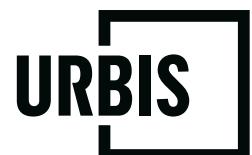




TRANSPORT IMPACT ASSESSMENT DENILQUIN BATTERY ENERGY STORAGE SYSTEM

Prepared for
**BESS ARCTIC PTY LTD C/- GRANSOLAR
DEVELOPMENT AUSTRALIA**
May 2025



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We acknowledge, in each of our offices, the Traditional Owners on whose land we stand.

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1. INTRODUCTION

1.1. OVERVIEW

Urbis has been engaged by BESS Arctic Pty Ltd C/- Gransolar Development Australia to prepare a Transport Impact Assessment (TIA) for the Battery Energy Storage System (BESS) development located at 21356 Riverina Highway in Deniliquin, New South Wales (NSW). This TIA has been prepared to support the Development Application (DA) for the development of the BESS.

Urbis has assessed the proposed development, provided input to the design, and confirmed that the proposal will achieve satisfactory traffic and transport outcomes and is designed in accordance with the relevant Australian Standards and Edward River Council (Council) guidelines.

1.2. PURPOSE OF THIS REPORT

The report sets out a transport assessment aimed at addressing the transport implications associated with the proposed BESS. It includes an assessment of:

- The suitability of the proposed transport network.
- The suitability of proposed access arrangements.
- The requirements for the construction of the development.
- The transport impacts of the proposed BESS on the surrounding transport network.

1.3. REPORT STRUCTURE

This report outlines an assessment of the potential transport impacts of the proposed development, including:

- Existing transport and traffic networks serving the site.
- Outline of the proposed development.
- Construction Traffic Management Plan and construction impacts.
- The transport and traffic implications of the proposed development during operation.
- Conclusion.

1.4. RESPONSE TO AGENCY COMMENTS

Table 1 provides an indication of how the NSW Government Planning Secretary's Environmental Assessment Requirements (SEARs) have been addressed in this report (dated 29/09/2023).

Table 2 provides an indication of how Transport for NSW (TfNSW) requirements have been addressed in this report. While some of the details requested may not be available at this stage of the project, the intent of the requested item has been discussed to the extent possible.

Table 3 outlines comments provided by TfNSW during a pre-lodgement meeting on 24 July 2024 and how these comments have been addressed.

Table 1 Planning Secretary's Environmental Assessment requirements

Planning Secretary's Environmental Assessment Requirements	Reference
An assessment of the peak and average traffic generation, including over-dimensional vehicles and construction worker transportation;	Section 2, Section 4, Section 5

Planning Secretary's Environmental Assessment Requirements	Reference
An assessment of the likely transport impacts to the site access route(s), site access point(s), any Crown land, particularly in relation to the capacity and condition of the roads, road safety and intersection performance;	Section 2.4.6, Section 4, Section 5
A cumulative impact assessment of traffic from nearby developments; and	Section 4.7, Section 5.3
Provide details of measures to mitigate and / or manage potential impacts including a schedule of all required road upgrades (including resulting from heavy vehicle and over mass / over dimensional traffic haulage routes), road maintenance contributions, and any other traffic control measures, developed in consultation with the relevant road authority;	Section 4.1, Section 4.3, Section 4.8 Appendix C, Appendix D

Source: Department of Planning, Housing and Infrastructure

Table 2 TfNSW requirements

TfNSW Requirements	Reference
Identify the timeframe for the schedule of works (commencement year and completion year) overlapping timeframe of components during construction (to capture worst case scenario) and identify the construction hours for the project.	Section 4.1, Section 4.7.2.1
Detailed plans identifying the proposed location of any: Project-related infrastructure within and outside of the project boundary. Transmission line infrastructure, or any other project-related structures, within a road reserve. Include demarcation of local and classified road reserves. Identify the key access roads with the classified road network required for the project (including any access required from classified road network for components being constructed outside of the project area) and justification of additional access required to a classified road in accordance with section 2.119 of State Environmental Planning Policy (Transport and Infrastructure) 2021 The Scoping Report identifies that ancillary infrastructure and temporary facilities are to be provided on site including (but not limited to) laydown areas. The TIA should identify the source for input materials and quantify the traffic generation associated with the haulage of the source materials.	Section 2.4, Section 3.1, Section 3.2 Section 3.6, Section 4.3, Section 4.6, Appendix C, Appendix D
Cumulative impacts: An assessment should be undertaken as a part of the EIS and TIA to identify the projects that will have overlapping construction periods and assess the cumulative traffic impacts with emphasis on the following: The cumulative impacts from traffic generated from the construction workforces in terms of the origin-destination routes, access, AM/PM peaks where there is overlap with other projects.	Section 4.8 , Section 5.4

TfNSW Requirements	Reference
▪ The cumulative impacts of heavy vehicle movements in terms of AM/PM peaks and routes where there is an overlap with other projects. ▪ Cumulative impacts and consideration in relation to the timing of movements of Oversized Over mass vehicles (OSOM) where other projects will be utilising the same routes as proposed for this development.	
Heavy vehicle and OSOM routes: Identify the return routes for OSOMs. National Heavy Vehicle Regulator (NHVR) approved routes identified on the Restricted Access Maps (RAV MAP) are to be utilised for the heavy vehicle routes for the proposed development. Roads that are approved for OSOM routes can be identified in the NSW Oversize Overmass Load Carrying Vehicles Network Map. Further include details on the number of OSOM movements, the intended time for OSOM movements to occur, and GPS coordinates along the proposed routes for pinch points, traffic management measures and pull-over bays / rest areas along the OSOM routes. Identifying road and rail projects occurring along the OSOM route within the anticipated schedule for the movement of the OSOM components. Inclusive of any impacts (e.g civil works or obstructions) that could impede the movement of the OSOM components due to the concurrent road and rail projects occurring along the nominated OSOM route(s).	Section 4.1, Section 4.3, Section 4.7, Appendix D
Project schedule: Hours and days of work, number of shifts and start and end times, Phases and stages of the project, including construction, operation and decommissioning.	Section 4, Section 5.5
Traffic volumes including: ▪ Existing background traffic (prepared based on traffic count surveys and inclusive of growth for the year of peak of construction), ▪ Project-related traffic for each phase or stage of the project, ▪ Projected cumulative traffic at commencement of operation, and a 10-year horizon post-commencement.	Section 2.4.4, Section 4.7, Section 5.2, Section 5.3
Traffic characteristics including: ▪ Number and ratio of heavy vehicles to light vehicles, ▪ Peak times for existing traffic, ▪ Peak times for project-related traffic including commuter periods, Note: If there is a reliance on shuttle buses/carpooling proposed to mitigate peak traffic volumes for the AM/PM peak of construction then the TIA is required to detail how the shuttle busing/carpooling commitment will be achieved through strategies, protocols, and the like. If carpooling and shuttle bus strategies cannot be supported by detailed methods/procedures that are achievable, enforceable,	Section 2.4.4, Section 4.1, Section 4.3, Section 4.7, Section 4.8.3, Appendix D

TfNSW Requirements	Reference
and practicable, then the shuttle bus/carpooling methods would not be viable and would require the TIA to be amended to assess the worst-case scenario during peak of construction. Proposed hours for transportation and haulage, Specify the design vehicles for the project (identifying the relevant types of heavy / OSOM / specialist vehicles and shuttle buses).	
Provide a breakdown of the calculations and assumptions for light vehicles, heavy vehicles requiring escort, heavy vehicles and heavy vehicles requiring NHVR permit and that are exempt from the escort requirements. All of these vehicle types should be factored into the traffic generation during AM/PM peaks for the project. Interactions between existing, project-related traffic, cumulative background traffic inclusive of other major projects that have coinciding timeframes and inclusion of the growth rate for background traffic for the peak construction period.	Section 4.7.2.3, Section 4.7.2.4, Appendix D
Traffic count surveys should be undertaken for a minimum of one day (preference seven days for improved accuracy of data). The traffic count survey is required to be collected outside of public holidays, events and school holidays. The traffic counts should be undertaken at the key intersections with the state classified road network in accordance with Part 3 of Austroads Guide to Road Design. The data obtained from the traffic count survey should be provided as an appendix to the TIA for the project and used to inform the background traffic counts within the base case (existing background) scenario. The AM/PM peaks are required to be measured based on a single trip from origin to destination as a one way vehicular movement from one point to another excluding the return journey.	Section 2.4.4, Section 4.7.2.2, Appendix A
Capacity analysis using SIDRA or other relevant application, to identify an acceptable Level of Service (LOS) at intersections with the classified (State) road, and where relevant, analysis of any other intersections along the proposed transport route/s.	Section 2.4.6, Section 4.7
The origins, destinations and routes for: ▪ Commuter (employee and contractor) light vehicles, pool vehicles and shuttle buses, ▪ Heavy (haulage) vehicles, heavy vehicles requiring NHVR permit and exempt from escort vehicle requirements and heavy vehicles requiring escort (OSOM).	Section 4.3, Section 4.5, Section 4.7, Appendix D
Road safety assessment of key haulage route/s. Where road safety concerns are identified at a specific location along the proposed haulage routes, TfNSW suggests that the TIA be supported by a targeted Road Safety Audit undertaken by suitably qualified persons in accordance with the Austroads Guidelines.	Appendix D

TfNSW Requirements	Reference
Identify the necessary road network infrastructure upgrades that are required to cater for and mitigate the impact of project related traffic on both the local and classified road network for the development (for instance, road widening and/or intersection treatments). In this regard, preliminary concept drawings should be submitted with the SSD application for any identified road infrastructure upgrades. It should be noted that any identified road infrastructure upgrades will need to be to the satisfaction of TfNSW and Council.	Section 3.2, Section 4.7.3
Proposed road facilities, access and intersection treatments are to be identified and be in accordance with Austroads Guide to Road Design including provision of Safe Intersection Sight Distance (SISD).	Section 4.7.3
Consideration of the local climate conditions that may affect road safety during the life of the project (e.g. fog, wet and dry weather, icy road conditions).	Section 4.8.4
The layout of the internal road network, parking facilities and infrastructure.	Section 3.1
Impact on rail corridors and level crossings detailing any proposed interface treatments. TfNSW notes that if transport of plant and equipment will originate from Victoria, the likely route would be utilising level crossings over the railway that is operated by V-Line. In this instance, V-line would need to review the route and provide its concurrence.	Appendix D
Impact on public transport (public and school bus routes) and consideration for alternative transport modes such as carpooling and shuttle buses during construction.	Section 4.8.3, Section 4.8.7
Consideration of any travelling stock routes.	Section 4.8.9
Consideration of any local events.	Section 4.8.8
Identification and assessment of potential environmental impacts of the project, such as blasting, lighting, visual, noise, dust and drainage on the function and integrity of all affected public roads.	Section 4.8.10
Controls for transport and use of any dangerous goods in accordance with State Environmental Planning Policy No. 33 – Hazardous and Offensive Development, the Australian Dangerous Goods Code and AS4452 Storage and Handling of Toxic Substances.	Section 4.8.12
A draft Traffic Management Plan (TMP) that could be implemented following approval of the EIS, in consultation with relevant Councils and TfNSW.	Section 4
Propose a Driver Code of Conduct for haulage operations which could include, but not be limited to: Safety initiatives for haulage through residential areas and/or school zones. An induction process for vehicle operators and regular toolbox meetings. A public complaint resolution and disciplinary procedure.	Appendix E

Table 3 TfNSW comments

TfNSW Comments	Reference
The route assessment is required for <u>high risk OSOM (as defined on TfNSW website)</u> required to deliver components to the project. The concept level route analysis must include: ▪ The port or point of origin and must be for the entire route to the site access or intersections required to facilitate the high risk OSOM movements required for the project. ▪ The TIA is required to include details of all high risk OSOM loads and vehicle configurations for the project. ▪ The location of pull-over bays / rest areas along the high risk OSOM routes (including GPS coordinates) and demonstrate through swept paths that the high risk OSOMs can be physically accommodate all high risk OSOMs for the project (in terms of size, width and accessibility).	Appendix D
Expanding on the points above, the concept route assessment is required to include: Details of the road geometry and alignment along the identified transport route/s, including existing formations, crossings, bridges, intersection treatments and any identified hazards, including: ▪ Bridge Assessments for any at risk bridges on the classified road network due to dimensions and weight of OSOM vehicles. ▪ Swept path analysis demonstrating the largest design vehicle can enter and leave the development, and simultaneously pass through intersections along the proposed transport route/s. ▪ The design vehicle templates used in the swept path analysis software are also requested in order for TfNSW to review the performance within the software (e.g. Autodesk Vehicle Tracking or Transoft AutoTURN). ▪ Highlighting each at-risk road structures that the haulage route crosses including bridges, traffic signals, signage, major culverts, and minor culverts that may not meet the desirable cover to cater for proposed axle loads.	Appendix D
Identify and provide the following measurements parameters of OSOM components / materials to be moved: Identify types and numbers of high risk OSOM vehicles proposed to be used for the project. ▪ Overall combination type, configuration, load and vehicle configuration: ▪ Wheelbase dimensions. ▪ length, width, height and mass gcm, tare, weight to axle and payload) for components and nominated vehicles. ▪ Maximum trailer articulation angle(s). ▪ Minimum overhang heights above the road surface. ▪ Vehicle configurations. ▪ Traffic mitigation measures or road works, modifications, or road upgrades to facilitate the movement of the high risk OSOM(s) associated with the project.	Appendix D

TfNSW Comments	Reference
Potential high level mitigation measures or commitments to mitigate known traffic, safety and impacts to road users along the high risk OSOM route (i.e school bus routes, mining shift changes, TSRs, harvest periods and events).	
Identify and assess implications of any road and rail projects that may be under construction during the indicative schedule for the OSOM movements. Note: NHVR permits do not cover road works or upgrades and environmental approvals required along any proposed OSOM route. Any road works or upgrades works required along the OSOM route must be included within the scope of works in the SSD to ensure the development is constructable. Note: Given the high number of renewable energy and other large-scale projects requiring haulage of OSOM components on the road network, restrictions and limitations on OSOM movements may be imposed. In this regard, it is recommended that you engage earlier with TfNSW's Development Services Renewables team to discuss the route assessment requirements. Identify the necessary road upgrades and scope to achieve compliance with Austroads and TfNSW requirements to mitigate the traffic, safety, efficiency and impacts to TfNSW assets on the state classified road network associated with the project. Any identified road infrastructure upgrades will need to be to the satisfaction of TfNSW and Council. Works must be appropriately designed in accordance with <i>Austroads Guide to Road Design</i>.	Section 4.7, Appendix D
Strategic concept designs will need to be accompanied by swept paths for the largest vehicle required to access the access point or intersection. The swept paths must demonstrate that the largest vehicle can turn concurrently in all turn directions without crossing into the incorrect lane, tracking off the proposed/existing pavement and within the existing intersection treatments (where applicable). Swept paths will be required for the high risk OSOM to demonstrate that the high risk OSOM can be delivered within the existing or proposed pavement and if further pavement widening is required to accommodate these movements.	Section 3.2, Section 4.7.3
The strategic concept designs must identify any acquisition required to facilitate the scope of the road upgrades and road works. The Developer will be responsible for the dedication and acquisition of land if required to accommodate the road infrastructure including, but not limited to, footways, structures, stormwater drainage, batters, maintenance access and utilities, to the satisfaction of TfNSW. <i>Note: The design needs to comply with TfNSW Strategic design requirements for DAs, TfNSW technical directions, supplements, corridor strategies and Austroads and any other applicable TfNSW policies/strategies.</i>	Section 4.7.3

2. EXISTING CONDITIONS

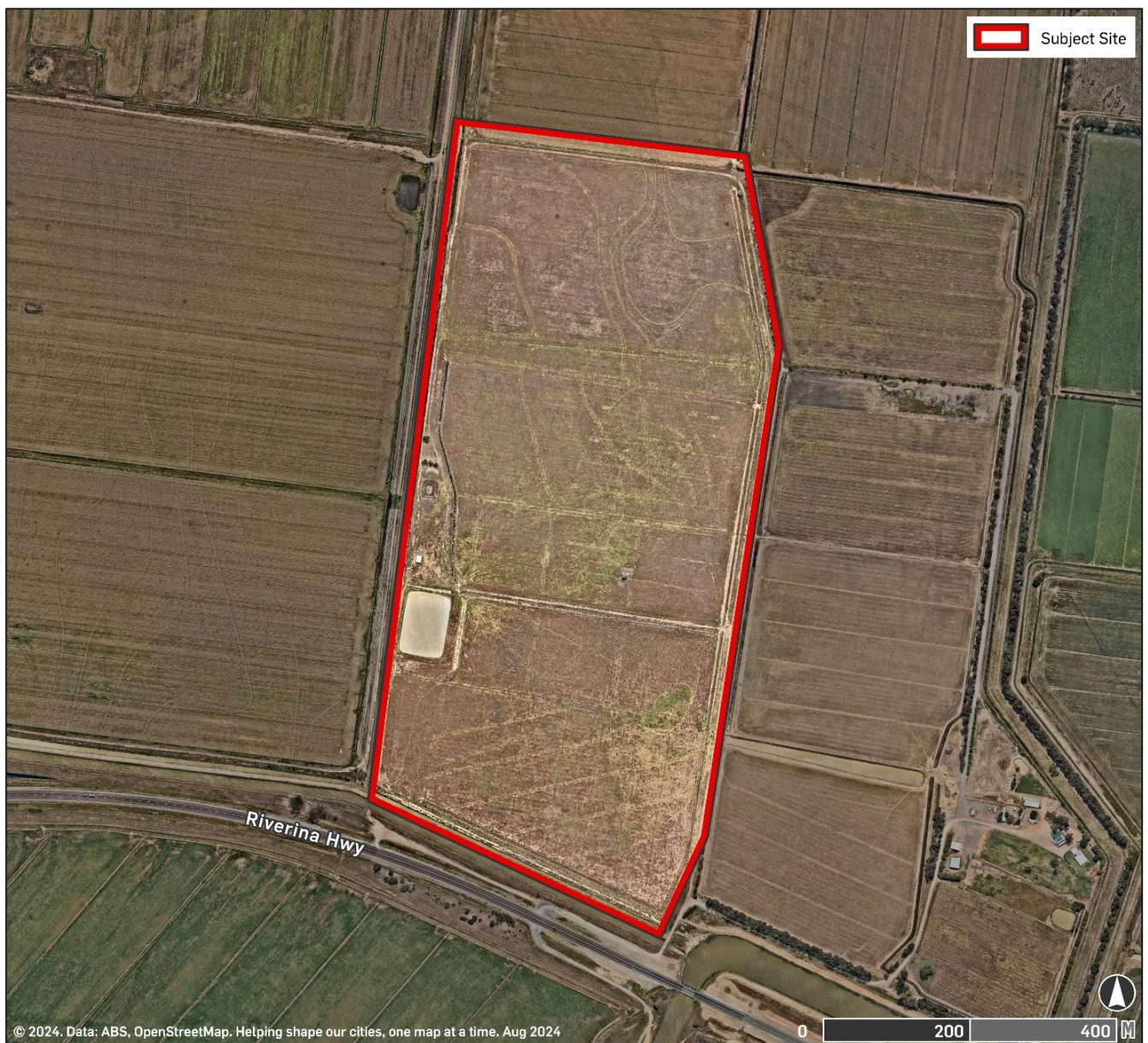
2.1. THE SITE

The Deniliquin BESS site ("the site") is located approximately 710 kilometres southwest of Sydney and is accessible via Riverina Highway in Deniliquin. The site is surrounded by other rural and agricultural land uses.

The site falls under the Edward River Council Local Government Area (LGA) and is subject to the Deniliquin Local Environmental Plan 2013. The site is bounded by Riverina Highway to the south and farmland in all other directions.

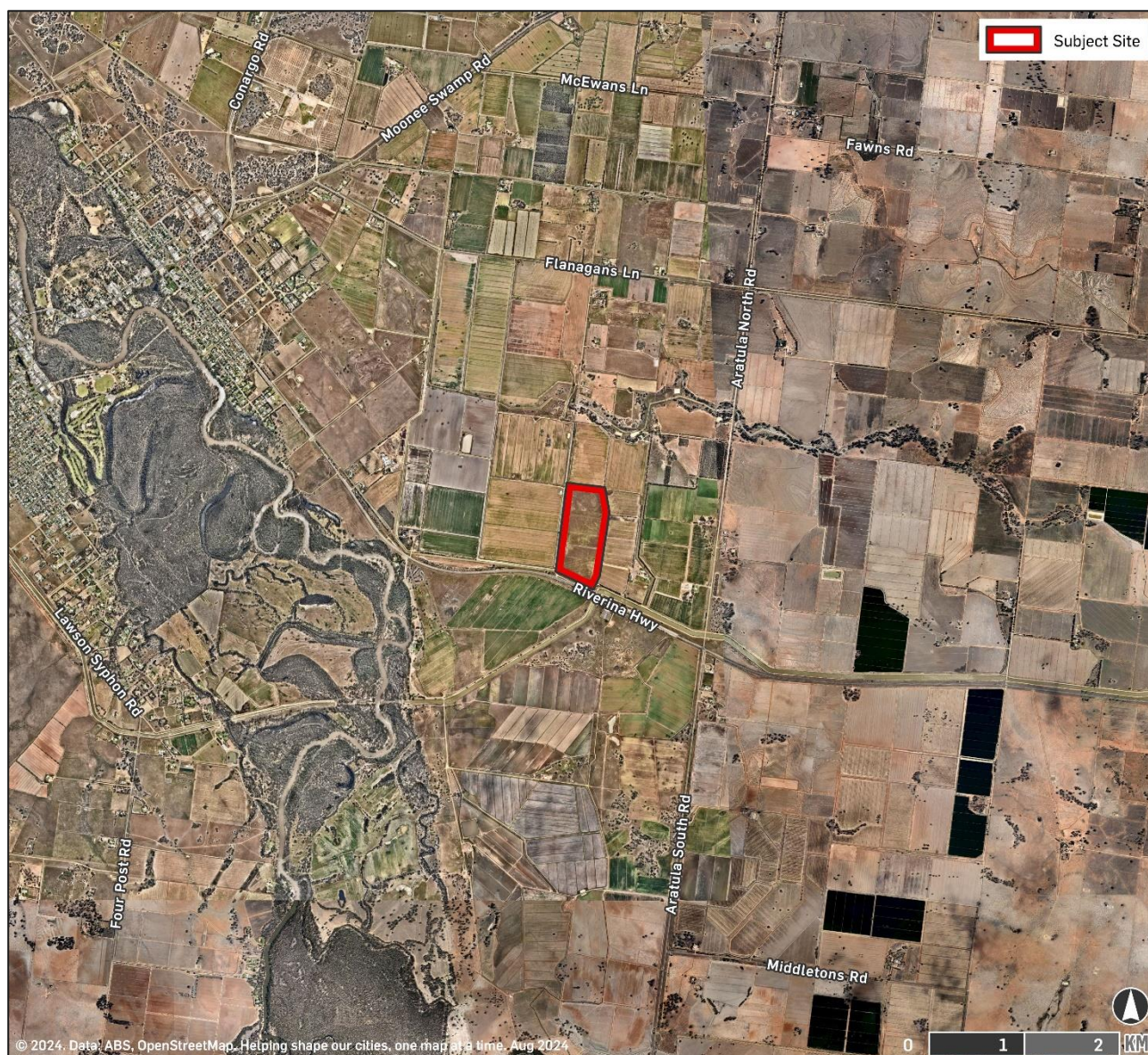
Figure 1 shows the local site context, and **Figure 2** shows the site context within the broader area.

Figure 1 Site map



Source – Nearmap modified by Urbis

Figure 2 Site context



Source - Nearmap modified by Urbis

2.2. PUBLIC TRANSPORT NETWORK

There is no public transport infrastructure or services that connect directly to the site. The closest public transport infrastructure is located in the town of Deniliquin and comprises of one local bus service (route DTS), none of which service the site.

2.3. WALKING AND CYCLING NETWORK

There is limited active transport infrastructure surrounding the site, with no footpaths on the roads immediately surrounding the site to enable walking. Cycling is permitted on the shoulder of roads; however, the nature of these roads (often being unsealed or having an unsealed shoulder) makes cycling on these roads challenging even for experienced riders. Cycling is not a significant form of transport in regional areas and is more likely used for recreational uses.

2.4. EXISTING TRANSPORT NETWORK

2.4.1. Road Hierarchy

Roads within NSW are categorised by classification (ownership) and function (use).

2.4.1.1. Road Classification

Roads are classified (as defined by the Roads Act 1993) based on their importance to the movement of people and goods within NSW (as a primary means of communication).

The classification of a road allows TfNSW to exercise authority on all or part of the road. Classified roads include Main Roads, State Highways, Tourist Roads, Secondary Roads, Tollways, Freeways and Transitways.

For management purposes, TfNSW has three administrative classes of roads. These are:

- **State Roads** – Major arterial links through NSW and within major urban areas. They are the principal traffic-carrying roads and fully controlled by TfNSW with maintenance fully funded by TfNSW. State Roads include all Tollways, Freeways and Transitways; and all or part of a Main Road, Tourist Road or State Highway.
- **Regional Roads** – Roads of secondary importance between State Roads and Local Roads which, with State Roads provide the main connections to and between smaller towns and perform a subarterial function in major urban areas. Regional roads are the responsibility of councils for maintenance funding, though TfNSW funds some maintenance based on traffic and infrastructure. Traffic management on Regional Roads is controlled under the delegations to local government from TfNSW. Regional Roads may form all or part of a Main Road, Secondary Road, Tourist Road or State Highway; or other roads as determined by TfNSW. The Regional Road category comprises two sub-categories: Regional Roads that have been classified under the Roads Act 1993, and those Regional Roads that are unclassified.
- **Local Roads** – The remainder of the council-controlled roads. Local Roads are the responsibility of councils for maintenance funding. TfNSW may fund some maintenance and improvements based on specific programs (e.g., urban bus routes, and road safety programs). Traffic management on Local Roads is controlled under the delegations to local government from TfNSW.

2.4.1.2. Functional Hierarchy

Functional road classification involves the relative balance of the mobility and access functions. TfNSW defines four levels in a typical functional road hierarchy, ranking from high mobility and low accessibility to high accessibility and low mobility. These road classes are:

- **Arterial Roads** – generally controlled by TfNSW, typically no limit inflow and designed to carry vehicles long distances between regional centres.
- **Sub-Arterial Roads** – can be managed by either TfNSW or the local council. Typically, their operating capacity ranges between 10,000 and 20,000 vehicles per day, and their aim is to carry through traffic between specific areas in a sub-region or provide connectivity from arterial road routes (regional links).
- **Collector Roads** – provide connectivity between local roads and the arterial road network and typically carry between 2,000 and 10,000 vehicles per day.
- **Local Roads** – provide direct access to properties and the collector road system and typically carry between 500 and 4,000 vehicles per day.

2.4.2. Surrounding Roads

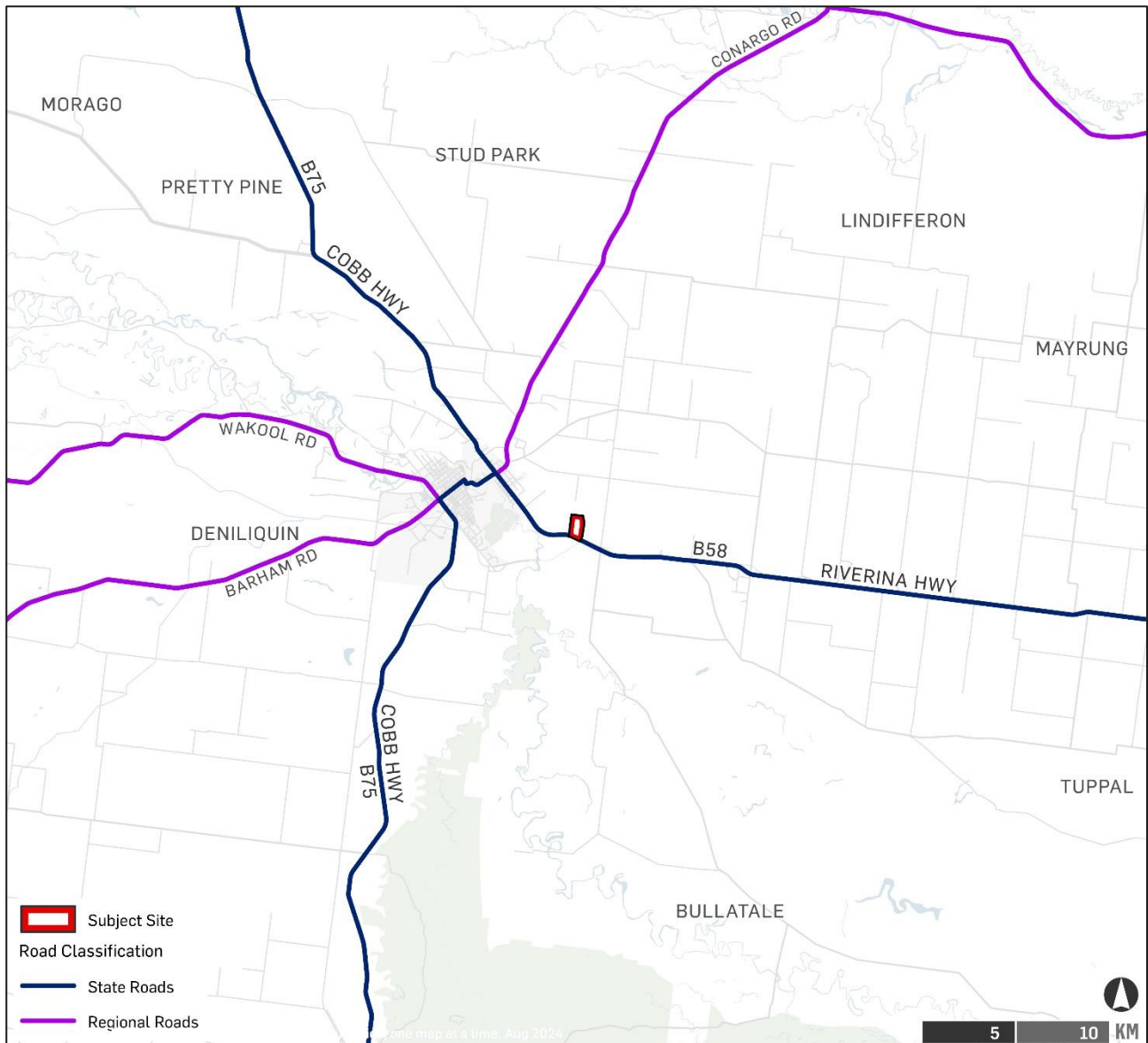
The characteristics of the surrounding road network are detailed in **Table 4**. The surrounding road network is shown in **Figure 3**.

Table 4 Characteristics of surrounding roads

Road Name	Aratula Rd	Riverina Hwy	Finley Road	Davidson Street
Classification / Function	Local	Arterial	Arterial	Arterial
Sealed (yes/no)	Yes	Yes	Yes	Yes
Movement lanes	One lane in each direction	One lane in each direction	One lane in each direction	One lane in each direction
Parking lanes	No	No	Yes	Yes
Approximate Carriageway width (m)	6	11	15	15
Signposted speed (km/h)	60	100	60	60
Line marking / divided lanes	No	Yes	Yes	Yes
Pedestrian pathways	No	No	Yes	Yes
Bus stops	No	No	Yes	Yes

Source: Nearmap, Google Street View

Figure 3 Surrounding road network



Source - Urbis

While the roads listed in **Table 4** are key roads near the site, **Figure 3** shows a wider context. Davidson Street and Finley Road form localised parts of the Cobb and Riverina Highway respectively within Deniliquin town centre.

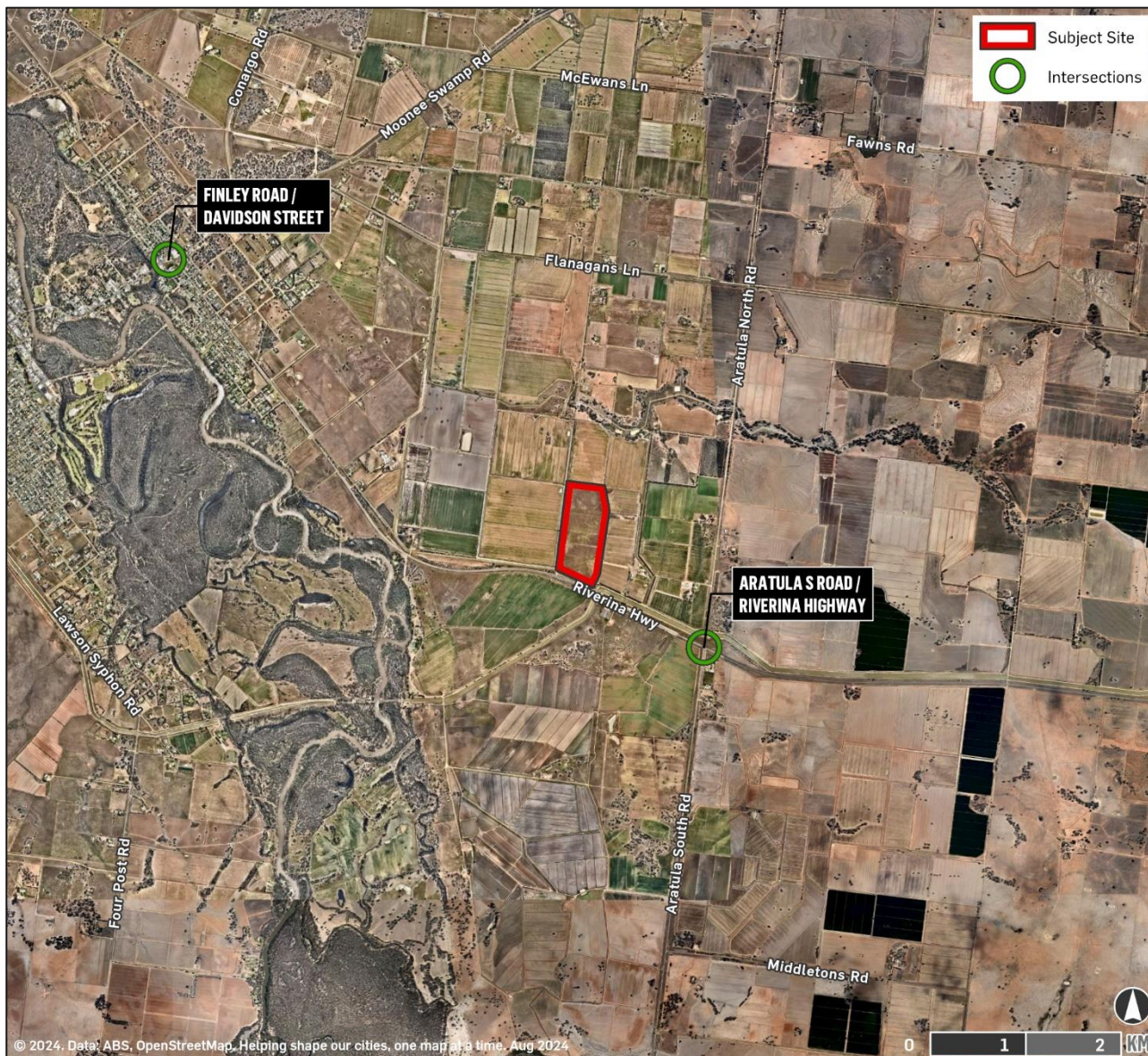
2.4.3. Nearby Intersections

The following intersections are situated within proximity to the site

- Aratula Road / Riverina Highway.
 - Priority controlled intersection.
- Finley Road / Davidson Road / Cobb Highway / Albert Street.
 - Roundabout intersection.
- Finley Road / Wanderer Street.
 - Priority controlled intersection.

Aratula Road is a minor rural road with limited traffic movements. No traffic volumes were collected from this intersection due to its minor nature and the assumed traffic generating locations associated with the site (discussed further in **Section 4**).

Figure 4 Surrounding intersections



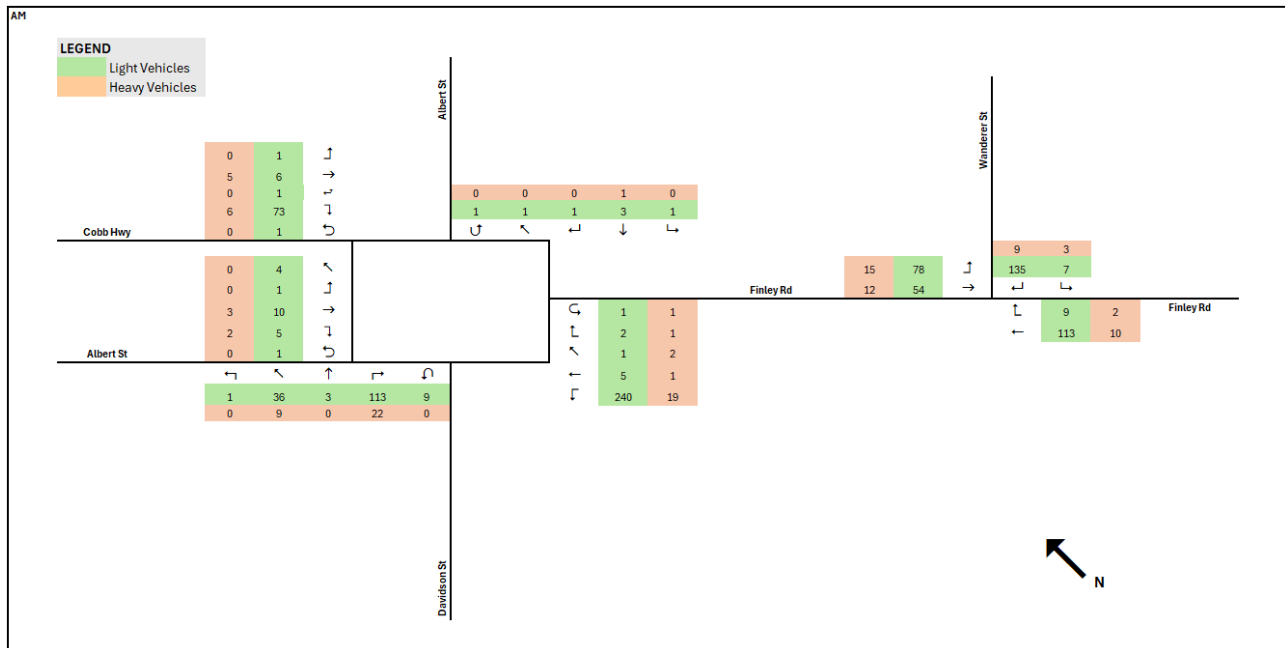
Source - Nearmap modified by Urbis

2.4.4. Existing Road Traffic Volumes

To gain an understanding of existing traffic volumes in the vicinity of the site, traffic movement surveys were commissioned on Tuesday, 27 August 2024 during the AM (6:00 AM – 10:00 AM) and PM (3:00 PM and 7:00 PM) peak periods at the Hay Road / Albert Street / Finley Road / Davidson Street roundabout intersection and Finley Street (Riverina Highway) / Wanderer Street T-intersection.

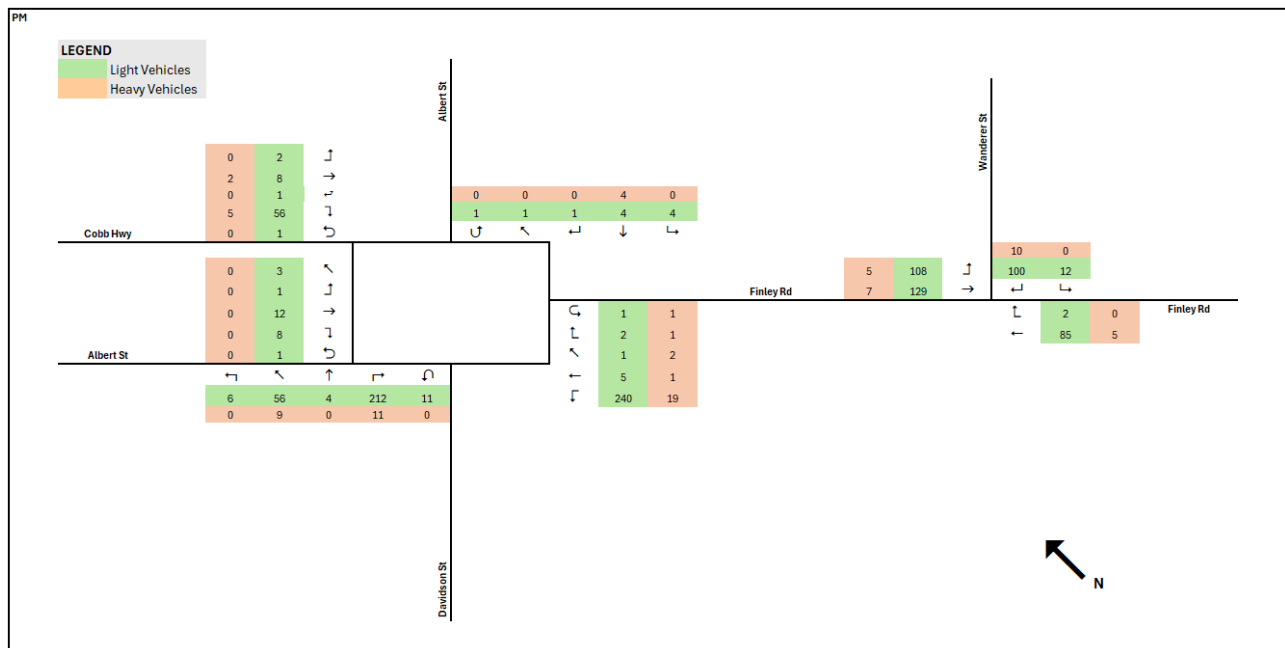
The survey data indicates that the AM peak hour is 8:00 AM – 9:00 AM and that the PM peak hour is 4:15 PM – 5:15 PM. The surveyed weekday AM and PM peak hour traffic volumes are shown in **Figure 5** and **Figure 6**. Detailed traffic survey data is found in **Appendix A**.

Figure 5 Existing AM peak hour (8:00 AM – 9:00 AM) traffic volumes



Source: Urbis, TIA

Figure 6 Existing PM peak hour (4:15 PM – 5:15 PM) traffic volumes



Source: Urbis, TIA

2.4.5. Midblock Traffic Volumes

Peak hour midblock volumes on Riverina Highway, along the site frontage, were derived from traffic survey data collected at the intersection of the Finley Road / Wanderer Street intersection given that:

- There are limited traffic generators between this intersection and the site.
- Most intersections between this intersection and the site are associated with farm access.

These derived midblock traffic volumes are shown below:

- AM Peak
 - Eastbound – 134 vph.
 - Westbound – 77 vph.
- PM Peak
 - Eastbound – 148 vph.
 - Westbound – 92 vph.

2.4.6. Existing Intersection Operation

The existing operation of the key intersections Cobb Highway / Albert Street / Finley Road / Davidson Street (roundabout intersection) and Finley Road / Wanderer Street (T-intersection) have been assessed using SIDRA INTERSECTION 9.1, a computer-based modelling package which calculates intersection performance.

The key parameters used to determine the operational performance of an intersection are average delay, queue length and degree of saturation (or volume to capacity ratio).

A brief explanation of the key parameters is provided as follows:

- **Average delay** is the average time in seconds it takes a vehicle to negotiate an intersection, including the time to negotiate corners and the time stopped in queues. This parameter is the most tangible to drivers.
- **The 95th percentile queue length** represents the queue length that is exceeded only five percent of the time.
- **The degree of saturation** (DOS) is the ratio of arrival flow to capacity flow. A DOS of 1.0 represents saturated conditions, however for a priority-controlled intersection, the desirable range is between 0.8 to 0.85.
- **The overall operational performance** of an intersection is qualitatively measured and classified by Level of Service (LoS). The LoS assessed here is based on the average delay. The LoS performance objectives for various intersection types are presented in **Table 5**.

Table 5 Intersection Level of Service (LoS) criteria

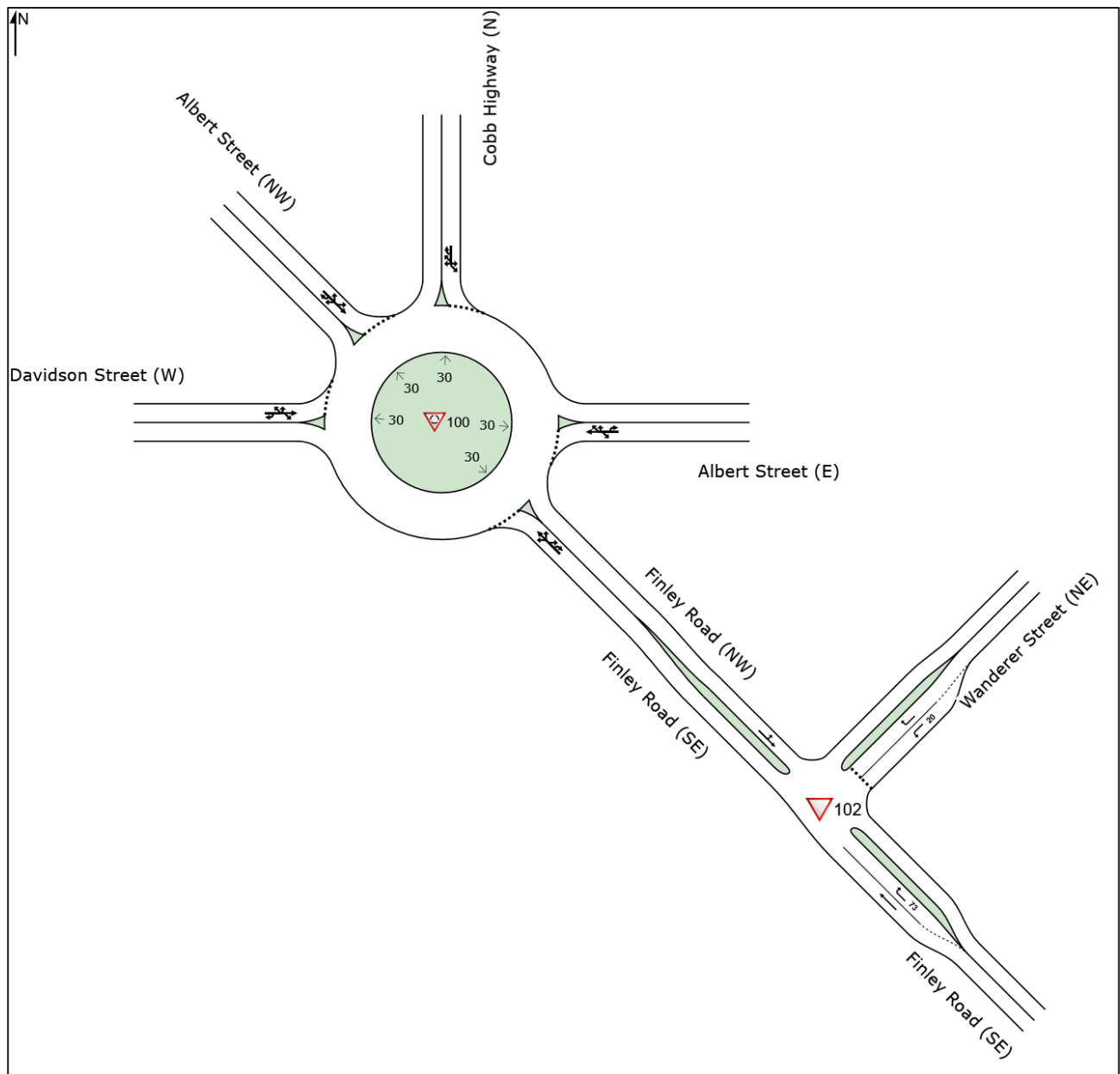
Level of service	Average Delay per Vehicle (sec/veh)	Traffic Signals or Roundabout	Give Way & Stop Signs
A	<14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but crash study required
D	43 to 56	Operating near capacity	Near capacity and crash study required
E	57 to 70	At capacity at signals, incidents will cause excessive delays Roundabouts require other control mode	At capacity, requires other control mode

Level of service	Average Delay per Vehicle (sec/veh)	Traffic Signals or Roundabout	Give Way & Stop Signs
F	>70	Overcapacity	Overcapacity

Source: Guide to Traffic Generating Development version 2.2 (TfNSW, 2002)

Figure 7 shows the SIDRA model layout for the Cobb Highway / Albert Street / Finley Road / Davidson Street roundabout intersection and Finley Road / Wanderer Street T-intersection.

Figure 7 Existing SIDRA network layout for Cobb Highway / Albert Street / Finley Road / Davidson Street roundabout intersection and Finley Road / Wanderer Street T-intersection



Source: SIDRA modified by Urbis

Table 6 provides a summary of the existing conditions of SIDRA modelling outputs, with detailed results provided in **Appendix B**.

Table 6 SIDRA Intersection results for existing conditions

Intersection	Peak Hour	Approach	Level of Service	Degree of Saturation	Average Delay (s)	95 th Percentile Queue Length (m)
Hay Road / Albert Street / Finley Road / Davidson Street	AM	Finley Road (southeast)	A	0.21	2 sec	9
		Albert Street (east)	A	0.01	5	1
		Cobb Highway (north)	A	0.08	8	3
		Alber Street (northwest)	A	0.02	4	1
		Davidson Street (west)	A	0.13	6	6
Finley Road / Wanderer Street	AM	Finley Road (southeast)	A	0.07	1	1
		Wanderer Street (northeast)	A	0.18	7	6
		Finley Road (northwest)	A	0.09	2	0
Hay Road / Albert Street / Finley Road / Davidson Street	PM	Finley Road (southeast)	A	0.15	2	6
		Albert Street (east)	A	0.01	4	1
		Cobb Highway (north)	A	0.07	8	3
		Alber Street (northwest)	A	0.02	5	1
		Davidson Street (west)	A	0.21	6	9
Finley Road / Wanderer Street	PM	Finley Road (southeast)	A	0.05	1	0

Intersection	Peak Hour	Approach	Level of Service	Degree of Saturation	Average Delay (s)	95 th Percentile Queue Length (m)
		Wanderer Street (northeast)	A	0.14	7	5
		Finley Road (northwest)	A	0.14	2	0

Source: Urbis

The results presented in **Table 6** indicate that during peak periods the intersections are operating well below the capacity, with a degree of saturation below 0.25 and LoS A.

2.4.7. Crash History

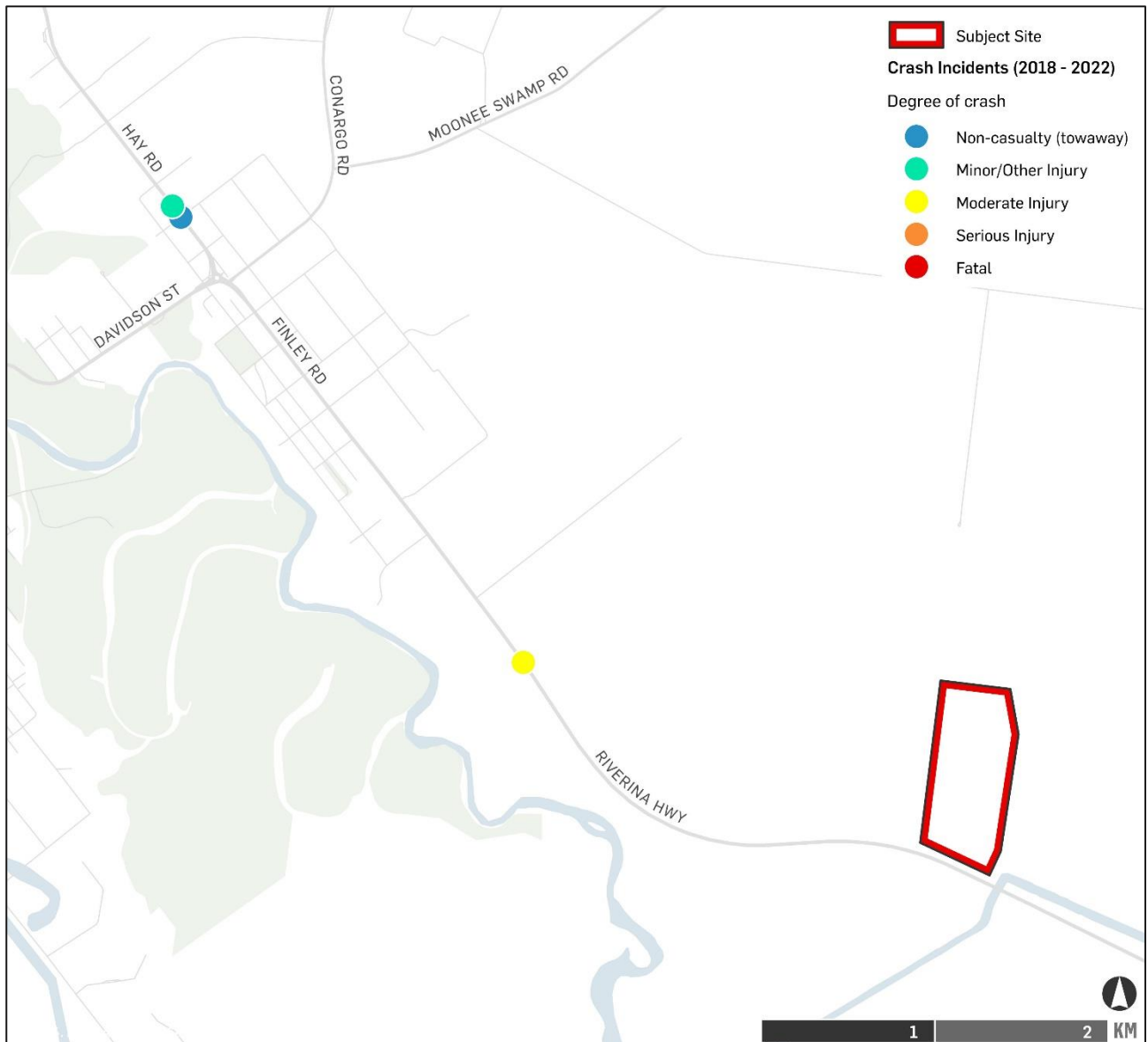
Crash data can provide valuable information about the safety performance of a given road network. Existing road safety deficiencies can be highlighted by examining crash data, which can aid in determining whether the proposed development's traffic generation will exacerbate any identified issues.

Crash statistics from the TfNSW allows users to analyse crash data based on time, location, conditions, crash type, and road user type. This data was analysed for the surrounding road network for the latest available five years period from 2018 to 2022. The statistics only consider the following:

- **Fatal injury** - A crash for which there is at least one fatality.
- **Serious injury** – A person not matched to a police report but has been identified as having an injury on a public road or injury on a traffic-public road for the hospital stay that is not an emergency department only admission (unless that ended in a transfer interstate, to a private hospital or other medical facility).
- **Moderate injury** – person identified in CrashLink (casualty or driver or rider) who is matched to an emergency department attendance record on the same day or on the day after a crash but was not killed or not subsequently admitted to hospital.
- **Minor or other injury** – A person identified as an injury in CrashLink who is not matched to a hospital admission record or emergency department attendance record.

The location of the crashes in the vicinity of the site for the last available five-year period (2018 – 2022) are shown in **Figure 8**, and a summary of the crash types is provided in **Table 7**.

Figure 8 Crash history in the vicinity of the site



Source – TfNSW Open Data Hub modified by Urbis

Table 7 Crash history

Location	Crash number				
	Killed	Seriously injured	Moderately injured	Minor/other injured	Other / Non-casualty
Riverina Highway – south of Mimosa Street	0	0	1	0	1
Riverina Highway – north of Browning Street	0	0	0	1	0

Source: TfNSW Centre for Road Safety

Table 7 indicates that three crashes occurred along Riverina Highway in the vicinity of the site. They were moderate injuries and minor injuries. None of these crashes involved heavy vehicles, pedestrians or cyclists. The crash history does not indicate any inherent road safety issue along Riverina Highway in the vicinity of the site.

3. DEVELOPMENT PROPOSAL

The proposed development entails establishing a BESS with a 100 MW/200MWh capacity and associated power conversion systems, switchgear and a control room. Associated infrastructure includes overhead lines and collector units, storage areas, internal access tracks, onsite parking, security fencing, temporary construction laydown area and landscaped screening.

The BESS will be connected to the nearby Deniliquin Substation (Deniliquin 132/66kV TS) via a 132kV overhead transmission line crossing the Mulwala Canal and Riverina Highway. The proposed site access is to be provided via a new six metre-wide vehicular access road, crossing the Moulamein Channel, and connecting to the Riverina Highway.

The Project Area, which includes the extent of the proposed development, the BESS compound, and associated transmission lines and road works is approximately 10.7ha in size. The Project Area includes land within the Road Reserve of the Riverina Highway.

3.1. DEVELOPMENT OVERVIEW

Subject to detailed design, the key elements included in the development proposal are as follows:

- Containerised lithium-ion battery modules with up to 100MW/200MWh capacity.
- Power conversion units, which convert the DC power from the battery modules to 33kV AC.
- On site 33/132 kV substation, including power transformer and oil containment system.
- A 33kV switch room.
- Control room.
- Maintenance container.
- A 132 kV overhead transmission line connecting with the Deniliquin Substation.

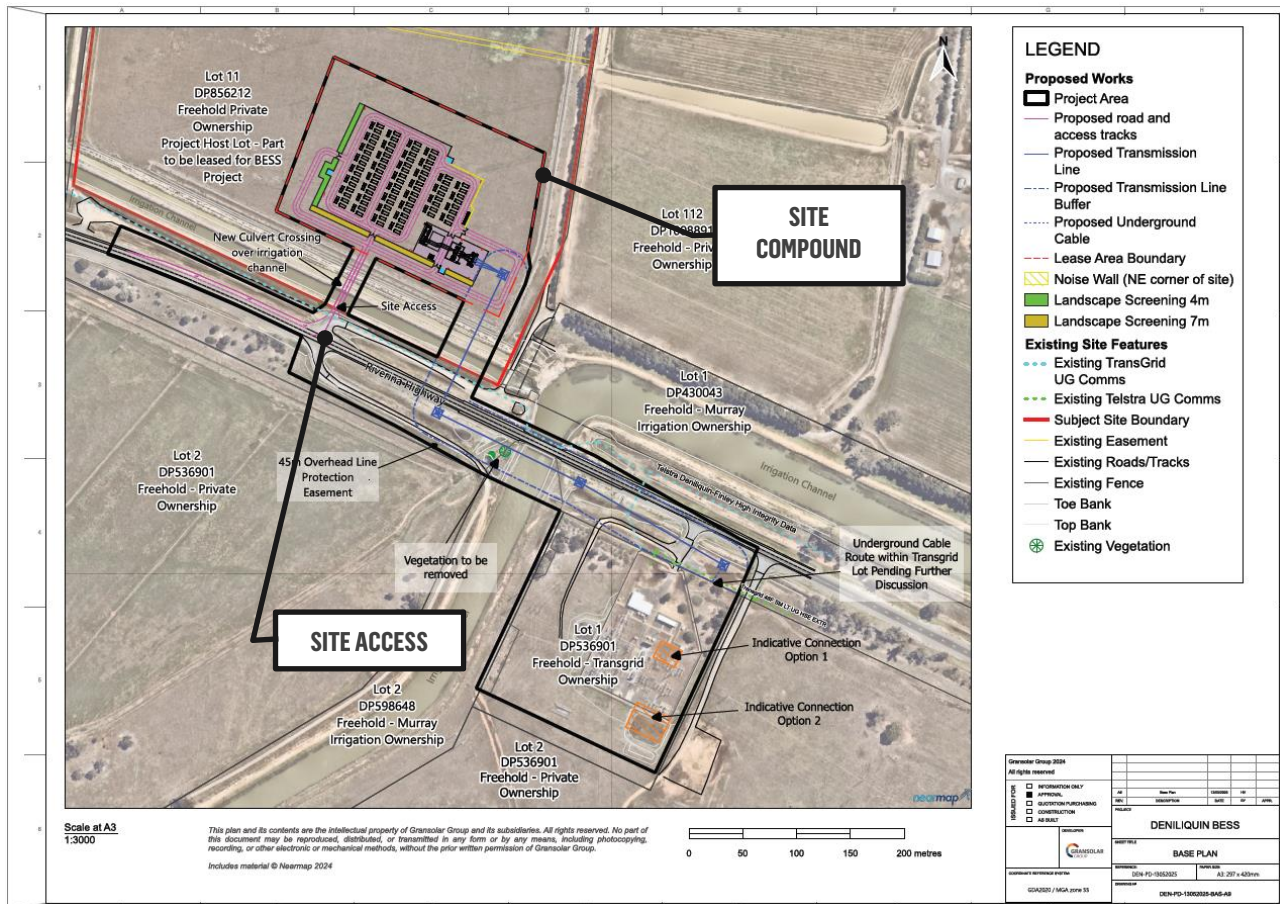
Permanent supporting infrastructure will include:

- Upgraded site vehicle access road and bridges to provide access to Riverina Highway.
- Internal access roads and car parking for maintenance vehicles.
- Three 25,000-litre water tanks.
- Security fencing and CCTV security system.
- Landscape screening.
- Lightning mast.

Temporary construction facilities will include:

- Laydown area.
- Construction materials storage.

Figure 9 Proposed development

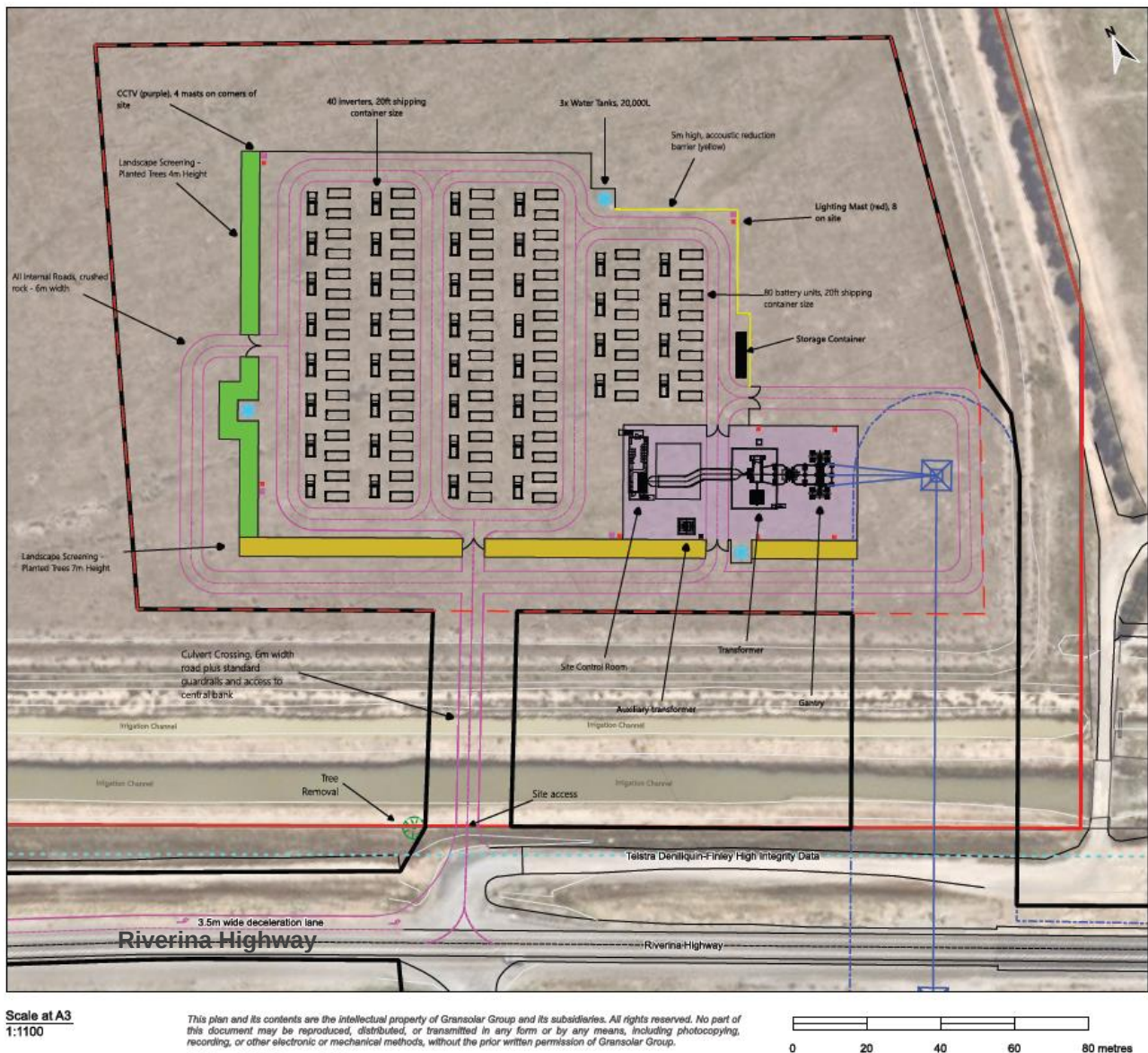


Source – BESS Arctic Pty Ltd C/- Gransolar Development Australia

3.2. VEHICLE ACCESS

Access to the site for vehicles will be facilitated through an access point off Riverina Highway. A bridge will be constructed over the Moulamein Irrigation Channel to provide access for vehicles to the site. **Figure 10** shows the proposed site access high-level design. A detailed design of the proposed bridge over the canal will be prepared and submitted to the relevant agencies for approval prior to the issue of a Construction Certificate (CC). This access will be used for both construction and operational access.

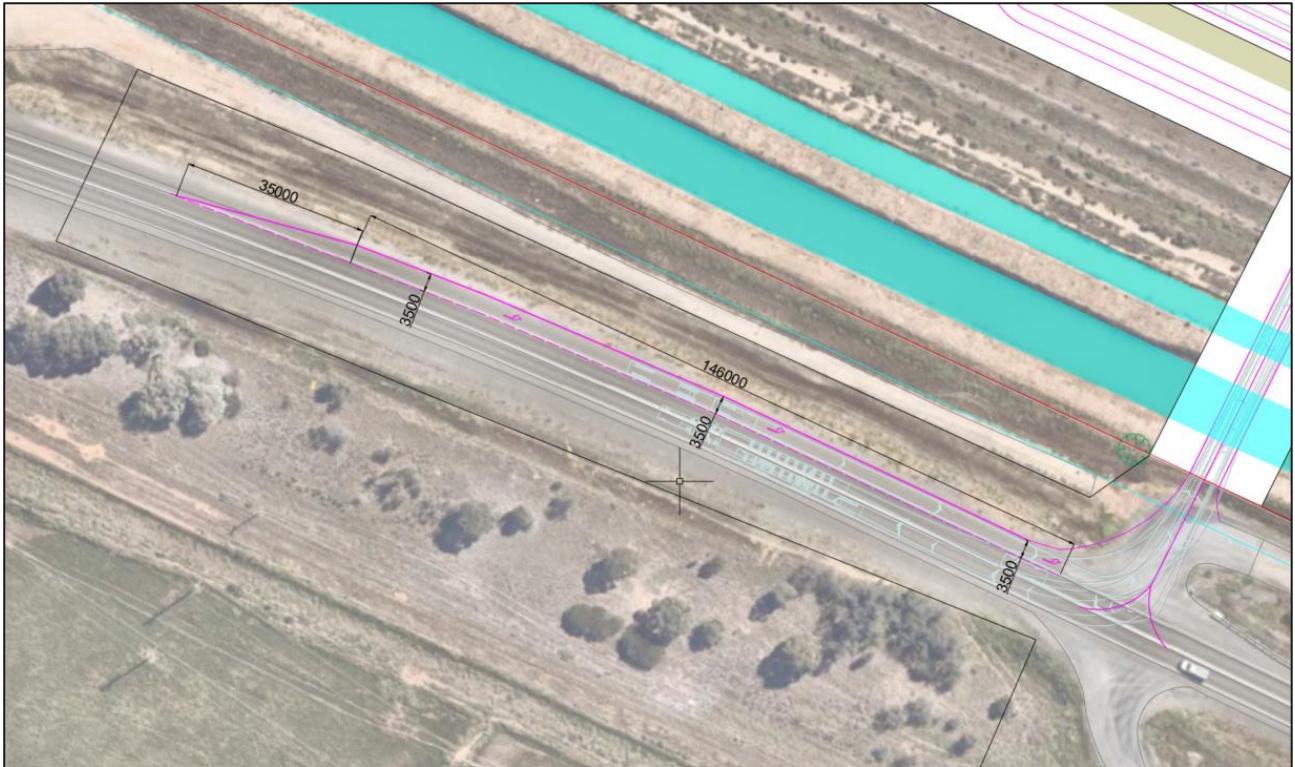
Figure 10 Vehicle access point high-level design



Source – Urbis

Additionally, a deceleration lane to support access into the site from the east is proposed. This lane will be 181 metres long including 34 metres of taper, this deceleration lane is shown in **Figure 11**. Further detail on the deceleration lane requirements are shown in **Section 4.7.3.2**.

Figure 11 Proposed deceleration lane



Source – Urbis

3.3. INTERNAL ROAD NETWORK

All internal roads are designed to enable two-way movement with a minimum width of six metres in accordance with the NSW Government / NSW Rural Fire Service Planning for Bush Fire Protection Guide as outlined in **Section 5.4**.

3.4. STAFFING LEVELS

During the operational phase, the site will have a staffing requirement of one to three individuals working permanently during business days in addition to the local contractors. These staff members will commute to the site using regular light vehicles. Their primary responsibilities will involve conducting maintenance inspections and performing repairs as needed.

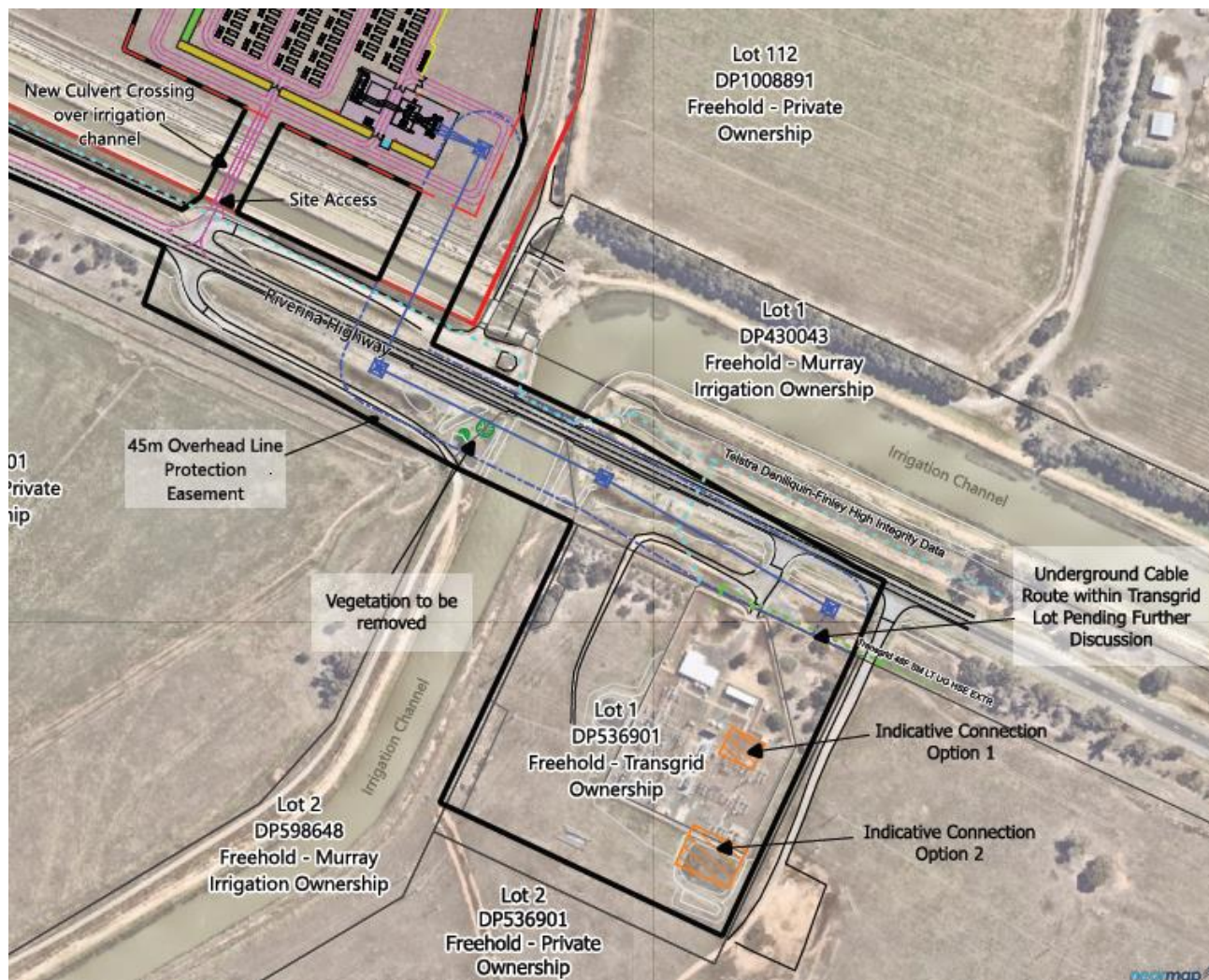
3.5. VEHICLE PARKING ARRANGEMENTS

Staff will be parking informally throughout the site based on the activities that need to be undertaken on a day-to-day basis. No permanent on site parking is proposed.

3.6. TRANSMISSION LINE INFRASTRUCTURE

In order to connect to the adjacent Deniliquin Sub Station, a transmission line and related infrastructure over the Riverina Highway is proposed. To achieve this, a structure is proposed within the Riverina Highway road reserve to support connectivity. Where the transmission line crosses the Riverina Highway, the vertical clearance above the carriageway will be a minimum of 15.3 metres. This structure and the transmission line are shown in **Figure 12** with the blue demarcation. **Appendix C** shows a cross-section of the transmission line.

Figure 12 Transmission line location within road reserve



Source: BESS Arctic Pty Ltd C/- Gransolar Development Australia

4. CONSTRUCTION TRAFFIC MANAGEMENT PLAN

This section provides details regarding the traffic implications of the construction stage and assesses the associated traffic impacts. Mitigation measures are also outlined which shall form the basis of the contractor's subsequent management plans.

4.1. CONSTRUCTION STAGING

The proposed development will be completed over 11 months, with a peak period of three months. The start date is yet to be determined.

4.2. VEHICLE SIZES

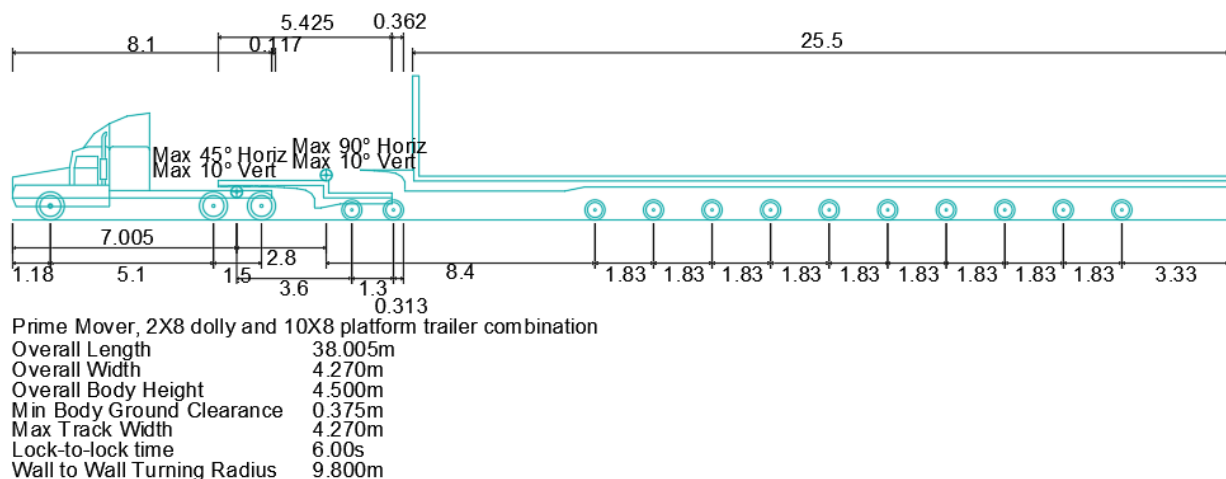
Several construction vehicles will be required to transport the battery systems and bulkier items, including the substation components and step-up transformers. Several construction vehicles will also be required for general construction activities on site in addition to delivery vehicles.

Two categories of vehicles will be used during construction as follows:

- Construction vehicles: These vehicles will be responsible for transporting batteries, inverters, substation components, step-up transformers, steel, road construction materials, concreting supplies, and water. They will be larger than personnel vehicles and include oversized vehicles. These vehicles will serve both for the delivery of materials and for general construction activities on site.
- Worker vehicles: This category includes utility vehicles and shuttle buses. These vehicles will be used for personnel movement, including construction personnel, subcontractors, and escort vehicles.

The largest vehicle to be utilised in the construction process will be a 38 m-long 10-axle platform trailer and dolly as outlined in **Figure 13**. This vehicle is an OSOM vehicle.

Figure 13 Largest nominated construction vehicle



Source – BESS Arctic Pty Ltd C/- Gransolar Development Australia, Urbis

A detailed analysis of the vehicle design and the proposed haulage route of this vehicle are provided in **Appendix D**.

This delivery will be a one-off vehicle movement and is not considered in the daily construction vehicle trip generation.

4.3. CONSTRUCTION VEHICLE ROUTE

Construction materials, including the transformer, will be sourced from the Port of Melbourne, resulting in one key origin point for all construction vehicle loads. A detailed concept route assessment for the suitability of this route to accommodate the OSOM vehicle has been completed and is included in **Appendix D**. The detailed route assessment outlines the largest vehicle, the route selection process, key constraints, and vehicle manoeuvrability of the largest vehicle at all key intersections and rest stops. An extract from this report is shown below detailing how the route was selected, as well as some critical constraints for structures. Note, that while this assessment has been completed in the context of the OSOM, all other construction vehicles will be utilising this route for haulage as Port Melbourne will be the port of origin for all materials.

The route selection has been conducted with the assistance of the NHVR Route Planner. The majority of the Victorian portion of the proposed route uses the Northern Highway between Wallan and Echuca, and the majority of the New South Wales (NSW) portion uses the Cobb Highway between Echuca and Deniliquin.

Within Victoria, the route is conditionally pre-approved from the Port of Melbourne to the Victorian / NSW border at Echuca for a Class 1 2x8 Dolly & 10x8 Platform Trailer up to 206 tonnes (Reference Vehicle 8). The conditions applicable to the pre-approved route include:

- *A bridge assessment for the West Gate Bridge (SN6225).*
- *Liaison with West Gate Tunnel Project team on the West Gate Freeway prior to travelling through the corridor due to potential overnight lane width reductions.*
- *Speed restriction to five kilometres per hour for an approximate two kilometre long section of the Northern Highway between Tooborac and Heathcote.*
- *Speed restriction to five kilometres per hour and requirement to straddle centreline of road for an approximate 1.9 kilometre long section of the Northern Highway immediately south of Echuca-Mitiamo Road.*
- *Various operational conditions on bridges along the route, specifying operating speed restriction and/or required positioning of combination on the structure, highlighted in Table 2.*

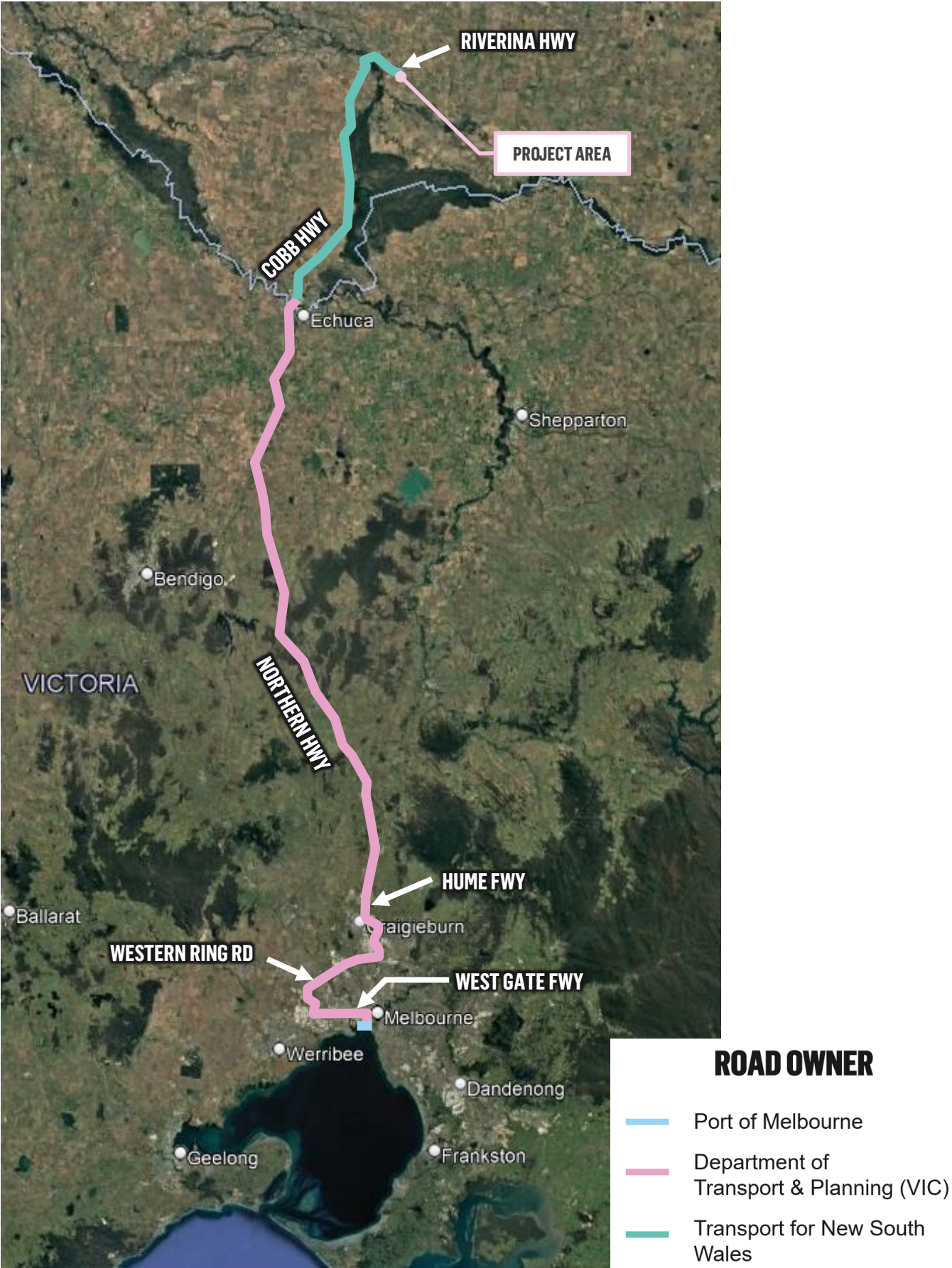
Given the proposed combination does not comply with the Multi-State Class 1 Load Carrying Vehicle Mass or Dimension Exemption Notices, the route is not pre-approved within NSW and requires assessment and subsequent permit via the NHVR.

There are no known planned upgrades along the route.

The proposed route is shown in **Figure 14**.

Table 2 in **Appendix D** highlights the requirements and conditions for structures along the haulage route.

Figure 14 Vehicle haulage route from Melbourne



Source – Urbis

4.4. CONSTRUCTION VEHICLE MANOEUVRABILITY

Two types of construction vehicles have been tested for vehicle manoeuvrability, these are B-doubles (the largest standard vehicle in the construction fleet, 26 metres long) and the OSOM vehicle associated with the delivery of the transformer as outlined in **Section 4.3**.

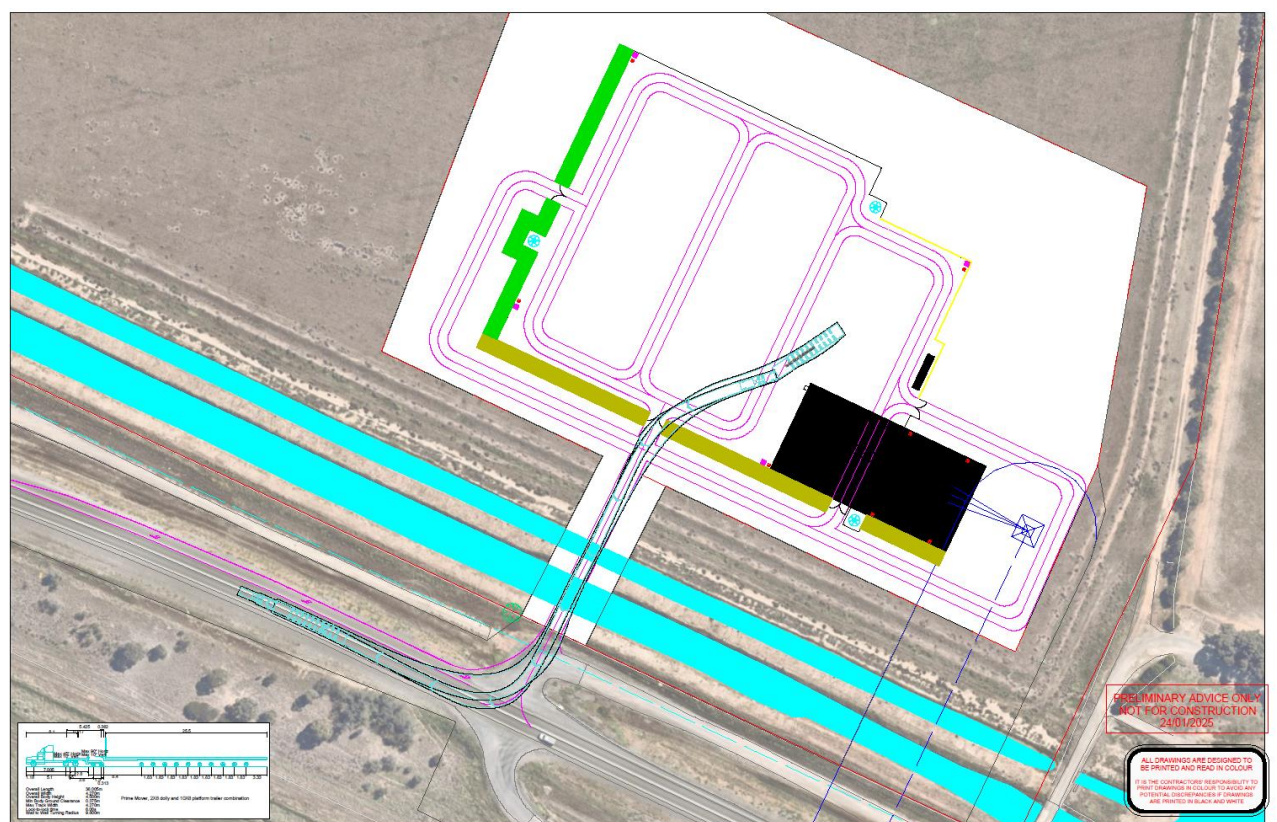
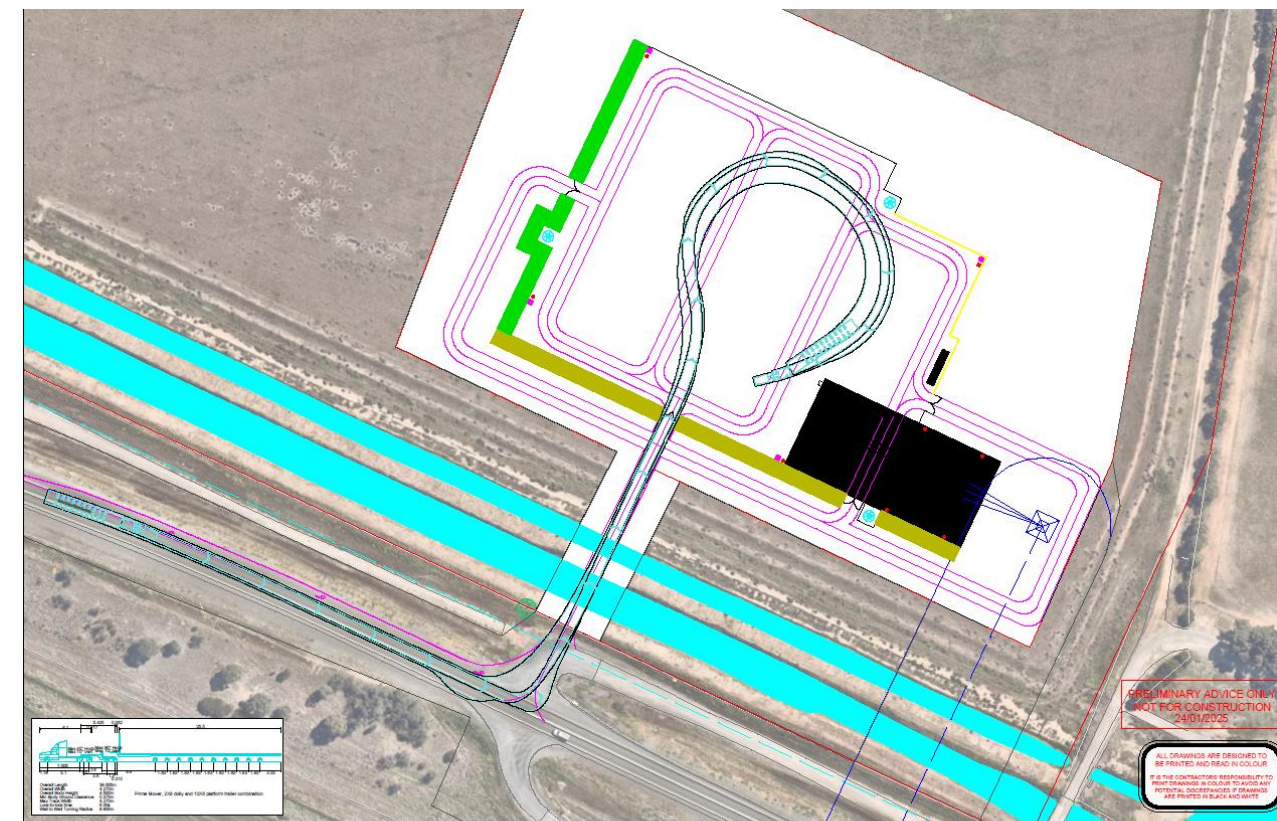
The detailed route assessment for the OSOM vehicle (see **Appendix D**) details vehicle manoeuvrability along the extent of the haulage route.

Figure 15 shows the vehicle manoeuvrability of the OSOM vehicle accessing the site. The figure below shows that the OSOM vehicle can safely access and egress the site with appropriate traffic control measures. Considering the nature of the OSOM vehicle's entry and exit movements, it is unlikely that any other vehicle movements will occur simultaneously. These movements will require appropriate traffic control measures due to the scale of the delivery vehicle. These measures will be outlined in the contractor's traffic management plans.

Figure 16 shows the vehicle manoeuvrability of the B-double vehicle accessing the site. As shown, the B-double can safely access and egress the site during the construction phase.

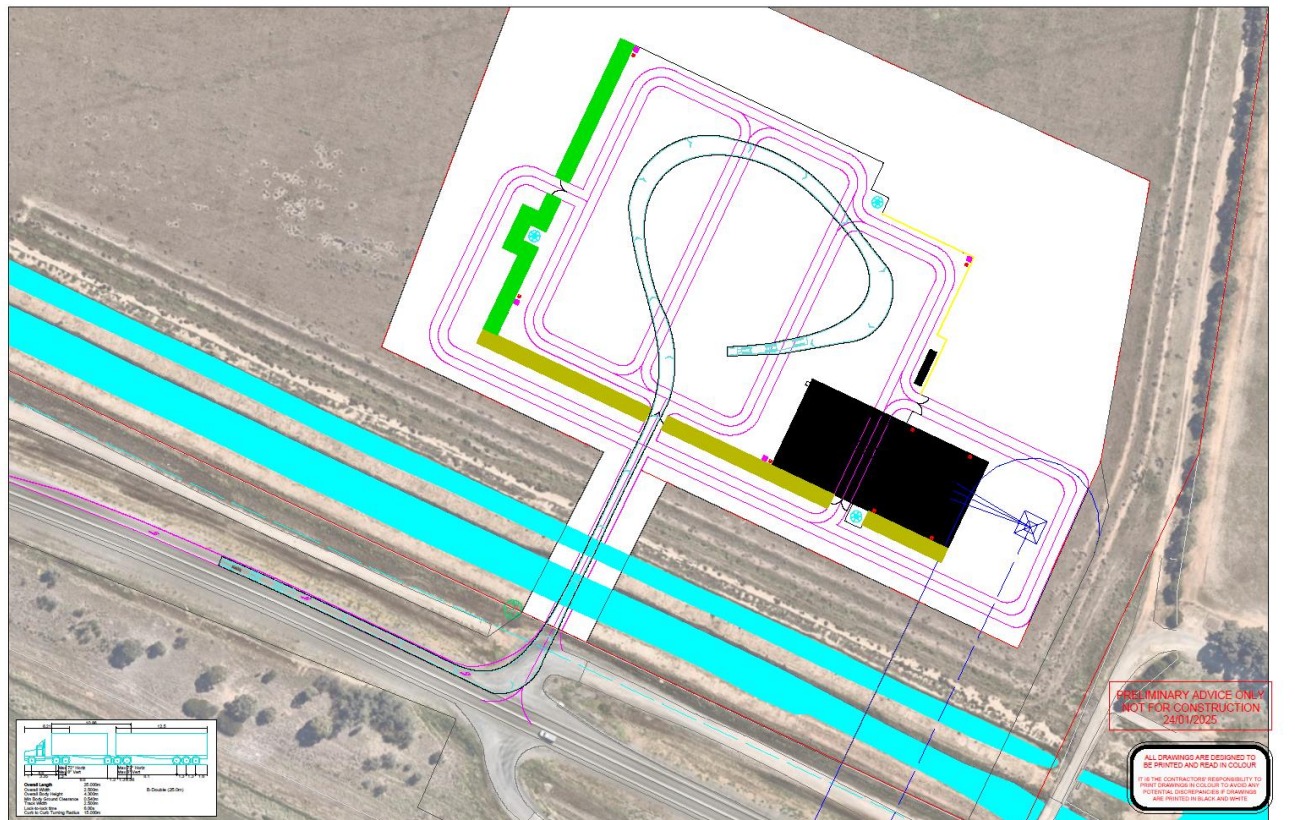
This swept path analysis is also presented in **Appendix F**.

Figure 15 OSOM vehicle manoeuvrability at site access



Source – BESS Arctic Pty Ltd C/- Gransolar Development Australia modified by Urbis

Figure 16 B-double vehicle manoeuvrability at site access



4.5. CONSTRUCTION WORKER MANAGEMENT

The construction of the proposed BESS will be completed over 11 months. The program for workers on site is shown below in **Table 8**. While the program timeline is identified, there is no confirmed start date yet. This information will be provided to the relevant agencies once the timeline is confirmed.

Table 8 Construction worker numbers throughout project

Month	1	2	3	4	5	6	7	8	9	10	11
Specialist – HSE / QA / Electrical / Grid	3	9	12	15	32	34	41	29	32	9	4
Civil / Mechanical	2	6	10	17	18	18	11	7	2	0	0
Total on site persons	5	15	22	32	50	52	52	38	34	9	4

Source: BESS Arctic Pty Ltd C/- Gransolar Development Australia

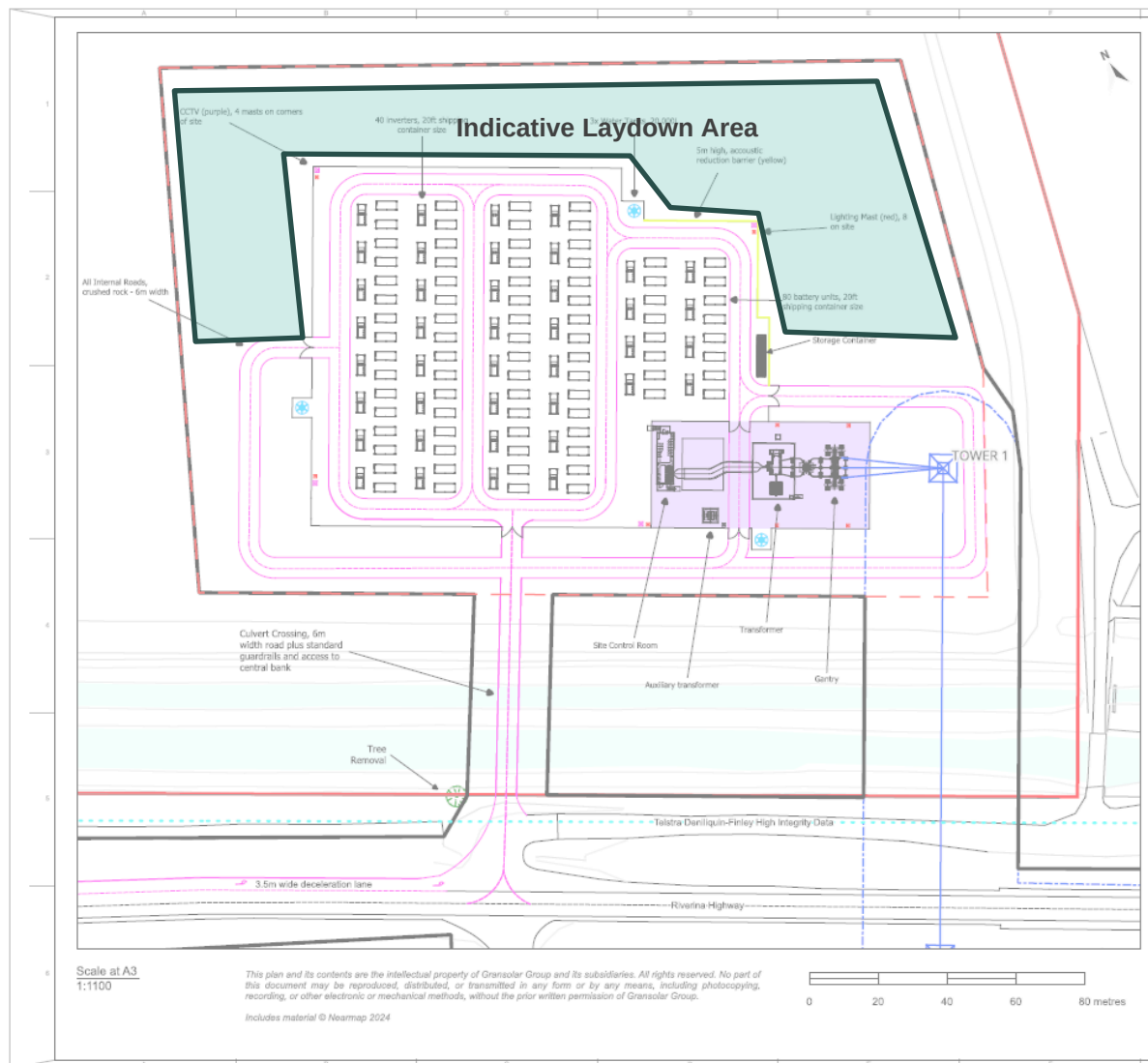
As shown in the above table, the peak workforce will be 52 persons.

Workers will primarily be accessing the site in shuttle buses. However, some site contractors and site managers will be accessing the site in light utility vehicles. For workers accessing the site in light vehicles, carpooling will be encouraged by the developer. This is discussed further in **Section 4.7** and **Section 4.8**.

4.6. CONSTRUCTION LAYDOWN AREA AND PARKING

The laydown area for the BESS will be on site and will be accessed via the Riverina Highway. It is likely that during the construction phase, the location of the laydown area will shift based on when certain parts of the project are completed. An indicative laydown area is shown in **Figure 17**. Similar to the laydown area, the on site car parking areas may be shifted throughout the construction period to accommodate certain construction phases.

Figure 17 Indicative construction laydown area



Source – BESS Arctic Pty Ltd C/- Gransolar Development Australia

4.7. CONSTRUCTION TRAFFIC IMPACT ASSESSMENT

This section provides a summary of the anticipated traffic impacts of vehicles associated with the construction stage of the development.

4.7.1. Estimated Existing Road Traffic Volumes

Existing midblock traffic volumes on the Riverina Highway adjacent to the site have been estimated based on traffic counts at the Finley Road / Wanderer Street intersection detailed in **Section 2.4.4**. These are presented as follows:

- AM Peak
 - Eastbound – 134 vph.
 - Westbound – 77 vph.
 - Total 211 – vph
- PM Peak
 - Eastbound – 148 vph.
 - Westbound – 92 vph.
 - Total – 240 vph

4.7.2. Construction Traffic Generation

The following section outlines trip generation for construction worker and construction vehicles (heavy vehicles) and their impact on the surrounding road network.

4.7.2.1. Construction Worker (Light Vehicles)

As previously stated, the construction period for the proposed development will be approximately 11 months with a peak period of three months.

All workers will be housed in accommodation in Deniliquin and other surrounding towns. These workers will be shuttled to site using shuttle buses. It is acknowledged that some workers, particularly site managers and foremen will be using light vehicles such as utility vehicles to access the site. It has been assumed that during peak construction, 52 workers will be on site. Two shuttle buses will be used to shuttle most workers to the site (20 workers per bus), and each shuttle bus is expected to arrive from and return to the west during both peak hours, creating four movements during both the morning and afternoon peak hours. To allow for a conservative assessment, it has been assumed that the shuttle buses will not remain on site during the work day therefore each generating an inbound and an outbound movement at the start and end of the work day.

The remaining workers (foreman / site managers) have been assumed to drive utility vehicles to the site with an average occupancy of two people per vehicle, resulting in a total of six vehicles being used or a total of 12 daily movements (on the basis that the vehicles remain on site during the work day). In addition, it is assumed that all trips by utility vehicles will be arriving from the west at the start of the work day and returning west towards Deniliquin after a day of work.

Urbis has been advised that the construction hours are proposed as below:

- Monday – Friday (7:00 AM – 6:00 PM).
- Saturday (8:00 AM – 1:00 PM).
- Sunday – No work.

Construction worker trips during the peak construction stage are detailed in **Table 9**.

Table 9 Vehicle trip generation for light vehicles during peak construction stage

Vehicle type	Number of daily movements (vpd)	AM Peak hour movements (vph)	PM Peak hour movements (vph)
Shuttle Buses	8	4	4
Utility Vehicles	12	6	6
Total Light Vehicle Generation	20	10	10

Source: BESS Arctic Pty Ltd C/- Gransolar Development Australia

The above table outlines the light vehicle (construction worker) traffic during peak construction. A total of ten vehicle trips are expected during both peak hours, reflecting the arrival and departure of workers.

4.7.2.2. Construction Vehicles (Heavy Vehicles)

Urbis has been informed that there will be up to 50 heavy vehicles accessing the site during the peak construction phase per day. This will result in the following generation:

- Daily traffic – 50 heavy vehicles per day.
- Peak hour traffic – six heavy vehicles per hour.
- The following in and out splits are adopted for the AM and PM peak hours.
- AM – 100 per cent in / 0 per cent out. (assuming entries will only occur towards the end of the AM peak after site set up, discussed further in **Section 4.7.2.5**).
- PM – No construction trips anticipated during the peak hour.

Based on the construction haulage route, heavy vehicles are assumed to be accessing the site from the west in the morning.

Further estimated vehicle trip generation for heavy vehicles during the peak construction phase is detailed in **Table 10**. This summarises the type of vehicle used, and the estimated total number of movements.

Table 10 Heavy vehicle trip generation during peak construction stage

Vehicle type	Number of daily movements (vpd)	AM Peak hour movements (vph)	PM Peak hour movements (vph)
HRV's	20	2	0
Long Loaders	10	2	0
B-Doubles	20	2	0
Total Heavy Vehicle Generation	50	6	0

Source: BESS Arctic Pty Ltd C/- Gransolar Development Australia

4.7.2.3. Total Traffic Generation

The following **Table 11** summarises the estimated total daily and peak hour traffic general of the site over the peak construction period.

Table 11 Total vehicle trip generation during peak construction stage

Vehicle type	Number of daily movements (vpd)	AM Peak hour movements (vph)	PM Peak hour movements (vph)
Shuttle Buses	8	4	4
Utility Vehicles	12	6	6
Total Light Vehicles	20	10	10
HRV's	20	2	0
Long Loaders	10	2	0
B-Doubles	20	2	0
Total Heavy Vehicles	50	6	0
Total Peak Vehicle Generation	70	16	10

Source: BESS Arctic Pty Ltd C/- Gransolar Development Australia

4.7.2.4. Construction Traffic Impact on Riverina Highway

The peak hour traffic generation on Riverina Highway is summarised in **Table 12**.

The total traffic generated during the construction phase has been added to the estimated existing midblock volumes to understand the expected impact of construction vehicles on the Riverina Highway and wider road network and is summarised in **Table 13**.

Table 12 Deniliquin – Peak hour construction traffic generation on Riverina Highway

Peak Hour Period			
Eastbound (inbound)	Total Construction LV Traffic Generation (vph)	Total Construction HV Traffic Generation (vph)	Total Construction Traffic Generation (vph)
AM	8	6	14
PM	2	0	2
Westbound (outbound)			
AM	2	0	2
PM	8	0	8

Source: Urbis

Table 13 Total peak hour construction traffic generation on Riverina Highway

Eastbound (inbound)	Estimated Existing Traffic Volume (vph)	Total Construction Traffic Generation (vph)	Total Traffic Volume (vph)	Percentage Increase
AM	134	14	148	10.4%
PM	148	2	150	1.4%
Westbound (outbound)				
AM	77	2	79	2.6%
PM	92	8	100	8.7%

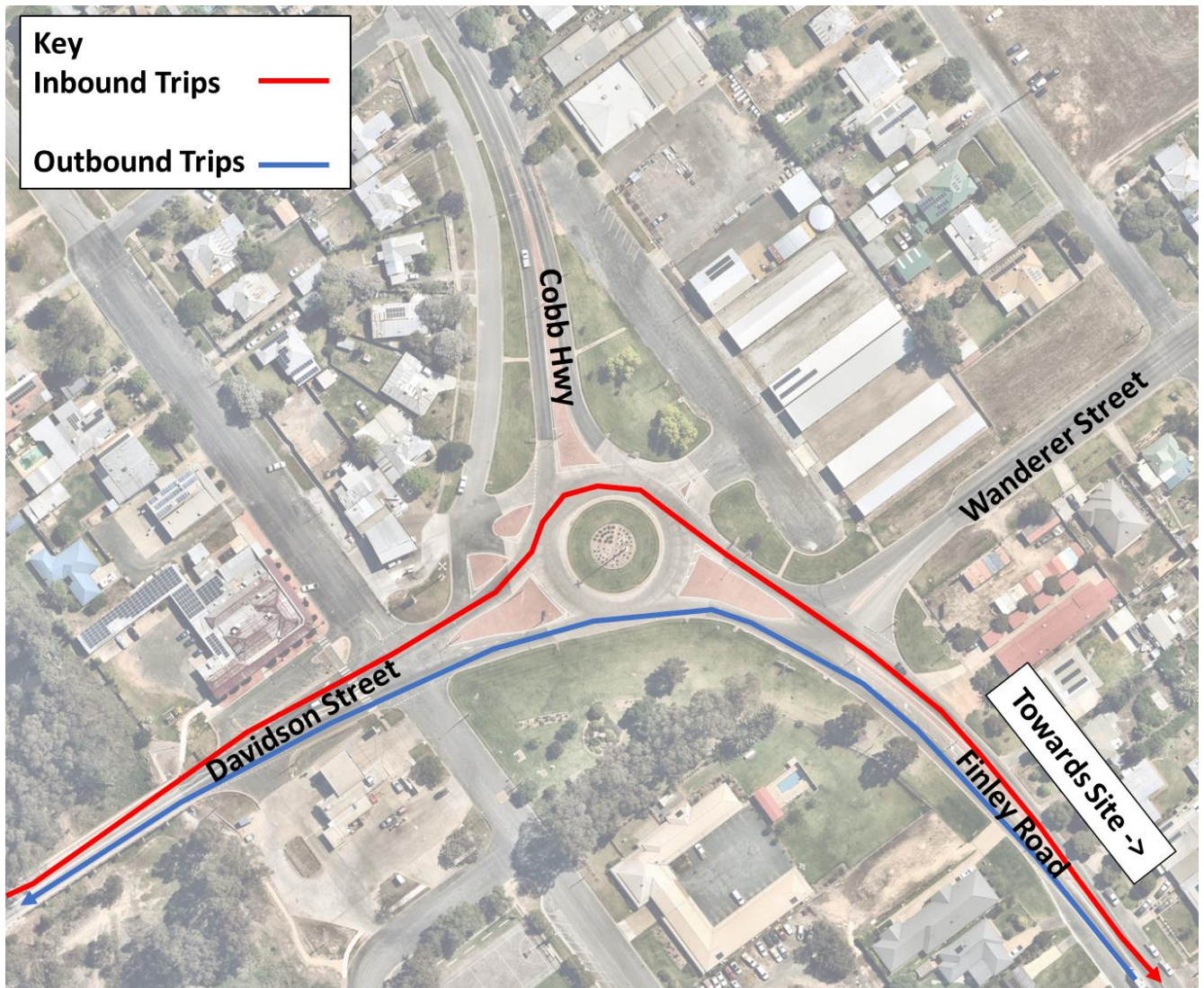
Source: BESS Arctic Pty Ltd C/- Gransolar Development Australia, TIA, Urbis

The above table indicates increases of approximately ten per cent in the eastbound direction in the AM peak, and negligible increases of between one per cent and nine per cent the AM westbound direction and in the PM peak. This will only be observed during the peak construction period. However, the total volume is well below the capacity of a single lane road (900 vph as referenced from *Austroads Guide to Traffic Management Part 3 Section 5.3 Multi Lane Roads*). As a result, the estimated traffic generation impact from construction traffic on the surrounding road network is anticipated to be minimal.

4.7.2.5. Construction Traffic Impact on Surrounding Intersections

The intersections of Cobb Highway / Albert Street / Finley Road / Davidson Street roundabout intersection and Finley Road / Wanderer Street T-intersection have been assessed using SIDRA INTERSECTION to determine the impact of construction traffic on the surrounding road network. Estimated construction traffic volumes and derived existing midblock volumes have been used, along with an assumed vehicle distribution of construction traffic as detailed in **Figure 19**.

Figure 18 Construction vehicle trip distribution through Davidson Street / Cobb Highway / Finley Road intersection towards the site



Source: Nearmap modified by Urbis

All construction vehicles will be heading inbound during the AM peak hour as it is not anticipated that the return trips will be completed during the peak hour given the time it will take to unload / reload vehicles. Additionally, the first construction deliveries will likely occur towards the end of the peak hour after site set up. The critical peak hour will be during the AM peak period as both workers and construction materials will be arriving on site during this hour. During the AM peak hour, 16 vehicle movements are expected to be generated by the site.

During the PM peak period, it is assumed that only the worker vehicles will be passing through the intersections as workers return to their accommodation. During the PM peak hour, ten vehicle movements are expected to be generated by the site.

Based on the construction vehicle generation, 70 vehicle movements will occur across the working day. However, given the associated site shutdown period, it is unlikely that any deliveries will occur in the late afternoon.

Table 14 provides a summary of the peak construction period SIDRA modelling outputs, with detailed results provided in **Appendix B**.

Table 14 SIDRA Intersection results for peak construction period

Intersection	Peak Hour	Approach	Level of Service	Degree of Saturation	Average Delay (s)	95 th Percentile Queue Length (m)
Hay Road / Albert Street / Finley Road / Davidson Street	AM	Finley Road (southeast)	A	0.21	2.2	10
		Albert Street (east)	A	0.08	4.7	1
		Cobb Highway (north)	A	0.08	8	4
		Alber Street (northwest)	A	0.03	4.2	1
		Davidson Street (west)	A	0.15	6.1	7
Finley Road / Wanderer Street	AM	Finley Road (southeast)	A	0.07	1	1
		Wanderer Street (northeast)	A	0.19	7	6
		Finley Road (northwest)	A	0.11	2	0
Hay Road / Albert Street / Finley Road / Davidson Street	PM	Finley Road (southeast)	A	0.16	2.	7
		Albert Street (east)	A	0.012	4	1
		Cobb Highway (north)	A	0.07	8	3
		Alber Street (northwest)	A	0.02	5	1
		Davidson Street (west)	A	0.21	6	9
Finley Road / Wanderer Street	PM	Finley Road (southeast)	A	0.05	1	0

Intersection	Peak Hour	Approach	Level of Service	Degree of Saturation	Average Delay (s)	95 th Percentile Queue Length (m)
		Wanderer Street (northeast)	A	0.15	7	5
		Finley Road (northwest)	A	0.14	2	0

Source: Urbis

Based on the above analysis, the proposed increase in trip generation resulting from site generated construction vehicles is expected to have a minimal impact on the operation of the assessed intersections which will all continue to operate at LoS A. As a result, no upgrades to existing intersections are necessary.

4.7.3. Site Access Intersection Requirements

4.7.3.1. Site Distance Assessment

The safe intersection sight distance (SISD) is defined in Section 3.2.2 of the Austroads *Guide to Road Design, Part 4A, Signalised and Un-signalised intersections*, as the minimum standard to be provided at an intersection with a major road. A SISD assessment was undertaken at the intersection of the proposed site access with the Riverina Highway.

Figure 19 Safe intersection sight distance (SISD) formula

$$SISD = \frac{D_r \times V}{3.6} + \frac{V^2}{254 \times (d + 0.01 \times a)}$$

where

- SISD = safe intersection sight distance (m)
- D_r = decision time (sec) = observation time (3 sec) + reaction time (sec) – refer to *AGRD Part 3* (Austroads 2016b) for a guide to values
- V = operating (85th percentile) speed (km/h)
- d = coefficient of deceleration – refer to Table 3.3 and *AGRD Part 3* for a guide to values
- a = longitudinal grade in % (in direction of travel: positive for uphill grade, negative for downhill grade)

Source – *Guide to Road Design Part 4A: Unsignalized and Signalised Intersections*

The SISD assessment is assessed based on the following parameters:

- An observation time of 3 seconds.
- A reaction time of 2.5 seconds.
- Deceleration coefficients for the purpose of SISD calculations are 0.46 for light vehicles and 0.24 for heavy vehicles.
- Driver eye height is 2.4 metres for trucks and 1.1 metres for cars.
- Speed zone of 100 km/h on the Riverina Highway along the subject section being assessed.

The results are summarised in **Table 15**.

Table 15 Safe intersection sight distance requirements

Location	Vehicle Type	Design Speed	Decision time	Grade	Required SISD
Riverina Highway	Truck	100 km/h	3.0 + 2.5 s	0 %	316 m
	Car	100 km/h	3.0 + 2.5 s	0 %	238 m

Source – Urbis

Near the site access point, the Riverina Highway is a straight road with a sight distance of more than 350 metres in both eastbound and westbound directions as shown in **Figure 21**. This length satisfies the SISD requirements. Accordingly, the available sight distance from the driveway can be considered adequate for the proposed site access.

Figure 20 Available sight distance from the site access point



Source – Urbis

4.7.3.2. Deceleration Lane Requirements

Following from the sight distance assessment of the proposed new access point from the Riverina Highway, a review of access requirements using a turn warrants assessment outlined Austroads *Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings Management* Section 3.3.6 Warrants for Basic Access (BA), Auxiliary Lanes (AU) and Channelised Lanes (CH) Turn Treatments was undertaken. This process assesses the major road volume (Q_M) against the left (Q_L) or right (Q_R). The volumes on Riverina Highway for the left and right turn are shown in **Table 16**.

Table 16 Major road traffic volumes and proposed turn treatment types

Movement	Calculation	Design hour volume (vph)	Proposed Turn Treatment Type
Left turn	$Q_M = Q_{T2}$	68	Auxiliary left turn lane treatment (AUL)
Right turn, no splitter	$Q_M = Q_{T1} + Q_{T2} + Q_L$	382	No change

Source: Austroads

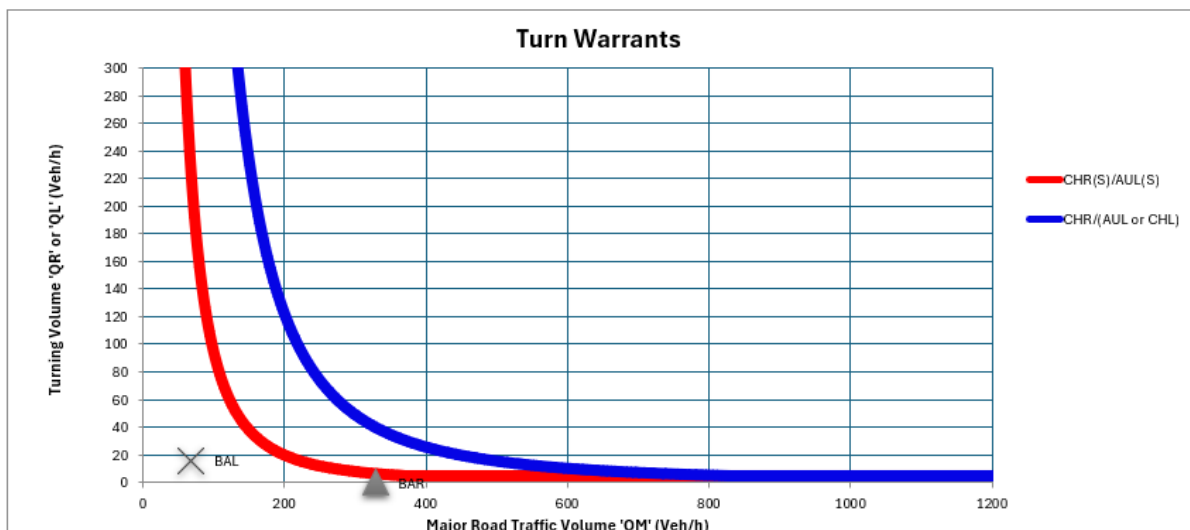
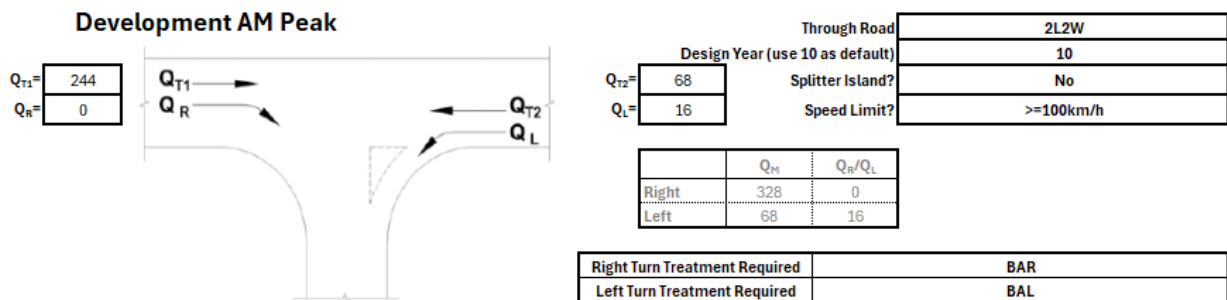
The traffic volume on the Riverina Highway (Q_M) has been calculated as 382 vehicles per hour (vph) for right-hand turns and 68 vph for left-hand turns. These figures were obtained by combining the construction trip generation data with the background traffic volumes detailed in **Section 2.4.4** of this report, specifically during the AM peak hour.

The maximum construction traffic approaching the site from Deniliquin is 16 vph. This value has been used in the assessment of the Riverina Highway intersection as Q_L . This is a conservative measure as it considers the absolute peak for construction vehicle generation. This generation is only expected to occur for a few months of the program. There is no Q_R volume based on the construction trip distribution.

Figure 22 plots to Q_M and Q_R / Q_L volumes against the Austroads turn warrants assessment diagram to gain an understand of access requirements.

Figure 21 Warrants for BA treatment

Riverina Highway / Site Access



Source – Austroads modified by Urbis

Based on **Figure 22**, a BA treatment for the left turn into the site would be sufficient. However, it is proposed to provide a full AUL to support the left turn movement into the site to better support the safe and efficient access of vehicles, particularly heavy vehicles. During construction, no vehicles are proposed to make a right turn into the site. As a result, no change to the current arrangement for right turn movements into the site is proposed. Vehicles travelling westbound on the Riverina Highway are associated with existing background traffic volumes and not associated with site trip generation.

The proposed AUL has been designed in accordance with *Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections*. The result of this is a deceleration lane 181 metres in length, including 34 metres of taper. The concept design of the proposed access to the site from the Riverina Highway was previously shown in **Figure 11**.

4.7.4. Cumulative Impact of Construction Vehicles

The SEARs for Deniliquin BESS requests undertaking a cumulative assessment having regarded the other nearby developments. As such, developments within the 50 kilometres radius have been considered. The

cumulative assessment for the 50 kilometres radius incorporates developments that are likely to utilise the proposed access / haulage routes in the surrounding road context.

Table 17 shows the developments considered in the cumulative impacts assessment, and their likelihood to coincide with nearby developments.

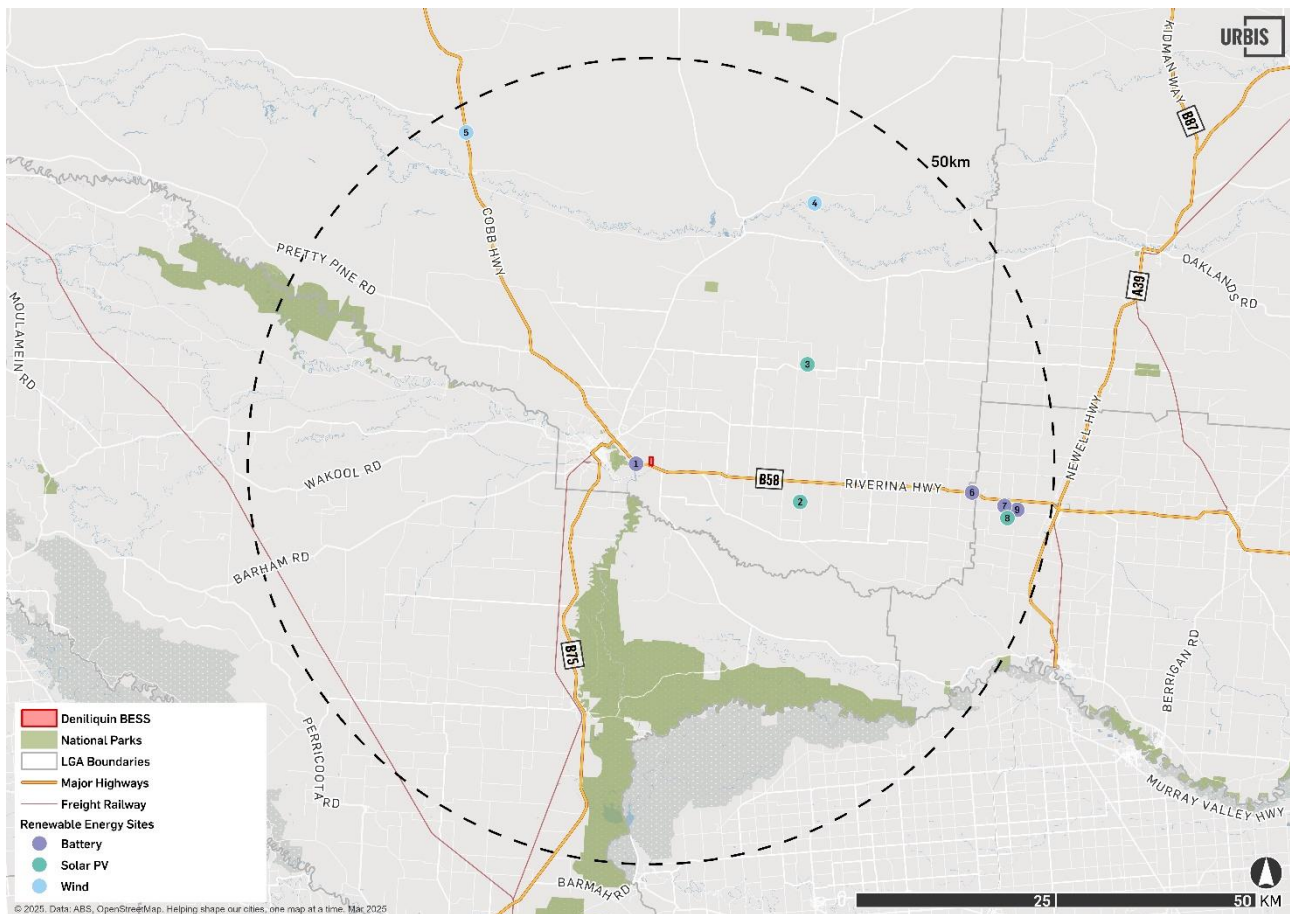
Table 17 Summary of nearby developments

Development	Map ID	Address	Planning Stage	Timing	Trips Generated	Likely to Coincide with Project
Deniliquin BESS	1	21541 Riverina Highway, Deniliquin, NSW	Proposed	Mid 2027	166 vpd (estimate)	High
Tarleigh Park Solar Farm	2	260 Parfreys Road, Deniliquin, NSW 2713	Approved	Unknown	285 vpd (estimate)	Low
Currawarra Solar Farm	3	1385 Mayrung Road, Deniliquin, NSW 2710	Approved	Unknown	303 vpd (estimate)	Low
Conargo Wind Farm	4	526 Yanco Road, Conargo, NSW 2710	Proposed	Unknown	Unknown	Low
Wanganella Wind Farm	5	Riverina Highway, Finley, NSW 2713	Proposed	Estimated construction 2027 and operation 2030+	Unknown	Low to medium
Finley BESS	6	16891 Riverina Highway, Finley, NSW 2713	Proposed	Unknown	Unknown	Low
Berrigan BESS	7	168 Canalla Road, Finley, NSW 2713	Proposed	Unknown	Unknown	Low
Finley Solar Farm	8	Broockmanns and Canalla Road Reserves, Finley, NSW 2713	Approved	Operational since 2019	2 vpd (estimate)	Low
South Coree BESS	9	198 Canalla Road, Finley, NSW 2713	Proposed	Unknown	Unknown	Low
Total					754 vpd	N/A

Source: Urbis

Figure 18 shows the location of the other nearby developments considered.

Figure 22 Other nearby developments considered



Source: Urbis

Given the challenges of obtaining development information, the extent of this review has focused on the impacts along the Riverina Highway. The Riverina Highway has a capacity of 900 vehicles per hour in each direction (or 1,800 vehicles per hour for a two way, two lane road) based on *Austrroads Guide to Traffic Management Part 3 Section 5.3 Multi Lane Roads*.

There is limited publicly available information on timing and associated trip generation for the surrounding developments, except for the Deniliquin BESS, Tarleigh Park Solar Farm, and Currawarra Solar Farm. It is noted that both Tarleigh Park and Currawarra Solar Farms have approved planning consents, while most other projects are still in the early development stages. Finley Solar Farm has been operational since 2019, and the trips generated during its operation is low, peaking at a maximum of two movements per day.

In assessing the worst-case scenario, all surrounding developments have been considered to evaluate the cumulative impact during construction.

The only development to the west of Deniliquin that is expected to use Riverina Highway is the Deniliquin BESS site which has an estimated peak construction period vehicle trip generation of 68 vehicles per day and an associated peak hour generation of 52 vehicles per hour¹. Developments to the east, such as Tarleigh Park Solar Farm and Currawarra Solar Farm, are also likely to use Riverina Highway. However, preliminary investigations suggest that construction traffic will potentially access the sites from the east, indicating a minimal impact on Deniliquin.

¹ Source: Deniliquin BESS Traffic Impact Assessment, dated November 2024, prepared by Amber Traffic and Transportation for NGH Consulting Pty Ltd

The cumulative impact of the proposed development and the nearby Deniliquin BESS is expected to result in an additional 68 peak hour vehicles movement on Riverina Highway. This would result in the total peak hour vehicle movements on the Riverina Highway being in the order of 308 vehicles per hour (existing volume of 240 vehicles per hour plus 68 vehicles per hour due to cumulative development). The cumulative total peak hour volume of 308 vehicles per hour is well within the 1,800 vehicles per hour capacity for a two-way, two-lane road. The cumulative impact on the operation of the Riverina Highway is therefore expected to be minimal.

While the cumulative traffic impact during construction is anticipated to be minimal, to mitigate the risk of project overlaps, it is recommended that the construction contractor liaise with the surrounding approved and proposed developments to understand their construction schedule and coordinate with other nearby developments should any overlapping construction works occur.

4.8. MITIGATION MEASURES

4.8.1. Dilapidation Survey

Before commencing construction, the contractor will conduct a dilapidation survey of the nearby roads within a two-kilometre radius of the BESS site. This survey will involve creating a written report and taking photos of any existing damage to public infrastructure. The report will cover the condition of table drains, gravel road surfaces, seals, signs, and other public infrastructure in front of the property, neighbouring properties, and along the designated haulage route.

During and immediately after construction, continued monitoring of the road conditions shall be made by the Contractor, site management team and a nominated representative. If any significant damage is caused by the Contractor or its subcontractors, the Site manager shall engage a contractor to repair the roads.

The log of photographic evidence shall be used as a reference in determining the extent of road dilapidation. Unless identified in the written report, any damage to infrastructure identified post construction will be attributed to the development.

It should be noted that the ultimate nature of the dilapidation surveys will be subject to agreement with TfNSW and Edward River Council. A copy of the road dilapidation report shall be submitted to TfNSW / Council prior to the commencement of works and once construction works are completed.

4.8.2. Construction Vehicle Movements Management

During construction, all vehicles and machinery associated with the construction of the site will be contained within the site. All vehicles associated with construction works, including the delivery and removal of materials and debris, will use the haulage route identified in **Section 4.3**. Appropriate traffic control measures will be taken to notify other road users of large vehicles entering and exiting the site. The detailed route assessment also considers support vehicles and a single escort vehicle (with three certified pilots to allow for rotation) accompanying the OSOM vehicle. An OSOM vehicle permit may need to be obtained from the NHVR. During the delivery of oversized materials, short-duration traffic control temporarily blocking access to certain sections of the Riverina Highway may be required.

The use of mobile cranes will be required during the unloading of batteries, which will take place only within the site. The contractor will further outline the nature and method of unloading the batteries.

To minimise disruptions and congestion, the project will schedule the movement of oversized vehicles outside of peak traffic periods. A detailed route assessment of the OSOM route has been completed. TfNSW raised concerns about the suitability of structures along the route. Details of the haulage route will be provided to both DTP and TfNSW assets teams for assessment and have confirmed that the route is suitable.

A bridge will be constructed over the irrigation canal to support site access. Detailed drawings of this bridge will be provided during the post-approval stage.

4.8.3. Worker Vehicle Management

As discussed in **Section 4.7**, two shuttle buses and six utility vehicles will be used to ferry staff to and from the site. The shuttle buses will be used to transport the majority of workers. The process for worker collection will be as follows:

- Workers travelling on shuttle buses will be housed in accommodation in Deniliquin or nearby towns, they will be grouped in nearby accommodation to ensure easy pick up.
- Workers will arrive a designated must point 45 minutes before the start of the work day.
- Buses will collect staff 30 minutes prior to the on site start time to allow for travel.
- In the evening, workers will be collected from site and ferried back to the muster point.

- Workers travelling in utility vehicles will be car pooling with two people per vehicle. To ensure that this is maintained, staff will be accommodated together in the same accommodation in Deniliquin or surrounding towns.

4.8.4. Weather Management

Local climate conditions are a key consideration for both the movement of vehicles and completing construction work. In the local area, two key environmental factors should be considered:

- Extreme heat – Deniliquin often has days above 30 degrees. Consideration for worker safety based on heat impacts will be completed each day during the pre-start checks. All work and deliveries will halt once the threshold for worker safety is passed.
- Flash flooding – The site is located adjacent to an irrigation canal in flat terrain. Appropriate safety measures and emergency procedures will be developed as a part of the detailed Construction Management Plan. All works and deliveries will stop if flooding and heavy rain is forecast.

4.8.5. Nature of Loads and Monitoring

Traffic monitoring during the construction phase will include daily pre-start visual inspections of vehicles to ensure that the vehicles are in good working order and follow manufacturer specifications. Noise controls (efficient silencers, low-noise mufflers, etc.) must be installed and maintained (where reasonable and practicable).

Deliveries to the site will be tracked in a register to ensure that allowable limits outlined in the conditions are maintained.

Civil works vehicles, including standard construction materials, concrete, prefabricated components, and steel reinforcement, shall cover their loads.

Street sweeping shall be undertaken following sediment tracking from the site if required. Soil is loaded onto trucks using machinery such as diggers, loaders and excavators. All trucks used to transport contaminated soil are licenced by the EPA. All trucks removing soil and material from the construction work site are covered to prevent dirt and dust from escaping. The project also aims to minimise the length of time that spoil is stockpiled on site.

No building materials, waste, machinery, or related matter shall be stored on the road. All loading and unloading of vehicles shall occur within the boundaries of the site. Truck tyres will need to be washed prior to entering the public roadway from the site.

The construction contractor is obligated to manage any debris or damage to roads in which vehicles associated with construction travel. Mitigation measures such as sediment tracking, dust suppression and wheel cleaning will be implemented to ensure debris from the site is managed. Remediation to public roads if required due to damage caused by vehicles associated with the site will be undertaken by the proponent.

A driver code of conduct for vehicles associated with the development has been prepared in draft and is shown in **Appendix E**. All drivers will be obliged to attend a pre-start briefing covering driver safety before the commencement of the project.

4.8.6. Community Consultation

The Project Manager will consult with and notify the surrounding property owners and any affected businesses of the proposed works and the proposed traffic management strategy.

A project-specific communication strategy will be developed by the contractor to determine the most effective way of notifying all affected parties. Where required, consultation will also be undertaken with the responsible road authority to determine suitable communication methods.

Possible communication methods that could be utilised are as follows:

- Mail drop to local residents.
- Email lists.
- Variable Message Signage.
- Noticeboard/Poster signage.
- Media advertisement (radio/newspaper).
- Website.

4.8.7. Impact on Public Transport Routes

The construction vehicles may overlap with the local bus route in Deniliquin, however, the low frequency of construction vehicle trip generation will result in a minimal impact on the surrounding public transport network. Major deliveries will be coordinated as not to occur during peak transit times. The only route that may be impacted is the DTS bus route.

4.8.8. Local Events

Through community engagement, local events (such as Deniliquin Ute Muster and Deni Fest) will be kept informed about the development. Additionally, construction vehicles will be coordinated to manage deliveries in a way that minimises impacts on major events.

4.8.9. Travelling Stock Routes

A review of travelling stock routes was completed and no known stock routes were identified along the corridor.

4.8.10. Environmental Impacts

Monitoring of the project site for environmental impacts such as noise, dust and drainage will occur throughout the project. Mitigation measures for these issues will be identified in the contractor's management plans.

4.8.11. Traffic Management Plan

A traffic management plan will be prepared by the contractor, prior to the issue of a Construction Certificate. This will include details of on-road management, location of workers and other relevant traffic management associated with major deliveries.

4.8.12. Hazardous Goods

According to State Environmental Planning Policy (Resilience and Hazards) 2021 (SEPP), PHA lithium batteries are identified as a Class 9 Dangerous Goods. When transporting these goods, compliance with the *Australian Code for Transport of Dangerous Goods by Road and Rail* needs to be achieved by the contractor. As stated in the Preliminary Hazard Assessment prepared by RiskCon for this development, the batteries will comply with testing in accordance UL9540A to ensure safety during transport.

5. TRANSPORT IMPACT ASSESSMENT

The following section assesses the transport impact of the site during the operational stage of the development. **Section 4** of this report reviews the construction transport impact.

5.1. ACCESS AND SERVICING

There is a singular access driveway to the internal road via a proposed bridge across the irrigation canal from the Riverina Highway as shown in **Figure 10**. This access point will be used for all vehicular access to the BESS for construction, maintenance and emergency purposes. Detailed design of the proposed bridge across the canal will be prepared and submitted prior to the issue of a Construction Certificate.

The sight distance and deceleration lane requirements have been assessed to accommodate vehicle movements during the construction stage. This process is outlined in **Section 4.7.3**.

5.2. OPERATIONAL TRIP GENERATION

The BESS site will operate with up to four permanent staff personnel and generate minimal regular traffic movements. One to three staff will be servicing the site on a daily basis, as well as occasional contractors. It is assumed that all of these staff will be driving individually to the site.

5.3. CUMULATIVE IMPACT OF OTHER SURROUNDING DEVELOPMENTS

Similar to the proposed development during the operational period, the surrounding renewable projects are anticipated to generate operational / maintenance staff. The Deniliquin BESS solar farm is estimated to generate traffic volumes of up to eight vehicle movements per day during the operational phase. There is minimal information about the other solar farms developments, but similar operational phase traffic generation can be estimated. As a result, the combined traffic impact of the proposed BESS development and the surrounding solar farm developments is anticipated to be minimal.

5.4. EMERGENCY VEHICLE ACCESS

NSW Government / NSW Rural Fire Service *Planning for Bush Fire Protection Guide* outlines the standards for providing safe, efficient and effective access for fire brigade vehicles to any premises.

The document outlines the following requirements for carriageway widths. A carriageway is to be wide enough to allow easy navigation by the fire appliance and provide room around the vehicle to allow firefighters to exist and work with equipment. Along any straight carriageway section, the minimum width should be designated as 5.5m, as shown in **Figure 23**.

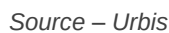
Figure 23 NSW RFS standard internal road type



Source - NSW Government / NSW Rural Fire Service *Planning for Bush Fire Protection*

The road network within the site shows that all internal roads are a minimum of six metres wide and can support the safe access of emergency vehicles.

Figure 24 Swept path of RFS vehicle circulating around the site



After an anticipated forty years of operation, decommissioning and rehabilitation of the site would be undertaken. In this process, all above ground infrastructure would be removed with the possible exception of the 66kV substation, as this would be at the discretion of the asset's owner. Key elements of decommissioning include:

- Traffic management required for decommissioning would be similar in type but of shorter duration than that anticipated during the construction phase. Detailed trip generation and vehicle types will be prepared in a Decommissioning TMP and submitted to relevant authorities near the decommissioning time of the site.

6. CONCLUSION

Based on the assessment, the following can be concluded about the proposed BESS development.

Access to the site will be via a single crossover to Riverina Highway. The access point has been designed conservatively to include an AUL deceleration lane to support left turning into the site of construction vehicles. A newly constructed bridge will be provided over the irrigation canal to facilitate entry to the site. Detailed designs for the access and bridge will be submitted prior to the issuance of a Construction Certificate.

Deliveries to the site will be from the Port of Melbourne and will utilise a number of roads including the Riverina Highway to access the site. During the construction, one OSOM vehicle will be accessing the site. **Appendix D** highlights the vehicle dimensions and a detailed assessment of the haulage route from the Port of Melbourne through the site. The route assessment confirms that the proposed vehicle route can accommodate the OSOM vehicle, with special permits and traffic control measures required to support its delivery to the site.

During construction, all workers will be staying off-site (likely in Deniliquin) and a maximum of 52 workers will be accessing the site. The workers will be accessing the site via a shuttle bus or light utility vehicle. During peak construction, there will be a maximum of 70 vehicle trips a day. This number is anticipated to be accommodated within the road capacity of the Riverina Highway and is expected to have a minimal impact on key intersections in Deniliquin.

During operation, one to three staff will be servicing the site on a daily basis, as well as occasional contractors. It is assumed that all these staff will be driving individually to the site. The operational stage of the development is anticipated to generate minimal traffic impact.

The site's internal road network will be designed in accordance with the NSW Government / NSW Rural Fire Service Planning for Bush Fire Protection guide as discussed in **Section 5.4**.

Appropriate traffic control and management measures will need to be adopted for the safe manoeuvrability of construction delivery vehicles in and out of the development as outlined in **Section 4**. Swept path diagrams for construction delivery vehicles entering the site from the Riverina Highway are shown in **Appendix F**.

The cumulative impact of the site and other surrounding developments have been reviewed for both the construction phase and operational phase. Given the low traffic-generating potential of the renewable energy projects, the cumulative impact of the sites during operation is expected to be minimal. While a high-level assessment during construction has been completed, information gaps present challenges to quantify the cumulative impacts at this time and it is recommended that the contractor review new information from other surrounding developments as they come into the public forum and coordinate where necessary.

7. DISCLAIMER

This report is dated 15th May 2025 and incorporates information and events up to that date only and excludes any information arising, or event occurring, after that date that may affect the validity of Urbis Pty Ltd (**Urbis**) opinion in this report. Urbis prepared this report on the instructions, and for the benefit only, of BESS Arctic Pty Ltd C/- Gransolar Development Australia (**Instructing Party**) for the purpose of Deniliquin Battery Energy Storage System Transport Impact Assessment (**Purpose**) and not for any other purpose or use. To the extent permitted by applicable law, Urbis expressly disclaims all liability, whether direct or indirect, to the Instructing Party which relies or purports to rely on this report for any purpose other than the Purpose, and to any other person which relies or purports to rely on this report for any purpose whatsoever (including the Purpose).

In preparing this report, Urbis was required to make judgements that may be affected by unforeseen future events, the likelihood and effects of which are not capable of precise assessment.

All surveys, forecasts, projections and recommendations contained in or associated with this report are made in good faith and on the basis of information supplied to Urbis at the date of this report, and upon which Urbis relied. Achievement of the projections and budgets set out in this report will depend, among other things, on the actions of others over which Urbis has no control.

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This report has been prepared with due care and diligence by Urbis and the statements and opinions given by Urbis in this report are given in good faith and in the reasonable belief that they are correct and not misleading, subject to the limitations above.

APPENDIX A TRAFFIC COUNTS

Location Finley Street Wanderer Street Riverina Highway
 Suburb DENILIQUIN
 Duration 6:00 - 10:00
 Date Thursday 21 March 2024
 Weather

All Vehicles Time Per 15 Mins		NORTHWEST Finley Street										NORTHEAST Wanderer Street										TOTAL		
		L					R					L					R							
		LIGHT		HEAVY		Σ	LIGHT		HEAVY		Σ	LIGHT		HEAVY		Σ	LIGHT		HEAVY		Σ			
		TOTAL		TOTAL		TOTAL	TOTAL		TOTAL		TOTAL	TOTAL		TOTAL		TOTAL	TOTAL		TOTAL		TOTAL			
6:00 - 6:15	24	1	25	9	1	10					35	0	0	0				9	1	10	10	49	4	53
6:15 - 6:30	19	0	19	5	1	6					25	0	0	0				8	0	8	8	41	2	43
6:30 - 6:45	26	1	27	8	0	8					35	1	0	1				7	1	8	9	58	5	63
6:45 - 7:00	21	0	21	7	0	7					28	0	0	0				8	1	9	9	61	3	64
7:00 - 7:15	13	0	13	13	2	15					28	0	0	0				14	2	16	16	54	7	61
7:15 - 7:30	15	2	17	13	1	14					31	1	0	1				12	3	15	16	63	7	70
7:30 - 7:45	21	2	23	19	5	24					47	3	0	3				18	3	21	24	91	13	104
7:45 - 8:00	22	1	23	8	1	9					32	3	0	3				27	0	27	30	90	5	95
8:00 - 8:15	19	4	23	6	2	8					31	2	0	2				31	4	35	37	82	15	97
8:15 - 8:30	16	4	20	10	6	16					36	3	2	5				34	2	36	41	95	15	110
8:30 - 8:45	17	2	19	14	3	17					36	2	1	3				34	3	37	40	93	10	103
8:45 - 9:00	26	5	31	16	1	17					48	0	0	0				36	0	36	36	114	11	125
9:00 - 9:15	10	4	14	23	1	24					38	0	1	1				17	4	21	22	77	12	89
9:15 - 9:30	9	6	15	13	0	13					28	2	1	3				22	5	27	30	78	17	95
9:30 - 9:45	13	2	15	18	3	21					36	3	0	3				16	3	19	22	74	9	83
9:45 - 10:00	20	6	26	20	2	22					48	4	0	4				26	1	27	31	95	13	108
Period End	291	40	331	202	29	231					562	24	5	29				319	33	352	381	1215	148	1363
15:00 - 15:15	27	4	31	20	3	23					54	1	0	1				20	3	23	24	95	11	106
15:15 - 15:30	27	5	32	25	13	38					70	3	0	3				28	1	29	32	102	21	123
15:30 - 15:45	21	2	23	19	1	20					43	3	0	3				33	12	45	48	102	15	117
15:45 - 16:00	29	4	33	19	0	19					52	0	0	0				23	2	25	25	93	12	105
16:00 - 16:15	19	2	21	24	0	24					45	3	2	5				35	2	37	42	100	10	110
16:15 - 16:30	24	0	24	16	3	19					43	4	0	4				25	2	27	31	96	7	103
16:30 - 16:45	27	2	29	36	2	38					67	1	0	1				21	2	23	24	104	8	112
16:45 - 17:00	21	0	21	40	1	41					62	3	0	3				33	5	38	41	120	7	127
17:00 - 17:15	36	3	39	35	1	36					75	4	0	4				21	1	22	26	114	5	119
17:15 - 17:30	20	2	22	20	1	21					43	0	0	0				19	0	19	19	86	4	90
17:30 - 17:45	26	1	27	24	3	27					54	0	0	0				23	0	23	23	88	6	94
17:45 - 18:00	14	0	14	23	0	23					37	3	0	3				35	1	36	39	87	3	90
18:00 - 18:15	18	2	20	12	1	13					33	0	0	0				12	1	13	13	52	5	57
18:15 - 18:30	15	0	15	11	0	11					26	1	0	1				13	1	14	15	51	1	52
18:30 - 18:45	10	2	12	12	0	12					24	1	0	1				10	1	11	12	43	4	47
18:45 - 19:00	5	2	7	9	0	9					16	1	0	1				6	0	6	7	27	3	30
Period End	339	31	370	345	29	374					744	28	2	30				357	34	391	421	1360	122	1482

All Vehicles Time Per 15 Mins		SOUTHEAST Riverina Highway										WEST -										TOTAL				
		L					R					L					R									
		LIGHT		HEAVY		Σ	LIGHT		HEAVY		Σ	LIGHT		HEAVY		Σ	LIGHT		HEAVY		Σ					
		TOTAL		TOTAL		TOTAL	TOTAL		TOTAL		TOTAL	TOTAL		TOTAL		TOTAL	TOTAL		TOTAL		TOTAL					
6:00 - 6:15				6	1	7				1	0	1												49	4	53
6:15 - 6:30				8	1	9				1	0	1												41	2	43
6:30 - 6:45				13	3	16				3	0	3												58	5	63
6:45 - 7:00				19	2	21				6	0	6												61	3	64
7:00 - 7:15				13	2	15				1	1	2												54	7	61
7:15 - 7:30				21	1	22				1	0	1												63	7	70
7:30 - 7:45				25	3	28				5	0	5												91	13	104
7:45 - 8:00				29	2	31				1	1	2												90	5	95
8:00 - 8:15				21	4	25				3	1	4												82	15	97
8:15 - 8:30				31	1	32				1	0	1												95	15	110
8:30 - 8:45				23	1	24				3	0	3												93	10	103
8:45 - 9:00				34	4	38				2	1	3												114	11	125
9:00 - 9:15				24	2	26				3	0	3												77	12	89
9:15 - 9:30				29	5	34				3	0	3												78	17	95
9:30 - 9:45				23	1	24				1	0	1												74	9	83
9:45 - 10:00				23	4	27				2	0	2												95	13	108
Period End				342	37	379				37	4	41												1215	148	1363
15:00 - 15:15				23	1	24				4	0	4												95	11	106
15:15 - 15:30				16	2	18				3	0	3												102	21	123
15:30 - 15:45				25	0	25				1	0	1												102	15	117
15:45 - 16:00				20	6	26				2	0	2												93	12	105
16:00 - 16:15				18	4	22				1	0	1												100	10	110
16:15 - 16:30				26	2	28				1	0	1												96	7	103
16:30 - 16:45				19	2	21				0	0	0												104	8	112
16:45 - 17:00				22	1	23				1	0	1												120	7	127
17:00 - 17:15				18	0	18				0	0	0												114	5	119
17:15 - 17:30				25	1	26				2	0	2												86	4	90
17:30 - 17:45				14	2	16				1	0	1												88	6	94
17:45 - 18:00				12	2	14				0	0	0												87	3	90
18:00 - 18:15				10	1	11				0	0	0												52	5	57
18:15 - 18:30				10	0	10				1	0	1												51	1	52
18:30 - 18:45				9	1	10				1	0	1												43	4	47
18:45 - 19:00				6	1	7				0	0	0												27	3	30
Period End				273	26	299				18	0	18												1360	122	1482

Location: Finley Street
Wanderer Street
Riverina Highway
Date: Thursday 21 March
Suburb: DENILQUIN
Weather: -

All Vehicles Time Per Hour		NORTHWEST Finley Street										NORTHEAST Wanderer Street										TOTAL		TOTAL							
		L				I				R				TOTAL		L				I				R				TOTAL		TOTAL	
		LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	TOTAL	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	TOTAL	LIGHT	HEAVY	Σ	TOTAL	LIGHT	HEAVY	Σ	TOTAL	LIGHT	HEAVY	Σ	TOTAL	
6:00	- 7:00	90	2	92	29	2	31				123	1	0	1				36	209	14	223										
6:15	- 7:15	79	1	80	33	3	36				116	1	0	1				42	214	17	231										
6:30	- 7:30	75	3	78	41	3	44				122	2	0	2				48	236	22	258										
6:45	- 7:45	70	4	74	52	8	60				134	4	0	4				61	269	30	299										
7:00	- 8:00	71	5	76	53	9	62				138	7	0	7				79	298	32	330										
7:15	- 8:15	77	9	86	46	9	55				141	9	0	9				98	326	40	366										
7:30	- 8:30	78	11	89	43	14	57				146	11	2	13				119	358	48	406										
7:45	- 8:45	74	11	85	38	12	50				135	10	3	13				135	360	45	405										
8:00	- 9:00	78	15	93	46	12	58				151	7	3	10				144	384	51	435										
8:15	- 9:15	69	15	84	63	11	74				158	5	4	9				130	379	48	427										
8:30	- 9:30	62	17	79	66	5	71				150	4	3	7				121	362	50	412										
8:45	- 9:45	58	17	75	70	5	75				150	5	2	7				91	343	49	392										
9:00	- 10:00	52	18	70	74	6	80				150	9	2	11				81	324	51	375										
Period End																															
15:00	- 16:00	104	15	119	83	17	100				219	7	0	7				122	392	59	451										
15:15	- 16:15	96	13	109	87	14	101				210	9	2	11				136	397	58	455										
15:30	- 16:30	93	8	101	78	4	82				183	10	2	12				134	391	44	435										
15:45	- 16:45	99	8	107	95	5	100				207	8	2	10				112	393	37	430										
16:00	- 17:00	91	4	95	116	6	122				217	11	2	13				125	420	32	452										
16:15	- 17:15	108	5	113	127	7	134				247	12	0	12				110	434	27	461										
16:30	- 17:30	104	7	111	131	5	136				247	8	0	8				102	424	24	448										
16:45	- 17:45	103	6	109	119	6	125				234	7	0	7				102	408	22	430										
17:00	- 18:00	96	6	102	102	5	107				209	7	0	7				98	375	18	393										
17:15	- 18:15	78	5	83	79	5	84				167	3	0	3				91	313	18	331										
17:30	- 18:30	73	3	76	70	4	74				150	4	0	4				86	278	15	293										
17:45	- 18:45	57	4	61	58	1	59				120	5	0	5				74	233	13	246										
18:00	- 19:00	48	6	54	44	1	45				99	3	0	3				44	173	13	186										
Period End																															

All Vehicles Time Per Hour		SOUTHEAST Riverina Highway										WEST -										TOTAL		TOTAL							
		L				I				R				TOTAL		L				I				R				TOTAL		TOTAL	
		LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	TOTAL	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	TOTAL	LIGHT	HEAVY	Σ	TOTAL	LIGHT	HEAVY	Σ	TOTAL	LIGHT	HEAVY	Σ	TOTAL	
6:00	- 7:00				46	7	53	11	0	11	64								209	14	223										
6:15	- 7:15				53	8	61	11	1	12	73								214	17	231										
6:30	- 7:30				66	8	74	11	1	12	86								236	22	258										
6:45	- 7:45				78	8	86	13	1	14	100								269	30	299										
7:00	- 8:00				88	8	96	8	2	10	106								298	32	330										
7:15	- 8:15				96	10	106	10	2	12	118								326	40	366										
7:30	- 8:30				106	10	116	10	2	12	128								358	48	406										
7:45	- 8:45				104	8	112	8	2	10	122								360	45	405										
8:00	- 9:00				109	10	119	9	2	11	130								384	51	435										
8:15	- 9:15				112	8	120	9	1	10	130								379	48	427										
8:30	- 9:30				110	12	122	11	1	12	134								362	50	412										
8:45	- 9:45				110	12	122	9	1	10	132								343	49	392										
9:00	- 10:00				99	12	111	9	0	9	120								324	51	375										
Period End																															
15:00	- 16:00				84	9	93	10	0	10	103								392	59	451										
15:15	- 16:15				79	12	91	7	0	7	98								397	58	455										
15:30	- 16:30				89	12	101	5	0	5	106								391	44	435										
15:45	- 16:45				83	14	97	4	0	4	101								393	37	430										
16:00	- 17:00				85	9	94	3	0	3	97								420	32	452										
16:15	- 17:15				85	5	90	2	0	2	92								434	27	461										
16:30	- 17:30				84	4	88	3	0	3	91								424	24	448										
16:45	- 17:45				79	4	83	4	0	4	87								408	22	430										
17:00	- 18:00				69	5	74	3	0	3	77								375	18	393										
17:15	- 18:15				61	6	67	3	0	3	70								313	18	331										
17:30	- 18:30				46	5	51	2	0	2	53								278	15	293										
17:45	- 18:45				41	4	45	2	0	2	47								233	13	246										
18:00	- 19:00				35	3	38	2	0	2	40								173	13	186										
Period End																															

Location	Hay Road	Duration	6:00	10:00
	Albert Street		15:00	19:00
	Finley Road			-
	Davidson Street	Day/Date	Tuesday, 27 August 2024	
	Albert Street	Weather	Dry	
Suburb	DENILQUIN			

[illegible]

Location	Hay Road	Duration	6:00	10:00
	Albert Street		15:00	19:00
	Finley Road		-	-
	Davidson Street	Day/Date	Tuesday, 27 August 2024	
Suburb	Albert Street	Weather	Dry	
Suburb	DENILIQUIN			

All Vehicles Time Per Hour	NORTH Hay Road												NORTHEAST Albert Street												SOUTHEAST Davidson Street												TOTAL													
	L1			L2			T			R			U			TOTAL	L1			L2			T			R			U			TOTAL	L1			L2			T			R			U			TOTAL	TOTAL	TOTAL
	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ		LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ		LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ						
6:00 - 7:00	0	0	0	0	0	0	9	53	8	61	0	0	0	0	0	0	70	1	0	1	1	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	555	83	638				
6:15 - 7:15	0	0	0	14	5	19	137	17	154	0	0	0	0	0	0	0	173	0	0	0	4	1	5	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1074	149	1223			
6:30 - 7:30	0	0	0	17	5	22	143	19	162	0	0	0	0	0	0	0	184	0	0	0	5	1	6	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1124	164	1288			
6:45 - 7:45	0	0	0	19	7	26	153	18	171	0	0	0	0	0	0	0	197	0	1	1	1	1	1	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1163	162	1318			
7:00 - 8:00	0	1	1	21	7	28	169	21	190	0	0	0	0	0	0	0	219	1	1	2	7	2	9	0	0	0	3	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1218	165	1383			
7:15 - 8:15	0	2	2	44	14	58	346	46	392	0	0	0	0	0	0	0	452	3	2	5	15	4	18	0	0	0	5	0	5	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2589	357	3146				
7:30 - 8:30	3	2	5	71	18	89	460	57	517	0	0	0	0	0	0	0	611	8	2	10	25	4	29	0	0	0	5	0	5	0	0	0	0	0	0	0	0	0	0	0	0	2	2	3725	432	4157				
7:45 - 8:45	3	2	5	72	20	92	468	56	524	0	0	0	0	0	0	0	621	9	2	11	29	4	33	0	0	0	5	0	5	0	0	0	0	0	0	0	0	0	0	0	0	2	2	3753	428	4181				
8:00 - 9:00	3	2	5	73	20	93	465	57	522	0	0	0	0	0	0	0	626	10	2	12	30	4	34	0	0	0	5	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	3777	449	4226			
8:15 - 9:15	3	2	5	73	20	93	465	61	526	0	0	0	0	0	0	0	624	10	2	12	30	4	34	0	0	0	5	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	3802	446	4248			
8:30 - 9:30	3	2	5	75	18	93	457	60	517	0	0	0	0	0	0	0	615	10	2	12	32	4	36	0	0	0	5	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	3804	445	4247			
8:45 - 9:45	3	2	5	76	17	93	447	58	505	0	0	0	0	0	0	0	603	11	2	13	31	3	34	0	0	0	5	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	3801	446	4246			
9:00 - 10:00	4	2	6	75	15	90	438	59	497	0	0	0	0	0	0	0	593	12	2	13	31	3	34	0	0	0	5	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	3767	446	4213			
Period End																																																		
15:00 - 16:00	3	0	3	34	5	39	156	15	171	0	0	0	0	0	0	0	213	7	0	7	19	0	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1477	140	1617			
15:15 - 16:15	3	0	3	32	4	36	147	14	161	0	0	0	0	0	0	0	200	6	0	6	15	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1426	131	1557		
15:30 - 16:30	3	0	3	31	4	35	143	13	156	0	0	0	0	0	0	0	194	5	495	47	542	3	0	3	19	5	24	5	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1370	106	1476			
15:45 - 16:45	3	0	3	32	4	36	144	11	155	0	0	0	0	0	0	0	190	5	451	37	488	2	0	2	19	5	24	6	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	1298	93	1391				
16:00 - 17:00	3	0	3	28	4	32	130	11	141	0	0	0	0	0	0	0	176	5	0	5	13	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1217	85	1302				
16:15 - 17:15	6	0	6	66	10	76	298	28	326	0	0	0	0	0	0	0	408	11	0	11	33	0	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2793	229	3022			
16:30 - 17:30	5	0	5	66	10	76	288	26	314	0	0	0	0	0	0	0	395	11	0	11	33	0	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2680	218	2898		
16:45 - 17:45	4	0	4	64	9	73	277	25	302	0	0	0	0	0	0	0	379	10	0	10	30	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2545	208	2753		
17:00 - 18:00	4	0	4	60	8	68	256	23	279	0	0	0	0	0	0	0	351	10	0	10	28	0	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2397	198	2595		
17:15 - 18:15	4	0	4	58	8	66	242	23	265	0	0	0	0	0	0	0	335	7	803	65	868	5	0	5	28	9	37	9	0	9	1	0	1	0	0	0	0	0	0	0	0	0	0	1	1	2256	189	2445		
17:30 - 18:30	4	0	4	52	8	60	226	23	249	0	0	0	0	0	0	0	313	7	759	64	823	5	0	5	26	9	35	9	0	9	1	0	1	0	0	0	0	0	0	0	0	0	0	1	1	2145	185	2330		
17:45 - 18:45	3	0	3	56	10	66	209	23	232	26	3	29	2	0	2	332	10	0	10	23	0	23	4	0	4	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2025	181	2206		
18:00 - 19:00	3	0	3	53	10	63	203	23	226	51	4	55	2	0	2	349	11	0	11	23	0	23	6	0	6	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1917	176	2093		
Period End																																																		
All Vehicles Time Per Hour	SOUTHWEST Finley Road												NORTHWEST Davidson Street												TOTAL	TOTAL																								
	L1			L2			T			R1			R2			U			TOTAL	L1			L2			R			U			TOTAL	TOTAL	TOTAL																
	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ		LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ				LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ										
6:00 - 7:00	2	0	2	27	25	52	6	0	6	209	21	230	5	2	7	297	11	0	11	0	0	0	32	1	33	9	2	11	0	0	0	55	555	610																
6:15 - 7:15	3	0	3	65	33	98	8	0	8	325	45	370	12	2	14	493	13	0	13	0	0	0	40	1	41	12	2	14	0	0	0	68	1074	1142																
6:30 - 7:30	4	0	4	74	34	108	12	0	12	320	49	369	14	2	16	509	15	0	15	0	0	0	38	1	39	12	2	14	0	0	0	68	1124	1242																
6:45 - 7:45	3	0	3	85	32	117	15	0	15	319	50	369	15	2	17	521	14	0	14	0	0	0	38	1	39	10	2	12	0	0	0	65	1163	1268																
7:00 - 8:00	3	0	3	90	27	117	12	0	12	327	56	383	17	1	18	533	14	0	14	0	0	0	33	2	35	9	0	9	0	0	0	58	1218	1347																
7:15 - 8:15	7	0	7	184	65	249	27	0	27	734	115	849	36	3	39	1171	32	0	32	0	0	0	76	4	80	23	2	25	0	0	0	137	2589	3141																
7:30 - 8:30	18	0	18	316	76	392	32	0	32	1152	135	1287	54	3	57	1786	39	0	39	0	0	0	98	4	102	41	2	43	0	0	0	184	3725	4324																
7:45 - 8:45	18	0	18	331	76	407	36	0	36	1160	134	1294	55	2	57	1812	38	0	38	0	0	0	96	4	100	41	2	43	0	0	0	181	3753	4234																
8:00 - 9:00	20	0	20	342	77	419	35	0	35	1182	152	1334	54	2	56	1864	39	0	39	1	0	1	92	3	95	40	2	42	0	0	0	177	3777	4154																
8:15 - 9:15	21	0	21	345	777																																													

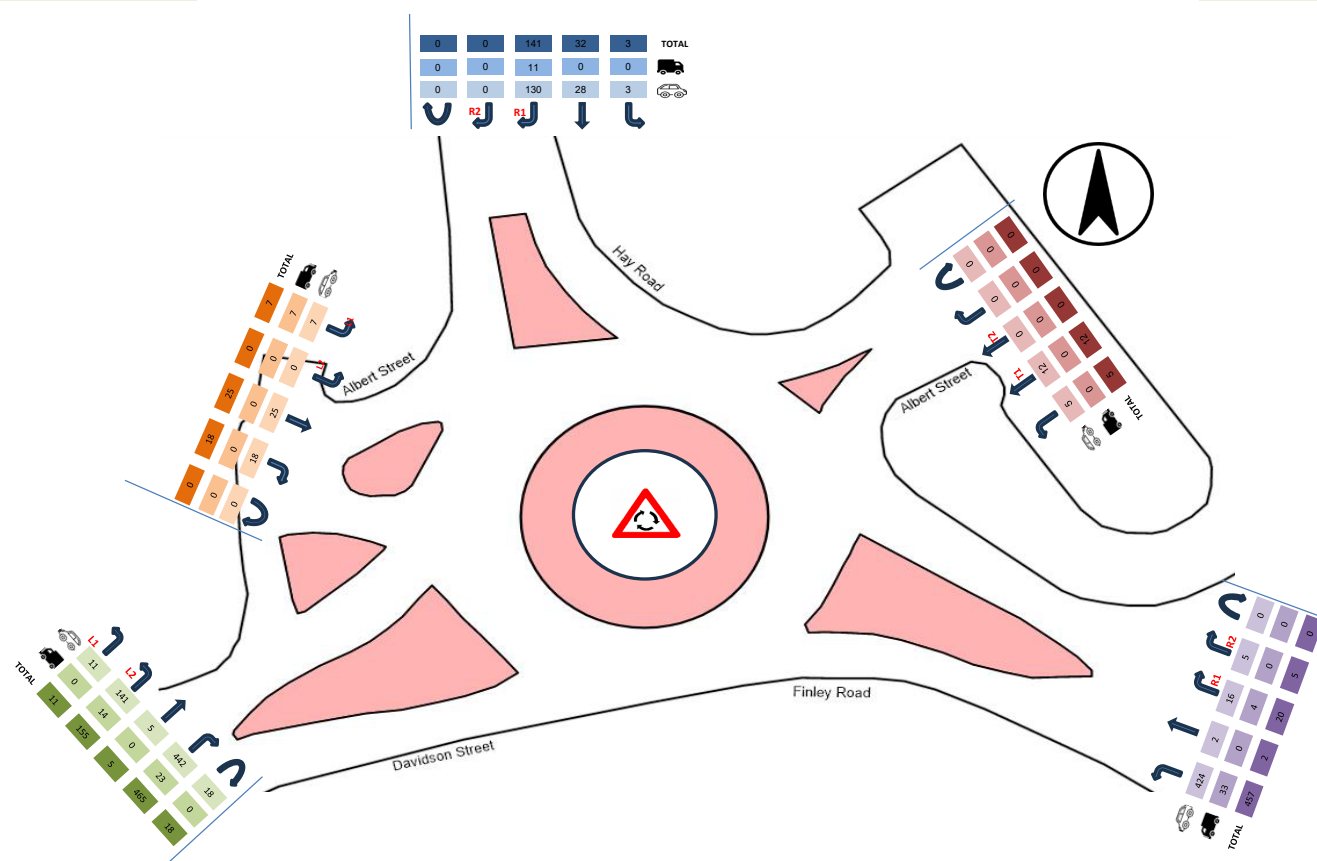
Location Hay Road
Albert Street
Finley Road
Davidson Street
Albert Street
 Suburb DENILQUIN

Duration 6:00 - 10:00
15:00 - 19:00
 Day/Date Tuesday, 27 August 2024
 Weather Dry

DATA SELECTION

Select Time:

TIME RANGE		
PEAK	-	PM
PEAK		
16:00	-	17:00



APPENDIX B SIDRA RESULTS

MOVEMENT SUMMARY

Site: 102 [Wanderer Street - Finley Road CON PM (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [PM - Construction (Network Folder: Construction)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%				[Veh. veh	Dist]				
			veh/h	%	veh/h	%	v/c	sec			m				km/h
SouthEast: Finley Road (SE)															
22	T1	All MCs	99	7.4	99	7.4	0.053	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
23	R2	All MCs	2	0.0	2	0.0	0.001	5.3	LOS A	0.0	0.0	0.35	0.48	0.35	45.2
Approach			101	7.3	101	7.3	0.053	0.1	NA	0.0	0.0	0.01	0.01	0.01	49.8
NorthEast: Wanderer Street (NE)															
24	L2	All MCs	13	0.0	13	0.0	0.009	5.0	LOS A	0.0	0.2	0.23	0.50	0.23	45.4
26	R2	All MCs	116	9.1	116	9.1	0.149	7.0	LOS A	0.6	4.5	0.45	0.65	0.45	42.2
Approach			128	8.2	128	8.2	0.149	6.8	LOS A	0.6	4.5	0.43	0.63	0.43	42.7
NorthWest: Finley Road (NW)															
27	L2	All MCs	119	4.4	119	4.4	0.142	3.9	LOS A	0.0	0.0	0.00	0.24	0.00	45.8
28	T1	All MCs	143	5.1	143	5.1	0.142	0.0	LOS A	0.0	0.0	0.00	0.24	0.00	47.9
Approach			262	4.8	262	4.8	0.142	1.8	NA	0.0	0.0	0.00	0.24	0.00	46.9
All Vehicles			492	6.2	492	6.2	0.149	2.7	NA	0.6	4.5	0.11	0.30	0.11	46.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

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

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

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

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

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

 **Site: 100 [Cobb Highway - Finley Road - Davidson Street-
Albert Street AM (Site Folder: General)]**

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

 **Network: N101 [AM
(Network Folder: Existing)]**

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh. veh	Dist] m				km/h
SouthEast: Finley Road (SE)															
21a	L1	All MCs	273	7.3	273	7.3	0.213	2.0	LOS A	1.2	9.2	0.30	0.31	0.30	46.3
22	T1	All MCs	366.7		366.7		0.213	2.6	LOS A	1.2	9.2	0.30	0.31	0.30	10.2
23a	R1	All MCs	616.7		616.7		0.213	6.4	LOS A	1.2	9.2	0.30	0.31	0.30	45.1
23b	R3	All MCs	250.0		250.0		0.213	8.6	LOS A	1.2	9.2	0.30	0.31	0.30	32.7
23u	U	All MCs	250.0		250.0		0.213	10.9	LOS B	1.2	9.2	0.30	0.31	0.30	33.5
Approach			286	8.8	286	8.8	0.213	2.2	LOS A	1.2	9.2	0.30	0.31	0.30	45.9
East: Albert Street (E)															
4b	L3	All MCs	1	0.0	1	0.0	0.008	2.3	LOS A	0.0	0.3	0.40	0.47	0.40	27.2
5	T1	All MCs	425.0		425.0		0.008	2.7	LOS A	0.0	0.3	0.40	0.47	0.40	44.4
6a	R1	All MCs	1	0.0	1	0.0	0.008	6.0	LOS A	0.0	0.3	0.40	0.47	0.40	8.1
6	R2	All MCs	1	0.0	1	0.0	0.008	7.0	LOS A	0.0	0.3	0.40	0.47	0.40	43.6
6u	U	All MCs	1	0.0	1	0.0	0.008	10.3	LOS B	0.0	0.3	0.40	0.47	0.40	28.3
Approach			812.5		812.5		0.008	4.6	LOS A	0.0	0.3	0.40	0.47	0.40	37.6
North: Cobb Highway (N)															
7	L2	All MCs	1	0.0	1	0.0	0.081	3.1	LOS A	0.4	3.1	0.35	0.56	0.35	41.3
7a	L1	All MCs	1245.5		1245.5		0.081	3.1	LOS A	0.4	3.1	0.35	0.56	0.35	41.4
9	R2	All MCs	83	7.6	83	7.6	0.081	8.4	LOS A	0.4	3.1	0.35	0.56	0.35	44.3
9b	R3	All MCs	1	0.0	1	0.0	0.081	9.3	LOS A	0.4	3.1	0.35	0.56	0.35	27.7
9u	U	All MCs	1	0.0	1	0.0	0.081	12.3	LOS B	0.4	3.1	0.35	0.56	0.35	47.2
Approach			9811.8		9811.8		0.081	7.7	LOS A	0.4	3.1	0.35	0.56	0.35	43.9
NorthWest: Albert Street (NW)															
27b	L3	All MCs	4	0.0	4	0.0	0.024	1.9	LOS A	0.1	0.9	0.37	0.47	0.37	44.5
27a	L1	All MCs	1	0.0	1	0.0	0.024	1.9	LOS A	0.1	0.9	0.37	0.47	0.37	30.7
28	T1	All MCs	1423.1		1423.1		0.024	2.3	LOS A	0.1	0.9	0.37	0.47	0.37	27.8
29b	R3	All MCs	728.6		728.6		0.024	7.9	LOS A	0.1	0.9	0.37	0.47	0.37	43.7
29u	U	All MCs	1	0.0	1	0.0	0.024	9.9	LOS A	0.1	0.9	0.37	0.47	0.37	7.5
Approach			2719.2		2719.2		0.024	4.0	LOS A	0.1	0.9	0.37	0.47	0.37	38.6
West: Davidson Street (W)															
10b	L3	All MCs	1	0.0	1	0.0	0.136	2.6	LOS A	0.7	5.8	0.11	0.49	0.11	27.1
10	L2	All MCs	4720.0		4720.0		0.136	2.5	LOS A	0.7	5.8	0.11	0.49	0.11	46.0
11	T1	All MCs	3	0.0	3	0.0	0.136	2.1	LOS A	0.7	5.8	0.11	0.49	0.11	43.6
12a	R1	All MCs	14216.3		14216.3		0.136	6.7	LOS A	0.7	5.8	0.11	0.49	0.11	43.7
12u	U	All MCs	9	0.0	9	0.0	0.136	11.6	LOS B	0.7	5.8	0.11	0.49	0.11	48.8
Approach			20316.1		20316.1		0.136	5.8	LOS A	0.7	5.8	0.11	0.49	0.11	44.7
All Vehicles			62312.2		62312.2		0.213	4.4	LOS A	1.2	9.2	0.25	0.42	0.25	44.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

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

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

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 102 [Wanderer Street - Finley Road AM (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [AM (Network Folder: Existing)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%				[Veh. veh	Dist] m				
			veh/h		veh/h		v/c	sec							km/h
SouthEast: Finley Road (SE)															
22	T1	All MCs	129	8.1	129	8.1	0.070	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
23	R2	All MCs	12	18.2	12	18.2	0.008	5.4	LOS A	0.0	0.3	0.29	0.49	0.29	45.1
Approach			141	9.0	141	9.0	0.070	0.5	NA	0.0	0.3	0.02	0.04	0.02	49.2
NorthEast: Wanderer Street (NE)															
24	L2	All MCs	11	30.0	11	30.0	0.008	5.1	LOS A	0.0	0.3	0.17	0.49	0.17	45.2
26	R2	All MCs	152	6.3	152	6.3	0.180	6.6	LOS A	0.8	5.6	0.43	0.62	0.43	42.5
Approach			162	7.8	162	7.8	0.180	6.5	LOS A	0.8	5.6	0.41	0.62	0.41	42.8
NorthWest: Finley Road (NW)															
27	L2	All MCs	98	16.1	98	16.1	0.098	3.9	LOS A	0.0	0.0	0.00	0.31	0.00	45.0
28	T1	All MCs	68	18.5	68	18.5	0.098	0.0	LOS A	0.0	0.0	0.00	0.31	0.00	47.3
Approach			166	17.1	166	17.1	0.098	2.3	NA	0.0	0.0	0.00	0.31	0.00	45.9
All Vehicles			469	11.4	469	11.4	0.180	3.2	NA	0.8	5.6	0.15	0.33	0.15	45.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

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

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

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

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

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

 **Site: 100 [Cobb Highway - Finley Road - Davidson Street-
Albert Street PM (Site Folder: General)]**

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

 **Network: N101 [PM (Network
Folder: Existing)]**

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed	
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh. veh	Dist] m				km/h
SouthEast: Finley Road (SE)															
21a	L1	All MCs	194	8.2	194	8.2	0.154	1.9	LOS A	0.9	6.3	0.26	0.31	0.26	46.3
22	T1	All MCs	1	0.0	1	0.0	0.154	2.1	LOS A	0.9	6.3	0.26	0.31	0.26	9.0
23a	R1	All MCs	11	0.0	11	0.0	0.154	6.2	LOS A	0.9	6.3	0.26	0.31	0.26	45.3
23b	R3	All MCs	4	0.0	4	0.0	0.154	8.2	LOS A	0.9	6.3	0.26	0.31	0.26	33.2
23u	U	All MCs	1	0.0	1	0.0	0.154	10.5	LOS B	0.9	6.3	0.26	0.31	0.26	33.5
Approach			211	7.5	211	7.5	0.154	2.3	LOS A	0.9	6.3	0.26	0.31	0.26	45.9
East: Albert Street (E)															
4b	L3	All MCs	4	0.0	4	0.0	0.012	2.6	LOS A	0.1	0.4	0.44	0.46	0.44	27.4
5	T1	All MCs	6	0.0	6	0.0	0.012	2.7	LOS A	0.1	0.4	0.44	0.46	0.44	45.2
6a	R1	All MCs	1	0.0	1	0.0	0.012	6.3	LOS A	0.1	0.4	0.44	0.46	0.44	7.4
6	R2	All MCs	1	0.0	1	0.0	0.012	7.3	LOS A	0.1	0.4	0.44	0.46	0.44	44.2
6u	U	All MCs	1	0.0	1	0.0	0.012	10.6	LOS B	0.1	0.4	0.44	0.46	0.44	28.7
Approach			14	0.0	14	0.0	0.012	3.9	LOS A	0.1	0.4	0.44	0.46	0.44	39.0
North: Cobb Highway (N)															
7	L2	All MCs	2	0.0	2	0.0	0.069	3.4	LOS A	0.3	2.6	0.41	0.58	0.41	41.3
7a	L1	All MCs	11	20.0	11	20.0	0.069	3.2	LOS A	0.3	2.6	0.41	0.58	0.41	41.4
9	R2	All MCs	64	8.2	64	8.2	0.069	8.8	LOS A	0.3	2.6	0.41	0.58	0.41	44.3
9b	R3	All MCs	1	0.0	1	0.0	0.069	9.6	LOS A	0.3	2.6	0.41	0.58	0.41	27.6
9u	U	All MCs	1	0.0	1	0.0	0.069	12.7	LOS B	0.3	2.6	0.41	0.58	0.41	47.2
Approach			79	9.3	79	9.3	0.069	7.9	LOS A	0.3	2.6	0.41	0.58	0.41	43.9
NorthWest: Albert Street (NW)															
27b	L3	All MCs	3	0.0	3	0.0	0.023	2.4	LOS A	0.1	0.8	0.43	0.52	0.43	43.9
27a	L1	All MCs	1	0.0	1	0.0	0.023	2.3	LOS A	0.1	0.8	0.43	0.52	0.43	29.6
28	T1	All MCs	13	0.0	13	0.0	0.023	2.6	LOS A	0.1	0.8	0.43	0.52	0.43	26.7
29b	R3	All MCs	8	0.0	8	0.0	0.023	8.1	LOS A	0.1	0.8	0.43	0.52	0.43	43.6
29u	U	All MCs	1	0.0	1	0.0	0.023	10.4	LOS B	0.1	0.8	0.43	0.52	0.43	7.8
Approach			26	0.0	26	0.0	0.023	4.6	LOS A	0.1	0.8	0.43	0.52	0.43	38.1
West: Davidson Street (W)															
10b	L3	All MCs	6	0.0	6	0.0	0.205	2.6	LOS A	1.2	8.6	0.11	0.49	0.11	27.1
10	L2	All MCs	68	13.8	68	13.8	0.205	2.4	LOS A	1.2	8.6	0.11	0.49	0.11	46.0
11	T1	All MCs	4	0.0	4	0.0	0.205	2.1	LOS A	1.2	8.6	0.11	0.49	0.11	43.5
12a	R1	All MCs	235	4.9	235	4.9	0.205	6.6	LOS A	1.2	8.6	0.11	0.49	0.11	43.5
12u	U	All MCs	12	0.0	12	0.0	0.205	11.6	LOS B	1.2	8.6	0.11	0.49	0.11	48.7
Approach			325	6.5	325	6.5	0.205	5.7	LOS A	1.2	8.6	0.11	0.49	0.11	44.1
All Vehicles			655	6.8	655	6.8	0.205	4.8	LOS A	1.2	8.6	0.22	0.45	0.22	44.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

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

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

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 102 [Wanderer Street - Finley Road PM (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [PM (Network Folder: Existing)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%				[Veh. veh	Dist] m				
			veh/h		veh/h		v/c	sec							km/h
SouthEast: Finley Road (SE)															
22	T1	All MCs	95	5.6	95	5.6	0.050	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
23	R2	All MCs	2	0.0	2	0.0	0.001	5.3	LOS A	0.0	0.0	0.35	0.48	0.35	45.2
Approach			97	5.4	97	5.4	0.050	0.1	NA	0.0	0.0	0.01	0.01	0.01	49.8
NorthEast: Wanderer Street (NE)															
24	L2	All MCs	13	0.0	13	0.0	0.009	5.0	LOS A	0.0	0.2	0.23	0.50	0.23	45.4
26	R2	All MCs	116	9.1	116	9.1	0.147	6.9	LOS A	0.6	4.5	0.44	0.64	0.44	42.2
Approach			128	8.2	128	8.2	0.147	6.7	LOS A	0.6	4.5	0.42	0.63	0.42	42.7
NorthWest: Finley Road (NW)															
27	L2	All MCs	119	4.4	119	4.4	0.142	3.9	LOS A	0.0	0.0	0.00	0.24	0.00	45.8
28	T1	All MCs	143	5.1	143	5.1	0.142	0.0	LOS A	0.0	0.0	0.00	0.24	0.00	47.9
Approach			262	4.8	262	4.8	0.142	1.8	NA	0.0	0.0	0.00	0.24	0.00	46.9
All Vehicles			487	5.8	487	5.8	0.147	2.7	NA	0.6	4.5	0.11	0.30	0.11	46.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

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

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

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

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

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

 Site: 100 [Cobb Highway - Finley Road - Davidson Street-Albert Street - CON AM (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

 Network: N101 [AM - Construction (Network Folder: Construction)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed	
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh. veh	Dist] m				km/h
SouthEast: Finley Road (SE)															
21a	L1	All MCs	273	7.3	273	7.3	0.213	2.0	LOS A	1.2	9.3	0.30	0.31	0.30	46.3
22	T1	All MCs	366	7.7	366	7.7	0.213	2.6	LOS A	1.2	9.3	0.30	0.31	0.30	10.2
23a	R1	All MCs	616	7.7	616	7.7	0.213	6.4	LOS A	1.2	9.3	0.30	0.31	0.30	45.1
23b	R3	All MCs	250	0.0	250	0.0	0.213	8.6	LOS A	1.2	9.3	0.30	0.31	0.30	32.7
23u	U	All MCs	250	0.0	250	0.0	0.213	10.9	LOS B	1.2	9.3	0.30	0.31	0.30	33.5
Approach			286	8.8	286	8.8	0.213	2.2	LOS A	1.2	9.3	0.30	0.31	0.30	45.9
East: Albert Street (E)															
4b	L3	All MCs	1	0.0	1	0.0	0.008	2.4	LOS A	0.0	0.3	0.42	0.48	0.42	26.9
5	T1	All MCs	425	0.0	425	0.0	0.008	2.8	LOS A	0.0	0.3	0.42	0.48	0.42	44.3
6a	R1	All MCs	1	0.0	1	0.0	0.008	6.1	LOS A	0.0	0.3	0.42	0.48	0.42	8.0
6	R2	All MCs	1	0.0	1	0.0	0.008	7.1	LOS A	0.0	0.3	0.42	0.48	0.42	43.5
6u	U	All MCs	1	0.0	1	0.0	0.008	10.4	LOS B	0.0	0.3	0.42	0.48	0.42	28.1
Approach			812	5.0	812	5.0	0.008	4.7	LOS A	0.0	0.3	0.42	0.48	0.42	37.5
North: Cobb Highway (N)															
7	L2	All MCs	1	0.0	1	0.0	0.083	3.2	LOS A	0.4	3.2	0.37	0.57	0.37	41.2
7a	L1	All MCs	1245	5.5	1245	5.5	0.083	3.3	LOS A	0.4	3.2	0.37	0.57	0.37	41.3
9	R2	All MCs	83	7.6	83	7.6	0.083	8.5	LOS A	0.4	3.2	0.37	0.57	0.37	44.2
9b	R3	All MCs	1	0.0	1	0.0	0.083	9.4	LOS A	0.4	3.2	0.37	0.57	0.37	27.6
9u	U	All MCs	1	0.0	1	0.0	0.083	12.5	LOS B	0.4	3.2	0.37	0.57	0.37	47.2
Approach			9811	8.0	9811	8.0	0.083	7.9	LOS A	0.4	3.2	0.37	0.57	0.37	43.9
NorthWest: Albert Street (NW)															
27b	L3	All MCs	4	0.0	4	0.0	0.025	2.0	LOS A	0.1	1.0	0.39	0.48	0.39	44.4
27a	L1	All MCs	1	0.0	1	0.0	0.025	2.0	LOS A	0.1	1.0	0.39	0.48	0.39	30.4
28	T1	All MCs	1423	3.1	1423	3.1	0.025	2.5	LOS A	0.1	1.0	0.39	0.48	0.39	27.4
29b	R3	All MCs	728	6.0	728	6.0	0.025	8.1	LOS A	0.1	1.0	0.39	0.48	0.39	43.6
29u	U	All MCs	1	0.0	1	0.0	0.025	10.0	LOS A	0.1	1.0	0.39	0.48	0.39	7.5
Approach			2719	2.0	2719	2.0	0.025	4.2	LOS A	0.1	1.0	0.39	0.48	0.39	38.5
West: Davidson Street (W)															
10b	L3	All MCs	1	0.0	1	0.0	0.153	2.6	LOS A	0.8	6.9	0.11	0.49	0.11	27.3
10	L2	All MCs	4720	0.0	4720	0.0	0.153	2.5	LOS A	0.8	6.9	0.11	0.49	0.11	46.3
11	T1	All MCs	3	0.0	3	0.0	0.153	2.1	LOS A	0.8	6.9	0.11	0.49	0.11	44.1
12a	R1	All MCs	16124	8.0	16124	8.0	0.153	6.9	LOS A	0.8	6.9	0.11	0.49	0.11	44.1
12u	U	All MCs	9	0.0	9	0.0	0.153	11.6	LOS B	0.8	6.9	0.11	0.49	0.11	49.1
Approach			22222	3.0	22222	3.0	0.153	6.1	LOS A	0.8	6.9	0.11	0.49	0.11	45.0
All Vehicles			64214	4.4	64214	4.4	0.213	4.5	LOS A	1.2	9.3	0.25	0.42	0.25	44.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

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

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

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

▼ Site: 102 [Wanderer Street - Finley Road CON AM (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

■ Network: N101 [AM - Construction (Network Folder: Construction)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	[Total HV]	[Veh. veh	Dist]									
			veh/h	%	veh/h	%	v/c	sec			m				km/h
SouthEast: Finley Road (SE)															
22	T1	All MCs	129	8.1	129	8.1	0.070	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
23	R2	All MCs	12	18.2	12	18.2	0.009	5.5	LOS A	0.0	0.3	0.32	0.50	0.32	45.0
Approach			141	9.0	141	9.0	0.070	0.5	NA	0.0	0.3	0.03	0.04	0.03	49.2
NorthEast: Wanderer Street (NE)															
24	L2	All MCs	11	30.0	11	30.0	0.008	5.2	LOS A	0.0	0.3	0.20	0.49	0.20	45.1
26	R2	All MCs	152	6.3	152	6.3	0.187	6.8	LOS A	0.8	5.7	0.45	0.64	0.45	42.3
Approach			162	7.8	162	7.8	0.187	6.7	LOS A	0.8	5.7	0.43	0.63	0.43	42.6
NorthWest: Finley Road (NW)															
27	L2	All MCs	98	16.1	98	16.1	0.113	3.9	LOS A	0.0	0.0	0.00	0.28	0.00	45.0
28	T1	All MCs	87	33.7	87	33.7	0.113	0.0	LOS A	0.0	0.0	0.00	0.28	0.00	47.3
Approach			185	24.4	185	24.4	0.113	2.0	NA	0.0	0.0	0.00	0.28	0.00	46.1
All Vehicles			488	14.4	488	14.4	0.187	3.1	NA	0.8	5.7	0.15	0.33	0.15	45.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

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

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

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

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

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

 Site: 100 [Cobb Highway - Finley Road - Davidson Street-Albert Street CON PM (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

 Network: N101 [PM - Construction (Network Folder: Construction)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed	
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh. veh	Dist] m				km/h
SouthEast: Finley Road (SE)															
21a	L1	All MCs	198	9.0	198	9.0	0.158	1.9	LOS A	0.9	6.5	0.27	0.31	0.27	46.2
22	T1	All MCs	1	0.0	1	0.0	0.158	2.1	LOS A	0.9	6.5	0.27	0.31	0.27	9.0
23a	R1	All MCs	11	0.0	11	0.0	0.158	6.2	LOS A	0.9	6.5	0.27	0.31	0.27	45.3
23b	R3	All MCs	4	0.0	4	0.0	0.158	8.2	LOS A	0.9	6.5	0.27	0.31	0.27	33.2
23u	U	All MCs	1	0.0	1	0.0	0.158	9.2	LOS A	0.9	6.5	0.27	0.31	0.27	33.5
Approach			215	8.3	215	8.3	0.158	2.3	LOS A	0.9	6.5	0.27	0.31	0.27	45.9
East: Albert Street (E)															
4b	L3	All MCs	4	0.0	4	0.0	0.012	2.6	LOS A	0.1	0.4	0.44	0.46	0.44	27.3
5	T1	All MCs	6	0.0	6	0.0	0.012	2.7	LOS A	0.1	0.4	0.44	0.46	0.44	45.2
6a	R1	All MCs	1	0.0	1	0.0	0.012	6.3	LOS A	0.1	0.4	0.44	0.46	0.44	7.4
6	R2	All MCs	1	0.0	1	0.0	0.012	7.3	LOS A	0.1	0.4	0.44	0.46	0.44	44.2
6u	U	All MCs	1	0.0	1	0.0	0.012	9.3	LOS A	0.1	0.4	0.44	0.46	0.44	28.5
Approach			14	0.0	14	0.0	0.012	3.8	LOS A	0.1	0.4	0.44	0.46	0.44	39.0
North: Cobb Highway (N)															
7	L2	All MCs	2	0.0	2	0.0	0.069	3.4	LOS A	0.3	2.6	0.41	0.58	0.41	41.3
7a	L1	All MCs	11	20.0	11	20.0	0.069	3.2	LOS A	0.3	2.6	0.41	0.58	0.41	41.4
9	R2	All MCs	64	8.2	64	8.2	0.069	8.8	LOS A	0.3	2.6	0.41	0.58	0.41	44.3
9b	R3	All MCs	1	0.0	1	0.0	0.069	9.6	LOS A	0.3	2.6	0.41	0.58	0.41	25.3
9u	U	All MCs	1	0.0	1	0.0	0.069	10.6	LOS B	0.3	2.6	0.41	0.58	0.41	44.3
Approach			79	9.3	79	9.3	0.069	7.9	LOS A	0.3	2.6	0.41	0.58	0.41	43.7
NorthWest: Albert Street (NW)															
27b	L3	All MCs	3	0.0	3	0.0	0.023	2.4	LOS A	0.1	0.8	0.43	0.52	0.43	43.9
27a	L1	All MCs	1	0.0	1	0.0	0.023	2.3	LOS A	0.1	0.8	0.43	0.52	0.43	29.6
28	T1	All MCs	13	0.0	13	0.0	0.023	2.6	LOS A	0.1	0.8	0.43	0.52	0.43	26.7
29b	R3	All MCs	8	0.0	8	0.0	0.023	8.1	LOS A	0.1	0.8	0.43	0.52	0.43	43.6
29u	U	All MCs	1	0.0	1	0.0	0.023	9.1	LOS A	0.1	0.8	0.43	0.52	0.43	7.8
Approach			26	0.0	26	0.0	0.023	4.6	LOS A	0.1	0.8	0.43	0.52	0.43	38.1
West: Davidson Street (W)															
10b	L3	All MCs	6	0.0	6	0.0	0.205	2.6	LOS A	1.2	8.6	0.11	0.49	0.11	27.0
10	L2	All MCs	68	13.8	68	13.8	0.205	2.4	LOS A	1.2	8.6	0.11	0.49	0.11	45.9
11	T1	All MCs	4	0.0	4	0.0	0.205	2.1	LOS A	1.2	8.6	0.11	0.49	0.11	43.3
12a	R1	All MCs	235	4.9	235	4.9	0.205	6.6	LOS A	1.2	8.6	0.11	0.49	0.11	43.3
12u	U	All MCs	12	0.0	12	0.0	0.205	9.6	LOS A	1.2	8.6	0.11	0.49	0.11	45.6
Approach			325	6.5	325	6.5	0.205	5.7	LOS A	1.2	8.6	0.11	0.49	0.11	43.8
All Vehicles			659	7.0	659	7.0	0.205	4.8	LOS A	1.2	8.6	0.22	0.44	0.22	44.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

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

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

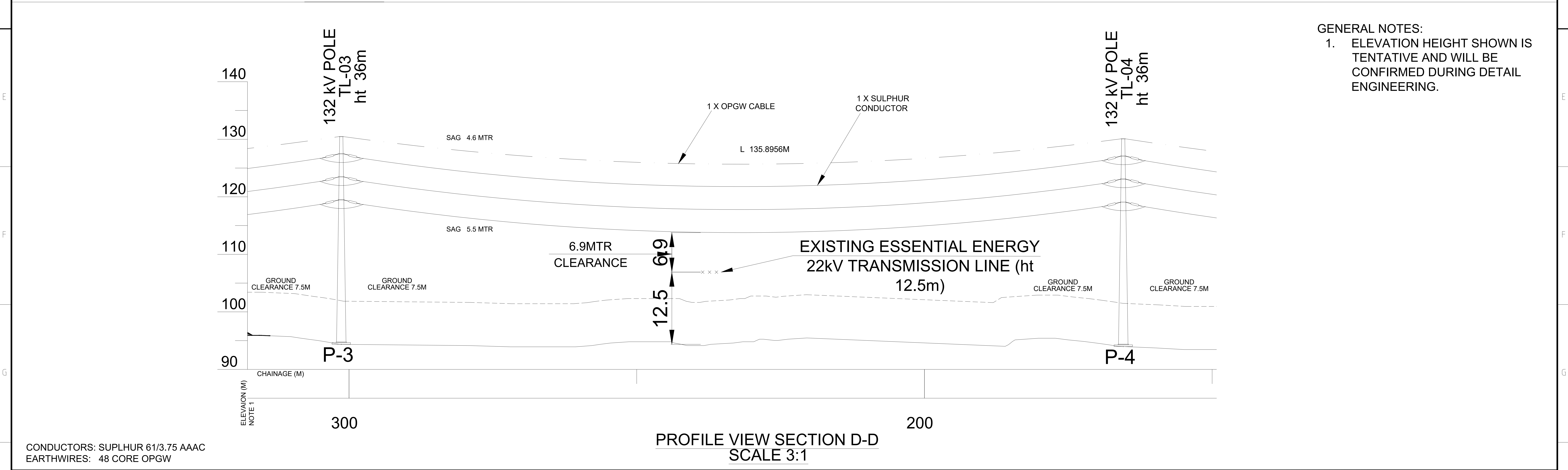
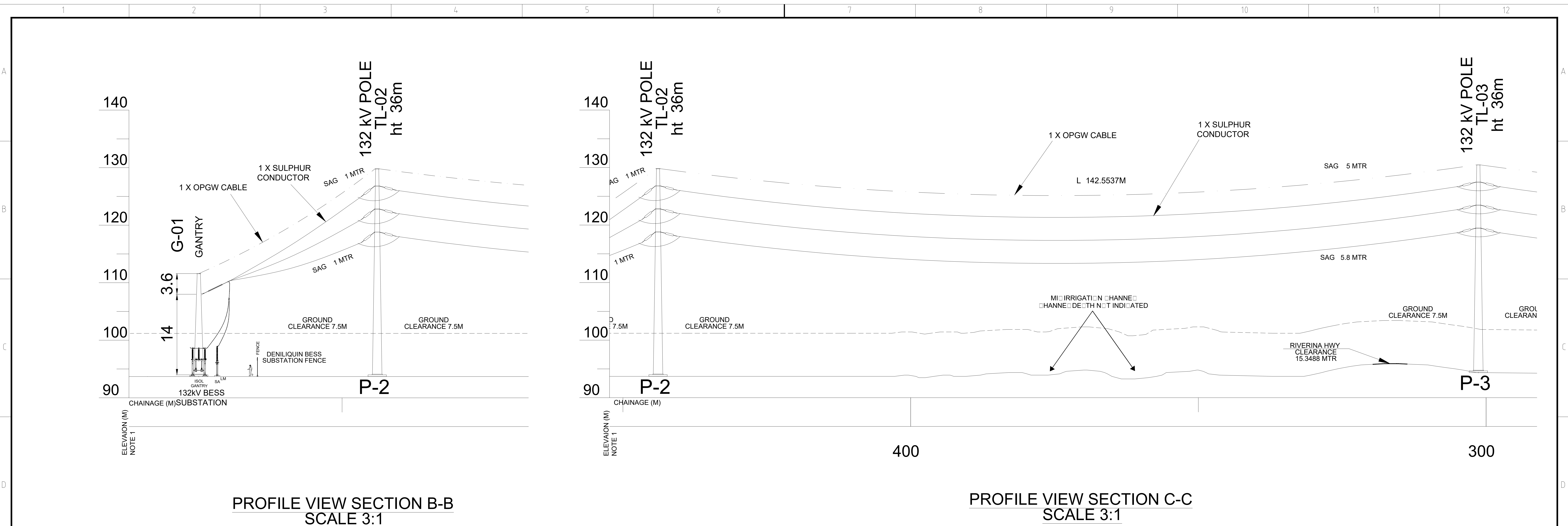
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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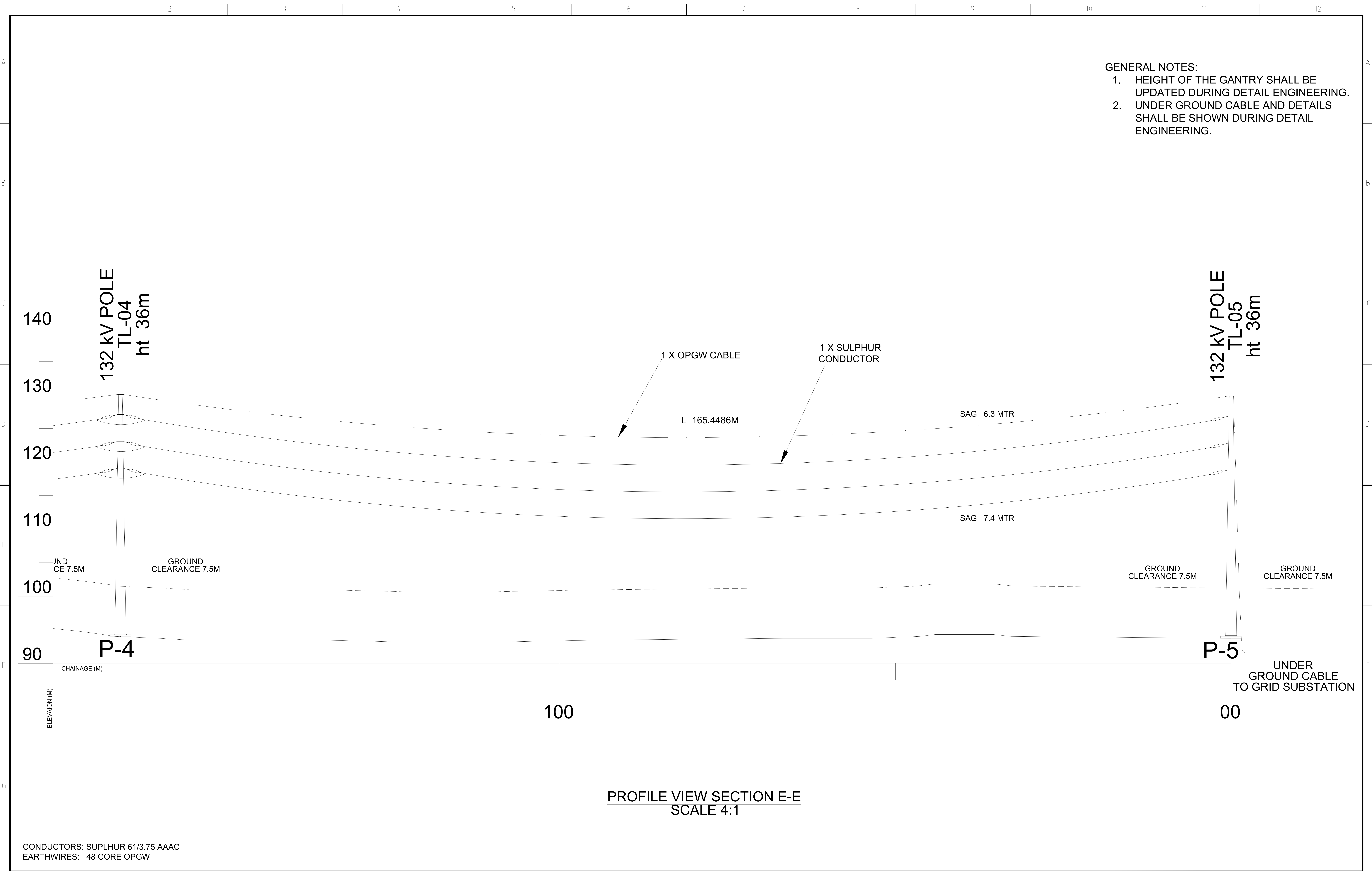
APPENDIX C OVERHEAD TRANSMISSION LINE CROSS SECTION



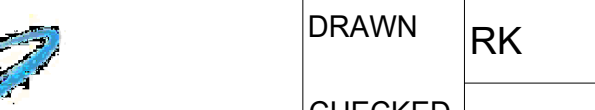
GENERAL NOTES:
1. ELEVATION HEIGHT SHOWN IS TENTATIVE AND WILL BE CONFIRMED DURING DETAIL ENGINEERING.

CONDUCTORS: SUPLHUR 61/3.75 AAAC
EARTHWIRES: 48 CORE OPGW

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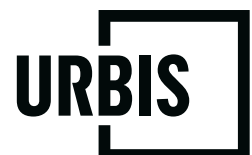
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APPENDIX D HAULAGE ROUTE ASSESSMENT



DENILQUIN BESS CONCEPT ROUTE ASSESSMENT

Prepared for
**BESS ARCTIC PTY LTD C/- GRANSOLAR
DEVELOPMENT AUSTRALIA**
31 March 2025



URBIS STAFF RESPONSIBLE FOR THIS REPORT WERE:

Director	Manesha Ravji
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Consultant	James Ramm
Assistant Planner	Jack Rogers
Project Code	P0050308
Report Number	Final

Urbis acknowledges the important contribution that Aboriginal and Torres Strait Islander people make in creating a strong and vibrant Australian society.

We acknowledge, in each of our offices, the Traditional Owners on whose land we stand.

DISCLAIMER

This report is dated 31 March 2025 and incorporates information and events up to that date only and excludes any information arising, or event occurring, after that date which may affect the validity of Urbis Ltd (Urbis) opinion in this report. Urbis prepared this report on the instructions, and for the benefit only, of BESS Arctic Pty Ltd C/- Gransolar Development Australia (Instructing Party) for the purpose of a Concept Route Analysis (Purpose) and not for any other purpose or use. To the extent permitted by applicable law, Urbis expressly disclaims all liability, whether direct or indirect, to the Instructing Party which relies or purports to rely on this report for any purpose other than the Purpose, and to any other person which relies or purports to rely on this report for any purpose whatsoever (including the Purpose).

In preparing this report, Urbis was required to make judgements which may be affected by unforeseen future events, the likelihood and effects of which are not capable of precise assessment.

All surveys, forecasts, projections and recommendations contained in or associated with this report are made in good faith and on the basis of information supplied to Urbis at the date of this report, and upon which Urbis relied. Achievement of the projections and budgets set out in this report will depend, among other things, on the actions of others over which Urbis has no control.

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1. INTRODUCTION

Urbis has been engaged by BESS Artic Pty Ltd C/- Gransolar Development Australia to undertake a Route Assessment to address the Transport for New South Wales (TfNSW) Oversized Overmass (OSOM) Concept Level Route Analysis requirements to accompany the Transport Impact Assessment being prepared for the proposed Battery Energy Storage System (BESS) development at 21356 Riverina Highway in Deniliquin, NSW.

In an email dated 12 August 2024, TfNSW specified that a concept level route assessment is required for high-risk OSOM vehicles required to deliver components to the site.

The requirements of this route assessment are reproduced below:

The route assessment is required for [*high risk OSOM \(as defined on TfNSW website\)*](#) required to deliver components to the project. The concept level route analysis must include:

- The port or point of origin and must be for the entire route to the site access or intersections required to facilitate the high risk OSOM movements required for the project.
- The TIA is required to include details of all high risk OSOM loads and vehicle configurations for the project.
- The location of pull-over bays / rest areas along the high risk OSOM routes (including GPS coordinates) and demonstrate through swept paths that the high risk OSOMs can be physically accommodate all high risk OSOMs for the project (in terms of size, width and accessibility).

Expanding on the points above, the concept route assessment is required to include:

- Details of the road geometry and alignment along the identified transport route/s, including existing formations, crossings, bridges, intersection treatments and any identified hazards, including:
 - Bridge Assessments for any at risk bridges on the classified road network due to dimensions and weight of OSOM vehicles.
 - Swept path analysis demonstrating the largest design vehicle can enter and leave the development, and simultaneously pass through intersections along the proposed transport route/s.
 - The design vehicle templates used in the swept path analysis software are also requested in order for TfNSW to review the performance within the software (e.g. Autodesk Vehicle Tracking or Transoft AutoTURN).
 - Highlighting each at-risk road structures that the haulage route crosses including bridges, traffic signals, signage, major culverts, and minor culverts that may not meet the desirable cover to cater for proposed axle loads.

Identify and provide the following measurements parameters of OSOM components / materials to be moved:

- Identify types and numbers of high risk OSOM vehicles proposed to be used for the project.
- Overall combination type, configuration, load and vehicle configuration:
- Wheelbase dimensions.
- length, width, height and mass (gcm, tare, weight to axle and payload) for components and nominated vehicles.
- Maximum trailer articulation angle(s).
- Minimum overhang heights above the road surface.
- Vehicle configurations.
- Traffic mitigation measures or road works, modifications, or road upgrades to facilitate the movement of the high risk OSOM(s) associated with the project.
- Potential high level mitigation measures or commitments to mitigate known traffic, safety and impacts to road users along the high risk OSOM route (i.e school bus routes, mining shift changes, TSRs, harvest periods and events).
- Identify and assess implications of any road and rail projects that may be under construction during the indicative schedule for the OSOM movements.

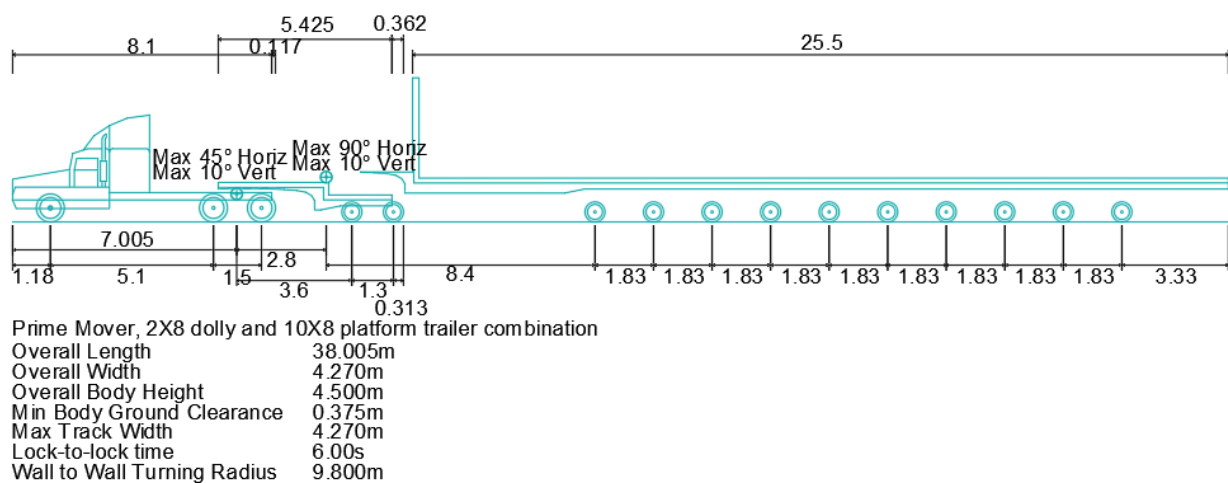
Note: NHVR permits do not cover road works or upgrades and environmental approvals required along any proposed OSOM route. Any road works or upgrades works required along the OSOM route must be included within the scope of works in the SSD to ensure the development is constructable.

Note: Given the high number of renewable energy and other large-scale projects requiring haulage of OSOM components on the road network, restrictions and limitations on OSOM movements may be imposed. In this regard, it is recommended that you engage earlier with TfNSW's Development Services Renewables team to discuss the route assessment requirements.

1.1. DESIGN VEHICLE

The high-risk OSOM vehicle applicable to the construction activity associated with the proposed BESS development at 21356 Riverina Highway in Deniliquin is shown in **Figure 1**. This vehicle will be used for transformer transport to the site.

Figure 1 Proposed Oversize Overmass (OSOM) Vehicle



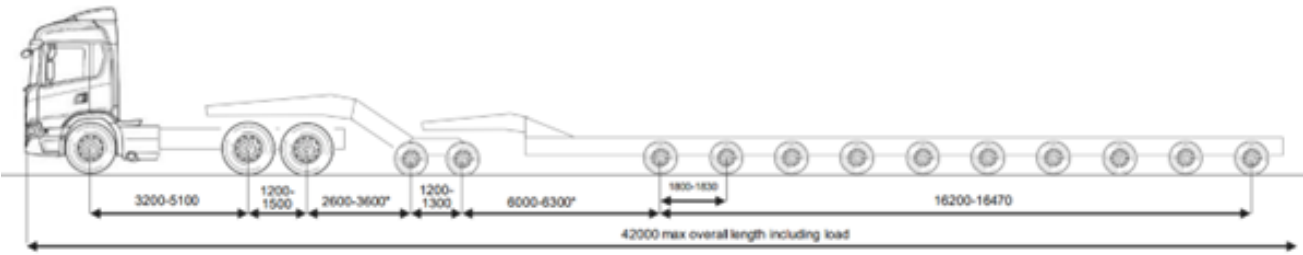
Source: Vehicle Tracking

The proposed OSOM vehicle comprises:

- a Prime Mover, 2 x 8 Dolly and 10 x 8 Platform Trailer combination,
- an overall length of 38 metres,
- a maximum width of 4.0 metres (at the platform trailer component),
- a net mass of up to 200 tonnes (including 129 tonne transformer and 71 tonne vehicle)
 - additional information regarding load placement points and detailed load drawings to be undertaken closer to the date of the movement during Class 1 permit application to the National Heavy Vehicle Regular (NHVR)
- a maximum laden height of 5.4 metres including:
 - metre trailer body height,
 - 4.0 metre transformer height,
 - 0.3 metre allowance for dunnage.

It is noted that the OSOM vehicle falls within the dimensions of Reference Vehicle 8 under the Victorian Department of Transport and Planning's (DTP) Platform Trailer Network, shown in **Figure 2**.

Figure 2 Victorian DTP Platform Trailer Network Reference Vehicle 8



Source: Transport Victoria

2. ROUTE ANALYSIS

2.1. PROPOSED ROUTE

The route selection has been conducted with the assistance of the NHVR Route Planner. The majority of the Victorian portion of the proposed route uses the Northern Highway between Wallan and Echuca, and the majority of the New South Wales (NSW) portion uses the Cobb Highway between Echuca and Deniliquin.

The proposed route alignment is shown in **Figure 3**.

Additional maps are provided for metropolitan Melbourne (**Figure 4**) and the Deniliquin township (**Figure 5**), highlighting the specific route alignment in these areas.

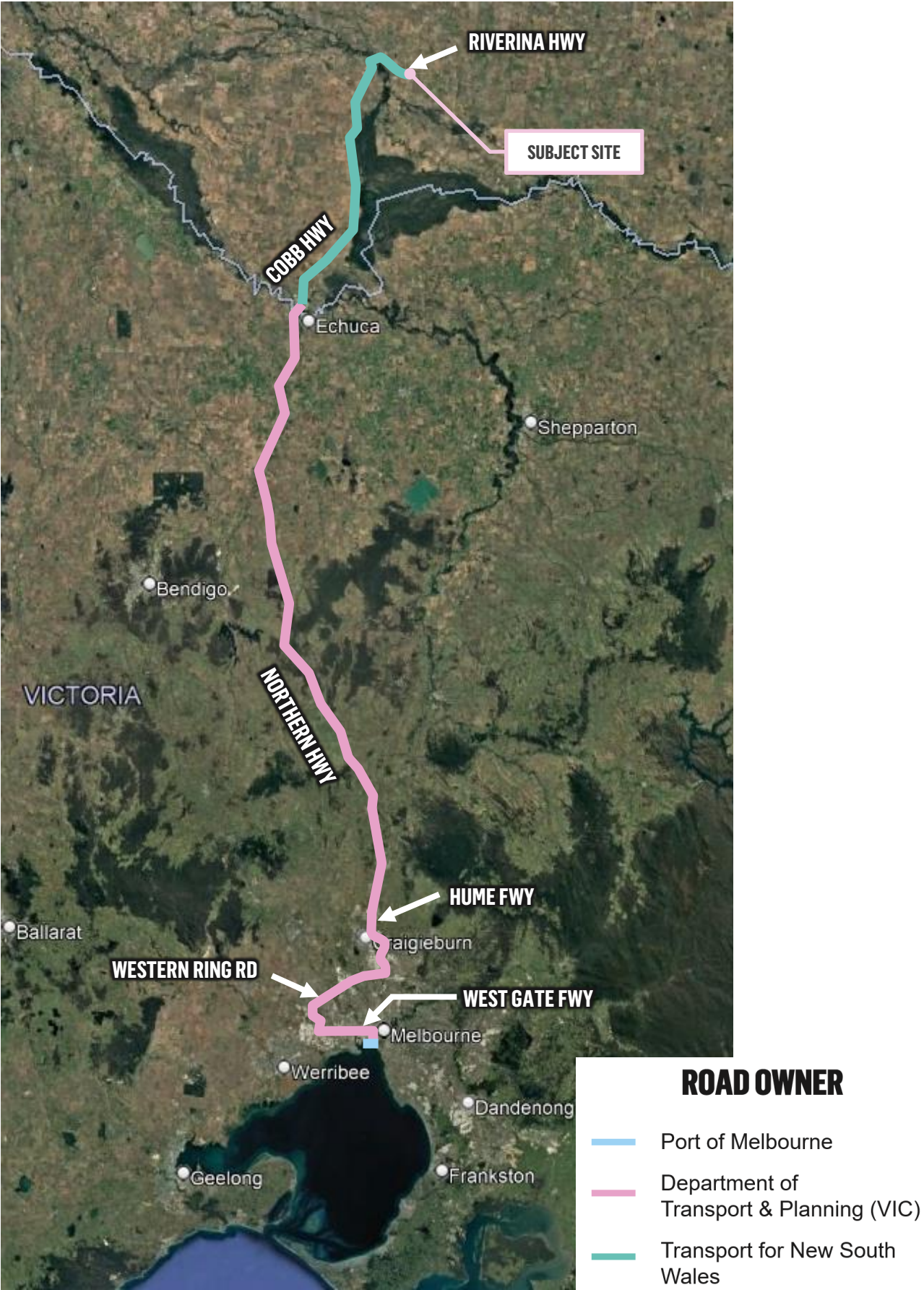
Within Victoria, the route is conditionally pre-approved from the Port of Melbourne to the Victorian / NSW border at Echuca for a Class 1 2x8 Dolly & 10x8 Platform Trailer up to 206 tonnes (Reference Vehicle 8). The conditions applicable to the pre-approved route include:

- A bridge assessment for the West Gate Bridge (SN6225).
- Liaison with West Gate Tunnel Project team on the West Gate Freeway prior to travelling through the corridor due to potential overnight lane width reductions.
- Speed restriction to five kilometres per hour for an approximate two kilometre long section of the Northern Highway between Tooborac and Heathcote.
- Speed restriction to five kilometres per hour and requirement to straddle centreline of road for an approximate 1.9 kilometre long section of the Northern Highway immediately south of Echuca-Mitiamo Road.
- Various operational conditions on bridges along the route, specifying operating speed restriction and/or required positioning of combination on the structure, highlighted in **Table 2**.

Given the proposed combination does not comply with the Multi-State Class 1 Load Carrying Vehicle Mass or Dimension Exemption Notices, the route is not pre-approved within NSW and requires assessment and subsequent permit via the NHVR.

There are no known planned upgrades along the route.

Figure 3 Proposed Route



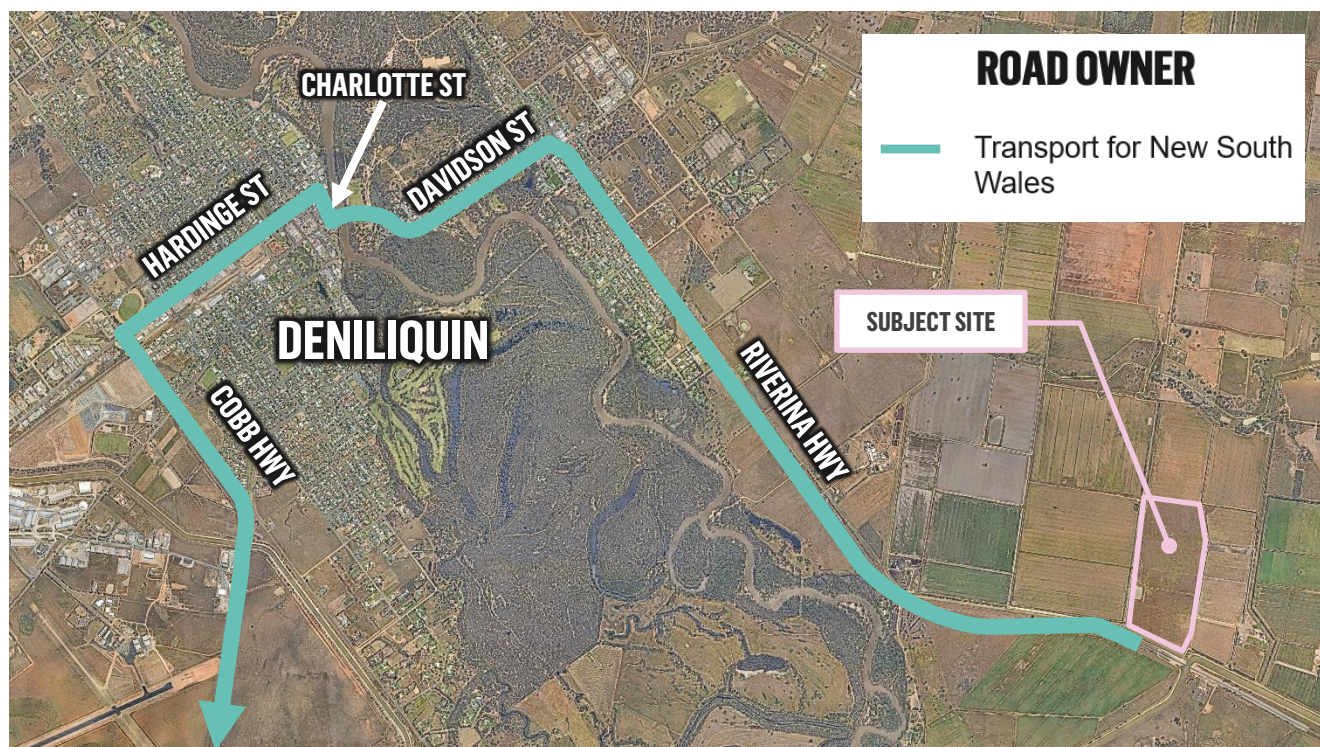
Source: Google Earth (modified by Urbis)

Figure 4 Proposed Route - Metropolitan Melbourne



Source: Nearmap (modified by Urbis)

Figure 5 Proposed Route - Deniliquin Township



Source: Nearmap (modified by Urbis)

2.2. ACCESS PERMITS

The proposed transformer combination exceeds prescribed mass and dimensional requirements and is proposed to carry a large indivisible item. As such, the vehicle is a Class 1 OSOM vehicle per the NHVR definition.

Given this OSOM status, a Class 1 permit is required for the combination to travel on NHVR roads (i.e. all roads on this route). Upon receipt of the permit application, the NHVR is responsible for consultation with respective road authorities prior to issuing the permit.

As discussed, the proposed route is conditionally pre-approved within Victoria.

2.3. TRANSPORT ESCORT

Due to the size of the proposed OSOM vehicle, it will occasionally need to use the entire carriageway widths along the route, particularly at intersections.

To minimise safety and operational impacts on the road network during transport, it is proposed to escort the combination along the length of the route.

Based on the NHVR's *Guide to pilot requirements in Victoria* (January 2018), it is proposed to utilise two certified pilots for the sections of the route located within Victoria.

Based on TfNSW's *Additional Access Conditions – Oversize and overmass heavy vehicles and loads* (October 2020), it is proposed to utilise three certified pilots for the sections of the route located within NSW.

It is noted that permit conditions may specify alternative pilot requirements or operating conditions, based on the NHVR assessment.

2.4. REST AREAS

The locations of pull-over bays and rest areas suitable for use by the OSOM vehicle along the proposed route are summarised in **Table 1**.

Table 1 Route Rest Areas

Location	Direction/s	GPS Co-Ordinates	Image
Hume Freeway near Donovans Lane, Beveridge, Victoria	Northbound / Southbound / Both	-37° 29' 46", 144° 57' 31"	
Northern Highway near Peters Gully Road, Heathcote, Victoria	Southbound	-36° 57' 15", 144° 44' 35"	
Northern Highway near Dowds Lane, Ladys Pass, Victoria	Southbound	-36° 47' 7", 144° 42' 5"	

Northern Highway near McColl Road, Ballendella, Victoria (Northbound)	Northbound	-36° 18' 37", 144° 41' 7"	
Northern Highway near Singer Road, Ballendella, Victoria (Southbound)	Southbound	-36° 16' 31", 144° 42' 5"	
Cobb Highway near Kiely Road, Moama, NSW	Both	-36° 5' 28", 144° 45' 4"	
Cobb Highway near Eleven Mile Road, Moama, NSW	Southbound	-35° 59' 4", 144° 50' 44"	

Swept path analysis demonstrating suitable OSOM vehicle access to each of these rest areas is provided in **Appendix A**.

3. POTENTIAL ROUTE CONSTRAINTS

3.1. TRAVEL RESTRICTIONS

The TfNSW requirements for a Concept Route Assessment require an assessment of impacts to traffic conditions during special events such as public holidays, harvest periods or large-scale events.

TfNSW's *Additional Access Conditions – Oversize and overmass heavy vehicles and loads* (October 2020) specifies travel restrictions for load carrying vehicles. The proposed route is not impacted by any travel restrictions listed in this document.

3.2. POTENTIAL HEIGHT AND WEIGHT CONSTRAINTS

A site and route inspection was conducted along the selected route on Monday 28 October 2024 and Tuesday 29 October 2024 to observe possible constraints for the design vehicles.

This inspection observed possible height clearance restrictions including bridge heights, power lines and electronic gantries. The route also identified bridges and other potential locations of weight constraint, such as level crossings.

Maps of these potential height and weight constraints are provided in **Figure 6** (for the West Gate Freeway and Western Ring Road sections), **Figure 7** (for the Hume Freeway section) and **Figure 8** (for the remainder of the route).

Freeway gantries are excluded from this map due to their frequency along metropolitan Melbourne freeways, however gantry height clearances obtained from the NHVR's *Height Clearance Under Overhead Structures* database have been reviewed and are considered appropriate for the maximum laden height of 5.4 metres. The overhead bridge heights from this database have been listed on the maps where provided and are less than or equal to the maximum laden height of 5.4 metres.

It is noted that the database does not include overhead height restrictions of power lines. Potentially constrained locations were identified on the route inspection and are highlighted as potential height constraints on the maps. It is understood that the NHVR and/or operator would liaise with relevant power authorities prior to the movement occurring to ensure safe transport.

ROAD OWNER

- Port of Melbourne
- Department of Transport & Planning (VIC)

HEIGHT CONSTRAINT

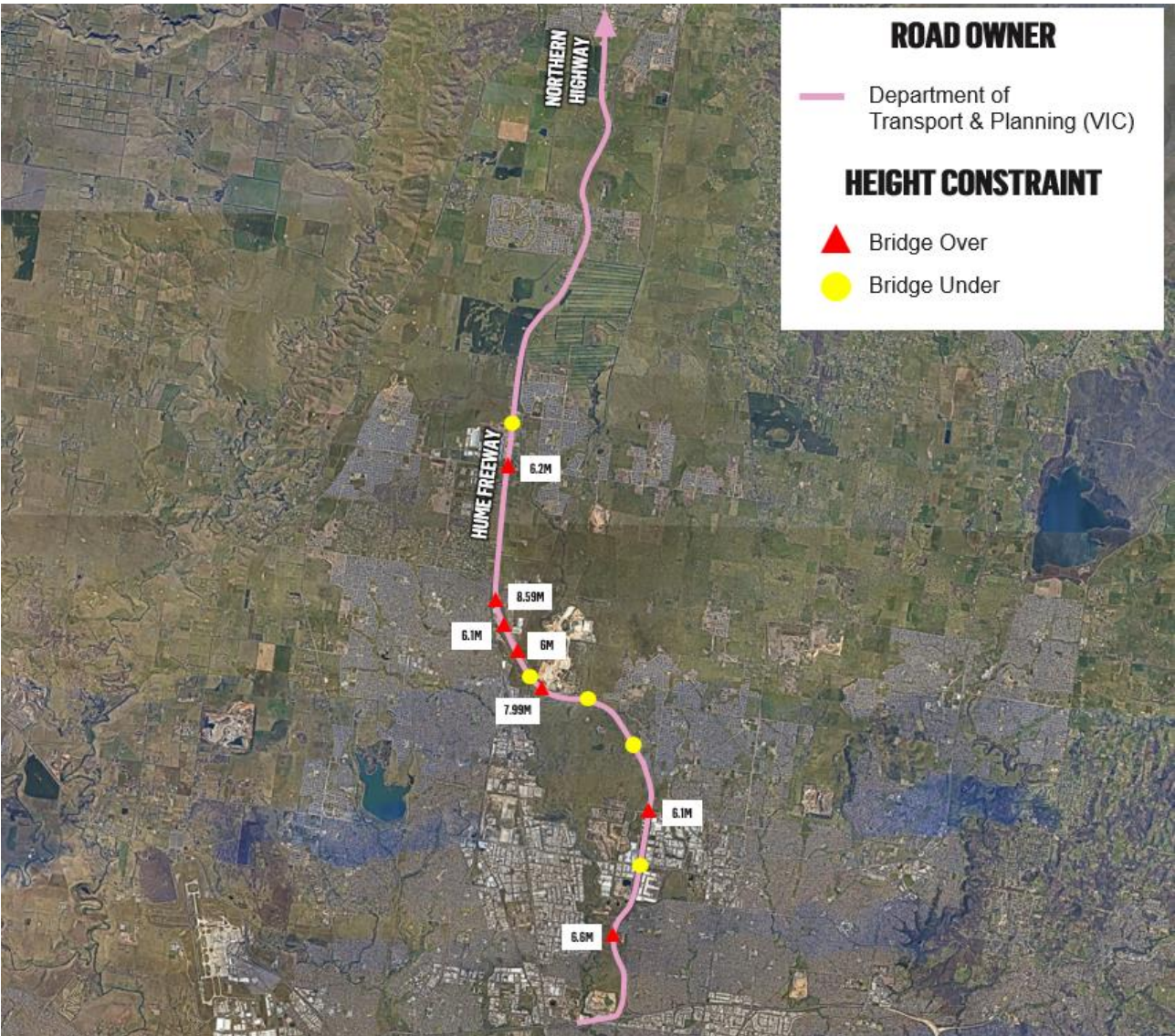
- Bridge Over
- Power Line Over
- Bridge Under

M80 ROUTE AND HEIGHT CONSTRAINTS:

- M80 RING ROAD/M79 CALDER FREEWAY INTERCHANGE:** 8.9M, 6.9M, 5.5M
- PASCOE VALE ROAD - CRAIGIEBURN LINE UNDERPASS:** 11M, 5.7M, 5.7M
- UPFIELD LINE - SYDNEY ROAD UNDERPASS:** 5.6M, 5.4M, 5.6M
- M80 RING ROAD/M2 TULLAMARINE FREEWAY INTERCHANGE:** 7.4M
- WEST GATE FWY:** 5.7M, 5.9M, 5.9M
- Other constraints along the route:** 6.2M, 5.8M, 5.5M, 6.1M, 5.8M, 7.1M, 5.4M, 5.5M, 6.2M, 7.7M

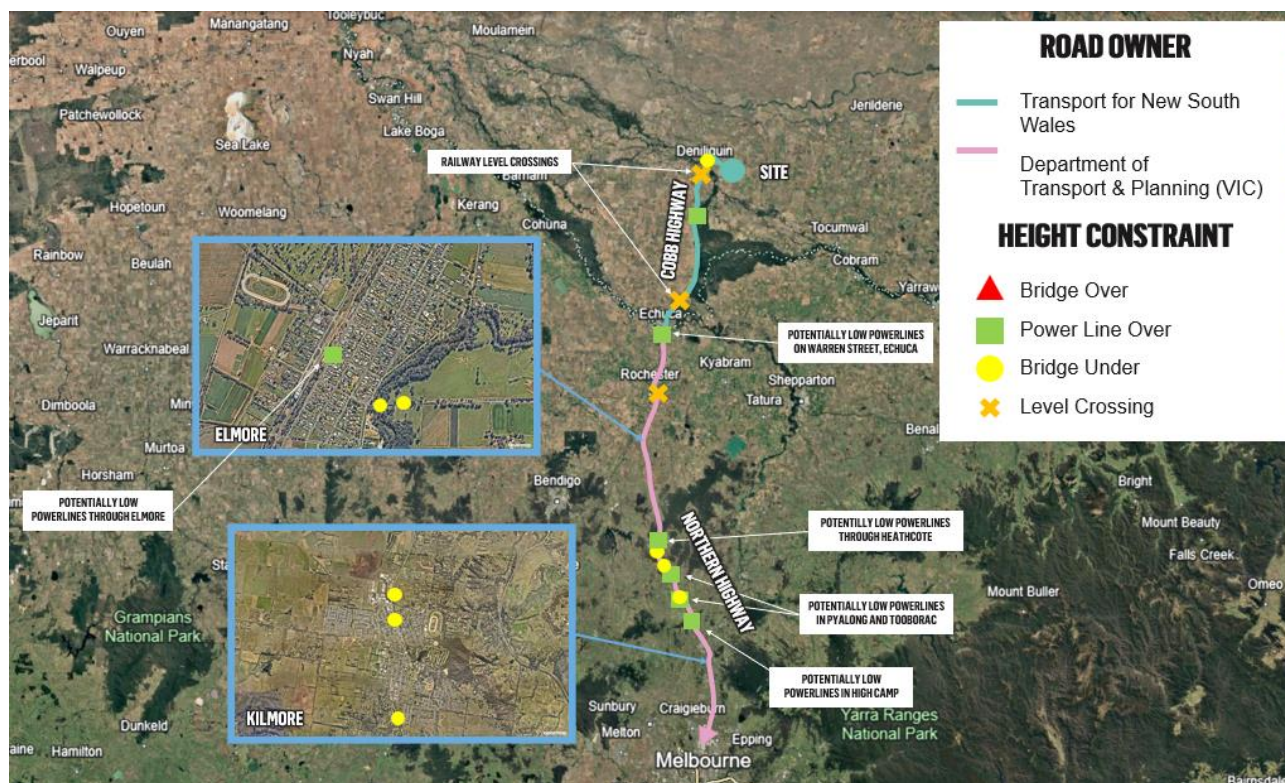
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P0050308 DENILQUIN BESS CONCEPT ROUTE ANALYSIS 250331

Figure 7 Potential Route Height and Weight Constraints - Hume Freeway



Source: Nearmap (modified by Urbis)

Figure 8 Potential Route Height and Weight Constraints - Remaining Route



Source: Nearmap (modified by Urbis)

Table 2 identifies all bridges along the proposed route and any relevant operating conditions specified on the NHVR Network Maps. There is one additional bridge located along the route within NSW, located in Deniliquin, however no information is provided on mass or axle loading restrictions on this bridge. It is noted that the bridge is approved under the NSW OSOM Load Carrying Vehicles Network and therefore is expected to be sufficient to support the proposed combination under particular operating conditions (such as a reduced speed and centreline straddling). It is understood that the NHVR will be responsible for a preliminary assessment of the load bearing capacity of the bridge and liaise with the operator and relevant authorities as considered necessary.

Table 2 Bridge Operating Conditions and Approval for Proposed Combination

Code	Bridge Name	Condition	Approval
SN6225	Bridge, West Gate Freeway	West Gate Bridge SN6225 is restricted to vehicle combinations up to 49.5 tonnes therefore combinations in excess of 49.5 tonnes require a bridge assessment to facilitate a permit.	Approved with conditions
SN6226	Bridge, West Gate Freeway (over Williamstown Road)	Slow to five kilometres per hour and straddle centreline of bridge (westbound)	Approved with conditions

Code	Bridge Name	Condition	Approval
SN2583	Bridge, West Gate Freeway (Express) (over Newport-Sunshine rail line)	Straddle centreline of bridge (westbound)	Approved with conditions
SN2584	Bridge, West Gate Freeway (over Millers Road)	Slow to five kilometres per hour and straddle centre of two left hand side (LHS) lanes (westbound)	Approved with conditions
SN2585	Bridge, West Gate Freeway (over Kororoit Creek)	Slow to five kilometres per hour (westbound)	Approved with conditions
SN8199	Bridge, Western Ring Road Onramp	Straddle centreline of bridge (westbound)	Approved with conditions
SN9008	Bridge, Western Ring Road (over Pipe Road)	N/A	Approved
SN8634	Bridge, Western Ring Road (over Boundary Road)	Straddle centreline of bridge (northbound)	Approved with conditions
SN8893	Bridge, Western Ring Road (over Sunshine-Deer Park rail line and Tilburn Road)	N/A	Approved
SN1452	Bridge, Western Ring Road (over Ballarat Road)	Straddle centre of three LHS lanes (southbound) and straddle centre of two right hand side (RHS) lanes (northbound)	Approved with conditions
SN1454	Bridge, Western Ring Road (over Jones Creek)	N/A	Approved
SN8888	Bridge, Western Ring Road (over Sunbury rail line + St Albans Road)	N/A	Approved
SN1324	Bridge, Western Ring Road (over Furlong Road)	Travel close to RHS barrier (northbound) and travel close to LHS barrier (southbound)	Approved with conditions
SN1281	Bridge, Western Ring Road (over Steele Creek)	Straddle centre of three LHS lanes (both directions)	Approved with conditions
SN1282	Bridge, Western Ring Road (over Melrose Drive)	N/A	Approved
SN1286	Bridge, Western Ring Road (over Tullamarine	Straddle centre of lanes 2 and 3 (northeast	Approved with conditions

Code	Bridge Name	Condition	Approval
	Outbound – Western Ring Road Outbound Ramp)	bound) and travel close to RHS barrier (southwest bound)	
SN1287	Bridge, Western Ring Road (over Tullamarine Freeway)	Straddle centre of two LHS lanes (northeast bound) and travel close to RHS barrier (southwest bound)	Approved with conditions
SN8595	Bridge, Western Ring Road (over Moonee Ponds Creek)	Straddle centre of two LHS lanes close to shoulder (westbound)	Approved (eastbound) Approved with conditions (westbound)
SN1296	Bridge, Western Ring Road (over Merlynston Creek)	N/A	Approved
SN9398	Bridge, Metropolitan Ring Road (over Merri Creek)	Straddle centreline of road (eastbound)	Approved with conditions
SN1892	Bridge, Hume Freeway (over Cooper Street)	N/A	Approved
SN0062	Bridge, Hume Freeway (over Vearings Road Drain)	N/A	Approved
SN0200	Bridge, Hume Freeway (over Curly Sedge Creek)	N/A	Approved
SN0204	Bridge, Hume Freeway (over Merri Creek)	N/A	Approved
SN0512	Bridge, Hume Freeway (over Kalkallo Creek)	N/A	Approved
SN0521	Bridge, Hume Freeway (over Lithgow Street)	N/A	Approved
SN9176	Bridge, Northern Highway (North of Wallan)	N/A	Approved
SN0439	Bridge, Northern Highway (over Kilmore Creek)	Slow to five kilometres per hour and straddle centreline of road (both directions)	Approved with conditions
SN9177	Bridge, Sydney Street (Kilmore)	Slow to five kilometres per hour and straddle centreline of road (southbound) and slow to five kilometres per hour and close to centreline (northbound)	Approved with conditions

Code	Bridge Name	Condition	Approval
SN0441	Bridge, Northern Highway (over Kilmore Creek)	Slow to five kilometres per hour (both directions)	Approved with conditions
SN6948	Bridge, Northern Highway (northwest of Kilmore)	N/A	Approved
SN0442	Bridge, Northern Highway (over Kilmore Creek)	N/A	Approved
SN0443	Bridge, Northern Highway (over Kilmore Creek)	N/A	Approved
SN0444	Bridge, Northern Highway (over Percivall Creek)	N/A	Approved
SN0445	Bridge, Northern Highway (over Mollison Creek)	Straddle centreline of bridge (both directions)	Approved with conditions
SN0446	Bridge, Northern Highway (over Mcivor Creek)	Straddle centreline of bridge (both directions)	Approved with conditions
SN0450	Bridge, Northern Highway (near Spring Plains Nature Conservation Reserve)	Slow to five kilometres per hour (both directions)	Approved with conditions
SN0455	Bridge, Kilmore Road (over Possum Gully)	N/A	Approved
SN0456	Bridge, Northern Highway (over Mcivor Creek)	N/A	Approved
SN0460	Bridge, Northern Highway (over Ladys Creek)	N/A	Approved
SN0462	Bridge, Northern Highway (over Mount Pleasant Creek)	N/A	Approved
SN0465	Culvert, Northern Highway (just north of Toolleen Angle Road)	N/A	Approved
SN0467	Culvert, Northern Highway (just north of Hayes Bridge Road)	N/A	Approved
SN0472	Bridge, Northern Highway (over Mount Pleasant Creek)	N/A	Approved

Code	Bridge Name	Condition	Approval
SN0474	Bridge, Midland Highway (over Campaspe River)	Stradle centreline (both directions)	Approved with conditions
SN0476	Bridge, Midland Highway (over Campaspe River)	Slow to five kilometres per hour (both directions)	Approved with conditions
SN0479	Bridge, Northern Highway (over Waranga Western Channel)	N/A	Approved
SN0487	Culvert, Northern Highway (north of Middleton Road)	N/A	Approved
SN0488	Bridge, Northern Highway (just south of Spiers Road)	N/A	Approved
SN0489	Bridge, Northern Highway (between Spiers Road and Echuca-Mitiamo Road)	Slow to five kilometres per hour and straddle centreline of road (both directions)	Approved with conditions
1707 (NSW)	Level Crossing, Cobb Highway (near Mathoura Line Road)	Contact Rail Infrastructure Manager. Rail Infrastructure Manager contact details available at: Oversize and/or overmass (OSOM) vehicles & loads Active control - primary flashing lights	Restricted
1724 (NSW)	Level Crossing, Ochertyre Street (south of Barham Road)	Contact Rail Infrastructure Manager. Rail Infrastructure Manager contact details available at: Oversize and/or overmass (OSOM) vehicles & loads Active control - primary flashing lights	Restricted

It is understood that the NHVR will liaise (or advise the client to liaise) with relevant road and rail authorities upon application for the Class 1 permit.

4. SWEPT PATHS

4.1. ROUTE

A vehicle swept path assessment has been undertaken for constrained intersections and rest areas along the route, where potential conflicts between the vehicle and roadside infrastructure were identified during the route inspection.

The swept paths have been undertaken for the selected design vehicle (**Section 1.1**) and are provided in **Appendix A**. The swept paths include notation for removal of relevant signs and highlights where a portion of the combination needs to traverse the verge or a mountable kerb or traffic island. These areas were identified as suitable for traversal based on the route drive.

A summary of the temporary alterations to road reserve infrastructure required along the route is provided below. The specific alterations are provided on the concept swept path assessment provided in **Appendix A**. Signage will be removed during the passage of the combination only and be reinstated immediately afterward.

- Remove two 'Keep Left' signs at Northern Highway / McIvor Highway in Heathcote.
- Remove two 'Give Way' signs, one bidirectional hazard marker and two directional signs at Northern Highway / Midland Highway east of Elmore.
- Remove one street name sign at Northern Highway / Midland Highway in Elmore.
- Remove five 'Keep Left' signs and one 'Give Way' sign at Northern Highway / Gillies Street in Rochester.
- Remove five directional hazard markers at Northern Highway / Murray Valley Highway in Echuca.
- Remove one 'Give Way' sign and one shared path give way sign at Northern Highway / Warren Street in Echuca.
- Remove two 'Give Way' signs and two 'Keep Left' signs at Cobb Highway / Hardinge Street in Deniliquin.
- Remove one refuge island sign, two 'Keep Left' signs and two 'Give Way' signs at Hardinge Street / Cressy Street in Deniliquin.
- Remove three 'Keep Left' signs and one 'Give Way' sign at Hardinge Street / Charlotte Street in Deniliquin.
- Remove one 'Keep Left' sign at Charlotte Street / Davidson Street in Deniliquin.

As noted, the design vehicle is required to traverse the verge in some locations, or mount kerbing or traffic islands that were considered suitable for traversal. No major intersection works are required to facilitate the vehicle. The operator will be responsible for remediation of removed signage and repair of any damaged infrastructure (i.e. kerbing) as a result of the drive.

4.2. SITE ACCESS

The proposed site access will be designed to accommodate the design OSOM vehicle.

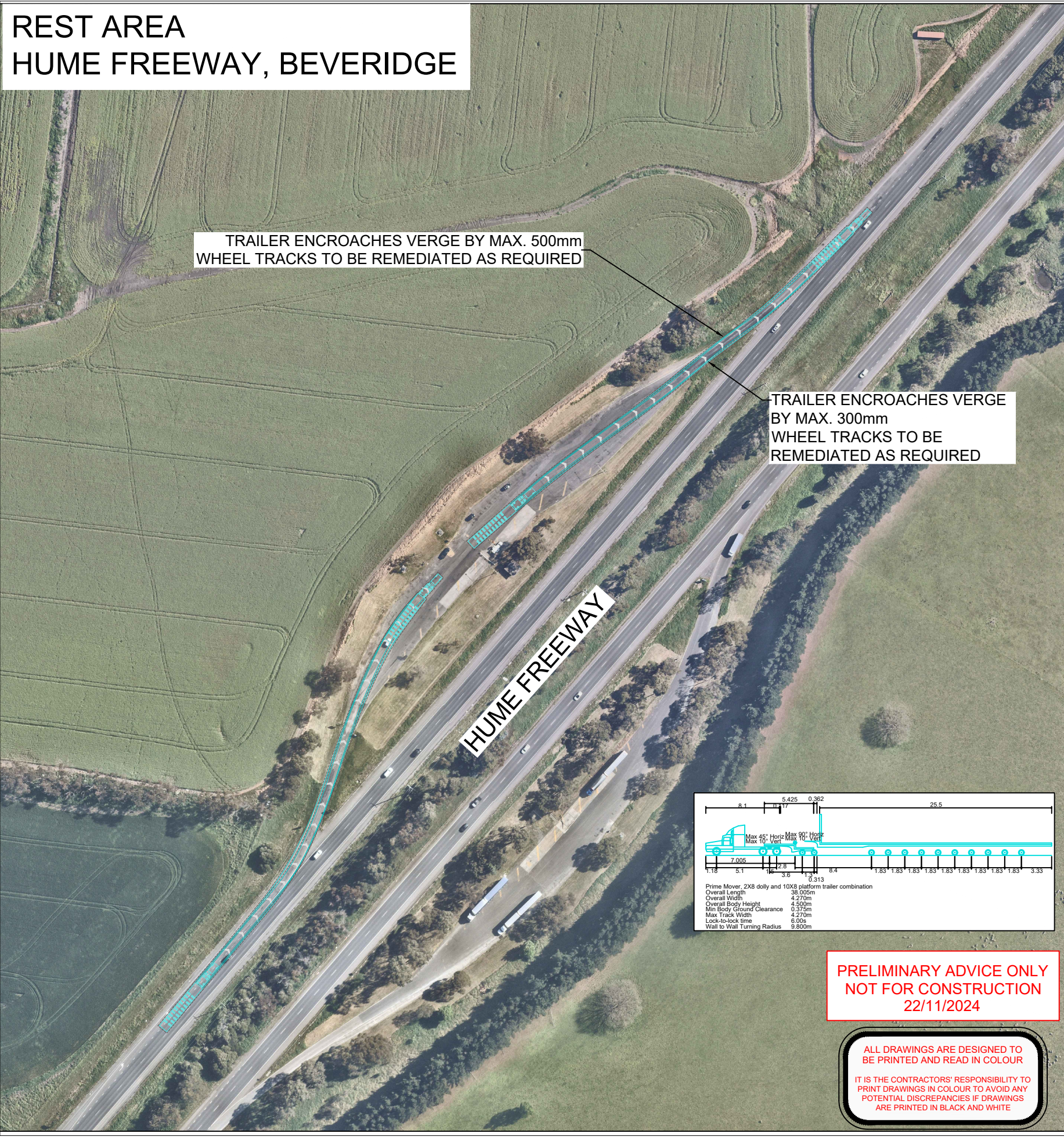
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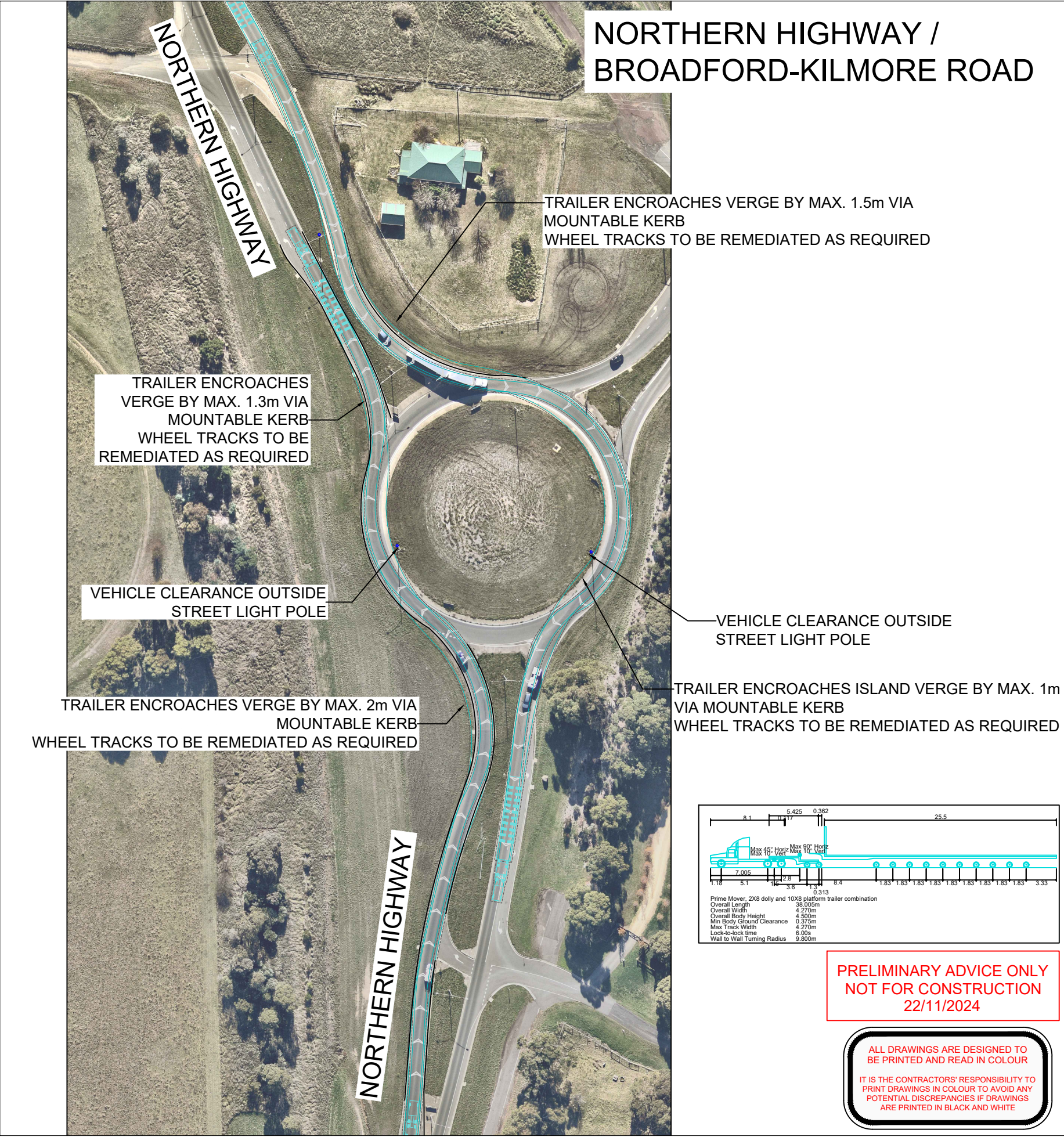
Urbis has completed a Concept Route Assessment in accordance with TfNSW requirements for the proposed high-risk OSOM vehicle transporting between the Port of Melbourne (Victoria) and the site in Deniliquin (NSW). The proposed route is shown in **Figure 3**. The following has been concluded from this assessment:

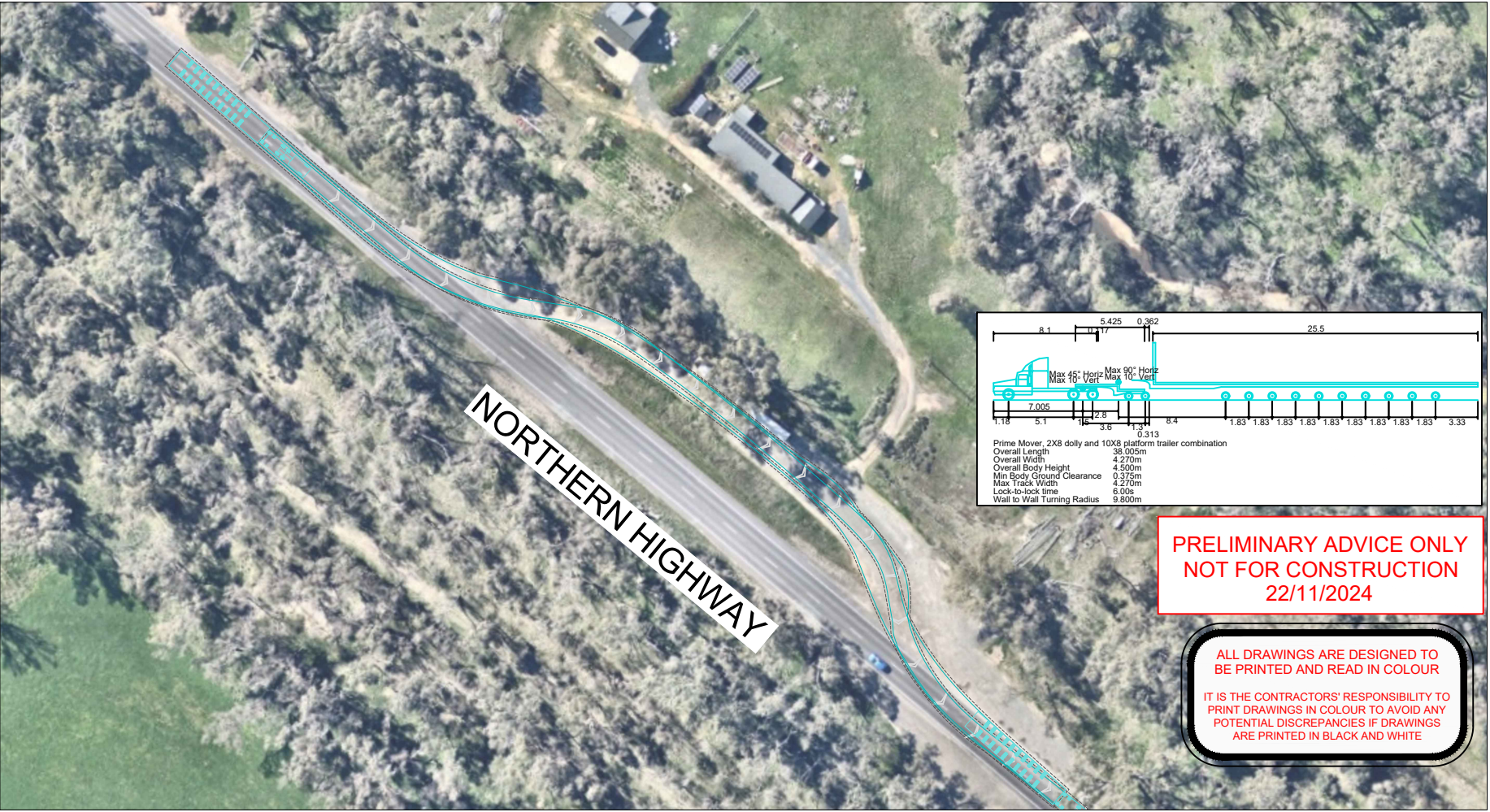
- The OSOM vehicle is conditionally approved to operate on the proposed Victorian roads along the route, noting the operating constraints listed in **Table 2**.
- The proposed OSOM vehicle does not comply with the Multi-State Class 1 Load Carrying Vehicle Mass or Dimension Exemption Notices, and therefore is not pre-approved along the NSW portion of the route.
- A number of rest areas have been identified along the route, which are suitable to accommodate the OSOM vehicle as shown in **Appendix A**. The locations of these rest areas have been identified in **Table 1**.
- Based on an overall laden height of 4.4 metres, it is expected that no major height restrictions will occur along the route due to bridges or gantries. It is recommended that the NHVR and/or operator liaise with relevant electricity providers to ensure that power lines are not impacted by the transport.
- Based on an overall laden mass of 200 tonnes, it is expected that no major weight restrictions will occur along the route. Within Victoria, all bridges are either approved or conditionally approved for traversal by the OSOM vehicle, as shown in **Table 2**. It is expected that the unmarked bridge in Deniliquin will also be suitable for traversal by the combination given it is approved under the NSW Oversize Overmass Load Carrying Vehicles Network.
- Vehicle swept paths have been prepared for intersections along the route, provided in **Appendix A**. The proposed OSOM vehicle can adequately manoeuvre all intersections. Some signage needs to be removed to facilitate vehicle movement at intersections, and at some locations the combination needs to traverse the verge or a mountable kerb or traffic island. These areas were identified as suitable for traversal based on the route drive.

APPENDIX A

ROUTE AND REST AREA SWEPT PATHS









NORTHERN HIGHWAY / MCIVOR HIGHWAY, HEATHCOTE

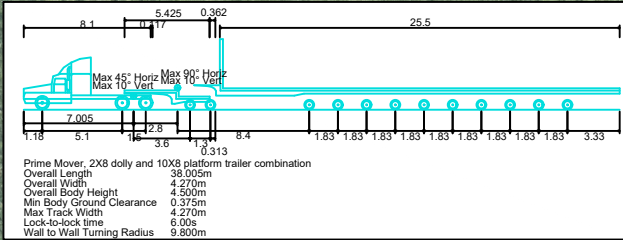
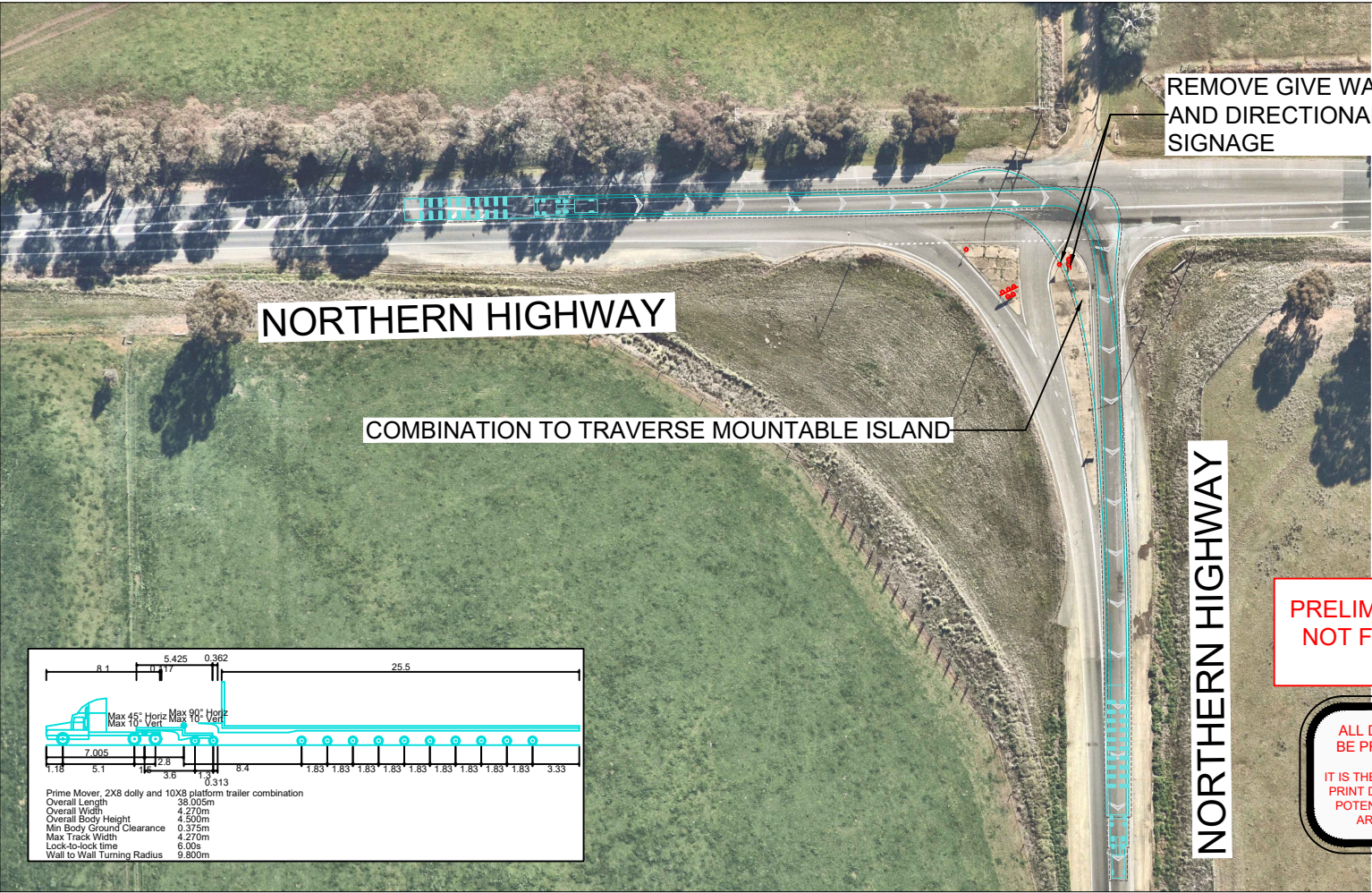
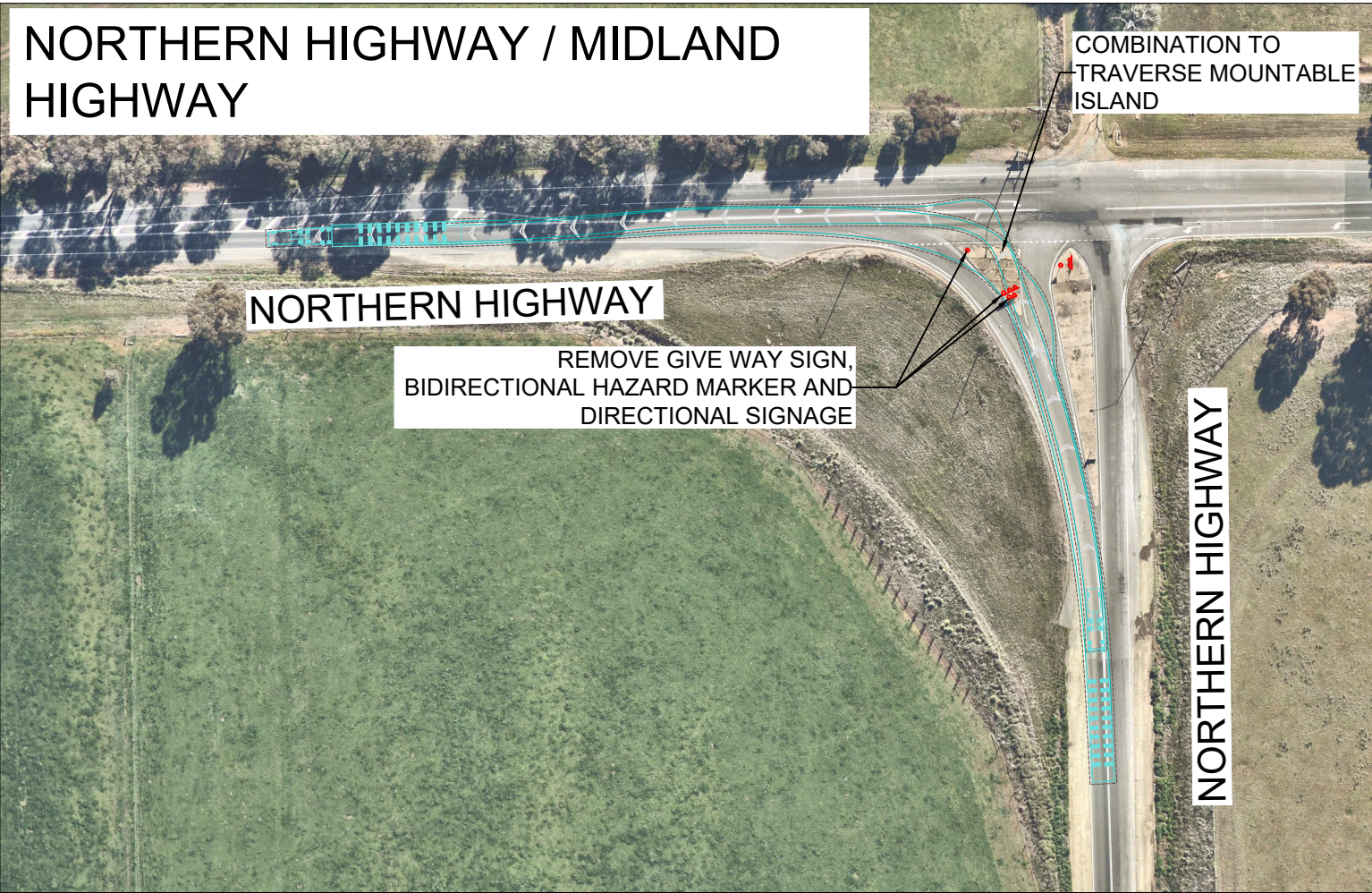
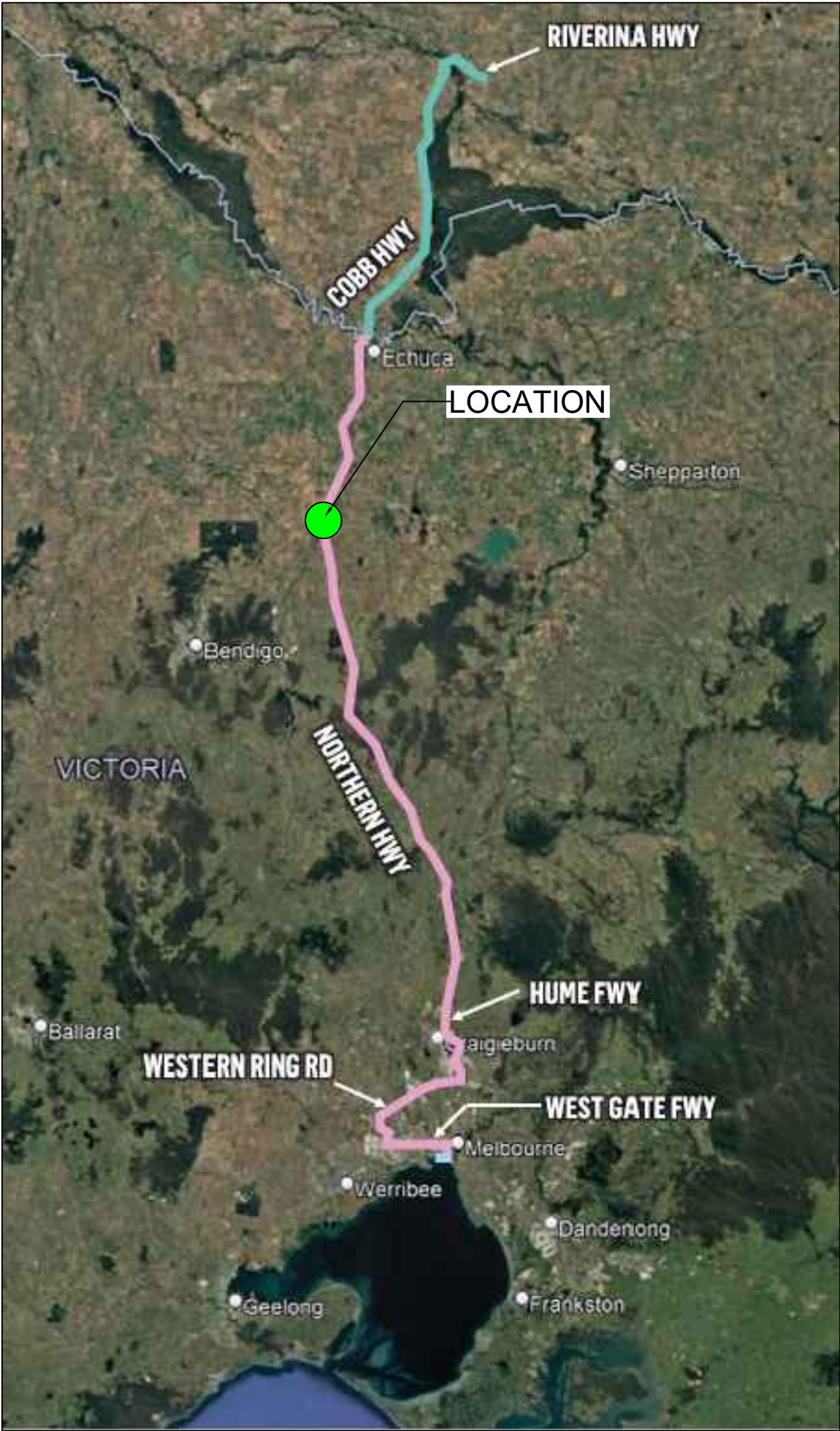


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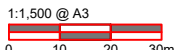
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PROJECTION
GDA2020 / MGA zone 55

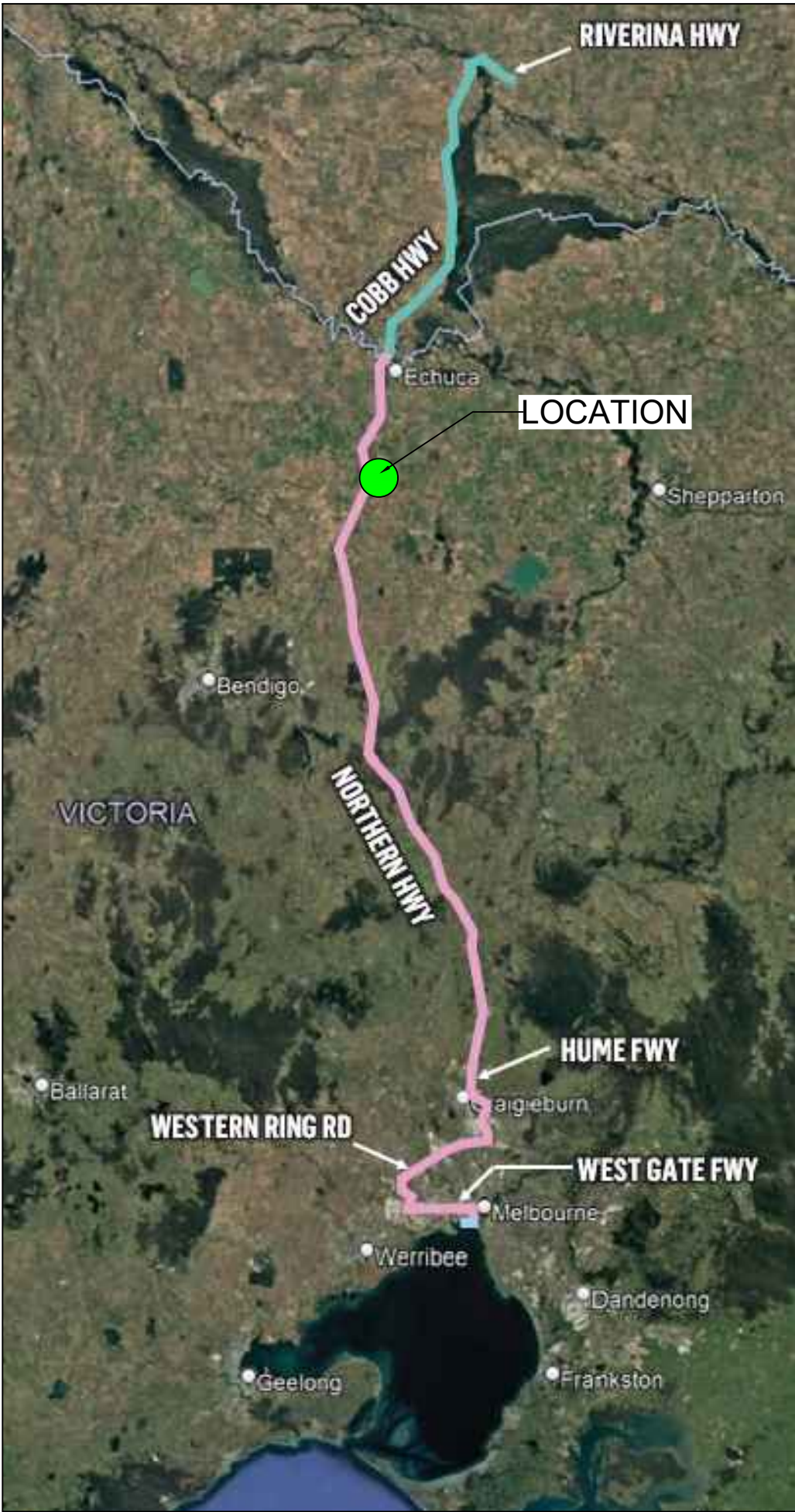
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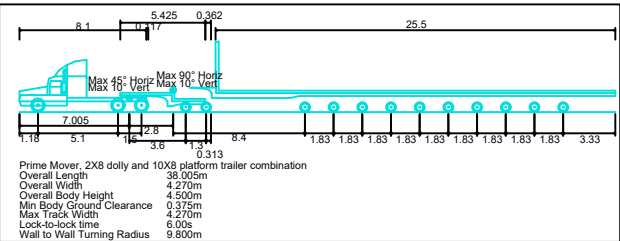
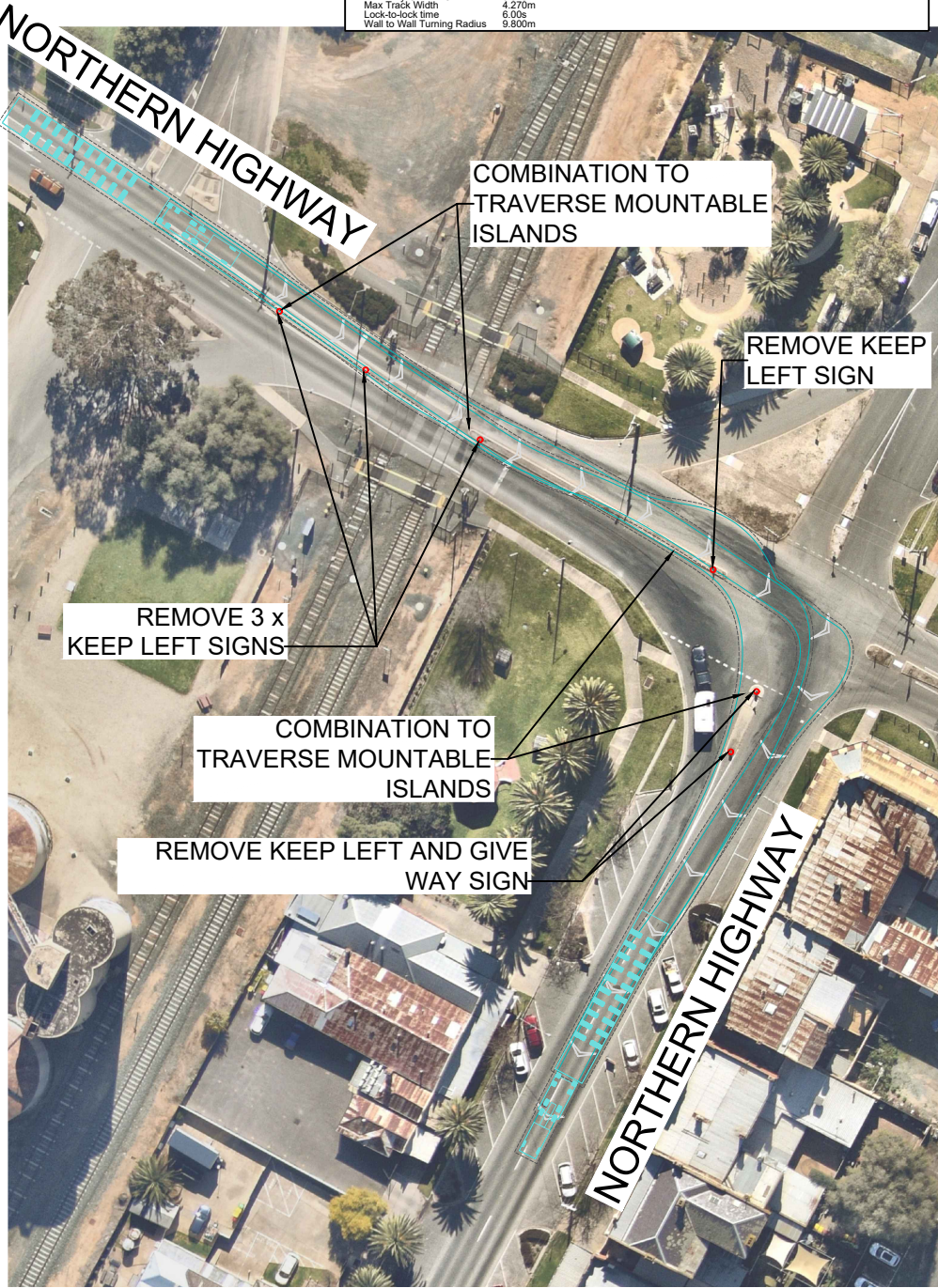
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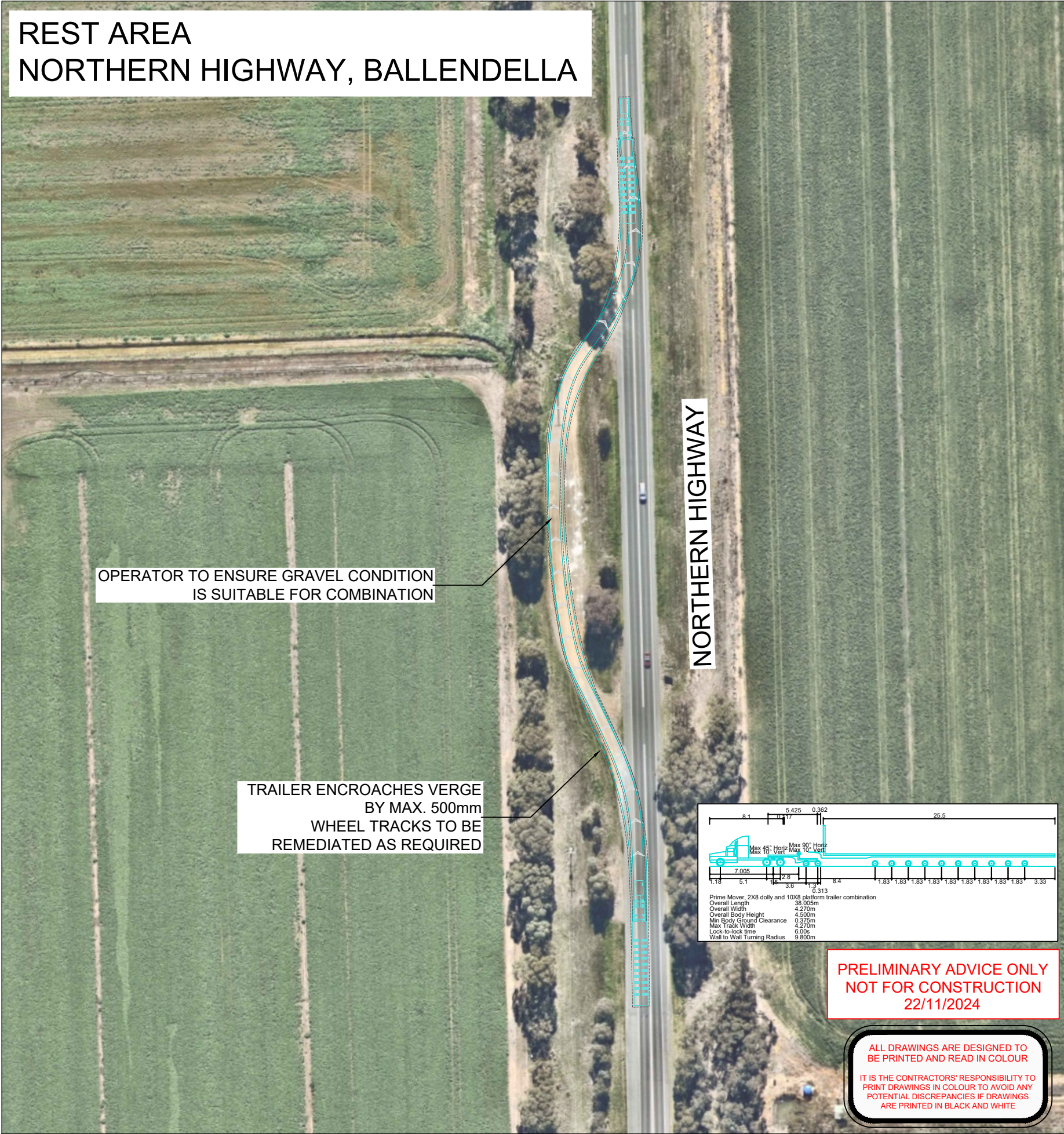
NORTHERN HIGHWAY / GILLIES STREET



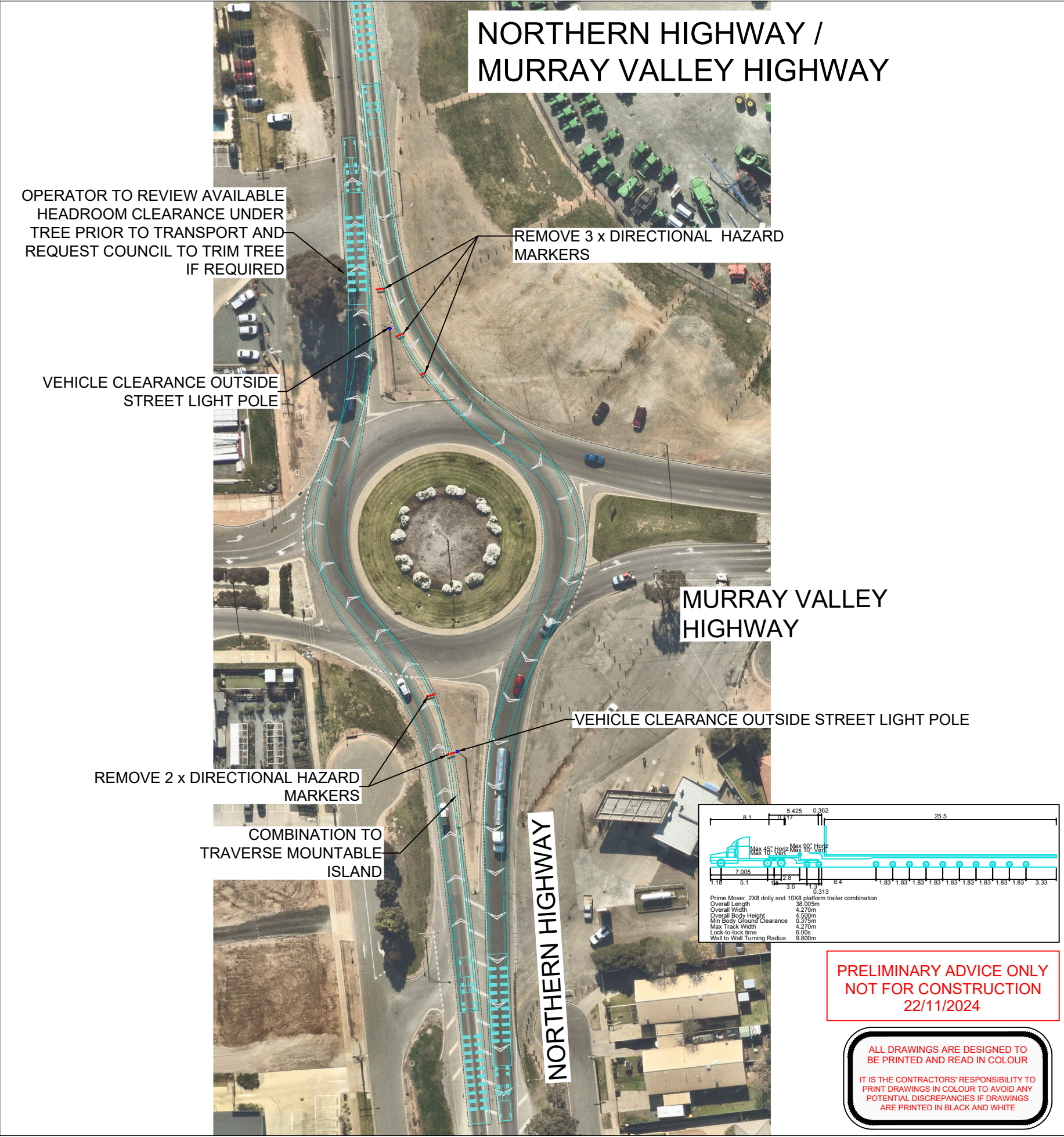
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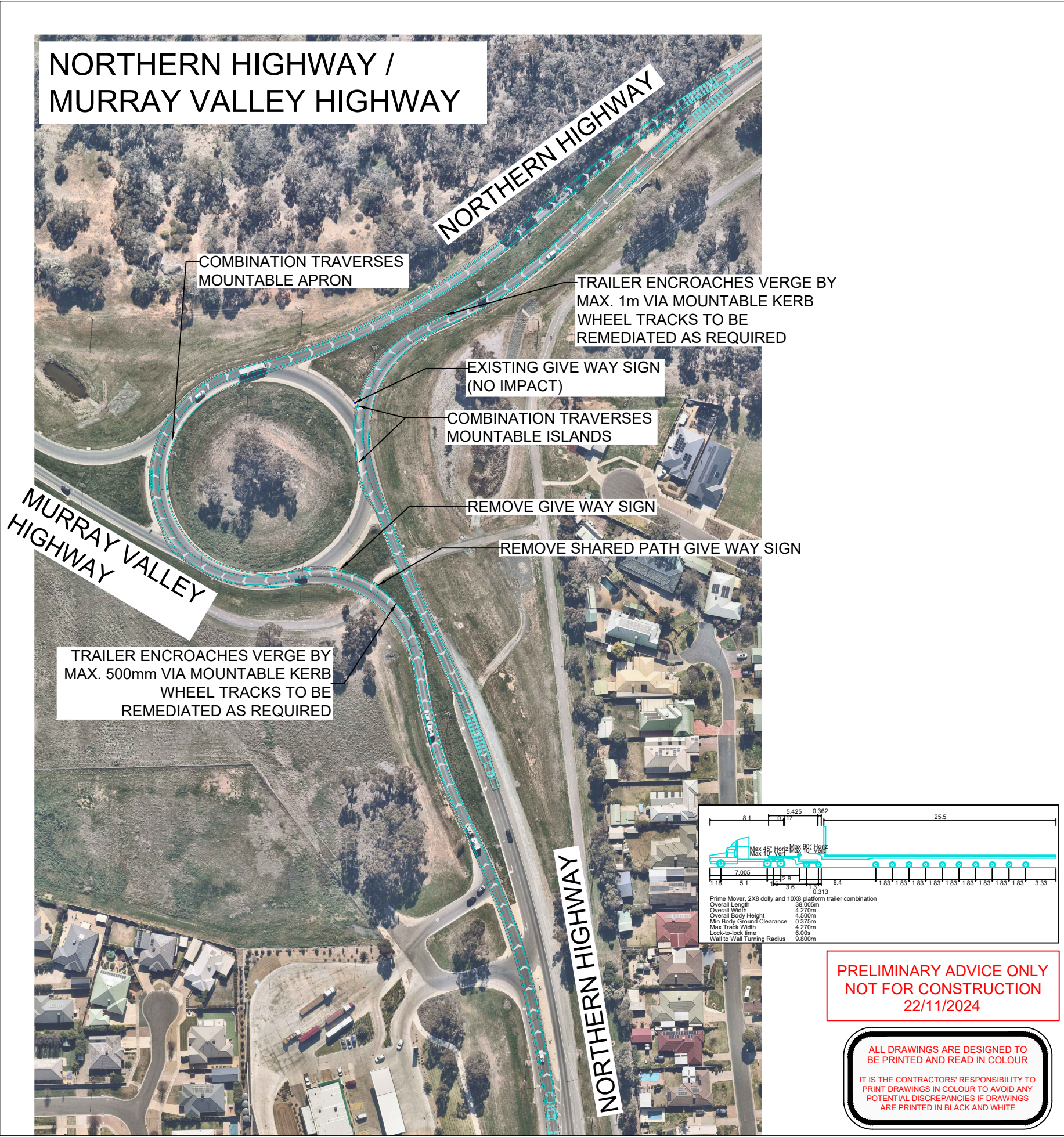
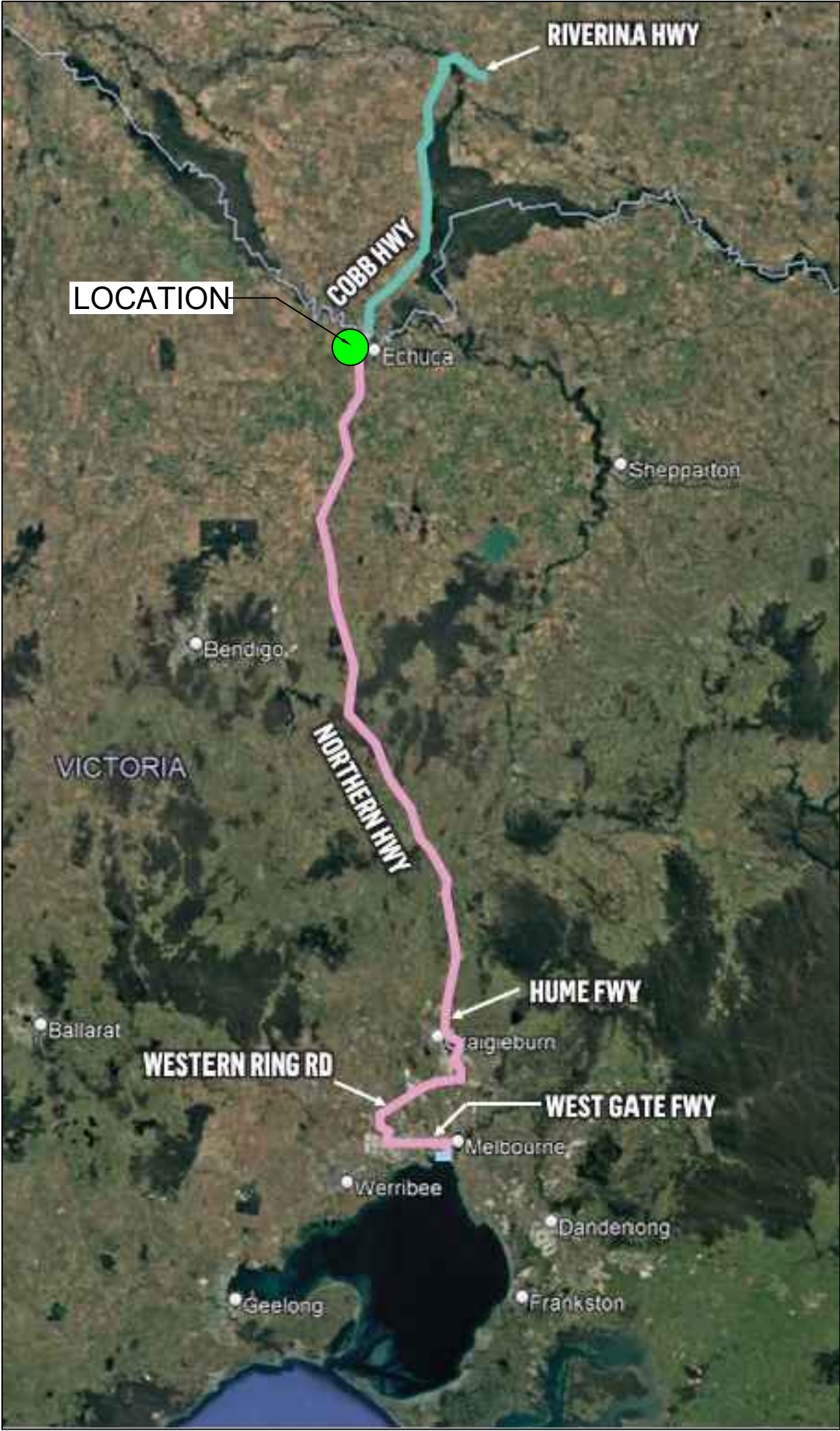
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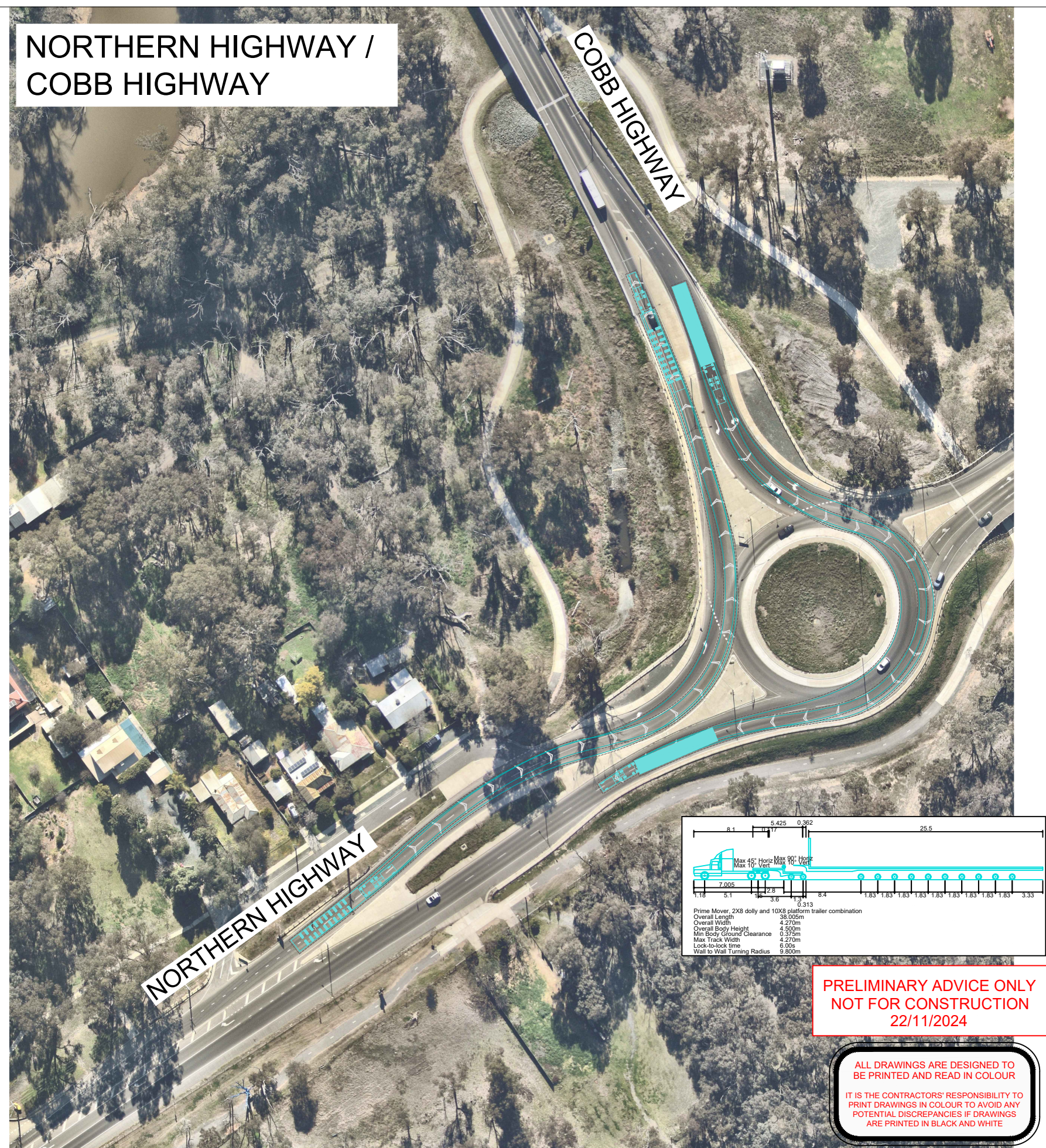
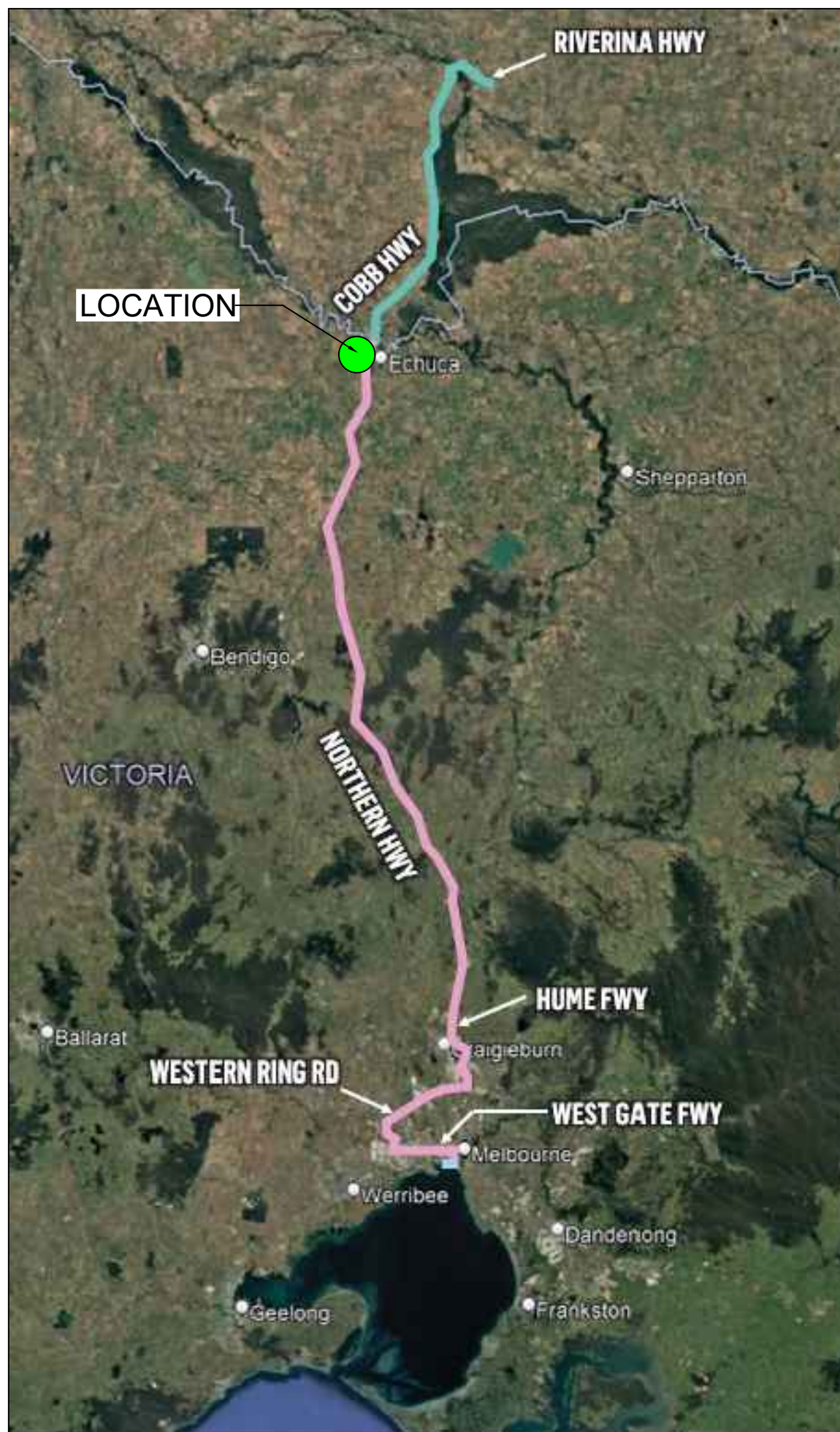
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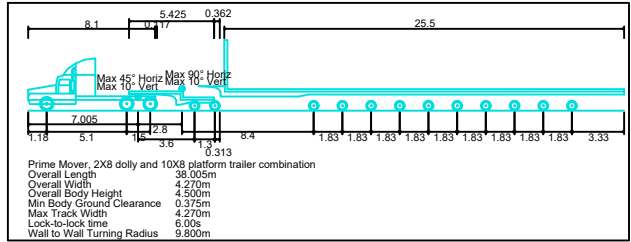








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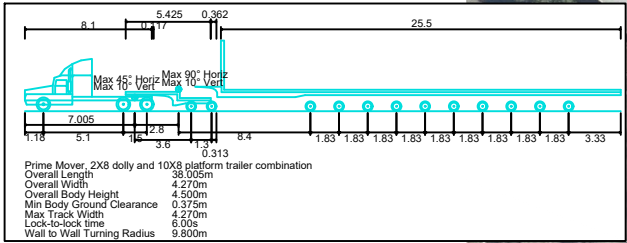
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HARDINGE STREET / CRESSY STREET

COMBINATION TRAVERSES MOUNTABLE ISLAND
COMBINATION TRAVERSES MOUNTABLE APRON
REMOVE GIVE WAY AND KEEP LEFT SIGNS
COMBINATION TRAVERSES MOUNTABLE ISLAND
REMOVE REFUGE ISLAND / KEEP LEFT SIGN

HARDINGE STREET
CRESSY STREET



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DATA SOURCE

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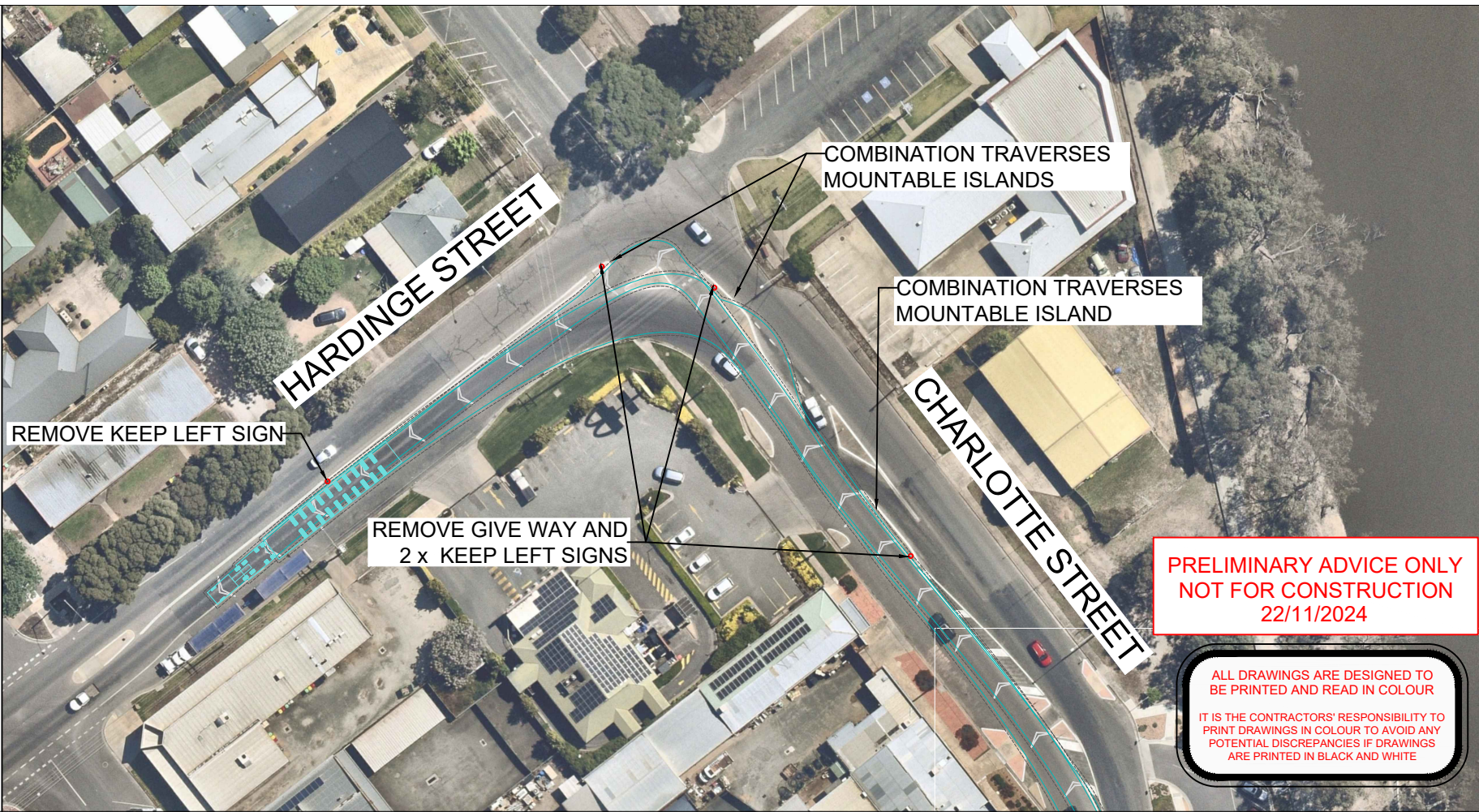
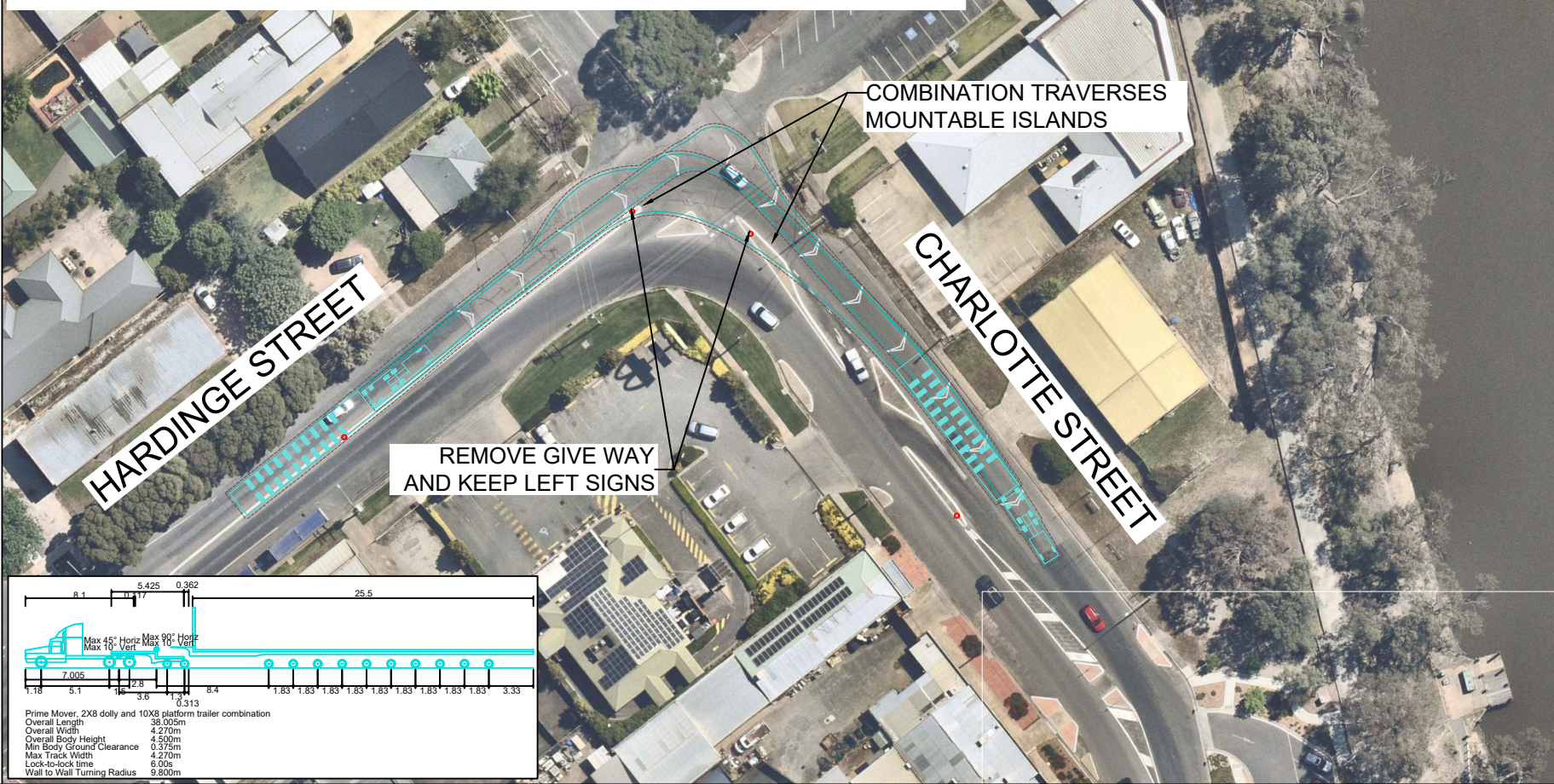
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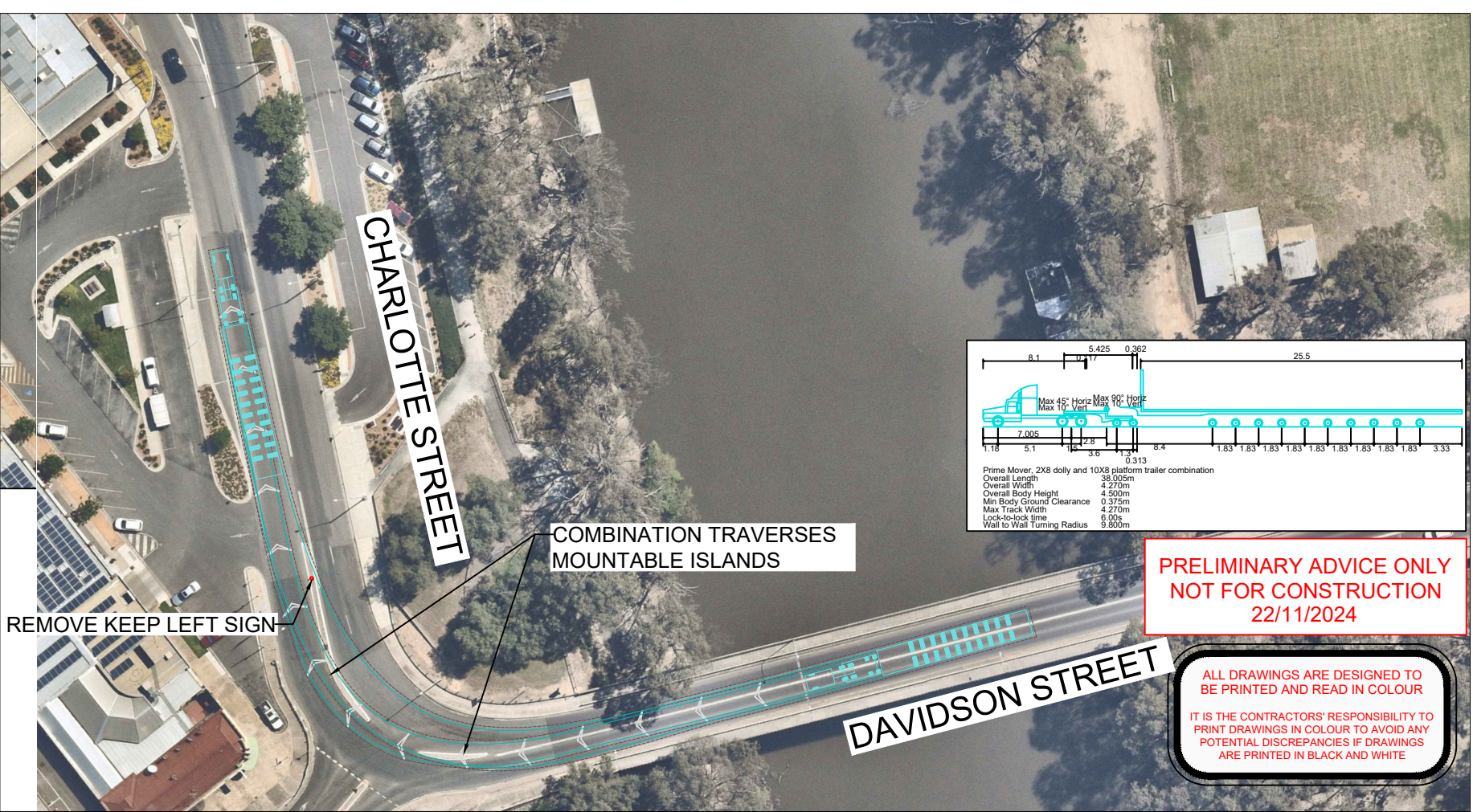
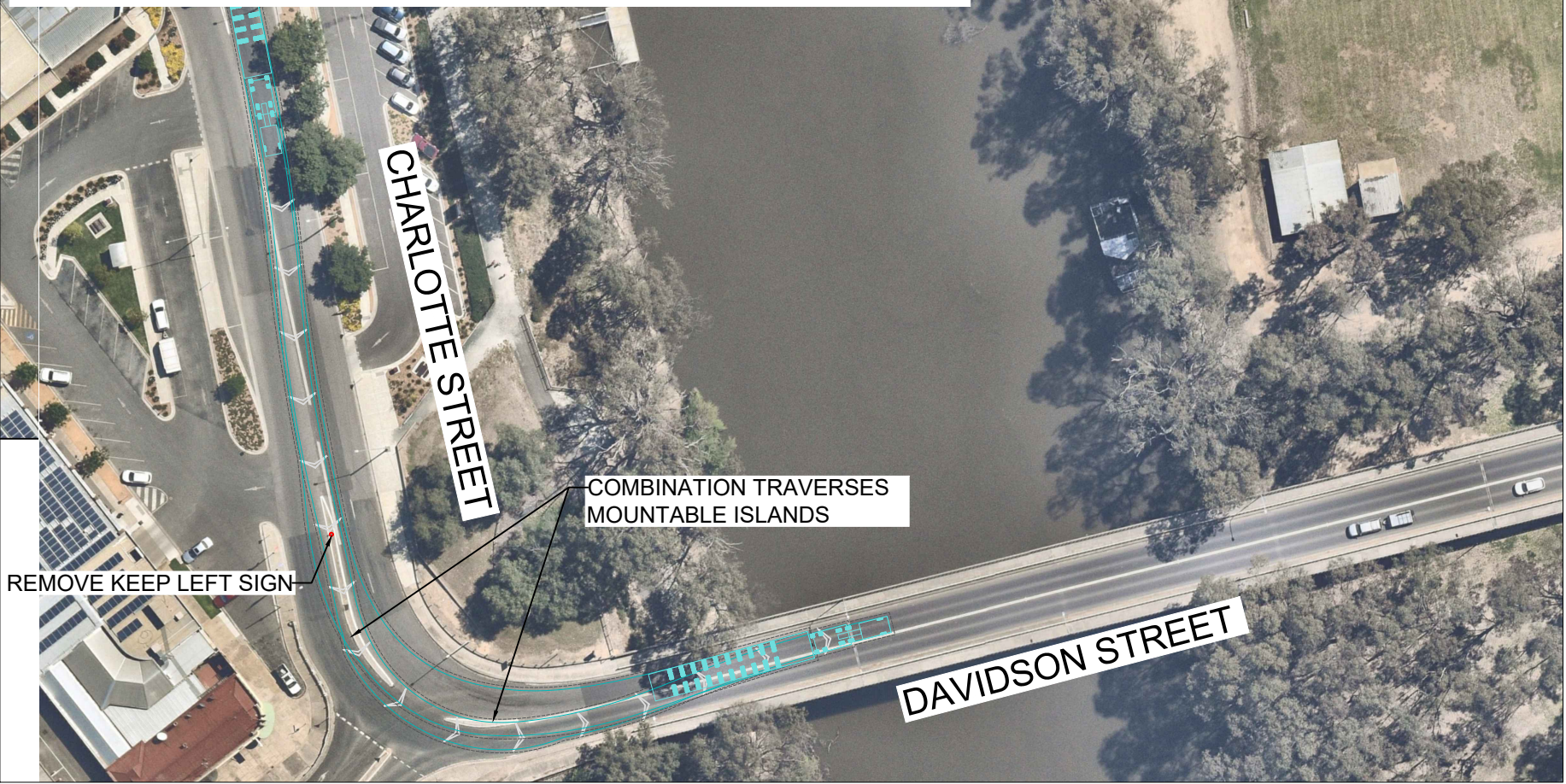


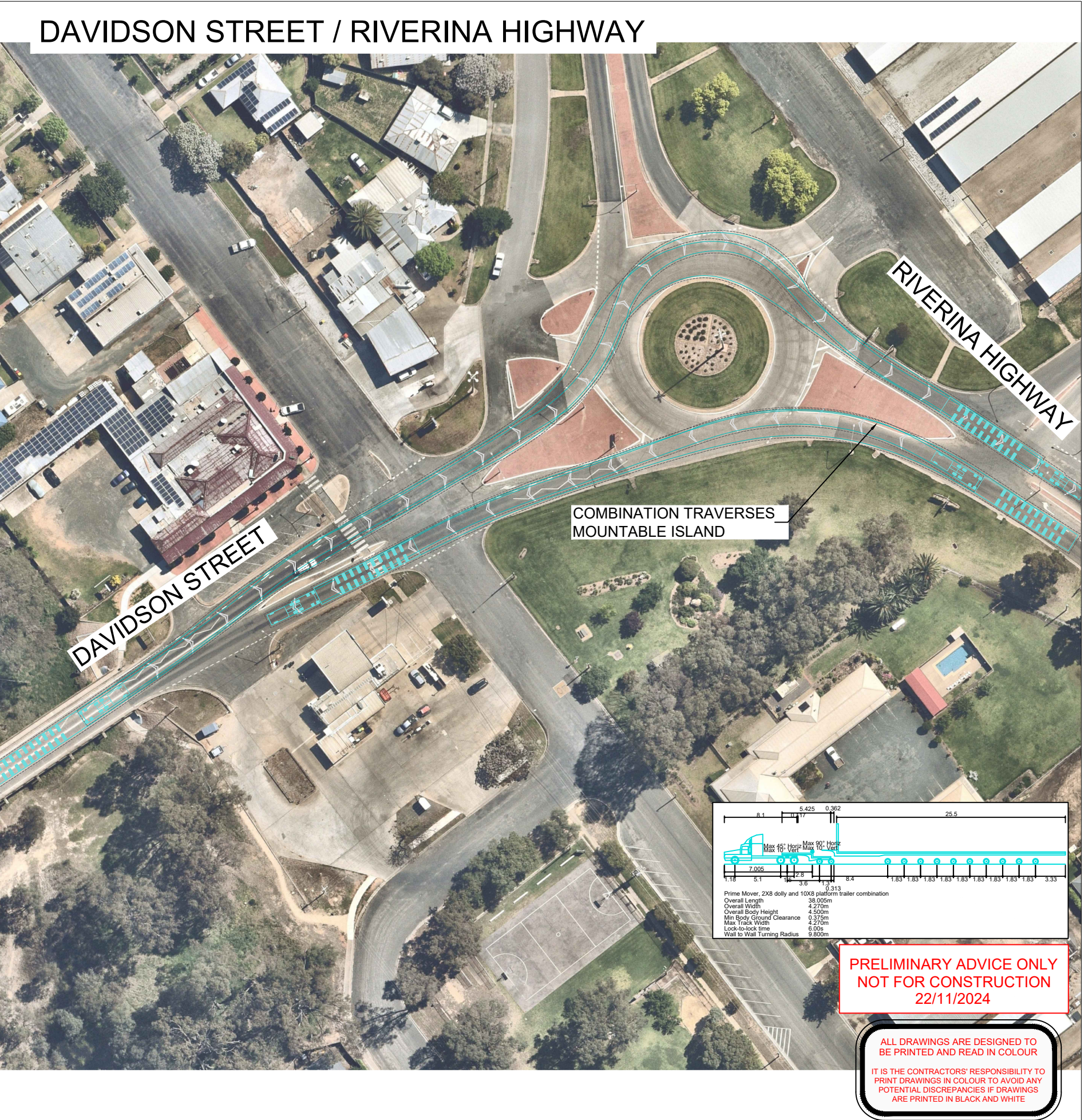
HARDINGE STREET / CHARLOTTE STREET





CHARLOTTE STREET / DAVIDSON STREET





APPENDIX E DRIVER CODE OF CONDUCT

DRIVER CODE OF CONDUCT

MINIMISE IMPACTS ON THE ROAD NETWORK

- All vehicles must be fully roadworthy and maintained
- All drivers must obey all signs, directions and instructions and strictly comply with all traffic regulations
- All drivers must comply with all maximum gazetted speed limits on all roads or a lesser speed as dictated by the site-specific signage
- All loads shall be covered with tarps and be secured

MINIMISE CONFLICTS WITH OTHER ROAD USERS

- Drivers are to remain calm and courteous when in contact with other road users, members of the public, and landowners.
- Drivers are not to use obscene language on radio or intercom communication.
- All drivers must yield "right of way" whenever appropriate to ensure the safe passage of other road users.
- All drivers are to at all times leave adequate distance between vehicles to allow safe passing by other road users, as required.
- Drivers should exit the site in a forward motion and check their left and right twice while exiting to ensure the safety of pedestrians, cyclists and other vehicles is maintained.
- Upon exiting, drivers must wait for a suitable gap in traffic. The Roads Act does not give any special treatment to trucks exiting a construction-site, but the vehicles on the road have the right-of-way.
- Truck engines should be turned off during deliveries.

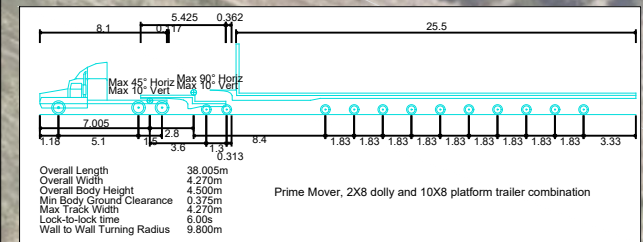
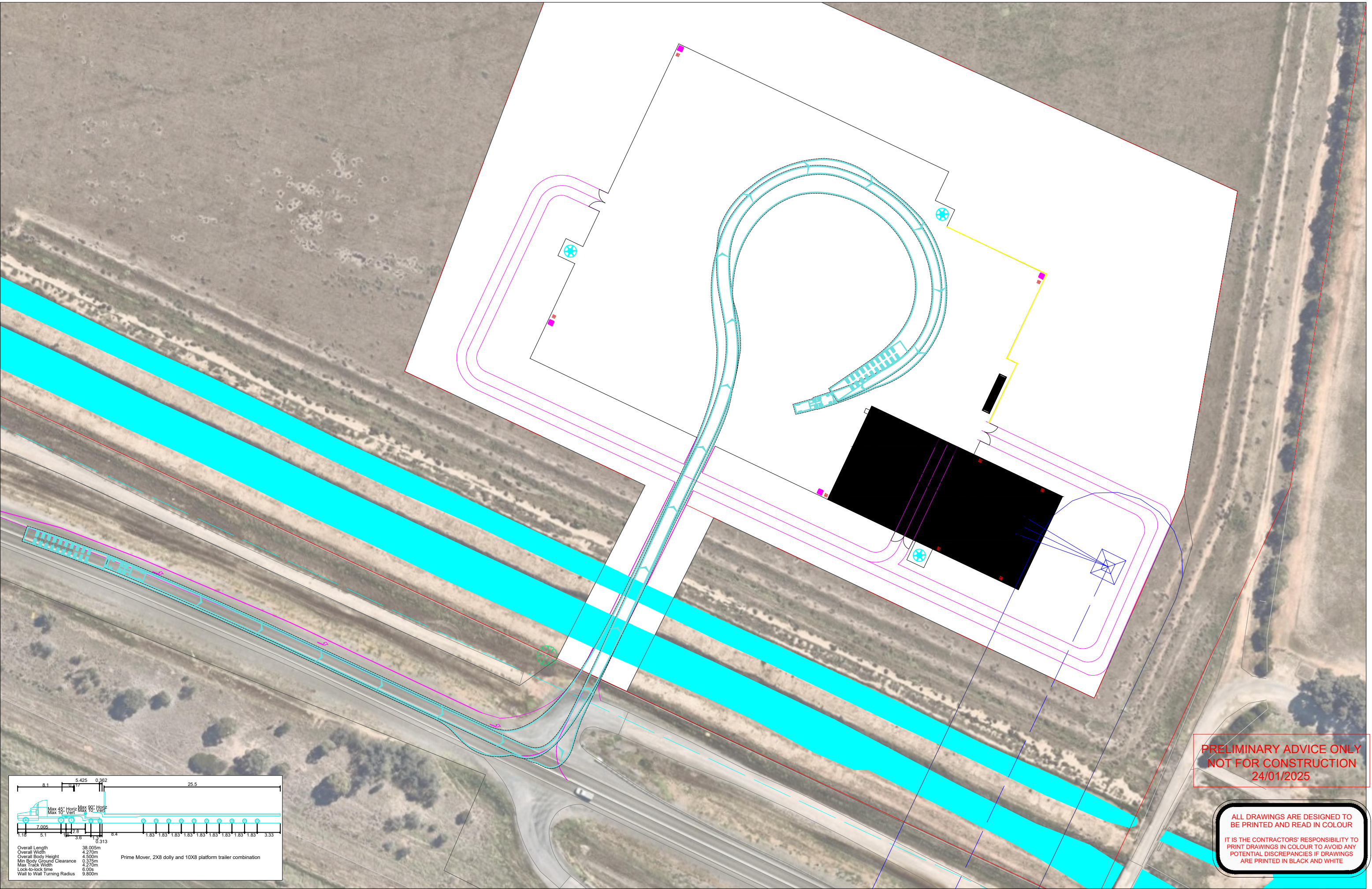
MINIMISE ROAD TRAFFIC NOISE

- Drivers are to decrease vehicle speeds to minimise dust and noise around private dwellings, road works and stationary vehicles.
- Drivers are to not use engine braking where noise is likely to adversely impact residents.
- Drivers should limit any excessive or unnecessary use of horns, in particular outside of working hours.

MINIMISE OTHER IMPACTS

- Drivers are to maintain vehicles in a clean and tidy condition.
- Drivers are to ensure that there is no littering.
- Drivers should avoid other noise-emitting activities, such as raised voices, shouting, yelling or loud radio volumes.

APPENDIX F SWEPT PATHS



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Deniliquin Battery Energy Storgae System Construction Vehicle Swept Path - Site Access

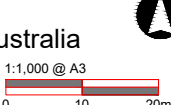
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DATA SOURCE
NearMaps
PROJECTION
GDA2020 / MGA Zone 55

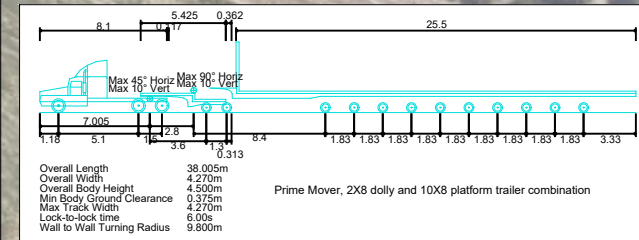
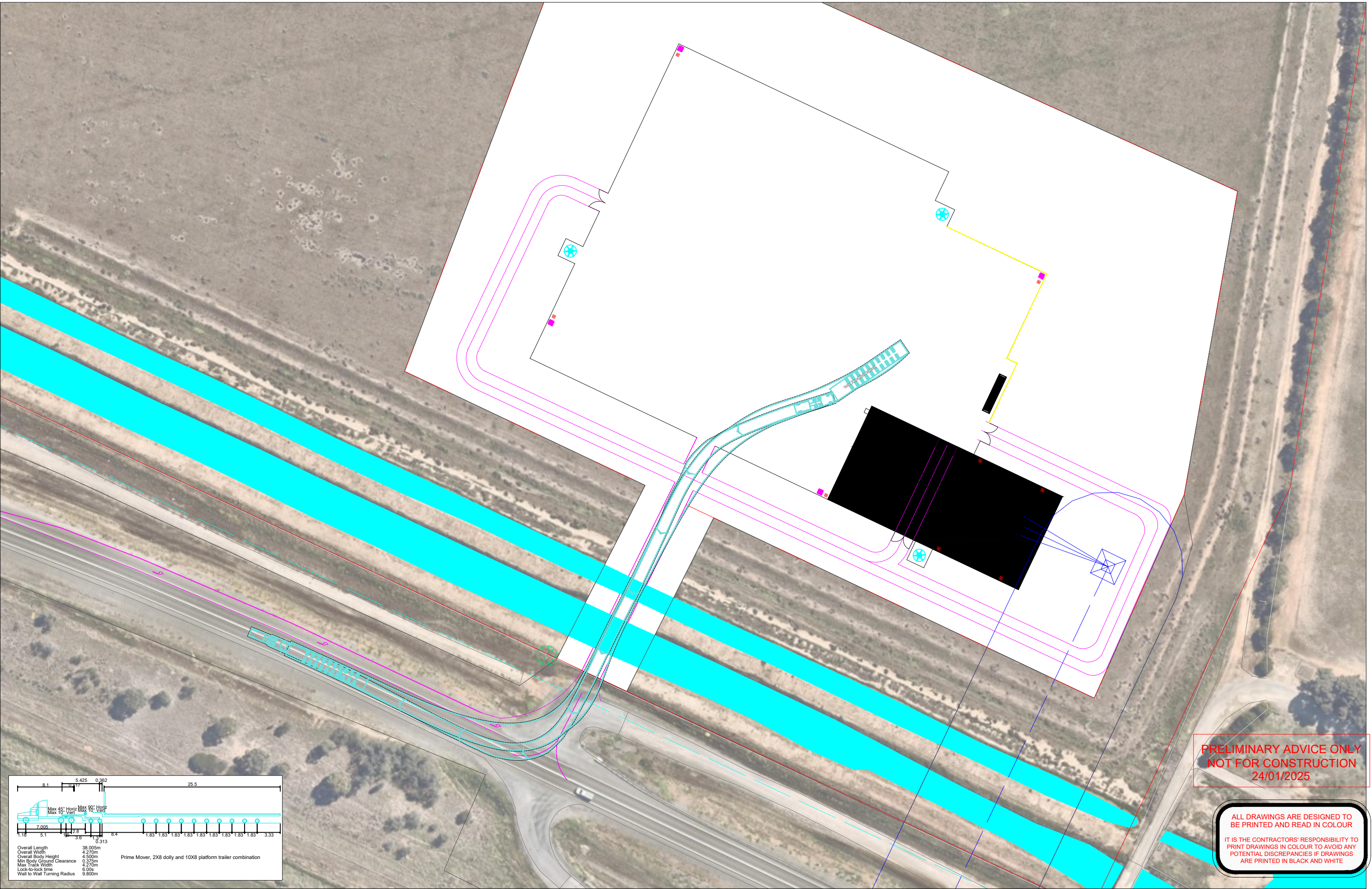
A	Preliminary Issue	SN	MR	24/01/2025
REV	DESCRIPTION	DWN	CHK	DATE

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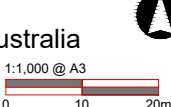
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DATA SOURCE
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PROJECTION
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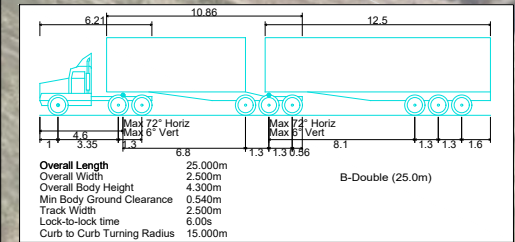
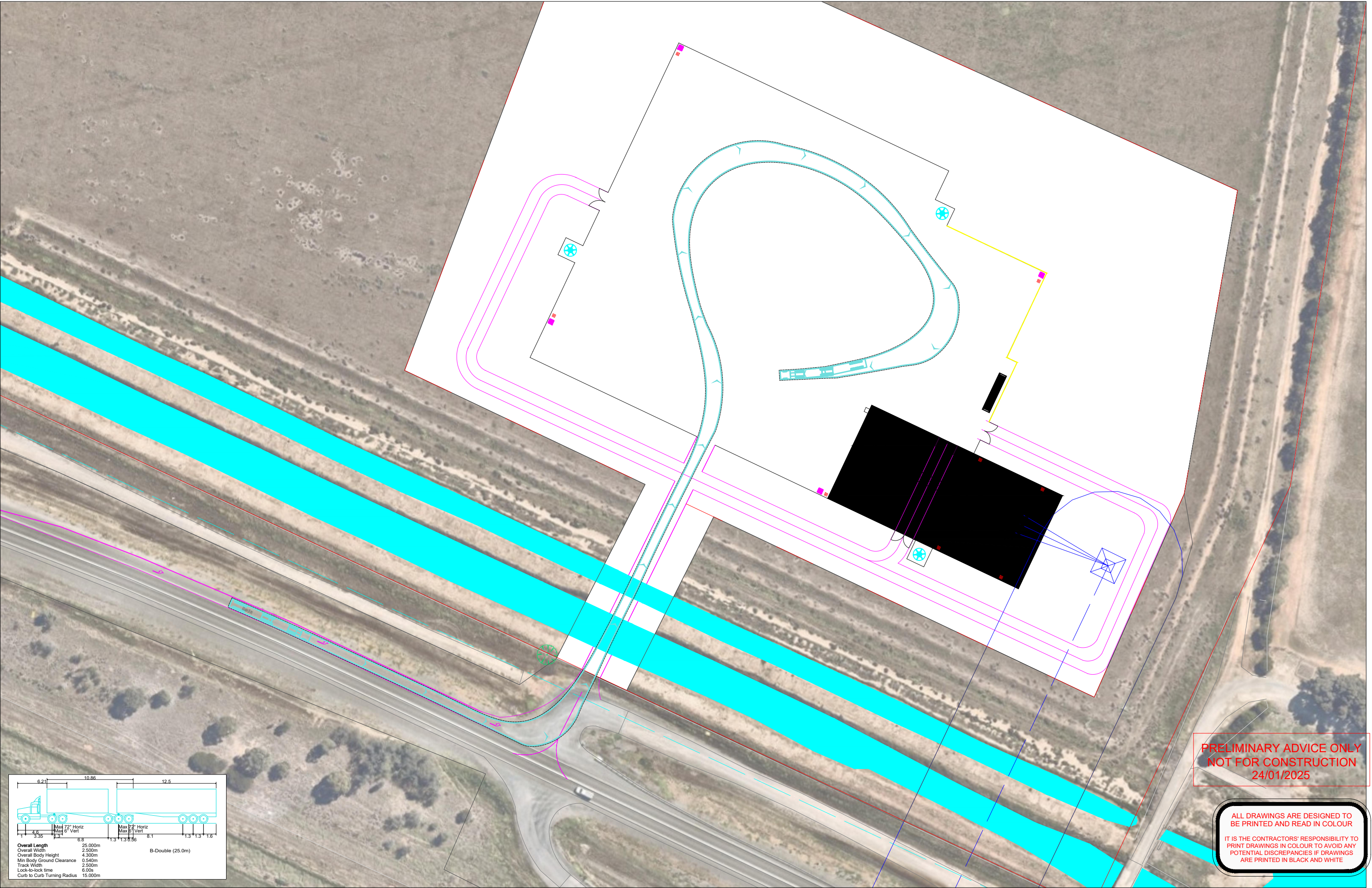
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A	Preliminary Issue	SN	MR	24/01/2025

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02	A



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DATA SOURCE
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REV DESCRIPTION

SN MR 24/01/2025
DWN CHK DATE

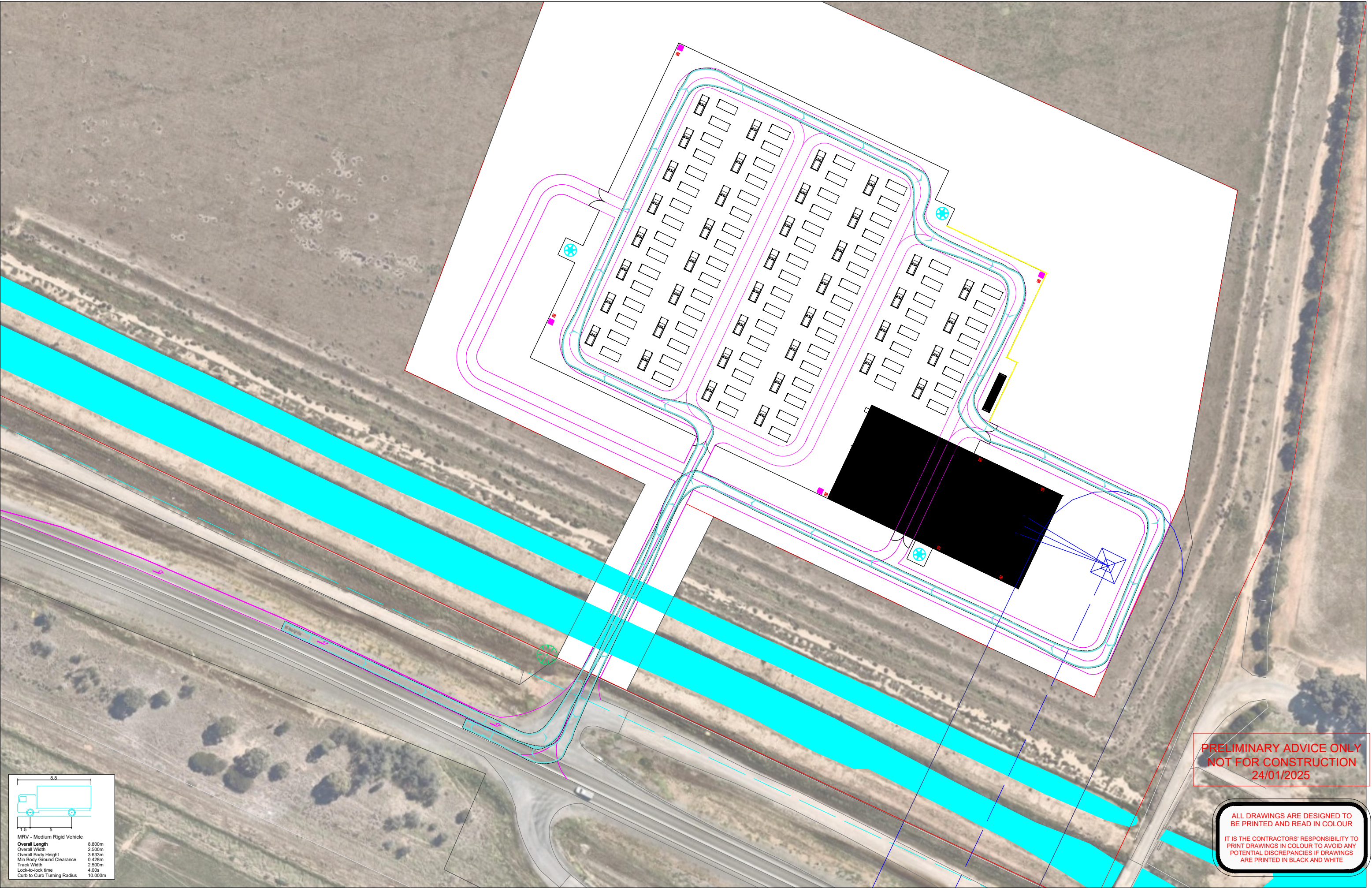
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1:1,000 @ A3
0 10 20m

PROJECT NO.
P0050308
DRAWING NO.
03

DATE
24/01/2025
REVISION
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8.8

1.5

5

MRV - Medium Rigid Vehicle

Overall Length

Overall Width

Overall Body Height

Min Body Ground Clearance

Track Width

Lock-to-lock time

Curb to Curb Turning Radius

8.800m

2.500m

3.633m

0.428m

2.500m

4.00s

10.000m

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Deniliquin Battery Energy Storgae System
Fire Truck Swept Path - Site Access and Internal Circulation

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1:1,000 @ A3

0 10 20m

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