ORANA

Golden Highway Road Corridor Business Case

Connecting Orana - Hunter and Beyond

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www.rdaorana.org.au

Regional Development Australia

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Acknowledgement of Country

Regional Development Australia Orana acknowledges First Nations peoples as the Traditional Owners and Custodians of Australia. We respect and celebrate the inherent strengths of Aboriginal and Torres Strait Islander peoples, and their commitment to the land, waters and their communities. We pay our respects to their Elders past and present.

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Overview

The Business Case for Golden Highway Road Improvements

Transport networks exist to connect communities with communities, communities with economic centres and to connect economic centres. They should be safe, efficient, reliable, resilient, and provide as direct access to ports as possible.

The Golden Highway Road Corridor Improvements Business Case has been developed through an extensive process of stakeholder engagement, measurement and Cost Benefit Analysis.

It outlines opportunities driving change in western NSW including the development of the Central West Orana Renewable Energy Zone, the growth in mining industry and the importance of agriculture underpinning the rural economy.

These changes require a plan of infrastructure improvements that will keep freight moving safely and efficiently from the Central West region to the Hunter Region and Port of Newcastle.

Investment in the transport network and the upgrade of the Golden Highway is essential. Upgrades include bridge replacement, bridge widening, new overtaking lanes, upgrades to railway crossings and intersection. The economic, social and environmental impacts present a strong case for improvement.

1. Executive Summary

This Business Case for Golden Highway Road Corridor Improvements was funded by the NSW Government's Regional Business Case and Strategy Development Fund. It has been developed by The Stable Group on behalf of Regional Development Australia (RDA) Orana.

The Golden Highway stretches from Dubbo to the intersection with the New England Highway and the Hunter Expressway and is an essential corridor for the movement of freight and provision of services between the Port of Newcastle and Western NSW through Dubbo. It is also part of a wider transport network which connects communities with communities, communities with economic centres and to connect economic centres.

During the development of the Business Case, the Stable Group consulted widely with the Port of Newcastle, businesses that use the road, and a Project Reference Group (PRG) to develop a clear understanding of the future freight needs of the Golden Highway and Beyond. The resultant modelling indicated significant growth in freight volumes and changes in types of freight well above previous modelling.

The objectives of this proposal are to:

- Provide insights and recommendations that will inform the region's transportation planning and help to address the challenges facing the freight industry.
- Establish a plan of infrastructure improvements that will keep freight moving safely and efficiently from the Central West region to the Hunter Region and Port of Newcastle.

The assessment of the costs involved in implementing the proposed infrastructure enhancements are detailed in this Business Case, and include:

- Economic costs to improve the Golden Highway Corridor include widening of bridges, provision of overtaking lanes and improving turn-off to side roads as well as the cost to business with a "do nothing" approach.
- Social costs of safety risks with projected increase in traffic volumes.
- Environmental cost of a "do nothing" approach with cumulative impacts of increased travel time and increasing inefficiency throughout the road network.

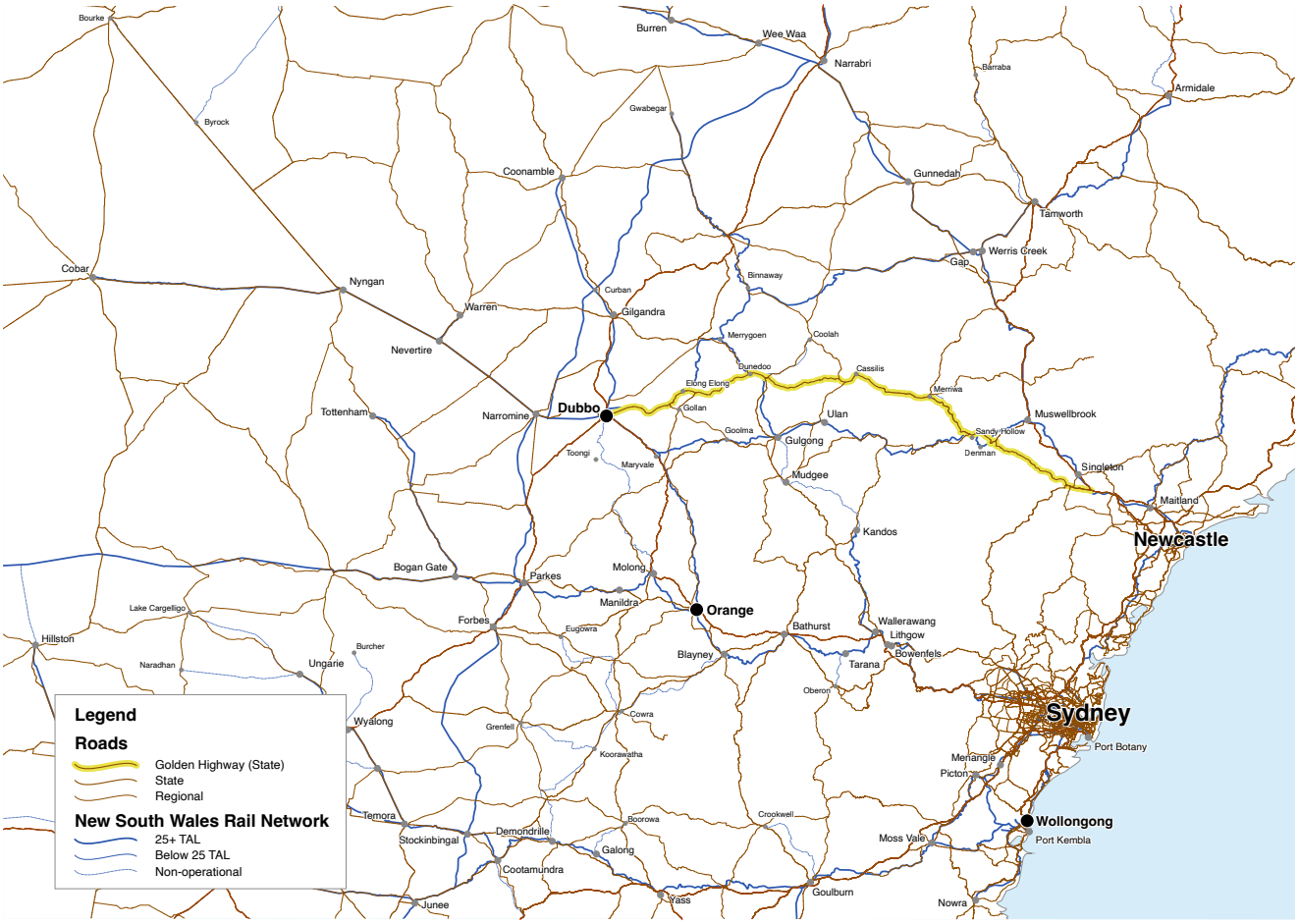
The assessment of the benefits evaluates the positive impacts that infrastructure improvements would bring to the community, stakeholders and the overall region and include:

- Tangible and intangible economic benefits through increased productivity and improved traffic flow.
- Social benefits including increased road safety and improved access to service centres for residents.
- Environmental benefits such as lower carbon emissions from improvements in freight efficiency and improved likelihood of timely construction of renewable energy projects in the Central West Orana Renewable Energy Zone (CWO-REZ)

The Business Case presents a strong net positive case for construction and upgrades on the Golden Highway. The project is estimated to generate $802M in benefit to the Orana Region and NSW over 30 years at a 5% discount rate, offset by $449 million in costs. The nominal investment required to complete the proposal is $496M. The project has a benefit cost ratio (BCR) of 2.3.

This proposal recommends the Priority 1 Projects suggested in this case proceed over a 5-year timeframe, with Priority 2 Projects then proceeding in a 5 – 15-year timeframe. The capital costs will likely be funded by the NSW Government and with opportunistic support from Federal Government.

Figure 1: The Golden Highway - Regional and State Road and Rail Network.



2. Case for Change

2.1 Background

RDA Orana is a not-for-profit association governed by a regional Board consisting of industry and government representatives whose primary focus is to promote economic development in the Orana region. The Orana Region is the largest and most diverse region in New South Wales, covering 25% of its area and serving a population of over 123,000 people. The main service centre in the region is Dubbo and it is the western starting point of the Golden Highway which is an essential corridor between the Orana Region and the Port of Newcastle and beyond.

The Golden Highway (B84) is a 314 km highway and critical corridor which provides a fairly low altitude crossing of the Great Dividing Range. The Golden Highway commences at the intersection with the Newell Highway in Dubbo and heads in an easterly direction through Dunedoo where it is concurrent with the Castlereagh Highway for approximately 10 kms then through Merriwa, Sandy Hollow, Denman, Jerry's Plains and Mount Thorley where it terminates at the intersection with the New England Highway before Belford. The highway is subject to higher rates of casualty crashes (those where at least one person sustains a minor injury) than the NSW average. In comparison to the surrounding State roads, the Golden Highway has a lower AADT, necessitating a review of the safety concerns along the highway.

The Stable Group, a very strong and trusted team of skilled professionals committed to creating change in Regional Australia, undertook the Orana Hunter Connections and Beyond - Golden Highway Transport Study, a desktop assessment and review of past studies and data on current freight flows and the performance of existing infrastructure. Previous studies on freight network, infrastructure and transport were reviewed to gather data before conducting stakeholder consultation across the region. Extensive consultation with a range of stakeholders including the Port of Newcastle, road users including freight and rail industries, and a Project Reference Group (PRG).

Following this extensive process, it was identified that:

- In NSW the Central West and Northwest regions are of critical importance as significant generators of Gross State Product. Logistics costs ex-farm gate and ex-mine are highly dependent on reliable and resilient transport networks that provide as direct access to ports as possible. The relevant networks are the Blue Mountains (A32 and Main West Rail) and in combination, the Golden Highway (B84) and part of the Hunter Rail network.
- The Golden Highway Corridor (GHC) in conjunction with the Hunter Expressway (M15) facilitates the movement of export commodity flows to Newcastle, and the inbound flow of goods and services across the region. It carries a relatively high proportion (30%) of heavy vehicles. It features very few overtaking lanes, narrow (some very narrow) bridges and inadequate intersections. It should serve as a relief route to and from Sydney when the Great Western Highway/Mitchell Highway is unavailable.
- Economic activities between the Orana and Hunter regions continue to expand beyond previous growth estimates.
  - With many significant infrastructure projects planned in the Orana Region and developments at the Port of Newcastle, the projections are for this to grow at a greater rate in years to come.
  - Without upgrades, the GHC faces significant challenges, including congestion due to restricted overtaking lanes, safety concerns, and inadequate capacity.
  - No prior substantial wholistic study has encompassed the entire GHC and highlighted the growth and emerging opportunities across multimodal and intermodal interfaces.

2.1.1 Current Freight Task of the Golden Highway

The current total freight task for the study catchment area (for all commodities, road and rail) utilising the GHC is estimated at 2.5 million tonnes per annum (Mtpa). The volume includes inbound and outbound volumes to the catchment area. It is estimated that 82% of volume, including grain and cotton, is outbound freight from the region, while 18% is inbound freight. Grain, cotton and mining related commodities are key volumes that contribute to the freight demand within the CGC. Grain and mineral concentrate are the predominant product that is currently transported out of the CGC.

The majority of the volume transported by rail is mineral concentrate in the form of half height bulk containers for export through the Port of Newcastle. The remainder is bulk export grain movements. Domestic grain travelling by road is generally destined for chicken feed mills located in Newcastle or complete partial GHC journeys to Upper Hunter and Liverpool Plains feedlots.

The road task also includes fuel, and mining inputs such as grinding media and general freight which typically moves between Orana Region and Newcastle.

2.1.2 Future Freight Task of the Golden Highway Corridor (Road and Rail)

The methodology for future freight data collection, aimed at validating commodity volumes and origin-destination matches, employed a comprehensive approach that harnessed a diverse range of data sources, including Australian Bureau of Statistics (ABS), TfNSW traffic data, and rail volumes. The ABS data served as a foundational reference, offering insights into national economic activity and trade flows. TfNSW traffic data and rail volume statistics provided valuable regional transportation insights, however, this data was mostly found to be out of date having been collected pre-2016 and it does not take into account the Department of Regional NSW Mining, Exploration and Geoscience estimated freight data. Transport for NSW Strategic Freight Forecasts - commodity forecast map[1]

To ensure the accuracy of origin-destination matches and commodity volumes, there were comprehensive stakeholder interviews involving industry experts, logistics professionals, and relevant authorities. This confirmed that future freight data was significantly higher than previous estimates by Treasury and Transport for NSW. This collaborative process ensured that data aligns with real-world experiences and expert insights.

Furthermore, inputs from organizations such as ABARES (Australian Bureau of Agricultural and Resource Economics and Sciences) and AEGIC (Australian Export Grains Innovation Centre), were incorporated, adding another layer of expertise to enhance our understanding of commodity flow dynamics and their associated origins and destinations.

It is evident from Table 1 that there is a steep increase in freight volumes from 2023 to 2033 and a slowing of the volumes through to 2050. These increases were confirmed through stakeholder interviews and largely driven by the non-coal mineral mining sector. It is important to state that only mineral projects considered by the NSW Government Mining, Exploration and Geoscience (MEG) within the Department of Regional NSW determined to be in "pre-construction" status have been included in volumes. It is assumed that a constant rate of extraction will be maintained from the mines stable operating point from 2033 to 2050. The inputs are proportional to the exports given the significant onsite processing of the materials. There is no reasonable forecast that can be made at this time to allow the assumption that there would be ramping up or down to meet demand. Therefore the conservative case is to assume a consistent volume from 2033 to 2050.

Agricultural production remains relatively static albeit with small increases of 2.5% per year. As previously stated, these increases are due in a large part to plant varietal improvements increasing yield within an increasingly variable climate.

1 Transport for NSW Strategic Freight Forecasts - commodity forecast map https://www.transport.nsw.gov.au/data-and-research/freight-data-19/strategic-freight-forecasts/strategic-freight-forecasts-commodity)

Table 1: Total Forecast Freight Volumes Golden Highway Corridor (tonnes per annum)

Commodity	2023	2033	2050
Agricultural Input	90,000	90,000	90,000
Fuel	113,200	121,700	121,700
Mine Input	131,400	2,184,000	2,184,000
Non-Coal Minerals	460,000	1,627,000	1,627,000
Other	100,000	350,000	500,000
Agriculture	1,640,000	1,919,500	1,817,000
Grand Total	**2,534,600**	**6,292,200**	**6,339,700**

***Note**: Coal transport is not included in data due to dedicated methodology for rail infrastructure provision via ARTC Hunter Valley Access Undertaking. The decrease in fuel transport is directly related to forecast reduction in coal production within the Ulan area.*

The forecast freight volumes have not assumed an increase in non-coal mineral inputs and outputs beyond 2033. This is the conservative case and based on stakeholder engagement used to obtain primary information on volumes.

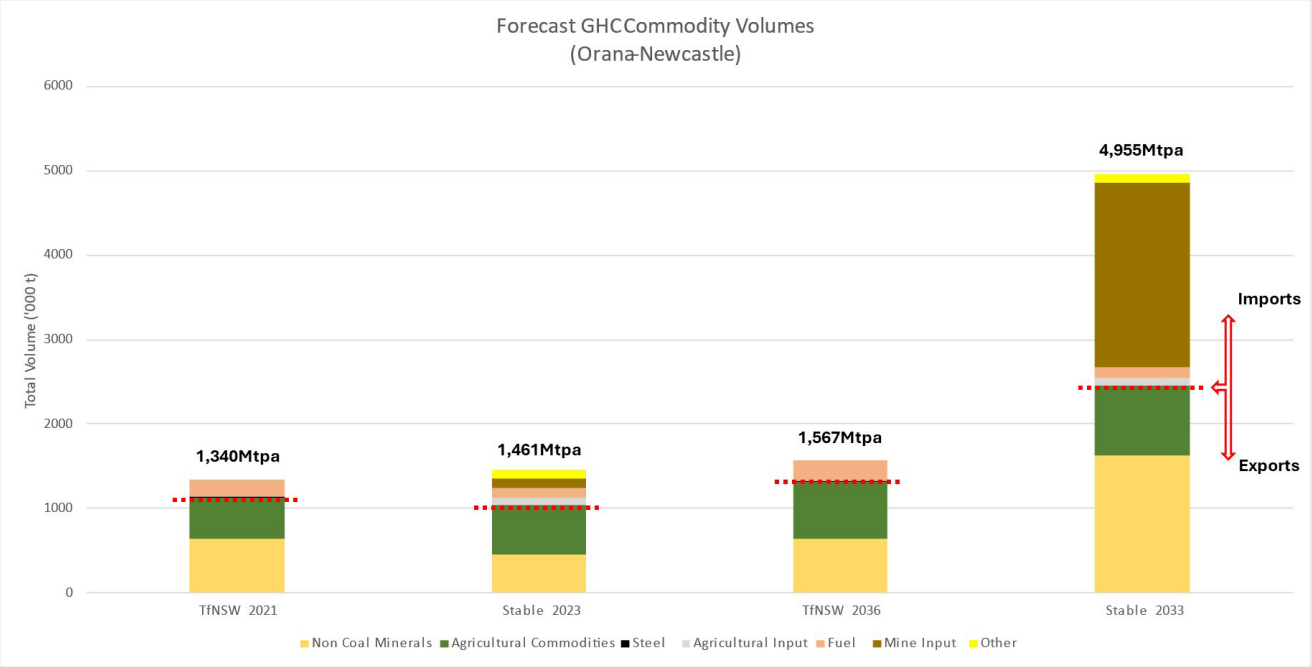
The study catchment area will continue to be a focal point for freight activities, comprised of mining and agricultural inputs (fuel, cement, fertiliser, reagents) which will continue to be the major inbound freight commodities and while predominantly transported by road this may change dependent on complementary infrastructure being constructed to promote modal shift to rail.

The GHC will witness a surge in volumes, especially in the transportation of general freight flows. Future freight demand within the study catchment area is estimated to increase from 2.5Mtpa in 2023 to 6.3Mtpa by 2033. These volumes encompass mining inputs like fuel, reagents, and cement as well as food and non-food consumer goods, business inputs, farm inputs, bulk fuel, and transport equipment and machinery.

There will be a shift from agriculture prominence to mining and mining inputs dominating the demand. Specifically, the expected growth in mining inputs is expected to grow in the vicinity of 2.1Mtpa or a 1600% increase by 2033. By 2033 mining inputs are likely to account for nearly 40% of all volumes being transported.

Comparing the dataset to Transport for NSW Data[2] included in the Freight Forecast from the Strategic Freight Model for Origin/Destination sets of Dubbo, Bourke - Cobar – Coonamble, Newcastle it is apparent there is a significant disparity of both assumed volumes and commodity share.

Figure 2: Forecast Volumes Orana - Newcastle (Source: TfNSW 2019, Stable 2023). These volumes reflect volume movement between Dubbo and Newcastle given forecast mine commencement.



Additionally, an extensive intra-regional freight task will persist, characterized by movements of grains and livestock from farms, distribution from local wholesalers to farms, commercial enterprises, and construction activities. Given the relatively short distances and smaller consignments associated with these flows, road transportation will continue to dominate the scene.

As we look toward 2040, the transport sector anticipates a continuation of existing patterns, albeit on a larger scale, driven significantly by the heightened demands of mining-related activities. The reliance on road transport, especially for short-distance and smaller consignment flows, is expected to persist, while the challenges and opportunities associated with rail transportation will continue to be shaped by its proximity to freight generators.

Without coordinated investment into rail infrastructure there is a high risk that much of this additional mining related freight will be incentivised to travel by road. Non-coal mining related freight (imports and exports) is estimated to increase from 0.59mtpa in 2023 to 3.8mtpa in 2033 due to the expansion of rare-earth mineral mines in the Orana region. If freight is deterred from travel by rail, this poses a significant safety concern and may add over 110,000 truck movements each year.

2 TPA-DAR-SFM-0011 Freight Forecast from the Strategic Freight Model, Release Date: February 2020 Transport Performance Analytics, Transport for NSW https://opendata.transport.nsw.gov.au/dataset/5da0e3b9-e46a-4aa3-96c9-2574d83fe6fb/resource/85eb1768-207d-49df-a736-331b9c4b623c/download/sfm-dataset-nov-2019_2.xlsx

2.1.3 Over-size, over-mass movements on the Golden Highway

The implementation of projects within the Central-West Orana Renewable Energy Zone (CWO-REZ) necessitates the transportation of not only personnel but also substantial components for renewable energy infrastructure from the Port of Newcastle. These components, such as wind turbine parts and transmission transformers, constitute crucial elements of the renewable energy projects in the region. However, the transportation of such oversized and over-mass items is poised to have significant repercussions on vehicular movements along the Golden Highway, extending beyond mere logistical concerns.

The shift to renewable energy requires transportation of personnel, equipment and machinery along the GHC. Overall, the actual number of small vehicle and standard truck movements will have minor impacts on the Golden Highway level of service but inherently alters the dynamics of traffic flow and road safety along the transportation route. The nature of these movements introduces unique challenges. Oversize and over-mass vehicles, by their very dimensions and weight, impose restrictions on conventional traffic patterns, necessitating adjustments and accommodations from other drivers sharing the road. For example, the components, including parts for wind turbines and transmission transformers, will be transported using oversize and over-mass (OSOM) vehicle movements. Expected movements by vehicle type per month for a 70 wind turbine generator (WTG) project being constructed over 24 months would result in an approximate increase of 130 vehicle movements per day of which 3 or 4 would be OSOM. It is assumed there will be a limit on the number of windfarms that could be in construction at any point in time given supply chain constraints related to workforce availability, component manufacture in addition to port receival and outturn capacity.

As these massive components traverse the highways en-route to project sites, they inevitably disrupt the flow of regular traffic, potentially causing delays and congestion. Furthermore, the presence of OSOM vehicles poses heightened risks for accidents and collisions, given their increased size, reduced manoeuvrability, and slower acceleration and deceleration rates compared to standard vehicles.

Moreover, the introduction of such OSOM vehicles into the transportation network may inadvertently encourage risky driving behaviours among other motorists. Faced with delays and congestion caused by the movement of these massive components, drivers might resort to aggressive manoeuvres or unsafe overtaking practices in a bid to mitigate travel delays, thus exacerbating the overall risk profile along the Golden Highway.

2.1.4 Conclusion

Ultimately, this Business Case for the Golden Highway Road Corridor Improvements (the proposal) was developed following consideration of the work completed in the Golden Highway Transport Study with a view to:

- Providing insights and recommendations that will inform the region's transportation planning and help to address the challenges facing the freight industry.
- Establishing a plan of infrastructure improvements that will keep freight moving safely and efficiently from the Central West region to the Hunter Region and Port of Newcastle.

The planned outcomes from the proposal are to improve economic, social and environmental outcomes for all road users and support regional freight movement for productive agricultural and mining industries (See Section 2.4).

2.2 Rationale for Investment

The Golden Highway (B84) features the most favourable topography of any road route through the Great Dividing Range. The more moderate terrain, open road alignment and limited urban ribbon development make investment in the Golden Highway Corridor Improvements a much more cost-effective way to gain substantial capacity and productivity improvements for connectivity for the Central-West and North-West regions to the coast, Newcastle and port facilities.

Conversely, the existing road corridor to Port Botany is constrained by the rugged terrain, ribbon urban development, multiple purposes of the transport corridor meaning it is often congested, running at high levels of service and/or at capacity with poor travel times and extremely vulnerable to disruption from traffic accidents and natural events. Further investment in this corridor to gain substantive capacity and travel time improvements is prohibitive and includes options such as tunnels and/or major urban impacts to communities.

The Golden Highway is an essential conduit for the freight movement of agricultural and mineral commodities between the Orana Regional Development Area and Newcastle in the Hunter region which is estimated to double by 2033.

The proposal also addresses key concerns related to the current safety and efficiency dynamics of the Golden Highway, including:

- A lack of overtaking lanes, increasing travel time, risky driving behaviour, and the risk for head-on collisions
- A lack of left-hand and right-hand turn lanes, posing a safety risk
- Narrow bridges, posing a safety risk.
- Heavy vehicles of Performance Based Vehicle Standards Class 2B are not able to access the highway without a permit due to unprotected level crossings, limiting road freight efficiency.

If the proposal does not proceed, these current safety and productivity issues are expected to be exacerbated by an increased future freight task, arising from:

- An increase in demand for agricultural commodities, driven by a growing population and increased domestic income.
- An increase in demand for critical minerals, of which the Orana and Mid-Western regions hosts plentiful reserves.
- The construction of the Central-West Orana Renewable Energy Zone, which will require transportation of components such as wind turbines using over-size over-mass vehicles.
- An increase in demand for fast moving consumer goods, driven by the projected population growth of inland cities, including Dubbo.

2.3 Strategic Alignment

The proposal aligns with the following Federal, NSW State, Regional and Local plans.

Table 2: : Strategic Alignment of the Golden Highway Road Corridor Improvements Proposal

Strategy	Alignment
Federal Government	
National Freight and Supply Chain Strategy (Transport and Infrastructure Council, 2019) **and its complementary** **National Action Plan (Transport and Infrastructure Council, 2019)**	The strategy notes "improved efficiency and international competitiveness" and "safe, secure and sustainable operations" as two of their key goals. The proposal will contribute to these strategic goals under their proposed actions: Action 1: Targeted infrastructure investment • Ensure domestic supply chains are serviced by resilient and efficient key freight corridors and assets (Action 1.1) • Providing regional and remote Australia with infrastructure capable of connecting regions and communities to major gateways through land links (Action 1.2) • Advance heavy vehicle road reform to facilitate efficient investment in infrastructure (Action 1.4). Action 2: Enabling improved supply chain efficiency. • Building "a supply chain approach to freight planning" (Action 2.1) by improving efficiency and capacity to access the Port of Newcastle, which will support interoperability along the supply chain. • Building community acceptance of freight operations (Action 2.4) through reduced disruption to community travel. Action 3: Better planning • Provides a proactive analysis of planning and operational solutions to improve freight access (Action 3.3).

2021 Australian Infrastructure Plan (Infrastructure Australia, 2021)	The proposal aligns with the following recommendations on the Reform Priority List: • Strengthening smaller cities and regional centres (Recommendation 1.2) by providing reliable and efficient freight and transport links • Attracting and retaining residents and businesses by identifying appropriate infrastructure requirements according to local community characteristics (Activity 1.2.1.3) actioned in the proposal through thorough stakeholder engagement. • Lifting access in small towns, rural communities and remote areas (Recommendation 1.3) by improving road infrastructure • Maximise the overall benefits of transport investments by aligning transport programs with place-based objectives (Recommendation 4.1), such as those expressed in the Orana and Hunter Regional Plans • Connecting regional and remote Australia (Recommendation 4.2) through reducing the total time taken by people in a rural or remote area to travel to and access services in Regional Centres and return home (Activity 4.2.3.1) • Ensuring long-distance passenger travel needs are serviced in line with access performance standards (Activity 4.2.3.3) upgraded in the proposal through investment in overtaking lanes.
Critical Mineral Strategy 2023-2030	This Strategy demonstrates their strong support for the industry through four key objectives: . Create diverse, resilient, and sustainable supply chains through strong and secure international partnerships. . Build sovereign capability in critical minerals processing. . Use our critical minerals to help become a renewable energy superpower. . Extract more value onshore from our resources, creating jobs and economic opportunity, including for regional and First Nations communities. In December 2022, Australia has 81 major critical minerals projects in the pipeline at an estimated value of between $30 billion and $42 billion (DISR 2022). A key objective of the Australian Government is to extract more value from our resources onshore. The Department of Industry, Science and Resources found the increased export of critical minerals as global demand grows could add $71.2 billion to Australia's GDP and increase the number of jobs in the economy by 115,100 from 2022 to 2040. However, building downstream refining and processing capability and securing a greater share of trade and investment could generate $139.7 billion in GDP and increase the number of jobs by 262,600 from 2022 to 2040.

NSW Government	
Premier's Priorities (2023)	The proposal contributes directly to the Premier's priorities through enhancing a strong economy and connecting communities.
State Infrastructure Strategy 2022 - 2042 (Infrastructure NSW, 2022)	The proposal aligns with the following objectives and strategic directions, and contributes progress towards the following recommendations: Boost economy-wide productivity and competitiveness (Objective 1) • Deliver efficient transport networks to support thriving cities, businesses and communities (Strategic Direction) • Improve freight efficiency, security and capacity to support NSW's industries and supply chains (Strategic Direction), including increasing freight rail mode share to create greater economies of scale. • Plan and deliver projects to increase the efficiency and reliability of freight networks in regional NSW (Recommendation 6), by "leveraging existing strengths of regional NSW" through rail and road passenger transport connectivity, addressing the "Golden Highway challenges" and freight link enhancements. Embed reliability and resilience in infrastructure (Objective 3) • Apply a structured and systematic approach to resilience across multiple asset types (Strategic Direction) • Deliver assets that reduce the risk and impact of major natural hazards and shocks (Strategic Direction) • Improve transport network response and recovery performance (Recommendation 20). Achieve an orderly and efficient transition to Net Zero (Objective 4) • Support a new wave in transmission infrastructure in a manner consistent with community expectations (Strategic Direction) • De-risk the planned delivery of a large program of new transmission infrastructure (Recommendation 23), such as the Central West-Orana Renewable Energy Zone.
Restart NSW	The proposal aligns with the following fund principles: • Funding for infrastructure projects that improves the State's economic growth and prosperity (Aim) as evidenced by the positive benefit-cost ratio and outcomes highlighted. • Although 30% of funding is to be targeted at regional and rural areas (Target), this is yet to be met and 67% of the $2.8 billion remaining in the fund as of September 2023 must be allocated to the regions to meet the target[3] – the Proposal aligns geographically with this target.

3 https://www.dailytelegraph.com.au/news/nsw/government-money-bound-for-the-bush-was-spent-in-sydney/news-story/db67d33b85e8e253fcafa4f527834cbf

20 Year Economic Vision for Regional NSW – Refresh	The proposal aligns with two key Principles for Future Investment: Principle 1: Improved travel between regional centres and from cities and international gateways • Making regional travel faster, easier and safer between and within regional centres, and to metropolitan areas (Aim) • The investigation of rail and road upgrades on lines between regional centres (5–10-year Priority). Principle 2: Freight networks that will increase the competitiveness of key regional sectors. • Improve freight networks from regional NSW to global gateways, to increase exports (Aim) • More efficient transport between inland intermodals and global gateways, which the proposal addresses by directly connecting Fletcher International Exports intermodal to the Port of Newcastle (5-year Priority) • More efficient east-west transport connections, including between inland NSW and Newcastle (5–10-year Priority) • Elevating regional NSW as a supplier by enabling supply chain infrastructure to improve export efficiency and access from regional NSW (5-year Priority updated in the Refresh).
2026 Road Safety Action Plan (NSW Government, 2022)	The proposal delivers value in four of the five key priorities: • Creating safer country roads (Priority 1): improving rural intersections by treating intersections with fully controlled turns, including provision of left and right- hand turn lanes. • Enhancing road safety in local communities (Priority 2): deliver local-led solutions to road safety problems by embedding local stakeholder insight in the business case development process. • Increasing the safety of light vehicles, heavy vehicles (Priority 3): provision of PBS 2B access improves road safety for heavy vehicles, while simultaneously reducing the number of lower classed vehicles required to carry the same amount of freight. • Making safer choices on our roads (Priority 4): provision of additional overtaking lanes and turning lanes to reduce risky road behaviour.

Future Transport Strategy (Transport for NSW, 2022)	The proposal delivers value in the following strategic directions: • Connectivity is improved across NSW (C1) • Connect our regional cities, centres, towns and villages (C1.2) • Facilitate efficient freight connectivity and access (C2.4) • Deliver strategies to achieve ambitious safety targets (C4.1) • Promote safe behaviours (C4.2) by increasing the number of overtaking lanes, preventing risky behaviour. • Deliver infrastructure safety treatments on regional roads (C4.6) • Plan and monitor for shocks and stresses (P5.2) and build and upgrade for shocks and stresses (P5.3), by allowing the Golden Highway to be a reliable alternative route for freight and passenger travel to and from Newcastle. • Improve freight efficiency, access and reliability on roads (E1.1) • Increase rail freight capacity and reliability (E1.2) • Optimise the use of strategic road network (E2.4) as the Golden Highway is a key conduit for freight and passenger movements to and from Newcastle. • Improve access and experiences in the visitor economy (E3.1) • Reduce cost pressures by enhancing spending efficiency (E4.2) through the proposals extensive stakeholder engagement targeting the most effective infrastructure improvements.
NSW Freight and Ports Plan 2018-2023 (Transport for NSW, 2018)	The proposal is aligned with all five stated objectives, and the following underlying actions: Objective 1: Economic growth • Enhancing productivity through investment in freight infrastructure. Objective 2: Efficiency, connectivity and access • Improve safety and efficiency. • Improve travel times and reliability. • Boost the efficiency of the rail network and trade gateways, including the Port of Newcastle • Increase use of safer and more productive vehicles, by allowing PBS 2B access on the Golden Highway. Objective 3: Capacity • Make capacity boosting investments in the rail freight network by improving the capacity of east-west movements. • Improve the road network through projects targeted at supporting key freight routes, including the Golden Highway. Objective 4: Safety • Reduce fatalities and serious injuries from crashes involving heavy vehicles or light trucks. Objective 5: Sustainability • Improving freight sustainability outcomes by improving productivity, utilising trucks of PBS 2B class.

Planning Reform Action Plan	The Government is also committed to supporting supply chain development through improving assessment timeframes for mining projects and reducing red tape through execution of the Planning Reform Action Plan. They will ensure critical minerals are a key consideration in any investment, energy or related strategy developed by the NSW Government.
Critical Minerals and High-Tech Metals Strategy	The NSW Government has committed to supporting the growth of the critical mineral industry through investment in exploration, mining, processing, downstream industries, and recycling. Their Critical Minerals and High-Tech Metals Strategy includes four key actions: 1. Establish Australia's first Critical Minerals Hub in the Central West. 2. Promote exploration for critical minerals resources. 3. Activate the industry through proactive development of supply chains. 4. Attract investment for critical minerals resources, downstream processing, and recycling. In September 2023, the Government announced consultations were beginning to develop a new Critical Minerals and High-Tech Metals Strategy.
Net Zero Industry and Innovation Program	The Government has invested $750 million via the Net Zero Industry and Innovation Program to drive demand in technologies requiring critical minerals. Investments in the Central West Renewable Energy Zone (CWO-REZ) will combine renewable energy generation such as wind and solar, battery storage and high voltage poles and wires to deliver reliable energy.
Special Activation Precincts	The NSW Government through Special Activation Precincts (SAP) will support the development of downstream industries for critical minerals, including the defence and aerospace industries located within the Newcastle area. Similarly, through investment in the Parkes SAP, Government hopes to support development in advanced manufacturing, with fast-tracked planning approvals for complying development, environmental approvals, and a dedicated investment concierge to support businesses to relocate or set up in Parkes.

Regional	
Central West and Orana Regional Transport Plan (Draft) (Transport for NSW, 2021)	The proposal is aligned with the following objectives: • Improve multi-modal connectivity within the region (Objective 2) and beyond the region (Objective 3) • Proactively address road safety issues across the Central West and Orana (Objective 4) • Enable appropriate freight connections to Inland Rail, Special Activation Precincts and major freight hubs (Objective 13), by reinstating the Maryvale-Gulgong line and upgrading the Gulgong-Ulan line. • Expand the High Productivity Vehicle (HPV) Network across the Central West and Orana (Objective 14), by expanding access to PBS 2B class vehicles. • Strengthen connections to major freight destinations beyond the region (Objective 15), with the Golden Highway being a key route to Newcastle.
Hunter Regional Transport Plan 2041 (Draft) (Transport for NSW, 2021)	The proposal is aligned with the following objectives: • Improve connectivity between key centres and towns within the region (Objective 1) • Improve multimodal connectivity beyond the region (Objective 2) • Proactively address road safety deficiencies and high-risk sections on the road network and address crash clusters across the Hunter (Objective 4) • Strengthen freight connections to Williamtown Special Activation Precinct (SAP), Newcastle Port and major freight generating precincts (Objective 14), with the Golden Highway as a key access route. • Provide a more productive freight network within the region (Objective 15) • Build greater resilience into the transport network (Objective 17).

Golden Highway Corridor Strategy (Transport for NSW, 2016)	The proposal closely aligns with the Golden Highway Corridor Strategy, highlighted as a key priority in the NSW State Infrastructure Strategy 2014. It will address several of the key objectives of the strategy, including: • Improve travel efficiency for local and regional road users by providing adequate overtaking opportunities. • Improve the efficiency of freight movements to support agricultural and mining activity. • Enable access for Higher Productivity Vehicles (PBS Class 2B) • Improve access to and from major regional facilities, as well as between existing and developing residential and commercial areas. • Minimise disruption to road users resulting from planned and unplanned road closures, recognising the needs of isolated communities and those sections of the route which have no alternative access. • Progressively upgrading the highway to ensure that the corridor remains fit for purpose and can continue to accommodate restricted access vehicles while optimising safety, efficiency and reliability • Reduce fatalities and serious injuries by upgrading sections of the corridor with poor road safety history. • The proposal also resolves unmet standalone targets that were highlighted for short-term upgrades, including: • Improving the four remaining level crossings to PBS 2B standard, with all being widened and one adding boom gates. • Provision of overtaking lanes, where the lack of overtaking lanes and steep grades causes localised queuing. • Enable access for Performance Base Standards (PBS) Class 2B heavy vehicles of up to 30 m in length. • Bridge widening and upgrade, including: – Cockfighter Bridge over Wollombi Brook, assessed as 'poor' under the Bridge Health Index – Krui River Bridge, which is 6.0m wide, compared to the recommended 8.4m width. • The proposal also resolves unmet standalone targets that were highlighted for medium and long-term upgrades, including: • BAL and BAR treatment of noted left- and right-hand turn lanes • Constructing additional overtaking lanes east of Denman, and eastbound and westbound climbing lanes between Denman and Dunedoo where heavy vehicle performance is affected. • Widening of 14 smaller bridges to a width of 9m.

Local Government	
Dubbo Transportation Strategy 2020 (Dubbo Regional Council, 2020)	The strategy highlights the continued population growth expected for Dubbo and surrounds, which the proposal will support by offering improved access to services and safer, more efficient linkage to Newcastle. It will also improve freight efficiency of fast-moving consumer goods into the city.
Dubbo Local Strategic Planning Statement (Dubbo Regional Council, 2020)	The proposal aligns with the following priorities: • Support for the growth and development of Dubbo as a mining services centre for the Orana and Western NSW (Plan Priority), allowing for the safe and efficient import of mine equipment, processing inputs and export of metals and minerals. • Continue to grow and develop agribusiness, transport and logistics and recognise the importance of these sectors to the regional, State and national economy (Plan Priority) • Quality freight, transport and infrastructure networks (Goal 3) • Improve freight connections to markets and global gateways (Plan Direction) • Plan for the infrastructure needs of an expanding population including the Newell and Golden Highways and their relationship with continued economic development (Plan Priority) • Establish the regional city of Dubbo as a centre of excellence for health care, social assistance and community services to support people within and beyond the region (Plan Priority).
Mid-Western Regional Strategic Planning Statement (Mid-Western Regional Council, 2020)	The proposal aligns with the following priorities: • Identify resources and infrastructure required to drive investment and economic growth in the Region (Planning Priority 8) • Develop a regional transport network in partnership with government agencies, that grows with the needs of residents and businesses (Planning Priority 10).
Warrumbungle Shire Council Community Strategic Plan 2022/2037 (Warrumbungle Shire Council, 2022)	The proposal aligns with the following strategies: • Road priority strategy supports the ability of productive landowners to get produce to markets (LE1.2).

2.4 Expected Outcomes

Table 3: Expected outcomes, their direct and indirect benefits, and their beneficiaries

Area	Outcomes	Direct Benefits	Indirect Benefits	Beneficiaries
Economic	Improved freight efficiency and reliability through a combination of bridge widening, increased overtaking lanes, extension of overtaking lanes and improved intersections.	Vehicle travel time is expected to be reduced by 30%. Vehicle operating cost savings, expected to be reduced by 35% through a reduction in fuel consumption. Crash cost reduction of 0.1%. Reduction in road fatalities of 0.01%. Creation of 200 jobs during the construction phase.	Stimulated economic activity and profitability. Enhancing the Orana and Hunter region's investment prospects and competitive edge. Providing a reliable and resilient vital link to other town centres within the GHC and beyond for local and regional traffic and supports the livelihood of several communities. This is highlighted by the variety of traffic types, ranging from heavy vehicles, commuting traffic, local traffic, tourism etc. Reliability is achieved by providing capacity that allows consistently acceptable performance levels.	Productivity of business and individuals is increased through a reduction in travel time. Improved competitiveness of regionally based businesses that rely on the timely and cost-effective delivery of freight. Workforce through creation of jobs.
	Improved resilience and efficiency through upgrade of the load capability of the Golden Highway to PBS2B standard through improvements to 4 rail level crossings.	Movement of PBS2B rated trucks increases by 25%. Increased load capacity per freight movement by 20%. Reduce the number of truck movements per '000 tonne of freight through increased capacity of trucks by 15%.	Improved network resilience as the Golden Highway is used as an alternative trade route in periods of degraded operations on rail or alternative highway networks arising from breakdown, fatality or natural disaster. Improved flexibility across the multi-modal transport network between the Orana and Hunter Regions.	Productivity of business and individuals is increased through a reduction in travel time. Improved competitiveness of regionally based businesses that rely on the timely and cost-effective delivery of freight. Workforce through creation of jobs.

Area	Outcomes	Direct Benefits	Indirect Benefits	Beneficiaries
Social	Reduced traffic delays through a combination of bridge widening, increased overtaking lanes and improved intersections.	The probability against an AADT count of 3,000 that some vehicles will be delayed more than 5 minutes is reduced from 35% to 15%. Increased average speed of traffic flow by 10km per hour.	Regional connectivity will be improved. Better access to workplaces, essential services, recreational activities. Reduction in major disruptions from post-crash road closures.	Business operators, and residents of the communities that access the Golden Highway for work, recreation and business. Safer travel conditions for workers community to and from work.
	Improved safety through a combination of bridge widening, increased overtaking lanes, extension of overtaking lanes and improved intersections	Reduction in crash rates by 0.1% Reduction in road fatalities by 0.01%	Quality of life for rural residents will be improved, enhanced by safer road conditions and reduced congestion. Facilitation of increased tourism flows between the Orana and Hunter regions.	Business operators, and residents of the communities that access the Golden highway for work, recreation and business. Safer travel to work conditions for workers.
Environmental	Contribute to a reduction in carbon emissions through improved freight efficiencies.	Reduce carbon emissions of freight vehicles. Increase load per trip.	Contribute to Australia's emissions reduction targets.	Community. Australian government emissions reduction targets to 2030.
	Efficient rollout of the Renewable Energy Zone.	Improving the likelihood of timely construction of projects in the Central West-Orana Renewable Energy Zone, which is anticipated to add 6 GW of renewable energy capacity to the network by 2038 if delivered on time.	Proponents of wind and solar power stations use the Golden Highway as a supply route for personnel, equipment and machinery.	Community. CWO-REZ construction companies. Australian Government emissions reduction targets to 2030.

2.5 Stakeholder and Community Support

2.5.1 Outline and Objectives

Outline

The overall level of community support for the proposal is considered high. The proposal has been developed through iterative consultation processes, including:

- A Project Reference Group (PRG) – the PRG consisting of 15 business and community leaders met monthly to discuss insights and initiatives
- Stakeholder Engagement – Processes and Report - Further information on stakeholder engagement activities and their findings are detailed in the Stakeholder Engagement Report.

Objectives

The Stakeholder Engagement included the following agreed objectives:

- Gain an understanding of community and commercial views and suggestions as to the preferred mode of freight transport, infrastructure barriers, risks and opportunities across the Orana and Hunter regions.
- Identification of potential network efficiencies, priority infrastructure upgrades and essential safety improvements
- Active engagement with a broad cross section of local communities and businesses to ensure their input, insights, needs and concerns are considered and recorded as supporting evidence for subsequent business case development.
- Develop a broad understanding the Regions' preferred mode of freight transport, infrastructure rationalisation or development goals, barriers to delivery and broad commercial and community opportunities.
- Identify the potential for short- and medium-term network efficiencies, pressing infrastructure upgrade requirements and essential safety improvements.
- Maintenance of ongoing engagement and feedback with stakeholders to support and clarify the business case development.

Consultation Activities Undertaken

A series of meetings were organised with the key stakeholders to delve into company, departmental or community freight requirements. The stakeholder selection and insights collected were agreed with a Project Reference Group, which consisted of 15 community and business leaders consulted monthly.

If this Business Case for Improvement is progressed, it is recommended that the relevant state bodies embed complementary stakeholder consultation processes in all phases of development, construction and maintenance.

2.5.2 Key Stakeholders

The key stakeholders who provided insights into the Stakeholder Engagement Report are outlined below.

Table 4: Key stakeholders

Stakeholder	Type of Entity	Sector
Australian Food and Fibre	Business	Large Ag Corporate
Maas Group	Business	Construction
ACE Energy	Business	Energy
Squadron Energy	Business	Energy
Inland Petroleum	Business	Fuel
Fletcher International Exports	Business	Large Ag Corporate
Grain Corp	Business	Large Ag Corporate
Manildra Flour Mill	Business	Large Ag Corporate
Robinson Grain Trading Co	Business	Large Ag Corporate
QUBE Agri	Freight	Large Ag Corporate
Energy Co	Government	Local Government
Maverick Biosciences	Business	Manufacturer
Alkane Resources	Business	Mining
Australian Strategic Materials	Business	Mining
CSA Mine (Metals Acquisition Ltd)	Business	Mining
Endeavour Mine (CBH Ltd)	Business	Mining
Hera Mine (Aurelia Metals)	Business	Mining
Peak Gold Mine (Aurelia Metals)	Business	Mining
Port of Newcastle	Freight	Export Import
Sunrise Energy Metals	Business	Mining
Tritton Copper Mines (Aeris Resources)	Business	Mining
Australia Post	Government Business	Postal service
Pacific National	Freight	Rail freight
Aurizon	Freight	Rail freight
Bright Mark	Business	Recycling
Coles	Business	Retail
Woolworths/Primary Connect	Business	Retail
QUBE Logistics	Freight	Road freight
SSR	Freight	Road freight
Australian Peak Shippers Association	Association	Shipping
Transport for NSW	Government	State Government

2.6 Key issues/concerns and proposal adaptation

Table 5: Insights from Stakeholder Engagement

Insight	Description	Proposal Adaptation
Current Freight Insights	There is a broader variety of commodity groups in the Orana Region than what is represented in the Transport for NSW (TfNSW) current freight volumes, including fuel, mining inputs, and mineral concentrate.	These insights highlight the necessity for regional preparedness and the development of infrastructure on the Golden Highway. The projects indicated have been prioritised based on contribution to increased freight efficiency to accommodate this demand.
Future Freight Insights	An 11% increase in mineral concentrate for bulk export is anticipated from the Bourke/ Cobar/Coonamble region over the next five years, however there is no growth indicated by TfNSW. Pre-construction mines in the Dubbo region are not included in TfNSW freight volumes estimates, resulting in an underestimation of imports for mining inputs and equipment, and export of mineral concentrate from the region. Stakeholder consultation indicated an overall 17% increase in commodity volumes from the Orana Region, with 6% growth indicated by TfNSW.	
Freight Movements	Throughout the peak construction phase of Spicers Creek Wind Farm, which spans two years, it is projected that daily traffic movements will encompass 590 light vehicle trips, 106 heavy vehicle trips, and 12 OSOM daily vehicle trips.	The proposal includes overtaking lanes, narrow bridge upgrades, and right- and left- hand turn lanes to reduce disruption to vehicle movements and allow for more safe and efficient over-size over-mass movements.
Heavy Vehicle Approvals - PBS 2B	The approval of PBS 2B classed heavy vehicles would significantly improve freight efficiency on the Golden Highway. Four level crossings prevent PBS 2B vehicles traveling on the Golden Highway between Newcastle and the Orana Region. The Denman Bridge currently imposes restrictions on PBS 2B vehicles, preventing them from exceeding their general mass limit and limiting oversize movements to specific width and height dimensions.	Upgrades are included on four level crossings, allowing PBS 2B vehicles to travel along the Golden Highway from Dubbo to Newcastle. Denman Bridge Bypass will be constructed to PBS 2B standard.

Insight	Description	Proposal Adaptation
Golden Highway Pinch Points	The lack of passing lanes between Merriwa and Dubbo, 24-hour heavy vehicle traffic in the main street of peaceful communities of Dunedoo and Merriwa, and various rail crossings, overhead power lines and narrow bridges on the highway that pose challenges for OSOM movements, have all been identified. The highway has several problematic intersections, a lack of turn off lanes and tight bends that need realignment or straightening.	The locations have been assessed by The Stable Group. While heavy vehicle traffic in Dunedoo and Merriwa and overhead power lines are noted, they fall outside of the main scope of the proposal. The upgrades included in the proposal will address the remaining issues with a carefully selected scope of work.

3. Analysis of the Proposal

3.1 Objectives and Indicators

The problems the proposal intends to address, proposal objectives to achieve this and their success indicators are outlined in the below table.

Table 6: Proposal Objectives and Indicators

Area	Key Problem/Issue	Key Proposal Objectives	Key Success Indicator
Economic	Failing to deliver freight efficiency over time if the base case is maintained due to predicted increasing quantity of general freight flow and OSOM vehicles using the Golden Highway causing disruption to traffic flow and congestion.	To improve freight efficiency through the proposed improvements to the Golden Highway which aim to improve traffic flow and reduce congestion.	• Freight efficiency is improved. • Improvements accommodate the increased traffic flow. • Congestion due to OSOM movements is reduced. • Reduction in down time due to crashes.
	The Golden Highway is not fit for purpose for trucks at PBS2B standard. The larger trucks cannot be used if the road does not meet the PBS2B standard for moving general freight between the PoN and western NSW causing failure to deliver potential freight efficiency.	To upgrade the load capability of the Golden Highway for PBS2B standard trucks along the length of the Golden Highway.	• Upgrade the Golden Highway to PBS2B standard. • Increase load capacity per freight movement. • Reduce the numbers of truck movements per '000 tonne of freight through increased capacity of trucks.

Area	Key Problem/Issue	Key Proposal Objectives	Key Success Indicator
Social	Traffic delays - increasing number of OSOM movements due to the development of the CWO-REZ and mining projects are increasing the delays, congestion and disruption to regular traffic flow	To reduce traffic delays through proposed improvements to the Golden Highway which aim to improve traffic flow and reduce congestion.	• Reduced traffic delay. • Reduced disruption to community travel through congestion caused by OSOM vehicles.
	Road safety issues - safety performance is assessed as marginal due to a combination of narrow pavements, poor ride quality and a significant lack of overtaking opportunities. This situation is exacerbated by several very narrow bridges. Crashes and road deaths have a deep and extensive impact on people living in regional communities	Improve road safety through proposed improvements to the Golden Highway which aim to improve traffic flow and reduce congestion beyond the base case.	• Reduce risky driving behaviour resulting from reduced frustration at traffic delays. • Reduce crash rates. • Reduce road deaths.
Environmental	Australia's target to reduce emissions by 50% by 2030 and to net zero by 2050 needs every aspect of the economy to reduce carbon emissions.	Reduce carbon emissions of freight vehicles.	• Increase load per trip. • Improved freight efficiencies through reduction in travel time.
	Transport inefficiencies and blockages will delay the rollout of the CWO-REZ.	Improving the likelihood of timely construction of projects in the Central West-Orana Renewable Energy Zone, which is anticipated to add 6 GW of renewable energy capacity to the network by 2038 if delivered on time.	• Increase load per trip. • Improved freight efficiencies through reduction in travel time.

3.2 The Base Case

The Base Case describes the Golden Highway Corridor as a freight linkage and part of the regional transport network. If the project doesn't proceed, the Base Case assumes that the **current transport network and modes will continue on a "business as usual basis**" for the evaluation period to 2061 in this current condition.

NOTE: The Main West and Hunter networks are insufficiently interdependent primarily due to Newcastle being currently unable to provide an alternative destination to Port Botany.

Current transport networks available include:

- Road transport by the **Great Western Highway (A32) to Sydney, including access to Port Botany**. This road passes through the Blue Mountains. The section from Katoomba to Hartley, at the foot of Victoria Pass is narrow and winding and subject to frequent interdiction, mostly from crashes, but also from natural events including bushfires and extreme rain.
  - **Rail transport by the Main Western Line over the Blue Mountains to Sydney**, including port access. The Main West Railway suffers from low freight reliability and resilience thus adversely affecting efficient movement through the network. This rail system is subject to frequent interruption from weather events and is compromised by the high proportion of passenger trains which are legislated as the priority on the network. Freight trains using this route are limited by the train management limitations in and at the entrance to Port Botany. Freight train reliability on this system is reported as poor, with up to 70% of trains missing their slot times. This situation is exacerbated by human incidents on the metropolitan passenger network, where some or all services may be suspended for a period. Freight trains will be held until the passenger timetable is recovered.
  - Road transport via the Golden Highway to the Hunter and Newcastle, including access to the Port of Newcastle. This road in conjunction with the eastern end of A15 links Dubbo with Newcastle. It carries a relatively high proportion (30%) of heavy vehicles. It features very few overtaking lanes, narrow (some very narrow) bridges and inadequate intersections. It does not serve as a relief route to and from Sydney when A32 is unavailable.
- **Rail transport via the Merrygoen line to Newcastle**. The current 177 km Dubbo – Gulgong (via Merrygoen) rail line to Newcastle is insufficient at 20.25 TAL capacity, requiring shunting at Merrygoen. This results in increased handling times, high incidence of delays, and a consequent reduction in the throughput capacity of the rail line. This impacts the ability of the rail network to serve as an efficient freight corridor between these points, affecting the speed at which goods can be transported from Dubbo to Newcastle and ultimately limiting the competitiveness of the corridor. Once on the Hunter Rail network the operations are mature, primarily delivering coal to Newcastle.

The Base Case **assumes only announced and committed upgrade projects** will be included in the forward program for the Base Case. At the time of publication of this report, there were no published project commitments by Transport for NSW4 on the Golden Highway Road Corridor of relevance to this Business Case, however, there was evidence emerging in the media of TfNSW's intention to improve the intersection at Cassilis which is a Priority 1 project Number I6 in this proposal.

4 https://www.transport.nsw.gov.au/projects/current-projects/golden-highway-upgrades

Programs to address pavement condition and ride quality are assumed to be delivered under the base case within current Major Periodic Maintenance budgets. We are assuming that these budgets and funds will be refreshed adequately to maintain the pavement condition up to the required minimum performance standards.

Constraints are noted in the Base Case which restrict increasing capacity of the Golden Highway and include:

- **Poor Pavement Condition:** Apart from some short sections of recent reconstruction, pavement condition is generally poor; not only due to the flooding rains of 2022 but also due to the rising proportion of heavy vehicles in total traffic and the increased mass of many heavy vehicles since the road was designed. High heavy-mass frequency and wet conditions invariably cause pavement damage.
- **Unsafe Ride Quality:** Current pavement condition generates significant oscillation in higher and heavier vehicles thus increasing the kinematic envelope beyond that underpinning the assumptions adopted for road and bridge design. This is a safety issue.
- **Underfunded Road Maintenance:** Road maintenance is generally underfunded in NSW. This situation is exacerbated by severe weather events, where urgent repairs have the effect of disrupting planned maintenance and upgrades. Repairs may be classified as minor routine maintenance or short section reconstruction, such as would be necessary if the subgrade requires reforming. Major road reconstruction and maintenance in NSW after the 2022 weather events has consumed all of maintenance budgets and most of grant funds released by governments.
- **Standard base inclusion approach to sectional reconstruction** which can be expected to cost approximately $0.7 million per kilometre for generally flat to undulating terrain. This cost rises sharply with larger culverts and water crossings. The average rate per km would change slightly downwards for larger sections and more sharply upwards for shorter sections.

The Base Case assumes **the current estimated total road freight task utilising the Golden Highway Corridor between Dubbo and the Hunter region including Newcastle is approximately 1 million tonnes per annum for all commodities inbound and outbound.** It is estimated that 62% of volume is outbound freight from the region, while 38% is inbound freight. The road task includes grain and cotton, fuel, and mining inputs such as grinding media and general freight between Orana and Newcastle.

The Base Case assumes **there will be significant increase in total demand for freight transport** by 2033 along this Golden Highway Corridor from 2.5Mtpa to 6.3Mtpa (road and rail). Both the size of the task and its components will significantly alter over the next decade; with a shift from agriculture prominence to mining and mining inputs dominating the demand. By 2033, mining inputs are likely to account for over 34% of all volumes being transported.

Additionally, **an extensive intra-regional freight task will persist**, characterized by movements of grains and livestock from farms, distribution from local wholesalers to farms, commercial enterprises, and construction activities. Given the relatively short distances and smaller consignments associated with these flows, road transportation will continue to dominate the scene.

Looking ahead to 2050, there is a notable transformation in the freight dynamics of the study catchment area utilising the Golden Highway Corridor. **Base Case Projections to 2050** indicate:

- A future freight task of approximately 6.3 million tonnes per annum, encompassing both inbound and outbound volumes to and from the catchment area.
- A significant shift away from agricultural dominance is evident, with mining production and related inputs such as reagents and grinding media escalating in volume.
- The reliance on road transport, especially for short-distance and smaller consignment flows, is expected to persist, while the challenges and opportunities associated with rail transportation will continue to be shaped by its proximity to freight generators.
- Assuming both PBS 2B classification and upgraded rail capability has been achieved on the entire Golden Highway and rail corridor the current transport mode share prevail it would result in a potential 83% increase of heavy vehicle movements on sections of the Golden Highway between Dubbo and Denman.
- Should a rail upgrade to 25TAL not be attained on the Dubbo Newcastle Line via Merrygoen, or via the Maryvale Gulgong Ulan line, there is a risk that volumes forecast for rail transport are likely to gravitate to road thereby exacerbating the increase in heavy vehicle movements.
- Central-West Orana Renewable Energy Zone (CWO-REZ) necessitates the transportation of not only personnel but also substantial components for renewable energy infrastructure from the Port of Newcastle. The transportation of oversize and over-mass components for renewable energy projects not only disrupts the regular flow of traffic but also engenders an environment conducive to heightened risk-taking behaviours among drivers.

Table 7: Total Road Forecast Freight Volumes Golden Highway Corridor (tonnes per annum)

Commodity	2023	2033	2050
Agricultural Input	90,000	90,000	90,000
Fuel	113,200	89,200	89,200
Mine Input	131,400	819,000	819,000
Non-Coal Minerals		20,000	20,000
Other	20,000	70,000	100,000
Agriculture	575,000	669,000	566,500
Grand Total	**929,600**	**1,757,200**	**1,684,700**

3.3 Options Considered

3.3.1 Do-Nothing Option

In a do-nothing scenario, the assets in the pipeline would degrade with the significant increase in freight load. The increased numbers of over-size over mass vehicles in the short term, and freight vehicles in the longer term, on the Golden Highway would degrade the route's service level, likely leading to an increase in crash rates and fatalities.

The Golden Highway itself lacks the capacity to enable reliable and reasonably free flow freight without the proposed projects. It also lacks resilience, as exemplified by the diversions necessary to allow urgent major remedial works on the Denman bridge in 2019. These works required a wide diversion via Wybong Road that could not accommodate heavy vehicles.

This option is not feasible.

3.3.2 Do-Minimum Option – Priority 1 Solutions

While the timely completion of all infrastructure solutions presented in the Golden Highway Study Report (Annex C) should be considered, the projects have been staged in two priority groups to ensure the short-term needs of the Corridor GHC are addressed as soon as practicable:

- Priority 1: Projects that should be constructed in a 5-year timeframe.
- Priority 2: Projects that should be constructed in a 5 to 15-year timeframe.

Therefore, the do-minimum option is those that fall into the 'Priority 1' group.

Priority 1 Infrastructure Solutions

On completion of the Priority 1 Infrastructure Solutions, vehicles of PBS Class 2B would be able to access the Golden Highway from Dubbo through to Newcastle. Additionally, they address the most pressing safety concerns highlighted in the Golden Highway Transport Study (The Stable Group, 2023) and Golden Highway Corridor Study (Transport for NSW, 2016), particularly due to the increase in over-size over-mass movements along the highway.

The do-minimum option includes those projects identified in the Golden Highway Study Report (Annex C) which should be completed in 5-year time frame. These include:

- 4 level crossing upgrades – 3 require protecting and widening, 1 requires widening only.
- 12 overtaking lanes – 6 eastbound, 6 westbound.
- 2 widening of small bridges.
- 1 widening of large bridge.
- 1 duplication of large bridge.
- 1 intersection upgrade.

Four Level Crossing Upgrades

The upgrade of the following level crossings should be prioritised to allow for PBS 2B access along the Golden Highway from Dubbo to the Hunter Expressway.

Table 8. Priority 1 – Level crossing upgrades

Latitude	Longitude	Description	Project Number	Notes
-32.197739	148.729455	Level Crossing Upgrade	LX1	Beni, needs protecting
-32.202414	148.811412	Level Crossing Upgrade	LX2	Ballimore, near Lesslies Road, needs protecting
-32.011943	149.401818	Level Crossing Upgrade	LX3	East Dunedoo, needs protecting
-32.370271	150.690967	Level Crossing Upgrade	LX4	Denman, needs widening

Overtaking Lanes (6 East Bound, 6 West Bound)

On analysis of the route, the following overtaking lanes were identified as those offering the greatest productivity and safety improvements.

Table 9. Priority 1 – Overtaking lanes

Latitude	Longitude	Description	Project Number	Notes
-32.169925	148.974177	Eastbound-Overtaking Lane start	E1	near Spicers Creek
-32.077137	149.547532	Eastbound-Overtaking Lane start	E4	West of Merotherie Road
-32.052651	149.746104	Eastbound-Overtaking Lane start	E6	near Talbragar River
-32.028538	149.954936	Eastbound-Overtaking Lane start	E11	near Four Mile creek
-32.103848	150.120834	Eastbound-Overtaking Lane start	E13	near Krui River, location subject to survey
-32.328607	150.534659	Eastbound-Overtaking Lane start	E16	2km west of Sandy Hollow
-32.631026	151.147602	Westbound-Overtaking Lane start	W1	near Putty Road
-32.359735	150.676983	Westbound-Overtaking Lane start	W4	near Denman
-32.233946	150.483939	Westbound-Overtaking Lane start	W6	near Giants Creek

Latitude	Longitude	Description	Project Number	Notes
-32.113038	150.129761	Westbound-Overtaking Lane start	W9	near Krui River
-32.029019	149.954735	Westbound-Overtaking Lane start	W11	near Four Mile Creek
-32.059071	149.908321	Westbound-Overtaking Lane start	W12	near Ulan Road

Bridge Widening and Duplication (Four Bridges)

The following bridges pose the greatest safety risk and hindrance to over-size, over mass movements.

Table 10. Priority 1 – Bridge widening

Latitude	Longitude	Description	Project Number	Notes
-32.02879	149.954859	Bridge widening - small	B10	over Four Mile Creek, 25m long
-32.09625	150.118455	Bridge widening - large	B11	Collaroy Bridge over Krui River, large bridge, 250m of steep embankment (widen) and 50m bridge (widen)
-32.567102	151.021656	Bridge duplication - large	B18	Cockfighters Bridge over Wollombi Brook, large bridge, 80m long (Note: a better value option may be to construct a new two-lane bridge on a deviation)
-32.227158	148.849219	Bridge widening - small	B2	over Mitchell Creek, 20m long

Intersection Upgrade (One)

The Cassilis Road intersection into Cassilis requires a significant upgrade.

Table 11. Priority 1 – Intersection upgrade

Latitude	Longitude	Description	Project Number	Notes
-32.019673	149.97577	Intersection upgrade	I6	Cassilis (Cassilis Road)

3.3.3 Do-Later Option – Priority 2 Solutions

The do-later option includes the remainder of the projects identified in the Golden Highway Study Report which have been classified as Priority 2. (Annex C). These Priority 2 solutions should be completed in a 5- to 15-year time frame. These include:

- A bypass of Denman, including the construction of one new bridge
- One large bridge – Merriwa Bridge over Merriwa River
- 21 overtaking lanes – 11 eastbound, 10 westbound
- 12 widening of small bridges
- 6 intersection upgrades

For a full list of projects and their locations, see Annex C.

3.3.4 Alternative Improvements Considered

The following options were also considered:

- **Completion of all infrastructure projects listed in Priority 1 and Priority 2** in a 5-year time frame. This option was considered but rejected due to the adverse effects of simultaneous construction of all projects on the service level of the Golden Highway.
- **Priority 3 Projects:** During the Golden Highway Transport Study, several alternative projects were highlighted as a priority in the Desktop Study and Stakeholder Engagement Report to improve safety and efficiency on the Golden Highway. While these projects are important to consider in the longer term (15+ years), further analysis demonstrated the short- to medium- term benefit realisation is maximised through the implementation of the preferred option. The other projects considered Priority 3 Projects (which are not endorsed by this report, not limited to this list) include:
- Shoulders and Bypass:
  - Golden Highway Increasing Shoulder Widths
  - Dubbo Freightway Ring Road Development
  - Merriwa Heavy Vehicle Detour
  - Denman Precinct Upgrade
- Dedicated turning lanes:
  - Golden Highway BAR Treatment at Ringwood Road
  - Golden Highway BAR / BAL Treatment at Westwood Road
  - Golden Highway BAR / BAL Treatment at Reedy Creek Road
  - Golden Highway BAR / BAL Treatment at Idaville Road
  - Golden Highway BAR Treatment at Castlereagh Highway
  - Golden Highway BAR Treatment at Ulan Road
  - Golden Highway BAR / BAL Treatment at Pembroke Road
- Feeder road upgrades:
  - Mitchell Highway Tantitha Road Intersection Upgrade
  - Saxa Road Upgrade
  - Goolma Road Upgrade
  - Gollan Road Upgrade

- Rail improvements: See Business Case 2: Dubbo – Newcastle Rail: Maryvale – Gulgong Reconstruction, Gulgong – Ulan Upgrade
  - Upgrade to Improve Rail Connections around Narromine
  - Dubbo to Toongi Rail Line Upgrade
  - Maryvale Gulgong Rail Line Construction
  - Dubbo to Gulgong via Merrygoen Rail Line Upgrade
  - Gulgong to Ulan Rail Line Upgrade
  - Gulgong to Newcastle Rail Line Passing Loops Upgrade
  - Dubbo to Narromine Line Macquarie River Rail Bridge Upgrade
- PBS 2B Access
  - Golden Highway Dubbo Rail Crossing Upgrade to PBS 2B Standard
  - Mitchell Highway Dubbo Rail Crossing Upgrade to PBS 2B Standard
  - Castlereagh Highway West Dunedoo Rail Crossing Upgrade to PBS 2B Standard
  - Castlereagh Highway Liamena Rail Crossing Upgrade to PBS 2B Standard
  - Castlereagh Highway Mendooran Rail Crossing Upgrade to PBS 2B Standard

3.3.5 Preferred Option

The preferred option is to complete the projects in Annex C in accordance with their prescribed Priority group. This means that Priority 1 is completed within 5 years, and Priority 2 within 5- to 15-years. Detailed staging is to be determined following a thorough assessment of each project, while maintaining the workability of the corridor during construction, and by the asset owner: Transport for NSW, Local Government, or ARTC.

3.4 Information About the Proposal

3.4.1 Scope of Works

Suggested scope of work for Priority 1 and Priority 2 works to improve function and performance include:

- Bridge widening - 4 large bridges (>20m deck length).
- Bridge widening - 14 smaller bridges.
- Overtaking lanes - 33 lanes.
- Improve 7 intersections.
- Improve 4 rail level crossings to PBS. 2B standard.

Location of the Proposal

A Golden Highway Study Report (The Study Report) (See Annex C) was prepared by experienced Engineer and Consultant following a road tour of the Golden Highway where observations and data were obtained. The study area is the Golden Highway between its intersections with New England Highway (A15) near Belford and Boothenba road, 13 km east of Dubbo. The study section is 299km in length.

The road known as the Golden Highway (B84) is a State Road, owned by NSW Government but maintained by Local Government Associations (LGAs) along the route under contract to TfNSW. It is of single carriageway construction and features narrow lanes, including on bridges. The posted speed limit is 100kmh except in built-up areas and in a few particularly narrow sections where the speed limit is reduced accordingly.

The Study Report makes a case for upgrades and some additional considerations on lighter-trafficked highways.

Relevant Design Standards

While the proposal is at the concept stage, it has been developed in line with the following standards:

- *Ref A: Policy and Guidelines for Overtaking lanes, WA Main Roads, updated Dec 2011*. This reference is based on Austroads guidance and makes no departures from them. Austroads is the association of the Australian and New Zealand transport agencies, representing all levels of government. Its Guides, which provide practical advice on the design, management and operation of road transport networks, are globally respected and continually updated.
- Ref B: Guidelines for Global Strategic Rates for project Cost Estimating ILC-MI-TPO-601-Go2, NSW Roads and Maritime Services Aug 2019. This reference provides strategic guidance only on cost estimates. Sounder cost estimates require a reference design, base contemporary cost data appropriately benchmarked and then adjusted for inherent and contingent risk.

Important points relating to the Study Report are outlined below:

Safety: On the Golden Highway, safety performance is assessed as marginal due to a combination of narrow pavements, poor ride quality and a significant lack of overtaking opportunities. This situation is exacerbated by several very narrow bridges.

Traffic Count: 2014 and 2021 traffic counts, although the latter was conducted in a Covid-19 year, indicate annual average daily traffic (AADT) west of Jerrys Plains at 3,000. Over the period, the proportion of heavy vehicles has grown from between 12% and 21% to between 25% and 30%. Note: An updated traffic count for the study area is currently in progress.

Alignment Descriptor: The appropriate alignment descriptor is assessed as "moderately constrained in undulating terrain" (Ref A). Sectional data reveals that the percentage of the route that provides sight distances greater than 900m is 10.8%. Ref A indicates that in this type of terrain, where the percentage is less than 30%, overtaking lanes are warranted, as shown on Table 10.

Traffic Delays: The lack of sufficient overtaking lanes where almost 30% of the traffic comprises heavy vehicles, coupled with the low percentage of sight distances greater than 900m, indicates that the probability against an AADT count of 3,000 that some vehicles will be delayed more than 5 minutes is approximately 35% (Ref A).

Table 12: Indicative Pc (Percentages of sections offering overtaking provision i.e. Sight Distance > 900 m)

Alignment Descriptor	Indicative Pc
High standard alignment in level terrain (less than 10% barrier-lined)	85
High standard alignment in undulating terrain or moderately constrained alignment in level terrain (about 20% barrier-lined)	60
Moderately constrained alignment in undulating terrain (about 40% barrier-lined)	30
Constrained alignment in hilly terrain (greater than 60% barrier-lined)	10

Performance: Provision for Over Size Over Mass (OSOM) on Golden Highway is confined to Class 9 vehicles (B doubles or equivalent). Renewable energy projects approved for the region and in development will generate a strong demand for OSOM movements with few if any route alternatives. This will require the upgrade of rail crossings to PBS 2B standard.

Other factors (Ref A): Where a prima-facie case is not evident to warrant an overtaking lane investment, some other factors could be considered:

- Narrow Seal: Car drivers are reluctant to overtake large vehicles on roads with narrow seal width. On sections of road where this is the primary factor contributing to excessive queuing behind large vehicles, the provision of occasional overtaking lanes may be a more cost-effective solution than general seal widening. The Golden Highway is generally of narrow seal pavement.
- Crash History: An investigation of crash history may help to decide on marginal cases for improvement. For overtaking lanes, particular attention should be paid to crashes associated with overtaking manoeuvres or where crashes may be attributable to slow moving vehicles.
- Percentage of Heavy Vehicles: Construction of passing lanes (sic) should be considered on roads with more than 15% heavy vehicles as defined by Austroads Class 3 and greater. The Golden Highway traffic comprises approximately 30% heavy vehicles.

Quantifiable details including area, length, and capacity

Table 13: Quantifiable details

Scope	Quantifiable Details	Strategic Estimate
Large Bridge widening – Cockfighter Bridge over Wollombi Brook (Warkworth)	• >20m deck length • Recommend duplication: 5m wide x 80m long = 400 sqm • Add 2 x 200m new lanes and earthworks	@$12,500 = $5 million. Est= $1million. Total $6 million
Large Bridge widening – Merriwa Bridge over Merriwa River	• >20m deck length, • Widen by 2.5m, 80m long = 200sqm, • plus approach lanes and earthworks	@ $12,500 sqm plus 25% = $3.125 million: Est $1million. Total $4.125 million
Large Bridge widening Collaroy Bridge over Krui River	• >20m deck length, • Widen by 3m, 50m long = 150 sqm • plus approach lanes and earthworks	@12,500 per sqm plus 25% = $2.34 million Est $1million. Total $3.34 million
Large Bridge widening - Denman bypass over Hunter River	• 3km new road on embankment including 1 incremental launch bridge. • Road including earthworks. • Assume land acquisition not costed	Bridge: $9.5 million Road including earthworks: $12.2 million. Total: $21.7 million
Bridge widening - 14 smaller bridges	• < 20m deck length • Widen by average 2.5 m, 14 no x 18 m long (average)	@ $3,750 per sqm of deck area plus 25% Total: $2.953 million
Overtaking lanes - 33 lanes	• Total of 33 lanes at 1.9km each	@$2.125 lane/km= Total: $133.24 million
Improve 7 intersections requiring 14 lanes	• Assume a total of 2 new lane km at each intersection. • Each intersection would feature a 100m right turn lane from the centre and a 100m passing lane on the near side, plus a 100m left turn lane. • Assume no property acquisition	@$2.125 per lane km Total: $29.75 million

Scope	Quantifiable Details	Strategic Estimate
Improve 4 rail level crossings to PBS2B standard. **ARTC, the rail-track lessee of the Hunter Valley network, and the maintenance contractor on the NSW Country Rail network are understood to be progressing these requirements**	• Widening (all 4) • Installation of boom gates (3 of 4)	Advice from our rail adviser is to include a nominal $1 million per crossing in our estimate. Total: $4m

Disclaimer: Accuracy – Dimensions and distances quoted in this study are estimates only based on visual estimate and some range finding. They are not a reliable basis for design or estimating below the strategic level.

Utility Adjustments or Property Acquisitions

The Denman Bypass will incur an additional cost to Compulsory Acquire, Negotiated Purchase or to Resume the 3km x 60m corridor (20ha) across the Denman Flood Plain. A preliminary analysis of the area has been conducted by a Stable Group consultant well versed in property acquisition and valuation. The full analysis can be found in Annex E.

The proposal requires acquisition from the intersection of Jerry's Plains Road and Denman Road to the rail crossing at Merriwa and Mangoola Roads. Estimates are based on conversations with real estate agents and sales data from RP Data, with a 30% contingency applied to raw costs.

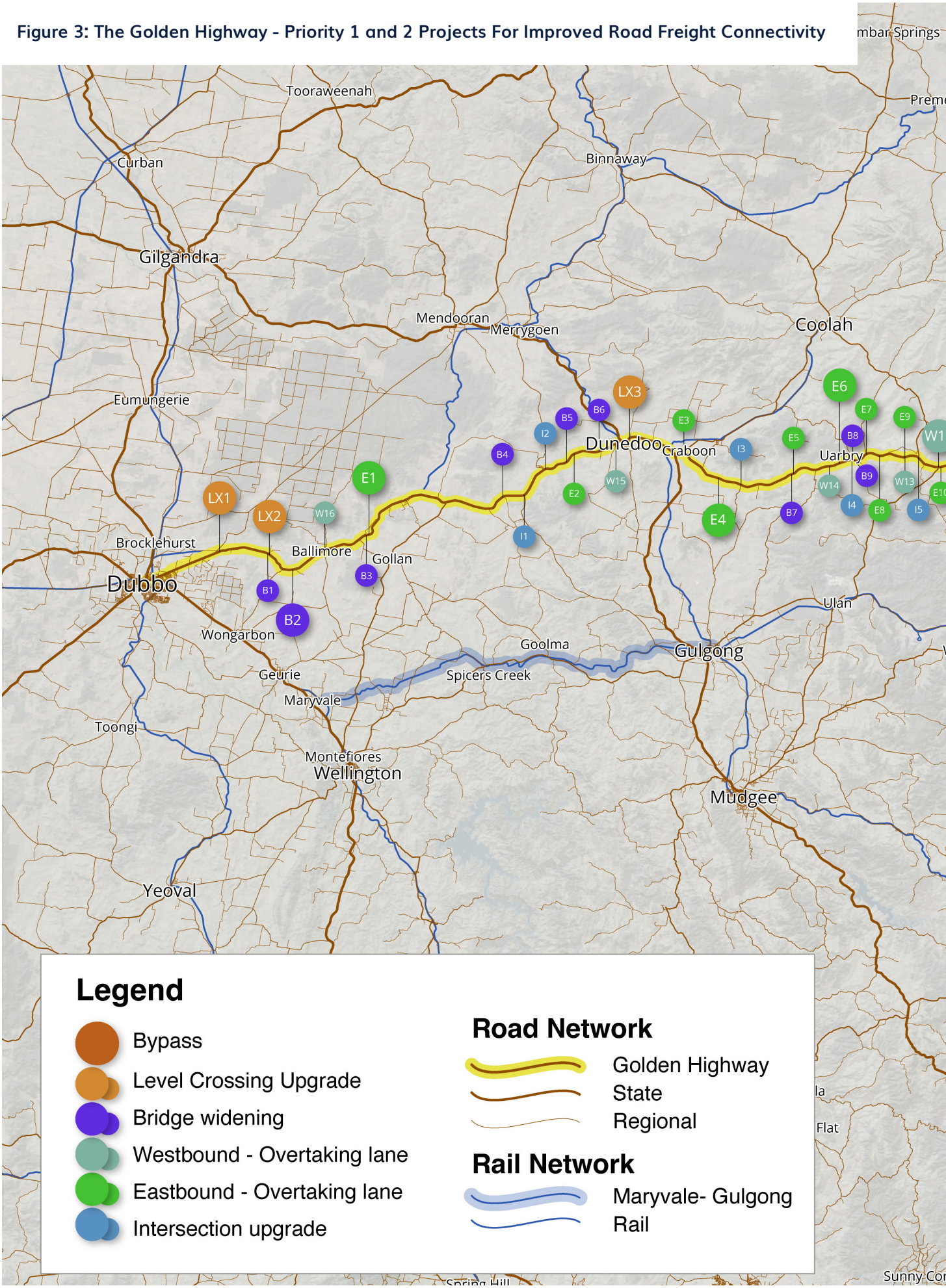
Analysis of the area indicates:

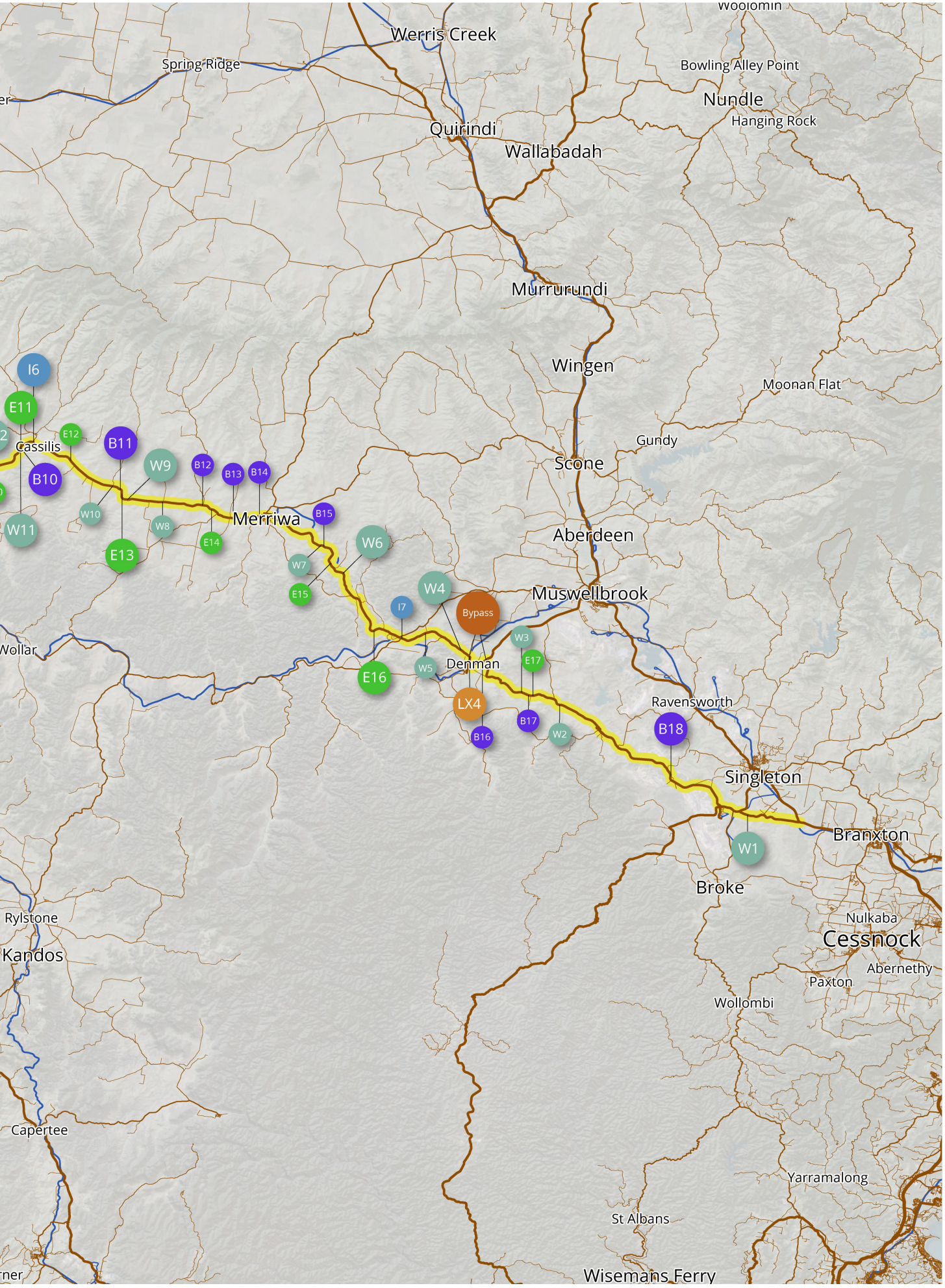
- $50Kpha for larger parcels
- $80-90Kpha for smaller parcels
- Average $75Kpha.

Therefore:

- Road corridor of 20ha: $1,500,000 raw value
- With 30% contingency applied: $1,950,000.

Figure 3: The Golden Highway - Priority 1 and 2 Projects For Improved Road Freight Connectivity



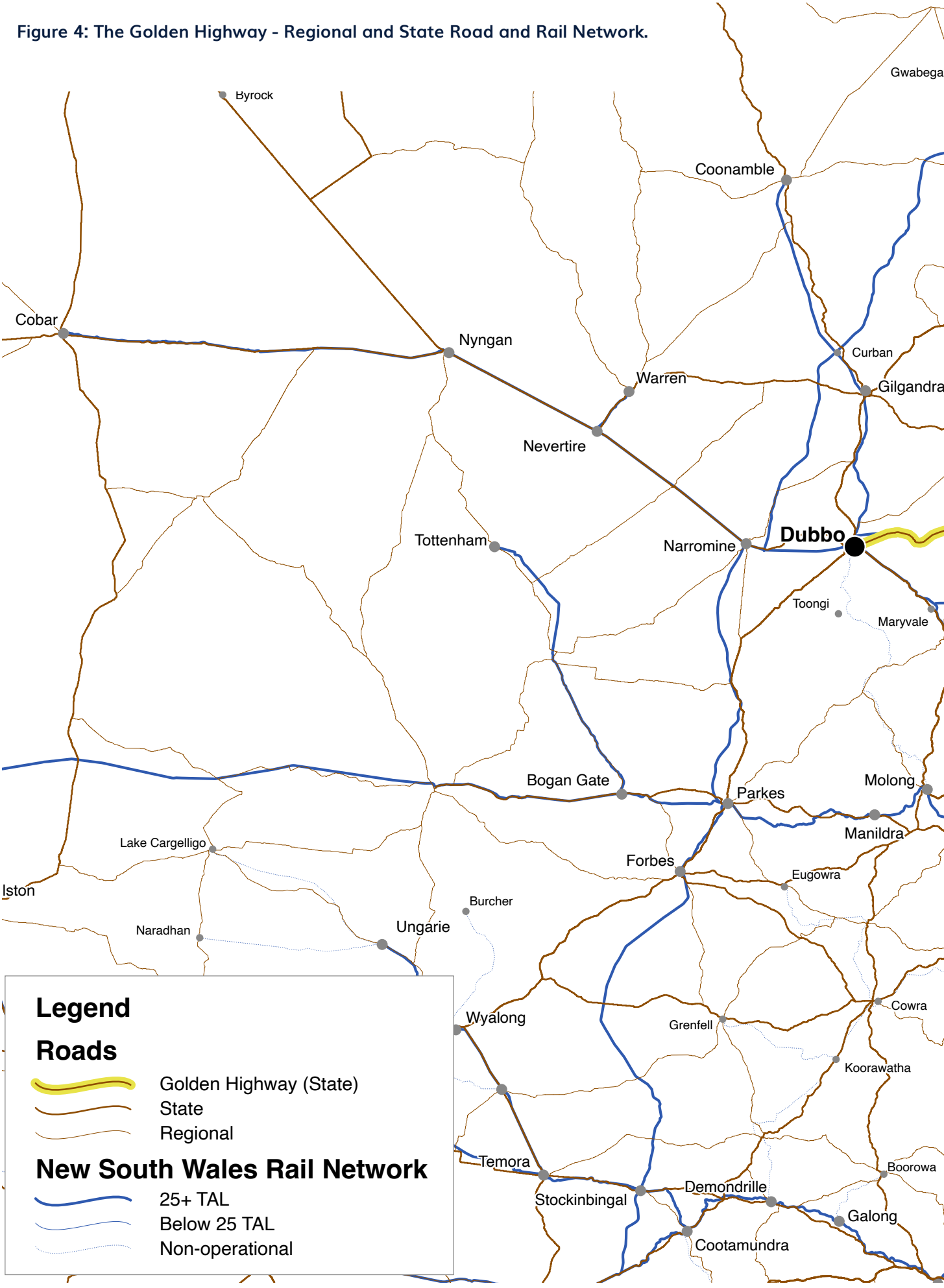

Werris Creek
Spring Ridge
Bowling Alley Point
Nundle
Hanging Rock
Quirindi
Wallabadah
Murrurundi
Wingen
Moonan Flat
Gundy
Scone
Aberdeen
Muswellbrook
Merriwa
Cassilis
Denman
Bypass
Ravensworth
Singleton
Branxton
Broke
Nulkaba
Cessnock
Abernethy
Paxton
Wollombi
Rylstone
Kandos
Capertee
Yarramalong
St Albans
Wisemans Ferry
Wollar
I6
E11
E12
B11
B10
W9
B12
B13
B14
W10
W11
W8
E13
E14
B15
W6
W7
E15
W4
I7
W5
E16
W3
E17
LX4
B16
B17
W2
B18
W1

Legend: The Golden Highway Priority 1 and 2 Projects Map

Label	Type	Size	Location	Latitude	Longitude
Priority 1					
B2	Bridge Widening	Length: 20 m	Mitchell Creek	-32.227158	148.849219
B10	Bridge Widening	Length: 25 m	Four Mile Creek	-32.02879	149.954859
B11	Bridge Widening	Large	Collaroy Bridge – Krui River	-32.09625	150.118455
B18	Bridge Widening	Length: 80 m	Cockfighters Bridge – Wollombi Brook	-32.567102	151.021656
E1	Overtaking Lane – Eastbound		Near Spicers Creek	-32.1699254	148.974177
E4	Overtaking Lane – Eastbound		Near Four Mile Creek	-32.077137	149.547532
E6	Overtaking Lane – Eastbound		Near Krui River	-32.052651	149.746104
E11	Overtaking Lane – Eastbound		2km West of Sandy Hollow	-32.028538	149.954936
E13	Overtaking Lane – Eastbound		West of Merotherie Road	-32.103848	150.120834
E16	Overtaking Lane – Eastbound		Near Talbragar River	-32.328607	150.534659
I6	Intersection Upgrade		Cassilis – Uarbry Road	-32.019673	149.97577
LX1	Level Crossing Upgrade (Protection)		Beni	-32.197739	148.729455
LX2	Level Crossing Upgrade (Protection)		Ballimore – Near Lesslies Road	-32.202414	148.811412
LX3	Level Crossing Upgrade		East Dunedoo	-32.011943	149.401818
LX4	Level Crossing Upgrade (Widening)		Denman	-32.370271	150.690967
W1	Overtaking Lane – Westbound		Near Putty Road	-32.631026	151.147602
W4	Overtaking Lane – Westbound		Near Denman	-32.359735	150.676983
W6	Overtaking Lane – Westbound		Near Giants Creek	-32.233946	150.483939
W9	Overtaking Lane – Westbound		Near Krui River	-32.113038	150.129761
W11	Overtaking Lane – Westbound		Near Four Mile Creek	-32.029019	149.954735
W12	Overtaking Lane – Westbound		Near Ulan Road	-32.059071	149.908321
Priority 2					
B1	Bridge Widening		Plain Creek	-32.200669	148.808806
B3	Bridge Widening	Length: 20 m	Spicers Creek	-32.170797	148.970352
B4	Bridge Widening	Length: 20 m	Sandy Creek	-32.108165	149.193629
B5	Bridge Widening	Length: 25 m	Tucklan Creek	-32.050696	149.298712
B6	Bridge Widening	Length: 15 m	Limestone Creek	-32.033471	149.351568
B7	Bridge Widening		Denis McGrath Bridge – Cainbill Creek	-32.070859	149.667369

Label	Type	Size	Location	Latitude	Longitude
B8	Bridge Widening	Length: 40 m	Piper's Bridge – Talbragar River	-32.047203	149.767434
B9	Bridge Widening		Flood Channel #2 – Talbragar River	-32.047451	149.769763
B12	Bridge Widening	Length: 20 m	Bow Creek	-32.122288	150.253065
B13	Bridge Widening	Length: 10 m	Farm Springs Creek	-32.143534	150.303272
B14	Bridge Widening	Large	Merriwa River	-32.140421	150.346491
B15	Bridge Widening	Length: 10 m	Worondi Creek	-32.189617	150.452291
B16	Bridge Widening		Denman Bridge – Hunter River	-32.379703	150.711817
B17	Bridge Widening		Saddlers Creek	-32.434118	150.787713
E2	Overtaking Lane – Eastbound		Near Clay Gully	-32.037499	149.310855
E3	Overtaking Lane – Eastbound		Near Leadville	-32.035721	149.49065
E5	Overtaking Lane – Eastbound		Near Cainbill Creek	-32.069833	149.670476
E7	Overtaking Lane – Eastbound		Near Tongi Lane	-32.037876	149.789981
E8	Overtaking Lane – Eastbound		Near Carnell Gully	-32.040359	149.811457
E9	Overtaking Lane – Eastbound		Begin Sawpit Creek	-32.042763	149.853236
E10	Overtaking Lane – Eastbound		Near Ironbark Creek	-32.058774	149.91196
E12	Overtaking Lane – Eastbound		Near Borambil Creek	-32.048824	150.036885
E14	Overtaking Lane – Eastbound		Near Ringwood Road	-32.129033	150.267564
E15	Overtaking Lane – Eastbound		Near Battery Rock	-32.217758	150.46346
E17	Overtaking Lane – Eastbound		Near Saddlers Creek	-32.43525	150.795114
I1	Intersection Upgrade		Spring Ridge Road	-32.104755	149.229146
I2	Intersection Upgrade		Cobbora Road	-32.062225	149.263758
I3	Intersection Upgrade		Merotherie Road	-32.088057	149.584397
I4	Intersection Upgrade		Church St – Entrance To Uarbry	-32.047203	149.766174
I5	Intersection Upgrade		Vinegaroy Road	-32.042947	149.875237
I7	Intersection Upgrade		Bylong Valley Way and Wybong Road	-32.340909	150.580432
W2	Overtaking Lane – Westbound		Near Hollydene Estate	-32.450238	150.839345
W3	Overtaking Lane – Westbound		Near Godolphin	-32.429689	150.77694
W5	Overtaking Lane – Westbound		Near Reedy Creek Road	-32.332702	150.619051
W7	Overtaking Lane – Westbound		Near Worondi Rivulet	-32.188617	150.447111
W8	Overtaking Lane – Westbound		Near Glenroy Road	-32.117216	150.187369
Proposed Denman Bypass					
Bypass	Denman Bypass – Eastbound Entry Point			-32.37038	150.691187
Bypass	Denman Bypass – Eastbound Exit Point			-32.376523	150.718782

Figure 4: The Golden Highway - Regional and State Road and Rail Network.




Barraba
Armidale
Gunnedah
Tamworth
Werris Creek
Gap
Binnaway
Merrygoen
Coolah
Dunedoo
Cassilis
Elong Elong
Merriwa
Gollan
Ulan
Muswellbrook
Goolma
Gulgong
Sandy Hollow
Denman
Singleton
Mudgee
Maitland
Kandos
Newcastle
Orange
Bathurst
Wallerawang
Lithgow
Blayney
Bowenfels
Tarana
Oberon
Sydney
Port Botany
Menangle
Picton
Crookwell
Wollongong
Moss Vale
Port Kembla
Goulburn

3.4.2 Proposal Exclusions

Excluded from this proposal are:

- Priority 3 Projects listed in Section 3.3.4 Alternative Improvements Considered, as analysis demonstrated the short- to medium- term benefit realisation is maximised through the implementation of the preferred option.
- Projects not situated on the Golden Highway, which may still be related to its efficiency and workability, are not considered in the scope of this proposal.
- Infrastructure required for private projects, such as safety signage for solar farm and wind farm projects.

3.4.3 Related Projects

This proposal is not contingent on the success of other projects, although the cumulative impact of these projects add to the scale of the benefit that will be derived from the upgrades to the Golden Highway.

Stakeholder consultation revealed a projected growth in commodity volumes over the next half-decade suggesting a substantial 17% increase. The study corridor movements will evolve from a majority of agricultural related bulk commodities to that dominated by mining. Specifically, the growth in mining inputs is expected to be in the vicinity of 2.1Mtpa or a 1600% increase by 2033.

This information highlights the importance of regional preparedness and the need for development of infrastructure funding plans to accommodate the future projects that are under construction or in the proposal stage which will require the Golden Highway as their main arterial point of access and egress to the Port of Newcastle.

These include, but are not limited to the following:

- Inland Rail: Ongoing construction of Inland Rail for the Narromine to Narrabri section.
- Central West Orana Renewable Energy Zone (CWO-REZ): with a projected capacity of 6GW by 2038, CWO-REZ wind and solar power stations will require access from Port of Newcastle via the Golden Highway. For example, the Spicer's Creek Wind Farm, with a projected capacity of 700MW, is situated west of Gulgong with road access via the Golden Highway, is set to feature 117 wind turbines. Assuming each turbine requires 8 loads as per the configuration, this will necessitate a total of 936 freight movements. Throughout the peak construction phase, which spans two years, it is projected that daily traffic movements will encompass 590 light vehicle trips, 106 heavy vehicle trips, and 12 OSOM daily vehicle trips.
- Mining projects: Discussions with stakeholders reveal an anticipated 11% increase in mineral concentrate for bulk export from the Bourke/Cobar/Coonamble region over the next five years. Cobar emerges as a significant hub, especially for mining-related commodities, featuring multiple indicators for mining inputs, fuel, and mineral concentrate.
- Mining Projects for the Dubbo region: stakeholder consultations signal the beginning of mining operations at ASM mine near Toongi and the further development of mining exploration and operations near Parkes. This indicates a need for significant volumes of mining inputs imported via the Golden Highway and concentrate for export to the Port of Newcastle.
- Port of Newcastle (PoN): development of a dedicated deep water shipping container terminal for general freight through the PoN combined with demand by emerging rare earth mining projects and the CWO-REZ will see greater demand for the PON facility. In tandem, the demand for Fast Moving Consumer Goods (FMCG) through the PoN is poised for substantial growth, in line with the anticipated population surges within the PoN footprint. For example, by 2061, 11.5 million people will be living in NSW, 40% more people than today. This will significantly impact the PoN's import needs, particularly in construction materials and infrastructure goods, as well as FMCG, to support the expanding urban and residential development within the PoN footprint. Similarly, Australia's population is projected to increase to 37.27 million by 2061. Subsequently, PoN will face a substantial rise in import demands, including energy resources and FMCG, to cater to the needs of an increasingly urbanised population and to sustain economic growth and improved living standards.

- **Agricultural production:** Coonamble, Nyngan, Gilgandra, Narromine, and Dubbo agricultural production play a pivotal role in underpinning the broader economy and would benefit from a more efficient, cost effective and safer network for access and egress to the Port of Newcastle.
- **Parkes Intermodal and Recycling Hub:** Up to 500 ktpa of waste sourced from the Hunter Region has been estimated, which will flow to either the potential Narromine Project or to the Parkes Special Activation Precinct. With indication of up to 1mtpa of waste flowing to the Parkes Precinct from the Sydney Basin along the Main West Line, significant capacity constraints will arise on the already congested Sydney freight network. This proposal offers an alternate freight route, reducing bottlenecks.

As detailed in the Desktop Study, prior studies on the freight task for the Golden Highway overlooked key data and projections for related projects. This led to the current situation where infrastructure doesn't meet the real-time needs. Stakeholder consultation verified that there will be a significant increase in annual freight volumes. As producers in the region have acknowledged, this increase will expose the shortfall in the current transportation infrastructure. If not addressed, the inefficiencies and bottlenecks will cause an increase in freight costs, carbon footprint and pose a risk to safety of commuters on the Golden Highway.

This report and the stakeholder engagement activities identified an urgent need for infrastructure solutions to ensure the efficient movement of freight required for the related projects.

3.5 Projected Costs

3.5.1 Projected Costs: Priority 1 Projects

Table 15: Priority 1 – Projected costs, plus overheads and contingency

Item	Construction cost $ million	Overheads (10%, design (6%), PM (7%), Insurance (1%)	Contingency 60%
Overtaking Lanes (W1, W4, W6, W9, W11, W12, E1, E4, E6, E11, E13, E16)	48.65	11.68	36.20
Large bridges (Warkworth/ Cockfighters Bridge: $6m, Krui River: $3.34m)	9.34	2.24	6.95
Small bridges (Four Mile Creek: $0.211, Mitchell Creek: $0.211)	0.42	0.10	0.31
Intersections (Cassilis – Cassilis Road)	4.25	1.02	3.16
Level crossings (Beni, Ballimore, East Dunedoo, Denman)	4.00	0.96	2.98
Totals	**66.66**	**16.00**	**49.60**
Total			**132.26**

3.5.2 Projected Costs: Priority 2 Projects

Table 16: Priority 2 – Projected costs, plus overheads and contingency

Item	Construction cost ($ million)	Overheads (10%, design (6%), PM (7%), Insurance (1%)	Contingency 60%
Overtaking Lanes	84.59	20.30	62.93
Large bridges excl Denman	4.13	0.99	3.07
Denman bridge (Note: see bypass option)	4.50	1.08	3.35
Small bridges	2.53	0.61	1.88
Intersections	25.50	6.12	18.97
Level crossings	0.00	0.00	0.00
Totals	**121.25**	**29.10**	**90.21**
Total			**240.55**

3.5.3 Projected Costs: All Projects (Priority 1 + 2)

Table 17: Priority 1 + 2 – Projected costs, plus overheads and contingency, escalated to 2024

Item	Construction cost ($ million)	Overheads (10%, design (6%), PM (7%), Insurance (1%)	Contingency 60%	Total (2020)	Escalated Total (2024)
Overtaking Lanes	$133.2	$32.0	$99.1	**$264.3**	**$333.7**
Large bridges excl Denman	$13.5	$3.2	$10.0	**$26.7**	**$33.7**
Denman bridge (Note: see bypass option)	$4.5	$1.1	$3.3	**$8.9**	**$11.3**
Small bridges	$3.0	$0.7	$2.2	**$5.9**	**$7.4**
Intersections	$29.8	$7.1	$22.1	**$59.0**	**$74.5**
Level crossings	$2.0	$0.5	$1.5	**$4.0**	**$5.0**
Nominal Capital Investment	$185.9	$44.6	$138.3	**$368.9**	**$465.7**

Source: Reference B[5], indexed by 25%

Note on Contingencies: Reference B[6] advises: Contingency for strategic estimates that have been derived using typical rates should be in the range of 40-70% depending on the confidence and reliability of the information used in preparing the estimate.

Please note that the Project estimating manual recommends a range of 35-70%. Values in the range 35-40% should be used only if the project has been advanced to concept phase level of development, risk and detail. The contingency chosen is based on the high end of the estimating manual, moderated to 60% as the vast majority of the infrastructure projects are based in the existing road reserve or require an upgrade of existing assets rather than greenfield development.

Project Timeframe and Escalation

Project start: 2025

Duration: up to 10 years if staged, which is likely.

Escalation: rate of 6% pa is suggested. Applied for 4 years escalation is calculated as:

Construction cost, other costs and contingency:	$368.9 m
Escalation 6% over 4 years	$96.8 m
Total estimated cost:	**$465.7 m**

The Denman bypass would add the following costs:

Construction cost, other costs and contingency:	$30.7 m
Total estimated cost:	**$496.4 m**

5 Ref B: Guidelines for Global Strategic Rates for Project Cost Estimating ILC-MI-TPO-601-Go2, NSW Roads and Maritime Services Aug 2019

6 Ref B: Guidelines for Global Strategic Rates for project Cost Estimating ILC-MI-TPO-601-Go2, NSW Roads and Maritime Services Aug 2019

3.6 Cost-Benefit Analysis

The business case presents a strong net positive case for construction and upgrades on the Golden Highway. It is estimated to generate $802 million in benefit over 30 years at a 5% discount rate, generating a benefit cost ratio of 2.3. A nominal investment of $496 million is required, including the Denman Bypass proposal.

The incremental quantified costs and benefits of each option are outlined in the table below:

Table 18: Summary of economic appraisal

	Base case	Option 1 - Road Net to Base Case
	Base case	At 5%
Costs: Present Value ($'M)	-	
• Capital Costs	15.25	370.6
• Operating and Maintenance and Other Costs	95.51	(17.1)
Total Capital and Other Costs	**110.76**	**353.5**
Benefits	0.00	727.6
Residual value	0.00	75.2
Total Benefits	**0.0**	**802.8**
Net/ Net Present Value ($'M)	(110.76)	449.3
Benefit Cost Ratio	**-**	**2.3**

3.6.1 Assessed Net Benefit

This analysis shows that the incremental quantified benefits of the proposal would be a minimum of $449 M to NSW, calculated as a present value over thirty years.

The proposal will deliver 130% more benefits than costs, that is, the benefit cost ratio is about 2.3.

Those net benefits are principally made up of operating savings for freight operators and time savings, as well as some safety and environmental benefits.

Table 19: Benefits

Present Value	Net operating cost/Increased Value of Output	Net Time Saving (Movements times modelled time saving)	Value of time saved	Value of Carbon	Safety	Total
@ 5%	$M	Hours per Base Case return journey (1180km)*				
Direct effect of roadworks	79.7	7.6	98.7	12.8	111.0	302.3
PBS2B standard implementation	95.3	7.9	100.7	20.2	125.5	341.6
Reduced delays during Over Size Over Mass Deliveries	16.4	0.4	3.3			19.7
Induced Demand	28.4					28.4
Logistics Risk	35.6					35.6
Residual	75.2					75.2
Avoided Cost of Road & Bridge Maintenance & Refurbishment	95.5					95.5
Total	**426.1**	**15.8**	**202.7**	**33.1**	**236.5**	**898.3**

These benefits can be matched against the project objectives as outlined in the table below.

Table 20: Benefits by project objectives

Benefit	Outcome Description
Economic	Operating Savings to the freight industry of $191.4 million
Economic	Induced demand in production of $28.4 million
Economic	Supply risk reduction in freight operations of $35.6 million
Social	Time Savings to private motorists and the freight industry of $202.7 million
Social	Safety benefits associated with freight operations of $236.5 million
Environmental	Carbon benefits associated with freight operations of $33.1 million
Economic	Residual value beyond the 30 year evaluation period of $75.2 million

3.6.2 Sensitivity Testing

The net benefits of the preferred option against the base case are positive for discount rates in the range 3 to 7%, ranging from $697M down to $243M.

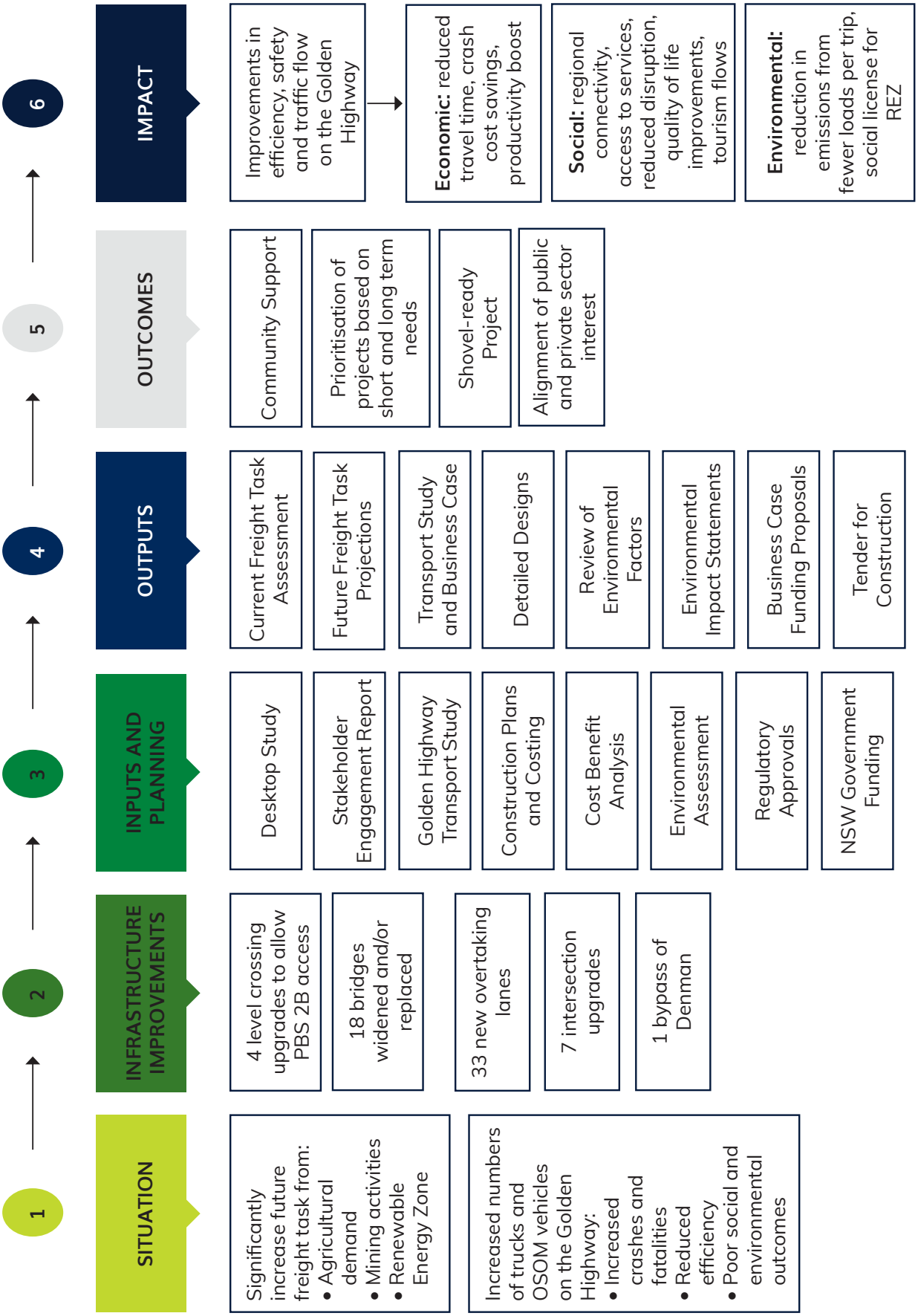
Sensitivity testing for a 15% change in costs or benefits (ie. on top of the 60% contingency on costs already allowed for in the analysis) does not result in a negative net present value to the base case. At the extreme, a 15% fall in benefits and a 15% rise in costs would result in a net present value of $99M.

Table 21: Sensitivity Testing

		Net Present Value @ Discount		
	$ M	**3%**	**5%**	**7%**
Increment to Base Case		697.0	449.3	243.2
Costs Up 15%		616.0	379.7	182.8
Benefits Down 15%		532.7	328.9	159.6
Costs Up 15%/ Benefits Down 15%		451.7	259.2	99.1
Net Present Value Per $ Total Capital Invested		**1.6**	**1.2**	**0.7**

The Net Benefit result is not sensitive to reasonable variation in costs and benefits at discount rates ranging from 3% to 7%.

Figure 5: Benefits Realisation Graph



3.7 Financial Appraisal

The projected total costs in Table 12 have been developed into a schedule according to the preferred option described in Section 3.3.4.

3.8 Capital Cost

3.8.1 Phase 1 – Priority 1 Infrastructure Solutions

Phase 1 of the project is from current year (Year 0, 2023/24) to Year 4 (2028/29, with the project commencing Year 1, 2024/25).

The focus of Phase 1 is completing the Priority 1 Infrastructure Solutions, in order to meet PBS 2B standards to increase the efficient load as quickly as possible and putting overtaking lanes in place for over-size and over-mass operations to the Central West – Orana Regional Energy Zone.

Table 22: Priority 1 – Capital cost schedule

Nominal Capital Costs	2023-24	2024-25	2025-26	2026-27	2027-28	Total
Nominally:	Year 0	Year 1	Year 2	Year 3	Year 4	
Capital Costs						
Overtaking Lanes X 12	$6,321	$12,641	$18,962	$18,962	$18,962	$75,849
Large bridges X 2		$3,513	$3,513	$3,513	$3,513	$14,053
Denman Bridge			$3,522	$3,522		$7,045
Small bridges X 2		$330		$330		$660
Intersections X 1		$6,653				$6,653
Level Crossings X 4		$1,578	$1,578			$3,156
Nominal Capital Investment	**$6,321**	**$24,716**	**$27,576**	**$26,328**	**$22,475**	**$107,416**
Contingency (60%)	$3,792	$14,830	$16,545	$15,797	$13,485	$64,449
Real Total Capital Investment	**$10,113**	**$39,546**	**$44,121**	**$42,125**	**$35,960**	**$171,865**
Escalation	$0	$1,285	$2,687	$3,682	$4,121	$5,586
Nominal Total Capital Investment	**$10,113**	**$40,831**	**$46,808**	**$45,807**	**$40,082**	**$177,451**

3.8.2 Phase 2 – Priority 2 Infrastructure Solutions

Phase 2 commences in 2028 and focuses on building throughput capacity for rising volumes through overtaking lanes and bridge capacity.

Table 23: Priority 2 – Capital cost schedule

Nominal Capital Costs	2028-29	2029-30	2030-31	2031-32	2032-33	Total
Nominally:	Year 0	Year 1	Year 2	Year 3	Year 4	
Capital Costs						
Overtaking Lanes X 21	$31,604	$25,283	$25,283	$25,283	$25,283	$132,735
Large bridges X 1	$3,513	$3,513				$7,026
Denman Bridge						$0
Small bridges X 12	$660	$660	$991	$991	$660	$3,962
Intersections X 6	$13,307	$6,653	$6,653	$6,653	$6,653	$39,920
Level Crossings X 0						$0
Nominal Capital Investment	**$49,084**	**$36,110**	**$32,927**	**$32,927**	**$32,596**	**$183,643**
Contingency (60%)	$29,450	$21,666	$19,756	$19,756	$19,558	$110,186
Real Total Capital Investment	**$78,534**	**$57,775**	**$52,683**	**$52,683**	**$52,154**	**$293,829**
Escalation	$13,619	$12,222	$13,219	$15,361	$17,396	$9,549
Nominal Total Capital Investment	**$92,152**	**$69,998**	**$65,902**	**$68,044**	**$69,551**	**$303,379**

Table 24: Denman Bypass – Capital cost schedule

Nominal Capital Costs	2033-34	2034-35	2035-36	2036-37	2037-38	Total
Nominally:	Year 10	Year 11	Year 12	Year 13	Year 14	
Capital Costs						
Overtaking Lanes						$0
Large bridges						$0
Denman Bridge	$1,950	$12,200	$9,500		$0	$23,650
Small bridges						$0
Intersections			$0	$0		$0
Level Crossings						$0
Nominal Capital Investment	**$1,950**	**$12,200**	**$9,500**	**$0**	**$0**	**$23,650**
Contingency (60%)	$1,170	$7,320	$5,700	$0	$0	$7,095
Real Total Capital Investment	**$3,120**	**$19,520**	**$15,200**	**$0**	**$0**	**$30,745**
Escalation	$1,176	$8,230	$7,111	$0	$0	$999
Nominal Total Capital Investment	**$4,296**	**$27,750**	**$22,311**	**$0**	**$0**	**$31,744**

3.9 Proposed Funding Arrangements

The project is expected to be funded by the NSW State Government as the road is a State Road. This is could be funded from the Restart NSW fund, subject to further analysis by the project sponsor. There may be an opportunity for Federal Government funding, or EnergyCo to work with the private developers of the Renewable Energy Zone to deliver infrastructure upgrades that align with the rollout of their projects.

3.10 Financial Health and Support

The lead organisation of this proposal is RDA Orana, but they will not be a funder of this project and their financial viability will not provide any risk to its implementation.

While there is no direct financial incentive for RDA Orana, the body's interest in the proposal success is derived from the direct alignment of proposal objectives and outcomes with their mission. RDA Orana's mission is to:

- Increase regional economic output.
- Increase investment into existing businesses.
- Attract new businesses.
- Attract and retain the regional workforce and population.

4. Implementation Case

4.1 Program and milestones

The program of key events and milestones are as below.

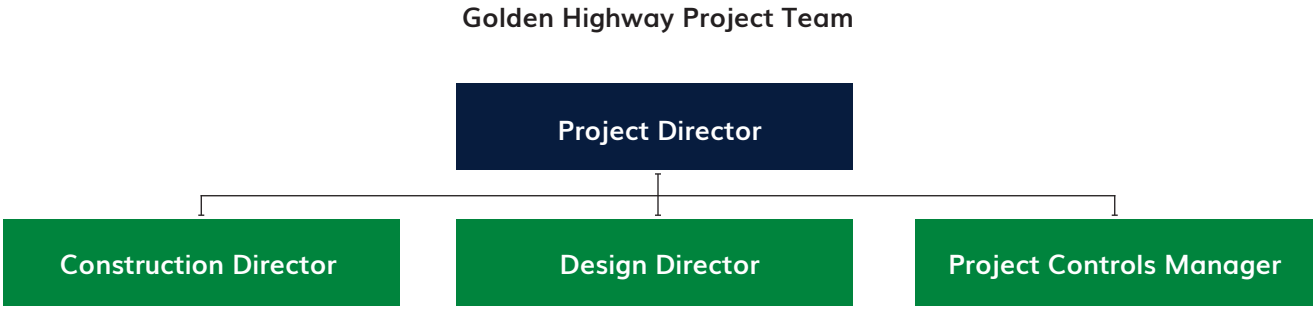
Table 25: Proposal Key Events

Event	Start	Finish
Stakeholder Community Engagement	Q1 2024	Q4 2034
Detailed Business Case and Approvals	Q1 2024	Q1 2025
Project Approval	Q2 2024	Q2 2025
Project Reference Design	Q2 2024	Q1 2025
Environmental and Heritage Process/Approvals	Q2 2024	Q4 2024
RFT Release	Q4 2024	
Tender Review Period	Q1 2025	
Contract Award	Q2 2025	
Detailed Design	Q2 2025	Q3 2026
Early Works and Site Establishment	Q2 2025	Q3 2026
Priority 1 Upgrades	Q2 2025	Q4 2029
Priority 2 Upgrades	Q1 2030	Q4 2034

4.2 Governance

Transport for NSW is likely to be the project sponsor as B84 (formerly State Highway 27) is a State Road. If the project is approved by Cabinet, Transport for NSW is likely to appoint its regional office at Newcastle to manage the project. This is known to be an experienced team.

The project team is likely to comprise:



4.2.1 Project Governance and delivery arrangements

The key tasks and outcome focus areas for each role within the project are outlined in the table below

.

Table 26: Project – Roles and Key Tasks

Role	Key Tasks and Outcomes Focus
Project Sponsor **(likely Transport for NSW)**	• Leads the project. • Is accountable for the delivery of planned benefits associated with the project. • Ensures resolution of the issues escalated by the Project Manager and the Project Reference Group. • Ensures resolution, or escalation, of the issues raised by external reviewers/ advisers. • Sponsors all communication about the project to the stakeholders. • Makes key organisational/commercial decisions for the project. • Ensures availability of essential project resources. • Approves the budget and decides tolerances. • Has ultimate authority and responsibility for the project. • Ensures the project is closed correctly and a Post-Implementation Review is scheduled and undertaken. • Ensures alignment with all policies. • Manages relationships with key external stakeholders.
Project Reference Group	• Oversees the delivery of the project, providing feedback and insights about the critical needs to their representative body. • Reviews and evaluates the established recommendations to ensure they align with the project intentions. • Participates in the project closure and Post-Implementation Review.

Role	Key Tasks and Outcomes Focus
Project Manager	• Managing and leading the project team. • Recruiting project staff and consultants. • Managing the coordination of the partners and working groups engaged in the project. • Detailed project planning and controlling including: • Developing and maintaining the detailed Project Execution Plan (including project schedule). • Managing project deliverables in line with the project plan. • Recording and managing project issues and escalating issues where necessary. • Managing project scope and change control and escalating issues where necessary. • Monitoring project progress and performance. • Management of contractor performance to schedule, budget and required quality. • Providing status reports to the Project Sponsor. • Liaising with and providing updates on progress to the Project Reference Group. • Managing other project evaluation and dissemination activities. • Managing consultancy input and variations within the defined budget.
Project Team	• Having a clear understanding of the project objectives and requirements prior to commencing any project work. • Having a detailed understanding of the expectations of the quality, timing and extent of the work required of them by the Project Manager and the Corporation prior to commencing work. • Obtaining input, advice and agreement of Council Representatives as required. • Raising issues which impact on the quality, timing or extent of the work to be undertaken, as they arise, with the Project Manager. • Completing the work, on-time, to budget and to quality standards. • Initiating and maintaining project documentation as required by the Project Manager. • Working with the stakeholders, as required, to ensure the project meets business needs. • Completion of all regulatory applications (registration and licences) as required in a timely manner.

4.3 Key Risks

The key risks to the delivery of the Regional Transport Strategy are detailed below.

They have been generally derived from the:

- 'PESTLE' perspective (political, economic, social, technological, legal and environment), and
- 'SABRE' perspective (safety, asset, business output, reputation and environment).

Refer to Annex G for the methodology and risk management process to determine the Consequence, Likelihood and Rating.

Table 27: Project risks and mitigation

Project Key Risks	Proposed mitigationz	Risk rating after mitigation		
		Consequence	Likelihood	Rating
Time required for upfront and ongoing consultation with community and industry stakeholders is under-estimated resulting in delays to commencement of the project.	• Project team onsite and in community at the start of the project • Early identification of relevant stakeholders to consult. • Project Reference Group in place from the start of the project	Moderate	Unlikely	Medium
Project budget underestimated or cost overrun through delay in project planning and approvals	• Allocate suitable contingency funding. • Effective and timely communication with decision makers	Moderate	Likely	Medium
Property acquisition process results in delays and requires legal intervention. (For example, localised dissent where a new easement or right of way is required to cross high value agricultural land)	• Project team onsite and in community at the start of the project • Early identification of relevant land acquisition requirements and the stakeholders to consult with	Minor	Likely	Medium
Scope of the project is too broad making it unachievable	• The project is managed in stages by a competent team from Transport NSW • The project is funded by the NSW State Government	Moderate	Very unlikely	Low

Project Key Risks	Proposed mitigationz	Risk rating after mitigation		
		Consequence	Likelihood	Rating
Proposed associated projects that would be beneficiaries of the road project do not go ahead or are delayed. For example, critical minerals projects or containerisation at the Port of Newcastle	• Each project's development is equally contingent on the efficiency and safety afforded by the Golden Highway • Australia is committed to reducing carbon emissions by 2030 and committed to the rollout of renewable energy which in turn will fuel the drive to develop reserves of minerals in western NSW	Minor	Very unlikely	Low
Australia reaches its emissions reduction target and therefore the demand to upscale does not occur.	• Current indications are that emissions reductions to net zero will not be met till 2050. • Road and rail infrastructure are unlikely to become obsolete especially with the push for electrification of cars, trains and trucks	Moderate	Unlikely	Low

4.4 Legislative, Regulatory Issues and Approvals

The project will require several approvals and agreements with State and Local government agencies during the design development phase.

Legislation relevant to the upgrades proposed on the Golden Highway as a State Road includes:

- *Roads Act 1993* (NSW)
- *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act)
- *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act)
- *Protection of the Environment Operations Act 1997* (NSW)
- *Heritage Act 1977* (NSW)

All elements of the scope of works, with the possible exception of the suggested Denman bypass, would be capable of assessment under a review of Environmental Factors (REF) process under the EP&A Act. Smaller bridge widening and some overtaking lane projects may not need any specific approval, subject to their heritage status assessment under the *Heritage Act 1997* (NSW).

Depending on Hunter River assessment, a Denman bypass project may need to be subject to an Environmental Impact Statement (EIS) under the NSW EP&A Act, and/or a referral to the Commonwealth under the EPBC Act.

There are no foreseeable regulatory and administrative approvals that could not be secured prior to construction. The majority of the scope of works in the proposal lie on the existing road reserve, which reduces the risk of approval issues delaying construction.

4.5 Proposed Management Activities

4.5.1 Risk Management

Activities undertaken during the Planning Stage to identify, monitor and mitigate the proposal's risks include:

- A team of consultants with wide ranging and appropriate expertise contributed to the development of the Business Case.
- During the planning phase of the proposal, stakeholders were identified and interviewed with a view to determine an accurate assessment of current and future freight flows.
- A project update was provided to the individual members of the Project Reference Group (PRG) during monthly meetings between The Stable Group, RDA Orana and the Project Reference Group. Members of the Project Reference Group are key stakeholders involved with the freight network and local communities, giving them capacity to deliver insights and recommendations to align the proposal with the needs of the network.

A Project Reference Group was formed to:

- Ensure the Transport Strategy developed aligns with the high priority needs of the organisations represented within the Reference Group.
- Provide insights and recommendations to be included within the Transport Strategy.
- Provide information and reporting as required by any relevant funding deed, or as advised by RDA Orana and RDA Hunter.

The Reference Group was comprised of:

- Organisations:
  - RDA Orana
  - RDA Hunter
  - Hunter Joint Organisation
  - EnergyCo
  - NSW Farmers Association – Modernising Rail Infrastructure Taskforce/Inland Rail Taskforce
  - National Farmers Federation
  - Port of Newcastle
  - Transport for NSW
- Local Government Areas:
  - Narromine Shire Council
  - Mid-West Regional Council - Mudgee
  - Dubbo Regional Council
- Companies:
  - Alkane Resources
  - Squadron Energy
  - Grain Industry Representative
  - Transport Industry Representative
  - Transport Business Representative
  - Rod Pilon Transport
  - Fletchers International

Activities proposed during the Delivery Stage to identify, monitor and mitigate the proposal's risks.

During the delivery phase of the proposal, project reporting should be undertaken in line with Transport for NSW guidelines and procedures.

It is advised that the responsible entity engage a Project Reference Group of key stakeholders to ensure the delivery of the project is in line with the needs of the network and expectations of the community. As the likely project sponsor, this is to be developed in line with Transport for NSW's Community Engagement Policy.

An example of a risk management strategy that could be applied for the proposal follows.

- A Risk Management Plan and Register[7] to be developed by the Project Team will guide risk reporting, monitoring and mitigation activities during the delivery phase of the Project, that is during pre-construction to construction, until completion.
- Day-to-day risk monitoring will be overseen by the Project Team, led by the Project Manager, with risk monitoring and reporting included within the monthly Project Control Group meetings.
- The risk monitoring and escalation framework will comprise:
- Project Team members to the Project Manager,
- Project Manager to the Project Reference Group, and
- Project Reference Group to the Project Sponsor.
- A risk management workshop prior to the commencement of each Pre-Construction activity, and subsequently at key progression points during the construction phase of the project. Projects that have a 'Very High' and 'High' risk rating will be monitored by the Project Manager on a weekly basis and updated in the 'weekly' progress report to the Project Control Group members.

In summary the project will address the management of risk by:

- Making risk and opportunity management as an integral component of the project management systems to ensure excellence in risk and opportunity management is reflected in all elements of the project.
- Identifying risks and opportunities, recognise potential impacts and to ensure that appropriate steps are in place to manage the risk or to capitalise on the opportunity.
- Ensuring that the responsibilities for identifying and managing risks and opportunities are clearly structured and included in the management of the project.
- Implementing continuous improvement through the adoption of the elements of AS/NZS ISO 31000: 2009 (Refer to Annex G – Risk Management Context)
- Incorporating risk functions/requirements into the roles and responsibilities of key staff and external suppliers with the project governance structure.
- The Project Manager ensuring all risks are recorded and monitored.

4.5.2 Asset Management and Operations

The assets delivered, as an outcome of the construction activities, will be owned, operated, and maintained jointly by the relevant state agencies. This is likely to be Transport for NSW.

7 To be based on the NSW Treasury TPP12-03c_Risk_Management toolkit for the NSW Public Sector.

Summary of Attachments and Annexes

Annex A - Orana Socio-Economic Context

Annex B - Demand Drivers

Annex C - Golden Highway Study Report

Annex D - Images from Golden Highway

Annex E - Preliminary Valuation of Denman Bypass

Annex F - Draft Project Schedule

Annex G - Risk Management Methodology

Annex A – Orana Socio-Economic Context

Demographic Data

The Orana region stretches across the Central West and Western region of NSW. It is the largest and most diverse region in the State, covering an area of over 190,000 square meters or 25% of NSW. It services a growing population and encompasses 12 Local Government Areas, with major regional towns including Dubbo, Mudgee and Cobar.

Table A.1: Demographic Data

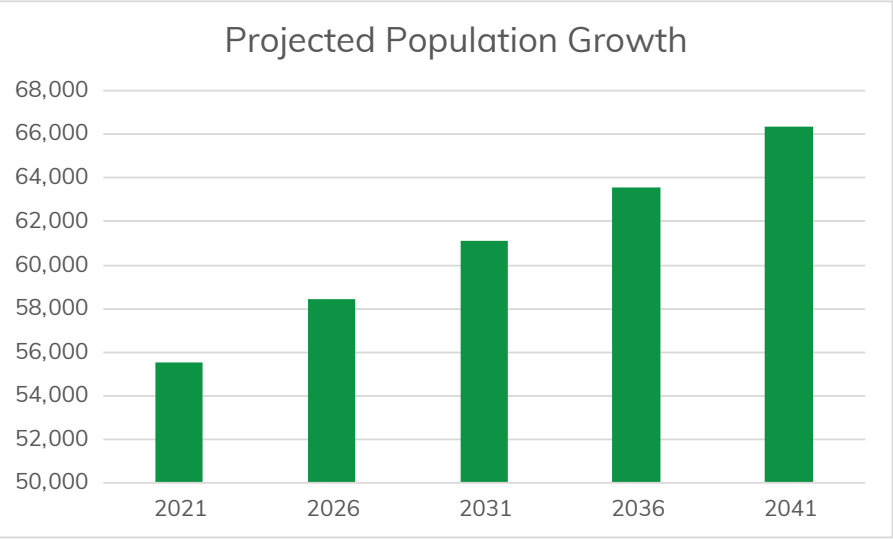
Town/Regional Council	Population (2021)	Estimated Population (2023)	Land Area (sq km)	Median Age (2021)	Median Weekly Household Income ($) (2021)
Mid-Western Regional LGA	25713	25795	8752	42	1486
Dubbo Regional LGA	54922	55894	7535	36	1597
Orana Regional Development Area	122272	123862	199000	40	N/A

Source: Mid-Western Regional, Dubbo Regional: ABS 2021 Census Community Profiles[8]
Orana Regional Development Area, 2023 Population Forecasts: Remplan Community Profiles (ABS includes Far West and Orana, where Far West is not within scope)[9]

Projected Population Growth – Dubbo Regional Council

Dubbo Regional Council population is projected to grow by 19.5% between 2021-2041, placing increased demand on the Golden Highway.

Figure A.1: Projected Population Growth – Dubbo Regional Council



Source: Remplan Dubbo Forecast Profile[10]

8 https://abs.gov.au/census/find-census-data/community-profiles/2021/SAL12527
9 https://app.remplan.com.au/regionaldevelopmentorana/community/population/age?state=g7Zvsj!GPmatP9K2HgKGX1IWABvMtLUNFgXJU9FbF2FliaF9R7
10 https://app.remplan.com.au/dubboregionalcouncil/forecast/population?state=gG5vh3wnbtW5XQaFnG2wbCvuZIdO0H_7kiksyMnoFIIJnZ

Employment Data

Table A.2: Employment Data

Source:

Maryvale, Gulgong, Ulan, Mid-Western Regional, Dubbo Regional: ABS 2021 Census Community Profiles

Orana Region: Remplan Economic Profiles (ABS includes Far West and Orana, where Far West is not within scope)[11]

Town/ Regional Council	Industry ranking of employment sector, by number of workers (2021)					Unemployment rate (2021)
	1	2	3	4	5	
Orana Region	Health Care and Social Assistance (15%)	Agriculture, Forestry and Fishing (12%)	Education and Training (10%)	Retail Trade (9%)	Construction (9%)	4.1%
Dubbo Regional Council	Health Care and Social Assistance (19%)	Retail Trade (10%)	Education and Training (9%)	Construction (9%)	Public Administration and Safety (8%)	3.6%
Mid-Western Regional Council	Mining (16%)	Health Care and Social Assistance (11%)	Retail Trade (9%)	Construction (8%)	Education and Training (8%)	4.0%
Gulgong	Mining (19%)	Health Care and Social Assistance (11%)	Retail Trade (10%)	Accommodation and Food Services (9%)	Education and Training (8%)	4.5%
Maryvale	Health Care and Social Assistance (19%)	Construction (14%)	Agriculture, Forestry and Fishing (12%)	Education and Training (12%)	Arts and Recreation Services (5%)	0.0%
Ulan	Mining (64%)	Accommodation and Food Services (23%)	Health Care and Social Assistance (18%)	Retail Trade (14%)	N/A	0.0%

11 https://app.remplan.com.au/regionaldevelopmentorana/economy/industries/value-added?state=DL1NFv!wDJ0Hdo03hrvpgecw5oJBHmTASlbwFpJ2JKTXjEj3IWSVgiaSMIAAVRTXZN

Gross Regional Product Data

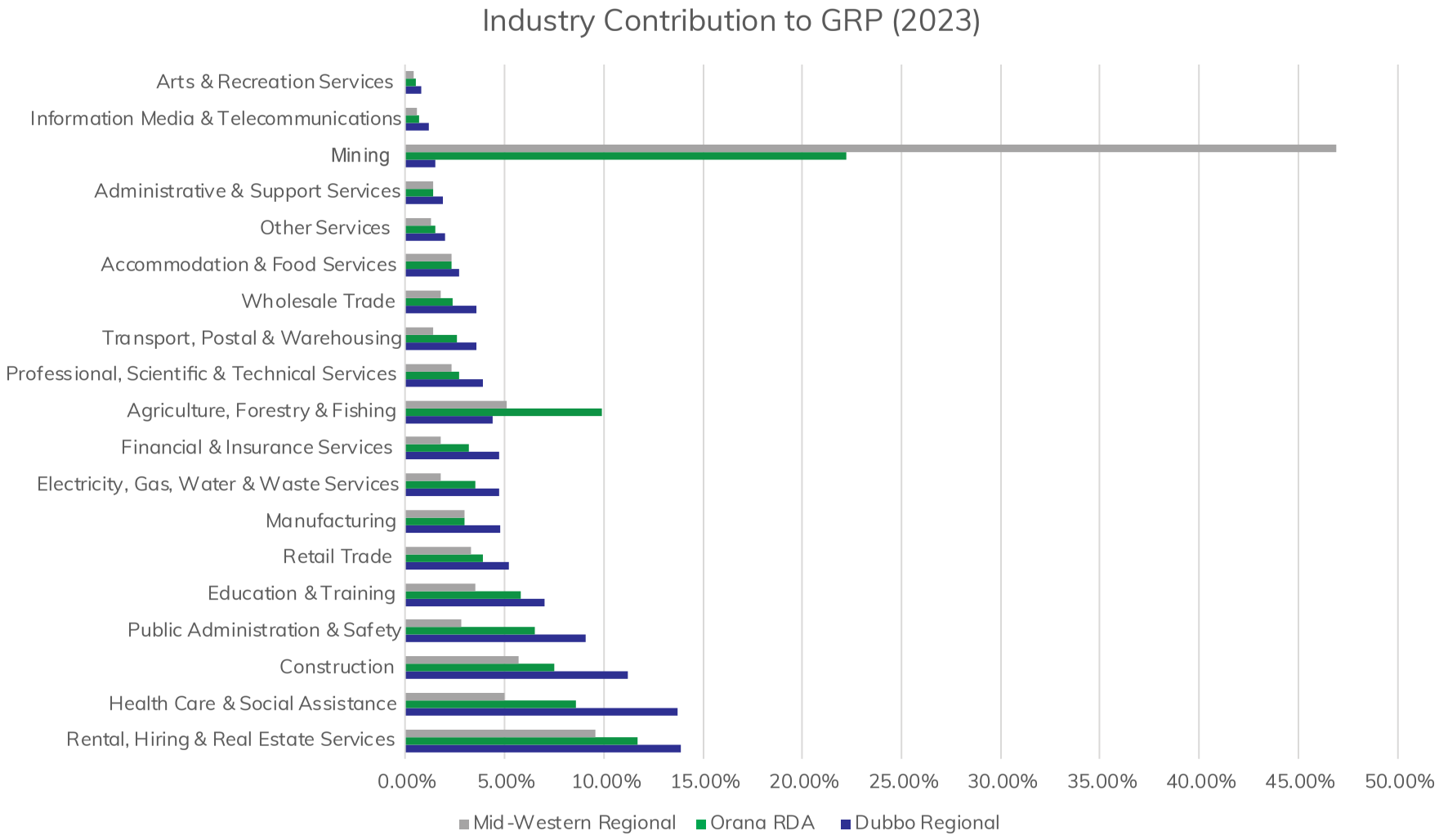
Table A.3: Gross Regional Product Data

Source: Remplan Economic Profiles (ABS 2021 census data, scaled to 2023)

Town/Regional Council	Industry ranking of value add to Gross Regional Product (2023)					Gross Regional Product (GRP) (2021)
	1	2	3	4	5	($bn)
Orana Regional Development Area	Mining (22%)	Rental, Hiring and Real Estate Services (12%)	Agriculture, Forestry and Fishing (10%)	Health Care and Social Assistance (9%)	Construction (8%)	11.336
Dubbo Regional Council	Rental, Hiring and Real Estate Services (14%)	Health Care and Social Assistance (14%)	Construction (11%)	Public Administration and Safety (9%)	Education and Training (7%)	4.552
Mid-Western Regional Council	Mining (47%)	Rental, Hiring and Real Estate Services (10%)	Construction (6%)	Agriculture, Forestry and Fishing (5%)	Health Care and Social Assistance (5%)	3.208

Industry Contribution to GRP

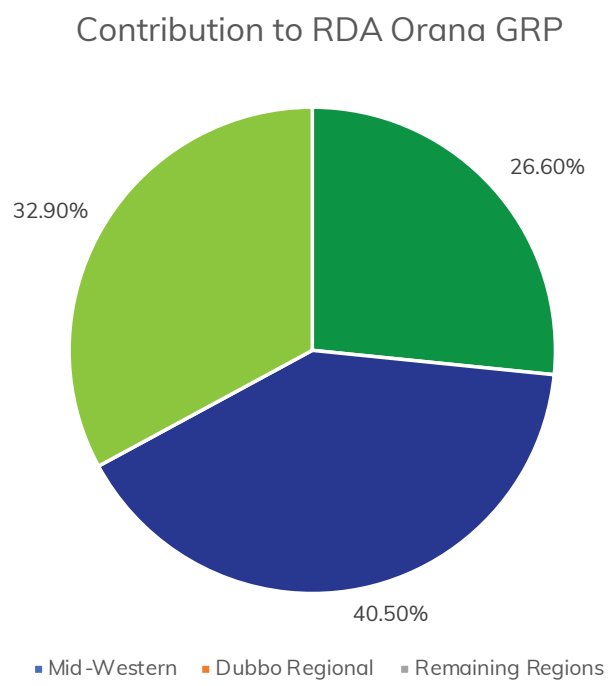
Figure A.2: Industry Contribution to GRP (2023)



Source: Remplan Economic Profiles (ABS 2021 census data, scaled to 2023)

Region contribution to RDA Orana GRP

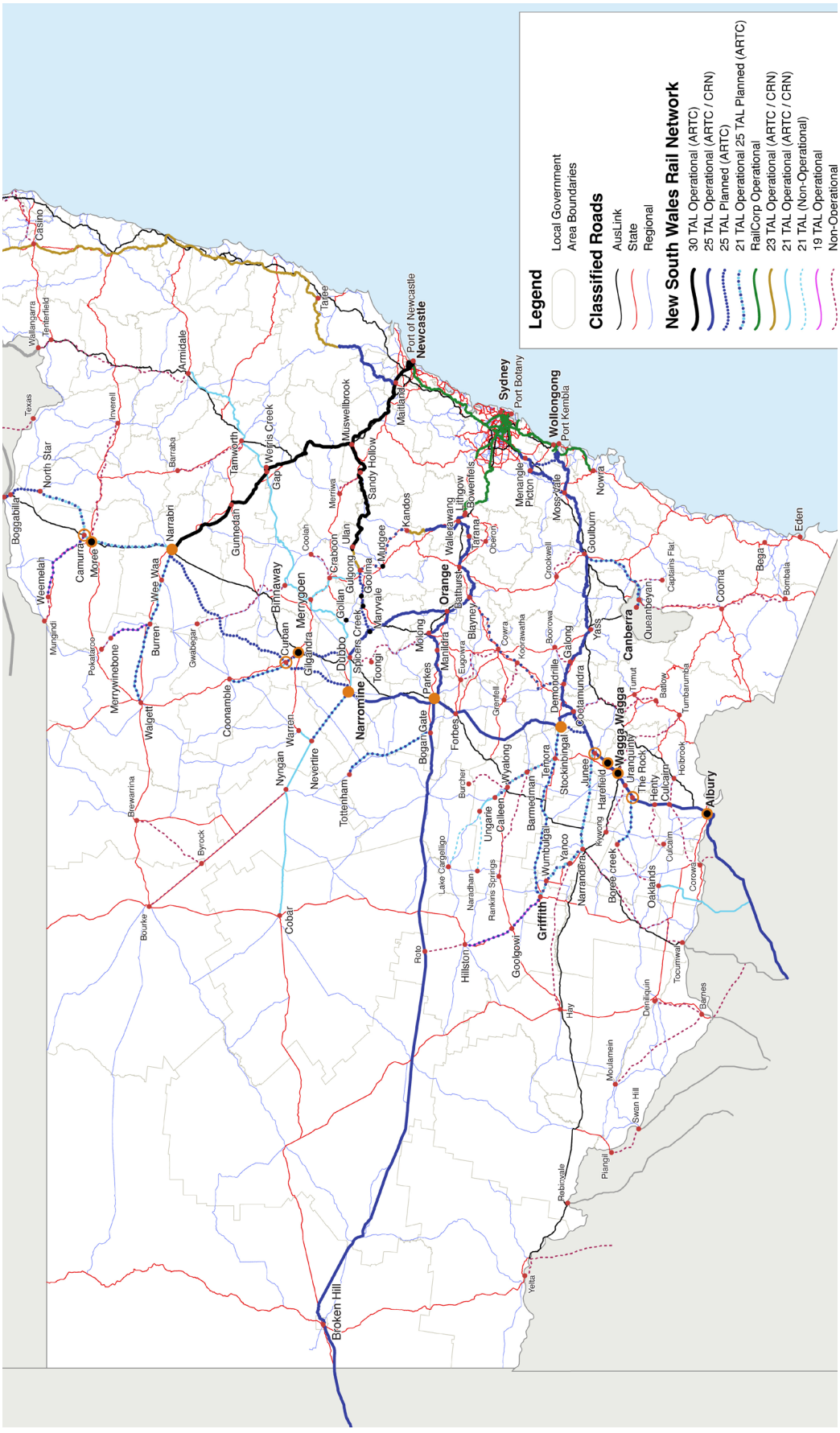
Figure A.3: Region contribution to RDA Orana GRP



Source: Remplan Economic Profiles (ABS 2021 census data, scaled to 2023)

Rail Lines

Figure A.4: Rail Lines in the Region

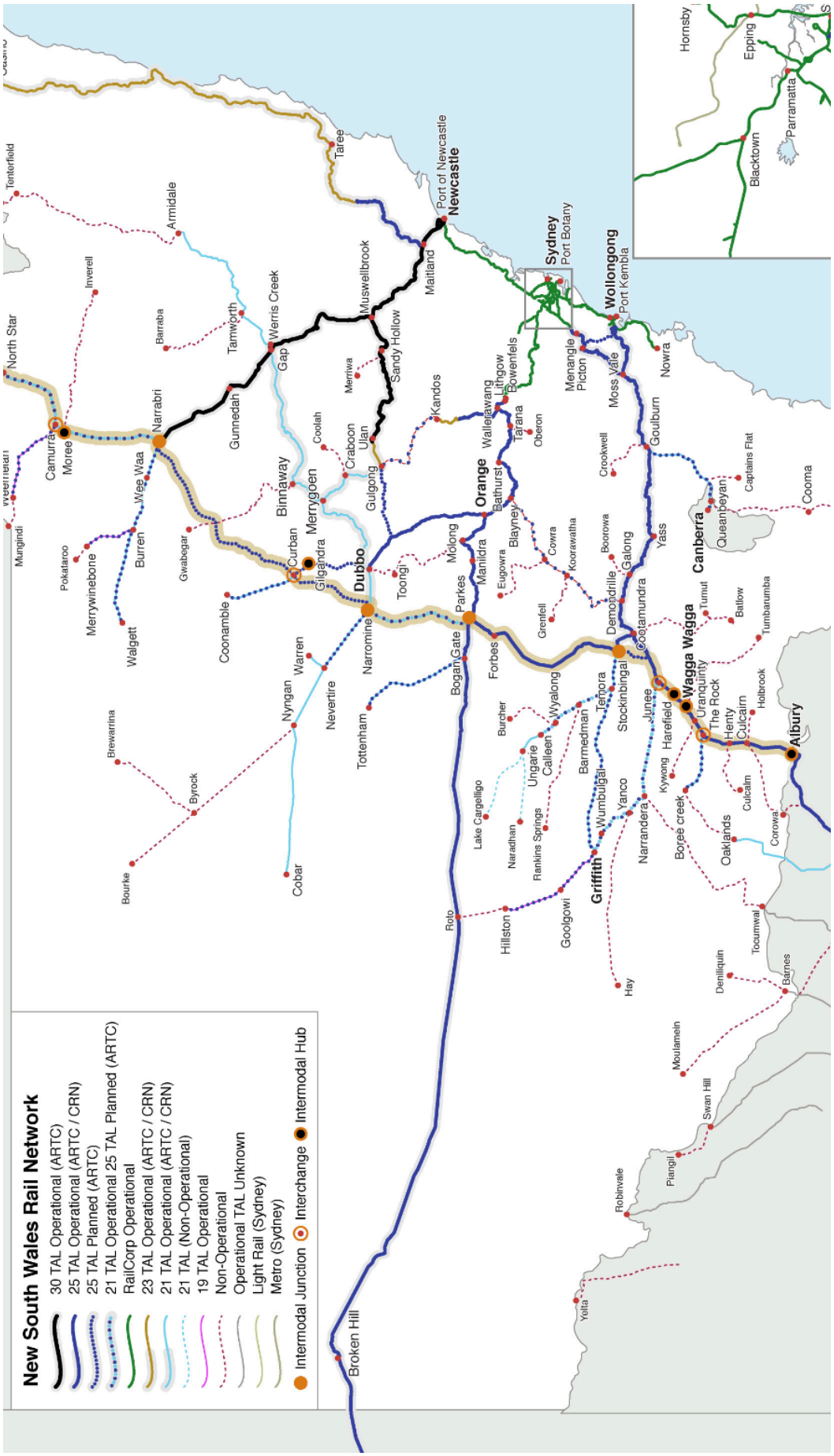


Source: The Stable Group[12]

12 An interactive map of rail lines and points of interest can be found here: http://tinyurl.com/rail-lines-map

NSW Rail Network Map

Figure A.5: NSW Rail Network Map



Annex B - Demand Drivers

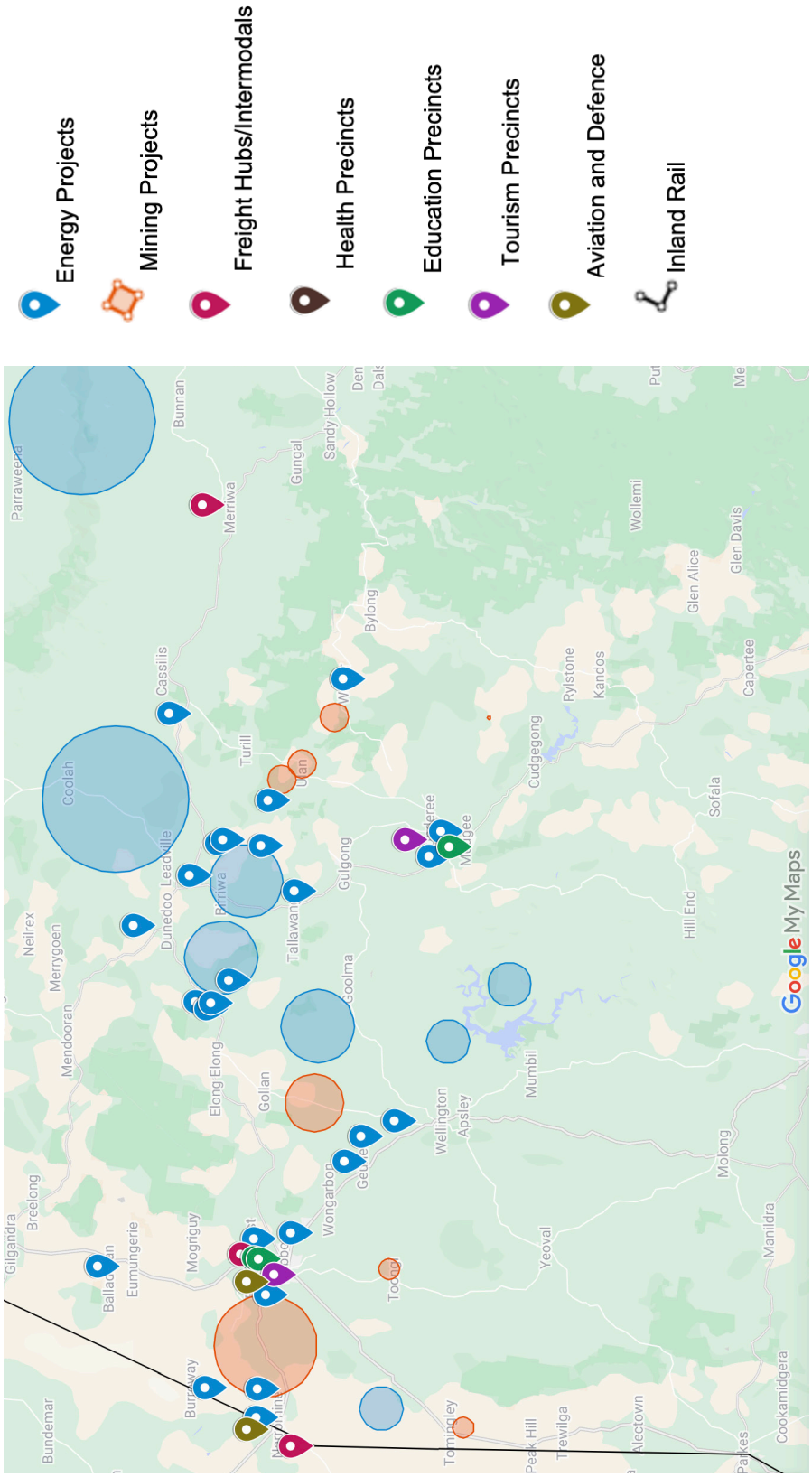


Figure A.6: Industry activities and points of interest driving increased freight and passenger traffic flows in the Golden Highway Corridor

Source: The Stable Group[1]

1 An interactive map of demand drivers can be found here, including those located in Newcastle: http://tinyurl.com/demand-drivers-map

Demand Drivers – Energy Projects

Energy Projects	Existing Projects/Projects Expected to 2033		Speculative Projects
Wind	Wallaby Creek Spicers Creek Wind Farm Orana Wind Farm Barneys Reef Wind Farm	Valley of the Winds Wind Farm Burrendong Wind Farm Uungula Wind Farm Liverpool Range Wind Farm	
Solar	Gilgandra Solar Farm Tallawang Solar Farm Narragamba Solar Dunedoo Solar Farm Wellington North Solar Farm Maryvale Solar Farm Wahroonga Solar Farm Burroway Solar Farm Sheraton Road Solar Farm Forest Glen Solar Farm	Cobbora Solar Farm Sandy Creek Solar Farm Dapper Solar Farm Burrundulla Solar Farm Blain Road Solar Farm Ulan Solar Farm Stubbo Solar Farm Geurie Solar Farm Wellington Road Solar Farm Birriwa Solar Farm and Battery Energy Storage System	
Other energy (battery, hydrogen)	Merotherie Energy Hub Site Neeleys Lane Ancillary Site	Elong Elong Energy Hub Site Wollar Switching Station Site	Narromine APWS - Renewable Energy and Circular Chemicals Facility Development Port of Newcastle Clean Energy Precinct

Demand Drivers – Mining

Mining Projects	Existing Projects/Projects Expected to 2033	Speculative Projects
Coal	Ulan Coal Mine (Mid-Western Council) Wilpinjong Mine (Peabody Energy) Moolarben Coal (Mid-Western Council)	
Metals	Bowden Silver Mine Alkane Resources Tomingley Gold Project Alkane Resources Northern Molong Porphyry Project CSA Mine (Metals Acquisition Ltd) Endeavour Mine (CBH Ltd) Hera Mine (Aurelia Metals) Peak Gold Mine (Aurelia Metals) Tritton Copper Mines (Aeris Resources)	Sunrise Energy Metals Cobar Superbasin Project (Peel Mining) Wonawinta Silver Project (Manuka Resources) Mallee Bull Copper Deposit (Peel Mining)
Minerals	Australian Strategic Materials Dubbo Project/Mine	
Gravel	MAAS Group Quarries	

Demand Drivers – Others

Sector	Existing Projects/Projects Expected to 2033	Speculative Projects
Freight Hubs/ Intermodals (grain, meat and livestock, cotton)	Fletcher International Exports Dubbo/Intermodal Dubbo sale yards Fletchers Abattoir Cotton gins Inland Rail Albury to QLD Border Port of Newcastle Empty Container Park & Deepwater Container Terminal	Inland Rail QLD border to Toowoomba/ Brisbane Beresfield freight distribution facility Merriwa Industrial Precinct Curban Intermodal GrainCorp Narromine Intermodal
Health	John Hunter Hospital Innovation Precinct Dubbo Hospital	
Education	University of Newcastle Charles Sturt University Dubbo Dubbo TAFE Country University Centre Mudgee	
Tourism	Dubbo Zoo Mudgee & Hunter wine regions Newcastle tourism hub	
Aviation/ Defence	Narromine Aerodrome and Aviation Business Park Newcastle Airport Expansion Dubbo Airport Williamtown ADF Singleton Military Area	

Annex C – Golden Highway Study Report

Golden Highway study report

References

A Policy and Guidelines for Overtaking Lanes, WA Main Roads, updated Dec 2011.

B Guidelines for Global Strategic Rates for Project Cost Estimating ILC-MI-TPO-601-Go2, NSW Roads and Maritime Services Aug 2019

Austroads is the association of the Australian and New Zealand transport agencies, representing all levels of government. Its Guides, which provide practical advice on the design, management and operation of road transport networks, are globally respected and continually updated.

Reference A is based on Austroads guidance and makes no departures from them. The document makes a case for some additional considerations on lighter-trafficked highways.

Reference B provides strategic guidance only on estimates. Sounder estimates require a reference design, base contemporary cost data appropriately benchmarked and then adjusted for inherent and contingent risk.

Disclaimer- Accuracy

Dimensions and distances quoted in this study are estimates only based on visual estimate and some range finding. They are not a reliable basis for design or estimating below the strategic level.

Purpose

To report the findings of a route study of the Golden Highway (B84) to CEO RDA Orana to enable TSG to complete a business case for improving the function and performance of the road.

Study Area

The study area is the Golden Highway (GH) between its intersections with New England Highway (A15) near Belford and with the Newell Highway (A39) via Boothenba road, north of Dubbo. The study section is 313km in length.

Description

The road is a state road meaning that it is owned by NSW Government but maintained by LGAs along the route under contract to TfNSW. It is of single carriageway construction and features narrow lanes, including on bridges. The posted speed limit is 100kmh except in built-up areas and in a few particularly narrow sections.

The appropriate alignment descriptor is assessed as "moderately constrained in undulating terrain" (Ref A).

Sectional data from a detailed on-road study reveals that the percentage of the route that provides sight distances greater than 900m is 10.8%. Ref A indicates that in this type of terrain, where the percentage is less than 30%, overtaking lanes are warranted, as shown below:

Table C.1: Indicative Pc (Percentages of sections offering overtaking provision -i.e. Sight Distance > 900 m)

Alignment Descriptor	Indicative Pc
High standard alignment in level terrain (less than 10% barrier-lined)	85
High standard alignment in undulating terrain or moderately constrained alignment in level terrain (about 20% barrier-lined)	60
Moderately constrained alignment in undulating terrain. (about 40% barrier-lined)	30
Constrained alignment in hilly terrain (greater than 60% barrier-lined)	10

Reference A states:

The guidelines emphasise the need for overtaking lanes on low traffic volume rural roads where significant delays can result from drivers not being able to overtake large slow-moving vehicles. These frustrations increase the potential crash rate due to road users attempting to overtake vehicles in unsafe situations.

The Austroads guidelines are adequate in high traffic volume situations but fail to recognise the need for overtaking lanes on low traffic volume rural roads on which significant delays can result from vehicles not being able to overtake large freight and slow-moving vehicles. These delays increase the potential crash rate by encouraging road users to attempt to overtake vehicles in unsafe situations.

2014 and 2021 traffic counts, although the latter was conducted in a Covid-19 year, indicate annual average daily traffic (AADT) west of Jerrys Plains at 3,000. Over the period, the proportion of heavy vehicles has grown from between 12 and 21 % to between 25 and 30%.

Note: An updated traffic count for the study area is currently in progress

The lack of sufficient overtaking lanes where almost 30% of the traffic comprises heavy vehicles, coupled with the low percentage of sight distances greater than 900m, indicates that the probability against an AADT count of 3,000 that some vehicles will be delayed more than 5 minutes is approximately 35% (Ref A).

Other Factors (Ref A)

Where a prima-facie case is not evident to warrant an overtaking lane investment, some other factors could be considered:

- Narrow Seal. Car drivers are reluctant to overtake large vehicles on roads with narrow seal width. On sections of road where this is the primary factor contributing to excessive queuing behind large vehicles, the provision of occasional overtaking lanes may be a more cost-effective solution than general seal widening. The Golden Highway is generally of narrow seal pavement.
- Crash History. An investigation of crash history may help to decide on marginal cases for improvement. For overtaking lanes, particular attention should be paid to crashes associated with overtaking manoeuvres or where crashes may be attributable to slow moving vehicles.
- Percentage of Heavy Vehicles. Construction of passing lanes (sic) should be considered on roads with more than 15% heavy vehicles as defined by Austroads Class 3 and greater. The Golden Highway traffic comprises approximately 30% heavy vehicles.

On the Golden Highway, safety performance is assessed as marginal due to a combination of narrow pavements, poor ride quality and a significant lack of overtaking opportunities. This situation is exacerbated by a number of very narrow bridges.

Ride Quality

Apart from some short sections of recent reconstruction, pavement condition is generally poor; not only due to the flooding rains of 2022 but also to the rising proportion of heavy vehicles in total traffic and the increased mass of many heavy vehicles since the road was designed. High heavy-mass frequency and wet conditions invariably cause pavement damage.

Major road reconstruction and maintenance in NSW after the 2022 weather events has consumed all of maintenance budgets and most of grant funds released by governments.

Current pavement condition generates significant oscillation in higher and heavier vehicles thus increasing the kinematic envelope beyond that underpinning the assumptions adopted for road and bridge design. This is a safety issue.

Road Maintenance

Road maintenance is generally underfunded in NSW. This situation is exacerbated by severe weather events, where urgent repairs have the effect of disrupting planned maintenance and upgrades. Repairs may be classified as minor routine maintenance or short section reconstruction, such as would be necessary if the subgrade requires reforming.

Sectional reconstruction can be expected to cost approximately $0.7 million per kilometre for generally flat to undulating terrain. This cost rises sharply with larger culverts and water crossings. The average rate per km would change slightly downwards for larger sections and more sharply upwards for shorter sections.

Performance

Provision for Over Size Over Mass (OSOM) on GH is confined to Class 9 vehicles (B doubles or equivalent). Renewable energy projects approved for the region and in development will generate a strong demand for OSOM movements with few if any route alternatives.

Suggested Scope of Work

Suggested scope of work to improve function and performance include:

- Bridge widening - 4 large bridges (>20m deck length), 11 smaller bridges.
- Overtaking lanes - 33 lanes total, 17 eastbound, 16 westbound
- Improve 7 intersections.
- Improve 4 rail level crossings.
- 1 bypass of Denman, Including construction of one new bridge

Strategic Estimate

Source: Reference B, indexed by 25%, based on recent tendered prices on a nearby large road project.

- Rates applied:
  - Add a 1 lane (e.g. overtaking lane) to an existing rural highway: $2.125 million lane/km.
  - Bridge widening:
    - PSC plank <18m: $3,750 per sqm of deck area plus 25%.
    - Balanced cantilever <55m: $12,500 per sqm of deck area plus 25%.
    - Incremental launch for span up to 79m: $12,500 per sqm of deck area, plus 25%.
- Overtaking lanes: 33 no at 1.9 km ea., @$2.125 lane/km= $133.24 million
- Bridge widening:
  - Large >20m:
    - Cockfighters (Warkworth), Recommend duplication 5m wide x 80m long; 400sqm @$12,500= $5 million; add 2x200 m new lanes and earthworks, est= $1million. Total $6 million. Alternatively, a deviation with a single new bridge may present better value.
    - Merriwa: Widen by 2.5m, 80m long = 200sqm @ $12,500 sqm plus 25% = $3.125 million, plus approach lanes and earthworks est $1million. Total $4.125 million.
    - Krui River (Collaroy); Widen by 3m, 50m long = 150 sqm@12,500 per sqm plus 25% = $2.34 million plus approach lanes and earthworks est $1million. Total $3.34 million.
    - Denman; see below re suggested Denman bypass.
  - Small ~ 18m
    - Widen by average 2.5 m, 14 no x 18 m long (average) x@ $3,750 per sqm of deck area plus 25% = $2.953 million
- Intersections (7)
  - Assume total 2 no new lane km at each intersection; assume no property acquisition required. 14 lane/km total@$2.125 per lane km =$ 29.75 million
- Denman bypass; 3km new road on embankment including 1 no incremental launch bridge: $ $9.5 million. Road including earthworks: $12.2million. Total $21.7million
- Level crossings. The four level crossings require widening (all 4) and the installation of boom gates (3 of 4). ARTC, the rail track lessee of the Hunter Valley network, and the maintenance contractor on the NSW country Rail network are understood to be progressing these requirements. Advice from our rail adviser is to include a nominal $1 million per crossing in our estimate.

Totals

Table C.2

Item	Construction cost $ million	Overheads (10%, design (6%), PM (7%), Insurance (1%)	Contingency 60%
Overtaking Lanes	133.24	31.98	99.13
Large bridges excl Denman	13.465	3.23	10.01
Denman bridge (But see bypass option)	4.5 (Est)	1.08	8.928
Small bridges	2.953	0.709	2.20
Intersections	29.75	7.14	22.134
Level crossings	4	0	0
Totals	**187.908**	**44.139**	**142.402**
Total			**374.449**

Contingency

Ref B advises:

Contingency for strategic estimates that have been derived using typical rates such as the ones indicated below should be in the range of 40-70% depending on the confidence and reliability of the information used in preparing the estimate.

Please note that the Project estimating manual recommends a range of 35-70%. Values in the range 35-40% should be used only if the project has been advanced to concept phase level of development, risk and detail.

Escalation

Escalation at 6% pa is suggested. Applied for 4 years escalation is calculated as ($ million):

Construction cost, other costs and contingency:	$374.449
Escalation @ 6% 0ver 4 years (excludes level crossings)	$97.234
Total estimated cost:	**$471.683**

Priority Projects

Staging of works is suggested based on both safety and economic considerations. Priority projects including base estimates are:

Table C.3

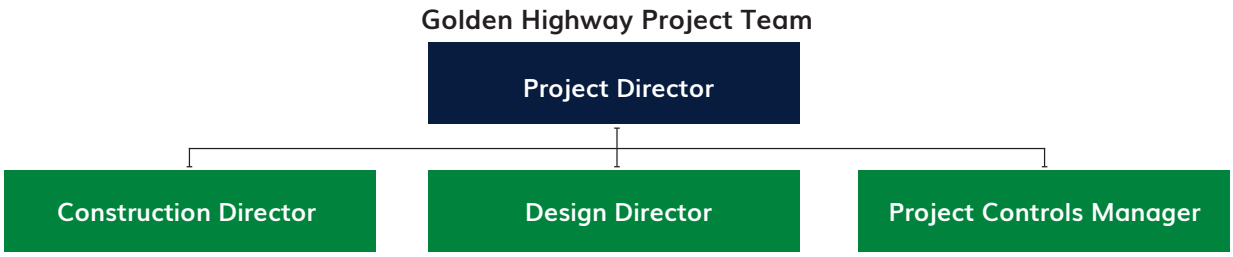
Bridges	Overtaking lanes Westbound from Belford	Overtaking lanes Eastbound from Dubbo	Intersections	Rail Level crossings
Warkworth (Cockfighters) $6m	W1-nr Putty Rd	E1-nr Spicers Creek	Cassilis (Uarbry Rd)	Beni
Krui River $3.34m	W4-nr Denman	E4-W of Merotherie Rd		Ballimore
Four Mile Creek $0.211	W6-Giants Creek	E6-nr Talbragar River		E Dunedoo
Mitchell Creek $0.211	W9-nr Krui River	E11-nr Four Mile Creek		Denman
	W11 -nr Four Mile creek	E13- nr Krui River		
	W12-nr Ulan Rd	E16-2km W of Sandy Hollow		
Total: $9.76m	**$24.23m**	**$24.23m**	**$4.250m**	**$4m**

Total Costs of Priority 1

Base cost:	$66.66
Overheads	$16.00
Contingency	$49.6
Total	$86.33

Governance

Transport for NSW (TfNSW) is likely to be the project sponsor as B84 (formerly State Highway 27) is a State Road. If the project is approved by Cabinet, TfNSW is likely to appoint its regional office at Newcastle to manage the project. This is known to be an experienced team. The project team is likely to comprise:



Planning Approvals

All elements of the scope of works, with the possible exception of the suggested Denman bypass, would be capable of assessment under a review of Environmental Factors (REF) process. Smaller bridge widening and some overtaking lane projects may not need any specific approval.

Depending on Hunter River possible issues, a Denman bypass project may need to be subject to an EIS under the NSW EP&A Act, and/or a referral to the Commonwealth under the EPBC Act.

Table C.4

Latitude	Longitude	Description	No. + Priority	Notes
-32.02879	149.954859	Bridge widening	B10 - Priority 1	over Four Mile Creek, 25m long
-32.09625	150.118455	Bridge widening	B11 - Priority 1	Collaroy Bridge over Krui River, large bridge, 250m of steep embankment (widen) and 50m bridge (widen)
-32.567102	151.021656	Bridge widening	B18 - Priority 1	Cockfighters Bridge over Wollombi Brook, large bridge, 80m long
-32.227158	148.849219	Bridge widening	B2 - Priority 1	over Mitchell Creek, 20m long
-32.169925	148.974177	Eastbound-Overtaking Lane start	E1 - Priority 1	near Spicers Creek
-32.028538	149.954936	Eastbound - Overtaking lane start	E11 - Priority 1	near Four Mile creek
-32.103848	150.120834	Eastbound-Overtaking Lane start	E13 - Priority 1	near Krui River, location subject to survey
-32.328607	150.534659	Eastbound-Overtaking Lane start	E16 - Priority 1	2km west of Sandy Hollow
-32.077137	149.547532	Eastbound-Overtaking Lane start	E4 - Priority 1	West of Merotherie Road
-32.052651	149.746104	Eastbound-Overtaking Lane start	E6 - Priority 1	near Talbragar River

Latitude	Longitude	Description	No. + Priority	Notes
-32.019673	149.97577	Intersection upgrade	I6 - Priority 1	Cassilis (Uarbry Road) - major upgrade required
-32.197739	148.729455	Level Crossing Upgrade	LX1 - Priority 1	Beni, needs protecting
-32.202414	148.811412	Level Crossing Upgrade	LX2 - Priority 1	Ballimore, near Lesslies Road, needs protecting
-32.011943	149.401818	Level Crossing Upgrade	LX3 - Priority 1	East Dunedoo
-32.370271	150.690967	Level Crossing Upgrade	LX4 - Priority 1	Denman, needs widening
-32.631026	151.147602	Westbound-Overtaking Lane start	W1 - Priority 1	near Putty Road
-32.029019	149.954735	Westbound-Overtaking Lane start	W11 - Priority 1	near Four Mile Creek
-32.059071	149.908321	Westbound-Overtaking Lane start	W12 - Priority 1	near Ulan Road
-32.359735	150.676983	Westbound-Overtaking Lane start	W4 - Priority 1	near Denman
-32.233946	150.483939	Westbound-Overtaking Lane start	W6 - Priority 1	near Giants Creek
-32.113038	150.129761	Westbound-Overtaking Lane start	W9 - Priority 1	near Krui River
-32.200669	148.808806	Bridge widening	B1 - Priority 2	over Plain Creek
-32.122288	150.253065	Bridge widening	B12 - Priority 2	over Bow Creek, 20m long
-32.143534	150.303272	Bridge widening	B13 - Priority 2	over Farm Springs Creek, 10m long
-32.140421	150.346491	Bridge widening	B14 - Priority 2	over Merriwa River, large bridge
-32.189617	150.452291	Bridge widening	B15 - Priority 2	over Worondi Creek, 10m long

Latitude	Longitude	Description	No. + Priority	Notes
-32.379703	150.711817	Bridge widening	B16 - Priority 2	Denman Bridge over Hunter River, large bridge - Approaching end of useful life, corrosion on lower beams Could be left to light traffic if bypass constructed
-32.434118	150.787713	Bridge widening	B17 - Priority 2	over Saddlers Creek
-32.170797	148.970352	Bridge widening	B3 - Priority 2	over Spicers Creek, 20m long
-32.108165	149.193629	Bridge widening	B4 - Priority 2	over Sandy Creek, 20m long
-32.050696	149.298712	Bridge widening	B5 - Priority 2	over Tucklan Creek, 25m long
-32.033471	149.351568	Bridge widening	B6 - Priority 2	over Limestone Creek, 15m long
-32.070859	149.667369	Bridge widening	B7 - Priority 2	Denis McGrath Bridge over Cainbill Creek
-32.047203	149.767434	Bridge widening	B8 - Priority 2	Piper's Bridge over Talbragar River, 40m long
-32.047451	149.769763	Bridge widening	B9 - Priority 2	Flood Channel No 2 over Talbragar River
-32.058774	149.91196	Eastbound-Overtaking Lane start	E10 - Priority 2	near Ironbark Creek
-32.048824	150.036885	Eastbound-Overtaking Lane start	E12 - Priority 2	near Borambil Creek
-32.129033	150.267564	Eastbound-Overtaking Lane start	E14 - Priority 2	near Ringwood Road
-32.217758	150.46346	Eastbound-Overtaking Lane start	E15 - Priority 2	near battery rock

Latitude	Longitude	Description	No. + Priority	Notes
-32.43525	150.795114	Eastbound-Overtaking Lane start	E17 - Priority 2	near Saddlers Creek
-32.037499	149.310855	Eastbound-Overtaking Lane start	E2 - Priority 2	near Clay Gully
-32.035721	149.49065	Eastbound-Overtaking Lane start	E3 - Priority 2	near Leadville
-32.069833	149.670476	Eastbound-Overtaking Lane start	E5 - Priority 2	near Cainbill Creek
-32.037876	149.789981	Eastbound-Overtaking Lane start	E7 -Priority 2	near Tongi Lane
-32.040359	149.811457	Eastbound-Overtaking Lane start	E8 - Priority 2	near Carnell Gully
-32.042763	149.853236	Eastbound-Overtaking Lane start	E9 - Priority 2	from Sawpit Creek
-32.104755	149.229146	Intersection upgrade	I1 - Priority 2	Spring Ridge Road
-32.062225	149.263758	Intersection upgrade	I2 - Priority 2	Cobbora Road
-32.088057	149.584397	Intersection upgrade	I3 - Priority 2	Merotherie Road
-32.047203	149.766174	Intersection upgrade	I4 - Priority 2	Church St, entrance to Uarbry
-32.042947	149.875237	Intersection upgrade	I5 - Priority 2	Vinegaroy Road
-32.340909	150.580432	Intersection upgrade	I7 - Priority 2	Bylong Valley Way and Wybong Road
-32.091068	150.105438	Westbound - Overtaking lane start	W10 - Priority 2	near Pembroke Road, cut here has fill for widening at Krui River
-32.042892	149.852763	Westbound - Overtaking lane start	W13 - Priority 2	near Sawpit Creek

Latitude	Longitude	Description	No. + Priority	Notes
-32.057721	149.728923	Westbound - Overtaking lane start	W14 - Priority 2	near Ross Crossing North Road
-32.02126	149.379385	Westbound - Overtaking lane start	W15 - Priority 2	near Avonside Road
-32.196142	148.902264	Westbound - Overtaking lane start	W16 - Priority 2	near Ballimore, location subject to survey
-32.450238	150.839345	Westbound - Overtaking lane start	W2 - Priority 2	near Hollydene Estate
-32.429689	150.77694	Westbound - Overtaking lane start	W3 - Priority 2	near Godolphin
-32.332702	150.619051	Westbound - Overtaking lane start	W5 - Priority 2	near Reedy Creek Road
-32.188617	150.447111	Westbound - Overtaking lane start	W7 - Priority 2	near Worondi Rivulet
-32.117216	150.187369	Westbound - Overtaking lane start	W8 - Priority 2	near Glenroy Road
-32.37038	150.691187	Proposed Denman bypass eastbound entry point		
-32.376523	150.718782	Proposed Denman bypass eastbound exit point		

Annex D – Images from Golden Highway

Photos

Image D.1: Cockfighter Bridge over Wollombi Brook – underlying condition

Image D.2: Truck crossing Cockfighter Bridge on centre lines

Image D.3: Denman Bridge: Heavy repairs and corrosion on cross beams

Image D.4: Denman Bridge: Corrosion on beams

Annex E – Preliminary Valuation of Denman Bypass

Aim

To determine a cost to Compulsory Acquire, Negotiated Purchase or to Resume the 3km x 60m corridor across the Denman Flood Plain.

The proposal is from the intersection of Jerry's Plains Rd and Denman Rd to the rail crossing at Merriwa and Mangoola Roads. I've spoken to some agents, dug out some sales from RP Data, but no detailed investigation with Council.

Observations

- Fertile flood plain with mixed rural use including lifestyle, irrigated cropping and turf farming.
- Tightly held with few recent sales.
- Lot size various with small lot subdivisions under earlier planning rules.
- Understand the minimum rural subdivision 70-80ha (increased from 40ha).
- Properties highly developed with some of the smaller lifestyle properties providing rates per hectare (pha) considerably higher than broad acres.
- Values have seen a considerable increase over last few years.
- Values vary greatly depending on quantity and standard of improvements, particularly lifestyle blocks.

Sales on the Flood Plain and/or Off Denman/Jerrys Plains and Mangoola Roads:

- 463 Dalswinton Rd Dalswinton 2015 90.35ha $2.26m $25Kpha. Flood plain.
- 76 Annandale Row Denman 2021 74.26ha $1.2m $16Kpha. (seems a bit odd)
- 1828 Denman Rd Denman 2021 70.45ha $1.86m $26.5Kpha. Turf farm.
- 1892 Denman Rd Denman 2021 25.61ha $0.935m $36.5Kpha.
- 1952 Denman Rd Denman 2021 12ha $0.31m $26Kpha.
- 2179 Denman Rd Denman 2022 26.18ha $0.87m $33Kpha.
- 2180 Denman Rd Denman 2022 14.59ha $1.21m $83Kpha.
- 1 Jerdan St Denman 2017 19.43ha $0.6m $31Kpha.
- 20 Mangoola Rd (railway side of subject area) Denman 2017 30.65ha 2 parcels $0.7m $45Kpha.
- 241 Merriwa Rd Denman 2019 14.08ha $0.67m $47.5Kpha.

Additional Issues to be considered that would require additional compensation and or land acquisition i.e. contingency.

- Highest and best use
- Water licenses
- Effect on holding due to severance.
- Access
- Disturbance
- Economic value
- Easements
- Hydraulic issues i.e. change to a flood plain and effect on property.

Estimate:

This is a very 'helicopter' view and any formal valuations would looking at each individual lot in and around the proposed corridor. This would take into account all of the above issues. Therefore, for the purpose of this exercise a considerable contingency should be applied.

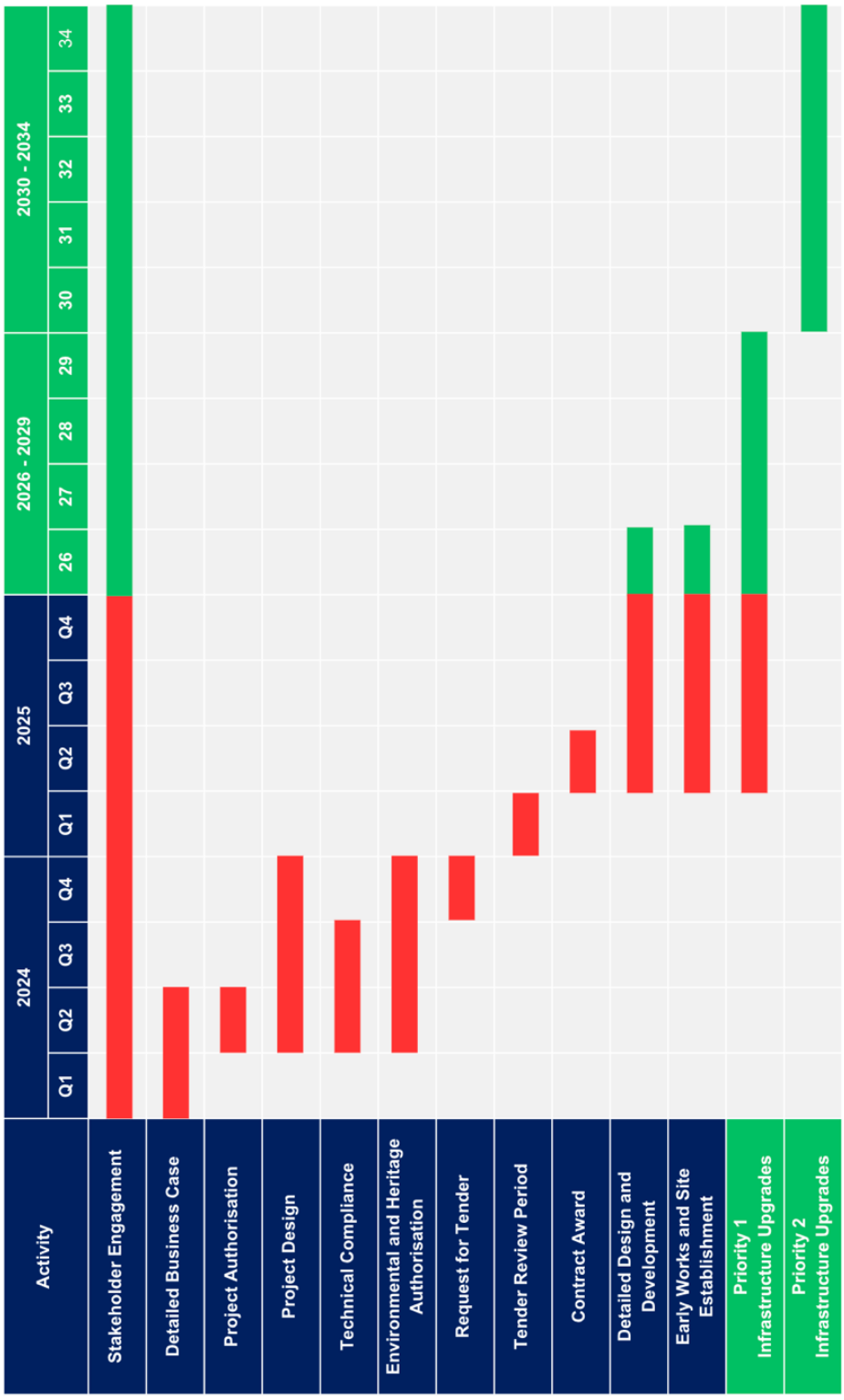
From discussions with local agents the area has seen considerable demand with little supply, which is evidenced by no recent comparable sales. The date of sales is all important, so I have only looked at sales over the last 3 years, which are a little historical. Even more historical are Dalswinton 2015, which is on the flood plain to the south, Jerdan St 2017, Mangoola 2017 & Merriwa Rds 2019, smaller hobby farm parcels, as I would also suspect 2180 Denman Rd.

There's quite a range and as previously noted each lot will have its own story with size, use and development. I believe a rate per hectare should be at the upper end with agents believing values have increased by over 50-70% in the last 2 years as "tree changers are a growing market sector". Therefore I would be allowing in the order of $50Kpha for larger parcels & $80-90Kpha for smaller averaging say $75Kpha. Road corridor of say 20ha $1,500,000 raw value. In these type of acquisitions the 'willing seller' principle does not necessarily apply, so the contingency should be healthy (outlined above) probably in the order of 30%.
To seriously assess the cost a detailed look at each individual holding would be required.

Annex F – Draft Project Schedule

The project is expected to follow the draft schedule below during implementation.

Figure E. 1: Draft project schedule

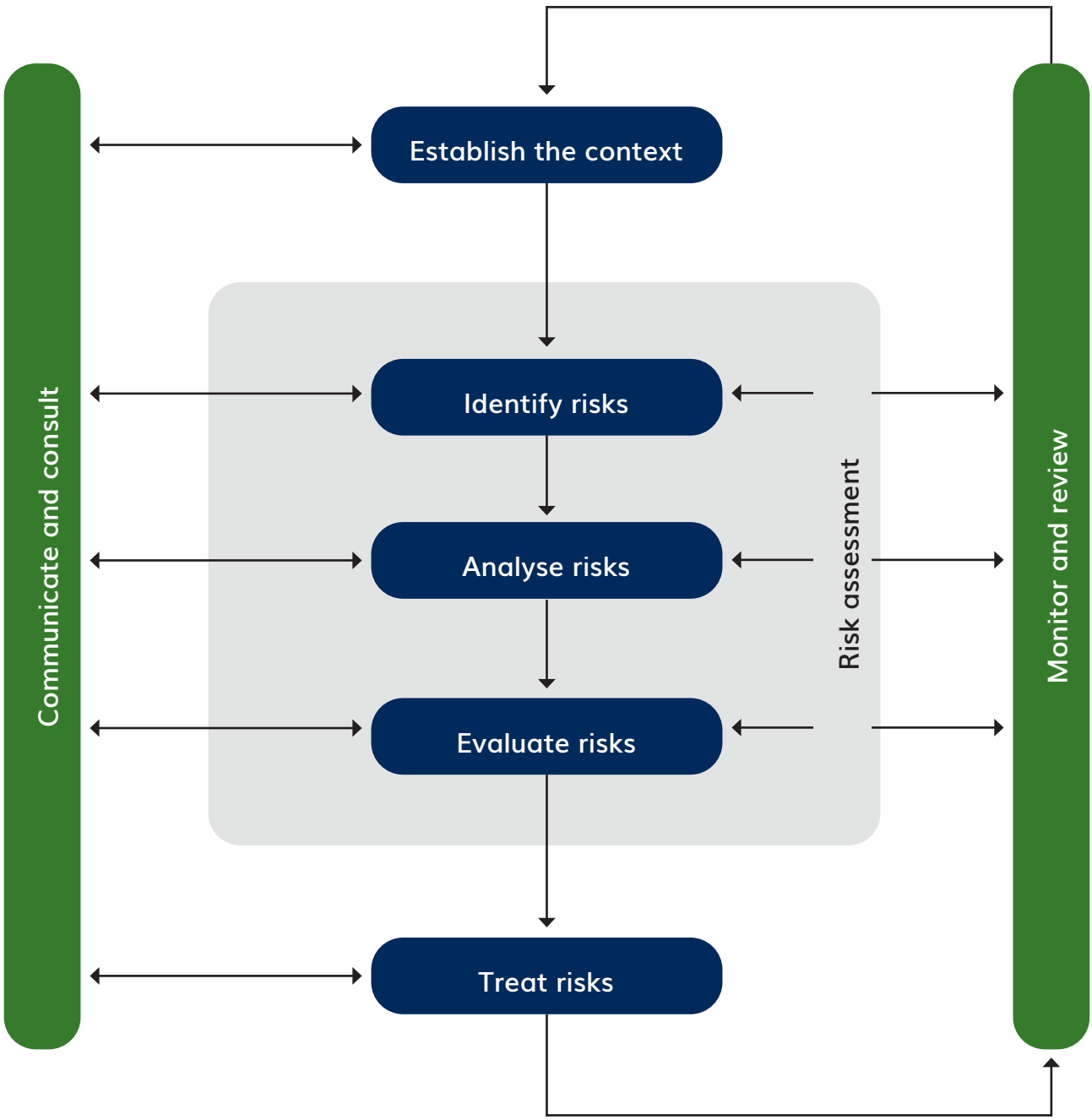


Annex G – Risk Management Methodology

The methodology for managing risk within the context of the Transport Strategy project follows.

The methodology is based on implementing continuous improvement through the adoption of the elements of AS/ NZS ISO 31000: 2009 (Risk Management Context refers)

Figure G.1: Risk Management Context



The initial Risk ratings and level of action to the be applied to the Activity is based on the 'overall risk' (Risk Table 1) rating for an identified risk.

Table G.1: Risk Table 1 - 'Risk Matrix Evaluation'

Risk Table 1: Risk Matrix Evaluation								
Risk Ratings:		**Risk Tolerance Rating**:		**Consequence**				
A – Very High	=	Generally intolerable		**Minor**	**Moderate**	**Major**	**Severe**	**Catastrophic**
B – High	=	Undesirable						
C – Medium	=	Tolerate		**C1**	**C2**	**C3**	**C4**	**C5**
D - Low	=	Broadly Acceptable						
Likelihood	**Almost Certain**		**L5**	B	B	A	A	A
	Very Likely		**L4**	C	B	B	A	A
	Likely		**L3**	C	C	B	B	A
	Unlikely		**L2**	D	C	C	B	B
	Very Unlikely		**L1**	D	D	C	C	B

The rating is determined by firstly considering the 'likelihood' (Risk Table 2) that the risk will occur, and then the 'consequence' (Risk Table 3) of the event to the business, from a financial, reputational, business, legal, community, project and staff perspective.

Table G.2: Risk Table 2 – 'Risk Likelihood Table'

Risk Table 2: Risk Likelihood Table					
Likelihood Rating		**Likelihood Description**			
		Qualitative		**Quantitative**	
		Expectation	**Experience**	**Probability (Single activity)**	**Frequency (Continuous operation)**
Almost Certain	**L5**	You expect it will definitely be a regular & repeated feature of the life of the project, activity, or task.	Has occurred frequently at the location	10 times or more every year	More than once a year at location or continuously
Very Likely	**L4**	You expect it will very likely occur during the life of the project, activity, or task.	Has occurred frequently in the Organisation	1-10 times every year	Once every 1 – 10 years at location
Likely / Possible	**L3**	You would expect it will more likely occur, than not occur during the life of the project, activity, or task.	Has occurred once or twice in the Organisation 'could happen'	Once each year	Once every 10 – 100 years at location
Unlikely	**L2**	You would expect it will more likely not occur than occur during the life of the project, activity, or task.	Has occurred many times in the 'industry', but not in the organisation	Once every 1 to 10 years.	Once every 100 – 1,000 years at location
Very Unlikely / Rare	**L1**	You do not expect it to occur during the life of the project, activity, or task. 'conceivable', but only in extreme circumstances'	Is unheard of, or has occurred once or twice in the 'industry'	Less than once, to once every 100 years.	Once every 1,001 or greater at location

Table G.3: Risk Table 3 – 'Risk Consequence Table'

Risk Table 3: Risk Consequence Table		
Consequence Level		**Impacts**
Extreme / Catastrophic	C5	Failure to meet the initiatives core outcomes. The organisation's viability is threatened. Severe reputational sensitivity. Failure to deliver on funding partner's expectations and requirements. Future operations curtailed. Very significant fines and prosecutions. Very serious litigation. Critical delays with the project which adversely affects publicly announced operations of a client, council, or funding partner. Single fatality or permanent total disability. Impacts on highly valued ecosystems, species, or habitat.
Severe	C4	Major threat to the delivery of the project's core outcomes. Major reputation sensitivity. Current operations curtailed. Serious breach of legislation, regulation, or contract. Major litigation. Major delays with the project which causes adverse impact to a client and requires rescheduling. Permanent partial disability. Impacts on ecosystems, species, or habitat.
Major	C3	Moderate impact on some outcomes and strategies. Close scrutiny of operations or future proposals. Breach of legislation or regulation with investigation, or report to authority with prosecution and/or moderate fine possible. Several delays with the project, no impact on client project/program/supply critical path. Major injury or Occupational illness or lost work case > 4 days. Impact on environment, but not effecting ecosystem function.

Risk Table 3: Risk Consequence Table		
Consequence Level		**Impacts**
Moderate	C2	Isolated or short-term local concern. Some impact on asset level non-service activities. Minor time delay and/or minor decrease in benefits. No delay on other projects or initiatives. Breach of contract or legislation or regulation or internal standard. First Aid Case to Moderate Injury/Occupation illness, Restricted workday case or Lost work case < 4 days or Medical Treatment Case. Localised effect to species or habitat but not effecting ecosystem function.
Insignificant / Minor	C1	Minimal impact on initiatives. No delay on key project milestones. Minimal reputational sensitivity. Consequences can be dealt with, within project processes.

The business sponsor then must determine the level of overall risk that the business is prepared to accept or take action to reduce through elimination, transfer or mitigation actions (refer to Risk Table 4) having evaluated the risk rating (Risk Table 1).

For the management of a project, Project Risks – that is the risks related to a specific project, or phase, or activity of a project are to be considered within the categories detailed at Risk Table 5 (to be included in the project's Risk Register) and the relevant management actions (generally detailed at Risk Table 6).

Table G.4: Risk Table 4 – 'Risk Tolerance and Response Table'

Risk Table 4: Risk Tolerance and Response Table					
Risk Rating	**Risk Tolerance Rating**	**Very High Risk**	**Initial Response Strategy**	**Response Qualification**	**Review Frequency (if other than fortnightly)**
A	**Generally intolerable**		**Terminate**	Very high risks, generally intolerable and are to be avoided except in extraordinary circumstances. Where the risk has health, safety or environmental consequences the activity should not be undertaken.	
B	**Undesirable**		**Transfer**	High risks are undesirable. Only to be tolerated if it is not reasonably practicable to reduce the risk further. Where the risk has environmental, health, or safety consequences the activity should not be undertaken, without agreement of the Manager. High risks are considered to be on the verge of being unacceptable and must be given immediate priority.	
C	**Tolerable**		**Treat**	Medium risks are tolerable if it is not reasonably practicable to reduce the risk further. Where the risk has health, safety or environmental consequences the activity should be reviewed to determine if the risk can be reduced further and whether all reasonable and practicable controls have been considered and /or applied. Additional treatment measures should be sought if significant benefit can be demonstrated and/or there is an additional treatment measure which is recognised as good practice in another like environment.	
D	**Broadly acceptable**		**Tolerate**	Low risks are considered broadly acceptable. Where the risk has health, safety or environmental consequences control measures should be effective, reliable, and subject to appropriate monitoring. If options for further risk reduction exist and costs are proportionate to the benefits, then implementation of such measures should be considered. The risks and its treatments should be subject to appropriate degrees and forms of monitoring to ensure that it remains at this level.	
		Negligible Risk			

Table G.5: Risk Table 5 – 'Project Risk Categories and Definitions/Examples'

Risk Table 5: Project Risk Categories and Definitions/Examples	
Category	**Examples of types of risk that would fall in this category**
Financial Risk	Failure to generate or obtain funding to implement; Failure to realise projected benefits. Extended delay in realisation of projected benefits. Significant overrun on projected cost of implementation.
Schedule / Time	Time / Schedule delays in project activities.
Quality	Deliverables do not meet stated requirements, formats, or required detail.
Safety	WHS risks.
Execution Risk	Lack of, or ineffective Commitment; Support; Sponsorship; or Alignment with other initiatives; or ineffective Organisational alignment; Business process redesign; Change management; Communication; Application control; Staffing; Training; Business continuity; facility availability; material requirement not planned/delivered.
Governance / Initiative Management Risk	Lack of, or ineffective Initiative Management, Planning; Monitoring; Controls; Scope; Tools and methodologies; or Decision making.
Functional Risk	Missing requirements. Adverse impact on Business process controls; Promised functionality, reliability, usability is realised; Adverse impacts on Customer requirements, expectations or experience., WH&S.
Resourcing Risk	Staffing or Contractor availability; lack or response from market
Regulatory Risk	Lack of compliance with regulatory and local compliance requirements
Technical Risk	Production equipment, Hardware; Software; Data conversion; System architecture; Networking; Performance; Security; Availability; or Disaster Recovery risks; Technology Integration, interoperability, or compatibility and commissioning risks.

Table G.6: Risk Table 6 – 'Project Management Actions'

Table 6: Project Management Actions	
Risk Category	Management Actions
A - Very High	Risk mitigated by Project Sponsor and Project control Group
B - High	Risk mitigated by Project Control Group and Project Manager as required
C - Medium	Risk managed, mitigated, and contained by the Project Team, Reported to the Project Control Group /Project Sponsor
D - Low	Managed by Project Team

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