

## Business case evaluation summary

# M1 Pacific Motorway Extension to Raymond Terrace and Hexham Straight Upgrade

### Location

Newcastle, NSW

### Geography

Smaller cities and Regional Centres

### Category

National Connectivity

### Capital cost

Pending (see endnote)

### Indicative timeframe

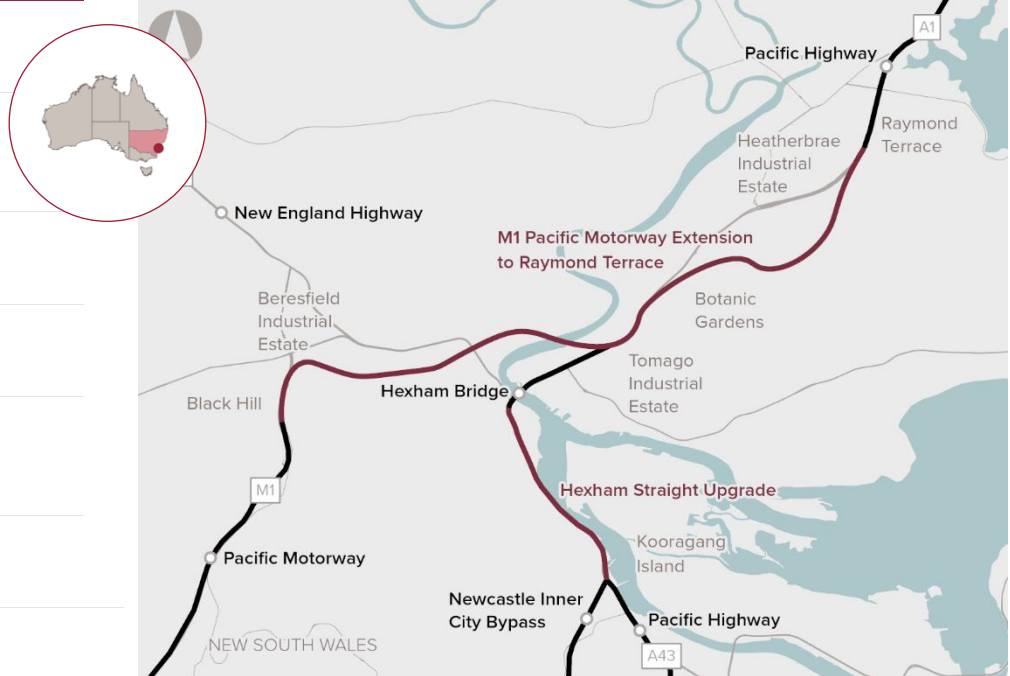
Construction Start: 2023  
Project completion by: 2028

### Proponent

NSW Government

### Evaluation date

14 October 2021



## 1. Evaluation Summary

Infrastructure Australia evaluated the business cases for the *M1 Pacific Motorway Extension to Raymond Terrace and Hexham Straight Upgrade* in accordance with our *Statement of Expectations*, which requires us to evaluate project proposals that are nationally significant or where Australian Government funding of \$250 million or more is sought. We have evaluated the two business cases together, reflecting the Australian Government funding commitment of \$1.6 billion to the proposals as a single program. The proposal was not considered for inclusion on the *Infrastructure Priority List* due to its Australian Government funding status.

The two proposals are intended to address network efficiency and safety issues at a key junction of the M1 Pacific Motorway, New England Highway and A1 Pacific Highway at Hexham, north-west of Newcastle. This junction of National Land Transport Network (NLTN) corridors is critical in providing connectivity to Sydney, Newcastle and its port, the New England and North West regions. The Pacific Motorway/Highway is one of the busiest road freight corridors in Australia and is a critical road transport connection between Sydney and Brisbane.

The convergence of several major corridors at Hexham has contributed to problems including high traffic volumes, constrained road capacity, complex interchanges, and complex interactions between the arterial and local roads, affecting overall network efficiency. In addition, the existing road layout and conditions in certain sections contribute to a high safety risk for road users and result in road closures during large flood events.

The NSW Government's *Outer Newcastle Study* identified the two proposals as having the greatest overall benefit of the improvement options considered. The proposals include the construction of a new 15-kilometre dual carriageway extension of the M1 Pacific Motorway from Black Hill to the Pacific Highway at Raymond Terrace to bypass Hexham, and widening the Hexham Straight, a six-kilometre section of the Pacific Highway, from four to six lanes. Expected benefits include improved travel time, vehicle operating costs, safety, freight productivity and flood resilience.

The proponent's business cases state the net present value (NPV) of the proposals as \$3.2 billion, with a benefit cost ratio (BCR) of 3.2<sup>1</sup>. While our review identified some deficiencies in the business cases, including the treatment of induced demand in the *Hexham Straight Upgrade* analysis, we are confident that the benefits of the proposals will outweigh the estimated costs individually and as a program.

## 2. Context

The M1 Pacific Motorway and A1 Pacific Highway are primary corridors to existing population hubs and the broader Hunter Region. The region is the second largest metropolitan area in NSW and is forecast to increase its 2021 population of 600,300 by approximately 16% by 2041.

The *Urban Transport Crowding and Congestion* supplementary report to the *Australian Infrastructure Audit 2019* identified that increasing road congestion associated with population growth is expected to especially affect major connections between central Newcastle and its surrounding region, including the New England Highway, and the Pacific Highway.

The M1 Pacific Motorway forms part of a continuous road corridor along the eastern coast of NSW and Queensland, connecting Sydney, Newcastle, Port Macquarie, Coffs Harbour and Brisbane. The M1 Pacific Motorway provides a motorway-standard road between Sydney and Beresfield, and the A1 Pacific Highway consists of a four-lane divided carriageway between Heatherbrae and Brisbane. The 13.5 kilometre section of the corridor between the northern end of the M1 Pacific Motorway and the southern end of the A1 Pacific Highway (from John Renshaw Drive to the North of Heatherbrae) is not motorway standard and is inadequate during periods of high traffic movements.

This north-south connectivity supports significant volumes of road freight, commuter and recreational traffic passing between the major urban centres along the coast, many of whom have Newcastle and the broader Hunter region as an origin/destination. The proposed M1 Pacific Motorway extension and the A1 Pacific Highway improvement at Hexham aim to improve network safety and efficiency by alleviating congestion and improving freight performance.

## 3. Problem description

The current connection between the M1 Pacific Motorway and A1 Pacific Highway is one of the most highly trafficked areas of the region's road network and is more heavily congested than adjacent sections of the Pacific Motorway/Highway corridor. The current alignment between the termination of the M1 Pacific Motorway at Black Hill and the A1 Pacific Highway at Raymond Terrace is not free flowing, does not meet motorway standards and is a congestion point on the NLTN.

The proponent identified the following five problems in the project area:

- **Poor road network efficiency:** The convergence of five arterial routes (M1 Pacific Motorway, John Renshaw Drive, New England Highway, A1 Pacific Highway, and Hexham Straight) result in high traffic volumes of approximately 60,000 vehicles per day, with freight, local and regional traffic competing for road capacity, creating inefficient operation of the road network
- **Poor road safety:** The existing road layout and condition in certain sections and intersections contributes to a high level of crash risk to road users. Continued increase in traffic volumes and population is expected to exacerbate crash risk to road users
- **Poor regional freight efficiency and costs to freight dependent industries:** The lack of dedicated freight infrastructure along Hexham Straight and heavy vehicle constraints on Hexham Bridge have resulted in inefficient freight movements and poor road network efficiency
- **Opportunity to support planned growth areas of outer Newcastle:** Realisation of the strategic growth plans of East Maitland, Beresfield, Tomago, and Williamstown is highly dependent on the provision of fit for purpose transportation network for the residents, employees, goods, and freight of the Pacific Motorway/Highway corridor.
- **Flooding:** The A1 Pacific Highway near Hexham is subject to flooding with an average recurrence interval between one-in-five and one-in-ten years. Some areas must close to traffic during large flood events leading to road network disruptions, diversions, travel time delays and loss of productivity for road users and associated businesses. The Pacific Highway is a key

<sup>1</sup> Using a 7% real discount rate and P90 capital cost estimate, evaluated over a 30-year period

road within regional emergency management plans so flood disruptions can hinder access to emergency or care sites during storm conditions, with implications for property damage, injuries and loss of life.

The 2019 *Urban Transport Crowding and Congestion* report forecast the average weekday cost to the Hunter region of road congestion to grow from \$3.5 million to \$6.6 million between 2016 and 2031. The report also identified that increased traffic congestion into Newcastle could potentially undermine the competitive lifestyle and affordability advantage enjoyed by Newcastle and the Hunter Region in comparison to Sydney. Congestion on the New England Highway corridor could also impact the productivity of Newcastle Port and associated industrial and commercial precincts.

#### 4. Options identification and assessment

The 2019 *Outer Newcastle Study* was commissioned by the NSW Government's Roads and Maritime Services (now part of Transport for NSW) to inform the prioritisation of road upgrades within the study area, which largely corresponds to the project areas of the *M1 Pacific Motorway Extension to Raymond Terrace and Hexham Straight Upgrade*.

The Study considered nine projects within the study area, assessed 11 project combinations, using rapid cost-benefit analysis and multi-criteria assessment. The study identified an extension of the M1 to Raymond Terrace and upgrades to Hexham Straight as the preferred project combination to provide high performances in network speed, travel time, reductions and intersection performance in peaks, and all modelled years. This combination was also found to provide the highest freight cost reduction and one of the highest reductions in crashes.

The proponent's preferred option for the *M1 Pacific Motorway Extension to Raymond Terrace* is supported by an extensive planning and optioneering process that commenced in 2004:

- Early phase options development: this focused on the potential provision of a motorway link between the M1 Pacific Motorway and A1 Pacific Highway
- Broader network considerations: recognition of the broader array of road users, development issues and aspects associated with outer Newcastle
- Preferred option development: refinement of concept options linking the M1 Pacific Motorway and A1 Pacific Motorway.

The proponent assessed a range of alternatives to the extension of the M1 Motorway prior to evaluating potential extension routes. This included the following options:

- Alternative 1: Do nothing (base case)
- Alternative 2: Do minimum
- Alternative 3: Rail as an alternative mode of transport and freight
- Alternative 4: Establishing a primary route to the west (New England Highway)
- Alternative 5: A motorway link from the M1 Pacific Motorway at Black Hill to the Pacific Highway at Raymond Terrace.

The submission provided a high-level summary of the lengthy options analysis and the shortlisting process for these proposals that took place over at least six stages between 2004 and 2019.

The *M1 Pacific Motorway Extension to Raymond Terrace* options development and assessment process included workshops and multi-criteria assessment processes. Based on the information provided, it is not clear which options were subject to rigorous assessment. Therefore, the comparative benefit of the proposal against these options is not well understood, particularly in quantified terms. The submission did not include evidence of the consideration of non-infrastructure options.

The proponent identified that the *Hexham Straight Upgrade* proposal did not consider a similar optioneering process. A strategic assessment of this proposal was carried out only as part of the Outer Newcastle Study. The proponent's submission did not provide sufficient information for us to be confident that the optimal option was selected for the Hexham Straight Upgrade.

Overall, we are confident in the proponent's top-level optioneering process in identifying the *M1 Pacific Motorway Extension to Raymond Terrace and Hexham Straight Upgrade* as the preferred

solution to addressing the nationally significant connectivity and congestion problems identified in the project area. However, we have not been provided with sufficient documentation to allow us to be confident in the process for identifying the preferred options for each of these proposals.

## 5. Proposal

The *M1 Pacific Motorway Extension to Raymond Terrace* will extend the motorway from its current northern terminus at Beresfield to Raymond Terrace, where it will join directly with the A1 Pacific Highway, bypassing Hexham. The key features of this proposal include:

- A 15-kilometre motorway comprised of a four-lane divided road (two lanes in each direction)
- Motorway access from existing road network via four new interchanges at:
  - Black Hill: connection to the M1 Pacific Motorway
  - Tarro: connection and upgrade (six lanes) to the New England Highway between John Renshaw Drive and the existing Tarro interchange at Anderson Drive
  - Tomago: connection to the Pacific Highway and Old Punt Road
  - Raymond Terrace: connection to the Pacific Highway
- A 2.6-kilometre viaduct over the Hunter River floodplain including new bridge crossings
- Bridge structures over local waterways at Tarro and Raymond Terrace, and an overpass of Masonite Road in Heatherbrae
- Connections and modifications to the adjoining local road network
- Adjustment of waterways, including at Purgatory Creek at Tarro and a tributary of Viney Creek
- Environmental management measures, including surface water quality control measures
- Walking and cycling considerations, allowing for existing and proposed cycleway route access
- Permanent and temporary property adjustments and property access refinements

The extension will separate through traffic on the Pacific Highway/Motorway from the New England and Pacific Highways and local road users at Hexham, significantly improving travel times for motorway users and the overall local network.

The *Hexham Straight Upgrade* will improve the six-kilometre Pacific Highway section between the Newcastle Inner City Bypass and Hexham Bridge. The proposed improvements include:

- Widening of the Pacific Highway/Maitland Road (A43) from the intersection with the Newcastle Inner City Bypass (A37) at Sandgate, to the Hexham Bridge on the New England Highway/Maitland Road. The Highway would be widened from two lanes to three lanes in each direction
- Replacement of the bridge spanning Ironbark Creek with new twin bridges. The existing bridge and piers would be demolished, and the outlet of a small drainage channel would be relocated
- Minor improvements of nine signalised intersections
- Minor improvements to access roads, unsignalized intersections, entry and exit ramps connecting to the Pacific Highway and the U-turn facility at the northern end of the proposal
- Closure of median and direct access at four locations
- Active transport considerations, allowing for existing and proposed cycleway route access
- Improvements to pedestrian facilities and access to public transport, in particular upgrades to the access of Hexham Train Station and bus stops along the corridor.

This proposal would improve the efficiency and reliability of the corridor by significantly increasing the capacity of this critical road link. It would improve traffic flow, deliver more reliable travel times for freight, and increase safety for all road users, including cyclists and pedestrians.

The scope of works for both proposals are aligned to the benefits targeted and project objectives.

## 6. Strategic fit

The *M1 Pacific Motorway Extension to Raymond Terrace* represents one of the final major upgrades, along with *Coffs Harbour Bypass*, that are needed to complete a four lane, divided carriageway along the east coast NLTN road corridor connecting Brisbane, Sydney, and Melbourne.

The proposal has strong strategic merit, is part of the broader Pacific Highway Upgrade Program and aligns with national, state and local policies, strategies and plans, including contributing to:

- *NSW Future Transport Strategy 2056*
- *NSW Greater Newcastle Future Transport Plan*
- *NSW Greater Newcastle Metropolitan Plan 2036*
- *NSW Hunter Regional Plan 2036*
- *NSW Connecting to the Future – 10-year Blueprint for Transport*
- *NSW State Infrastructure Strategy 2018-2038*
- *NSW Road Safety Plan 2021*
- *NSW Freight and Ports Plans 2018-2023*
- *NSW Heavy Vehicle Access Policy Framework*
- *Regional NSW Services and Infrastructure Plan.*

The proposals benefit all road users through improved network efficiency, accessibility, safety and infrastructure resilience. They will lower costs for users particularly during peak and holiday periods. The proposals support broader regional economic development through increased freight access and carrying capacities consistent with the M1 Pacific Motorway and A1 Pacific Highway to the south and north of the project area. Increased freight efficiency lowers the costs of transport and supports growth of freight dependent industries and developments.

The proposal responds to the *Pacific Motorway (M1) – Extension to Raymond Terrace* proposal on the *Infrastructure Priority List*, which identified the national significance of the connectivity problems in this section of the NLTN.

## 7. Societal Impact

The proponent's business cases state that the net present value of the combined program is \$3.2 billion with a benefit-cost ratio of 3.2, using a 7% real discount rate and P90 capital cost estimates. We considered the sensitivity of the appraisal to the discount rate and note that:

- Using a 4% discount rate results in a NPV of \$6.5 billion and a BCR of 4.8
- Using a 10% discount rate results in a NPV of \$1.5 billion and a BCR of 2.2.

Estimates indicate annual, nationally significant benefits of \$200 million in 2028 - the expected first year of operation. In addition to the combined program results, the proponent's submission also included standalone results for each proposal:

- The NPV of the *M1 Pacific Motorway Extension to Raymond Terrace* was stated as \$1.6 billion, with a BCR of 2.3
- The NPV of the *Hexham Straight Upgrade* was stated as \$1.5 billion, with a BCR of 7.9.

The proponent's reported results indicate their expectation that the joint delivery of the two proposals as a single program would provide synergies that result in lower total costs and higher overall benefits. Based on our evaluation of the submission, it is not clear whether the two projects would crowd out some benefits (and the total net benefit is less than the sum of their parts), or whether there are synergies that mean that the net benefits are more than additive. However, each proposal is strong individually, and they are expected to produce positive societal impacts even in the absence of the program synergies expected by the proponent.

The economic appraisal methodology for both proposals align with our *Assessment Framework*, except for the following observations:



- The freight productivity benefit estimate in the *M1 Pacific Motorway Extension to Raymond Terrace* was not based on research, but on an assumption calculated from traffic survey information for long haul freight movements between Sydney and Brisbane. Given the size of freight productivity benefits reported, we cannot be confident in the size of this estimate without a more rigorous evidence base and sensitivity testing
- The *M1 Pacific Motorway Extension to Raymond Terrace* is the final link in a series of upgrades that are needed to allow larger freight vehicles (such as A-doubles) to operate on the M1/A1 corridor between Sydney and Brisbane. All benefits from this enhanced freight corridor are attributed to this project, even though there are other ongoing works along the corridor. The benefits related to the use of high productivity freight vehicles are likely to be overstated
- The traffic and transport modelling for *Hexham Straight Upgrade* utilised a fixed demand matrix, which does not account for induced traffic. Our Assessment Framework recommends the consideration of induced demand and notes that fixed matrix modelling is only appropriate for minor improvement projects:
  - Use of a fixed matrix approach may overstate or understate the economic value of the proposal as induced demand may reduce benefits by using up the additional network capacity provided by the proposal before the end of the appraisal period
  - This could lead to reduced travel time savings, reduced vehicle operating cost savings and increased external costs – in particular, congestion and environmental externalities arising from additional or longer journeys.

The following table presents a breakdown of the benefits and costs stated in the business case.

### Benefits and costs breakdown

Proponent's stated benefits and costs	Present value (\$m,2020/21) @ 7% real discount rate			% of total
	M1 Extension to Raymond Terrace	Hexham Straight Upgrade	Combined Program <sup>4</sup>	
<b>Benefits</b>				
Travel Time Saving	1,353.8	1,265.6	2,681.2	57%
Freight Productivity Savings	881.5	-	881.5	19%
Vehicle Operating Cost Savings	505.0	407.6	926.4	20%
Residual Value	84.8	10.4	95.1	2%
Change in Externalities	40.3	-10.2	31.6	1%
Safety improvements	33.4	60.8	96.0	2%
Reduced flooding	1.9	-	1.9	0%
<b>Total Benefits<sup>1</sup></b>	<b>2,900.7</b>	<b>1,734.2</b>	<b>4,713.7</b>	(A) <b>100%</b>
Total capital costs (P90)	1,238.0	217.9	1,469.3	
Operating costs	21.6	3.1	24.7	
<b>Total Costs<sup>1</sup></b>	<b>1,259.6</b>	<b>221.0</b>	<b>1,494.0</b>	(B) <b>100%</b>
<b>Net benefits - Net present value (NPV)<sup>2</sup></b>	<b>1,641.1</b>	<b>1,531.2</b>	<b>3,219.7</b>	
<b>Benefit-cost ratio (BCR)<sup>3</sup></b>	<b>2.3</b>	<b>7.9</b>	<b>3.2</b>	

Source: Proponent's business case

(1) Totals may not sum due to rounding

(2) The net present value is calculated as the present value of total benefits less the present value of total costs (A – B)

(3) The benefit-cost ratio is calculated as the present value of total benefits divided by the present value of total costs (A ÷ B)

(4) The results of the M1 Pacific Motorway Extension to Raymond Terrace and Hexham Straight Upgrade do not sum to the results for the Combined Program, which is attributed to program synergies in the submission.

Overall, we are confident that if the proposals are delivered within the estimated costs, the benefits of both proposals are likely to outweigh their costs, both individually and as a program.

Tangible modelled benefits include travel time savings on the following trips:

- 6-10 minutes per trip between Pacific Motorway South and Pacific Highway East
- 5-8 minutes per trip between M1 Pacific Motorway South and Adelaide Street
- 3-5 minutes per trip between New England and Pacific Highway East.

The proponent's reported capital costs and funding is presented in the following table.

Capital costs and funding	
Total capital cost	Pending (see endnote)
Australian Government funding contribution	To be confirmed
Other funding (NSW Government)	To be confirmed

The Australian Government has committed \$1,600 million towards the project.

We note that the proponent completed the economic analysis for the two proposals prior to the release of Transport for NSW guidance on assessing the impacts of COVID-19 for business cases in June 2021. The guidance recommends sensitivity testing of cost-benefit analysis results to understand the potential impacts of COVID-19 on long term transport trends, particularly the impacts of reductions in population growth and increases in working from home.

The proponent does not consider the long-term effects of COVID-19 to pose risks to the economic viability of these proposals. A range of sensitivity tests were undertaken for both proposals and the combined program relating to capital cost increases, lower benefits, and slower traffic growth. These are comparable to those recommended in the COVID-19 guidance. A sensitivity test by the proponent combining a 20% increase in capital costs with a 20% decrease in benefits yields a NPV of \$2.0 billion and a BCR of 2.1, using a 7% real discount rate and P90 capital cost estimates. This indicates that the proposal is still expected to deliver significant net benefits for society under conditions resulting in a substantial reduction in benefits and increase in costs for the proposals.

## 8. Deliverability

Transport for NSW is leading the delivery of the projects and they have extensive experience in delivering similar projects.

The selected procurement approaches are based on:

- An assessment of the potential for a private public partnership (PPP)
- A delivery options strategy workshop which involved representatives from Transport for NSW
- A market interaction process to gauge industry appetite and feedback on the optimal model to be utilised for the procurement and delivery of the project.

The proponent decided to not proceed with a PPP, based on their assessment, which found:

- A lack of unique or specific benefits to be derived if this project was to be procured as a PPP
- A PPP would not lead to any significant change in risk profile associated within design and construction of the project.

Based on the outcomes of the workshop and market interaction process undertaken to identify the preferred packaging strategy and contracting model, the proponent decided to deliver the *M1 Pacific Motorway Extension to Raymond Terrace* through two packages comprising a southern and northern section. The southern package includes the 10-kilometre Black Hill to Tomago section, while the northern package includes the 5-kilometre section from Tomago to Raymond Terrace. Market feedback also confirmed that a design and construct contract is the most suitable option for delivering the *M1 Pacific Motorway Extension to Raymond Terrace*.

The procurement process for *Hexham Straight Upgrade* builds upon the analysis and market interaction process conducted for the *M1 Pacific Motorway Extension to Raymond Terrace* as several factors are considered to overlap, such as market competition. The proponent indicated that delivery will likely be through a single design and construct contract due to the analysis undertaken and in response to an accelerated project schedule. However, the business case also states that a collaborative form of contract may be suitable. The procurement strategy for the

*Hexham Straight Upgrade* was not completed at the time of our evaluation. We recommend that the proponent prioritise the selection of a procurement model and implementation of a procurement strategy for the *Hexham Straight Upgrade* to mitigate against delivery delays.

The proponent identified ten key delivery risks for the two projects, which were originally rated as “very high” and remained “high” with risk mitigation measures, which include:

- lack of funding to fully complete the program
- Health and Safety in Design issues
- addressing contamination issues
- adverse flood impacts
- existing structures and pavements on Hexham Straight being in worse condition than expected
- traffic management if both proposed projects are delivered concurrently.

Proposed mitigation measures involve further assessments to better understand the contamination, flood and road condition risks. Design reviews and treatment are proposed to address the safety and flood risks. We note that the proponent is working with the Australian Government to address funding risks. Overall, we consider the proponent’s risk management plan to be appropriate.

Benefits Realisation Management Plans have been developed for the *M1 Pacific Motorway Extension to Raymond Terrace* and *Hexham Straight Upgrade*. The benefits realisation plan sets out the measures, targets, baseline, data source, and reporting responsibility for each key performance indicator. We encourage the proponent to conduct and publish a Post Completion Review to assess the extent to which the benefits and costs set out in the business cases are realised.

### **Consideration of COVID-19**

The COVID-19 pandemic has significantly affected the use of infrastructure. Infrastructure Australia has been working collaboratively with the Australian Government to provide advice on a staged response for managing, and recovering from, the impacts of the COVID-19 pandemic.

One critical element of our advice is to maintain a pipeline of nationally significant infrastructure investments. Nationally significant infrastructure projects are long-term investments, typically considering a 30-year view of a proposal’s societal impacts. In undertaking this evaluation, Infrastructure Australia continues to take a long-term view and has also considered the sensitivity of key planning assumptions using the best data available to us.

As noted in the 2019 Australian Infrastructure Audit, we must continue to evolve the way we plan for Australia’s infrastructure to embrace uncertainty. There are still many uncertainties regarding the long-term impact of the COVID-19 pandemic on infrastructure use.

We will continue to collaborate with industry, the community and governments at all levels to understand the impacts of the COVID-19 pandemic on infrastructure decisions in Australia.

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This evaluation summary currently excludes the estimated capital cost (nominal, undiscounted) as the project is currently in active procurement. It will be updated once this information is publicly available.