Appendix I

Option analysis
Proposal objectives
The Primary Object of the project is:

- Widen the bridge to accommodate the capacity for HML vehicles and improve road freight productivity

The Secondary Objects of the project are:

- Provide new safety barriers on both sides of the bridge
- Upgrade the road approaches on both sides of the bridge to improve safety.

Alternatives Options Considered
Methodology for selection of the preferred alternative option
Selection of the preferred option was based on a risk assessment approach using a risk assessment matrix with weighted criteria.

Options were assessed against the following ten key criteria:

1. Risk of environmental impacts e.g. impacts to threatened species, impacts to platypuses, soil and water quality impacts
2. Risk or Impact to Heritage (Aboriginal and non-Aboriginal heritage)
3. Visual Impact (Landscape character and views)
4. Road Safety
5. Utilities
6. Ability to meet the proposal objectives
7. Property acquisition
8. Constructability and Work Health and Safety
9. Cost
10. Traffic impact and control
11. Aboriginal and non-Aboriginal heritage

Identified Alternative options
A total of eight (8) alternative options were considered as detailed below:

Option 1 – Do nothing
The do nothing option would not result in the bridge or its approaches being widened. The current infrastructure would be retained in the proposal site.

Option 2 – Demolish existing bridge and build a new two lane bridge
This option would involve demolishing the existing heritage listed bridge and constructing a new two-lane bridge.

The strategic estimate of the project is $8 to $10 Million

Option 3 – Major strengthening of existing bridge
This option would require the removal and reconstruction of the bridge deck and parapets. It would also require the upgrading and strengthening of key structural members of the bridge which may include new structural steel members, steel plates, external post tensioning, FRP or new concrete infill sections.
The strategic estimate of the project is $5.0+ Million

**Option 4 – Construction of new two lane bridge on a new road alignment.**
*(Existing bridge and road section redundant)*

This option would involve the construction of new bridge and new alignment on the southern side of the existing bridge. The new alignment would start approximately 200m east of Polacks Flat Rd and tie back into the Snowy Mountains Hwy 400 west of West Kameruka Rd.

The scope of works of this project would involve:

- Construction of approximately 1.1km of new two lane road (3.5m lane width with 2m shoulder) and 500m of reconstruction of existing road at either end.
- Construction of new 100-120m long two lane bridge over the Bemboka River.
- Property acquisition of approximately 35,200m2 of private property

The new two lane bridge and alignment would result in the existing heritage listed bridge over the Bemboka River redundant along with the section this section of the Snowy Mountain Hwy.

The strategic estimate of the project is $15 Million

**Option 5 – Construction of new bridge parallel to existing bridge with 0 m separation**

This option would involve building a new, structurally independent bridge immediately adjacent to the existing bridge with zero (0m) separation, resulting in continuous deck, with each bridge carrying a single lane of traffic.

The scope of works of this project would involve:

- Construction of new 1 lane bridge directly parallel to existing bridge with 0m separation to form a continuous deck
- Installation of a wire rope median barrier
- Property acquisition of approximately 3000 to 6000m2 of private property
- Possible relocation of optic fibre cable.
- Upgrading road approaches on either side to the bridge
- Construction of accidently spill basins

**Scope of works to Existing Heritage Listed Bridge**

- Upgrading existing heritage bridge safety barriers (not originally)
  - Hydro demolition of the existing cantilever sections of the deck (1000mm each side)
  - Reconstruction of these sections of deck and the installation of the new concrete safety barrier
  - Additional asphalt laid on bridge to change cross and drainage

The strategic estimate of the project is $6.5 Million

**Option 6 – Construction of new bridge parallel to existing bridge with 5m separation**

This option would involve building a new, structurally independent bridge immediately
adjacent to the existing bridge with a five (5m) separation, resulting in each bridge carrying a single lane of traffic.

The scope of works of this project would involve:

- Construction of new 1 lane bridge directly parallel to existing bridge with a 5m separation
- Installation of concrete median barriers and crush terminals on both approaches to the bridges
- Property acquisition of approximately 4000 to 8000 m² of private property
- Possible relocation of optic fibre cable.
- Upgrading road approaches on either side to the bridge
- Construction of accidently spill basins

Scope of works to Existing Heritage Listed Bridge

- Upgrading existing heritage bridge safety barriers (not originally)
  - Hydro demolition of the existing cantilever sections of the deck (1000mm each side)
  - Reconstruction of these sections of deck and the installation of the new concrete safety barrier

The strategic estimate of the project is $9.0 Million

**Option 7– Construction of new bridge parallel to existing bridge with 15m separation. (Existing bridge and road section redundant)**

This option would involve building a new, structurally independent bridge immediately adjacent to the existing bridge a min (15m) separation. The existing bridge and this section of road become redundant as the new bridge would be designed to accommodate both directions of traffic.

This configuration would eliminate the requirement for a concrete medium barrier and crash terminals of either approach, but still required guardrail safety barrier terminals.

The scope of works of this project would involve:

- Construction of new 2 lane bridge parallel to existing bridge with a min 15m separation
- Installation of guardrail safety barriers on the approaches to the bridges
- Property acquisition of approximately 8000 to 12000 m² of private property
- Possible relocation of optic fibre cable.
- Construction of new road approaches on either side to the bridge
- Construction of accidently spill basins

Scope of works to Existing Heritage Listed Bridge

- Nil (Existing bridge and road section redundant)

The strategic estimate of the project is $12 Million
Option 8 – Alternative Route for HML Vehicles- via Yankee Gap Rd/Polacks Flat Rd.

This option would use Yankee Gap/Polacks Flat Rd as an alternate route for HML vehicles. The alternated route would involve upgrading 13.2 km of local unsealed road and three bridge crossing over the Bemboka River.

The scope of works of this project would involve:

- Upgrading of widening of 13.2km of local unsealed road.
- Installation and upgrading to road drainage
- Installation of guardrail safety barriers
- Demolition and reconstruction of 3 bridge crossing
  - New 62m bridge, 770m north on Yankee gap Rd
  - New 20m bridge, 2.5km north on West on Polacks Flat Rd
  - New 20m bridge, 2.5km north on West on Polacks Flat Rd
- Property acquisition of approximately 8000 to 12000 m² of private property
- Possible relocation of optic fibre cable.

The strategic estimate of the project is $70+ Million

Analysis of alternative options

**Option 1 - Do nothing**

**Advantages**

- The ‘do nothing’ option would have no construction impacts.
- There would be no environmental impacts (e.g. to heritage or biodiversity, including on platypuses).
- No utility adjustment would be required.
- No property acquisition would be required.

**Disadvantages**

- This option would not meet the objectives of the proposal.
- This option would not address the strategic need for the proposal.
- HML vehicles would not have continuous access along the length of the Snowy Mountains Highway.
- Safety risks associated with the narrow bridge and approaches would continue to exist at the site.
- Environmental risks from spills on the bridge directly entering the river would continue to exist at the site.

**Option 2 – Demolish existing bridge and build a new two lane bridge**

**Summary**

This option would result in a moderate impact to the environment and significant portion of the works would occur within the directed zone, and it the equal 2nd best option compared the other options. The overall visual impacts of this option is comparable to the other options.
A major advantage of this option is a very high level of road safety that will be achieved as the majority of the current safety deficiencies and constraints such as deck level, hog, lane and shoulder widths, low rating concrete barrier can be eliminated with the construction of the new bridge in the same position.

The amount of property acquisition is compared to options 5, 6 and 7 of which were rated as having low to moderate impact and risk.

The costs of construction of this option provides 2nd best value for money for the RMS compared some of the other options. Another advantage of this option is that the new bridge will have a 100 year design life, whereas same of other options which maintain the existing bridge.

The construability and WHS risk of this option is high and is also the 2nd highest compared to the other options. It is very likely that the bridge constructed will be staged will introduces sign cant WHS risks to workers and travelling motorists and makes the overall planning and construction of the bridge far more difficult and time consuming.

This option fails to meet the primary objective of the project which’s to widen the existing bridge however it be succeed in meeting the secondary project objectives of upgrading the road approaches and bridge barriers.

However a major disadvantage with this option is that the existing heritage listed bridge would be demolished and replace with a new bridge. The loss of such a visually distinctive and significant heritage listed bridge would a great loss and is unacceptable when there are other as practically and feasible options available.

Another major disadvantage is this has potential of the highest impact to traffic flow of the options, due the full lane closure or detours depending if the bridge construction is staged.

Key Advantages
- Moderate impact on the environment.
- High level of road safety achieved
- Good value for money

Key Disadvantages
- Failure of primary project objective to widen the existing the bridge
- Unacceptable impacts to the heritage values of the existing bridge.
- High construability risks- staged construction
- Highest risk of impact to traffic flow

Conclusion

The determination of the options assessment rated this option the 3rd best available.

This option has been determined to be an unacceptable alterative option manly as a result of the unacceptable impact to heritage, difficult constructability, high WHS risks and failure to meet primary objectives of the project.
Option 3 – Major strengthening of existing bridge

Summary

A key advantage of this option is that it will have a very low environmental impact as there will minimum disturbance to the flora, fauna and vegetation immediately adjacent area of the bridge. As a result this option rated the lowest in environmental impact of all the option considered.

This option will have a high visual impact on the visual character and appearance of the existing bridge, many of the key features and elements will be lost as a result of the upgrade works. The visual impact to the bridge looking from a key side elevation will also be very high. However it will have negligible to very low visual impact to the residents to the south-east of the bridge and for motorist travelling over the bridge. Overall this option will have low to moderate visual impact.

This option would also achieve a very high road safety standard as most of the current road safety deficiencies and constraints such as, lane and shoulder width, removal of the hog of the bridge, upgrading safety barriers could be removed and upgraded with incorporated into the strengthening and upgrade works. There still may be some road safety issues such alignment and deck levels that may not be fully eliminated due the limitations of the strengthening and upgrades works that can be completed.

A key advantage of this option is that is has a very high potential to completely satisfy the primary objective of the project which is to widen the existing bridge to accommodate HML vehicles. There is risk that due to limitations of the structurally members and the improvements that the strengthening can achieve that the full width or loading requirements may not be fully achieved. The same high potential exist for this option to completely satisfy both secondary objectives, however there is a low potential risk that due to the limitations of the upgrades works that some of the deficiencies may not be able to eliminated.

A major disadvantage is the most difficult in terms of construability and WHS risks. The design of the strengthening and upgrades would be highly complex involving specialist material and construction methods most likely requiring specialist sub-contractors to complete some of the works. Access would be required to the sub structure of the bridge to complete the strengthening works, which would complex process. The WHS risk for this option is also the highest risk level of all the options. The majority of the works would involve working at height via elevated works platforms, scaffolds, cherry pickers, which is fundamental, a very high risk. This work may be staged with the bridge open to traffic, which again is high risk to worker safety.

There will also be high impact the heritage value of the bridge. This option would require the removal and reconstruction of the bridge deck and parapets. It would also require the upgrading and strengthening of key structural members of the bridge which may include new structural steel members, steel plates, external post tensioning, FRP or new concrete infill sections. All this work would have a high impact on the visual character and appearance of the existing bridge, many of the key features and elements will be lost as a result of the upgrade works.

Although this option is the cheapest of all the alternative options it provides the 2nd lowest value for money of all the options.
This option would have the second highest impact on traffic. Some of the strengthening work to the sub structure could be done can be done under live traffic conditions on the bridge. However the majority of the works especially the deck demolishing and reconstruction would have to be under a full closure of the bridge and an alternate route implemented.

Key Advantages
- Lowest impact on the environment of all the options
- Lowest visual impact on the options.
- Highest potential to satisfy all the objectives of the project.

Key Disadvantages
- High impact of Heritage (2nd highest)
- Extreme construability risks of all the options
- 2nd lowest value for money of all the options
- Very high impact to traffic flow (2nd highest)

Conclusion

The determination of the options assessment rated this option the 4th best available.

This option has been determined to be an unacceptable alterative option due to the high impact on heritage value of the bridge and the landscape, the extreme construability and WHS risks and that it provides the 2nd lowest value for money. The impact to traffic will also be very high for a long period of time.

Option 4 – Construction of new bridge on a new alignment.

Summary

The major key advantage of this option is that it would achieve the highest level of road safety. The new section of road and the bridge would be designed to the latest standards comply with 100km/hr standards. Due to new alignment the safety would not be compromised at the tie-ins tie ins at either end, there is very minimal existing constraints.

Another key advantage is that this option would have the lowest traffic impact compared to the other options. The new two lane bridge can be constructed completed off line. The vast majority of the new two lane road can also be constructed off line. The only time that traffic impact may occur is during the construction of the tie ins off the new road alignment with the existing road. This impact would be minimal.

Traffic can continue to use both lanes of the existing bridge throughout the entire duration of the project.

A key advantage of this option will be that the new bridge and road alignment will provide a new additional opportunity for passing motorist with a clear and uninterrupted view of the side elevation of the existing bridge. At present motorist driving over the current alignment and bridge will essential be unaware or unable to
view any significant heritage elements or features of the existing bridge

A minor advantage is that this option will have the lowest impact on the optic fibre cable of all the options. There will still be low risk and impact to the copper telephone cable on the eastern side of the river.

This option will have the highest level of constructability and lowest WHS risk of all the options. In terms of constructability, the vast majority of the project is a green field site that has excellent access and very good terrain. No work will occur to the existing bridge as it will become a redundant. This option will require minimal lane closures. The tie ins at both ends will be the more complex stage of the construction however with correct vertical and horizontal alignment in design this is expected to be relatively easy compared to the other options. Similarly the WHS risk of this option is the lowest of all the options. Again as the majority of the project is offline, there is insignificant risk for live traffic as it continues to use the existing section of the highway including the existing bridge.

Although this option has some significant advantages as listed above it also results has some major disadvantages and high impacts are shown below.

A major disadvantage of this option will have the highest potential impact on the environment of all the options. Although the most of the new road construction would occur in existing rural agricultural land with of low environmental quality. This option would require a significant amount of vegetation clearing and grubbing at the river side and banks compared to the other options. New access tracks for the new bridge construction would need to be constructed on either side of the river. Due to alignment of the new bridge there is potential that the bridge length and spans may need to be increased in lengths compared to options 5 and 6. This will also increase the disturbance and potential impact of the environment on the river banks and within the river bed itself.

Another key disadvantage of is that the although the strategic cost of this option is relatively low compared to option 8 (alternative route) it is the 2nd highest cost option available and over double that of option 5 which has been determined to provide the best value for money of all the options considered.

The direct visual impact of the new bridge and road alignment will have negligible to very low impact of the visual character and landscape of the existing bridge. There will have an extreme visual impact the resident south east of the existing bridge as the new road alignment would be up to 40m closer to the resident and require a new large fill to be constructed on the eastern side for the new road and bridge alignment.

As per option 2, although this option will result in a new widened bridge which will be able to accommodate HML vehicles. It fails to meet the No 1 project objective which is to widen the existing bridge as a completely new bridge will be constructed. It will however completely satisfy both secondary objectives.

Key Advantages
- Lowest impact on the environment of all the options
- Lowest visual impact on the options.
- Highest potential to satisfy all the objectives of the project.

Key Disadvantages
High impact of Heritage (2nd highest)
Extreme construability risks of all the options
2nd lowest value for money of all the options
Very high impact to traffic flow (2nd highest)

Conclusion

The determination of the options assessment rated this option the 7th best available.

This option has been determined to be an unacceptable alternative option due to the high impact on heritage value of the bridge and the landscape, the extreme construability and WHS risks and that it offers the lowest value for money. The impact to traffic will also be very high for a long period of time.

Option 5 – Construction of new bridge parallel to existing bridge with 0m separation

This option would involve building a new, structurally independent bridge immediately adjacent to the existing bridge with zero (0m) separation, resulting in continuous deck, with each bridge carrying a single lane of traffic. This configuration would require a wire rope median barrier to separate the two lanes.

The major key advantage of this option is that it results in the best possible road safety outcome of all the options while still utilizing the existing bridge. Also unlike option 6 does not change the existing access configuration of the bridge access road, Polacks Flat Rd and the nearby neighbour’s private driveway.

A key advantage of this option is that although there is potential high risk of impact to some sections of ECC’s, platypus, hydrology and water quality, the overall environmental impact of this option has been assessed of moderate and is lower compared to option 4, 6 & 7.

This option has been assessed as having the best value for money of all the options considered.

This option has a moderate WHS and Construability risk which is the 3rd best compared to the options, but it slightly higher compared to option 6

Although this option has a relative low impact on the heritage value of the bridge, and it significantly lower compared to options 2, 10. Due to the zero separation of two bridges it has a slightly higher impact on heritage value of the existing bridge compared to option 6

Key Advantages
- Best possible road safety outcome of all the options while still utilizing the existing bridge.
- Overall moderate potential impact on the environment, equal 2nd best option.
- Best value for money of all the options considered.

Key Disadvantages
• Higher impact on heritage value the bridge compared to 6, 7 & 8.
• Higher WHS and Construability risk compared to some other options.

Conclusion

The determination of the options assessment rated this option as best available.

This option has been determined to provide the best overall balance when considering all the assessment criteria, especially road safety, environment & heritage.

Option 6 – Construction of new bridge parallel to existing bridge with 5m separation

This option would involve building a new, structurally independent bridge immediately adjacent to the existing bridge with five (5m) separation, resulting in each bridge carrying a single lane of traffic. This original configuration would require a concrete medium barrier and crash terminals of either approach.

A key advantage of this option is that it has been assessed as having a low heritage impact on the existing bridge. Although minor modification are still required to the existing heritage bridge, when completed the two bridges will be clearly seen as two separate elements. This option is the equal 2\textsuperscript{nd} best option available in terms impact on heritage value of existing bridge.

Another advantage is that the will have less visual impact on the character of the existing bridge because of the clear separation of the two bridge elements.

This option has the equal 2\textsuperscript{nd} best WHS and Construability risk compared to the other options and his lower overall risk when compared to option 5 as the entire bridge can be completed offline and the road construction is slightly less complex and more can be constructed offline.

However a major disadvantage of this option is that it was further identified that given the curvature on the approaches (and the resultant poor sight distance for vehicles approaching the bridge(s)) it would be necessary to extend a median barrier to the next straight section of the road, beyond the curves. The resulting median barrier would extend approximately 450m west and 300m east of the bridge(s). The road safety benefit that results from this modification is that the crash cushions on the bridge approaches are no longer required. Standard guardrail or possibly wire rope barriers can be used.

This results in the bridge access road, Polacks Flat Rd and the nearby neighbour’s private access being left in/out only. Currently all these roads and accesses have full right in/out and left in/out access and the construction of U-turn facilities.

Another key disadvantage of this option is that due to proposed new bridge and road footprint being set 5m from the existing bridge. This would result in additional environmental impacts, including additional impact to riparian habitat, terrestrial habitats, and to neighbouring properties. As a result there would be a higher impact on environmental factors from the development of Option 6 in comparison to the Option 5

Option 6 would require substantial excavation of the large cutting on the western side of the project site to accommodate the new road alignment. The extra widening will
generated approximately an additional 10,000m³ of excess spoil, which is an increase of 41% in excess spoil compared to the Option 5.

Key Advantages
- Low impact on the heritage value of the existing bridge.
- Low visual impact on the existing bridge.

Key Disadvantages
- Results in Polacks Flat Rd and the nearby neighbour’s private access being left in/out only.
- High potential Environmental Impact.

Conclusion

The determination of the options assessment rated this option the 6th best available.

This option has been determined to be an unacceptable alternative option due to the high potential impact on the environment and impact to Polacks Flat Rd, bridge access track and the nearby neighbour’s private access becoming left in/out only.

Option 7– Construction of new bridge parallel to existing bridge with 15m separation

This option would involve building a new, structurally independent bridge immediately adjacent to the existing bridge with five (15m) separation, the existing bridge and section of road become redundant as the new bridge would be designed to accommodate both directions of traffic.

The major key advantage of this option is that it will deliver the equal 2nd highest level of road safety compared to the other options, as the existing constraints and limitations of the current road alignment and bridge levels are eliminated.

Another advantage is that most of the bridge and road alignment can be built offline which results is a moderate WHS and constructability risk, which is lower compared to options 2, 3 & 5.

A key advantage of this project is that is a very low direct impact on the heritage value of the bridge. However because the existing bridge will become redundant the ongoing current level of maintenance of the bridge would significantly reduce or essential cease, which will reduce the remaining life of the bridge.

A key advantage of this option compared to both options 5 and 6 is that due to the 15m separation, the road alignment of the western approach would likely avoid the large cutting and hence likely result in the cut/fill balance being close to equal.

However this advantage is offset by the significant increase of the potential impact this option will have on the environmental of the river, river banks and immediate areas.

Overall this option will have the same potential Very High Impact on the environment as option 4, 6 & 8.
A disadvantage of this option is that it will result in greater visual impact to the nearest resident to the south-east of the bridge compared to options 5 and 6.

The major disadvantage of this option is that although it directly results in a low immediate impact on the heritage value of the bridge and its setting. It does result in the existing bridge becoming a redundant structure. The existing bridge will be removed from the RMS State Road responsibility, Council would have to accept the ownership and maintain the bridge. It has advised that is interest in taking over maintenance responsibility for the bridge. The ongoing current level of maintenance of the bridge would significantly reduce or essential cease, which will reduce the remaining life of the bridge.

Key Advantages
- Equal 2nd highest level of road safety of the options.
- Low direct heritage impact on the existing bridge.
- Moderate WHS and construability risk.

Key Disadvantages
- High potential Environmental Impact.
- Results in existing bridge becoming redundant.
- Greater visual impact on the nearby resident.

Conclusion

The determination of the options assessment rated this option the 2nd best available, however it was ruled out because unlike option 3, 5, 6 it does not utilise the existing heritage bridge, it also results in equal highest impact on the environmental compared to all the other options and results in higher visual impact to the nearby resident.

Option 8– Alternative Route for HML Vehicles- via Yankee Gap Rd/Polacks Flat Rd.

This option would use Yankee Gap/Polacks Flat Rd as an alternate route for HML vehicles. The alternated route would involve upgrading 13.2 km of local unsealed road and two bridge crossing over the Bemboka River.

The project would involve the following key scope of works:

- Construction of over 13 km of new pavement on current alignment
- Installation of new safety barriers
- Extension of drainage structures
- Replacement of three bridges over the Bemboka River:
  - New 62m bridge, 770m north on Yankee gap Rd
  - New 20m bridge, 2.5km north on West on Polacks Flat Rd
  - New 20m bridge, 2.5km north on West on Polacks Flat Rd

A major advantage of this option that is results in a zero impact on the heritage value of the existing bridge. The existing bridge and road will be continued to be used by motorists with the alternative route primary for HML vehicles.

The major disadvantage of this project is the

Advantages
- This option would meet the objectives of the proposal.
Zero heritage and visual impact on existing bridge at Morons Crossing.

Disadvantages

- The strategy costs of $70M+ is well beyond the current funding available under the bridges to bush program. The project would not proceed under the current funding available.
- Extraordinary high cost to carter for only a very small amount of Heavy vehicles which is around 160 per day.
- Road would need to be changed over local council road to.
- Additional ongoing high maintenance costs of 13.5km and three new bridges.

Conclusion

The determination of the options assessment rated this option the 2\textsuperscript{nd} best available, however it was ruled out because unlike option 3, 5, 6 it does not utilise the existing heritage bridge, it also results in the equal highest impact on the environmental compared to all the other options and results in higher visual impact to the nearby resident.

Summary

Based on the above assessment amylases of the above alternate options it was determined that option 5 is the preferred alternative option as it results in the best overall balance option when assessed against all the assessment criteria, especially road safety, environment & heritage and it is the best value for money of all the alternative options.

Preferred Option

Two concept design were initially developed for the preferred alternative option 5:

- 5a- Upstream alignment
- 5b- Downstream alignment

These two designs matched the existing pier location, abutment and span lengths of the existing bridge.

Methodology for selection of preferred option 5

Selection of the preferred option 5 was based on a risk assessment approach with incorporating a Preliminary Environmental Investigation (PEI).

Options were assessed against the following criteria:

- Environmental impacts (e.g. impacts to threatened species, impacts to platypuses, soil and water quality impacts)
- Aboriginal and non-Aboriginal heritage
- Community Consultation
- Visual amenity impacts
- Road Design & Bridge Design
- Utilities adjustments
- Property acquisition
- Constructability and Work Health and Safety
- Geotechnical considerations
- Asset maintenance
Traffic impact and control

Option 5– Construction of new bridge parallel to existing bridge with 0m separation- Various Alignments

5a - Concept Plan - Upstream alignment

The upstream alignment in the concept plans, dated 13 August 2012, would involve the bridge being widened by constructing a new bridge on the upstream side of the existing bridge. The number of piers would be the same as for the existing bridge with pier placement mirroring the piers on the existing bridge. Safety barriers on the new and existing bridge would be AS5100 compliant concrete barriers.

This option would involve road works with the same eastern extent as the preferred option, but would be about 40 metres shorter at the western extent. This option would require about 8,200m³ of cut and 13,600m³ of fill material, resulting in a shortfall of about 5,400m³ of fill material. Property acquisition of about 0.08 hectares would be required.

Option 5b - Concept Plan - Downstream alignment

The downstream alignment in the concept plans, dated 13 August 2012, would involve the bridge being widened by constructing a new bridge on the downstream side of the existing bridge. The number of piers would be the same as for the existing bridge with pier placement mirroring the piers on the existing bridge. Safety barriers on the new and existing bridge would be AS5100 concrete barriers.

This option would involve road works with the same start and end points as the preferred option. It would require about 14,500m³ of cut and 11,000m³ of fill material, resulting in about 3,500m³ of excess cut material. Property acquisition of about 0.12 hectares would be required.

After the completion of the original PEI in November 2012 it was identified:

- both options have a similar overall environmental impact, with each having greater and lesser degrees of impact for different criteria
- Option 5a (upstream) was considered to have greater risks in relation to terrestrial ecological factors, visual amenity, and lane use and property.
- Option 5b (Downstream) was considered to have greater potential risk in terms of the local platypus population and community utilization

In terms of the specific impact on the local platypus colony it was identified that:

- Option 5a would have a greater potential impact on the quality of suitable platypus bank characterisers upstream of the bridge
- Option 5b would likely have greater impact due the reduced availability of deeper areas within the downstream pool and removal of rocky bed habit, caused by the placement of the piers in the centre of the river and on the banks
- Option 5b would also have greater potential impact upon existing burrows near the existing neat the existing bridge.
Concerns were also raised from the local resident about the potential impact on the local platypus colony with the proposed concept designs.

Based on the potential risks, recommendations and conclusions in the PEI and concerns from the local resident the RMS significantly modified both concept designs to mitigate or minimise the risks identified in the PEI, in particular the potential impact on the local platypus colony.

These changes included removing some piers from the centre of the river and spanning the river, increasing the span length, further set back of abutments compared to the existing bridge, modified pier design to reduce footprint as detailed below:

**Option 5c - Revised Concept Plan – Upstream alignment**

The revised concept plans, dated December 2012, would result in the new bridge being constructed on the upstream side of the existing bridge. Only two piers would be constructed within the Bemboka River, aligned with existing piers 3 (midstream) and 5 (on western bank) of the existing bridge. The western abutment of the new bridge would align with that of the existing bridge, while the eastern abutment would be about 2.5 to 3 metres further east that that of the existing bridge. A combination of AS5100 compliant safety barriers would be constructed.

The extent of road works, cut and fill quantities and property acquisition would be similar to that in Option 5a.

**Option 5d - Revised Concept Plan – Downstream alignment (preferred option)**

The revised concept plans, December 2012, would involve the bridge being widened by constructing a new bridge on the downstream side of the existing bridge (refer Appendix B). Only two piers would be constructed within the Bemboka River, aligned with two of the piers on the existing bridge. The western abutment of the new bridge would align with that of the existing bridge, while the eastern abutment would be about 7.5 metres further east that that of the existing bridge.

A combination of AS5100 compliant safety barriers would be constructed, comprising a 1300 millimetres high Medium Performance Level traffic barrier on the downstream side of the new bridge, a Thrie Beam 30% of Regular Performance Level traffic barrier on the upstream side of the existing bridge, with a wire rope safety barrier on the upstream edge of the new bridge acting as a median barrier between the two traffic lanes.

This option would involve road works extending about 420 metres east and 590 metres west of the existing bridge. It would require about 34,200m$^3$ of cut, 6,900m$^3$ of fill material, and 2,600m$^3$ of topsoil, resulting in about 24,700m$^3$ of excess cut material. Property acquisition similar to Option 5b.

The potential impacts on the environmental risks identified in the PEI of these two revised designs were reevaluated with an addendum to the PEI, with a focus on the potential impact the bridge and its construction would have on the local platypus colony.

Selection of the preferred option 5c or 5d was based on an updated risk assessment approach and criteria as detailed in section 1.2.4 with incorporating the updated
addendum to Preliminary Environmental Investigation (PEI) and revised design drawings.

Analysis of Preferred options

Option 5 – Construction of new bridge parallel to existing bridge with 0m separation- Various Alignments

Option 5c - Revised Concept Plan – Upstream alignment (preferred option)

Key Advantages
- This option would meet the objectives of the proposal.
- Very low risk of potential affecting resting or breeding burrows.

Key Disadvantages
- Higher in-stream construction impacts required to build construction platform to construct the in stream pier. This is not required for option 5d.
- Impact to prime platypus river bank habitat.
- Removal of low – medium condition EEC.
- Utility adjustment required (optic fibre cable).
- Greater risks in relation to hydrology, water quality, and visual amenity (generally) than Option 5d.
- Additional land owners affected by property acquisition compared to option 5d.
- Overall higher potential environmental impact compared to option 5d.

Option 5d - Revised Concept Plan – Downstream alignment

Key Advantages
- This option would meet the objectives of the proposal.
- Overall Lower level of environmental impacts compared to Option 5c.
- No utility adjustment would be required (optic fibre cable).
- Lower level of in-stream construction impacts required than Option 5c.
- Lower number of land owners affected by properly acquisition.
- No impact to the upstream Prime Platypus river bank habit.

Key Disadvantages
- Higher risk of potential affecting resting or breeding burrows compared to option 5c.
- Removal of low – medium condition EEC.
- Greater risks to community utilisation of surrounding area than Option 5c.
- Larger area of property acquisition required than Options 5c.

Preferred option

Option 5d - Revised Concept Plan – Downstream alignment is the preferred option. The evaluation of the overall RMS risk assessment concluded that this option has the overall lower environmental and community impact and has lower overall risk. It has therefore been selected as the preferred option.

As a result of ongoing community consultation, there were still concerns about the potential impacts that each of the proposed design could I have the local platypus habit and population.
As a result of this consultation the RMS engaged Dr Tom Grant (Ecologist & Leading Platypus specialist) to:

- Review the PEI & addendum PEI.
- Review the draft biodiversity assessment of the Review of Environmental Factors (REF).
- Complete an assessment of the site.

The result of this review and site assessment concluded that the amended Option 5d is the construction scenario likely to have the least potential impact on the platypus population in this section of the Bemboka River.

This independent review and site assessment further strengthened option 5d as the preferred option.