

▴ Goulburn River
Solar Farm

Traffic and Transport Impact Assessment

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Definitions and abbreviations

Definitions and abbreviations to be applied to the Transport Impact Assessment are listed in the table below.

Abbreviation	Definition
95% back of queue	The length of vehicle queue at an intersection that is not exceeded in 99% of all cycles
ARTC	Australian Rail Track Corporation
Auxiliary lane	A portion of the roadway adjoining the through traffic lanes, used for speed change or for other purposes supplementary to through traffic movement
B-double	A combination consisting of a prime mover towing two semitrailers, with the first semitrailer being attached directly to the prime mover by a fifth wheel coupling and the second semitrailer being mounted on the rear of the first semitrailer by a fifth wheel coupling on the first semitrailer.
BESS	Battery Energy Storage System
CRN	Country Regional Network
CTMP	Construction Traffic Management Plan
CWO REZ	Central West Orana Renewable Energy Zone. A group of new wind and solar power generation in the Central West Orana region so that it can be efficiently stored and transmitted across NSW
DOS	Degree of Saturation
EP&A Act	Environmental Planning and Assessment Act 1979
EPA	Environmental Protection Authority
GAV	General Access Vehicles
Haulage routes	Roads designed for heavy or bulk transport of materials by heavy vehicles.
HML	NSW Combined Higher Mass Limits
km/h	Kilometres per hour
kV	kilovolt
LOS	Level of Service
MWdc	Megawatt defined conditions
MWh	Megawatt hour
MWp	Megawatt peak
NSW	New South Wales
OSOM vehicle	Oversize Overmass. A vehicle or vehicle combination that exceeds any general access mass or dimension limits
Peak period	The period that has the highest demand volume of traffic and/or number of passengers during the day (peak hour, peak half hour, etc.)
RAV	Restricted Access Vehicles
ROL	Road Occupancy License
RUM	Road User Movement
SISD	Safe Intersection Sight Distance
SRD SEPP	State Environmental Planning Policy (State and Regional Development)
SSD	State Significant Development
Swept path	The area bounded by lines traced by the extremities of the bodywork of a vehicle while turning.
Tie-in infrastructure	Operations and maintenance buildings, civil works and electrical components

1. Introduction

1.1. Background

Lightsource Development Services Australia Pty Ltd (Lightsource bp) proposes to develop a solar farm in the Upper Hunter region of New South Wales (NSW), approximately 28 kilometres southwest of Merriwa. The proposed Goulburn River Solar Farm (the Project) would be located on an agricultural parcel of land zoned RU1 – Primary Production (the Project Area), surrounded by the Goulburn River National Park.

The Project would involve the construction, operation and decommissioning of approximately 550-megawatt peak (MWp) of solar photovoltaic (PV) generation as well as a Battery Energy Storage System (BESS) with 280 MW / 570 megawatt hour (MWh) capacity. The Project would also include a substation and connection to an existing 500 kilovolt (kV) transmission line. The Project would include various associated infrastructure, including road repairs and upgrades to Ringwood Road and Wollara Road, temporary construction facilities, operation and maintenance buildings, internal access roads, civil works and electrical infrastructure to connect the Project to the existing transmission line which passes through the Project Area.

The Project Area covers an area of approximately 2,000 hectares with a development footprint of approximately 799.5 hectares. The Project Area encompasses two freehold properties and sections of Crown Land.

The Project is considered a State Significant Development (SSD) under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP).

The objectives of the Project are to:

- Deliver affordable and sustainable renewable energy to business and communities within NSW
- Provide renewable energy that would contribute to the reduction of greenhouse gases across NSW, avoiding up to 705,000 tonnes per annum of carbon dioxide
- Support the local regional economy by preferencing local workers and businesses in the development, construction and operation of the Project
- Facilitate community engagement and participation in the design, development and operation of the Project
- Minimise environmental and heritage impacts to the Project Area through adaptive design.

Subject to planning approval, construction is proposed to commence in 2024.

1.2. Scope and objectives of this report

This report assesses the existing transport network conditions as well as the anticipated traffic and transport network impacts during construction and operation. Where feasible, mitigation and management measures to reduce the anticipated impacts of the Project have been identified. This report includes the consideration of the following:

- Existing traffic and transport within the study area including a review of:
 - The road network
 - Parking provision
 - Public transport
 - Pedestrians and bicycle users
 - Road safety
- Construction traffic and transport associated with the Project
- Operational traffic and transport associated with the Project
- Potential mitigation measures that may be implemented to minimise traffic and transport impacts associated with the Project.

1.2.1. Secretary’s environmental assessment requirements

The Secretary’s environmental assessment requirements for the Project were issued on 1 February 2022. The requirements specific to transport, and where these requirements are assessed in this report, are outlined in Table 1-1.

Table 1-1: Secretary’s environmental assessment requirements (transport)

Secretary’s environmental assessment requirements		Where addressed
a.	An assessment of the peak and average traffic generation, including over-dimensional vehicles and construction worker transportation;	Section 3.2, Section 3.3 and Section 4.1.1
b.	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 3.2.3, Section 3.2.4, Section 3.2.5, Section 3.2.6 and Section 4
c.	A cumulative impact assessment of traffic from nearby developments; and	Section 4.1.5
d.	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 authorities;	Section 5

1.3. References

In preparing this report, reference has been made to the following:

- *Guide to Road Design Part 3: Geometric Design* (Austroads, 2021)
- *Guide to Road Design Part 4A: Unsignalised and Signalised Intersections* (Austroads, 2021)
- *Guide to Road Traffic Management Part 6: Intersections, Interchanges and Crossings Management* (Austroads, 2020)
- *Austroads Design Vehicles and Turning Path Templates Guide* (Austroads, 2013)
- *Traffic Modelling Guidelines* (Roads and Maritime Services, 2013)
- *Guide to Traffic Generating Developments* (Roads and Traffic Authority, 2002)
- *Golden Highway Corridor Strategy* (Transport for NSW, 2016)
- *Goulburn River Solar Farm Scoping Report* (Umwelt (Australia) Pty Ltd, 2021).

1.4. Report structure

The report has the following structure:

- Chapter 1 (this chapter) provides an overview of the Project
- Chapter 2 details the existing traffic and transport environment
- Chapter 3 provides a description of the Project
- Chapter 4 provides an assessment of the potential traffic and transport impacts during the construction and operational phase of the Project
- Chapter 5 identifies traffic and transport mitigation and management measures
- Chapter 6 provides a summary of traffic and transport impacts due to the Project.

2. Existing conditions

2.1. Study area

The Project is proposed to be constructed on 2,000 hectares of freehold land in the locality of Merriwa in the Upper Hunter Region of NSW. The site is located on Wollara Road, approximately 170 kilometres northwest of Newcastle.

The Project is bounded by the Goulburn River National Park to the north, east and south and Wollara Road to the west. The study area adopted for the traffic and transport assessment is shown in Figure 2-1.

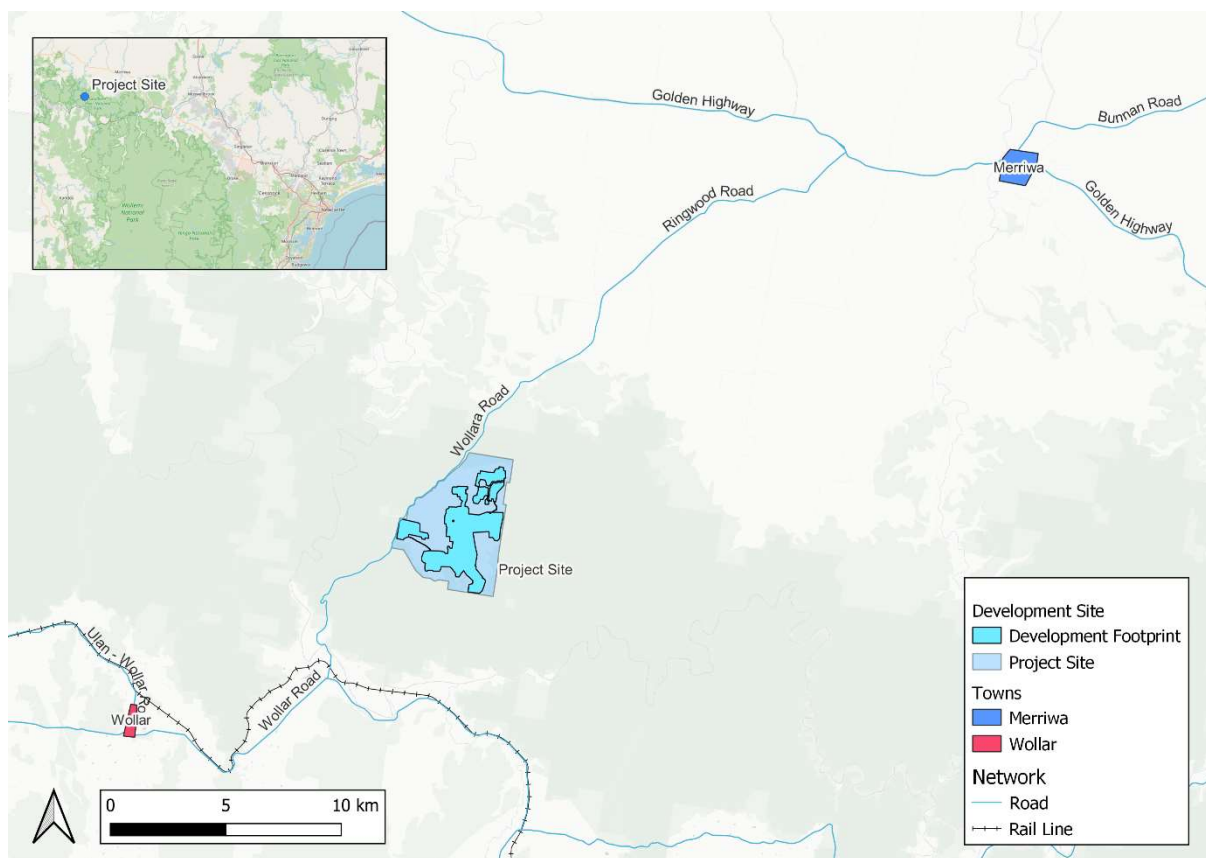


Figure 2-1: Study area

2.2. Road network

Key roads that provide access to the Project include the Golden Highway, Ringwood Road, Wollar Road and Wollara Road. The local road network and modelled intersections for this Project are shown in Figure 2-2.

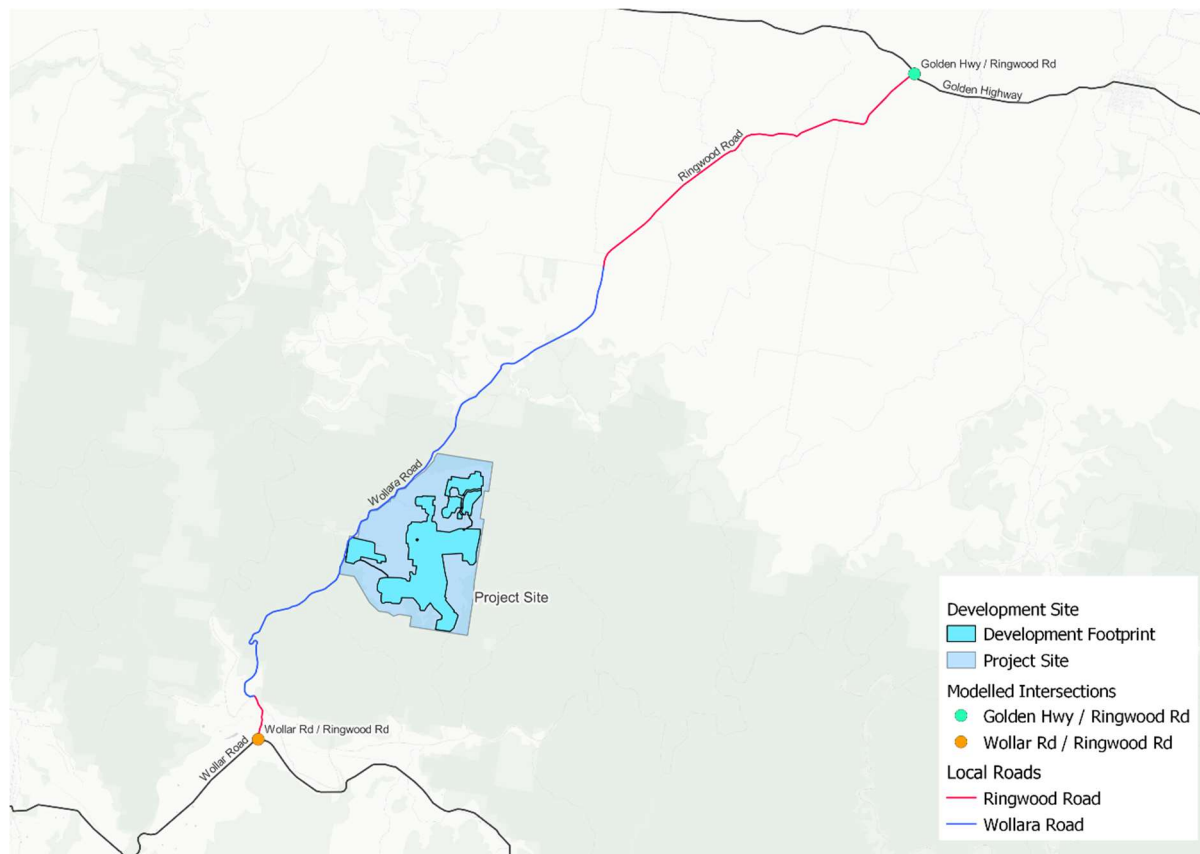


Figure 2-2: Local road network

- **Golden Highway**, which is a key east-west corridor located in the Hunter and Orana regions, connecting Newcastle and Dubbo. The highway is an approved B-double route. The highway is classified as a State road and has a posted speed limit of 100 km/h. Figure 2-3 shows the configuration of the Golden Highway at its intersection with Ringwood Road, as observed during a site visit carried out on 22 September 2021.



Figure 2-3: Golden Highway looking west (left) and east (right)

- **Ringwood Road**, which is a local road forming part of a continuous north-south road corridor with Wollara Road between the Golden Highway and Wollara Road. Ringwood Road is divided into two sections on this corridor, with the northern section running between the Golden Highway and Neverfail Road, and the southern section running between the Goulburn River and Wollara Road. Between these two sections, the road is designated as Wollara Road. Ringwood Road is sealed and generally flat with low vertical grades. The road operates under a default speed limit of 100km/h as there were no regulatory speed signs observed during a site visit carried out on 22 September 2021. However, advisory speed signs (35, 65 and 85km/h) were located at bends along the road alignment. Figure 2-4 shows a typical section of Ringwood Road as observed during the site visit.



Figure 2-4: Ringwood Road looking south (left) and north (right)

- **Wollara Road**, which is a local road forming part of a continuous north-south road corridor with Ringwood Road between the Golden Highway and Wollara Road. The Wollara Road section on this corridor runs between Neverfail Road and the Goulburn River. The road provides direct access to the Project and comprises a combination of sealed and unsealed sections north of the site and

unsealed sections south of the site. The road operates under a default speed limit of 100km/h, as there were no regulatory or advisory speed signs observed during a site visit carried out on 22 September 2021. Figure 2-5 shows a typical unsealed section of Wollara Road as observed during the site visit.



Figure 2-5: Wollara Road looking north (left) and south (right)

- **Wollar Road**, which is an east-west regional road between Bylong at its junction with Bylong Valley Way and Budgee Budgee at its junction with Ulan Road. The road is sealed and has a posted speed limit of 100km/h. Figure 2-6 shows the configuration of Wollar Road at its intersection with Ringwood Road, as observed during a site visit carried out on 22 September 2021.



Figure 2-6: Wollar Road looking east (left) and west (right)

2.2.1. Heavy Vehicles

Golden Highway is an approved B-double route and has been identified as an important connection between the Central West and the Port of Newcastle. There is also a State target to facilitate the movement of high productivity vehicles on the highway in the long term under a package of upgrades funded by the NSW Government’s Regional Freight Pinch Point and Safety Program and the Australian Government’s Heavy Vehicle Safety and Productivity Package. An overview of proposed upgrades along the Golden Highway to improve the heavy vehicle network is shown in Figure 2-7.

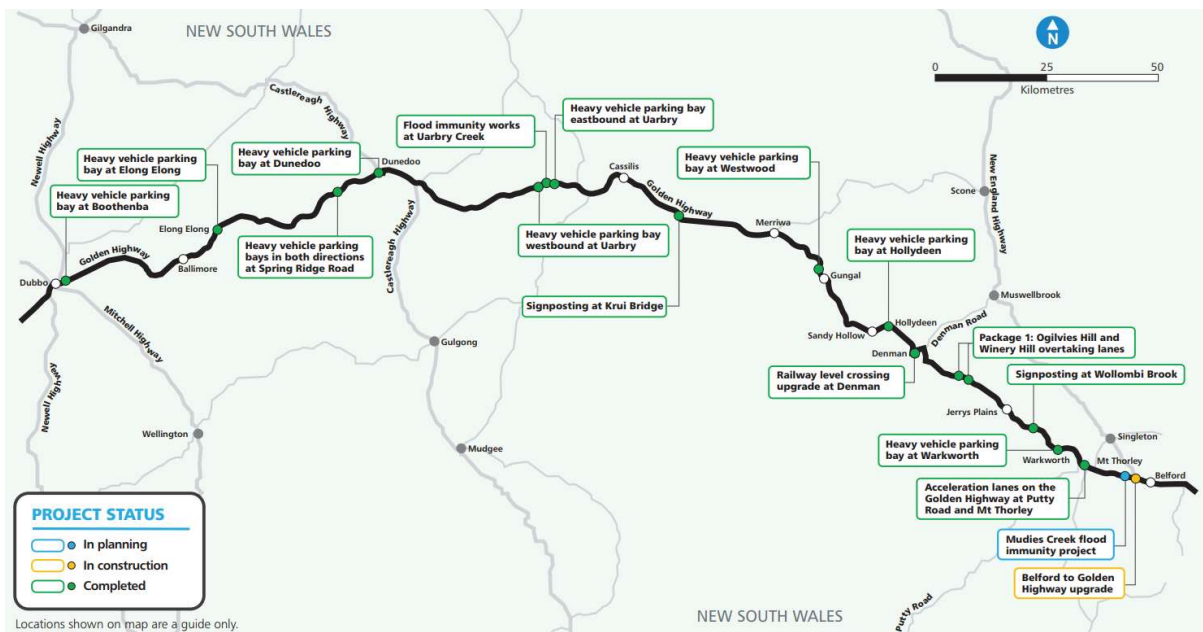


Figure 2-7: Golden Highway upgrades

Source: Golden Highway upgrades overview map (Transport for NSW, 2022)

Wollar Road is also an approved B-double route but includes an 80km/hr B-double speed limit and may only be used by B-doubles outside of school bus operation times.

Wollara Road and Ringwood Road are not approved B-double routes and hence heavy vehicles that are classified as a General Access Vehicle (GAV) may use these roads. GAV’s include buses and semi-trailers up to 19 metres in length.

A map of the heavy vehicle network surrounding the Project site is shown in Figure 2-8.

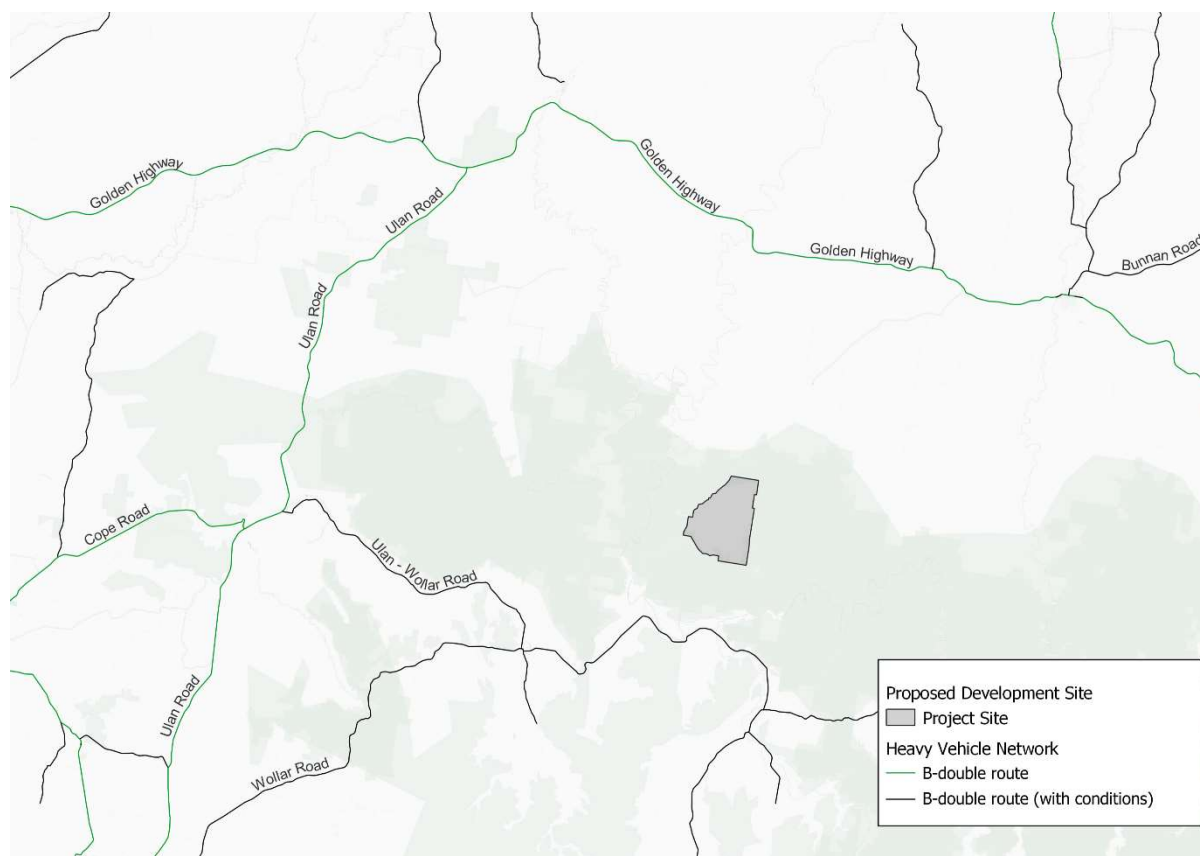


Figure 2-8: Heavy vehicle network

Source: NSW Combined Higher Mass Limits (HML) and Restricted Access Vehicles (RAV) Map (Transport for NSW, 2020)

2.2.2. Intersection layout and geometry

Key intersections assessed include Golden Highway / Ringwood Road and Wollar Road / Ringwood Road as shown in Figure 2-2. These intersections are priority controlled.

Basic left turn and right turn treatments exist at the intersections, except at the Golden Highway / Ringwood Road intersection where there is an auxiliary left turn lane on Golden Highway in the westbound direction.

2.2.3. Safe intersection sight distance

The safe intersection sight distance (SISD) is the minimum sight distance which should be provided on the major road at any intersection.

Given that Golden Highway / Ringwood Road is proposed to be the main access for large construction vehicles travelling to and from the site, an assessment of SISD was undertaken at the intersection.

Table 3.2 of the *Guide to Road Design Part 4A: Unsignalised and Signalised Intersections* (Austroads, 2021) outlines sight distance requirements for a variety of design speeds. Golden Highway has a sign-posted speed limit of 100km/h. However, 75km/h advisory signs

are located on approach to Ringwood Road from the east and west. Hence, assuming a 100km/h design speed and a driver reaction time of 2.5 seconds, based on Table 5.2 of the *Guide to Road Design Part 3: Geometric Design* (Austroads, 2021), a SISD of 262 metres is required.

Site investigations carried out at the intersection and a review of aerial imagery showed that the SISD requirement may not be met, given the existing horizontal alignment of Golden Highway in both directions. Investigation into potential upgrades that may be required at the intersection to accommodate construction vehicles generated by the Project and make this intersection compliant with the SISD is discussed in Section 3.2.5.

2.2.4. Existing traffic volumes

Intersection turning movement volumes were collected at the Golden Highway / Ringwood Road intersection on Thursday, 31 March 2022, from 6:00am to 7:00pm and the Wollar Road / Ringwood Road intersection on Thursday, 7 April 2022, from 6:00am to 7:00pm. On the surveyed day, the Golden Highway / Ringwood Road intersection experienced a morning peak hour from 7:15am to 8:15am and an evening peak hour from 3:00pm to 4:00pm, and the Wollar Road / Ringwood Road intersection experienced a morning peak hour from 6:00am to 7:00am and an evening peak hour from 5:30pm to 6:30pm. Peak hour traffic volumes at these intersections are shown in Figure 2-9 and Figure 2-10.

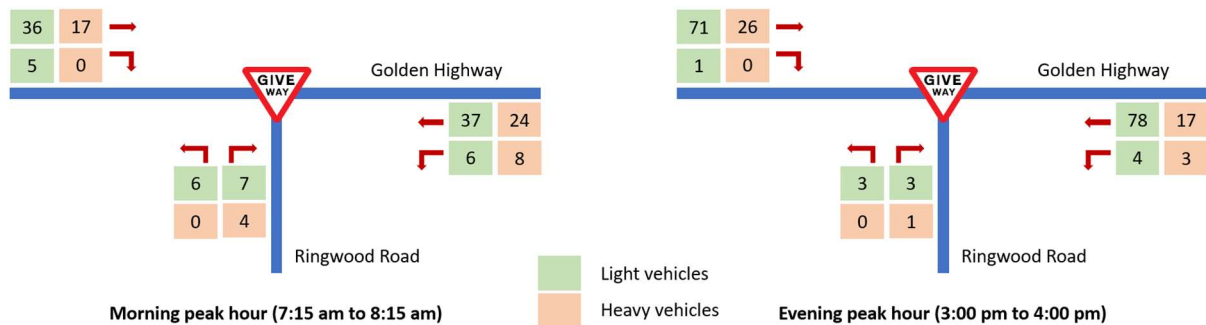


Figure 2-9: Peak hour traffic volumes at the Golden Highway / Ringwood Road intersection

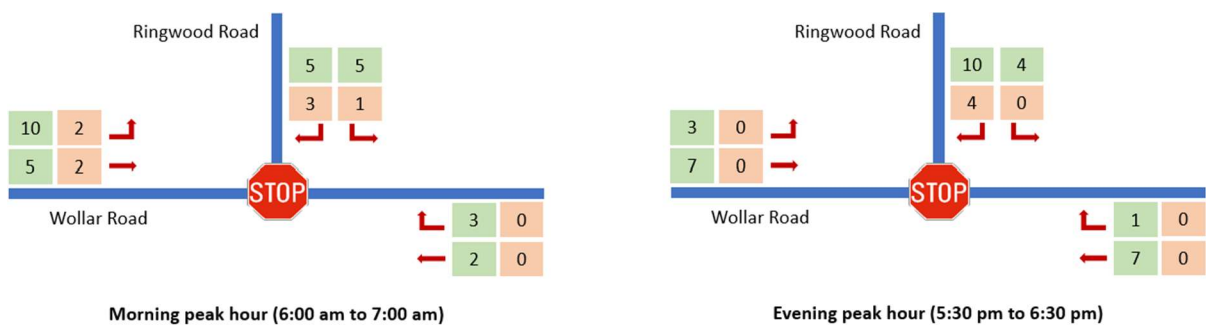


Figure 2-10: Peak hour traffic volumes at the Wollar Road / Ringwood Road intersection

At the Golden Highway / Ringwood Road intersection, evening peak hour volumes are generally higher than morning peak hour volumes. In addition, traffic volumes turning into and out of Ringwood Road are low, with Golden Highway eastbound and westbound through vehicles as the major movements at the intersection.

At the Wollar Road / Ringwood Road intersection, traffic volumes are low during both peak hours, with each movement being undertaken by 14 vehicles or less on the surveyed day.

Hourly traffic volumes in both directions along Ringwood Road were also collected over a one-week period from Thursday, 31 March 2022, to Wednesday, 6 April 2022. Figure 2-11 and Figure 2-12 show the bi-directional hourly average traffic volumes observed on Ringwood Road during the surveyed week on weekdays and weekends, respectively.

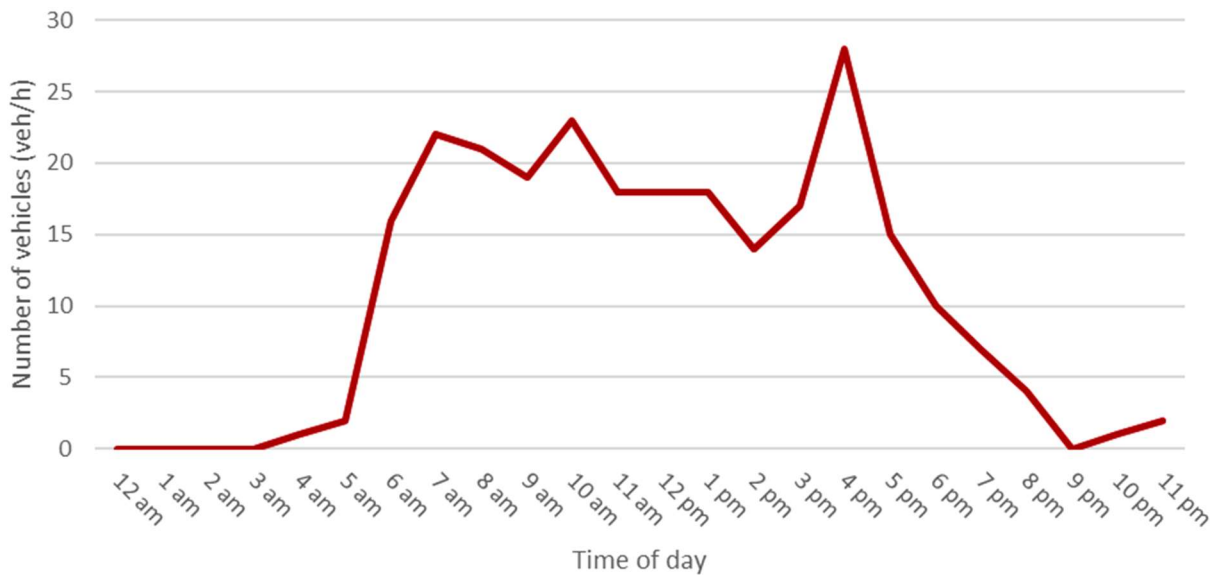


Figure 2-11: Average weekday traffic volumes on Ringwood Road

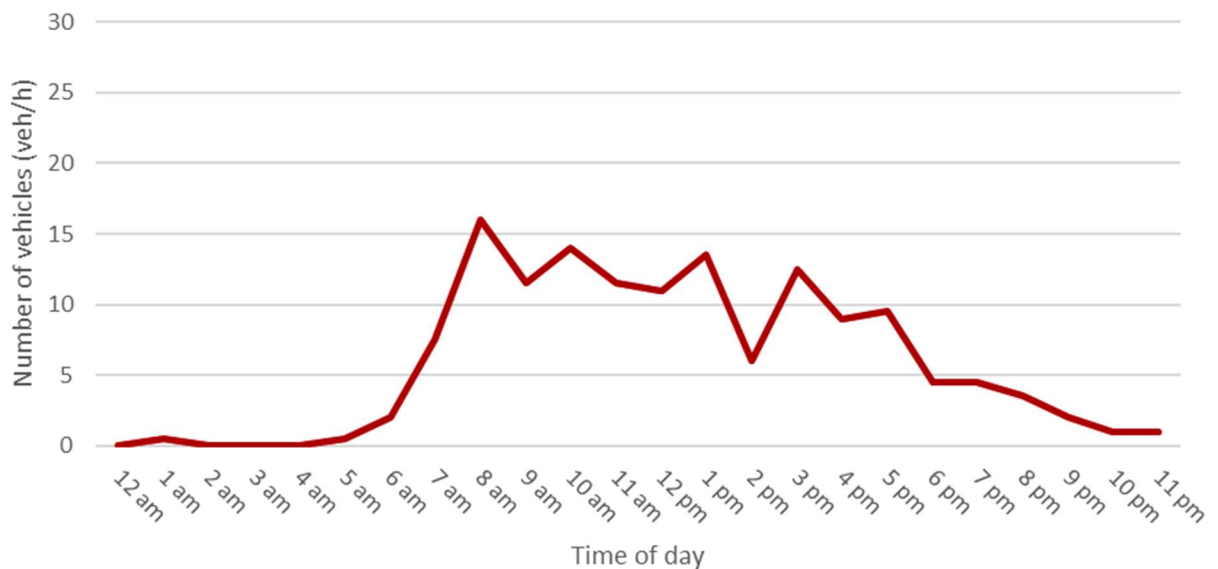


Figure 2-12: Average weekend traffic volumes on Ringwood Road

Ringwood Road carried low traffic volumes on the surveyed weekdays, with a maximum average hourly volume of 28 vehicles observed from 4:00pm to 5:00pm. Traffic volumes were lower on the surveyed weekend, with a maximum average hourly volume of 16 vehicles observed from 8:00am to 9:00am.

2.2.5. Existing intersection performance

An assessment of intersection performance has been based on criteria outlined in the *Guide to Traffic Generating Developments* (Roads and Traffic Authority, 2002). The average delay assessed for signalised intersections is for all movements, and for priority (sign-controlled) intersections is for the worst movements and is expressed in seconds per vehicle. Table 2-1 shows the criteria adopted for the intersection performance assessment.

Table 2-1: Intersection performance criteria

Level of service	Average delay per vehicle	Traffic signals and roundabouts	Give-way and stop sign
A	Less than 15	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 accident study required
D	43 to 56	Operating near capacity	Near capacity, required other control mode
E	57 to 70	At capacity; at signals, incidents will cause delays. Roundabouts	At capacity, required other control mode
F	Over 70	Extra capacity required	Extreme delay, traffic signal or other major treatment required

Golden Highway / Ringwood Road and Wollar Road / Ringwood Road were modelled using *SIDRA Intersection* modelling software. *SIDRA Intersection* is a micro-analytical tool for evaluation of intersection performance in terms of capacity, Degree of Saturation (DOS), Level of Service (LOS), average delay and queue length, and is an appropriate tool for modelling individual intersections.

The existing performance of the modelled intersections in SIDRA is shown in Table 2-2 and Table 2-3.

Table 2-2: Existing intersection performance (2022) - Golden Highway / Ringwood Road

Period	Approach	DOS	Average delay (sec/veh)	LOS	95% back of queue (m)
Weekday morning peak (7:15am to 8:15am)	Golden Highway eastbound	0.04	8	A	<5
	Golden Highway westbound	0.04	9	A	<5
	Ringwood Road northbound	0.02	7	A	<5
	Overall intersection	0.04	9	A	<5
Weekday evening peak (3:00pm to 4:00pm)	Golden Highway eastbound	0.06	8	A	<5
	Golden Highway westbound	0.06	9	A	<5
	Ringwood Road northbound	0.01	7	A	<5
	Overall intersection	0.06	9	A	<5

Table 2-3: Existing intersection performance (2022) - Wollar Road / Ringwood Road

Period	Approach	DOS	Average delay (sec/veh)	LOS	95% back of queue (m)
Weekday morning peak (6:00am to 7:00am)	Wollar Road eastbound	0.01	8	A	<5
	Wollar Road westbound	<0.01	8	A	<5
	Ringwood Road southbound	0.01	9	A	<5
	Overall intersection	0.01	9	A	<5
Weekday evening peak (5:30pm to 6:30pm)	Wollar Road eastbound	0.01	8	A	<5
	Wollar Road westbound	<0.01	8	A	<5
	Ringwood Road southbound	0.02	9	A	<5
	Overall intersection	0.02	9	A	<5

As shown in Table 2-2 and Table 2-3, both intersections operate at LOS A with spare capacity, low average delays and minimal queues on all approaches during the morning and evening peak hour.

2.3. Parking

There are no formal parking facilities located near the site. A heavy vehicle rest area is located on the northern side of Golden Highway, approximately 300 metres west of the Ringwood Road / Golden Highway intersection as shown in Figure 2-13.

The closest formal parking facilities are located in the towns of Merriwa and Wollar, both some 20-30 kilometres from the site.

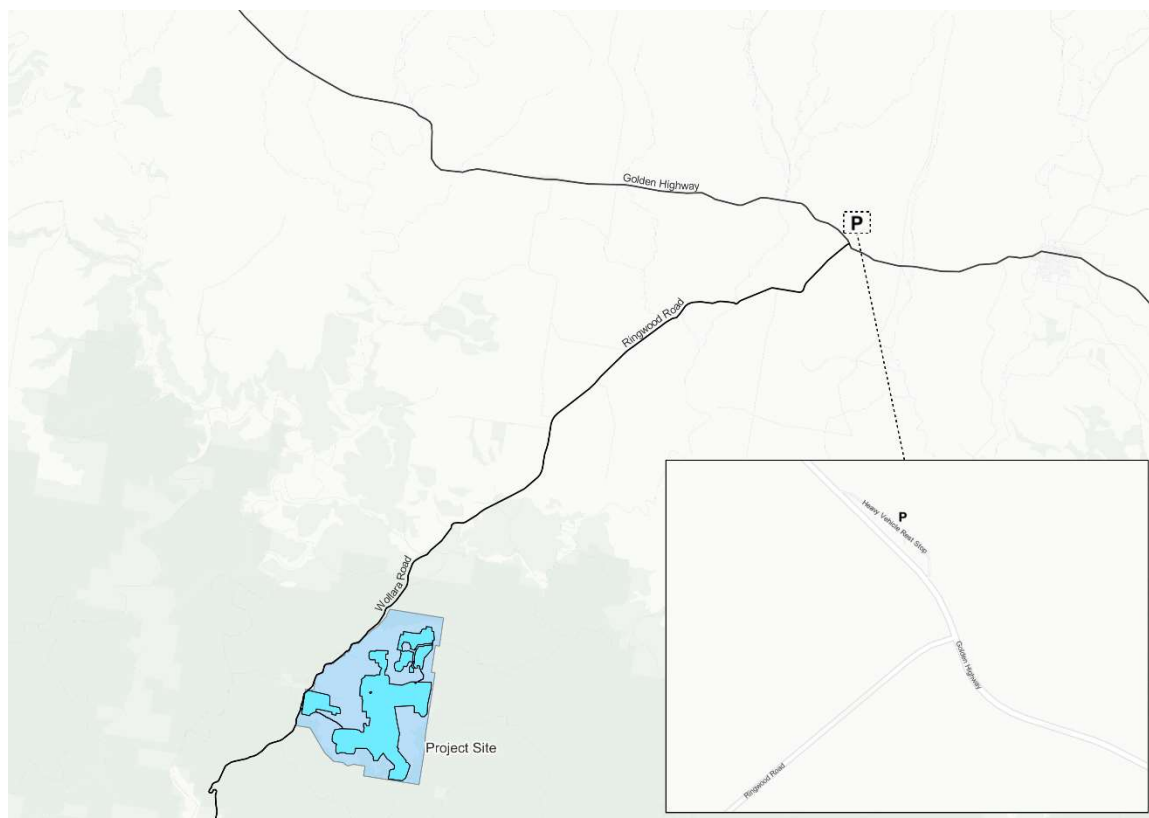


Figure 2-13: Heavy vehicle rest area

2.4. Public transport

2.4.1. Bus network

TransCare, a private bus operator, provides a weekday bus service between Merriwa and Scone via the Golden Highway. The bus route operates once per day, with an additional service between Merriwa and Singleton operating once a month. These private bus services connect Merriwa to the NSW rail network at Aberdeen, Scone, Muswellbrook and Singleton.

Merriwa is also served by another private bus operator, Sid Foggs, as part of its Dubbo to Newcastle route. This route operates three days per week. Figure 2-14 shows the bus routes operated by TransCare and Sid Foggs.

A school bus route operated by Ogden's Coaches runs on Wollar Road between Mudgee and Wollar, serving students and staff from Cudgegong Valley Public School, Mudgee High School, Mudgee Public School and St Matthews Catholic School. One service is provided on school days in each direction, corresponding to the school start and finish times.

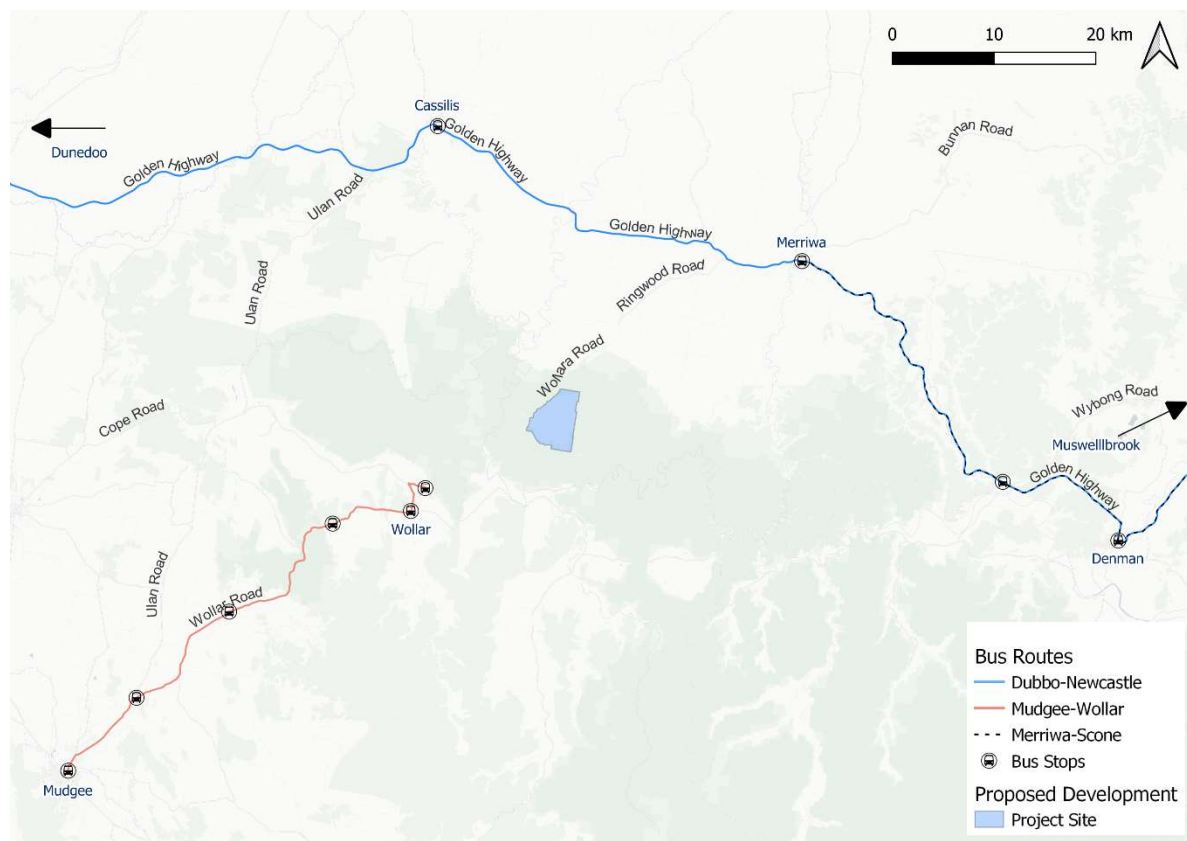


Figure 2-14: Bus routes

Source: Merriwa – Sandy Hollow – Denman – Muswellbrook Bus Timetables (Transcare, 2022), Dubbo to Newcastle Express Coach Services (Sid Foggs, 2022) and Mudgee school route – Wollar (Ogden’s Coaches, 2022)

2.4.2. Rail network

The Sandy Hollow – Gulgong rail line, primarily used to transport coal from the Ulan mines, passes through Wollar (Figure 2-1). This rail line is owned by Transport for NSW and is operated by the Australian Rail Track Corporation (ARTC). The rail line has multiple level crossings on Ulan Road, Wollara Road and Ringwood Road, south of the site.

Another rail line exists between Merriwa and Sandy Hollow and is part of the Country Regional Network (CRN), owned by Transport for NSW. However, this line is currently non-operational.

2.5. Active transport

The pedestrian and cycle network surrounding the study area is limited. There are no formal pedestrian and cycle facilities provided on the Golden Highway, Ringwood Road, Wollara Road and Wollar Road. The closest pedestrian facilities are provided at the Merriwa town centre. An off-road 700 metre long shared path is located in Merriwa and passes underneath the Golden Highway, providing a connection between the Merriwa Showgrounds and Dutton Street.

Sections of the Golden Highway are defined as moderate or high difficulty cycle routes at locations where the road shoulder is wide enough to facilitate cyclists. There is also a short, shared path in Merriwa along the eastern side of the Merriwa River. Figure 2-15 shows the cycle network surrounding the site.

Bicycle NSW identifies a scenic cycle route between Bylong and Merriwa. The recommended route travels along Golden Highway, Forest Reserve Road, Killoe Road, Ringwood Road, Wollara Road, Wollar Road and Bylong Valley Way. This route is also shown in Figure 2-15.

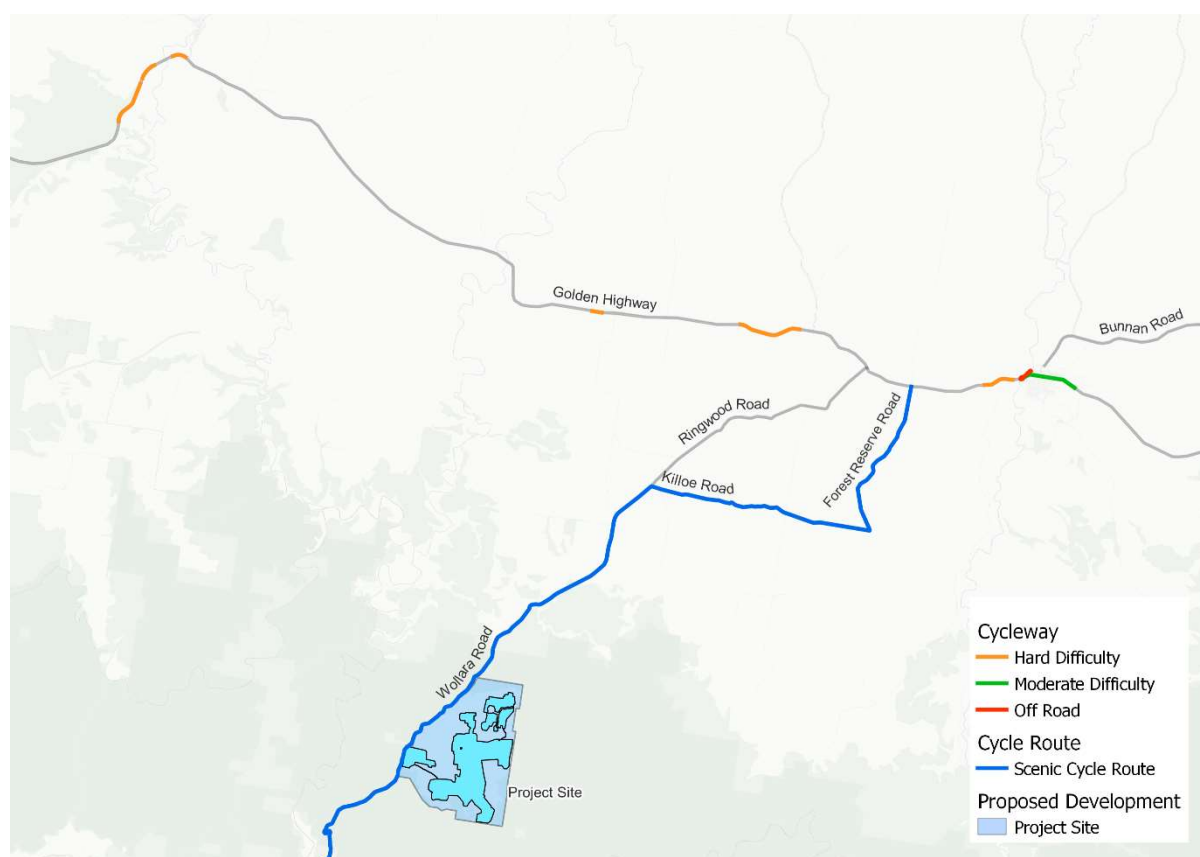


Figure 2-15: Cycle network

Source: Cycleway finder (Transport for NSW, 2022) and Hunter Valley & Northern Tablelands rides routes (Bicycle NSW, 2022)

2.6. Road safety

A summary of crash data on roads surrounding the site for the most recent five-year period with available data (2016 to 2020) from Transport for NSW's *Centre for Road Safety* is shown in Figure 2-16.

In the five-year period from 2016 to 2020, a total of 32 crashes were recorded on roads within the study area. Three crashes occurred near the Wollar Road / Ringwood Road intersection, with these crashes resulting in moderate or serious injuries. Two crashes occurred on Wollara Road and Ringwood Road, resulting in moderate injuries. Crashes along the Golden Highway were generally dispersed with increased occurrences in and

around the Merriwa town centre. A total of 20 crashes across the study area resulted in at least one injury, with two crashes within the Merriwa town centre resulting in a fatality.

Crash data by Road User Movement (RUM) code is provided in Appendix A.

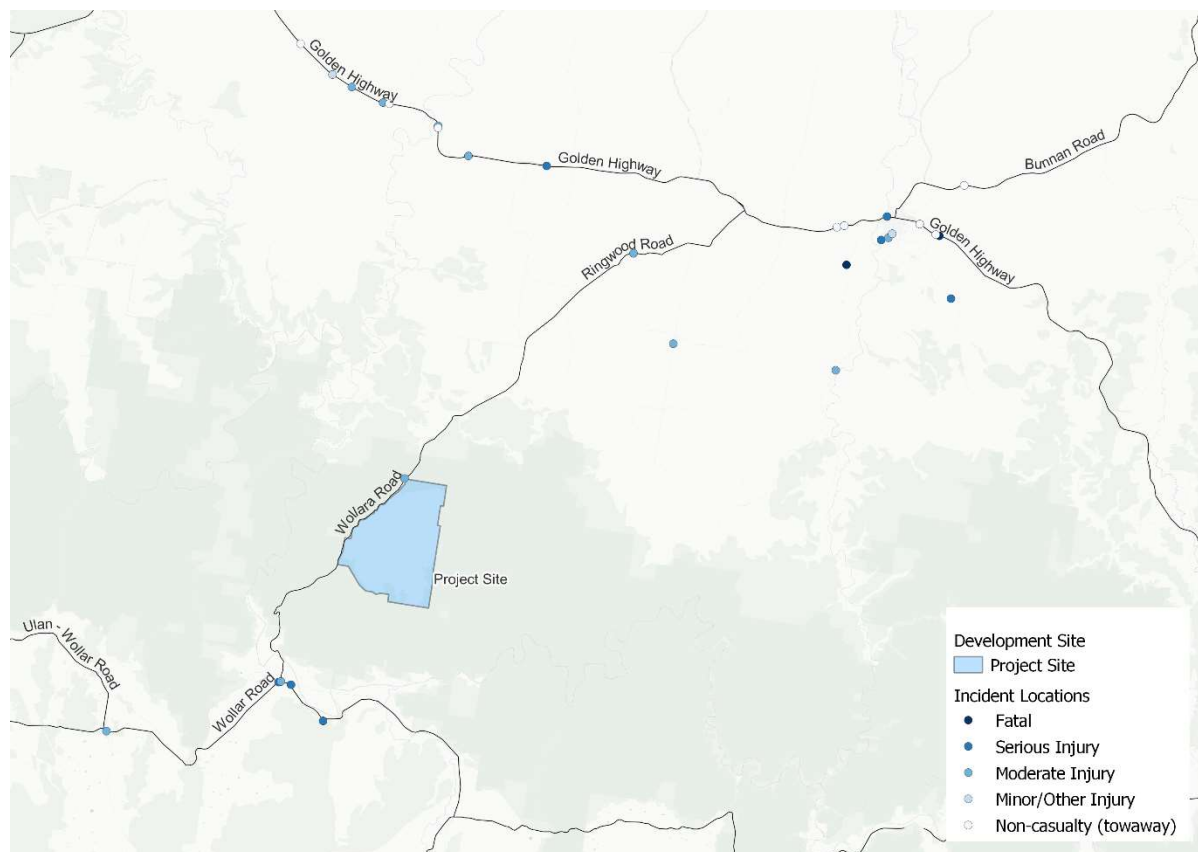


Figure 2-16: Vehicle incident locations

3. Proposed development

3.1. Goulburn River Solar Farm

Key components of the Project are proposed to include:

- Approximately 1 million bifacial solar PV modules in an east-west single-axis tracking arrangement with an approximate height of five metres above ground level
- A BESS with an approximate 280 MW and 570 MWh capacity. The BESS would be housed in a series of outdoor containers grouped together adjacent to the substation
- Onsite 500 kV switchyard and substation, with underground electrical conduits and cabling leading into the yard and overhead lines reaching above to the existing transmission line. An additional tower may be erected on the current line to accommodate the grid connection
- Onsite power line connection via underground electrical conduits and cabling
- Communications tower, up to 30 metres high, providing communications, radio and cellular services to the site and wider region
- Internal and perimeter access allowing for site maintenance
- Site office and operations and maintenance building with parking for the operations team
- A primary solar farm site access point off Wollara Road at an existing driveway to the south. Two secondary access points are proposed off Wollara Road (for emergency and National Parks and Wildlife Service access only), one opposite the White Box Trail and one north of the White Box Trail
- Drainage line crossings if and where required to manage existing surface water flows (to be determined during further design development) and access points for construction purposes
- Perimeter security fencing, crossing gates, water tanks or dams, and potential alternate internal secondary access points (within the Project site) to facilitate sheep grazing.

3.2. Construction activities

3.2.1. Working hours

Subject to approval, construction is expected to commence in 2024 and take up to 27 months to complete.

Construction activities would mostly occur from 6:00am to 6:00pm, Monday to Saturday.

3.2.2. Construction compound areas

Construction compound areas (including laydown areas, security hut and temporary parking) are proposed within the Project site as shown in Figure 2-1.

3.2.3. Construction vehicle routes

Roads forming part of the construction vehicle routes for light vehicles and/or heavy vehicles include the Golden Highway, Ringwood Road, Wollara Road and Wollar Road. Heavy and oversized vehicles would be limited to accessing the site from the north while light vehicles and shuttle buses would access the site from the north and south from surrounding regional towns and cities. All deliveries to site (excluding oversized loads discussed in Section 3.3.2) would be carried out by 19 metre semi-trailers to comply with heavy vehicle restrictions on Wollara Road and Ringwood Road. These deliveries would be conducted via the Hunter Expressway, New England Highway, Golden Highway, Ringwood Road and Wollara Road. One primary and two secondary access points (for emergency and National Parks and Wildlife Service access only), are proposed on Wollara Road as shown in Figure 3-1.

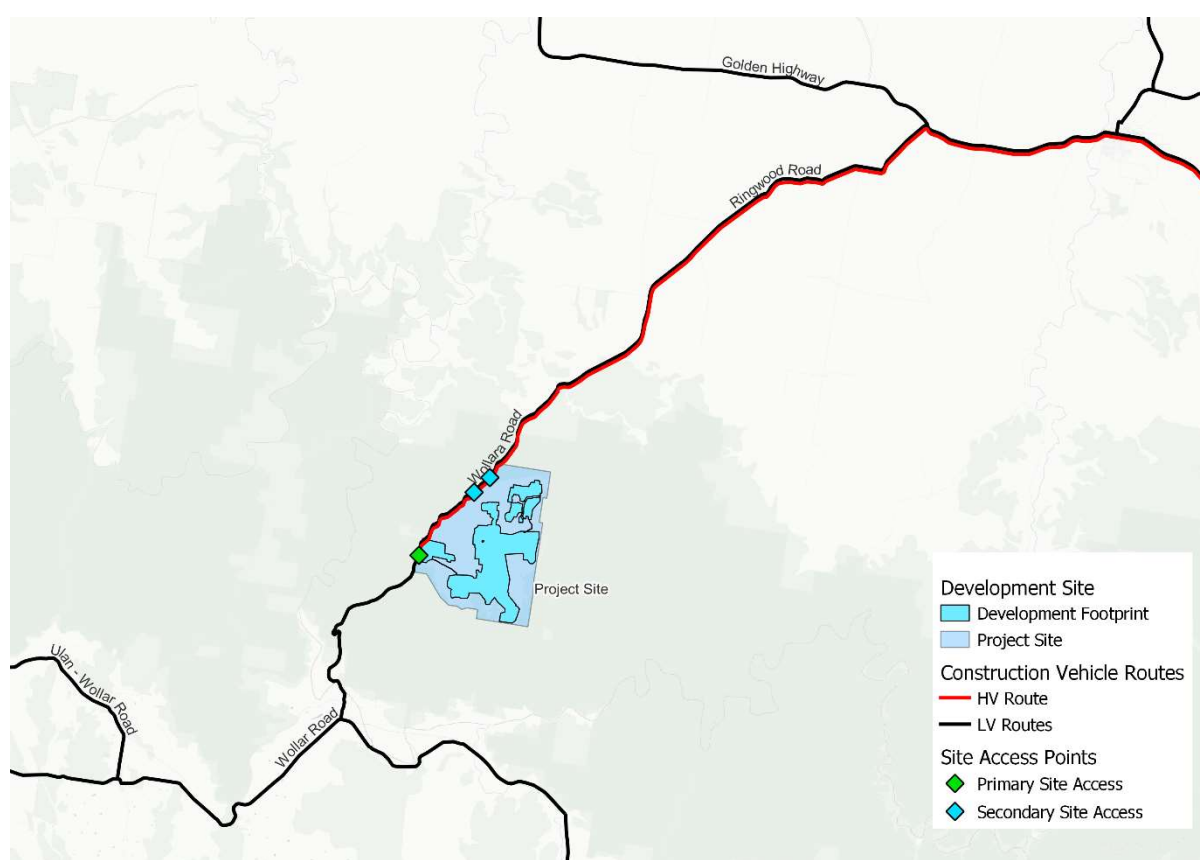


Figure 3-1: Construction vehicle routes and site access

3.2.4. Swept paths

Swept paths along the proposed construction vehicle route for heavy vehicles were assessed and are provided in Appendix B.

A review of the swept paths for a low loader / semi-trailer (19 metre length as per *Austrroads Design Vehicles and Turning Path Templates Guide* (Austrroads, 2013)) showed the following:

- At the Golden Highway / Ringwood Road intersection, semi-trailers performing a right turn from Ringwood Road onto the Golden Highway would have to cross a small portion of the solid dividing line when merging onto the Golden Highway. Due to existing road signage warning motorists of turning heavy vehicles from side streets as well as low traffic volumes, this would not present any safety issues
- The primary site access point in its current configuration may only be able to accommodate one vehicle in or out at a time due to the density of surrounding vegetation. Hence, single vehicle entry/exit would be provided at the primary access, with no vegetation removal required. Traffic management would be used to control vehicle movements at the site access and outlined in a Construction Traffic Management Plan (CTMP) to be prepared prior to the commencement of construction, as discussed in Section 5
- The two secondary access points would be used for emergency and National Parks and Wildlife Service access only, and not for construction access.

3.2.5. Oversize Overmass vehicle routes

Transportation of large Project infrastructure would require Oversize Overmass (OSOM) vehicles exceeding the regulatory limits of standard vehicle dimensions of 19m in length, 2.5m in width, 4.3m in height and 42.5t in weight (depending on axle groups). OSOM vehicles would likely be transported to the site from Port of Newcastle via Industrial Drive, Pacific Highway, Newcastle Inner City Bypass, Newcastle Road, Hunter Expressway, New England Highway and Golden Highway, as shown in Figure 3-2. These are all approved B-double roads and would be suitable for OSOM vehicles.

A review of the OSOM vehicle route shown in Figure 3-2 was undertaken with the infrastructure in its current condition. The causeways at Bow River and Killoe Creek require upgrades (discussed in Section 3.2.6) to facilitate the swept path of the OSOM loads, as shown in Appendix C. At other locations along the route, traffic management measures such as using spotters at pinch points, limiting OSOM movements to off-peak periods, undertaking OSOM movements under police escort, and the use of manual traffic control at specific locations in accordance with an appropriately designed Traffic Guidance Scheme are required. These traffic management measures would be outlined in a Traffic Management Plan to be developed by the construction contractor during detailed investigation of the OSOM vehicle route at a later stage of the Project. Locations that may require traffic management measures include:

- Pacific Highway / Newcastle Inner City Bypass – Due to the intersection geometry, traffic management may be required so that OSOM vehicles can negotiate the left turn from Pacific Highway onto Newcastle Inner City Bypass
- Newcastle Inner City Bypass in Sandgate and Jesmond – Due to vertical limitations at four overpasses along the Bypass, OSOM vehicle loads may need to be lowered to ensure enough clearance is provided
- New England Highway / Golden Highway – The NSW Government is currently upgrading this intersection as part of the New England Highway Upgrade between Belford and Golden Highway, which is scheduled for completion in late

2024. A review of available public information shows that the existing and proposed intersection design could accommodate OSOM vehicles. As part of the detailed OSOM route assessment, the progress of the New England Highway Upgrade project would be checked to determine if traffic management measures are required

- Golden Highway / Putty Road / Mount Thorley Road intersection – Due to the intersection geometry, traffic management may be required so that OSOM vehicles can negotiate the right turn from Golden Highway/Putty Road onto Golden Highway/Mount Thorley Road
- Golden Highway near Ogilvies Hill and Winery Hill – Due to some steep grades, additional pull trucks may be required to assist OSOM vehicle movements through this area
- Golden Highway at Denman Bridge – Due to vertical and horizontal limitations at the Denman Bridge truss structure, OSOM vehicle loads may need to be lowered to ensure enough clearance is provided
- Golden Highway / Ringwood Road intersection – Due to the intersection geometry, traffic management may be required so that OSOM vehicles can turn into and out of Ringwood Road
- Ringwood Road and Wollara Road – The causeways at Bow River and Killoe Creek were identified as inadequate to accommodate OSOM vehicles. Hence, culvert upgrades (discussed in Section 3.2.6) are proposed and would be designed and constructed to be able to accommodate the OSOM vehicles generated by the Project (see Appendix C).

The movement of OSOM vehicles would require a permit to access public roads with escort vehicles as part of a convoy. In obtaining a permit, a Transport Management Plan, as discussed above, would need to be prepared by the construction contractor and includes details such as the route, duration, road closures, traffic detours, notifications and any required Traffic Guidance Schemes.



Figure 3-2: Indicative OSOM vehicle route

3.2.6. Road and culvert upgrades

As discussed in Section 3.2.5, upgrades to the two water crossings on Ringwood Road at Bow River and Killoe Creek are required to accommodate construction vehicles. These upgrades would include:

- Installing culverts designed to accommodate two-way heavy vehicles, including B-doubles and various farm machinery
- Culvert width of 7 m (3.5 m lane width) with a sealed carriageway, guardrails, signage and associated drainage works
- Stockpile site to be located on disturbed land within the road reserve in consultation with Upper Hunter Shire Council
- Temporary side track at both locations to facilitate access during construction.
- All culvert upgrades have been designed to B-double standards. However, the Project would only use 19 metre semi-trailers, with the exception of OSOM loads.

In addition, a review of the roads forming part of the construction vehicle routes based on a drive-through visual inspection showed that sections of Ringwood Road and Wollara Road had poor pavement condition and poor drainage. Upper Hunter Shire Council were contacted to determine the existing pavement profile of these roads and if any works had been carried out on these roads with available design drawings. Since conducting the initial inspection, Upper Hunter Shire Council has conducted repairs to the road pavement to

reduce the surface defects. While the roads have surface defects in sections, they are sufficient to accommodate the 19 metre semi-trailers proposed for the Project. In spite of this, the proponent has committed to further road upgrades to benefit the community as follows:

- Widening and resealing of a 1.8km section of Ringwood Road between Bow River and Killoe Creek. These upgrades would include 8m bitumen-sealed formation with a minimum of 500mm unsealed shoulders. The horizontal and vertical alignment of the proposed road would ensure safe sight distance, safe movement of longer vehicles, and an improved road network for the users
- All road upgrades have been designed to B-double standards. However, the Project would use 19 metre semi-trailers, with the exception of OSOM loads.

Drawings of the proposed road upgrades are provided in Appendix D.

As discussed in Section 2.2.3 and as observed during the site inspection, sight distance at the intersection of Ringwood Road and the Golden Highway from Ringwood Road is slightly deficient for existing vehicles. However, given that warning signage notifying motorists on the Golden Highway that trucks are turning into and out of Ringwood Road is already installed near the intersection, no additional upgrades would be required. Notwithstanding, to further improve safety, temporary warning signage could be installed during the construction period, indicating that trucks would be turning at the intersection.

Additional warning signs (“Symbolic Truck”) are recommended near the primary site access point. These are shown in Appendix B.

A summary of the proposed road and culvert upgrades are shown in Table 3-1 and Figure 3-3. These upgrades would be undertaken in consultation with Upper Hunter Shire Council.

Table 3-1: Schedule of road and culvert upgrades

Works to be carried out	Reason	Timing
Upgrade of Ringwood Road north of the National Park (currently all sealed) including a 1.8km section to be widened and resealed between Bow River and Killoe Creek	Community benefit	Prior to construction of the Project
Additional signage at the primary site access (See Appendix B)	Improve safety	Prior to construction of the Project
Installation of a culvert on Ringwood Road at Bow River	Accommodate construction vehicles including OSOM loads	Prior to construction of the Project
Installation of a culvert on Ringwood Road at Killoe Creek	Accommodate construction vehicles including OSOM loads	Prior to construction of the Project

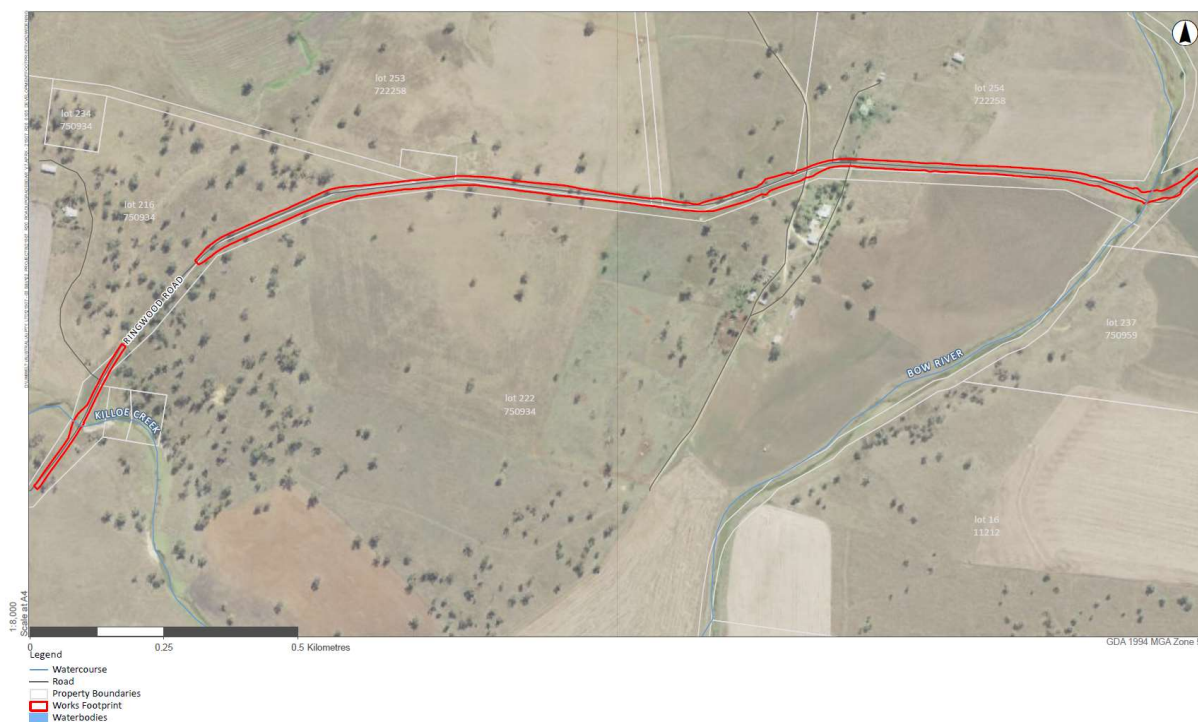


Figure 3-3: Road and culvert upgrades

3.3. Traffic generation

3.3.1. Workforce

The workforce anticipated during construction of the Project includes an approximate 350 construction jobs created during peak construction. This would comprise licensed electrical and mechanical trade personnel, machinery operators, riggers and labourers. The breakdown of workforce personnel during the construction program is shown in Table 3-.

Table 3-2 Workforce breakdown

Month	Personnel	Month	Personnel
1	30	11	350
2	50	12	350
3	100	13	320
4	150	14	270
5	160	15	220
6	240	16	200
7	260	17	160
8	280	18	80
9	280	19	80
10	280	20	40

3.3.2. Construction traffic

During peak construction, the following trips are anticipated to be generated by the Project:

- Light vehicles – 60 two-way trips per day
- Shuttle buses – 15 two-way trips per day
- Heavy vehicles – 55 two-way trips per day.

In addition, 6 to 12 oversized loads are expected throughout the construction period, with a maximum of two loads per day.

Mobilisation would occur during the first months of the construction program, with more intense construction occurring during mechanical completion. Following this, the Project would move into the commissioning phase during the final months of the construction program.

3.3.3. Operational traffic

During operation, it is likely that up to 10 staff would be on-site concurrently. Staff travelling to and from the site during operation of the Project would generate on average, 10 two-way trips per day.

3.4. Parking

On-site parking would be provided for all vehicles during construction and operation of the Project.

4. Transport impact assessment

4.1. Construction impacts

4.1.1. Impacts on the road network

Intersection performance

The peak construction year that has been assessed is 2025, representing a worst-case scenario when background traffic volumes and construction volumes are at their highest. A two per cent per year background traffic growth rate has been applied to the 2022 traffic volumes collected, based on corridor growths outlined in the *Golden Highway Corridor Strategy* (Transport for NSW, 2016).

Peak hour construction volumes used in this assessment have been determined by applying the following assumptions to the daily construction volumes outlined in Section 3.3.2:

- All light vehicle and shuttle bus trips assumed to travel inbound during the morning peak hour and outbound during the evening peak hour to represent a worst-case scenario. In reality, the majority of light vehicle and shuttle bus trips would likely occur before the morning peak hour and after the evening peak hour
- Light vehicle and shuttle bus trips have been evenly distributed on the road network, with equal proportions travelling to and from the site from the north and south
- Ten percent of daily heavy vehicle trips to occur during the peak hours
- Inbound and outbound heavy vehicle trips to occur during both peak hours
- Oversized vehicle trips would not occur during the peak hours
- Shuttle buses have been classified as a heavy vehicle for modelling purposes.

Construction peak hour volumes adopted for the intersection performance assessment is shown in Figure 4-1 and Figure 4-2.

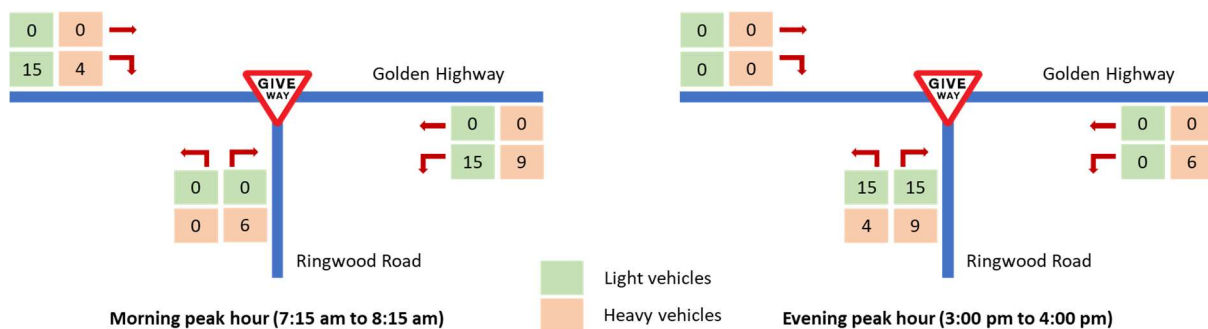


Figure 4-1: Construction peak hour traffic volumes at the Golden Highway / Ringwood Road intersection

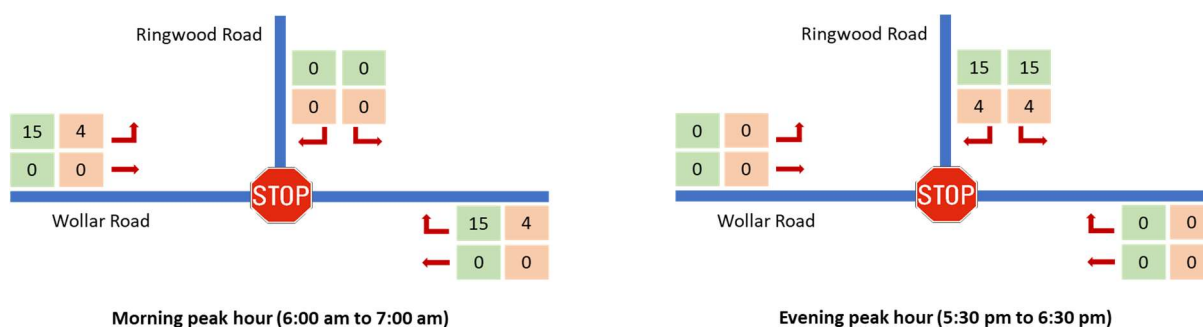


Figure 4-2: Construction peak hour traffic volumes at the Wollar Road / Ringwood Road intersection

The performance of the modelled intersections in SIDRA with and without construction vehicles in 2026 is shown in Table 4-1 and Table 4-2.

Table 4-1: Intersection performance during construction – Golden Highway / Ringwood Road

Approach and peak period	2025 base				2025 construction			
	DOS	Average delay (sec/veh)	LOS	95% back of queue (m)	DOS	Average delay (sec/veh)	LOS	95% back of queue (m)
Weekday morning peak (7:15am to 8:15am)								
Golden Highway eastbound	0.05	8	A	<5	0.06	9	A	<5
Golden Highway westbound	0.05	9	A	<5	0.05	9	A	<5
Ringwood Road northbound	0.02	7	A	<5	0.03	8	A	<5
Overall intersection	0.05	9	A	<5	0.06	9	A	<5
Weekday evening peak (3:00pm to 4:00pm)								
Golden Highway eastbound	0.07	8	A	<5	0.07	8	A	<5
Golden Highway westbound	0.06	9	A	<5	0.06	10	A	<5
Ringwood Road northbound	0.01	7	A	<5	0.05	8	A	<5
Overall intersection	0.07	9	A	<5	0.07	10	A	<5

Table 4-2: Intersection performance during construction – Wollar Road / Ringwood Road

Approach and peak period	2025 base				2025 construction			
	DOS	Average delay	LOS	95% back of queue (m)	DOS	Average delay	LOS	95% back of queue (m)
Weekday morning peak (6:00am to 7:00am)								
Wollar Road eastbound	0.01	8	A	<5	0.03	8	A	<5
Wollar Road westbound	<0.01	8	A	<5	0.02	8	A	<5
Ringwood Road southbound	0.01	9	A	<5	0.01	9	A	<5
Overall intersection	0.01	9	A	<5	0.03	9	A	<5
Weekday evening peak (5:30pm to 6:30pm)								
Wollar Road eastbound	0.01	8	A	<5	0.01	8	A	<5
Wollar Road westbound	0.01	8	A	<5	0.01	8	A	<5
Ringwood Road southbound	0.02	9	A	<5	0.05	9	A	<5
Overall intersection	0.02	9	A	<5	0.05	9	A	<5

As shown in Table 4-1 and Table 4-2, the addition of construction traffic on the road network would result in a marginal increase in average travel time of up to one second, with LOS remaining at LOS A. Both intersections would continue to operate with spare capacity, low average delays and minimal queues during the morning and evening peak hour. Therefore, overall impacts on road network performance during construction is anticipated to be minor.

Road and culvert upgrades

Prior to the commencement of construction of the Project, the proposed road and culvert upgrades on Ringwood Road north of the National Park as discussed in Section 3.2.6 would impact vehicles that travel on these roads. However, impacts are anticipated to be minor given the low volume of traffic using these roads. Furthermore, the number of construction vehicles generated during the road and culvert upgrades would be lower than the number of construction vehicles generated during construction of the Project. The community would be notified of any works proposed and changed road conditions so that impacted road users can plan their trips well in advance of the proposed changes.

Warrants for intersection improvements

The *Guide to Road Traffic Management Part 6: Intersections, Interchanges and Crossings Management* (Austroads, 2020) specifies warrants for additional turning bays at an intersection, based on a combination of peak hour through and turning traffic movements. Figure 4-3 and Figure 4-4 show the warrants for turn treatments at unsignalised intersections and the approach to calculate major road traffic volumes, respectively.

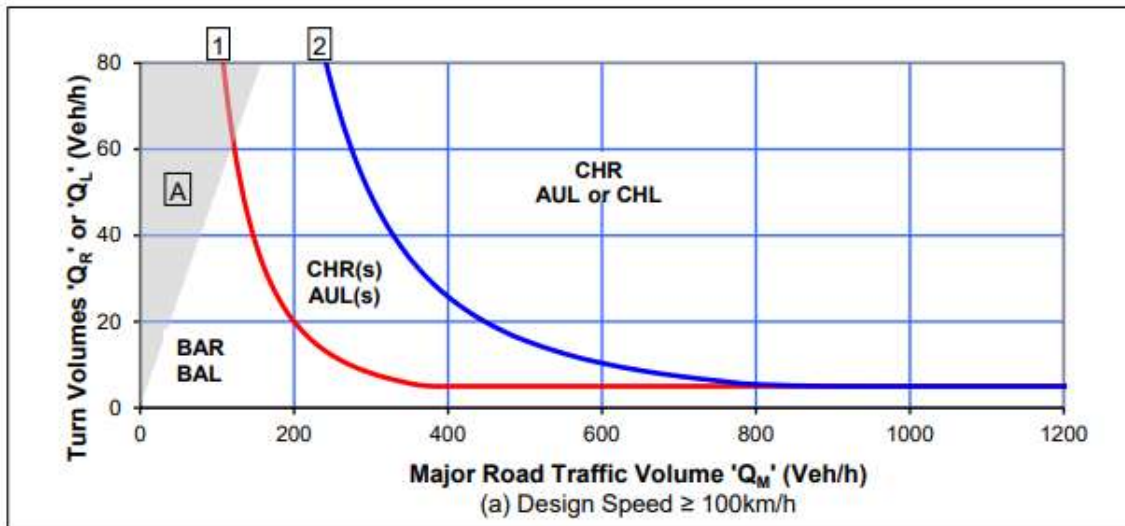
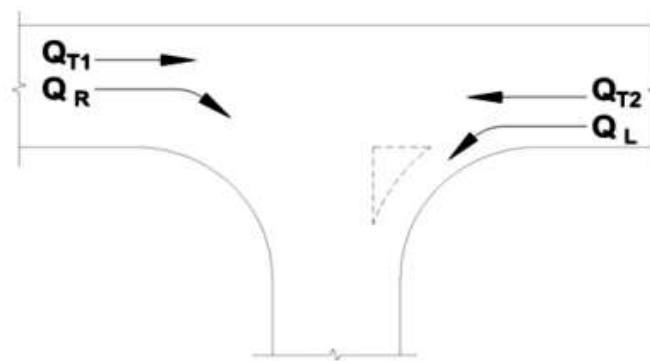


Figure 4-3: Warrants for turn treatments on the major road at unsignalised intersections



Road type	Turn type	Splitter island	Q _M (veh/h)
Two-lane two-way	Right	No	= Q _{T1} + Q _{T2} + Q _L
		Yes	= Q _{T1} + Q _{T2}
	Left	Yes or no	= Q _{T2}
Four-lane two-way	Right	No	= 50% x Q _{T1} + Q _{T2} + Q _L
		Yes	= 50% x Q _{T1} + Q _{T2}
	Left	Yes or no	= 50% x Q _{T2}
Six-lane two-way	Right	No	= 33% x Q _{T1} + Q _{T2} + Q _L
		Yes	= 33% x Q _{T1} + Q _{T2}
	Left	Yes or no	= 33% x Q _{T2}

Figure 4-4: Calculation of major road traffic volume

Approach traffic volumes at the Golden Highway / Ringwood Road intersection and Ringwood Road / Wollar Road intersection in 2025 with and without construction traffic are shown in Table 4-3 and Table 4-4.

Table 4-3: Traffic volumes for turn treatments analysis – Golden Highway / Ringwood Road

Movement	2025 base		2025 construction	
	Morning peak hour	Evening peak hour	Morning peak hour	Evening peak hour
Major road traffic volume (Q _M) for left turn	64	101	64	101
Major road traffic volume (Q _M) for right turn	145	211	169	217
Left turn volume (Q _L)	14	7	38	13
Right turn volume (Q _R)	5	1	24	1

Table 4-4: Traffic volumes for turn treatments analysis – Ringwood Road / Wollar Road

Movement	2025 base		2025 construction	
	Morning peak hour	Evening peak hour	Morning peak hour	Evening peak hour
Major road traffic volume (Q _M) for left turn	7	7	7	7
Major road traffic volume (Q _M) for right turn	22	17	41	17
Left turn volume (Q _L)	13	3	32	3
Right turn volume (Q _R)	3	1	22	1

Applying the volumes above into the graph shown in Figure 4-3, additional turn treatments would not be required at both intersections during construction. This is supported by the 2025 intersection performance results where both intersections would operate with spare capacity and at a good LOS during construction.

4.1.2. Impacts on parking

During construction, impacts on parking are not anticipated given that on-site parking would be provided for all vehicles generated by the Project. Furthermore, no formal parking facilities are located within close proximity to the site.

4.1.3. Impacts on public transport

Bus network

Minimal impacts are anticipated on bus services that travel on the Golden Highway or Wollar Road given the infrequency of these bus services, the low volume of peak hour construction traffic generated by the Project, and the ample spare capacity available on the road network. Furthermore, construction vehicles on Wollar Road would comprise light vehicles and shuttle buses, with these trips generally occurring prior to the school start and end times. Hence, it is unlikely that the school bus service operating on Wollar Road would interact with construction traffic.

Rail network

Level rail crossings located on Ulan Road, Wollar Road and Ringwood Road would be traversed by construction light vehicles and shuttle buses travelling to and from the site from the south. Given the infrequent number of trains using this line, minimal impacts are anticipated on the rail network.

4.1.4. Impacts on active transport

No impacts on the pedestrian network are anticipated during construction given the limited pedestrian infrastructure in the study area.

Impacts on the cycle network would be limited to the potential interaction of cyclists with construction vehicles on the Golden Highway, Ringwood Road or Wollara Road. Given that sections of the Golden Highway are designated as moderate or high difficulty, cyclists that currently travel on the Golden Highway would be experienced riders. In addition, Ringwood Road and Wollara Road form part of a recommended scenic cycle route. However, no formal cycle infrastructure is provided. Therefore, cyclist volumes on the Golden Highway, Ringwood Road and Wollara Road would likely be low and hence, the overall impact on cyclists is anticipated to be minor.

4.1.5. Cumulative construction impacts

Projects within proximity to the Project site that have construction programs that overlap with construction of this Project may present cumulative impacts relating to the combined increased demand on local infrastructure, transport, and services. Projects that have been considered for the cumulative construction impact assessment are shown in Table 4-5.

Table 4-5: Relevant projects in proximity to site

Project	Status	Proximity and location	Key project details
Stubbo Solar Farm	Approved	50 kilometres west	<ul style="list-style-type: none"> • Planning approval for a 400 MW AC Solar farm • Construction commencement: late 2022 • 24 - 26 month construction program • Peak workforce of approx. 400 workers • Located within the Central West Orana Renewable Energy Zone (CWO REZ)
Wollar Solar Farm	Approved	22 kilometres south-west	<ul style="list-style-type: none"> • Planning approval for a 290MW AC Solar Farm • Construction commencement: February 2023 • 18 month construction program • Peak workforce of approx. 400 workers
Dunedoo Solar Farm	Approved	70 kilometres north-west	<ul style="list-style-type: none"> • Planning approval for a 55MW AC Solar farm • Construction commencement: late 2022 • 12 Month construction program • Peak workforce of approx. 100 – 125 workers • Located within the CWO REZ

Liverpool Range Wind Farm	Approved but currently seeking a modification	55 kilometres north-west	<ul style="list-style-type: none"> • Planning approval for up to 267 wind turbines • Modification Application submitted • Construction commencement: TBC • 36 month construction program • Located within the CWO REZ
Valley of the Winds Wind Farm	Proposed	57 kilometres north-west	<ul style="list-style-type: none"> • Proposal for 148 wind turbines • Response to Submissions phase • Construction commencement: Q1 2024 • 24 – 42 month construction program • Peak workforce of approx. 400 workers • Located within the CWO REZ
Bowdens Silver Project	Approved	45 kilometres south-west	<ul style="list-style-type: none"> • Planning approval for an open cut silver mine • Construction commencement: TBC • 18 month construction program • Peak workforce of approx. 180 workers
Barneys Reef Wind Farm	Proposed	50 kilometres west	<ul style="list-style-type: none"> • Proposal for 65 wind turbines • Environmental Impact Statement being prepared • Construction commencement: Q3 2024 • 28 month construction period • Located within the CWO REZ
Tallawang Solar Farm	Proposed	50 kilometres west	<ul style="list-style-type: none"> • Proposal for a 500MW solar farm • Response to Submissions phase • Construction commencement: Mid 2024 • 34 month construction period • Located within the CWO REZ
Birriwa Solar Farm	Proposed	60 kilometres north-west	<ul style="list-style-type: none"> • Proposal for a 600MW solar farm • Response to Submissions phase • 28 month construction period • Located within the CWO REZ
Merriwa Solar Farm	Proposed	30-kilometres north-west	<ul style="list-style-type: none"> • Proposal for a 550MW solar farm and 400MW battery • Environmental Impact Statement being prepared • 18-month construction period and 2025 completion
Spicers Creek Wind Farm	Proposed	80 kilometres west	<ul style="list-style-type: none"> • Proposal for 122 wind turbines • Environmental Impact Statement being prepared • Located within the CWO REZ
Sandy Creek Solar Farm	Proposed	83 kilometres west	<ul style="list-style-type: none"> • Proposal for a 840MW solar farm • Environmental Impact Statement being prepared • Located within the CWO REZ
Cobbora Solar Farm	Proposed	82 kilometres west	<ul style="list-style-type: none"> • Proposal for a 700MW solar farm • Environmental Impact Statement being prepared • Located within the CWO REZ

Construction vehicle routes for the Stubbo Solar Farm include the Golden Highway and Ulan Road. A review of the proposed construction program indicates that the project would be completed in 2024 and may overlap with the construction program of this Project. Peak construction for the Stubbo Solar Farm is anticipated in 2023, with 230 light vehicle and 60 heavy vehicle two-way trips forecast per day. Given that peak construction of Stubbo Solar Farm would occur prior to peak construction of this Project, cumulative vehicle generation during the period when construction overlaps between the two projects is anticipated to be lower than the peak construction vehicles generated by this Project.

Construction vehicle routes for the Wollar Solar Farm that overlap with the construction vehicle routes (light vehicles and heavy vehicles) for the Goulburn River Solar Farm include the Golden Highway, Ringwood Road, Wollara Road, Wollar Road and Ulan Road. No road upgrades are proposed as part of this project along Ringwood Road and Wollara Road, with the majority of heavy vehicles accessing the Wollar Solar Farm further west via Ulan Road, Wollar Road and Barigan Road. Peak construction for the Wollar Solar Farm is anticipated in 2023, with 100 light vehicle and 72 heavy vehicle two-way trips per day. Given that peak construction of Wollar Solar Farm would occur prior to peak construction of this Project, cumulative vehicle generation during the period when construction overlaps between the two projects is anticipated to be lower than the peak construction vehicles generated by this Project.

Construction vehicle routes for the Liverpool Range Wind Farm, Valley of the Winds Wind Farm, Tallawang Solar Farm and Birriwa Wind Farm include the Golden Highway. A review of available construction information for these projects indicates that if approved, construction of the Valley of the Winds Wind Farm and Tallawang Solar Farm would coincide with the construction program for this Project. The construction commencement year for the Liverpool Range Wind Farm and Birriwa Wind Farm is not known. Furthermore, the Liverpool Range Wind Farm is an approved project with a modification proposed. If the modification is approved, this would result in a lower number of construction heavy vehicles required by the project under the modification. The forecast peak daily construction volumes for these projects include:

- Liverpool Range Wind Farm: 24 light vehicle and 128 heavy vehicle two-way trips (project is seeking a modification which would reduce the number of heavy vehicle trips)
- Valley of the Winds Wind Farm: 253 light vehicle and 36 heavy vehicle two-way trips
- Tallawang Solar Farm: 300 light vehicle and 272 heavy vehicle two-way trips
- Birriwa Solar Farm: 373 light vehicle and 120 heavy vehicle two-way trips.

Although peak construction for these projects may occur at the same time, the Golden Highway is the only common construction vehicle route and has sufficient spare capacity to accommodate the construction vehicles generated by these projects.

Construction vehicle routes for the Bowdens Silver Project would not overlap with the construction vehicle routes for the Goulburn River Solar Farm.

Projects that are either scheduled to be completed prior to the commencement of the Goulburn River Solar Farm or are currently in the planning and approval stage with limited available construction information include:

- Barneys Reef Wind Farm
- Dunedoo Solar Farm
- Merriwa Solar Farm
- Spicers Creek Wind Farm
- Sandy Creek Solar Farm
- Cobbora Solar Farm.

Cumulative construction impacts are anticipated to be minor given the following:

- The majority of projects identified in Table 4-5 are either in their planning stages and do not have available construction information or would be completed prior to the commencement of construction of this Project
- Peak construction of Stubbo Solar Farm and Valley of the Winds Wind Farm would occur prior to peak construction of this Project
- Golden Highway forms part of the construction vehicle routes for Wollar Solar Farm, Stubbo Solar Farm, Liverpool Range Wind Farm, Valley of the Winds Wind Farm, Tallawang Solar Farm and Birriwa Wind Farm. This road has spare capacity (as shown in Section 4.1.1) and would be able to accommodate the additional through movement vehicles generated by these projects
- During peak construction of this Project and non-peak construction of other projects, the surrounding road network would be able to accommodate the additional construction vehicle volumes due to the spare capacity available.

4.2. Operational impacts

Operation of the solar farm would require up to 10 concurrent staff members on-site, with 10 two-way light vehicle trips anticipated per day. In addition, infrequent heavy vehicle deliveries may be required during this phase. Parking would be provided on site for operational staff and heavy vehicle deliveries. Due to the low volumes of operational traffic and provision of parking on-site, minimal impacts on the road network, parking, public transport network and active transport network are anticipated.

5. Mitigation and management measures

Most long-term impacts of the Project would have been addressed through the design process. However, residual impacts that arise from engineering constraints or from construction activities, and which cannot be removed through the design could be managed through mitigation measures.

The following mitigation and management measures are recommended to minimise impacts during construction and/or operation of the Project:

- Prior to the commencement of construction, a CTMP would be prepared in accordance with relevant guidelines and in consultation with Transport for NSW, Upper Hunter Shire Council, National Parks and Wildlife Service and any other relevant stakeholders. The CTMP would outline how construction activities would avoid, mitigate and manage risks involving construction activities, users of the traffic and transport network and residents
- Deliveries to site (excluding oversized loads) would be carried out by 19 metre semi-trailers to comply with heavy vehicle restrictions on Wollara Road and Ringwood Road
- A detailed OSOM vehicle route assessment would be undertaken by the construction contractor and outlined in a Transport Management Plan. The Plan would discuss any traffic management measures required and include details on the OSOM vehicle route, duration, road closures, traffic detours, notifications and any required Traffic Guidance Schemes
- The community would be notified in advance of proposed road and transport network changes through appropriate media and other forms of community liaison
- Where relevant, Road Occupancy Licences (ROLs) and crane permits would be submitted and approved prior to the closure of any roads
- Construction workers would be encouraged to carpool or use the shuttle buses to travel to and from the construction site
- Parking requirements for the Project during construction and operation would be provided on-site, and parking would not be provided on public roads adjacent to the site
- Additional warning signs (“Symbolic Truck”) are recommended near the primary site access point
- Upper Hunter Shire Council would continue to be consulted on upgrades required on Ringwood Road.

6. Summary and conclusions

The key findings of the traffic and transport impact assessment of the Project include the following:

- The Project is proposing significant road upgrades to Ringwood Road to accommodate the project and enhance the road infrastructure for the benefit of the local community
- The Bow River and Killoe Creek culvert upgrades would facilitate the delivery of the OSOM loads to the site
- The widening and sealing of 1.8km of Ringwood Road is for community benefit
- Additional trips generated by the Project during construction and operation of the Project would not have a material impact on road network performance
- No impacts are anticipated on parking and the pedestrian network
- Minimal impacts are anticipated on the bus network and would be limited to the potential interaction of bus services with construction vehicles on the Golden Highway or Wollar Road
- Minimal impacts are anticipated on the cycle network and would be limited to the potential interaction of cyclists with construction vehicles on surrounding roads
- Cumulative construction impacts are anticipated to be minor given that the Golden Highway is the only common construction vehicle route for the majority of nearby relevant projects and has spare capacity to accommodate cumulative construction vehicle volumes. In addition, peak construction of some projects would not coincide with peak construction of this Project.
- Minimal impacts are anticipated on the traffic and transport network during operation of the Project due to the anticipated low traffic volumes generated
- Prior to the commencement of construction, a CTMP would be prepared in consultation with Transport for NSW, Upper Hunter Shire Council, National Parks and Wildlife Service and any other relevant stakeholders, outlining how construction activities would avoid, mitigate and manage risks involving construction activities, users of the traffic and transport network and residents.

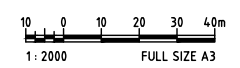
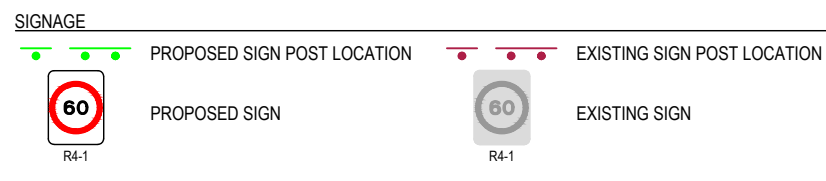
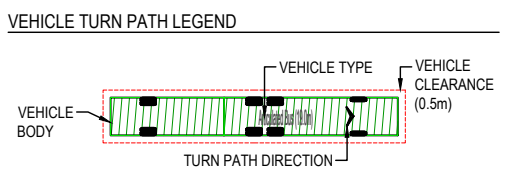
Appendix A Crash history in proximity to proposed site

Severity of Crash	Year	RUM Code	Description	
Fatal	2018	87	off lft/lft bnd= >obj	
	2016	73	Off rd rght = > obj	
Serious Injury	2018	88	Out of cont on bend	
	2017	80	Off left/right bend	
	2017	81	off left/rt bnd= >obj	
	2020	73	Off rd rght = > obj	
	2019	81	Off left/rt bnd= >obj	
	2018	80	Off left/right bend	
	2018	75	Off end of road	
	Moderate Injury	2016	73	Off rd rght = > obj
2017		82	Off right/right bend	
2020		71	Off rd left = > obj	
2020		72	Off road to right	
2020		88	Out of cont on bend	
2019		80	Off left/right bend	
2019		88	Out of cont on bend	
2018		90	Fell in/from vehicle	
2018		71	Off rd left = > obj	
2018		71	Off rd left = > obj	
2017		86	Off left/left bend	
Minor/Other Injury		2020	67	Struck animal
		2020	71	Off rd left = > obj
Non-casualty (towaway)	2020	71	Off rd left = > obj	
	2020	74	On road-out of cont.	
	2018	67	Struck animal	
	2018	71	Off rd left = > obj	
	2017	73	Off rd rght = > obj	
	2017	47	Emerging from drive	
	2016	88	Out of cont on bend	
	2016	73	Off rd rght = > obj	
	2016	70	Off road to left	
Unclassified	2016	71	Off rd left = > obj	

Appendix B Swept paths



FOR INFORMATION ONLY



GOULBURN RIVER SOLAR FARM
SIGNAGE & SWEEP PATH
SHEET 1 OF 3

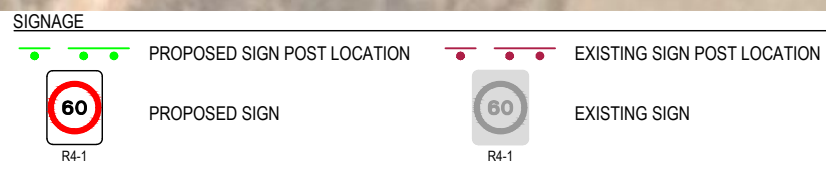
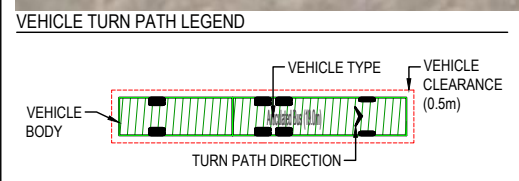
25/01/2023



0305-INF-RD-SWEPT-PATH-01



FOR INFORMATION ONLY



GOULBURN RIVER SOLAR FARM
SIGNAGE & SWEEP PATH
SHEET 2 OF 3

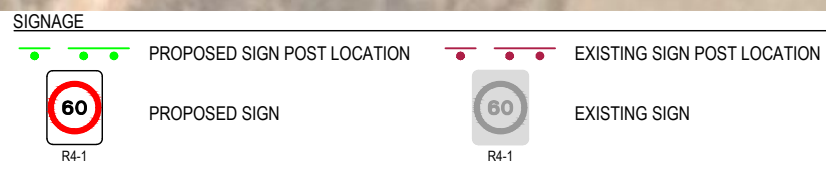
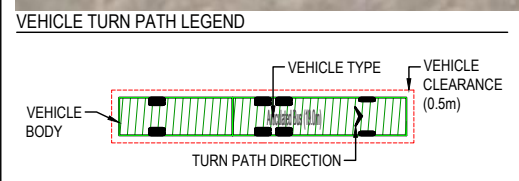
25/01/2023



0305-INF-RD-SWEEP-PATH-02



FOR INFORMATION ONLY



GOULBURN RIVER SOLAR FARM
SIGNAGE & SWEEP PATH
SHEET 3 OF 3

25/01/2023



0305-INF-RD-SWEEP-PATH-03

Appendix C OSOM vehicle checks



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© 2023 Microsoft Corporation © 2022 Maxar ©CNES (2022) Distribution Airbus DS



CLIENT:



DATE:	REVISION:	DESCRIPTION:
09.02.2023	0	CLIENT REVIEW

PROJECT:
RINGWOOD ROAD UPGRADE

DRAWING TITLE:
SWEPT PATHS

ISSUE STATUS:
CLIENT REVIEW



SCALE:
1:750 @ A3

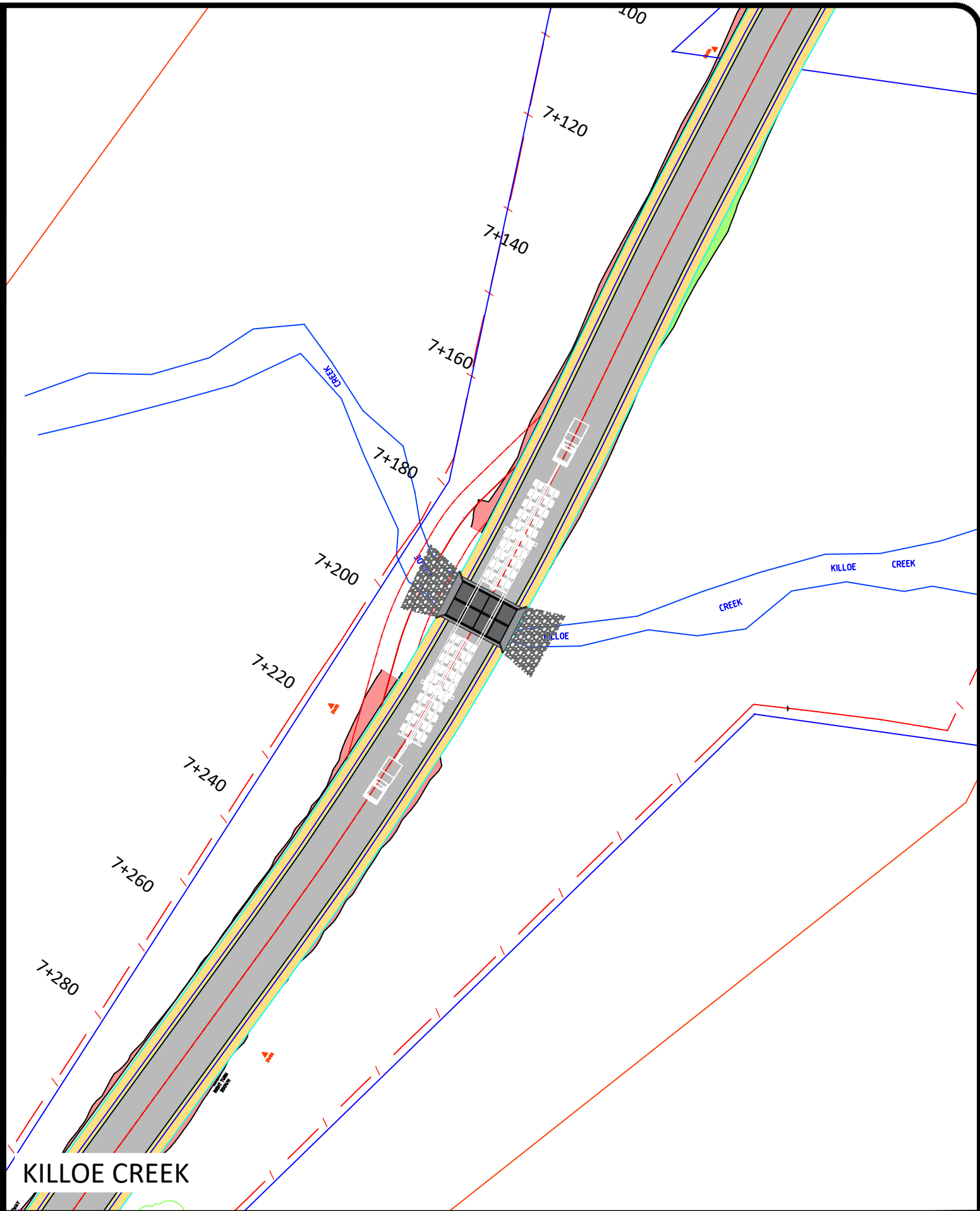
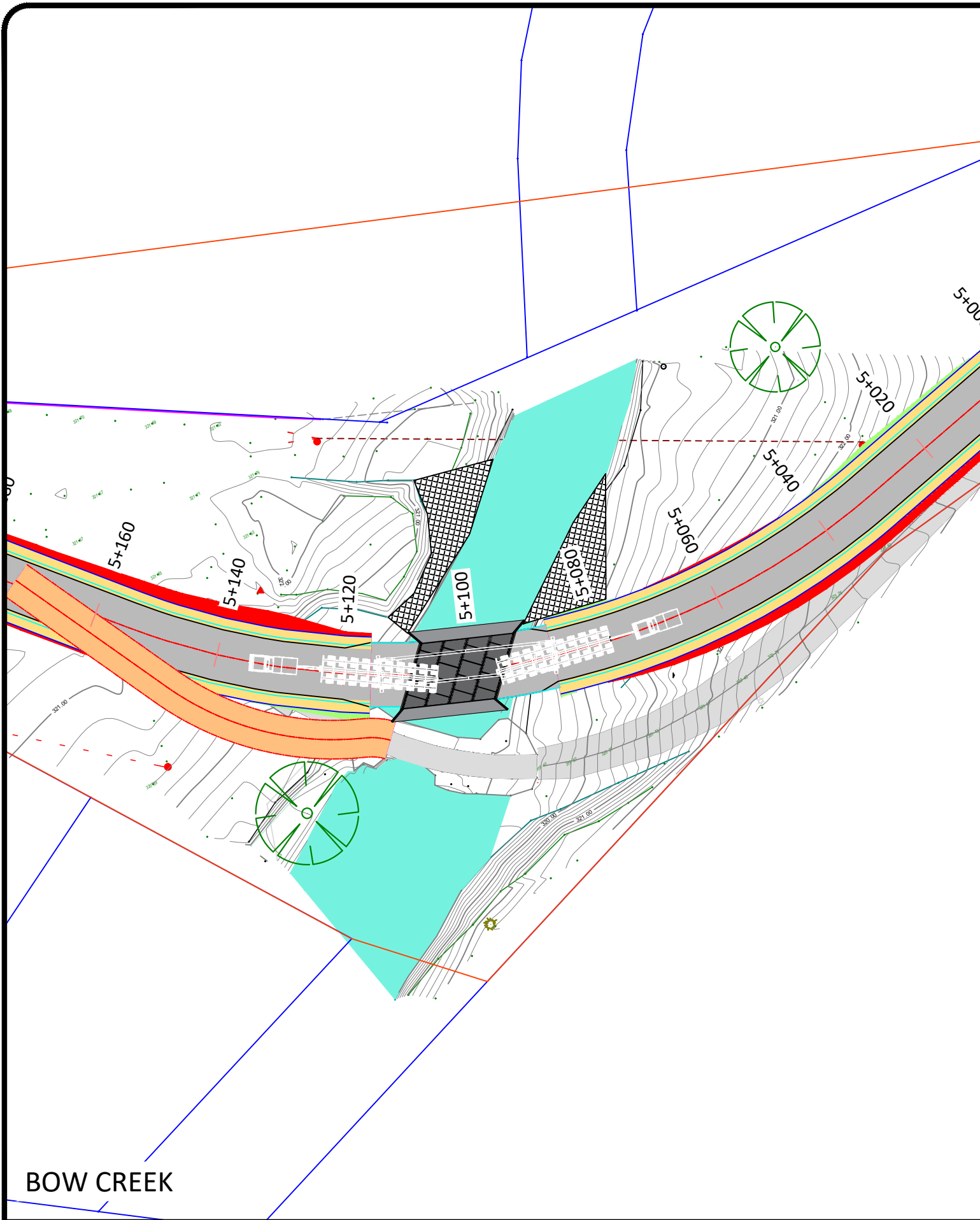
DWG No: HEC22_
JOB No: 22Q3J3

COORDINATE SYSTEM: MGA ZONE 56 GDA 2020
DATUM: AHD

SURVEYED:
OTHERS

DESIGNED: RS
DRAWN: RJ

SHEET: 1
REV: 0



BOW CREEK

KILLOE CREEK



CLIENT:



DATE:	REVISION:	DESCRIPTION:
09.02.2023	0	CLIENT REVIEW

PROJECT:
RINGWOOD ROAD UPGRADE

DRAWING TITLE:
SWEPT PATHS

ISSUE STATUS:
CLIENT REVIEW



SCALE:
1:750 @ A3

DWG No: HEC22_
JOB No: 22Q3J3

COORDINATE SYSTEM: MGA ZONE 56 GDA 2020
DATUM: AHD

SURVEYED:
OTHERS

DESIGNED: RS
DRAWN: RJ

SHEET: 2
REV: 0

Appendix D Proposed road upgrades

LEGEND

- CADASTRAL BOUNDARY (DCDB)
- FENCE LINE
- FOG LINE
- CENTRELINE OF ROAD
- EDGE OF BITUMEN
- EDGE OF UNSEALED SHOULDER
- STORMWATER PIPE
- ▲ SURVEY CONTROL POINT
- DENOTES TREE
- ▽ DENOTES CUT AND FILL



LOT 16
DP 11212

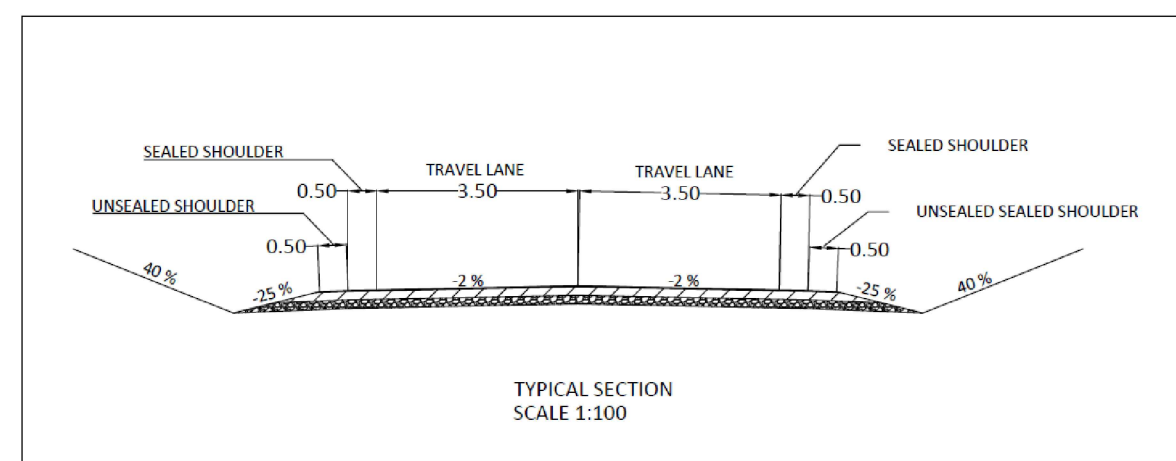
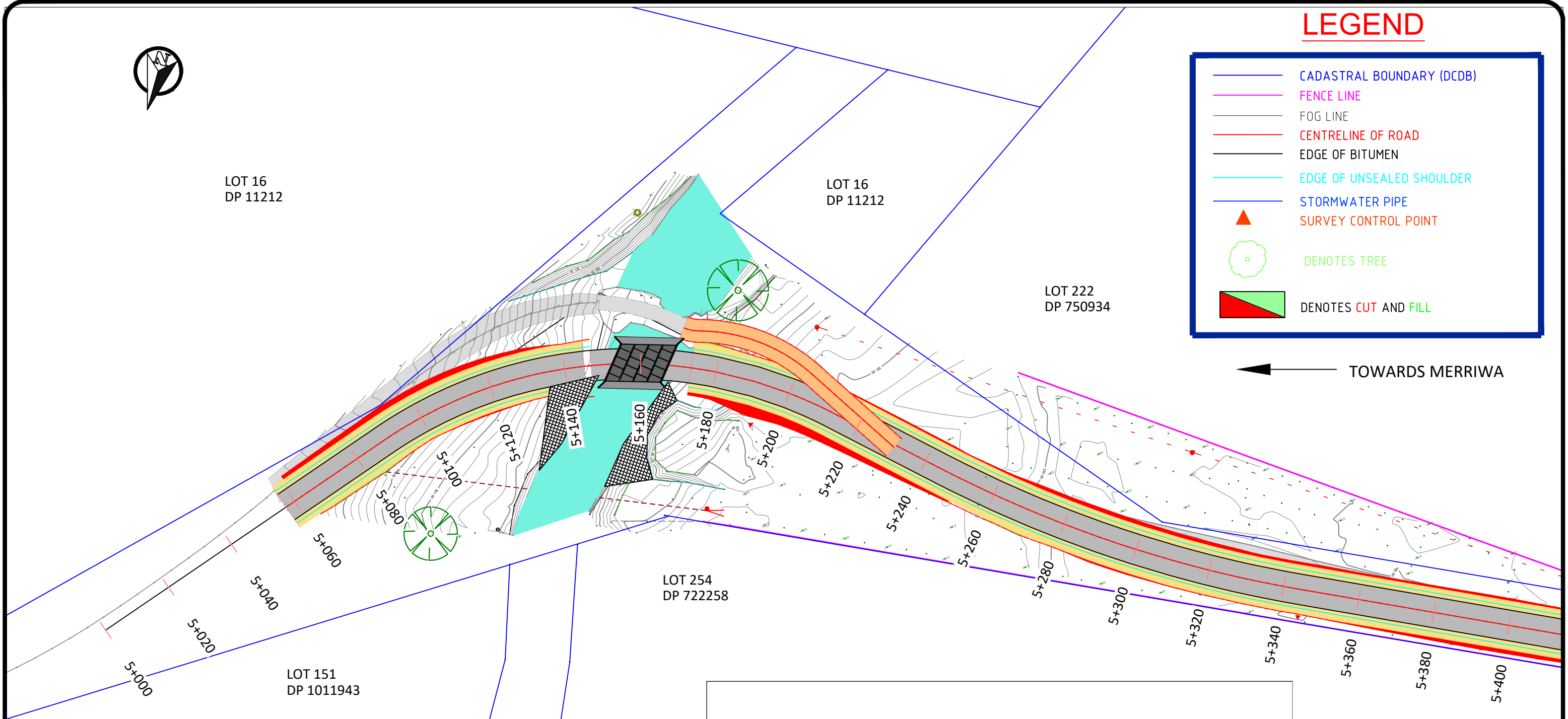
LOT 16
DP 11212

LOT 222
DP 750934

LOT 254
DP 722258

LOT 151
DP 1011943

← TOWARDS MERRIWA



CLIENT:
lightsourcebp

DATE:	REVISION:	DESCRIPTION:
24.01.2023	0	CLIENT REVIEW

PROJECT:
RINGWOOD ROAD UPGRADE

DRAWING TITLE:
Proposed Alignment

ISSUE STATUS:
CONCEPTUAL DESIGN CLIENT REVIEW

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JOB No: 22Q3J3	COORDINATE SYSTEM: MGA ZONE 56 GDA 2020
DATUM: AHD	

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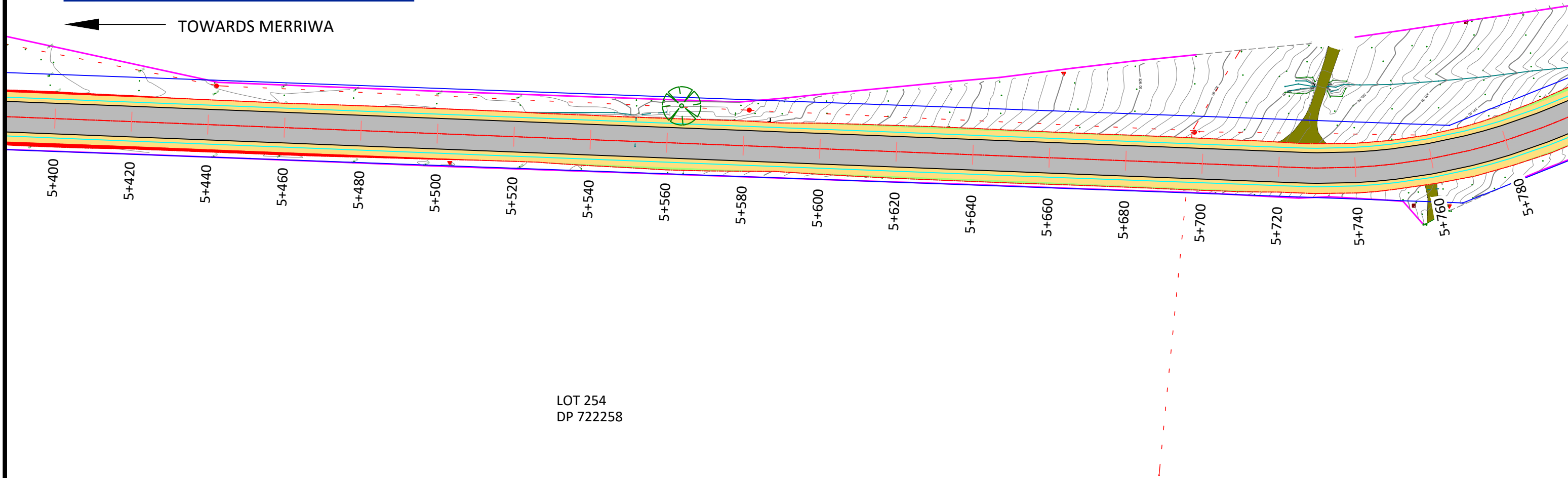
LEGEND



	CADASTRAL BOUNDARY (DCDB)
	FENCE LINE
	FOG LINE
	CENTRELINE OF ROAD
	EDGE OF BITUMEN
	EDGE OF UNSEALED SHOULDER
	STORMWATER PIPE
	SURVEY CONTROL POINT
	DENOTES TREE
	DENOTES CUT AND FILL

LOT 22
DP 750934

← TOWARDS MERRIWA



LOT 254
DP 722258



CLIENT:



DATE:	REVISION:	DESCRIPTION:
24.01.2023	0	CLIENT REVIEW

PROJECT:
RINGWOOD ROAD UPGRADE

DRAWING TITLE:
Proposed Alignment



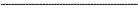







ISSUE STATUS:
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SCALE:
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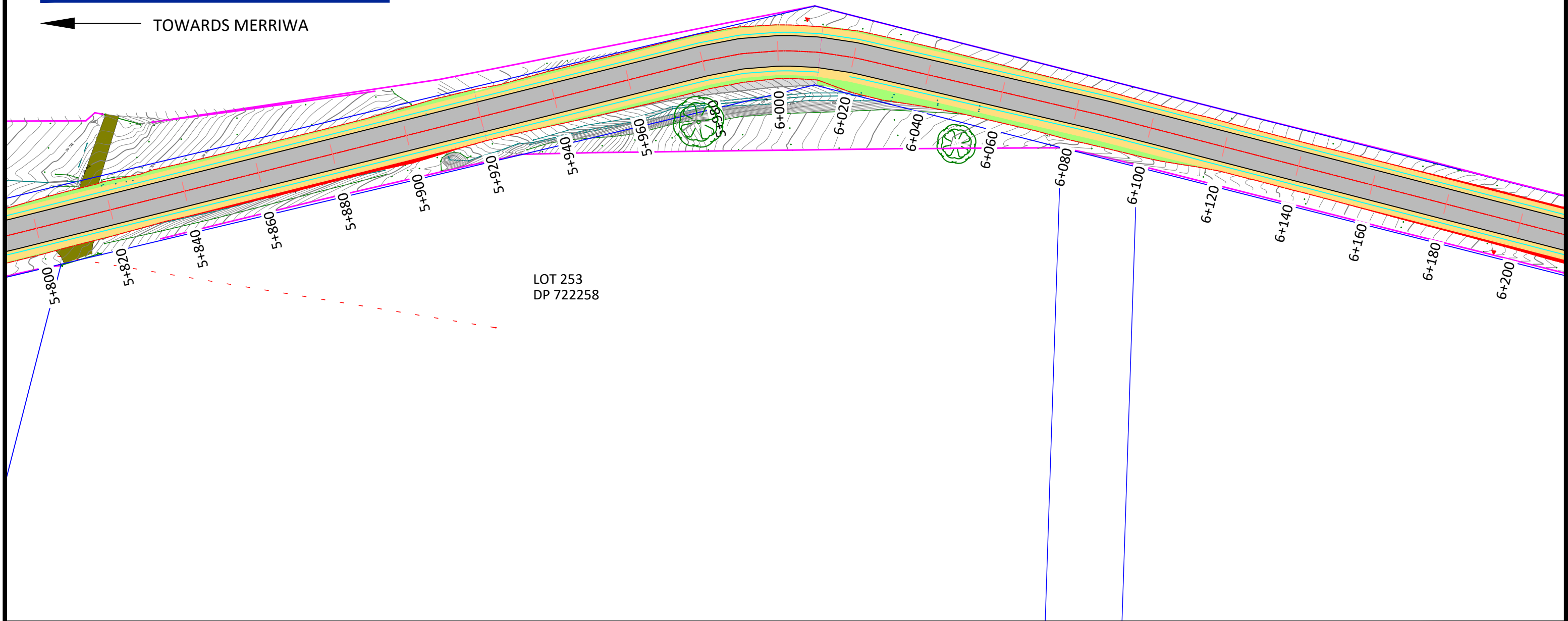
LEGEND

	CADASTRAL BOUNDARY (DCDB)
	FENCE LINE
	FOG LINE
	CENTRELINE OF ROAD
	EDGE OF BITUMEN
	EDGE OF UNSEALED SHOULDER
	STORMWATER PIPE
	SURVEY CONTROL POINT
	DENOTES TREE
	DENOTES CUT AND FILL



LOT 222
DP 750934

← TOWARDS MERRIWA



LOT 253
DP 722258



DATE:	REVISION:	DESCRIPTION:
24.01.2023	0	CLIENT REVIEW

PROJECT:
RINGWOOD ROAD UPGRADE

DRAWING TITLE:
Proposed Alignment











ISSUE STATUS:
CONCEPTUAL DESIGN CLIENT REVIEW

SCALE: 1:1000
DWG No: HEC22_
JOB No: 22Q3J3
COORDINATE SYSTEM: MGA ZONE 56 GDA 2020
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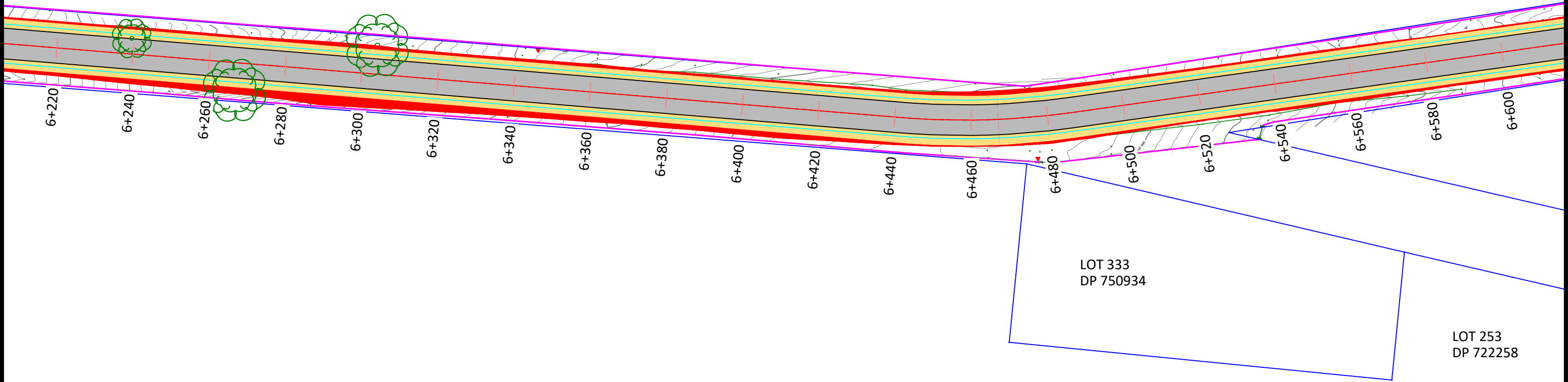
LEGEND



-  CADASTRAL BOUNDARY (DCDB)
-  FENCE LINE
-  FOG LINE
-  CENTRELINE OF ROAD
-  EDGE OF BITUMEN
-  EDGE OF UNSEALED SHOULDER
-  STORMWATER PIPE
-  SURVEY CONTROL POINT
-  DENOTES TREE
-  DENOTES CUT AND FILL

LOT222
DP 750934

← TOWARDS MERRIWA



DATE:	REVISION:	DESCRIPTION:
24.01.2023	0	CLIENT REVIEW

PROJECT:
RINGWOOD ROAD UPGRADE



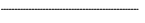

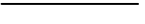





DRAWING TITLE:
Proposed Alignment

ISSUE STATUS:
CONCEPTUAL DESIGN CLIENT REVIEW

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JOB No: 22Q3J3
COORDINATE SYSTEM: MGA ZONE 56 GDA 2020
DATUM: AHD

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SHEET: 4	REV: 0

LEGEND

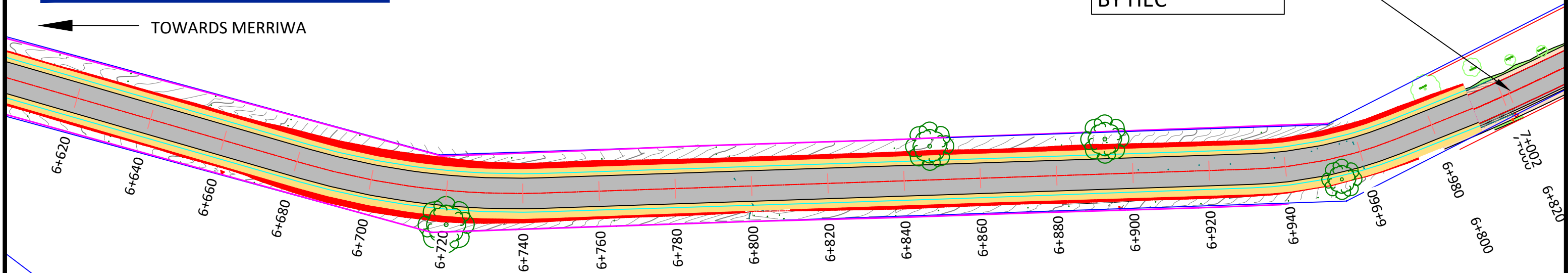
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-  FENCE LINE
-  FOG LINE
-  CENTRELINE OF ROAD
-  EDGE OF BITUMEN
-  EDGE OF UNSEALED SHOULDER
-  STORMWATER PIPE
-  SURVEY CONTROL POINT
-  DENOTES TREE
-  DENOTES CUT AND FILL



LOT 222
DP 750934

TIE INTO EXISTING
CONSTRUCTED
ROAD. DESIGNED
BY HEC

← TOWARDS MERRIWA



LOT 216
DP 750934



CLIENT:



DATE:	REVISION:	DESCRIPTION:
24.01.2023	0	CLIENT REVIEW

PROJECT:
RINGWOOD ROAD UPGRADE

DRAWING TITLE:
Proposed Alignment











ISSUE STATUS:
CONCEPTUAL DESIGN CLIENT REVIEW

SCALE:
1:1000

DWG No: HEC22_	DESIGNED: RS	DRAWN: RJ
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DATUM: AHD		

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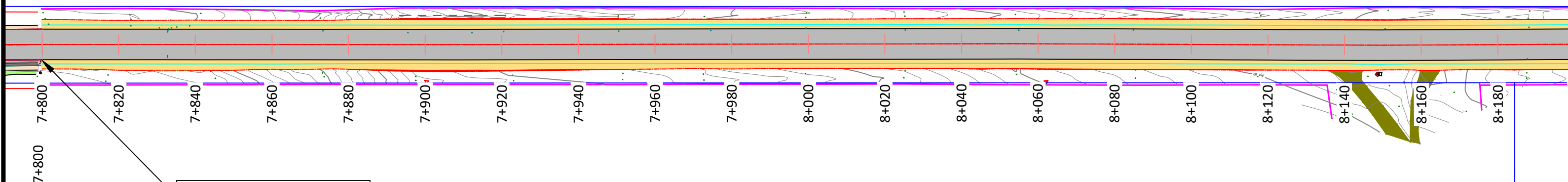
LEGEND

-  CADASTRAL BOUNDARY (DCDB)
-  FENCE LINE
-  FOG LINE
-  CENTRELINE OF ROAD
-  EDGE OF BITUMEN
-  EDGE OF UNSEALED SHOULDER
-  STORMWATER PIPE
-  SURVEY CONTROL POINT
-  DENOTES TREE
-  DENOTES CUT AND FILL

LOT 246
DP 750934

LOT 217
DP 750934

← TOWARDS MERRIWA



TIE INTO EXISTING
CONSTRUCTED
ROAD. DESIGNED
BY HEC



DATE:	REVISION:	DESCRIPTION:
24.01.2023	0	CLIENT REVIEW

PROJECT:
RINGWOOD ROAD UPGRADE

DRAWING TITLE:
Proposed Alignment

ISSUE STATUS:
CONCEPTUAL DESIGN CLIENT REVIEW

SCALE:
1:1000

DWG No: HEC22_
JOB No: 22Q3J3

COORDINATE SYSTEM:
MGA ZONE 56 GDA 2020











DATUM: AHD

SURVEYED:
RAP SURVEYING

DESIGNED: RS
DRAWN: RJ

SHEET: 6
REV: 0

LEGEND

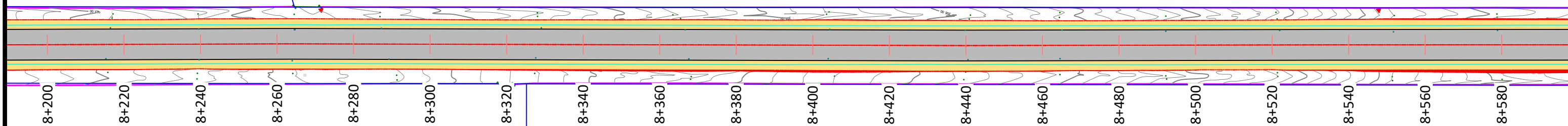
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	CENTRELINE OF ROAD
	EDGE OF BITUMEN
	EDGE OF UNSEALED SHOULDER
	STORMWATER PIPE
	SURVEY CONTROL POINT
	DENOTES TREE
	DENOTES CUT AND FILL



LOT 222
DP 750934

LOT 223
DP 750934

← TOWARDS MERRIWA



8+200 8+220 8+240 8+260 8+280 8+300 8+320 8+340 8+360 8+380 8+400 8+420 8+440 8+460 8+480 8+500 8+520 8+540 8+560 8+580

LOT 237
DP 750934

LOT 217
DP 750934



CLIENT:



DATE:	REVISION:	DESCRIPTION:
24.01.2023	0	CLIENT REVIEW

PROJECT:
RINGWOOD ROAD UPGRADE

DRAWING TITLE:
Proposed Alignment

ISSUE STATUS:
CONCEPTUAL DESIGN CLIENT REVIEW

SCALE:
1:1000

DWG No: HEC22_	DESIGNED: RS	DRAWN: RJ
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LEGEND

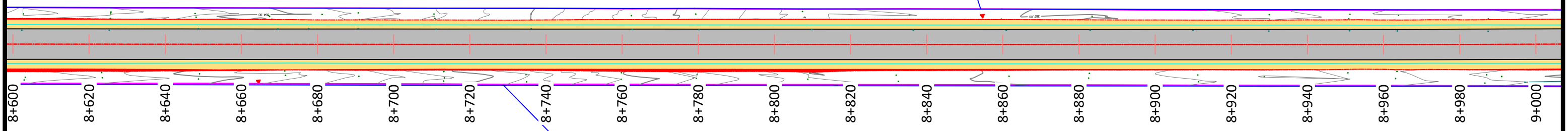


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	FOG LINE
	CENTRELINE OF ROAD
	EDGE OF BITUMEN
	EDGE OF UNSEALED SHOULDER
	STORMWATER PIPE
	SURVEY CONTROL POINT
	DENOTES TREE
	DENOTES CUT AND FILL

LOT 223
DP 750934

LOT 224
DP 750934

← TOWARDS MERRIWA



LOT 217
DP 750934

LOT 220
DP 750934



CLIENT:



DATE:	REVISION:	DESCRIPTION:
24.01.2023	0	CLIENT REVIEW

PROJECT:
RINGWOOD ROAD UPGRADE

DRAWING TITLE:
Proposed Alignment

ISSUE STATUS:
CONCEPTUAL DESIGN CLIENT REVIEW

SCALE:
1:1000

DWG No: HEC22_	DESIGNED: RS	DRAWN: RJ
JOB No: 22Q3J3		
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DATUM: AHD		

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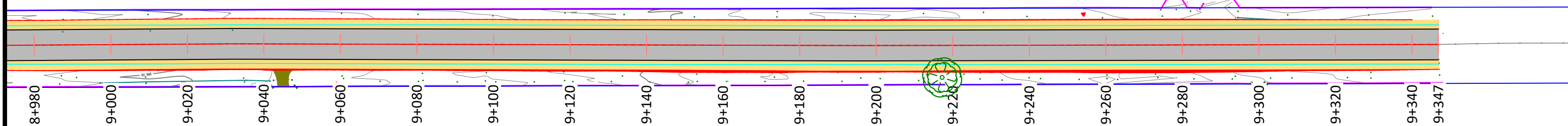
LEGEND



	CADASTRAL BOUNDARY (DCDB)
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	FOG LINE
	CENTRELINE OF ROAD
	EDGE OF BITUMEN
	EDGE OF UNSEALED SHOULDER
	STORMWATER PIPE
	SURVEY CONTROL POINT
	DENOTES TREE
	DENOTES CUT AND FILL

LOT 224
DP 750934

← TOWARDS MERRIWA



LOT 220
DP 750934



DATE:	REVISION:	DESCRIPTION:
24.01.2023	0	CLIENT REVIEW

PROJECT:
RINGWOOD ROAD UPGRADE

DRAWING TITLE:
Proposed Alignment

ISSUE STATUS:
CONCEPTUAL DESIGN CLIENT REVIEW

SCALE: 1:1000	DWG No: HEC22_
	JOB No: 22Q3J3
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