BELLWETHER

Princes Highway Upgrade program – Jervis Bay Road to Hawken Road

Value Management Workshop Report

BW-1125-DOC-RP-0003-B

August 2022

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PROJECT INFORMATION

Project Name	Princes Highway Upgrade Program – Jervis Bay Road to Hawken Road
Project no.	P.0046893
Contract no.	19.0000302650.0560-0025
Cardno Project Number	80021067
Location	Princes Highway between Jervis Bay Road and Hawken Road
Local Council	Shoalhaven City Council
Length (size) of the project	Approximately six kilometres

Project Features	• Upgrade of the existing Princes Highway, including realignment and widening from two lanes to a four-lane divided highway (two lanes in each direction) with median separation (e.g. flexible barriers) providing road users uninterrupted travel through approximately six kilometres of the alignment for the Princes Highway between Jervis Bay Road and Hawken Road
	• Tie-in to the Jervis Bay Road intersection upgrade to the north of the project
	• Tie-in to the existing Princes Highway approximately two kilometres south of Hawken Road to the south of the project
	• New local access roads which include:
	  ▪ Service Road 01 to allow local residents access to the western side of the Princes Highway via Willowgreen Road and the Jervis Bay Road Interchange
	  ▪ Service Road 02 from the northern tie-in at the Jervis Bay Road interchange to allow residents access to Mortimer Road on the eastern side of the Princes Highway.
	• An upgraded intersection between the Princes Highway, Blackbutt Range Road and Hawken Road
	• Changes in the access to Gorindah Road potentially redirecting local traffic to the existing connections of Baron Road and Pepper Road
	• Modifications to the connections between local roads and the Princes Highway, including Willowgreen Road, Mortimer Road, Pepper Road, Sinclair Road, Hawken Road and Blackbutt Range Road
	• Earthworks including cuttings, embankments and retaining walls along the Princes Highway
	• Adjustment of drainage structures along the project
	• Shared user paths to provide pedestrian and cyclist connectivity at the Hawken Road intersection to provide access to public transport facilities, local roads and Princes Highway

Project Name	Princes Highway Upgrade Program – Jervis Bay Road to Hawken Road
	• Emergency access and emergency U-turn facilities at suitable locations along the Princes Highway • Establishment and use of temporary ancillary facilities during construction • Roadside furniture including safety barriers, signage, line marking, lighting and fencing • Property works including acquisition, demolition and adjustments to properties, and at-property noise treatments if required • Rehabilitation of disturbed areas and landscaping in consideration of health and safety in design, work health and safety, and maintenance requirements • Adjustment, protection and relocation of existing utilities.

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DOCUMENT HISTORY AND STATUS

Revision	Date	Description	Author	Reviewer	Approver
A	1/07/2022	First draft for TfNSW review	AV	MLS	
B	1/08/2022	Updated draft responding to TfNSW	AV	MLS	

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1. Introduction

1.1 Background

The Princes Highway is critical to a thriving South Coast of New South Wales (NSW). The Princes Highway helps drive the State's third largest regional economy, is relied upon by over 500,000 local residents, and welcomes almost four million tourists each year. The Princes Highway connects regional centres and essential services, and is the main transport corridor for freight to the region. Since 2011, $5.1 billion has been committed to upgrading the Princes Highway from Albion Park to Victoria. This has transformed and better-connected communities, employed thousands of local workers, improved safety, eased traffic congestion, and grown regional economies.

Transport for NSW (TfNSW) is proposing to upgrade a six kilometre section of the Princes Highway between Jervis Bay Road and Hawken Road (stage one of the Jervis Bay Road to Sussex Inlet Road upgrade project). The proposed upgrade to this section of the Princes Highway would deliver better -connected and more mobile regional centres, deliver a more resilient transport network, improve safety, ease traffic congestion and grow regional economies.

TfNSW has engaged Cardno to undertake the concept design of Princes Highway between Jervis Bay Road and Hawken Road.

1.2 Purpose of this report

The purpose of this report is to document the outcomes of the VMW for the project to recommend a preferred treatment option for the upgrade of the intersection between the Princes Highway, Blackbutt Range Road and Hawken Road. This report provides a recommendation for the preferred option of the highway upgrade and intersection treatment and is one of several components of the design process.

1.3 Project locality and description

The project is located in the Shoalhaven Local Government Area (LGA), approximately 170 kilometres south of Sydney and 12 kilometres south of Nowra. It forms a key part of the transport corridor for local traffic, freight, tourists and public transport users, and provides access to regional coastal and inland towns including Huskisson, Vincentia, Tomerong, Sanctuary Point and surrounding villages.

An overview of the project study area is shown in Figure 1.1 and a summary of the key features include:

- Upgrade of the existing Princes Highway, including realignment and widening from two lanes to a four-lane divided highway (two lanes in each direction) with median separation (e.g. flexible barriers) providing road users uninterrupted travel through approximately six kilometres of the alignment for the Princes Highway between Jervis Bay Road and Hawken Road
- Tie-in to the Jervis Bay Road intersection upgrade to the north of the project
- Tie-in to the existing Princes Highway approximately two kilometres south of Hawken Road to the south of the project

- New local access roads which include:
  - Service Road 01 to allow local residents access to the western side of the Princes Highway via Willowgreen Road and the Jervis Bay Road interchange
  - Service Road 02 from the northern tie-in at the Jervis Bay Road interchange to allow residents access to Mortimer Road on the eastern side of the Princes Highway.
- An upgraded intersection to connect Blackbutt Range Road and Hawken Road with the Princes Highway
- Adjustments of local roads to maintain direct access to the Princes Highway including:
  - Mortimer Road, Sinclair Road, Peterson Road, and Pepper Road
  - Blackbutt Range Road (using the Hawken Road interchange on and off ramps)
  - Hawken Road (using the Hawken Road interchange on and off ramps).
- Earthworks including cuttings, embankments and retaining walls along the Princes Highway
- Adjustment of drainage structures along the proposal to include permanent and temporary flood management structures
- Emergency access and emergency U-turn facilities at suitable locations along the Princes Highway to facilitate emergency vehicle movements
- Establishment and use of temporary ancillary facilities during construction
- Roadside furniture including safety barriers, signage, line marking, lighting and fencing
- Property works including acquisition, demolition and adjustments to properties, and at-property noise treatments if required
- Rehabilitation of disturbed areas and landscaping in consideration of health and safety in design, work health and safety, and maintenance requirements
- Adjustment, protection and relocation of existing utilities.

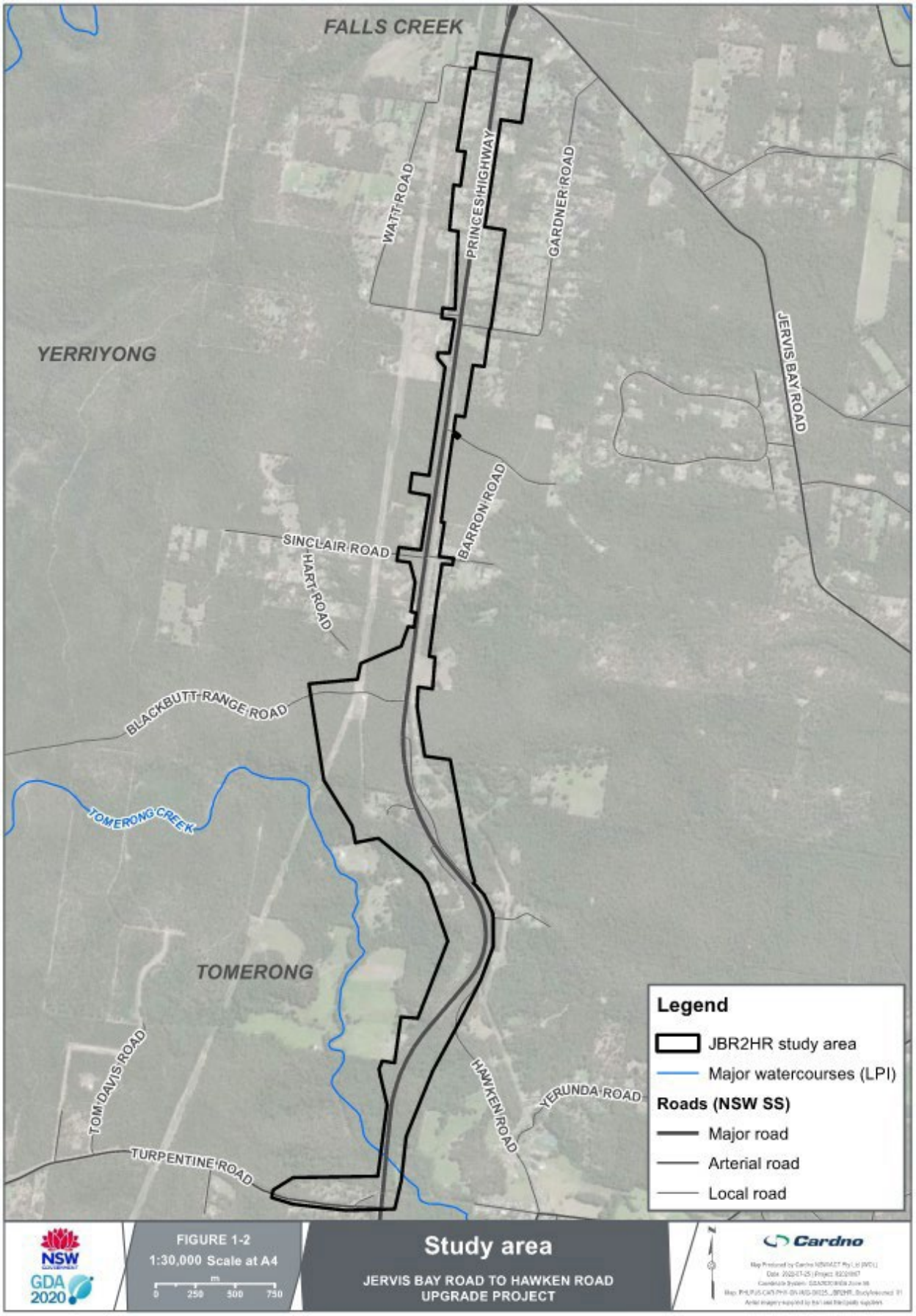


Figure 1.1 Project study area

2. Project objectives

The existing section of the Princes Highway is largely an undivided road with one lane in each direction. It has been identified as a priority for upgrade due to the need for improved safety and efficiency. The upgrade would aim to address the 70 crashes, including 22 serious injury crashes and one fatality, on this section of highway in the ten years from 2011 to 2021. The project was identified as a priority for upgrade in the short term as part of the Princes Highway Upgrade Program Roadmap 2040 (Transport for NSW, 2020). The key objectives of the project are to:

- Improve network safety for all transport users
- Improve freight access and efficiency
- Improve traffic efficiency and connectivity
- Enable an increase in the use of public and active transport
- Improve transport and network resilience
- Support sustainability of the region
- Respect our community and environment.

These objectives formed the basis of the evaluation conducted during the VMW, and the relevant weightings were applied as discussed in Sections 4.2 and 5.4.

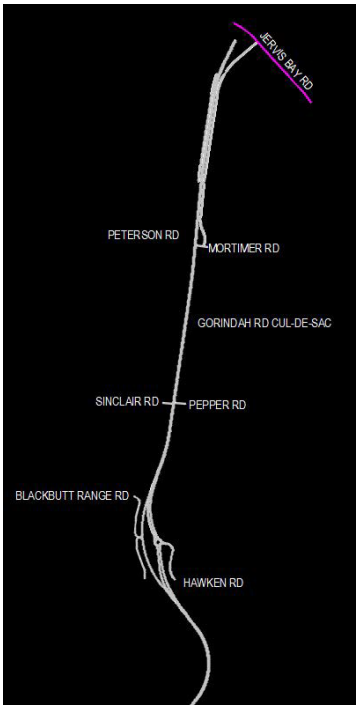
3. Intersection options

The five options assessed at the VMW mainly differed at the intersection treatments of the Princes Highway and Hawken Road, the Princes Highway and Blackbutt Range Road and to the south of these locations. To the north of Sinclair Road, all five options assessed contained the same upgrade design of the Princes Highway.

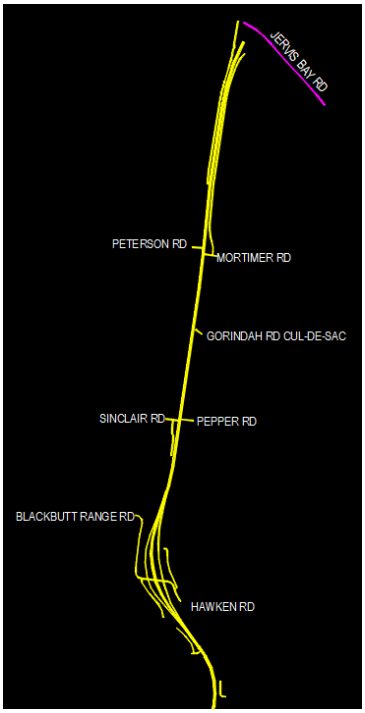
The options that are were assessed at the VMW include:

- **Option 1A – three-leg roundabout with northbound bypass lane:** This option includes a three leg, at-grade roundabout at the intersection of Hawken Road with a northbound bypass lane. Residents west of the Princes Highway in the vicinity of Blackbutt Range Road would be provided left in/left out access to the Princes Highway and would be required to use Jervis Bay Road to travel southbound on the highway
- **Option 2 – diamond interchange:** This option includes a grade-separated diamond interchange at Hawken Road providing full access to Blackbutt Range Road and to residents both east and west of the Princes Highway
- **Option 3A – in-line roundabout:** This option includes a four-leg roundabout at Hawken Road providing all movements and at-grade east and west connectivity
- **Option 4A – s-type grade separated intersection:** This option provides at-grade left in left out treatments at Hawken Road and Blackbutt Range Road with east to west connectivity via an overpass south of both intersections
- **Option 6A – left in left out and U-turn facility:** This option includes a left in left out (LILO) treatment at Hawken Road and Blackbutt Range Road with southbound and northbound U-turn facility approximately one kilometre south of the Hawken Road intersection.

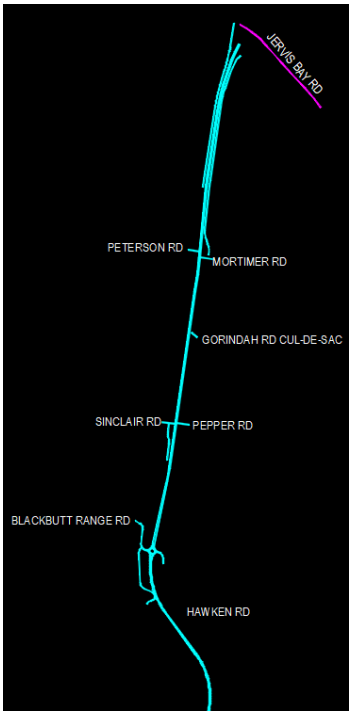
Figure 3-1 shows schematic layouts for the five shortlisted options.



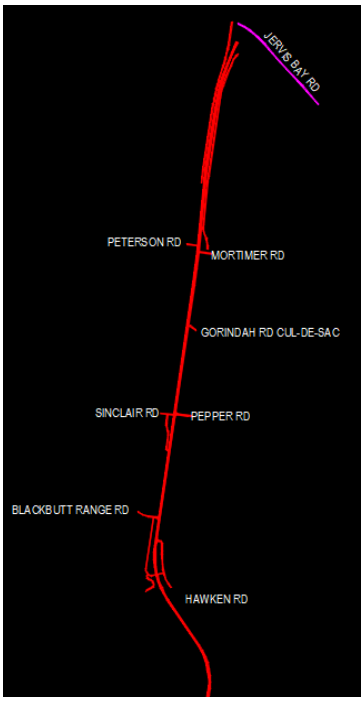
Option 1A – roundabout with northbound bypass lane



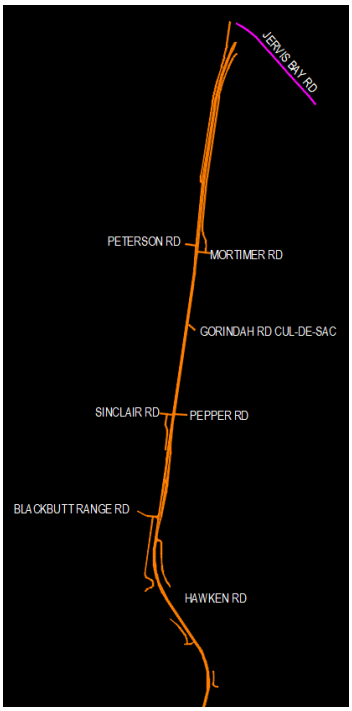
Option 2 – diamond interchange



Option 3A – in-line roundabout



Option 4A – grade separated intersection



Option 6A – left in left out and U-turn facility

Figure 3.1 Schematic Design Options

4. Value management workshop overview and purpose

4.1 Workshop methodology

The VMW was facilitated by Bellwether Consulting Pty Ltd and was held online utilising Microsoft Teams over two days on 9 and 14 June 2022. This was to ensure that adequate time was available to permit all workshop attendees to participate and robust discussions to be undertaken without having to curtail them.

The workshop utilised a structured process to enable key issues to be discussed and recorded to assist the project team in advancing the project. Rather than splitting the workshop into smaller groups, participants were kept within a single large group to ensure all attendees had equal access to information and discussions.

4.2 Workshop preparation

Based on their experience in developing the intersection options for the project, the Cardno and TfNSW project team developed a spreadsheet tool to assist in the weighting of the project specific objectives and the scoring of options. The Cardno and TfNSW project team also met on several occasions with the workshop facilitator to develop initial weightings and scores for the workshop participants to consider and amend, as necessary.

The project specific objectives identified in Section 2 were used to develop the key result areas (KRAs) for the project to further clarify the factors being considered within each objective. For each KRA, a series of key performance indicators (KPIs) was identified which could be used to justify how particular options were scored. An important consideration was focussing on measurable KRAs and KPIs that would aid in the comparison of options. Priority was given to quantitative rather than qualitative KPIs where possible. The KRAs and KPIs identified for each project objective are summarised in Table 4.1.

Background information relating to each of the KRAs and KPIs was gathered for each proposed option to inform the scoring of each option against the criteria. The information was assessed as to whether it enabled the scoring to be undertaken quantitatively or qualitatively. This was summarised in Value Management Workshop Background Technical (VMWBT) memorandum (PHUPJS-CAR-NWW-OA-MEM-000002) and distributed to all workshop participants prior to the VMW. Access was also granted to the GIS portal for participants to view the data.

A preliminary weighting was applied to each of the objectives and KRAs based on several coordination meetings with the project team and the desired outcomes to be achieved from the workshop. These weightings were developed prior to the VMW to provide participants at the workshop with a starting point for their further consideration and endorsement.

For each KRA considered to be based entirely on quantitative KPIs, the relevant subject matter expert from the Cardno project team provided a score for the KRA to provide participants at the workshop with a starting point for their further consideration and endorsement.

Where the background information identified that there were no differences between the options for a particular KRA or KPI, this was noted in the VMWBT memorandum and a zero weighting applied to the relevant KRA or KPI as applicable.

Table 4.1 Preliminary project objectives, key result areas and key performance indicators

Key result area	Key performance indicator	Type
1. Improve network safety for all transport users		
1.1. Improve operational safety	1.1.1. Operational (customer) safety	Qualitative
1.2. Enable safe construction and maintenance	1.2.1. Construction safety	Qualitative
	1.2.2. Operational (maintenance) safety	Qualitative
2. Improve freight access and efficiency		
2.1. Improve freight access	2.1.1. Improved access to local freight network (Hawken Rd and Blackbutt Range Rd)	Qualitative
2.2. Improve freight efficiency	2.2.1. Heavy vehicle travel time at weekday peaks	Quantitative
	2.2.2. Number of braking and acceleration locations, give way points	Quantitative
3. Improve traffic efficiency and connectivity		
3.1. Improve network efficiency	3.1.1. Light vehicle travel time at weekday peaks	Quantitative
	3.1.2. Light vehicle travel time at holiday peaks	Quantitative
	3.1.3. Minimum network level of service C at 2036 (weekday)	Quantitative
3.2. Minimise impact on existing local connectivity	3.2.1. Turnaround time for righthand turn movement from Blackbutt Range Rd onto the Princes Hwy	Quantitative
	3.2.2. Turnaround time for righthand turn movement from Hawken Rd onto the Princes Hwy	Quantitative
	3.2.3. Number of local access impacts	Quantitative
4. Enable an increase in the use of active and public transport		
4.1. Support an increase in active transport use by improving accessibility and facilities	4.1.1. Attractiveness for the use of cyclists at Hawken Rd intersection/interchange	Qualitative
	4.1.2. Attractiveness for the use of pedestrians at Hawken Rd intersection/interchange	Qualitative
	4.1.3. No. of Cyclist conflict points	Quantitative
	4.1.4. No. of Pedestrian conflict points	Quantitative
4.2. Support an increase in public transport use by improving accessibility and facilities	4.2.1. Ability to improve accessibility and connectivity to the public transport network	Qualitative
	4.2.2. Efficient movements for buses at Hawken Rd intersection/interchange	Qualitative
5. Improve transport network resilience		
5.1. Improve resilience to major flood events	5.1.1. Ability to continue operation in a flood event	Qualitative
5.2. Improve resilience to major bushfire event	5.2.1. Proximity to dense and continuous bushland	Quantitative
	Availability of alternative routes and connectivity to fire trails	Qualitative

5.3. Improve transport network resilience to respond to incidents and emergencies	5.3.1. Ability to allow for diverge movements, detour routes and contra flow options	Qualitative
6. Support sustainability of the region		
6.1. Support economic and tourism growth on local business	6.1.1. Comparative ranking of commercial impact	Qualitative
6.2. Support sustainable construction	6.2.1. Total construction site area	Quantitative
	6.2.2. Ease of ability to upgrade in the future	Qualitative
	6.2.3. Longevity of infrastructure	Qualitative
	6.2.4. Achieving balanced earthworks	Quantitative
7. Respect our community and environment		
7.1. Minimise impact on terrestrial ecology	7.1.1. Area of native vegetation impacted	Quantitative
	7.1.2. Number of habitat impacts	Quantitative
7.2. Minimise impact on Aquatic ecology	7.2.1. Area of key fish habitat impacted	Quantitative
	7.2.2. Number of water course crossings impacted	Quantitative
7.3. Minimise impact on non-Aboriginal heritage	7.3.1. No of impacts	Quantitative
	7.3.2. Comparative ranking of sensitivity / importance of impacts	Qualitative
7.4. Minimise impact on Aboriginal heritage	7.4.1. Impact on areas of high cultural value	Qualitative
	7.4.2. Number of sites impacted	Quantitative
7.5. Minimise property impacts and acquisition	7.5.1. No. of partial property acquisitions	Quantitative
	7.5.2. No. of whole property acquisitions	Quantitative
7.6. Minimise disruption impacts to the community during construction	7.6.1. No of stages and switches	Qualitative
	7.6.2. Potential construction issues	Qualitative
7.7. Minimise impacts on incompatible land uses	7.7.1. Area of Crown Land, Forestry Corporation NSW (FCNSW), Native Title, National Parks, impacted.	Quantitative
7.8. Minimise impact on landscape character and visual impact	7.8.1. Minimise impact on landscape character and visual impact	Qualitative

5. Value management workshop

5.1 Stakeholder representation

The best outcomes from a VMW are gained by ensuring that key stakeholders and subject matter experts are in attendance when the options are considered, and recommendations made. The stakeholders invited to the VMW were selected as they provided a comprehensive representation of knowledge and key issues affecting the project objectives. The following organisations and speciality areas were represented as set out in Table 5-1.

Table 5.1 Stakeholders represented

Organisation	Focus area
Commonwealth Government	Infrastructure Investment
NSW National Parks and Wildlife Service	Environmental and sustainability
NSW Police Force	Emergency response Law enforcement
NSW Rural Fire Service	Emergency response
Shoalhaven City Council	Asset management Economic development Transport planning
Transport for NSW	Asset management Commercial and financial Communications and stakeholder management Engineering (civil and structural) Freight industry Environmental and sustainability Indigenous and cultural heritage Infrastructure construction and maintenance Property, road and transport safety Transport operations and management Transport and network planning Urban design and landscape Workplace health and safety

5.2 Project context and design overview

The establishment of a shared, common understanding of the proposal by participants is a key step in a VMW. To assist with this, a presentation was made by the TfNSW project team on the proposal itself, project context and the current status of the project development.

Presentations were also made by the Cardno project team to provide an overview of the site and the five design options proposed. Specific information relating to each KPI were not given as part of the design overview but were provided by the relevant Cardno subject matter expert immediately prior to each KRA being assessed by the group later in the workshop. This information was drawn from the VMWBT memorandum that was distributed to all workshop participants prior to the VMW.

5.3 Givens, constraints and other important factors

The Cardno project team identified the following constraints prior to the workshop and provided an overview of them to the workshop participants with the assistance of the GIS portal:

- Design constraints:
  - Safe System Assessment Framework (barrier requirements, allowable movements at intersections, etc.)
  - Tie-in to Jervis Bay Road interchange project to the north
  - Have no physical impact on the United Petroleum service station at Tomerong (identified contaminated soils risk)
  - National Parks set revocation areas and environmental offset areas
  - Jerrinja Local Aboriginal Land Council Land in close proximity to Gorindah Road
  - Tomerong zone substation on Blackbutt Range Road and associated infrastructure (underground cabling)
  - Avoidance on high voltage (33 kV) powerlines running along the Princes Highway.
- Key environmental constraints:
  - No go zones:
    - Coastal Wetlands (Resilience and Hazard SEPP)
    - National Parks (outside of revocation submission).
  - Minimise – avoidance if possible / minimise impact:
    - Private property
    - Crown and Local Aboriginal Land Council land
    - Key fish habitat, dams and state forests
    - Acid sulfate soils and soft soils.
  - Avoid – immediately notify environment team:
    - Medium and high risk of potential areas of environmental concern (PAEC)
    - TEC and Species Credit Species (SCP) Detected/Assumed Present – Offsetting Required (e.g., Green and Golden Bell Frogs)
    - Terrestrial and/or Aquatic Groundwater Dependent Ecosystems (GDE).

The following additional givens, constraints and important factors were identified by the workshop participants:

- Character zone, landscape character and visual impact was considered an important factor for consideration and each design option will have different impacts to these elements. The existing Princes Highway has rural residential, rural lands and forested lands character zones and landscapes which the community expects will be maintained and impacts limited by the project. This is considered by the KRA 7.8 'Minimise impact on landscape character and visual impact' under project objective 7 'Respect our community and environment'
- Shoalhaven City Council raised the issue of whether the option selected for the Hawken Road intersection would impact the future options for Turpentine Road and connectivity to Pine Forest Road. TfNSW reiterated that they are aware of Council's strategic vision through previous discussions for the area and while the focus of the workshop is the Hawken Road intersection, the workshop will review the potential impacts of the recommended option

- Shoalhaven City Council raised at the VMW that there are over 250 registered businesses in the nearby area, the majority of which are construction based. The impacts to these businesses will need to be considered when scoring the KRAs.

5.4 Confirmation of project objectives, assessment criteria and weightings

As noted in section 4.2, project objectives had been proposed by the project team and preliminary weightings had been given to each of the objectives. The initial scoring by the project team was based on the rationale that the project is driven by the Strategic Program Business Case, the need to increase safety and freight efficiency for the Princes Highway, therefore the weighting for these critical elements had been weighted higher than the other objectives. At the VMW, there was a much broader range of interests and expertise represented, so the workgroups were asked to review the objectives, KRAs and preliminary weightings and to amend these, as necessary, to reflect the consensus of the group.

The agreed project objective final weightings of the group are provided in Table 5.2. There were several changes from the preliminary weightings, reflecting the desire of the group to recognise sustainability and respect for the community and environment as important priorities for the project:

- Project objective 1 – Improve network safety for all transport users – The design options proposed will all achieve the minimum level of network safety required as the design standards do not permit an unsafe outcome, and each option is an improvement on the state of the existing highway. While it remains the primary objective for the project, the participants agreed that its weighting could be reduced slightly to allow the weighting associated with sustainability and the environment (project objectives 6 and 7) to be increased to reflect their importance
- Project objective 2 – Improve freight access and efficiency – This was regarded by the group as one of the main differentiators between the design options and also aligned with the overall objectives of the Princes Highway upgrade program. It was agreed that no change to the weighting was required as it already reflected its relative importance
- Project objective 3 – Improve traffic efficiency and connectivity – This was regarded by the group as another main differentiator between the design options and also aligning with the overall objectives of the Princes Highway upgrade program. It was agreed that the weighting should be increased to match project objective 2
- Project objective 4 – Enable an increase in the use of active and public transport – The group was concerned that the initial weighting for project objective 4 placed the overall weighting of its KRAs higher than those in relation to network safety, efficiency and connectivity. While recognised as a project objective, the group agreed that improvements to active and public transport would be natural outcomes for each of the design options, and a lesser order objective compared to the other project objectives. The weighting could therefore be reduced and redistributed to the other project objectives which the group determined to have an increased importance
- Project objective 5 – Improve transport and network resilience – The preliminary weighting was considered appropriate by the group in relation to the other project objectives based on the workshop discussions
- Project objective 6 – Support sustainability of the region - While aspects of sustainability are captured throughout some of the KRAs and KPIs associated with other project objectives, it is important, and the preliminary weighting of five per cent did not reflect this. The

environmental aspects of the project are generally captured under project objective 7 which had an increased weighting, and therefore the group agreed to increase the weighting of objective 6 to 10 per cent

- Project objective 7 – Respect our community and environment – Was marginally increased to better reflect the bushland and environmental constraints that the project will be impacting in going through the area.

Table 5.2 Project objective final weightings

Project objective	Preliminary weighting	Final weighting
1. Improve network safety for all transport users	30.0%	22.5%
2. Improve freight access and efficiency	15.0%	15.0%
3. Improve traffic efficiency and connectivity	10.0%	15.0%
4. Enable an increase in the use of public and active transport	15.0%	10.0%
5. Improve transport and network resilience	10.0%	10.0%
6. Support sustainability of the region	5.0%	10.0%
7. Respect our community and environment.	15.0%	17.5%

Following agreement of the project objective weightings, the KRA weightings and associated KPIs were assessed by the group. Where it was considered that the KRA or KPI did not provide a differentiation between design options, a weighting of zero was applied. This did not mean that the KRA or KPI was not considered important by the group, just that the lack of differentiation would mean that each option would receive the same score, potentially diluting the scoring.

5.4.1 Project objective 1: Improve network safety for all transport users

The agreed final weightings of the group for the KRAs under project objective 1: Improve network safety for all transport users are provided in Table 5.3. There were several changes from the preliminary weights and to the KRAs and the following comments from participants were noted:

- The consensus of the group was that safe construction and maintenance should be scored as separate KRAs since there may not necessarily be a correlation between the two, which could lead to difficulty in scoring a composite KRA if an option provided good construction safety but poor maintenance safety (or vice versa)
- The group considered that all designs should have a relatively high level of operational (customer) safety as a safe systems approach was being applied to their design, and road design standards generally ensured that unsafe approaches were not adopted. The consensus of the group was the weighting of KRA 1.1 Improve operational safety could be reduced to 50 per cent
- The consensus of the group was that construction activities have a relatively smaller time window but generally a higher number of risks, while maintenance activities occur over a longer term, but have a lower number of risks. The remaining proportion of the objective weighting could be evenly split between KRA 1.2 Construction safety and KRA 1.3 Operational (maintenance) safety.

Table 5.3 Project objective 1 Improve network safety for all transport users final KRA weightings

Key result area	Key performance indicator	Preliminary weighting	Final weighting	Overall weighting
1. Improve network safety for all transport users				
1.1. Improve operational safety	1.1.1. Operational (customer) safety	66.7%	50.0%	11.25%
1.2. Enable safe construction	1.2.1. Construction safety	33.3%	25.0%	5.265%
1.3. Enable safe maintenance	1.3.1. Operational (maintenance) safety		25.0%	5.265%

5.4.2 Project objective 2: Improve freight access and efficiency

The agreed final weightings of the group for the KRAs under project objective 2: Improve freight access and efficiency are provided in Table 5.4. There were no changes from the preliminary weights or to the KRAs and the following comments from participants were noted:

- KRA 2.1 Improve freight access – there are a number of localised businesses operating in wider local road catchments (i.e. should not just consider direct catchment and through freight) which should be considered during the evaluation.
- KRA 2.2 Improve freight efficiency – it is important to support the wider freight network, as efficiency will affect a higher number of customers, and the focus of evaluating this KRA should be on through freight along the Princes Highway.

Table 5.4 Project objective 2 Improve freight access and efficiency final KRA weightings

Key result area	Key performance indicator	Preliminary weighting	Final weighting	Overall weighting
2. Improve freight access and efficiency				
2.1. Improve freight access	2.1.1. Improved access to local freight network	33.3%	33.3%	5.0%
2.2. Improve freight efficiency	2.2.1. Heavy vehicle travel time at weekday peaks	66.7%	66.7%	10.0%
	2.2.2. Number of braking and acceleration locations, give way points			

5.4.3 Project objective 3: Improve traffic efficiency and connectivity

The agreed final weightings of the group for the KRAs under project objective 3: Improve traffic efficiency and connectivity are provided in Table 5.5. There were changes to the preliminary weights for the KRAs and the following comments from participants were noted:

- KRA 3.1 Improve network efficiency was considered as an important component of the wider Princes Highway upgrade program by the group and should therefore be weighted higher relative to KRA 3.2 Minimise impact on existing local connectivity.

Table 5.5 Project objective 3 Improve traffic efficiency and connectivity final KRA weightings

Key result area	Key performance indicator	Preliminary weighting	Final weighting	Overall weighting
3. Improve traffic efficiency and connectivity				
3.1. Improve network efficiency	3.1.1. Light vehicle travel time at weekday peaks	25.0%	60.0%	9.0%
	3.1.2. Light vehicle travel time at holiday peaks			
	3.1.3. Minimum network level of service C at 2036 (weekday)			
3.2. Minimise impact on existing local connectivity	3.2.1. Turnaround time for righthand turn movement from Blackbutt Range Rd onto the Princes Hwy	75.0%	40.0%	6.0%
	3.2.2. Turnaround time for righthand turn movement from Hawken Rd onto the Princes Hwy			
	3.2.3. Number of local access impacts			

5.4.4 Project objective 4: Enable an increase in the use of active and public transport

The agreed final weightings of the group for the KRAs under project objective 4: Enable an increase in the use of active and public transport are provided in Table 5.6. There were changes to the preliminary weights for the KRAs and the following comments from participants were noted:

- KRA 4.2 Support an increase in public transport use by improving accessibility and facilities – a key objective of the Princes Highway upgrade program is to support additional public transport services along the highway, while active transport use is likely to be the same for all design options. The consensus of the group was that KRA 4.2 is more critical and therefore be weighted higher relative to KRA 4.1 Support an increase in active transport use by improving accessibility and facilities. The KRA weightings were therefore swapped.

Table 5.6 Project objective 4 Enable an increase in the use of active and public transport final KRA weightings

Key result area	Key performance indicator	Preliminary weighting	Final weighting	Overall weighting
4. Enable an increase in the use of active and public transport				
4.1. Support an increase in active transport use by improving accessibility and facilities	4.1.1. Attractiveness for the use of cyclists at Hawken Rd intersection/interchange	66.7%	33.3%	3.33%
	4.1.2. Attractiveness for the use of pedestrians at Haken Rd intersection/interchange			
	4.1.3. No. of Cyclist conflict points			
	4.1.4. No. of Pedestrian conflict points			
4.2. Support an increase in public transport use by improving accessibility and facilities	4.2.1. Ability to improve accessibility and connectivity to the public transport network	33.3%	66.7%	6.67%
	4.2.2.Efficient movements for Buses at Hawken Rd intersection/interchange			

5.4.5 Project objective 5: Improve transport network resilience

The agreed final weightings of the group for the KRAs under project objective 5: Improve transport network resilience are provided in Table 5.7. There were no changes to the preliminary weightings for the KRAs, however there were amendments to the wording of the KRAs and KPIs, with the following comments from participants noted:

- KRA 5.1 Improve resilience to major flood events – major flood events generally impacted areas south of the study area of the alignment away from the Hawken Road intersection. It was considered by the group that this KRA was not a differentiator between the options as all options would be designed to the same flood immunity criteria. The assessment should be focused on whether each design responds better in high intensity rainfall events and not just if the option is located within a floodplain. It was agreed that this should be assessed under the revised KRA 5.2
- KRA 5.2 Improve resilience to natural hazards and severe weather events – this KRA was previously titled 'Improve resilience to major bushfire event'. The consensus of the group was this was too narrow of a focus for the KRA as there were no real difference in the design options in regard to a bushfire, especially in a major bushfire event. The focus of the KRA should be focused on ability to respond to a major natural hazard with more weighting given to KRA 5.3
- KRA 5.3 Improve transport network resilience to respond to incidents and emergencies – this was considered by the group as the more important factor as each intersection option would

provide different capabilities and capacities for the broader transport network to respond to an event and provide overall network resilience. For example:

- In the event of a bushfire along the Princes Highway, would the design option allow for traffic to be easily turned around or facilitate mass evacuation?
- In the event of a traffic incident along the Princes Highway, would the design option allow for closure of a carriageway and easy contra flow of traffic whilst maintaining operation of the Hawken Road intersection and broader transport network?

Table 5.7 Project objective 5 Improve transport network resilience final KRA weightings

Key result area	Key performance indicator	Preliminary weighting	Final weighting	Overall weighting
5. Improve transport network resilience				
5.1. Improve resilience to major flood events	5.1.1. Ability to continue operation in a flood event	0.0%	0.0%	0.0%
5.2. Improve resilience to natural hazards and severe weather events	5.2.1. Improve resilience to natural hazards and severe weather events	25.0%	25.0%	2.5%
	5.2.2. Availability of alternative routes and connectivity to fire trails			
5.3. Improve transport network resilience to respond to incidents and emergencies	5.3.1. Ability to allow for diverge movements, detour routes and contra flow options	75.0%	75.0%	7.5%

5.4.6 Project objective 6: Support sustainability of the region

The agreed final weightings of the group for the KRAs under project objective 6: Support sustainability of the region are provided in Table 5.8. There were changes to the preliminary weights for the KRAs, and also to the KRAs and KPIs, with the following comments from participants were noted:

- KRA 6.1 Support economic and tourism growth on local business – while this was considered an important factor by the group, it was agreed that it would be difficult to evaluate as the information and data required was not available to accurately assess. On a qualitative basis there did not appear to be any difference in impacts between the design options that could be identified, and it was therefore not considered to be a differentiator. The group agreed that each of the remaining KRAs should be weighted equally
- KRA 6.2 Support sustainable construction – the group considered that the remaining preliminary KRA was focused more on sustainability during construction rather than the sustainability of the assets over their entire lifecycle. It included several KPIs that were related to the operational lifecycle phase rather than the construction lifecycle phase and that they should be assessed under a separate KRA

- KPI 6.2.3 Total earthworks – while the cut to fill earthworks balance is an important element of achieving sustainability through the reuse of materials, the overall earthworks volume was considered a reasonable proxy for the amount of carbon dioxide and pollution that would be generated through the use of diesel for fuelling the earthmoving equipment, and therefore the climate impacts during construction of the different design options. This specific element was considered qualitatively. The group decided to rename this KPI so that it could consider the broader impacts of the earthworks operations, and not just materials reuse.

- KRA 6.3 Longevity of infrastructure – this KRA was created by transferring KPIs 6.3.1 Ease of ability to upgrade in the future and 6.3.2 Longevity of infrastructure from KRA 6.2 as the group determined that they were related to the operational lifecycle phase rather than the construction lifecycle phase and should be evaluated separately
- KRA 6.4 Adapt to climate change risks – the ability of a design option to adapt to climate change risks was considered by the group to be important for the sustainability of the project and the region. The group consensus was that there are different factors and impacts compared to KRA 5.2 Improve resilience to natural hazards and severe weather events and required its own KRA. Pavement area was considered by the group to be a reasonable proxy for the risk of climate change adaption, as larger pavement areas would result in larger increases in runoff from severe weather events.

Table 5.8 Project objective 6 Support sustainability of the region final KRA weightings

Key result area	Key performance indicator	Preliminary weighting	Final weighting	Overall weighting
6. Support sustainability of the region				
6.1. Support economic and tourism growth on local business	6.1.1. Comparative ranking of commercial impact	0.0%	0.0%	0.0%
6.2. Support sustainable construction	6.2.1. Total construction site area	100.0%	33.3%	3.33%
	6.2.2. Bridge Deck Area			
	6.2.3. Total earthworks			
6.3. Longevity of infrastructure	6.3.1. Ease of ability to upgrade in the future	0.0%	33.3%	3.33%
	6.3.2. Longevity of infrastructure			
6.4. Adapt to climate change risks	6.4.1. Pavement Area	0.0%	33.3%	3.33%

5.4.7 Project objective 7: Respect our community and environment

The agreed final weightings of the group for the KRAs under project objective 7: Respect our community and environment are provided in Table 5.9. There were changes to the preliminary weights for the KRAs with the following comments from participants were noted:

- KRAs 7.1 Minimise impact on terrestrial ecology and 7.2 Minimise impact on Aquatic ecology – the project alignment is located in a non-fragmented terrestrial ecology setting. The assessment of this KRA needs to as high resolution as possible – i.e focus on impact to particular Endangered Ecological Communities (EECs) or offset species. Given the relatively small number of aquatic habitats impacted by the Hawken Road intersection, the group considered the impacts to terrestrial ecology to be of greater concern and the weighting of KRA 7.1 was increased relative to KRA 7.2, which was reduced
- KRAs 7.3 Minimise impact on non-Aboriginal heritage and 7.4 Minimise impact on Aboriginal heritage – while potential heritage impacts were considered by the group to be important, there were no impacts identified. Mapping of Aboriginal Potential Archaeological Deposits (PADs) had been completed and no mapped PADs were identified within areas impacted by the various Hawken Road intersection design options. Native Title issues are present as all options would be affected, however the group considered this to be a separate factor which was already being evaluated under KRA 7.7 Minimise impacts on incompatible land uses. Therefore, they were not thought by the group to be differentiators and were assigned a zero weighting
- KRA 7.5 Minimise property impacts and acquisition – the impact to private land was assessed by the group to be a major factor as it was a consider to be an important community consideration. Its relative weighting was therefore increased by the group
- KRA 7.6 Minimise disruption impacts to the community during construction – this was considered by the group to be an important factor and community consideration. Its relative weighting was therefore marginally increased by the group
- KRA 7.7 Minimise impacts on incompatible land uses – this considered the impacts to public land and the existing Native Title claims
- KRA 7.8 Minimise impact on landscape character and visual impact – as discussed in section 5.3, the impact to the character zone, landscape character and visual impact was deemed as an important factor by the group for consideration. Liveability of the region is a major community concern and should be considered as a key objective of the program. Many of the local community have chosen to reside in the area due to the current landscape character and the group thought it important to ensure that design options did not significantly change the existing character and have a large visual impact. It was therefore weighted relatively higher than the other KRAs.

Table 5.9 Project objective 7 Respect our community and environment final KRA weightings

Key result area	Key performance indicator	Preliminary weighting	Final weighting	Overall weighting
7. Respect our community and environment				
7.1. Minimise impact on terrestrial ecology	7.1.1. Area of native vegetation and TECs impacted	13.3%	20.0%	3.5%
	7.1.2. Number of habitat impacts			
7.2. Minimise impact on Aquatic ecology	7.2.1. Area of key fish habitat impacted	13.3%	10.0%	1.75%
	7.2.2. Number of water course crossings impacted			
7.3. Minimise impact on non-Aboriginal heritage	7.3.1. No. of impacts	0.0%	0.0%	0.0%
	7.3.2. Comparative ranking of sensitivity / importance of impacts			
7.4. Minimise impact on Aboriginal heritage	7.4.1. Impact on areas of high cultural value	0.0%	0.0%	0.0%
	7.4.2. Number of sites impacted			
7.5. Minimise property impacts and acquisition	7.5.1. No. of partial property acquisitions	13.3	20.0%	3.5%
	7.5.2. No. of whole property acquisitions			
7.6. Minimise disruption impacts to the community during construction	7.6.1. No. of stages and switches	13.3	15.0%	2.625%
	7.6.2. Potential construction issues			
7.7. Minimise impacts on incompatible land uses	7.7.1. Area of Crown Land, FCNSW, Native Title, National Parks, impacted.	13.3	10.0%	1.75%
7.8. Minimise impact on landscape character and visual impact	7.8.1. Minimise impact on landscape character and visual impact	33.3	25.0%	4.375%

5.5 Non-price evaluation of options

5.5.1 The process

For the scoring of the KRAs, the workshop participants were kept within a single large group to ensure all attendees had equal access to information and discussions.

Prior to the scoring of each KRA, specific information relating to each KPI within the KRA being assessed was presented by the relevant Cardno subject matter expert. This information was drawn from the VMWBT memorandum that was distributed to all workshop participants prior to the VMW. All participants were then provided with an opportunity to ask questions or present their views on the relevant issues associated with the KRA for the design options.

Scoring was undertaken by the group identifying the best performing option against the KRA and assigning it a score of 4. The group then assessed how much worse performing each of the remaining design options were relative to the best performing option and assigned a score to each option as follows:

- No difference – score 4
- Minor difference – score 3
- Medium difference – score 2
- Major difference – score 1.

To assist with the scoring process, the Cardno subject matter expert provided their opinion on the scoring where the KRAs were based on KPIs with quantitative data. This initial scoring was generally challenged by the group for almost all KRAs. The group discussion continued until the best performing option was identified and scoring agreed. The agreed scores were then entered into a common scoring spreadsheet along with a summary of the group discussion before progressing to the next KRA.

This enabled all participants the opportunity to question and challenge particular issues. At the end of this process, the group as a whole had ownership of the scoring and the relative performance of the options against the objectives and KRAs for consensus.

Once the process was completed, the whole worksheet was shown to the group revealing the overall non-price score for each option.

5.5.2 Initial outcomes

The initial outcomes of the non-price scoring are summarised in Table 5.10. Option 4A was identified as the design option with the highest score, followed closely by Option 2. The overall weighted scores for each option listed from highest to lowest score were as follows:

- Option 4A – Score 3.30
- Option 2 – Score 3.15
- Option 3A – Score 2.74
- Option 6A – Score 2.12
- Option 1A – Score 1.89.

Table 5.10 Initial key result area and objective non-price scoring

Key result area (KRA)	Option KRA Score					Preferred Option
	1A	2	3A	4A	6A	
1. Improve network safety for all transport users						
1.1. Improve operational safety	3	4	3	3	1	2
1.2. Enable safe construction	3	2	4	1	3	3A
1.3. Enable safe maintenance	1	2	3	4	2	4A
Objective 1 weighted score	***2.5***	***3.00***	***3.25***	***2.75***	***1.75***	***3A***
2. Improve freight access and efficiency						
2.1. Improve freight access	2	4	4	4	1	2, 3A & 4A
2.2. Improve freight efficiency	1	4	1	3	3	2
Objective 2 weighted score	***1.33***	***4.00***	***2.00***	***3.33***	***2.33***	***2***
3. Improve traffic efficiency and connectivity						
3.1. Improve network efficiency	2	4	2	3	3	2
3.2. Minimise impact on existing local connectivity	2	4	4	4	1	2, 3A & 4A
Objective 3 weighted score	***2.00***	***4.00***	***2.80***	***3.40***	***2.20***	***2***
4. Enable an increase in the use of active and public transport						
4.1. Support an increase in active transport use by improving accessibility and facilities	1	3	2	4	1	4A
4.2. Support an increase in public transport use by improving accessibility and facilities	2	4	2	4	2	2 & 4A
Objective 4 weighted score	***1.67***	***3.67***	***2.00***	***4.00***	***1.67***	***4A***
5. Improve transport network resilience						
5.1. Improve resilience to major flood events	0	0	0	0	0	N/A
5.2. Improve resilience to natural hazards and severe weather events	3	4	2	4	3	2 & 4A
5.3. Improve transport network resilience to respond to incidents and emergencies	1	4	1	3	1	2
Objective 5 weighted score	***1.50***	***4.00***	***1.25***	***3.25***	***1.50***	***2***
6. Support sustainability of the region						
6.1. Support economic and tourism growth on local business	0	0	0	0	0	N/A
6.2. Support sustainable construction	2	1	4	3	2	3A
6.3. Longevity of infrastructure	1	4	3	4	3	2 & 4A
6.4. Adapt to climate change risks	3	2	4	3	3	3A
Objective 6 weighted score	***2.00***	***2.33***	***3.67***	***3.33***	***2.67***	***3A***
7. Respect our community and environment						
7.1. Minimise impact on terrestrial ecology	1	1	2	4	3	4A
7.2. Minimise impact on aquatic ecology	3	3	3	4	3	4A
7.3. Minimise impact on non-Aboriginal heritage	0	0	0	0	0	N/A
7.4. Minimise impact on Aboriginal heritage	0	0	0	0	0	N/A
7.5. Minimise property impacts and acquisition	2	2	4	4	2	3A & 4A
7.6. Minimise disruption impacts to the community during construction	1	2	4	4	2	3A & 4A
7.7. Minimise impacts on incompatible land uses	2	1	3	3	4	6A
7.8. Minimise impact on landscape character and visual impact	2	1	4	3	2	3A
Objective 6 weighted score	***1.75***	***1.55***	***3.40***	***3.50***	***2.64***	***4A***
Overall weighted score	**1.89**	**3.15**	**2.74**	**3.30**	**2.12**	**4A**

5.5.3 Discussion of results

The participants had a broad discussion on the results obtained. In general, Option 4A scored better against objectives related to sustainability, community, and environment with Option 2 scoring poorly against these. Option 2 generally scored better against objectives related to network safety, efficiency and resilience, however Option 4A scored relatively closely in these objectives resulting in it receiving the highest overall score. No fatal flaws preventing any of the design options from proceeding were identified by the group, with only design refinement opportunities being recommended.

Option 4A (S-Type grade separated interchange) scored relatively lower on network safety and efficiency KRAs (objectives 1, 2 and 3) due to the absence of acceleration and deceleration slip lanes for side roads intersecting with the Princes Highway in Option 4A compared to Option 2 which possesses on and off ramps. The group believed this negatively impacted both the network safety and efficiency for Option 4A relative to Option 2. Cardno advised that slip lanes could be included as part of the concept design for Option 4A, however, there may be potential impacts that would require assessment. The group agreed that for the purpose of the VMW Option 4A should be evaluated as shown, and the slip lanes provide an opportunity for improvement which could potentially increase the score. This was considered during the sensitivity analysis.

The relatively lower score for Option 2 (grade separated diamond interchange) compared to Option 4A in the objectives related to sustainability, community, and environment (objectives 6 and 7) was primarily due to the increased footprint of Option 2. This resulted in the negative impacts of Option 2 against the KRAs under these objectives being much greater compared to Option 4. The group consensus was that limited improvements could be made to the design of Option 2 to reduce these impacts by virtue of the minimum requirements to implement a grade separated diamond interchange.

Option 3A (four leg roundabout) generally performed relatively well against the objectives related to network safety, sustainability, community, and environment (objectives 1, 6 and 7) due to its smaller footprint. However, it performed relatively poorly against the objectives related to efficiency, resilience and public transport (objectives 2, 3, 4 and 5) as a roundabout generally disrupts traffic efficiency, provides limited options for contraflow, generally doesn't permit public transport to stop offline from the main highway.

Option 6A (left-in/left-out with U-turn) performed relatively poorly against all objectives primarily due to the larger footprint required by the wider central median to provide the U-turn facility and restriction of movements and access for the side roads. Like Option 4A it also scored relatively lower on network safety and efficiency KRAs due to the absence of acceleration and deceleration slip lanes for side roads and U-turn facility on the Princes Highway. Cardno advised that slip lanes could be included as part of the concept design for Option 6A however it would likely increase the footprint, particularly for the U-turn facility, and there may be other potential impacts that would require assessment. Cardno also advised that the U-turns were designed to a 12.5 metre single unit truck design vehicle and if the design vehicle was to allow for a larger vehicle this would also increase the footprint. The group agreed that for the purpose of the VMW Option 6A should be evaluated as shown.

Option 1A (bypass roundabout) performed relatively poorly against all objectives primarily due to the larger footprint required, poor traffic efficiency, limited access from Blackbutt Range Road, and the roundabout providing limited options for contraflow and public transport.

A key focal point of the group discussion in comparing the results between Options 2 and 4A was the impacts to the potential designs that would be likely for intersections to the south of Hawken Road depending upon which option is adopted.

Island Point Road was viewed by both Council and TfNSW as having larger traffic volumes compared to Hawken Road and would be a more appropriate location for a potential grade separated interchange in the future. Option 2 would introduce a grade separated diamond interchange at Hawken Road. To avoid multiple major high order interchanges, which could be considered as 'gold plating', a future fully grade separated interchange at Island Point Road would be less likely. The S-Type grade separated interchange provided by Option 4A was considered more conductive to facilitating a full grade separation of the Island Point Road intersection in the future while also retaining multiple options for all intersections south of Hawken Road.

Option 4A was considered as being the best solution on balance as it retained some flexibility for the design of future intersections south of Hawken Road, while Option 2 would potentially be a 'gold plated' solution in the wrong location.

5.5.4 Sensitivity analysis

Some sensitivity analysis of the results was undertaken by varying the weightings assigned to the project objectives. The following adjustments were undertaken to assess the impact on the ranking of the options:

- Each objective weighting progressively increased to 50 per cent, with the balance spread evenly amongst the remaining objectives
- Marginally reducing objectives 1 and 3, and increasing objectives 6 and 7
- Marginally reducing objectives 6 and 7, and increasing objectives 1, 2 and 3.

The outcomes of the sensitivity analysis are provided in Table 5.11. Depending upon the weighting adopted, the highest ranked option generally switches between Option 2 and Option 4A. However, the relative score differences between these two options are relatively small, with Option 4A always being very close to Option 2 under those scenarios.

Table 5.11 Non-price criteria weighting sensitivity analysis

Weighting adjustment	Objective weighting							Option weighted non-price score					Preferred Option
	1	2	3	4	5	6	7	1A	2	3A	4A	6A	
Original weighting	22.5%	15.0%	15.0%	10.0%	10.0%	10.0%	17.5%	1.89	3.15	2.74	3.30	2.12	4A
Prioritise objective 1	50.0%	8.3%	8.3%	8.3%	8.3%	8.3%	8.3%	2.10	3.13	2.88	3.11	1.96	2
Prioritise objective 2	8.3%	50.0%	8.3%	8.3%	8.3%	8.3%	8.3%	1.62	3.55	2.36	3.35	2.20	2
Prioritise objective 3	8.3%	8.3%	50.0%	8.3%	8.3%	8.3%	8.3%	1.90	3.55	2.70	3.38	2.15	2
Prioritise objective 4	8.3%	8.3%	8.3%	50.0%	8.3%	8.3%	8.3%	1.76	3.41	2.36	3.63	1.93	4A
Prioritise objective 5	8.3%	8.3%	8.3%	8.3%	50.0%	8.3%	8.3%	1.69	3.55	2.05	3.32	1.86	2
Prioritise objective 6	8.3%	8.3%	8.3%	8.3%	8.3%	50.0%	8.3%	1.90	2.85	3.06	3.35	2.34	4A
Prioritise objective 7	8.3%	8.3%	8.3%	8.3%	8.3%	8.3%	50.0%	1.79	2.53	2.95	3.42	2.33	4A
Reduce objectives 1 & 3, increase objectives 6 & 7	20.0%	15.0%	10.0%	10.0%	10.0%	15.0%	20.0%	1.87	3.03	2.79	3.32	2.17	4A
Reduce objectives 6 & 7, increase objectives 1, 2 & 3	25.0%	17.5%	17.5%	10.0%	10.0%	7.5%	12.5%	1.89	3.29	2.68	3.28	2.08	2

The workshop group agreed that the sensitivity analysis demonstrated that 4A was well balanced across the board and did not have key failures in any one area. The initial outcome of Option 4A being the highest ranked and recommended option based on the non-price scoring criteria was valid.

5.6 Overall combined score

5.6.1 Price multiplier

TfNSW separately engaged MI Engineers as the cost estimators for the project who generated cost estimates for each of the design options. The estimates were based on:

- Construction costs only, not full lifecycle
- The Jervis Bay Road to Blackbutt Range Road section was costed and used across all options
- Comparative cost estimate analysis strategic level cost estimation applied.

The cost estimates were converted to a relative price by dividing the price for each design option by the price of the lowest cost design option. The intent of the cost multiplier was to reduce the non-price score for higher cost options compared to lower cost options. The relative price could not be used directly as the price multiplier since the lower cost options would have lower multipliers, while the higher cost options would have the higher multipliers. In addition, the cost multiplier also needed to be adjusted based on the relative weighting between the non-price score and relative cost.

The following formula was therefore adopted to calculate an adjusted price multiplier for each design option:

$$Adjusted\ price\ multiplier = 1 - (Relative\ Price - 1) \times \frac{(1 - Non\ price\ weighting\%)}{Non\ price\ weighting\%}$$

5.6.2 Overall outcomes

The adjusted price multipliers for each design option based on a non-price weighting of 70 per cent advised by TfNSW and the cost estimates provided MI Engineers were applied to the overall non-price scores for each option to produce an overall combined score for each option. The outcome is summarised in Table 5.12.

Table 5.12 Relative price and adjusted price multipliers for each design option

Design option	1A	2	3A	4A	6A
Overall weighted non-price score	1.89	3.15	2.74	3.30	2.12
Relative price	1.015	1.134	1.009	1.000	1.032
Adjusted price multiplier	0.994	0.943	0.996	1.000	0.986
Overall combined score	1.87	2.97	2.73	3.30	2.09

Option 4A had the lowest cost estimate with Options 1A, 3A and 4A only slightly higher, with the difference between 1-5 per cent. Option 2 had the highest cost estimate, which showed a 15 per cent higher cost than Option 4A. In general, the pavement, earthworks and structures costs were where the main differences between each option.

Given that Option 4A had the lowest cost estimate, the overall combined price was unchanged from the overall non-price score. The overall combined score for Option 2 reduced the most as it had the highest cost estimate, however the overall ranking was unchanged.

When presented with these outcomes the workshop group was satisfied with the scoring methodology adopted and that Option 4A was the preferred design option to be recommended by the group and progress to concept design.

6. Recommended options and actions

The VMW group as a whole decided that the following option and actions be progressed into the concept design for the upgrade of the Princes Highway from Jervis Bay Road to Hawken Road:

- Design Option 4A a grade separated S-type intersection at Hawken Road be adopted which comprises of:
  - Hawken Road and Blackbutt Range Road connected to Princes Highway in left-in / left-out arrangements
  - A new overpass is provided connecting Hawken Road to Blackbutt Range Road over Princes Highway, providing full east and west connectivity.
- Opportunities for the provision of acceleration and deceleration slip lanes on the Princes Highway to support the left-in / left-out arrangements for Hawken Road and Blackbutt Range Road be investigated to improve network safety and efficiency
- Opportunities for the provision of off-line bus stop and pick-up / drop-off areas at the intersection of Hawken Road and Blackbutt Range Road be investigated
- Turn priorities on the intersections of minor roads away from the Princes Highway be investigated and optimised.