	C9 SOIL - 19/5/2020 SE206541.011	C10 SOIL - 19/5/2020 SE206541.012
Naphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(k)fluoranthene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(ah)anthracene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(ghi)perylene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Carcinogenic PAHs, BaP TEQ <LOR=0	TEQ (mg/kg)	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Carcinogenic PAHs, BaP TEQ <LOR=LOR	TEQ (mg/kg)	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Carcinogenic PAHs, BaP TEQ <LOR=LOR/2	TEQ (mg/kg)	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total PAH (18)	mg/kg	0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Total PAH (NEPM/WHO 16)	mg/kg	0.8	<0.8	<0.8	<0.8	<0.8	<0.8

PAH (Polynuclear Aromatic Hydrocarbons) in Soil [AN420] Tested: 22/5/2020 (continued)

PARAMETER	UOM	LOR	DA SOIL - 19/5/2020 SE206541.013
Naphthalene	mg/kg	0.1	<0.1
2-methylnaphthalene	mg/kg	0.1	<0.1
1-methylnaphthalene	mg/kg	0.1	<0.1
Acenaphthylene	mg/kg	0.1	<0.1
Acenaphthene	mg/kg	0.1	<0.1
Fluorene	mg/kg	0.1	<0.1
Phenanthrene	mg/kg	0.1	<0.1
Anthracene	mg/kg	0.1	<0.1
Fluoranthene	mg/kg	0.1	<0.1
Pyrene	mg/kg	0.1	<0.1
Benzo(a)anthracene	mg/kg	0.1	<0.1
Chrysene	mg/kg	0.1	<0.1
Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1
Benzo(k)fluoranthene	mg/kg	0.1	<0.1
Benzo(a)pyrene	mg/kg	0.1	<0.1
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1
Dibenzo(ah)anthracene	mg/kg	0.1	<0.1
Benzo(ghi)perylene	mg/kg	0.1	<0.1
Carcinogenic PAHs, BaP TEQ <LOR=0	TEQ (mg/kg)	0.2	<0.2
Carcinogenic PAHs, BaP TEQ <LOR=LOR	TEQ (mg/kg)	0.3	<0.3
Carcinogenic PAHs, BaP TEQ <LOR=LOR/2	TEQ (mg/kg)	0.2	<0.2
Total PAH (18)	mg/kg	0.8	<0.8
Total PAH (NEPM/WHO 16)	mg/kg	0.8	<0.8

SGS

ANALYTICAL RESULTS SE206541 R0

Soluble Anions (1:5) in Soil by Ion Chromatography [AN245] Tested: 27/5/2020

PARAMETER	UOM	LOR	B1-300 SOIL - 19/5/2020 SE206541.001	B1-1500 SOIL - 19/5/2020 SE206541.002
Chloride	mg/kg	0.25	9.3	35
Sulfate	mg/kg	5	15	160

SGS

ANALYTICAL RESULTS SE206541 R0

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR) [AN122] Tested: 25/5/2020

PARAMETER	UOM	LOR	B1-300 SOIL - 19/5/2020 SE206541.001	B1-1500 SOIL - 19/5/2020 SE206541.002
Exchangeable Sodium, Na	mg/kg	2	49	900
Exchangeable Sodium, Na	meq/100g	0.01	0.21	3.9
Exchangeable Sodium Percentage*	%	0.1	0.6	8.4

SGS

ANALYTICAL RESULTS SE206541 R0

Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES [AN040/AN320] Tested: 25/5/2020

PARAMETER	UOM	LOR	C1 SOIL - 19/5/2020 SE206541.003	C2 SOIL - 19/5/2020 SE206541.004	C3 SOIL - 19/5/2020 SE206541.005	C4 SOIL - 19/5/2020 SE206541.006	C5 SOIL - 19/5/2020 SE206541.007
Arsenic, As	mg/kg	1	4	3	2	1	11
Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Chromium, Cr	mg/kg	0.5	15	79	18	57	1200
Copper, Cu	mg/kg	0.5	11	24	16	19	17
Lead, Pb	mg/kg	1	9	8	160	9	15
Nickel, Ni	mg/kg	0.5	8.6	120	15	26	16
Zinc, Zn	mg/kg	2	37	34	77	33	150

PARAMETER	UOM	LOR	C6 SOIL - 19/5/2020 SE206541.008	C7 SOIL - 19/5/2020 SE206541.009	C8 SOIL - 19/5/2020 SE206541.010	C9 SOIL - 19/5/2020 SE206541.011	C10 SOIL - 19/5/2020 SE206541.012
Arsenic, As	mg/kg	1	2	1	1	5	5
Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Chromium, Cr	mg/kg	0.5	9.9	33	49	11	14
Copper, Cu	mg/kg	0.5	13	14	20	12	12
Lead, Pb	mg/kg	1	4	150	28	6	7
Nickel, Ni	mg/kg	0.5	23	22	34	11	11
Zinc, Zn	mg/kg	2	57	56	38	26	27

PARAMETER	UOM	LOR	DA SOIL - 19/5/2020 SE206541.013
Arsenic, As	mg/kg	1	4
Cadmium, Cd	mg/kg	0.3	<0.3
Chromium, Cr	mg/kg	0.5	14
Copper, Cu	mg/kg	0.5	11
Lead, Pb	mg/kg	1	9
Nickel, Ni	mg/kg	0.5	8.6
Zinc, Zn	mg/kg	2	38

SGS

ANALYTICAL RESULTS SE206541 R0

Mercury in Soil [AN312] Tested: 25/5/2020

PARAMETER	UOM	LOR	C1 SOIL - 19/5/2020 SE206541.003	C2 SOIL - 19/5/2020 SE206541.004	C3 SOIL - 19/5/2020 SE206541.005	C4 SOIL - 19/5/2020 SE206541.006	C5 SOIL - 19/5/2020 SE206541.007
Mercury	mg/kg	0.05	<0.05	<0.05	<0.05	<0.05	<0.05

PARAMETER	UOM	LOR	C6 SOIL - 19/5/2020 SE206541.008	C7 SOIL - 19/5/2020 SE206541.009	C8 SOIL - 19/5/2020 SE206541.010	C9 SOIL - 19/5/2020 SE206541.011	C10 SOIL - 19/5/2020 SE206541.012
Mercury	mg/kg	0.05	<0.05	0.45	<0.05	<0.05	<0.05

PARAMETER	UOM	LOR	DA SOIL - 19/5/2020 SE206541.013
Mercury	mg/kg	0.05	<0.05

SGS

ANALYTICAL RESULTS SE206541 R0

Moisture Content [AN002] Tested: 22/5/2020

PARAMETER	UOM	LOR	B1-300 SOIL - 19/5/2020 SE206541.001	B1-1500 SOIL - 19/5/2020 SE206541.002	C1 SOIL - 19/5/2020 SE206541.003	C2 SOIL - 19/5/2020 SE206541.004	C3 SOIL - 19/5/2020 SE206541.005
% Moisture	%w/w	1	4.9	15.8	12.6	21.6	4.8

PARAMETER	UOM	LOR	C4 SOIL - 19/5/2020 SE206541.006	C5 SOIL - 19/5/2020 SE206541.007	C6 SOIL - 19/5/2020 SE206541.008	C7 SOIL - 19/5/2020 SE206541.009	C8 SOIL - 19/5/2020 SE206541.010
% Moisture	%w/w	1	6.8	12.2	18.7	2.1	9.0

PARAMETER	UOM	LOR	C9 SOIL - 19/5/2020 SE206541.011	C10 SOIL - 19/5/2020 SE206541.012	DA SOIL - 19/5/2020 SE206541.013
% Moisture	%w/w	1	24.5	21.1	13.1

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METHOD SUMMARY

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METHOD	METHODOLOGY SUMMARY
AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN040/AN320	A portion of sample is digested with nitric acid to decompose organic matter and hydrochloric acid to complete the digestion of metals. The digest is then analysed by ICP OES with metals results reported on the dried sample basis. Based on USEPA method 200.8 and 6010C.
AN040	A portion of sample is digested with Nitric acid to decompose organic matter and Hydrochloric acid to complete the digestion of metals and then filtered for analysis by ASS or ICP as per USEPA Method 200.8.
AN122	Exchangeable Cations, CEC and ESP: Soil sample is extracted in 1M Ammonium Acetate at pH=7 (or 1M Ammonium Chloride at pH=7) with cations (Na, K, Ca & Mg) then determined by ICP OES/ICP MS and reported as Exchangeable Cations. For saline soils, these results can be corrected for water soluble cations and reported as Exchangeable cations in meq/100g or soil can be pre-treated (aqueous ethanol/aqueous glycerol) prior to extraction. Cation Exchange Capacity (CEC) is the sum of the exchangeable cations in meq/100g.
AN122	The Exchangeable Sodium Percentage (ESP) is calculated as the exchangeable sodium divided by the CEC (all in meq/100g) times 100. ESP can be used to categorise the sodicity of the soil as below: ESP < 6% non-sodic ESP 6-15% sodic ESP >15% strongly sodic Method is referenced to Rayment and Lyons, 2011, sections 15D3 and 15N1.-
AN245	Anions by Ion Chromatography: A water sample is injected into an eluent stream that passes through the ion chromatographic system where the anions of interest ie Br, Cl, NO2, NO3 and SO4 are separated on their relative affinities for the active sites on the column packing material. Changes to the conductivity and the UV-visible absorbance of the eluent enable identification and quantitation of the anions based on their retention time and peak height or area. APHA 4110 B
AN312	Mercury by Cold Vapour AAS in Soils: After digestion with nitric acid, hydrogen peroxide and hydrochloric acid, mercury ions are reduced by stannous chloride reagent in acidic solution to elemental mercury. This mercury vapour is purged by nitrogen into a cold cell in an atomic absorption spectrometer or mercury analyser. Quantification is made by comparing absorbances to those of the calibration standards. Reference APHA 3112/3500
AN403	Total Recoverable Hydrocarbons: Determination of Hydrocarbons by gas chromatography after a solvent extraction. Detection is by flame ionisation detector (FID) that produces an electronic signal in proportion to the combustible matter passing through it. Total Recoverable Hydrocarbons (TRH) are routinely reported as four alkane groupings based on the carbon chain length of the compounds: C6-C9, C10-C14, C15-C28 and C29-C36 and in recognition of the NEPM 1999 (2013), >C10-C16 (F2), >C16-C34 (F3) and >C34-C40 (F4). F2 is reported directly and also corrected by subtracting Naphthalene (from VOC method AN433) where available.
AN403	Additionally, the volatile C6-C9 fraction may be determined by a purge and trap technique and GC/MS because of the potential for volatiles loss. Total Recoverable Hydrocarbons - Silica (TRH-Si) follows the same method of analysis after silica gel cleanup of the solvent extract. Aliphatic/Aromatic Speciation follows the same method of analysis after fractionation of the solvent extract over silica with differential polarity of the eluent solvents.
AN403	The GC/FID method is not well suited to the analysis of refined high boiling point materials (ie lubricating oils or greases) but is particularly suited for measuring diesel, kerosene and petrol if care to control volatility is taken. This method will detect naturally occurring hydrocarbons, lipids, animal fats, phenols and PAHs if they are present at sufficient levels, dependent on the use of specific cleanup/fractionation techniques. Reference USEPA 3510B, 8015B.
AN420	(SVOCs) including OC, OP, PCB, Herbicides, PAH, Phthalates and Speciated Phenols (etc) in soils, sediments and waters are determined by GCMS/ECD technique following appropriate solvent extraction process (Based on USEPA 3500C and 8270D).
AN420	Carcinogenic PAHs may be expressed as Benzo(a)pyrene equivalents by applying the BaP toxicity equivalence factor (NEPM 1999, June 2013, B7). These can be reported as the individual PAHs and as a sum of carcinogenic PAHs. The sum is reported three ways, the first assuming all <LOR results are zero, the second assuming all < LOR results are half the LOR and the third assuming all <LOR results are the LOR.
AN433	VOCs and C6-C9 Hydrocarbons by GC-MS P&T: VOC's are volatile organic compounds. The sample is presented to a gas chromatograph via a purge and trap (P&T) concentrator and autosampler and is detected with a Mass Spectrometer (MSD). Solid samples are initially extracted with methanol whilst liquid samples are processed directly. References: USEPA 5030B, 8020A, 8260.

FOOTNOTES SE206541 R0

FOOTNOTES

*	NATA accreditation does not cover the performance of this service.	-	Not analysed.	UOM	Unit of Measure.
		NVL	Not validated.	LOR	Limit of Reporting.
**	Indicative data, theoretical holding time exceeded.	IS	Insufficient sample for analysis.	↑↓	Raised/lowered Limit of Reporting.
		LNR	Sample listed, but not received.		

Unless it is reported that sampling has been performed by SGS, the samples have been analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calculated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the " Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.
Note that in terms of units of radioactivity:

a. 1 Bq is equivalent to 27 pCi
b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC and MU criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: www.sgs.com.au/en-gb/environment-health-and-safety.

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STATEMENT OF QA/QC PERFORMANCE

SE206541 R0

CLIENT DETAILS		LABORATORY DETAILS	
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Email	luke@envirowest.net.au	Email	au.environmental.sydney@sgs.com
Project	11858	SGS Reference	**SE206541 R0**
Order Number	11858	Date Received	21 May 2020
Samples	13	Date Reported	28 May 2020

COMMENTS

All the laboratory data for each environmental matrix was compared to SGS' stated Data Quality Objectives (DQO). Comments arising from the comparison were made and are reported below.

The data relating to sampling was taken from the Chain of Custody document.
This QA/QC Statement must be read in conjunction with the referenced Analytical Report.
The Statement and the Analytical Report must not be reproduced except in full.

All Data Quality Objectives were met with the exception of the following:

Extraction Date	Soluble Anions (1:5) in Soil by Ion Chromatography	2 items
Surrogate	VOC's in Soil	2 items
	Volatile Petroleum Hydrocarbons in Soil	2 items
Duplicate	Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES	1 item

SAMPLE SUMMARY

Samples clearly labelled	Yes	Complete documentation received	Yes
Sample container provider	SGS	Sample cooling method	Ice Bricks
Samples received in correct containers	Yes	Sample counts by matrix	13 Soil
Date documentation received	21/5/2020	Type of documentation received	COC
Samples received in good order	Yes	Samples received without headspace	Yes
Sample temperature upon receipt	12.7°C	Sufficient sample for analysis	Yes
Turnaround time requested	Standard		

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SGS

HOLDING TIME SUMMARY

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SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS "Field Sampling Guide for Containers and Holding Time" (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in Green when within suggested criteria or Red with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR) — Method: ME-(AU)-[ENV]AN122

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
B1-300	SE206541.001	LB200369	19 May 2020	21 May 2020	16 Jun 2020	25 May 2020	16 Jun 2020	28 May 2020
B1-1500	SE206541.002	LB200369	19 May 2020	21 May 2020	16 Jun 2020	25 May 2020	16 Jun 2020	28 May 2020

Mercury in Soil — Method: ME-(AU)-[ENV]AN312

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
C1	SE206541.003	LB200348	19 May 2020	21 May 2020	16 Jun 2020	25 May 2020	16 Jun 2020	28 May 2020
C2	SE206541.004	LB200348	19 May 2020	21 May 2020	16 Jun 2020	25 May 2020	16 Jun 2020	28 May 2020
C3	SE206541.005	LB200348	19 May 2020	21 May 2020	16 Jun 2020	25 May 2020	16 Jun 2020	28 May 2020
C4	SE206541.006	LB200348	19 May 2020	21 May 2020	16 Jun 2020	25 May 2020	16 Jun 2020	28 May 2020
C5	SE206541.007	LB200348	19 May 2020	21 May 2020	16 Jun 2020	25 May 2020	16 Jun 2020	28 May 2020
C6	SE206541.008	LB200348	19 May 2020	21 May 2020	16 Jun 2020	25 May 2020	16 Jun 2020	28 May 2020
C7	SE206541.009	LB200348	19 May 2020	21 May 2020	16 Jun 2020	25 May 2020	16 Jun 2020	28 May 2020
C8	SE206541.010	LB200348	19 May 2020	21 May 2020	16 Jun 2020	25 May 2020	16 Jun 2020	28 May 2020
C9	SE206541.011	LB200348	19 May 2020	21 May 2020	16 Jun 2020	25 May 2020	16 Jun 2020	28 May 2020
C10	SE206541.012	LB200348	19 May 2020	21 May 2020	16 Jun 2020	25 May 2020	16 Jun 2020	28 May 2020
DA	SE206541.013	LB200348	19 May 2020	21 May 2020	16 Jun 2020	25 May 2020	16 Jun 2020	28 May 2020

Moisture Content — Method: ME-(AU)-[ENV]AN002

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
B1-300	SE206541.001	LB200191	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	27 May 2020	27 May 2020
B1-1500	SE206541.002	LB200191	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	27 May 2020	27 May 2020
C1	SE206541.003	LB200191	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	27 May 2020	27 May 2020
C2	SE206541.004	LB200191	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	27 May 2020	27 May 2020
C3	SE206541.005	LB200191	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	27 May 2020	27 May 2020
C4	SE206541.006	LB200191	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	27 May 2020	27 May 2020
C5	SE206541.007	LB200191	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	27 May 2020	27 May 2020
C6	SE206541.008	LB200191	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	27 May 2020	27 May 2020
C7	SE206541.009	LB200191	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	27 May 2020	27 May 2020
C8	SE206541.010	LB200191	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	27 May 2020	27 May 2020
C9	SE206541.011	LB200191	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	27 May 2020	27 May 2020
C10	SE206541.012	LB200191	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	27 May 2020	27 May 2020
DA	SE206541.013	LB200191	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	27 May 2020	27 May 2020

PAH (Polynuclear Aromatic Hydrocarbons) in Soil — Method: ME-(AU)-[ENV]AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
C1	SE206541.003	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	28 May 2020
C2	SE206541.004	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	28 May 2020
C3	SE206541.005	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	28 May 2020
C4	SE206541.006	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	28 May 2020
C5	SE206541.007	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	28 May 2020
C6	SE206541.008	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	28 May 2020
C7	SE206541.009	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	28 May 2020
C8	SE206541.010	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	28 May 2020
C9	SE206541.011	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	28 May 2020
C10	SE206541.012	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	28 May 2020
DA	SE206541.013	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	28 May 2020

Soluble Anions (1:5) in Soil by Ion Chromatography — Method: ME-(AU)-[ENV]AN246

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
B1-300	SE206541.001	LB200487	19 May 2020	21 May 2020	26 May 2020	27 May 2020†	24 Jun 2020	28 May 2020
B1-1500	SE206541.002	LB200487	19 May 2020	21 May 2020	26 May 2020	27 May 2020†	24 Jun 2020	28 May 2020

Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES — Method: ME-(AU)-[ENV]AN040/AN320

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
C1	SE206541.003	LB200340	19 May 2020	21 May 2020	15 Nov 2020	25 May 2020	15 Nov 2020	28 May 2020
C2	SE206541.004	LB200340	19 May 2020	21 May 2020	15 Nov 2020	25 May 2020	15 Nov 2020	28 May 2020
C3	SE206541.005	LB200340	19 May 2020	21 May 2020	15 Nov 2020	25 May 2020	15 Nov 2020	28 May 2020
C4	SE206541.006	LB200340	19 May 2020	21 May 2020	15 Nov 2020	25 May 2020	15 Nov 2020	28 May 2020
C5	SE206541.007	LB200340	19 May 2020	21 May 2020	15 Nov 2020	25 May 2020	15 Nov 2020	28 May 2020
C6	SE206541.008	LB200340	19 May 2020	21 May 2020	15 Nov 2020	25 May 2020	15 Nov 2020	28 May 2020
C7	SE206541.009	LB200340	19 May 2020	21 May 2020	15 Nov 2020	25 May 2020	15 Nov 2020	28 May 2020
C8	SE206541.010	LB200340	19 May 2020	21 May 2020	15 Nov 2020	25 May 2020	15 Nov 2020	28 May 2020

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HOLDING TIME SUMMARY

SE206541 R0

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS "Field Sampling Guide for Containers and Holding Time" (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in Green when within suggested criteria or Red with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES (continued) — Method: ME-(AU)-[ENV]AN040/AN320

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
C9	SE206541.011	LB200340	19 May 2020	21 May 2020	15 Nov 2020	25 May 2020	15 Nov 2020	28 May 2020
C10	SE206541.012	LB200340	19 May 2020	21 May 2020	15 Nov 2020	25 May 2020	15 Nov 2020	28 May 2020
DA	SE206541.013	LB200340	19 May 2020	21 May 2020	15 Nov 2020	25 May 2020	15 Nov 2020	28 May 2020

TRH (Total Recoverable Hydrocarbons) in Soil — Method: ME-(AU)-[ENV]AN403

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
C1	SE206541.003	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C2	SE206541.004	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C3	SE206541.005	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C4	SE206541.006	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C5	SE206541.007	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C6	SE206541.008	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C7	SE206541.009	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C8	SE206541.010	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C9	SE206541.011	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C10	SE206541.012	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
DA	SE206541.013	LB200187	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020

VOC's in Soil — Method: ME-(AU)-[ENV]AN433

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
C1	SE206541.003	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C2	SE206541.004	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C3	SE206541.005	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C4	SE206541.006	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C5	SE206541.007	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C6	SE206541.008	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C7	SE206541.009	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C8	SE206541.010	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C9	SE206541.011	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C10	SE206541.012	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
DA	SE206541.013	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020

Volatile Petroleum Hydrocarbons in Soil — Method: ME-(AU)-[ENV]AN433

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
C1	SE206541.003	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C2	SE206541.004	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C3	SE206541.005	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C4	SE206541.006	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C5	SE206541.007	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C6	SE206541.008	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C7	SE206541.009	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C8	SE206541.010	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C9	SE206541.011	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
C10	SE206541.012	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020
DA	SE206541.013	LB200182	19 May 2020	21 May 2020	02 Jun 2020	22 May 2020	01 Jul 2020	27 May 2020

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SURROGATES

SE206541 R0

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA/QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in Green when within suggested criteria or Red with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

PAH (Polynuclear Aromatic Hydrocarbons) in Soil — Method: ME-(AU)-[ENV]AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
2-fluorobiphenyl (Surrogate)	C1	SE206541.003	%	70 - 130%	92
	C2	SE206541.004	%	70 - 130%	85
	C3	SE206541.005	%	70 - 130%	91
	C4	SE206541.006	%	70 - 130%	78
	C5	SE206541.007	%	70 - 130%	93
	C6	SE206541.008	%	70 - 130%	87
	C7	SE206541.009	%	70 - 130%	94
	C8	SE206541.010	%	70 - 130%	86
	C9	SE206541.011	%	70 - 130%	88
	C10	SE206541.012	%	70 - 130%	88
	DA	SE206541.013	%	70 - 130%	89
d14-p-terphenyl (Surrogate)	C1	SE206541.003	%	70 - 130%	114
	C2	SE206541.004	%	70 - 130%	122
	C3	SE206541.005	%	70 - 130%	96
	C4	SE206541.006	%	70 - 130%	99
	C5	SE206541.007	%	70 - 130%	112
	C6	SE206541.008	%	70 - 130%	116
	C7	SE206541.009	%	70 - 130%	91
	C8	SE206541.010	%	70 - 130%	110
	C9	SE206541.011	%	70 - 130%	105
	C10	SE206541.012	%	70 - 130%	100
	DA	SE206541.013	%	70 - 130%	98
d5-nitrobenzene (Surrogate)	C1	SE206541.003	%	70 - 130%	99
	C2	SE206541.004	%	70 - 130%	98
	C3	SE206541.005	%	70 - 130%	97
	C4	SE206541.006	%	70 - 130%	97
	C5	SE206541.007	%	70 - 130%	92
	C6	SE206541.008	%	70 - 130%	96
	C7	SE206541.009	%	70 - 130%	94
	C8	SE206541.010	%	70 - 130%	96
	C9	SE206541.011	%	70 - 130%	96
	C10	SE206541.012	%	70 - 130%	93
	DA	SE206541.013	%	70 - 130%	100

VOC's in Soil — Method: ME-(AU)-[ENV]AN433

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Bromofluorobenzene (Surrogate)	C1	SE206541.003	%	60 - 130%	76
	C2	SE206541.004	%	60 - 130%	80
	C3	SE206541.005	%	60 - 130%	80
	C4	SE206541.006	%	60 - 130%	74
	C5	SE206541.007	%	60 - 130%	76
	C6	SE206541.008	%	60 - 130%	82
	C7	SE206541.009	%	60 - 130%	79
	C8	SE206541.010	%	60 - 130%	75
	C9	SE206541.011	%	60 - 130%	80
	C10	SE206541.012	%	60 - 130%	70
	DA	SE206541.013	%	60 - 130%	76
d4-1,2-dichloroethane (Surrogate)	C1	SE206541.003	%	60 - 130%	104
	C2	SE206541.004	%	60 - 130%	109
	C3	SE206541.005	%	60 - 130%	112
	C4	SE206541.006	%	60 - 130%	104
	C5	SE206541.007	%	60 - 130%	108
	C6	SE206541.008	%	60 - 130%	113
	C7	SE206541.009	%	60 - 130%	111
	C8	SE206541.010	%	60 - 130%	113
	C9	SE206541.011	%	60 - 130%	109
	C10	SE206541.012	%	60 - 130%	102
	DA	SE206541.013	%	60 - 130%	109
d8-toluene (Surrogate)	C1	SE206541.003	%	60 - 130%	117
	C2	SE206541.004	%	60 - 130%	127
	C3	SE206541.005	%	60 - 130%	131 ⓒ

SGS

SURROGATES

SE206541 R0

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA/QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in Green when within suggested criteria or Red with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

VOC's in Soil (continued) — Method: ME-(AU)-[ENV]AN433

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
d8-toluene (Surrogate)	C4	SE206541.006	%	60 - 130%	120
	C5	SE206541.007	%	60 - 130%	124
	C6	SE206541.008	%	60 - 130%	126
	C7	SE206541.009	%	60 - 130%	127
	C8	SE206541.010	%	60 - 130%	128
	C9	SE206541.011	%	60 - 130%	132 ⓘ
	C10	SE206541.012	%	60 - 130%	119
	DA	SE206541.013	%	60 - 130%	122

Volatile Petroleum Hydrocarbons in Soil — Method: ME-(AU)-[ENV]AN433

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Bromofluorobenzene (Surrogate)	C1	SE206541.003	%	60 - 130%	76
	C2	SE206541.004	%	60 - 130%	80
	C3	SE206541.005	%	60 - 130%	80
	C4	SE206541.006	%	60 - 130%	74
	C5	SE206541.007	%	60 - 130%	76
	C6	SE206541.008	%	60 - 130%	82
	C7	SE206541.009	%	60 - 130%	79
	C8	SE206541.010	%	60 - 130%	75
	C9	SE206541.011	%	60 - 130%	80
	C10	SE206541.012	%	60 - 130%	70
	DA	SE206541.013	%	60 - 130%	76
d4-1,2-dichloroethane (Surrogate)	C1	SE206541.003	%	60 - 130%	104
	C2	SE206541.004	%	60 - 130%	109
	C3	SE206541.005	%	60 - 130%	112
	C4	SE206541.006	%	60 - 130%	104
	C5	SE206541.007	%	60 - 130%	108
	C6	SE206541.008	%	60 - 130%	113
	C7	SE206541.009	%	60 - 130%	111
	C8	SE206541.010	%	60 - 130%	113
	C9	SE206541.011	%	60 - 130%	109
	C10	SE206541.012	%	60 - 130%	102
	DA	SE206541.013	%	60 - 130%	109
d8-toluene (Surrogate)	C1	SE206541.003	%	60 - 130%	117
	C2	SE206541.004	%	60 - 130%	127
	C3	SE206541.005	%	60 - 130%	131 ⓘ
	C4	SE206541.006	%	60 - 130%	120
	C5	SE206541.007	%	60 - 130%	124
	C6	SE206541.008	%	60 - 130%	126
	C7	SE206541.009	%	60 - 130%	127
	C8	SE206541.010	%	60 - 130%	128
	C9	SE206541.011	%	60 - 130%	132 ⓘ
	C10	SE206541.012	%	60 - 130%	119
	DA	SE206541.013	%	60 - 130%	122

SGS

METHOD BLANKS

SE206541 R0

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in Green when within suggested criteria or Red with an appended dagger symbol (†) when outside suggested criteria.

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR)

Method: ME-(AU)-[ENV]AN122

Sample Number	Parameter	Units	LOR	Result
LB200369.001	Exchangeable Sodium, Na	mg/kg	2	0

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

Sample Number	Parameter	Units	LOR	Result
LB200348.001	Mercury	mg/kg	0.05	<0.05

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Sample Number		Parameter	Units	LOR	Result
LB200187.001		Naphthalene	mg/kg	0.1	<0.1
		2-methylnaphthalene	mg/kg	0.1	<0.1
		1-methylnaphthalene	mg/kg	0.1	<0.1
		Acenaphthylene	mg/kg	0.1	<0.1
		Acenaphthene	mg/kg	0.1	<0.1
		Fluorene	mg/kg	0.1	<0.1
		Phenanthrene	mg/kg	0.1	<0.1
		Anthracene	mg/kg	0.1	<0.1
		Fluoranthene	mg/kg	0.1	<0.1
		Pyrene	mg/kg	0.1	<0.1
		Benzo(a)anthracene	mg/kg	0.1	<0.1
		Chrysene	mg/kg	0.1	<0.1
		Benzo(a)pyrene	mg/kg	0.1	<0.1
		Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1
		Dibenzo(ah)anthracene	mg/kg	0.1	<0.1
		Benzo(ghi)perylene	mg/kg	0.1	<0.1
		Total PAH (18)	mg/kg	0.8	<0.8
	Surrogates	d5-nitrobenzene (Surrogate)	%	-	99
		2-fluorobiphenyl (Surrogate)	%	-	91
		d14-p-terphenyl (Surrogate)	%	-	119

Soluble Anions (1:5) in Soil by Ion Chromatography

Method: ME-(AU)-[ENV]AN245

Sample Number	Parameter	Units	LOR	Result
LB200487.001	Chloride	mg/kg	0.25	<0.25
	Sulfate	mg/kg	5	<5.0

Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES

Method: ME-(AU)-[ENV]AN040/AN320

Sample Number	Parameter	Units	LOR	Result
LB200340.001	Arsenic, As	mg/kg	1	<1
	Cadmium, Cd	mg/kg	0.3	<0.3
	Chromium, Cr	mg/kg	0.5	<0.5
	Copper, Cu	mg/kg	0.5	<0.5
	Nickel, Ni	mg/kg	0.5	<0.5
	Lead, Pb	mg/kg	1	<1
	Zinc, Zn	mg/kg	2	<2.0

TRH (Total Recoverable Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN403

Sample Number	Parameter	Units	LOR	Result
LB200187.001	TRH C10-C14	mg/kg	20	<20
	TRH C15-C28	mg/kg	45	<45
	TRH C29-C36	mg/kg	45	<45
	TRH C37-C40	mg/kg	100	<100
	TRH C10-C36 Total	mg/kg	110	<110

VOC's in Soil

Method: ME-(AU)-[ENV]AN433

Sample Number		Parameter	Units	LOR	Result
LB200182.001	Monocyclic Aromatic Hydrocarbons	Benzene	mg/kg	0.1	<0.1
		Toluene	mg/kg	0.1	<0.1
		Ethylbenzene	mg/kg	0.1	<0.1
		m/p-xylene	mg/kg	0.2	<0.2
		o-xylene	mg/kg	0.1	<0.1

SGS

METHOD BLANKS

SE206541 R0

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in Green when within suggested criteria or Red with an appended dagger symbol (†) when outside suggested criteria.

VOC's in Soil (continued) — Method: ME-(AU)-[ENV]AN433

Sample Number		Parameter	Units	LOR	Result
LB200182.001	Polycyclic VOCs	Naphthalene	mg/kg	0.1	<0.1
	Surrogates	d4-1,2-dichloroethane (Surrogate)	%	-	117
		d8-toluene (Surrogate)	%	-	112
		Bromofluorobenzene (Surrogate)	%	-	84
	Totals	Total BTEX	mg/kg	0.6	<0.6

Volatile Petroleum Hydrocarbons in Soil — Method: ME-(AU)-[ENV]AN433

Sample Number		Parameter	Units	LOR	Result
LB200182.001		TRH C6-C9	mg/kg	20	<20
	Surrogates	d4-1,2-dichloroethane (Surrogate)	%	-	117

SGS

DUPLICATES

SE206541 R0

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in Green when within suggested criteria or Red with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Mercury in Soil — Method: ME-(AU)-[ENV]AN312

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE206541.012	LB200348.014	Mercury	mg/kg	0.05	<0.05	<0.05	200	0
SE206547.005	LB200348.022	Mercury	mg/kg	0.05	<0.05	<0.05	200	0

Moisture Content — Method: ME-(AU)-[ENV]AN002

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE206541.009	LB200191.011	% Moisture	%w/w	1	2.1	2.2	76	2
SE206547.005	LB200191.021	% Moisture	%w/w	1	8.7	8.9	41	3

PAH (Polynuclear Aromatic Hydrocarbons) in Soil — Method: ME-(AU)-[ENV]AN420

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE206541.011	LB200187.014		Naphthalene	mg/kg	0.1	<0.1	<0.1	200	0
			2-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	200	0
			1-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	200	0
			Acenaphthylene	mg/kg	0.1	<0.1	<0.1	200	0
			Acenaphthene	mg/kg	0.1	<0.1	<0.1	200	0
			Fluorene	mg/kg	0.1	<0.1	<0.1	200	0
			Phenanthrene	mg/kg	0.1	<0.1	<0.1	200	0
			Anthracene	mg/kg	0.1	<0.1	<0.1	200	0
			Fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
			Pyrene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(a)anthracene	mg/kg	0.1	<0.1	<0.1	200	0
			Chrysene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(k)fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(a)pyrene	mg/kg	0.1	<0.1	<0.1	200	0
			Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1	<0.1	200	0
			Dibenzo(ah)anthracene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(ghi)perylene	mg/kg	0.1	<0.1	<0.1	200	0
			Carcinogenic PAHs, BaP TEQ <LOR=0	mg/kg	0.2	<0.2	<0.2	200	0
			Carcinogenic PAHs, BaP TEQ <LOR=LOR	mg/kg	0.3	<0.3	<0.3	134	0
			Carcinogenic PAHs, BaP TEQ <LOR=LOR/2	mg/kg	0.2	<0.2	<0.2	175	0
			Total PAH (18)	mg/kg	0.8	<0.8	<0.8	200	0
		Surrogates	d5-nitrobenzene (Surrogate)	mg/kg	-	0.5	0.5	30	2
			2-fluorobiphenyl (Surrogate)	mg/kg	-	0.4	0.4	30	1
			d14-p-terphenyl (Surrogate)	mg/kg	-	0.5	0.5	30	7
SE206547.005	LB200187.022		Naphthalene	mg/kg	0.1	<0.1	<0.1	200	0
			2-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	200	0
			1-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	200	0
			Acenaphthylene	mg/kg	0.1	<0.1	<0.1	200	0
			Acenaphthene	mg/kg	0.1	<0.1	<0.1	200	0
			Fluorene	mg/kg	0.1	<0.1	<0.1	200	0
			Phenanthrene	mg/kg	0.1	<0.1	<0.1	200	0
			Anthracene	mg/kg	0.1	<0.1	<0.1	200	0
			Fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
			Pyrene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(a)anthracene	mg/kg	0.1	<0.1	<0.1	200	0
			Chrysene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(k)fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(a)pyrene	mg/kg	0.1	<0.1	<0.1	200	0
			Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1	<0.1	200	0
			Dibenzo(ah)anthracene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(ghi)perylene	mg/kg	0.1	<0.1	<0.1	200	0
			Carcinogenic PAHs, BaP TEQ <LOR=0	mg/kg	0.2	<0.2	<0.2	200	0
			Carcinogenic PAHs, BaP TEQ <LOR=LOR	mg/kg	0.3	<0.3	<0.3	134	0
			Carcinogenic PAHs, BaP TEQ <LOR=LOR/2	mg/kg	0.2	<0.2	<0.2	175	0
			Total PAH (18)	mg/kg	0.8	<0.8	<0.8	200	0
		Surrogates	d5-nitrobenzene (Surrogate)	mg/kg	-	0.5	0.5	30	1
			2-fluorobiphenyl (Surrogate)	mg/kg	-	0.4	0.4	30	4

SGS

DUPLICATES

SE206541 R0

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in Green when within suggested criteria or Red with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

PAH (Polynuclear Aromatic Hydrocarbons) in Soil (continued) — Method: ME-(AU)-[ENV]AN420

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE206547.005	LB200187.022	Surrogates	d14-p-terphenyl (Surrogate)	mg/kg	-	0.5	0.4	30	27

Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES — Method: ME-(AU)-[ENV]AN040/AN320

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE206541.012	LB200340.014		Arsenic, As	mg/kg	1	5	5	49	1
			Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	200	0
			Chromium, Cr	mg/kg	0.5	14	12	34	14
			Copper, Cu	mg/kg	0.5	12	11	34	10
			Nickel, Ni	mg/kg	0.5	11	11	35	5
			Lead, Pb	mg/kg	1	7	6	45	14
			Zinc, Zn	mg/kg	2	27	24	38	15
SE206547.005	LB200340.022		Arsenic, As	mg/kg	1	4	4	56	17
			Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	200	0
			Chromium, Cr	mg/kg	0.5	11	11	35	1
			Copper, Cu	mg/kg	0.5	78	190	30	81 ⑤
			Nickel, Ni	mg/kg	0.5	13	14	34	6
			Lead, Pb	mg/kg	1	10	9	41	10
			Zinc, Zn	mg/kg	2	44	47	34	6

TRH (Total Recoverable Hydrocarbons) in Soil — Method: ME-(AU)-[ENV]AN403

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE206541.011	LB200187.014		TRH C10-C14	mg/kg	20	<20	<20	200	0
			TRH C15-C28	mg/kg	45	<45	<45	200	0
			TRH C29-C36	mg/kg	45	<45	<45	200	0
			TRH C37-C40	mg/kg	100	<100	<100	200	0
			TRH C10-C36 Total	mg/kg	110	<110	<110	200	0
			TRH >C10-C40 Total (F bands)	mg/kg	210	<210	<210	200	0
		TRH F Bands	TRH >C10-C16	mg/kg	25	<25	<25	200	0
			TRH >C10-C16 - Naphthalene (F2)	mg/kg	25	<25	<25	200	0
			TRH >C16-C34 (F3)	mg/kg	90	<90	<90	200	0
			TRH >C34-C40 (F4)	mg/kg	120	<120	<120	200	0
SE206547.005	LB200187.022		TRH C10-C14	mg/kg	20	<20	<20	200	0
			TRH C15-C28	mg/kg	45	<45	<45	200	0
			TRH C29-C36	mg/kg	45	<45	<45	200	0
			TRH C37-C40	mg/kg	100	<100	<100	200	0
			TRH C10-C36 Total	mg/kg	110	<110	<110	200	0
			TRH >C10-C40 Total (F bands)	mg/kg	210	<210	<210	200	0
		TRH F Bands	TRH >C10-C16	mg/kg	25	<25	<25	200	0
			TRH >C10-C16 - Naphthalene (F2)	mg/kg	25	<25	<25	200	0
			TRH >C16-C34 (F3)	mg/kg	90	<90	<90	200	0
			TRH >C34-C40 (F4)	mg/kg	120	<120	<120	200	0

VOC's in Soil — Method: ME-(AU)-[ENV]AN433

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE206541.011	LB200182.014	Monocyclic	Benzene	mg/kg	0.1	<0.1	<0.1	200	0
		Aromatic	Toluene	mg/kg	0.1	<0.1	<0.1	200	0
			Ethylbenzene	mg/kg	0.1	<0.1	<0.1	200	0
			m/p-xylene	mg/kg	0.2	<0.2	<0.2	200	0
			o-xylene	mg/kg	0.1	<0.1	<0.1	200	0
		Polycyclic	Naphthalene	mg/kg	0.1	<0.1	<0.1	200	0
		Surrogates	d4-1,2-dichloroethane (Surrogate)	mg/kg	-	10.9	13.1	50	18
			d8-toluene (Surrogate)	mg/kg	-	13.2	12.1	50	9
			Bromofluorobenzene (Surrogate)	mg/kg	-	8.0	7.8	50	3
		Totals	Total Xylenes	mg/kg	0.3	<0.3	<0.3	200	0
			Total BTEX	mg/kg	0.6	<0.6	<0.6	200	0
SE206547.005	LB200182.022	Monocyclic	Benzene	mg/kg	0.1	<0.1	<0.1	200	0
		Aromatic	Toluene	mg/kg	0.1	<0.1	<0.1	200	0
			Ethylbenzene	mg/kg	0.1	<0.1	<0.1	200	0
			m/p-xylene	mg/kg	0.2	<0.2	<0.2	200	0
			o-xylene	mg/kg	0.1	<0.1	<0.1	200	0
		Polycyclic	Naphthalene	mg/kg	0.1	<0.1	<0.1	200	0
		Surrogates	d4-1,2-dichloroethane (Surrogate)	mg/kg	-	13.5	10.9	50	21

SGS

DUPLICATES

SE206541 R0

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in Green when within suggested criteria or Red with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

VOC's in Soil (continued) — Method: ME-(AU)-[ENV]AN433

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE206547.005	LB200182.022	Surrogates	d8-toluene (Surrogate)	mg/kg	-	12.1	10.2	50	16
			Bromofluorobenzene (Surrogate)	mg/kg	-	8.7	7.7	50	12
		Totals	Total Xylenes	mg/kg	0.3	<0.3	<0.3	200	0
			Total BTEX	mg/kg	0.6	<0.6	<0.6	200	0

Volatile Petroleum Hydrocarbons in Soil — Method: ME-(AU)-[ENV]AN433

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE206541.011	LB200182.014		TRH C6-C10	mg/kg	25	<25	<25	200	0
			TRH C6-C9	mg/kg	20	<20	<20	200	0
		Surrogates	d4-1,2-dichloroethane (Surrogate)	mg/kg	-	10.9	13.1	30	18
			d8-toluene (Surrogate)	mg/kg	-	13.2	12.1	30	9
			Bromofluorobenzene (Surrogate)	mg/kg	-	8.0	7.8	30	3
		VPH F Bands	Benzene (F0)	mg/kg	0.1	<0.1	<0.1	200	0
			TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	<25	200	0
SE206547.005	LB200182.022		TRH C6-C10	mg/kg	25	<25	<25	200	0
			TRH C6-C9	mg/kg	20	<20	<20	200	0
		Surrogates	d4-1,2-dichloroethane (Surrogate)	mg/kg	-	13.5	10.9	30	21
			d8-toluene (Surrogate)	mg/kg	-	12.1	10.2	30	16
			Bromofluorobenzene (Surrogate)	mg/kg	-	8.7	7.7	30	12
		VPH F Bands	Benzene (F0)	mg/kg	0.1	<0.1	<0.1	200	0
			TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	<25	200	0

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LABORATORY CONTROL SAMPLES

SE206541 R0

Laboratory Control Standard (LCS) results are evaluated against an expected result, typically the concentration of analyte spiked into the control during the sample preparation stage, producing a percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in Green when within suggested criteria or Red with an appended dagger symbol (†) when outside suggested criteria.

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB200348.002	Mercury	mg/kg	0.05	0.21	0.2	70 - 130	105

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB200187.002		Naphthalene	mg/kg	0.1	4.4	4	60 - 140	110
		Acenaphthylene	mg/kg	0.1	4.6	4	60 - 140	114
		Acenaphthene	mg/kg	0.1	4.3	4	60 - 140	107
		Phenanthrene	mg/kg	0.1	3.8	4	60 - 140	95
		Anthracene	mg/kg	0.1	4.4	4	60 - 140	109
		Fluoranthene	mg/kg	0.1	4.0	4	60 - 140	99
		Pyrene	mg/kg	0.1	4.5	4	60 - 140	112
		Benzo(a)pyrene	mg/kg	0.1	4.4	4	60 - 140	109
	Surrogates	d5-nitrobenzene (Surrogate)	mg/kg	-	0.5	0.5	40 - 130	99
		2-fluorobiphenyl (Surrogate)	mg/kg	-	0.5	0.5	40 - 130	92
		d14-p-terphenyl (Surrogate)	mg/kg	-	0.4	0.5	40 - 130	86

Soluble Anions (1:5) in Soil by Ion Chromatography

Method: ME-(AU)-[ENV]AN245

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB200487.002	Chloride	mg/kg	0.25	92	100	70 - 130	92
	Sulfate	mg/kg	5	91	100	70 - 130	91

Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES

Method: ME-(AU)-[ENV]AN040/AN320

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB200340.002	Arsenic, As	mg/kg	1	350	318.22	80 - 120	109
	Cadmium, Cd	mg/kg	0.3	5.7	5.41	80 - 120	106
	Chromium, Cr	mg/kg	0.5	41	38.31	80 - 120	107
	Copper, Cu	mg/kg	0.5	320	290	80 - 120	109
	Nickel, Ni	mg/kg	0.5	200	187	80 - 120	107
	Lead, Pb	mg/kg	1	95	89.9	80 - 120	106
	Zinc, Zn	mg/kg	2	290	273	80 - 120	106

TRH (Total Recoverable Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN403

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB200187.002		TRH C10-C14	mg/kg	20	39	40	60 - 140	98
		TRH C15-C28	mg/kg	45	<45	40	60 - 140	93
		TRH C29-C36	mg/kg	45	<45	40	60 - 140	70
	TRH F Bands	TRH >C10-C16	mg/kg	25	40	40	60 - 140	100
		TRH >C16-C34 (F3)	mg/kg	90	<90	40	60 - 140	85
		TRH >C34-C40 (F4)	mg/kg	120	<120	20	60 - 140	60

VOC's in Soil

Method: ME-(AU)-[ENV]AN433

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB200182.002	Monocyclic	Benzene	mg/kg	0.1	3.5	5	60 - 140	71
	Aromatic	Toluene	mg/kg	0.1	3.8	5	60 - 140	75
		Ethylbenzene	mg/kg	0.1	3.7	5	60 - 140	74
		m/p-xylene	mg/kg	0.2	7.7	10	60 - 140	77
		o-xylene	mg/kg	0.1	3.6	5	60 - 140	73
	Surrogates	d4-1,2-dichloroethane (Surrogate)	mg/kg	-	11.2	10	70 - 130	112
		d8-toluene (Surrogate)	mg/kg	-	10.1	10	70 - 130	101
		Bromofluorobenzene (Surrogate)	mg/kg	-	9.3	10	70 - 130	93

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB200182.002		TRH C6-C10	mg/kg	25	71	92.5	60 - 140	77
		TRH C6-C9	mg/kg	20	60	80	60 - 140	75
	Surrogates	d4-1,2-dichloroethane (Surrogate)	mg/kg	-	11.2	10	70 - 130	112
		Bromofluorobenzene (Surrogate)	mg/kg	-	9.3	10	70 - 130	93
	VPH F Bands	TRH C6-C10 minus BTEX (F1)	mg/kg	25	49	62.5	60 - 140	78

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MATRIX SPIKES

SE206541 R0

Matrix Spike (MS) results are evaluated as the percentage recovery of an expected result, typically the concentration of analyte spiked into a field sub -sample during the sample preparation stage. The original sample's result is subtracted from the sub-sample result before determining the percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA/QC plan (ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in Green when within suggested criteria or Red with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

QC Sample	Sample Number	Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE206541.003	LB200348.004	Mercury	mg/kg	0.05	0.20	<0.05	0.2	89

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE206541.004	LB200187.023		Naphthalene	mg/kg	0.1	4.4	<0.1	4	109
			2-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	-	-
			1-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	-	-
			Acenaphthylene	mg/kg	0.1	4.4	<0.1	4	111
			Acenaphthene	mg/kg	0.1	4.3	<0.1	4	107
			Fluorene	mg/kg	0.1	<0.1	<0.1	-	-
			Phenanthrene	mg/kg	0.1	4.0	<0.1	4	100
			Anthracene	mg/kg	0.1	4.6	<0.1	4	114
			Fluoranthene	mg/kg	0.1	4.3	<0.1	4	106
			Pyrene	mg/kg	0.1	4.5	<0.1	4	112
			Benzo(a)anthracene	mg/kg	0.1	<0.1	<0.1	-	-
			Chrysene	mg/kg	0.1	<0.1	<0.1	-	-
			Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1	<0.1	-	-
			Benzo(k)fluoranthene	mg/kg	0.1	<0.1	<0.1	-	-
			Benzo(a)pyrene	mg/kg	0.1	4.4	<0.1	4	110
			Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1	<0.1	-	-
			Dibenzo(ah)anthracene	mg/kg	0.1	<0.1	<0.1	-	-
			Benzo(ghi)perylene	mg/kg	0.1	<0.1	<0.1	-	-
			Carcinogenic PAHs, BaP TEQ <LOR=0	TEQ (mg/kg)	0.2	4.4	<0.2	-	-
			Carcinogenic PAHs, BaP TEQ <LOR=LOR	TEQ (mg/kg)	0.3	4.6	<0.3	-	-
			Carcinogenic PAHs, BaP TEQ <LOR=LOR/2	TEQ (mg/kg)	0.2	4.5	<0.2	-	-
			Total PAH (18)	mg/kg	0.8	35	<0.8	-	-
		Surrogates	d5-nitrobenzene (Surrogate)	mg/kg	-	0.5	0.5	-	97
			2-fluorobiphenyl (Surrogate)	mg/kg	-	0.5	0.4	-	94
			d14-p-terphenyl (Surrogate)	mg/kg	-	0.4	0.6	-	87

Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES

Method: ME-(AU)-[ENV]AN040/AN320

QC Sample	Sample Number	Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE206541.003	LB200340.004	Arsenic, As	mg/kg	1	50	4	50	92
		Cadmium, Cd	mg/kg	0.3	43	<0.3	50	86
		Chromium, Cr	mg/kg	0.5	61	15	50	93
		Copper, Cu	mg/kg	0.5	56	11	50	90
		Nickel, Ni	mg/kg	0.5	56	8.6	50	94
		Lead, Pb	mg/kg	1	54	9	50	89
		Zinc, Zn	mg/kg	2	80	37	50	86

TRH (Total Recoverable Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN403

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE206541.004	LB200187.023		TRH C10-C14	mg/kg	20	42	<20	40	105
			TRH C15-C28	mg/kg	45	<45	<45	40	98
			TRH C29-C36	mg/kg	45	<45	<45	40	90
			TRH C37-C40	mg/kg	100	<100	<100	-	-
			TRH C10-C36 Total	mg/kg	110	<110	<110	-	-
			TRH >C10-C40 Total (F bands)	mg/kg	210	<210	<210	-	-
		TRH F Bands	TRH >C10-C16	mg/kg	25	41	<25	40	103
			TRH >C10-C16 - Naphthalene (F2)	mg/kg	25	41	<25	-	-
			TRH >C16-C34 (F3)	mg/kg	90	<90	<90	40	95
			TRH >C34-C40 (F4)	mg/kg	120	<120	<120	-	-

VOC's in Soil

Method: ME-(AU)-[ENV]AN433

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE206541.003	LB200182.024	Monocyclic	Benzene	mg/kg	0.1	3.4	<0.1	5	67
		Aromatic	Toluene	mg/kg	0.1	3.8	<0.1	5	76
			Ethylbenzene	mg/kg	0.1	3.4	<0.1	5	68
			m/p-xylene	mg/kg	0.2	6.9	<0.2	10	69
			o-xylene	mg/kg	0.1	3.3	<0.1	5	65

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MATRIX SPIKES

SE206541 R0

Matrix Spike (MS) results are evaluated as the percentage recovery of an expected result, typically the concentration of analyte spiked into a field sub -sample during the sample preparation stage. The original sample's result is subtracted from the sub-sample result before determining the percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA/QC plan (ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in Green when within suggested criteria or Red with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

VOC's in Soil (continued) — Method: ME-(AU)-[ENV]AN433

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE206541.003	LB200182.024	Polycyclic	Naphthalene	mg/kg	0.1	<0.1	<0.1	-	-
		Surrogates	d4-1,2-dichloroethane (Surrogate)	mg/kg	-	10.9	10.4	10	109
			d8-toluene (Surrogate)	mg/kg	-	10.4	11.7	10	104
			Bromofluorobenzene (Surrogate)	mg/kg	-	8.4	7.6	10	84
		Totals	Total Xylenes	mg/kg	0.3	10	<0.3	-	-
			Total BTEX	mg/kg	0.6	21	<0.6	-	-

Volatile Petroleum Hydrocarbons in Soil — Method: ME-(AU)-[ENV]AN433

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE206541.003	LB200182.024		TRH C6-C10	mg/kg	25	73	<25	92.5	79
			TRH C6-C9	mg/kg	20	65	<20	80	81
		Surrogates	d4-1,2-dichloroethane (Surrogate)	mg/kg	-	10.9	10.4	10	109
			d8-toluene (Surrogate)	mg/kg	-	10.4	11.7	10	104
			Bromofluorobenzene (Surrogate)	mg/kg	-	8.4	7.6	-	84
		VPH F	Benzene (F0)	mg/kg	0.1	3.4	<0.1	-	-
		Bands	TRH C6-C10 minus BTEX (F1)	mg/kg	25	53	<25	62.5	84

MATRIX SPIKE DUPLICATES

SE206541 R0

Matrix spike duplicates are calculated as Relative Percent Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The original result is the analyte concentration of the matrix spike. The Duplicate result is the analyte concentration of the matrix spike duplicate.

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in Green when within suggested criteria or Red with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

No matrix spike duplicates were required for this job.

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FOOTNOTES

SE206541 R0

id samples expressed on a dry weight basis.

criteria are subject to internal review according to the SGS QA/QC plan and may be provided on request or alternatively can be found he
s://www.sgs.com.au/~/media/Local/Australia/Documents/Technical Documents/MP-AU-ENV-QU-022 QA QC Plan.pdf

*	NATA accreditation does not cover the performance of this service.
**	Indicative data, theoretical holding time exceeded.
-	Sample not analysed for this analyte.
IS	Insufficient sample for analysis.
LNR	Sample listed, but not received.
LOR	Limit of reporting.
QFH	QC result is above the upper tolerance.
QFL	QC result is below the lower tolerance.

①	At least 2 of 3 surrogates are within acceptance criteria.
②	RPD failed acceptance criteria due to sample heterogeneity.
③	Results less than 5 times LOR preclude acceptance criteria for RPD.
④	Recovery failed acceptance criteria due to matrix interference.
⑤	Recovery failed acceptance criteria due to the presence of significant concentration of analyte (i.e. the concentration of analyte exceeds the spike level).
⑥	LOR was raised due to sample matrix interference.
⑦	LOR was raised due to dilution of significantly high concentration of analyte in sample.
⑧	Reanalysis of sample in duplicate confirmed sample heterogeneity and inconsistency of results.
⑨	Recovery failed acceptance criteria due to sample heterogeneity.
⑩	LOR was raised due to high conductivity of the sample (required dilution).
†	Refer to relevant report comments for further information.

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Chain of Custody Form – Ref 11858

Sheet 1 of 1

Ref:	11858		**Sample matrix**			**Sample preservation**			**Analysis**					
Investigator:	Envirowest Consulting 9 Cameron Place PO Box 8158 ORANGE NSW 2800								**SGS Method Code**					
Telephone:	(02) 6361 4954									CL10				
Email:	Luke@envirowest.net.au													
Contact Person:	Luke Niven													
Invoice:	accounts@envirowest.net.au													
Laboratory:	SGS SYDNEY 16/33 Maddox Street ALEXANDRIA NSW 2015		Water	Soil	Sludge	Cool	HNO3/HCl	Unpre-served	Exchangeable sodium, chloride and sulphate	TRH, BTEXN, PAH, 8 metals				
Quotation #:														
Courier/CN:														
	Sample ID	**Container***	**Sampling Date/Time**											
1	B1-300	A	19/05/2020		X		X	X	X					
2	B1-1500	A	19/05/2020		X		X	X	X					
3	C1	A	19/05/2020		X		X	X		X				
4	C2	A	19/05/2020		X		X	X		X				
5	C3	A	19/05/2020		X		X	X		X				
6	C4	A	19/05/2020		X		X	X		X				
7	C5	A	19/05/2020		X		X	X		X				
8	C6	A	19/05/2020		X		X	X		X				
9	C7	A	19/05/2020		X		X	X		X				
10	C8	A	19/05/2020		X		X	X		X				
11	C9	A	19/05/2020		X		X	X		X				
12	C10	A	19/05/2020		X		X	X		X				
13	DA	A	19/05/2020		X		X	X		X				

SGS EHS Sydney COC
SE206541

Investigator: I attest that the proper field sampling procedures were used during the collection of these samples.

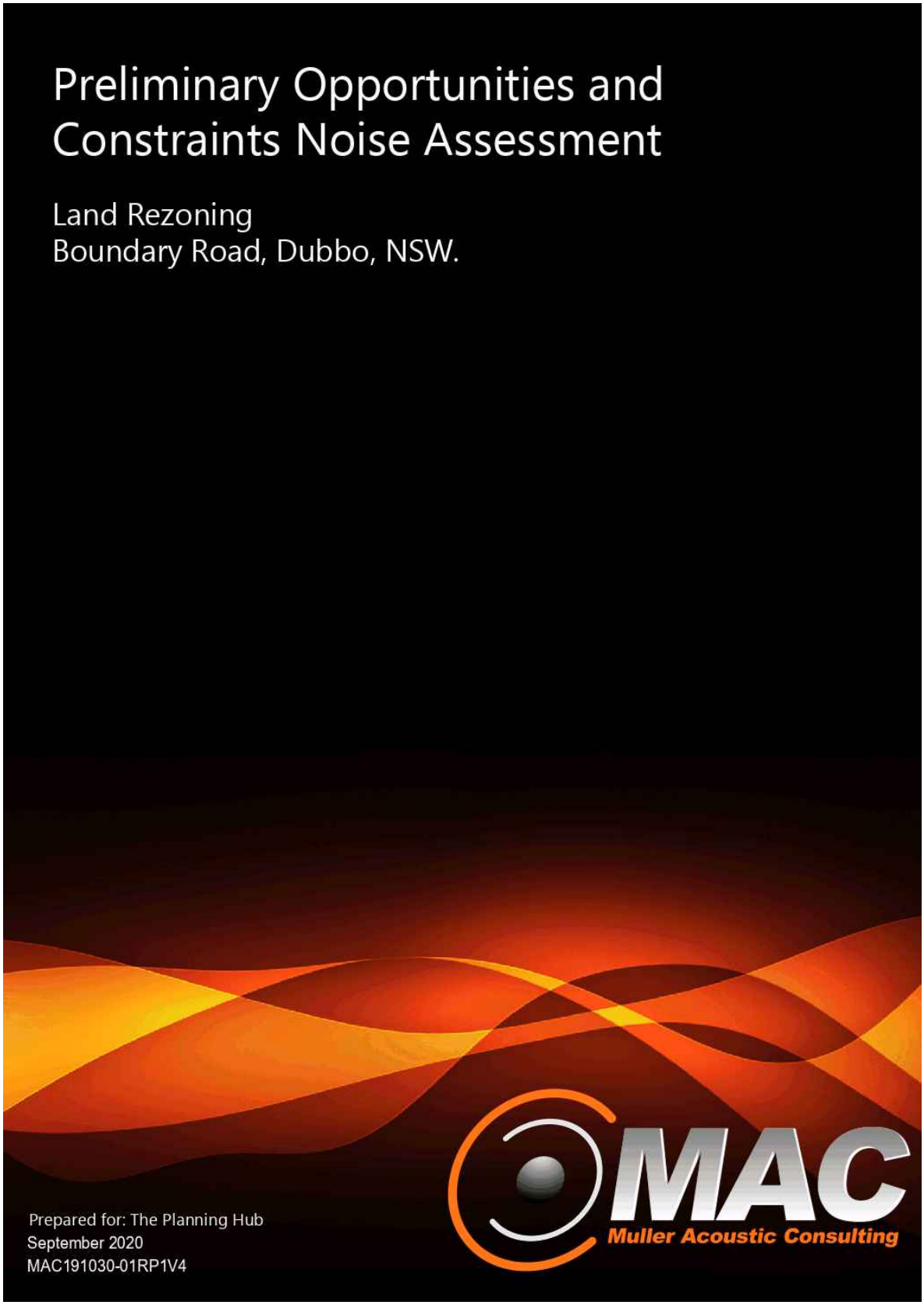
Sampler name: Luke Niven
Date: 19/05/2020 Time: 1300-1500

Relinquished by: (print and signature)	Luke Niven	Date	Time	Received by: (print and signature)	Date Time
		20/05/2020	16:00		21/05/20 @ 12.30

Please return completed form to Envirowest Consulting, *A = Solvent rinsed glass jar with Teflon lined lid and green label, B= Plastic with green label, C= Amber with green label, D= Vial with white label, E= Plastic with red label

Preliminary Opportunities and Constraints Noise Assessment

Land Rezoning
Boundary Road, Dubbo, NSW.



Document Information

Preliminary Opportunities and Constraints

Noise Assessment

Boundary Road, Dubbo, NSW.

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DOCUMENT ID	STATUS	DATE	PREPARED BY	SIGNED	REVIEWED BY	SIGNED
MAC191030-01RP1V4	Final	22 September 2020	Robin Heaton	Robin Heaton	Oliver Muller	

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by The Planning Hub (TPH) to complete a Preliminary Opportunities and Constraints Noise Assessment (the 'assessment') for the proposed rezoning of Lot 502, DP1255115, Boundary Road, Dubbo, NSW (the 'proposal').

The assessment has been undertaken to provide a summary of existing environmental noise and identifies opportunities and constraints related to the rezoning of the site to allow the development of a registered club (RC). The assessment will accompany the planning proposal for the site, which is being prepared by The Planning Hub.

The main aspects to be considered in the assessment to support the proposal include:

- Noise emissions during the construction phase of a potential registered club;
- Independent Liquor and Gaming Authority (ILGA) noise emissions from the proposal site;
- Noise emissions associated with the internal operation of a RC including likely facilities such as restaurant, bar and function room;
- Noise emissions associated with the potential external activities including the use of the sports facilities and outdoor terrace areas;
- Operational noise from the mechanical plant associated with a RC; and
- Road traffic noise from patron access and egress from the proposal site.

A glossary of terms, definitions and abbreviations used in this report is provided in **Appendix A**.

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2 Project Description

The site is located within Lot 502, DP1255115, Boundary Road, Dubbo, NSW (the 'proposal site'), which has been subdivided as part of the Keswick Estate development. The Keswick Estate is a new development consisting of residential, commercial and infrastructure developments, approximately 4.5km south east of Dubbo town centre and is located within the Dubbo Regional Council (DRC) Local Government Area (LGA).

The proposal includes the rezoning of the undeveloped site to allow for the potential construction of a registered club. Typically a RC may include the following amenities:

- Main reception;
- Food Preparation Areas;
- Kids Play and Family Areas;
- Bar and Sports Lounge;
- Gaming Areas;
- Function Room;
- Outdoor decked terrace with terrace seating for sports events;
- Back-of house facilities;
- Sports field;
- cricket nets, tennis courts or similar;
- Car park; and
- Support facilities.

2.1 Proposed Activities

The proposal would allow for the potential development of a RC, which may include various services and support different sporting activities. Whilst the final operating times of any facility and service are yet to be confirmed, there are several typical key activities associated with such a proposal that have the potential to generate acoustic impacts on nearby receivers.

These may include the hosting of events on the sports field and the playing of amplified music in the gallery seating area. It is likely that the sports field will be utilised most weekday evenings for training sessions and will host games on the weekends typically during the daytime. Additionally, live and amplified music internally within the RC is typically only performed Friday to Sunday during the day and evening periods. The day to day operation of the site will include the use of the bar and sports lounge, gaming areas and restaurant.

Table 1 provides a summary of the potential proposal noise sources and their assumed assessment period in which they could occur. Once the final layout and operational times have been confirmed, it is recommended that these be provided for inclusion in the NIA.

Table 1 Noise Generating Activities

Activity/Source	Period1	Operational
Customer light vehicles	Day	✓
	Evening	✓
	Night	✓
Bar, Sports Lounge, Gaming Area and Restaurant	Day	✓
	Evening	✓
	Night	✓
Mechanical Plant	Day	✓
	Evening	✓
	Night	✓
Internal Live Music Events	Day	✓
	Evening	✓
	Night	X
Sporting Events with Amplified Music within the seating gallery	Day	✓
	Evening	✓
	Night	X
Goods Deliveries / Waste Collection	Day	✓
	Evening	✓
	Night	✓

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

3 Receiver Review

The proposal locality is currently described as a rural environment with undeveloped lots located on all sides of the proposal site. The current noise environment is dominated by natural and wildlife noise sources.

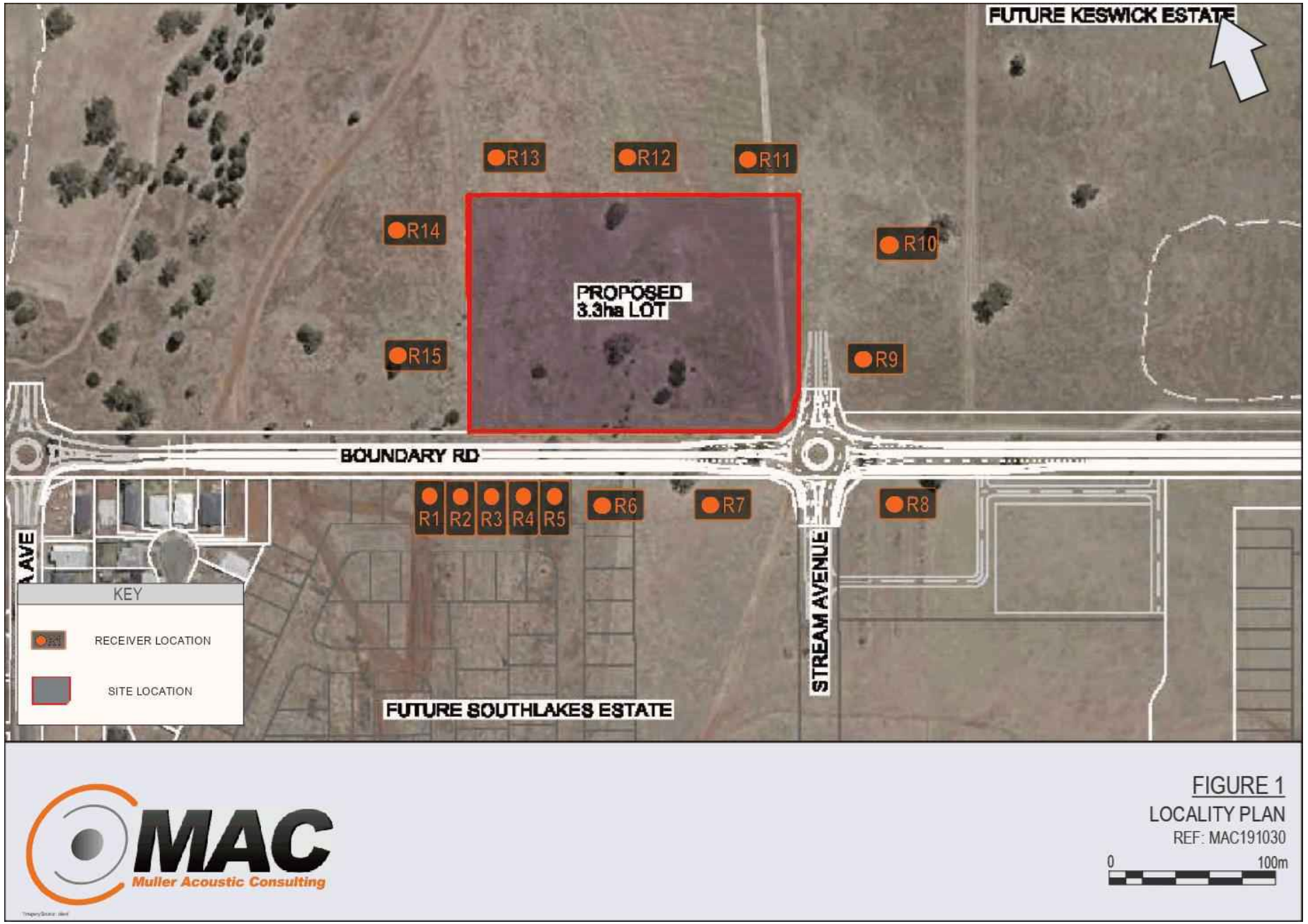
It is however noted that as the estate develops, the ambient environment surrounding the proposal site will evolve from a rural to a suburban environment, with traffic and domestic noise becoming the dominating sources.

Once the estate is developed the site will be bound to the south by the Boundary Road extension and to the east by (proposed) Stream Avenue. The undeveloped lots to the west and north are expected to be residential or light commercial.

To assess noise levels at the nearest potential residences, hypothetical receiver points have been identified in close proximity to each side of the proposal site. The hypothetical receiver points are presented in **Table 2** along with the approximate setback distance from the proposal boundary. **Figure 1** presents the site location and the surrounding hypothetical receivers visually.

Table 2 Receiver Locations

Receiver	MGA 55 Coordinates		Approximate Set Back Distance (m)
R1	653908	6428290	35
R2	653923	6428284	35
R3	653948	6428281	35
R4	653964	6428278	35
R5	653984	6428276	35
R6	654015	6428274	35
R7	654080	6428261	35
R8	654191	6428241	75
R9	654191	6428324	35
R10	654202	6428395	35
R11	654146	6428460	15
R12	654070	6428477	15
R13	653999	6428485	15
R14	653940	6428452	15
R15	653928	6428379	15


FUTURE KESWICK ESTATE
R13
R12
R11
R14
R10
PROPOSED
3.3ha LOT
R15
R9
BOUNDARY RD
R1
R2
R3
R4
R5
R6
R7
R8
STREAM AVENUE
KEY
RECEIVER LOCATION
SITE LOCATION
FUTURE SOUTHLAKES ESTATE
MAC
Muller Acoustic Consulting
FIGURE 1
LOCALITY PLAN
REF: MAC191030
0
100m

4 Noise Policy and Guidelines

The following section summarises relevant policy and guidelines pertinent to undertaking a noise impact assessment for this type of proposal.

4.1 Noise Policy for Industry

The EPA released the Noise Policy for Industry (NPI) in October 2017 which provides a process for establishing noise criteria for consents and licenses enabling the EPA to regulate noise emissions from scheduled premises under the Protection of the Environment Operations Act 1997.

The objectives of the NPI are to:

- provide noise criteria that is used to assess the change in both short term and long-term noise levels;
- provide a clear and consistent framework for assessing environmental noise impacts from industrial premises and industrial development proposals;
- promote the use of best-practice noise mitigation measures that are feasible and reasonable where potential impacts have been identified; and
- support a process to guide the determination of achievable noise limits for planning approvals and/or licences, considering the matters that must be considered under the relevant legislation (such as the economic and social benefits and impacts of industrial development).

The policy sets out a process for industrial noise management involving the following key steps:

1. Determine the Project Noise Trigger Levels (PNTLs) (ie criteria) for a development. These are the levels (criteria), above which noise management measures are required to be considered. They are derived by considering two factors: shorter-term intrusiveness due to changes in the noise environment; and maintaining the noise amenity of an area.
2. Predict or measure the noise levels produced by the development with regard to the presence of annoying noise characteristics and meteorological effects such as temperature inversions and wind.
3. Compare the predicted or measured noise level with the PNTL, assessing impacts and the need for noise mitigation and management measures.

4. Consider residual noise impacts - that is, where noise levels exceed the PNTLs after the application of feasible and reasonable noise mitigation measures. This may involve balancing economic, social and environmental costs and benefits from the proposed development against the noise impacts, including consultation with the affected community where impacts are expected to be significant.

5. Set statutory compliance levels that reflect the best achievable and agreed noise limits for the development.

6. Monitor and report environmental noise levels from the development.

4.1.1 Project Noise Trigger Levels (PNTLs)

The policy sets out the procedure to determine the PNTLs relevant to an industrial development. The PNTL is the lower (ie, the more stringent) of the **Project Intrusiveness Noise Level** (PINL) and **Project Amenity Noise Level** (PANL) determined in accordance with Section 2.3 and Section 2.4 of the NPI.

4.1.2 Project Intrusiveness Noise Level (PINLs)

The PINL ($L_{Aeq(15min)}$) is the RBL + 5dB and seeks to limit the degree of change a new noise source introduces to an existing environment. Hence, when assessing intrusiveness, background noise levels need to be measured from which RBLs are determined. Background noise levels need to be determined before intrusive noise can be assessed. The NPI states that background noise levels to be measured are those that are present at the time of the noise assessment and without the subject development operating. For the assessment of modifications to existing premises, the noise from the existing premises should be excluded from background noise measurements. It is note that the exception is where the premises has been operating for a significant period of time and is considered a normal part of the acoustic environment; it may be included in the background noise assessment under the following circumstances:

- the development must have been operating for a period in excess of 10 years in the assessment period/s being considered and is considered a normal part of the acoustic environment; and,
- the development must be operating in accordance with noise limits and requirements imposed in a consent or licence and/or be applying best practice.

Where a project intrusiveness noise level has been derived in this way, the derived level applies for a period of 10 years to avoid continuous incremental increases in intrusiveness noise levels. This approach is consistent with the purpose of the intrusiveness noise level to limit significant change in the acoustic environment. The purpose of the project amenity noise level is to moderate against background noise creep.

4.1.3 Project Amenity Noise Level (PANL)

The PANL is relevant to a specific land use or locality. To limit continuing increases in intrusiveness levels, the ambient noise level within an area from all combined industrial sources should remain below the recommended amenity noise levels specified in Table 2.2 (of the NPI). The NPI defines two categories of amenity noise levels:

- **Amenity Noise Levels (ANL)** – are determined considering all current and future industrial noise within a receiver area; and
- **Project Amenity Noise Level (PANL)** – is the recommended level for a receiver area, specifically focusing the project being assessed.

Additionally, Section 2.4 of the NPI states: "*to ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area, a project amenity noise level applies for each new source of industrial noise as follows*":

PANL for new industrial developments = recommended **ANL** minus 5dBA.

The following exceptions apply when deriving the PANL:

- areas with high traffic noise levels;
- proposed developments in major industrial clusters;
- existing industrial noise and cumulative industrial noise effects; and
- greenfield sites.

Notwithstanding, where the PANL is applicable and can be satisfied, the assessment of cumulative industrial noise is not required. The recommended amenity noise levels as per Table 2.2 of the NPI are reproduced in **Table 3**. It is reiterated that the project site is currently located within a rural environment but as the Keswick Estate develops the area surrounding the site will likely evolve into a suburban noise environment.

Table 3 Amenity Criteria

Receiver Type	Noise Amenity Area	Time of day	Recommended amenity noise level LAeq, dBA
Residential	Rural	Day	50
		Evening	45
		Night	40
	Suburban	Day	55
		Evening	45
		Night	40
Hotels, motels, caretakers' quarters, holiday accommodation, permanent resident caravan parks	See column 4	See column 4	5dBA above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day
School classroom – internal	All	Noisiest 1-hour period when in use	35
Area specifically reserved for passive recreation (e.g. national park)	All	When in use	50
Active recreation area (e.g. school playground, golf course)	All	When in use	55
Commercial premises	All	When in use	65

Notes: The recommended amenity noise levels refer only to noise from industrial noise sources. However, they refer to noise from all such sources at the receiver location, and not only noise due to a specific project under consideration. The levels represent outdoor levels except where otherwise stated.

Types of receivers are defined as rural residential; suburban residential; urban residential; industrial interface; commercial; industrial – see Table 2.3 and Section 2.7.

Time of day is defined as follows: (These periods may be varied where appropriate, for example, see A3 in Fact Sheet A.)

- day – the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays;
- evening – the period from 6pm to 10pm;
- night – the remaining periods.

In the case where existing schools are affected by noise from existing industrial noise sources, the acceptable LAeq noise level may be increased to 40dB LAeq(1hr).

4.2 Independent Liquor and Gaming Authority (ILGA)

The NSW EPA's Noise Guide for Local Government (NGFLG) (2013) summaries criteria related to licensed premises. The Independent Liquor and Gaming Authority (ILGA) (formerly OLGR) criteria are reproduced from NGFLG below and have been adopted as the principle criteria for residential receivers in this assessment:

> *'The LA10 noise level emitted from the licensed premises shall not exceed the background noise level in an Octave Band Centre Frequency (31.5Hz – 8kHz inclusive) by more than 5dB between 7:00am and 12:00midnight at the boundary of any affected residence.*
>
> *The LA10 noise level emitted from the licensed premises shall not exceed the background noise level in an Octave Band Centre Frequency (31.5Hz – 8kHz inclusive) between 12:00midnight and 7:00am at the boundary of any affected residence. Notwithstanding compliance with the above, the noise from the licensed premises shall not be audible within any habitable room in any residential premises between the hours of 12:00midnight and 7:00am.'*

4.3 Road Noise Policy

The road traffic noise criteria are provided in the Department of Environment, Climate Change and Water NSW (DECCW), Road Noise Policy (RNP), 2011. The policy sets out noise criteria applicable to different road classifications for the purpose of quantifying traffic noise impacts. Road noise criteria relevant to this assessment are presented in detail in **Section 5.3**.

4.3.1 Maximum Noise Trigger Level Assessment

The potential for sleep disturbance from maximum noise level events from a proposal during the night-time period needs to be considered. The NPI considers sleep disturbance to be both awakenings and disturbance to sleep stages.

Where night-time noise levels from a development/premises at a residential location exceed the following criteria, a detailed maximum noise level event assessment should be undertaken:

- $L_{Aeq(15min)}$ 40dB or the prevailing RBL plus 5dBA, whichever is the greater, and/or
- L_{Amax} 52dB or the prevailing RBL plus 15dBA, whichever is the greater.

A detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period.

Other factors that may be important in assessing the impacts on sleep disturbance include:

- how often the events would occur;
- the distribution of likely events across the night-time period and the existing ambient maximum events in the absence of the development;
- whether there are times of day when there is a clear change in the noise environment (such as during early morning shoulder periods); and
- current understanding of effects of maximum noise level events at night.

4.4 Interim Construction Noise Guideline

The assessment and management of noise from construction work is completed with reference to the Interim Construction Noise Guideline (ICNG). The ICNG is specifically aimed at managing noise from construction work regulated by the EPA and is used to assist in setting statutory conditions in licences or other regulatory instruments. The types of construction regulated by the EPA under the POEO Act (1997), include construction, maintenance and renewal activities carried out by a public authority, such as road upgrades as described in Schedule 1 of the POEO Act.

The ICNG provides two methodologies for the assessment of construction noise emissions:

- Quantitative, which is suited to major construction projects with typical durations of more than three weeks; or
- Qualitative, which is suited to short term infrastructure maintenance (for projects with a typical duration of less than three weeks).

4.4.1 Standard Hours for Construction

Table 4 summarises the ICNG recommended standard hours for construction activities where the noise from construction is audible at residential premises.

Table 4 Recommended Hours for Construction

Hour Commencing	12 AM	1 AM	2 AM	3 AM	4 AM	5 AM	6 AM	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	8 PM	9 PM	10 PM	11 PM
Monday	OOH Period 2							Standard Hours											OOH Period 1					
Tuesday																								
Wednesday																								
Thursday																								
Friday																								
Saturday																								
Sunday								OOH Period 1											OOH Period 2					
Public Holiday																								

The recommended hours do not apply in the event of direction from police, or other relevant authorities, for safety reasons or where required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm. Work conducted outside of standard hours are considered out of hours work (OOH). OOH periods are divided into two categories representing evening and night periods and cover the hours listed below:

OOH Period 1 (evening/low risk period): Monday to Friday – 6pm to 10pm, Saturdays – 1pm to 6pm, Sundays – 8am to 6pm.

OOH Period 2 (night/medium to high risk period): Monday to Friday – 10pm to 7am, Saturdays/Sundays – 6pm to 7am (8am on Sunday mornings).

Construction activities are anticipated to occur between 7am and 6pm, 7 days per week. As a result, works would occur during out of hours for this project.

4.4.2 Construction Noise Management Levels

Table 5 reproduces the ICNG management levels for residential receivers. The construction noise management levels are the sum of the management level and relevant rating background level (RBL) for each specific assessment period.

Table 5 Noise Management Levels

Time of Day	Management Level LAeq,15min1	How to Apply
Recommended standard hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or public holidays.	Noise affected RBL + 10dB.	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured LAeq(15min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of work to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75dBA.	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account times identified by the community when they are less sensitive to noise such as before and after school for work near schools, or mid-morning or mid-afternoon for work near residences; and if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours.	Noise affected RBL + 5dB.	A strong justification would typically be required for work outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5dBA above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2.

Note 1: The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the construction noise management levels for noise assessment purposes and is the median of the ABL's.

5 Noise Assessment Criteria

5.1 Operational Noise Criteria

5.1.1 Project Intrusiveness Noise Levels

Due to the rural nature of the locality surrounding the proposal site existing background noise levels have been assumed to likely be lower than the minimum applicable Rating Background Levels (RBL) described in Section 2.3 of the NPI. Therefore, the minimum applicable RBLs of 35dBA for the day period and 30dBA for the evening and night periods would be adopted for the proposal

It is noted that pending progression of the development, noise monitoring may be undertaken prior to the preparation of the NIA to ascertain the ambient noise environment in the area due to the development of Keswick Estate. Notwithstanding, the PINLs based on the minimum RBLs outlined in the NPI are presented in **Table 6** and have been determined based on the RBLs +5dBA.

Table 6 Project Intrusiveness Noise Levels

Receiver	Period[1]	Adopted RBL dB LA_{90}	PINL dB $LA_{eq(15min)}$
Residential Receivers	Day	35	40
	Evening	30	35
	Night	30	35

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

5.1.2 Project Amenity Noise Levels

The PANLs for receivers potentially affected by the project are presented in **Table 7**.

Table 7 Project Amenity Noise Levels

Receiver Type	Noise Amenity Area	Assessment Period[1]	Recommended ANL dB $LA_{eq(period)}$[2]	PANL dB $LA_{eq(period)}$[3]	PANL dB $LA_{eq(15min)}$[4]
Residential	Rural	Day	50	50	53
		Evening	45	45	48
		Night	40	40	43
Commercial	All	When In Use	65	65	68

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.
Note 2: Recommended amenity noise levels as per Table 2.2 of the NPI.
Note 3: Project Amenity Noise Level equals the amenity noise level as there is no other industry in the area.
Note 4: Includes a +3dB adjustment to the amenity period level to convert to a 15-minute assessment period as per Section 2.2 of the NPI.

5.1.3 Project Noise Trigger Levels

The PNTLs are the lower of either the PINLs or the PANLs. **Table 8** presents the derivation of the PNTLs in accordance with the methodologies outlined in the NPI.

Table 8 Project Noise Trigger Levels

Receiver Type	Assessment Period[1]	PINL dB LAeq(15min)	PANL dB LAeq(15min)	PNTL dB LAeq(15min)
Residential	Day	40	53	40
	Evening	35	48	35
	Night	35	43	35
Commercial	When In Use	N/A	68	68

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

5.2 Independent Liquor and Gaming Authority (ILGA) Criteria

The relevant ILGA criteria for a period is derived by analysing the single octave LA90 statistical levels of unattended noise monitoring data. The periods typically analysed are 6pm to 10pm for the evening period and 12am to 1.30am for the night period. As unattended noise logging for the project has not been completed at this point, single octave LA90 statistical levels are not available and ILGA criteria cannot be set. Therefore, it is recommended that ambient octave data is identified so conservative level criteria are avoided.

5.3 Road Traffic Noise Criteria

The road traffic noise criteria are provided in the NSW EPA's Road Noise Policy (RNP) (2011).

The local roads categories as specified in the RNP will be adopted for this assessment. **Table 9** reproduces the road traffic noise assessment criteria reproduced from the RNP relevant for this road type. It is noted that the criteria is applicable for existing residences only, but as a best practice approach this criteria is accepted for the future residences along Boundary Road, as future dwellings may be occupied prior to the completion of proposal construction works.

Table 9 Road Traffic Noise Assessment Criteria for Residential Land Uses

Road category	Type of project/development	Assessment Criteria - dBA	
		Day (7am to 10pm)	Night (10pm to 7am)
Local Road	Existing Residences affected by additional traffic on existing local roads generated by land use developments	55dBA LAeq(1hr)	50dBA LAeq(1hr)

5.3.1 Maximum Noise Trigger Levels

The maximum noise trigger levels shown in **Table 10** is based on night time RBLs and trigger levels as per Section 2.5 of the NPI. The trigger levels will be applied to transient noise events that have the potential to cause sleep disturbance.

Table 10 Maximum Noise Assessment Trigger Levels

Residential Receivers			
$L_{Aeq(15min)}$		LAmax	
40dB $L_{Aeq(15min)}$ or RBL + 5dB		52dB LAmax or RBL + 15dB	
Trigger	40	Trigger	52
RBL +5dB	35	RBL +15dB	45
Highest	**40**	**Highest**	**52**

Note: As per Section 2.5 of the NPI, the highest of the two criteria are adopted as the trigger level.

5.4 Construction Noise Management Levels

The Noise Management Levels (NMLs) for construction activities for standard construction hours and out of hours periods are summarised in **Table 11**.

Table 11 Construction Noise Management Levels

Location	Assessment Period	RBL dBA	NML dB $L_{Aeq(15min)}$
All Residential Receivers	Day (Standard Hours)	35	45 (RBL+10dBA)
	Evening (OOH Period 1)	30	35 (RBL+5dBA)
	Night (OOH Period 2)	30	35 (RBL+5dBA)
Commercial	Day (All Periods)	N/A	70dBA

Note: See Table 4 of this report for Recommended Standard Hours for Construction.

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6 Noise Sources

6.1 Sound Power Levels

Table 12 presents the typical sound power level for noise sources which may be associated with the operation of the RC.

It is noted that sound power levels are indicative only to identify constraints for the proposal and were sourced from manufacturer's specifications or from in-field measurements at similar project sites. The sound power levels have been adjusted to account for duration over a 15-minute period.

Table 12 Acoustically Significant Sources – Sound Power Levels *(re 10-12 Watts)*

Item and number modelled per 15-minutes	Individual Sound Power Level dB $L_{Aeq(15min)}$	Total source Sound Power Level dB $L_{Aeq(15min)}$	Assumed Source Location
Operation			
Mechanical Plant (x6)	75	83	Rooftop
Truck deliveries (x1)	92	92	Loading Bay
Patron light Vehicles (x50)	73	90	Car Park
PA/REF Whistle Noise (x1)	90	90	Sports Fields
Spectator Crowd Noise (x1)	100	100	Gallery Seating
Medium Level Amplified Music (x3)	97	102	Gallery Seating/ Internal/Terrace
Group of 4 Patrons (x25)	70	84	Terrace
Sleep disturbance assessment (LAmax), Night time periods (10pm to 7am)			
Delivery Impact	102		Loading Bay
Car Door Slam	85		Car Park
Patron Yelling	92		Terrace/Entrance
Construction Fleet			
Combined Construction Fleet	108		Entire Site

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7 Constraints Summary

This review has identified several preliminary constraints for the proposal relating to noise emissions which are summarised below. It is anticipated a detailed Noise Impact Assessment (NIA) will provide details on management and mitigation measures to address potential noise exceedances.

7.1 Residential Receivers

A review of potential residential receivers surrounding the proposal site identifies that the nearest potential residential receiver is approximately 15m to the north of the proposal site. Given the short separation distance, it is anticipated that the potential risk of operational noise impacts associated with the proposal would be moderate to high, particularly during to weekend sports and internal live music events. It is however noted that noise sources in closest proximity to the northern boundary, are related to vehicle movements and sporting events on the proposed pitch and are typically undertaken during the day and evening periods only.

Receivers to the east and south at a set back distance of approximately 35m or greater and have the potential to be affected by noise from offsite proposal generated traffic.

7.2 Noise Environment and Project Noise Trigger Levels

Due to the rural nature of the locality and the absence of any existing significant noise generating activities in the area such as commercial or industrial facilities, it is considered that the construction and operational phase noise criteria would be based on minimum background noise levels as per the NPI.

Notwithstanding, as the Keswick Estate is established it is likely that noise levels will rise during all periods and it is recommended that updated noise monitoring be undertaken prior to the preparation of the NIA to measure contemporary background levels and to ascertain single octave LA90 statistical levels to set ILGA criteria.

7.3 Intervening Topography

A review of the local topography indicates that the proposal site is located on a relatively flat terrain with no intervening topography between the site and future noise sensitive receivers. Accordingly, the future receivers in close to the proposal would not benefit from the shielding effect of the intervening topography. The construction of intervening buildings or the installation of noise barriers or bunds can be used to reduce the received noise levels at surrounding noise sensitive receivers.

7.4 Operational Noise Impacts

The potential for operational noise impacts are dependent on the period of operation and the events being held at the site. Accordingly, the operations are broken up into two typical indicative scenarios outlined below:

- Daily Operation of the proposal; and
- Sporting Events.

7.4.1 Daily Operations

Significant noise sources at the proposal site during daytime periods include mechanical plant and car park noise generated by customer vehicles. Considering the draft site layout and offset distances to the surrounding receivers, it is possible that the site will exceed the applicable PNTLs. Therefore, mitigation measures such as acoustic screens surrounding the rooftop mechanical plant and along the south eastern boundary may be required. This will be confirmed when a final site layout can be assessed.

7.4.2 Sporting Events

During sporting events, the significant noise sources at the proposal site include possible crowd noise within the gallery seating , PA, amplified music noise at the gallery and the terrace of the club, and referee/umpire whistle noise. Receivers surrounding the sports field maybe affected by such noise sources however, typically small sports fields may be surrounded by earth mounds to assist spectator view the game. Such mounds would be beneficial for the proposal to mitigate noise emissions from the site coupled with intervening buildings like the clubhouse. Amplified music being played through the PA system may also be managed with the use on a noise limiter which controls the output of the system and selection of PA location with respect to orientation and receivers.

7.5 Traffic Noise Summary

A key noise source associated with this proposal is offsite traffic, especially during events such as sporting matches being played on the proposed sports field.

As the area is undeveloped there is negligible existing road traffic. During sports events there is the potential for up to a total of 200 vehicle movements per hour to and from the proposal site.

A review of the future receiver locations indicates that the separation distance to the centre of the proposed estate roads is less than 20m. Based on the separation distance between the road and the residential receivers, noise levels from traffic are expected to comply with the relevant road noise criteria during the daytime, however large events during the night period have the potential to exceed the applicable criteria. Notwithstanding, it is unlikely that the RC would generate 200 vehicles movements an hour during the night period, however this should be reviewed and confirmed as part of a formal NIA.

7.6 ILGA Summary

As the ILGA criteria cannot be accurately established in the absence of unattended noise data, an initial constraints assessment is not possible, it however noted that external ILGA sources such as patrons and music in external areas would be a dominant noise source. Based on the current site layout and taking into account the set back distance to surrounding receivers and intervening buildings, the risk to the receivers is low to medium.

7.7 Construction Noise Impacts

MAC understands that construction activities associated with the proposal would include construction of a RC including buildings, gallery seating, formation of sports facilities, and the laying of asphalt for the car park. The use of heavy machinery for these activities may potentially result in community reaction to the noise.

It is noted that due to the separation distances, the risk of noise impacts during construction of any RC structures would likely be low to moderate. Furthermore, the area is currently being developed as part of the Keswick Estate and construction activities are expected to be undertaken in the surrounding area for an extended period as part of the estate development. Accordingly, the daytime construction noise would be typical for the area in the foreseeable future. Furthermore, the surrounding receivers may not be completed prior to the project associated construction works and accordingly may not be occupied.

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8 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has conducted a Preliminary Opportunities and Constraints Noise Assessment for the proposed rezoning of Lot 502, DP1255115, Boundary Road, Dubbo, NSW. The assessment reviewed opportunities and constraints associated with rezoning to allow future potential developments on the site including of a registered club in regard to noise impacts on the community.

The review identified that the rural nature of the locality, short separation distances between the proposal site and nearby receivers, and the nature of the proposal activities would result in a moderate to high risk of noise impacts, particularly from sports/external events and road traffic noise.

The review does note that as Keswick Estate develops it is likely that the ambient rural noise environment will evolve into a typical suburban noise environment.

The review has concluded that during the construction phase of a potential registered club, there is potential that the generated noise levels may be above the relevant criteria, however as the area is currently undergoing development, construction noise may be typical for the area for the foreseeable future. It is also noted that the lots surrounding the project site are undeveloped and that many receivers would not be completed or occupied prior to construction of the facility.

During operation of a potential registered club, there is a moderate to high risk of noise impacts within the community. The risk of potential impacts would be greater during the evening and night period as a result of the more stringent period criteria. It is therefore considered that management and mitigation measures may be required to reduce the potential impacts on the community.

The management and mitigation measures will be provided in more detail in the Noise Impact Assessment report for the project.

In summary pending final layout plans for any future registered club development, the proposal site is considered suitable for rezoning to allow for the potential future development of a registered club.

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Appendix A – Glossary of Terms

A number of technical terms have been used in this report and are explained in **Table A1**.

Table A1 Glossary of Terms

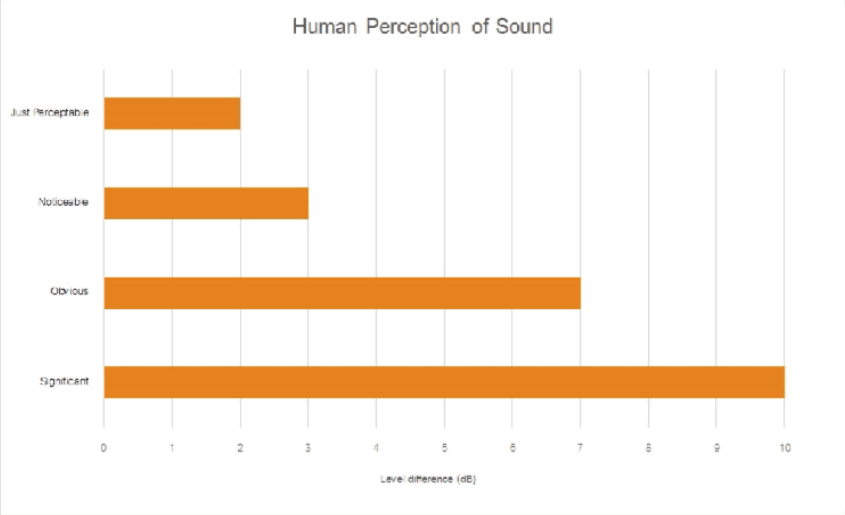
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured LA90 statistical noise levels.
Ambient Noise	The noise associated with a given environment. Typically a composite of sounds from many sources located both near and far where no particular sound is dominant.
Extraneous Noise	Noise resulting from activities that are not typical of the area. Atypical activities include sources such as construction and holiday period traffic.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(Z), dB(L)	Decibels Linear or decibels Z-weighted.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA10	A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels.
LA90	Commonly referred to as the background noise, this is the level exceeded 90 % of the time.
LAeq	The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period.
LAmax	The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval.
RBL	The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABL's.
Sound power level (LW)	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment. Or a measure of the energy emitted from a source as sound and is given by : = 10.log10 (W/Wo) Where: W is the sound power in watts and Wo is the sound reference power at 10-12 watts.

Table A2 provides a list of common noise sources and their typical sound level.

Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA

Source	Typical Sound Level
Threshold of pain	140
Jet engine	130
Hydraulic hammer	120
Chainsaw	110
Industrial workshop	100
Lawn-mower (operator position)	90
Heavy traffic (footpath)	80
Elevated speech	70
Typical conversation	60
Ambient suburban environment	40
Ambient rural environment	30
Bedroom (night with windows closed)	20
Threshold of hearing	0

Figure A1 – Human Perception of Sound



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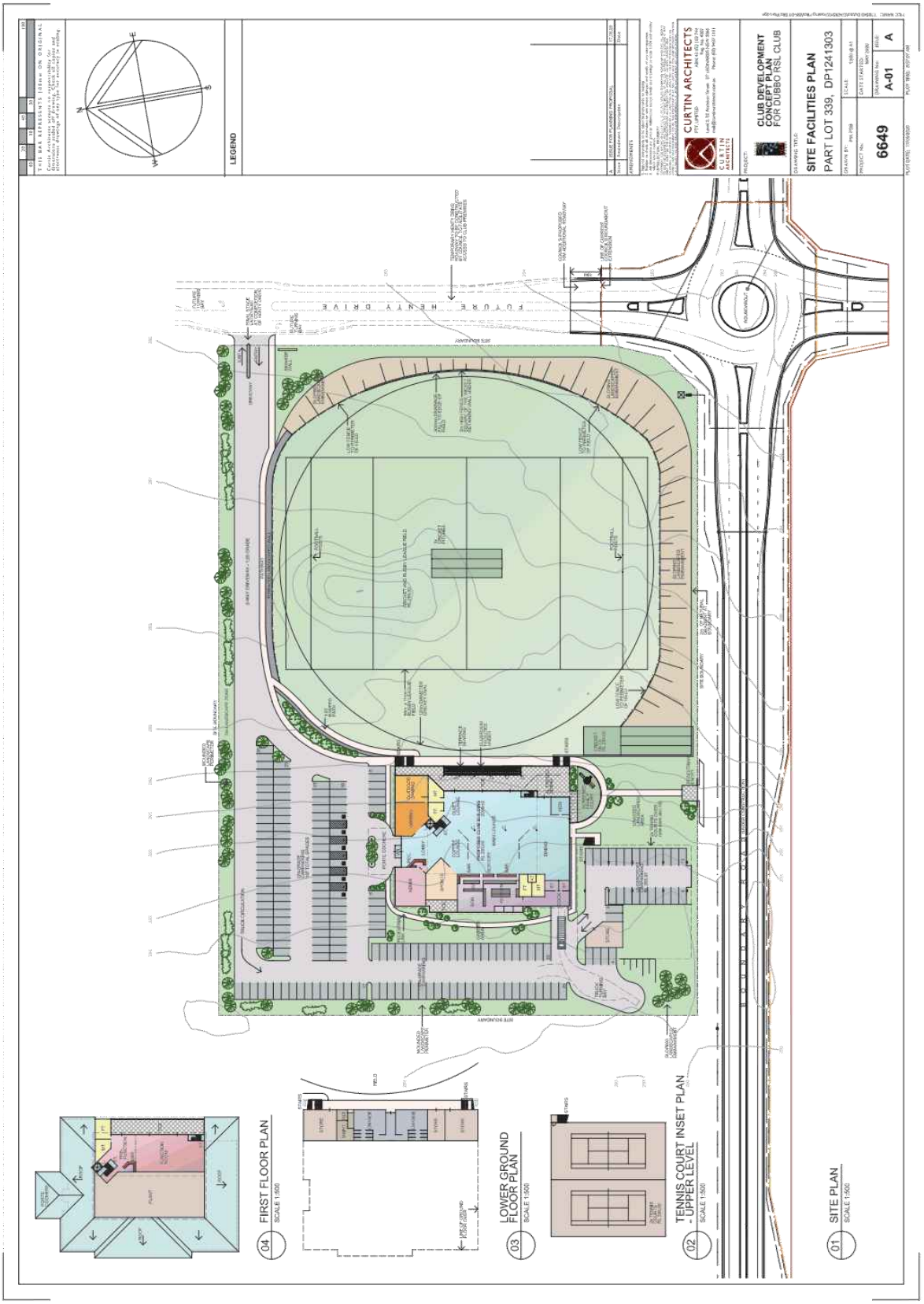
Appendix B – Site Plans


LEGEND
CURTIN ARCHITECTS
CLUB DEVELOPMENT
CONCEPT PLAN
FOR DUBBO RSL CLUB
SITE FACILITIES PLAN
PART LOT 339, DP1241303
6649
A-01
A
FUTURE HENRY DRIVE
SITE BOUNDARY
01 SITE PLAN
SCALE 1:500
02 TENNIS COURT INSET PLAN - UPPER LEVEL
SCALE 1:500
03 LOWER GROUND FLOOR PLAN
SCALE 1:500
04 FIRST FLOOR PLAN
SCALE 1:500

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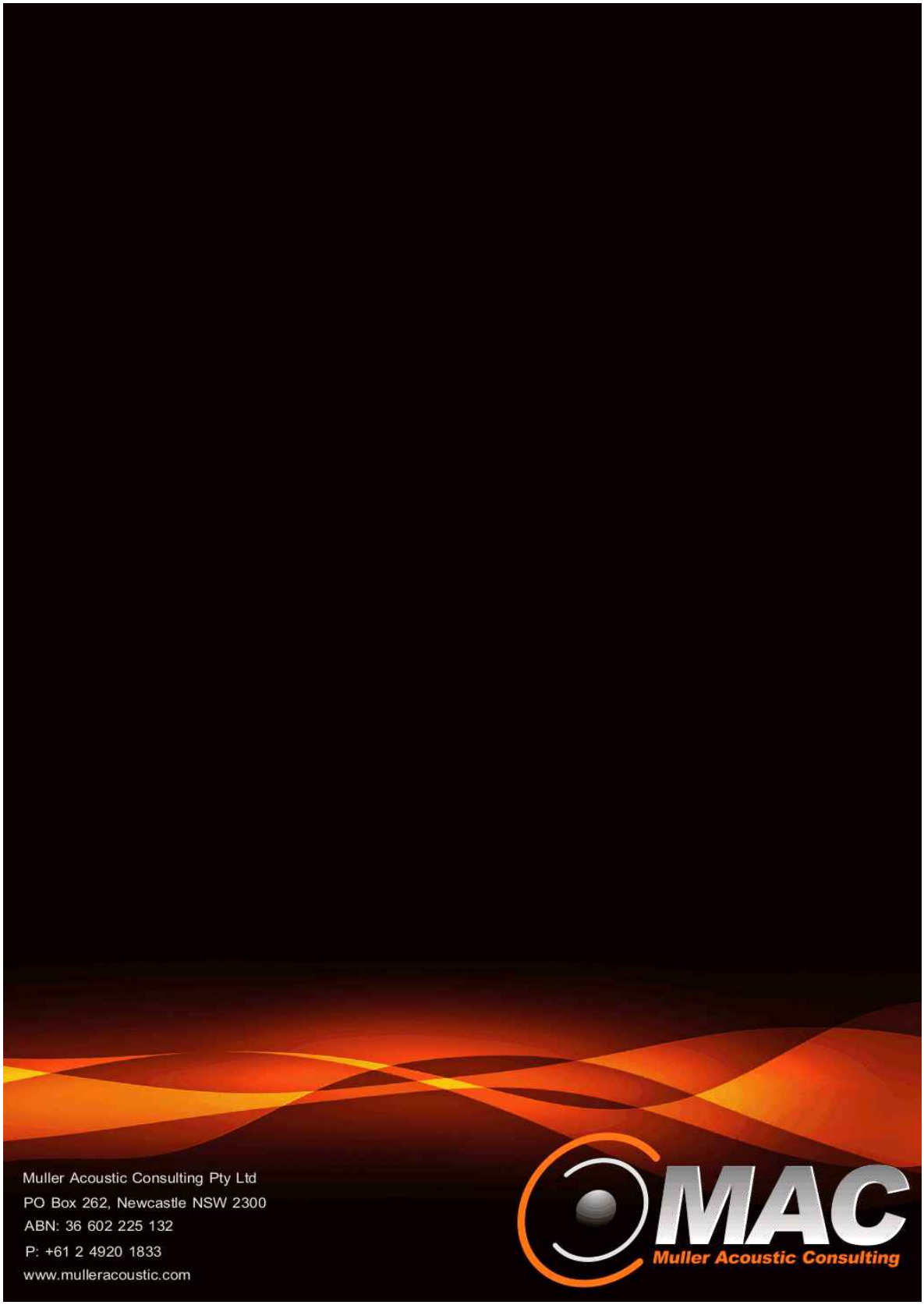
Muller Acoustic Consulting Pty Ltd
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P: +61 2 4920 1833
www.mulleracoustic.com
MAC
Muller Acoustic Consulting

at&l

Dubbo RSL
Civil Engineering Servicing Report

CLIENT/ DUBBO RSL MEMORIAL CLUB
DATE/ SEPTEMBER 2020
CODE/ REP001-04-20-740-CIVIL ENGINEERING SERVICING REPORT

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Document Registration

Document Title	Dubbo RSL - Civil Engineering Servicing Report
Document File Name	REP001-04-20-740-Civil Engineering Servicing Report
Section	Civil Engineering
Document Author	Andrew Tweedie

Issue	Description	Date	Author	Checked	Approved
001	DRAFT	27/04/20	Alexandra Chung	☒	☒
002	FINAL	29/05/20	Andrew Tweedie	☐	☐
003	FINAL	24/07/20	Andrew Tweedie	☒	☒
004	FINAL	29/09/20	Andrew Tweedie	☒	☒
				☐	☐

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3.3. Sewer 9
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Appendix A Extract from Boundary Road Extension Stage 2 – Civil Package
Appendix B Dial Before You Dig Records
Appendix C Email Correspondence - Chris Godfrey 20th April 2020

1. Introduction

1.1 Background

AT&L has been commissioned by Dubbo Memorial Club Pty Ltd to prepare a Civil Engineering Servicing Report to support the planning proposal for the New Club Development, Dubbo RSL Club. The planning proposal is to amend the Dubbo Local Environmental Plan (Dubbo LEP) 2011 to accommodate a new registered club facility and associated recreational facilities.

The subject site is situated in the suburb of Dubbo, within the Dubbo Regional Council Local Government Area. The proposed site currently forms part of a larger site that will be subdivided to accommodate the proposal. The larger site is commonly known as Volta Avenue, Dubbo, legally described as Lot 502, DP 1255115. Figure 1 below indicates the relative location of the site.



Figure 1: Subject Site Locality (The Planning Hub 2020)

The purpose of this report is to provide preliminary advice regarding:

- Dial Before you Dig (DBYD) records;
- Locations of existing services;
- Review of Dubbo Council's Stage 2 Boundary Road extension documentation;
- Proposed service upgrades as part of the Stage 2 works; and
- Potential service upgrades required to ensure adequate supply to the site.

1.2 Existing Site

The subject site currently forms part of Lot 502, DP1255115. There is currently no road or utility services leading to the proposed site.

Following the proposed subdivision, the site will be bound by the future extension of Boundary Road to the South and Stream Avenue to the East. Lands located immediately North and West of the site are nominated for Future Keswick Estate Lands. Refer Appendix A showing relative locations of Keswick Estate and the proposed Boundary Road.

The proposed development site covers a total area of approximately 3.3ha containing no existing infrastructure and is covered in light to medium grass cover.

1.3 Proposed Development

This planning proposal is being produced to rezone the site to include the additional permitted use of a registered club and recreation facilities. The proposal will facilitate the future development of a new registered club facility and associated recreational facilities. The key design features include:

- Club Building;
- Kids play and family area;
- Sports and recreation facilities;
- Off street on-grade Parking; and
- Sports field and supporting external amenities.

Refer Figure 2 for the proposed site layout prepared by Curtin Architects.

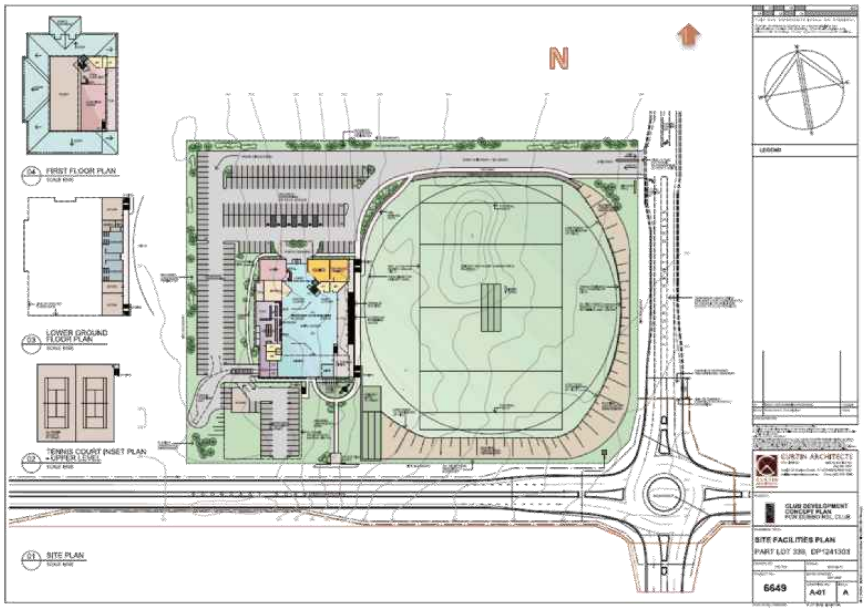


Figure 2: Proposed Development Site Plan (Curtin Architect September 2020)

2. Boundary Road Extension

As part of Dubbo Council's investment of capital projects, the Boundary Road Extension project is proposed to provide connection between Wheelers and Sheraton Road to the east. The purpose of this extension was to provide access to developing The Kewsick and South Lake housing estates and improve access for residents to Dubbo's growth areas.

Stage 1 of the Boundary Road Extension Project, between Wheelers Lane and Alexandria Ave was completed by Council in late 2018. Stage 2, between Alexandria Ave and Sheraton Road is currently being reviewed for Construction Certificate approval and construction is anticipated to begin within Q2 2020.

The Stage 2 extension is a 1.2km long two-lane sealed and fully kerbed extension with integrated bike lanes and a footpath on the southern side. The following utilities will be installed as part of the works;

- Stormwater;
- Potable Water;
- Sewer;
- Street lighting and underground electricity;
- Telecommunications; and
- Gas.

Refer Appendix A for Boundary Road Extension Stage 2 documentation.

3. Services Strategy

In order to provide a servicing strategy for the proposed lot, a desktop review of the existing services in the area was carried out using Nearmap and DBYD results. Refer Appendix 2 for all DBYD results.

The following existing services and associated asset owners were found within the wider vicinity of the site:

- Stormwater – Dubbo Regional Council;
- Water – Dubbo Regional Council;
- Sewer – Dubbo Regional Council;
- Electrical – Essential Energy;
- Gas – Jemena; and
- Telecommunications – Telstra, NBN.

In addition, Dubbo Council also provided information and construction documentation relating to the proposed Boundary Road Stage 2 Extension works. Refer Appendix A for Boundary Road Construction Drawings and Appendix C for Council advice received from Chris Godfrey, Acting Manager Infrastructure Strategy and Design on 20th April 2020.

3.1. Stormwater Drainage

Dial Before You Dig (DBYD) records from Dubbo Regional Council indicate there is no existing piped stormwater infrastructure on the site or within the proposed street frontages to the site.

As part of the Boundary Road extension works scheduled for completion by Dubbo Council, stormwater drainage has been proposed within the road reserve. The proposed network indicates a DN525mm pipe will be installed in the south-east corner of the lot fronting Stream Ave and a DN300mm pipe will be installed in the south-east corner of the lot fronting Boundary Road. These two connection locations ultimately drain into the same trunk drainage network to the east. Council have advised it will be possible to connect the proposed lot into this system, subject to their consultation and approval. Refer Figure 3 indicating the Stormwater network proposed as part of the Dubbo Council Boundary Road Stage 2 Extension Works.

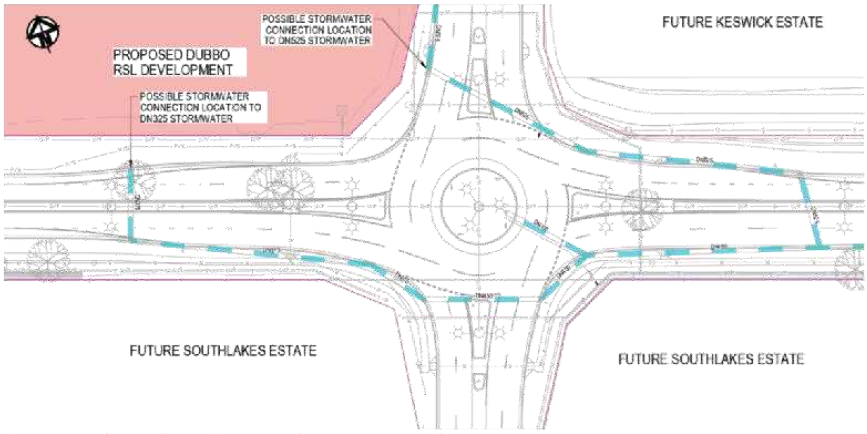


Figure 3: Boundary Road Extension Proposed Stormwater Network

3.1.1 On-site detention

In order to control stormwater runoff, a new stormwater drainage network will be constructed within the proposed site to service the development. Prior to discharging into Council's street trunk drainage system, on-site detention will be provided to satisfy the permissible discharge requirements for the site.

All stormwater drainage infrastructure will be designed in accordance with the requirements of the relevant engineering standards including the Dubbo Development Control Plan 2013 and AS3500.3.

3.1.2 Stormwater Quality Treatment

In order to ensure disturbance to natural stream systems are minimised, water quality treatment measures will be installed to treat the surface water prior to discharging into Councils street trunk drainage system.

All stormwater quality infrastructure will be designed in accordance with the requirements of the relevant engineering standards including the Dubbo Development Control Plan 2013.

3.2. Potable Water

Dial Before You Dig (DBYD) records from Dubbo Regional Council indicate there is no existing potable water infrastructure on the site or within the proposed street frontages to the site. There is however an existing potable water service at the intersection of Alexandria Avenue and Boundary Road.

As part of the Boundary Road extension works, Dubbo Council have advised a DN150mm PVC potable water main will extend from the potable water service at the intersection of Alexandria Avenue and Boundary Road and be provided within the verge fronting the south east corner of the lot. Council have advised connection to this potable water service is possible, subject to their consultation and approval. Refer Figure 4 showing the Potable Water network proposed as part of the Dubbo Council Boundary Road Stage 2 Extension Works.

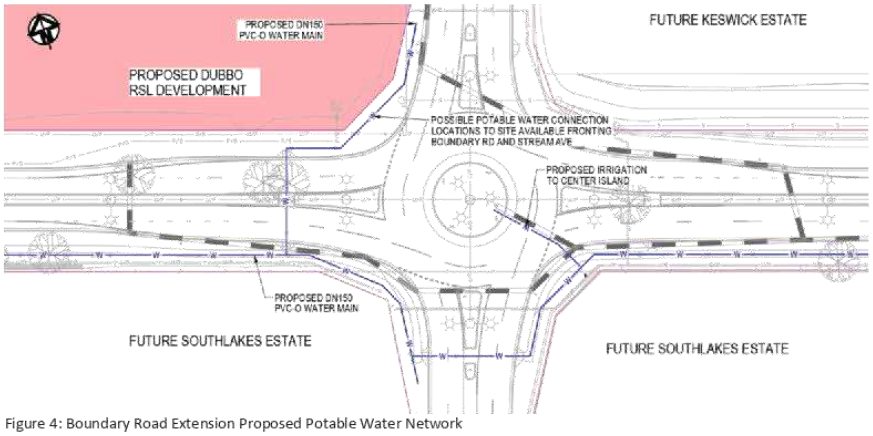


Figure 4: Boundary Road Extension Proposed Potable Water Network

3.3. Sewer

Dial Before You Dig (DBYD) records from Dubbo Council indicate there is no existing sewer infrastructure on the site or within the proposed street frontages to the site.

As part of the Boundary Road extension works, Dubbo Council propose a HDPE DN50mm pressure sewer connection and pressure sewer boundary kit will be made available to the lot. Council have advised connection to the pressured sewer network is possible, subject to the construction of an on-site sewer pump station and their consultation and approval.

In addition to the pressurised system, a DN150mm gravity sewer connection will also be provided to the lot. Connection to this service will not be available for use until such a time the Southlakes Residential subdivision to the south of Boundary Road extends its internal sewer network. Once the gravity sewer is made live, the lot can be disconnected from the pressure sewer network and connected to the gravity sewer. Refer Figure 5 showing the Sewer network proposed as part of the Dubbo Council Boundary Road Stage 2 Extension Works.

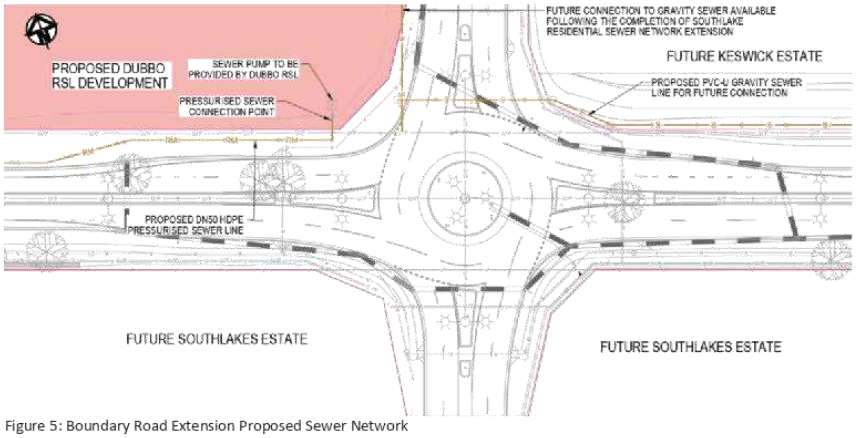


Figure 5: Boundary Road Extension Proposed Sewer Network

3.4. Electrical

Dial Before You Dig (DBYD) records from Essential Energy indicate there is no existing electrical infrastructure on the site or within the proposed street frontages to the site. However, Council's Boundary Road extension documentation show 2 x 11kV existing underground feeders from the Sheraton Road Solar Farm to the east of the proposed site. Connection to these feeders are not available and need to be protected during construction.

As part of the Boundary Road extension works, Dubbo Council propose the installation of underground electrical conduits located within the centre median and the southern verge of Boundary Road, and within a crossing connection on Stream Avenue. Council have not confirmed the capacity within these conduits, however, have expressed both high (11kV) and low voltage (415V) conduits are likely to be provided. Connection to this service is available, subject to the approval of the Essential Energy. Refer Figure 6 showing the Electrical network proposed as part of the Dubbo Council Boundary Road Stage 2 Extension Works.

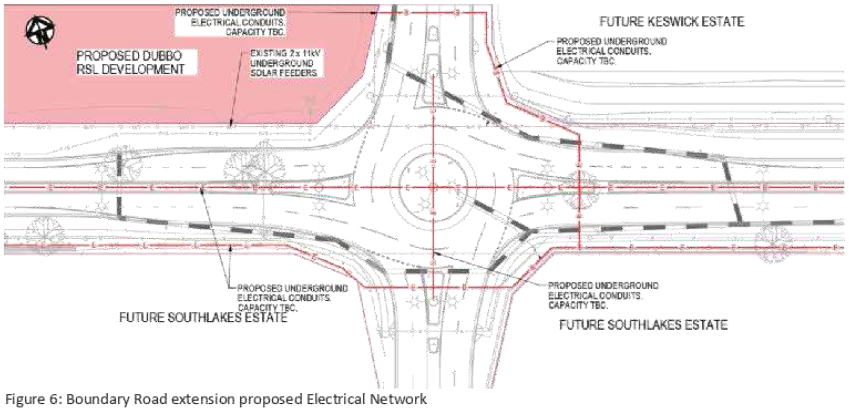


Figure 6: Boundary Road extension proposed Electrical Network

3.5. Natural Gas

Dial Before You Dig (DBYD) records indicate there is no existing gas infrastructure on the site or within the proposed street frontages to the site.

As part of the Boundary Road extension works, Dubbo Council propose a low-pressure natural gas main in the southern verge of Boundary Road and within a crossing connection on Stream Avenue. The diameter of the gas main has not been finalised, however will likely be either DN32mm or DN50mm. Connection to this gas main will be available in the south-east corner of the site within the Stream Avenue verge. Refer Figure 7 showing the Gas network proposed as part of the Dubbo Council Boundary Road Stage 2 Extension Works.

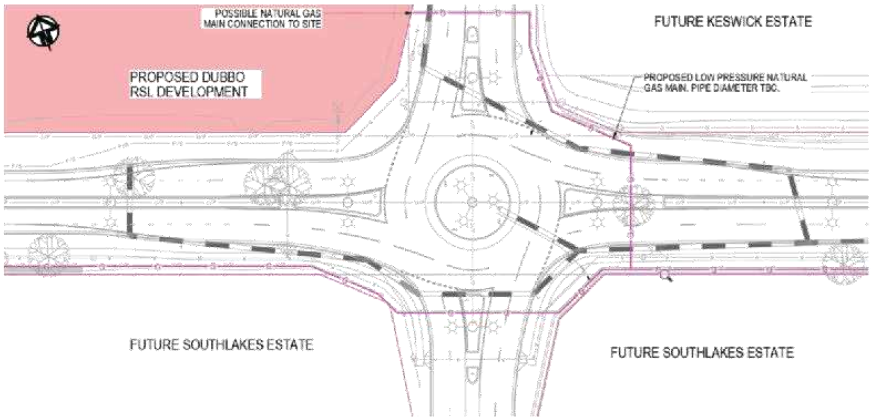


Figure 7: Boundary Road Extension Proposed Natural Gas Network

3.6. Telecommunications

Dial Before You Dig (DBYD) results from NBN indicate there is no existing telecommunications infrastructure on the site or within the proposed street frontages to the site.

As part of the Boundary Road extension works, Dubbo Council propose NBN pit and pipe network in the southern verge of Boundary Road and within a crossing connection on Stream Avenue. The network will provide conduits only and fibres are to be provided by the proposed development in consultation with the NBN. Refer Figure 8 below showing the Telecommunications pit and pipe network proposed as part of the Dubbo Council Boundary Road Stage 2 Extension Works.

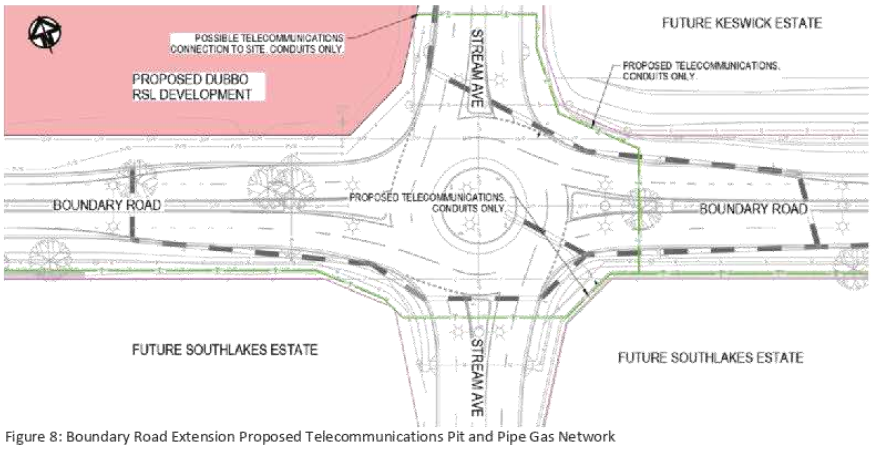


Figure 8: Boundary Road Extension Proposed Telecommunications Pit and Pipe Gas Network

4. Summary

This Servicing Strategy report Civil Engineering Servicing report has been completed for the proposed new Club development and facilities for Dubbo RSL at Lot 502, DP 1255115. Key findings from AT&L's Servicing Strategy assessment and analysis are summarised below:

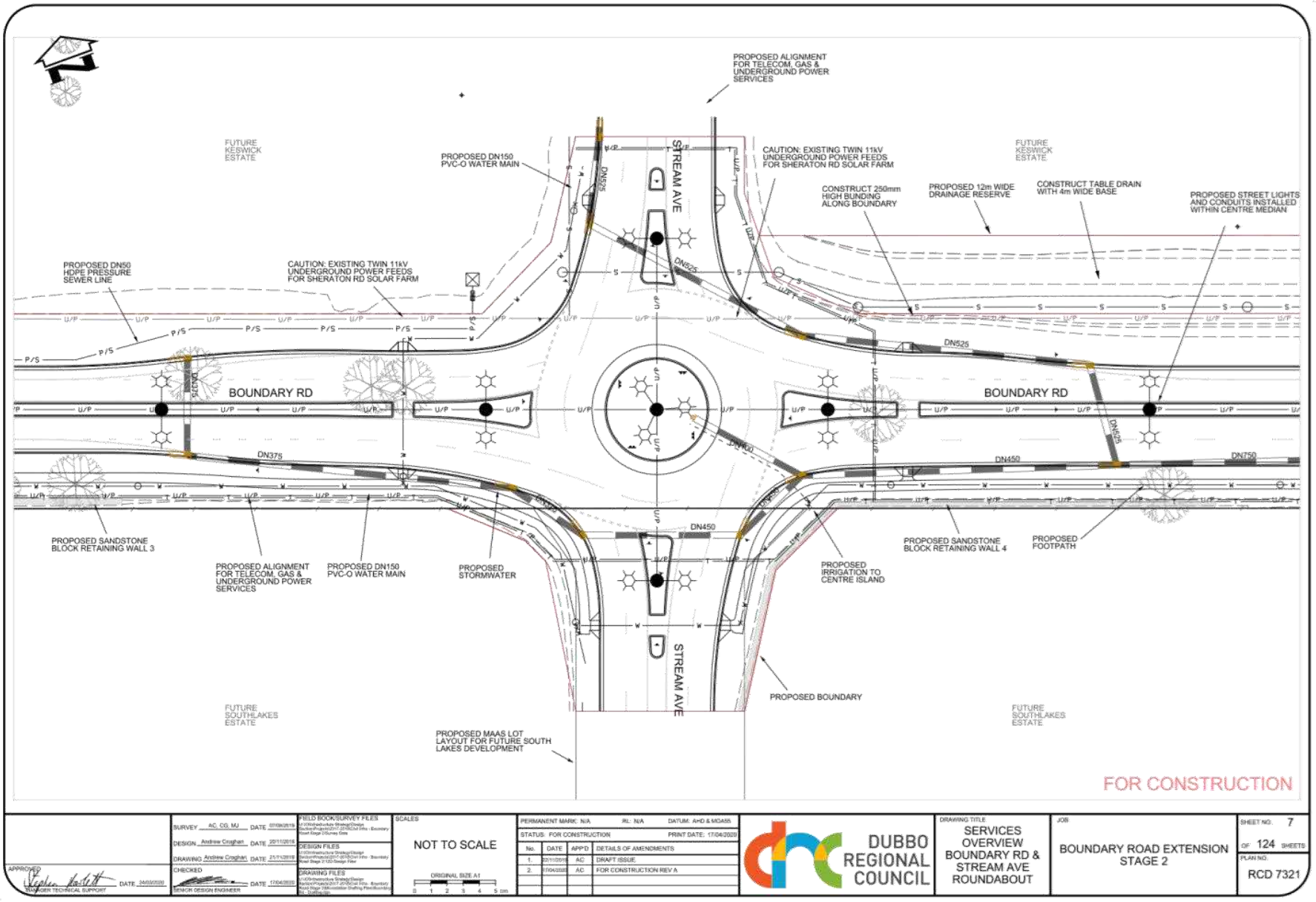
- Desktop review and DBYD records indicate the proposed development does not currently have a road or any services leading to the proposed frontage of the site.
- As part of Dubbo Council's investment of capital projects, the Boundary Road Extension Stage 2 of the project is due to commence in this current quarter, Q2 2020.
- The Boundary Road Stage 2 Extension extends from Alexandria Avenue to Sheraton Road, approximately 1.2km long.
- The Stage 2 extension is a 1.2km two-lane sealed and fully kerbed extension with integrated bike lanes, a footpath and utilities.
- Following the completion of the Boundary Road extensions:
    - Two (2) **stormwater** connections will be available for connection in the south-east corner of the site;
    - A DN150mm PVC **potable water** main will be available for connection in the south east corner of the site;
    - A HDPE DN50mm pressure **sewer** connection and pressure sewer boundary kit will be made available to the lot. Use of the connection will require the developer provision of an on-site sewer pump out station;
    - A DN150mm gravity **sewer** connection will also be provided to the lot. Disconnection from the pressurised system and connection to this service will not be available for use until the Southlakes Residential subdivision extends its internal sewer network; and
    - **Underground electrical** conduits, a **low-pressure gas** main and an **NBN pit and pipe system** will be available for connection in the south east corner of the site.

  The connections to the above services are subject to the requirements and approval of the relevant authorities.

Based on the above findings, it can be concluded that all essential utility services are available from the south-eastern frontage of the proposed site following the completion of the Boundary Road Stage 2 extension works. It is not anticipated that any lead-in infrastructure will be required to service the site.

Appendix A

Extract from Boundary Road Extension Stage 2 – Civil Package


PROPOSED ALIGNMENT FOR TELECOM, GAS & UNDERGROUND POWER SERVICES
FUTURE KESWICK ESTATE
PROPOSED DN150 PVC-O WATER MAIN
STREAM AVE
CAUTION: EXISTING TWIN 11kV UNDERGROUND POWER FEEDS FOR SHERATON RD SOLAR FARM
CONSTRUCT 250mm HIGH BUNDING ALONG BOUNDARY
PROPOSED 12m WIDE DRAINAGE RESERVE
CONSTRUCT TABLE DRAIN WITH 4m WIDE BASE
PROPOSED STREET LIGHTS AND CONDUITS INSTALLED WITHIN CENTRE MEDIAN
PROPOSED DN50 HDPE PRESSURE SEWER LINE
BOUNDARY RD
DN525
DN375
DN450
DN750
PROPOSED SANDSTONE BLOCK RETAINING WALL 3
PROPOSED ALIGNMENT FOR TELECOM, GAS & UNDERGROUND POWER SERVICES
PROPOSED DN150 PVC-O WATER MAIN
PROPOSED STORMWATER
PROPOSED IRRIGATION TO CENTRE ISLAND
PROPOSED SANDSTONE BLOCK RETAINING WALL 4
PROPOSED FOOTPATH
PROPOSED BOUNDARY
FUTURE SOUTHLAKES ESTATE
PROPOSED MAAS LOT LAYOUT FOR FUTURE SOUTH LAKES DEVELOPMENT
FOR CONSTRUCTION
NOT TO SCALE
DUBBO REGIONAL COUNCIL
SERVICES OVERVIEW BOUNDARY RD & STREAM AVE ROUNDABOUT
BOUNDARY ROAD EXTENSION STAGE 2
RCD 7321

Appendix B

Dial Before You Dig Records

Dial Before You Dig Enquiry Response

DUBBO REGIONAL COUNCIL

27/03/2020

Mr Roshan Paheerathan
AT&L
level 7 153 Walker Street
North Sydney NSW 2060

Attention Mr Roshan Paheerathan

Job number: 19276334
Sequence number: 96188197
Location: Boundary Road, Dubbo
Date received: 27/03/2020

RESPONSE FROM SERVICES AUTHORITY:

After referring to the Dubbo Regional Council asset mapping system (see attached extract for the relevant area), Dubbo Regional Council advises that within the vicinity of the proposed works there are:

WATER SUPPLY, STORMWATER DRAINAGE AND SEWERAGE ASSETS IN THE AREA.
Note: Pipe maps do not include property water services or roof drainage pipes and private stormwater systems not under Council's control

If proposed excavation is likely to be in close proximity to Council's undergrounds services, it is recommended that you arrange for a Dubbo Regional Council representative to meet on site to identify the location of DRC assets. Please telephone (02) 6801 4000 and allow at least 48 hours notice for a Council officer to attend.

The initial site visit will not normally incur a charge however subsequent visits may, at the discretion of Dubbo Regional Council, incur a charge at an hourly rate.

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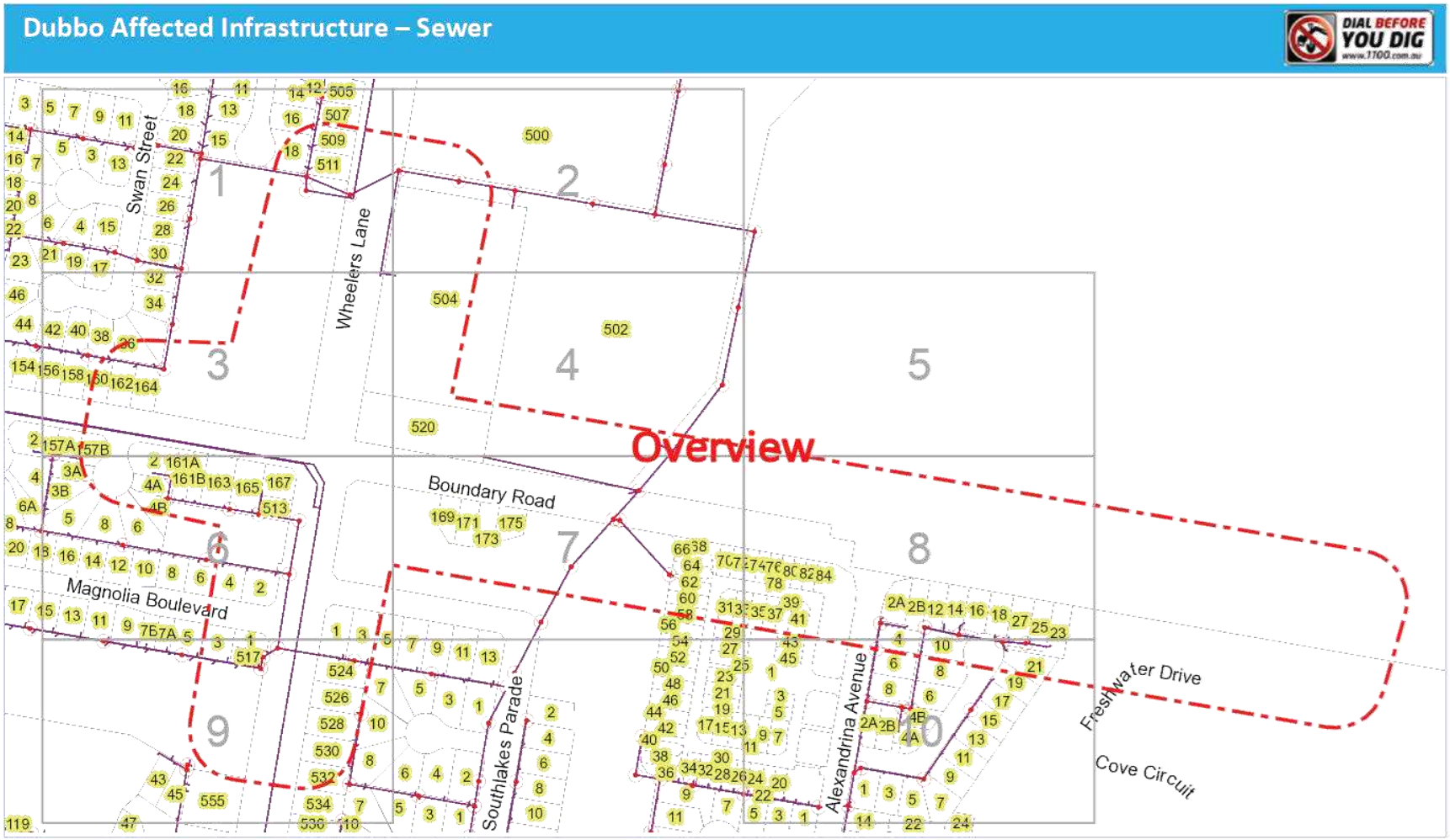
This reply relates only to the location indicated by the applicant with a radius of 40 meters from the original DBYD enquiry and is valid for 28 days from the date sent.



DUBBO REGIONAL COUNCIL

DBYD Job: **19276334**
DBYD Seq: **96188197**
Location: **Boundary Road, Dubbo, NSW 2830**

Legend
Sewer Manhole
Sewer line

Map Scale: 1:4100

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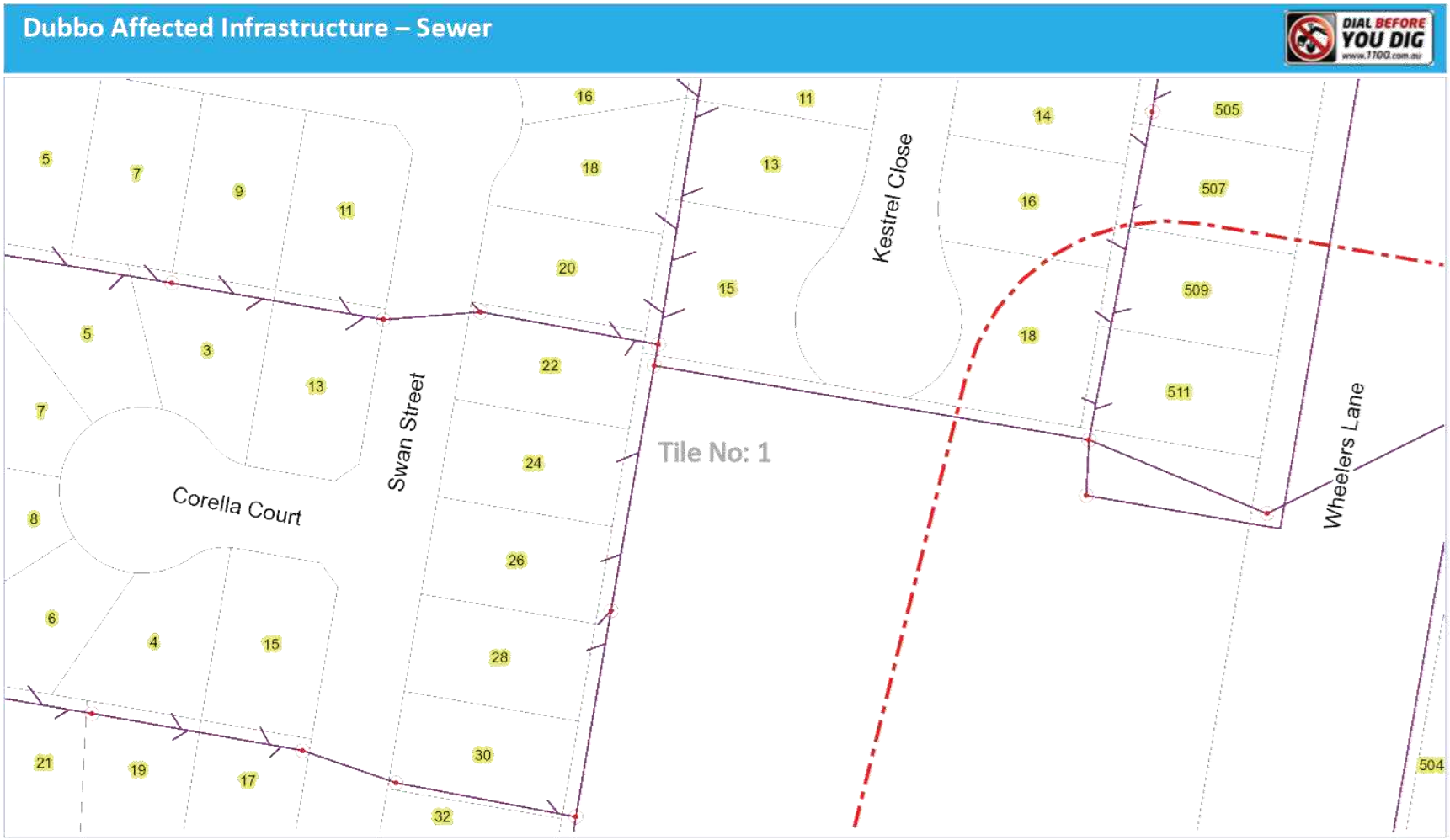

DUBBO REGIONAL COUNCIL

DBYD Job: **19276334**
DBYD Seq: **96188197**
Location: **Boundary Road, Dubbo, NSW 2830**

Legend

Sewer Manhole

Sewer line

Map Scale: 1:1000

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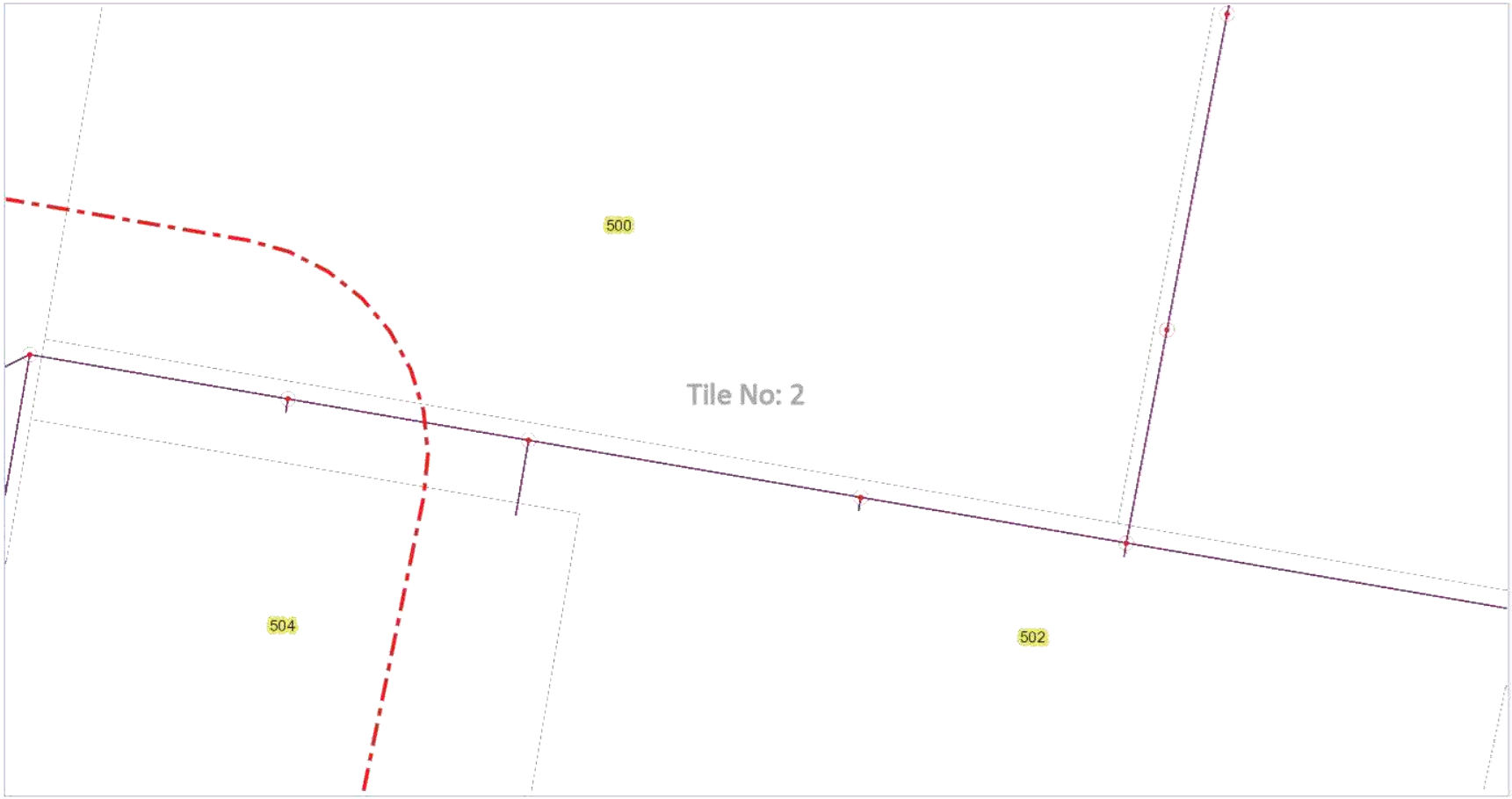
Dubbo Affected Infrastructure – Sewer

DIAL BEFORE YOU DIG www.1100.com.au



DUBBO REGIONAL COUNCIL

DBYD Job: **19276334**
DBYD Seq: **96188197**
Location: **Boundary Road, Dubbo, NSW 2830**

Legend

Sewer Manhole

Sewer line

Map Scale: 1:1000

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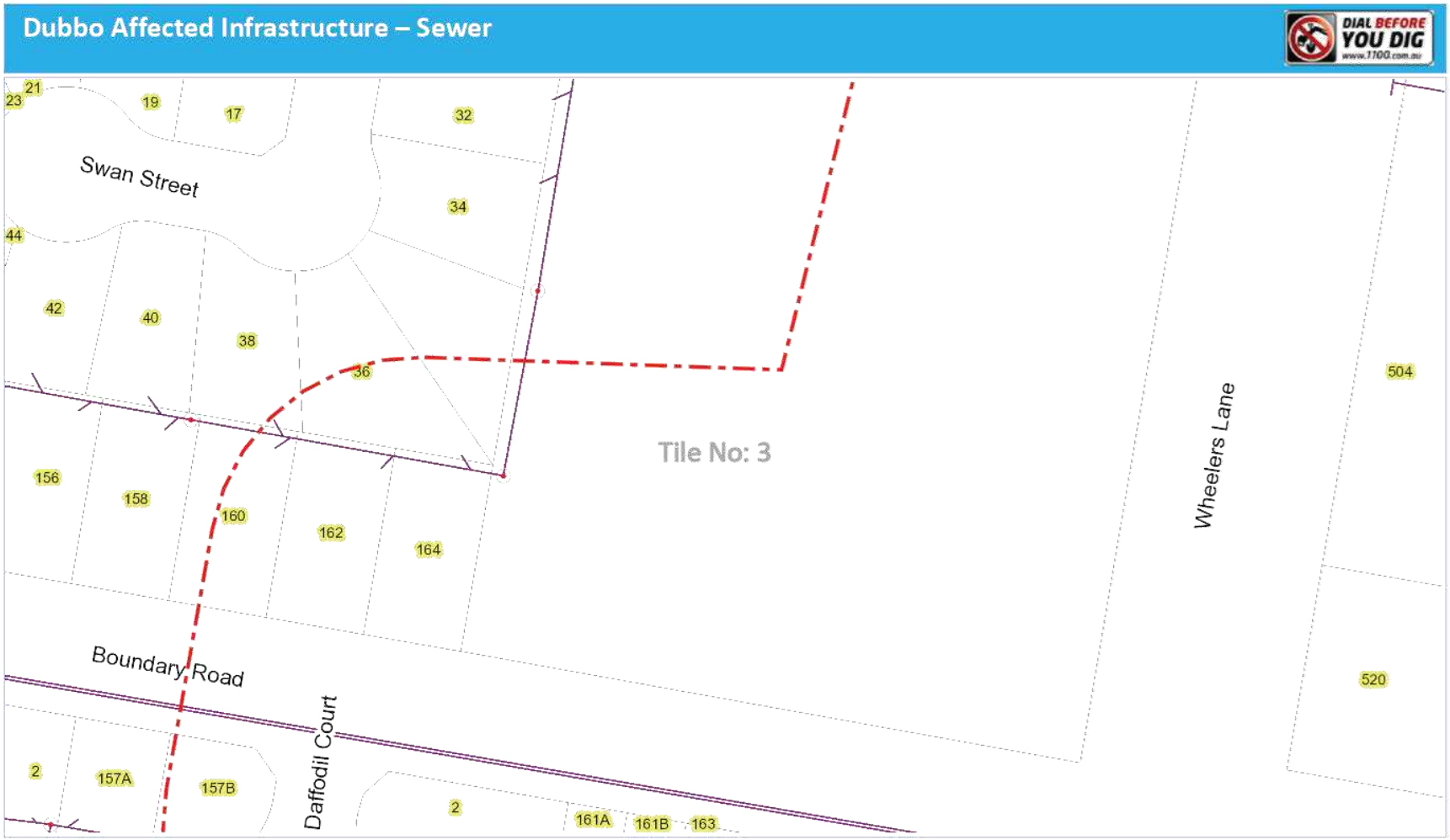

DUBBO REGIONAL COUNCIL

DBYD Job: **19276334**
DBYD Seq: **96188197**
Location: **Boundary Road, Dubbo, NSW 2830**

Legend

Sewer Manhole — Sewer line

Map Scale: 1:1000

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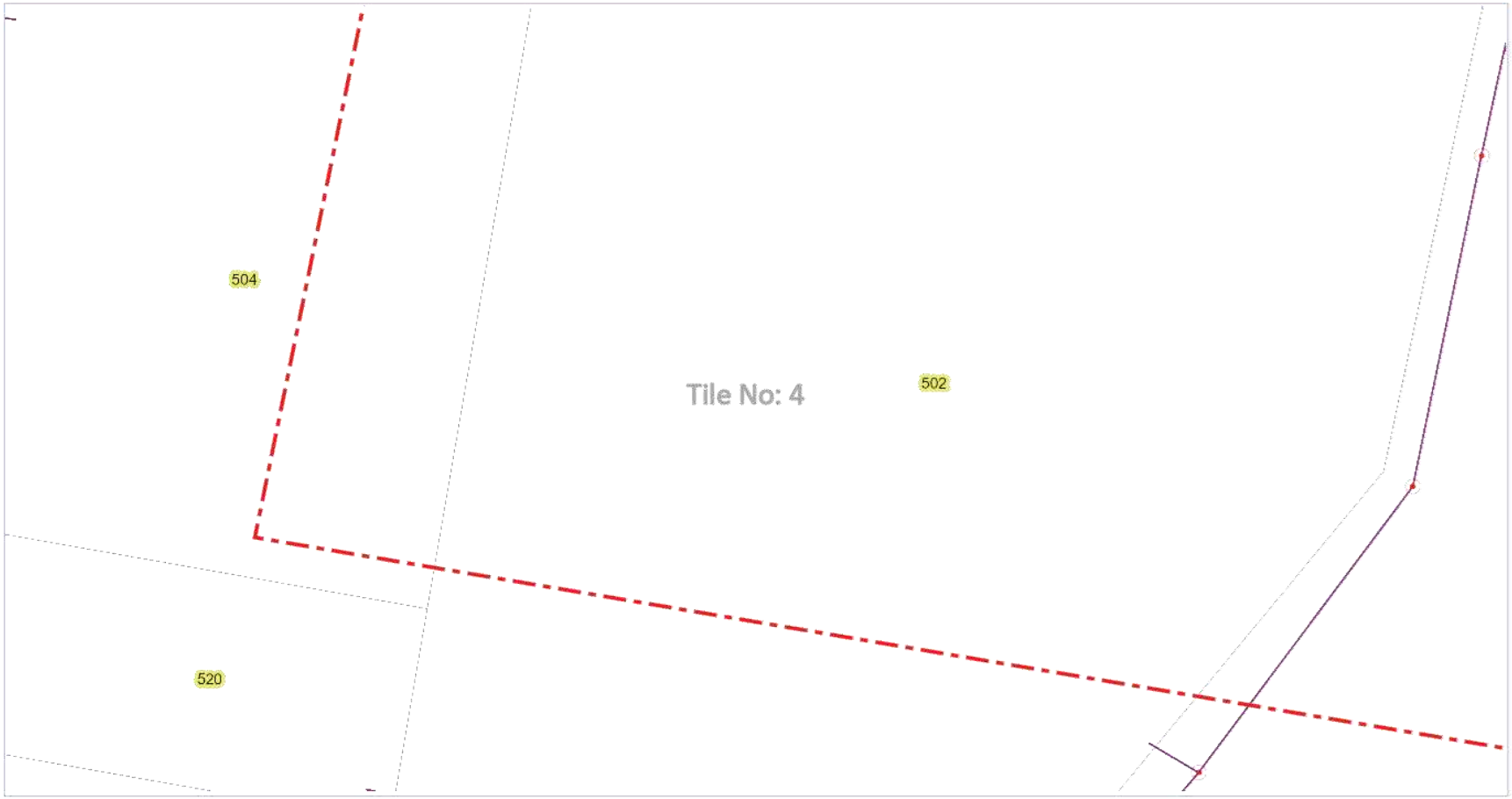
Dubbo Affected Infrastructure – Sewer

DIAL BEFORE YOU DIG www.1100.com.au



DUBBO REGIONAL COUNCIL

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Location: **Boundary Road, Dubbo, NSW 2830**

Legend

Sewer Manhole

Sewer line

Map Scale: 1:1000

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Dubbo Affected Infrastructure – Sewer

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DUBBO REGIONAL COUNCIL

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Location: **Boundary Road, Dubbo, NSW 2830**

Legend

Sewer Manhole

Sewer line

Map Scale: 1:1000

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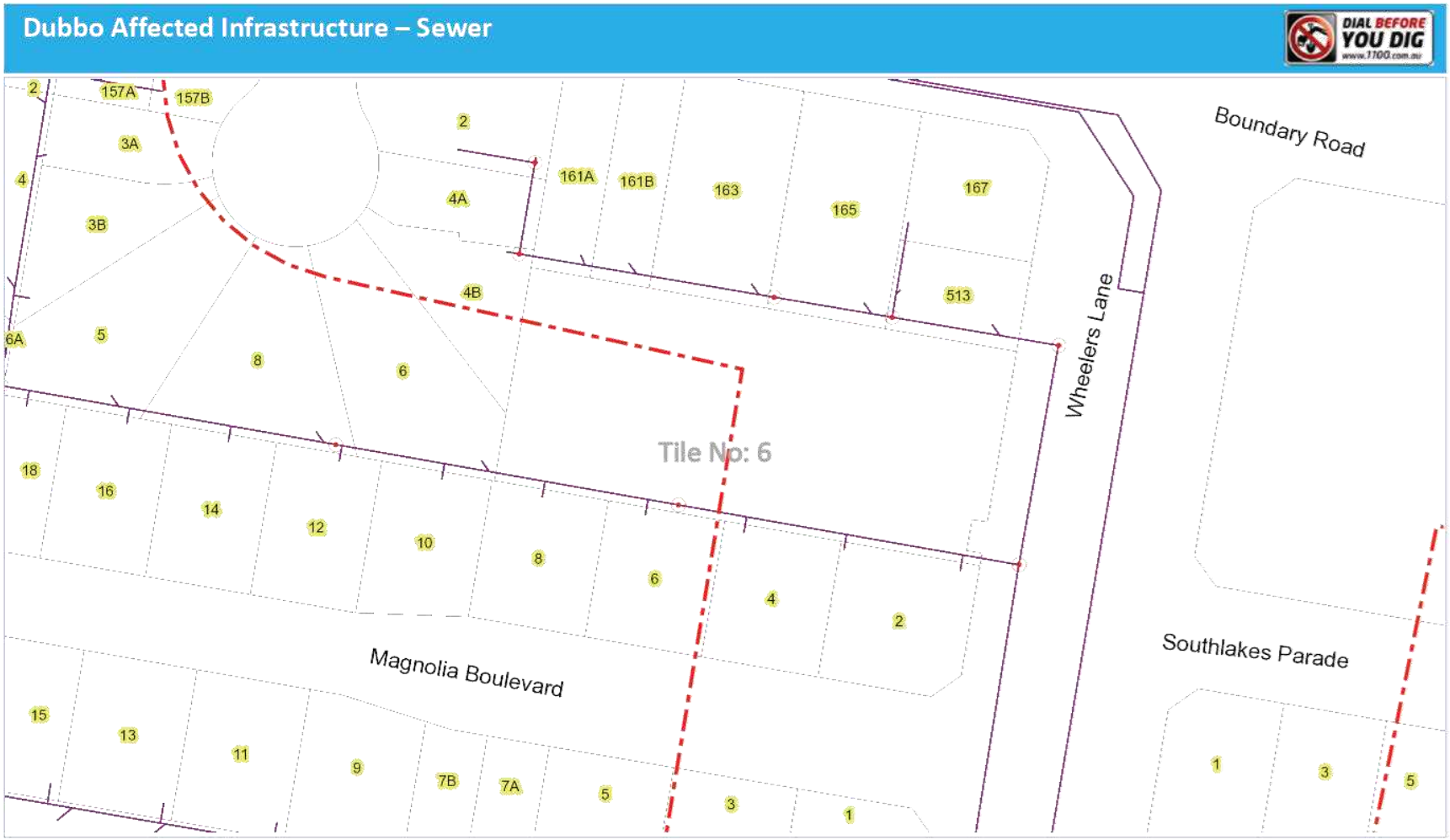

DUBBO REGIONAL COUNCIL

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Legend
Sewer Manhole
Sewer line

Map Scale: 1:1000

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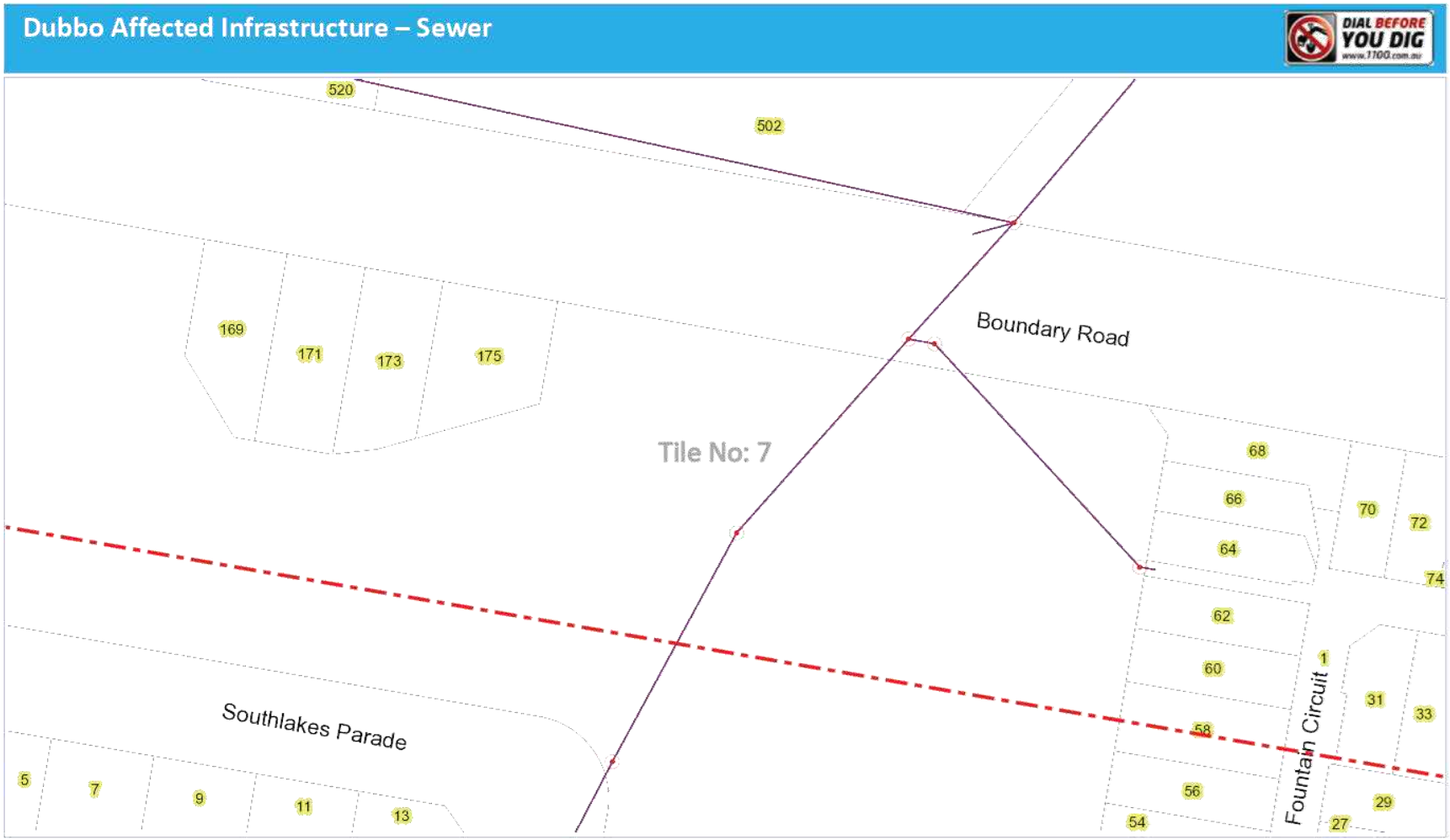

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Sewer line

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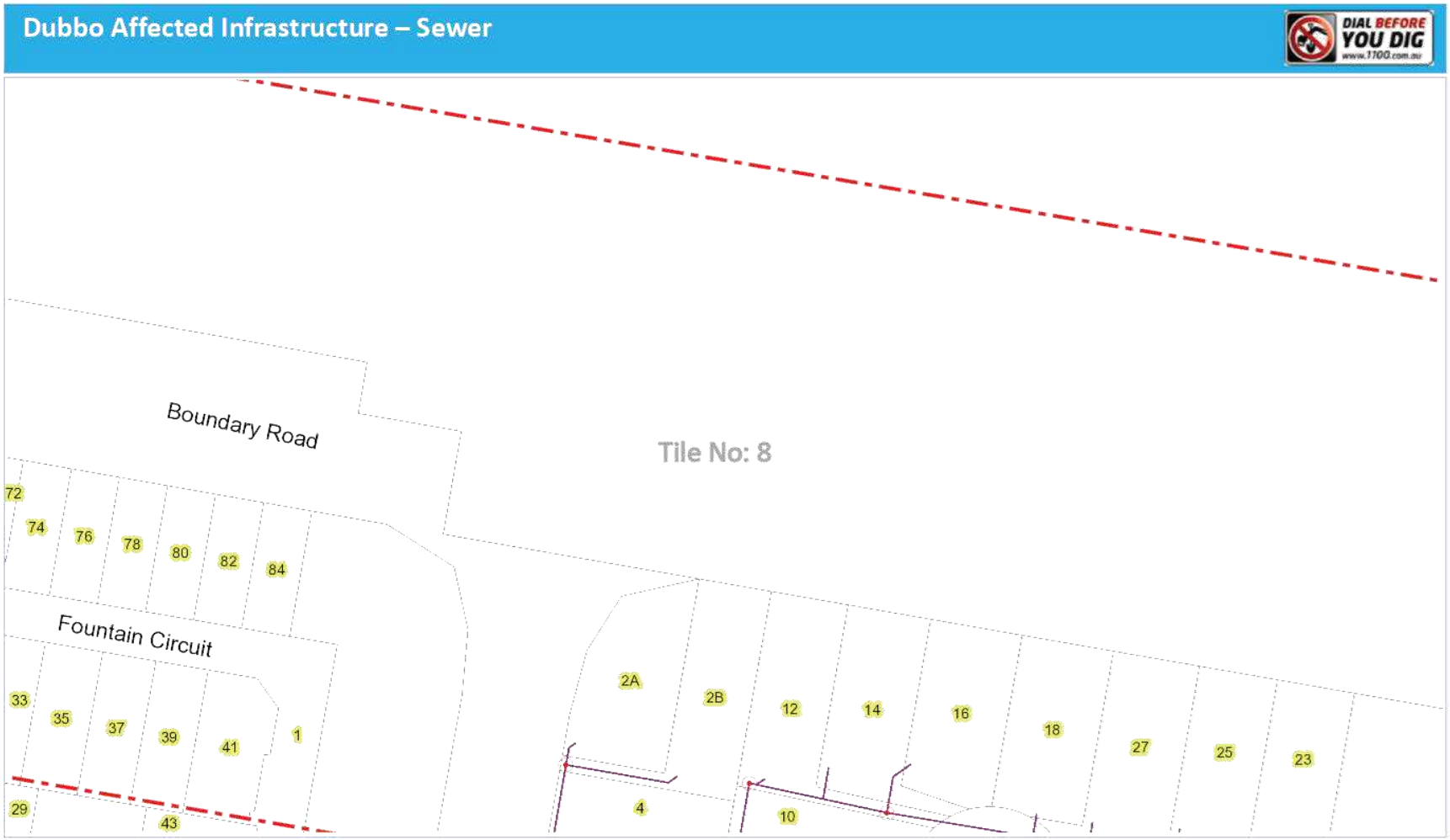

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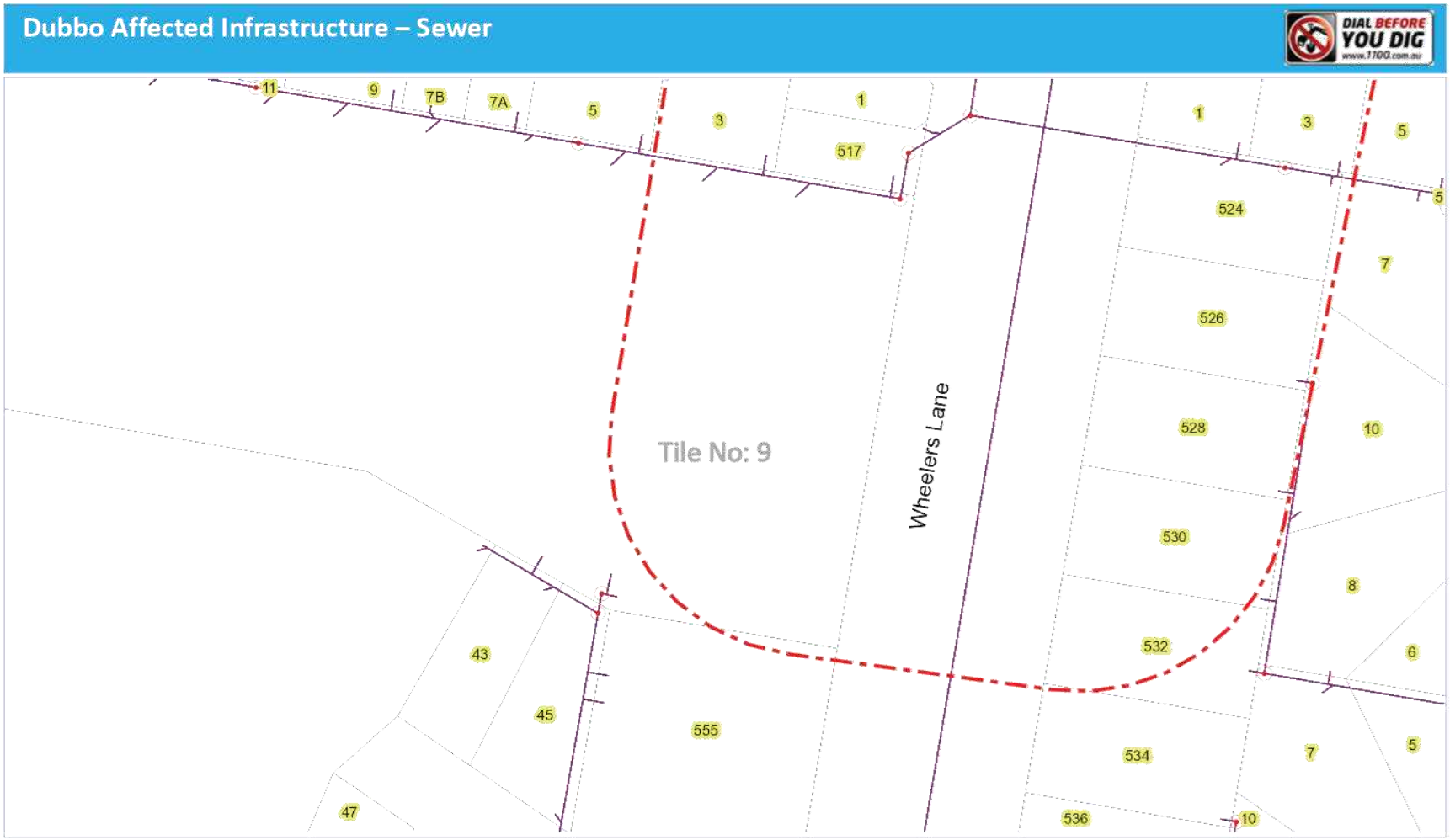

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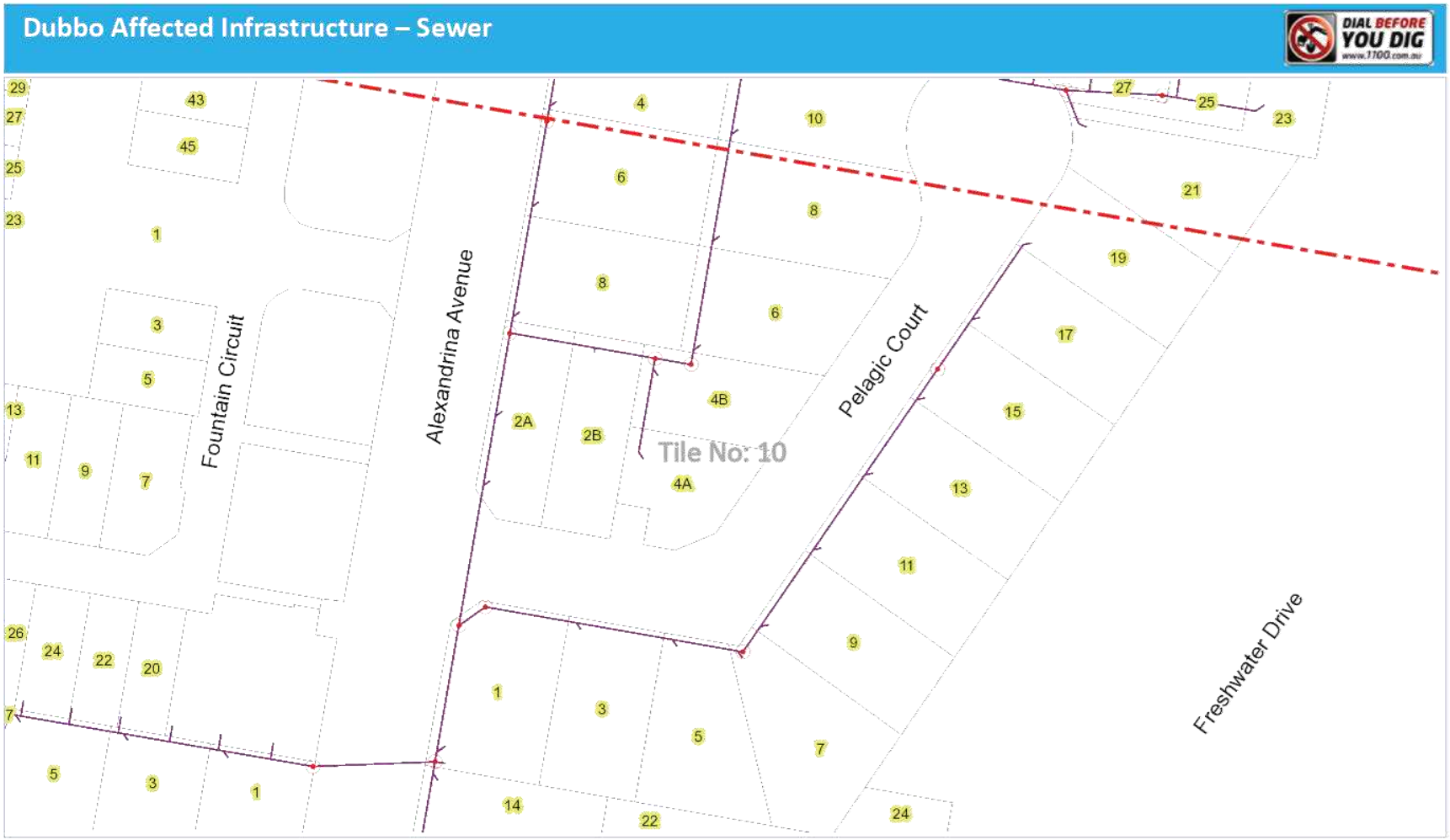

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Dubbo Affected Infrastructure – Stormwater

DIAL BEFORE YOU DIG www.1100.com.au

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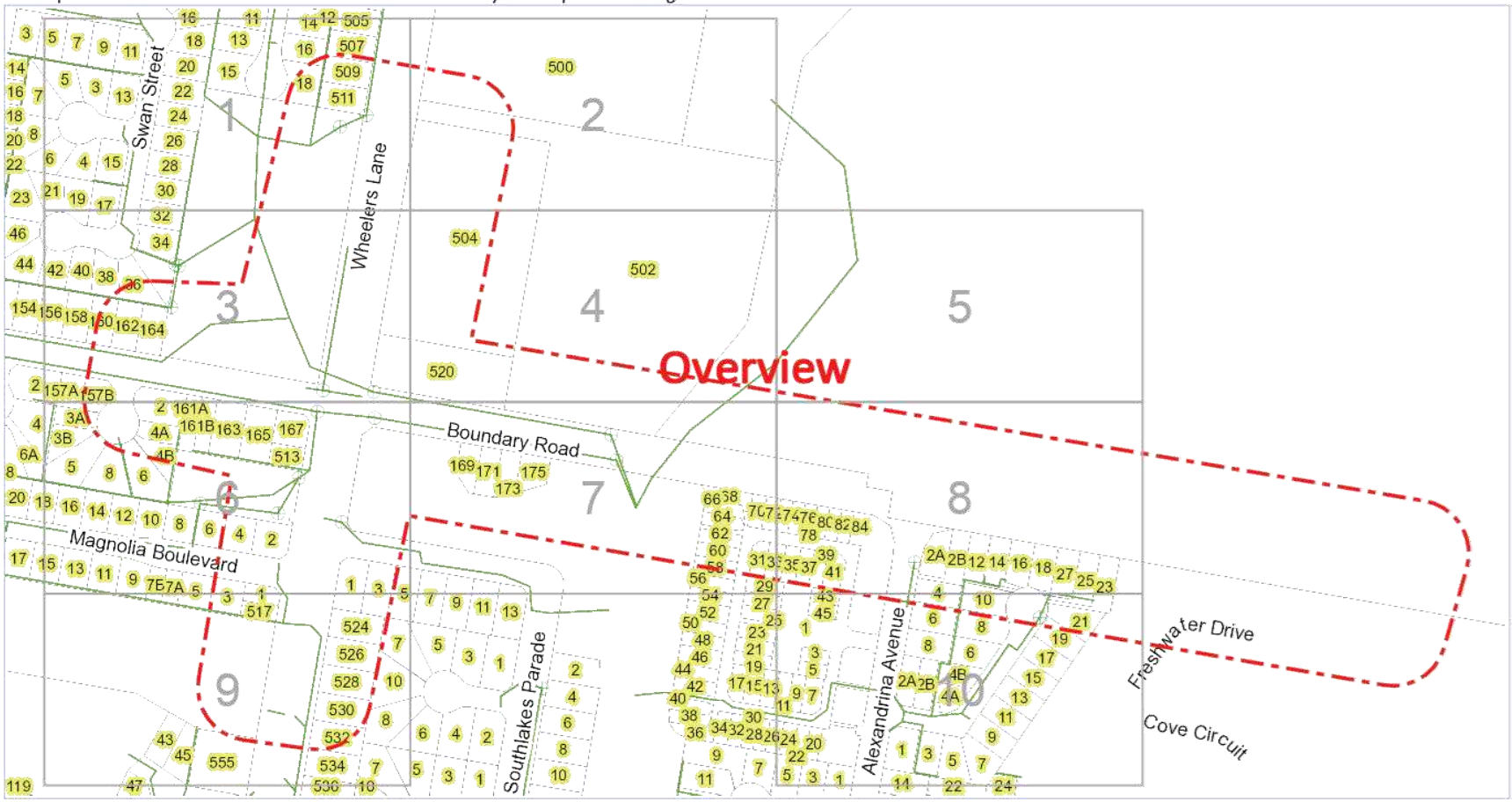

DUBBO REGIONAL COUNCIL

DBYD Job: **19276334**
DBYD Seq: **96188197**
Location: **Boundary Road, Dubbo, NSW 2830**

Legend
Stormwater Pit
Stormwater Line

Map Scale: 1:4100

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Legend
Stormwater Pit
Stormwater Line

Map Scale: 1:1000

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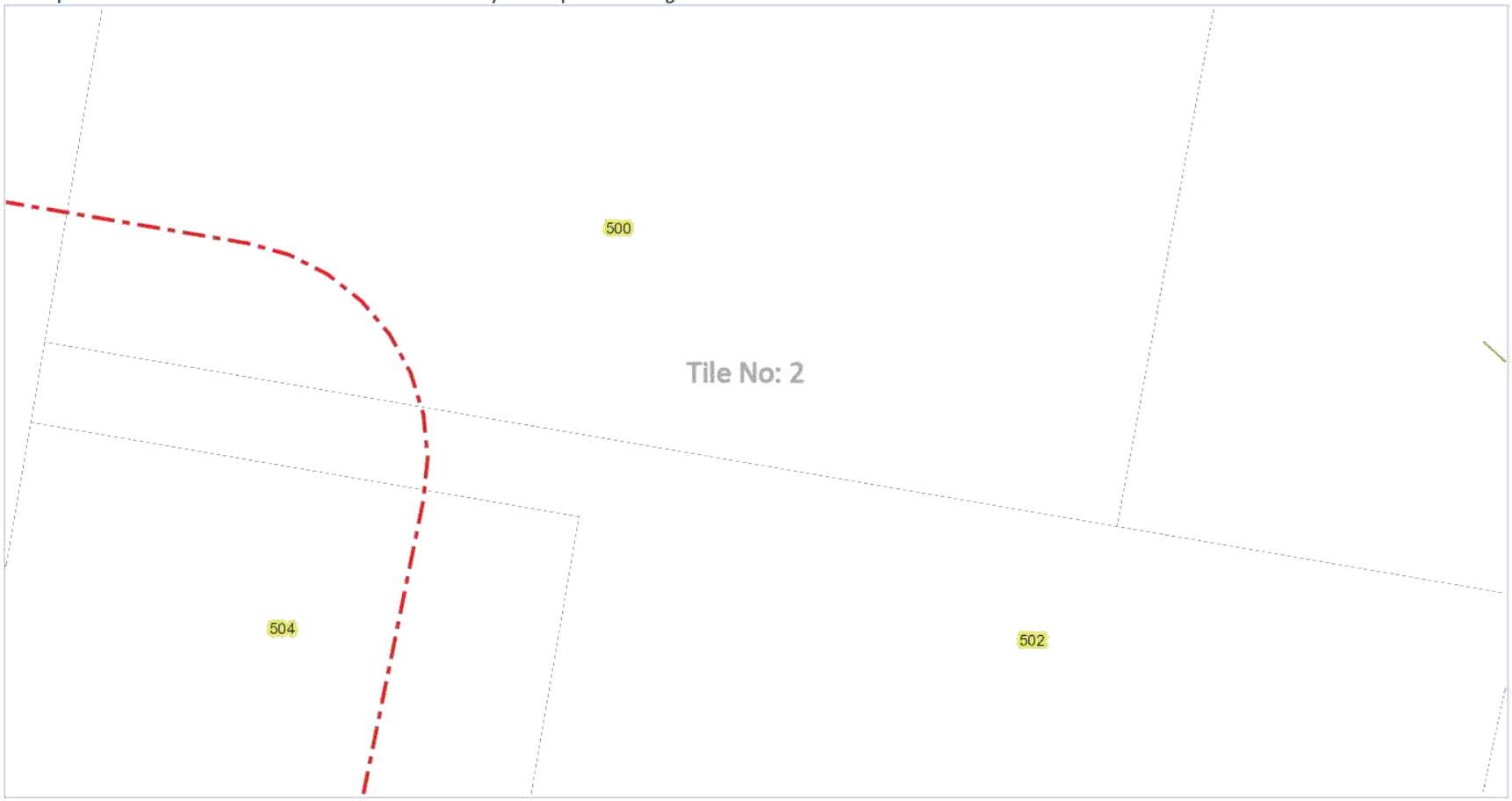

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Legend
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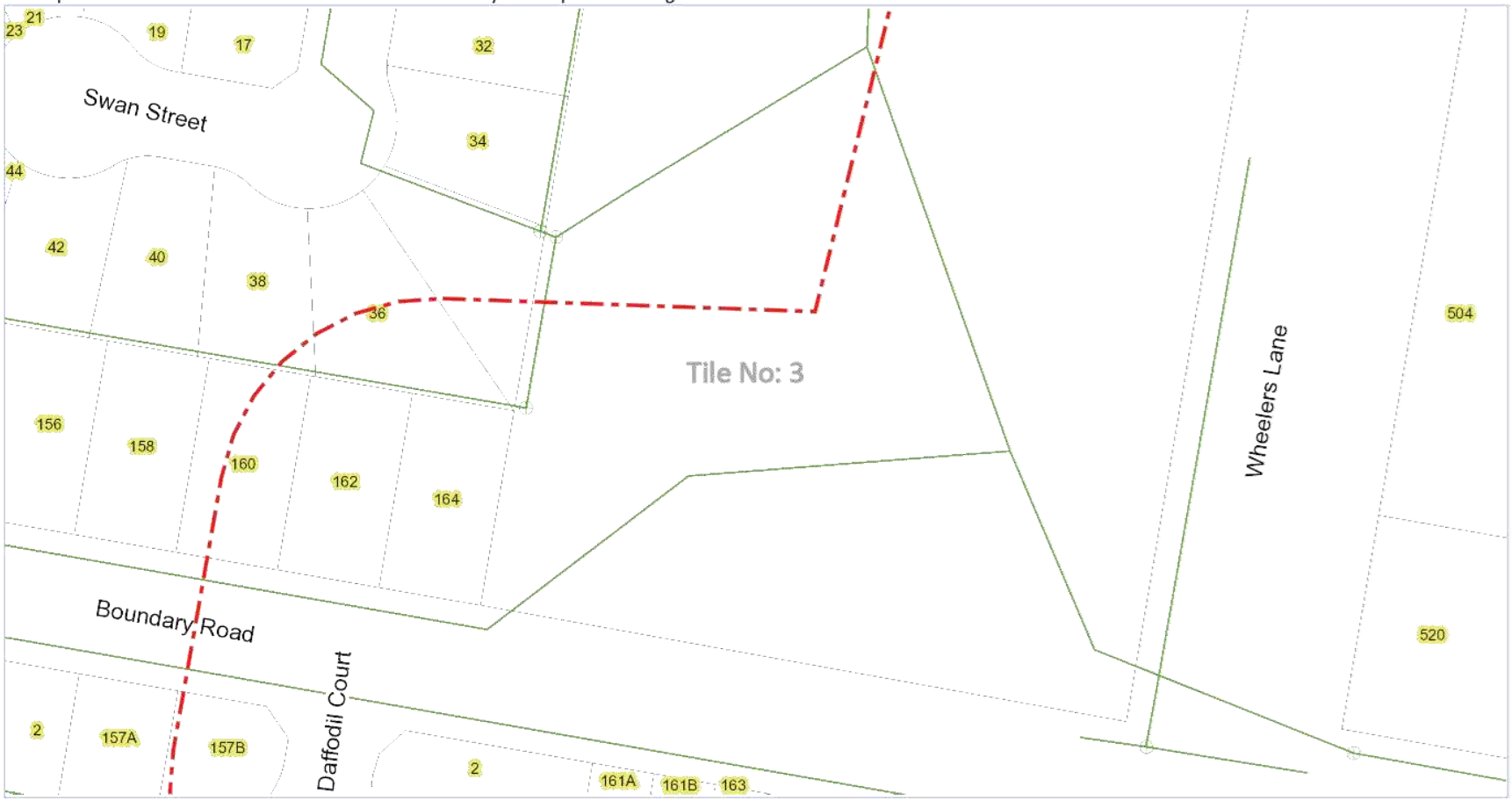

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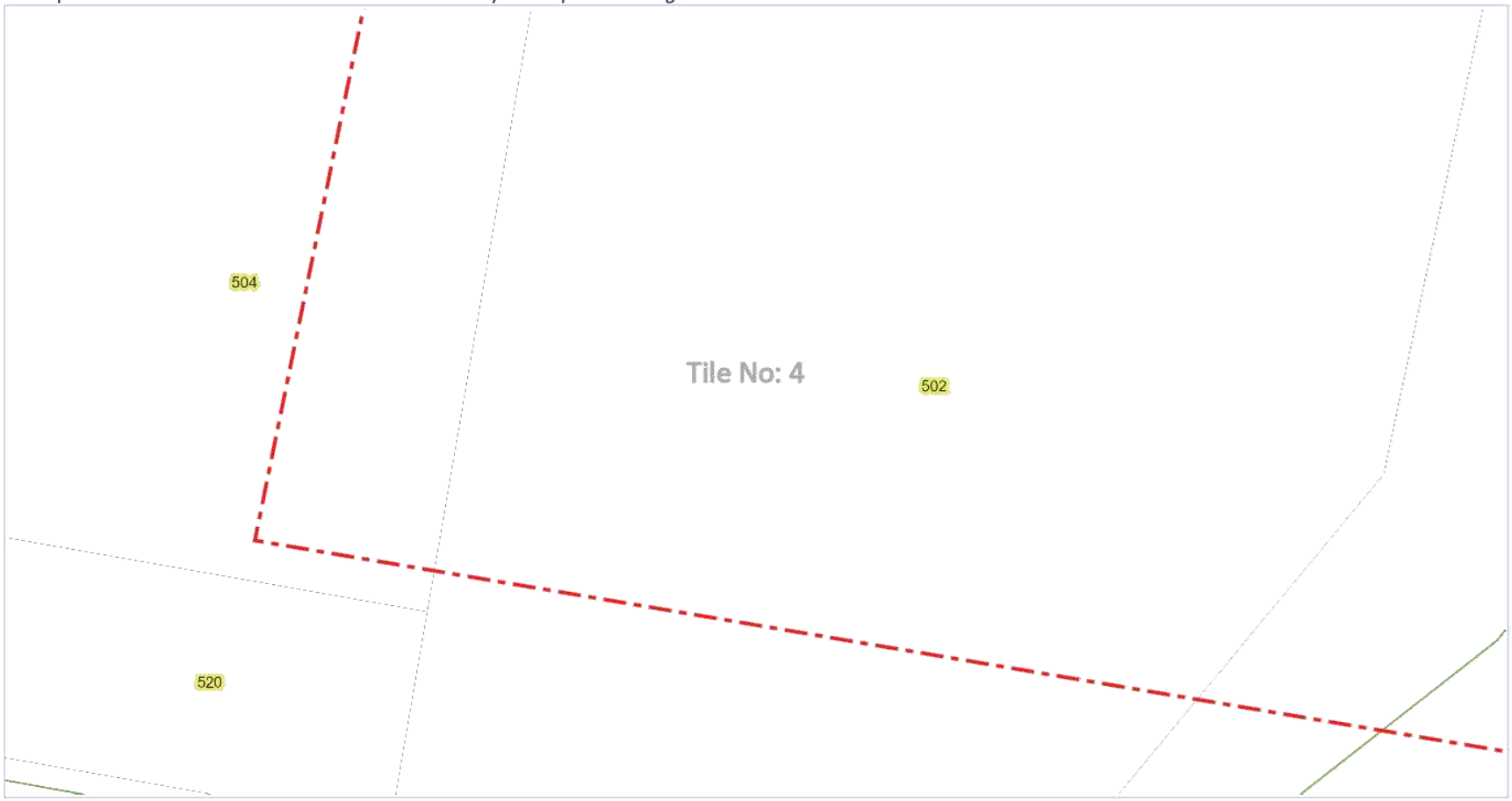

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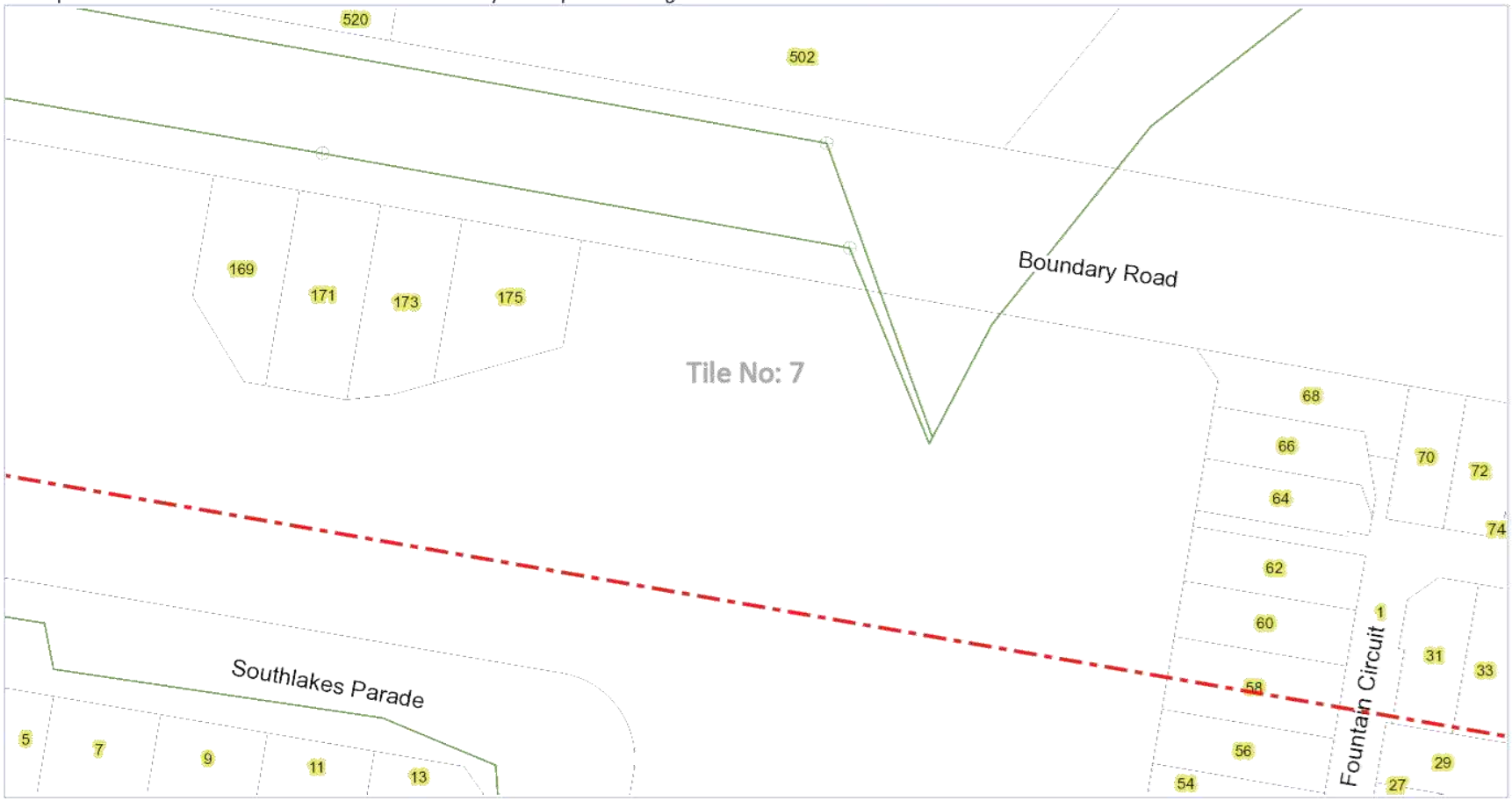

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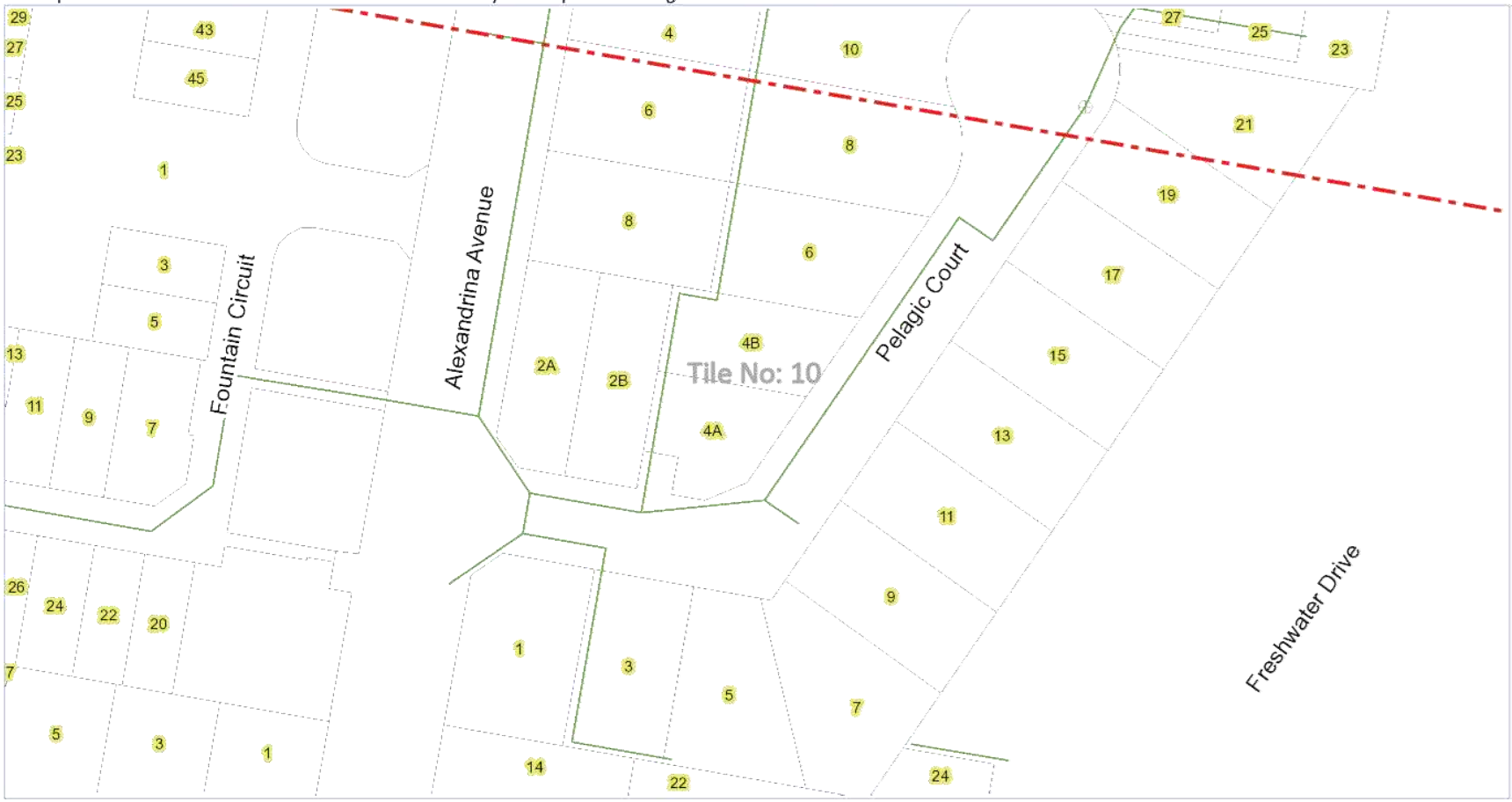

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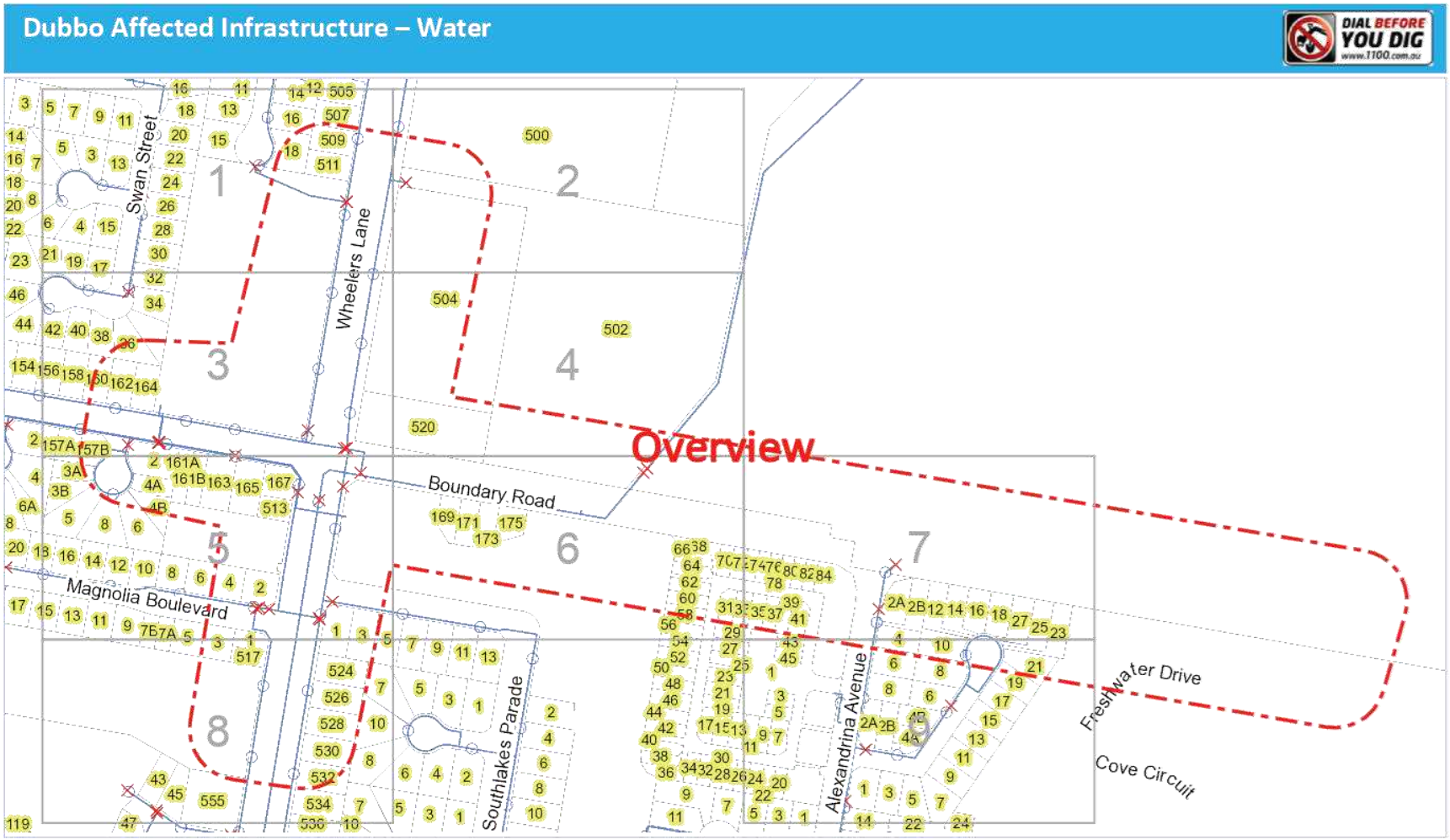

DUBBO REGIONAL COUNCIL

DBYD Job: **19276334**
DBYD Seq: **96188197**
Location: **Boundary Road, Dubbo, NSW 2830**

Legend
Hydrant
Stop Valve
Water Line

Map Scale: 1:4100

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Dubbo Affected Infrastructure – Water



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Dubbo Affected Infrastructure – Water

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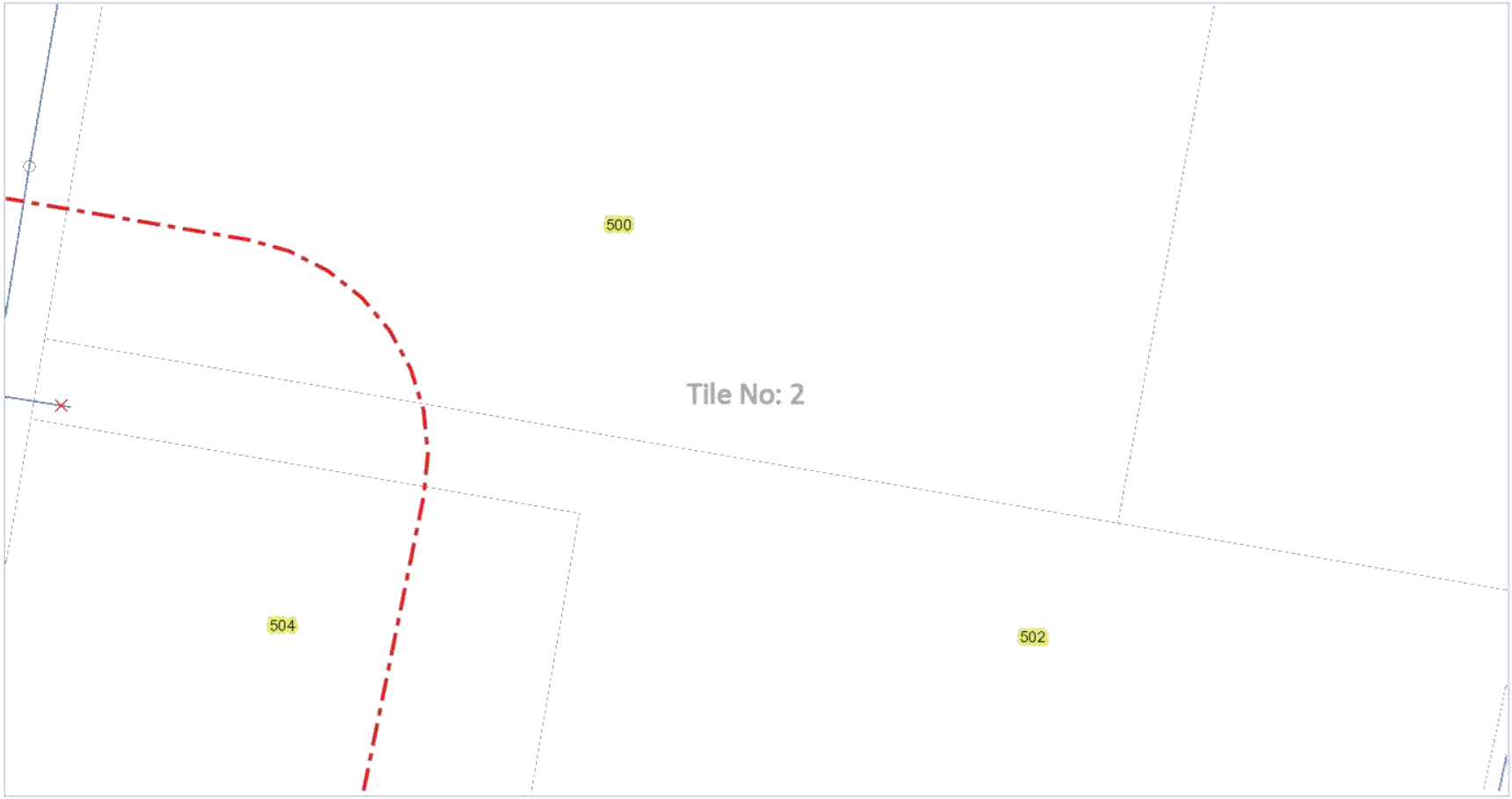

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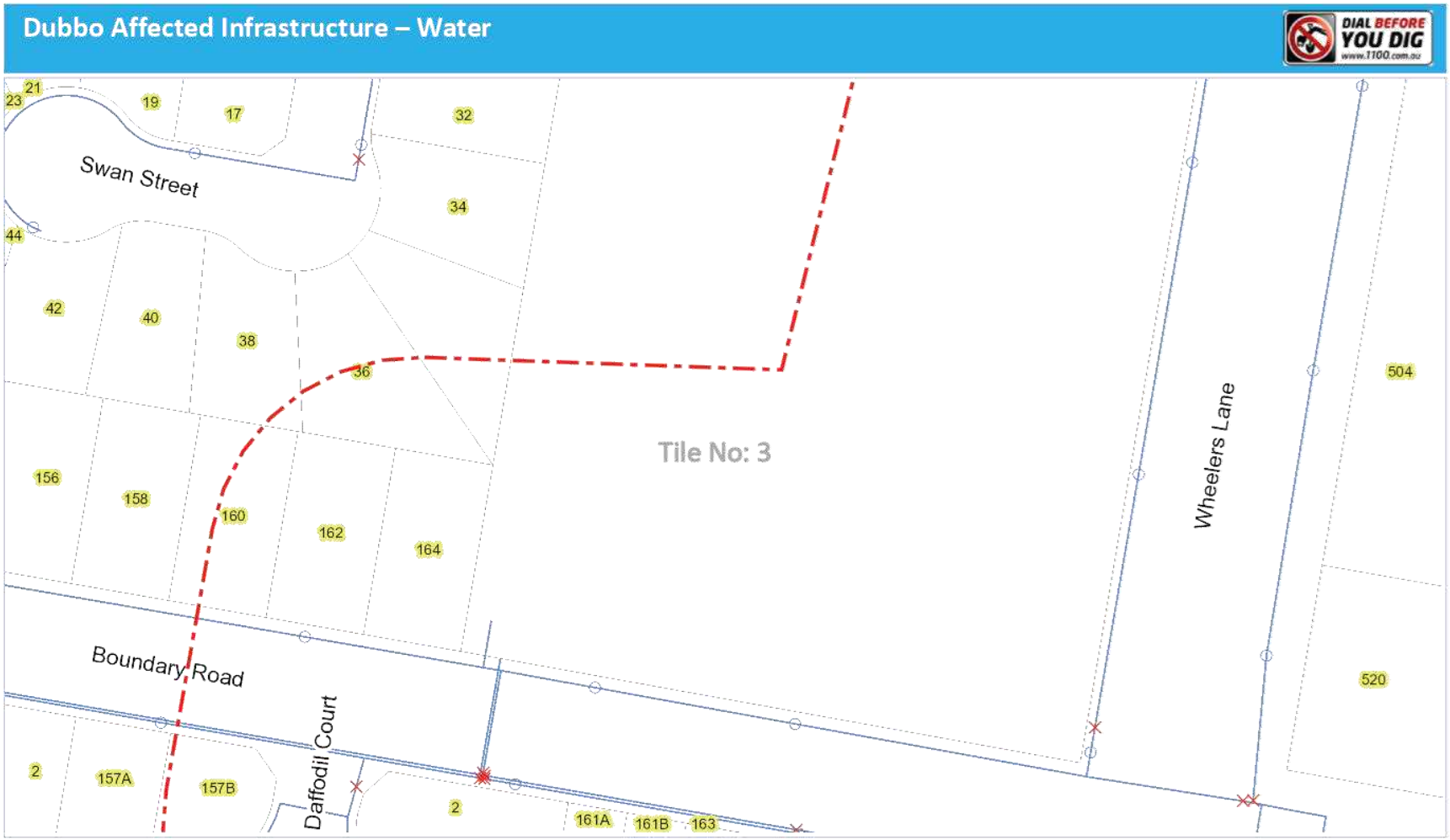

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Dubbo Affected Infrastructure – Water

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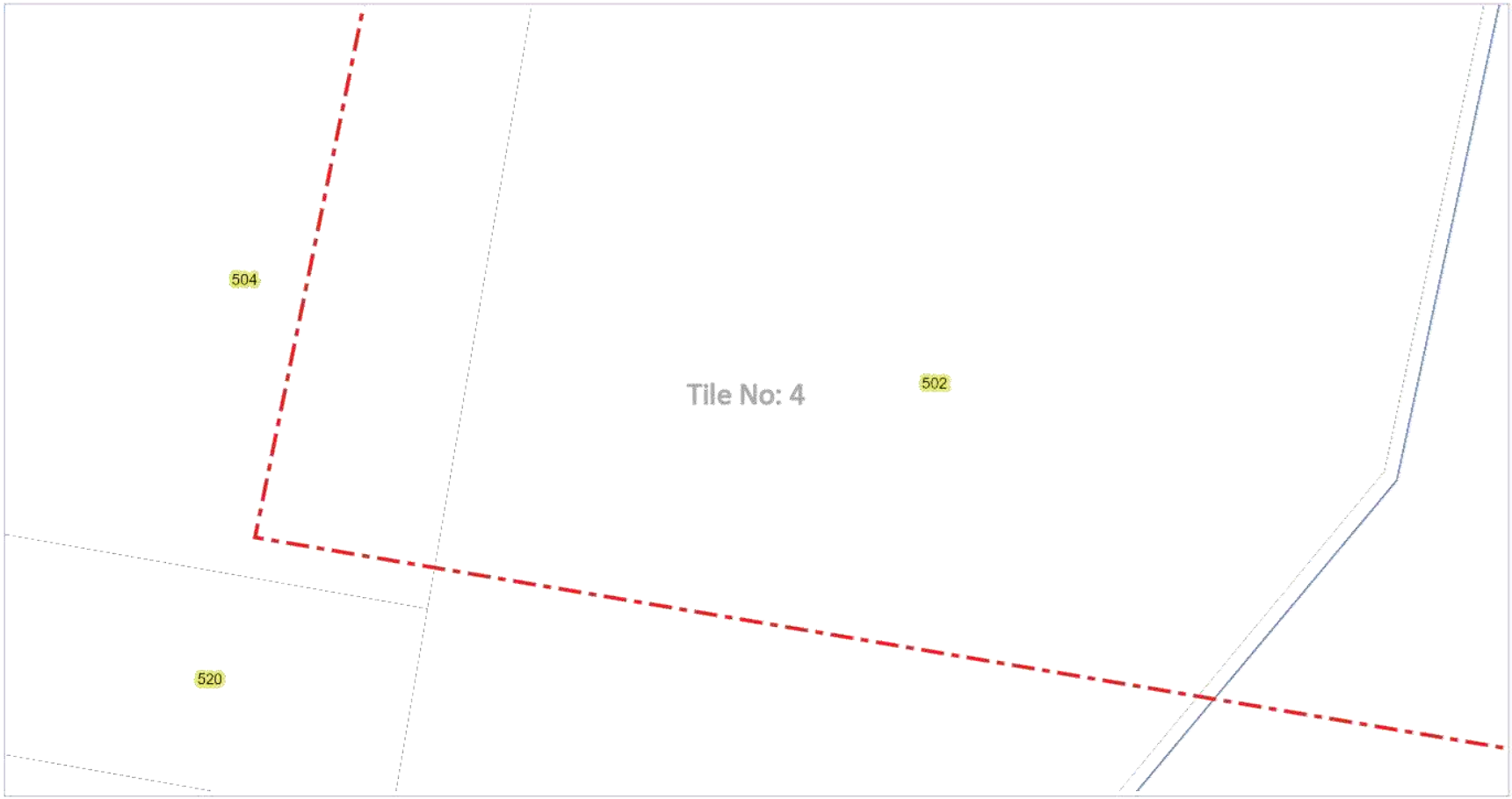

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Dubbo Affected Infrastructure – Water



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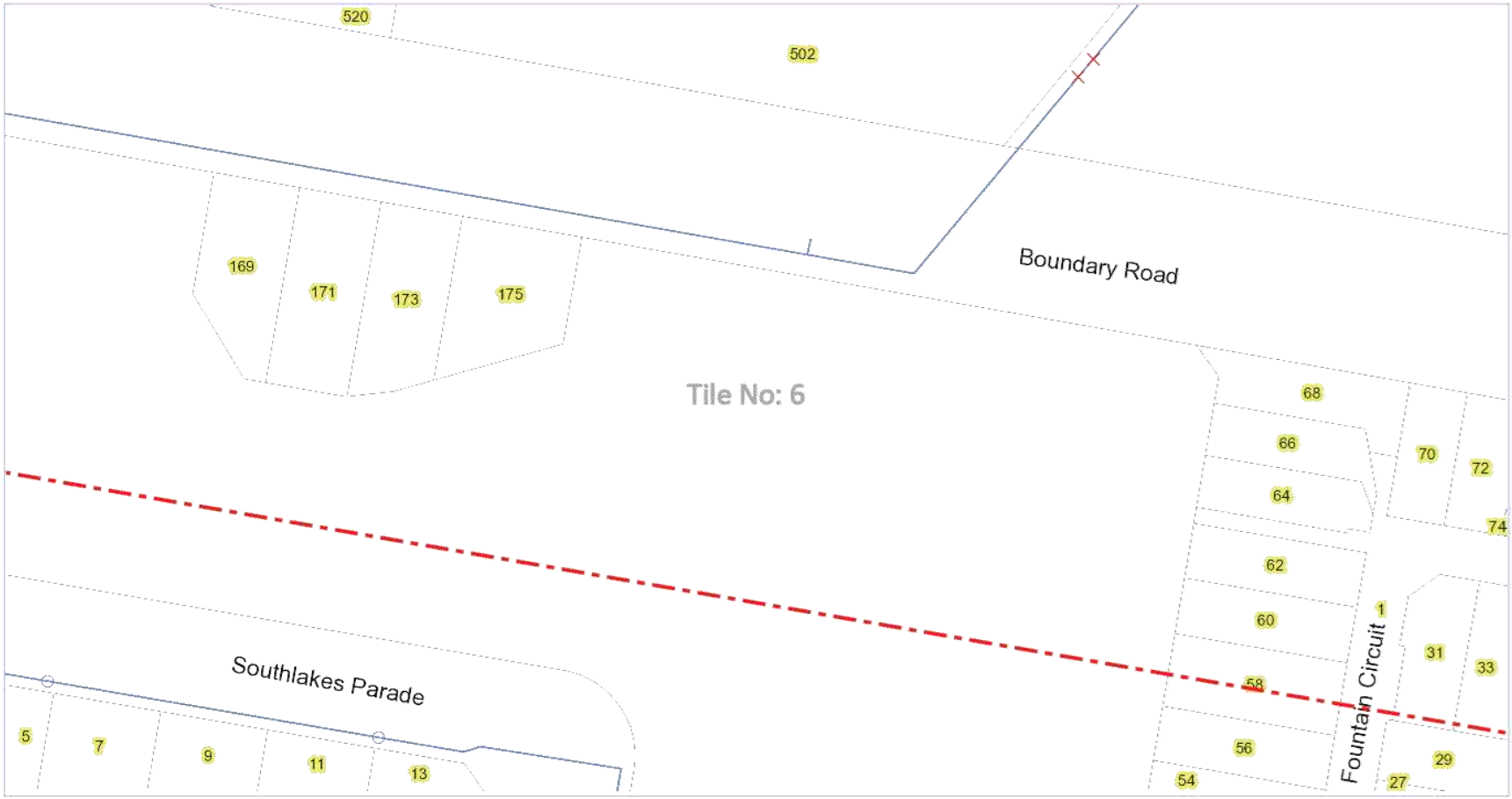
Dubbo Affected Infrastructure – Water



DUBBO REGIONAL COUNCIL

DBYD Job: **19276334**
DBYD Seq: **96188197**
Location: **Boundary Road, Dubbo, NSW 2830**

Legend
Hydrant | Stop Valve | Water Line

Map Scale: 1:1000

Disclaimer
While reasonable measures have been taken to ensure the accuracy of the information contained in this plan response, neither Dubbo Regional Council or PelicanCorp shall have any liability whatsoever in relation to any loss, damage, cost or expense arising from the use of this plan response or the information contained in it or the completeness or accuracy of such information. Use of such information is subject to and constitutes acceptance of these terms.
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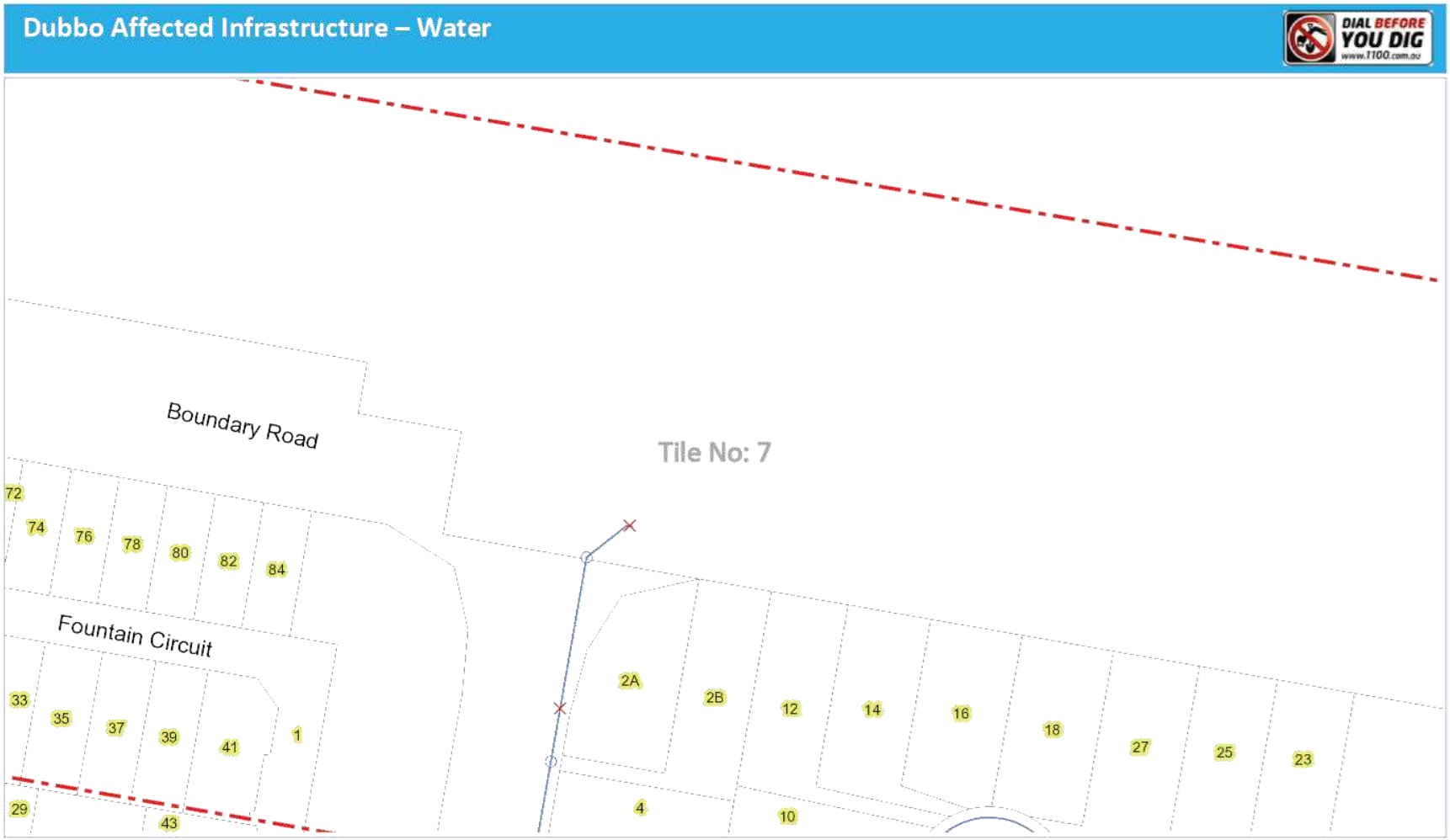

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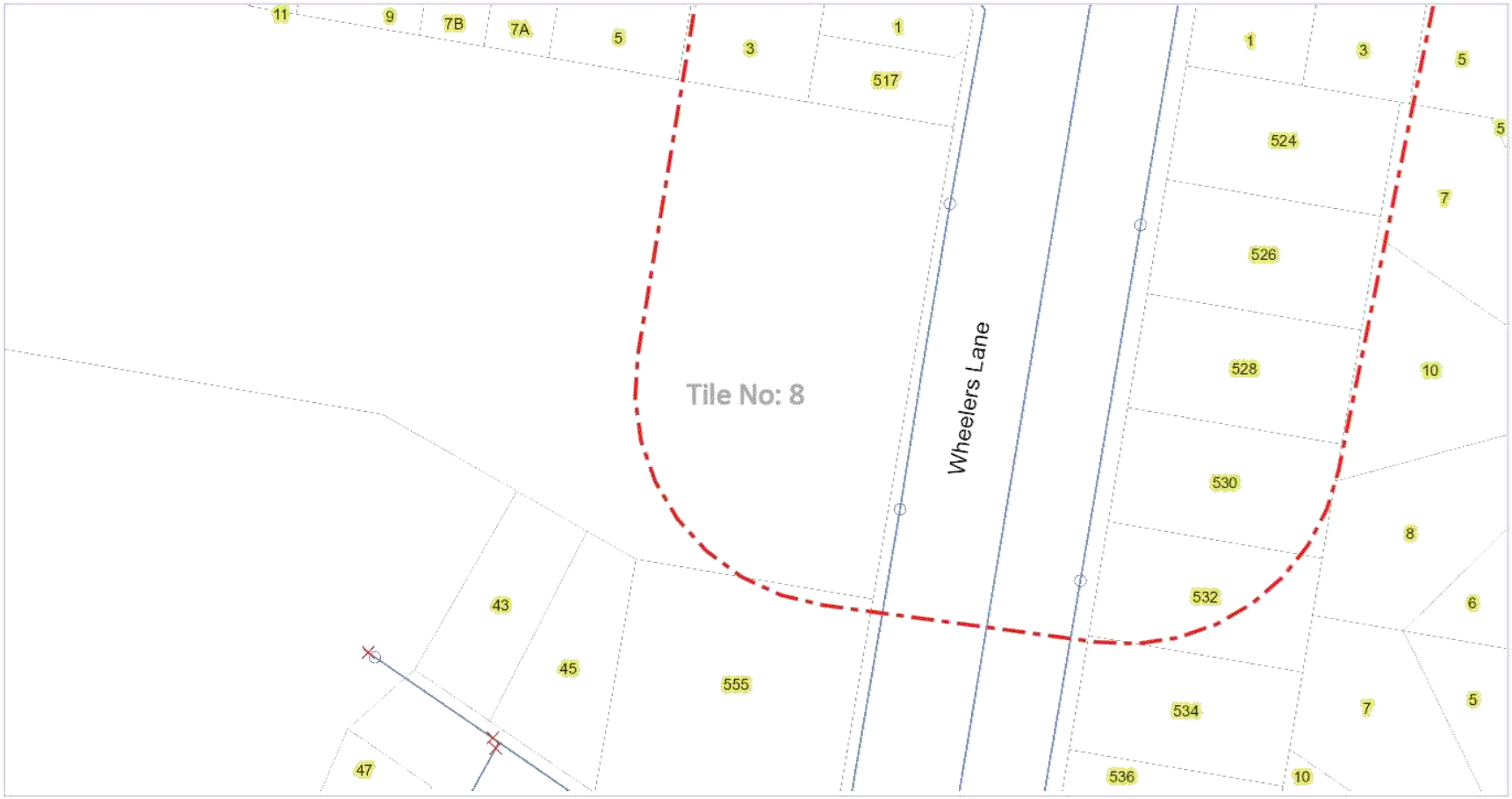

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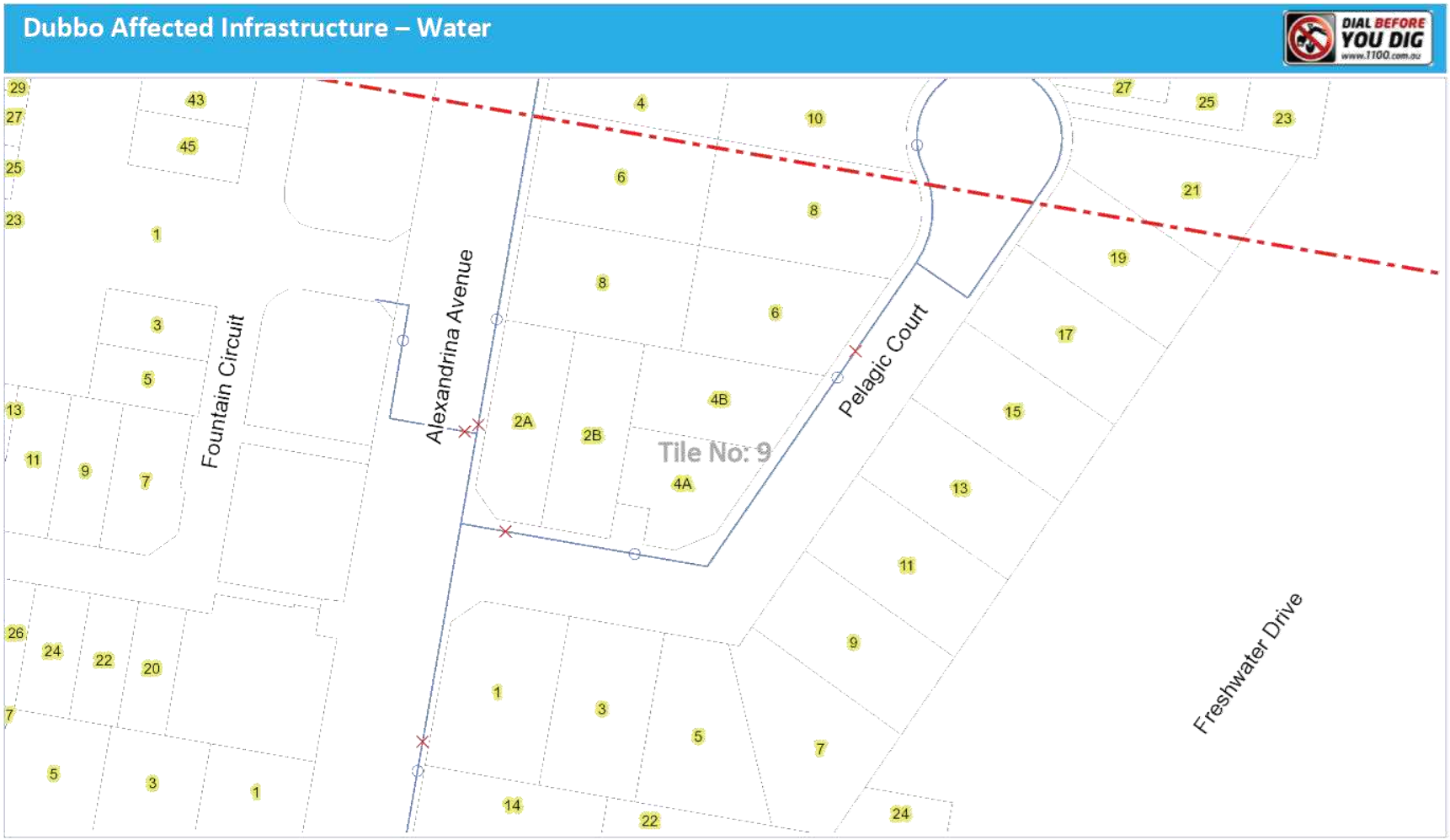

DUBBO REGIONAL COUNCIL

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Legend
Hydrant | Stop Valve | Water Line

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This reply relates only to the location indicated by the applicant with a radius of 40 meters from the original DBYD enquiry and is valid for 28 days from the date sent.

Date: Friday, 27 March 2020

To: Mr Roshan Paheerathan

Company: AT&L

Address: level 7 153 Walker Street North Sydney NSW 2060

Email: alex.c@atl.net.au

Fax: Not Supplied

ELECTRICAL CABLE LOCATION

Dear Mr Roshan Paheerathan

With reference to your enquiry:

- Location: Boundary Road Dubbo NSW 2830
- Sequence No: 96188198
- Dial Before You Dig Job No: 19276334
- Dial Before You Dig Customer No: 2241644



CRITICAL UNDERGROUND ASSETS IN AREA – DO NOT COMMENCE EXCAVATION BEFORE CALLING TECHNICAL ENQUIRIES ON 13 23 91.

www.essentialenergy.com.au
ABN 37 428 185 226
PO Box 5730 Port Macquarie NSW 2444
Telephone: 13 23 91 Facsimile: 1800 354 636

Date: Friday, 27 March 2020

To: Mr Roshan Paheerathan

Company: AT&L

Address: level 7 153 Walker Street North Sydney NSW 2060

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Caution!

PLAN DOES NOT IDENTIFY ALL UNDERGROUND ASSETS IN THIS AREA. DO NOT COMMENCE EXCAVATION BEFORE CALLING TECHNICAL ENQUIRIES ON 13 23 91.

1 www.essentialenergy.com.au
ABN 37 428 185 226
PO Box 5730 Port Macquarie NSW 2444
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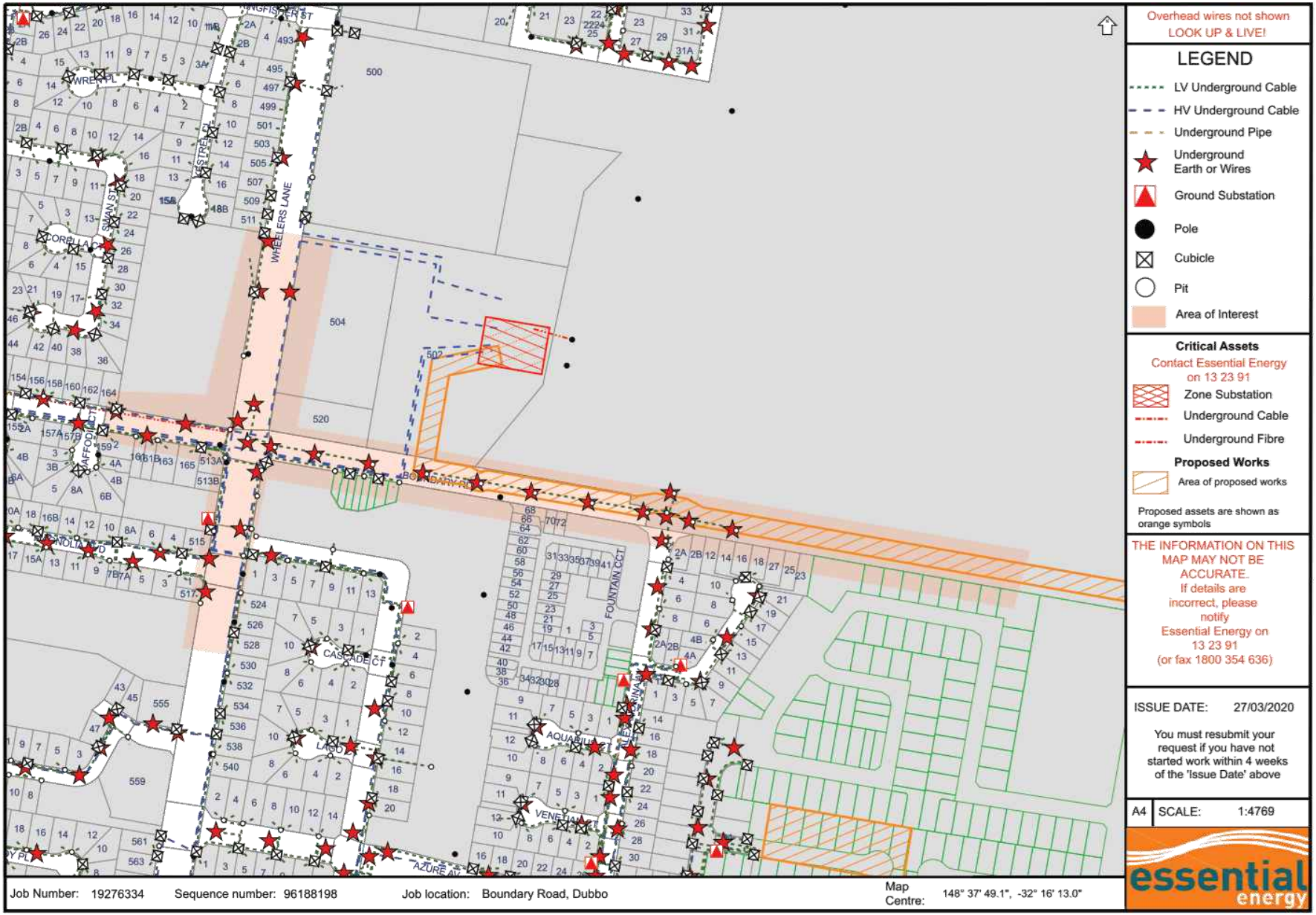
Overhead wires not shown
LOOK UP & LIVE!
LEGEND
LV Underground Cable
HV Underground Cable
Underground Pipe
Underground Earth or Wires
Ground Substation
Pole
Cubicle
Pit
Area of Interest
Critical Assets
Contact Essential Energy on 13 23 91
Zone Substation
Underground Cable
Underground Fibre
Proposed Works
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: 27/03/2020
You must resubmit your request if you have not started work within 4 weeks of the 'Issue Date' above
A4 SCALE: 1:4769
essential energy
Job Number: 19276334 Sequence number: 96188198 Job location: Boundary Road, Dubbo
Map Centre: 148° 37' 49.1", -32° 16' 13.0"
WHEELERS LANE
BOUNDARY RD
CASCADE CT
FOUNTAIN CCT
AQUARIUS CT
VENETIAN CT
AZURE AV



nbn has partnered with Dial Before You Dig to give you a single point of contact to get information about **nbn** underground services owned by **nbn** and other utility/service provider in your area including communications, electricity, gas and other services. Contact with underground power cables and gas services can result in serious injury to the worker, and damage and costly repairs. You must familiarise yourself with all of the Referral Conditions (meaning the referral conditions referred to in the DBYD Notice provided by **nbn**).

Practice safe work habits

Once the DBYD plans are reviewed, the Five P's of Excavation should be adopted in conjunction with your safe work practices (which must be compliant with the relevant state Electrical Safety Act and Safe Work Australia "Excavation Work Code of Practice", as a minimum) to ensure the risk of any contact with underground **nbn** assets are minimised.

Plan: Plan your job ensuring the plans received are current and apply to the work to be performed. Also check for any visual cues that may indicate the presence of services not covered in the DBYD plans.

Prepare: Prepare for your job by engaging a DBYD qualified Plant Locator to help interpret plans and identify on-site assets. Contact **nbn** should you require further assistance.

Pothole: Non-destructive potholing (i.e. hand digging or hydro excavation) should be used to positively locate **nbn** underground assets with minimal risk of contact and service damage.

Protect: Protecting and supporting the exposed **nbn** underground asset is the responsibility of the worker. Exclusion zones for **nbn** assets are clearly stated in the plan and appropriate controls must be implemented to ensure that encroachment into the exclusion zone by machinery or activities with the potential to damage the asset is prevented.

Proceed: Proceed only when the appropriate planning, preparation, potholing and protective measures are in place.

Working near nbn™ cables



Identify all electrical hazards, assess the risks and establish control measures.



When using excavators and other machinery, also check the location of overhead power lines.



Workers and equipment must maintain safety exclusion zones around power lines.

Once all work is completed, the excavation should be re-instated with the same type of excavated material unless specified by **nbn**. Please note:

- Construction Partners of **nbn** may require additional controls to be in place when performing excavation activities.
- The information contained within this pamphlet must be used in conjunction with other material supplied as part of this request for information to adequately control the risk of potential asset damage.

Contact

In the event of the **nbn**™ network facility damage please call 1800 626 329

Disclaimer

This brochure is a guide only. It does not address all the matters you need to consider when working near our cables. You must familiarise yourself with other material provided (including the Referral Conditions) and make your own inquiries as appropriate.

nbn will not be liable or responsible for any loss, damage or costs incurred as a result of reliance on this brochure.

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DIAL BEFORE YOU DIG www.1100.com.au

Indicative Plans

Issue Date:	27/03/2020
Location:	Boundary Road , Dubbo , NSW , 2830

DIAL BEFORE YOU DIG www.1100.com.au

1	4	7
2	5	8
3	6	9

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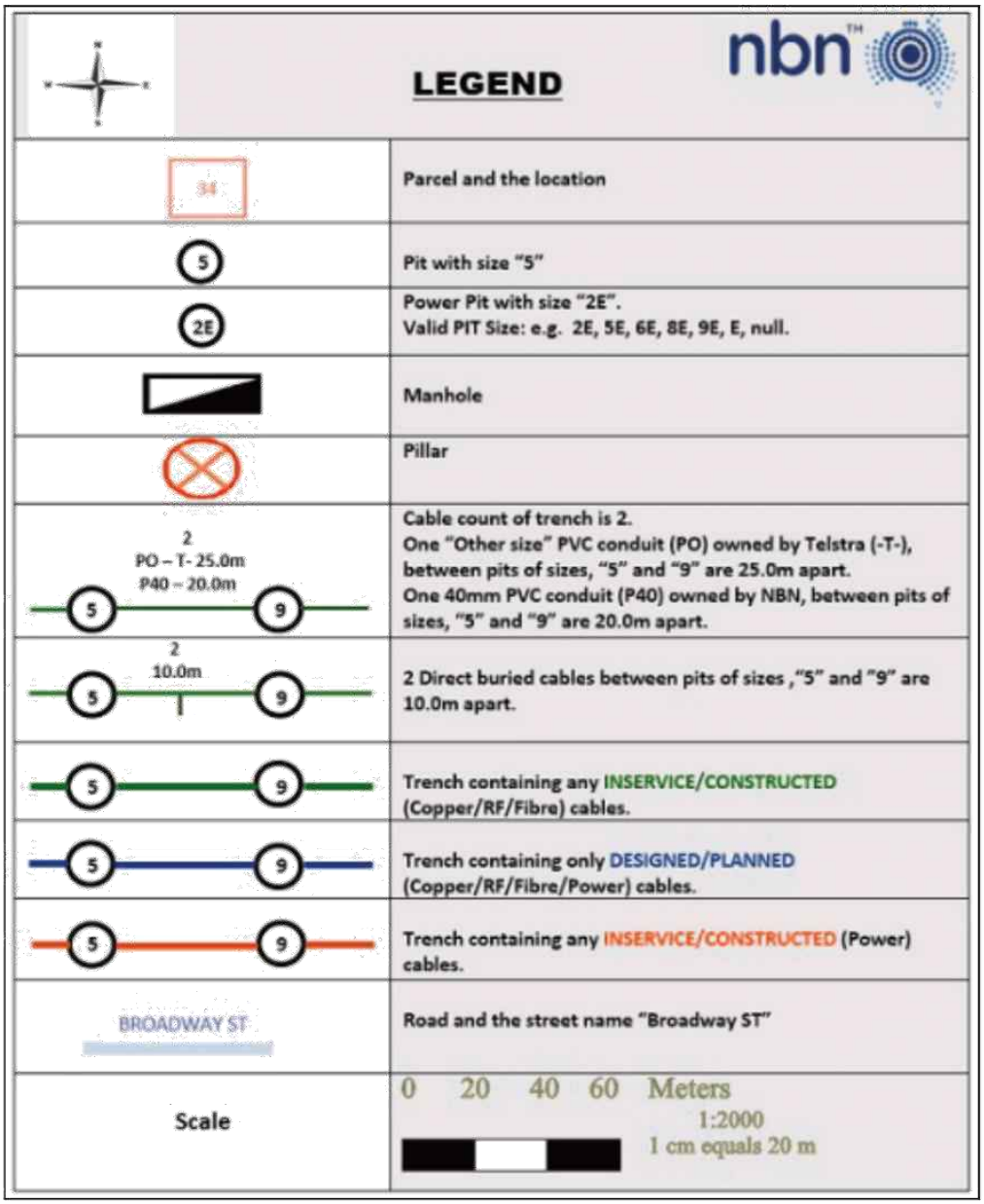

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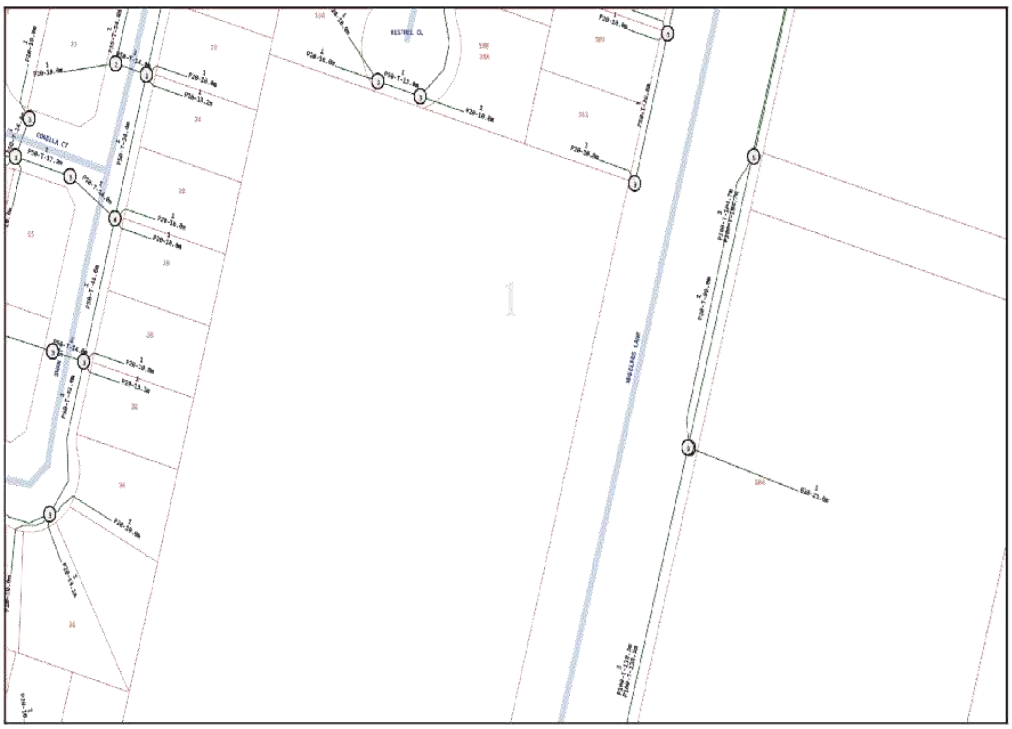

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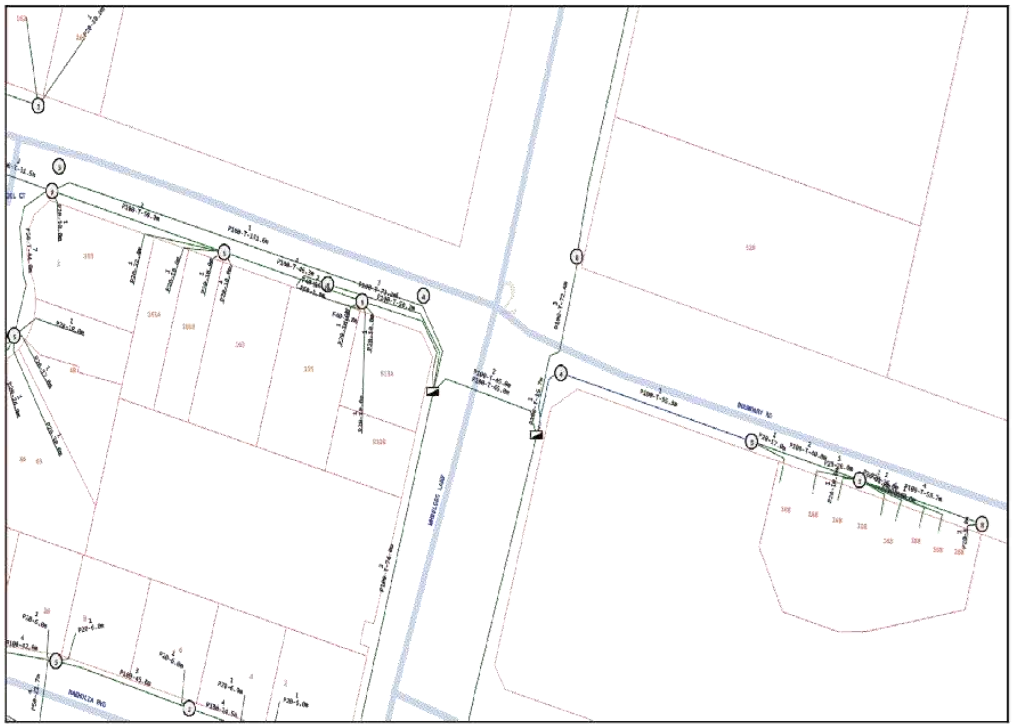

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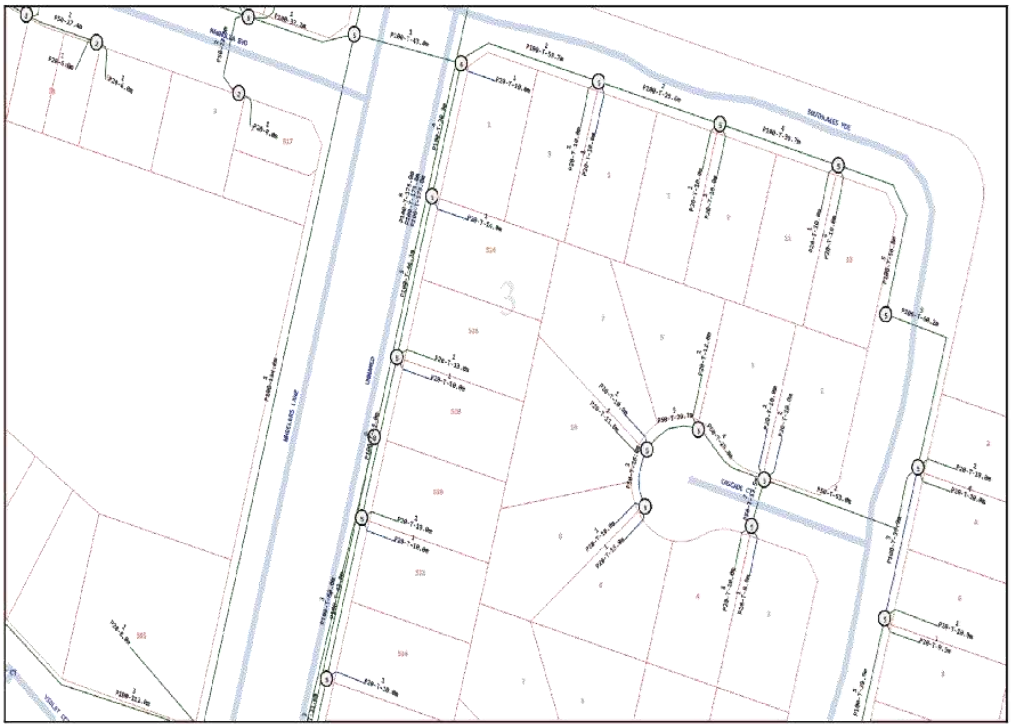

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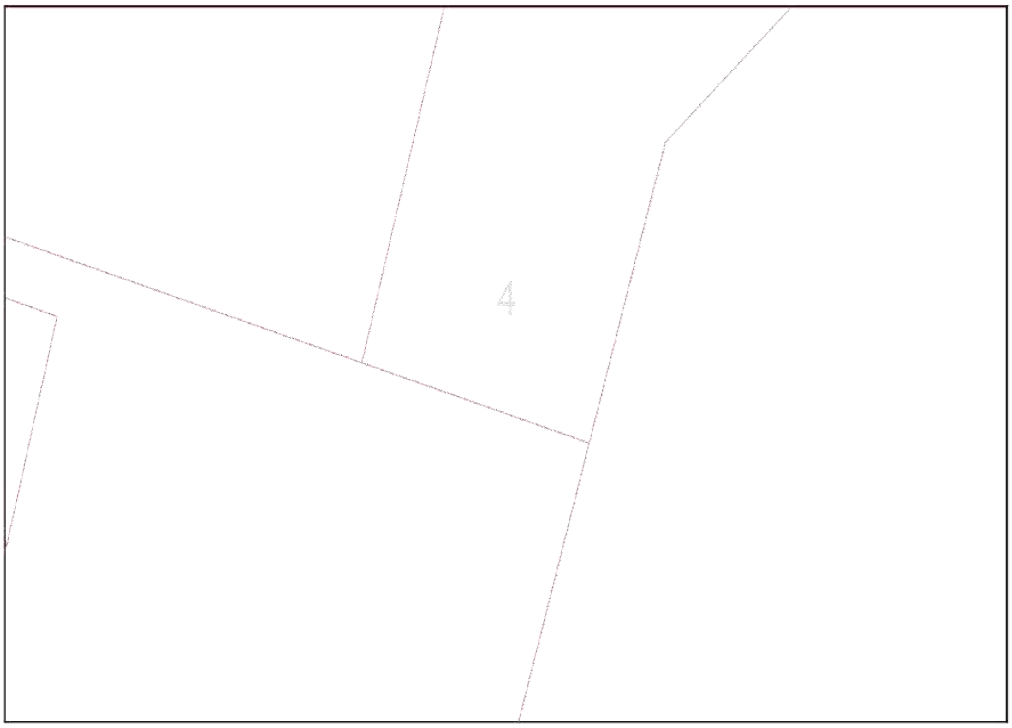

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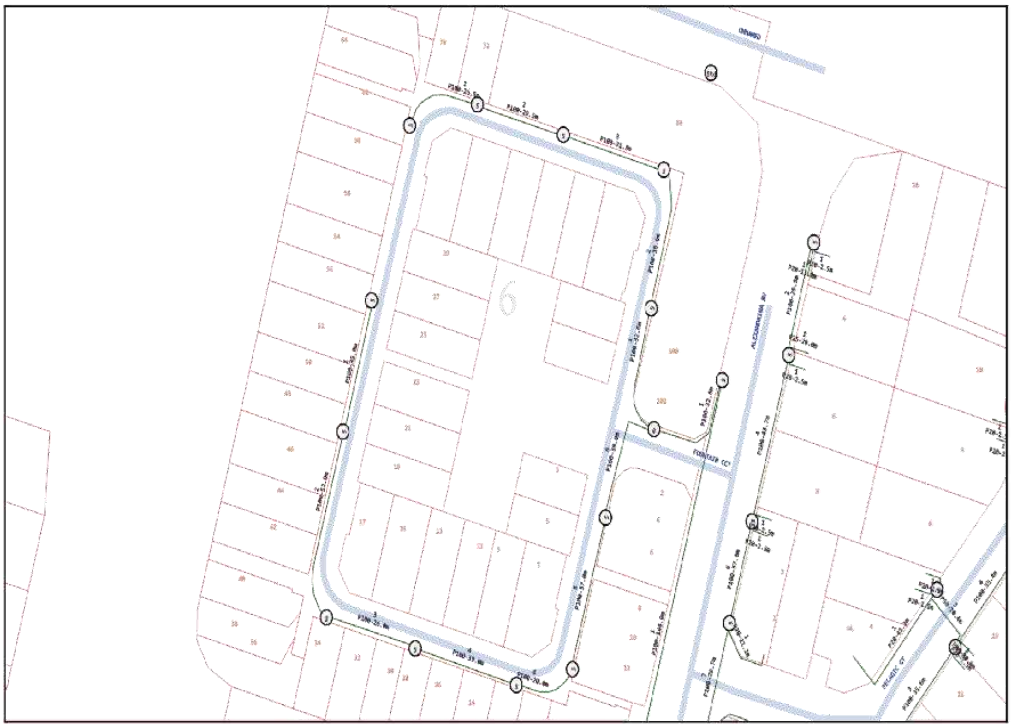

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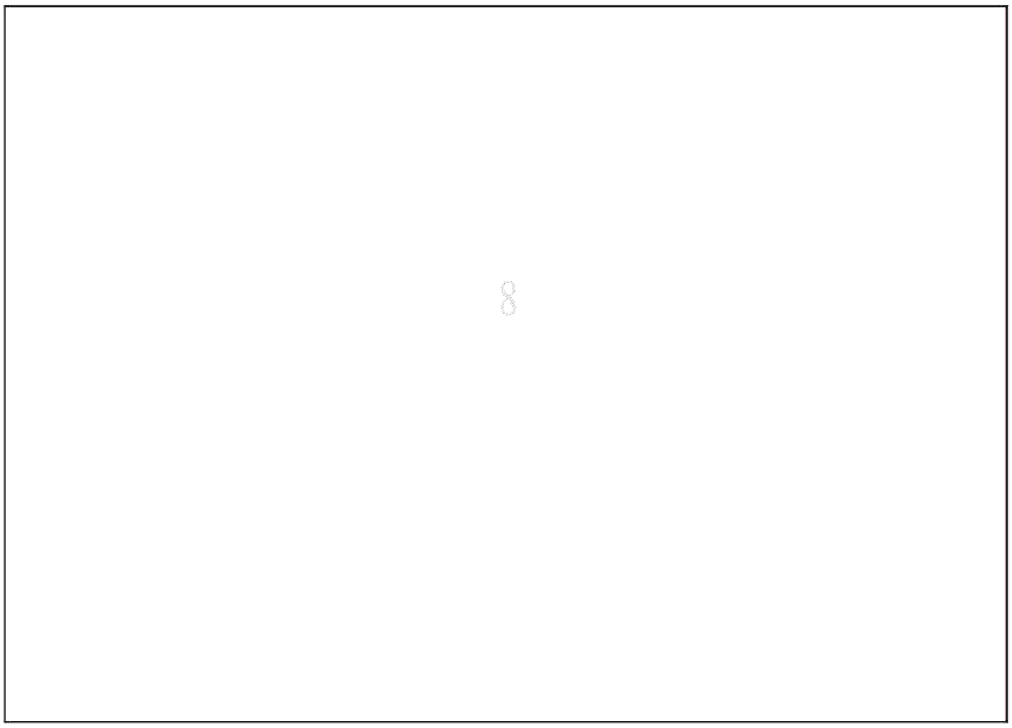

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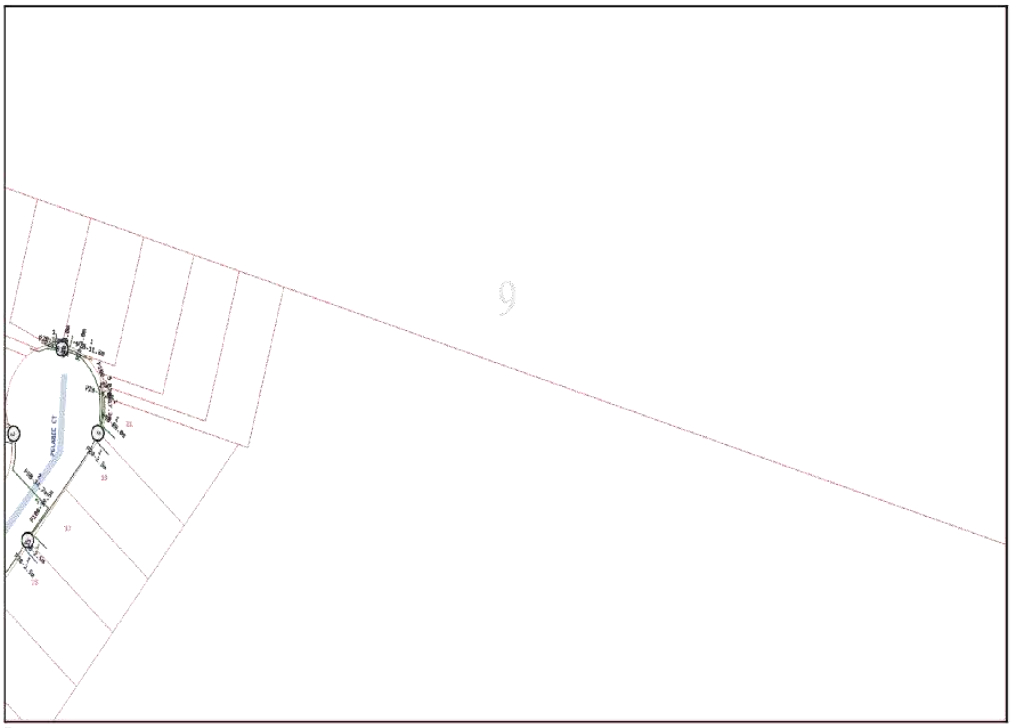

Emergency Contacts

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

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Indicative Plans

Issue Date:	27/03/2020
Location:	Boundary Road , Dubbo , NSW , 2830

DIAL BEFORE YOU DIG www.1100.com.au

1	4	7
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LEGEND	
34	Parcel and the location
5	Pit with size "5"
2E	Power Pit with size "2E". Valid PIT Size: e.g. 2E, 5E, 6E, 8E, 9E, E, null.
	Manhole
	Pillar
2 PO – T- 25.0m P40 – 20.0m 5 9	Cable count of trench is 2. One "Other size" PVC conduit (PO) owned by Telstra (-T-), between pits of sizes, "5" and "9" are 25.0m apart. One 40mm PVC conduit (P40) owned by NBN, between pits of sizes, "5" and "9" are 20.0m apart.
2 10.0m 5 9	2 Direct buried cables between pits of sizes ,"5" and "9" are 10.0m apart.
5 9	Trench containing any INSERVICE/CONSTRUCTED (Copper/RF/Fibre) cables.
5 9	Trench containing only DESIGNED/PLANNED (Copper/RF/Fibre/Power) cables.
5 9	Trench containing any INSERVICE/CONSTRUCTED (Power) cables.
BROADWAY ST	Road and the street name "Broadway ST"
Scale	0 20 40 60 Meters 1:2000 1 cm equals 20 m

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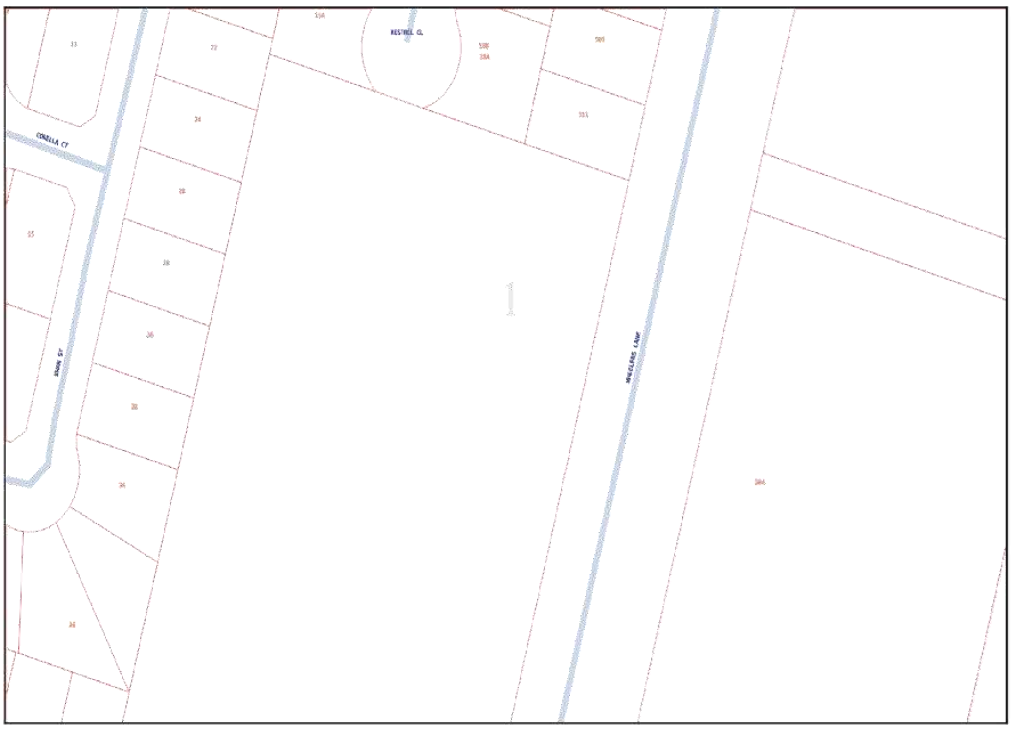

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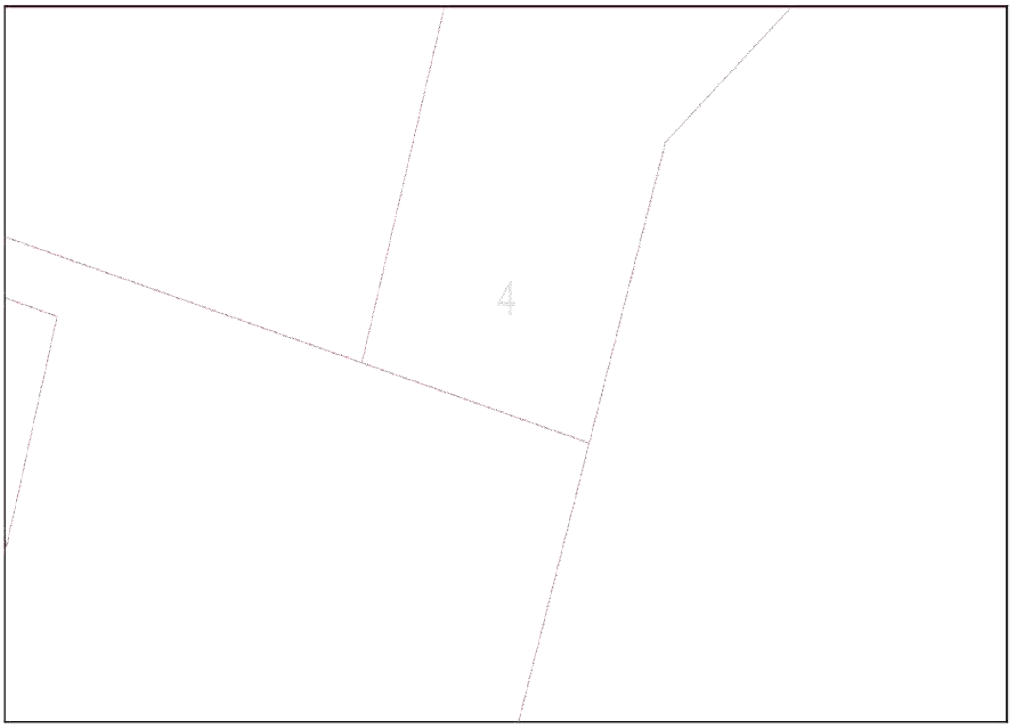

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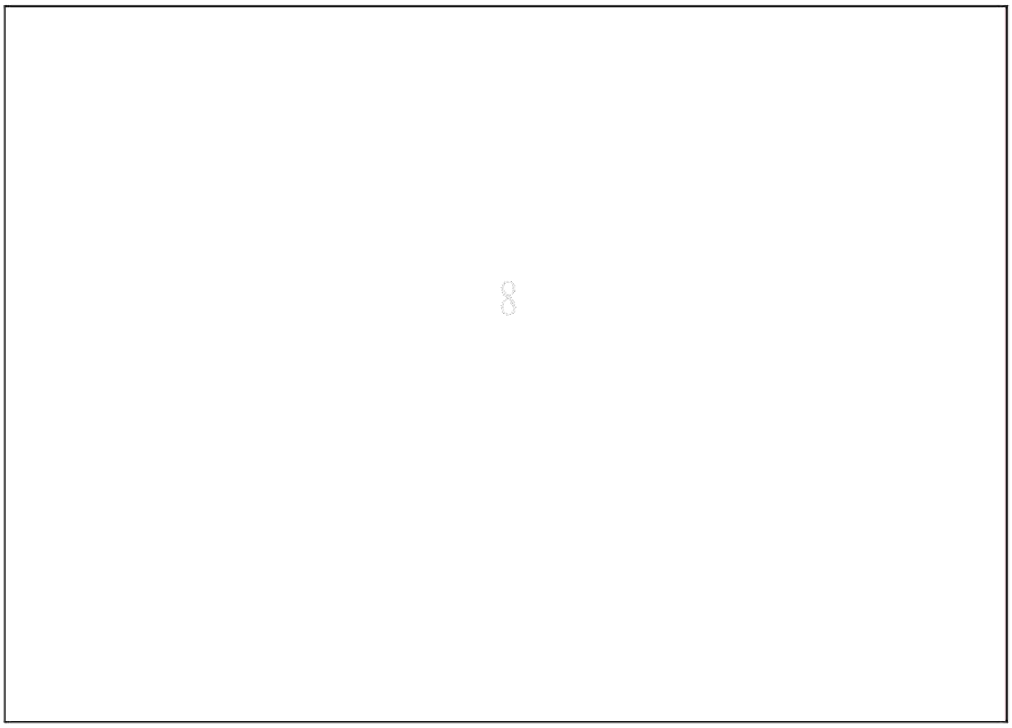

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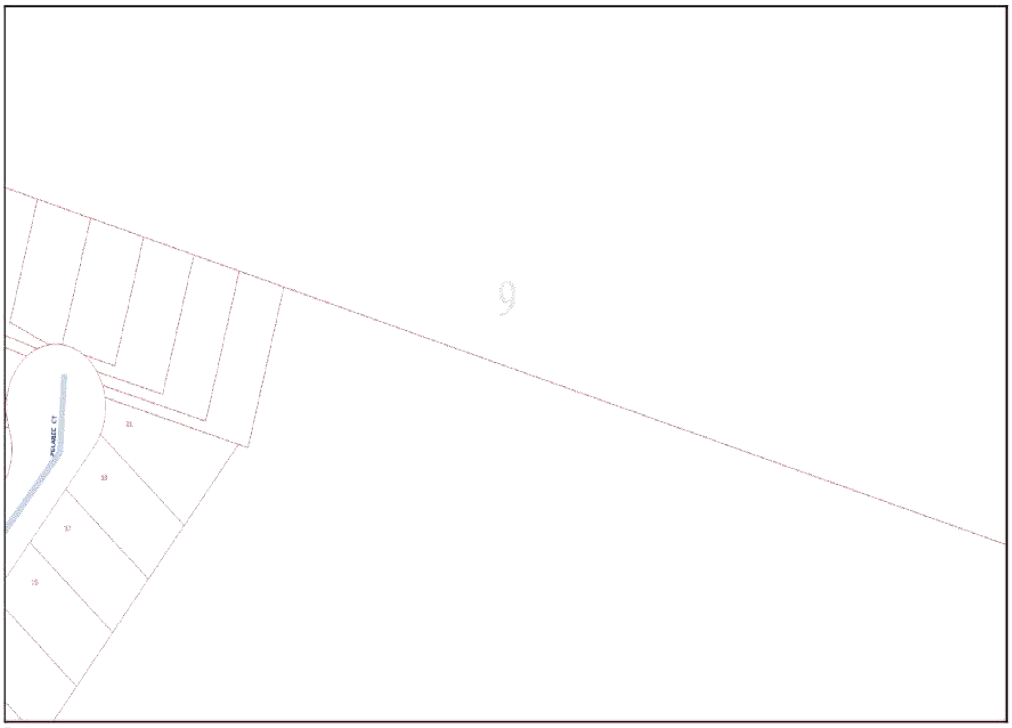

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To:	Mr Roshan Paheerathan
Phone:	Not Supplied
Fax:	Not Supplied
Email:	alex.c@atl.net.au

Dial before you dig Job #:	19276334	DIAL BEFORE YOU DIG www.1100.com.au
Sequence #	96188201	
Issue Date:	27/03/2020	
Location:	Boundary Road , Dubbo , NSW , 2830	Some impact. No onsite action required.

Information

The area of interest requested by you contains one or more assets.

nbn Assets	Search Results
Communications	Asset identified
Electricity	Asset identified

In this notice **NBN Facilities** means *underground fibre optic, telecommunications and/or power facilities, including but not limited to cables, owned and controlled by* ***nbn***

Location of Underground Power Facilities

We thank you for your enquiry. In relation to your enquiry at the above address:

- **nbn's** records indicate that there **ARE nbn** Facilities in the vicinity of the location identified above ("Location").
- **nbn** indicative plan/s are attached with this notice ("Indicative Plans").
- The Indicative Plan/s show general depth and alignment information only and are not an exact, scale or accurate depiction of the location, depth and alignment of **nbn** Facilities shown on the Plan/s.
- In particular, the fact that the Indicative Plans show that a facility is installed in a straight line, or at uniform depth along its length cannot be relied upon as evidence that the facility is, in fact, installed in a straight line or at uniform depth.
- You should read the Indicative Plans in conjunction with this notice and in particular, the notes below.
- You should note that, at the present time, the Indicative Plans are likely to be more accurate in showing location of fibre optics and telecommunications cables than power cables. There may be a variation between the line depicted on the Indicative Plans and the location of any power cables. As such, consistent with the notes below, particular care must be taken by you to make your own enquiries and investigations to precisely locate any power cables and manage the risk arising from such cables accordingly.
- The information contained in the Indicative Plan/s is valid for 28 days from the date of issue set out

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above.You are expected to make your own inquiries and perform your own investigations (including engaging appropriately qualified plant locators at your cost to locate **nbn** Facilities during any activities you carry out on site).

We thank you for your enquiry and appreciate your continued use of the Dial Before You Dig Service. If you are planning to excavate and require further information, please contact **nbn** on 1800 626 329. For any enquiries related to moving assets or Planning and Design activities, please visit the **nbn** Commercial Works website to complete the online application form.

Notes:

1. You are now aware that there are **nbn** Facilities in the vicinity of the above property that could be damaged as a result activities carried out (or proposed to be carried out) by you in the vicinity of the Location.
2. You should have regard to section 474.6 and 474.7 of the *Criminal Code Act 1995* (CoA) which deals with the consequences of interfering or tampering with a telecommunications facility. Only persons authorised by **nbn** can interact with **nbn's** network facilities.
3. Any information provided is valid only for **28 days** from the date of issue set out above.

Referral Conditions

The following are conditions on which **nbn** provides you with the Indicative Plans. By accepting the plans,you are agreeing to these conditions. These conditions are in addition, and not in replacement of, any duties and obligations you have under applicable law.

1. **nbn** does not accept any responsibility for any inaccuracies of its plans including the Indicative Plans. You are expected to make your own inquiries and perform your own investigations (including engaging appropriately qualified plant locators at your expense to locate **nbn** Facilities during any activities you carry out on site).
2. You acknowledge that **nbn** has specifically notified you above that the Indicative Plans are likely to be more accurate in showing location of fibre optics and telecommunications cables than power cables. There may be a variation between the line depicted on the Indicative Plans and the location of any power cables.
3. You should not assume that **nbn** Facilities follow straight lines or are installed at uniformed depths along their lengths, even if they are indicated on plans provided to you. Careful onsite investigations are essential to locate the exact position of cables.
4. In carrying out any works in the vicinity of **nbn** Facilities, you must maintain the following minimum clearances:
   - 300mm when laying assets inline, horizontally or vertically.
   - 500mm when operating vibrating equipment, for example: jackhammers or vibrating plates.
   - 1000mm when operating mechanical excavators.
   - Adherence to clearances as directed by other asset owner's instructions and take into account any uncertainty for power cables.
5. You are aware that there are inherent risks and dangers associated with carrying out work in the vicinity of underground facilities (such as **nbn** fibre optic,copper and coaxial cables,and power cable feed to **nbn** assets).Damage to underground electric cables may result in:
   - Injury from electric shock or severe burns, with the possibility of death.
   - Interruption of the electricity supply to wide areas of the city.
   - Damage to your excavating plant.
   - Responsibility for the cost of repairs.
6. You must take all reasonable precautions to avoid damaging **nbn** Facilities. These precautions may include but not limited to the following:
   - All excavation sites should be examined for underground cables by careful hand excavation. Cable cover slabs if present must not be disturbed. Hand excavation needs to be undertaken with extreme care to

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minimise the likelihood of damage to the cable, for example: the blades of hand equipment should be aligned parallel to the line of the cable rather than digging across the cable.
- If any undisclosed underground cables are located, notify **nbn** immediately.
- All personnel must be properly briefed, particularly those associated with the use of earth-moving equipment, trenching, boring and pneumatic equipment.
- The safety of the public and other workers must be ensured.
- All excavations must be undertaken in accordance with all relevant legislation and regulations.

7. You will be responsible for all damage to **nbn** Facilities that are connected whether directly, or indirectly with work you carry out (or work that is carried out for you or on your behalf) at the Location. This will include, without limitation, all losses expenses incurred by **nbn** as a result of any such damage.
8. You must immediately report any damage to **nbn™** network that you are/become aware of. Notification may be by telephone - 1800 626 329.
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All works undertaken shall be in accordance with all relevant legislations, acts and regulations applicable to the particular state or territory of the Location. The following table lists all relevant documents that shall be considered and adhered to.

State/Territory	Documents
National	Work Health and Safety Act 2011
	Work Health and Safety Regulations 2011
	Safe Work Australia - Working in the Vicinity of Overhead and Underground Electric Lines (Draft)
	Occupational Health and Safety Act 1991
NSW	Electricity Supply Act 1995
	Work Cover NSW - Work Near Underground Assets Guide
	Work Cover NSW - Excavation Work: Code of Practice
VIC	Electricity Safety Act 1998
	Electricity Safety (Network Asset) Regulations 1999
QLD	Electrical Safety Act 2002
	Code of Practice for Working Near Exposed Live Parts
SA	Electricity Act 1996
TAS	Tasmanian Electricity Supply Industry Act 1995
WA	Electricity Act 1945
	Electricity Regulations 1947
NT	Electricity Reform Act 2005
	Electricity Reform (Safety and Technical) Regulations 2005
ACT	Electricity Act 1971

Thank You,

Network Operations Centre - Assurance

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Date: 27/03/2020

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Appendix C

Email Correspondence - Chris Godfrey 20th April 2020

From: Chris Godfrey
To: Alexandra Chung
Subject: RE: Attn: Civil Engineering Dept - Information on proposed Boundary Rd
Date: Friday, 17 April 2020 3:45:03 PM
Attachments: image002.png
image004.png
image005.png
image006.png
image007.png
image008.png
image009.png
ATT00001.png

Good afternoon Alexandra,

With regard to the RSL lot on Boundary Road, the following service connections will be made available:

Sewer – A HDPE DN50 pressure sewer connection will be made available to the lot. A pressure sewer boundary kit will be provided. Pressure sewer pump station to be constructed by others. A DN150 gravity sewer connection will also be provided to the lot although it will not be available for use until such a time that the Southlakes residential subdivision to the south of Boundary Road extends its internal sewer network. Once the gravity sewer is made live, the pressure sewer system can be disconnected and the RSL lot redirected.

Potable Water – A DN150 main will be provided in the footpath area on the south eastern corner of the lot. A service connection can then be made with the lot.

Natural Gas – A low pressure natural gas main will be made available to the lot. The final diameter of this pipeline is still being considered. It is likely to be either DN32 or DN50 however.

Stormwater – A DN525 main will be installed in the footpath area in front of the south eastern corner of the lot. This pipeline will provide drainage to the road corridor. It will be possible to connect the lot to this system however.

Telecommunications – Council is currently arranging NBN pit and pipe work for the extension of Boundary Road. A communications pit will be provided somewhere in the footpath reserve of the south eastern corner of the lot. No fibres will be installed within the pit however.

Electricity – It is Council's intention to install electrical conduits as part of the Boundary Road extension project. These conduits would provide a connection point to the south eastern corner of the RLS lot. This aspect of the project is still being finalised however although it is likely that both high (11kV) and low voltage (415V) conduits will be provided.

In addition, I will provide you with the construction plans for the Boundary Road extension project once I have finalised reviewing the document.

Happy to discuss anything further if you like.

Thanks and regards,

Chris Godfrey
Acting Manager Infrastructure Strategy and Design
Dubbo Regional Council
P 02 6801 4911 **M** 0400 842 143
E Chris.Godfrey@dubbo.nsw.gov.au



http://dubbo.nsw.gov.au

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From: Alexandra Chung <Alex.C@atl.net.au>
Sent: Thursday, 16 April 2020 10:47 AM
To: Dubbo Regional Council <council@dubbo.nsw.gov.au>
Subject: Attn: Civil Engineering Dept - Information on proposed Boundary Rd

[**EXTERNAL Message:** Be cautious of clicking on links or opening attachments.]

I am writing on behalf of my Client, Dubbo RSL who is proposing works on the following Boundary Rd extension.

I am wanting to get some information on the proposed Boundary road extension and the services that will be installed within the frontage. Could someone please contact me with any information on this Road?

My mobile is best – 0402019313.

at&l

Alexandra Chung
Civil Engineer

Level 7, 153 Walker Street
North Sydney NSW 2060

e: Alex.C@atl.net.au

p: 02 9439 1777
m: 0402 019 313

w: www.atl.net.au

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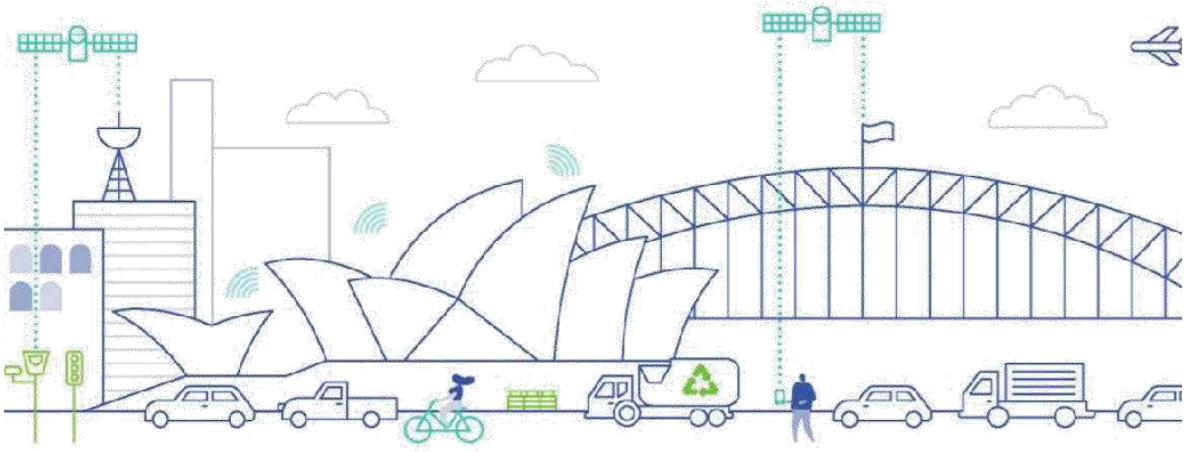
Traffic Assessment – Planning Proposal

Proposed Dubbo RSL Club

at Corner Boundary Road and Henty Drive

on behalf of Dubbo RSL Club



Revision Record

No.	Author	Reviewed/Approved	Description	Date
1.	Baqir Husain/Richard Watson	Richard Watson	For submission	06/08/2020
2.	Baqir Husain/Richard Watson	Richard Watson	Interim access description	29/09/2020
3.				
4.				

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Level 8, 369 Ann Street, Brisbane. PO Box 12015 Brisbane 4003

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1 Introduction

1.1 Background

TTM Consulting was engaged by The Planning Hub to prepare a traffic assessment investigating the rezoning of the low-density residential land for future development of a new registered club facility and its associated recreational facilities. The development will be operated by Dubbo RSL Club and will be located at the future extension of Boundary Road and Henty Drive in South-East Dubbo. It is understood that a Planning Proposal for rezoning will be lodged with Dubbo Regional Council.

1.2 Scope

This report investigates the traffic aspects associated with the proposed development. The scope investigated includes:

- Review relevant background documentation and information, including relevant LEP, DCP, SEPP and planning documents for the local area
- Preliminary design advice of the development concept plans, with respect to the Dubbo Regional Council Traffic, Access, Parking and Servicing requirements
- Estimation of the future parking requirements (car, motorcycle, bicycle, loading etc.) for the site based on Council's LEP/DCP/SEPP and/or RMS requirements
- Estimation of the traffic generation of the proposed development and identification of potential traffic impacts on the local road network
- Preliminary advice on pedestrian, bicycle and public transport provisions

The development concept plan has been assessed against the following:

- Dubbo Local Environmental Plan 2011;
- Australian Standards (AS 2890); and
- RTA (RMS) Guide to Traffic Generating Developments.

1.3 Site Location

The proposed Dubbo RSL Club site currently forms part of a larger site that will be subdivided to accommodate the proposal. The development site is legally described as part Lot 502, DP 1255115. The subject size is approximately 3.3 ha and will be located on the future extension of Boundary Road and Henty Drive.

The site is in an area identified for future residential development forming part of the existing residential estate to the west known as Keswick Estate and the wider South-East Dubbo Urban Release Residential Area.

The site context and site map view location are shown in Figure 1.1 and Figure 1.2. The development concept plan along with the geometry of the adjacent roads are shown in Appendix A.



Figure 1.1: Site Location Context



Figure 1.2: Site Location Map View

1.4 Development Profile

1.4.1 Scale

The Club building will indicatively be in the order of 2000m^2 in gross area, with up to 950m^2 of this being licensed and dining area. Additionally, an outdoor terraced area of approximately 400 - 500m^2, is proposed, and this area includes some terraced seating, children's play area and a recreational deck.

TTM are informed, that at this stage, it is anticipated that a maximum patronage at the club at any one time will be in the order of 450 people.

1.4.2 Probable Components

A detailed floor plan of the proposed club building has not been prepared. For a neighbourhood club of this size it is expected that a diverse range of facilities will be provided to include:

- indoor and outdoor gaming lounges
- large reception and foyer area
- sports lounge
- family lounges
- dining facilities and coffee shop
- entertainment and function lounge
- kids play areas
- extensive back-of-house storage and service area
- change room facilities for sporting activities.
- a sports field for local cricket and rugby league teams to both train during the week and play on weekends.

A development concept plan is included in Appendix A.

1.4.3 Access, Parking and Servicing

A single all movements vehicular access driveway is proposed on Henty Drive, approximately 130m north of the intersection with the Boundary Road extension. The median divided driveway will cater for all anticipated vehicles, including visitor / staff cars, and service vehicles up to and including HRVs.

A total of 197 at-grade car parking spaces (inclusive of PWD parking) are indicatively shown on the development concept plan.

A dedicated service vehicle loading and manoeuvring area, suitable for vehicles up to and including HRVs, is provided in the south-west corner of the site.

2 Existing Transport Network

2.1 Road Network Details

The proposed development is in South-East part of Dubbo where the road network is still under construction. The site will be located on the southern edge of the future Keswick Estate. Keswick State is bounded by Mitchell Highway to the north, Sheraton Road to the East and the extension of Boundary Road to the South. Mitchell Highway is the only State Road in the vicinity.

Construction has started on Dubbo Regional Council's Boundary Road extension project. The 1.2km two-lane sealed and fully kerbed extension will connect Boundary Road from Alexandrina Avenue through to Sheraton Road. There is no design for the road (Henty Drive) at this stage which will be another future extension off Boundary Road. Boundary Road and Henty Drive are proposed to form a roundabout intersection. All roads surrounding the project site will be maintained by Dubbo Regional Council.

2.2 Public Transport

Due to absence of existing road network near the development site area there are currently limited public transport options. Most of the bus services run along Mitchell Highway with one bus service (Route 570) travelling along Wheelers Lane. The current Dubbo bus network map is presented in Figure 2.1.

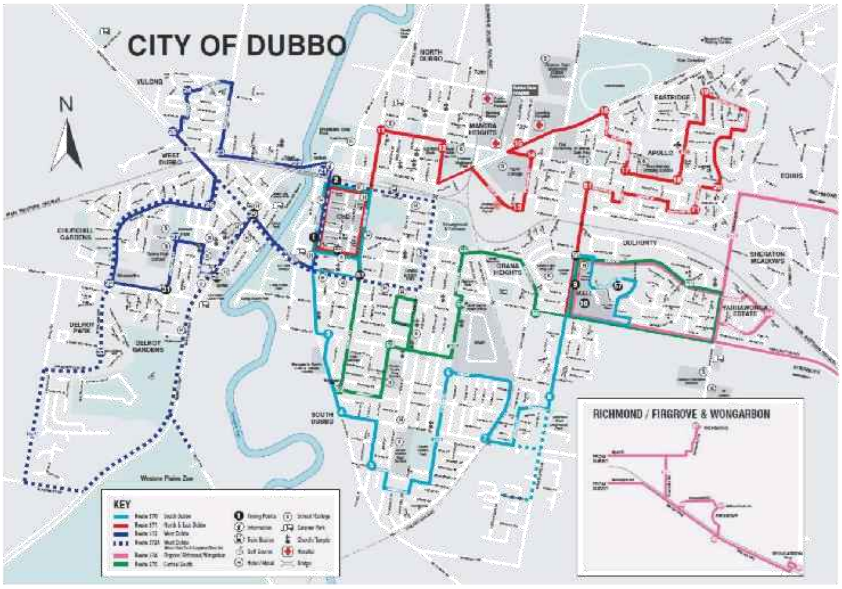


Figure 2.1: Existing Dubbo Bus Network

The Dubbo City Planning and Transportation Strategy 2036 proposes future public transport bus routes to be within 500m of developments in existing and new areas of Dubbo. The concept involves radiating bus service loops from the city centre as shown in Figure 2.2. This proposed concept may result in new bus services passing along Boundary Road and Henty Drive in future.

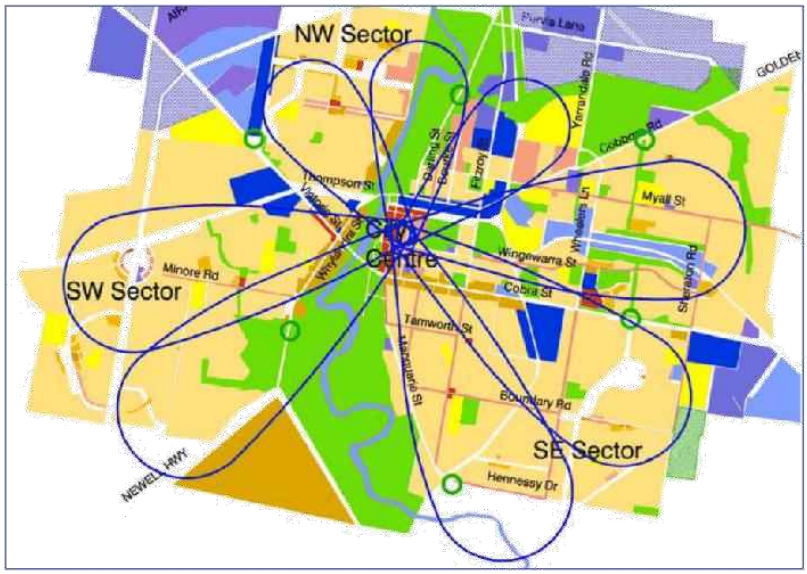


Figure 2.2: Concept for Future Bus Route

2.3 Pedestrian and Bicycle Facilities

Due to absence of existing road network near the development site area pedestrian footpath and bicycle path details are not available surrounding the project site.

The undergoing Boundary Road extension south of the project site will provide integrated bike lanes and pedestrian footpath on the southern side.

The Dubbo City Planning and Transportation Strategy 2036 incorporates design of a shared bike-walking system to provide safe, convenient crossings of all streets and highways and linking to all living area of Dubbo city.

3 Parking Supply

3.1 Council Car Parking Requirement

The relevant car parking supply requirements for the indicative proposed development, as outlines in the Dubbo Development Control Plan are presented in Table 3-1.

Table 3-1: Parking spaces requirement Council DCP

Land Use	Car Parking Rate	Extent	Required Car Parking Spaces
Registered Club	1 space per 5m² licensed / dining floor area	950m² #1	190
Recreation facilities (major) ie the sports oval	1 space per 10 seats	120 seats	12
TOTAL			202

#1: the project architect has estimated that up to 950m² of the total floor area could be allocated as licensed / dining floor area.

For a car park with greater than 100 spaces, the Dubbo DCP requires PWD parking for 'community uses' to be provided as follows:

> *(2 PWDs for the first 40 total spaces) + (2 PWDs for the next 60 total spaces) + (1 PWD for each additional 100 total spaces, or part thereof).*

For a total of 202 parking spaces, this equates to 6 PWD spaces, and for a reduced total of 197 spaces, it equates to 5 PWD spaces.

3.2 Practical Car Parking Demand

3.2.1 Registered Club

An estimate of the maximum practical parking demand has been made based on the following assumptions:

- maximum patronage of 450
- 15% of patrons/staff will arrive by other than private car, including taxi/Uber/private car drop-off, public bus, courtesy bus and walk / cycle.
- 85% of patrons/staff arrive by private car (parked on site)
- Average car occupancy is 2 persons per car

The preliminary estimate for maximum parking demand is 450 x 85% ÷ 2 = 191, which is consistent with the Council requirement calculated in the previous section.

3.2.2 Recreation Facility (Major)

Application of the same transport assumptions, as applied to the club in the previous section, results in a parking demand of 51 spaces for the 120 terraced seats associated with the sports oval.

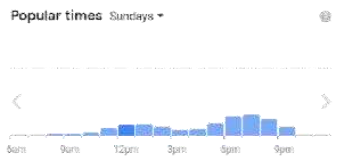
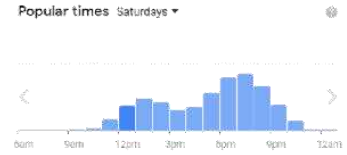
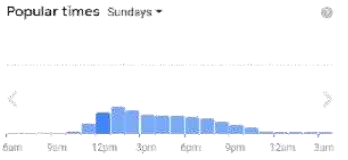
3.2.3 Temporal Distribution of Club Parking Demand

The peak parking demands for the sports oval are expected to be on game-day, which is likely to be in the morning / afternoon (but not the evening) on either Saturday or Sunday. Parking demands for sports training, at other times of the week, generally weekday evenings, is expected to be significantly lower.

To understand the likely corresponding parking demands of the RSL club at the time of peak demand for the sports oval, TTM used Google Maps to examine the temporal distribution of activity at three comparable clubs in the region. The results are indicated in Table 3-2.

This information suggests that there is generally quite low activity throughout Sunday, with Saturday activity until about 5pm, being at least 25% lower than the peak (evening) demand.

Table 3-2: Temporal Activity At Comparable Regional Clubs

	Saturday	Sunday
Dubbo RSL Memorial Club		
Bathurst RSL Club		
Orange Ex-Services Club		

3.2.4 Estimated Total Peak Parking Demand

The peak parking demand of the two primary uses on the site, is expected on Saturday afternoon, with the club generating a demand for 143 spaces (75% of its peak demand), and the sports oval generating a demand for 51 spaces. The total estimated demand is therefore 194 spaces.

3.3 Proposed Car Parking Supply

The development concept plan indicates a total of 197 car parking spaces, which is largely consistent with the Council parking requirement (202 spaces), and the estimated maximum practical parking demand (194 spaces).

The plans indicate 6 x PWD parking spaces, which complies with the requirements of the DCP.

4 Development Traffic Generation and Impact

During the development peak hour (expected to be on a Saturday afternoon, as discussed in Section 3.2.3), and assuming 75% of the peak patronage arrives in one hour, the estimated development peak hour traffic generation is in the order of 200vph.

The estimated traffic generation during the weekday AM peak hour is expected to be negligible, whilst the estimated traffic generation during the weekday PM peak hour is expected to be in the order of 100vph.

Given the local road network is currently non-existent, a detailed impact assessment has not been conducted. Traffic impacts would, however, normally be conducted for the weekday traffic peak hours, rather than for weekend periods. Given the estimates of development generated traffic during these times are relatively low, and that the access driveway has been located as far from the adjacent intersection as possible, it is considered likely that the future road network will easily accommodate the development generated traffic.

5 Access and Car Parking Layout

It is understood that Council has stated that access to the site will not be permitted from Boundary Road due to anticipated traffic volumes and road gradient considerations.

Vehicular access to the site is therefore proposed via a single driveway crossover on Henty Drive, in the north-east corner of the site. The preliminary design indicates an all-movements, unsignalized access with dedicated left and right turn lanes into the site from Henty Drive.

Given that the timing for the construction of Henty Drive is uncertain, and in order to facilitate access to the site, Council has advised that it will construct and maintain an interim arrangement on Henty Drive until such time as full construction takes place. TTM are advised that his interim arrangement will consist of a two lane bitumen sealed access from the roundabout along the entire eastern frontage of the site.

In order to minimise the potential for traffic impacts on the Henty Drive/Boundary Road roundabout, particularly during peak hours, the proposed access driveway is located at the northern corner of the site, approximately 120m from the roundabout. Given the spatial requirements for the sports field, there is no opportunity to locate it further south / closer to the roundabout.

Car parking is located on the northern and western sides of the site, in close proximity to the club building.

Table 5-1 identifies the characteristics of the proposed parking area and driveways with respect to the Council/AS 2890 requirements. The last column identifies the compliance of each design aspect.

Table 5-1: Access and Parking Layout Design Requirements And Provision

Design Aspect	Council DCP / AS 2890 Requirements	Proposed Provision	Compliance
Access Driveway Width	11m total, comprising a 6m entry + 1m median + 4m exit (AS2890.1)	11m total (6m entry+ 1m median + 4m exit)	Compliant
Crossover Grade	First 6m from the property boundary shall be a maximum of 1:20 (5%) (AS2890.1)	First 6m from the property boundary has a grade no greater than 1:20 (5%)	Compliant
Maximum roadway grade – Private Vehicle – Service Vehicle	 1 in 6 (16.7%) max (AS2890.1) 1 in 6.5 (15.4%) max (AS2890.2)	Essentially flat	Compliant
Parking space length (min)	5.4m (AS2890.1)	5.5m	Compliant
Standard space width (min) PWD space width (min)	2.5m (AS2890.1) 2.4m + 2.4m shared zone (AS2890.6)	2.5m 2.5m + 2.5m shared zone	Compliant Compliant
Parking aisle width (min)	5.8m (AS2890.1) 6.0m (if serving 0-50 spaces, DCP) 6.5m (if serving 50+ spaces, DCP)	Generally 7.0m, and 6.4m connection to the 24 parking spaces under the tennis courts	Compliant
Circulation roadway width (min)	5.5m (AS2890.1) & 6.5m (AS2890.2)	8.0m	Compliant
Porte cochere height clearance	2.5m for PWD use (AS2890.6). Also suitable for B99 cars and vans (ie Hiace minivan)	Unknown but easily achieved	
Blind aisle treatment	1m extension beyond the last parking space (AS2890.1)	1m extension (minimum)	Compliant

The geometry and layout of the car park complies with the requirements of the Dubbo DCP and Australian Standard AS2890.

6 Other Transport Facilities

6.1 Taxi / Uber / Private Dropoff

A dedicated porte cochere is proposed adjacent to the main pedestrian entry on the northern side of the club building. This facility is for use by taxi, Uber and private vehicles when dropping off and picking up patrons. If a courtesy bus is provided, it could also use this facility dependant on appropriate design.

Up to three cars can load / unload simultaneously in this facility, with the canopy large enough to allow two to do so under cover from inclement weather.

Assuming a generous 5 minute headway (between groups of 3 cars), this facility could accommodate up to 36 cars per hour, transporting, say 54 patrons.

6.2 Courtesy Bus

Typically, clubs such as the proposed development, offer a courtesy bus service for use by local club members. The vehicles generally used for this type of service range in size / capacity from a Toyota Hiace (11 passengers) to a Toyota Coaster (22 passengers).

The preliminary design and scale of the porte cochere would limit the size of a courtesy bus to Hiace size.

Assuming 4 services per hour (in the evening club peak), a single Hiace sized courtesy bus could transport up to 44 patrons per hour to the site.

6.3 Public Bus

Whilst no specifics are available, given the planned future increase in residential density in in the south east of the city, the proposed expansion of the bus network to serve the new communities, and the growth of the local road network (including the extension of Boundary Road), it is considered likely that one or more bus stops will be constructed on either Boundary Road or Henty Drive. Should this be the case, the local bus service could provide substantial capacity to move patrons to and from the proposed development.

Whilst bus stops on either road would be beneficial for the development, a stop on Boundary Road would be particularly convenient given the proximity of the club building to this frontage. The development concept plan indicates dedicated and convenient pedestrian access from the Boundary Road frontage to the club building.

6.4 Cycle Access and Parking

The planning for Boundary Road and Henty Drive indicates the inclusion of bicycle lanes. As noted in the previous section, the development concept plan indicates dedicated and convenient pedestrian access from the Boundary Road frontage to the club building, and this could also be used as the primary cycle access into the site.

Whilst the Dubbo DCP does not specify any bicycle parking requirement for this type of development, it is not considered unreasonable to provide a nominal amount, say 10-20 spaces, for use by staff and patrons.

7 Service Vehicle Arrangements

The proposed development is expected to be serviced by vehicles up to and including medium / heavy rigid vehicles (MRVs and HRVs) for deliveries, with refuse collection being undertaken by similar sized vehicles.

Service vehicles will access the site via the Henty Drive access driveway, and traverse the site internally along the northern and western boundaries to reach the dedicated service area in the south west corner of the site. The service area comprises a dedicated loading bay of sufficient size to accommodate vehicles up to HRV size, plus a hardstand area to facilitate 3-point turns by these vehicles.

Servicing is generally likely to occur outside peak business hours (ie prior to lunch on weekdays), and as such interaction between heavy service vehicles and patrons cars will be minimised. Furthermore, whilst the single large loading bay at the rear of the site is considered sufficient to cater for the demands of the development, the fact that there will be minimal activity in the car park prior to lunch would permit small delivery / courier type vans to use the carpark for servicing purposes at these times, should this be more convenient.

The vehicles will be loaded/unloaded in the loading area shown on the development concept plan included in Appendix A.

8 Summary

8.1 Development Access

Vehicular access to the site is provided via a single 11m wide divided driveway crossover on Henty Drive, in the north-east corner of the site. The preliminary design indicates an all-movements, unsignalized access with dedicated left and right turn lanes into the site from Henty Drive.

The proposed access location is cognisant not only of Council restrictions, but also of the practical spatial requirements of the sports field and of the desire to minimise traffic impacts on the roundabout.

Given that the timing for the construction of Henty Drive is uncertain, and in order to facilitate access to the site, Council has advised that it will construct and maintain an interim arrangement on Henty Drive until such time as full construction takes place. TTM are advised that his interim arrangement will consist of a two lane bitumen sealed access from the roundabout along the entire eastern frontage of the site.

8.2 Parking Arrangements

The total proposed parking supply is 197 spaces including 6 x PWD spaces. This satisfies the estimated maximum practical demand for the development (194 spaces), and essentially satisfies the Council requirement as outlined in the Dubbo DCP, being just 5 spaces (or 2.5%) less than the calculated requirement.

The dimensions layout and geometry of the car park design are consistent with the requirements of AS2890, and the Dubbo DCP.

Whilst the Dubbo DCP does not specify any bicycle parking requirement for this type of development, it is not considered unreasonable to provide a nominal amount, say 10-20 spaces, for use by staff and patrons.

8.3 Impact on Surrounding Road Network

During the development peak hour (expected to be on a Saturday afternoon) the estimated development peak hour traffic generation is in the order of 200vph. The estimated traffic generation during the weekday AM peak hour is expected to be negligible, whilst the estimated traffic generation during the weekday PM peak hour is expected to be in the order of 100vph.

Given the local road network is currently non-existent, a detailed impact assessment has not been conducted, however traffic impacts would, however, normally be conducted for the weekday traffic peak hours, rather than for weekend periods. Given the estimates of development generated traffic during these times are relatively low, and that the access driveway has been located as far from the adjacent intersection

as possible, it is considered likely that the future road network will easily accommodate the development generated traffic.

8.4 Service Vehicle Arrangements

The proposed development is expected to be serviced by vehicles up to and including medium / heavy rigid vehicles (MRVs and HRVs) for deliveries, with refuse collection being undertaken by similar sized vehicles.

The single large dedicated loading bay is of sufficient size to accommodate vehicles up to HRV size, plus a hardstand area to facilitate 3-point turns by these vehicles, with the access route through the site being via 7m wide aisles.

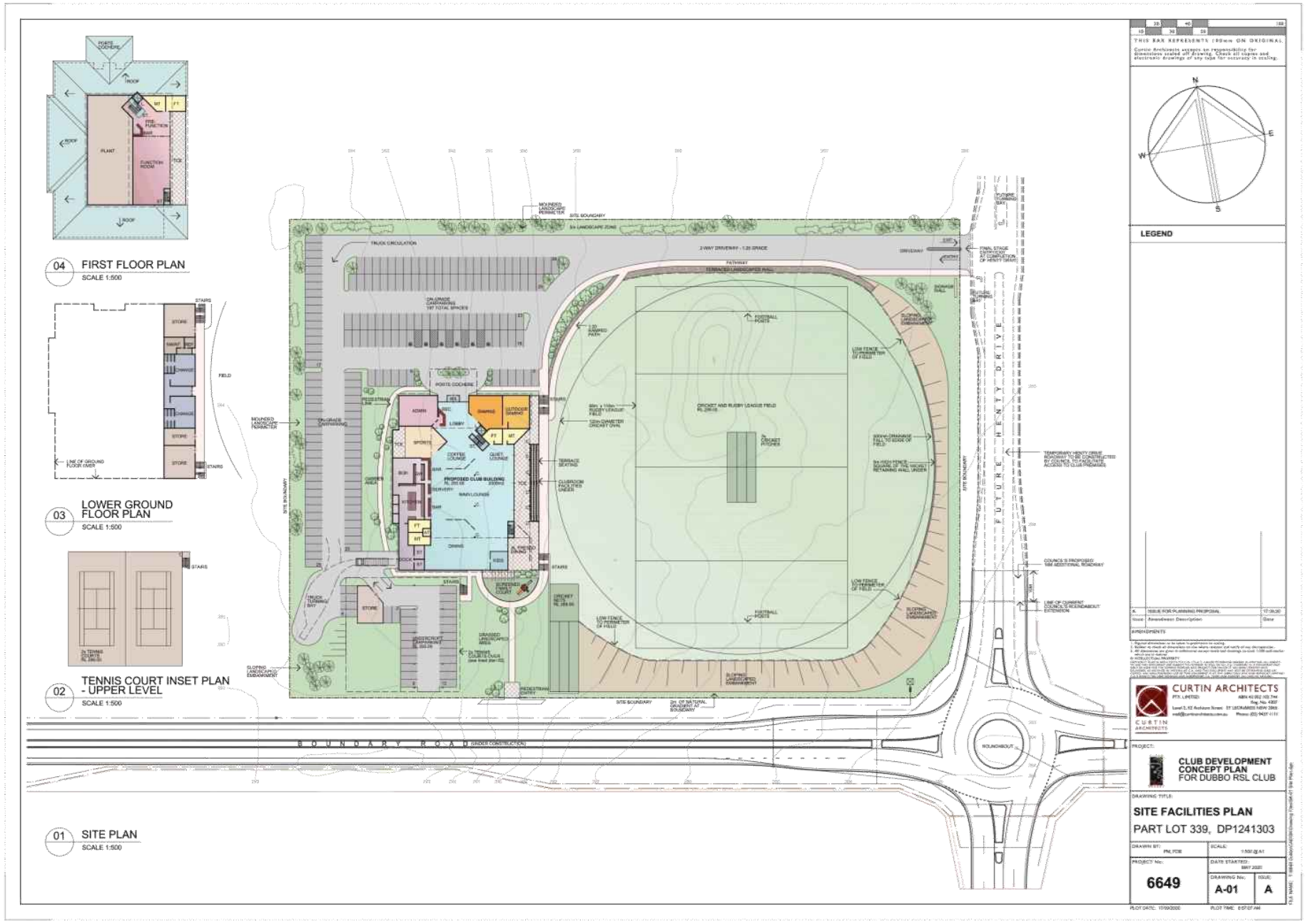
Servicing is generally likely to occur outside peak business hours, and as such interaction between heavy service vehicles and patrons cars will be minimised.

The servicing arrangements are considered appropriate for the proposed development.

8.5 Conclusion

Based on the assessment on this report, TTM see no traffic engineering reason why the relevant approvals should not be granted.

Appendix A Development Concept Plan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CLUB DEVELOPMENT CONCEPT PLAN
FOR DUBBO RSL CLUB
SITE FACILITIES PLAN
PART LOT 339, DP1241303
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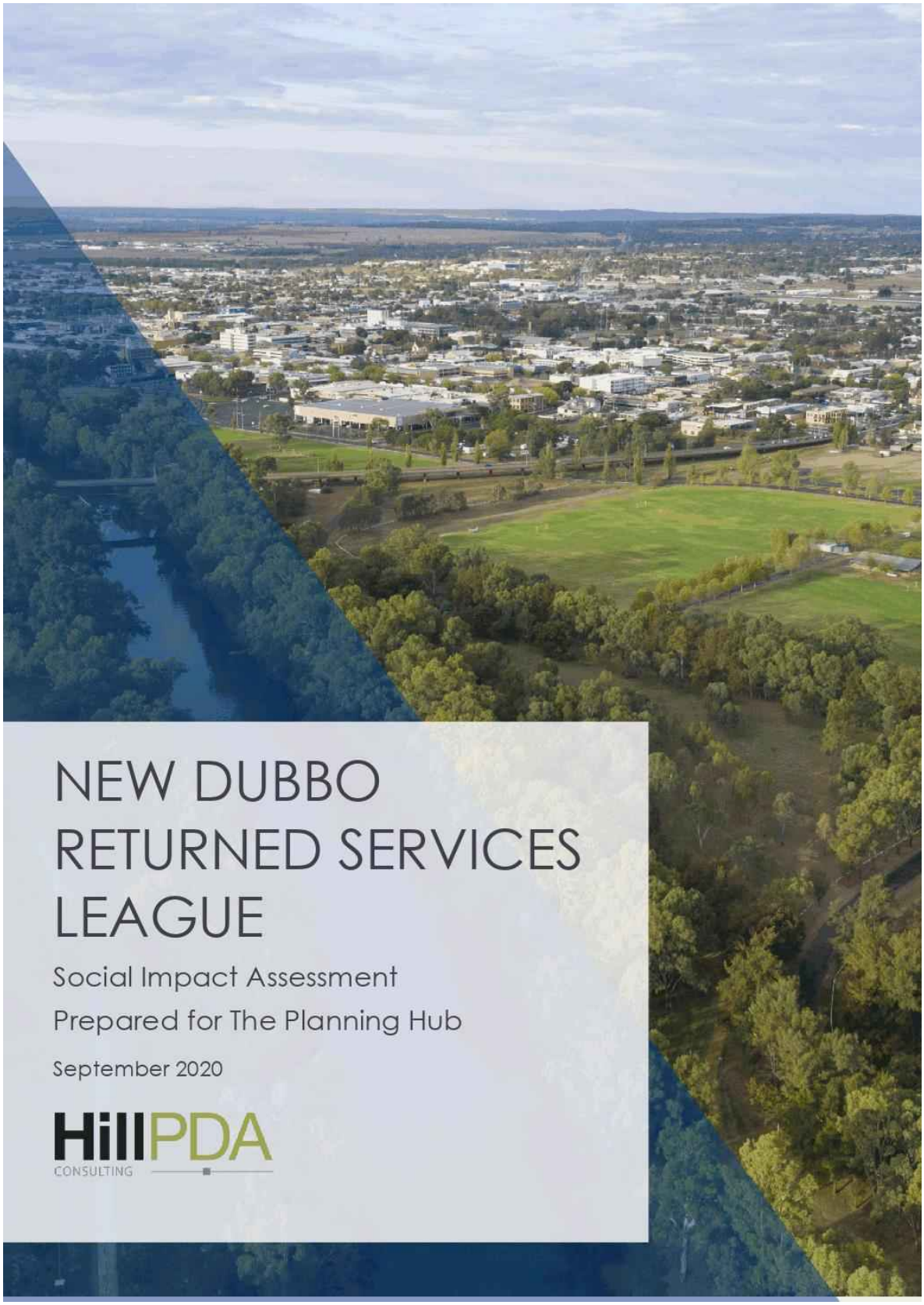
NEW DUBBO RETURNED SERVICES LEAGUE
Social Impact Assessment
Prepared for The Planning Hub
September 2020
HillPDA
CONSULTING

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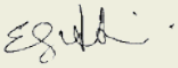
Reviewer

Signature		Dated	

Report Details

Job Number	P20057
Version	3
File Name	P20057 - Dubbo RSL SIA_200505
Date Printed	21 September 2020

INTRODUCTION

1.0 INTRODUCTION

HillPDA has been engaged by The Planning Hub to prepare a social impact assessment to accompany a Planning Proposal to amend the Dubbo Local Environmental Plan 2011 to accommodate a new registered RSL club facility and associated recreational facilities.

The Dubbo RSL Club (The Club) is a registered club currently located at 178-188 Brisbane Street, Dubbo. The Club provides a range of community facilities and services at the Brisbane Street site including event and conference space, gym and aquatic centre and several bars and food outlets. The Club also operates a number of other community facilities and services in the Dubbo region including the Dubbo RSL, the Dubbo City Bowling Club and the Rhino Lodge.

To expand this portfolio, The Club propose to use a newly subdivided site in Dubbo's southeast that is commonly known as Volta Avenue, Dubbo (Lot 502, DP1255115) and develop a new Dubbo RSL club with an associated community and recreation facility. The site is within an area identified for future residential development and forms part of an existing residential estate known as Keswick Estate and the wider South-East Dubbo Urban Release Residential Area. The site is currently zoned R2 Low Density Residential under the provisions of the Dubbo Local Environmental Plan (LEP) 2011. Registered clubs are prohibited in the R2 zone under the Dubbo LEP. As such it is proposed to rezone the site to include the additional permitted uses of a registered club and recreation facilities to facilitate the future development of the site.

This Social Impact Assessment provides background to the planning proposal, a description of the existing social environment and an assessment of the potential social impacts from the proposed development. The methodology used to assess the potential social impacts for the proposed development is consistent with current best practice and NSW Government policy.

This report provides an assessment of the social impacts that may arise as a result of the proposed development. The impact assessment also considers potential impacts to sensitive receivers in the area.

HillPDA is a suitably qualified planning and economics firm with extensive experience in social impact assessment for licensed venues and other services-based developments.

METHODOLOGY

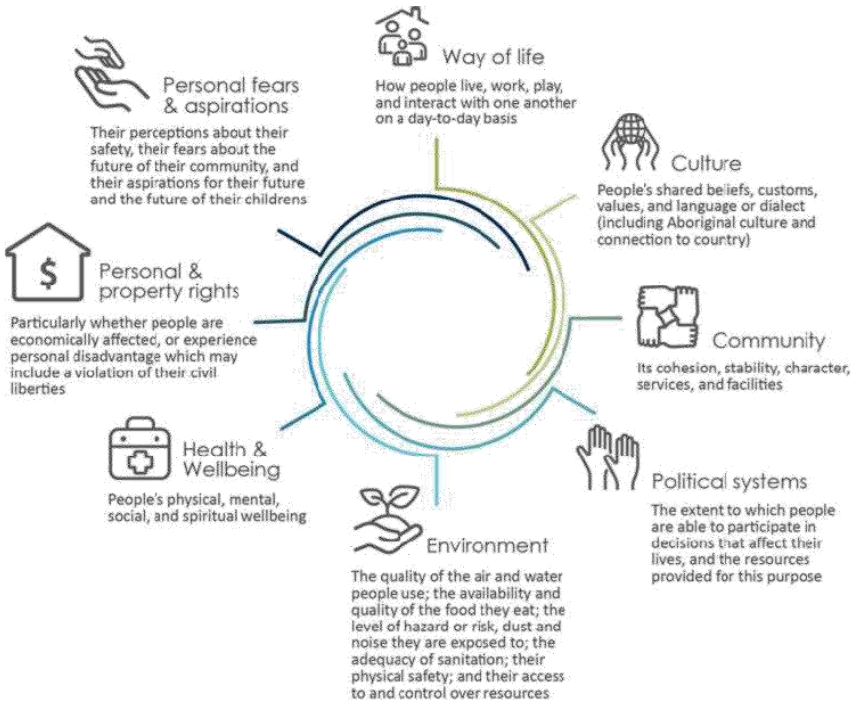
2.0 METHODOLOGY

2.1 Defining social impacts

A social impact can be defined as the net effect of an activity on a community and the well-being of individuals and families. The NSW Department of Planning, Industry and Environment (DPIE) *Social Impact Assessment Guideline* provides a detailed guideline that can be applied to any social impact assessment across NSW. Dubbo City Council provides guidance on preparation of a Social Impact Assessment through the Dubbo development Control Plan 2013 (DCP). Additionally, HillPDA has carried out research into best practice social impact assessment. This social impact assessment covers the requirements of the NSW DPIE guideline, Dubbo City Council DCP 2013 and best practice research.

The DPIE Guideline is designed to establish a clear, consistent and rigorous framework for identifying, predicting, evaluating and developing responses to the social impacts of those projects, as part of the overall environmental impact assessment. The guideline builds on work from Vanclay (2003) and establishes that social impacts arise from changes that impact people in any of several ways. Figure 1 details these potential areas that could be impacted by a development.

Figure 1: Social impacts



Source: Adapted from Vanclay, F. (2003). International Principles for Social Impact Assessment. Impact Assessment & Project Appraisal 21(1), 5-11

2.2 Assessment methodology

This social impact assessment has been prepared having regard to the relevant NSW Government and Council guidelines. Figure 2 presents the key steps and tasks undertaken to prepare this Social Impact Assessment.

Figure 2: Assessment methodology

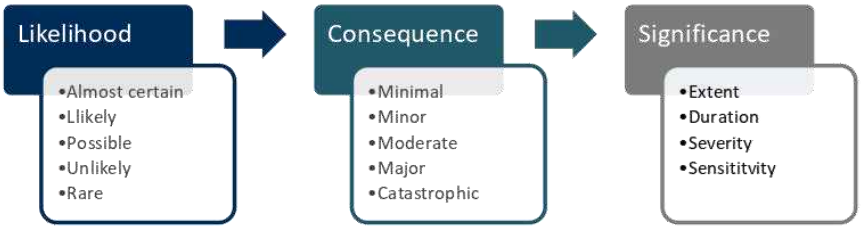


Adapted from Vanclay, F., et al. (2015): p. 7

2.3 Impact assessment framework

The impact assessment presented in this report identifies and evaluates changes to existing social conditions due to the project. This includes the assessment of direct and indirect benefits and effects/impacts, as well as consideration of any cumulative impacts. Individual impacts are evaluated in terms of the likelihood of the impact occurring, the magnitude of the consequence and the significance of the impact.

Figure 3: Social Impact Assessment process



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2.3.1 Likelihood of impact

The likelihood of a potential impact is a primary element of considering each social impact and its risk rating. The criteria used to determine the likelihood of any potential impact are described in Table 1.

Table 1: Likelihood of impact

Likelihood	Description	Indicative Probability
Almost certain	Expected to occur, almost frequently	90 percent
Likely	Could occur in many instances	70 percent
Possible	Just as likely to happen as not	50 percent
Unlikely	Limited occurrence	30 percent
Rare	Very limited occurrence	10 percent

2.3.2 Consequence of impact

The consequence of a potential impact is a key consideration to determine a risk rating. Each consequence is detailed below in Table 2.

Table 2: Consequence

Consequence	Description
Insignificant	No lasting detrimental or negligible impact on the community or environment.
Minor	Minor, short-term isolated impact on the community or environment.
Moderate	Modest, medium-term, widespread impact on the community or environment.
Major	Serious, long-term, widespread impact on the community or environment. Widespread community unrest or discomfort.
Catastrophic	Severe/ extensive on-going, widespread impact on the community or environment.

2.3.3 Significance of impact

Potential impacts are identified as part of the scoping process (see Section 6). They are then analysed based on the nature of the impact and its predicted severity. A mitigation strategy is proposed if necessary and finally both impacts are assigned a Social Risk Rating (SRR). The matrix used to calculate SRR is below in Table 3.

Table 3: Social Risk Matrix

		Consequence				
		Insignificant	Minor	Moderate	Major	Catastrophic
Likelihood	Almost certain	High	High	Extreme	Extreme	Extreme
	Likely	Moderate	High	High	Extreme	Extreme
	Possible	Low	Moderate	High	Extreme	Extreme
	Unlikely	Low	Low	Moderate	High	High
	Rare	Low	Low	Moderate	High	High

Source: NSW Planning & Environment (2017) | Vanclay, F; Esteves, A; Aucamp, I; Franks, D (2015)

POLICY CONTEXT

3.0 POLICY CONTEXT

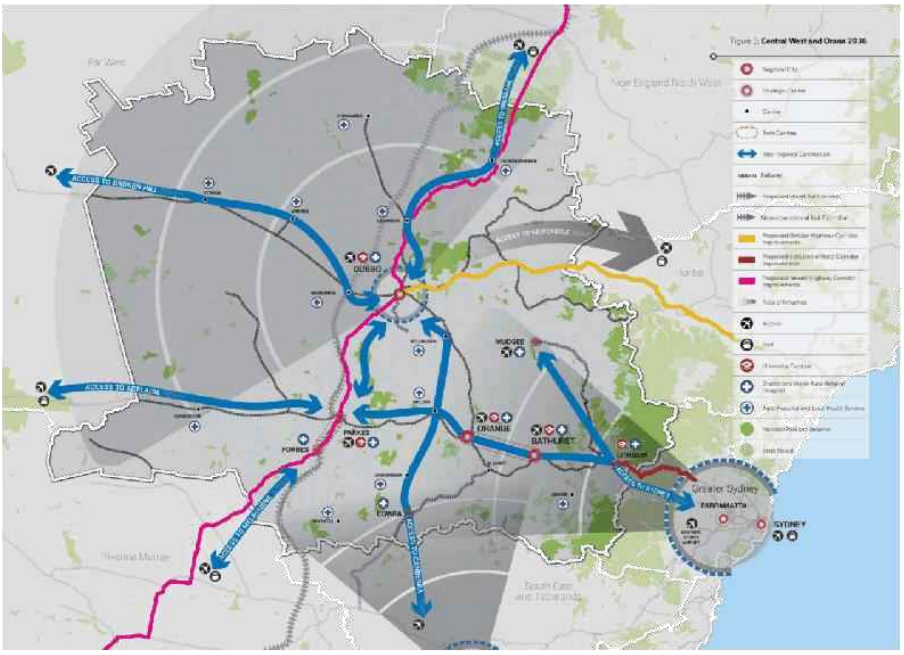
3.1 Central West and Orana Regional Plan 2017

The Central West and Orana Regional Plan was developed by the then Department of Planning and Environment was published in 2017. The Plan sets out a vision, goals, directions and actions for the future of this growing region to 2036.

The Plan identifies the region, that spans from approximately Lithgow to Nyngan and Cowra to Coonabarabran, as one of NSW's most diverse regional economies. The region is expected to grow by over 23,000 people by 2036 to 308,000 people. This population is ageing population and 15,800 new dwellings are required to meet the housing needs.

The region has several centres at Forbes, Parkes, Orange, Bathurst and Dubbo at the core, a network of opportunities with major road and rail connecting them. The region also includes the strategic centres of Cowra, Lithgow and Mudgee (Figure 4).

Figure 4: Central West and Orana 2036



The vision for the region is:

> *"the most diverse regional economy in NSW with a vibrant network of centres leveraging the opportunities of being at the heart of NSW"*

To achieve this vision the NSW government acknowledges the two diverse part of the region. The distinctive agricultural hinterland of the Central West and the vast slopes and plains of the Orana (Figure 5). Dubbo serves as the central hub for connections to a large number of dispersed rural communities. It is not only the

geographical centre of the region but is also the economic centre. To help reach the above-mentioned vision the following regionally focused goals are outlined in the strategy:

- The most diverse regional economy in NSW
- A stronger, healthier environment and diverse heritage
- Quality freight, transport and infrastructure networks
- Dynamic, vibrant and healthy communities.

Figure 5: Two parts of the Central West and Orana



The site is located in the Dubbo residential area and will provide the growing community with recreational infrastructure and entertainment options, aligning with goal 4: Dynamic, vibrant and healthy communities.

3.2 Dubbo Regional Council Community Strategic Plan 2018

The Dubbo Regional Council Community Strategic Plan is a plan for the growing community of the Dubbo region up to 2040. The LGA is expected to see an increase of 12,288 people, with a need for an additional 4,291 dwellings required in Dubbo centre. Dubbos affordable housing market is a key attractor to the region and there is ample space for the required dwellings to meet the needs of the projected population and beyond.

The Strategic Plan outlines the vision for the future of the Dubbo Region:

> *"In 2040 we will celebrate our quality of life, the opportunities available for us to grow as a community, our improved natural environment, and being recognised as the inland capital of regional NSW.*

The Strategy covers key themes for the future of Dubbo Regional Council with goals and strategies for each:

1. Housing
2. Infrastructure
3. Economy
4. Community leadership
5. Liveability

Key strategies relevant to this development:

- 3.1.5 events that provide for activities that foster cultural and recreational opportunities and community interaction
- 5.3.2 a variety of youth activities and entrainment is available

- 5.5.1 access to recreation and cultural activities for young people is improved
- 5.5.3 unique recreational facilities and opportunity are available
- 5.5.4 our sporting facilities are recognised as catering for a wide range of local, regional and state sporting events and opportunity

3.3 Guide for Establishing and Managing Night Time Economy Uses 2018

This guide was published by the NSW Government in 2018 to help guide businesses that operate or have a desire to operate within the night time economy and councils to plan a thriving and safe night time economy. It is intended to be a quick and easy reference tool.

The night time economy can be defined as social or business activities that take place between 6pm and 6am. The night time economy includes but is not limited to:

- Entertainment
  - Performing arts, music and culture
  - Sports
  - Amusement parks and centres
  - Casinos and other gambling activities
- Food
  - Cafes and restaurants
  - Takeaway food services
- Drink
  - Liquor retailing
  - Pubs, taverns, clubs and bars hotels

The guideline details the application process through the planning system and the elements that should be considered throughout the preparation. The guideline also includes a DA checklist and instructions on how to obtain a liquor licence.

THE PROPOSAL

4.0 THE PROPOSAL

4.1 The site

The site commonly known as Volta Avenue, Dubbo (Lot 502 DP1255115) is located to the southeast of Dubbo town centre . The site is proposed to be subdivided as shown in Figure 6. It sits within an area identified for future residential development forming part of the existing residential estate to the west known as Keswick Estate and the wider South-East Dubbo Urban Release Residential Area.

The site is currently zoned R2 Low Density Residential under the provisions of the Dubbo Local Environmental Plan (LEP) 2011. Registered clubs are prohibited in the R2 zone under the Dubbo LEP. As such it is proposed to rezone the site to include the additional permitted uses of a registered club and recreation facilities to facilitate the future development of the site.

The proposed new lot is located on a proposed extension of the existing Boundary Road. The extended road will connect to Sheraton Road with a four way round about. A round-about will also be located on the south eastern corner of the proposed RSL. The proposed RSL is envisioned to service the future Keswick estate community as beyond.

Figure 6: Proposed RSL Lot locality



Source The Planning Hub

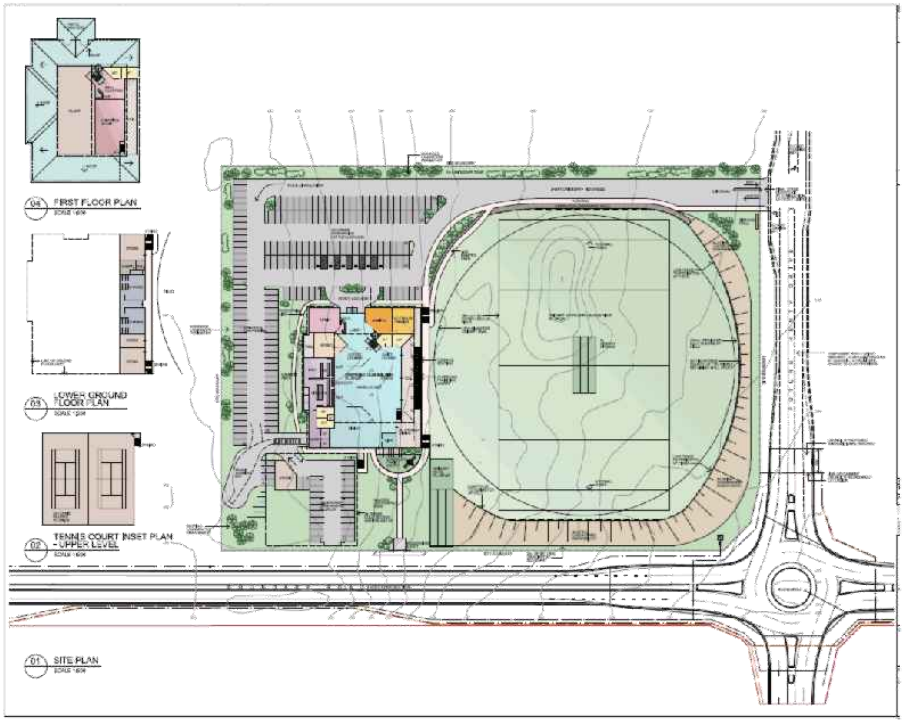
4.2 Concept proposal

The proposal is intended to facilitate the construction and operation of a new Dubbo RSL Club including:

- Club building including food prep/bars, lounges, gaming, sports, terraces, function rooms, reception and back-of-house facilities
- Kids play and family area
- 2 x tennis courts

- On-grade parking for 197, under croft parking for 22
- Cricket and rugby league field
- 3 x Cricket nets
- supporting amenities and landscaping to support spectators .

Figure 7: Proposed RSL concept plan



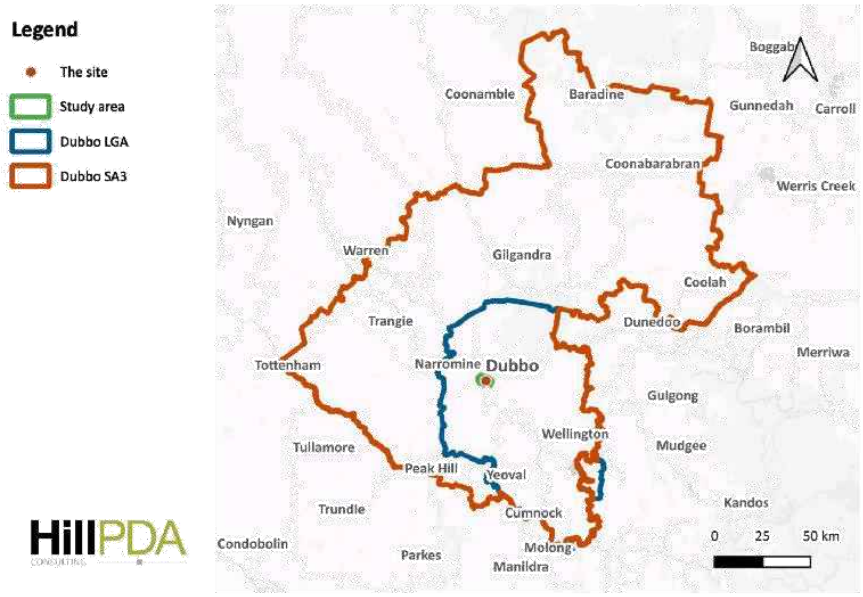
COMMUNITY PROFILE

5.0 COMMUNITY PROFILE

5.1 The study area

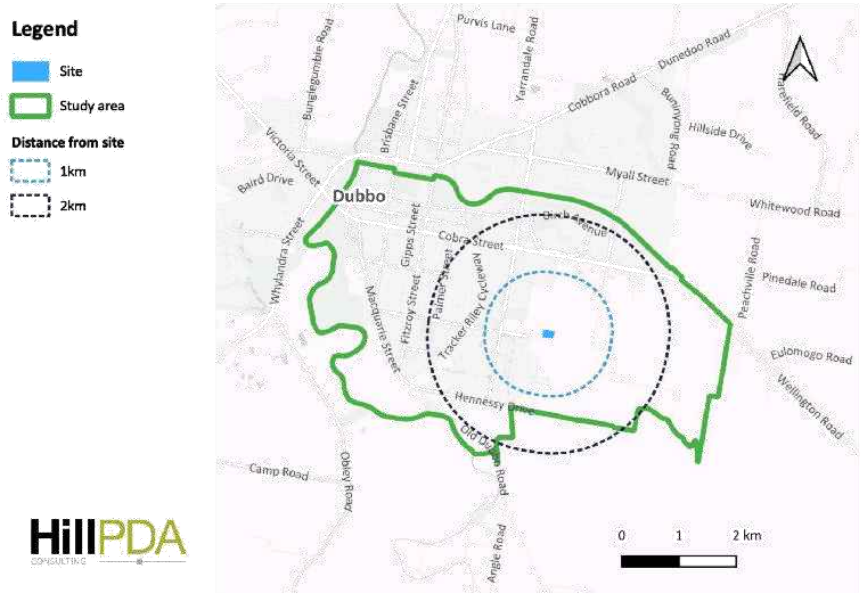
For the purposes of this demographic profile, the study area has been defined as Dubbo-South (SA2). The Dubbo Region (SA3) and the rest of NSW GCCSA has been used to compare and assess demographics against the wider region. The border of the selected SA2 (the study area) in relation to the site is seen in Figure 8.

Figure 8: Location



Source HillPDA

Figure 9: Study area boundary



Source HillPDA

5.1.1 The surrounds

This section considers the surrounding development in order to understand the proximity of the hotel to sensitive receivers and to other licensed venues, noting that a high density of licensed premises can present a greater risk of social harm.

5.1.2 Sensitive receivers

The following section provides an overview of potential sensitive receivers based on land uses located within the study area. This audit has been informed by a desktop analysis of geographical data and resources, including;

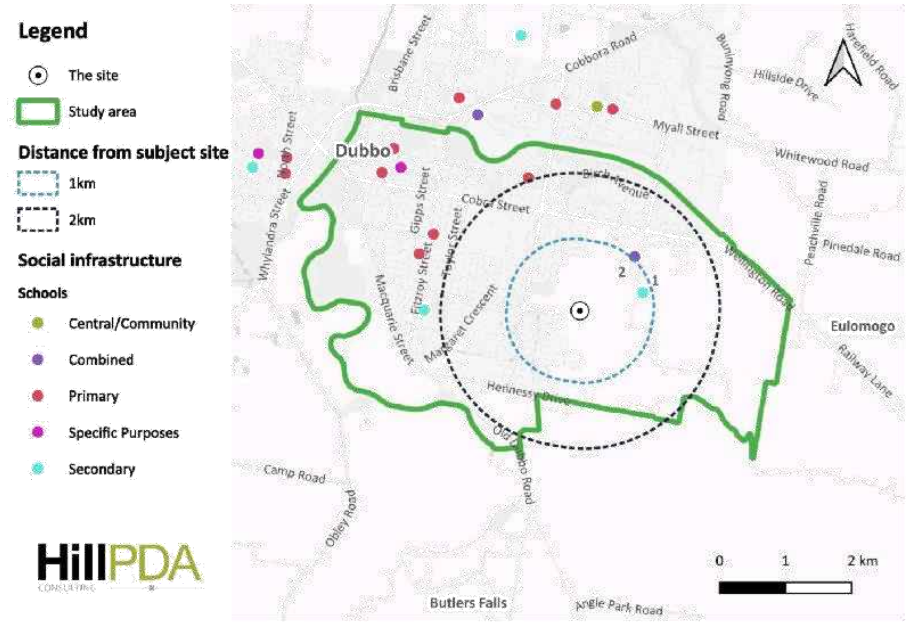
- Dubbo Regional Council website
- Transport for NSW website
- NSW Education website
- Australian Curriculum Assessment and Reporting Authority My School website
- Australian Children's Education & Care Quality Authority (ACECQA) Starting Blocks website.

The audit is indicative and based on the data available at the time of preparing this report.

Sensitive receivers considered are schools, childcare centres and places of worship as the primary purposes of these facilities have potential to be impacted by any change in land use or development of nearby land. The Dubbo Masonic Village Residential Care and Retirement Living community is located approximately 1km to the north of the site, the residents of this community could be considered sensitive receivers.

Figure 10 shows the schools in the area including St Johns College and Dubbo Christian School approximately 1km from the site. The schools have their own sporting facilities and are currently surrounded by farmland to the east and will be surrounded by the future community of Keswick. These schools are generally open between 8am and 4pm.

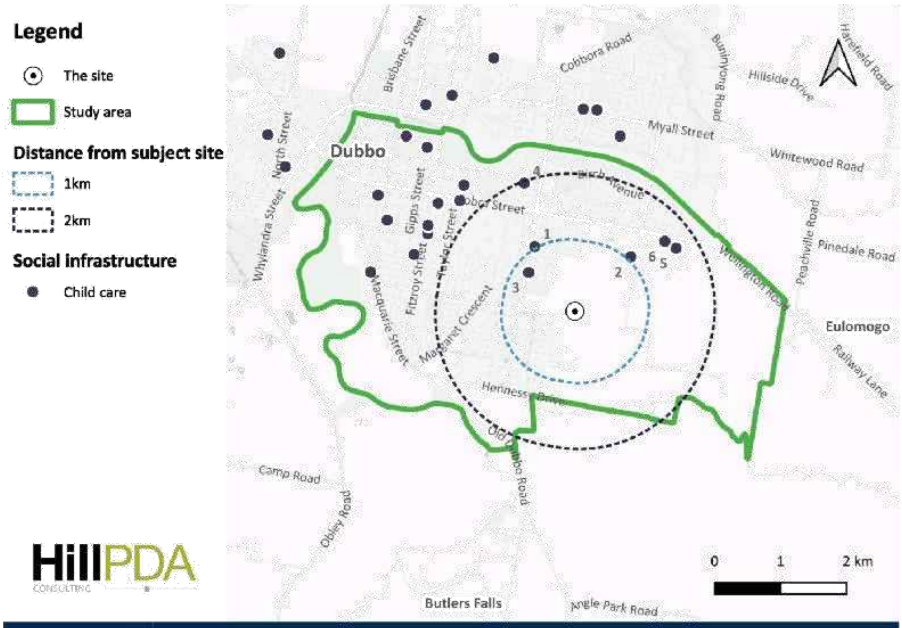
Figure 10: Nearby sensitive receivers – School



ID	Schools within 2km of the Site
1	St Johns Primary and College schools
2	Dubbo Christian School

Figure 11 shows the childcare facilties in the area with six facilities within 2 km of the site. All of the existing childcare facilities are in residential areas. They are priamrily open between 7am and 6pm.

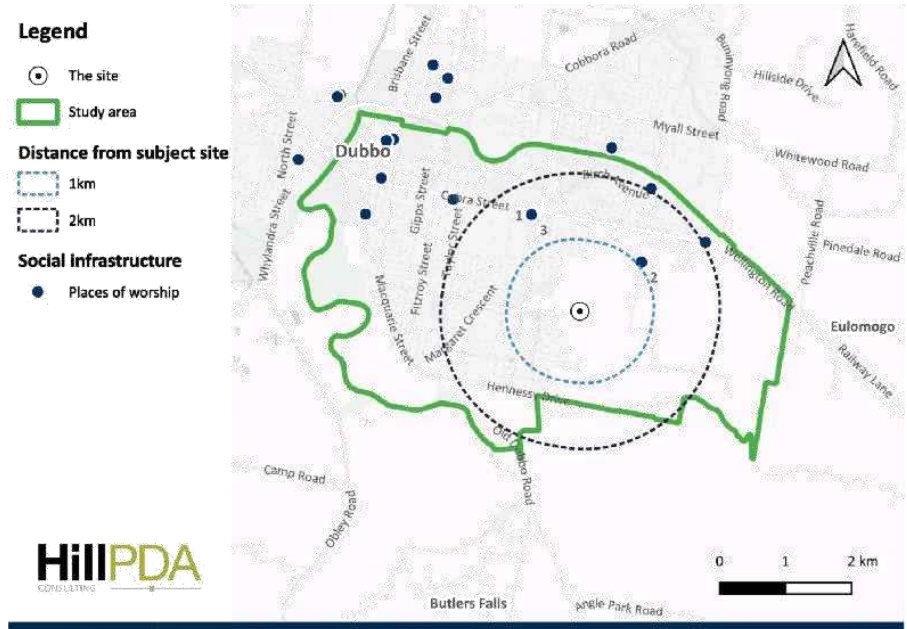
Figure 11: Nearby sensitive receivers – Childcare



ID	Childcare within 2km of the Site
1	Goodstart Early Learning Dubbo - Wheelers Lane
2	Dubbo Christian Preschool
3	Little Learners Long Day Care and Preschool
4	Orana Heights After School Care Inc
5	Dubbo Early Learning Centre
6	Imagine Childcare and Preschool Blueridge Park

Figure 12 shows places of worship in the area with three facilities located within 2km. Each facility is located in a residential area and hours of operation are generally early evenings and daytime on weekends.

Figure 12: Nearby sensitive receivers – Places of worship



ID	Places of Worship within 2km of the Site
1	Dubbo Baptist Church
2	Generocity church
3	Dubbo Renew Presbyterian Church

5.1.3 Nearby licences

Existing hotel, packaged liquor and club licenses within the study area are indicated in Figure 13. The location of licenses has been identified from the register of licensed premise provided by Liquor and Gaming NSW in May 2020. The study area of Dubbo South (SA2) has 12 relevant licences as of May 2020[1]. As shown in Table 4 the study area has a slightly lower rate of licences per 1,000 people than the Dubbo LGA and NSW quotient.

Table 4: Licences per 1,000 people

	Study Area (Dubbo South)	Dubbo LGA	NSW total
Population (2016)	**16,942**	**51,404**	**7,480,228**
Club licences	3	9	1,286
Hotel licences	9	26	2,121
Packaged Liquor licences	-	9	2,662
Total Licences (Club, packaged liquor and hotels)	**12**	**44**	**6,069**
Licences/1,000 people	**0.71**	**0.86**	**0.81**

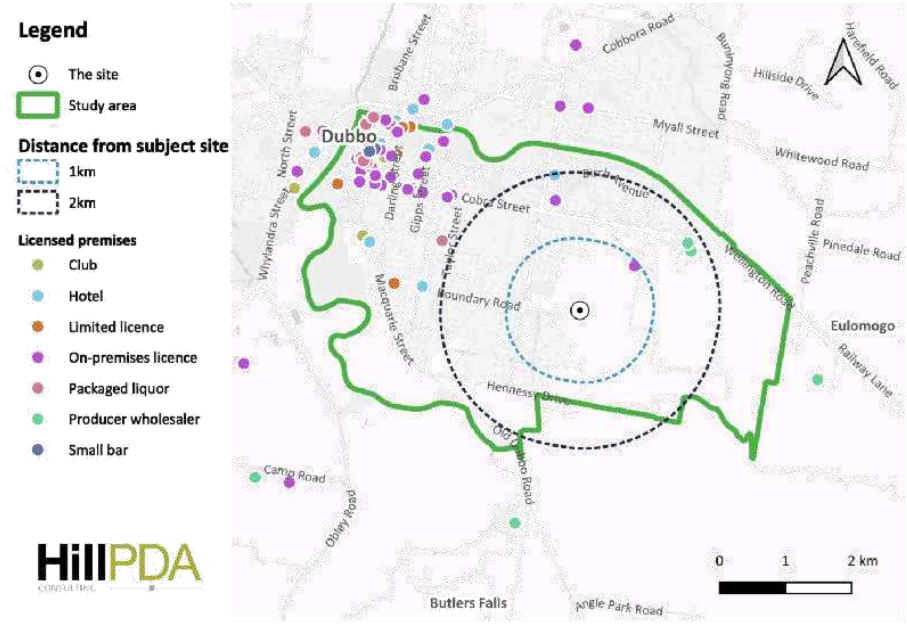
Source: NSW Government Customer Service Liquor Licence data, April 2020 and ABS, 2016

The suburb of Dubbo-South has 12 registered licences in the clubs, hotels and packaged liquor categories, these are primarily clustered within the city centre focused south of the Dubbo railway station and bound by the Macquarie River, Fitzroy Street and the southern alignment of Cobra Street.

The closest hotel or club licence to the site is the Macquarie Inn Hotel/Motel located approximately 2 kilometres to the northwest. The general opening hours are until midnight to 1am the next day on weeknights and until 2am the next day on Friday and Saturday nights, however the bistro closes at 9pm every day.

[1] NSW Government Customer Service Liquor Licence data, April 2020

Figure 13: Nearby licenced venues



5.1.4 Key findings

- There are several schools and churches within 2 kilometres of the site, which could be sensitive receivers to proposed activity
- The study area currently has a marginally lower rate of licences per 1,000 people than the LGA and NSW. There are limited competing premises the closest hotel or club licence to the site is the Macquarie Inn Hotel/Motel located approximately 2 kilometres to the northwest.
- There is evidence of clustering of licenced clubs/hotels within the town centre.
- There are no other club, hotel or packaged liquor licensed within a two kilometre radius of the site.

5.2 Demographic profile

This section provides a community profile and social baseline for the social impact assessment in section 7.0.

5.2.1 Population and growth projections

This population of the study area was 16,942 in 2016, compared with approximately 69,414 for the Dubbo Region (SA3). The study area has a comparable rate of persons per household as the Rest of NSW (GCCSA) but a slightly smaller household than the Dubbo region and NSW average size household.

Table 5: Summary of demographics

2016	Study area (Dubbo-South)	Dubbo Region (SA3)	Rest of NSW outside of Sydney (GCCSA)	NSW
Population	16,942	69,414	2,643,536	7,480,228
Families	4,284	17,577	693,180	1,940,226
Households	7,416	30,194	1,203,865	3,059,599
Average people per household	2.4	2.5	2.4	2.6

Source: ABS Census 2016, Dubbo-South (SA2), Dubbo (SA3), Rest of NSW (GCCSA), New South Wales (STE)

Projected population is not available at the study area scale, however, the Dubbo LGA is projected to increase in population to 57,980 by year 2036 (Table 6: Population Projections). This growth represents a 11 percent increase from 2016, in contrast over the same period the population of NSW is expected to increase by 30 percent.

Table 6: Population Projections

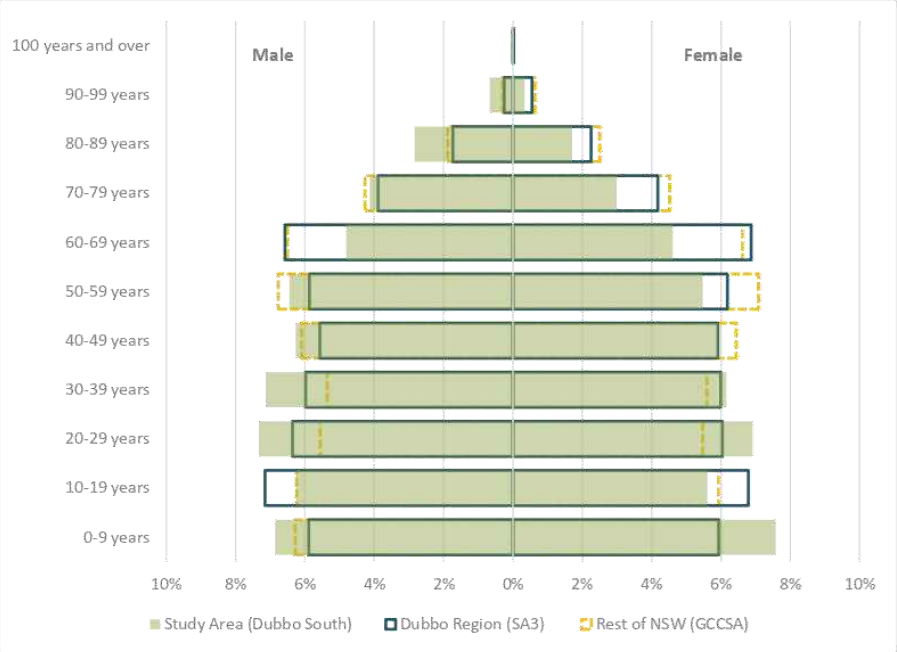
	2016	2021	2026	2031	2036	% change between 2016 and 2036
Dubbo LGA	51,404	53,724	55,530	56,926	57,980	11.3%
NSW Total	7,732,858	8,414,978	9,011,010	9,560,567	10,077,964	30%

Source: NSW ASGS 2019 LA Projections

5.2.2 Age structure

The age distribution in the study area tends to be younger than that of the wider Dubbo Region and Rest of NSW GCCSA, with a greater representation of people aged 20 to 39 and children between 0-9 while there is a lower proportion of 50 to 69 year olds.

Figure 14: Age by ten-year group (study area and Dubbo Region SA3)

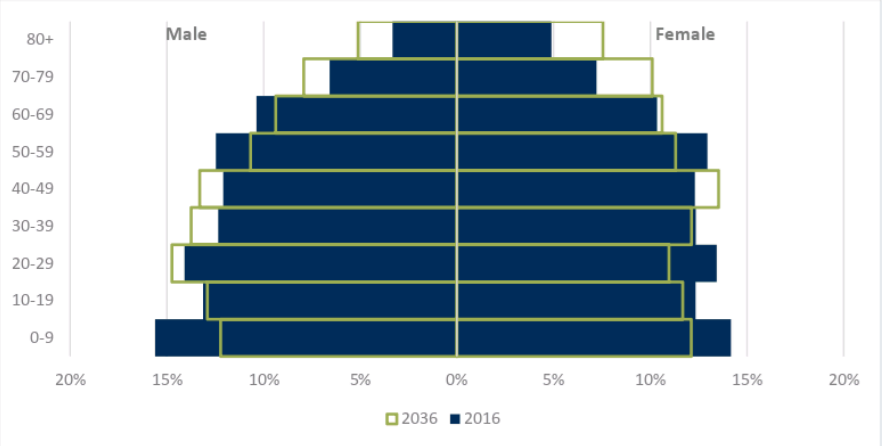


Source: ABS Census Tablebuilder 2016

5.2.3 Population projections

Population forecasts are calculated by local government area by the Department of Planning, Industry and Environment. Population projections for Dubbo Regional LGA show an increase of 6,576 people between 2016 and 2036. However, as shown in Figure 15, the greatest increase in population age range will be both in the younger age bracket of 20 to 49 in males and 40 to 49 age bracket for females and older age groups, indicating that the Dubbo Regional has an ageing population, which is consistent with state and national population trends. This is important for social infrastructure planning when considering health and recreation needs of older people.

Figure 15: Population projections (Dubbo Regional LGA)

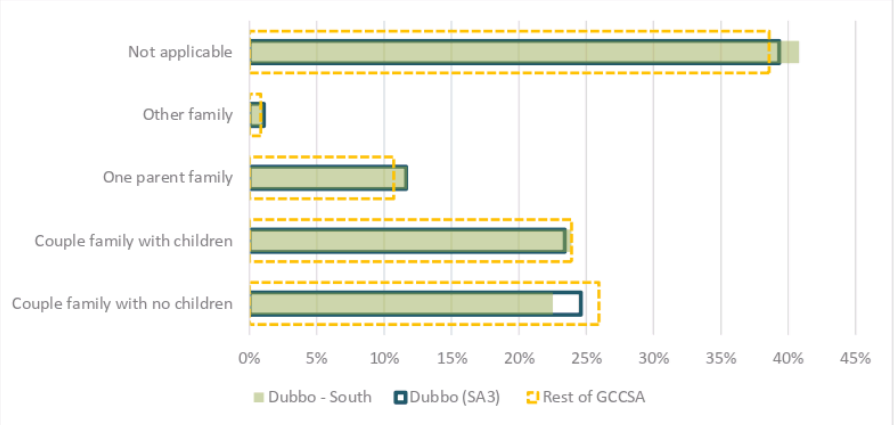


Source: NSW Department of Planning, Industry and Environment Population Projections, 2019

5.2.4 Family and household structure

The study area reflects a similar family structure as the NSW average with couples with children as the most common family structure, however the rest of NSW (GCCSA) showed couples with no children as the most common family structure. The study area showed a slightly higher representation of one parent family structure and a lower representation of Couple family with no children compared to Rest of NSW GCCSA.

Figure 16: Family composition Liverpool LGA and NSW (2016)

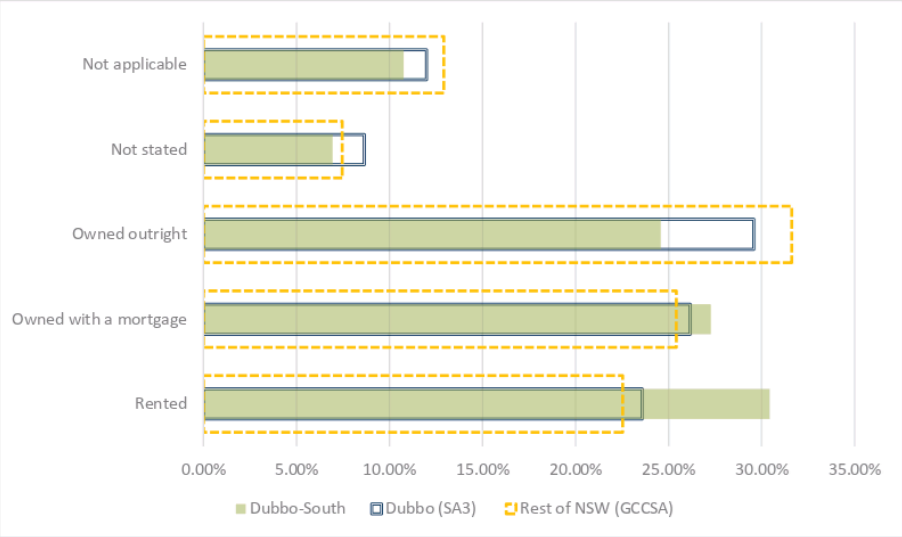


Source: ABS Census Tablebuilder 2016

5.2.5 Housing tenure

Housing tenure in the study area and greater Dubbo region showed a higher proportion of home owners with a mortgage and renters, whilst a lower representation of home owners owned outright compared to the Rest of NSW GCCSA. The study area showed a comparatively lower proportion of home owners owned outright that the greater Dubbo region.

Figure 17: Housing tenure



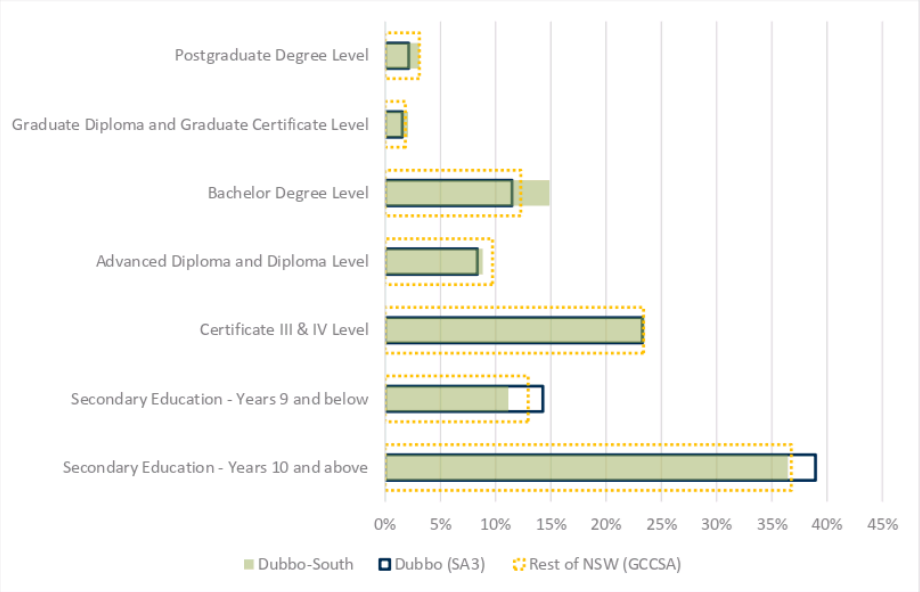
Source: ABS Census Tablebuilder 2016

5.2.6 Education, Employment and Labour force

The study area and greater Dubbo area have generally the same results when considering education, employment status and occupation, as such this section will consider the variances between these areas and the rest of NSW (GCCSA).

The study area has a higher proportion of bachelor attainment compared to both the Dubbo region and rest of NSW (GCCSA). The data shows a similar proportion of people who list Certificate III & IV Level (23%) and Graduate Diploma and Graduate Certificate Level (2%) as their highest level of attainment compared to rest of NSW (GCCSA). Whilst in the study area, there was a lower proportion of Advanced Diploma and Diploma Level and Secondary Education - Years 9 and below compared to the rest of NSW (GCCSA). This correlates with the higher proportion of professional employment as demonstrated below.

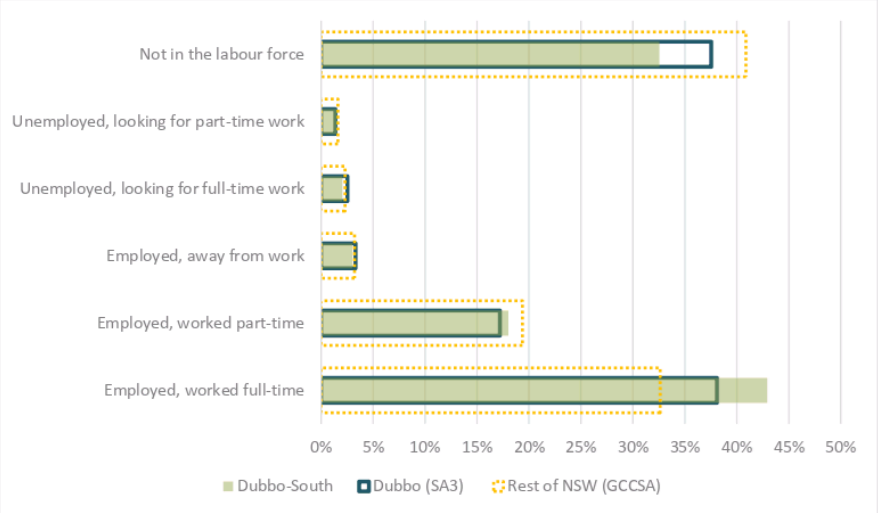
Figure 18: Highest level of Education Attained



Source: ABS Census Tablebuilder 2016

Employment in the Dubbo region and the study area is similar to that of NSW; however the study area has a greater representation of people working full-time but a lower proportion of people working part-time and not in the labour force.

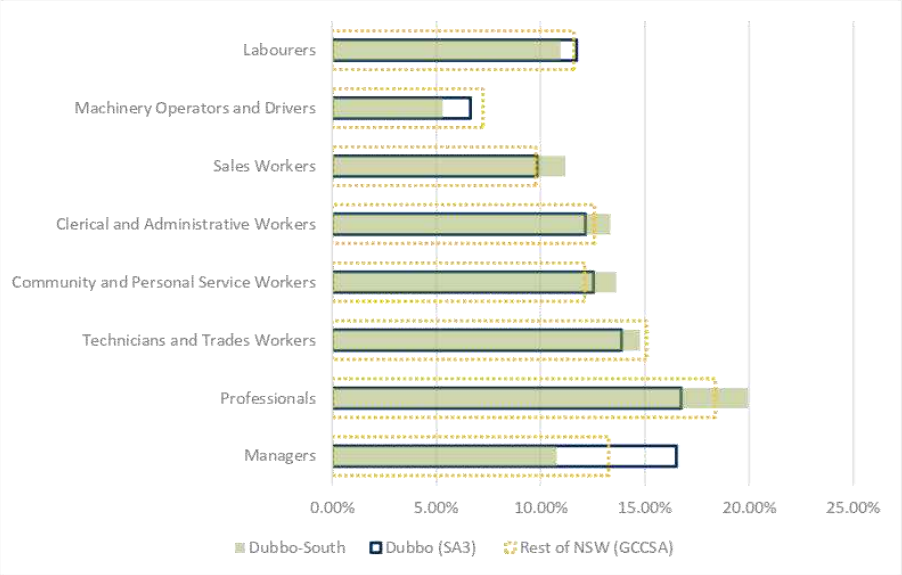
Figure 19: Employment status



Source: ABS Census Tablebuilder 2016

Residents within the study area and the Dubbo region are generally more likely to be in occupations classified as Professional, Sales Workers, Community and Personal Service Workers, Clerical and Administrative Workers or Technicians and Trades Workers compared to the Rest of NSW (GCCSA), with other occupation categories showing lower representation, particularly Managers, Labourers and Machinery Operators and Drivers. This indicates a young and professional population.

Figure 20: Occupation of employment

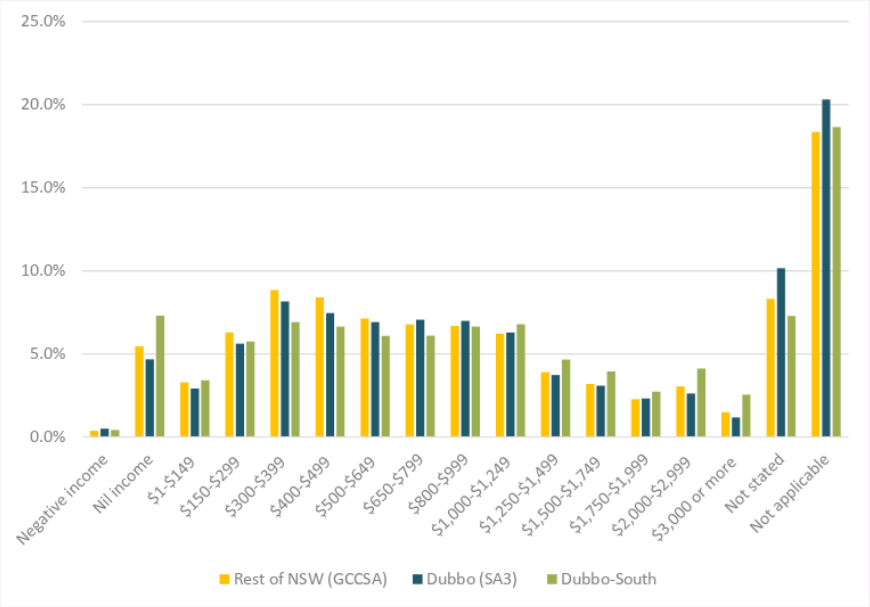


Source: ABS 2016. Excludes not stated, not applicable and inadequately described.

5.2.7 Income

Personal income ranges are shown below in Figure 21. It can be seen that the community within the study area have slightly higher than average income compared to the wider Dubbo region. The study area has a lower representation of those with nil income compared to the wider Dubbo region.

Figure 21: Total personal income ranges (weekly)



Source: ABS 2016

5.2.8 Transport

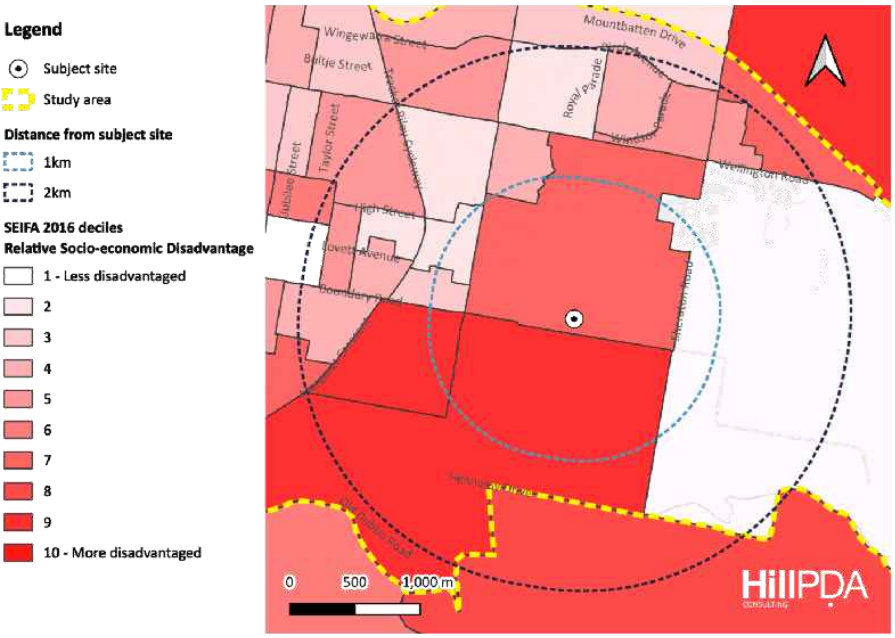
There is no public transport services available to the site, the closest bus services is along Mitchell Highway which connects to the city centre, Orana Mall and Richmond.

Bus services along Mitchell Highway end services between 2.03pm to 5.55pm depending on the service and day. The site is also located approximately 900 metres from Mitchell Highway which connects to Newell Highway, Narromine Road and Dunedoo Road.

5.2.9 Socioeconomic advantage and disadvantage

The Socio-Economic Indices for Areas (SEIFA) has been developed by the ABS to provide an overview of social and economic wellbeing and welfare of communities across a range of spatial scales based on characteristics such as income, education, unemployment and occupations. The output is an index which ranks the relative socioeconomic status of areas against each other at state and national levels (Figure 22). Areas without a colour do not have sufficient population to conclude a ranking.

Figure 22: SEIFA deciles of relative socio-economic Disadvantage



Source: ABS Census of Population and Housing: Socio-Economic Indexes for Areas (SEIFA), Australia, 2016

Generally, the study area ranks in the centre quintile indicating an average level of advantage and disadvantage. Comparatively the areas to the north are generally ranked in the lower quintiles and the areas to the south are ranked in the upper quintiles indicating greater disadvantage. This is likely to change following the development of the Keswick estate as planned, however current community reflects some risk for vulnerable communities.

5.2.10 Crime

Assaults are the most common crime associated with licenced hotels. Figure 23 indicates the location of crime in the area surrounding the site for the period between January and December 2019. It can be seen that there are high concentrations of Domestic assault, break and enter dwelling and malicious damage to property in nearby areas. There are no hotspots for non-domestic assault, robbery or break and enter non-dwelling in the immediate area.

There is a relatively high concentration of crime of all varieties approximately one kilometre to the west in the direction of the Dubbo town centre.

The overall level of crime at the site is relatively low, the concentrations of assaults near the site have been analysed below.

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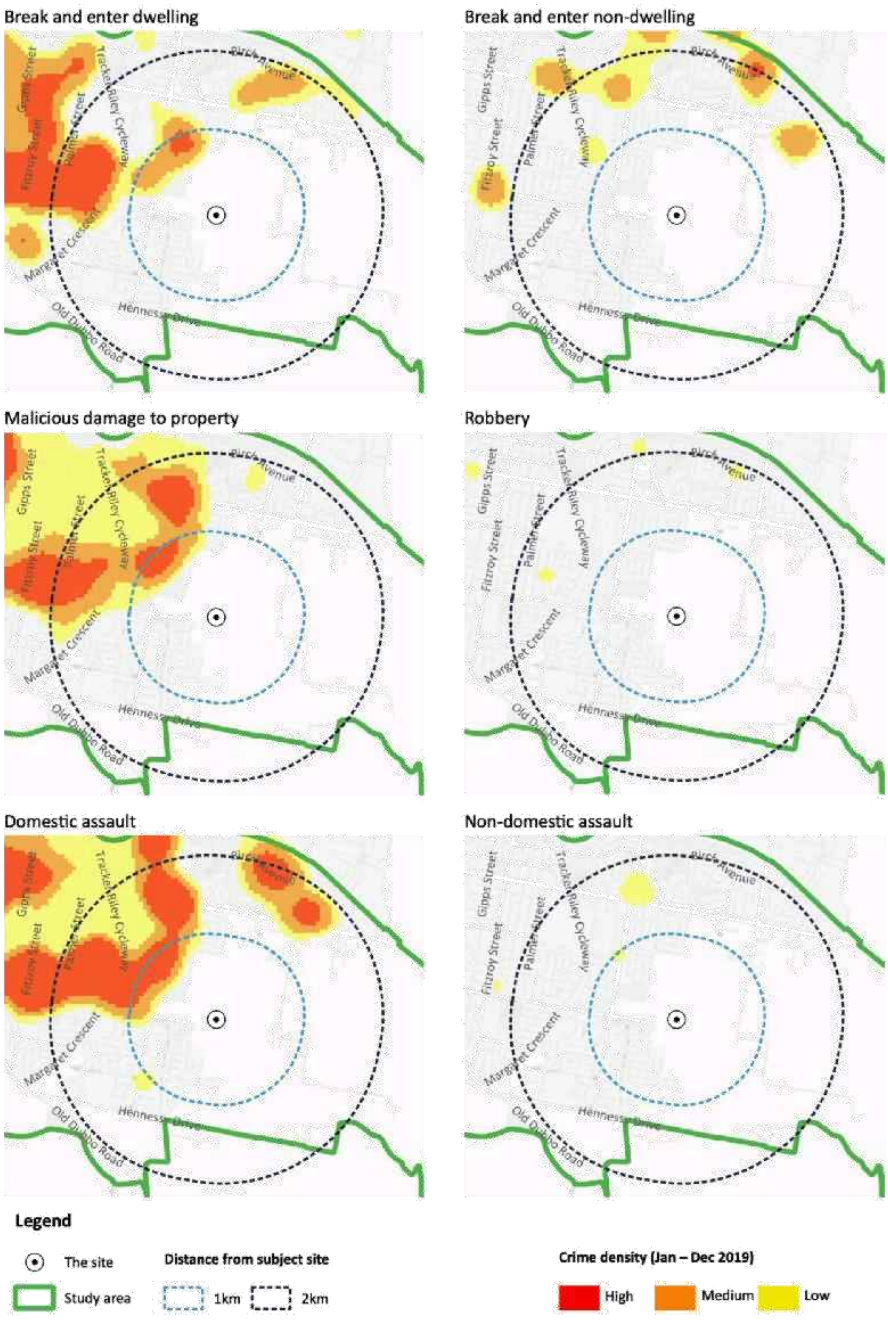
Figure 23: BOCSAR crime hotspots (incidents between January and December 2019)



Source: Bureau of Crime Statistics and Research Crime mapping Tool. Maps are for incidents of crime occurring January to December 2019.

Table 7 states the number of assaults at licenced premises in the suburb of Dubbo. It shows there was on average 180 alcohol related assaults per year and about 520 non-alcohol related assaults per year.

Table 7: Incidents of alcohol related assault at licensed premises in Dubbo (suburb)

	2015	2016	2017	2018	2019
Alcohol related assaults (per 10,000 population)					
Non domestic violence	1.2	1.3	1.4	1.3	1.3
Domestic violence related	1.1	1.2	0.9	1.5	1.8
total	**2.3**	**2.5**	**2.3**	**2.8**	**3.1**
Alcohol related non-alcohol related assaults (per 10,000 population)					
Non domestic violence	2.4	2.9	2.9	3.8	3.5
Domestic violence related	3.7	3.2	3.1	5.3	6.5
total	**6.1**	**6.1**	**6.0**	**9.1**	**10.0**

Source: NSW Bureau of Crime Statistics (2020)

5.2.11 Potentially vulnerable population groups

Those needing assistance for core activities

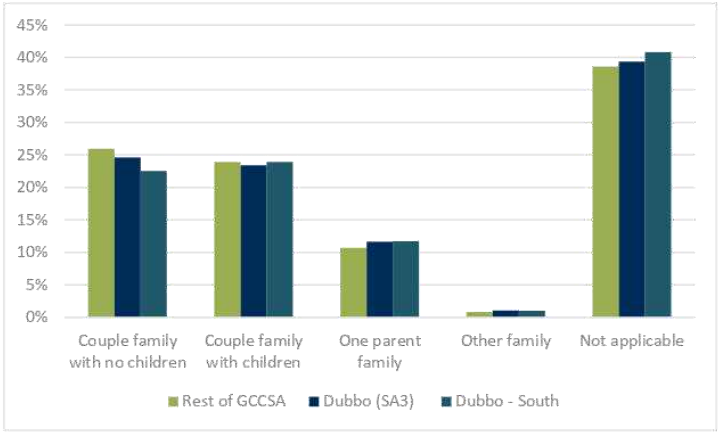
The study area, Dubbo Region and Rest of NSW (GCSSA) present similar proportions of the community requiring assistance with core activities. Approximately six per cent of the community require assistance with core activities in the study area, Dubbo and the Rest of NSW.

Lone parent households

As shown in Figure 24 one parent families similar across the board and are slightly more common in the study area and greater Dubbo region (12 percent) compared to that of rest of NSW (11 per cent).

Similarly to NSW both Dubbo and the study area, lone parents are most common with females representing approximately 82 to 84 percent of lone parent households.

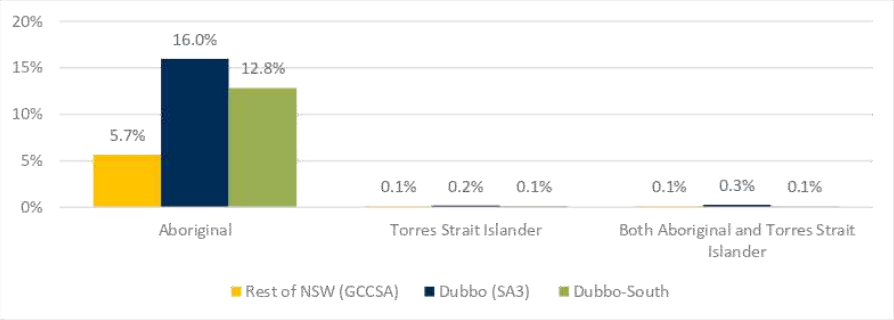
Figure 24: Family structure (2016)



Aboriginal and Torres Strait Islanders

The study area and greater Dubbo area have approximately 13% and 16% people who identify as Aboriginal and less than 1 per cent identification of Torres Strait Islander. In comparison to the rest of NSW (GCCSA) which shows a representation of 6% of people of Aboriginal heritage.

Figure 25: Aboriginal and Torres Strait Islander Status (2016)



Source: ABS 2016

5.2.12 Local history and community values

The Tubbagah People of the Wiradjuri Nation are Dubbo's traditional owners of the land on which the Dubbo RSL. The Wiradjuri Nation is geographically the largest Indigenous Nation within NSW which extends from Coonabarabran in the north, straddling the Great Dividing Range down to the Murray River and out to western NSW. Wiradjuri traditional country includes the townships of Dubbo, Condobolin, Orange, Bathurst, Wagga Wagga, Albury, Narrandera, and Griffith.

There are a number of iconic events, sites and landmarks across the Dubbo City that promotes and represent Aboriginal tradition and heritage. This includes the Red Ochre Festival, museum and galleries of the Western Plains Cultural Centre and Terramungamine Reserve.

5.2.13 Key findings

- The community in the Dubbo Region is expected to grow significant by 11.3 per cent by 2036 with a shift towards middle age and older age groups
- The study area has a younger population than that of the wider Dubbo Region and Rest of NSW GCCSA
- Households with one parent are somewhat more common in the Dubbo Region compared to NSW
- A greater portion of residents are homeowners with a mortgage in the greater Dubbo region compared to the rest of NSW
- The study area has a higher proportion of bachelor attainment compared to both the Dubbo region and rest of NSW (GCCSA), with a higher level of workforce participation and strong representation of professional employment
- Personal income in the study area is marginally higher than the average income compared to the wider Dubbo area and Rest of NSW (GCCSA)
- The study area overall has an average level of socioeconomic disadvantage when compared to other areas in NSW and Australia
- There are concentrations of socioeconomically disadvantaged people in the south and east of the site
- Crime records show on average 180 alcohol related assaults per year and about 520 non-alcohol related assaults per year.

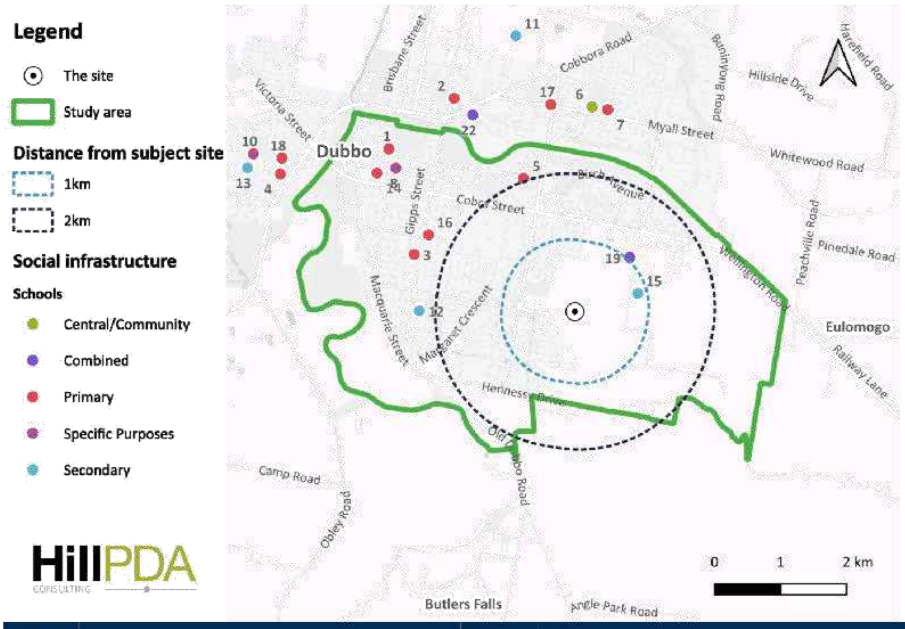
5.3 Existing social infrastructure in the locality

This section details the surrounding social infrastructure with particular note of those items within 1 km of the site. The hours of operation of these items are of primary concern for the assessment of social impact.

5.3.1 Education

There are several educational institutions within the study area, with the Dubbo Christian School and St Johns Primary and College schools located approximately 1 km from the site in the general north-easterly direction. Neither school appears to provide Out of School Hours care.

Figure 26: Schools

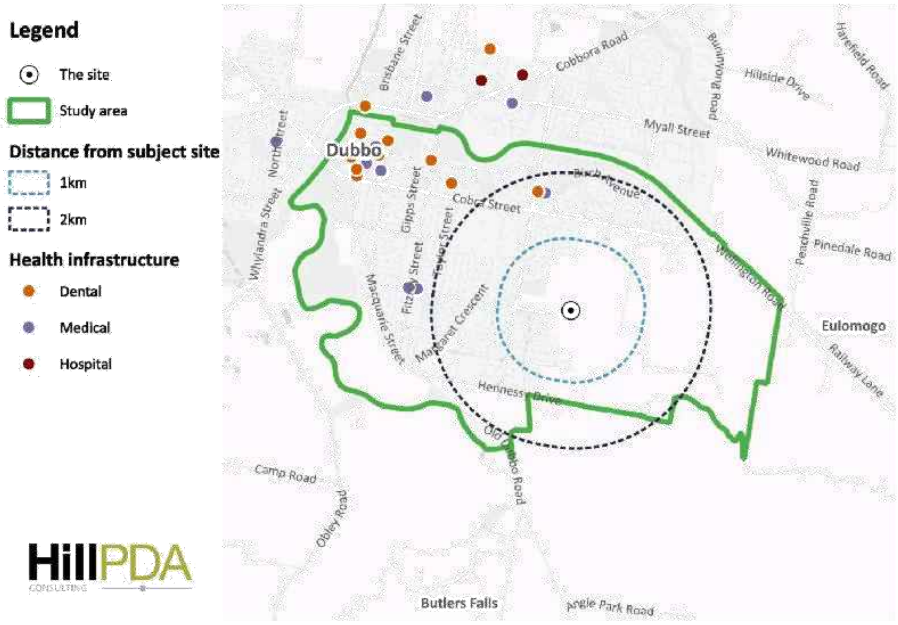


ID	School name	ID	School name
1	Dubbo Public School	12	Dubbo College South Campus
2	Dubbo North Public School	13	Dubbo College Delroy Campus
3	Dubbo South Public School	14	St John's Primary School
4	Dubbo West Public School	15	St John's College
5	Orana Heights Public School	16	St Laurence's Primary School
6	Dubbo School of Distance Education	17	St Mary's Primary School
7	Buninyong Public School	18	St Pius X Primary School
8	Mian School	19	Dubbo Christian School
9	Lincoln School	20	Burrabadine Cornerstone Christian School
10	Yawarra Community School	21	Macquarie Anglican Grammar School
11	Dubbo College Senior Campus	22	Western College Alesco Learning Centre

5.3.2 Health

There are several health hubs in the area particularly at within the city centre, Dubbo has Dubbo Base Hospital and Dubbo Private Hospital. Dubbo Hospital is under development to provide expanded and upgraded clinical services to the people of Western NSW. In 2015, a new clinical services building that features maternity, operating theatres and day surgery services was completed. The following stages includes new 34-bed surgical unit, new clinical building which will include an emergency department, medical imaging, ambulatory care services and critical care floor and the Western Cancer Centre Dubbo.

Figure 27: Health service providers

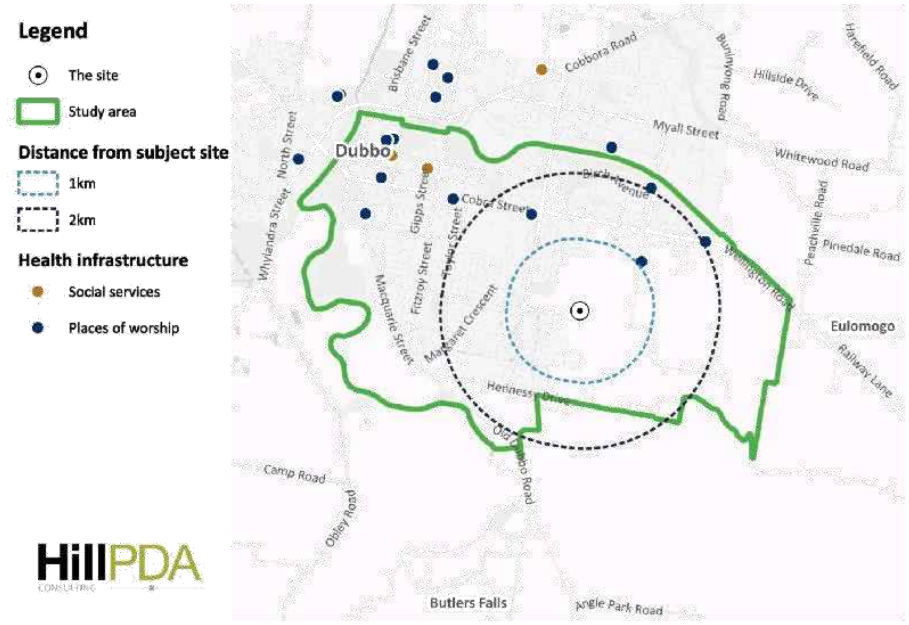


5.3.3 Social services

Social services and places of worship are located throughout the study area as illustrated below in Figure 28 but clusters within the city centre.

Within 2 km of the site are four places of worship, the closest places of worship are Generocity Church (2 premises), Dubbo Presbyterian Church and Dubbo Baptist Church. These would operate primarily on weekends during the day and some evenings during the week. It is unlikely to be a conflicting use during the proposed additional morning hour and will be closed during the early hours of the morning when the remaining extension is proposed.

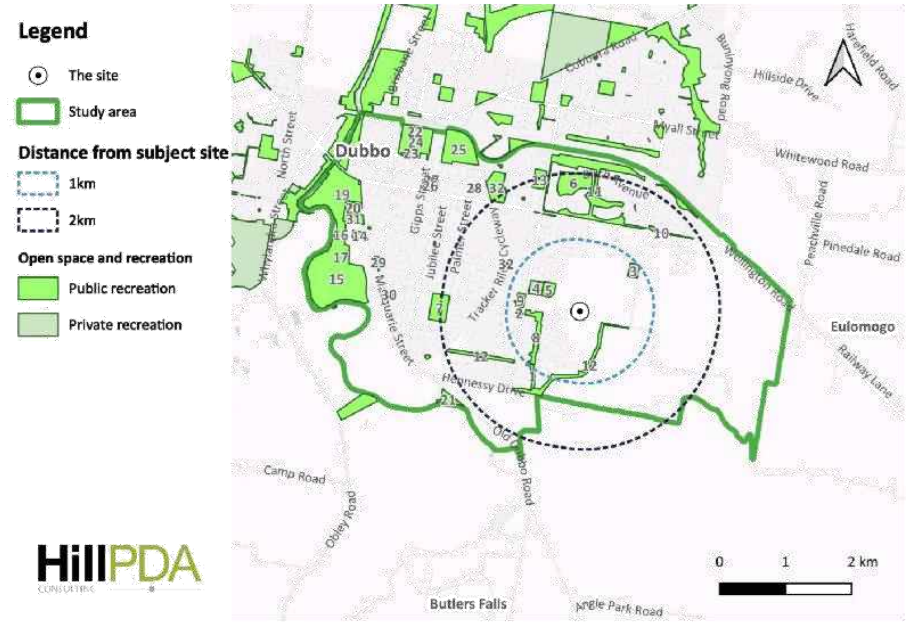
Figure 28: Social Services and Places of Worship



5.3.4 Open space and recreation

The existing open space and recreation facilities in the study area (Figure 29) include several linear parks to the north and south, a greyhound track to the west and three general recreation parks. The schools to the north east have several sports fields and Dubbo Sports field provides indoor sports facilities for the community.

Figure 29: Open Space and Recreation



ID		ID	
1	Southlakes Park	17	Sunderlands Park
2	Dietes Park	18	Sandy Beach Park
3	Dubbo Sportsworld	19	Lady Cutler Ovals
4	Dawson Park (greyhound track))	20	Bastielle Land
5	Egret Park	21	Caroline Reserve
6	Elizabeth Park	22	Dubbo Aquatic Centre
7	Mona Alice Berruex Park	23	Dubbo City Bowling Club
8	Southlakes Park	24	Victoria Park
9	Brian Dickens Park	25	Dubbo Showground
10	Corner park	26	Elston Park
11	Buckingham Drive Park	27	Paramount Tennis Club
12	Future linear park	28	Daphne Park
13	Jubilee Oval	29	Wahroonga Park
14	The Macquarie Club	30	Bennets Park
15	Regland Park	31	Pavans Park
16	Lady Cutler Park	32	Cormorant Crescent Park

Source: Openstreetmap, 2020 and DPIE, 2020

POTENTIAL SOCIAL IMPACTS

6.0 POTENTIAL SOCIAL IMPACTS

The potential social impacts of this project are summarised in this section with potential mitigation measures suggested.

6.1 Access and connectivity

How patrons arrive to and from a licensed premise can have a significant impact on the amenity and safety of an area. The longer a patron must wait for transport generally increases the opportunity for antisocial behaviour and risk to themselves and the community.

The proposal would result in people arriving and departing from the venue throughout the day and evening, including patrons and staff as well as users of the recreational facilities. This will create demand for private vehicle parking, public transport, taxis or rideshare services. Vehicular parking could be accommodated on site.

Bus services are currently available along Wheelers Lane to the west of the site from early morning until early evening, however it is expected additional services will be added following the development of the residential areas to the north and south of the site. Public transport is not a viable option for patrons to travel home during the late night-time, however it is expected that the majority of patrons would depart the venue prior to approximately 9pm. Dubbo has several taxi services and was expected to launch rideshare services in May 2020 (the 2020 global health crisis may impact the timing of this launch) that would provide services outside of public transport operational hours.

Ensuring that the proposed development has adequate public transport and a high quality and frequent taxi service would improve safety and amenity of the area. Patrons should be encouraged to use an alternative transport from their private vehicles to reduce drink driving, this should be supported by a dedicated pick up/drop off area.

The existing Dubbo RSL runs a free courtesy bus on Thursday, Friday and Saturday evenings from 6.00pm for pick-ups with regular departures from 9:30 until 11:30. There is the potential for this service to be extended.

It is noted that the technical traffic and transport assessment prepared by ttm consulting concludes the proposed development includes appropriate servicing arrangements and traffic engineering.

Mitigation measures:

Mitigation measures can be considered at the Development application stage to ensure potentially including:

- A courtesy bus could operate throughout the evening, similar to the service for the existing Dubbo RSL
- Liaise with taxi and rideshare operators to manage pick up-drop off areas
- Work with Council and bus service providers to ensure the proposed club is serviced y an extended bus route in the area.
- Security until closing to encourage safe passage of patrons from the premises.

6.2 Amenity

Licensed premises and commercial operations have the potential to result in additional environmental noise. Unwanted noise may result in reduced residential amenity for neighbouring residents.

Noise at late hours could emanate from activity on the club and sporting amenities deck area, or from patrons arriving/leaving the venue. The sports facilities have potential to create some negative noise impacts from large crowd gathering and amplified horns and music during games.

Adopting the recommendations of the acoustic report would manage the potential noise impacts generated from the proposal. Doing so would ensure compliance with the NSW Government's Office of Liquor, Gaming and Racing (OLGR) noise limits and help mitigate potential social impacts resulting from increased noise.

The Muller Acoustic Consulting acoustic assessment notes the following regarding operational noise:

> *"During operation of a potential registered club, there is a moderate to high risk of noise impacts within the community. The risk of potential impacts would be greater during the evening and night period as a result of the more stringent period criteria. It is therefore considered that management and mitigation measures may be required to reduce the potential impacts on the community."*

The acoustic assessment concludes the proposal site is considered suitable for rezoning to allow for the development of a registered club.

The proposal could result in positive amenity benefits for the future community of Keswick with the addition of the football field, bowling greens and supporting amenities as private recreation facilities and the club building services providing entertainment for the community.

Benefit enhancements

- Potential for visual amenity improvements with the recreational facilities providing diversity in the streetscape of the residential area
- General amenity improvements for the community with greater access to recreation facilities and entertainment options.

Mitigation measures:

At the development application stage, mitigation measure can be established to minimise the potential for amenity impacts such as:

- A notice should be clearly displayed to remind patrons to arrive and leave in a quiet manner to avoid disturbing the neighbours
- Minimise noise at the outdoor and deck areas during night time hours (10pm – 2am)
- A contact phone number for the hotel manager should be made available to neighbours to facilitate communication and issues
- Complaints from the community should be noted in an incident diary with details of the complaint and the action taken to address the complaint
- Management should monitor incidents and review management practices if needed.

6.3 Community cohesion

The review of the surrounds (section 5.1.1) indicates that the proposed venue is isolated from other licenced venues and late-night venues. The proposal is likely to benefit the community both, adults and children, in the eastern Dubbo area who may use the new Dubbo RSL as an option for entertainment and recreation.

There is notable research that indicates that better social outcomes are achieved within socially connected and cohesive communities. As identified in section 5.0, the site is not currently within walking distance to any community facilities. Limited access to community facilities and high car dependency can result in inadequate opportunities for residents to 'cross paths' and interact and engage. It is likely that some other facilities will be provided in the existing residential zone, however, there is unlikely to be a cluster of licenced venues.

The proposed development is expected to be generally publicly accessible and would act as a place for social interaction. As such, it could increase the opportunities for residents of the surrounding residential community

and surrounds to interact, subsequently would be beneficial to community cohesion within the study area and provide social benefits.

At the DA stage it will be important for operational procedures to be detailed in a Plan of Management prepared by Club management. This should include procedures for emergency management, incident reporting and liaison with future neighbouring landowners. These procedures have been established to enable a line of communication with relevant stakeholders. This could positively affect the community by providing a voice for local area management.

Benefit enhancements

- Raise awareness of the proposed recreation facilities and services available
- Increase the range of sporting facilities available to the population in Dubbo
- Provision of an additional high quality cricket and rugby field, tennis courts and cricket nets
- Encourage future surrounding residents to walk to the proposed facilities on site, reducing private vehicle use and increasing opportunities for social interaction.

Mitigation measures

Mitigation measure can be put in place at the development application stage such as:

- A description of the behaviour, complaints and conflicts procedure should be detailed in a Plan of Management prepared by Club management
- A commitment by management to participate in the Dubbo Local Liquor Accord, as per the existing club, to be aware of local issues relating to licensed premises and to maintain arrangements with local police in monitoring patron behaviour.
- Encouragement of management establishing a good working relationship with the local Police so that any issues, should they arise, may be discussed and interventions implemented.

6.4 Community health and safety

Public safety

Crime associated with alcohol consumption could be perceived as a risk to public safety in the local area. Alcohol related antisocial behaviour can negatively impact patrons, employees, property, neighbouring residents, police and emergency service workers, and hospitality workers in general.

As identified in the joint select committee report on Sydney's night-time economy, venues with later trading hours are associated with alcohol-related violence.[2] The clustering of venues together is another factor that can increase the risk of alcohol-related violence. Alcohol related violence can cause severe impacts to patrons and employees. The concept proposal would not result in a clustering of licensed premises.

Section5.2.10 of this report indicates that the area surrounding the site does not have a high incidence of alcohol-related assault or non-domestic assault crimes. The proposed venue is not located near other licenced venues which indicates that a clustering effect of alcohol-related antisocial behaviour is less of a risk.

Vulnerability to alcohol and gambling

Health surveys and clinical studies have demonstrated that some groups are more at risk of alcohol and gambling related harm than others. In order to reduce alcohol related health issues in disadvantaged and vulnerable communities, local Councils may consider:

- Limiting the accessibility of alcohol and gambling

[2] Parliament of New South Wales, Report on the Joint Select Committee on Sydney's Night Time Economy, 1/57 – September 2019

- Improving access to non-alcohol or gambling related services and facilities
- Provide support services targeted to specific at-risk groups

Social capital and community connectedness in an area can also reduce alcohol related harm.

Groups considered to be at risk of alcohol related harm are detailed in Table 8.

Table 8: Groups most at risk of alcohol related harm

Group	Considerations	Study area	NSW
Young people and young adults (15-24 years)	• There is an increased tendency to consume alcohol at levels of high-risk • Demonstrated issues include risk-taking, lower alcohol tolerance, increased risk of cognitive impairment and alcohol dependence in later life[3] • Increased hospitalisation and admission rates at emergency departments over the past decade[4] • Brain development is not complete until around 25 years of age, and excessive consumption before this point is a developmental risk [5]	12%	13%
Older adults (75+ years)	• Older adults are the most likely to drink daily, despite having a lower tolerance to alcohol consumption, and the presence of co-morbidity factors or risky interactions with medicines[6]	9%	7%
Aboriginal and Torres Strait Islanders	• Seventeen per cent of Aboriginal and Torres Strait Islanders were drinking at long term risk levels[7]	12%	3%
Gender	• Males are more likely to drink at long-term and short-term risky levels than women • Women are more likely to experience some negative health and wellbeing impacts associated with alcohol consumption – including road related trauma, sexual abuse, interpersonal issues and family violence[8]	Males 47% Females 53%	Males 49% Females 51%
Disadvantaged communities	• There is a complex evidence base in the relationship between socio-economic disadvantage and alcohol related harm. There is a correlation between the high levels of disadvantage and an increased likelihood of suffer from alcohol related health concerns.	Overall the study area is more disadvantaged than average, with similar levels of disadvantage in surrounding areas and more advantaged on the outer areas of town.	

The Aboriginal and Torres Strait Islander population presents as an at-risk group with an above average representation in the study area. It is noted that Drug and Alcohol Services are available in Dubbo centre and the

[3] Australian Government Preventative Health Taskforce (2009)
[4] Australian Government Preventative Health Taskforce (2009)
[5] Australian Government Preventative Health Taskforce (2009)
[6] Australian Institute of Health and Welfare (2011) 2010 National Drug Strategy Household Survey report
[7] Australian Bureau of Statistics (2010) The Health and Welfare of Australian's Aboriginal and Torres Strait Islander Peoples
[8] National Institute on Alcohol Abuse and Alcoholism (1999)

Bila Muuji Aboriginal Corporation Health Service provides targeted support to this community offering education and services to promote healthy behaviour. Regular contact with this and other drug and alcohol service organisations could assist in monitoring the impact of the proposal to this group.

Benefit enhancements

- Additional sports facilities for the community encouraging healthy active lifestyles
- Increase in passive surveillance in the future residential neighbourhood

Mitigation measures:

- Implementing CPTED Principles in the development of proposed scheme and DA drawings
- Ensuring commitments at the DA stage to:
  - Ensuring secure access and dispersal, adequate crowd control
  - Ongoing staff training in responsible service of alcohol (mandatory in NSW)
  - Signage, including directions to transport and requests that patrons respect the residential amenity of the area
  - Regular checking that CCTV are in working order.
- A commitment at the development application stage to ensuring access to sufficient taxis and courtesy bus services at the development application stage

6.5 Local economy and employment

Employment generated

It is expected that the site will generate significant employment for the community during construction, providing employment for workers and economic benefits from materials and transport of goods. During operation the proposed facility would provide employment for staff required to run and service the restaurants and bars as well as maintain and run the sports facilities. There will also be ancillary employment benefits from the food and entertainment provided at the venue for general operation and special events.

Employment generated by the proposal could positively affect the local economy by encouraging economic activity. Staff will have income to spend in the general area.

Benefit enhancements

Potential for additional local employment through construction and operation phases

Mitigation measures:

No mitigation required

6.6 Provision of social infrastructure and recreation facilities

The proposal includes the following recreation facilities:

- Kids play and family area
- Bowling greens
- Football field and supporting amenities, maintenance shed and seating gallery

At current the proposal includes unique facilities that are not currently available within 2km of the site. The Club would provide facilities for the new and existing community to enjoy sports, recreation and entertainment locally. The additional facilities would have a positive impact on the community.

Benefit enhancements

Potential access to additional facilities for the local community encouraging healthy active lifestyles

Mitigation measures:

No mitigation required

IMPACT ASSESSMENT FRAMEWORK

7.0 IMPACT ASSESSMENT FRAMEWORK

The impact assessment presented in this report identifies and evaluates changes to existing social conditions due to the project. This includes the assessment of direct and indirect benefits and effects/impacts, as well as consideration of any cumulative impacts.

The assessment process that was undertaken to determine the overall significance of impacts is described in section2. The following sections outline the criteria that underpin each of the assessment components that contribute to the assessment framework. Professional judgement and experience is applied on a case-by-case basis to identify the significance of impact on the social environment.

As noted in section 2.3.3 the social risk matrix is the primary tool for assessing the social impact of a development. Each impact has been analysed based on the nature of the impact and its predicted severity. A mitigation strategy is proposed if necessary and finally both impacts are assigned a Social Risk Rating (SRR).

7.1 Significance of impacts

Table 6 provides the assessment of the social risk of each impacts expected to result from the proposal. This section includes an assessment of the likelihood and consequences of each impact which are input into the social risk matrix (section 2.3.3) to provide a significance rating. Mitigation measures have been provided for negative impacts.

Table 6: Significance of social impacts

Impact theme	Impact detail	Stakeholders impacted	Suggested mitigation during DA phase	Post mitigation		
				Likelihood	Consequence	Level of significance
Access and connectivity	Higher demand for private vehicle parking, public transport, taxi or ride share services	• Other users of the car park • Public transport, Taxi and ride share operators	• It is suggested that a courtesy bus operate throughout the evening, similar to the service for the existing Dubbo RSL. • Promote public transport use to staff and customers. • Work with Council and bus service providers to ensure an extended bus route in the area	**Possible**	**Minor**	**Moderate**
	Increased traffic on surrounding streets caused by taxi and ride share services	• Neighbouring residents • Road users	• Liaise with taxi and rideshare operators to manage pick up-drop off areas • Security until closing to encourage safe passage of patrons from the premises.	**Possible**	**Insignificant**	**Low**
Amenity	Possible noise at late hours from egress of patrons	Neighbouring residents	• A notice should be clearly displayed to remind patrons to arrive and leave in a quiet manner to avoid disturbing the neighbours • Minimise noise at the outdoor restaurant dining area during night time hours (10pm – 2am) *[note: the outdoor dining will close a midnight Monday -Saturday and 10pm Sunday]* • A contact phone number for the hotel manager should be made available to neighbours to facilitate communication and issues • Complaints from the community should be noted in an incident diary with details of the complaint and the action taken to address the complaint. • Management should monitor incidents and review management practices if needed.	**Unlikely**	**Moderate**	**Moderate**

	Potential for visual amenity improvements with the recreational facilities providing diversity in the streetscape of the residential area	Local community	No mitigation required	**Possible**	**Moderate**	**Positive high**
	Additional local sports, recreation, and entertainment options	Local community	No mitigation required	**Possible**	**Moderate**	**Positive high**
Community cohesion	Additional sporting facilities available to the pop	Local community	No mitigation required	**Possible**	**Moderate**	**Positive high**
	Possible anti-social behaviour i.e. property damage, public intoxication	• Patrons • Neighbouring residents and businesses • Nearby public open spaces	• A description of the behaviour, complaints and conflicts procedure should be detailed in a Plan of Management prepared by Club management • A commitment by management to participate in the Dubbo Local Liquor Accord and be aware of local issues relating to licensed premises • Encouragement of management establishing a good working relationship with the local Police so that any issues, should they arise, may be discussed and interventions implemented.	**Unlikely**	**Moderate**	**Moderate**
Community health and safety	Possible alcohol related crime	• Patrons and employees • Neighbouring businesses • Neighbouring residents • Property • Emergency response workers	• Implementing CPTED Principles in the development of proposed scheme and DA drawings • Ensuring commitments at the DA stage to: – Ensuring secure access and dispersal, adequate crowd control – Ongoing staff training in responsible service of alcohol (mandatory in NSW) – Signage, including directions to transport and requests that patrons respect the residential amenity of the area – Regular checking that CCTV are in working order.	**Unlikely**	**Moderate**	**Moderate**

			• A commitment at the development application stage to ensuring access to sufficient taxis and courtesy bus services at the development application stage			
	Vulnerability to alcohol and gambling	• At risk groups (younger and older adults, Aboriginal and Torres Strait islanders, males, disadvantaged communities) • Patrons and employees • Neighbouring business patrons and employees • Neighbouring residents • General community	• Raise awareness of the health impacts associated with increased alcohol consumption • Raise awareness of alternative, non-alcohol or gambling related recreational facilities in close proximity • Management to participate the Dubbo Liquor Accord to ensure an awareness of local issues.	**Possible**	**Moderate**	**High**
Local economy and employment	Employment generation for the local community	Local community	No mitigation required	Likely	Moderate	**Positive high**
Provision of social infrastructure	Additional sports, recreation and entertainment facilities	Local community	No mitigation required			

MITIGATION MEASURES

8.0 MITIGATION MEASURES

The following list summarises the mitigation measures suggested as a result of the social impact assessment detailed throughout this report.

- It is suggested that a courtesy bus operate throughout the evening, similar to the service for the existing Dubbo RSL.
- Work with Council and bus service providers to ensure the proposed club is serviced by an extended bus route in the area.
- Promote public transport use to staff and customers.
- Liaise with taxi and rideshare operators to manage pick up-drop off areas
- Security until closing to encourage safe passage of patrons from the premises.
- Ensure Construction Management Plan includes sufficient construction impact mitigation measures including dust screening and reasonable construction hours to reduce impact to neighbouring residents and businesses.
- A notice should be clearly displayed to remind patrons to arrive and leave in a quiet manner to avoid disturbing the neighbours
- Minimise noise at the outdoor restaurant dining area during night time hours (10pm – 2am) [note: the outdoor dining will close a midnight Monday -Saturday and 10pm Sunday]
- A contact phone number for the hotel manager should be made available to neighbours to facilitate communication and issues
- Complaints from the community should be noted in an incident diary with details of the complaint and the action taken to address the complaint.
- Management should monitor incidents and review management practices if needed.
- Raise awareness of the proposed public facilities and services available
- Encourage future surrounding residents to walk to the proposed facilities on site, reducing private vehicle use and increasing opportunities for social interaction.
- A description of the behaviour, complaints and conflicts procedure should be detailed in a Plan of Management prepared by Club management
- A commitment by management to participate in the Dubbo Local Liquor Accord, as per the existing club, to be aware of local issues relating to licensed premises and to maintain arrangements with local police in monitoring patron behaviour.
-
- Management should establish a good working relationship with the local Police so that any issues, should they arise, may be discussed and interventions implemented.
- Implementing CPTED Principles
- Ensuring secure access and dispersal, adequate crowd control
- Ongoing staff training in responsible service of alcohol (mandatory in NSW)
- Access to sufficient public transport and taxis services would also mitigate any potential negative impacts associated with late night dispersal
- Signage, including directions to transport and requests that patrons respect the residential amenity of the area
- Regular checking that CCTV are in working order.
- Raise awareness of the health impacts associated with increased alcohol consumption
- Raise awareness of alternative, non-alcohol or gambling related recreational facilities in close proximity
- Management to participate the Dubbo Liquor Accord to ensure an awareness of local issues.

CONCLUSION

9.0 CONCLUSION

The site is currently zoned R2 Low Density Residential under the provisions of the Dubbo LEP. Registered clubs are prohibited in the R2 zone under the Dubbo LEP. As such it is proposed to rezone the site to include the additional permitted uses of a registered club and recreation facilities to facilitate the development of a secondary Dubbo RSL Club and associated recreation facilities at the Volta Avenue site in Dubbo (Lot 502, DP1255115). The proposal is intended to facilitate the construction and operation of a new Dubbo RSL Club including:

- Club building including food prep/bars, lounges, gaming, sports, terraces, function rooms, reception and back-of-house facilities
- Kids play and family area
- 2 x tennis courts
- On-grade parking for 197, under croft parking for 22
- Cricket and rugby league field
- 3 x Cricket nets
- supporting amenities and landscaping to support spectators.

The demographic characteristics of the study area show generally average levels of socioeconomic disadvantage and advantage with small pockets of disadvantage in nearby areas. The study area has generally average representation of most at risk groups, however there is a substantial over representation of Aboriginal and Torres Strait Islander people (13% per cent of the community compared to 5.7% per cent for the rest of NSW(GCCSA)). The immediate area has a low rate of alcohol related crime and there is only one other licensed premises within 1 km of the site. However, the area has a low density of licenses when compared to the LGA.

A tailored Plan of Management can be prepared at the DA stage to minimise the risk of antisocial behaviour at the site and ensure that ongoing operations at the site appropriately managed and monitored.

Overall, the negative impacts of the proposed development can be successfully managed with the implementation of the above mitigation measures. The community will benefit from the addition of local sports, recreation and entertainment facilities.