

## ISSUES REVIEW - FITTING INTO THE BUILT FABRIC

### KEEP THE ROAD FOOTPRINT TO THE MINIMUM POSSIBLE TO ACHIEVE GOOD DESIGN OUTCOMES

The road footprint is already at a minimum, and the proposed increase in speed to 80km/h and four lanes will increase the required footprint. The road sits within a predominantly natural bushland environment and is constrained throughout much of its length by steep topography, existing land use, and important ecological, topographical and cultural constraints.

The ridge top location and steep nature of the adjacent terrain means that there will be substantial cut and fill impacts the increased footprint will create a loss of established vegetation cover in the road widening and construction footprint, with resultant visual impacts within all the options as the road is expanded. Similarly any erosion control measures or detention basins need to be kept to a minimum.

### INTEGRATE NOISE CONTROL INTO ROAD CORRIDOR AND PROJECT DESIGN

The key residential areas are predominantly to the north and east of the site. At the far eastern end of the site the residential areas will occur on both sides of the road. The noise-sensitive and vibration-sensitive receivers in this vicinity are generally well set back and unlikely to present a major constraint on the project. At this stage on advice provided by RMS, it is not anticipated that there will be requirements for noise walls on the road.

Given the relatively elevated nature of the road in relation to the lower residential areas, this northern side will also be the one with likely views.

### AVOID ADVERSE VISUAL IMPACTS WHEN PLANNING AND DESIGNING ROADS

Given the ridgetop setting of Mona Vale Road there are potentially considerable visual impacts from the road expansion through the loss of tree ridge line canopy. The steep nature of the terrain adjacent to the road also means that any horizontal curve enlargements will impact into bushland and steeply sloping terrain through creation of cut and fill batters.

Given the sandstone character of the landscape, there is an opportunity to maximise cut batters, dependent on the structural quality of the sandstone. The natural sandstone should allow for near vertical batters, and provide a high quality aesthetic appearance. On the down hill sides, extensive retaining walls will be necessary to minimise the impact of fill batters which will need to chase downhill a considerable distance.

### CONSIDER THE POTENTIAL USE OF ADJOINING LAND

Kimbriki Tip Waste Recycling Plant is a regional facility servicing the Northern Beaches. It is on the south side of the road and Management has indicated that they are planning expansions to the facility. The preferred road design option will need to consider the impact of turning into the Tip, particularly from the large urban catchments that exist to the west of the site.

While the main town centre in any future development will be located further to the north, consideration should be given to potential gateway opportunities to this future residential land, particularly from either Tumburra Street or Addison Road.

### DESIGN ROAD BOUNDARIES IN RESPONSE TO LOCAL CHARACTER

Many of the road boundaries for this section of Mona Vale Road will be adjoining bushland and the road character will need to accommodate and respond to this. There are also important views of the Baha'i Temple that need to be retained and protected from the eastern end of the road near Powder Works Road.

### PRINCIPLES:

- Maximise usage of cut embankments where adequate sandstone is present. Use the natural qualities of the stone to limit the need for expensive wall structures, but avoid the use of unsightly shotcrete.
- Simplify the top line of cut embankments
- Loose material at the top and clay lenses should be faced with locally won stone from road excavation.
- Consider gateway opportunities for the new road to address / entry points future residential lands.
- Provide suitable entry points or turning locations for any future residential lands and adjoining landuses such as Kimbriki Tip.
- Keep erosion control measures and detention basins to a minimum.
- Maintain ridge lines and associated tree canopy wherever possible.
- Retain important views including those of the Baha'i Temple.
- Minimise large fill batters through use of retaining walls.

## ISSUES REVIEW - CONNECTING MODES AND COMMUNITIES

### CONSIDER CONNECTIVITY INTO AND THROUGH SURROUNDING URBAN ENVIRONMENTS

As a ridge top road corridor with bushland on either side there is little opportunity at Mona Vale Road for urban connectivity by road, particularly on the western end and southern side of the road. The curving and dipping nature of the road, and adjacent terrain also limit turn-off opportunities. Future residential development should allow for networked connectivity that links back to Mona Vale Road. There are possibilities that cycleways on the northern side could use local corridors within the residential areas. The road corridor is also popular with horse riders. Where feasible, a bridal path may be accommodated next to the multi use path.

### CONSIDER CONNECTIVITY BETWEEN MODES

The only modes of transport accommodated on Mona Vale Road at present are private car, buses, cycling and walking. As outlined before, there are no likely rail options, any improvements are likely to come out of bus ways and integrated cycleways / pedestrian walkways. As such it is important that the nodal points for connectivity maximise the potential for bus and bike usage, including 'kiss and ride' drop off points and connectivity between bus stops, cyclepaths and footpaths. This will be particularly important in the area around the proposed town centres.

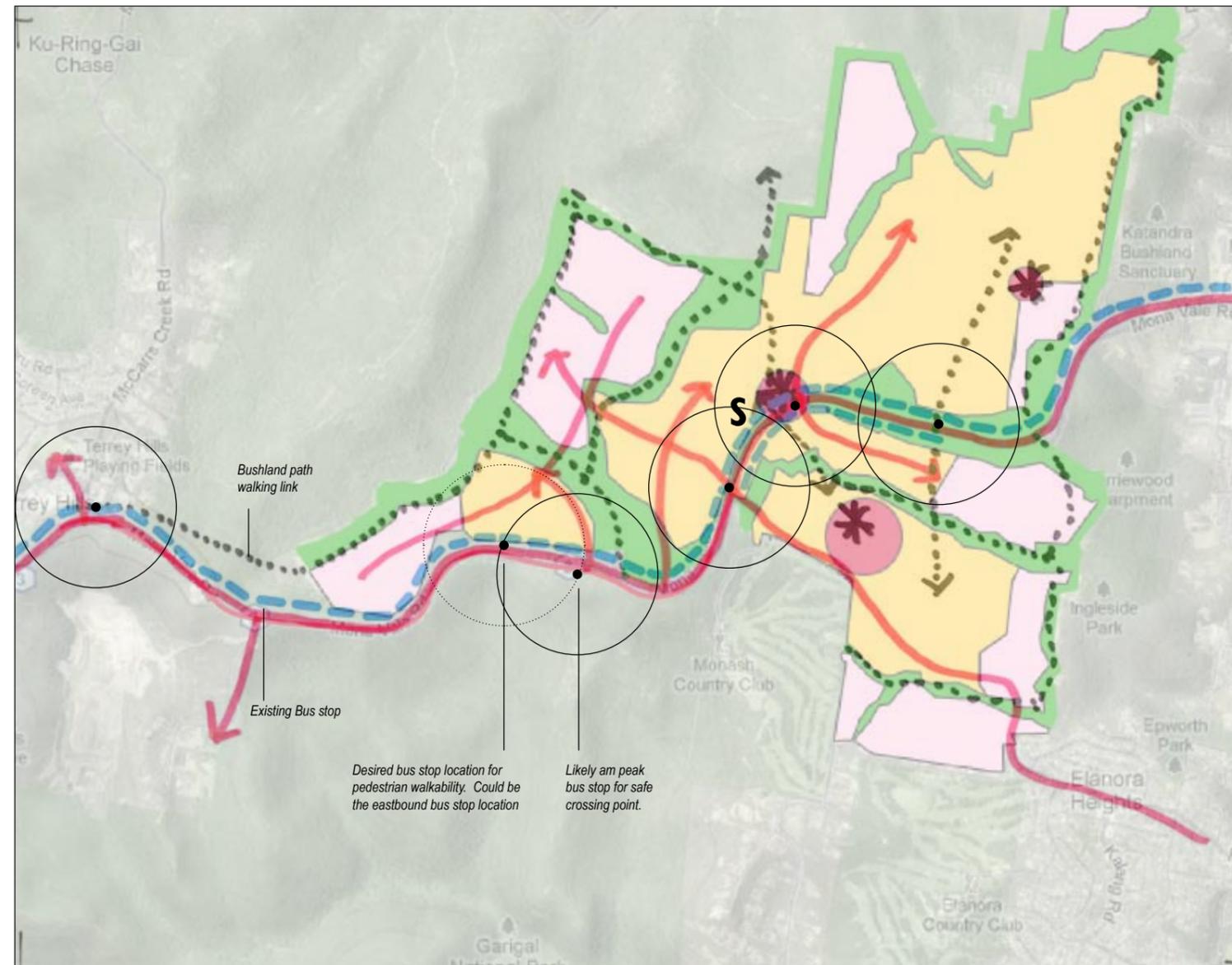
### CONSIDER WHERE PEOPLE WANT TO CROSS AND THE QUALITY OF CROSSING POINTS ALONG A BUSY ROAD

On the eastern end of the corridor the road will separate the future residential centres. Opportunities for vehicle and pedestrian connectivity across Mona Vale Road are important here and to the east of our site corridor, particularly as the population density increases.

Morning peak hour bus stops on the western end of Mona Vale Road are located on the southern side. The ability to safely cross the road is important in this location.

### PRINCIPLES:

- Provide a safe and convenient multi use path on the northern side of road.
- Ensure that any future residential development maximises pedestrian walkability and cycling access throughout the development, along with connections to Terrey Hills to the North and between the centres that will be on opposite sides of Mona Vale Road. Seek early agreement on intersection options to assist with local access and connectivity.
- Interconnect key bus stops, cycleways, bridal trails, pedestrian paths and potential 'kiss and ride' stops on Mona Vale Road and within the future development.
- Provide safe and convenient crossing points for pedestrians crossing Mona Vale Road between residential destinations and key access points such as town centre, schools and bus stops.
- Ensure that the local environments and urban development create walkable environments and overcome barriers created by the width of Mona Vale Road. Limit possible walls and screening structures.



**CONNECTIVITY FOR POTENTIAL 4900 LOT DEVELOPMENT FOR ROAD WIDENING**

Source: Adapted from Urban Growth NSW presentation

## ISSUES REVIEW – FITTING WITH THE LANDFORM

### FORM A ROAD IN RESPONSE TO TOPOGRAPHY AND LANDFORM

At present the road has a sinuous curving form that follows the existing landscape closely. The road corridor itself is very narrow and the bushland is very close to the road. This forms part of the road's character, charm and visual identity. This is partly driven by the current low design speed, and the age of the road where mature trees have established close to the road. This bushland character also provides a gateway experience, passing through residential land, then bushland before reaching northern beaches residential areas.

### Road Footprint

Within the constraints of the vertical and horizontal alignments, along with the extensive ecological constraints, Aboriginal cultural heritage issues, steep topography and potential extent of cut and fill required, the road footprint has been kept to a minimum.

### Split Carriageway Option

A split carriageway was initially presented as an option (circa 1966) as a way of overcoming the constraint posed by the rocky outcrop and the steep topography to the south of Mona Vale Road.

The split carriageway approach would possibly assist in the retention of the road's character as a bushland corridor.

In line with the original 1966 split carriageway proposal, Option 3 - Split Carriageway was investigated but not recommended as the preferred option because it was less flexible to constructability issues, isolated the rock outcrop and was restrictive to future public transport expansion.

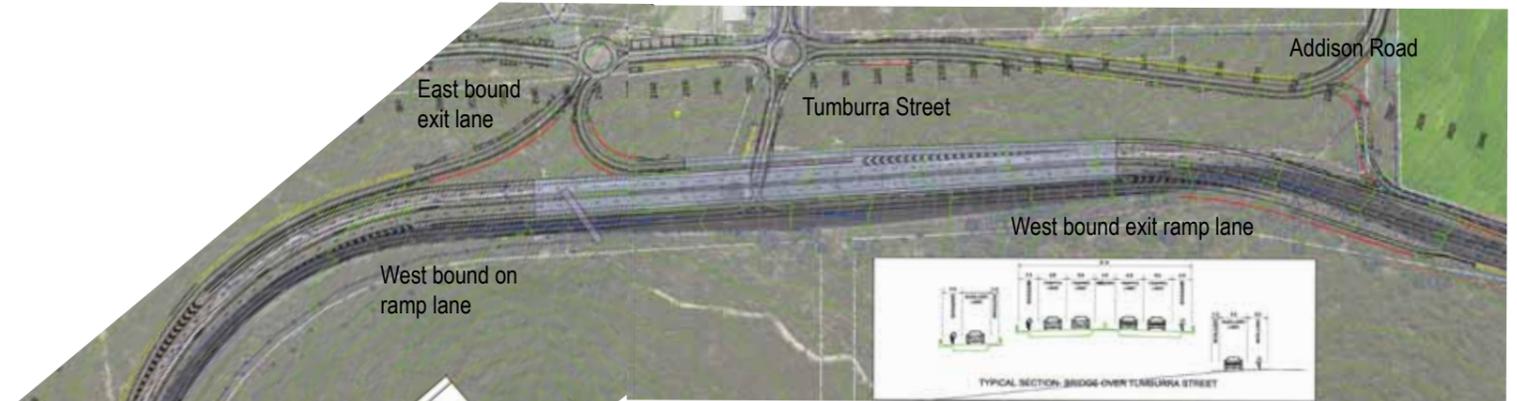
### Viaduct Option

A Viaduct option has been proposed for the road section adjacent the Tumburra Street intersection and has a number of benefits from an urban design and road user perspective.

The Viaduct eases out the vertical curve and essentially creates a grade separated intersection that would remove the traffic lights from this intersection. This would have benefits for vehicles in maintaining speed down the hill before the steep climb particularly travelling east.

### CONSIDER SLOPE STABILISATION DESIGN AS PART OF THE PROJECT

Given the sandstone topography and steeply undulating topography, it is recommended that, where possible a reliance on more cut than fill will help to limit the extent of slope stabilisation needs. This will allow for near vertical cut batters. It also has the benefit of a natural aesthetic solution. Fill batters should be limited as much as possible and consideration should be given to Rip Rap options that have a high angle of repose, or alternatively near vertical retaining walls. Geo-technical



LOCATION OF POTENTIAL VIADUCT OPTION

investigation has indicated a presence of substantial floaters and poor quality rock near the vicinity of the Kimbriki Tip entrance that greatly effects the construction viability of option 1 and 3. See photo opposite.

### PRINCIPLES:

- Utilise cut batters where possible in sandstone and minimise fill batters. Keep batters as vertical as possible, or tapered back at 1:10 ( subject to testing and feasibility).
- Utilise sandstone rip-rap batters with a high angle of repose.
- Consider elevated structure or 1:10 vertical retaining walls.
- Integrate sound walls where required into the road design or find options to 'design them out'. Where any noise walls are required use a high level of transparency to facilitate bushland and distant views and improve character and experience for users.
- Any cut embankments should have smooth continuous curving lines at the top of the batter, and not necessarily be driven by the exact adjoining ground line.
- Investigate intersection options in the next stage of design that complement the natural terrain, maximize traffic efficiency and road safety.



Substantial floaters and poor quality rock near the Kimbriki Tip entrance

## ISSUES REVIEW – RESPONDING TO NATURAL PATTERN

### INTEGRATE NATURAL PATTERNS AND SYSTEMS INTO ROAD DESIGN

#### Geology and Hydrology

The underlying Hawkesbury sandstone geology of the site has influenced the location of the road as well as the heavily dissected landform and existing plant communities. Mona Vale Road largely sits on the ridge top dividing two catchments. (Refer to diagram on page 13). Deep Creek on the south in Garigal National Park drains to Narrabeen Lagoon while Wirreanda Creek and McCarrs Creek in Ku-ring-gai Chase National Park drain northwards to Pittwater. To the east Mullet Creek drains through Monash Country Club and primarily residential lands to the upper end of Narrabeen Lakes.

The natural falls of the land and the placement of the preferred route alignment would lead to road drainage connection to Wirreanda Creek.

#### Topography

The topography of the site, with slopes of between 1:2 and 1:10 covering large areas beside the road, along with cultural constraints has been an important factor in the horizontal and vertical design outcomes for the road. Combined with the underlying geology, there may be cost and urban advantages of utilising exposed sandstone in cuttings if geotechnical testing identifies that this is feasible.

#### Bushfire

Most of the road exists within a high fire danger environment with large bushland catchments on steeply sloping ground below the road. The road provides the only fire evacuation / escape route for a number of properties which access off Addison Road and Tumburra road. Given its strategic nature the road also forms an essential route for emergency services and bush fire vehicles.

#### Vegetation Communities and Threatened Species

The study area is surrounded by large areas of good quality native vegetation and the ecological investigation identified eight native vegetation communities and six other ecological communities. These include:

- One threatened ecological community (Duffys Forest Ecological Community), which is listed as endangered under the NSW Threatened Species Conservation Act 1995 (TSC Act).
- One ecological community (Coastal Upland Swamp) with a preliminary determination for listing as endangered under the TSC Act.
- One rare community (Yellow-top Ash Mallee).

The ecological investigation recorded 295 native plant species, subspecies and varieties in the study area. Thirteen of these species are noteworthy:

- Two endangered species: *Microtis angusii* (Angus's Onion Orchid) and *Grevillea caleyi* (Caley's Grevillea). These are listed as endangered under both the NSW TSC Act and Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).
- Two vulnerable species: *Pimelea curviflora* var. *curviflora*, listed as vulnerable under both the TSC Act and EPBC Act, and *Tetratheca glandulosa*, listed as vulnerable under the TSC Act.
- Five rare species and four species considered regionally important in northern Sydney.

### ENSURING PHYSICAL CONTINUITY OF NATURAL SYSTEMS

Mona Vale Road at Ingleside passes through largely intact bushland for much of its length, with large tracts of high value bushland managed in two national parks on either side of the road. Being at the top of the catchment, it seems to be relatively free of weeds, compared to other sections of Mona Vale Road further east on the Ingleside escarpment.

#### Wildlife Corridors and Habitat Fragmentation

The central section of the site represents an important wildlife corridor that can potentially link the relatively large areas of Garigal National Park and Ku-ring-gai National Park. Although the canopy is very close to the road in places, there is no continuous canopy access for arboreal animals, nor safe crossing for mammals and reptiles.

In 2010 RMS commissioned a study to look at options for the reduction of wildlife roadkill on several arterial roads on the Northern Beaches. This study identified three roadkill hotspots along Mona Vale Road, one of which occurs within the study area. This particular hotspot extends from the Kimbriki Road intersection to the Tumburra Street intersection and is particularly important in terms of Swamp Wallaby road kills. This hotspot was identified as having the highest priority along Mona Vale Road due to its location within a regional fauna corridor between Ku-ring-gai Chase and Garigal National parks.

The ecological survey identifies that consideration be given to minimising road kill and allowing for fauna movement across the road. Options include over road crossings or culvert style crossings under the road.

Any split carriageway designs will tend to fragment the vegetation further, although the power lines and powerline easements already partially fragment Wirreanda Road residential land to the north of this area.

### USE NATURAL CHARACTERISTICS IN THE ROAD'S LANDSCAPE DESIGN

Given the road fronts onto two National Parks, the natural ecosystems are important and should be replicated in any landscape rehabilitation of the road corridor. Locally sourced provenance and seed will be important to maintaining the ecological integrity of the bushland. Like many road corridors there are some weed infestations at the sides of the road and particularly on fill batters where introduced species such as lantana have gained a foothold. As these are at the top of the catchment where weed seed can be carried down hill, any development of the road corridor should seek to remove these and replace them with indigenous species of local provenance.

It is likely that the road may fill across the headwaters of a number of streams and creeks. The management of water and runoff should seek to minimise pollutants flowing into the two National Parks. This will be important in terms of turbidity during construction. This should be balanced against the need to minimise the size of any temporary detention and siltation basins and the physical impact they may have.

### PRINCIPLES:

- Minimise impacts upon threatened species and communities.
- Provide woodland/ fauna corridors where any opportunities arise.
- Consider a large overland fauna crossing that can link Garigal and Ku-Ring-Gai Chase National Parks.
- Utilise locally sourced provenance species in re-vegetation works. Consider early works and sourcing lead times.
- Maintain the continuity of local creek systems and minimise pollutants flowing down the creek systems.
- Minimise the size of any temporary detention and siltation basins.
- Consider infiltration trenches in lieu of sediment basins in final design to minimise surface impact on bushland areas.
- Consider bushfire in planning and design options.

## ISSUES REVIEW - INCORPORATING HERITAGE AND CULTURAL CONTEXTS

### PROTECT AND INCORPORATE ABORIGINAL HERITAGE IN PROJECTS Aboriginal Cultural Heritage

There are a Aboriginal cultural heritage sites within the study area. Due to the importance and sensitivity of the identified sites, their characteristics and locations have not been identified in this report. They have driven the road design options and the preferred option offers the best long term outcome for the culturally sensitive sites.

### INTEGRATE HISTORIC BUILDINGS AND PRECINCTS INTO ROAD DESIGN THINKING.

#### European Cultural Assets

Located high on the ridge top at the eastern end of the road, is the Baha'i temple. It is listed on the Pittwater Local Environmental Plan 1993 (Pittwater LEP) as an important cultural landmark and important placemaking element in the road experience. Its contrasting white form is visible from many view points in the region and easily visible from the road near the Powder Works Road intersection.

The Baha'i temple precinct occupies a important piece of land which the road curves around. The Pittwater council LEP shows the inside of the radius set aside for road widening purposes.

### RECOGNISE EUROPEAN CULTURAL PLANTINGS

There is one item pertinent to the study area on the Pittwater LEP - a group of Monterey Pines (*Pinus radiata*) on Mona Vale Road, cadastral address Lots 201, 202 and 203 in DP 1054875. These plantings are not impacted by the project.

### ADAPTIVELY RE-USE HERITAGE INFRASTRUCTURE IN PROJECTS.

There is no known heritage infrastructure that can be utilised in the project.

### PROTECT BRIDGES OF HERITAGE SIGNIFICANCE WITHIN THEIR SETTING

There are no heritage bridges within the precinct.

### PRESERVE ROADS THAT PROVIDE A SENSE OF HISTORY

While this aspect has not been researched, many of the aboriginal sites were recorded by Surveyor W.D Campbell and published in his memoirs in 1899. [Kelleher Nightingale 2011, p8] Mona Vale Road was previously known as "Lane Cove Road" and parts of the road in Warriewood and Ingleside are still called this.

### PRINCIPLES:

- Protect any Aboriginal cultural heritage sites from damage.
- Maintain the visual connection to the Baha'i temple as a placemaking element on the road journey.
- Protect the vistas to the Baha'i Temple.



Baha'i Temple, Mona Vale Road.

## ISSUES REVIEW - DESIGNING ROADS AS AN EXPERIENCE IN MOVEMENT

### ENHANCE THE VIEW FROM THE ROAD

This is a beautiful stretch of road occupying a high ridge top in an attractive bushland setting with relatively high value natural assets such as the adjacent Garigal and Ku-ring-gai National Parks. The important cultural landmark of the Baha'i Temple which is an important point of interest along the road is a distinctive and a memorable placemaking landmark.

As the road is elevated on a high ridge line, there are a number of long distance vistas of the Pacific Ocean, particularly driving east down Tumbledown Dick Hill, near the Kimbriki Tip. These assist in orientation and provide an important part of the road user's experience.

With the steep terrain, there will be a number of retaining walls on the lower sides of the road. While these will need parapet barriers, they should utilise rail barriers on top to reduce the height of concrete and to maximise bushland and long distance views. While it is unlikely that noise walls will be required, if required they should be transparent to maximise views.

### PROVIDE VISUAL STIMULI WITHIN THE ROAD CORRIDOR

As the road is a short corridor and there are key vistas and important landmarks, it is not seen as necessary for the road experience to be punctuated with specific additional visual stimuli. However any built features including cuttings and so forth should consider their aesthetics. Consideration should be given to the gateway potential of a fauna overpass on the road that would provide a habitat linkage between Ku-ring-gai Chase and Garrigal National Parks. If this were to be developed, its scale would require that important consideration be given to its design, as it would create an important gateway on the road. It should be designed to form an attractive simple element such as the fauna overpass on the Pacific Highway.

### CREATE A PROGRESSIVE SEQUENCE OF EVENTS

#### Choreography and Movement

The road at present provides an undulating and curving road experience with nearby enclosing bush and occasional long distance glimpses. There are important elevation changes along the road providing an almost rollercoaster like drive through the narrow bushland corridor. While the design will tend to ease out the horizontal and vertical curves, the future road experience seeks to maintain this undulating bushland parkway experience.

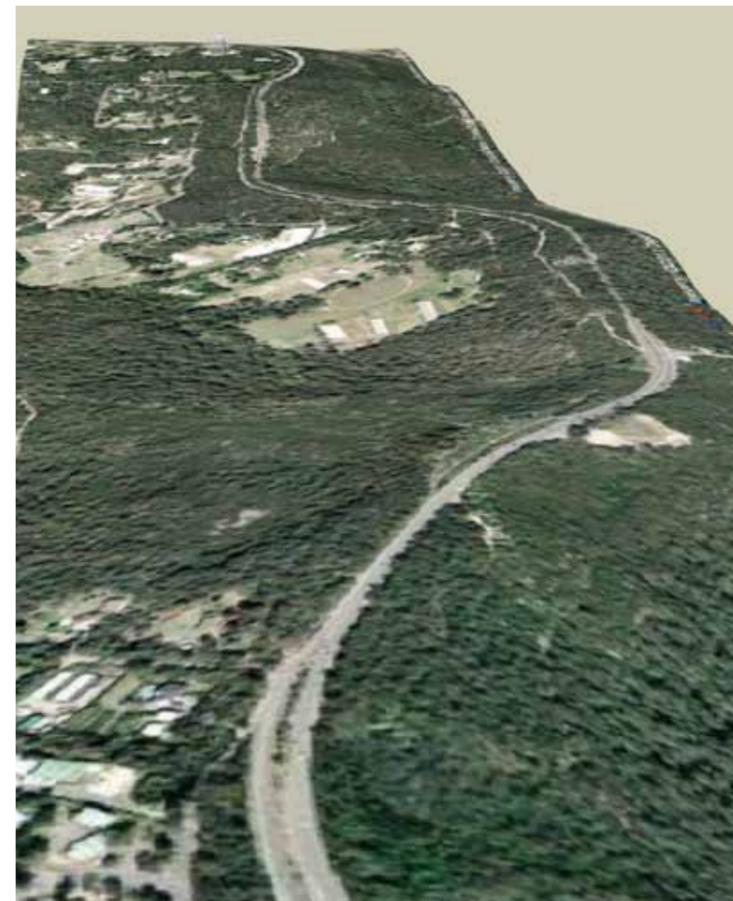
#### Gateway Opportunities

This Ingle side section of roadway flanked by National Parks separates the rural bushland Terrey Hills plateau from the more densely populated northern beaches and provides the opportunity to form a western gateway to the northern beaches. This gateway does not need to be considered as a literal signpost but more as a change in environment. For example, the road could take a more 'urban' form with signature street tree planting to mark the potential new town centre and potential higher built form (once beyond the Baha'i temple landmark at Powder Works Road).

Consideration should be given to providing a transition landscape from the "bushland rollercoaster" to suburban development.

There are opportunities within the road design to also ensure that the entire experience including road infrastructure (barriers, walls, medians etc) are designed in such as way as to provide a memorable and seamless experience

There should be a consistent suite of urban elements associated with the road that provide continuity to the road experience. This includes barriers, and how they terminate and connect with road infrastructure and concrete work.



### PRINCIPLES:

- Maintain, where possible, the curving and undulating nature of the road.
- Maintain and protect the adjacent bushland character and natural qualities of the place that are part of the road experience.
- The tree planting palette should utilize indigenous bushland species to maintain the feeling that the road has been carved out of the bush.
- Maintain long distant views of the Pacific Ocean from the top of Tumbledown Dick Hill, and other areas where they are present.
- Maintain the visual connection to the Baha'i temple as a placemaking element on the road journey.
- Consider the use of natural rock cuttings and carefully integrate any road infrastructure into the design.
- Deep cuttings may provide options for land bridges over the top that can act as cultural and wildlife corridors.
- Any off form concrete or walls patterning should be simple and stylized.
- Maintain a restrained palette of materials with muted colours.



## ISSUES REVIEW – CREATING SELF EXPLAINING ROAD ENVIRONMENTS

### DISTINGUISH BETWEEN THE DIFFERENT FUNCTIONS AND SPEEDS OF ROADS BY DIFFERENTIATING THEIR APPEARANCE

Given the short stretch of this road, it has similar functions and a single speed along its length. The road will change appearance over time at its eastern end as the area becomes more urbanized. There are opportunities to signal the arrival of the township and treat the road as a gateway to the Northern Beaches.

### IMPROVE THE LEGIBILITY OF ROADS

The road is not intended to be a high speed motorway, nor will the terrain allow for such wide sweeping radii. The road should still convey the sense of a bushland parkway that winds and curves up, around and over the terrain.

There are opportunities within the road design to also ensure that the entire experience including road infrastructure (barriers, walls, medians etc) are designed in such a way as to provide a memorable and seamless experience.

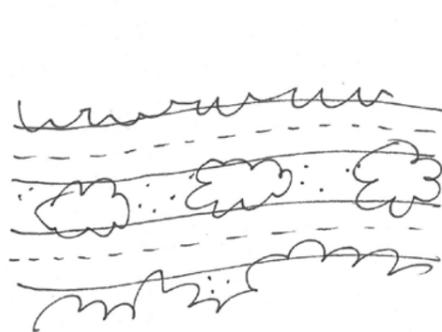
Mona Vale Road, between Terrey Hills and Ingleside will form a transition road landscape environment with the same posted speed, linking the split grass median in the section west of Terrey Hills, with the more urban form in the section to the east.

### PRINCIPLES:

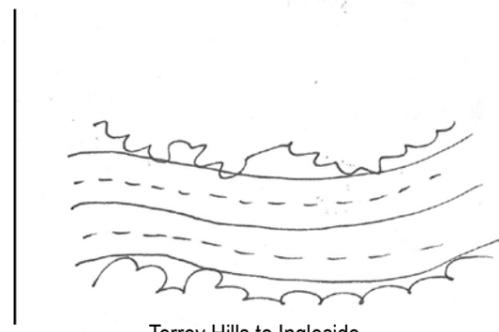
- Utilise the opportunity to provide a gateway quality to the future residential expansion areas and signal a more urban environment with the detailed design of the road character.
- Ensure trees are retained as close to the road as possible to create a narrow corridor for visual purposes to provide visual cues to reduce speed.



The intention is that Mona Vale Road integrate back into its sandstone environment in the longer term like this example on the Great Western Highway through the Blue Mountains.

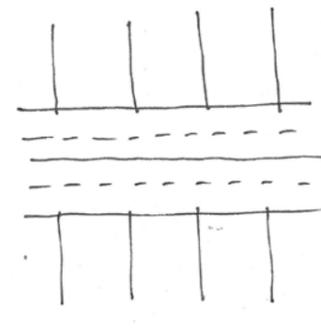


80km/h  
Bushland



Terrey Hills to Ingleside

80km/h  
Transition



80km/h  
Urban Environment

## ISSUES REVIEW – ACHIEVING INTEGRATED AND MINIMAL MAINTENANCE DESIGN

### USE ROBUST AND DURABLE MATERIALS FIT FOR PURPOSE AND PLACE

The Corridor has an important bushland character. Where possible the design should seek to use natural material such as cut sandstone and simple uncomplicated concrete work to fit within the bushland setting. Standard roadside barriers should be used to maintain bushland as close to the road as possible.

### PROVIDE A SELF RELIANT AND MINIMAL MAINTENANCE NATURAL LANDSCAPE

Given the proximity of the National Parks, plant material should be low-water use, endemic sourced plant material. The natural bushland should be allowed to regenerate up to the road corridor, through topsoil management and weed suppression.

The use of high maintenance and potential weed species soft materials such as grass for medians and verges should be avoided.

### AVOID OPPORTUNITIES FOR VANDALISM

Opportunities for vandalism, and in particular graffiti, should be reduced through ensuring limited access to any large concrete sections and protection of concrete with anti-graffiti coatings. The road should allow for ongoing casual surveillance and employ Crime Prevention Through Environmental Design (CPTED) principles that minimize infrastructure that is out of sight. Given the nature of the terrain, there are likely to be wall side sections of the multi use pathway that may have limited casual surveillance.

### CREATE A SIMPLE, COORDINATED AND NEAT COMPOSITION OF ROAD ELEMENTS ALONG A CORRIDOR

#### Considered Palette

Road infrastructure and the materials palette has an impact on the quality of the road experience. The materials are used and how well these components are integrated into the design are very important to the end user road experience. The existence of outcropping sandstone in this area will be of benefit to the road cuttings, where the natural qualities of the rock can be exploited and are of sufficient structural quality. These should reflect the quality of the sandstone and could, at its upper expression, consist of cut sandstone as has been used on recently in Kariong. Good quality precast concrete facework is another suitable option, particularly for down hill sides of the road. It is recommended that naturalistic representations be avoided.

Shotcrete should not be used as a facing treatment in this corridor. Refer to the RMS Shotcrete Design Guidelines.

### CONSIDER THE DESIGN QUALITY AND MAINTAINABILITY OF MAJOR ROAD COMPONENTS AND INDIVIDUAL ROAD ELEMENTS.

Roads have a long lifespan. Good quality design and materials can greatly improve the visual aspects of the road and its experience for the users. Good design should not necessarily cost more although the quality of materials can have an impact on the overall cost. It should also be simple and relatively timeless. There are good benchmarks for quality outcomes in the Sydney region, including the F3 built in the 1960's, the more recent M7 and the Great Western Highway in the Blue Mountains.

#### Noise Walls

While it is unlikely that noise walls will be needed, any noise walls that may be considered, should take into account both the appearance and the need to not block vistas and be simple in design and ease of maintainability.

#### Parapets and Railings

The current designs all have a central vertical barrier and median barriers on the retaining wall sides. The final choice of these barriers should consider through visibility as well as maintenance. As the retaining walls fall on the downhill sides, it is preferable to maintain an open character here to maximise views and vistas. It is recommended that the tops of barriers be steel to maximise views. Similarly central median barriers should be simple vertical concrete medians or utilise steel barriers that are of low maintenance construction.

#### Viaducts

There may be viaduct / bridge elements if it is selected an option and this should be well considered, and in particular the integration of abutments and the viaduct in the final design.

#### Tunnels and Portals

Given the road splits two very large contiguous areas of bushland, consideration may need to be given to the creation of an overland land bridge that can provide an habitat link for smaller animals and mammals. The tunnel portals should be simple, geometric and well considered.

#### Signage and Advertising

Signage, including variable message signs should be kept to an absolute minimum here, other than necessary traffic related signage. It should be co-ordinated so as to minimise the number of poles and signs.

#### Artworks

Any artworks should be limited and considered early on in the design solution as an integrated and considered option not an afterthought.

#### Rest Areas

No rest areas are required in this short road corridor.

#### Utilities, Lighting and Other Elements

There should be a consistent suite of urban elements associated with the road that provides continuity to the road experience and design language. This includes the type of barriers and how they terminate and connect with road infrastructure and concrete work.

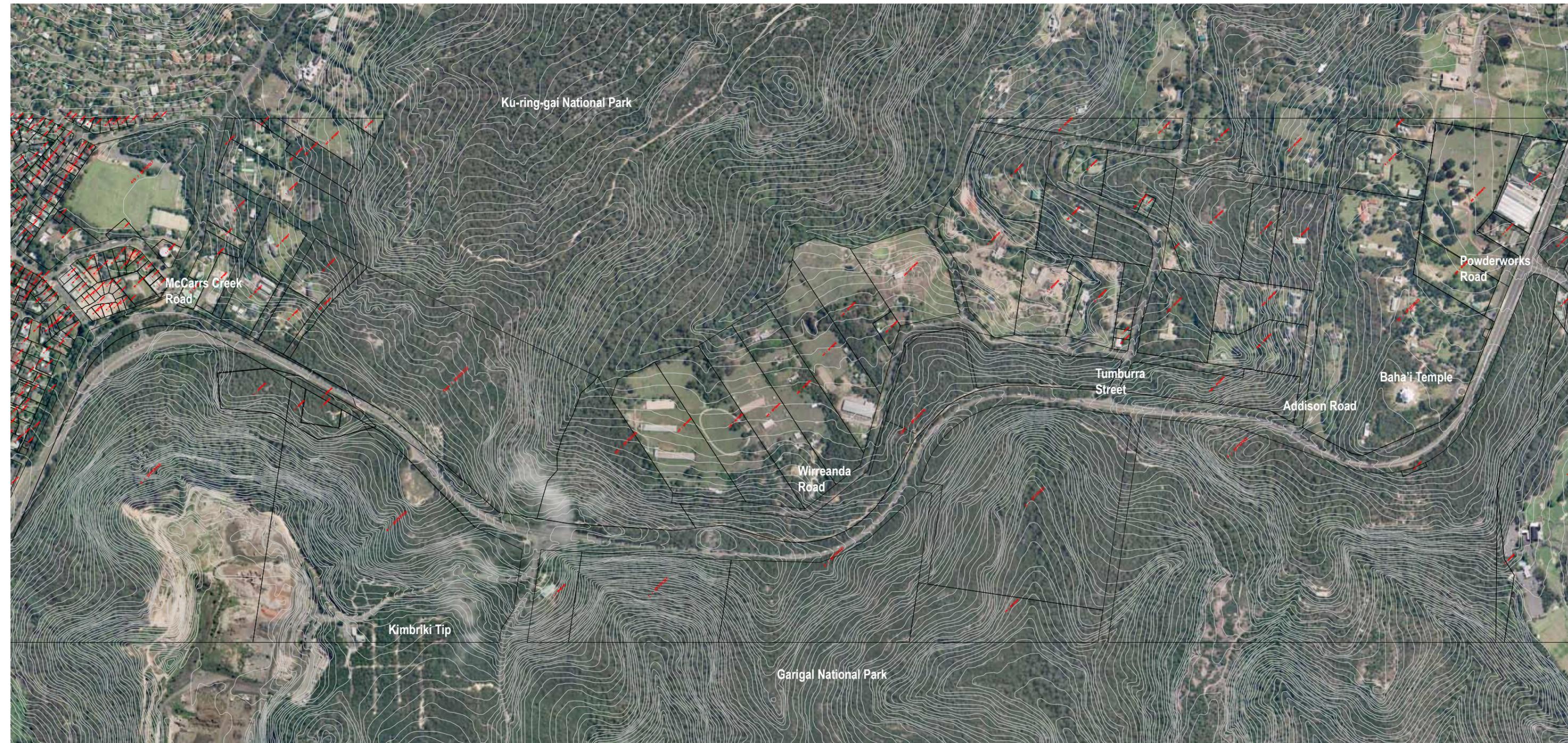
Should tidal flow be considered in the long term then options for elements which operate and manage it should be a simple and as low key as possible. Moveable medians or digital LED light options, or future technology options may all be considered.

While lighting along the road will be limited to intersections, and multi use pathways, consistent light pole fittings should be used throughout the scheme. Where light poles are used they should be integrated with other infrastructure, such as the smart pole system. Multi use path lighting should be in character with its bushland setting.

#### PRINCIPLES

- Retaining walls should use construction methodology that limits the construction impacts into retained bushland.
- The hardscape materials palette should be limited and preferably should include:
  - Sandstone exposed in cuttings
  - Sandstone rip rap
  - Sandstone stacking blocks
  - Well considered off form concrete
  - Precast concrete
- Planting should reflect natural systems and avoid heavy patterning. Where it forms the gateway to more urban areas where it might transition with indigenous species to a more formal arrangement, or abstracted representation of bushland.
- Consider options for carbon credits and carbon sequestration in planting design.
- Utilise locally provenanced plant material.
- Patterning should be simple and stylized.
- Minimal signage.
- Consistent language of materials.
- Consider adequate soil depths to provide a growing medium for long term tree canopy re-establishment.
- 100yr design life for structures.
- Barrier types should be simple and maintainable and designed to maintain visibility through the barrier.

# SITE PLAN









# Vision and Urban Design Direction

## CHAPTER 4 - MONA VALE ROAD VISION AND DESIGN DIRECTIONS

*Mona Vale Road Ingleside provides a strategic link that respects and integrates its sandstone bushland corridor setting within an undulating sweeping road experience. It provides road users with memorable views to the ocean and cultural landmarks. The road is a gateway to the suburbs of the northern beaches and fosters the development of a healthy community with safe cycling, walking and public transport options.*



Alex E. Proimos



## ROAD DESIGN CONSTRAINTS REVIEW

### DEVELOPMENT AND REVIEW OF ALIGNMENT OPTIONS

As part of the Preliminary Urban Design process, three options were developed by the RMS. The design development of the three route options has been an iterative process involving a number of inputs, including field investigations, engineering design, community submissions and technical workshops.

The Terrey Hills to Ingleside section of Mona Vale Road as outlined in the Issues Section is a highly constrained section of road. Its narrow ridge top location, extensive National Park frontages, and substantial ecological and cultural constraints greatly limit design options for the road corridor. The eastern and western ends of the road are identical for all three options developed for the corridor, while the central section has more flexibility and a number of options were developed for the road design.

The three options investigated were:

- Option 1: Existing Corridor.
- Option 2: Northern Alignment.
- Option 3: Split Carriageway.

There were however, a number of common issues that influenced the design including the following.

#### Protection of Endangered Species.

The location of endangered species has severely constrained the road design options and the preferred option has minimised the impact along its length.

#### Duffys Forest Plant Community Impacts

All options will have some impact on the threatened Duffy's Forest plant community adjacent both sides of the road near the Baha'i temple and further to the west, near Terrey Hills. This is inevitable, but construction processes should be set up to minimise the construction footprint.

#### Retention and Protection of Culturally Sensitive Areas

There are a number of culturally sensitive sites that have driven the road design that have been retained and protected. The design alignments and construction curtilages have avoided these areas. Protective fencing measures and induction procedures are likely to ensure that they are protected during construction from inadvertent damage. Further consultation with the community will be implemented in the next stages.

#### Kimbriki Tip Entrance

This substantial facility is set to expand to provide ongoing recycling and management for ambitious targets set by the regional councils that use this facility. The key issue is enlarging the operation and a design proposal has been submitted.

#### Retention of Garigal National Park ridge top south of the Baha'i Temple

The retention of the ridge top to the south due to the curve widening is important in maintaining a visual buffer, as well as maximizing cut opportunities in sandstone.

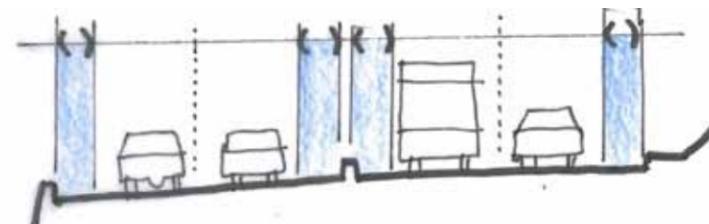
#### Road Configuration, Public Transport and Cycling

As outlined in the report, this road forms a critical component of a strategic route in a region with very limited public transport options. It is considered essential to plan for bus priority options as well as options for bus lanes to serve the morning and evening peak hours.

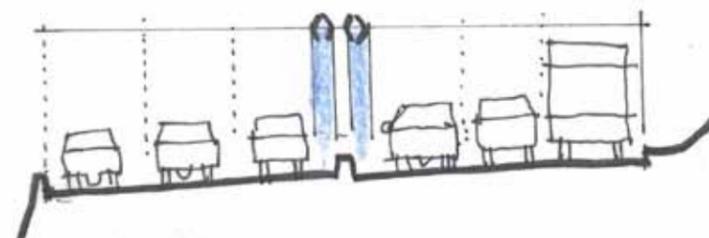
It is also considered important to facilitate safe commuter cycling and walking options. The preferred route would enable a multi use path to complement the upgrade for its full extent. In option 1 utilising the existing corridor for example, a multi use path would need to deviate away from the upgrade as it passes to the north of the rocky outcrop.

#### Public Transport Expansion

Where possible the design options have allowed for the possibility of conversion to six lanes by utilising hard shoulder running. In this scenario, the shoulders are reduced and lanes narrowed. The preferred option particularly adapts to this future expansion consideration for possible growth. Alternatively, the road configuration is suited to potential future tidal flow arrangements.

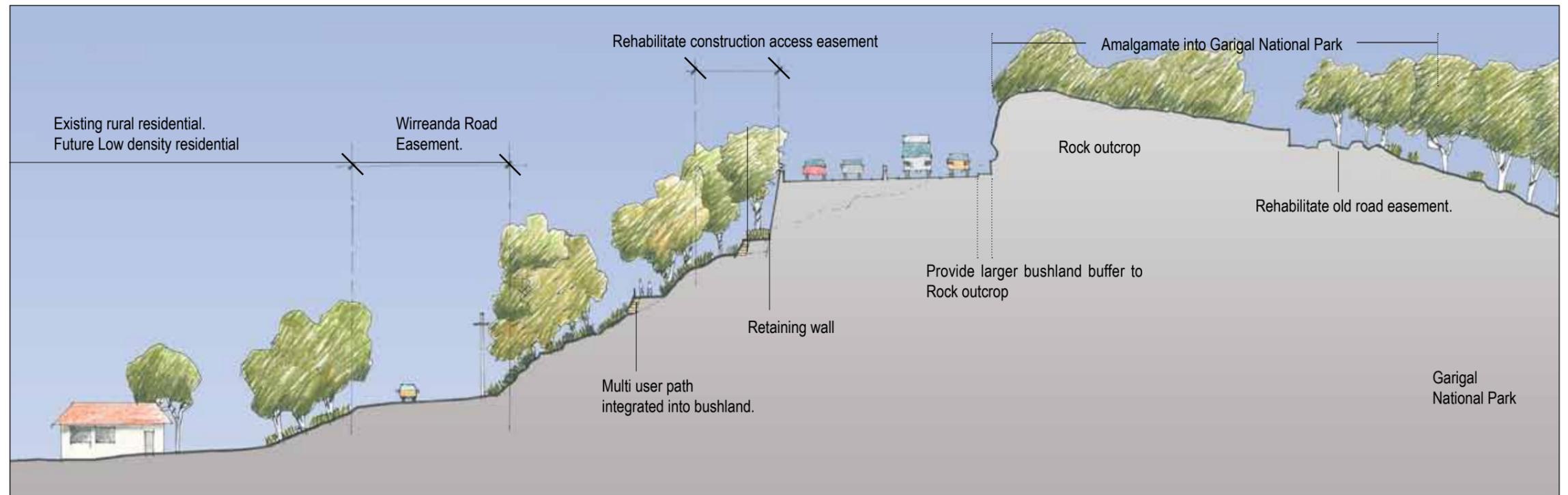


Normal cross-section - shoulders in blue



Hard shoulder running cross section

## PREFERRED OPTION - NORTHERN ALIGNMENT



Section AA • Typical central ridge section - option 2

### PREFERRED OPTION: MOVING THE ROAD CORRIDOR

This option moves the whole road corridor in the central section to the north where the terrain, while steep is substantially less challenging than on the south side of the rock outcrop.

At present the various constraints on curves and alignments mean that the present alignment is very close to the large rock outcrop and it would be preferable to have it further away to provide a bushland buffer between the road and outcrop.

The multi use path in this option would be located on the north side of the road and links down to Wirreanda Road. The proposal here is to utilise the early relocation of service corridors to form the multi use pathway. The issues here is that there is a substantial level change to Wirreanda Road and the terrain at ground level is very challenging with the multi use pathway currently graded at 1:6.

Careful construction of the multi use path and rehabilitation of the construction access areas will be important, particularly at the western end where the multi use path is adjacent the retaining wall. In this area where the wall will be viewed close up, detailed consideration should be given to the appearance and urban quality as well as the potential integration of public art of this wall in particular.

### Benefits:

The benefits of this option are that the geotechnical constraints are not as severe as other alignment options. It allows the services to be moved in advance into the areas to be taken up by the multi use path. It has benefits for motorists during construction as the existing central part of the road can be utilised while the new section is under construction speeding up the construction programme.

This option amalgamates the ridge top including the large rock outcrop and currently isolated bushland into a contiguous part of Garigal National Park, reducing habitat fragmentation. The old section of road would need to be re-habilitated, but could also serve limited recreation purposes.

This option also provides a very good opportunity for a substantial habitat overpass linking the two large National Parks where the new road deviates from the current alignment (just to the west of the Kimbriki tip entrance). A 4.5m cut batter in rock on the western side could provide the start of a bridge section using the existing road corridor at the eastern end.

### Pros:

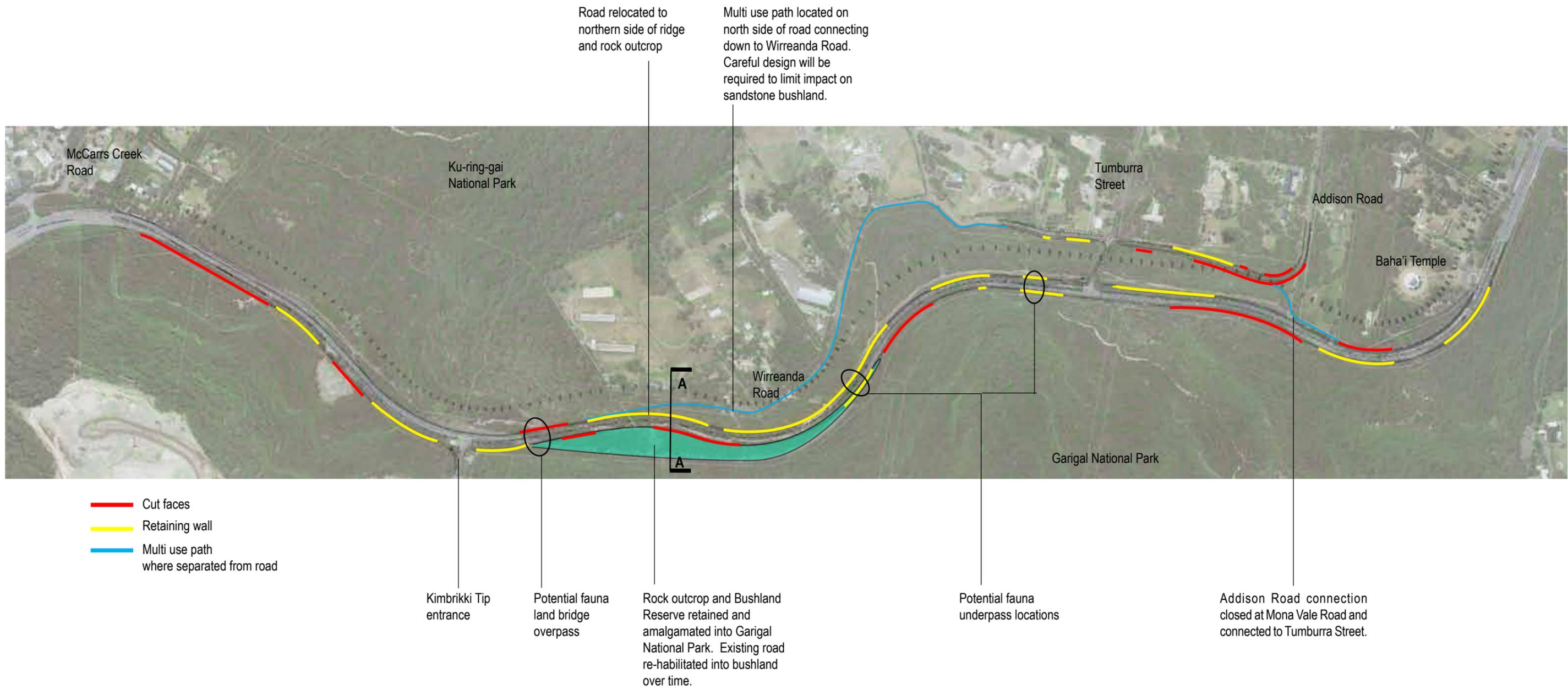
- Creates a clear division and fire break between Garigal National Park and future residential lands to the north.

- Consolidates a fragmented piece of bushland to the north of the road into a more contiguous area of Garigal National Park and reduces need to acquire land from this National Park.
- Provides an opportunity to provide a substantial land bridge habitat link rather than underpasses.
- Conserves the rock outcrop.
- Protects endangered species.
- The old road could be used for public access for bushwalking access to National Park trails.
- Provides 2.5 m shoulders for the full extent of the upgrade.
- Provides for future public transport/growth through the option for hard shoulder running/tidal flow.

### Cons:

- Bushland and visual impacts on new road alignment to north.
- Greater acquisition of Ku-ring-gai Chase National Park land required.
- Moves the road and therefore noise potentially closer to residential dwellings and future residential.

PREFERRED OPTION - NORTHERN ALIGNMENT





*Bushland of Mona Vale*

## DESIGN ELEMENTS AND MATERIALS AND FINISHES

### CUT AND FILL

In the steep bushland terrain occupied by Mona Vale Road, there are substantial areas of cut and fill. Where possible it is preferred to be in cut where the natural sandstone face can be exploited as a wall material.

#### Uphill Side

The uphill side of any cut road will be highly visible from the road corridor as motorists pass by in both directions. Given the National Park context, the preferred option is to maximise the use of natural stone facing.

Where the quality of the underlying stone is of sufficient quality, the natural stone face should be revealed. There are modern cutting methods and tools that can provide very precise cut faces. These can be dressed with different tools as has recently occurred on the M2 upgrade and at Kariong on the Central Coast.

Based on preliminary geotechnical reports it is likely that there will be clay lens intrusions and poor quality stone near the surface that will lead to an uneven top of cut. The desired urban design approach here is to utilise large stone blocks won from site to provide a consistent sandstone facing to the exposed stone face.

As a building material sandstone provides, strength, durability and presents a quality urban finish.

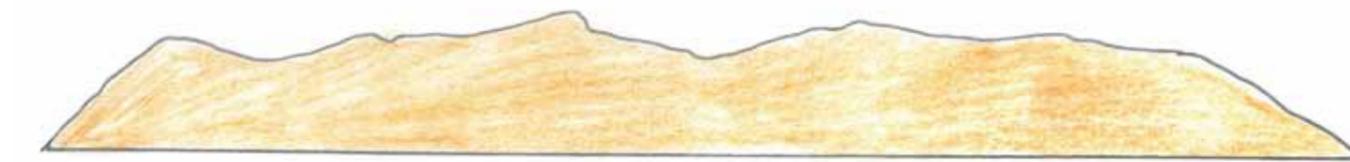
#### Simple Continuous Lines to the Top of the Cut Batter

From the perspective viewed along the roadway, this will foreshorten and exaggerate any unevenness in the top of the cut face. The experience of driving along at 80Km/h can make this even more noticeable. See example below and diagrams to the right.

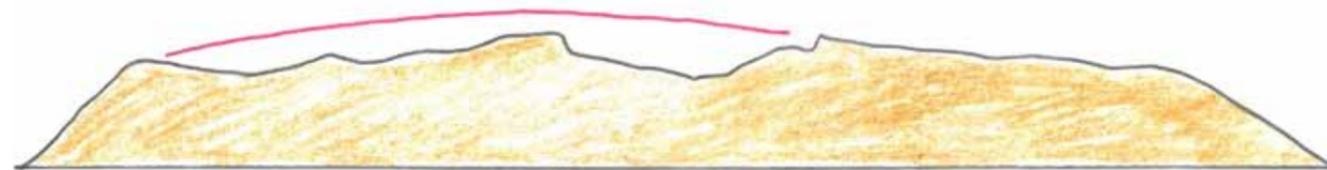


Example of uneven top to sandstone cut face. Great Western Highway - Blue Mountains.

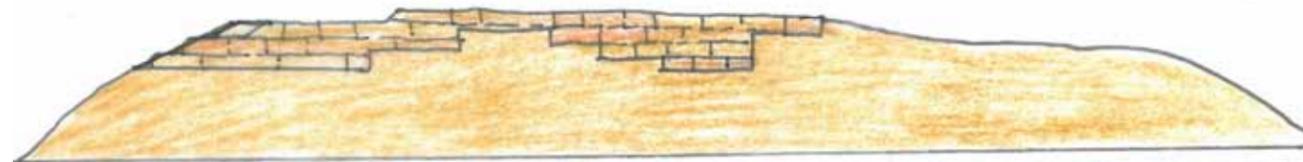
The intention with the top of the cut batter is to even out these natural imperfections so that the top has a more gently curving, smooth flowing form. The preference is to cut level benches to allow large site won sandstone blocks to be placed in these gaps. A recent example of this exists at Kariong on the Central Coast illustrated in the adjacent column.



CUT FACE ELEVATION AFTER REMOVAL OF LOOSE STONE AT TOP.



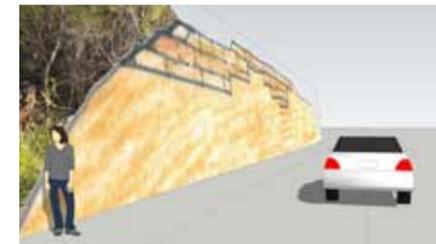
SIMPLIFIED LINE FOR TOP.



IRREGULARITIES BENCHED OUT AND FILLED WITH SANDSTONE BLOCK.



Foreshortened view creates a very busy top line



Foreshortened view with stone block infill simplifies the top cut line.



Cut stone block infills utilised at Kariong - Central Coast



Large rough cut sandstone - Gosford Quarries stacking block

## DESIGN ELEMENTS AND MATERIALS AND FINISHES

### Clay lenses in sandstone cut faces

Where there are clay lenses, it is preferred that they are clad with rough split smaller stone won from site. The stone should be laid on its natural bed (horizontally).



Example stone cladding for areas of clay lenses.

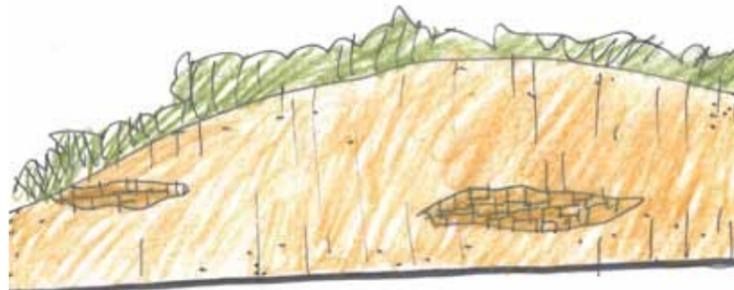


Possible Gabion basket facings to clay lenses.

In smaller areas it may also be feasible to use gabion baskets packed with crushed sandstone. While this will have a similar colouring, it does not have the same monolithic colour as the cut stone face.

If required, shotcrete can be used to stabilise the materials, but should be completely hidden from view by use of the sandstone cladding. No shotcrete, should be used as a visible final face.

Where the cut faces are completely unsuitable, then for consistency, the cut faces should ideally be clad in stone.



Example stone pitching on clay lens

### DOWNHILL SIDE

From a motorist's perspective, the downhill fill batters/ walls will be far less visible. While the distances are quite large, they will however be visible from adjacent areas and existing and by future landowners, particularly on the northern side of the ridge.

#### Fill batters.

For short fill batters, the desired outcome will be to restore sandstone woodland planting with indigenous provenance material, so that eventually the batters provide a seamless integration with the existing bush. Where possible fill batters should be limited, and may benefit from the use of locally won sandstone blocks in providing a terraced landscape that can reduce the overall footprint of the batter. The intention here would be to use as large a block as possible (nom 3x1x1m). Where cut easily stackable blocks are not available, rip rap would be acceptable.

#### Retaining Walls Patterning and Form.

Given the steeply sloping land and a preference to minimise disturbance, retaining walls will be necessary for a large extent of the road corridor. Except for one large curved section in Option 2, the lower retaining wall faces will not be readily visible by motorists. Given also that the nearest neighbours will be some distance away and separated by bush, the walls don't have the same visual significance as the uphill cut batters. In this respect, the material could be concrete with the walls having a relatively simple patterning. Where insitu concrete walls are used, simple vertical patterning which will minimise long acute angles against the capping would be appropriate. Where precast walls or cladding are used, it could be again a simple rebated pattern (such as sand blast), or vertical pattern. The final finish should facilitate the removal of graffiti.

Where possible a slight inward taper on the walls would be preferable to vertical.

#### Construction Methodology

Walls should be constructed in a manner that minimises construction impact and large vehicle access in the retained bushland areas. Where possible, works should be constructed in a manner that uses the carriageway as the construction access. If precast wall panels are placed over shotcreted faces, then they should be lowered down from the top. Reinforced earth walling also provides an opportunity to work within the road corridor.

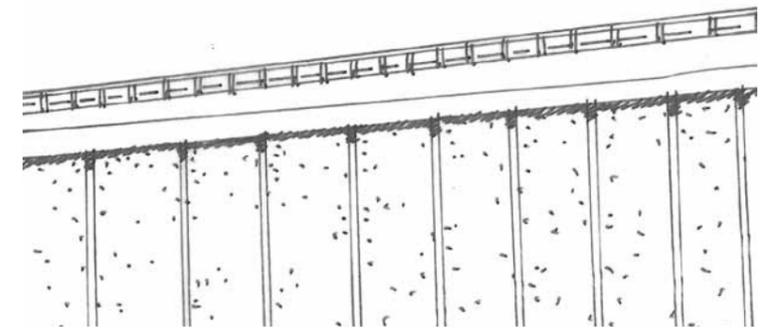
Should reinforced earth walls be used, the pattern should reflect that on other sections of wall that are not reinforced earth. Good examples of reinforced earth walls occur on the Princes Highway south of South Kiama Drive. A simple robust continuous capping should provide a shadow line overhang that creates a neat edge to the top of walling. The top coping should be continuous across all retaining wall options and be smooth continuous curves rather than faceted or kinked.



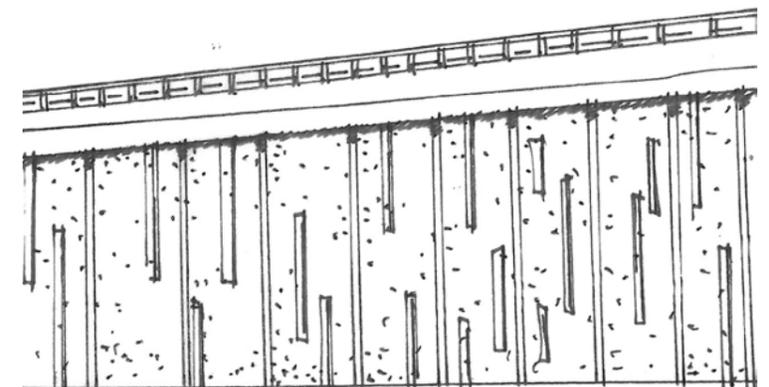
Simple vertical rebate with an inward taper.



Simple stylised tree pattern.



Down hill side retaining wall - simple vertical panels, solid continuous cope on top.



Down hill side retaining wall - simple vertical panels with additional texture

## DESIGN ELEMENTS AND MATERIALS AND FINISHES

### URBAN INFRASTRUCTURE

#### Road Barriers

Barriers on the downhill side of the road, could preferably utilise a metal railing on top to improve visibility out from the road corridor to the associated bushland.

The central median kerb should be as small as practical, and a simple vertical shape, like type VCB over the traditional Type F barrier. Consideration could also be given to utilising a metal crash barrier in the central median to provide a more open appearance, such as on the Great Western Highway, through the Blue Mountains.

Metal crash railing should be carefully integrated into concrete ends and abutments, by neatly tapering and considering junctions.



#### Lighting

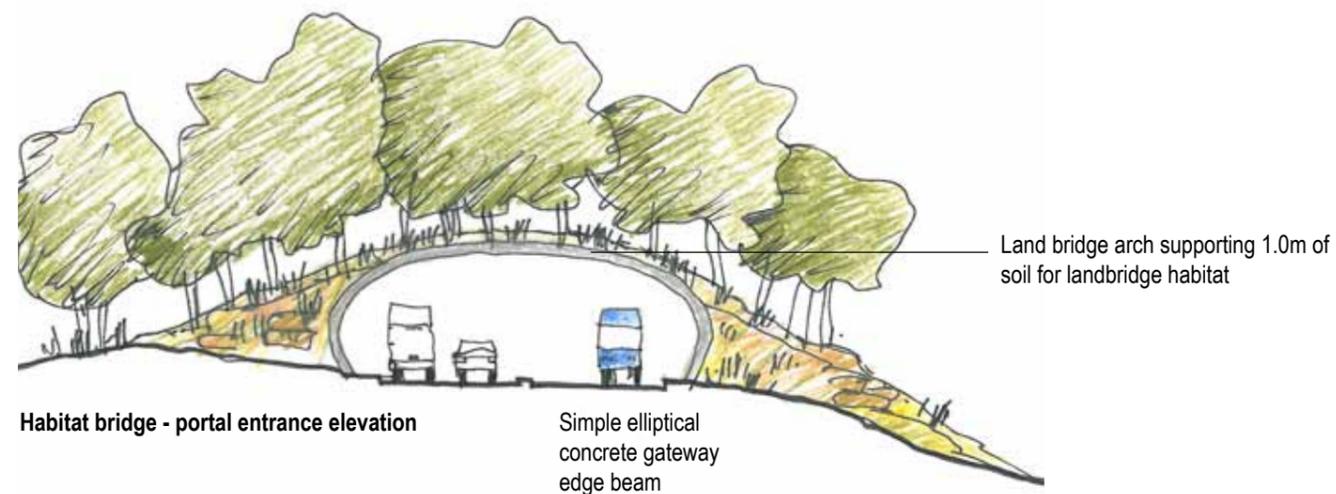
Where lighting occurs at intersections and along the multi use path, it should be placed so that the infrastructure appears as uncluttered as possible, whilst also fitting with the bushland character.

#### Habitat Connection and Land Bridges

This section of Mona Vale Road divides two very large National Park habitat areas. The Environmental Report identified this as an issue and there is the potential to provide an overhead land bridge linkage between these two habitat areas. A geographically suitable location for such a bridge occurs east of the Kimbriki tip entrance.

The location and design of the crossing structure will be refined during the concept and detailed design stage. Any land bridge would be a substantial design intervention in the landscape and would need to be carefully considered. It should be as simple and elegant as possible. (See attached sketches). The portal entrances could be designed such that the gateway edge also forms the fence, to avoid the addition and visual impact of a fence on top.

Underpasses should be sufficient in height for small mammals and have light shafts to illuminate the centre section. Should the habitat links also be drainage lines then they should be designed to have always dry sections through them. The entrances should provide sufficient habitat cover and rocks for reptiles and small animals.



## DESIGN ELEMENTS AND GUIDELINES

### MULTI USE PATH AND PEDESTRIAN AND REHABILITATION OF CONSTRUCTION AREAS.

The location of the multi use pathway on the north side of the road through bushland linking down to Wirreanda Road presents a design challenge for its successful integration into the landscape. At present the multi use pathway has been graded at 16% (approximately 1:6) which is too steep to meet the technical requirements of a Shared User Pathway. The present design is similar to the existing section between Addison Road and the Bahai Temple.

#### Reduction in gradients for the multi user path

Future design stages should investigate options to ease out the gradient of the pathways. Consideration may need to be given to switch backs or extending the path further along the contours and deviating away from the services alignment, which may bend to shortcut down to Wirreanda Road. Considerations would include angling the path in at least one point to avoid a "gun barrel" visual cut through the bush. Consider boring for services where feasible to reduce vegetation impact.

#### Integration of the Services easement and multi user pathway into the Bushland

The bushland below the road is comprised of a series of sandstone rock shelves that could potentially be heavily damaged in the installation of underground services and construction access for the road retaining wall. This could impact upon the value and aesthetic appearance the future multi use pathway, and possible bridal trails.

Investigate ways the multi user path can be better integrated into the into the steeply sloping bushland and rock shelf terrain through careful detailing and construction methods. The design of low scale walling and other solutions such as elevated boardwalks will need to be carefully reviewed. Options might include hand screwed footings rather than concrete and on site incremental fabrication using the boardwalk for construction access. This could be further considered by on site pegging in the next stages of design.



#### Proximity to the Large Rock Outcrop

The preferred option has the road within meters of the large rock outcrop. At present there is little room for error for movement of machinery, or should difficult geotechnical conditions arise. It is recommended that the buffer be extended as much as possible as illustrated on the following page.

#### Maintenance Access to Retaining Wall

It has been suggested that a maintenance access pathway may be required at the base of the retaining walls. This will limit the ability to plant close to the walls and will also facilitate easy vandal access. It is recommended that any access that is required for the retaining wall be via the multi use pathway.

#### Crime Prevention Through Environmental Design (CPTED) Considerations

There will be a small section where the multi use pathway departs from the road corridor and connects to Wirreanda Road. This will be an area of low casual surveillance. Good lighting will be essential along this section at night.

Refer to the 'Multi Use Path and Rehabilitation of Construction Areas' diagram opposite.

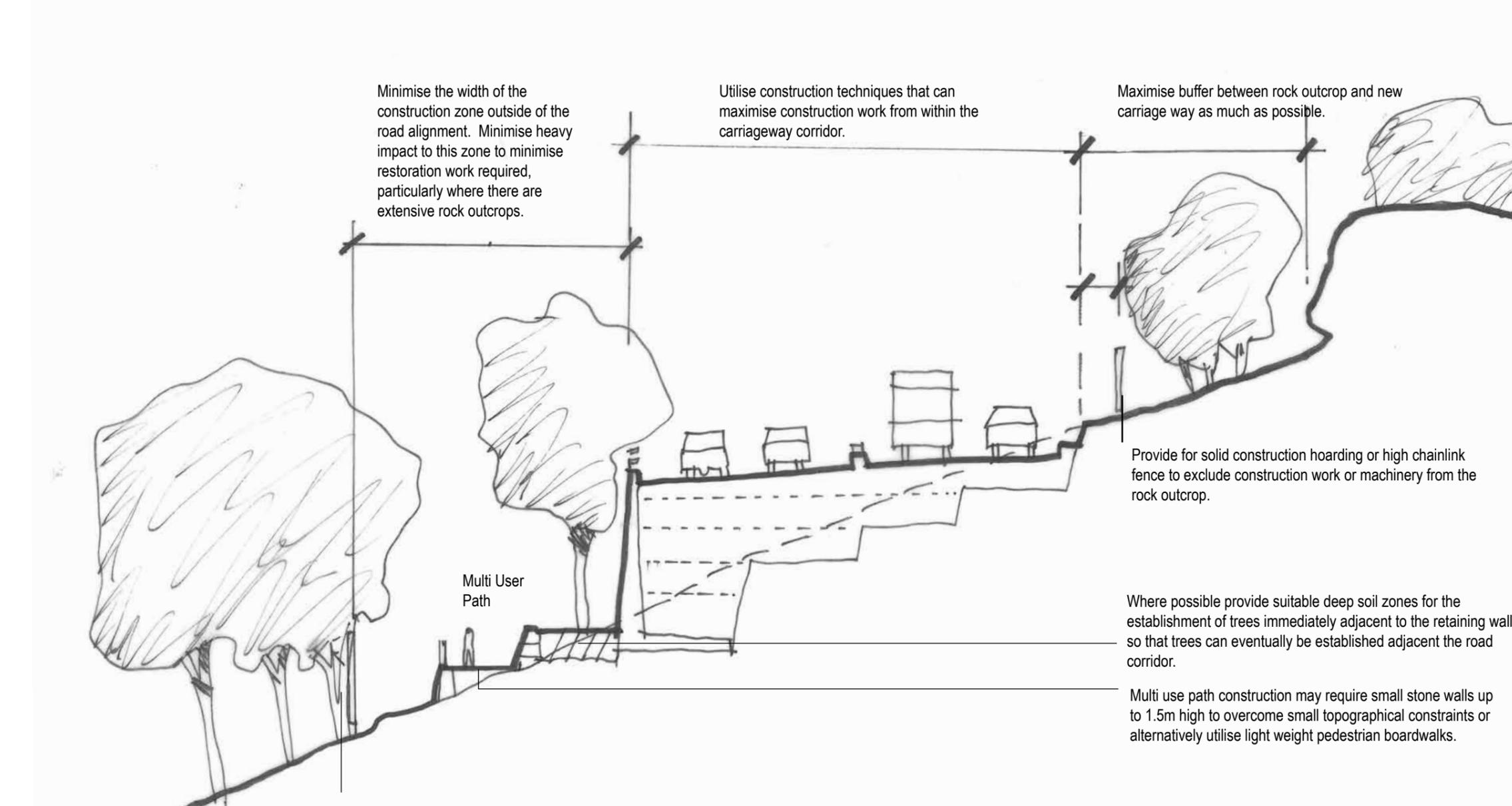


Example of bushland terrain in proposed multi use path location.



## DESIGN ELEMENTS AND GUIDELINES

### MULTI USE PATH AND REHABILITATION OF CONSTRUCTION AREAS.



Provide Construction hoarding the bushland below provide maximum retention of adjacent woodland.

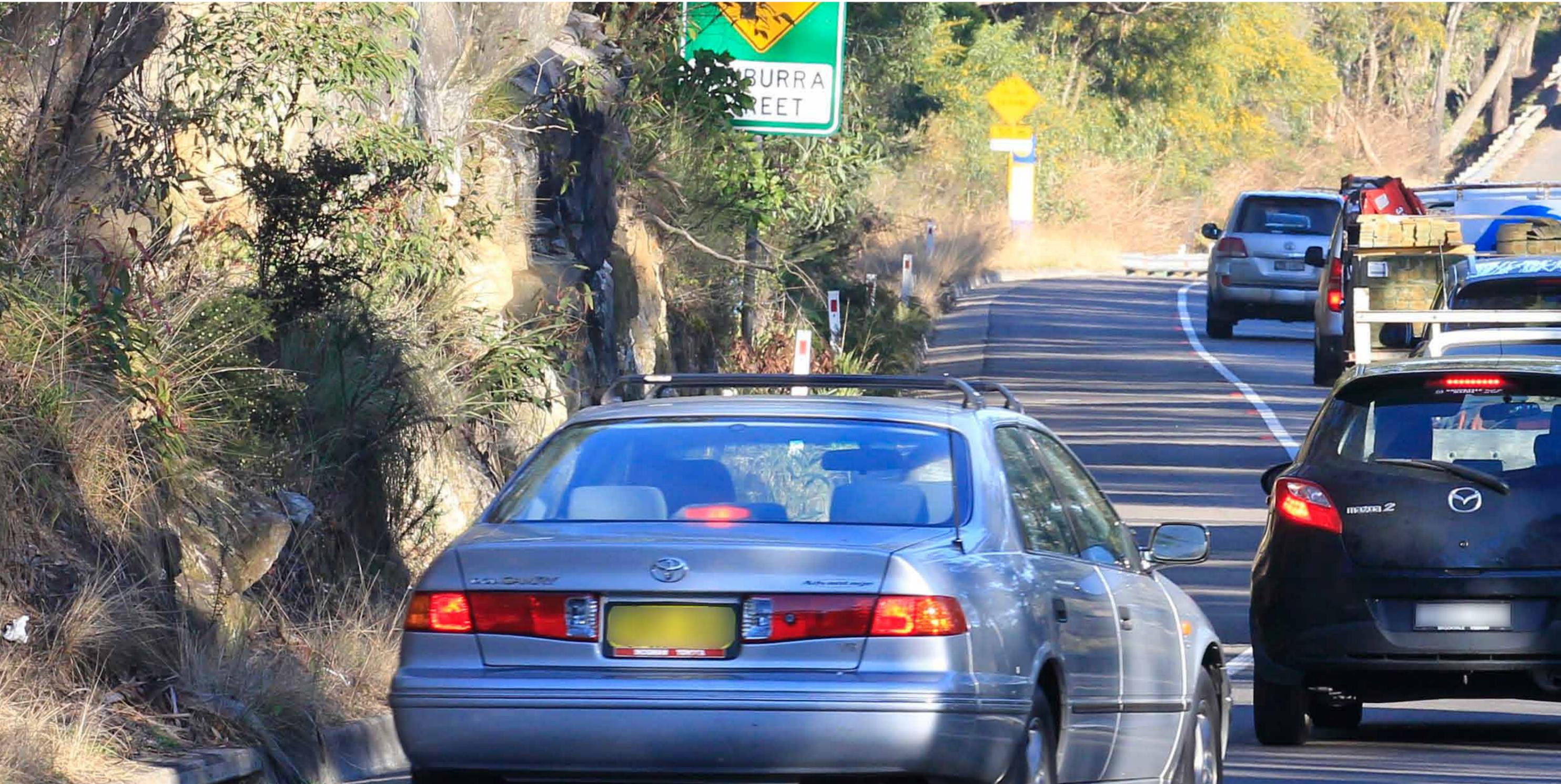


Image source RMS

# Conclusions and Recommendations



## CHAPTER 5 - CONCLUSIONS AND RECOMMENDATIONS

### CONCLUSION

The intention of this Preliminary Urban Design Strategy is to provide guidance that will help direct future design development of the road corridor.

Mona Vale Road forms a strategic link between the population centres of the Northern Beaches with the employment and education precincts of Macquarie Park. Situated on a steep sided ridge top surrounded largely by National Parks and bushland, it is highly constrained by complex and difficult terrain, important cultural assets, threatened plant communities and endangered species.

In developing the road from the Strategic Urban Design report, three road options were investigated. This was an iterative process and as a result of community consultation, constructability and risk management reviews, the northern alignment was selected as the preferred option. This option relocates the central section of the road corridor to the north of a large rock outcrop and ridge. There are a number of benefits in this option as outlined below.

- The disparate collection of services that currently crisscross the road, will be relocated into a single consolidated alignment.
- The relocation of the road to the north connects a large previously fragmented section of bushland in State ownership to Garrigal National Park.
- There is an opportunity with gradients here that would allow for the provision of a fauna overpass connecting the two very large contiguous areas of National Park either side of the road.
- The preferred option provides for future expansion within the carriageway through the option of either hard shoulder running or implementation of tidal flow measures.

### DESIGN LANGUAGE

A key outcome of this urban design report has been to integrate the new road into its bushland environment. Key design language items responding to this include:

- Utilising natural sandstone in cut embankments or facing of unsuitable sections with sandstone.
- Ensuring that the top line of these cut embankments have simple geometries, by filling sections with loose or poor material with large sandstone blocks recovered from site excavation.
- No visible shotcrete.
- The use of concrete retaining walls with simple panelling for down hill sides that utilize simple panelling and continuous parapets to provide shadow lines.
- The use of a consistent concrete cope on the top of downhill retaining walls integrated into the crash barrier.
- Utilising open metal railings as part of crash barriers to allow views to bushland and visually open up the road corridor.

### RECOMMENDATIONS AND NEXT STEPS

The key recommendations arising from this report are as follows:

- Investigate road alignment refinements to provide a more substantial buffer to the large rock outcrop as illustrated on page 47.
- Review road construction and staging options to maximize bushland retention by minimizing the size of temporary construction access required for the construction of downhill retaining walls.
- Undertake further detailed design on the alignment and construction methodology of the services easement. The intention should be to minimise impacts to bushland and rock outcrops.
- Investigate ways the multi user path can be better integrated into the steeply sloping bushland and rock shelf terrain carefully detailing construction methods. We recommend that in the next stages the alignment of the multi user path should be pegged on site and surveyed to assist in the design decisions.
- Investigate ways of improving the grade of the multi user path wherever possible.
- The preferred option provides an opportunity for a fauna overpass. Design and detailing of this should be simple and elegant.
- While expense may be a limitation there are benefits in the viaduct option for the Tumburra Street Intersection that should be considered with further review.
- Continue to consider long terms options that will facilitate modal shift in the region by providing for efficient and well serviced public transportation. After this expansion there is no more room to widen the road. Therefore means of better utilising the carriageway should be considered in any planning including both tidal flow and hard shoulder running.
- At a strategic level it will be important to continue to liaise with Urban Growth NSW and Pittwater Council regarding the future urban expansion of the Ingleside / Warriewood Urban Release area to ensure Mona Vale Road is not a barrier to pedestrian connectivity and to maximise pedestrian walkability and cycling connectivity through the development and to key destinations such as town centres, schools and bus stops.
- Work with Transport for NSW to co-ordinate public transport with the road and the new release area.





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