

Transport for NSW

Outer Sydney Orbital Stage 2 (OSO2) Corridor – Sector 1

Options Report
Greater Macarthur Growth Area



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Acknowledgement

Transport for NSW acknowledges that the Tharawal and Dharug peoples are the traditional custodians of the land engaged by this project and wishes to pay respect to Elders past and present and recognises continuing connection to country.

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1. Executive Summary

This report details current investigations into the Outer Sydney Orbital Stage 2 (OSO2) and, in particular, corridor options identified for community and stakeholder engagement between the Hume Motorway and Appin Road east of the Appin township. The OSO2 is part of the wider Outer Sydney Orbital corridor project; a new major north-south route that will define Greater Sydney's emerging Western Parkland City and provide connections to regional NSW. The OSO2 is focusing on connections between the Western Parkland City and the Illawarra-Shoalhaven region.

The Western Parkland City is the fourth largest urbanised area in Australia. The Greater Sydney Region Plan has forecast significant population and economic growth in the coming decades within the area between Fairfield and the foot of the Blue Mountains (the 'Western Parkland City') to grow from 740,000 people in 2016 to over 1.5 million by 2056.

The Macarthur region is part of the Western Parkland City with planned urban land release areas identified by the Government in Greater Macarthur 2040 and Wilton 2040. It is expected that over the next 20-30 years approximately 54,000 new dwellings and 35,000 jobs will be delivered in the Greater Macarthur and Wilton Growth Areas.

Transport investigations completed for the Greater Macarthur Growth Area (GMGA) and the Wilton Growth Area (WGA) identified the need for future connections between Appin Road and the Hume Motorway including the OSO2. Planning for the OSO2 corridor is required to enable future urban development within the GMGA and to meet forecast regional travel needs. Staged investigation of the OSO2 corridor will consider upgrades to Appin and Picton Road outside the GMGA, together with a potential new crossing of the Illawarra Escapement. New connections to Picton Road from the Hume Motorway will also be examined, that direct through-traffic away from Wilton in the longer term.

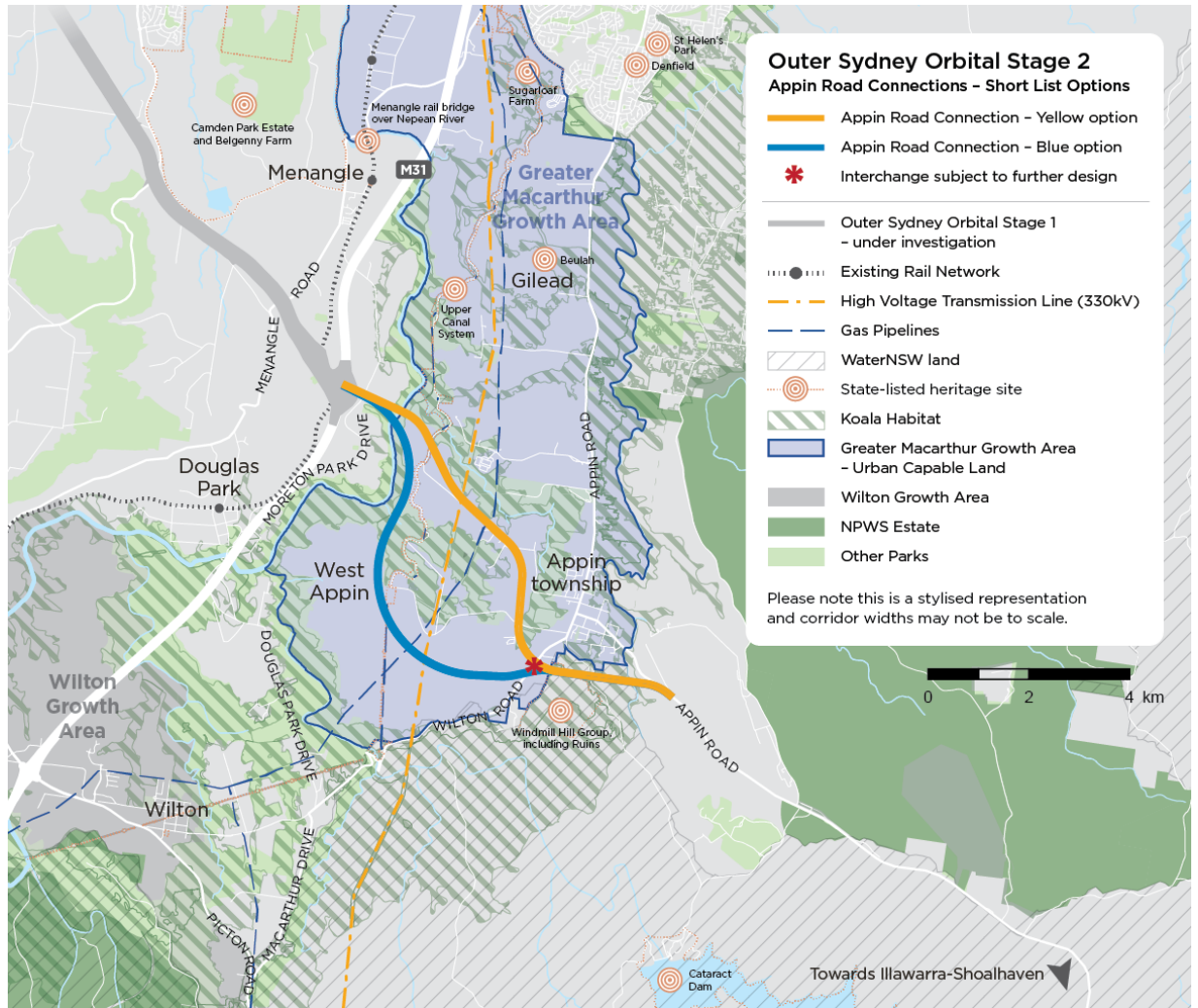
The OSO2 corridor investigations have been informed by this earlier work on the GMGA and WGA, as well as input from an Advisory Group consisting of agencies from across Government and local councils. The process of identifying corridor options commences with the analysis of existing land use and environmental constraints. Identifying available land for a future transport corridor involves balancing different types of potential impacts, including heritage, existing and future communities, and the natural environment.

To guide this analysis, corridor objectives have been developed consistent with the Government's strategic land use and transport policies for the Greater Sydney Region and the Western Parkland City. The objectives are also aligned with planning for the Greater Macarthur and Wilton Growth Areas together with the Illawarra-Shoalhaven region. This strategic context is important to explain the purpose of the corridor and the type of outcomes being sought, including the efficient movement of passengers and goods between regions and key impacts to be avoided or otherwise managed.

Business requirements were also developed to enable the effective construction of future infrastructure. While further design refinement will happen following community and stakeholder engagement, it is expected that an 80m wide corridor of land is required through the GMGA to accommodate a future six lane arterial road together with sufficient space for separated cycle and pedestrian paths. The corridor also needs space to accommodate utilities, drainage, earthworks, and landscaping.

After initial design discussions with the Advisory Group and filtering to test different approaches to constraints, six options were assessed using a multi-criteria analysis (MCA) process. The MCA process was based on criteria reflecting the corridor objectives. After further analysis, the two shortlisted options shown in Figure ES1 below were identified for community and stakeholder engagement.

Figure ES1: OSO2 – Short Listed Options Connecting from the Hume Motorway to Appin Road



The analysis of options in this report seeks to represent the key opportunities and constraints for each option. The potential mitigation of different impacts is also considered. For example, all corridor options need to cross the State heritage listed Upper Canal that runs north-south through the GMGA. Whilst this is an unavoidable future impact, it can be successfully mitigated through design in accordance with WaterNSW guidelines. However, some options had impacts that are very difficult to mitigate including, for example, amenity impacts where options pass in close proximity to Appin township. These impacts significantly reduced the assessed performance and feasibility of those options.

The avoidance of ecological impacts has also proven difficult given the extent of land with biodiversity value throughout the GMGA. Specialist ecological advice, together with guidance from the Department of Planning, Industry and Environment (DPIE), has been essential in designing corridor options to minimise these impacts. Potential mitigations include the use of elevated structures above the Nepean River and other creek systems. These can minimise

habitat loss and provide sufficient clearance for wildlife crossing, in particular koalas. Any future application to construct infrastructure within the OSO2 corridor will be required to identify biodiversity impacts including the use of offsets consistent with the Cumberland Plain Conservation Plan.

An important consideration in the assessment of the options is the impact on private property and how these impacts has been minimised wherever possible. Government owned land has been used, where feasible, including land adjoining the Hume Motorway and Appin Road. However, a significant proportion of the land considered for corridor options is held in single ownership.

The two shortlisted options identified in the report achieved the best overall performance against the MCA criteria after mitigations were considered.

The benefits of the identifying a corridor within the GMGA are substantial and include providing certainty for communities and landowners, as well as for planners and the development industry. The OSO2 corridor will enable the sustainable provision of future transport infrastructure when it is needed and avoid pressure to locate infrastructure on environmentally sensitive land. Future OSO2 infrastructure will increase the capacity of the transport network, and potentially reduce travel times, reduce delays, and offer an opportunity to improve road safety outcomes in line with the Government's Towards Zero vision.

Some specific travel benefits may include:

- Improved inter-regional access for tourism, education and employment trips.
- Supporting the future expansion of operations at Port Kembla, which is the designated second container port for NSW.
- Increased opportunities for business collaboration between the Illawarra-Shoalhaven and the Western Parkland City, with both regions having identified the advanced manufacturing, tertiary education, logistics, aerospace and defence as growth industries.
- Diverting inter-regional through-traffic away from Appin Road north of Appin township and reduced congestion in and around Campbelltown-Macarthur.

Seeking advice from the community and stakeholders is a critical step in the corridor planning process. Feedback received from the community during engagement will be considered and a response provided in a subsequent submissions report. Transport for NSW (TfNSW) will complete its technical investigations and address specific issues raised by landowners and the community, and additional work will be undertaken on further ways to mitigate corridor impacts.

The community and stakeholders will have another opportunity to provide comment on a recommended corridor before the finalisation of Greater Macarthur 2040. The construction of infrastructure within the OSO2 corridor is likely within the next 20 years, subject to demand and available funding.

The corridor planning process does not affect current land uses. Land owners to speak with the project team to obtain further information about the corridor investigation process.

You can provide your feedback about the shortlisted corridor options in the following ways:

- **Visit the website for more information**

transport.nsw.gov.au/corridors/oso2

- **Use the interactive online map to see the locations of the corridor options and to provide your feedback**

transport.nsw.gov.au/corridors/oso2

- **Email corridors@transport.nsw.gov.au**

- **Write**

Corridor Investigation Office

Transport for NSW

PO BOX K659

Haymarket NSW 1240

- **Call 1800 837 511**

2. Introduction

2.1 Purpose of this report

The Outer Sydney Orbital Stage 2 (OSO2) corridor project is investigating options for future transport connections between the Hume Motorway and the Illawarra-Shoalhaven region. The purpose of this report is to present options connecting from the Hume Motorway through the Greater Macarthur Growth Area (GMGA) to Appin Road east of Appin township.

This report provides details of initial technical investigations into existing land use and environmental constraints that have informed the identification and assessment of proposed corridor options. The approach and findings of this assessment are explained to support engagement with land owners and the community with particular reference to shortlisted corridor options.

It is anticipated that following input from land owners and the community, additional investigations will be required to identify a recommended final corridor that minimise impacts, where possible, on property, land uses and the environment. Mitigating impacts on threatened flora and fauna in the GMGA, including koalas and their habitat, is a critical consideration. Transport for NSW (TfNSW) is working closely with the Department of Planning, Industry, and Environment (DPIE) and other stakeholders to achieve this.

2.2 Project definition

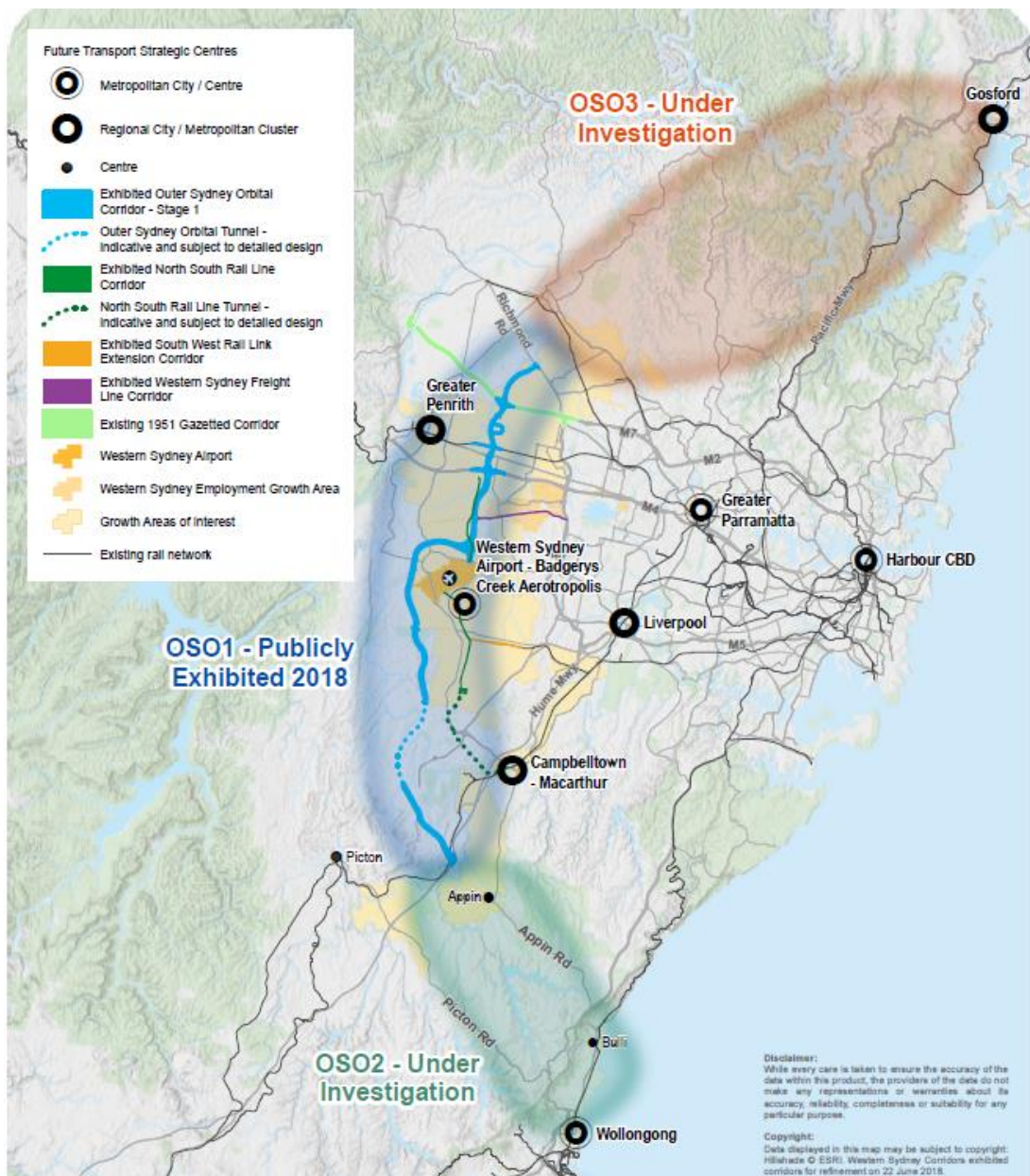
2.2.1 The Outer Sydney Orbital

Transport for NSW is seeking to identify a corridor for the Outer Sydney Orbital (OSO), a new major north-south route that will define Sydney's emerging Western Parkland City and connect its Aerotropolis with the Central Coast and Illawarra-Shoalhaven regions. As shown in [Figure 1](#) below, the OSO corridor is being investigated in three stages:

- **Stage 1** – From the Hume Motorway at Menangle, across the Western Parkland City via the Aerotropolis to Richmond Road at Marsden Park.
- **Stage 2** – From the Hume Motorway at Menangle to the Illawarra-Shoalhaven region (i.e. the subject of this report).
- **Stage 3** – From Richmond Road at Marsden Park to the Central Coast.

A first stage of the OSO (OSO1) was publicly exhibited in March 2018. Following consideration of public submissions, the Government announced in June 2018 that it would consider a route between Richmond Road at Marsden Park and the Hume Motorway at Menangle. The announcement also relocated the proposed interchange on the Hume Motorway to Government owned land. It is envisaged that the OSO2 corridor would extend the connectivity offered by OSO1 to the Illawarra-Shoalhaven region. A corridor for a third stage of the OSO (OSO3), between Richmond Road and the Central Coast, is the subject of a separate investigation.

Figure 1: Outer Sydney Orbital Corridor Investigation

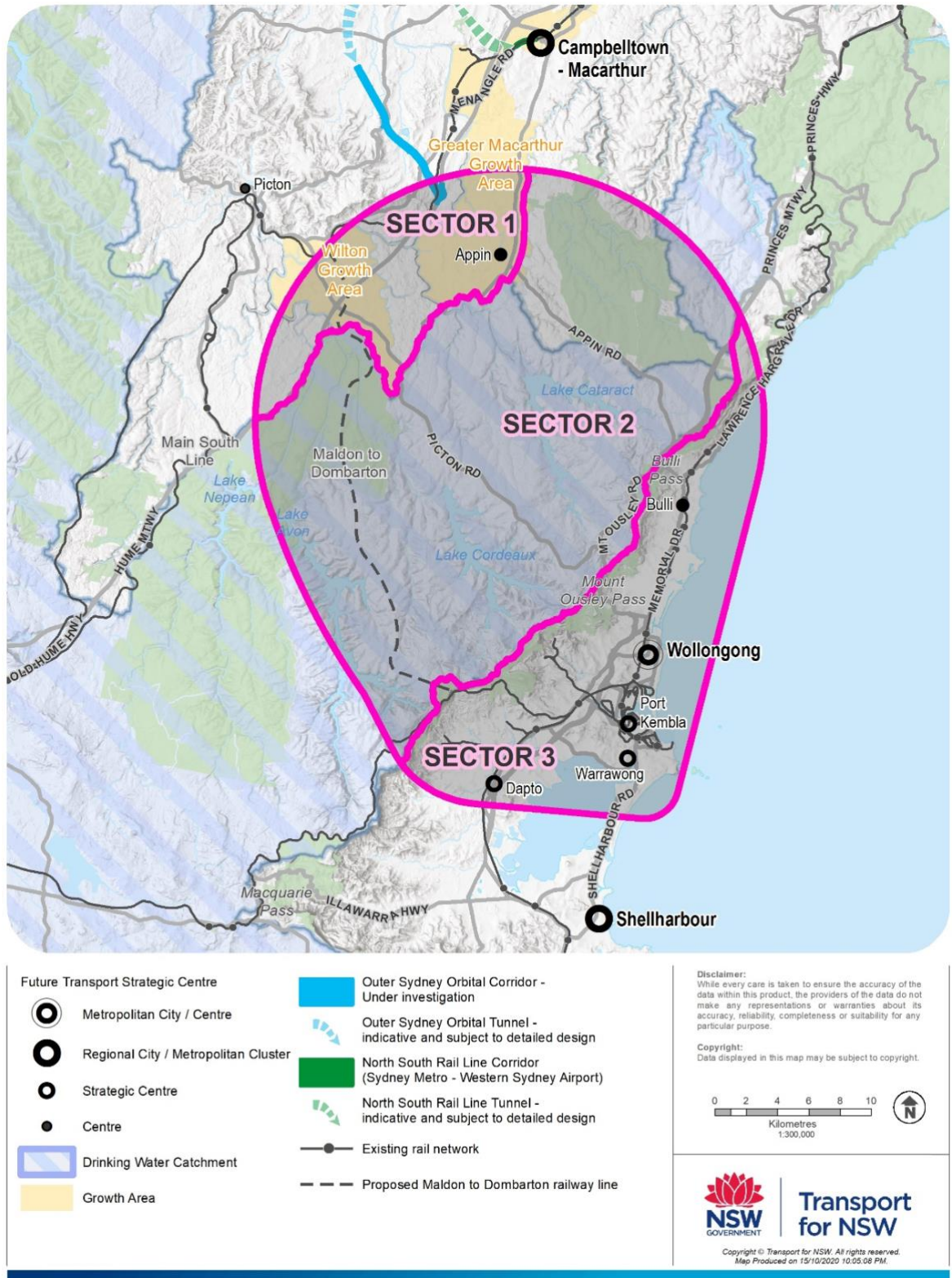


2.2.2 The Outer Sydney Orbital 2 Study Area

The OSO2 study area, as shown in Figure 2 below, is large with diverse planning issues and place values. Accordingly, the investigation has been divided into three 'sectors' based on land use and physical characteristics.

- **Sector 1 – Greater Macarthur Growth Area and Surrounds:** In 2018, Department of Planning, Industry and Environment released an interim plan for the GMGA – Greater Macarthur 2040. This plan identifies a number of future transport connections linking the GMGA with the Hume Motorway. To provide certainty for planning and future development, there is an urgent need to identify corridor requirements for future inter-regional transport infrastructure.
- **Sector 2 – Drinking Water Catchment:** This sector is predominantly WaterNSW's Metropolitan Special Area, a major drinking water catchment for Sydney. It also includes the Appin and Picton Road corridors together with approved mining activities. Sector 2 investigations will focus on potential upgrades to Appin and Picton Roads to avoid significant impact on the environment and the drinking water catchment and to inform future business cases. These investigations are underway and will be informed by the Sector 1 engagement and corridor investigations.
- **Sector 3 – Connecting to the Illawarra-Shoalhaven:** This sector encompasses the culturally, environmentally, and geologically significant Illawarra Escarpment and the complex residential, commercial and industrial urban fabric of Wollongong. The need for a future crossing of the Illawarra Escarpment and potentially feasible locations will be addressed following investigations of Sectors 1 and 2. The investigation will commence with initial geotechnical assessment of potential locations for Escarpment crossings, having regard to previous and current mining activities and the geological conditions of the Escarpment.

Figure 2: The OSO2 study area



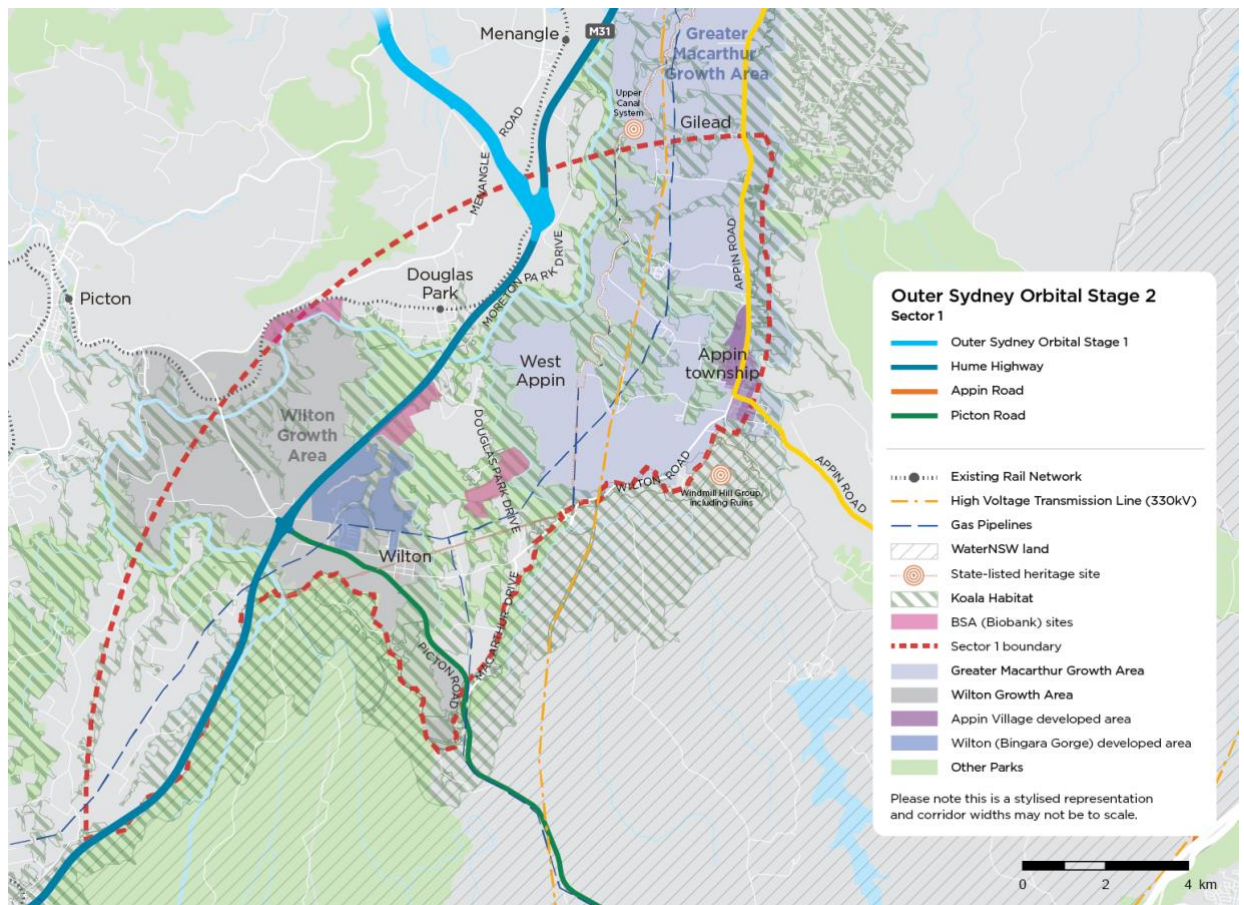
2.2.3 Sector 1

The OSO2 corridor, as detailed above, is being investigated in three parts, commencing with Sector 1, which is focused on the southern part of the GMGA and surrounds, including the neighbouring WGA. The study area for Sector 1 is shown in Figure 3 and incorporates parts of the Wollondilly and Campbelltown local government areas.

Sector 1 is predominantly rural, but this is expected to change over time with urban development expected to occur across both the GMGA and WGA.

A detailed description of existing and planned land uses in the area, along with its environmental characteristics can be found in Chapter 3. Community profiles developed for the existing townships of Appin, Wilton and Douglas Park are provided in Appendix A. These broadly suggested that these communities share common features with many other outer suburban places, with relatively high levels of socio-economic advantage, employment, and car use. This analysis together with the other constraints assessment outlined in Chapter 3 has informed the corridor planning process.

Figure 3: OSO2 – Sector 1



2.2.4 Existing Transport Connections

The OSO2 study area (Sectors 1-3) includes several existing major transport infrastructure corridors including the Hume Motorway (M31), The Princes Motorway (M1), the Main South and Illawarra Railway Lines and the protected, not yet fully constructed, Maldon Dombarton Railway Line.

Picton Road and Appin Roads are the primary road connections between the Western Parkland City and the Illawarra-Shoalhaven region. Picton Road connects between the Hume Motorway at Wilton and the Princes Motorway at the top of the Illawarra Escarpment outside Wollongong, while Appin Road connects between Campbelltown and the Princes Motorway at Bulli Tops. Both Appin and Picton Roads have single lane and multi-lane sections, with varying speed zones that reflect changing road conditions. Heavy vehicles represent 20 percent of traffic on Picton Road and 15 percent of traffic on Appin Road.

Travel between Wollongong and Sydney is constrained by the Illawarra Escarpment, which rises sharply around 400 metres between sea level and the Woronora Plateau. Currently, the two main Escarpment crossings are Mount Ousley Road (interfacing most directly with Picton Road) and Bulli Pass (interfacing most directly with Appin Road). While Mount Ousley Road is multi-lane (three lanes uphill, with two lane sections downhill), Bulli Pass is only single lane in either direction with limited overtaking opportunities. Both routes are not ideal for heavy vehicles - the maximum grade on Mount Ousley Road is 10.9 percent and the maximum grade on Bulli Pass is 14.6 percent.¹

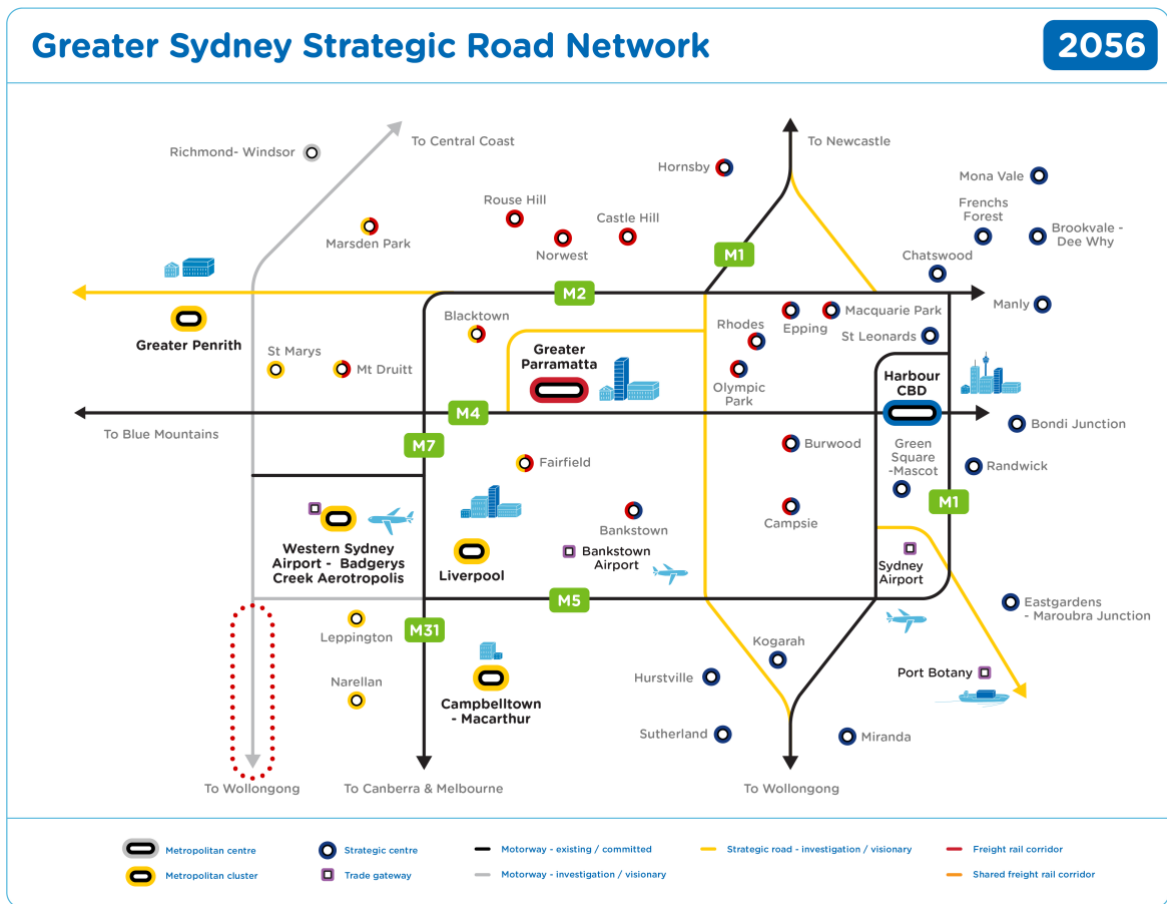
The proposed Maldon to Dombarton Railway is a 35-kilometre single-track rail freight line between the Main South Line at Maldon (in Wollondilly Shire) and Dombarton (near Port Kembla). Construction on the line started in 1983 but was suspended in 1988 due to an economic downturn and the forecast growth in coal traffic not eventuating. By this time, around 25km of earthworks (such as major cuttings and embankments) had been completed and ballast had been installed. A bridge and tunnel portals were also partially built. If completed, the Maldon to Dombarton Railway could provide additional rail freight capacity in and out of Port Kembla, helping to cater for the forecast long-term growth in NSW freight when future demand for passenger services on the Illawarra Line may constrain freight. However, existing capacity on the Illawarra rail network is adequate in the short to medium term.

2.3 Strategic Context and Needs

The Government's strategic transport plan for NSW – Future Transport 2056, as shown in Figure 4 below, identifies connections between Western Sydney and the Illawarra-Shoalhaven as an important element of the future Greater Sydney Strategic Road Network.

¹ Australian road design standards suggest a maximum grade of 4 to 6 percent is preferable.

Figure 4: Future Transport 2056 – Greater Sydney Strategic Road Network



Future Transport 2056 provides the basis for assessment into the feasibility of the OSO2 corridor, as part of the broader orbital connection between the Illawarra-Shoalhaven and the Central Coast via the Western Sydney Aerotropolis. The OSO2 assessment of needs has included the following considerations:

- Strategic spatial planning for both Western Sydney and the Illawarra-Shoalhaven region.
- Other directions set in Future Transport 2056 and its associated plans including for freight, ports, and road safety.
- Strategic transport modelling to understand the capacity of existing infrastructure and the possible implications of different infrastructure and service investments.
- Local governments' local strategic planning statements (LSPSs), community strategic plans (CSPs) and other policy documents.
- Stakeholders' expressions of needs, including advocacy by the Illawarra-Shoalhaven Joint Organisation and others for improvements to transport services and infrastructure connecting Western Sydney and the Illawarra-Shoalhaven region to achieve better economic and social outcomes.

This initial assessment has found that high-quality transport connections will be required in Sector 1 from the Hume Motorway to both Appin Road and Picton Roads in the next 30 years. However, increasing pressure for development within the GMGA, and in particular West Appin, requires urgent engagement with the community to identify future transport needs.

Future infrastructure within the OSO2 corridor will enable reduced inter-regional travel times for journeys between the Western Parklands City and the Illawarra-Shoalhaven region for work, study and leisure. It will also have important benefits for the movement of freight including reducing the cost of moving goods between Port Kembla, the Western Sydney Aerotropolis and other logistic hubs in the Western Parkland City and the Illawarra-Shoalhaven. Future OSO2 infrastructure will also increase the capacity of the transport network, potentially reduce delays and offer an opportunity to improve road safety outcomes in line with the Government's Towards Zero vision. Within and around the GMGA, it will also have the crucial effects of diverting inter-regional through-traffic away from Appin Road north of Appin township and contribute toward reducing congestion in and around Campbelltown-Macarthur.

A viable corridor option through the GMGA is the first step in establishing improved inter-regional connections. Identifying a corridor early can also avoid future disruption for communities and reduce delivery costs that may otherwise delay a project. The input of land owners and communities as part of the corridor planning process is critical in identifying a viable corridor that either avoids or can successfully mitigate the potential impacts from future infrastructure.

The Future of Appin Road and Picton Roads

Both Appin Road east of Appin township and Picton Road south of the Hume Motorway are expected to continue to have important functions for inter-regional road traffic.

Picton Road provides the most direct connection between Port Kembla and Western Sydney, while Appin Road will provide an increasingly important role connecting the GMGA and the Illawarra-Shoalhaven region.

The OSO2 corridor investigation has initially focused on connections through the GMGA to Appin Road. Investigations are also underway into the potential future upgrade of Picton Road between its interchanges with the Hume and Princes Motorways. This work will also consider the need for a corridor between the GMGA and Picton Road to supplement Picton Road's capacity through Wilton and divert inter-regional through-traffic away from the area.

2.4 Investigation Approach

2.4.1 Project Team

The OSO2 corridor investigation has been led by Transport for NSW and supported by several professional service providers: Mott MacDonald (engineering), Ethos Urban (strategic land use planning), Ecoplaning (ecology), WolfPeak (Aboriginal and European heritage) and Arup (strategic transport planning).

An Advisory Group made up of subject matter experts from across the NSW Government and other bodies has also been integral to the investigation. The Advisory Group included representatives from:

- A range of Transport for NSW business units including from teams with responsibilities for road, rail, freight, and regional transport planning
- A range of Department of Planning, Industry and Environment business units including from teams with responsibilities for land release, environmental planning, conservation and regulation

- The Greater Sydney Commission and the Department of Premier and Cabinet including the Heritage Office
- WaterNSW
- Campbelltown, Wollondilly, and Wollongong councils.

2.4.2 Project Objectives

The OSO2 Project Objectives in Figure 5 were adopted by Advisory Group to guide the OSO2 investigation as a process. While tailored to the OSO2, these reflect Transport for NSW’s general approach to corridor preservation investigations and are informed by the requirements of Department of Planning, Industry and Environment’s Planning Guideline for Major Infrastructure Corridors and the NSW Government’s Practitioner’s Guide to Movement and Place.

Figure 5: OSO2 Project Objectives



2.4.3 Corridor Objectives

The Advisory Group also assisted the development of the OSO2 Corridor Objectives listed in Table 1 below based on key issues identified during the assessment of the OSO2's strategic context and needs. These outline the matters that need to be considered when identifying and selecting corridor alignment options and ultimately recommending a corridor.

Table 1: OSO2 Corridor Objectives

OSO2 Corridor Objectives	
1	Helps people to move efficiently and safely between the Western Parkland City and the Illawarra-Shoalhaven region
2	Enables freight to move efficiently and safely between the Western Parkland City and Illawarra-Shoalhaven region
3	Supports the urban development of the Illawarra-Shoalhaven region and the Wilton and Greater Macarthur Growth Areas, facilitates great places, and provides certainty for investment
4	Avoid impacts on communities and, where avoidance is not reasonably possible, minimise and mitigate those impacts
5	Avoid impacts on important environments and habitat and, where avoidance is not reasonably possible, minimise and mitigate those impacts
6	Ensures future infrastructure can be delivered sustainably and cost effectively.

2.4.4 Business Requirements Statement

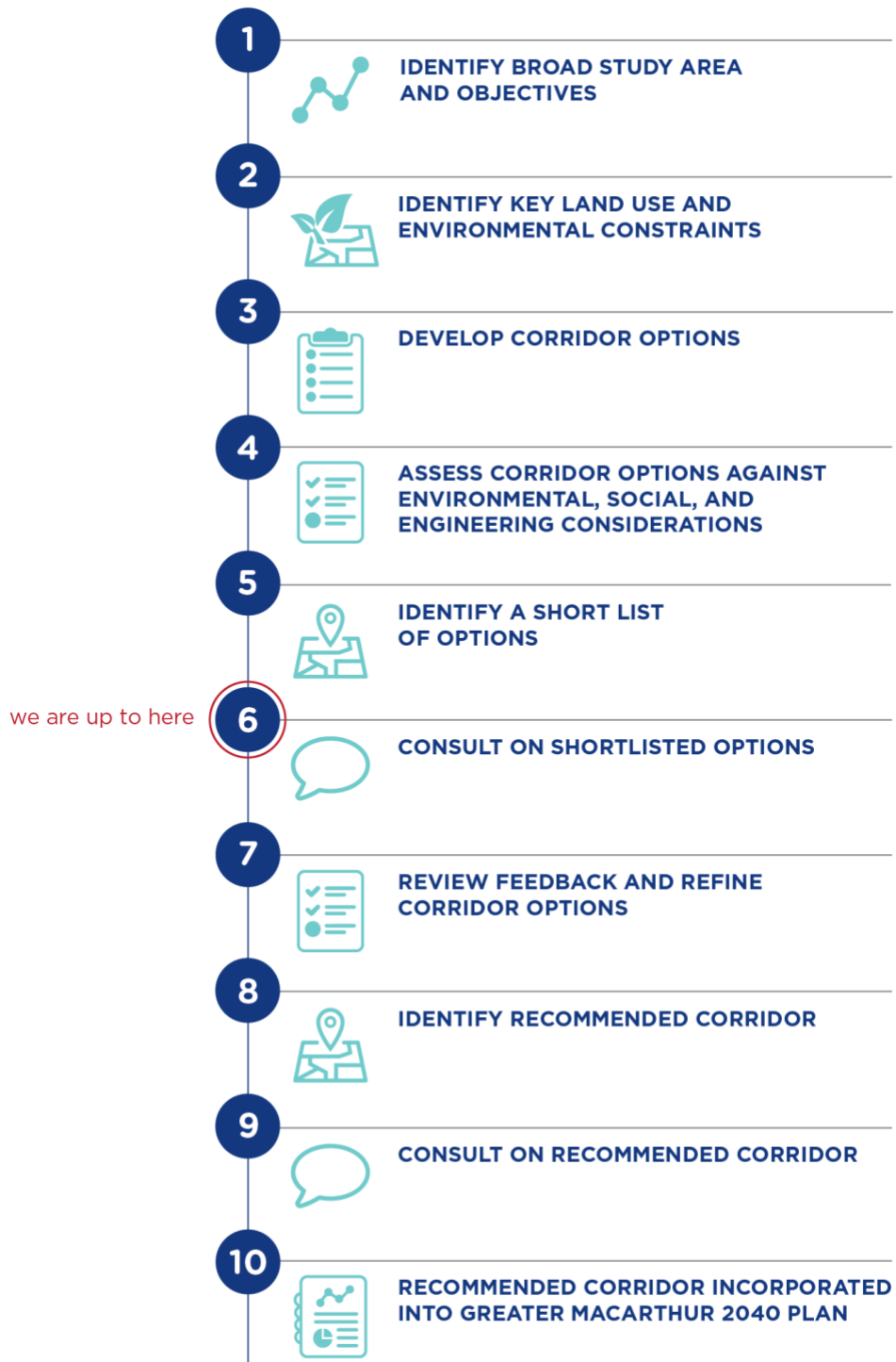
A Business Requirements Statement (BRS) developed for the OSO2 can be found at [Appendix B](#). While it is not currently proposed to construct OSO2 infrastructure, the BRS sets out in technical terms what form future infrastructure might take to meet the OSO2 Corridor Objectives, and consequently the nature of the land that may be required for preservation. The BRS has been developed with reference to subject matter experts on particular issues (e.g. road safety) and other sources of contemporary best practice.

It should be noted that the BRS is a guide. Further refinement of the corridor in terms of widths and alignment together with movement and place principles, will be undertaken following community engagement. Prior to construction, a separate environmental assessment process will be required with further community engagement. The construction of infrastructure is not envisaged in the short to medium term.

2.4.5 Investigation Process

Building from the elements above, a systematic approach was followed to develop and assess the options presented in this report. The approach is consistent with the requirements of Department of Planning, Industry and Environment's Planning Guideline for Major Infrastructure Corridors, and the NSW Government's Practitioner's Guide to Movement and Place. Both require engagement with relevant stakeholders regarding the potential environmental, economic, and social impacts of a proposed corridor. This process so far is summarised in [Figure 6](#) below.

Figure 6: The OSO2 Investigation Process



3. Constraints and opportunities

3.1 Introduction

Before considering potential routes for corridor options, early investigations across the OSO2 study area were undertaken to identify existing land use, environmental, and engineering constraints relevant to future corridor preservation, and the delivery of transport infrastructure.

Constraints mapping is an important early step in the corridor planning process. Overlaying the different constraints and opportunities within the study area allows for corridors options to be identified, and achieve a workable balance between different impacts on property, land use, and the environment. Wherever possible, impacts on the most sensitive constraints are avoided. For unavoidable impacts, mitigations are considered that can reduce the severity of the impact.

The constructability of future infrastructure within a corridor is also a critical consideration. In providing for a future major road connection, the OSO2 corridor will need to be of sufficient width to accommodate space for up to six lanes of general traffic plus separated cycle and pedestrian paths together with sufficient space for landscaping. Space within the corridor is also needed to accommodate future potential for utilities, intersections, drainage and earthworks. While further design refinement will happen after community and stakeholder engagement, it is expected that an 80m wide corridor of land is required through the GMGA connecting to Appin Road.

The constraints mapping layers developed for the OSO2 has been included on the project web site transport.nsw.gov.au/corridors. Feedback from the community and key stakeholders can ensure that existing constraints are clearly understood and can inform the planning process to identify a corridor.

3.2 Land Use and Landscape

3.2.1 Existing Land Uses and Landscapes

In general, Sector 1 of the study area has an undulating topography comprising a mixture of cleared farmland, remnant native vegetation along watercourses, and deeper gorges such as that of the Nepean River. The region has historical associations with early European farming in Australia and a large proportion of the sector remains zoned as Rural Landscape.

The largest existing settlement in the southern part of the GMGA is Appin township. The first land grant in the Appin area was made in 1811 and a town plan was created in 1834. Appin township today has a population of around 2,600 people and the centre of township contains a retail and service centre for the surrounding community. Historic churches, community facilities, a public school and a sports ground are located either side of Appin Road. To the north of the Appin township lies a greyhound track and recreational motorcycle facilities (i.e. Macarthur Motorcycle Club).

Appin township is predominantly zoned Low Density Residential. There are two Medium Density Residential zones associated with land subdivisions located to the east, and west of the town centre including the Appin Valley estate site for over 300 home. A Local Centre zone traverses both sides of Appin Road accommodating retail, and commercial uses to service

the town. Light Industrial zoned land to the south of the town on Wilton Road accommodates a number of industrial uses including Baines Masonry.

Wilton lies to the west of the GMGA and has grown considerably in recent times following the first sales of lots in the Bingara Gorge residential subdivision in 2007. It has a current population of just over 3,000. New shops, services and a primary school are located within the subdivision, and a golf course provides a buffer with the Hume Motorway. The Wilton urban area is predominantly zoned Low Density Residential between the Hume Motorway and Wilton Road.

Also west of the GMGA, Douglas Park has a population of 1,400 and is located to the north of the Hume Motorway and Nepean River. The township features a small number of shops, a primary school along Camden Road and a railway station served by diesel passenger services on the Southern Highlands Railway Line. Large lot rural residential properties surround the township. To the south, the Douglas Park Drive area contains the historic St Mary's Towers Retreat Centre, the Appin West Colliery, a cluster of dwellings along Douglas Park Drive intersecting with Wilton Road.

A number of rural residential properties are present between the townships along with agri-businesses and religious facilities. Broughton Pass, between Wilton and Appin, contains a weir along with other water infrastructure that is not suitable for heavy vehicles.

There are also significant sub-surface mining operations in the area, and associated surface infrastructure including the Appin East Colliery to the south of Appin township. The mining industry provides a significant number of local jobs both directly and indirectly. This connection with mining was recently commemorated in the Appin Sportsground with a memorial to 14 miners killed during a 1979 mine explosion.

Existing urbanised areas within the GMGA are considered to be a significant constraint and wherever possible avoided when identifying a future corridor.

3.2.2 Expected Land Use and Landscape Change

Much of the remainder of Sector 1 is expected to become urbanised in accordance with the Government's planning for the GMGA and WGA, which is detailed in the Greater Macarthur 2040 and Wilton 2040 structure plans.

Greater Macarthur Growth Area

Greater Macarthur 2040 and the associated draft Special Infrastructure Contribution (SIC) for the growth area foreshadow the large-scale rezoning of land, environmental areas to be protected, and various forms of infrastructure (and its staging) required to support growth. Greater Macarthur 2040's vision includes:

- 'Engaging, well designed places'
- 'Sensitivity to koalas, biodiversity and heritage'
- 'Transport will form the spine of the Growth Area'

The OSO2 study area interfaces primarily with the southernmost of new land release areas identified extending south of Campbelltown to Appin. Approximately 39,000 new dwellings and 20,000 jobs are planned in these areas.

Greater Macarthur 2040, as shown in [Figure 7](#) below, identifies urban capable land, the location of future centres, and environmentally sensitive land together with indicative future major transport connections. The latter includes:

- A north-south rapid public transport spine – the Greater Macarthur Transport Corridor (GMTC)
- Three indicative east-west arterials in the GMGA with interchanges on the Hume Motorway
- Upgrading of Appin Road as an arterial between Campbelltown and Appin township.

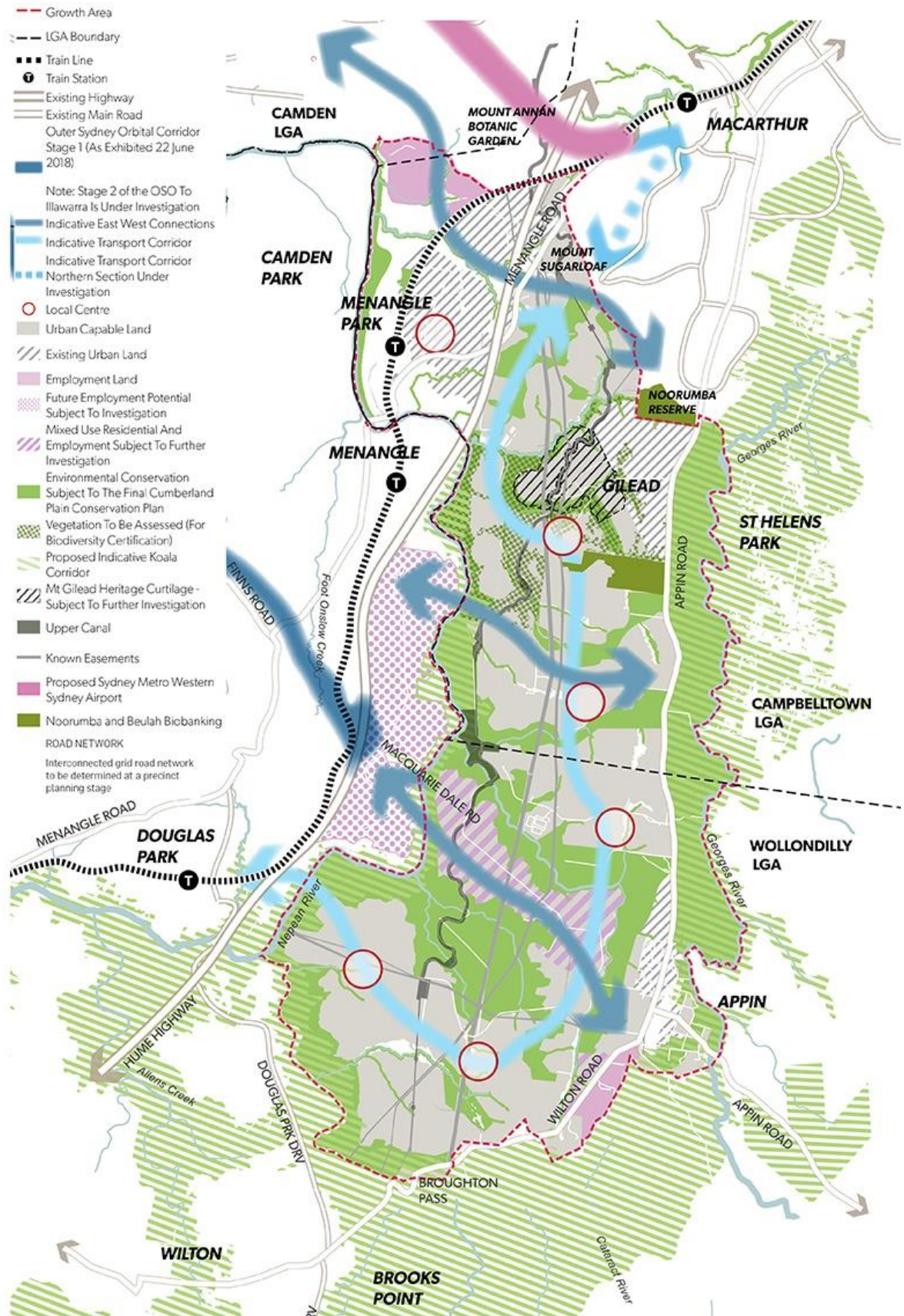
The Growth Area was formally declared in 2019 through an amendment to the State Environmental Planning Policy (Sydney Region Growth Centres) (2006) (commonly referred to as the 'Growth Centres SEPP'). Some applications have already been lodged seeking to rezone land to enable urban development. These include a planning proposal in the Macquariedale Road area to the west of Appin for approximately 63 hectares, and other proposals for land release are expected to be lodged within the next 18 months.

A feedback report was released by Department of Planning, Industry and Environment following the exhibition of Greater Macarthur 2040 and draft SIC. A number of transport related issues were raised, including:

- Alternate transport corridor alignments and potential for rail.
- The width of the GMTC and its potential to split neighbourhoods.
- The effects of transport corridors on neighbourhood amenity.
- Avoiding unnecessary traffic through Campbelltown.
- The impact of the planned Outer Sydney Orbital.
- Uncertainty for affected landowners until corridors are finalised.
- Suitable crossings for koalas of Appin Road and other transport links.

OSO2 corridor option development must therefore consider how options will relate to future land uses in the GMGA, land to be protected for environmental reasons, and other infrastructure including other transport connections. Having certainty over the location of the OSO2 will address some of these concerns.

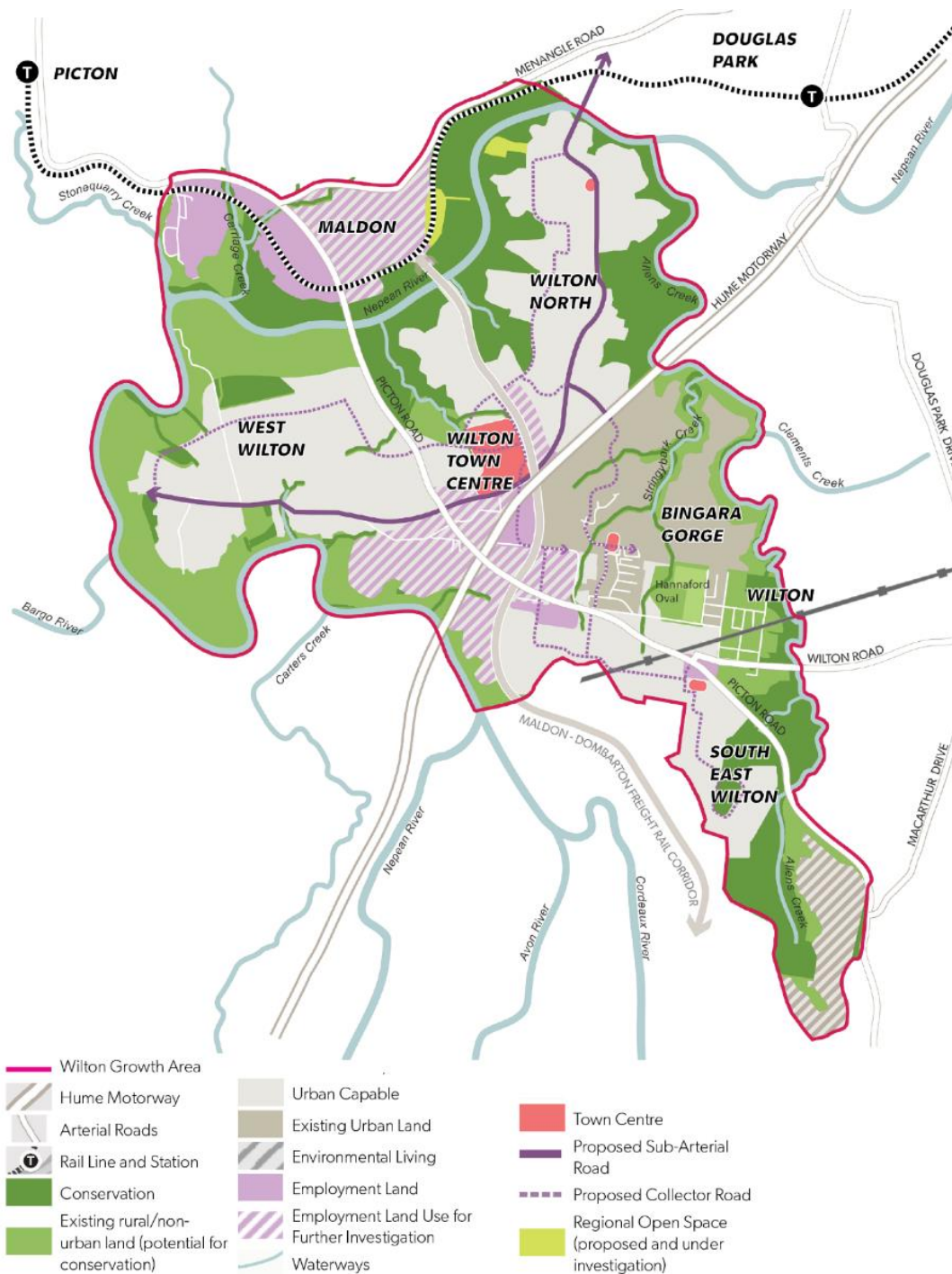
Figure 7: Greater Macarthur 2040 Structure Plan (Land Release Areas)



Wilton Growth Area

Whilst separate to the GMGA, the WGA will be a significant source of demand for travel in the immediately surrounding area, and flows to and from it need to be considered. When fully developed, the WGA is expected to accommodate 15,000 new dwellings and 15,000 jobs across five precincts. Two have been rezoned for primarily residential development (North Wilton and South East Wilton). A new town centre with 50,000m² of floor space will be the commercial and social infrastructure focal point for the new community. The developing Bingara Gorge residential estate also forms part of the Growth Area. Department of Planning, Industry and Environment's structure plan for the WGA (from the Wilton 2040 plan) is at Figure 8 below.

Figure 8: Wilton 2040 Structure Plan



The plan's vision also includes the following elements:

- 'An employment hub for logistics'
- 'An accessible place'
- 'A protected and enhanced environment'

Transport planning for the WGA has identified needs for widening of the Hume Motorway, new access ramps, and upgrading of Picton Road within the Growth Area. The need for a connection through the GMGA to Picton Road is the subject of further analysis as part of the OSO2 corridor investigation.

3.3 Biodiversity

Whilst much of Sector 1 has been impacted by agriculture post-European settlement, it nonetheless contains significant remnant native vegetation. Aquatic systems are also present (as regulated by the State's *Water Management Act*) including waterways such as the Nepean and Georges Rivers, wetlands, and farm dams. A number of databases and reports were reviewed to gain an understanding of the sector's biodiversity values including the:

- BioNet Atlas of NSW Wildlife for *Biodiversity Conservation Act* (BC Act) listed threatened species and communities (i.e. State Government matters)
- Protected Matters Search Tool for *Environmental Protection and Biodiversity Conservation Act* (EPBC Act) matters of national environmental significance (i.e. matter regulated by the Commonwealth)
- SEED Environmental Database
- Conserving Koalas in Wollondilly and Campbelltown LGAs (Office of Environment and Heritage report, January 2018)

It is important to note that corridor planning will not have any immediate impacts on land use and the environment. Nonetheless, the matters outlined below have been identified as sensitive and attempts have been made during options development to avoid them as far as possible. Future infrastructure delivery within the corridor will need to undertake further detailed environmental assessment ahead of obtaining approval for construction.

The analysis of biodiversity impacts draws on the experience of experts in other Government agencies familiar with the study area and its biodiversity.

3.3.1 Threatened Ecological Communities (TECs)

The concept of an 'ecological community' is an important way of understanding local biodiversity, and these are defined under the Biodiversity Conservation Act as 'an assemblage of species occupying a particular area'. Ecological communities are not limited to assemblages of plant species, although the majority of ecological communities listed under State (Biodiversity Conservation Act) and Commonwealth (EPBC Act) legislation are based around and defined by vegetation types.

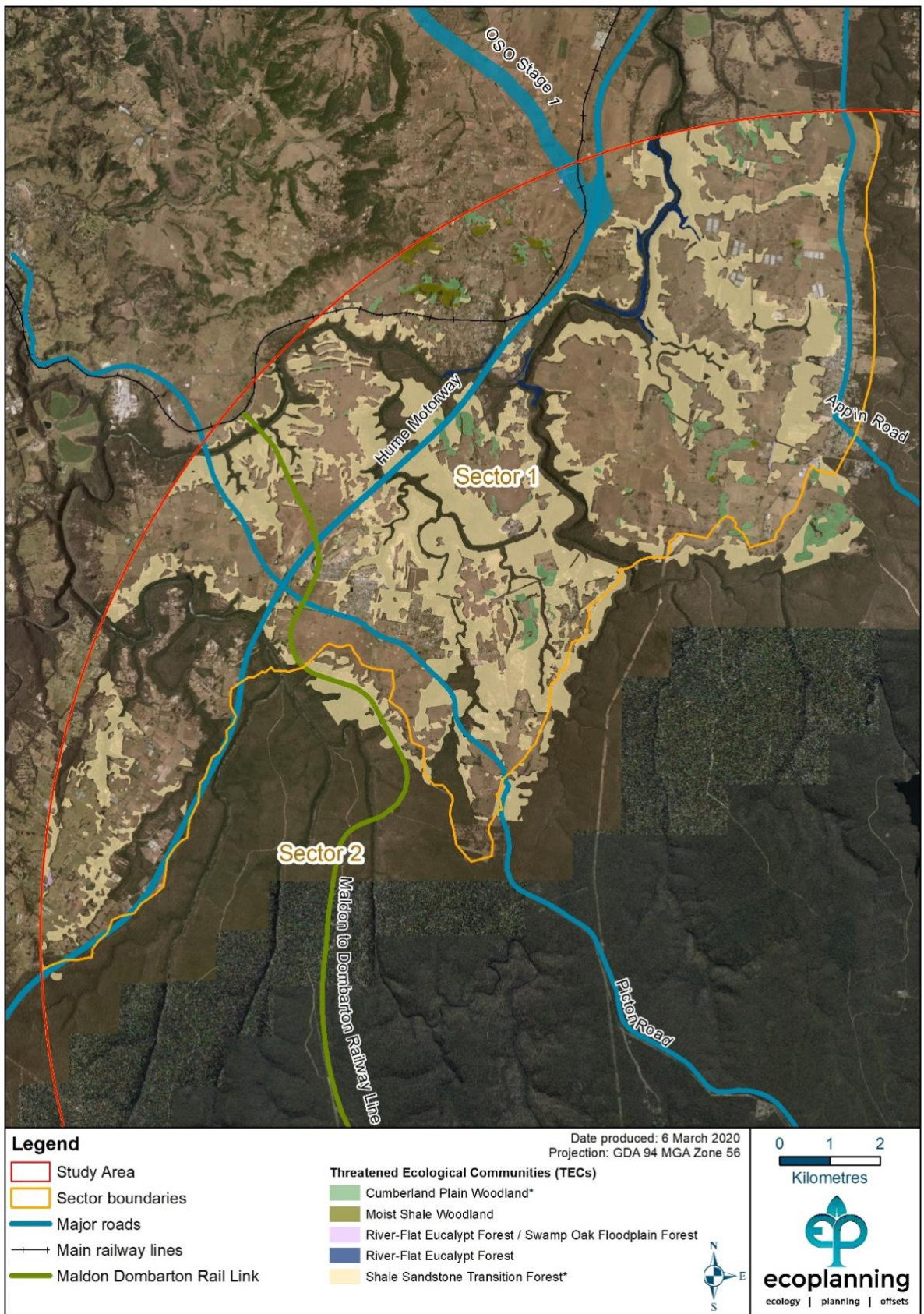
State and Commonwealth legislation recognise different categories of Threatened Ecological Communities (TECs) of conservation significance: Vulnerable (V), Endangered (E), and Critically Endangered (CE). The listing of ecological communities as TECs takes into consideration the natural rarity of different ecological communities, current and historical

reductions in their extent and threats to their continued existence. Table 2 below outlines the TECs identified in Sector 1 of the OSO2 study area. The location of TECs in Sector 1 is shown in Figure 9.

Table 2: TECs identified in the OSO2 study area – Sector 1

Threatened Ecological Communities	Status
Western Sydney Dry Rainforest in the Sydney Basin Bioregion	BC Act - E EPBC Act CE
Moist Shale Woodland in the Sydney Basin Bioregion	BC Act – E EPBC Act – CE
Cumberland Plain Woodland in the Sydney Basin Bioregion	BC Act - CE EPBC Act - CE
Shale Sandstone Transition Forest in the Sydney Basin Bioregion	BC Act – CE EPBC Act – CE
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregion	BC Act - E
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	BC Act – E EPBC Act – E

Figure 9 – TECs within the OSO2 study area – Sector 1



3.3.2 Fauna and Flora

Individual flora and fauna species were also considered with the threatened species in Table 3 being identified as present in Sector 1:

Table 3: Threatened flora and fauna species – OSO2 study area - Sector 1

Common name	Scientific name	Conservation Status
FAUNA		
Koala	<i>Phascolarctos cinereus</i>	State – Vulnerable C'wealth - Vulnerable
Macquarie Perch	<i>Macquaria australasica</i>	State – Endangered C'wealth – Endangered
FLORA		
Hairy Geebung	<i>Persoonia hirsuta</i>	State – Vulnerable C'wealth - Vulnerable
Spiked Rice-flower	<i>Pimelea spicata</i>	State – Endangered C'wealth - Endangered
Sydney Plains Greenhood	<i>Pterostylis saxicola</i>	State – Endangered C'wealth - Endangered

While all of these species have biodiversity significance, koalas are known to be of particular community concern. Koalas have become an icon amongst the community in south west Sydney for sustainable development and the health of the local environment, and many planning decisions have been made that endeavour to protect the species and maintain a viable population in the long term.

Within the OSO2 study area, koalas feed on a variety of eucalypts that include *Eucalyptus tereticornis* (Forest Red Gum), *E. amplifolia* (Cabbage Gum), *E. moluccana* (Grey Box), *E. crebra* (Narrow-leaved Ironbark), *E. fibrosa* (Red Ironbark), *E. punctata* (Grey Gum), *E. globoidea* (White Stringybark), *E. piperita* (Sydney Peppermint), *E. longifolia* (Woollybutt), *E. pilularis* (Blackbutt) and *E. agglomerata* (Blue-leaved Stringybark). Based on mapping of these species, koala habitat and movement corridors have been identified by Department of Planning, Industry and Environment across the Wollondilly and Campbelltown local government areas, with a particular focus on *E. punctata* (Grey Gum) and *E. globoidea* (White Stringybark). Figure 10 below shows koala habitat and corridors, along with other threatened flora records, in Sector 1.

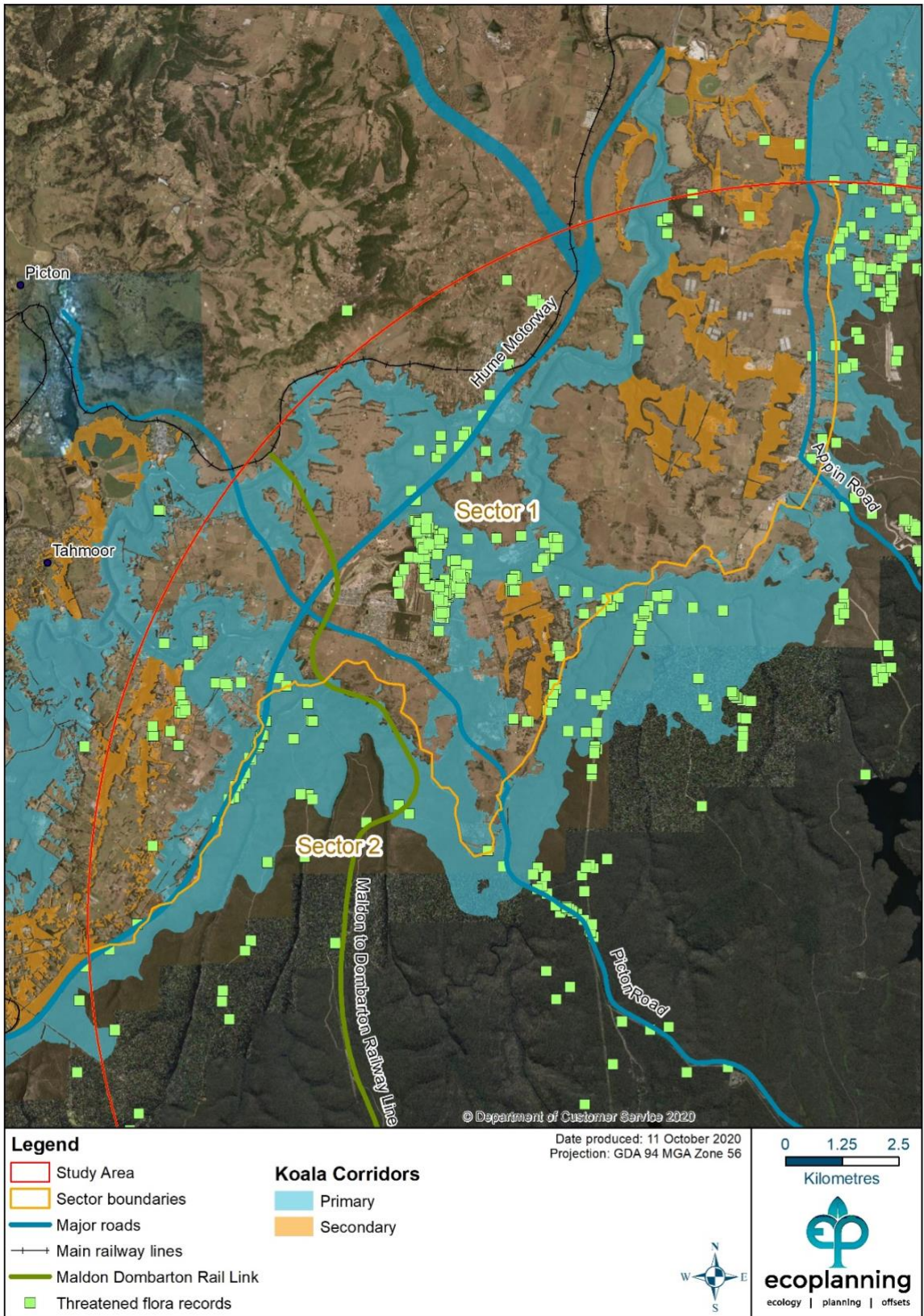
The Office of the Chief Scientist and Engineer has recently delivered a report that provides clear and tangible pathways to increase koala numbers in the Greater Macarthur region. This will require:

- increasing and improving existing habitat
- constructing road underpasses and ongoing monitoring of their use by koalas
- separating koalas from key threats using exclusion fencing and appropriately wide buffer zones
- active predator management.

Consistent with Greater Macarthur 2040, the report also supports the protection of north–south koala movement corridors and recognises that further work is required to protect east–west corridors through the infrastructure and precinct planning process. Where koala habitat cannot be completely avoided it may be possible to mitigate impacts through elevating structures or using the other measures identified by the Office of the Chief Scientist and Engineer and currently in use such as koala fencing.

The development of corridor options was very focused on identifying those locations which had least impact on primary koala corridors and habitat. In this regard, the narrowest sections of the Nepean River were identified that would enable future bridging structures to give adequate clearance for koalas, and to minimise impacts to surrounding habitat. Avoiding vegetation along Ousedale Creek and providing a firm edge with infrastructure (to limit human access to koala habitat) was another consideration as part of the design of corridor options. Similarly, cleared land was seen as an opportunity to avoid and reduce impacts.

Figure 10: Koala habitat and corridors and threatened flora records – OSO2 study area – Sector 1



3.3.3 The Cumberland Plain Conservation Plan

The Government has been consulting on the Cumberland Plain Conservation Plan (CPCP) to protect, and manage biodiversity across Western Sydney in association with the development of new urban areas, including the GMGA.

The CPCP's strategic conservation planning assesses and conserves biodiversity upfront in the planning process for large scale development. In the GMGA, it has sought to identify opportunities to protect the TECs discussed above, along with koalas, and other fauna and flora. This includes creating a new koala-focused National Park to the east of Appin Road as well as seeking to protect other locations. This may include new Biodiversity Stewardship Agreement (BSA) sites that are privately owned but legally protected in perpetuity to preserve their biodiversity values.

The OSO2 Project Team is working closely with Department of Planning, Industry and Environment's CPCP team to ensure sites of interest to the CPCP are avoided as far as possible. Any offsets required for future OSO2 infrastructure would be identified prior to construction. Transport for NSW will continue working with Department of Planning, Industry and Environment to ensure that the future offsets are consistent with and enhance the strategic conservation planning of the CPCP.

3.4 Aboriginal Heritage

Prior to European settlement, Sector 1 was an interface area between three tribal groups:

- the Dharawal people, who generally occupied the Illawarra coastal region southwards from the Georges River to the Shoalhaven River
- the Gundungurra people, who occupied the Southern Highlands and southern Blue Mountains area; and
- the Dharug people, who occupied Western Sydney and northern Blue Mountains up to the Hunter region.

Aboriginal heritage was previously examined in a 2017 report commissioned by Department of Planning, Industry and Environment as part of preliminary studies for the GMGA. This report was considered by the OSO2 investigation together with the Aboriginal Heritage Information Management System (AHIMS) database, the State Heritage Inventory (SHI), the Wollondilly Local Environmental Plan 2011, and State Environmental Planning Policy (Sydney Region Growth Centres) 2006.

Twenty-one AHIMS sites were identified in a focus area between the Hume Motorway and the northern boundary of the Metropolitan Special Area (broadly south of Appin township). These sites included rock shelters, artefact scatters, axe grinding grooves, and scarred trees. As would typically be expected, the AHIMS sites are concentrated around the key waterways within the study area. The highest potential for significant cultural material will most likely be found in areas along these waterway corridors with elevations and sandstone outcrops and a general absence of development.

An Aboriginal place is also listed under Schedule 5 of the Wollondilly Local Environmental Plan being the site of the 1816 Appin Massacre, where at least 14 Dharawal people were killed by British soldiers. It appears to be generally agreed that the massacre occurred in the vicinity of Broughton's Pass, although this site is presumed to contain no physical evidence of the event. A memorial has been established within the grounds of Cataract Dam and an annual memorial

ceremony is held. The 2017 Department of Planning, Industry and Environment study also identified a massacre site and hanging tree in the West Appin area.

The investigations to date for the OSO2 corridor options are preliminary and will significantly benefit from the input of Aboriginal groups and other key stakeholders. This engagement will help inform the corridor identification process.

3.5 Non-Aboriginal Heritage

Government databases were searched to identify sites in Sector 1 that have been recognised for their non-Aboriginal heritage value, they include:

- Items of State Significance and listed under the *Heritage Act 1977*
- Items of Local Significance and listed within Schedule 5 of the Wollondilly Local Environmental Plan 2011 (excluding Aboriginal items)
- Items of Local Heritage Significance and listed within Schedule 5 of the State Environmental Planning Policy (Sydney Region Growth Centres) 2006 – Appendix 14 – South East Wilton Precinct Plan

Two State significant sites and 21 locally significant sites have been identified in a focus area between the Hume Motorway and the northern boundary of the Metropolitan Special Area.

3.5.1 State significant sites

The Upper Canal System has been assessed as meeting the threshold for historical, associative, research potential and rarity heritage significance at the State level. Constructed in the nineteenth century, the canal is still operational and an important part of Sydney's bulk drinking water distribution network. It is 64km long between Broughton Weir at the south of the GMGA and the Prospect Reservoir near Wetherill Park as it traverses through rural, suburban and urban areas across the Western Parkland City. There are numerous existing roads and other infrastructure crossings along its course and future development would need to comply with WaterNSW's Guidelines for Development Adjacent to the Upper Canal and Warragamba Pipelines.

The Windmill Hill Group, south of Appin township (on land owned by WaterNSW), has been assessed and endorsed as meeting the threshold for historical, aesthetic, social, research potential, rarity and representative heritage significance at the State level. The State Heritage Inventory includes the following statement of its significance:

'The Windmill Hill Group, including Ruins, has State heritage significance for its ability to demonstrate the pattern of middle level farming and settlement in the Cumberland Plain from the 1820s to the early twentieth century, through its cluster of ruined farm buildings, granary, plantings and archaeological remains within a relatively intact rural setting, including remnant native bushland. When viewed from below the western ridgeline, the few visible elements in the landscape create a strong sense of place and retain the historic setting of the group of farm buildings and their relationship to one another, which is increasingly rare as the Cumberland Plain is subjected to development pressure. The rural vernacular character of the various buildings and ruins contributes to the high aesthetic quality of the group. This significance is reinforced through the visual connections between each individual farm across the valley.'

Figure 11: Windmill Hill Group – North Farm Structures



The options constraints analysis process identified the Windmill Hill Group as an important State heritage item. The curtilage of the property extends along Wilton Drive and a cultural heritage management plan has been prepared. The project team is working closely with the Heritage Council to mitigate any potential impacts on State heritage items. Avoiding impacts on existing structures and minimising impacts on the heritage curtilage was a guiding principle in the corridor selection process.

3.5.2 Locally significant sites

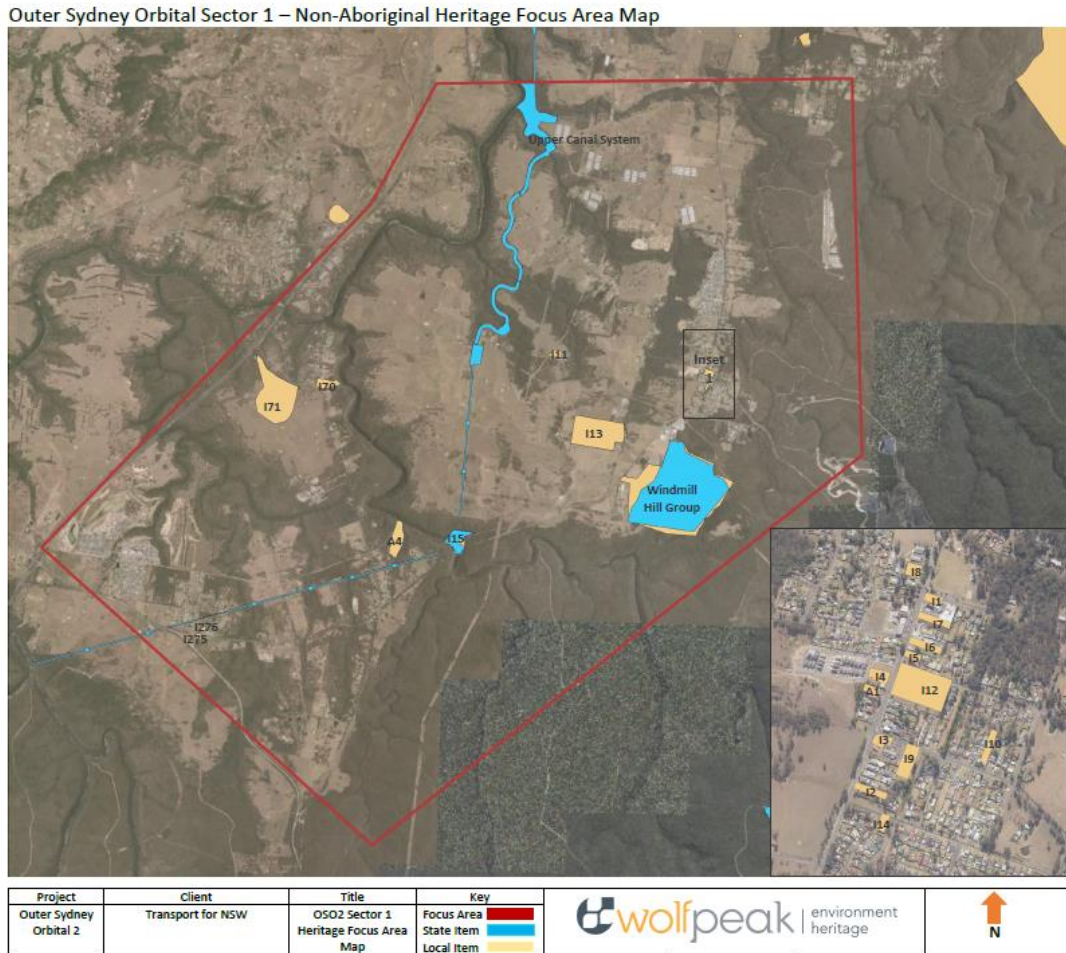
A range of predominately nineteenth century homes, commercial buildings, and religious facilities were identified from Schedule 5 of the *Wollondilly Local Environmental Plan 2011* and Schedule 5 of the *State Environmental Planning Policy (Sydney Region Growth Centres) 2006 – Appendix 14 – South East Wilton Precinct Plan* as sites of local heritage significance, they include:

- Darcy's House Site (51 Appin Road, Appin)
- Stone Ruin (45 Whitticase Lane, Douglas Park)
- Appin Hotel (84 Appin Road, Appin)
- Former Courthouse and Gaol (22 Appin Road, Appin)
- Darcy's Corner (38 Appin Road, Appin) – NB: This structure was demolished in February 2020
- Appin Inn (61 Appin Road, Appin)
- Bungalow (66 Appin Road, Appin)

- Former Shop (70 Appin Road, Appin)
- Stone Cottage (78 Appin Road, Appin)
- Appin Public School and Schoolmaster's Residence (97 Appin Road, Appin)
- St Mark's Anglican Church and Graveyard (1–3 Church Street, Appin)
- Weatherboard Cottage (24 Church Street, Appin)
- Elladale (80 Elladale Road, Appin)
- St Bede's Catholic Church and Graveyard (60 Appin Road, Appin)
- Northhamptondale Group (60-80 Northhamptondale Road West, Appin)
- Former St Marks Rectory – (5 Toggerai Street, Appin)
- Stone Cottages (380 Douglas Park Drive, Douglas Park)
- St Mary's Towers (415 Douglas Park Road, Douglas Park)
- Cottage (1090 Argyle Street, Wilton)
- St Luke's Anglican Church (1095 Argyle Street, Wilton)
- Windmill Hill Group (NB: The local listing has slightly different boundaries to the State listing)

The locations of the State and locally significant non-Aboriginal heritage items identified and outlined in Figure 12 below. The first response to these heritage items in terms of corridor identification is avoidance. Where avoidance is not possible, opportunities to mitigate any impacts is required. The majority of locally listed heritage items, outlined in Figure 12, are within Appin township, which is also a major land use constraint for corridor options.

Figure 12: Locations of Non-Aboriginal Heritage Items



KEY

Heritage Item SHR/LEP No. and Heritage Item

01373 (SHR) Upper Canal System (Pheasants Nest Weir to Prospect Reservoir)	13 Darcy's Corner (38 Appin Road, Appin)	19 St Mark's Anglican Church and Graveyard (1-3 Church Street, Appin)	174 St Marks Rectory - former (5 Toggerai Street, Appin)
115 Broughton Pass Weir	14 Appin Inn (61 Appin Road, Appin)	110 Weatherboard Cottage (24 Church Street, Appin)	170 Stone Cottages (380 Douglas Park Drive, Douglas Park)
01931 (SHR) Windmill Hill Group including ruins (Wilton Road, Appin)	15 Bungalow (66 Appin Road, Appin)	111 Elladale (80 Elladale Road, Appin)	171 St Mary's Towers (415 Douglas Park Road, Douglas Park)
A1 Darcy's House Site (51 Appin Road, Appin)	16 Shop - former (70 Appin Road, Appin)	112 St Bede's Catholic Church and Graveyard (60 Appin Road, Appin)	I275 Cottage (1090 Argyle Street, Wilton)
11 Appin Hotel (84 Appin Road, Appin)	17 Stone Cottage (78 Appin Road, Appin)	113 Northhamptondale Group (60-80 Northhamptondale Road West, Appin)	I276 St Luke's Anglican Church (1095 Argyle Street, Wilton)
12 Courthouse and Gaol former (22 Appin Road, Appin)	18 Appin Public School and Schoolmaster's Residence (97 Appin Road, Appin)		

3.6 Geotechnical and mining

Geological databases and other sources of information were reviewed to build an understanding of the geological environment including acid sulfate soil risk potential, and mining activities. These characteristics are described below with the exception of certain aspects of mining which was not deemed to be significant constraints for future transport infrastructure. Ongoing liaison with Subsidence Advisory NSW will be required for future applications to support urban development and transport infrastructure.

3.6.1 Geological environment

The basic geology of Sector 1 is that of the Cumberland Plain which makes up much of Western Sydney. This is dominated by the Wianamatta Group, a geological formation which comprises claystone, siltstone, laminite and fine to medium grained lithic sandstone weathering to soils ranging in texture from loam to heavy clay.

The Wianamatta Group overlies discontinuously the Mittagong Formation (interbedded sandstone shale) and Hawkesbury Sandstone geologies. The Mittagong Formation and Hawkesbury Sandstone outcrop on the margins of the Cumberland Plain especially along watercourses where the overlying shale has eroded during the development of a stream beds.

Further geotechnical investigations will be required to support future urban development over time. Applications for infrastructure approval within an OSO2 corridor will also require further geotechnical investigations together with other detailed environmental constraints analysis.

3.6.2 Folding and lineaments

There is north-south running folding and lineaments particularly within the western side of sector 1. The dominant structure is the northerly plunging Camden Syncline that has resulted from the east-west compression associated with the Sydney Basin. The most prominent lineament is the north-south running Narellan Lineament that traverses Picton Road.

3.6.3 Acid sulfate soil

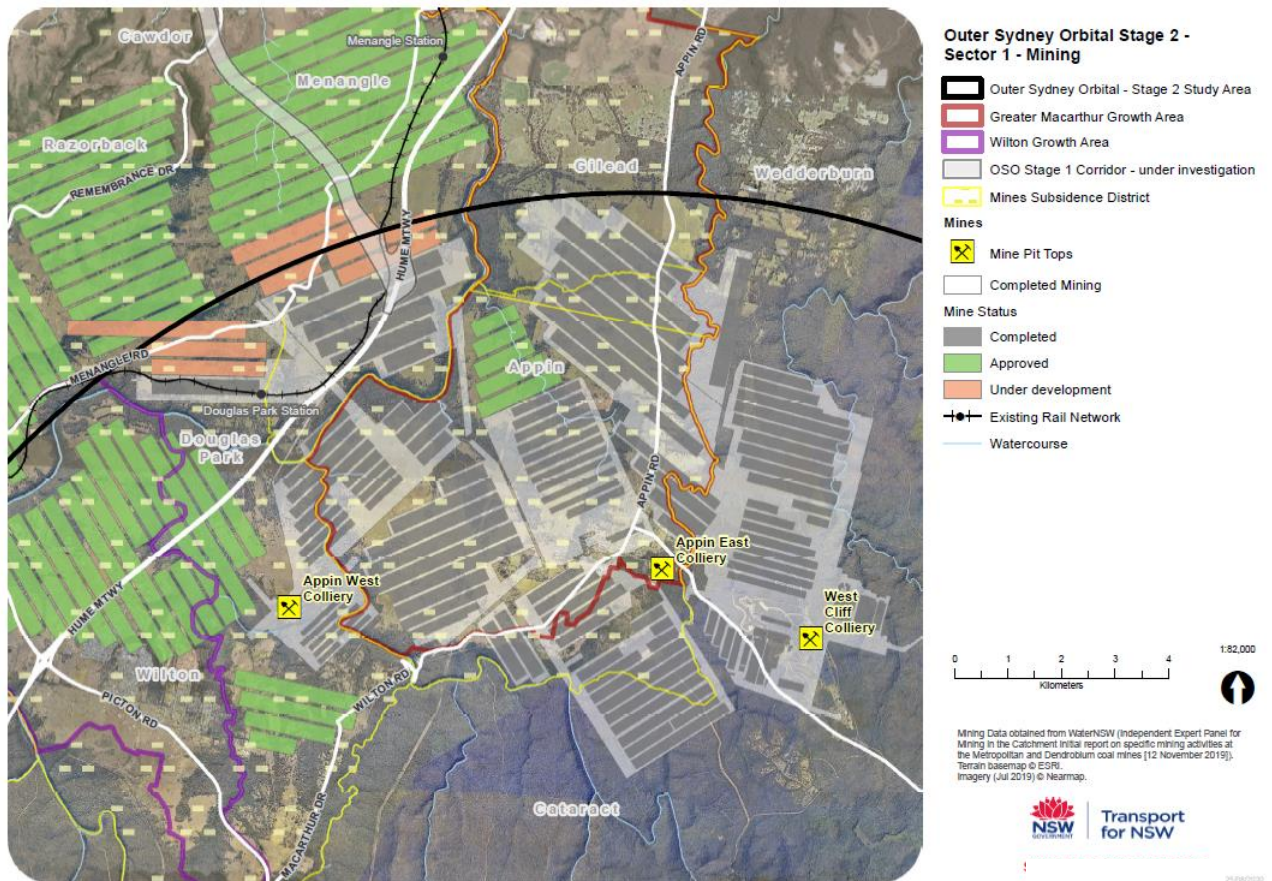
There are no known areas of potential acid sulfate soil within Sector 1.

3.6.4 Mining

Mining activities have been carried out in the Macarthur region for many decades and are expected to continue for an extended period of time. South 32, an ASX listed firm, operates extensive underground coal mining operations around Appin. These are accessed by three pit tops: Appin West (off Douglas Park Drive), Appin East (off Colliery Lane to the south of Appin township), and at West Cliff to the south east of Appin township.

The status of mining including the location of completed, approved, proposed and under development mining in Sector 1 is illustrated in Figure 13.

Figure 13: Historic and current mining activity in Sector 1



A major consequence of underground mining is ground subsidence which may affect the stability of the built environment above it. This typically takes place within one to two years after the completion of mining. As mining has largely been completed within the boundary of the GMGA, and the delivery of OSO2 infrastructure is not expected for many years, subsidence is not considered to be a significant constraint (i.e. future mining in the area of likely interest for OSO2 options such as in the vicinity of Macquariedale Road, is likely to be completed before infrastructure is built). However, the continuing functions of surface mining infrastructure, such as the Appin East Colliery and ventilation portals, have been recognised as part of the constraints analysis process.

3.7 Flooding and hydrology

Sector 1 contains several major watercourses, of which the most significant are stretches of the Nepean, Cataract, and Georges Rivers. These flow through deep gorges that would require major spans to cross. Each of these rivers also have tributaries, such as Ousedale Creek, Elladale Creek, Mallaty Creek, and Simpsons Creek which flow into the Nepean. While Clements Creek, Allens Creek, and Stringybark Creek shape the area between Wilton and Douglas Park. Generally, the rolling nature of Sector 1 mitigates against widespread flooding, land in and around part of Appin township has been identified in Greater Macarthur 2040 as being at 1-in-100 year flood risk.

Sector 1 is also adjacent to (though downstream from) WaterNSW's Metropolitan Special Area, which together with other elements of the Upper Nepean catchment typically supplies between 20 to 40 percent of Sydney's water. The impacts of future development including infrastructure like the OSO2 on water quality and flows in relation to the Metropolitan Special Area will need to be closely addressed in the future detailed design stage.

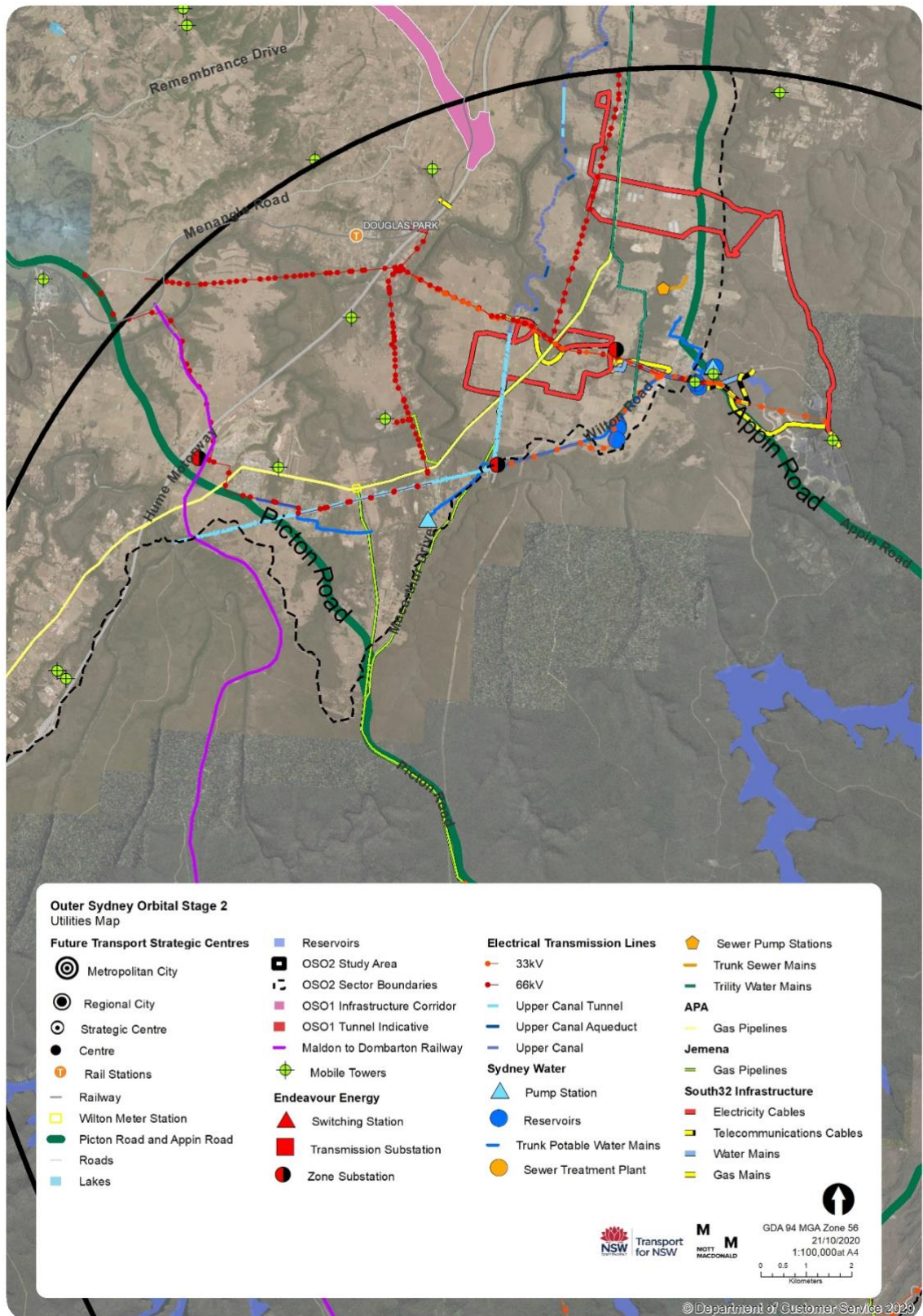
Overall, flooding has been assessed as a manageable constraint within the study area, and can be appropriately addressed through the future design of structures, and other mitigation measures, which includes placing future transport structures on viaduct and embankment. Further detailed flood assessment will be completed as part of any future applications for infrastructure within the proposed OSO2 corridor prior to construction.

3.8 Utilities

A utilities assessment was undertaken based on information collated from public sources as well as GIS data provided by utility authorities. The assessment focused on larger trunk infrastructure that would be costly or difficult to relocate. Details regarding individual trunk utility services are provided below and locations are shown in [Figure 14](#).

The majority of existing utilities have established easements that are difficult and costly to relocate. Wherever possible utilities should be avoided and buffering provided to avoid impacts on existing structures. If required, the design of crossing points will be considered prior to construction, as part of future infrastructure development applications within the proposed OSO2 corridor.

Figure 14: OSO2 – Sector 1 Utilities



3.8.1 Potable and sewer water infrastructure

Sydney Water, WaterNSW, and TRILITY own and operate a number of major water infrastructure items in Sector 1 including potable and sewer mains, the Upper Canal, reservoirs, and pump stations.

Local potable water supply is provided by Sydney Water and TRILITY infrastructure. The Macarthur Water Filtration Plant on Wilton Road extracts raw water from Broughton Pass weir. Treated water is then transferred to the surrounding area via a 1200mm trunk main located within an easement. It would be preferable for this trunk main to remain in its existing location due to its size and the resulting difficulties and costs associated with relocation. Other smaller trunk mains are also present. A single submersible wastewater pump station and adjoining pipe 300mm in diameter are believed to be the only large trunk sewer infrastructure.

Pump stations and reservoirs should be avoided, and interfaces with other water infrastructure will be considered at the time of construction of any infrastructure within the proposed OSO2 corridor. WaterNSW's guidelines for development adjacent to the Upper Canal (noted earlier in relation to this item's heritage value) also address design requirements for this item's function as a utility supplying Sydney.

3.8.2 Electrical infrastructure

From the Dapto bulk supply point (BSP), a 330kV a TransGrid transmission line passes north through the Illawarra Escarpment and Lake Cordeaux on the western side. The transmission line enters Sector 1 near Broughton Pass and then continues northwards to the Macarthur BSP. Relocating this line would be relatively difficult.

Endeavour Energy (EE) maintains a number of infrastructure items, including three zone substations located at Wilton, Broughton Pass and Appin. These substations are connected via a series of overhead 33kV and 66kV transmission lines.

The Appin and Broughton Pass substations are connected via 66kV transmission lines which generally follow the alignment of Wilton and Brooks Point Road. These transmission lines also extend to the Appin and West Cliff Collieries, located on Appin Road.

33kV transmission lines originate from the Douglas Park switching station, located on Prices Road. These transmission lines exit the switching station to the south and generally follow the alignment of Douglas Park Drive. The Appin West Colliery is supplied by these transmission lines. The Wilton substation is supplied by the 33kV network via transmission lines which traverse the Bingara Gorge development site boundary and connects Douglas Park Drive.

EDL has developed a large Waste Coal Mine Gas (WCMG) power station at Appin that captures WCMG from South 32 mines and generates a significant amount of electricity used in mine operations.

Where possible electrical easements and structures should be avoided. However, future crossing points will require future detailed design prior to construction of infrastructure within the proposed OSO2 corridor.

3.8.3 Gas infrastructure

Two bulk gas providers - Jemena and APA - operate several significant infrastructure items in Sector 1. These include:

- A section of Jemena's Eastern Gas Pipeline (EGP), an 800km major natural gas asset that runs between Longford, Victoria and Horsley Park, Sydney via Wollongong and which supplies more than half of the gas consumed in NSW.
- Several smaller Jemena trunk lines, including a connection to the Appin West Colliery
- A stretch of APA's Moomba-Sydney Pipeline
- Jemena (trunk receiving and metering stations) and APA (metering station) facilities on Ashwood Rd between Douglas Park and Wilton.

All of these items would be difficult and costly to relocate. Gas providers have specific design requirements for other linear infrastructure such as roads which need to cross their easements. These requirements are well understood by Transport for NSW and will be addressed as part of any future applications for infrastructure development within the proposed OSO2 corridor.

3.8.4 Telecommunications infrastructure

Telecommunications infrastructure was reviewed but due to its nature (e.g. mobile towers) was considered to not be a significant constraint as items could be relatively easily relocated or otherwise addressed if needed.

3.9 Contaminated Land

Department of Planning, Industry and Environment databases were search to identify sites registered as contaminated land in accordance with NSW environmental protection legislation. No sites were identified as significant constraints. Further detailed investigations into contamination will be conducted prior to construction of any infrastructure within the proposed OSO2 corridor.

3.10 Constraints Summary

The issues mapped and discussed above were considered by the project team and Advisory Group during corridor options development (see Chapter 4 below). Some of the items were considered as being more sensitive than other constraints, and these are outlined below.

Land Use and Landscape

- The existing townships of Appin, Douglas Park, Wilton and adjacent subdivisions
- The industrial estate to the south of Appin township
- Potential future GMGA centres and major infrastructure corridors

Biodiversity

- Threatened ecological communities
- Primary and secondary koala corridors
- Biodiversity Stewardship Agreement sites
- Land identified as being of interest for future protection as a part of the Cumberland Plain Conservation Plan

Cultural Heritage

- Aboriginal heritage sites (AHIMS sites)
- State significant heritage items
- Local heritage items

Geotechnical and Mining

- Surface mining infrastructure and supporting utilities

Flooding and Hydrology

- Major watercourses (i.e. the Nepean, Georges and Cataract Rivers)

Utilities

- Major water, electrical, and gas infrastructure

Mitigations

The initial identification of constraints above does not reflect that mitigations can be implemented when future infrastructure is designed in detail. Depending on where and how infrastructure is designed and built, mitigations may substantially reduce impacts. In the first instance, corridor options would seek to avoid the most sensitive constraints.

Common mitigations for linear transport infrastructure include, for example, barriers to address visual or noise impacts, and underpasses or overpasses to help people or animals to cross it. Biodiversity offsets can also be used to address residual impacts.

It is important to note that corridor identification, in itself, typically does not create environmental or physical impacts. However, it is acknowledged that there will be various community concerns which need careful consideration having regard to both existing and future land use. The identification of corridor options within a growth area also needs to consider how future infrastructure can impact and benefit future planned development.

4. Corridor Option Development and Assessment

4.1 Initial options identification

The Project Team and the Advisory Group used a range of tools to identify potential options for interregional connections through the GMGA between the Hume Motorway and Appin Road. The constraints mapping discussed in the previous chapter informed the development of alignments along with the OSO2 Corridor Objectives, in accordance with the following guiding design principles:

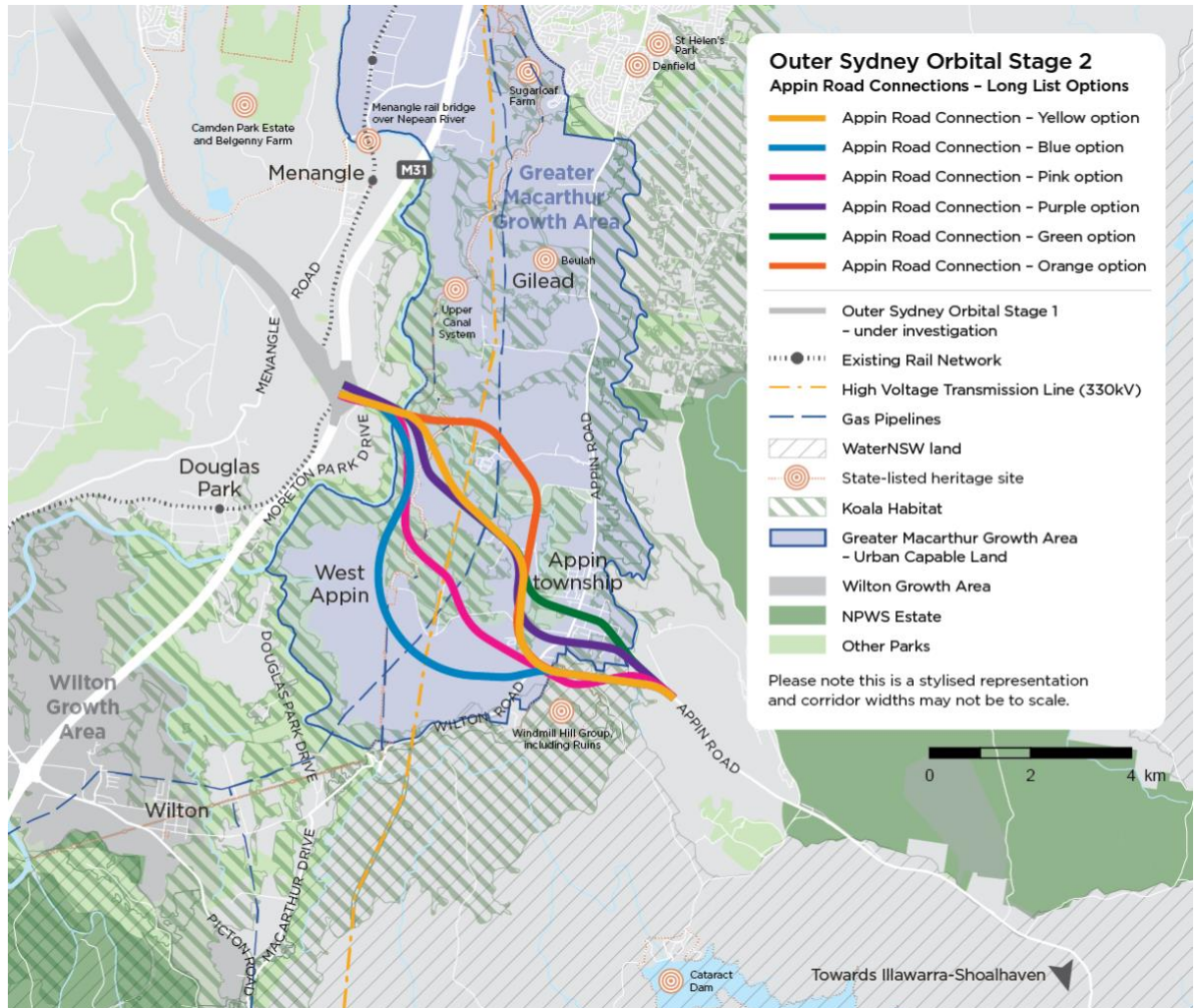
- **Hume Motorway connection point:** It was assumed that OSO2 should connect with the Hume Motorway at the planned Outer Sydney Orbital Stage 1 interchange on Government-owned land announced in 2018 (see [Figure 3](#)).
- **Provide attractive routes for transport customers:** Alignments were sought that offer a logical (e.g. relatively direct route) between the Hume interchange and Appin Road east of Appin township in the context of the identified constraints.
- **Test different approaches in avoiding or otherwise addressing major constraints:** Given that major constraints could be found across the study area, it was determined that no option could reasonable avoid all significant constraints. Accordingly, a range of initial options were to be developed that offered greater or lesser impacts on different forms of constraint discussed in Chapter 3.
- **Avoid the most sensitive constraints:** Notwithstanding the above, alignments sought as far as reasonably possible to avoid items identified as particularly sensitive during the constraint mapping process, particularly where effective impact mitigations would be difficult to achieve.

The design of the corridor options also considered the Business Requirements Statement (BRS) at [Appendix B](#). Following review by the Advisory Group and subject matter experts, options east of the Appin township were discounted due to unacceptable impact on Koala habitat and a new National Park proposed by the Government. Land previously identified for a potential Appin Bypass was also avoided due to the potential for unacceptable social and environmental impacts.

4.2 Long List Options

After initial optioneering discussions, six options were identified by the project team and Advisory Group for further analysis. This long list of options shown in Figure 15 below.

Figure 15: OSO2 Sector 1 – Long List Options



Each of the options are discussed below (from west to east) including the potential opportunities and known constraints. Many of the options have similar benefits and constraints but there are a number of elements that impact on the performance of the options, which are further compared in Section 4.3.

Pink option

Connection to Appin Road via Elladale Road/Brooks Point Road Area

This option proceeds from the OSO1/Hume interchange, crossing the Nepean River before turning south and sweeping to the south-west of Appin township via the approximate routes of Elladale Road and Brooks Point Road and connecting to Appin Road to the east of the Appin township through Government (WaterNSW) owned land, inclusive of the Windmill Hill Group site curtilage.

Opportunities

- Avoids Appin township including the outer residential areas of the township.
- Avoids industrial land south of the Appin township including the Baines Masonry site and Appin East Colliery along Colliery Road.
- Avoids future employment lands proposed in the Macquariedale Road area.
- Utilises Government owned land south of Appin township.

Constraints

- Needs to cross the Nepean River gorge and other nearby tributaries.
- Crosses over the Upper Canal (State heritage), which can be mitigated with a clear span bridging structure.
- Minor impacts on the curtilage of the Windmill Hill Group (State and local heritage). Importantly, the North Farm structures are unaffected.
- Impacts Elladale homestead (Local heritage).
- Impacts an extensive area of native vegetation, including koala habitat, near the Nepean River and Elladale Creek areas and on approach to Appin Road.
- Involves areas of cut and fill to accommodate undulating topography.
- Various rural residential property impacts.

Yellow option

Connection to Appin Road via Macquariedale Road Area and South of Appin township

This option proceeds from the OSO1/Hume interchange and crosses the Nepean River, before running approximately along the route of Macquariedale Road. It would then pass to the south of Appin township and connect to Appin Road to the east of the township on Government owned (WaterNSW) land.

Opportunities

- The alignment avoids the Appin township and industrial areas to the south of the township, including the Baines Masonry site and Appin East Colliery.
- Can support future proposed employment land uses in the Macquariedale Road vicinity.
- Is broadly consistent with an indicative east-west road link identified in Greater Macarthur 2040.
- Largely avoids native vegetation (apart from unavoidable impacts near crossing the Nepean River and on approach to Appin road, which are potentially mitigated through elevated bridging structures and use of existing cleared land).
- Could serve as a 'hard edge' to protect Ousedale Creek koala habitat from human access.
- May provide opportunities for colocation with the Greater Macarthur Transport Corridor.
- Utilises Government owned land south of Appin township.

Constraints

- Need to cross the Nepean River gorge and other nearby tributaries
- Crosses over the Upper Canal (State heritage), which can be mitigated with a clear span bridging structure.
- Minor impacts on the curtilage of the Windmill Hill Group (State and local heritage). Importantly the North Farm structures are unaffected.
- Various rural residential property impacts.

Purple option

Connection to Appin Road via Macquariedale Road Area and Colliery Road

This option proceeds from the OSO1/Hume interchange and crosses the Nepean River, before running along the route of Macquariedale Road. It would then run close to the south of the Appin township via Colliery Road before connecting with Appin Road predominantly on private land.

Opportunities

- Largely avoids native vegetation (apart from minor impacts near the crossing of the Nepean River, which is common to most options and also in the Colliery Road area).
- Can support future proposed employment land uses in the Macquariedale Road vicinity.
- Could serve as a 'hard edge' to protect Ousedale Creek koala habitat from human access.
- Is broadly consistent with the indicative east-west road link identified in the Greater Macarthur 2040.

Constraints

- Need to cross the Nepean River gorge and other nearby tributaries.
- Crosses over the Upper Canal (State heritage), which can be mitigated with a clear span bridging structure.
- Passes close to existing homes south of the Appin township backing onto Colliery Road.
- Impacts on critical habitat west of the Township, avoided by other options.
- Passes near to surface mining infrastructure (Appin East Colliery) and would impact on the edge of the Colliery site.
- Various rural residential property impacts.

Blue option

Connection to Appin Road via West Appin and then South of Appin

This option proceeds from the OSO1/Hume interchange before crossing the Nepean River, then turns south and follows the bush line to the north of future urban development at West Appin, before passing Appin township to the south and connecting with Appin Road.

Opportunities

- Avoids Appin township including industrial areas to the south of the township, including the Baines Masonry site and Appin East Colliery.
- Largely avoids native vegetation (apart from minor impacts in its section near Nepean River).
- Crosses the Upper Canal at a point where it is in tunnel and thus has less visual impact on that item.
- Utilises Government owned land south of Appin township.
- May provide opportunities for colocation with the proposed Greater Macarthur Transport Corridor.

Constraints

- Impacts on the curtilage of the Windmill Hill Group (State and local heritage). Importantly, the North Farm structures are unaffected.
- Need to cross the Nepean River gorge and other nearby tributaries
- Slightly longer and less direct route compared with other options
- Various rural residential property impacts.

Green option

Connection to Appin Road via Macquariedale Road Area and through Appin township

This option proceeds from the OSO1/Hume interchange and crosses the Nepean River, before running along the route of Macquariedale Road. It would then run through Appin township and connect with Appin Road from the north-east.

Opportunities

- Largely avoids native vegetation (apart from minor impacts near the crossing of the Nepean River, which is common to most options).
- Can support future proposed employment land uses in the vicinity of Macquariedale Road.
- Could serve as a 'hard edge' to protect Ousedale Creek koala habitat from human access.
- Is broadly consistent with the indicative east-west road link identified in Greater Macarthur 2040.
- Avoids impacts on the Windmill Hill Group heritage item.

Constraints

- Need to cross the Nepean River gorge and other nearby tributaries.
- Crosses over the Upper Canal (State heritage).
- Significant amenity impacts on existing housing, commercial uses and local heritage in Appin township.
- Impacts on critical habitat west of the township, avoided by other options
- Major traffic network implications for Appin township.
- Various rural residential property impacts.

Orange option

Connection to Appin Road via Ousedale Creek Route and then South of Appin

This option proceeds from the OSO1/Hume interchange and crosses the Nepean River, before running to the north of Ousedale Creek. It would turn south crossing Brian Road and the Creek, and then run along part of Macaquariedale Road before sweeping south of Appin township and connecting with Appin Road to the east.

Opportunities

- The alignment avoids Appin township, including industrial areas to the south of the township, including the Baines Masonry site and Appin East Colliery.
- Utilises Government owned land south of Appin township.
- May provide opportunities for colocation with the Greater Macarthur Transport Corridor.

Constraints

- Involves one major river crossing of the Nepean and also needs to span Ousedale Creek, which is heavily incised (approximately 30m in depth near the proposed crossing point).
- Ousedale Creek is also an important east-west koala corridor and future bridge crossings will require significant mitigations.
- Crosses over the Upper Canal (State heritage) which can be mitigated through future design.
- Minor impacts on the curtilage of the Windmill Hill Group (State and local heritage). Importantly the North Farm structures are unaffected.
- Impacts existing recreational facilities (Macarthur Motorcycle Club).
- Slightly longer route compared with some other options.
- Various rural residential property impacts.

Picton Road Connection Options

As noted earlier, a connection to Picton Road from the Hume Motorway/Outer Sydney Orbital Stage 1 may also be needed through the GMGA.

A Picton Road connection could also offer an opportunity to replace the existing extremely constrained crossing of Broughton Pass.

Further engineering, environmental and heritage investigations are required. These investigations will need to determine how existing communities and sensitive environmental areas can be avoided where possible. A shortlist of options will be presented to the community for consideration following the completion of these technical investigations.

4.3 Multi Criteria Analysis (MCA)

A multi criteria analysis (MCA) process was used to comprehensively examine the comparative performance of the long list corridor options. This was based on six criteria expanding on the OSO2 Corridor Objectives and business requirements. The assessment process involved the Project Team and other subject matter experts (e.g. koala ecologists, heritage experts, and social planners) scoring the options through a collaborative process that again drew on the constraints and opportunities mapping discussed in Chapter 3.

Each of the six criteria are outlined below.

4.3.1 People Movement

Based on OSO2 Corridor Objective 1: Helps people to move efficiently and safely between the Western Parkland City and the Illawarra-Shoalhaven region

This criterion assessed the effectiveness of options in moving people. Based on the Future Transport 2056 customer outcomes and the issues known to be important to Transport for NSW's road customers based on previous customer satisfaction surveys, two sub-criteria were identified for analysis:

- **Travel Time:** Calculation of travel time between the Hume/OSO1 interchange to Appin Road at the border of WaterNSW's Metropolitan Special Area (i.e. the beginning of the study area's Sector 2).
- **Customer Experience:** Those options offering a more direct travel experience performed better than other options with less direct routes.

4.3.2 Freight Movement

Based on OSO2 Corridor Objective 2: Enables freight to move efficiently and safely between the Western Parkland City and Illawarra-Shoalhaven region

While travel time and customer experience are also important to freight customers, road grades are known to be of particular concern to heavy vehicle operators due to their cost impacts (e.g. fuel consumption and vehicle wear). Accordingly, a scale was used based on the percentage of a route with grades between 4-6% and percentage of a route with grades greater than 6% (i.e. these thresholds being drawn from Austroads standards). Heavy vehicles expend more energy and emissions on steep sections of road including steep declines under heavy braking.

4.3.3 Supporting Urban Development and Growth

Based on OSO2 Corridor Objective 3: Supports the urban development of the Illawarra-Shoalhaven region and the Wilton and Greater Macarthur Growth Areas, facilitates great places, and provides certainty for investment

This criterion assessed the effects of the options on supporting the Government's strategic spatial planning (Greater Macarthur 2040) and future associated development. To undertake this, three sub-criteria were identified:

- **Development Yield:** Qualitative assessment of how the corridor would affect the development yield of Greater Macarthur 2040, informed by quantitative analysis of relative loss of urban capable land.
- **Amenity of New and Existing Development:** Qualitative assessment (including noise, vibration, air quality and visual impacts) based predominantly on the intensity of sensitive land uses within 100m of the corridor (e.g. housing and some forms of social infrastructure).
- **Infrastructure Network Integration:** Qualitative assessment based on:
 - Alignment with Greater Macarthur 2040 transport network planning
 - Opportunity to improve future communities' connections (i.e. via interchanges)
 - Opportunities for collocation of utilities within corridors, where appropriate.

4.3.4 Community Impacts

Based on OSO2 Corridor Objective 4: Avoid impacts on communities and, where avoidance is not reasonably possible, minimise and mitigate those impacts

This criterion assessed how corridor options might affect existing communities and the heritage values associated with places via six dimensions:

- **Residential Property Impacts:** potential property impacts and the significance of those impacts.
- **Commercial Property Impacts:** potential property impacts and the significance of the impacts.
- **Social Infrastructure and Open Space Impacts:** potential property impacts and the significance of the impacts, as well as reductions in open space-zoned land.
- **Severance of Local Connectivity:** Analysis of barriers created by options between, for example, local centres or social infrastructure (e.g. schools, parks, community facilities) and their catchments.

- **Impact on Aboriginal Heritage:** Based on number of Aboriginal Heritage Information Management System (AHIMS) listed sites impacted and other known sites previously identified as having heritage value.
- **Impact on Non-Aboriginal Heritage:** Based on number of listed (State and local government) sites impacted and the nature of the impacts.

4.3.5 Environmental Impacts

Based on OSO2 Corridor Objective 5: Avoid impacts on important environments and habitat and, where avoidance is not reasonably possible, minimise and mitigate those impacts

The possible impact of options on the natural environment was assessed across seven sub-criteria reflecting State, Commonwealth, and local government environmental policies and responsibilities:

- **Impact on Threatened Fauna Population and Connectivity:** Potential impacts of options on fauna – other than koalas - listed as threatened by the State or Commonwealth in terms of habitat and connectivity risks.
- **Impact on Threatened Flora:** Potential impacts in terms of area lost and the level of significance of those impacts in the context of the status of affected species.
- **Impact on Koala Habitat:** Noting the high level of community concern about koalas, the potential impacts of options on koala habitat and connectivity was assessed separately with reference to current State and local conservation planning for the species.
- **Impact on other Vulnerable, Endangered and Critically Endangered Ecological Communities:** The potential impact of options on State and Commonwealth listed ecological communities was assessed in terms of area potentially affected and the significance of those effects.
- **Impact on Conservation Areas (e.g. National Parks and BSA sites):** Options were assessed in terms of the quantity of land they would require from areas currently protected for conservation purposes or identified for potential future protection as part of the Cumberland Plain Conservation Plan.
- **Impacts to Hydrology and Riparian Corridors:** The options were considered in terms of how they may affect water flows in terms of water quality and quantity, and level of challenge in appropriately managing issues in light of relevant regulation.
- **Visual Impacts on Landscape:** Analysis was undertaken of the options in terms of their possible impact on sensitive landscapes, noting anticipated landscape changes in parts of the study area (e.g. urbanisation across much of Sector 1).

4.3.6 Future Proofing

Based on OSO2 Corridor Objective 6: Ensures future infrastructure can be delivered sustainably and costed effectively.





Five sub-criteria were used to assess how deliverable options might be in the future, particularly in terms of the cost and challenge of constructing them from engineering and economic perspectives.

- **Constructability:** Need for earthworks and major structures (e.g. bridges and tunnels) based on underlying topography and business requirements.
- **Geotechnics:** Analysis of risk issues including soil landscapes (for land slope stability), geology (including features such as faulting), mine subsidence, and information gaps.
- **Major Utilities:** Analysis of how options interface with major utilities (existing and proposed) and associated design challenges.
- **Adaptability:** Ability to potentially accommodate passenger rail, with a particular focus on grades.
- **Network Upgrades Required:** Analysis of additional investment needed on other parts of the transport network (e.g. upgrades of interfacing arterial roads) and if other planned investments (e.g. proposed upgrades of existing roads) could be deferred or avoided.

4.4 Outcomes of the Long List MCA

Subject matter experts within the Project Team conducted initial assessments of the options against the sub-criteria. These initial assessments were then taken to the Advisory Group for discussion among further subject matter experts. For example, the assessment of the environmental impacts criterion and its sub-criteria was reviewed with ecology experts in Government, while assessment of the future proofing criterion and its sub-criteria were reviewed by a panel of engineers. **Table 4** below explains the assessment scale used:

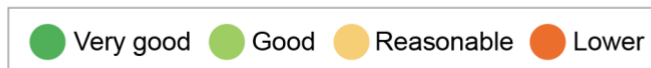
Table 4: MCA assessment scale

	Very good performance against criterion / Very low level of constraint
	Good performance against criterion / Low constraints exist
	Reasonable performance against criterion / Medium constraints exist
	Lower performance against criterion / Significant constraints exist

The initial outcome of the MCA process in terms comparative analysis is shown in **Table 5** below.

Table 5: OSO2 Appin Road Connections – Long List MCA – Initial Assessment

MCA Criteria	Pink Option	Yellow Option	Purple Option	Blue Option	Green Option	Orange Option
People Movement	●	●	●	●	●	●
Freight Movement	●	●	●	●	●	●
Supporting Urban Movement	●	●	●	●	●	●
Community Impacts	●	●	●	●	●	●
Environmental Impacts	●	●	●	●	●	●
Future Proofing	●	●	●	●	●	●
Overall Assessment	●	●	●	●	●	●



From the initial analysis, it was observed that:

- All options engaged significant environmental sensitivities (i.e. no option performed better than ‘Reasonable’ for this criterion). This was flagged by the Advisory group as required further review.
- All options faced constructability challenges (i.e. no option performed better than ‘Reasonable’ for this criterion of future proofing).
- Most options performed well in terms of People Movement with direct access between Appin Road and the Hume Motorway.
- There were mixed outcomes across the options in terms of Supporting Urban Development.

4.5 Identification of Short Listed Options

The six options were reviewed again by the Project Team following the MCA process to identify suitable options for community and stakeholder engagement. This review considered the initial MCA scores, specific issues raised during the MCA deliberations, and further inputs from Advisory Group members, in particular biodiversity experts. Importantly, potential design mitigations were also considered in more detail and the extent that they may improve the ultimate performance of options. The final assessments of the options are outlined below.

4.5.1 Final Assessment of the Green Option

The Green Option was considered to be the lowest performing option and performed no better than 'Reasonable' across any of the criteria.

Key Performance Issues

- This option would have very high impacts on Appin township, in particular, impacts on properties, increased noise and vibration and severance of local communities.
- Impacts on State heritage (Upper Canal).
- Impact on critical vegetation west of the Appin township.

Mitigations

- Noise, vibration, and severance could be partially mitigated but the township's character would still be substantially negatively impacted.
- Construct a span over the Canal in accordance with WaterNSW requirements.
- Impacts on critical habitat would require biodiversity offsets.

4.5.2 Final Assessment of the Purple Option

The Purple Option was assessed as performing as 'Good' for People Movement, but problematic due its impacts on the Appin township.

Key Performance Issues

- This option would have very high impacts on Appin township, in particular, impacts on properties, increased noise and vibration and severance of local communities.
- There would also potentially be interface issues with surface mining infrastructure (Appin East Colliery).
- Impact on critical vegetation west of the Appin township.
- Stretches of steep road grades would negatively impact on heavy vehicle operators.
- Impacts on State heritage (Upper Canal).

Mitigations

- Noise and vibration could be partially mitigated but residential amenity in part of the township would still be substantially negatively impacted.
- Impacts on Appin East Colliery would need to be carefully managed in consultation with the site operator, but operations may still be adversely impacted.
- Road grades could be improved through further design development (e.g. realignments and/or additional earthworks). However, substantial cuts and fills would also create visual and landscape impacts.
- Impacts on critical habitat would require biodiversity offsets.
- Construct a span over the Canal in accordance with WaterNSW requirements.

4.5.3 Final Assessment of the Pink Option

This option performed well across most criteria and particularly in terms of People Movement. However, following further discussions with subject matter experts in ecology it was determined that certain strategic conservation planning opportunities in the Elladale Road area would be precluded by the option.

Key Performance Issues

- This option engages a significant area of land identified under the CPCP as having conservation value, including koala habitat.
- Stretches of steep road grades would negatively impact on heavy vehicle operators.
- Impacts on State heritage (Upper Canal and Windmill Hill Group).

Mitigations

- It would be difficult to mitigate the land take and severance impacts of major transport infrastructure on flora and fauna.
- Road grades could be improved through further design development (e.g. realignments and/or additional earthworks). However, substantial cuts and fills would also create visual and landscape impacts.
- Span over the Upper Canal and develop treatments for Windmill Hill Group in liaison with WaterNSW.

4.5.4 Final Assessment of the Orange Option

This option was assessed as offering 'Good' performance across some criteria, particularly in terms of People Movement and Freight Movement. However, it was also seen as the most challenging option in terms of the Future Proofing criterion. The latter was partially driven by the need for a substantial bridge across Ousedale Creek, with this area also being an important east-west koala movement corridor as identified by ecology experts and the Department of Planning, Industry and Environment CPCP team.

Key Performance Issues

- Crosses Ousedale Creek, requiring a major additional bridge and impacts on an east-west koala movement corridor.
- Impacts on recreational land north of Ousedale Creek.
- Impacts on State heritage (Upper Canal and Windmill Hill Group).

Mitigations

- Construct a major bridge over Ousedale Creek.
- Develop koala impact design treatments.
- Identify ways of reducing impacts on recreational activities through liaison with affected land users.
- Span over the Upper Canal and develop treatments for Windmill Hill Group in liaison with WaterNSW.

4.5.5 Final Assessment of the Yellow Option

This option performed well in terms of People Movement and Community Impacts. While its Freight Movement performance was initially assessed as challenging, it was considered likely that a better road gradient could be achieved with further design development. The option was also considered to have benefits in enabling the development of employment land and providing a protective edge for the Ousedale Creek environment.

Key Performance Issues

- Stretches of steep road grades would negatively impact on heavy vehicle operators.
- Impacts on State heritage (Upper Canal and Windmill Hill Group).

Mitigations

- Road grades could be improved through further design development (e.g. realignments and/or additional earthworks).
- Span over the Upper Canal and develop treatments for Windmill Hill Group in liaison with WaterNSW and the Heritage Council.

4.5.6 Final Assessment of the Blue Option

This option performed well across most criteria and was not assessed as 'Lower' performing for any criterion. The option had very few performance issues that needed further attention and those issues noted below are readily mitigated through future design.

Key Performance Issues

- Impacts on State and local heritage (Upper Canal and Windmill Hill Group).

Mitigations

- Span over the Upper Canal and develop treatments for Windmill Hill Group in liaison with WaterNSW.

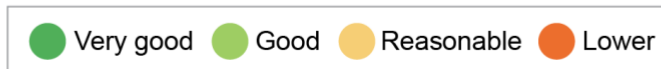
4.5.7 Updated MCA of the Options

Based on the above final assessments, adjustments were made to the MCA as shown in Table 6:

- The Pink Option's Environmental Impact performance was adjusted to 'Lower' to reflect the increased conservation value placed on land within the alignment.
- The Yellow Option's Freight Movement performance was adjusted to 'Good' to reflect the likely ability to improve its gradient following further design development.
- This consequently saw the overall assessment of the Pink Option change to 'Lower' performing, while the Yellow Option changed to 'Good' performance.

Table 6: OSO2 Appin Road Connections – Long List MCA – Final Assessment

MCA Criteria	Pink Option	Yellow Option	Purple Option	Blue Option	Green Option	Orange Option
People Movement	●	●	●	●	●	●
Freight Movement	●	●	●	●	●	●
Supporting Urban Movement	●	●	●	●	●	●
Community Impacts	●	●	●	●	●	●
Environmental Impacts	●	●	●	●	●	●
Future Proofing	●	●	●	●	●	●
Overall Assessment	●	●	●	●	●	●

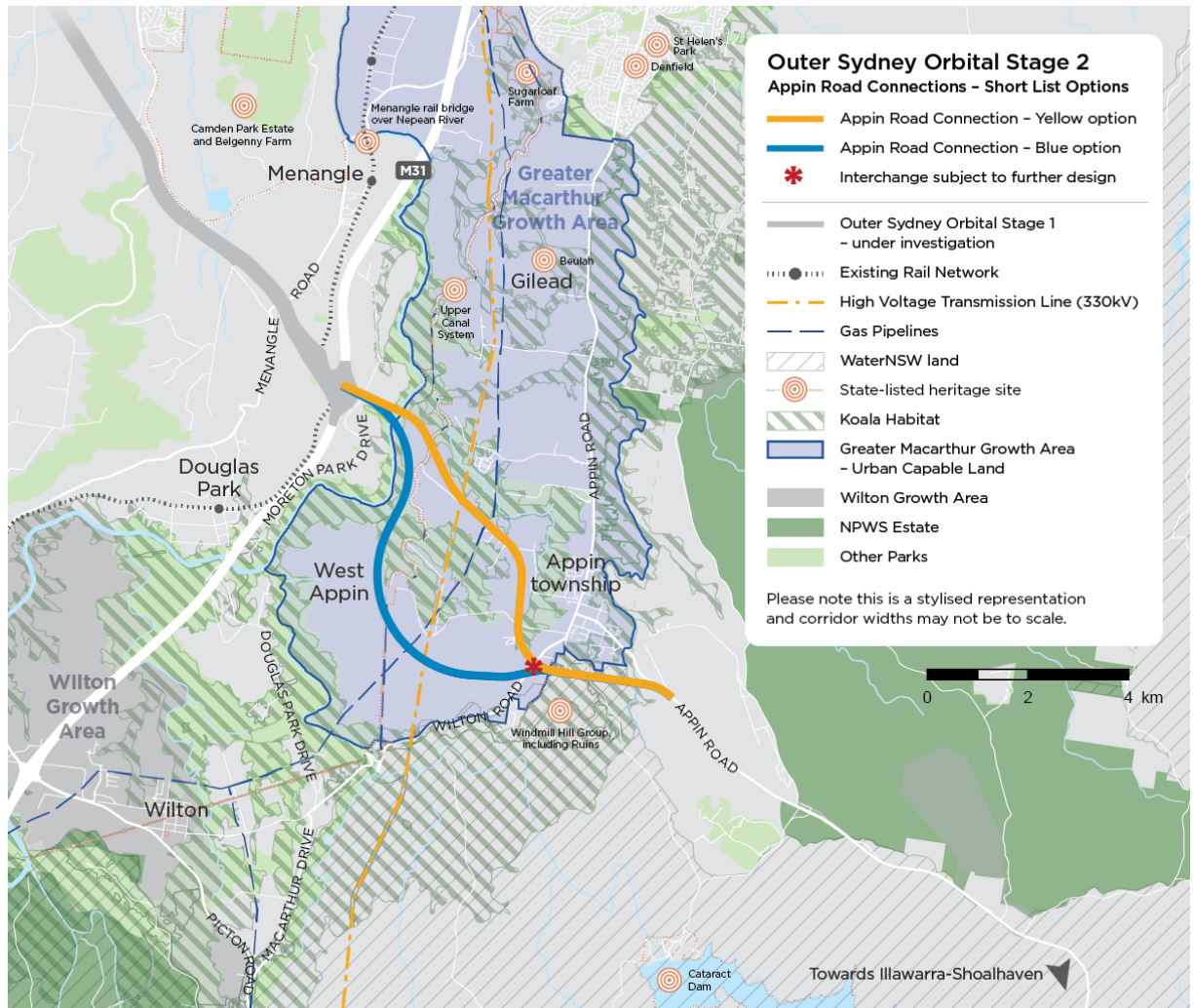


4.5.8 The Short Listed Options

Based on the final assessments, **Figure 16** below shows the two shortlisted options – the Yellow Option and the Blue Option –for community and stakeholder engagement.

These options are believed to strike the best balances across different constraints and have both been assessed as achieving ‘Good’ performance in terms of the OSO2 Corridor Objectives. As previously mentioned, the performance values of all options will be further considered following engagement with the community and land owners.

Figure 16: OSO Sector 1 – Appin Road Connections – Short Listed Options for Community and Stakeholder Engagement



Connecting with Wilton Road and crossing local roads

The Yellow and Blue Options both cross Wilton Road. More space will potentially be required at this point to allow for a connection (i.e. the corridor will be wider here than 80 metres). Future planning and design work ahead of infrastructure delivery will determine the type of connection, which could be a fully grade separated interchange or other form of intersection. The extent of land impacted at the Wilton Road Interchange is identified in the online mapping tool transport.nsw.gov.au/corridors. The area affected for each option at the interchange represents the likely maximum requirement.

The options also cross other local roads. For example, the Yellow Option passes across Macquariedale Road and Brooks Point Road. It is intended that future infrastructure within the OSO2 corridor will be grade separated (with the OSO2 infrastructure above the local road). Grade separation of local roads will maintain future property access.

5. Next steps

This Options Report is intended to inform feedback and views on the OSO2 Corridor Objectives, constraints analysis, and options assessment.

This feedback can take different forms and may include written submissions, emails or discussions with the project team on virtual platforms given continuing public health considerations as a result of the COVID-19 Pandemic.

Details concerning the long list of corridor options have been provided to ensure that the community and stakeholders are aware of the different alignments that have been considered by the project team and why certain corridors have not progressed.

Transport for NSW believes the two short listed corridor options reflect the best balances between the different constraints in the study area in seeking to achieve the OSO2 Corridor Objectives. However, the community and stakeholders may have different perspectives and the project team will examine each submission and its recommendations as part of identifying a single recommended final corridor option.

The community and stakeholders will have a further opportunity to provide comment on a single, final recommended corridor in coordination with the finalisation of Greater Macarthur 2040. More advice will be provided to the community at this time about the corridor. The construction of infrastructure within the OSO2 corridor is likely within the next 20 years, subject to demand and available funding.

You can provide your feedback about the shortlisted corridor options in the following ways:

- **Visit the website for more information**

transport.nsw.gov.au/corridors/oso2

- **Use the interactive online map to see the locations of the corridor options and to provide your feedback**

transport.nsw.gov.au/corridors/oso2

- **Email corridors@transport.nsw.gov.au**

- **Write**

Corridor Investigation Office

Transport for NSW

PO BOX K659

Haymarket NSW 1240

- **Call 1800 837 511**

6. Appendix A – Community Profiles

6.1 Appin Community Profile

Summary: Compared to Greater Sydney, the demographic profile of Appin shows that it is characterised by above average household incomes, a relatively young age profile, a relatively high share of residents born in Australia, a relatively high share of households owning their homes, a relatively high share of residents occupied in 'blue collar' activities, and employment focused principally on the tertiary sector but supported by strong employment in the secondary sector.

6.1.1 Social and Economic Profile

Key socio-economic characteristics of the community of Appin is provided below including comparisons with Greater Sydney (GCCSA), Illawarra (SA4) and Outer South West (SA4) benchmarks.

Age: Appin has a median age (31.2) which is significantly below that of Sydney Outer West (35.0), Illawarra (39.2) and Greater Sydney (36.4)

Household composition: 86.7% of households in the Appin area are family households. This is higher than both Sydney Outer West (81.1%) and Greater Sydney (72.1%) and likely explains the low median age of the area.

Cultural background. The population is largely Australian born, with only 10.3% of residents being born outside of Australia compared to 38.1% for Greater Sydney.

Employment: Labour force participation in the Appin area (75.3%) is significantly higher than the Greater Sydney benchmark of 65.6%.

Income (household): Median household incomes in Appin (\$104,470) are higher than the benchmark incomes, specifically 13.3% higher than the Greater Sydney median (\$92,200). The Appin income profile is principally due to higher labour force participation rates than benchmarked areas.

Median house price: The median house price in February 2020 was \$721,000.

Relative advantage/disadvantage (SEIFA): Appin SCC has an above average level of socio-economic advantage (score of 1042), being at the 78th percentile in NSW. Therefore, Appin SCC can be considered to have relatively low levels of disadvantage.

Housing tenure: Appin is characterised by high home ownership rates (84.7%) compared with the Greater Sydney benchmark of 64.2%. Home ownership includes dwellings with a mortgage and those fully owned.

Vehicle ownership (by dwelling): Appin is highly car dependant, with 78.8% of households owning two cars or more compared to 50.2% for Greater Sydney.

Occupation: Appin has a significantly lower proportion of residents occupied as managers / professionals (23.8%) compared to Greater Sydney (40.0%), but a higher share of residents occupied as labourers, trades and technicians and machinery drivers and operators (36.6%) relative to Greater Sydney (24.9%).

Industry of work (residents): The majority of Appin residents work in the tertiary sector (69.4%), this includes producer services (e.g. transport, postal and warehousing) and consumer services (e.g. retail trade), this share is well below the Greater Sydney benchmark (80.0%). The community has a relatively high level of secondary sector participation (e.g. construction, manufacturing) with 24.0% of residents working in the sector (compared to 14.0% for Greater Sydney). A relatively small portion of residents work in primary industries (3.1%) which includes agriculture, forestry and fishing and the mining industry, although this is higher than for Greater Sydney (0.4%).

6.1.2 Social Infrastructure Context

The township centre includes a community hall co-located with sport and recreation facilities, a primary school, post office, an early learning centre, and a number of churches. Trails and track facilities around the township attract significant motocross and mountain biking activity.

A district-level skate park is planned for Appin as part of the Wollondilly Liveability Fund.

GMGA planning has identified a number of new community facilities for the Appin area, with the draft SIC proposing funding for several new schools, a health centre, and a Fire and Rescue station.

6.1.3 Stakeholder Issues

Based on local planning documents and other sources, the following issues are believed to be important to the Appin community.

- Increased population is placing pressure on the limited services available in this location, and highlighting short term infrastructure deficits affecting local residents.
- Opposition to the development of rural and agricultural land:
 - Wollondilly Shire Council and the Help Save Appin community group have frequently indicated they have reservations about urban development in the Appin area.
- Koala conservation:
 - Concern for koala populations is a common theme in community objections to development proposals in the area.
 - A 'Save our Koalas' petition of 2018 attracted over 13,000 signatures.
- Strong heritage and historical character within Appin – The heritage of the area is a key attractor for tourists and visitors. Appin is also a site of mourning for Aboriginal people as the location of the Appin Massacre of 1816, in which at least fourteen Aboriginal people were killed by British soldiers at a site near Cataract Dam. Annual commemorations of this event (held in April) now attract several hundred attendees.

6.2 Wilton Community Profile

Summary: Wilton is characterised by above average household incomes; a relatively young age profile; a relatively high share of residents born in Australia; a relatively high share of households owning their homes; a relatively high share of residents occupied in 'blue collar' activities; and an industry structure focused principally on the tertiary sector but supported by a strong secondary sector.

6.2.1 Social and Economic Profile

A summary of the socio-economic characteristics of the Wilton community is provided below:

Age: Wilton residents have a median age (31.6) which is notably below that of Sydney Outer West (35.0), Illawarra (39.2) and Greater Sydney (36.4).

Household composition: 90.7% of households in Wilton are family households. This is higher than both Sydney Outer West (81.1%) and Greater Sydney (72.1%) and contributes to the low median age of the area.

Cultural background: The population is largely Australian born, with only 9.6% of residents being born outside of Australia compared to 38.1% for Greater Sydney.

Employment: The labour force participation rate for Wilton (79.1%) is significantly higher than Greater Sydney (65.6%).

Income (household): Median household incomes in Wilton (\$113,990) are higher than the benchmark incomes, specifically 23.6% higher than the Greater Sydney median (\$92,200). The Wilton income profile is influenced by higher labour force participation rates than the benchmarked areas.

Median house price: The median house price in February 2020 was \$825,000.

Relative advantage/ disadvantage (SEIFA): Wilton has an above average level of socio-economic advantage (score of 1,102), being at the 97th percentile in NSW.

Housing tenure: Wilton is characterised by very high home ownership rates (89.1%) compared with the Greater Sydney benchmark of 64.2%. Home ownership includes dwellings with a mortgage and those fully owned.

Vehicle ownership (by dwelling): The level of car ownership and dependency in Wilton is high, with 87.8% of households owning two or more cars, compared to Sydney Outer West (63.1%), Illawarra (56.0%) and Greater Sydney (50.2%).

Occupation: Wilton has a lower proportion of residents occupied as managers / professionals (32.2%) compared to Greater Sydney (40.0%); but a higher share of residents occupied as labourers, trades and technicians and machinery drivers and operators (30.9%) compared to Greater Sydney (24.9%).

Industry of work (residents): Wilton residents predominately work in the tertiary sector (71.2%), this includes producer services (e.g. transport, postal and warehousing) and consumer services (e.g. retail trade), this share is below the Greater Sydney benchmark (80.0%). The community is also relatively involved in the secondary sector (e.g. construction, manufacturing) with 21.8% of residents working in the sector (compared to 14.0% for Greater Sydney). Only a small portion of residents work in primary industries (2.9%) which includes the agriculture, forestry and fishing and the mining industry, although this is higher than for Greater Sydney (0.4%).

6.2.2 Social Infrastructure Context

Wilton contains a newly-renovated community centre co-located with sport and recreation facilities, one primary school, one early learning centre, an Anglican Church, a number of commercial businesses, and an Australia Post office.

Bingara Gorge is the first new precinct of the WGA to be developed and is nearing completion. Located immediately northwest of the pre-existing Wilton township surrounding Wilton Public School (a Government primary school), the master planned community incorporates local shops, a preschool, a medical clinic, an 18-hole golf course, open bushlands, and recreation spaces.

Co-located with the Wilton Community Centre is the Wilton Recreational Reserve, the largest recreation space in the Shire, with 15.5 hectares. This reserve will undergo upgrades in accordance with a recently adopted and funded masterplan from the Council.

With Wilton's transition to a city of over 50,000, new community facilities will be expected to serve larger catchments. Through a Wilton SIC the Government has proposed to collect \$771 million in development contributions for infrastructure including:

- A community health facility
- Two primary schools and a K-12 school
- A Fire and Rescue station
- Regional open space.

6.2.3 Stakeholder Issues

Key social issues and trends within Wilton include:

- Major focus of growth across Wollondilly LGA – Wollondilly Shire Council supports the development at Wilton, and Council is seeking to ensure that new communities at this location are supported by high quality infrastructure. Council sees growth at Wilton as an opportunity to “plan for liveable communities by maintaining and enhancing these communities as great places to live, work, visit and play. Liveable communities are those that are vibrant, prosperous, connected, accessible, resilient, distinct, well designed, attractive, healthy and safe”.
- A lack of public and active transport increases car dependency, which has the potential to have negative impacts on health and the quality of the urban environment. A lack of alternative transport connections also limits access to employment, education and other services, requiring residents to be dependent on car travel for everyday needs.

6.3 Douglas Park Community Profile

Summary: The locality is characterised by above average household incomes, a relatively old age profile, a relatively high share of residents born in Australia, a relatively high share of households owning their home, a relatively high share of residents occupied in ‘blue collar’ activities, and an industry structure focused principally on the tertiary sector supported by a strong secondary sector.

6.3.1 Social and Economic Profile

The demographic characteristics of residents in Douglas Park include:

Age: The median age of 41.3 in Douglas Park is significantly above that in Sydney Outer West (35.0) and Greater Sydney (36.4), however, it is broadly in line with the Illawarra region (39.2).

Household composition: Over 70% (72.9%) of households in Douglas Park comprise of families.

Cultural background: The population is largely Australian born, with just 11.1% of residents being born outside of Australia compared to Greater Sydney which has 38.1% of residents born overseas.

Employment: The labour force participation rate in Douglas Park (67.7%) is broadly in line with that of with Greater Sydney (65.6%).

Income (household): The median household incomes (\$98,370) in Douglas Park is higher than the benchmark incomes, including 6.1% higher than the Greater Sydney median (\$92,200).

Median house price: The median house price in February 2020 was \$925,000.

Relative advantage/ disadvantage (SEIFA): Douglas Park has a SEIFA score of 1,063 which is above the average NSW level of socio-economic advantage. It falls in the 83rd percentile in NSW indicating a relatively low level of disadvantage.

Housing tenure: Households in Douglas Park are predominately owner occupied either with a mortgage (49.4%) or owned outright (38.4%). This represents a higher home ownership rate compared to Greater Sydney (mortgage: 34.2%, owned outright: 30.0%).

Vehicle ownership (by dwelling): 81.0% of households in Douglas Park own two or more cars, compared to 50.2% for Greater Sydney.

Occupation: Douglas Park has a lower proportion of residents occupied as managers / professionals (28.9%) compared to Greater Sydney (40.0%), but a higher share of residents occupied as labourers, trades and technicians and machinery drivers and operators (39.2%) compared to Greater Sydney (24.9%).

Industry of work (residents): The majority of Douglas Park residents work in the tertiary sector (72.2%), this includes producer services (e.g. transport, postal and warehousing) and consumer services (e.g. retail trade), this share is slightly below the Greater Sydney benchmark (80.0%). The community is relatively involved with the secondary sector (e.g. construction, manufacturing) with 21.1% of residents working in the sector (compared to 14.0% for Greater Sydney). A relatively small portion of residents work in primary industries (3.6%) which includes agriculture, forestry and fishing and the mining industry, although this is higher than for Greater Sydney (0.4%).

6.3.2 Social Infrastructure Context

Douglas Park township includes a community centre co-located with sport and recreation facilities, a primary school, Australia Post, general storage, an early learning centre, and a limited number of local businesses, including a hair salon and bottle shop.

There is a proposal to develop a 17-hectare site at 430-490 Douglas Park Drive as a multi-denominational cemetery. The cemetery is estimated to be a \$20 million development which would include over 27,000 burial plots.

6.3.3 Stakeholder Issues

Based on local planning documents and other sources, the following issues are believed to be important to the Douglas Park community:

- Rural lifestyle.
- Residents generally need to travel long distance to access the services and facilities required for daily living, including health and education infrastructure and employment opportunities.
- Unlike Wilton and Appin, the area has not been identified for increased growth, and there is unlikely to be significant change to the population in the short and medium term.
- In the area surrounding Douglas Park there are coal mines that employ a significant number of local residents.

7. Appendix B – Business Requirements Statement

NB: The BRS was developed for the whole of the OSO2 between the Western Parkland City and the Illawarra-Shoalhaven region. Departures from certain provisions may be considered in particular locations where appropriate (e.g. reduced speeds or corridor widths in urbanised or tunnelled sections).

Item	Design Parameter	Setting/Measure	Compliance
01	General standards	Design should be based on relevant Austroads and NSW Government standards relating to motorways and other high capacity roads	Required
02	Corridor width	Indicative width of 80 metres, with reductions to be considered where place constraints exist	Desirable
03	Road formation width on straight horizontal alignment, excluding median and excluding active transport	Two carriageways , each comprising three lanes – each 3.5m wide, outer shoulder - 3m wide	Required
04	Road median	Optimal width – 7m, with a central barrier (i.e. 3.5 m either side of the barrier, assuming 2.5m of grass and 1m of shoulder) Minimum width – 2m, with a central barrier	Desirable
05	Road vertical clearance	5.4m minimum clear height (i.e. pavement surface to any overhead structural element, internal surface, fitting or item of equipment)	Required
06	Maximum road speed	Design speed – 110km/h Posted speed - 110 km/h The posted speed will be the subject of future considerations in terms of what is appropriate for particular places.	Desirable
07	Minimum road speed	Design speed – 90 km/h Posted speed - 80 km/h	Required
09	Tunnels	None preferred outside of Sector 3 (Escarpment crossings) Fire and life safety access / egress	Desirable Mandatory

Item	Design Parameter	Setting/Measure	Compliance
10	Connections with other roads	The future design of intersections will be subject to detailed design. Where appropriate intersections will be at grade.	Required
11	Gradient	Avoid prolonged grades in excess of 4% Maximum 6% - Excluding tunnels Maximum 4% - Tunnels	Required
12	Road crossfall / Superelevation	Minimum crossfall: -3% Maximum superelevation: +3%	Desirable
13	Road curvature	Minimum radius - 810m Preferred radius – 900m	Desirable
14	Design life	100 years	Required
15	Design flood level	100 year ARI (Average Recurrence Interval)	Required
16	Operational noise and vibration	Design should be consistent with EPA road noise guidelines	Required
17	Road checking and design vehicle	Design vehicle – 30m PBS 2B heavy vehicles Checking vehicle - 36.5m B-triple	Required
18	Passenger rail	Not excluding dual track electrified passenger heavy rail (40 metre sub-corridor) Track vertical grades should be less than 1.5 % where practical	Desirable
19	Rail level crossings	No level crossings	Required
20	Water catchment	Avoid WaterNSW catchment if possible Where the alignment must pass through catchment design should be consistent with WaterNSW's 'Neutral or Beneficial Effects' water impact assessment guidelines	Required
21	Fauna management	Design should be consistent with relevant NSW Government guidelines or subject matter expert advice relating to safe fauna management (e.g. the use of koala movement barriers and/or crossings)	Required

Item	Design Parameter	Setting/Measure	Compliance
22	Road safety	Design should be consistent with NSW's 'Safe System' approach and Centre for Road Safety subject matter expert advice	Required
23	Smart motorway technology	Design should be consistent with relevant NSW Government guidelines or subject matter expert advice in relation to the provision of smart motorway technologies	Required
24	Active transport	Design should provide for walking and cycling routes physically separated from motorised traffic Safe crossings to be provided for intersecting walking and cycling routes	Desirable