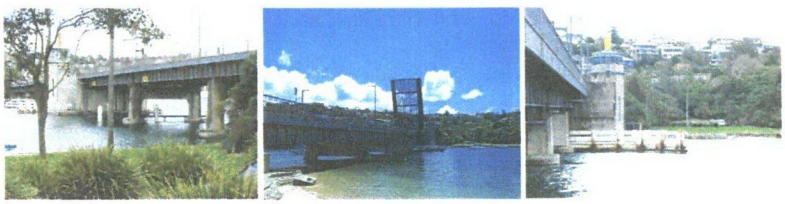
NSW Roads and Traffic Authority

Proposed widening of the Spit Bridge over Middle Harbour



Statement of Environmental Effects/ Review of Environmental Factors

Volume 1 – Main report

March 2003

Contents

Appendices

Appendices D-J are contained in Volume 2.

Table Index

Figure Index

Glossary

Abutment	The end support of a bridge, built on the bank.
Approach	The section of road leading to the bridge deck.
Bascule bridge	Opening bridge.
Beam	A narrow and deep, or shallow and wide, rectangular member or an I-section or T-section structural element (also round section for timber), spanning between pier supports. A bridge is often made up of number of these beams. Also known as girders when they are deep.
Bedrock	The solid rock layer beneath the silt and sand of a river bed or estuary.
Benthic	Also described as 'bottom dwelling' - referring to organisms living in or on the sediments of aquatic habitats.
Benthos	The sum total of organisms living in, or on, the sediments of aquatic habitats.
Coffer dam	A structure for keeping out water to allow excavations and building of foundations in ground below water level. It differs from a caisson because it is open to the air.
Contra peak	Traffic flowing in the opposite direction to peak hour traffic.
dB(A)	A unit of sound measurement that has its frequency characteristics modified by a filter (A-weighted) so that it more closely approximates the frequency response of the human ear.
Deck	Generally the top part of a bridge superstructure which forms the running surface for vehicles or pedestrians.
Ecosystem	A community (living components) and all the physical and biological non-living components of the environment.
Formwork	Temporary timber or metal shuttering to contain and support concrete while it hardens.
Geo-textile	Human-made textiles used to help stablise soil/sand and prevent erosion.
Girder	A large or deep beam.
Headstock	A horizontal beam at the top of a pier that supports the deck.
Intertidal	The area between the highest and lowest tide.
Invertebrate	An animal without a vertebral column or backbone.
L_{A1}	The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.
L_{A10}	The L_{A10} level is the noise level which is exceeded for 10% of the sample period. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise. It is normally used to characterise typical *maximum noise levels*.

L_{A90}	The L_{A90} level is the noise level which is exceeded for 90% of the sample period. This measure is commonly referred to as the *background noise level*.
L_{Aeq}	The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise and is also referred to as the *average noise level*.
$L_{Aeq\ (15hr)}$	Relates to an equivalent continuous 'day-time' noise level between 7.00am and 10.00pm
$L_{Aeq\ (1hr)}$	Is the highest tenth percentile hourly L_{Aeq} noise level between 7.00am and 10.00pm or between 10.00pm and 7.00am, whichever is relevant to the particular criterion in question.
$L_{Aeq\ (9hr)}$	Relates to an equivalent continuous 'night-time' noise level between 10.00pm and 7.00am.
Macroalgae	Algae which can be seen easily, without using a microscope.
Macroinvertebrate	Invertebrate organisms which can be seen without a microscope.
Perennial	Plants with a life span of more than two years/seasons.
Pier	The support of a bridge deck span, that is not on the bank. It is also a general term used for the base or foundation of a bridge.
Pile	A structural member driven or cast into the ground to support the piers and abutments.
Reinforced concrete	Concrete that is strengthened with high-tensile steel bars or rods to give the concrete tensile strength and ductility.
Rhizome	Horizontal underground stems that roots and plant shoots can develop from.
Seagrass	An angiosperm (flowering plant) that grows within the marine environment, usually on a muddy or sandy substrate (bottom). It attaches to the substrate on which is grows by means of a rhizome.
Stanchions	An upright bar, post or support.
Substructure	A general term for the collective of piers and abutments.
Superstructure	The part of the bridge above the substructure.

List of abbreviations

AHIMS	Aboriginal heritage information management system
ANZECC	Australian and New Zealand Environment and Conservation Council
ASS	Acid sulfate soils
BCR	Benefit cost ratio
CBD	Central business district
DA	Development application
DGAC	Dense grade asphaltic concrete
ECRTN	Environmental Criteria for Road Traffic Noise
EIS	Environmental impact statement
EMP	Environmental management plan
ENMM	Environmental Noise Management Manual (RTA)
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPA	Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESD	Ecologically sustainable development
LALC	Local Aboriginal Lands Council
LEP	Local environmental plan
LGA	Local government area
m	Metre
mm	Millimetre
NES	National environmental significance
NPWS	National Parks and Wildlife Service
OGAC	Open grade asphaltic concrete
PAD	Potential archaeological deposit
RBL	Rating background level
REF	Review of environmental factors
ROTAPS	Rare or threatened Australian plant species
RTA	Roads and Traffic Authority
SEE	Statement of environmental effects
SEPP	State environmental planning policy
SHOROC	Regional organisation of Councils incorporating Manly, Mosman, Pittwater and Warringah Councils
STA	State Transit Authority
TSC Act	*Threatened Species Conservation Act 1995*

Part A Preliminaries

Part A Preliminaries

1. Introduction

1.1 Overview

The NSW Roads and Traffic Authority (RTA) proposes to widen the Spit Bridge by providing an additional two lanes for the movement of traffic (the proposal). This would involve constructing a new two-lane bridge directly abutting the existing bridge to the west, and reconfiguring the lanes on the existing bridge. The proposal also involves widening the existing approaches to the west, at the northern and southern banks, to tie in the new section of bridge with Manly Road to the north and Spit Road to the south.

GHD was commissioned to undertake an assessment of the potential environmental impacts of the proposal, and prepare a statement of environmental effects (SEE)/review of environmental factors (REF) to summarise the results of this assessment in accordance with the requirements of the *Environmental Planning and Assessment Act 1979* (the EP&A Act).

1.2 Background to the proposal

The proposal is focussed on facilitating public transport (bus access) over Middle Harbour, between the northern beaches, Warringah Peninsula and the city/lower north shore.

Significant traffic flow issues and delays are currently experienced, mainly for southbound traffic during the morning peak in the vicinity of the Spit Bridge, and the intersections between Sydney Road and the Burnt Bridge Creek Deviation/Manly Road (on the northern side) and Mosman Junction and Ourimbah Road (on the southern side).

The proposal would involve conversion of the bridge crossing to six lanes, consistent with its approach roads. The existing bridge provides four lanes of traffic, while the approach roads (Manly and Spit Roads) both provide six lanes. The bridge and approach roads currently operate on a tidal flow arrangement, to make the most of the available lanes. This reduces access across the bridge to a single lane northbound during the morning peak, and a single lane southbound during the afternoon/evening peak, impacting on the reliability of buses travelling in these directions.

The facilitation of bus access is consistent with the Government's commitment to improving access for public transport. Current Government policy includes expansion of the system of red painted bus lanes on key arterial roads throughout Sydney. The Spit Bridge provides the main link for State Transit Authority (STA) buses, between the northern beaches, Warringah Peninsula and the city and lower north shore. Presently, buses travel along a transit lane. The south bound transit lane has recently been painted red between the Sydney Road/Burnt Bridge Creek Deviation intersection and the Spit Bridge.

The proposal would enable the extension of this bus lane over the bridge. It is noted that the proposal would not preclude or replace future investigations into additional traffic management works between the northern suburbs and other areas of Sydney.

The proposal would facilitate bus flows in the opposite ('contra') direction to peak hour flows, that is, northbound bus transport in the morning peak, and southbound access in the

evening peak, by increasing the number of lanes (from the current single lane) available for traffic flow at these times. Almost 50 % of peak flow bus services operate back 'in service' over the Spit Bridge. With one contra flow lane operating at this time, it is a key 'choke point' for these services.

1.3 Location and study area

The Spit Bridge is located across Middle Harbour, linking the suburb of Mosman (to the south) with Seaforth (to the north). The northern and southern banks of the harbour in this area are separated by approximately 200 m of water.

Figure 1.1 shows the location of the bridge.

The southern approach to the bridge (Spit Road) is located on The Spit peninsula, in the northern area of Mosman, within the Mosman Local Government Area (LGA). The southern approach is surrounded by an area of land at the northern end of The Spit peninsula, roughly bounded to the north, east and west by Middle Harbour and to the south by the intersection with Parriwi Road.

The northern approach (Manly Road) is located in the suburb of Seaforth, within the Manly LGA. It is surrounded by an area of land roughly bounded by Middle Harbour to the south, Battle Boulevard to the north and west, and Avona Crescent to the east.

The land uses in the area include:

- Residential to the northwest;
- A reserve to the northeast (below Avona Crescent); and
- A reserve, carparking area and a number of marine based businesses, clubs and restaurants to the south.

These areas form the main study area and the focus of investigations for the SEE/REF. The majority of detailed investigations undertaken as part of the SEE/REF are concentrated on this area and the immediate surroundings. The SEE/REF does however consider the implications of the proposal on the wider surrounding environment. The 'study area' considered for the purposes of detailed investigations may vary in extent, depending on the environmental issue considered, and the nature of potential impacts.

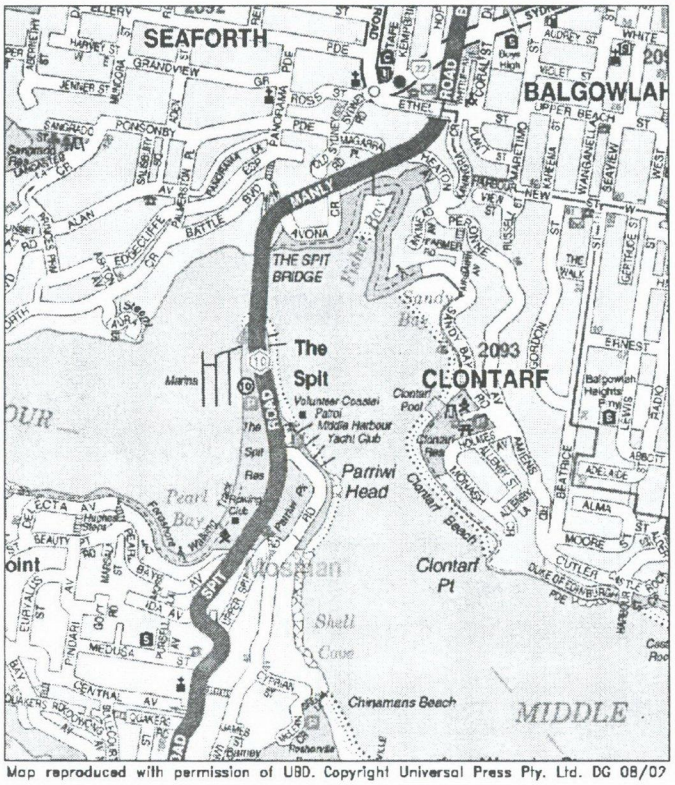


Figure 1.1 Bridge location

1.4 Summary of statutory position

The proposal is to be assessed under both Part 4 and Part 5 of the EP&A Act 1979.

Development consent under Part 4 of the Act is required for:

- That part of the proposal located within the Manly LGA (broadly involving widening of the approach road);
- Works within the waterway (construction of the new two lane bridge); and
- Works outside the existing road reserve within the Mosman LGA (part of the approach widening works).

Other than for works requiring consent under clause 31A of the Mosman LEP (acid sulphate soil provisions), development consent is not required for works within the existing road reserve in Mosman. Where development consent is not required, the proposal would be assessed in accordance with Part 5 of the EP&A Act.

The RTA is the proponent for the proposal, and the determining authority for that part of the proposal assessed under Part 5 of the Act. The consent authorities are as follows:

- Manly Council for works within the Manly LGA; and

- The Minister for Transport for works below high water mark; and
- Mosman Council for those works within the Mosman LGA that require development consent.

Further information on the statutory position is provided in Section 4.

This report has a dual role. It is a SEE supporting the RTA's applications for development consent under Part 4 of the EP&A Act, and an REF enabling internal consideration by the RTA of environmental impacts under Part 5 of the EP&A Act.

1.5 Key issues

Potential environmental impacts associated with the proposal include:

- Property and access related impacts, including the need to continue to maintain access to all properties and activities in the vicinity of the bridge, including the D'Albora Marina and residential dwellings in the vicinity of the northern approach;
- Impacts on water quality and aquatic ecology, particularly as a result of construction activities and the potential for generation of sediment, if adequate mitigation measures are not put in place;
- Construction noise impacts as a result of the topography of the local area;
- Impacts of the geotechnical environment on the bridge design and the potential for environmental impacts such as the generation of sediment during construction;
- Impacts on traffic flow, bridge opening and public transport, including the movement of buses and potential for disruptions during construction; and
- Impacts on heritage and archaeology (both non-Aboriginal and Aboriginal) – it is noted that the bridge is heritage listed.

These issues, together with other potential environmental impacts, are considered within this SEE/REF.

1.6 Purpose of the SEE/REF

The SEE/REF has been prepared in accordance with the RTA's Environmental Impact Assessment Guidelines (2001), as well as the requirements of the EP&A Act and the *Environmental Planning and Assessment Regulation 2000* (the Regulation).

It has been prepared to:

- Describe the proposal;
- Provide information on the need for, and justification of, the proposal;
- Identify and assess the significance of all potential environmental impacts;
- Describe the practices which would be undertaken to manage and where possible minimise any adverse environmental impacts;
- Accompany the RTA's applications for development consent under Part 4 of the EP&A Act, and enable assessment of the proposal by the RTA under Part 5 of the EP&A Act; and

- Assist the RTA in determining whether or not the proposal would have a significant impact to the environment, pursuant to section 111 of the *Environmental Planning and Assessment Act* (EP&A Act) 1979 (if significant impacts are likely, an EIS is required).

1.7 Structure of the SEE/REF

The SEE/REF is divided into six parts:

Part A – Preliminaries - provides an introduction to the proposal and the environmental impact assessment process.

Part B – Information on the proposal – provides information on the need for the proposal, and a description of what the RTA proposes, including information on the concept design and construction program.

Part C – Planning and legislative context - provides information on the factors that provide the framework and background for the SEE/REF, including the statutory framework, outline of the decision making and approval process, and the results of initial statutory agency consultation.

Part D – Environmental impact assessment - provides an assessment of the potential environmental impacts of the proposal. It includes a description of the existing environment of the study area, which forms the baseline against which potential environmental impacts are considered and assessed. Measures to mitigate potential impacts are recommended.

Part E – Environmental management - provides information on the recommended environmental management and monitoring requirements for the proposal and a summary of the mitigation measures and approvals required; and

Part F – Conclusion - provides a summary of the findings of the SEE/REF, outlining the justification for the proposal, and provides the conclusion.

1.8 Specialist studies

The following specialist studies provided input to the SEE/REF:

- Statement of Heritage Impact: The Spit Bridge over Middle Harbour, NSW (Austral Archaeology Pty Ltd, 2003);
- Aboriginal heritage assessment (Australian Museum Business Services Pty Ltd, 2003);
- Noise Assessment (Wilkinson Murray Pty Ltd, 2003);
- Aquatic Ecology Impact Assessment (Australian Museum Business Services, 2003);
- Terrestrial Flora and Fauna Assessment (Australian Museum Business Services, 2003); and
- Landscape, urban design and visual quality assessment (Bryant Associates, 2002).

The results of these assessments are summarised in Part D. Full reports are included in Appendices D-J (within volume 2).

Part B Information on the proposal

2. Need for the proposal

2.1 Strategic overview

The northern beaches/Warringah Peninsula area includes those suburbs within the Manly, Warringah and Pittwater LGAs. The area has a total resident population (according to 2001 ABS Census figures) of 232,694 people.

At present there are four means of access to the northern beaches/Warringah Peninsula area:

- Mona Vale Road;
- Roseville Bridge;
- The Spit Bridge; and
- The ferry from Circular Quay.

There have been no major improvements or additions to the road access to the peninsula since the reconstruction of the Roseville Bridge in 1966 and the construction of the Burnt Bridge Creek deviation in 1985.

Over the years there have been numerous studies into the accessibility of this area, as well as studies examining congestion on the Military Road route (including the adjacent Ourimbah Road - Ernest Street route) and its feeders. These studies have generally acknowledged the desire to balance improving vehicular access against sustaining a high level of self-containment within the peninsula.

The NSW strategic transport plan as outlined in *Action For Transport 2010* does not include any specific new infrastructure to service the area, other than referring to a Chatswood to Dee Why rail link that may occur beyond the 2010 time horizon. *Action For Transport 2010* also refers to encouraging multi occupancy vehicles by generally improving city bound transit lanes and by creating a transit lane along Military Road from the Warringah Freeway to the Spit. This would be achieved partly by providing major intersection improvements.

The SHOROC (regional organisation of Councils incorporating Manly, Mosman, Pittwater and Warringah Councils) vision statement calls for a high standard convenient public transport system in conjunction with a well connected road network incorporating an additional crossing of Middle Harbour and alternative routes for freight.

The northern beaches/peninsula area has developed a considerable amount of local employment opportunity and is well above Sydney's average for providing local employment and other consumer functions. This could be attributable in part to the constraints on the road access system. However, North Sydney and the Sydney CBD continue to be major destinations and origins for weekday commuters to and from the area.

During commuting hours public transport patronage from this area is lower than the Sydney wide average, possibly as a result of a perception of poor service as well as generally lower residential densities. As well as low densities the region also has a lower than average growth rate at 0.8% pa compared with Sydney's overall average of 1.4%.

The area contains a significant proportion of Sydney's beaches and waterways as well as areas of scenic merit. It is a popular destination attracting considerable tourist and recreational traffic, particularly on weekends.

The existing road corridors are now severely congested during both commuter peaks and the weekend leisure hours, particulary the Spit/Military Road corridor.

2.2 Need for the proposal

The proposal is focussed on facilitating public transport (bus access) over Middle Harbour, between the northern beaches, Warringah Peninsula and the city/lower north shore.

As noted in Section 1, significant traffic flow issues and delays are currently experienced, mainly for southbound traffic during the morning peak in the vicinity of the Spit Bridge, and the intersections between Sydney Road and the Burnt Bridge Creek Deviation/Manly Road (on the northern side) and Mosman Junction and Ourimbah Road (on the southern side).

2.2.1 Public transport issues

Bus operations and travel times

The Spit Bridge provides the main link for bus access to the northern beaches/peninsula area.

Public transport along the corridor is primarily provided by the State Transit Authority (STA). All STA buses to and from the area travel via the Spit Bridge with the exception of a service to Chatswood. Destinations serviced by these buses include North Sydney, Milsons Point, Chatswood and Epping as well as the Sydney CBD.

The proposal to widen the bridge would provide a significant opportunity for public transport. The proposal would improve timetable reliability as well as provide some savings in travel times. These are fundamental issues with respect to enhancing the attractiveness of public transport as an alternative to the private motor vehicle.

There is a requirement for buses, originating from the northern beaches depots, to return north across the Spit Bridge in the morning peak and 'reposition' for a second trip – almost 50% of peak flow bus services operate back 'in service' over the Spit Bridge. This repositioning is currently compromised by the contra peak (that is, flowing in the opposite direction to peak hour traffic) congestion at the bridge.

According to the STA, the contra peak buses have experienced a 10 – 15% increase in travel times over the last two years between the city and Balgowlah. The proposal would arrest this increase in travel time.

The increase in lane capacity on the bridge (from four to six lanes) would clear the backup of buses after bridge openings considerably quicker, as there would be no need to merge.

Higher capacity 14.5m buses are not currently able to be used on the route, as the existing lane widths are too narrow to allow comfortable negotiation of the tight curves and merges at the bridge approaches. The proposed improvement to the lane widths and the alignments of the approaches and the removal of the constraints at the merge points could facilitate the use of these larger buses in the future.

Better Buses North

The STA has recently proposed changes to the route structure for its northern beaches bus services (the 'Better Buses North' proposal). The proposed changes are now being finalised following evaluation of the results of the community consultation process (submissions closed in November 2002). The aim is to improve bus services to the area to attract more people to public transport.

The proposed changes involve:

- Introduction of eight new direct city services;
- Increased frequencies on the main roads and to some suburbs;
- Improved links to the regional shopping and service centre at Warringah Mall and Dee Why; and
- Simplifying the stopping patterns for limited stop and peak hour express services.

As part of the proposed changes, there would be additional express type buses and off peak services operating via the Burnt Bridge Creek Deviation and over the Spit Bridge.

The proposal would play a role in facilitating the implementation of these changes.

2.2.2 Current traffic issues

The tidal flow arrangement results in extensive delays for traffic flowing against the peak direction. Travel time survey data reveals significant increases in the contra peak travel times for both directions over the last three years. Peak and business hour travel times have also been increasing steadily for the peak direction.

There are also extensive delays during the weekend when the tidal flow does not operate. At the weekends traffic from both directions merges from three to two lanes at the bridge approaches resulting in significant queuing at times and causing a major choke point at the bridge. It is suspected that there have been a number of unreported minor collisions at the merge points.

At present, the Spit Bridge itself is not the most significant choke point along the corridor for peak direction commuters. The volume of traffic flowing onto the bridge is regulated by the intersections at Seaforth and Spit Junction. However, the easing of the bottlenecks on either side of the bridge would result in the bridge itself becoming the major bottleneck.

Traffic across the bridge is further delayed when the bascule span is raised to allow the passage of tall vessels. Bridge openings to allow navigation traffic do not occur during the weekday commuter peaks. Bridge openings generally last for less than ten minutes but can cause long queues, especially at weekends. Dispersal of these queues is impeded by the traffic having to merge from three lanes to two. The provision of the additional lanes should significantly reduce the time to clear these queues.

Proposed traffic changes

The RTA is proposing to reduce the weekend openings of the Spit Bridge and to implement a 3pm to 7pm clearway on weekends and public holidays for southbound traffic along Spit

Road to Ourimbah Road. This proposal aims to reduce weekend traffic congestion along the Spit Road corridor. It involves:

- Reducing weekend and public holiday Spit Bridge openings from 11 per day to 8 per day; and
- Implementing a 3pm to 7pm clearway on weekends and public holidays for southbound traffic on Spit Road between the Spit Bridge and Ourimbah Road, Mosman. Buses and taxis would be allowed to pick up and set down passengers. There would be a loss of parking associated with this.

It is anticipated that this proposal would have the following benefits:

- Reduction in afternoon congestion on weekends and public holidays;
- Improvement in traffic flow along the Spit Road corridor; and
- Improvement in public transport operations.

Public comment on this proposal was recently sought, and the RTA has prepared an environmental impact assessment to consider the potential impacts.

2.3 Alternatives to the proposal

Several alternatives have been considered over the last few years. These include:

- A tunnel connecting the Burnt Bridge Creek Deviation to the Warringah Freeway;
- A tunnel from the northern abutment of the existing bridge to the Warringah Freeway;
- A high level bridge at the Spit; and
- A tunnel from the Manly area to Rose Bay.

A study recently undertaken by Maunsell into possible options for a tunnel between the Burnt Bridge Creek Deviation and the Warringah Freeway concluded that the cost could vary between $705 million and $1.1 billion.

Other key issues associated with the tunnel include:

- The potential for induced traffic as well as traffic diverting off Roseville Bridge and resultant impacts, including increased levels of traffic in the lower northern beaches suburbs;
- Community impacts, including local traffic impacts ('rat running') and issues associated with the need to locate ventilation stacks in the suburbs under which the tunnel passes;
- Environmental impacts would need to be considered in detail;
- Implications in terms of public transport and bus access;
- Broader road network impacts, including impacts on the Warringah Expressway, North Sydney and the Harbour Bridge; and
- Construction impacts - construction of the tunnel would be a major undertaking, with the potential for significant disruptions to traffic, given that the entrance portals are proposed to be located on arterial roads. Large construction work sites would also be required in the vicinity of the entrance portals.

A high level bridge would remove the need for an opening span. There are a number of issues associated with a high level bridge, including:

- The Spit is not the ideal location as a result of the topography;
- A high level bridge would be considerably more expensive than the current proposal;
- Potential significant disruption as part of the construction of abutments and approach roads, particularly on the Mosman side;
- Potential for significant visual impacts to the locality; and
- Potential to compromise the heritage significant of the existing structure.

These alternatives have been rejected by the RTA as being unaffordable at this stage, or not providing a good return on the investment of community resources.

3. Description of the proposal

3.1 Existing situation

The existing Spit Bridge was opened to traffic in 1958. It is a steel and concrete girder low-level opening bridge with a single leaf opening bascule span (that is, one end is hinged and rises to near vertical).

The bridge has the following features:

- Seven spans with a total length of 227.3 m;
- Four traffic lanes (approximately 3.4 m wide each) and a pedestrian walkway of 1.5m on either side;
- There are three spans at either end of the opening span. Each of the six fixed spans has four welded plate girders as the main members, with cross girders, but without stringers or horizontal bracing. The concrete deck is dowelled to the steelwork;
- The opening span has two main girders, with cross girders and stringers, covered by an open mesh steel deck which has a coating of bitumen;
- The two footways are of concrete on the fixed spans, and steel on the bascule span;
- The piers either side of the opening span are flanked by fenders, and when the bridge is in the open position a navigation channel of 24.4 m is created;
- At the Mosman end, the slab and two column piers rest on concrete piles driven into to the sands of the harbour bed, at a depth of between 12-15 m;
- At the Manly end, the harbour bottom slopes up steeply to outcropping rock on which the northern abutment sits. Piers between the abutment at the Manly end and the bascule lift span are double cylinder piers sitting on bedrock below the harbour bed;
- The main pier, which supports the bascule span, is Pier four. It rests on four cylinders taken down to sandstone bedrock at a depth of between 14-23 m, which is 23-32 m below mean sea level. The pier is box-like and supports all machinery for the operation of the bascule, including the operator's cabin;
- The approaches and abutments at each end are varied as a result of the topography. The southern abutment (Abutment A at the Mosman end) is built up from the sandy beach level and has a retaining wall faced with stone on either side. Abutment B (at the Manly end) rests directly on the rock on the western side, and is built up on the eastern side with a retaining wall;
- There is a grade of 2.68 % from south to north as a result of the variation in ground level on each shore; and
- Traffic across the bridge is regulated by traffic lights at either end of the lift span (located at the end of Spans two and six) and by roadway gates that operate as the bridge is about to open.

During weekdays, the bridge opens seven times in the winter months and eight times in the summer (daylight savings) months. The first opening time is 10.15am, with no openings between 2.45 and 7.30pm.

During the weekends, the bridge currently opens 11 times, approximately hourly between 8.30am and 9.30pm.

3.2 Description of the proposal

The proposal involves the widening of the Spit Bridge and approaches to six lanes by addition of two lanes on the western side. The widening incorporates the provision of 3m wide shared pedestrian cycleway on the western side of the bridge, and on the southern approach to the bridge. The bridge design would replicate design features of the existing bridge to minimise the visual impact and impacts to its heritage significance.

The proposal would maintain the functionality of the existing lift span for the purpose of maintaining boat access to Middle Harbour.

3.3 Objectives of the proposal

The objective of the proposal is to provide six traffic lanes on the Spit Bridge and on approaches to match with the existing six traffic lanes available on adjoining road sections on Manly and Spit Roads. This widening may allow further development of tidal flow arrangements, including bus and transit lanes that could further improve public transport access to the northern beaches/peninsula area. Stated objectives are as follows:

- Provide an additional two lanes on the Spit Bridge.
- Widen the pedestrian / cycleway to 3.0m.
- Maintain vehicle access to No 1-3 Manly Road , Seaforth
- Maintain vehicle access to d'Albora Marina
- Improve vehicle turning safety from marina parking area.
- Minimise impact on marina

3.4 Design considerations

Horizontal alignment

The horizontal alignment of the bridge approaches is determined by the transition from existing lane widths to the proposed bridge lane widths. The entire bridge structure is on one single straight.

Vertical alignment

The vertical alignment follows the existing surface.

Design speed

The speed limit of the existing road is 60 km/hr.

The design suits a design speed of 70 km/hr and a design speed of 70 km/hr has been adopted to suit the existing horizontal alignment. The posted speed limit would remain 60 km/hr.

3.4.1 Intersections

The existing bridge contains traffic signals and boom gates to control traffic during the opening of the bridge. The current alignment provides a minimum stopping sight distance of 120m, which is adequate for the design speed. The new design maintains the existing stopping sight distance.

3.5 Information on the proposal

The description of the proposal provided below is based on the concept design produced by the RTA as part of the project development process. The concept design, illustrated in the figures provided in Appendix A, shows the location, alignment and configuration of the proposal.

Detailed design would be undertaken if the proposal was approved. The detailed design would involve refining the concept to produce a design suitable for construction purposes. It would take into account the recommended measures to mitigate potential environmental impacts contained in this SEE/REF, as well as issues raised during the consultation process and conditions recommended by approval/determining authorities. It is likely that detailed design would be undertaken by a professional services contractor engaged by the RTA.

The proposed widening of the Spit Bridge would involve two main elements:

- A new two lane bridge directly abutting the existing bridge to the west, with a reconfiguration of the lanes and pedestrian walkways on the existing bridge. The piers for the new section of bridge would be in identical longitudinal locations and to the west of the existing piers; and
- Widening the existing approaches at the northern and southern banks (to the immediate west of the existing approaches), to tie in the new section of bridge with Manly Road to the north and Spit Road to the south.

These elements are described below.

3.5.1 Description of the concept for the bridge widening

The proposed widening method is to construct a new concrete bridge adjacent, and to the west of, the existing structure and join the two bridges to form what will be effectively one widened structure.

The proposed activities would see the trafficable width of the bridge deck widened from the current 16.4m to 24.5m.

Generally the cross section on the bridge would be:

- 3.1m shared footway/cycleway (western side);
- 0.5m guard fence;

- 3.5m kerbside lane;
- 3.2m lane;
- 3.3m centre lane;
- 3.3m centre lane;
- 3.2m lane;
- 3.5m kerbside lane; and
- 2.135m existing footway (eastern side).

3.5.2 Description of the concept for widening the approaches

The widening of the approaches is limited to the work necessary to connect the proposed six lane bridge to the existing six lane approach roads. The adjustments to the approaches extend approximately 140m to the north and 130m to the south of the existing abutments. Adjustments are required to the existing access to D'Albora Marina and to the service road accessing residences at 1 Manly Road. The approach on the northern side will retain the integrity of the footway and stairs connecting to the Spit to Manly walkway.

Generally the cross section on the approaches would be:

- 3.0m footway (western side only on southern approach);
- 3.5m kerbside lane;
- 3.2m lane;
- 3.3m centre lane;
- 3.3m centre lane;
- 3.2m lane;
- 3.5m kerbside lane; and
- 2.135m existing footway (eastern side).

The width of traffic lanes would be reduced at the beginning of both approaches to match existing lane widths.

3.5.3 Urban design features

Key design features would include the following:

Bridge

- The superstructure and piers would be built generally to match the existing west elevation;
- Piers would be located in line with existing piers;
- The slope on the proposed deck would match that on the existing deck;
- The central pylon would be extended to form a turret on the western façade;

- The edge beam of the superstructure would be a continuous beam, interrupted only by the central pylon. The edge beam would be in a continuous line on the bascule section of the bridge;
- The piers would be a consistent square shape with a widening taper from top to bottom, with small chamfers on the edges;
- Headstocks would sit proud of piers, but would not disrupt the line of the proposed edge beam;
- A 3m wide shared pedestrian/cycleway which would be provided on the widened side of the bridge and the approaches. The existing narrow footway would remain on the eastern side of the bridge;
- The pedestrian walkway/cycleway would be separated from the roadway by a half height new jersey kerb and metal handrail;
- A new metal handrail would be provided on the western parapet;
- The deck would cantilever from the edge beam by approximately one metre. There would be no substructural girders needed to support this cantilever. The edge parapet would be a thin edge, compared to the existing parapet;
- Light poles would be provided on western parapet; and
- Light poles and handrails would be finished in an inorganic zinc silicate that matches the finishes on the eastern balustrade.

Southern abutment and approaches

- The proposed southern approach requires widening the existing road about 100 m past the existing abutment. The widening would involve construction of a new footpath, new driveway into the d'Albora marina, and a new abutment; and
- The new southern abutment would be in the form of a pitched retaining wall.

Northern abutment and approaches

- The proposed northern abutment would match the existing, with a concrete wall constructed off the existing exposed rockface. A new staircase access would be constructed at the western abutment to replace the existing one, which would be partially removed as part of the works;
- The widening will encroach onto the parking provided at the corner of Manly Road and Battle Boulevard with subsequent loss of several parking spaces;
- Access to 1 Manly Road is to be retained by realigning the frontage road and reconstructing the turning circle at the southern end adjacent to the property acess.

3.5.4 Drainage

Drainage from the existing road and bridge generally flows untreated through a pipe network directly into Middle harbour. The proposal involves an increase in the paved area by approximately 200m^2. As a result the increase in run off will be negligible.

Gross pollutant traps would be incorporated into the existing pipe networks to treat road runoff before discharging into Middle Harbour.

3.5.5 Pavement

The top 45mm of the existing road pavement would be removed and replaced with 45mm of asphalt concrete. It is assumed that the new composite pavement road for the widening sections would include:

- 300mm of selected crushed sandstone fill;
- 180mm of rolled concrete subbase; and
- 240mm of asphalt concrete bitumen heavy duty.

This pavement will be verified during the construction process following testing of the available materials.

3.6 Provision for services and utilities

The proposal would require adjustments to the utility services on the western side. Utility services on the eastern side of the bridge would not be affected by the widening.

The following utilities have been identified on the western side of the northern approach:

- A 150mm diameter water main - advice would be sought from Sydney Water regarding their requirements with respect to this main. The main would be located directly underneath (concrete safety barrier), which would restrict maintenance access. This may necessitate relocation of the water main;
- The existing electricity distribution cabinet and cable would be relocated; and
- Gas lines in existing service road to remain unchanged.

The following utilities have been identified on the western side of the southern approach:

- A P50 telecommunication cable running through a 100mm diameter conduit crosses the bridge approach. If necessary, this cable would be relocated.
- Electricity light poles and associated cable would be relocated.

No utility protection structures would be required.

3.7 Land acquisitions

Minimal land acquisition would be required for the proposal:

- On the western side of the southern approach, approximately 89.5m^2 would need to be acquired at the frontage of the D'Albora Marina to accommodate a new driveway access. This land is owned by the Maritime Services Board of New South Wales (Waterways) and is currently leased to Flagship Marinas Pty Ltd. The lease is due to expire on 31 August 2027.
- On the western side of the northern approach two lots would be affected by modifications to the service road:

- In Lots 1-3 of Strata Plan No: 60087 46.9m^2 would need to be acquired (1 Manly Road); and
- In Lot B1 of DP393053 27.8m^2 would need to be acquired (7B Battle Boulevard).

Details of proposed changes to property are shown on the following drawings in Appendix A: 0164.293.MD.0001 (d'Albora Marina) and 0164.279.MD.0001 (1-3 Manly Road, Seaforth and 7B Battle Boulevard).

Further liaison with landowners and tenants would be carried out during the approvals process.

3.8 Cost of the proposal

The preliminary estimate of cost of the proposal is approximately $30 million for the bridge, plus a further $5 million for the approach works.

3.9 Access to properties and other property related impacts

The existing access to the D'Albora Marina (and beyond that to the Ellery carpark at the western side of The Spit) is a narrow road, which does not allow for an average car (5m long) to turn without executing a three point turn. The driveway to the D'Albora Marina would be modified to accommodate widening of the approach road and footpath. The proposal would allow a car to make the U turn in one movement (unlike the current situation), but would still require a three point turn for larger vehicles and the reversing of the petrol tanker for fuel delivery.

On the western side of the northern approach the service road would be modified to accommodate the widening of the bridge and the approach. The carriageway would be reduced to a single lane, with a kerb to kerb width of 4m. The vertical alignment of the service road would be adjusted to match the northern bridge abutment.

3.10 Construction

3.10.1 Construction delivery method

At this stage it is envisaged that, the procurement method to be adopted will be a traditional Design contract followed by a Construct Only contract. This procurement strategy is considered to be the most appropriate form of delivery method as it appears to best fit with the timing for development and approval of the project. This form of delivery strategy offers the most flexibility if there is any delay incurred through the implementation of the environmental management measures outlined in the SEE/REF and conditions applied.

The RTA would be responsible for overseeing implementation of the proposal.

3.10.2 Construction timing

The detailed design and tender assessment process would take approximately 12 months. Construction would commence once this process is complete.

Length of construction period

The construction period is expected to be 18 months.

The duration of the various construction activities is estimated as follows (activities would overlap to some degree):

- Site establishment – 6 weeks;
- Piling – 4 months
- Pile caps and piers – 9 months;
- Bridge superstructure – 5 months; and
- Approach road works – 3 months.

Construction hours

The standard construction hours for the proposal would generally be limited to five days per week 7am – 6 pm and Saturday 7am – 3 pm.

As the widening would interface with the existing bridge, some activities would need to occur outside these hours. These activities include the widening of the lift span and removal of the existing footway and barrier on the western side. The contractor may have to work 24 hours around the clock for a number of days or weeks on these activities to minimise disruption to traffic and navigation. The bridge bascule span opening will need to be suspended for a period of approximately 4 weeks to enable the installation of the widened bascule span and lifting mechanism.

3.10.3 Construction methodology and equipment

The specific details of the construction methodology would be determined by the contractor, within the constraints of the specification developed by the RTA. A general outline of the construction process is provided below

Site establishment

Site establishment would involve erecting a chain wire fenced security compound around the contractor's site offices, amenities block and material storage area. A 30 tonne mobile hydraulic crane, truck and backhoe with post-hole auger would be used for this purpose. The compound area would be paved with compacted road base material to provide we weather access. A front end loader, grader and 20 tonne vibrating roller would be used for this task. The contractor's and RTA site offices would comprise modular prefabricated units that would be brought to site by truck and placed in position by the 30 tonne mobile crane. Utility service (electricity, telephone, water and sewer) would be connected to the site offices and amenities block. Sewerage would be connected to existing sewers wherever possible, or alternatively a separate pump-out system would be provided.

Removal of the existing western footway

The removal of the footway would require concrete saws to cut the deck and oxy cutting of steel girders. A crane would be required to lift cut sections and load them onto trucks for haulage off site. The cutting would be done in normal working hours wherever possible. In the circumstances where this is not possible, removal of the cut sections would need to

occur at night, with traffic flow reduced to one lane in each direction to allow a working space for the crane and trucks.

Piling

At this stage, the exact method of piling is not known and this would be resolved by the designer/constructor. However, driven piles or bored piles with steel casings may be used.

The RTA has advised that the bridge foundations would be driven composite piles south of the lift span. Little disturbance to the sediment is associated with this activity. The lift span and to the north would involve bored cased piles.

The construction method would involve constructing the pile and installing precast skirts, then dewatering and constructing the pile cap. Piling works would be carried out by drilling rigs mounted on barges with suitable mitigation such as silt curtains, and the contract specifications will be compiled to ensure that the construction of the bridge would not cause any non-compliance with water quality objectives. It is expected that there would be very little sediment lost into the water.

If bored piles are used, the excavated material would be disposed off site.

Barges would travel at very slow speeds and carefully manoeuvred into position. The barges would be anchored firmly into position with some adjustment as required to compensate for tidal movements.

A pile driving hammer would be used to install the driven piles.

Pile caps, piers and headstocks

Pile caps, piers and headstocks would be constructed at and above water level to match the existing structure. The precast skirts would be dewatered prior to construction of the pile caps. Standard reinforced concrete techniques would be used for the pile caps, piers and headstocks. This would involve placement of steel reinforcement and form work, followed by pouring concrete and stripping of form work once the concrete has hardened.

Approaches

Rock excavation at the northern approach would occur for approximately 6 weeks. A break-out face would be developed by drilling holes at approximately 400mm centres on the vertical slope of the realigned rock face. These holes would be drilled by a track mounted drilling rig equipped with a hydraulic or pneumatic drill. The overburden rock would be excavated back to this face by using rippers or hydraulic hammers mounted on an excavator. The contractor may elect to pre-split the break-out face by using a non-explosive method. Approximately 1m horizontal width of overburden rock would be excavated.

Deck construction

Bridge girders would be delivered by trucks and lifted into position from the existing bridge outside peak hours.

A reinforced concrete deck would be constructed to match the existing deck.

It is expected that agitator trucks would deliver concrete. Pumps would be used to carefully place the concrete. Some lane closures would be required during non peak periods for delivery of steel reinforcement, formwork and concrete.

There would be minimal use of barges for construction work, however a barge may need to be used for the installation of the widened bascule span. Openings of the bridge would need to be suspended for the duration of the installation of the widened bascule span.

Other

Dredging would only be required if remains of the old timber bridge structure need to be removed at harbour bed level, where there is a conflict with the piling for the widening.

A small number of runabout work vessels may also be used.

Generators would be used for power tools. Small concrete vibrators would be used for compaction of concrete during concrete pours.

3.10.4 Construction work sites

There would be a need to establish construction work sites in the vicinity of the northern and southern approaches to the bridge. Possible options for construction work site locations include:

1. A section of the grassed reserve below Avona Crescent.

2. At the northern tip of The Spit below, just to the west of the southern approach (in the Ellery Park car parking area).

3. In The Spit west car park (to the southwest of the southern approach, off Spit Road).

4. In the car parking area near Battle Boulevard (to the northwest of the northern approach).

There may be a need to establish work sites at some or all of these locations. The potential impacts of these options are considered in Section 6.

3.10.5 Transport and pedestrian flow arrangements during construction

Construction traffic

Material delivery, general construction vehicles and workforce/visitors parking would be associated with the contractor's main construction compound. Parking would need to be provided for approximately 25 vehicles. Deliveries to the construction compound would take place during daylight hours. It is estimated that this would average three trucks per day. Delivery of steel girders would take place during non-peak hours, and would most likely involve delivery to a temporary staging area where they would undergo preparation prior to lifting in position during nighttime lane closures.

Road traffic

Road traffic would be unaffected during peak hours. Some temporary lane closures would be required during non-peak periods and at night. Lane closures would need to be sanctioned by the RTA's Traffic Management Centre.

Watercraft

There would be minimal potential for impacts to the passage of watercraft, other than during erection of the widened bascule span. During erection of the widened bascule span, the bridge would not be able to open for a period of approximately four weeks.

Pedestrians and cyclists

The western footway would be closed to pedestrian and cycle traffic for the duration of the project. Pedestrian and cycle access via the eastern footway be unaffected.

3.10.6 Property access arrangements during construction

Access to the D'Albora Marina would be maintained by the provision of temporary access through the car park on the southern boundary of the marina whilst construction of the permanent access is in progress.

Access will be maintained to the residential properties near the northwest approach, however some short term restrictions may be required during rock excavation activities as a result of public safety considerations. Some restrictions would be negotiated with property owners.

3.11 Other issues

3.11.1 Environmental management

The RTA has an established management system. The RTA's environmental management system extends to monitoring the activities of contractors working on behalf of the Authority. A series of specifications and guides form sub components to the management system. These are intended for use as part of roadworks and bridgeworks contracts let by the RTA. The relevant specifications for environmental management are:

- G35 Environmental Protection (Management Plan); and
- G36 Environmental Protection (Management System).

Further information on environmental management procedures is provided in Section 21.1.

Part C Planning and legislative context

4. The statutory framework

4.1 Decision making process

4.1.1 Does the proposal require development consent?

The need for development consent must be considered with respect to the different elements of the proposal (that is, the northern approach, the southern approach, and the construction of the bridge).

Based on a review of the legislation and relevant environmental planning instruments, the RTA have determined that the majority of the proposal requires development consent, under the Mosman and Manly Local Environmental Plans (LEPs) and Sydney Regional Environmental Plan 23 (SREP 23). Consent requirements are indicated on Figure 4.1.

Mosman Local Environmental Plan 1998

Development consent under Part 4 of the EP&A Act is required for works outside the existing road reserve, and the works within the unzoned road reserve area that trigger clause 31A of the LEP, within the Mosman LGA (part of the approach widening works):

- Part of the southern approach would impact on land zoned 6(a) Public Recreation and 3(d) The Spit Waterside Business. Development for the purpose of a road is allowed only with development consent in these zones;
- Development consent is required for works that impact on an item of environmental heritage listed by the LEP (construction of the bridge would impact on the item listed as 'The Spit Bridge'); and
- Development consent is required for works in an acid sulfate soils area, unless it can be shown that that an acid sulfate soils management plan is not required.

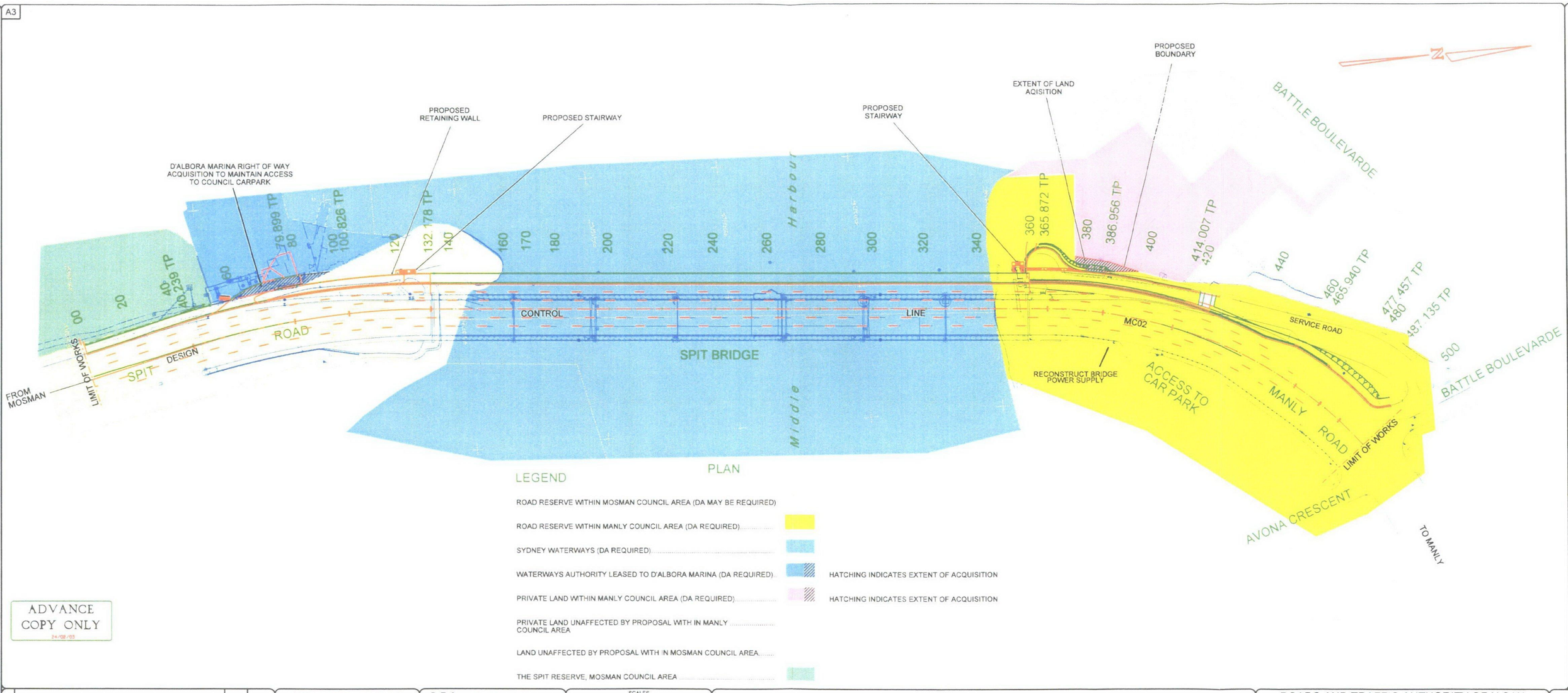
The proposal also encroaches on unzoned land (the road reserve). Other than the requirement for consent according to clause 31A, the LEP contains no provisions relating to development on unzoned land.

Manly Local Environmental Plan 1988

Development consent under Part 4 of the Act is required for that part of the proposal located within the Manly LGA (broadly involving widening of the approach road). The proposal encroaches on unzoned land and land zoned Residential (to the northwest):

- Development within the Residential zone is permissible only with development consent;
- Consent is required for works that impact on an item of environmental heritage listed by the LEP (that is, the Spit Bridge); and
- With respect to the unzoned land (the road reserve), the LEP adopts Clause 14 of the EP&A Act Model Provisions, which states that development may not be undertaken on land shown uncoloured except with consent.

A3



PLAN

LEGEND

ROAD RESERVE WITHIN MOSMAN COUNCIL AREA (DA MAY BE REQUIRED)

ROAD RESERVE WITHIN MANLY COUNCIL AREA (DA REQUIRED)

SYDNEY WATERWAYS (DA REQUIRED)

WATERWAYS AUTHORITY LEASED TO D'ALBORA MARINA (DA REQUIRED) — HATCHING INDICATES EXTENT OF ACQUISITION

PRIVATE LAND WITHIN MANLY COUNCIL AREA (DA REQUIRED) — HATCHING INDICATES EXTENT OF ACQUISITION

PRIVATE LAND UNAFFECTED BY PROPOSAL WITH IN MANLY COUNCIL AREA

LAND UNAFFECTED BY PROPOSAL WITH IN MOSMAN COUNCIL AREA

THE SPIT RESERVE, MOSMAN COUNCIL AREA

ADVANCE COPY ONLY
24/02/03

No	ISSUE DETAIL	AUTH	DATE
1	ORIGINAL ISSUE - UNAPPROVED	TH	

COMPUTER FILE REFERENCES

SURVEYOR: TONY DEGIORGIO
SURVEY MODEL: SURV SHT NO $NODIM NTH SURV SHT NO $NODIM STH
DESIGN MODEL: DESIGN STEVE
DRAW FILE: -
CADD FILE: $FILEABBREV$
LEVELS USED: -
ROADLOC START: -
FINISH: -

RTA PROJECT DESIGN TECHNICAL SERVICES OPERATIONS

DESIGNED: S WIJESOMA
CHECKED: T. HUFTON

SCALES

AS SHOWN
0 10 20 30 40 50
SCALE 1:1000

DATUM: AHD | GRID: MGA56
FILE: 293.1573
PRINTED DATE: $DATE$

ROADS AND TRAFFIC AUTHORITY OF N.S.W.
MOSMAN AND MANLY COUNCIL AREAS
MR 164 MANLY ROAD - SPIT BRIDGE
WIDENING OF SPIT BRIDGE
AND APPROACHES TO SIX LANES
PLANNING APPROVAL FOR BRIDGE WIDENING

SHEET 01

0164.293.MD.0002

Figure 4.1 Consent requirements

Use of SEPP 4 - Development without consent

In some instances, *State Environmental Planning Policy Number 4 (SEPP 4) – Development Without Consent* can be used to override the need for development consent for works undertaken by a public authority (including by the RTA). However, SEPP 4 cannot be applied to works involving a heritage item, or works occurring within a foreshore scenic protection area.

The proposal involves both works to a heritage item, and works within foreshore scenic protection areas. Therefore, SEPP 4 cannot be used to overcome the need for development consent.

4.2 The NSW legislative framework for development consent

NSW environmental planning legislation comprises three elements, which determine development consent requirements for projects in NSW:

- The *Environmental Planning and Assessment Act 1979* (EP&A Act);
- The *Environmental Planning and Assessment Regulation 2000* (the Regulation); and
- Environmental planning instruments made under the Act (including Local Environmental Plans (LEPs), State Environmental Planning Policies (SEPPs) and Regional Environmental Plans (REPs)).

Information on the relevance of these elements to the proposal are provided below.

4.2.1 Environmental Planning and Assessment Act 1979

The EP&A Act forms the statutory basis for planning and environmental assessment in New South Wales. The Minister for Planning, statutory authorities and local councils have responsibilities under the EP&A Act.

The RTA considers that the majority of the proposal would require assessment under Part 4 of the EP&A Act.

Part 4 of the EP&A Act

Part 4 of the Act establishes the requirements for the development consent under environmental planning instruments made in accordance with the Act. Whenever an environmental planning instrument (for example, a LEP) requires that consent be obtained before a particular proposal can be carried out, then the provisions of Part 4 of the EP&A Act apply. These assessment provisions are incorporated into the process of obtaining development consent. The factors to be considered when development consent is required are listed in section 79C of the EP&A Act.

Development consent from Mosman and Manly Councils and the Minister for Transport is required. This means that the RTA would be required to submit a 'Crown development application' (Crown DA) to both Councils and the Waterways Authority (the delegate of the Minister for Transport under SREP 23).

This SEE/REF would be submitted as part of the Crown DA.

Part 5 of the EP&A Act

Development consent is not required for works within the existing road reserve in Mosman (other than the consent requirement triggered by clause 31A of the Mosman LEP). As development consent is not required, this section of the proposal is to be assessed in accordance with Part 5 of the EP&A Act.

In accordance with Part 5, potential environmental impacts of an activity must be considered by the 'determining authority' (usually the agency undertaking the activity). The Act requires (section 111) determining authorities to 'take into account to the fullest extent possible all matters affecting or likely to affect the environment'.

With the exception of those matters detailed above which require assessment under Part 4 of the EP&A Act, the remainder of the proposal is subject to determination under Part 5 of the EP&A Act.

Factors which need to be considered when preparing a SEE/REF are outlined in Clause 228 of the Regulation, and are addressed in Appendix B. Sections 6 to 18 provide detailed descriptions of how the proposal is likely to impact on these factors.

Is an EIS required?

If a development for which consent is required is listed as designated development (either in the Regulation or an environmental planning instrument) then an environmental impact statement (EIS) must accompany the application for consent.

However, the proposal is not considered to be a designated development under the Regulation. For this reason, an EIS is not required to support a DA under Part 4 of the Act.

With respect to Part 5 of the Act, section 112 requires the determining authority to consider whether the proposal is 'likely to significantly affect the environment (including critical habitat) or threatened species, populations or ecological communities, or their habitats. If a significant impact is identified, then a Species Impact Statement (SIS) and an Environmental Impact Statement (EIS) is required.

This SEE/REF examines the potential environmental impacts of the proposal, the RTA would determine whether an EIS is required based on the findings of this SEE/REF.

Crown DAs

Part 5A of the Act applies to development by or on behalf of the Crown. Section 115I of the Act provides that Councils must not refuse consent to applications, or impose a condition of consent, except with the written approval of the Minister or by agreement with the Crown agency involved. If the consent authority has not determined the development application within 60 days, the application may be referred to the Minister.

4.2.2 Local Environmental Plans

Information on the requirements of the Mosman and Manly LEPs are provided below.

Mosman Local Environmental Plan 1998

Zoning

Construction of the majority of the southern approach would take place within the existing road reservation. However, the proposal would impact on a small amount of land at the north-western end of The Spit zoned 6(a) Public Recreation and 3(d) The Spit Waterside Business.

According to the provisions of these zones, development for the purpose of road is allowed only with development consent.

Heritage item

The Spit Bridge is listed as a heritage item of State significance by the LEP.

Clause 33 of the LEP requires the consent of Council for works to a heritage item or a building, work, relic or a place within a heritage conservation area.

This issue is considered further in section 7 of the SEE/REF.

Foreshore scenic protection area

According to the relevant LEP map, the proposal falls within a foreshore scenic protection area. The provisions of the LEP (clause 27) state that the 'Council must not consent to the alteration or erection of a building on land in the foreshore scenic protection area unless it has made an assessment, having regard to the objectives of Sydney Regional Environmental Plan No 23 – Sydney and Middle Harbours, of the impact of the proposal on the natural environment, the visual environmental and the environmental heritage of Mosman'. This means that the potential impacts on this area must be considered as part of Council's assessment process, where development consent is required.

Acid sulfate soils

According to the relevant LEP map, the proposal also falls within an acid sulfate soil area. Assessment of the potential for acid sulfate soil conditions is required.

The provisions of the LEP (clause 31A) state that in this area, the following works require the consent of Council: - works beyond 1m below the existing ground surface and/or involving the disturbance of more than 1 tonne of soil, or works that are likely to lower the groundwater table in a foreshore scenic protection area. Development consent is not required, if a preliminary assessment of the proposal (undertaken in accordance with the Acid Sulfate Soils Assessment Guidelines) indicate that an acid sulfate soils management plan is not required.

This issue is considered further in section 15.

Manly Local Environmental Plan 1988

Zoning

The proposal requires acquisition of a narrow portion of land to the northwest zoned residential. According to the provisions of these zones, development for the purpose of road is allowed only with development consent. The remainder of the affected land is unzoned.

Heritage items

The following items of environmental heritage listed in Schedule 4 of the LEP are located within, or in close proximity to, the study area:

- The Spit Seaforth;
- Reserved track for trams – from Whittle Avenue to the Spit Bridge, Seaforth;
- Former Bridge – The Spit, Seaforth;
- Vehicular Ferry Ramp – The Spit Bridge, Seaforth;
- Tram terminus and wharf for tram punt – The Spit Bridge, Seaforth; and
- Monument – The Spit Bridge, Seaforth.

The heritage item 'The Spit Seaforth' would be affected by the proposal. The other heritage items would not be affected.

Clause 18 of the LEP requires the consent of Council for works to a building, work, relic or place that is an item of environmental heritage.

Foreshore scenic protection area

According to the relevant LEP map, the northern approach falls within a foreshore scenic protection area. The provisions of the LEP (clause 17) state that Council should not grant consent to the carrying out of development unless it is satisfied that the development will not have a detrimental effect on the amenity of the foreshore scenic protection area.

Acid sulfate soils

According to the LEP, the northern approach falls within land classified as 'class 5' on the LEP's Acid Sulfate Soils Planning Map. The consent of Council is only required for works occurring in class 5 within 500 m of an adjacent class of land. This is not the case with respect to the proposal.

4.2.3 Regional Environmental Plans

Sydney Regional Environmental Plan No.23 – Sydney and Middle Harbours (SREP 23)

SREP 23 applies to the waterway component of the proposal.

Based on SREP 23, the waterway component is zoned W1 – General Waterways. Clause 10 describes the zone objectives and development control table.

Part 4 relates to the heritage provisions of SREP 23. A 'heritage item' is defined as 'a building, work, relic, tree or place described in Schedule 5'. Heritage items within, or in close proximity to, the study area are as follows:

- Remains of tram terminus and wharf for tram punt – Avona Crescent, Seaforth;
- Remains of vehicular ferry ramp – Avona Crescent, Seaforth;
- Remains of former bridge – Avona Crescent, Seaforth;
- The Explosives Wharf – Spit Road, Mosman;

- Remains of former 'Grant Wharf' – The Spit, Mosman.

The RTA's position with respect to consent requirements under the instrument is to treat those parts of the proposal below the high water mark as 'water based development' requiring consent under SREP 23. The consent authority for water based development under SREP 23 is the Minister for Transport. The Waterways Authority acts under delegation from the Minister. Applications for development consent are lodged with the Waterways Authority.

Sydney Harbour and Parramatta River Development Control Plan for Sydney Regional Environmental Plans No 22 and 23

The Development Control Plan (DCP) was prepared for SREP 23. It includes design guidelines for development in the area to which the plan applies. The aims of the DCP are to:

- Protect ecological communities within the area covered by the REPs ;
- Ensure that the scenic quality of the area is protected or enhanced;
- Provide siting and design principles for new buildings and waterside structures within the area; and
- Identify potential foreshore access locations in the area.

Potential impacts of the proposal are considered within relevant sections of this SEE/REF.

4.2.4 State Environmental Planning Policies

State Environmental Planning Policy No. 4 - Development Without Consent

SEPP 4 permits development for certain purposes (such as classified roads) without the need for development consent.

The proposal involves a 'classified road' under the *Roads Act 1993*. Clause 11C of SEPP 4 applies, to the effect that development for the purposes of a 'classified road' is permissible without consent.

However, clause 2 (6) overrides this provision, by stating (in part) that 'nothing in this Policy ... permits the alteration of or addition to, or the extension or demolition of, a building or work described in an environmental planning instrument as a heritage item ... or on land described in an environmental planning instrument as comprising or being within a foreshore scenic protection area ...'

As described above, this means that SEPP 4 cannot be used to override the relevant development consent requirements.

State Environmental Planning Policy No. 4 - Development Without Consent

The aim of this policy is to co-ordinate the planning and development of land comprising the foreshores of Sydney Harbour and its tributaries. It includes a number of guiding principles which have to be taken into account in the determination of development applications. Guiding principles include matters such as increasing public access, protecting environmental and visual values, and protecting items of heritage significance.

Potential impacts of the proposal are considered within relevant sections of this SEE/REF.

4.3 Other environmental legislation and approvals

Other potentially relevant legislation is described below, with comment on relevance to the proposal.

Commonwealth Environmental Protection and Biodiversity Conservation Act 1999

Under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) EPBC Act, any actions which are likely to have a significant impact on matters of National Environmental Significance (NES matters), or a significant impact on Commonwealth land requires referral to the Commonwealth Minister for the Environment for approval. NES matters include:

- World heritage properties;
- Listed migratory species;
- Listed threatened species and communities;
- Nuclear actions;
- Wetlands of international importance; and
- Commonwealth marine areas.

The proposal would not impact on any NES matters. Accordingly, the proposal has not been referred to the Commonwealth Minister for the Environment.

Ports Corporatisation and Waterways Management Act 1995

This Act establishes and confers waterways management responsibilities to the Waterways Authority.

The Maritime Property Assets Division of Waterways manages key maritime assets of the Waterways Authority that were owned by the former Maritime Services Board. The Marine Ministerial Holding Corporation (MMHC), a statutory agency that was formally abolished on 29 June 2000, previously owned these assets, which include the bed of Sydney Harbour.

Under the *Environmental Planning and Assessment Act 1979* (EP&A Act), the Maritime Property Assets Division has two consent roles in respect of development proposals:

- Give land owners consent for proposed developments on lands vested in the Waterways Authority (formerly MMHC); and
- As a development consent authority in respect of Sydney Regional Environmental Plans 22 and 23.

Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) lists a number of factors to be taken into account in deciding whether there is likely to be a significant impact on threatened species, populations or ecological communities or their habitats.

In accordance with the TSC Act a 'species impact statement' is required when it is determined by the 'eight part test', undertaken in accordance with section 5A of the EP&A

Act, that there is likely to be a significant impact on a threatened species, population or ecological community.

As identified in Sections 11 and 12, the proposal would not significantly impact on a threatened species, population or ecological community.

National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* provides the basis for legal protection and management of Aboriginal sites in NSW. The implementation of the Aboriginal heritage provisions in the Act are the responsibility of the National Parks and Wildlife Service.

This Act, together with the policies of the NPWS, provides for the following:

- It is an offence to knowingly disturb an Aboriginal artefact or site without an appropriate permit;
- Prior to instigating any action which may conceivable disturb a 'relic', archaeological survey and assessment is required; and
- When the archaeological resource of an area is known or can be reliably predicted, appropriate land use practices should be adopted which will minimise the necessity for the destruction of sites/relics, and prevent the destruction of sites/relics which warrant conservation.

Section 8 discusses the potential for the proposal to impact on items of Aboriginal significance.

Heritage Act 1977

The *Heritage Act 1977* identifies and protects heritage items and is administered by the NSW Heritage Council and NSW Heritage Office. Under the Act it is an offence to disturb an item of heritage significance without the consent of the Heritage Office. Any work, which will impact on an item listed on the State Heritage Register, requires approval from the Heritage Council under section 60 of the *Heritage Act 1977*. Approval may also be required from the Heritage Council under section 139 of the *Heritage Act 1977* if it is proposed to disturb a relic. It is noted that the Spit Bridge is not currently listed on the State Heritage Register.

A heritage 'item' is defined as 'a place, building, work, relic, moveable object or precinct'. Environmental heritage is defined as places, buildings, works, relics, moveable objects, and precincts of State or local heritage significance.

The relics provisions in the *Heritage Act 1977* require an excavation permit to be obtained from the Heritage Council prior to commencement of works if disturbance to a site with known or potential archaeological relics is proposed.

The *Heritage Act* 1977 defines items of environmental heritage to be 'those buildings, works, relics or places of historic, scientific, cultural, social, archaeological, architectural, natural or aesthetic significance for the state of New South Wales'.

The Act defines *a relic* as:

'Any deposit, object or material evidence:

(a) which relates to the settlement of the area that comprises NSW, not being Aboriginal settlements; and

(b) which is 50 or more years old.'

Protection of the Environment and Operations Act 1999

Activities required to obtain a licence under the POEO Act are detailed in Schedule 1 to the Act. The proposal is not a scheduled activity and the works are not a scheduled activity.

The RTA has the option of obtaining an Environment Protection Licence, for the carrying out of a non-scheduled activity, with respect to the regulation of water pollution.

Roads Act 1993

Section 88 of the *Roads Act 1993* states that:

'A roads authority may, despite any other Act or law to the contrary, remove or lop any tree or other vegetation that is on or overhanging a public road if, in its opinion, it is necessary to do so for the purpose of carrying out road work or removing a traffic hazard.'

Water Management Act 2000

The *Water Management Act 2000* (WM Act) is administered by DLWC. The WM Act replaces the *Water Act 1912* (although some parts of the Water Act remain in operation including licensing and permit provisions) and will ultimately replace the *Rivers and Foreshores Improvement Act 1948* (RFI Act). The WM Act repealed all aspects of the RFI Act with the exception of approvals. Once the WM Act replaces the RFI Act, it is understood that approval from DLWC will be required for all works within 40m of a waterway as the existing exemptions would no longer apply.

Until such time as the WM Act replaces the RFI Act, all works within 40m of a waterway continue to be subject to the RFI Act.

Rivers and Foreshores Improvement Act 1948

Approval under Part 3A of the *Rivers and Foreshores Improvement Act 1948*, is required to:

- Excavate or remove material from the bank, shore or bed of any stream, estuary or lake, or land that is not more than 40m from the top of the bank or shore of protected waters;
- Build erosion control works or other structures in a river, estuary or lake; or
- Place any fill material in a river, estuary or lake

As a public authority, the RTA does not require a Part 3A permit prior to commencing works. Nevertheless, the works still need to comply with all relevant Government policy. The need to minimise the potential for erosion and sedimentation to impact on local waterways has been considered during development of the concept design for the proposal.

Fisheries Management Act 1994

Section 199 of the Fisheries Management Act requires that the Minister for Fisheries must be notified prior to a public authority undertaking or authorising any dredging or reclamation activities. Such works include construction of temporary crossings/sidetracks, bridges,

creek diversions, geotechnical investigations, excavating or reclaiming the bed or banks of a waterway. Fisheries will be notified in relation to the proposal.

Any works involving 'harm' to marine vegetation (seagrass, mangroves or seaweeds) require a permit under sections 204 and 205 of the Act.

A permit is also required under section 219 of the Act for any works which may result in the temporary or permanent blockage of fish passage within a watercourse.

These issues are considered further in section 11. The aquatic ecology impact assessment found that the works would not involve direct impacts to marine vegetation, nor would there be a blockage of fish passage.

5. Consultation

5.1 Statutory consultation

Consultation with statutory agencies was undertaken during the preparation of the SEE/REF. Agencies were contacted in writing, a short description of the proposal was provided, and input sought in terms of issues that should be addressed during the environmental impact assessment process.

Contact was made with, and responses received from, the following agencies:

- Transport NSW;
- NSW Fisheries;
- NSW National Parks and Wildlife Service;
- Environment Protection Authority (EPA);
- Department of Land and Water Conservation (DLWC); and
- Waterways Authority.

Copies of responses received are provided in Appendix C.

An outline of the issues raised in these responses is provided in Table 5.1, together with a reference to where the issue is addressed within the SEE/REF.

Table 5.1 Issues raised by statutory agencies

Issue raised	Where addressed in the SEE/REF
Transport NSW	
The Spit Bridge is just one part of the overall transport management task for the Northern Beaches corridor.	Noted
Provide information on project justification.	Sections 2 and 21
Existing impediments and possible improvements to public transport services	Section 9
Connections for pedestrians and cyclists to the north and south of the new pedestrian / cycleway are important. Analyse connections to cycling and pedestrian access paths.	Sections 3 and 9
Induced traffic as a result of the increase in capacity on the Spit Bridge.	Section 9
STA is the primary bus operator in this section of corridor. Issues raised by the STA include: • Take into account proposed changes to the route structure for its Northern Beaches bus services. • Consider benefits to buses in the contra peak direction. • STA's preference is for a 3/3 lane configuration during peak times with the provision of a bus lane during the morning and afternoon peaks. • Allow for the STA to operate 14.5 metre buses, to increase capacity during peaks times. • In the longer term, Military Road congestion also needs to be addressed. • Consider enforcement issues for illegal use of Transit Lanes and Bus Lanes.	Section 9

Issue raised	Where addressed in the SEE/REF
◗ Mitigative measures should be put in place during construction to minimise delays to bus services.	
Continue consultation with Transport NSW throughout the EIA process.	Noted
NSW Fisheries	
The main issues are: Possible impact to marine vegetation ◗ Presence of *Caulerpa taxifolia* – a noxious marine alga ◗ Presence of aquatic threatened species ◗ Any obstruction to fish passage whether temporary or permanent ◗ Any dredging or reclamation as defined under the Fisheries Management Act	Section 11
NSW Fisheries provided general requirements for environmental impact assessment were provided (included in Appendix C).	Noted
National Parks and Wildlife Service	
General requirements for environmental impact assessment were provided (included in Appendix C).	Noted
EPA	
Continue to liase with the EPA during development of the proposal.	Noted
The REF should provide an overall environmental protection perspective.	Noted
Consider noise and vibration issues.	Section 10
Consider soil and geology issues.	Section 15
Consider water issues.	Section 16
Consider air quality issues.	Section 17
Waste and spoil management	Section 18
Flora and fauna	Section 12
Environmental management plan	Section 21
DLWC	
General requirements for consideration and assessment relating to matters that form the responsibility of DLWC were provided (included in Appendix C).	Noted
Waterways Authority	
Consent authority for 'water based development' under SREP 23 is the Minister for Transport. The Waterways Authority acts under delegation from the Minister.	Noted
It is not strictly necessary for the RTA as a public authority to seek the Waterways Authority's consent as land owner to lodge the DA/s, however the Authority should be consulted prior to lodgement.	Noted
Details of the proposal including plans and cross sections.	Section 3 and Appendix A
Outline of construction method, erosion and sediment control measures.	Sections 3 and 16
Impacts on navigation.	Section 9.2

Issue raised	Where addressed in the SEE/REF
Impacts on water-dependent facilities, eg marina and slipway.	Section 6.2
Direct and indirect impacts on marine vegetation and impacts on aquatic ecology.	Section 11
Visual assessment.	Section 14
Impacts on items of heritage significance.	Section 7
Address SEPP 56, SREP 23 and DCP for Sydney Harbour and Parramatta River.	Section 4.2
Justification for the proposal and consideration of alternative options.	Sections 2.3 and 22

The agencies were also offered the opportunity to meet with the RTA to discuss the proposal in detail. The RTA met with the following agencies:

- Planning NSW;
- Transport NSW; and
- State Transit Authority.

5.2 Community consultation

Requirements in relation to public participation for other advertised development are set out in Division 7 of the Regulation. Requirements include:

- The consent authority must give written notice of the application; and
- The consent authority must give published notice (in a local newspaper) of the application.

Issues will be identified within community submissions provided to the consent authorities. These submissions will be considered as part of the assessment process.

Part D Environmental impact assessment

6. Land use and property impacts

6.1 Description of the existing environment

6.1.1 Context of the study area

Areas to the south of Spit Bridge

The suburb of Mosman is located to the south of the bridge. The locality of Beauty Point is located to the southwest. Pearl Bay is located to the southwest, approximately 750 m from the bridge. A number of yachts and some houseboats are permanently moored in Pearl Bay.

Parriwi Head, Parriwi Park and The Spit Reserve are located to the south of the bridge. Shell Cove is located further to the southeast. The closest areas of residential housing within Mosman are located approximately 800 m south of the southern approach.

Areas to the north of Spit Bridge

Directly to the north of the bridge are the suburbs of Seaforth, Balgowlah and Clontarf. Residents in some areas to the north and northwest, mainly on the slopes of Seaforth, overlook the bridge. Residents in some areas of Clontarf and Balgowlah Heights further to the northeast also overlook the bridge.

Clontarf Reserve and Sandy Bay Beach (located opposite the bridge, approx 600 m to the east) is a popular recreation destination, particularly for families and picnickers. This reserve is well used on the weekends. A boat refuelling area is located in the vicinity of Clontarf Reserve.

There is a narrow reserve located along the harbour foreshore to the northeast of the bridge (below Avona Crescent). The Spit Bridge to Manly walk starts in the vicinity of this reserve. A small bay (Fisher Bay) is located approximately 300 m to the northeast.

The area to the northwest of the bridge's northern approach consists mainly of residential areas within Seaforth, many with views over Middle Harbour and The Spit.

Middle Harbour

Boats travel under the bridge in an easterly direction to access other areas of Middle Harbour (including Hunters Bay/Balmoral Beach to the southeast) or North Harbour and Manly Cove to the east/northeast. Port Jackson and Sydney Harbour, as well as the open sea, are located further to the east.

Boats travelling under the bridge to the west have access to other areas of Middle Harbour (including Long Bay, Sailors Bay, Castle Cove, Bantry Bay), the Garigal National Park (to the west of the Roseville Bridge) and boat refuelling at Roseville Bridge Marina.

Land uses, land ownership and activities occurring within the immediate study area are described below.

6.1.2 Land uses within the study area

Land uses in the area surrounding the bridge and its approaches include a mix of:

- Recreation;
- Commercial activities (including various marine services and restaurants);
- Car parking; and
- Residential.

The Spit provides the base for a range of boating and marine related recreation activities.

Land uses in the vicinity of the southern and northern approaches are described below. Information on the activities that occur is provided in Section 6.1.4.

Southern approach

The southern approach is located on The Spit. A number of businesses are located adjacent the bridge's southern approach. Land in this area is relatively flat.

This area (on either side of Spit Road) receives high levels of use, particularly during the weekends (day and night) and summer evenings. It is a popular recreation destination, mainly for water based activities. It is also the location for a number of commercial (mainly marine related) activities, a number of restaurants, and sailing/rowing clubs.

Recreation land uses

The southwestern side of Spit Road is dominated by a recreation reserve. The Spit Reserve is a long narrow reserve, located on reclaimed land, which extends from just south of the bridge's southern approach. It is approximately 600 m long and 100 m wide at its widest point, located between Pearl Bay (to the west) and Spit Road (to the east). The reserve is a popular picnic destination, overlooking Pearl Bay. It is a relatively flat, mainly grassed area. There are a number of mature trees, including a row of Norfolk Pines along the eastern side of the reserve, adjacent Spit Road and a number of Moreton Bay figs to the north. These would not be impacted by the proposal.

The reserve includes picnic tables, a memorial, a toilet/amenities block towards the north, and a car park. Mosman Council has recently planted some additional trees within the reserve, in the vicinity of Spit Road.

The Mosman Rowing Club is located at the southern end of the reserve, near Pearl Bay.

The Beauty Point foreshore walking track, which links Beauty Point (further to the west) with The Spit, links to the reserve.

There is a small strip of sandy beach to the southeast of the southern approach, facing towards Clontarf/Sandy Bay.

Parriwi Park (containing Parriwi lookout) is located approximately 600 m to the south of the bridge's southern approach.

The northern tip of The Spit is a popular fishing spot. Also popular is Parriwi Head to the southeast of the bridge's southern approach. Boat launching is available near Parriwi Head.

Ellery Park, is a small reserve located at the northwestern end of The Spit. It is used mainly for fishing and carparking. It is currently being landscaped by Mosman Council. This includes provision of heritage interpretation.

There are three sailing clubs located on the eastern side of Spit Road – the Middle Harbour 16 ft Skiff Club, Middle Harbour Yacht Club, and the Middle Harbour Amateur Sailing Club. As a result, the foreshore and parking areas can become busy (particularly on the weekends) with boats rigging and derigging, spectators, loading of boats on cars etc.

Commercial land uses

The D'Albora Marina is located adjacent to the northern tip of the reserve, directly to the west of the bridge's southern approach. It provides the location for a number of marine related businesses, a restaurant, boat berthing and associated services and facilities (refer Section 13 for more information). There are two active underground fuel tanks located between the frontage of the Marina building and the western side of the bridge's southern approach. The fuel tanks are associated with the boat refuelling service offered by the Marina.

A number of other marine related activities, businesses, sailing clubs, restaurants and a marina are located on the eastern side of Spit Road.

There are a number of restaurants (nine) to the southeast. Many of these are popular weekend function destinations (for weddings, parties etc). They can receive high levels of use as a result of their location and outlook. Patrons park within the car parks on either side of Spit Road.

Car parking

There is a small Council car park (within Ellery park) at the northwestern end of The Spit. The car park is used mainly by people fishing in this area or visiting D'Albora Marina. It has been the subject of improvement works recently undertaken by Mosman Council.

Other Council car parking areas near the southern approach include the large car park adjacent to The Spit Reserve (known as The Spit west car park). The car park starts approx 200 m south of the bridge, and extends approximately 300 m to the south. A smaller car park (The Spit east car park) is located on the eastern side of Spit Road, near the intersection with Parriwi Road. The two car parks provide parking for approximately 400 cars.

A number of parking spaces are also available along the road, on the eastern side of Spit Road.

Other

The headquarters of the Royal Volunteer Coastal Patrol is located to the southeast of the bridge's southern approach.

Northern approach

The area in the vicinity of the northern approach is less intensively used. The land slopes steeply up from the water's edge to meet Manly Road.

Residential

To the northwest of the approach are a number of residences located off Battle Boulevard. Residential apartments (at 1 Manly Road) are located directly to the northwest.

Recreation

The Spit to Manly walk starts to the east of the bridge's northern approach. The walk passes through a small area of foreshore reserve located below Avona Crescent, directly to the east of the northern approach.

The foreshore in this area is also used for recreational fishing.

Car parking

A small car park is located to the north of the bridge (on the western side of Manly Road), approximately 100 m to the north of the northern approach. The car park, located near the intersection with Battle Boulevard, is usually mainly on the weekends by people undertaking the Spit Bridge to Manly walk or fishing in the area.

An access road extends from this carpark, providing access to 1 Manly Road. Parallel car parking currently occurs along this road. Stairs are located at the end of this road, providing access to the foreshore and The Spit to Manly Walk.

6.1.3 Land ownership information

The bed of Sydney Harbour and its tributaries is publicly owned land. The Waterways Authority is responsible for exercising Ministerial landowner delegation for the beds of Sydney Harbour and its tributaries.

The road reserve, and land on which D'Albora Marina is located, is also publicly owned land. D'Albora Marina lease land on which their property is located from the Waterways Authority.

A small area of privately owned land (at the northwestern approach) would also be impacted.

6.1.4 Activities occurring within the study area

Recreation and business/commercial related activities are the main activities occurring in the vicinity of the bridge.

Recreation

The study site (including the land and the sea in the vicinity of the bridge) provides the base for a range of marine and boating related recreation activities. These include:

- Yacht racing - via the Middle Harbour Yacht Club;
- Dinghy (sailboat) racing - via the Middle Harbour 16 ft Skiff Club and the Middle Harbour Amateur Sailing Club;
- Sail training – there are a number of sailing schools based at The Spit for both adults and children (sailing dinghies and yachts);

- Recreational sailing/boating (power and sail) – including boats berthed at the Marinas or moored in the vicinity, and those that pass through the area (under the bridge). Boats also stop at The Spit to refuel, pick up ice etc;
- Fishing – around the shoreline in and the water within and in the vicinity of the study area;
- Kayaking – including local hire and those that pass through the area (under the bridge); and
- Rowing – via the Mosman Rowing Club in Pearl Bay.

Other recreation activities that occur include:

- Walking – including the Spit Bridge to Manly walk and the Beauty Point foreshore walk;
- Picnicking – on the beaches or in The Spit Reserve; and
- Spectating sailing races or visiting the sailing clubs and restaurants in the area.

Businesses and other activities

Further information on business and commercial activities is provided in section 13.

6.2 Assessment of potential impacts

The proposal would impact on land use in the vicinity of the northern and southern approaches to the bridge, where the approaches to the new bridge impinge on land to the west of the existing alignment.

As outlined in Section 3.7, minimal land acquisition would be required for the proposal. The proposal would require acquisition of 89.5m^2 of publicly owned land on the southwestern side of the southern approach, and 74.7m^2 of private land at the northwestern side of the northern approach.

Construction of the southern approach would require the acquisition of a strip of land directly at the front of the D'Albora Marina. As a result, the road would move closer to the front of the Marina building. The existing land uses would remain, although the land available for these uses would be reduced.

The two underground fuel tanks located in this area would need to be relocated or protected. Further information on potential access related and business impacts is provided in Sections 9 and 13 respectively. Information on relocation of public utilities required as part of the proposal is provided in Section 3.6.

Public access to the Ellery carpark at the northwestern end of The Spit would be restricted during construction of the southern approach and abutment to the bridge. This impact would be limited to the construction period.

Construction of the northern approach would result in the reconfiguration of the service road providing access to the residential property at 1 Manly Road and the stairs near the northern approach, resulting in a loss of some of the existing car parking located along the road. The road would narrow to become a shared pedestrian footway (for access to the stairs) and driveway (for access to 1 Manly Road). No car parking would be available along the road. Further information on the proposed access arrangement is provided in section 9.

Potential impacts on land use and activities during the construction period would include short term changes to access arrangements, and a short term change of land use for the land where the construction work site/s are located.

A summary of the potential impacts on the different types of land use and activities is provided below.

Residential land uses

There would be minor adjustments to two residential lots as a result of the proposal (the amount of adjustment is described in Section 3.7. Potential access related impacts are discussed in section 9 and residential amenity impacts are discussed in Sections 10 (noise), 13 (socio-economic considerations), 14 (visual quality), and 17 (air quality).

Recreation land uses

The main potential impacts to recreation land uses would occur as a result of altered access arrangements during the construction period. This would be mainly limited to activities occurring in close proximity to the northern and southern approaches.

If the northern end of The Spit and/or the reserve below Avona Crescent were used as construction work sites, this would reduce the access to these areas during the construction period. The amount of foreshore land available in this area for fishing would also reduce for the duration of the construction period.

Construction of the northern approach would result in restrictions to access to The Spit to Manly walk via the stairway at the northwest of the northern approach. This access is used mainly by people travelling from the south, who park their cars in the car park near Battle Boulevard, or those walking across the bridge along the western footway. Access to the walk would continue to be available via Avona Crescent on the eastern side of Manly Road.

Other than potential for a small reduction in the area of land available for car parking (if a construction work site is located in The Spit west car park) there is not likely to be any impacts to The Spit reserve and associated recreation activities, or activities associated with the sailing clubs on the eastern side of Spit Road.

Commercial land uses

There would be a need for a change to the access to, and frontage of the D'Albora Marina complex.

There is also the potential for impacts as a result of any change to access arrangements during the construction period.

Potential business related impacts are considered in section 13.

Construction work sites

As identified in section 3.7.4, there would be a need to establish construction work sites in the vicinity of the northern and southern approaches to the bridge.

The main potential issue is that there is limited room for potential construction work sites in the vicinity of the bridge. All areas, particularly to the south, are busy and well used,

particularly on the weekends. Potential impacts associated with the options proposed include:

1. The reserve below Avona Crescent – this is in a public reserve and at the start of the Spit Bridge to Manly walk. As this area is close to the foreshore, there is the potential for visual impacts, a change in land use for the duration of the construction period, and disturbance of the land surface while this area is being used.

2. The northern tip of The Spit below and just to the west of the southern approach (in the Ellery park car parking area) – as this area is already sealed and used as a car park, the potential for impacts as a result of disturbance of the land surface (such as erosion) would be reduced. There would however be a change in the land use for the duration of the construction period, and potential visual impacts, as the area is very close to the foreshore. Runoff from the site directly into the water would have to be carefully managed. Access to this area is tight, and is located in close proximity to the proposed southern approach and the existing D'Albora Marina.

3. In The Spit west car park – depending on the location selected, this site would be at least 100m distance from construction activities. There would be a change in the land use for the duration of the construction period (loss of a few carparking spots). As the car park is already sealed and predominately screened from Spit Road (as a result of the presence of mature trees and the landform) there is less potential for issues related to land disturbance and associated visual impacts.

4. Car park near Battle Boulevard – There would be a change in the land use for the duration of the construction period (loss of carparking). As this area is already sealed and used as a car park, the potential for impacts as a result of disturbance of the land surface (such as erosion) would be reduced. There would be some visual impacts as the site is highly visible to vehicles travelling on Manly Road.

Other

There would be no impacts on the operation of the Royal Volunteer Coastal Patrol as a result of the construction or operation of the proposal.

6.3 Mitigation measures

Mitigation measures include:

- Further liaison with landowners and tenants would be carried out during the approvals process;
- The acquisition of any land required would be undertaken in accordance with the RTA's Land Acquisition Policy and compensation undertaken in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*;
- Any changes to access arrangements for land uses in the area (such as access to reserves, car parks, businesses etc) would be clearly signposted;
- Signage would also indicate the availability of access to all businesses in the vicinity of the bridge during the construction period;

- Restrictions to access to Ellery park during the construction period, and the potential use of areas within existing reserves and car parks as construction work sites, would be negotiated with Mosman and Manly Council; and
- Arrangements and requirements in terms of the relocation of services would be negotiated with the operators of D'Albora Marina.

7. Heritage assessment

This section provides a summary of the results of the Statement of Heritage Impact undertaken by Austral Archaeology. The full report is provided in Appendix D.

7.1 Introduction

A Statement of Heritage Impact is required for items of Local or State Significance where modification, removal or change in use is proposed. The objective of a Statement of Heritage Impact is to convey what the impact or impacts of a proposal would be to an item or place of cultural significance.

All works associated with the Statement of Heritage Impact were carried out in accordance with the 'best practice' archaeological and heritage management practices, and the standards and principles of the Australia ICOMOS Burra Charter (1999), and the NSW Heritage Manual. A site inspection was carried out to assess the bridge and identify other items of heritage significance. The site inspection did not involve intervention or disturbance of the bridge fabric.

7.2 Description of the existing environment

The Spit Bridge (RTA Bridge No.50) can be described as a steel and concrete girder bridge with a steel bascule lift span, completed in 1958. It comprises of three spans on the Mosman side of Middle Harbour, and three at the Manly end. The bridge was designed by the Department of Main Roads and built by an English firm, the Cleveland Bridge and Engineering Company in the 1950s.

7.2.1 Historical context

In Balmoral, farming activity was established by 1813. In Mosman, a whaling station was developed 18 years later, followed by other land grants in the Mosman area in the 1830s.

Although a punt crossing was in operation from the 1850s, the area immediately around The Spit itself was not settled until the 1880s.

Prior to the construction of permanent bridge crossings, large areas of Sydney Harbour could only be traversed by boat. The establishment of defensive works at Georges Head helped to open up the headlands beyond Mosman.

By 1832, a track was established from North Sydney to Middle Harbour, following a route roughly in line with Military and Spit Roads.

The Spit provided one of the narrowest harbour crossing places, and a punt is first thought to have been operated in 1849 by Peter Ellery (and later his son).

As settlement expanded, transportation requirements increased to service the area.

The Government ferry commenced operation during the 1880s.

In 1893, electric trams ran between North Sydney and Spit Junction with services extending to The Spit by 1900. Cheap transportation allowed the suburbs to further open up, and a period of home building in the Mosman area followed the arrival of the trams.

The Spit was a narrow stretch of sand at this time, with limited land available. Most activity at The Spit itself was associated with sailing and recreational activity. Boatsheds and private moorings were built some time after 1891.

This changed with the construction of the new sewerage system with associated buildings at The Spit and Clontarf. Excavation for the pipeline removed large quantities of soil, which was redistributed over the tidal flats west of The Spit. A seawall was built, forming an area of reclaimed land now used for recreation purposes.

7.2.2 History of the Spit Bridge

Previous bridge at The Spit

The existing Spit Bridge replaced an earlier bridge, which spanned the waterway since 1924.

The previous bridge was mainly a timber beam span construction with piers, walings and braces sheathed in metal. The opening span consisted of a double leaf bascule (that is, both sides opened). Trams could not be accommodated on the bridge and tram passengers walked across.

Certain physical constraints affected the design of the previous bridge and the approaches. A new alignment for Spit Road was constructed and on the northern side, a road was cut through the rockface to help eliminate dangerous hairpin bends that had characterised the northern route to the punt. The road level on the rocky northern shore was located approximately 12m above the sand spit, and the bridge was constructed with a different gradient either side of the opening span. The road on the southern side was prone to landslides and was considered unfit for increased traffic. To solve this problem, work was started in 1923 on a new road on the west of the hill (towards Pearl Bay). This was named Spit Road and the old alignment re-named Parriwi Road.

Form of the bridges

The present Spit Bridge continues a long tradition in NSW of providing opening road bridges over a navigation channel. Opening span bridges were mainly built over larger river channels or harbours where commercial freight and passenger services operated and where a high level bridge was not feasible. High level bridges often require extensive approaches to achieve the necessary height clearance and are thus generally more expensive and intrusive over a larger area. Opening span bridges are favoured in areas where the volume and needs of road traffic exceed that of shipping, as is the case for the Spit Bridge.

Both bridges built at The Spit have had bascule type opening spans. This type was favoured during the 1890s and continued to be used into the twentieth century. Between 1902 and 1926 the girders were generally steel with timber decks and the bascule opening was controlled by a series of counterweights rolling down a curved track.

By the time of construction of the second bridge, advances in bridge construction had been made and newer stronger materials were more readily available. After the First World War, a new era of bridge building in New South Wales began where steel and reinforced concrete became the preferred materials for large highway bridge construction. For the next fifty years, reinforced concrete was the dominant material for bridge design in New South Wales.

The Second World War caused a lull in concrete bridge construction. Before the war, more than 60 bridges were being built per year, but a shortage of manpower and bridge contractors meant fewer public works of this nature could go ahead. This lull lasted until the boom in road vehicle usage and city expansion of the 1950s.

Construction of the new bridge

Tenders for the construction of the new bridge were called in May 1950. Controversy surrounded the proposal to replace the previous bridge with another low level opening bridge. The basis for this decision was the costs associated with a high level bridge, the potential impacts on The Spit, and the preference for an alternative location for a high level bridge (that is, that The Spit was not considered to be the best location for a high level bridge).

The new bridge, as proposed at the time, involved the following features:

- Built downstream of the existing wooden structure;
- Built higher and wider, carrying four lanes of traffic and two footways;
- Designed by the Department of Main Roads;
- Built of concrete and steel with seven plate girder spans and one opening span - all of the superstructure was to be steel, while the substructure was concrete;
- An electrically driven single-leaf bascule opening span allowing marine traffic to pass through;
- Depending on the position of the piers, some foundations were placed on bedrock (up to 100 feet below the water) and the rest on concrete piles;
- A bridge operator, housed in a control cabin with views over both harbour and road traffic; and
- Work also involved improving the road approaches, eliminating the steep one-way roads with hair-pin bends that were still in use on the Manly side.

Construction of the bridge commenced in September 1952 and concluded six years later in 1958 after 33 separate industrial disputes, together with difficulties in constructing the foundations, contributed to delays of almost four years.

It is noted that there are no significant modifications that detract from the integrity of the original design.

7.2.3 Heritage listings

Statutory controls and current listings

State heritage register

All historic remains and all potential sub-surface archaeological features are subject to the relics provisions of the NSW *Heritage Act 1977 (amended 1998)* and are therefore afforded concurrent statutory protection under this Act.

The NSW State Heritage Inventory includes its listing in both the Mosman and Manly LGAs (database numbers 2060470, 10065).

The bridge is not listed as an item on the State Heritage Register, and Heritage Council approval is not required.

RTA's heritage register

In addition, Section 170 of the Heritage Act requires that culturally significant places managed by government agencies be listed in their departmental Heritage and Conservation Registers. Items listed on the RTA Section 170 register must be managed in accordance with the RTA's Heritage Management Procedures and Heritage Guidelines (RTA 1999).

The Spit Bridge is listed on the RTA register as a place of historical significance.

Local and regional listings

Local Environmental Plans (LEPs) make provisions for responsible management of items of environmental heritage. Generally, the provisions of the LEP include referral of all works to listed items to the council for approval. Regional Environmental Plans (REPs) also list items of environmental heritage.

The Bridge is listed by both the Mosman and Manly Council LEPs but is not listed by SREP 23.

Non-statutory controls

Both the National Trust of Australia and the Australian Heritage Commission (Register of the National Estate) maintain registers of significant heritage items.

The National Trust of NSW has not classified the bridge, nor does it appear on their Industrial Archaeology register, although the Trust noted that additional items are likely to be added to their register as they continue their survey work throughout NSW.

The Bridge is not listed on the Register of the National Estate.

7.2.4 Other heritage items

Listings

The Mosman LEP lists the following archaeological sites in the study area:

- Remains of former bridge and seawall, Spit Road (local significance); and
- Site of former road to the Spit, Upper Spit Road Parriwi Park, end of Upper Spit Road (local significance).

In addition, Spit and Parriwi Roads (from Spit Junction to James Street) are listed as being Historic Road Alignments under Schedule 4 Original estate roads. The site of the former road to The Spit is also listed on the NSW State Heritage Inventory.

The Manly LEP lists various components associated with the former bridge and transportation as 'Items of the Environmental Heritage':

- The former Spit Bridge, between Seaforth and The Spit;
- Reserved track for trams from Whittel Avenue to the Spit Bridge, Seaforth;
- Vehicular ferry ramp, Spit Bridge, Seaforth; and
- Tram terminus and wharf for traffic punt, Spit Bridge, Seaforth.

The above items are also included on the NSW State Heritage Register.

Certain trees in the immediate area are also listed by the LEP as items of landscape heritage.

Field survey

There are no visible signs of any remnants of the original bridge, however it is possible that some remnants of the original Bridge's pilings may still exist in the harbour bed.

During the field survey, a number of other heritage items were identified in the vicinity of the bridge. These items (described below) are all transport related and represent the various methods of providing transport across Middle Harbour.

Remnant vehicular ferry ramp

There are substantial in situ remnants of the sandstone ramps used for the loading and unloading the tram cars onto the punt that operated across the Spit. These ramps are present on both sides of the crossing.

The southern ramp is situated directly in front of the southern abutment, while the northern ramp is located approximately 75 m east of the northern abutment. These ramps are listed on the NSW State Heritage Register.

Remnant tram terminus and ferry wharf

There are substantial in situ remnants of the sandstone retaining walls used to form the level platform for the tram terminus and its associated wharf facilities. The tram terminus and wharf remnants are located in the same general area as the northern ramp.

The remnant retaining walls are situated along the tideline and commence approximately 20 m east of the northern abutment and continue, in an incomplete fashion, for approximately 50-75 m in an easterly direction.

Reconstructed seawall – adjacent the southern abutment

There is a small section of reconstructed seawall adjacent to the western side of the bridge at the Mosman end. The structure is located approximately 3m west of the western margin of the bridge and extends to halfway between the southern abutment and pier 1.

7.3 Significance assessment

7.3.1 Assessment of cultural significance

The following is an assessment of the cultural significance of the bridge according to relevant criteria established by the NSW State heritage Register.

Criterion A (Historic): an item is important in the course, or pattern, of NSW's cultural or natural history.

The Spit Bridge has a high level of significance to the localities of Mosman and Manly. The large scale development of the northern beach suburbs was dependant upon a crossing at Middle Harbour. The Spit Bridge, in its current form has served this purpose since 1958.

Criterion B (Social): an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history;

Not applicable.

Criterion C (Technical/Aesthetic/Creative): an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW.

The Spit Bridge has aesthetic significance due to its low level nature and ability to blend with the surrounding urban and marine landscapes. The fact that the lift span is still operational contributes to the aesthetic appeal of the structure. Due to its size and bulk it forms a significant local landmark.

Criterion D (Social): an item has strong or special association with a particular community or cultural group in NSW for social, cultural or spiritual reasons.

The Spit Bridge has significance as the gateway between Mosman and the northern beaches. The Spit is the major geographical feature in the area, and the centre for recreation, particularly sailing, which has a long history in this location.

Criterion E (Scientific/Technical): an item has the potential to yield information that will contribute to an understanding of NSW's cultural and natural history.

The bridge has significance under this heading, as it is a rare example of the bridge type. The Spit Bridge is the only remaining example of a bascule lift span that is operational on a major arterial road in the greater Sydney area. It is noted that there are no significant modifications that detract from the integrity of the original design.

Criterion F (Rarity): an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history.

The Spit Bridge is a rare example of an operational lift span bridge situated on a major arterial road within the metropolitan area.

Criterion G (Representative): an item is important in demonstrating the principal characteristics of a class of NSW's cultural or natural places; or cultural or natural environments.

The Spit Bridge is an excellent example of a moveable span bridge that is located in an easily accessible area. The bridge also represents the ongoing role of The Spit as an important crossing point over Middle Harbour since the early days of colonial settlement.

7.3.2 Statement of Heritage Significance

The Statement of Heritage Significance provided within the Statement of Heritage Impact is as follows:

The Spit Bridge is considered to be an item of moderate State significance based on its ability to fulfil the Historic, Aesthetic/Technical, Social, Scientific, Rarity and Representative criteria under the *NSW heritage Act 1977* (as amended).

It is a substantial landscape feature that has played a role in allowing the development of the northern beaches suburbs to occur over the last 44 years. The bridge is also rare, as it is the only lift bridge still operational on a major arterial road in Sydney. As such, the Spit Bridge is representative of all the major lift bridges that were once a common sight throughout NSW. The relative lack of modification to the original design of the bridge also contributes to its level of significance. Historically, the bridge has a high level of significance developed primarily through being part of an important local transport route, which has been in operation over a large period of time, in different forms.

The Spit Bridge cultural landscape also contains remnant features and the location of the former bridge and punt crossing, and the remains of other transportation links such as the tramways.

7.4 Assessment of potential impacts

The predicted impact is based on the proposal to widen the existing bridge structures. As noted previously, the proposed widening method would involve constructing a new concrete bridge adjacent and to the west of the existing structure and join the two to form what effectively would be one widened structure. As such, the proposal would fall within the broad concept of adaptive re-use and would see the existing bridge continue to function, complete with operational lift span as integral components of an important transport corridor.

A condition of the design brief is that the design is to be sympathetic in form to the existing structure, and would be required to reproduce important detail components such as the handrails and light stanchions from the existing structure.

While the form and fabric of the new bridge would be relatively sympathetic to the original structure, it would be readily identifiable as a result of differences in fabric, construction technique and design issues (this is required under the Burra Charter). The proposal would involve removing a moderate amount of structure from the western side of the existing bridge. Structure removed would mainly be the railings, footway and kerbing on the western side of the bridge, along with a proportion of the abutments as required.

The proposal aims to keep the design of the new structure in keeping with that of the existing bridge.

As a result, it is considered that the proposal would have only a moderate negative impact upon the heritage value of the overall bridge complex.

This impact is minimised as the proposal keeps the existing Spit Bridge in use as a functioning component of what is a continuously evolving road system.

7.4.1 Assessment of heritage impact

Based on the guidelines of the NSW Heritage Office Manual, the Statement of Heritage Impact needs to address a number of questions relating to the proposed works on an item of cultural significance.

These questions help to ascertain whether all options have been explored prior to the proposed works taking place. The questions that need to be asked differ depending upon the type of development proposed and the item to be affected. The following discussion is presented in response to the relevant questions from the manual, relating to the minor demolition works component of the project:

1. Is the demolition component of the project essential for the Spit Bridge to function?

- The demolition is not required for the bridge to keep functioning in its present form. However, in order for the bridge to function effectively in the future the partial demolition is necessary to enable the widening of the structure to take place.
- If the bridge is not widened, it would not be able to remain an effective component of the contemporary road system due to the volumes of traffic in this area.
- Therefore, it can be argued that the partial demolition is required in order for the bridge to continue functioning efficiently and remain in its primary context.

2. Are important features of the Spit Bridge affected by the demolition?

- The demolition components of the proposed works focus on removing the bridge's western hand rail, overhead lighting stanchions, kerbing, partial abutment wings and other sundry minor structural items.
- The pedestrian railings and lighting stanchions are very significant visual and stylistic components of the bridge.
- The western wing of the bridge's southern abutment would be removed.

3. Is the resolution to partially demolish sympathetic to the heritage significance of the Spit Bridge?

- Assessed in isolation, the proposed demolition works are not sympathetic to the heritage significance of the bridge, as they would remove a small proportion of original structural fabric.
- Assessed within the context of keeping the bridge as an operative component of the road network, the proposed demolition works are sympathetic to the heritage significance of the bridge.

4. Is the partial demolition a result of the condition of the fabric?

- The partial demolition of bridge structure is not required due to the condition of the fabric.

5. How is the impact of the addition on the heritage significance of the Spit Bridge to be minimised?

- The additions to the bridge are to be carried out in a manner that is sympathetic to the form and structure and scale of the existing bridge.
- The concept design demonstrates the reuse of the existing pedestrian barriers and lighting stanchions from the demolished section of the current structure. The inclusion of these visually distinctive components supports the view of the proposed development as an ongoing modification of the existing structure.
- The re-use of original fabric would help to tie the two structures together visually so that they are perceived as a single unit.

6. How is the impact of the new development on the surrounding cultural and visual landscape to be minimised?

- The proposed additions to the bridge do not insert a wholly new and independent item into the cultural landscape. The new structure is an extension to an item that already exists. The new structure would be integrated with the existing bridge. The scale of the proposed new structure, combined with the integration of old and new fabric would not fundamentally change the way the bridge complex interacts with the surrounding cultural landscape.
- Stakeholder consultation, regarding landscaping around the structure would take place during the ongoing design and construction phases of the project, in order to further minimise visual impact.

7. Will the additions tend to visually dominate the existing Spit Bridge?

- The western aspect of the bridge would be dominated by the proposed widening, however it would be sympathetic in form to the bridge as a whole.
- The additional traffic lanes would marginally widen the existing bridge deck. The concept proposal indicates that the design and size of the support structures, i.e. piers, girders etc would be kept in line with the existing bridge components.
- Changes in technology construction technology would ensure that the new structural components would be readily identifiable as new fabric, whilst being sympathetic in size, style and fabric to the original.

8. Are the additions sited on any known, or potentially significant archaeological deposits? If so, have alternative positions for the additions been considered?

- Refer section 8.

9. Has the advice of a heritage consultant/specialist been sought?

- Austral Archaeology Pty Ltd was engaged by the RTA to conduct a Heritage Assessment of the Spit bridge and prepare a Statement of Heritage Impact for the proposal works.

7.5 Conclusion and mitigation measures

The proposed widening of the Spit Bridge would have some negative impact on its cultural heritage significance. However, this impact is considered to be relatively benign, as it would ensure that the bridge remains firmly situated within its primary context for a number of years to come.

The Statement of Heritage Impact prepared by Austral concluded:

- The design of the new bridge components would remain fundamentally sympathetic to the form, function and design ethic of the existing structure and adhere to the principles of the 'Australia ICOMOS Burra Charter 1999' (refer Appendix D);
- The new design would be consistent with the form of the western face of pier four and other major visual components of the bridge structure;
- There would be no significant impact upon the appearance of the control tower, as this forms a major visual component of the bridge;
- As depicted in the concept drawing, the handrails and light stanchions from the western side of the existing bridge should be re-erected along the western side of the new structure;
- It is recommended that an archival quality photographic essay of the Spit Bridge should be carried out prior to any works taking place. In addition, construction of the new section of bridge would also be archivally recorded, as well as the way in which it interacts with the original structure. Following completion of construction, this information could form part of the interpretation of the overall bridge complex;
- All photography and other recording would comply with the standards of the NSW Heritage Office (refer Appendix D)
- During the construction works, the cultural resources within the surrounding landscape would be protected as far as practicable. Prior to any site works taking place, these items should be identified and fenced off. Controls regarding protection of these items would be included within the construction EMP;
- The EMP would include a requirement that works associated with the proposal must cease if historic artefacts are uncovered during the construction process, regardless of whether archaeological monitoring is taking place. The NSW Heritage Office must be contacted if historic remains are uncovered;
- The EMP would include information about the statutory legislation protecting sites and places of cultural heritage, the process required when remains are uncovered, and responsibilities in this regard.
- Interpretation, in the form of information and educational boards, would be provided as follows:
  - The significance of the cultural landscape as an important transport corridor and crossing place should be interpreted with respect to the thematic topics identified by the NSW Heritage Office, and the recently revised Australian Heritage Commission 'Australian Historic Themes' (2001) and the Australia ICOMOS Burra Charter (1999) (refer Appendix D for more information);

- The information presented should inform the visitor of the individual and group significance of the cultural resources according to the NSW heritage legislation and assessment criteria. It should educate the visitor about the heritage framework that protects heritage resources, such as these bridges;
- The interpretive information should discuss the technology of bridge design and its context in the immediate region and the broader landscape. In particular, the interpretation should address the way in which the bridge came into being and the role it, and the crossing in general, has played in the general development of the area; and
- Some interpretation should be installed prior to the commencement of the works, to inform the public of what is going on and what efforts are being made to protect significant items of cultural heritage.

8. Aboriginal heritage and archaeology

This section provides a summary of the results of the Aboriginal heritage assessment undertaken by Australian Museum Business Services (AMBS), and includes historical information provided by Austral Archaeology. AMBS's full report is provided in Appendix E, and Austral's report is located in Appendix D.

8.1 Introduction

The archaeological assessment was carried out in consultation with the local Aboriginal community, through the Metropolitan Local Aboriginal Land Council (LALC), and in accordance with the requirements of the National Parks and Wildlife Service. It involved an assessment of the potential for impact on Aboriginal heritage. This assessment aimed to identify whether there were any known Aboriginal sites or Aboriginal heritage values within the area likely to be impacted by the proposal.

The broad methodology of the assessment involved:

- Review of available background information on Aboriginal heritage in the area, including a search of the NPWS Aboriginal Heritage Information Management System (previously the Aboriginal Sites Register) and review of previous archaeological investigations in the local area. The environmental context of the study area and previous land use history was also reviewed;
- A site inspection with a representative of the Metropolitan LALC;
- Consultation with the local Aboriginal community, through the Metropolitan LALC, regarding Aboriginal sites, heritage values and management issues;
- The scope of works aimed to identify the known and potential Aboriginal heritage (incorporating both sites and values) within the study area;
- Identification of management measures to reduce or ameliorate any adverse impacts of the proposal on Aboriginal heritage; and
- Assessment and reporting.

8.2 Description of the existing environment

8.2.1 General context

The Spit is recorded as being called Burrabru and Burrabri. The origin of the name Burra is not clear. It may have come from the association of this group with the area around The Spit.

Aboriginal people were observed to often use the rock shelters around Port Jackson. People were seen spear fishing in Middle Harbour in the 1850s.

The Spit and the north shore of Middle Harbour may have formed only part of the country over which local Aboriginal communities would have obtained their resources. The vegetation and animal communities available would have extended well beyond the

boundaries of the study area, and other communities of woodland, forest and heath as well as estuarine swamps provided other plants and animals which provided additional types of food and raw materials.

The inhabitants of the northern stretches of Sydney Harbour around present day Mosman were the Cammeragal people (or Cam-mer-ray-gal) named after the portion of harbour known as Cam-mer-ray. Their territorial range extended north to the Warringah area. Archaeological investigation of caves in the region identified Aboriginal occupation dating back to approximately 3780 BC, with extensive occupation evidenced by midden remains and numerous examples of rock art. The area was covered with thick bushland and the many high rocky cliffs with narrow bays provided natural defences and ample resources from marine and terrestrial sources. With the arrival of English settlers, the northern shores of the harbour become an early location for contact between the Aboriginal tribes and sailors as the coves were used to provide anchorage for visiting ships.

The last tribal corroboree was held at Clontarf in 1968 in honour of the visiting Duke of Edinburgh with participants from all the Sydney tribes. By this time tribal structure had severely broken down and traditional hunting and fishing grounds around Mosman were falling out of use.

In the coastal zone, Aboriginal sites have survived mainly in areas of natural bushland, and along undeveloped foreshores in national parks and local council reserves.

Aboriginal sites around Middle Harbour are mostly shell middens either in open contexts or in rock shelters. The density and number of middens and deposits is highest on the Middle Harbour sub-catchment. This distribution may be due to the Middle Harbour sub-catchment having a greater length of estuarine foreshore, greater area of Hawkesbury sandstone and greater areas of undeveloped bushland in national parks and council reserves where sites could survive.

8.2.2 Aboriginal sites in the surrounding area

NPWS database records

While no Aboriginal archaeological sites have been recorded in the immediate vicinity of the bridge, a number of sites are identified in the surrounding area, both on the northern and southern shores of Middle Harbour near The Spit.

There are 19 sites registered on the NPWS Aboriginal Heritage Information Management System for the surrounding area. These include 12 shelters with midden, three open middens, two open camp sites (artefact scatters), one rock engraving and one shelter with art and midden. The sites are listed in Appendix E.

The site closest to the bridge is a rock shelter with midden (45-6-1022) recorded in 1979. The site, called 'Spit Bridge Cave', is situated on the northern shore of Middle Harbour. The database record locates the site to the northeast of the Bridge (refer to Figure 1 of Appendix E). However, the site card describes the site as being on the northwest side of the Spit Bridge. The Australian map grid coordinates may be incorrect. This could be the result of the conversion of the Imperial coordinates to Australian map grid coordinates, as it is an early site recording. The site card does not provide much detail on the site, other than

stating that the shelter is large and contained shell midden but no art. The site card also states that early recordings suggest The Spit itself was a favoured camping spot and that because of the narrowness may have been a main contact and trading point.

Another previously recorded site (45-6-1027) situated near the bridge (approximately 160m northeast), is an open midden reported to be located at the head of Fisher Bay at the west end of the beach. The site was also originally recorded in 1979. At that time it was described as a densely overgrown midden. An attempt was made to locate this site in 1989 as part of the Port Jackson Archaeological Project, however it was not found. This was attributed to the dense vegetation in the area.

Results of site survey

Southwest side of bridge

Archaeological visibility was restricted to about 5% by grass cover and trees. There was some bushland on a steep slope to the west of the road in the far south. There was one rock shelter which had a sloping rock floor.

No Aboriginal sites or areas of Potential Archaeological Deposit (PAD) were found.

Southeast side of bridge

No Aboriginal sites or areas of PAD were found.

Northwest side of bridge

This was private land apart from a small section of rocky shore under the bridge. The private land was not surveyed. Site 45-6-1022 was recorded as being located in this area but it could not be relocated.

No Aboriginal sites or areas of PAD were observed in the area surveyed. The site may now be within private land (which was not surveyed), given the increased residential development since the site was recorded in 1979.

Northeast side of bridge

Archaeological visibility was low, being about 5% in the park (away from the tracks), due to dense undergrowth and leaf litter.

The inspection of this area covered the grassed area and the tracks through the reserve about as far as the grid location given for site 45-6-1027. This site, a shell midden, could not be relocated. The grid location given placed it in Fisher Bay. A thorough search was carried out of approximately a 100m radius around the reported grid location in an effort to find the site. No rock shelters were seen in this area.

No Aboriginal sites or areas of PAD were found.

8.3 Assessment of potential impacts

The landscape of the Spit Bridge area suggests that it was an area that would have been used by Aboriginal people in the past.

It is reasonable to conclude that Aboriginal people used The Spit as a waterway crossing point, as it is the narrowest part of the waterway at this location.

However, much of the study area has been substantially disturbed by historic land uses so that any evidence of past Aboriginal occupation and use is likely to have been destroyed.

The extent of previous disturbance to the immediate landscape has substantially reduced the possibility of Aboriginal archaeological sites remaining intact within the study area. Therefore, the study area has no known archaeological significance.

There is some potential for archaeological evidence to remain in areas that are intact and where archaeological sites have previously been recorded, such as the reserve around Fisher Bay to the northeast of the bridge.

A review of background information and an inspection of the study area did not reveal any Aboriginal archaeological sites within the area of impact. There are no known constraints to the proposal on the basis of Aboriginal heritage.

No known Aboriginal sites would be affected by the proposed bridge widening. No additional approvals are required to be issued by the NPWS.

No sites were registered on AHIMS within 100m of the Spit Bridge (although the revised location of site 45-6-1022 should be noted). No Aboriginal sites were found during the site inspection of the study area. Sites previously recorded in the vicinity could not be relocated. If sites remain in the area below Avona Crescent there may be the potential for them to be impacted by any disturbance to this area (for example, during use as a construction site).

The heritage value of the place to the local Aboriginal community is a separate issue. The local Aboriginal community, through the Metropolitan LALC, has not yet provided a statement on the cultural significance of the study area. While there is a lack of archaeological material, the fact that the study area is The Spit itself, which has been described as being a 'favoured camping spot' (site card for 45-6-1022) and is the narrowest point at which to cross the waterway, there is a likelihood that it was an important place to the Aboriginal people that lived in and used this area.

8.4 Conclusion and mitigation measures

There are no constraints to the proposed bridge widening on the basis of Aboriginal heritage.

All 'Aboriginal objects' (commonly referred to as sites) are protected under the *National Parks and Wildlife Act 1974*. Therefore, care should be taken to avoid ground disturbance in any areas which potentially retain buried Aboriginal archaeological material. In addition, if an Aboriginal archaeological site is found during development works, all works on or adjacent to the Aboriginal site must cease and the NPWS contacted regarding how to proceed.

The archaeological assessment did not identify any Aboriginal archaeological sites ('Aboriginal objects' defined under the *National Parks and Wildlife Act 1974*) within the study area. However, a number of Aboriginal archaeological sites are known to occur in areas surrounding the Spit Bridge, on both sides of Middle Harbour. Mitigation measures include the following:

- Given the presence of Aboriginal archaeological sites nearby, particularly the shelter with midden to the north west of the bridge (45-6-1022), the shell midden near Fisher Bay (45-6-1027) and the artefact scatter site at Fisher Bay (45-6-2351) on a flat grassy area adjacent to the water, care would be taken to avoid any ground disturbance in these areas which potentially retain buried Aboriginal archaeological material.
- All 'Aboriginal objects' are protected under the *National Parks and Wildlife Act 1974*, as outlined above. It is an offence to destroy, deface or damage an Aboriginal object or Place without a consent issued by the National Parks and Wildlife Service.
- Controls regarding protection of these items would be included within the construction EMP;
- The EMP would include a requirement that works associated with the proposal must cease if an Aboriginal archaeological site is uncovered during the construction process. The Indigenous Heritage Division of the NPWS must be contacted if Indigenous artefacts are uncovered;
- The EMP would include information about the statutory legislation protecting sites and places of cultural heritage, the process required when remains are uncovered, and responsibilities in this regard.
- The local Aboriginal community, through the Metropolitan LALC, would continue to be consulted in any future decisions regarding the study area. Continued liaison should ensure that any works do not compromise the Aboriginal heritage value of the place. Any specific recommendations made by the Metropolitan LALC should be incorporated.

9. Traffic, public transport and access

Background data for this section was provided by the RTA.

9.1 Description of the existing environment

9.1.1 Road network and traffic

Traffic volumes

Current traffic volumes at the Spit Bridge average 69,000 vehicles per day. In typical weekday peak periods, volumes of 3700 vehicles per hour are observed city-bound in the morning and 3600 per hour northbound in the evening.

Traffic growth averaged 0.9% per annum between 1989 and 1999, and no significant growth has been observed since 1999.

Network and road capacity

The Spit Bridge currently provides four traffic lanes, with a peak period tidal flow scheme which allocates three lanes to the peak direction and one lane to the contra-peak. The approach roads (Spit and Manly Roads) both provide three lanes in each direction.

Intersections within 500m of the bridge include Battle Boulevard to the northwest, Avona Crescent to the northeast and Parriwi Road to the southeast.

The existing road corridors are now severely congested both during commuter peaks and during the weekend leisure hours, particularly the Spit/Military Road corridor. Morning commuting motorists travelling towards the city encounter congestion at the Seaforth roundabout on Frenchs Forest Road and at the Frenchs Forest Road / Burnt Bridge Creek Deviation / Sydney Road intersection. There are also constraints on the city side of the bridge at the Spit bends (at the top of the Spit Hill) and the intersections with Medusa and Ourimbah Roads, and from Spit Junction along Military Road to the Warringah Freeway.

There is significant peak hour usage of local roads, or rat runs, in the area. In particular, Pearl Bay Road is used by City bound traffic in the morning peak. There is a one way section on this route that prevents it being used in the opposite direction.

In the morning peak the bridge operates with a city bound T3 transit lane (along which the buses travel) from the Burnt Bridge Deviation to Military Road. The bridge is operated as three lanes towards the city (including the T3 lane) and one lane to the north. This requires northbound traffic to merge from three lanes into one. Further up Spit Hill to the south of the bridge, a right turn into Pearl Bay Road is permitted. This attracts considerable traffic when the lights at Medusa Street (at the top of the Spit hill) are blocking oncoming traffic. This traffic eventually emerges onto the Ourimbah Road route that travels parallel to Military Road.

In the evening peak, there is a northbound clearway from the Spit Junction to the Sydney Road Junction, and a southbound bus lane between the Burnt Bridge Deviation and Avona Crescent. The bridge operates as three lanes to the north and one to the south requiring a

merge from three lanes into one for southbound traffic. The Pearl Bay Road access is not available for city bound traffic.

In off peak periods the bridge operates with two lanes in each direction, requiring a merge from three lanes to two for traffic travelling in either direction. The Pearl Bay Road access is not available for city bound traffic.

The tidal flow arrangement operating during peak hours is implemented by inserting 'candy bars' into the road pavement on the approaches to each side of the bridge. This involves manually changing the candy bars both before and after each peak period, requiring the use of two crews (2 trucks, four people) for about an hour for each of the four changes. This activity has been estimated to cost approximately $200,000 per annum.

The tidal flow arrangement results in extensive delays for traffic flowing against the peak direction. Travel time survey data reveals significant increases in the contra peak travel times for both directions over the last three years. Peak and business hour travel times have also been increasing steadily for the peak direction.

There are also extensive delays during the weekend when the tidal flow does not operate. At the weekends traffic from both directions merges from three to two lanes at the bridge approaches resulting in significant queuing at times and causing a major choke point at the bridge. It can be expected that there have been a number of unreported minor collisions at the merge points.

Other relevant proposals

As noted in Section 2, the RTA is proposing to reduce the weekend openings of the Spit Bridge and to implement a 3pm to 7pm clearway on weekends and public holidays for southbound traffic along Spit Road to Ourimbah Road. The proposal aims to reduce weekend traffic congestion along the Spit Road corridor, improve traffic flow at what is a peak time, and improve efficiency of weekend afternoon bus operations.

9.1.2 Public transport

As noted in Section 2, the Spit Bridge provides the main link for bus access to the northern beaches/peninsula area.

Public transport along the corridor is primarily provided by the State Transit Authority (STA). All STA buses to and from the northern beaches/Warringah peninsular area travel via the Spit Bridge, with the exception of a service to Chatswood. Destinations serviced by these buses include North Sydney, Milsons Point, Chatswood and Epping as well as the Sydney CBD.

During peak hours, buses travel in the signed T3 lane. Peak period flows include approximately 90 buses per hour in the peak direction, and 20 buses per hour in the contra-peak.

There are bus stops within approximately 100m of the bridge on both Manly and Spit Roads.

9.1.3 Access to nearby properties

Access to the D'Albora Marina is off Spit Road adjacent to the western lanes of the southern approach (for vehicles travelling north). This access lane also provides access to the Ellery carpark at the northwestern end of the Spit.

A slip lane off Spit Road adjacent to the eastern lanes of the southern approach (for vehicles travelling south) provides access to businesses at the northwestern end of the Spit. Access to other businesses and carparks is directly off Spit Road and/or Parriwi Road.

Access to residential dwellings at 1 Manly Road (to the northwest of the northern approach) is via a service road that runs parallel to Manly Road, intersecting with Battle Boulevard.

The road is marked with double white lines in the vicinity of the bridge – this – together with the level of traffic, means that access is via left turn only.

9.1.4 Car parking

Information on existing carparking in the vicinity of the bridge is provided in Section 6.2.

9.1.5 Pedestrian and cyclist networks

Pedestrian and cycle access is provided over the bridge by means of a shared cycle/walk way on each side of the bridge, separated from road traffic by a fence.

9.1.6 Navigation

The current situation with regard to opening of the bridge is as follows:

- Weekdays – the bridge opens seven times in winter and eight times in summer. The first opening is at 10.15am, with no openings between 2.45 and 7.30pm.
- Sat-Sun – opens 11 times, approximately hourly between 8.30am and 9.30pm.

9.2 Assessment of potential impacts

9.2.1 Construction impacts

Short term impacts on traffic and access would occur during the construction period. Partial closure of the bridge would occur at limited times during the construction period. However, these impacts would be short term only and appropriate measures would be implemented to minimise disruption to traffic and access.

Watercraft

During installation of the widened bascule span, the opening span would not be able to operate for an extended period (up to four weeks). This would restrict passage of high masted vessels during this time.

Bridge traffic

Potential impacts to traffic during construction would be minimised as a consequence of construction techniques employed by the contractor. In general, construction would follow accepted road-construction practices.

The majority of the widening would not impact on traffic flow. The standard construction hours for the proposal would generally be limited to five days per week 7am – 6 pm and Saturday 7am – 3 pm.

At the interface with the existing bridge, some activities would need to occur outside these hours. These activities include the widening of the lift span and removal of the existing footway and barrier on the western side. The contractor may have to work 24 hours a day for a couple of weeks on these activities to minimise disruption to traffic and navigation. There may be need to reduce the number of lanes operating on the bridge at these times. This would however be restricted to off peak times.

Property access

As noted in Section 3, Access to the D'Albora Marina would be maintained by the provision of temporary access through the car park on the southern boundary of the marina whilst construction of the permanent access is in progress.

Access will be maintained to the residential properties near the northwest approach, however some short term restrictions may be required during rock excavation activities as a result of public safety considerations. Some restrictions would be negotiated with property owners.

Pedestrians and cyclists

The western footway would be closed to pedestrian and cycle traffic for the duration of the project. Pedestrian and cycle access via the eastern footway be unaffected.

Construction traffic

Material delivery, general construction vehicles and workforce/visitors parking would be associated with the contractor's main construction compound. Parking would need to be provided for approximately 25 vehicles. Deliveries to the construction compound would take place during daylight hours. It is estimated that this would average three trucks per day. Delivery of steel girders would take place during non-peak hours, and would most likely involve delivery to a temporary staging area where they would undergo preparation prior to lifting in position during nighttime lane closures.

9.2.2 Operation impacts

Road network/traffic

At present, the Spit Bridge itself is not the most significant choke point along the corridor for peak direction commuters. The volume of traffic flowing onto the bridge is regulated by the intersections at Seaforth and Spit Junction. However, the easing of any of the bottlenecks on either side of the bridge would result in the bridge itself becoming the major bottleneck.

Traffic across the bridge is further delayed when the bascule span is raised to allow the passage of tall vessels. Bridge openings to allow navigation traffic do not occur during the weekday commuter peaks. Bridge openings generally last for less than ten minutes but can cause long queues, especially at weekends. Dispersal of these queues is impeded by the traffic having to merge from three lanes to two. The provision of the additional lanes should significantly reduce the time to clear these queues.

The existing Spit Bridge provides four traffic lanes, with a peak period tidal flow scheme which allocates three lanes to the peak direction and one lane to the contra-peak. Widening the bridge to provide three lanes in each direction would provide no significant benefits to traffic in the peak direction, but would reduce travel times in the contra-peak direction by approximately two minutes.

Public transport

As stated in Section 2, the proposal has the potential to provide a significant opportunity for public transport. This potential has been recognised in correspondence received from the Department of Transport (incorporating input from the STA).

In particular, there is a requirement for buses to return north across the Spit Bridge in the morning peak to reposition for a second trip. Almost 50% of peak flow bus services operate back 'in service' over the Spit Bridge. This repositioning is currently compromised by the contra peak (that is, flowing in the opposite direction to peak hour traffic) congestion at the bridge. The Spit Bridge, with one contra flow lane at this time, is a critical choke point for these services.

According to the STA, the contra peak buses have experienced a 10 – 15% increase in travel times over the last two years between the city and Balgowlah. Recently, eight minutes additional operating time was provided for contra flow peak services to reduce late running in the corridor. The proposal would improve timetable reliability as well as provide some savings in travel times.

With respect to contra peak flows, accidents and breakdowns in the single available lane significantly effect bus services. The STA has indicated that one or two additional lanes would considerably enhance reliability.

The increase in lane capacity would clear the backup of buses after bridge openings considerably quicker, as there would be no need to merge.

The higher capacity 14.5m buses are not used on the route, as the existing lane widths are too narrow to allow comfortable negotiation of the tight curves and merges at the bridge approaches. Anecdotal evidence indicates that there are a considerable number of unreported bump and scrape accidents. The proposed improvement to the lane widths and the alignments of the approaches and the removal of the constraints at the merge points would facilitate the use of these larger buses.

In summary, it is considered that the proposal would result in the following positive impacts:

- Slight decrease in travel times in general (particularly a decrease in travel times in the contra peak direction);

- Smoother traffic flow in both directions at all times (removing the need for traffic to merge);
- Enables opportunities offered by other existing and any future proposals to be more fully realised;
- Increased efficiency in bus operations by decreasing travel times in the contra peak direction;
- Potential to increase the attractiveness of bus travel;
- Opportunities to use higher capacity buses; and
- Potential for reductions in illegal use of the T3 lane (as a result of the freer flow of traffic).

Property access

The existing access to the D'Albora Marina (and beyond that to the Ellery carpark at the western side of The Spit) is a narrow road which does not allow for an average car (5m long) to turn without executing a three point turn. As a result, vehicles must wait for a break in traffic (caused by the Parriwi road traffic signals) before attempting a three point turn, to then head north across the bridge. This situation would be addressed by the proposal.

The driveway to the D'Albora Marina would be modified to accommodate widening of the approach road and footpath.

A petrol tanker currently delivers fuel to the marina via this access road. The tanker stops on the ramp and temporarily blocks access while unloading. The tanker then reverses back to Spit Road and continues north across the bridge.

The proposal would allow a car to make the U turn in one movement, but would still require a three point turn for larger vehicles and the reversing of the petrol tanker for fuel delivery.

On the western side of the northern approach the service road would be modified to accommodate the widening of the bridge and the approach. The carriageway would be reduced to a single lane, with a kerb to kerb width of 4m. The vertical alignment of the service road would be adjusted to match the northern bridge abutment.

9.3 Mitigation measures

In order to minimise impact on traffic flow during construction, the following mitigation measures are proposed:

- Provide adequate traffic management, including temporary speed restrictions, precautionary signs, illuminated warning devices, manual traffic control and temporary barriers and markers;
- The boating community, including yachting clubs and marinas, would be consulted regarding the period of closure of the bridge's bascule span. At least three months notice of the proposed closure would be provided;
- Property owners in the immediate vicinity of the bridge would be consulted regarding proposed access arrangements during both construction and operation;

- The modification of the bascule span would occur in a period of least interruption to yachting traffic. It is expected that this would be the winter months.
- Maintain a thoroughfare for emergency vehicles at all times, with priority given to these movements when required;
- Establish safe access points to work areas from the adjacent road network including safety measures such as barriers, appropriate visibility and signage and the provision of traffic management measures such as those identified above;
- Ensuring property access is maintained at all times. This may require the temporary relocation of property access while permanent improvement works are made;
- Only the minimum practicable length and width would be under construction at any one time, to minimise disruption and inconvenience to road users during the works;
- Schedule disruptive works to take place outside peak commuting hours; and
- All traffic management measures would be undertaken in accordance with AS 1742.3 1996, Manual of Uniform Traffic Control Devices, Part 3: Traffic control devices for work on roads.

10. Noise

This section provides a summary of the results of the noise impact assessment undertaken by the Wilkinson Murray. The full report is provided in Appendix F.

10.1 Introduction

A noise and vibration assessment of the proposal was undertaken in accordance with the requirements of the NSW EPA's 'Environmental Noise Control Manual' (ENCM), and the EPA's 'Environmental Criteria for Road Traffic Noise' (ECRTN). The mitigation of operational traffic noise impacts was considered with regard to the RTA's Environmental Noise Management Manual (ENMM).

The assessment involved the following:

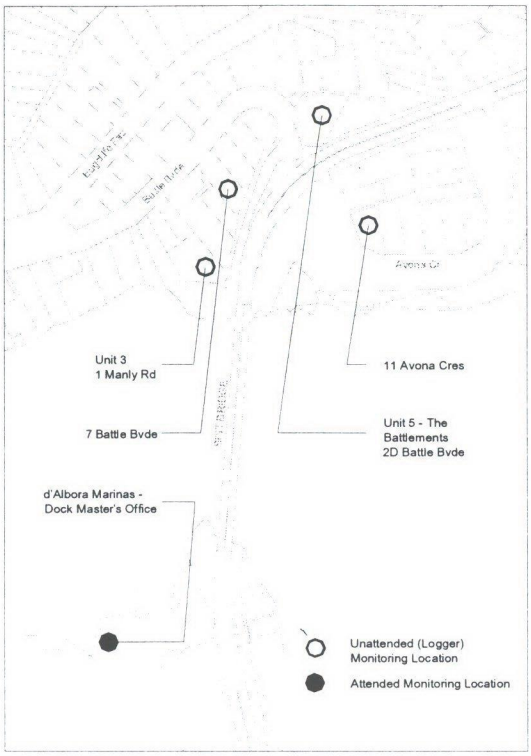
- Measurement of background noise levels in the study area;
- Establishment of construction and operational noise assessment goals;
- Prediction of existing traffic noise levels and comparison with the measured levels to validate the noise prediction model;
- Prediction and assessment of future road traffic noise levels from the proposal using computer noise models;
- Prediction and assessment of noise and vibration from construction activities; and
- Where required, investigation of possible noise control options to reduce predicted noise and vibration impacts using the criteria provided in the EPA's ECRTN and the RTA's ENMM.

10.2 Description of the existing environment

Background noise in the areas adjacent to the Spit Bridge is dominated by traffic on Spit and Manly Roads.

10.2.1 Noise measurements

Existing background noise levels were measured at several locations north of the bridge and at one location south of the bridge. These monitoring locations are shown in Figure 10.1. This information was processed to determine ambient background levels and other noise level descriptors relevant to the assessment of road traffic noise for both the operation and construction phases of the proposal.



Source: Wilkinson Murray Pty Ltd, 2003

Figure 10.1 Noise monitoring locations

10.2.2 Background noise monitoring results

Detailed monitoring results are provided in Appendix F. The monitoring results indicate firstly, the existing level of L_{Aeq} traffic noise which is required for prescribing traffic noise criteria and secondly, the existing level of L_{A90} background noise which is required to be known for determining construction noise criteria.

Table 10.1 summarises the noise level parameters for each of the locations at which noise monitoring was conducted.

Table 10.1 Summary of noise monitoring results

	Measured Noise Level, dB(A)				
	Traffic Noise Level		Rating Background Level [3]		
Monitoring Location	$L_{Aeq,15hr}$	$L_{Aeq,9hr}$	Day	Evening	Night
1 – Unit 3/1 Manly Rd	68.3	60.0	56	58	42
2 – 7 Battle Bvde	67.5	63.3	58	60	48
3 – Unit 5/2D Battle Bvde	64.1	59.4	54	57	37
4 – 11 Avona Cres	65.8[1]	61.7[1]	55	58	39
5 – d'Albora Marinas[2]	60.2[1]	56.1[1]	50	53	38

Notes: (1) Monitoring data have been corrected by +2.5 dB(A) for facade effects.
(2) Noise parameters for d'Albora Marinas have been estimated based on the results of a 15 minute attended noise measurement at that site.
(3) Equivalent to the L_{A90} background noise level

10.3 Assessment goals

10.3.1 Construction noise

The guidelines for assessment of construction noise are specified by the EPA's ENCM. Although not explicitly stated in the ENCM, it is considered, for construction periods greater than 26 weeks (relevant to the implementation of this proposal), that the EPA would expect that the L_{A10} level not exceed the L_{A90} background level by more than 5dB(A).

In addition, the EPA specifies the following time restrictions for construction activities:

- Monday to Friday - 7.00 am to 6.00 pm;
- Saturday - 8.00 am to 1.00 pm (if noise is audible at residential premises); and
- No construction work is to take place on Sundays or Public Holidays.

Based on the measured daytime and night time RBL values for 3/1 Manly Road (refer to Table 10.1), Table 10.2 details construction noise criteria for those residences immediately west of the northern approach to the bridge. These residences would be potentially worst impacted from construction activities. Noise criteria are also prescribed for those residences near Seaforth Crescent, further west of Battle Boulevard (based on estimated RBL values).

Table 10.2 Construction LA10 Noise Level Goals

	Noise Goal - dB(A)	
Residential Location	Daytime (7.00am – 6.00pm)	Night Time (6.00pm – 7.00am)
Battle Boulevard[(1)]	61	47
Residences near Seaforth Crescent	53	40

Notes: (1) Including apartments at 1 Manly Road.

At the measurement locations, existing noise levels are already higher than recommended operational noise levels (see section 10.4). This would suggest that these goals may not be appropriate at all locations.

In the case of major construction projects occurring in close proximity to residential and even commercial buildings, it can be difficult to comply with the EPA's ENCM construction noise criteria. However, the criteria nominated in the EPA's ENCM are 'noise design goals'. Where these goals cannot be achieved in practice, the EPA recommends the use of best practice measures to minimise the risk of potential noise impacts.

10.3.2 Operational traffic noise

Criteria for the assessment of road traffic noise are contained in the EPA's ECRTN. According to the ECRTN, this proposal would be described as 'redevelopment of existing freeway/arterial road'. For residences, the relevant 'base' noise criteria are 60dB(A) $L_{Aeq,15hr}$ during the daytime and 55dB(A) $L_{Aeq,9hr}$ during the nightime.

Where these criteria are already exceeded, the *ECTRN* states: 'In all cases, the redevelopment should be designed so as not to increase existing noise levels by more than

2dB(A). Where feasible and reasonable, noise levels from existing roads should be reduced to meet the noise criteria.'

A threshold value of 2dB(A) above existing traffic noise levels is used as the 'allowance' criterion. The allowance of plus 2dB(A) is assessed in respect of existing (2002) traffic noise levels. These are referred to as the 'existing' noise levels (ie without the proposal).

The relevant operational goal is therefore 60dB(A) $L_{Aeq,15hr}$ during the daytime and 55dB(A) $L_{Aeq,9hr}$ during the nightime if the existing noise level meets the criteria, or the existing plus 2dB(A) if it does not.

For the noise impact assessment, the assessment of operational traffic noise impacts was based on predicted traffic volumes, provided by the RTA, for the year 2016 (assuming the implementation of the proposal).

10.4 Assessment of potential impacts

10.4.1 Construction noise

Predicted noise levels during construction

Indicative information regarding the number and concurrence of plant required for each of the stages of construction was advised by the RTA.

It is likely that the two loudest periods of construction would occur during piling (and potentially concurrent with construction of pile caps, piers and headstocks) and the forming and construction of the concrete deck. In addition, an expected typical night time construction scenario was also proposed for assessment. Table 10.3 contains the maximum sound power levels (L_{WA}) of the significant plant likely to be used at any one time for these phases of construction.

Table 10.3 Typical maximum sound power levels from construction plant

Daytime construction			
Piling & piers/headstocks	**L_{WA} dB(A)**	**Concrete deck construction**	**L_{WA} dB(A)**
Pile driver	122	Haul truck	112
Sheet piling	119	Mobile crane	110
Bored piling[1]	112)	Generator	111
Haul truck	112	Concrete truck (1 of 3 in motion)	110
Mobile crane (2 of)	110 (each)	Concrete vibrator (5 of)	108 (each)
		Concrete pump (2 in operation)	105 (each)

Night time construction		
	Removal of existing structures	**L_{WA} dB(A)**
	Concrete saw	114
	Haul truck	112
	Mobile crane	110
	Generator	111

(1) Not included in calculation of noise impacts. Data included only for the purpose of information.
Note that the sound power levels quoted do not account necessarily for specific impact noises (such as girders impacting the existing bridge structure as they are removed).

Noise levels at residences were predicted by grouping together typical types and numbers of noise sources for each construction phase, and by taking into account relevant acoustic factors such as noise attenuation over distance and the fact that plant would generally not operate at the maximum levels quoted all of the time.

Impacts are assessed with respect to the potentially worst affected residences west of the northern approach to the bridge (for example, receiver 13 – refer Table 10.4) and at those residences further west of the bridge in near the intersection with Seaforth Crescent (for example, receiver 1).

Noise levels from piling and construction of piers and headstocks

The predicted maximum combined sound power level of all items listed in the relevant section of Table 10.3 (excluding the bored piling rig) is 119dB(A). These predicted worst case construction noise levels exceed the EPA noise goal at the closest residences by up to 15dB. However, this would occur during daylight hours for short periods only.

Noise levels from forming and construction of the concrete deck

The worst case noise emission from the forming and construction of the concrete deck was based on the concurrent operation of all items listed in the relevant section of Table 10.3. The predicted maximum sound power level of these plant, operating in combination, is 114dB(A). These predicted worst case noise levels exceed the EPA noise goals by up to 9dB. This level of construction noise would be clearly audible. However, this scenario represents the peak period of activity. Noise during this phase of construction may be reduced sufficiently so that exceedances are not registered in some cases.

Noise levels from night time construction activities

The predicted worst case night time noise impacts from the concurrent operation of plant listed in Table 10.3, is a maximum combined sound power level of 113 dB(A). These predicted worst case noise levels exceed the EPA noise goals by up to 22dB which represents a significant level of impact if no mitigation measures were implemented. However, this scenario represents a likely peak and short term period of activity. Noise during this phase of construction may be reduced, so that exceedances are not registered in some cases, by not operating noisy plant in combination or restricting noisy activities to daytime hours. For example, the operation of the crane in isolation would yield noise levels approximately 8dB(A) less than those predicted.

These predictions are based on the quietest background noise levels during night periods. Given the variation of background noise levels during the night time period, smaller exceedances of noise criteria would result where activities are constrained to operate in other than the early morning hours. In particular, given that background noise levels during evening periods (6pm to 10pm) are higher than the corresponding daytime background noise levels (refer to Table 10.1), criteria up to approximately 16dB(A) higher may be applied where activities can be contained within those hours (although it is recognised that this period coincides with the evening peak traffic period).

10.4.2 Operational noise

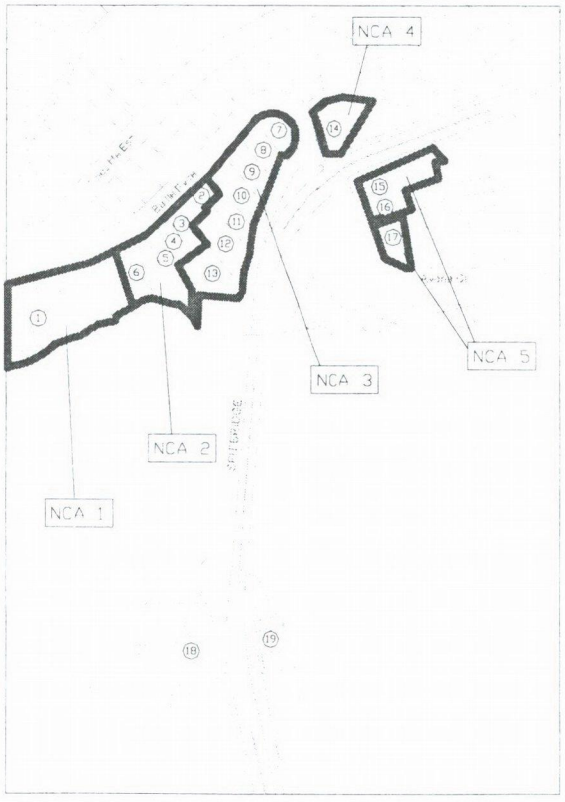
Computer model noise predictions were made to compare noise impacts for existing and predicted road traffic volumes, to enable assessment of the potential noise impacts as a result of the implementation of the proposal.

Two models were used:

- One representing the existing road, which is used for model validation and also for the calculation of 'existing' noise levels; and
- One representing the proposal, used for the prediction of future (2016) potential noise levels.

For the noise assessment, 19 receiver locations were identified, representing residences and other noise-sensitive locations in the vicinity of the proposal. Residential receivers with similar exposure to traffic noise were grouped into noise catchment areas (NCAs). The assessment of potential traffic noise impacts included the consideration of noise to habitable levels of worst affected residences, the location of which were determined based on from residential survey data provided by the RTA.

Receiver locations and NCAs are shown in Figure 10.2.



Source: Wilkinson Murray Pty Ltd, 2003

Figure 10.2 Receiver locations and noise catchment areas (NCAs) used in noise modelling

$L_{Aeq,15hr}$ and $L_{Aeq,9hr}$ noise levels were initially calculated at the highest floor of each receiver for the following two conditions:

- 'Existing' – using 2002 traffic volumes with the existing road, and
- 'Redeveloped, 2016' – using predicted 2016 traffic volumes for the proposal.

The calculated noise levels at the highest habitable level of each receiver are summarised in Table 10.4.

Noise levels for residences behind the first row of residences exposed to traffic noise was not considered, as it was not possible at this stage to accurately account for the extent of acoustic shielding provided by this 'front line' of houses.

Table 10.4 Predicted existing and future traffic noise levels

Receiver	Location	Period Day/ Night	Noise Level		Change	Exceedance of base? (dB)	Future meets + 2dB criterion?
			Existing (2002)	Future (2016)			
1	29 Battle Boulevarde	Day	57.0	58.0	1.0	-	Yes
		Night	51.1	52.0	0.9	-	Yes
2	9 Battle Boulevarde	Day	64.0	65.0	1.0	5.0	Yes
		Night	58.0	58.9	0.9	3.9	Yes
3	11 Battle Boulevarde	Day	64.3	65.3	1.0	5.3	Yes
		Night	58.3	59.3	1.0	4.3	Yes
4	13 Battle Boulevarde	Day	63.3	64.3	1.0	4.3	Yes
		Night	57.3	58.2	0.9	3.2	Yes
5	17 Battle Boulevarde	Day	61.3	62.3	1.0	2.3	Yes
		Night	55.3	56.3	1.0	1.3	Yes
6	21 Battle Boulevarde	Day	61.1	62.1	1.0	2.1	Yes
		Night	55.1	56.1	1.0	1.1	Yes
7	1 Battle Boulevarde	Day	64.3	65.2	0.9	5.2	Yes
		Night	58.2	59.1	0.9	4.1	Yes
8	3 Battle Boulevarde	Day	67.2	68.2	1.0	8.2	Yes
		Night	61.1	62.1	1.0	7.1	Yes
9	5 Battle Boulevarde	Day	66.3	67.4	1.1	7.4	Yes
		Night	60.2	61.2	1.0	6.2	Yes
10	7 Battle Boulevarde	Day	66.8	67.9	1.1	7.9	Yes
		Night	60.7	61.8	1.1	6.8	Yes
11	7A Battle Boulevarde	Day	67.7	69.0	1.3	9.0	Yes
		Night	61.7	62.9	1.2	7.9	Yes
12	7B Battle Boulevarde	Day	64.4	65.5	1.1	5.5	Yes
		Night	58.4	59.5	1.1	4.5	Yes
13	3/1 Manly Rd	Day	66.7	67.7	1.0	7.7	Yes
		Night	60.7	61.7	1.0	6.7	Yes
14	2D Battle Boulevarde (The Battlements)	Day	72.5	73.5	1.0	13.5	Yes
		Night	66.3	67.3	1.0	12.3	Yes
15	14 Avona Crescent	Day	67.3	68.2	0.9	8.2	Yes
		Night	61.1	61.9	0.8	6.9	Yes

Receiver	Location	Period Day/ Night	Noise Level		Change	Exceedance of base? (dB)	Future meets + 2dB criterion?
			Existing (2002)	Future (2016)			
16	13 Avona Crescent	Day	66.1	66.8	0.7	6.8	Yes
		Night	60.1	60.8	0.7	5.8	Yes
17	11 Avona Crescent	Day	63.4	64.4	1.0	4.4	Yes
		Night	57.5	58.4	0.9	3.4	Yes
18(1)	d'Albora Marina Moorings	Day	57.7	58.8	1.1	-	Yes
		Night	51.8	52.8	1.0	-	Yes
19(1)	Spit Rd (East)	Day	71.6	72.6	1.0	12.6	Yes
		Night	66.0	67.0	1.0	12.0	Yes

Note: (1) Non-residential receivers.

From the data contained within Table 10.4, the following points are noted:

- In all cases, the change in noise levels between the existing and future cases is generally only 1dB for both day ($L_{Aeq,15hr}$) and night ($L_{Aeq,9hr}$) periods. Accordingly, there are no receivers for whom the 2dB allowance criterion would be exceeded;
- In all cases, exceedance of the 'base' noise criterion is higher for daytime $L_{Aeq,15hr}$ noise levels than for night time $L_{Aeq,9hr}$ levels;
- Noise impacts, in terms of criterion exceedance, are anticipated to be equivalent or lower in the case of night time levels;
- For all but one of the 17 residential receivers considered, existing daytime noise levels are already in excess of the 'base' noise criterion. For eight of these receivers, existing noise levels are 'acute' as defined in the ENMM (i.e. noise levels are above 65dB(A)). In the worst case, the exceedance is approximately 13dB; and
- Assuming no noise mitigation, for the 'future 2016' case, all but one of the 17 residential receivers are predicted to be exposed to levels in excess of the 'base' criterion. For 12 of these receivers, the noise levels would be 'acute'. In the worst case, the exceedance would be approximately 14dB (as a result of the existing exceedence).

Maximum noise levels

As required by the ECRTN, the potential maximum noise levels associated with individual heavy vehicle movements were calculated. It was found that, in general, the proposed (unmitigated) future traffic scenario would not give rise to appreciable differences in the maximum noise levels. The changes, if any, in the maximum noise levels from vehicles would generally be less than 1dB.

10.4.3 Vibration

The potential for vibration impacts from construction will be greatest during either the piling activities or the minor excavation works proposed for the western sandstone wall at the northern approach.

Rock excavation at the northern approach would occur for approximately 1-2 weeks, and would likely be by means of rippers and rock splitters rather than rockbreakers or other percussive plant. At its closest point, this excavation work would occur within

approximately 15-20m of residences within Battle Boulevarde and Manly Road. In the critical case, piling will be located approximately 60m away from residences. Both activities would be restricted to daytime hours.

The actual level of vibration received at residences from either activity would be dependent on the location and type of plant to be deployed but otherwise on the configuration of the local ground sub-structure.

However, at the separation distances outlined, no exceedance of daytime vibration limits would be expected in terms of either the potential for building damage or in terms of exceedance of human comfort levels.

10.5 Noise mitigation techniques and options

A number of techniques can be used to reduce the impact of traffic noise. The main methods include:

- Reducing traffic speed;
- Reducing vehicle noise emissions;
- Building design and planning controls;
- Use of quieter road surfaces;
- Providing shielding (noise barrier walls); and
- Noise control treatment to individual residences (architectural treatment).

The noise impact assessment report (Appendix F) provides an evaluation of these methods. Those most relevant to the proposal are considered below.

Use of a quieter road surface

In some circumstances, use of open grade asphaltic concrete (OGAC) compared with the proposed dense grade asphaltic concrete (DGAC) surface, can provide benefits in terms of slight reduction in noise levels.

Other than the deck at the bascule (opening) span, the existing bridge deck is constructed from concrete. It is proposed that the future bridge would also be finished as a concrete deck (except for the bascule span). As a result, no difference in generated noise levels is anticipated in this regard. Further, given that predicted noise impacts to the residences north of the bridge result primarily from the traffic flows closest to them on Manly Road (as opposed to the contribution to the total noise level from traffic on the bridge), changes to the bridge deck would only marginally alter noise levels received by them.

A small acoustic benefit may be obtained by the use of alternative road surfaces for those residences (eg. residences west of the bridge) for whom traffic noise results primarily from the traffic on the bridge. However, as a result of the potential safety issues (potential for skidding as a result of the grade of the road in this area) associated with OGAC, its use as part of the proposal is unlikely.

Providing shielding (noise barrier walls)

Erecting noise barrier walls can reduce traffic noise impacts to residences, depending on the particular circumstances associated with each proposal.

Given the topography in the vicinity of the proposal, the effectiveness of noise barriers would be diminished (and potentially negligible) where residences are significantly elevated above the level of the road.

In addition, for a barrier to be effective it must have sufficient mass to attenuate the noise and should be positioned either close to the road or the location to be protected. The barrier should break the line of sight between the source and receiver and should be free from gaps which reduce the effectiveness of the barrier.

The ENMM states that, because of the potential for significant visual impacts, barrier heights above 8m generally need not be considered. The modelling has indicated in this instance that to be effective in this area (as a result of the topography) barriers would have to be extremely high (much greater than 8m). As a result of the potentially significant visual impacts and cost issues, barriers are not considered a viable option.

Noise control treatment to individual residences (architectural treatment)

It is possible, and often relatively more feasible where there are fewer affected residences, to provide noise control treatment to individual residences. This usually includes provision of air-conditioning or mechanical ventilation to allow external windows to be kept closed. This can reduce noise by approximately 10dB(A) compared with open windows. Further benefits can be provided by upgrading external glazing and, in extreme cases, walls and roof/ceiling structures. This treatment would not provide any reduction in noise level experienced in outdoor areas.

As the predicted exceedance as a result of the proposal is less than 2dB(A) over the existing noise levels for all potentially affected residents, the RTA has determined that it would not be feasible or reasonable to implement noise mitigation measures

10.6 Summary and mitigation measures

10.6.1 Summary

The assessment found that noise as a result of construction activities is likely to exceed relevant criteria at most nearby residences, particularly during piling activities and construction of the bridge deck. These impacts would be limited to times where high noise generating activities occurred, particularly if such activities occurred in combination.

With respect to operational noise, the assessment found that noise levels (calculated for the year 2016) would exceed the EPA base criteria at residences close to the road. However, it is noted that existing noise levels at these receivers are already in excess of the base criteria.

Notwithstanding that there are a number of residences that currently exceed the recommended base noise criteria of 65 db(A), in no case is the predicted exceedance as a result of the proposal greater than 2dB(A) over the existing noise levels. As a result the

RTA has determined that it would not be feasible or reasonable to implement noise mitigation measures to address the existing operational noise associated with the bridge and its approach roads.

In general, the increase in future traffic noise would be minimal, at approximately 1dB(A) for both the day and night periods. While this level of increase falls within the EPA's plus 2dB(A) 'allowance' criterion.

The timing and type of night time construction activities would be carefully considered at the detailed design stage of the proposal.

The construction EMP would include a noise management strategy, which would consider the methodology proposed by the construction contractor and the relative phasing of different construction activities in different areas. The timing of construction activities with respect to rise and fall of background noise levels would serve as a primary means by which impacts are managed. As a result, additional baseline noise measurements at all residences potentially affected by construction noise is recommended.

It is recommended that the noise management strategy incorporate the following:

- The use of quietest plant available, regularly maintained and fitted with appropriate mufflers. In particular, consideration should be given to the use of bored rather than driven piling where possible;
- Possible restrictions in construction hours (beyond EPA requirements), where noise impacts are likely;
- Minimising the potential for impact type noise events (such as girders impacting the bridge structure) during night time periods;
- Notification of residents prior to noisy or vibration generating activities; and
- Noise monitoring to ensure best practice is being implemented.

It is possible that some activities may be required beyond the EPA recommended construction hours. Contact with the EPA, Manly and Mosman Councils and residents would be undertaken prior to these activities. These procedures are outlined in the RTA document 'Consultation Procedure for Roadworks Undertaken Outside of Normal Working Hours'.

11. Aquatic ecology

This section provides a summary of the results of the aquatic ecology impact assessment undertaken by the Australian Museum Business Services (AMBS). The full report is provided in Appendix G.

11.1 Introduction

The assessment undertaken by AMBS involved the following tasks:

- Mapping the seagrass beds present within the study area;
- Examining and describing the macroalgae present within the study area;
- Examining and describing the macro-invertebrate assemblages of the intertidal rocky shore within the study area;
- Sampling water quality parameters and comparing them with the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC Guidelines, 2000);
- Considering whether the proposal is likely to have a significant impact on aquatic flora or fauna of conservation significance. Flora and fauna of conservation significance are defined as threatened species, populations or ecological communities listed on the Threatened Species Schedules of the *Fisheries Management Act 1994* and the *Commonwealth Environment Protection and Biodiversity Act 1999* (EPBC Act);
- Determining the fish species likely to be present within the study area;
- Providing recommendations to minimise the potential for impact on significant flora or fauna; and
- Recommending whether further investigations or actions are likely to be required under the provisions of the Threatened Species Schedules of the *Fisheries Management Act 1994* considering the requirements of the relevant statutory agencies.

The study area for the purposes of the assessment extended 500 m (for intertidal rocky shore macro-invertebrates) to 700 m (macroalgae and seagrass) either side of the bridge along the northern and southern shores. The study area was estimated as the area within the vicinity of the bridge that could potentially be subject to direct or indirect impacts as a result of the proposal. The four aquatic ecological communities considered of significance by NSW Fisheries (i.e. seagrasses, macroalgae, intertidal rocky shore macroinvertebrates and fishes) were surveyed.

For the purposes of the assessment, the study area was divided into four sub-sites – northeast and northwest of the bridge, and southeast and southwest of the bridge.

A survey of the study area was undertaken between 28 - 30 August 2002. Macroalgae and rocky intertidal sampling, water quality sampling and seagrass mapping were undertaken at six transects. Macroalgae, seagrasses and in situ water quality were sampled at a seventh transect at each of the four site sub-sites. A total of 28 transects were sampled. The transects were located:

- Within the first 100m from the bridge - transects one and two;
- 200m (transect three), 300m (transect four), 400m (transect five) and 500m (transect six) from the bridge; and
- 700m from the bridge (transect seven).

Figures indicating the locations of transects are provided in Appendix G.

11.2 Description of the existing environment

11.2.1 General habitat

The southern shore is predominantly a sand spit. It is enclosed to the west by a vertical, or near vertical sandstone retaining wall with a variable (but usually limited) intertidal area and shallow sandy sea floor. The area immediately to the west of the bridge was fenced for public works during the survey period. Buildings and marinas encroach on the southern shore to the east and west.

Natural rocky intertidal areas composed of sandstone are more extensive on the northern shore, occurring both to the east and west of the bridge. The northwestern shore generally has steep sandstone cliffs to the water's edge, with a deep (greater than 2m) sandy bottom. The northeastern sub-site has a rocky shore environment, with a gently sloping shelf that ends approximately 5-10m from the shore, dropping to a deep sandy benthos.

Two species of seagrass, 73 species of macroalgae, 59 intertidal organisms and a number of fish species were present or had the potential to be present at the study site. The survey results are outlined below. Species lists are provided in Appendix G.

11.2.2 Seagrasses

Two seagrasses were identified in the study area - eelgrass *Zostera* spp. and the paddlegrass *Halophila* sp. Figures mapping the location of seagrasses are provided in Appendix G. The findings of the site survey are outlined below.

Northwestern side of the bridge

No seagrasses were present, with the exception of a small sparse bed 700m from the bridge, consisting of individual *Zostera* between 5-8m from shore.

Southwestern side of the bridge

Beds of *Zostera* were present 250m from the bridge on the western side of the D'Albora marina. The beds were located inshore of the marina berthing arms, beginning as sparse individuals extending 3m from shore. At 400m, the beds began 5m from shore and extended for 3m. At 500m, these beds thickened to sparse patches of *Zostera* extending to 10m from shore. At 700m, the plants were more evenly distributed but were present as a thin band extending from eight to ten m from shore.

Northeastern side of the bridge

Zostera beds were present within 100m east of the bridge. These were 3m wide, ranging from sparse individuals to moderate continuous beds, and were present from 5-8m from

shore. By 200m, the beds extended from 4-10 m from shore and were composed of individual *Zostera* plants. These were initially evenly distributed and gradually thinned as the bed extended from shore.

Halophila was present from 5-8m in the *Zostera* beds as sparse individuals. By 300m from the bridge, occasional *Halophila* plants were present. Seagrasses were not present again until 500m from the bridge, where they were present as a sparse bed of individual *Zostera* plants, extending 1m from the shore. By 700m, the beds extended 3m from shore and comprised a mixture of sparse individual *Zostera* and *Halophila* plants.

Southeastern side of the bridge

The seagrass beds in this area began 300 m from the bridge behind the marina. Moderate density evenly spread beds of *Zostera* were mixed with individual sparse *Halophila* plants to 8m, where the *Zostera* spp continued to 15m from shore as individual sparse plants.

By 400m, individual sparse *Halophila* plants were present from 3-5m from shore. The beds were gradually replaced by sparse individual *Zostera* to 8m. The plants became thicker and the bed more continuous to 20m. At 500m from the bridge, the *Zostera* and *Halophila* began 3m from shore as sparse individual plants. The *Zostera* gradually thickened and became more dense to 20m, while the *Halophila* beds thinned by 8m. At 700m, *Zostera* beds were located as moderate patches between 9-13m from shore.

11.2.3 Macroalgae

Macroalgae common to Sydney Harbour are present throughout the survey sub-sites. The species recorded are typical of shallow estuarine areas and apart from a few green and some brown algal species, the vast majority of the species present are red algae.

A total of 73 species of macroalgae were identified in the 104 samples taken. All except one species are typical NSW algae. *Mazoyerella arachnoidea* is a very small, filamentous red alga that was previously known from Kangaroo Island in South Australia and northern Tasmania. Its diminutive size and cryptic habit would suggest that it has probably existed in the harbour as a native. Only DNA sequencing would be able to confirm whether the NSW population is a clone of the southern Australian populations (thus introduced) or is disjunct. This is not a threatened species.

The tropical aquatic weed *Caulerpa taxifolia* was not present in any of the macroalgae samples.

11.2.4 Intertidal rocky shore macro-invertebrates

The study identified 59 intertidal rocky shore macro-invertebrate taxa (mostly representing single species). Although the intertidal rocky area on the northern shore offers a broader variety of habitats, at least 33 (56%) of the total number of taxa identified also occurred on the artificial substrates of the southern shore.

The macroinvertebrate community assemblages are fairly consistent throughout the intertidal habitats in the study area. The dominant intertidal macro-invertebrate on hard substrates (both natural rocky shores and artificial surfaces) in terms of surface area covered was the rock oyster (*Saccostrea glomerata*).

Other dominant organisms on hard substrata in the lower level of the intertidal zone (i.e. below the area occupied by the rock oyster) include the encrusting tube worm *Galeolaria caespitosa* (sometimes referred to as Sydney coral), a blue mussel *Mytilus* sp., the hairy or bearded mussel *Trichomya hirsuta* and the ascidian *Pyura stolonifera*.

11.2.5 Fishes

The Australian Museum Fish Collection has records of approximately 60 species of fishes collected in the vicinity of the Spit Bridge in Middle Harbour from 1910 to 1999.

Most of these fishes inhabit seagrass beds as juveniles (and also as adults such as in the case of pipefishes, blennies and gobies) where they can shelter from predators and obtain the necessary food for their growth and survival. Other fishes that are known to be common in the Spit Bridge area at times include bream (*Acanthopagrus australis*) and pelagic species such as yellow-tail kingfish (*Seriola lalandi)* (Barry Hallett, Southern Cross Divers, pers. comm. Sept. 2002). Species of mullet, flathead and whiting are also likely to use the area at particular times of the year.

11.2.6 Significant species

No endangered species, populations and ecological communities (as specified under the Threatened Species Schedules of the *Fisheries Management Act 1994)* were present or considered likely to occur at the study site, based on the ecological survey conducted and searches of fish database records and information relating to habitat ranges.

Aquatic threatened species

The NSW Fisheries Threatened Species Schedules of the *Fisheries Management Act 1994* (updated 21/12/01) lists four fishes that have been historically recorded from the Sydney Harbour region (including either Middle Harbour, North Harbour and/or the Parramatta River). These fishes are the grey nurse shark, green sawfish, great white shark and the black cod. The former two species are both listed as Endangered on Schedule 4, Part 1 of the Threatened Species Schedules of the *Fisheries Management Act 1994* and the latter two species are listed as Vulnerable in Schedule 5 of the same Act.

There have been no recent sightings of any of these species in the vicinity of the study area, and the study area is not considered to be of critical importance to their survival.

Aquatic endangered populations

Two endangered populations of fishes are listed on Schedule 4, Part 2 of the *Fisheries Management Act 1994*. These are the western populations of both the purple spotted gudgeon *Mogurnda adspersa* and the olive perchlet *Ambassis agassizi.* Neither species occurs in the Sydney Harbour region.

EPBC Act matters

Comment regarding relevant matters of national environmental significance under the EPBC Act is provided below.

- Listed threatened species and ecological communities - Threatened fishes that are listed on the EPBC Act that occur in the Sydney region include:

- Critical - Grey Nurse Shark (east coast population);
- Endangered - No species from the Sydney region are listed on the EPBC Act; and
- Vulnerable - Great White Shark.

As discussed above, none of these species are likely to be adversely affected by the proposal. No listed threatened ecological communities occur in the immediate area of the proposed activities.

- Listed migratory species, the whale shark *Rhincodon typus* is known to occur in the Sydney region at times, but the area of the proposal is not considered to be a valuable habitat for this species.
- Commonwealth Marine Area - not applicable to the proposal.

11.3 Assessment of potential impacts

None of the aquatic or intertidal communities studied are likely to be directly damaged or destroyed by the proposal:

- The seagrasses (*Zostera* and *Halophila*) do not occur within 100 m of the proposal and would not be directly disturbed or damaged during construction;
- It is unlikely that the macroalgae in the vicinity of the proposal would be directly impacted, as the bridge piers would be located outside of the existing macroalgae beds;
- No direct impacts on rocky shore macroinvertebrates are anticipated as none of the proposed construction activities would occur within the intertidal habitats; and
- No direct impacts on the fishes present within the study area are anticipated, as a result of the localised nature of the construction activities and the high mobility of the fishes.

Whilst the proposal is considered unlikely to result in any *direct* impacts on the four aquatic communities targeted for this investigation, as with all projects occurring at the land-water interface, there is the potential for *indirect* impacts or ecological disturbances. Unless adequately managed, these disturbances have the potential to impact on the aquatic flora and fauna assemblages in the study area and result in a change to the existing environment. These potential impacts are summarised below, together with an assessment of the likelihood and significance of the impacts with respect to the proposal.

11.3.1 Potential construction impacts

Blockage of fish passage

Any blockage of the waterway during construction has the potential to impact on the passage of fish. Interrupting migratory pathways by blocking fish passage can cause particular fish species to decline in numbers by limiting their reproductive success.

It is considered unlikely that construction of the proposal would result in this impact. The barges and piling equipment used during construction would not span the entire width and depth of the waterway. Depths below the bridge are greater than 4m and fishes can swim under barges and around piling equipment to move under the bridge. The potential impacts

of construction noise on the movements of migratory fishes are difficult to predict. However, such impacts would be short-term and highly localised.

Increased turbidity

Any activities that disturb sediment in the watercourse or cause the erosion of the banks could introduce sediment into the water column, resulting in increased turbidity levels and reduced light penetration. This has the potential to impact on the aquatic environment, particularly the growth of seagrasses and macroalgae beds. Increased turbidity can also affect fish by mechanical and abrasive impairment of the gills, and can potentially change feeding behaviour particularly for species that use visual cues for foraging. As a result of their method of feeding, significant increases in particulate matter in the water column also has the potential to impact on intertidal rocky shore macro-invertebrates.

The proposed construction methods would result in minimal sediment being released into the water column.

In terms of the potential significance of these impacts with respect to the proposal, if sediment were to enter the water column the associated increased turbidity would have the greatest impact closest to the source. An area within 100m of the proposal has been selected as a hypothetical limit based on tidal influence.

Most of the seagrass beds are located at least 300m from the proposal in shallow sandy beaches sheltered by existing marinas/berths. As a result, they would be unlikely to experience significant indirect impacts, as long as sediment disturbance is minimal and sediments are adequately contained by means of the measures recommended in Section 11.4.2. There are seagrass beds to the northeast of the bridge sub-site present within 100m of the existing bridge (although they are greater than 100m from the construction area). These could be disturbed by increased turbidity if it was inadequately controlled, and it extended past 100m of the construction site.

Macroalgae communities are present within 100m of the proposal. However, the macroalgae present are not significant to the site, and are present throughout the study area. The communities are also unlikely to experience significant indirect impacts, as long as sediment disturbance is minimal and sediments are adequately contained.

If the turbidity became too high for the fishes to tolerate, they may temporarily or permanently seek new areas nearby for food and shelter by undergoing localised, small-scale migrations. This extreme reaction is considered unlikely and the effects would be localised and short term.

Naturally occurring rocky shore invertebrates within the study area are most extensive beyond 100 metres of the proposal. Therefore, if the impact of any increased turbidity is restricted to within 100m of the bridge, it would be unlikely to have a significant effect on intertidal rocky shore macro-invertebrates in the study area.

The potential for adverse impacts as a result of increased turbidity can be mitigated by the implementation of best practice construction methods, including those described in Section 11.4.2.

Increased nutrient levels

Increased nutrient levels (eutrophication) in the water column can occur as a result of runoff or sediment disturbance, resulting in nuisance growths of aquatic plants. An increase in nutrient levels has the potential to change species diversity of fishes and intertidal rocky shore invertebrates as a result of changes to the community structure of aquatic plants. It can also affect the growth of macroalgae, with increases in nutrients causing faster growth blooms of certain species.

An increase in nutrient levels also has the potential to change the composition and density of existing seagrass communities by stimulating the growth of nuisance plants.

With respect to this proposal, the significance of the impact would depend on the degree of increase in nutrient levels. If any increases in nutrient levels are small, and localised within 100m of the construction area, tidal flushing combined with the distribution and level of significance of the existing communities is likely to minimise the potential significance of any impacts.

It is assumed that with the implementation of best practice construction methods (including those described in Section 11.4.2), the input of nutrients would be minimal and the existing aquatic flora and fauna assemblages would not be significantly affected.

Increased wave action

Increased wave action as a result of the movement of boats has the potential to impact on the aquatic environment, including the distribution of seagrass and macroalgae communities.

Wave action as a result of the proposal would be restricted to the immediate vicinity of the bridge. The closest seagrass beds are located >100m from the construction area.

Apart from physical disturbance caused by increased wave action (where the increase is such to actively removed the attached plants), most macroalgae are unlikely to be significantly affected by increases in wave action.

Given the natural variation in orientation and topology of the shore line and the associated variations in the fauna encountered, increased wave action by itself is unlikely to have a significant effect on intertidal rocky shore macro-invertebrates of the study area.

Any potential impacts on fishes would be highly localised and short term in duration.

11.3.2 Potential operational impacts

Increased nutrient levels via bridge runoff

If not managed correctly, runoff associated with the widened bridge and the roadway at the approaches has the potential to result in increased nutrient levels (eutrophication) in the water column and nuisance growths of aquatic plants. The potential impacts are similar to those discussed in Section 11.3.1.

The integration of runoff controls in the design of the proposal would mitigate the potential for this impact.

Eddying and scouring around piers

Natural tidal flow and water currents around the new piers may result in eddying and scouring of the surrounding sediment and could influence conditions in the water column.

Eddying and scouring around the bottom of the piers may increase turbidity at the bottom and wash sediment away with the tide. The general effects of increased turbidity to aquatic flora and fauna is discussed in Section 11.3.1.

With respect to the proposal, the potential impacts as a result of eddying and scouring are considered to be localised and not significant to the site as a whole.

Shading

Permanent changes to light availability to seagrass and macroalgae communities has the potential to directly affect the composition, morphology and density of the communities. Increased shading may also alter the species diversity of fishes.

The proposal would result in increased shading of communities on the western side of the bridge. It is estimated that there is the potential for impacts to habitats within 30m of the west of the bridge.

There are no seagrass communities in the area that would be impacted by increased shading.

Macroalgae present within 30m of the bridge may be impacted. However, this impact is not considered significant as the area that would be impacted is localised in nature, and contains species present throughout the study site.

As the existing bridge already provides significant shade, increased shading may extend the area of suitable habitat for those fishes that currently live in the shaded areas. This may concurrently displace the fishes that prefer unshaded areas further to the west.

Long term restriction to fish passage

As the new piers would be placed within 10m of the existing piers, in the same longitudinal location, the proposal would not result in any long term restriction to fish passage.

11.4 Summary and mitigation measures

11.4.1 Summary of potential impacts

The current survey examined the existing ecological assemblages and physical environment at the site. No threatened species, populations or ecological communities or key threatening processes as specified under the Threatened Species Schedules of the *Fisheries Management Act 1994* were present or are considered likely to occur at the study site. Consequently, it is considered that the proposal would be highly unlikely to impose a significant threat to threatened aquatic biota.

The study area has been disturbed by recreational and commercial activities over a long period and the existing bridge has modified the natural aquatic environment at this location. The aquatic habitats and communities present in the study area are typical of disturbed estuarine environments and are not considered uncommon for Sydney Harbour. In

addition, the communities that may potentially be disturbed are not unique to the site being widely distributed throughout the study site and the surrounding area.

None of the aquatic or intertidal communities studied are likely to be directly damaged or destroyed by the proposal:

Whilst no direct impacts are anticipated, there is the potential for indirect impacts unless appropriate mitigation measures are implemented, particularly during construction. Such mitigation measures mainly relate to controlling the potential for impacts to water quality. As with all other projects occurring at the land-water interface, the control of erosion, sedimentation and other water quality impacts is a key issue. However, given the existing disturbance in the vicinity of the bridge and the fact that construction would be required to incorporate implementation of appropriate environmental management and impact mitigation measures, the potential impacts are unlikely to be substantial or significant with regard to aquatic communities.

11.4.2 Mitigation measures

Mitigation measures relevant to protection of water quality are included in Section 16.4. To minimise the potential for impacts to aquatic ecology the following would occur:

- The construction EMP would specify that construction vessels not span the width of the waterway at any time;
- A threshold level of turbidity would be determined and specified within the construction EMP. Monitoring of turbidity would be undertaken during construction. Further monitoring of nutrient levels would be undertaken if any turbidity exceedances are identified. The EMP would require cessation of construction activities in the event of any exceedance of this level;
- Monitoring of physical water quality parameters such as sediment, turbidity and nutrients would determine whether the safeguards are adequate. Threshold levels for these parameters, and responses should these levels be exceeded, would be specified within the EMP. Monitoring during construction would be particularly important during and following rainfall events;
- An emergency contingency plan for dealing with accidental spills on the bridge would be developed; and
- The speed and movement of all barges and support vessels would be kept to a minimum and comply at all times with Waterways regulations.

12. Terrestrial flora and fauna

This section provides a summary of the results of the flora and fauna impact assessment undertaken by the Australian Museum Business Services (AMBS). The full report is provided in Appendix H.

12.1 Introduction

The aims of the assessment were to:

- Examine and describe the fauna habitats and vegetation present within the vicinity of the proposal;
- Consider whether the proposal is likely to have a significant impact on flora or fauna of conservation significance;
- Provide recommendations to minimise the potential for impact on significant flora or fauna; and
- Indicate whether further investigations or actions are likely to be required under the provisions of the *Threatened Species Conservation Act 1995* (TSC Act) or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Flora and fauna of conservation significance are defined as threatened species, populations or ecological communities listed on the schedules of the TSC Act and/or are listed as matters of national environmental significance by the EPBC Act. The assessment also considered species or habitats that may have regional or local significance, such as rare or threatened Australian plant species (ROTAPS).

The methodology for the assessment involved the following tasks:

- An initial survey of the study area was carried out on 22 July 2002 to examine the types and condition of flora and fauna habitats present. The bridge abutments were examined for evidence of use by birds and micro-chiropteran bats;
- Searches of the National Parks and Wildlife Service's (NPWS) *Atlas of NSW Wildlife Data* were undertaken for threatened fauna records within a 5 km radius of the study area (data released in August 2002), together with a review of reference material regarding threatened species that may occur in the area; and
- A botanical survey of the study area was carried out in August 2002. The area was inspected and the plant species present recorded, together with observations regarding the nature of the vegetation and related features. An assessment was made of the conservation significance of the vegetation.

12.2 Description of the existing environment

12.2.1 Results of database search

The NPWS *Atlas of NSW Wildlife Data* provided records of a number of terrestrial fauna species listed by the TSC Act as occurring within a five kilometre radius of the study area. These are listed in Table 12.1. There were also records of migratory species listed under the EPBC Act. The majority of these species were recorded only once; however, there are several records of the red-crowned toadlet, grey-headed flying fox, common bent-wing bat and superb fruit dove within the five kilometre radius.

Table 12.1 Terrestrial fauna species listed on the TSC Act occurring within a five km radius of the study area

Common name	Scientific name
Spotted-tailed quoll	*Dasyurus maculatus*
Giant burrowing frog	*Heleioporus australiacus*
Southern giant petrel	*Macronectes giganteus*
Common bentwing bat	*Miniopterus schreibersii*
Powerful owl	*Ninox strenua*
Osprey	*Pandion haliaetus*
Koala	*Phascolarctos cinereus*
Red-crowned toadlet	*Pseudophryne australis*
Gould's petrel	*Pterodroma leucoptera leucoptera*
Grey-headed flying fox	*Pteropus poliocephalus*
Superb fruit dove	*Ptilinopus superbus*
Sooty tern	*Sterna fuscata*
Rosenberg's goanna	*Varanus rosenbergi*

12.2.2 Results of site survey

Flora

Area surrounding the southern approach

Trees planted on the western side included two rows of large mature Norfolk Island pine located parallel to, approximately 3 - 14m west of the road margin. Other tree species included rusty fig, Hill's weeping fig, poplar, coral tree and palms. Tree height was generally between 20 - 25m. The only naturally occurring species observed was one bleeding heart of one metre height, growing in poor condition in the top of the seawall north of the marina.

Buffalo grass was the main ground cover on the western side of Spit Road. Small amounts of couch grass and Parramatta grass also occurred.

Trees on the eastern side comprised a few swamp oak, river oak and Hill's weeping fig. Couch grass and kikuyu were the main grasses.

Localised concentrations of weed species occurred near the bridge abutment. Weeds also occurred in cracks and joins in the hard paving and seawall. Common species included: various *Asteraceae*, pellitory and lamb's tongue.

Area surrounding the northern approach

Some natural vegetation occurred along and above the sandstone cliff, including individual native trees (mainly cheese tree, sweet pittosporum and rusty fig) and localised ferns under a sandstone overhang. A small stand of young swamp oak and one smooth-barked apple occurred at or near the cliff-top.

The nature strip south of Battle Boulevard had been planted with Christmas bush and spiny-headed mat-rush. Much of the remaining vegetation on the western side was composed of introduced species that were a mixture of garden plantings and weeds. Garden plantings included madeira vine, banana, and spider lily. Common weeds included lantana, fern asparagus and privets.

The area to the east of the northern approach contained remnants of the natural plant communities, landscape plantings, and a parkland area of mown grass which extended almost to the shoreline and a small stormwater drainage channel. The drainage channel was separated from the access road and parkland by a low brick bund. The drainage channel had probably replaced an original creek, however the sandstone bed of the channel appeared to have retained some natural features.

Bushland was limited to the area south of Avona Crescent. This area contained mainly regrowth mesic species, particularly cheese tree, sweet pittosporum, and rusty fig. A couple of mature coast banksia were present between the drainage channel and road. The bushland was more natural east of the drainage channel. This largely comprised regrowth sweet pittosporum scrub with smaller numbers of other species, and weeds.

Apart from a couple of individuals of coast banksia and *Stephania japonica* var. *discolor*, the eastern batter is planted with numerous native trees, shrubs and ground covers. Most of these were locally-occurring species (for example, lilly pilly and spiny-headed mat-rush), although some were not natural in this location.

Environmental weeds were recorded within and upslope of the bushland zone. Some of these threaten the future survival of the bushland. Weeds observed included wandering jew, lantana, morning glory, cape ivy and Mickey Mouse plant.

Fauna habitats

Area surrounding the southern approach

Fauna habitats along both sides of the southern approach were highly disturbed, simplified and subject to ongoing impacts from the high level of human use. The area contained virtually no shrub layer, a mown ground cover and a relatively low diversity and density of trees. Habitats for a variety of fauna groups (including frogs, large reptiles, ground-dwelling mammals, most arboreal mammals and small birds) were therefore limited or absent. The area was considered likely to be utilised mostly by species typical of coastal suburban

parkland environments and capable of exploiting human-disturbed areas, particularly birds (such as silver gulls and noisy miners and possibly mammals such as the brush-tailed possum.

The shoreline to the east of the southern approach and around the bridge could potentially be utilised for foraging by a variety of water and wading birds, although the high level of human use suggests that its value is probably limited. Due to the lack of understorey or ground cover, nesting sites for these birds was limited or absent.

The most significant feature (in terms of fauna habitat value) was considered to be the *Ficus* spp. planted in the recreation reserve. These trees were considered to provide potential foraging habitat for the threatened grey-headed flying fox.

Area surrounding the northern approach

Fauna habitats along both sides of the northern approach were disturbed, but not to the extent of the southern approach. The most significant habitat areas were considered to be the vegetated gully between Avona Crescent and the waterfront, which contained a relatively dense tree and understorey strata, although the ground cover was heavily weed infested. The drainage channel was considered potential habitat for some frog species. Similar to the southern approach, the shoreline could potentially be utilised for foraging by a variety of water and wading birds, although the high level of human use suggested that its value is probably limited, and nesting sites for these birds was limited or absent.

Bridge structure

No evidence of roosting micro-chiropteran bats was detected at the time of the survey. However, evidence that the bridge structure is used by bird species was observed in the form of droppings and the presence of feral pigeons.

12.2.3 Assessment of significance

Flora

The vegetation at the northern end of Spit Bridge has been previously mapped as Sydney Sandstone Gully Forest. This is generally consistent with the results of the current survey, which indicate that the natural vegetation is a mixture of mesic and sclerophyllous plant communities. Similar vegetation has been recorded on sandstone slopes and gullies in nearby locations. It is likely that the mesic components have spread into additional locations due to the lack of natural fire and supply of excess nutrients from upslope development. The actual area of bushland is less than that previously mapped, as a large proportion comprised introduced species and bushland-style landscaping.

Sydney Sandstone Gully Forest is generally considered to have low conservation significance. However, the mesic (rainforest) component of this vegetation is more significant that the sclerophyllous components, owing to its specific habitat requirements and much smaller total area. The scrub and low closed forest north-east of the bridge is considered to have local conservation significance (Manly and Sydney district) owing to the very limited area of rainforest communities and threats posed by clearing and riparian impacts in this district.

None of the artificial plant communities have any conservation significance.

The planted flora species (particularly Norfolk Island pine and *Ficus* spp. in the south-western recreation reserve) have no ecological significance (except as potential fauna habitat in the case of the *Ficus* spp. – see below) but may be considered significant for their landscape value. The introduced grasses have no conservation significance. Other bushland plant species recorded are not considered to be of conservation significance individually.

Fauna

The majority of the study area is considered to be of limited habitat value for most native fauna species, particularly along the southern approach. The most significant areas are likely to be the bushland below Avona Crescent, the planted *Ficus* spp. in the recreation reserve south of the Marina, and (possibly) the drainage channel in the north-eastern section.

Threatened and migratory species

On the basis of the habitats present, it is considered unlikely that the study area provides significant habitat for the southern giant petrel, powerful owl, osprey, Gould's petrel or sooty tern, although any of these species could occur from time to time. Potential habitat for the koala, Rosenberg's goanna and spotted-tailed quoll is marginal, and confined to areas that would not be directly affected under the current proposal. The giant burrowing frog is considered highly unlikely to occur within the study area.

Given the number of records of the grey-headed flying fox in the vicinity and the presence of potential foraging habitat, it is considered probable that this species utilises the *Ficus* spp. in the recreation reserve.

Similarly, given the number of records of the superb fruit-dove in the vicinity, it is possible that this species occasionally utilises the study area, particularly the bushland below Avona Crescent.

Potential habitat for the red-crowned toadlet is marginal and confined to the modified drainage channel in the northeast of the study area. However, there are a number of records of this species in the vicinity and it is therefore possible that the species does occur.

The common or large bent-wing bat may utilise the existing bridge as a temporary roost site. The species occurs widely but patchily throughout its eastern range (NPWS 1994) and is regarded as abundant (Dwyer 1995). Although relatively widespread and abundant, the long-term security of the large bent-wing bat is reliant on the continued presence of traditional breeding caves and overwintering sites. The study area does not contain potential breeding caves or overwintering sites for this species.

A number of migratory species listed on the EPBC Act have been recorded within a five kilometre radius of the bridge. Some of these species may use the area occasionally for foraging.

Endangered populations

The proposal would not result in any direct impacts on endangered populations.

12.3 Assessment of potential impacts

There would be no loss of existing vegetation as a result of the proposal. The Norfolk Island pines on the southern approaches and the figs on the sandstone cliff on the northern approaches would be unaffected by the proposal.

The proposal would not impact on significant habitat for any threatened or migratory species, or any endangered populations. Accordingly, the potential impact of the proposal is not likely to be significant for any of these species.

The proposal would disrupt a very small proportion of potential foraging habitat that is already highly disturbed and subject to weed infestation. It is therefore considered highly unlikely that the proposal would have an impact that could be considered significant under the assessment criteria set out in the EPBC Act.

The use of the bridge as a temporary roost site for the common or large bent-wing bat may be disrupted during the construction period. This potential impact would be limited to the duration of the construction period. The widening bridge would increase the area able to be used for this purpose.

Potential impacts to the vegetation community below Avona Crescent may occur if a construction worksite was established in this general area. Potential impacts could include disturbance to the vegetation as a result of the movement of construction vehicles and the introduction of weed species.

Construction activities and the movement of construction vehicles have the potential to impact on the foraging behaviour of the flying fox. This impact would be limited to the construction period, and would be mitigated to some extent by the distance between the bridge and ficus trees.

12.4 Mitigation measures

The following measures are recommended to minimise the potential for flora and fauna impacts:

- The proposal would avoid disturbance to the bushland below Avona Crescent. If a worksite is established in the reserve near this bushland, vegetated areas would be fenced off, and access to the work site clearly defined to avoid impacts to the bushland;
- Works at the northwestern approach, including excavation of the sandstone cliff, would minimise disturbance of existing vegetation at the top of the cliff;
- A targeted survey for the red-crowned toadlet in suitable conditions is recommended to confirm the presence or absence of this species;
- The location of construction worksites, facilities and plants would avoid the root zones for significant trees in the study area (including the ficus spp and Norfolk Island pines) in order to avoid long-term damage to the trees through soil compaction in the root zones;
- The following measures would be implemented if unpaved or grassed areas are used to locate facilities:
  - aeration of soil following use;

- strict controls to prevent any release of chemicals or pollutants; and
- re-establishment of vegetation following construction work.

- Significant disturbance to flying fox foraging behaviour would be avoided. Recommended measures include:
  - locating facilities and plant away from the *Ficus* trees;
  - preventing light spill into these areas; and
  - minimising the amount of noise and activity in these areas at night.
- Any landscape work proposed for the northern approach would utilise suitable local indigenous species.

13. Socio-economic considerations

13.1 Description of the existing environment

Businesses located at The Spit

A number of businesses are located on The Spit peninsula near the bridge. The majority are located on the eastern side of Spit Road.

Fergusons Boatshed Marina

Fergusons is located to the southeast, and directly adjacent to, the southern approach of the bridge. The two storey complex includes the following businesses/services:

- Marina office (berths for 24 boats) and associated services and facilities;
- Boat sales and shipwrights;
- A restaurant;
- A scuba diving business; and
- Marine upholstery and marine electrical businesses.

Smiths Boatshed

Smiths Boatshed is located adjacent Fergusons, to the southwest of the bridge's southern approach. The two storey complex includes the following businesses/services:

- A ship chandlers;
- A sailing school;
- Sea kayaking hire and sales;
- Sydney Yachting Centre and Northshore Yachts; and
- A restaurant.

Middle Harbour 16ft Skiff Club

The skiff club is located adjacent to (and south of) the Coastal Patrol building, approximately 170 m to the south of the above properties. As well as facilities associated with the club's activities, the property includes the following:

- Two restaurants; and
- A sailing school;

The Catalina Anchorage

The Catalina Anchorage building is located adjacent to the Skiff Club building, to the south. The complex includes approximately 15 commercial units (on two stories within two buildings) leased to a variety of businesses. Businesses include:

- Yacht sales and chartering;
- Two restaurants; and
- Other non-marine related businesses.

Orso Restaurant

Orso restaurant is located in its own building adjacent to the O'Rourke's Boatshed (to the south).

Middle Harbour Yacht Club

The Middle Harbour Yacht Club is located approximately 50 m south of Orso Restaurant, separated from the restaurant by The Spit east car park. It is located on the site of the old Spit Baths. As well as facilities associated with the club's activities (such as facilities for racing meets), the property includes the following:

- Two restaurants;
- Function room and conference facilities (including meeting rooms);
- Beachfront kiosk (open weekends and Wednesday and Thursday during daylight savings); and
- A yacht chartering, management and sailing school business.

D'Albora Marina

D'Albora Marina is located to the southwest of the bridge, directly adjacent the southern approach. The Marina provides 160 floating berths and visitor berthing. Marina maintenance facilities include a 25 tonne slipway served by two cradles. The marina also houses an engineering, mechanical and electrical workshop, providing a full range of services for both power and sail boats. A ship's chandlery and valet boat care and antifouling service are also located on site.

The complex includes the following businesses/services:

- Marina office;
- A restaurant/kiosk;
- A ships chandlery;
- Power boat sales;
- Marine engineering, shipwrights and brokerage services; and
- Yacht sales.

Other facilities include:

- Boat fuelling facilities (ULP and diesel) and ice sales available seven days per week;
- Pay phones; and
- Sewage pump-out facility.

Social significance of the bridge

The social significance of the bridge relates to the provision of access across Middle Harbour, as well as its historical significance.

The bridge provides one of only two links over Middle Harbour, linking suburbs in the northern beaches/Warringah peninsula with other areas of Sydney, including the lower north shore, Sydney CBD, and the western, eastern and southern suburbs.

The bridge provides the main means of access for STA buses between these areas, which, other than the Manly ferry and limited private buses services, are the main form of public transport for northern beaches residents.

It also provides one of the main points of access for residents from other areas of Sydney visiting the northern beaches and Pittwater area. The bridge experiences high levels of use on the weekends for this purpose.

Further information on the bridge's cultural (historical and heritage) significance is provided in Section 7.

Social significance of the study area

The social significance of the study area relates to the activities undertaken in the area. The following aspects attribute to the significance of the area:

- It is a popular recreation destination, providing the base for a range of recreation activities and clubs (sailing and rowing);
- It is a popular fishing spot;
- The area provides the base for a wide range of boating services and facilities (including sales, refuelling, the volunteer coastal patrol, mooring and berthing);
- The area provides access to two popular foreshore walks (The Spit Bridge to Manly and Beauty Point walks);
- There are a number of restaurants, the area is a destination for dining out and various functions;
- It is a scenic area, designated by the LEPs as a scenic foreshore protection area; and
- A few residential dwellings are located in close proximity to the northern approach to the bridge, and in addition, the bridge and the surroundings form part of the view for houses on the surrounding slopes with views over The Spit.

13.2 Assessment of potential impacts

The proposal would have both positive and negative impacts on local businesses; people visiting and recreating in the study area; residents living in close proximity to the study area; and people using the bridge for access to and from the northern beaches/peninsular areas.

These impacts are associated with the following environmental interactions, which are considered in detail in other sections:

- Land use and property impacts are considered in section 6;
- Traffic, public transport and access impacts are considered in section 9;
- Noise and air quality impacts, which can influence residential amenity and the quality of the recreation experience for visitors to the area, are considered in Sections 10 and 17; and
- Visual quality impacts are considered in section 14.

Potential socio-economic impacts are summarised below.

13.2.1 Potential business impacts

As described in section 3.6, construction of the southern approach to the bridge would require the acquisition of a strip of land directly at the front of the D'Albora Marina, with Spit Road moving closer to the front of the marina building.

As a result, the road would move closer to the front of the marina building. This also has the potential to impact on the operation of the two businesses located at the front of the Marina, as well as access to the activities associated with the marina. Potential impacts to the Marina and associated businesses include:

- Loss of the area currently used to display boats outside the front of the building. There would however be no impact to the boat display area within the building;
- Need to relocate the underground fuel tanks, which would result in a temporary disruption to the boat fuelling service operated by the Marina;
- Alterations to the access arrangements during construction and operation (refer Sections 3.5 and 3.7.6 for more information); and
- Potential for a downturn in trade during the construction period if the number of visitors to the area reduce (as a result of any disruptions to access, reduction in the general amenity of the area and/or any reduction in car parking spaces).

The provision of adequate long term access to these businesses and the marina complex as a whole, as well as maintaining access throughout the construction period, would assist in minimising the significance of these impacts.

Other businesses in the area, which rely on trade from visitors to The Spit (such as restaurants, boat sales, hire activities) may experience a downturn in trade during the construction period if there is a reduction in the number of people visiting The Spit. Reduction in visitor numbers could occur as a result of the following:

- Perception that the area is less attractive as a result of construction noise, visual impacts and general construction activities;
- Reduction in the availability of car parking – if sections of the car parks are used for construction sites; and
- Any changes to the existing access arrangements, making it difficult to stop or directly access businesses in the area.

These impacts would be short term, and would be limited to the duration of the construction period. Recommended measures listed below would assist in mitigating the significance of these impacts.

13.2.2 Potential social impacts

The proposal has the potential for positive social impacts through the facilitation of bus access across Middle Harbour. As discussed in Section 9, the proposal has the potential to reduce the travel time between the northern beaches and the lower north shore. It also has the potential to reduce the time buses spend queuing at the Sydney Road/Manly Road/Burnt Bridge Creek Deviation intersection and along Manly Road. This could play a role in making public transport more attractive.

Potential noise impacts may result in impacts to the general amenity of residents living in close proximity to the bridge's northern approach. This impact is considered in Section 10. Mitigation measures contained in this section would assist in minimising the significance of such impacts.

Potential impacts to recreation activities would be short term and limited to the duration of the construction period. These include:

- Perception that the area is less attractive as a result of construction noise, visual impacts and general construction activities;
- Reduction in the availability of car parking – if sections of the car parks are used for construction sites; and
- Any changes to the existing access arrangements, making it difficult to stop or directly access businesses in the area.

13.2.3 Economic assessment

As noted in section 3, the preliminary estimate cost of the proposal is approximately $30 million for the bridge widening and $5 million for the approach works.

Preliminary economic assessment of the performance of the proposal undertaken by the RTA indicates a positive return on community investment in the proposal. The benefits measured in this assessment are to both public transport and road users. They include road safety. The costs include construction, property acquisition, maintenance and external impacts. The benefit cost ratio (BCR) has been estimated at 1.2 for a three lane operation in each direction. The adverse impact on contra peak flows gives a reduced BCR for tidal flow arrangements.

13.3 Mitigation measures

It is recommended that a community consultation and communication plan be developed covering local businesses and clubs, surrounding residents and the wider community. The plan should detail activities to be implemented in the lead up to, and during, the construction period. Recommended consultation tools include:

- A nominated and dedicated consultation manager responsible for ongoing liaison with the community and businesses/clubs on the Spit;
- A community hotline – operating 24 hours during the construction period – to enable response to questions, complaints etc;
- Regular meetings with key stakeholders and surrounding residents. This should include discussions with sailing clubs, marinas, restaurants and other businesses in the area regarding access and other requirements to identify potential issues and develop appropriate management mechanisms. Other key stakeholders include Mosman and Manly Councils and state agencies;
- Consult with yachting clubs and marinas regarding the period of closure of the bridge's bascule span and provide at least three months notice of the proposed closure;
- Widely advertising changes to bridge opening times;

- Project newsletters/information sheets distributed to residents of surrounding suburbs;
- Regular project updates in the Manly Daily and the Mosman Daily;
- Use of signboards, directional signage and electronic signs in the vicinity of the bridge providing updates on traffic conditions, changes to access arrangements etc; and
- A project information signboard erected in the vicinity of the construction site providing regular update on the progress of the project, contact details etc.

In addition, the following measures are recommended to minimise the potential for socio-economic impacts:

- Ensuring that access to businesses and sailing clubs is maintained throughout the construction period;
- Careful placement of construction worksites to minimise the potential for disruption of access to businesses and recreation activities;
- Minimising loss of carparking during construction periods; and
- Any temporary lane closures should occur during the periods of lowest traffic flow and, as far as practicable, outside operating hours for businesses in the area.

14. Landscape, urban design and visual quality

This section provides a summary of the results of the landscape, urban design and visual quality assessment undertaken by Bryant Associates. The full report is provided in Appendix I.

14.1 Introduction

The assessment considered the potential landscape, urban design and visual impacts of the proposal and broadly involved the following tasks:

- Identification of the study area, including the areas surrounding the site potentially impacted by the proposal;
- Defining the landscape character and visual quality of the study area and key urban design features potentially impacted by the proposal;
- Analysis of the visibility of the proposal, and identification of sensitive visual receivers;
- Analysis of the potential impact of the proposal; and
- Recommending measures to mitigate any significant adverse impacts and enhance any positive impacts of the proposal.

14.2 Description of the existing environment

14.2.1 Landscape character

The visual character of the study area is dominated by a complex pattern of built form (which includes the bridge), a mixture of vegetation types, and the waterway.

The estuarine conditions of Middle Harbour and the sandstone geology have created a foreshore that alternates between rocky headlands and sandy beaches. The Spit Bridge is located in the narrowest stretch of water within Middle Harbour.

The Spit is a low lying narrow stretch of land that extends from the sandstone escarpments of Mosman into the shallow waters surrounding The Spit. The area is characterised by intensive boating and related activities and parkland. The parks are made up of flat grass areas with distinctive tree plantings. Sandy beaches occur between the marinas.

The study area has generally been cleared of endemic vegetation, except for the small area of remnant bushland below Avona Crescent. Some significant mature cultural plantings exist. These plantings are dominated by a row of mature Norfolk Island pines in a park setting. Other trees in the park include figs, and banksias.

The Seaforth side of Middle Harbour, opposite The Spit, is dominated by the steep landform of the sandstone geology. Land falls steeply into deep water and is generally dominated by remnant natural vegetation. The shore edge is natural rock or artificial stone walling.

14.2.2 Characteristics of the existing bridge and approaches

The southern approaches to the bridge are built upon The Spit. The low-lying nature of The Spit determines the low level of the bridge, and the need for a bascule opening.

The underlying sand proscribes the nature of the piers at the southern end. Slab and two-column piers have been driven into the harbour bed. The southern abutment is a pitched stone retaining wall.

The northern approaches are heavily incised into the sandstone cliff landform and extend into deep waters. The bridge begins from a more elevated abutment on the higher level northern side, and its circular piers are founded on bedrock.

Commonly accepted aesthetics on bridge design suggest that, to be visually pleasing, bridges should be symmetrical, with a consistency in the detailing and supports. In this case the natural conditions present valid reasons for an exception to these concepts. The natural conditions give rise to the following characteristics:

- A 2.7% fall from north to south;
- Different types of piers at the northern and southern ends;
- A slightly off-centre main pylon, which supports the bascule span and houses the operator's cabin and viewing platform above deck level; and
- Abutments of different characters.

The bridge superstructure consists of steel beams that span continuously between concrete piers. A recessed bearing at the top of the pier provides a visual separation between the pier and the superstructure, accentuating the linearity of the superstructure.

The concrete deck is built on a down slope that falls from north to south. The deck cantilevers east and west from the edge beams by 2m. The cantilever is supported by regular girders, which are concealed behind a fascia that forms the parapet of the bridge deck. The guard rail and light poles with dark grey zinc silicate finish sit upon the parapet.

The hinge mechanism of the bridge's centre bascule span is fixed to a main pylon that supports two concrete turrets above deck level. When closed, the bascule span's superstructure forms a seamless part of the bridge. Only the turrets on the pylon intercept the line of the edge beam and the deck.

On the approaches to the northern side there is a two lane road to the west of the main roadway that services local residences. To the west of the service road is a vertical sandstone cliff that, together with dense plantings, separates the roadway from the residential buildings beyond. A staircase on the western side of the northern abutment (near the end of the service road) provides access to the shoreline below the bridge and the recreational areas to the east.

The southern abutment is built up from a pitched stone wall. On the western side the stone wall rises from the carpark. The western edge of the approach is dominated by a large flat grass reserve and in the immediate vicinity of the bridge, a driveway and carpark to the marina.

On the eastern side the pitched stone wall is located within a small parkland. Marinas, carparking and parkland are intermingled on the eastern side of the southern approach.

14.3 Assessment of potential impacts

Key urban design features of the proposal are described in section 3.2.3.

14.3.1 Impacts to landscape character

The proposed widening of the approaches would impact mainly on existing hardstand areas. As a result, there would be only a minor change to the existing landscape character of the study area.

As identified previously, there would be no loss of existing vegetation as a result of the proposal. The Norfolk Island pines on the southern approaches and the figs on the sandstone cliff on the northern approaches would be unaffected by the proposal.

The sandstone cliffs are distinctive natural features on the northern approaches. The proposal would result in a limited impact on the cliffs, as it involves some excavation of the rockface.

The main impact in terms of the existing built form in the area would be the reduction in the frontage area to the D'Albora Marina, with the approach road located closer to the front and the loss of the existing external boat display area.

The appearance of the bridge, and the waterway in this area, would be altered by the introduction of a wider bridge. However the design of the bridge, which integrates with the existing bridge form, would minimise the significance of this impact.

14.3.2 Visibility and visual quality

The proposal would be predominantly a horizontal construction, and its vertical members would be aligned with existing vertical members of the bridge. As a result, it is not considered to result in a significant visual impact to view points in Beauty Point, Northbridge and Cammeray to the east.

Visual receivers in Clontarf are over 1km away, and while the proposed deck widening would be visible, it would be an inconsequential part of their view composition as it would be added to the 'back' of the existing bridge.

For viewers in Seaforth viewing the bridge on a downwards angle, the proposal would result in an apparent increase in the width of the roadway. The significance of this impact, in terms of the degree to which is dominates views of the waterway, would be determined by the distance from the viewer to the bridge and the angle of the view.

To most visual receivers, the proposal would not be more visible than the existing situation. This is a result of the horizontal nature of the bridge and the design concept, which generally matches the existing layout with respect to the alignment of piers and the arrangement of the desk edge and its superstructure.

For the majority of viewers, the bridge would mainly form a background element to their views. As such, the form of the proposal would only marginally affect the composition of the views in terms of the patterns of built form and natural elements.

Most of the views would be through, and in some instances over, tree canopies. As a result, it is considered that the proposal would have a low impact on the current view composition for the majority of sensitive visual receivers.

Some residences that are closer to the bridge would have their view composition altered to a greater degree. For these residences, the proposal would be in the middle ground. There are only a few of these residences, which are those immediately adjacent to the study area on the northern side.

Significance of visual quality impact

The significance of the potential impact is considered to be low to moderate:

- Generally, the adverse impacts relate to the visibility of the proposal to residents in close proximity to the bridge and pedestrians;
- The intrinsic character of the study area would not be altered;
- The appearance of the widened bridge would be similar to the existing bridge;
- The use of the study area would not be changed;
- The proposal is an addition to an established built element;
- The height and scale of the proposal is in keeping with that of the existing bridge;
- Existing vegetation would be retained;
- There would be limited impacts to the cliffs at the northwestern approach; and
- The bridge approaches would lead to some reconfiguration of existing hardstand areas.

14.3.3 Potential construction impacts

During construction there would be an adverse impact as a result of the presence of construction equipment, plant, facilities and general disturbance of the existing situation. This impact would be limited to the duration of the construction period.

14.4 Mitigation measures

Design of the bridge must take into account its visual and well as its heritage significance. These two aspects are integrally linked. The proposed bridge should be designed so that both the existing and the new section of bridge are similar in elevation. It is not essential that the bridge is an exact replica of the existing bridge. It is more appropriate for the new sections to express a more contemporary appearance within a framework that mirrors the form and line of the existing bridge.

It is recommended that the following design criteria be incorporated in the detailed design. Most of these criteria have already been incorporated into the concept design, and should be maintained in the development of the detailed design.

- The existing bridge has an eclectic nature that arises from the topography at the two approaches. The proposed widened section should not add any complexity to the visual qualities of the overall bridge. The simplicity of the existing bridge should be maintained in the detailed design of the bridge. It should be as simple and as unobtrusive as practicable;
- Piers should be located in line with existing piers. It is not necessary for the piers to be dimensionally the same as existing piers, however they should have a consistent geometric shape with a widening taper from top to bottom (on the side elevation). Edge chamfers should be minimised;
- Headstocks should not disrupt the line of the proposed edge beam. Headstocks should have minimal overhang from piers;
- The longitudinal slope on the proposed existing deck should match that on the existing deck. The deck should cantilever from the edge beam by at least one metre to ensure that the deck is visually dominant. The edge beam of the deck should appear as thin as practicable to avoid making the bridge look too 'heavy'. There should be no substructural girders to support this cantilever. The edge beam of the superstructure should be a continuous beam (straight line), interrupted only by the central pylon, and should be in a continuous line on the bascule section of the bridge;
- The central pylon should be extended to form a turret on the western façade, emphasising the change in pier type from north to south and accentuating the bascule section of the bridge;
- There should be no additional above deck structures beyond the existing situation;
- Light poles and handrails should be finished in an inorganic zinc silicate which matches the finishes on the eastern balustrade;
- Edges should be detailed to avoid streaking or staining on exposed concrete surfaces; and
- Disturbance to existing vegetation, and the sandstone cliffs near the northern abutment, should be minimised.

15. Topography, soils and geotechnical issues

This section provides a summary of the results of the geotechnical assessment undertaken by the RTA. The full report is provided in Appendix J.

15.1 Description of the existing environment

As part of the Geotechnical study, bore holes were drilled providing an indication of the soils and geology of the study area.

The Sydney geological map indicated Hawkesbury sandstone with Quaternary marine sands underlay the study area.

Natural rocky intertidal areas composed of sandstone are more extensive at the northern approach, occurring both to the east and west of the bridge. The northwestern shore generally has steep sandstone cliffs to the waters' edge with a deep (greater than 2m) sandy bottom. The northeastern sub-site has a rocky shore environment, with a gently sloping shelf that ends approximately 5-10m from the shore, dropping to a deep sandy benthos (AMBS 2003).

The channel bed to the north descends sharply to the south, to the middle pier. Closest to the northern bank, sandstone is overlaid with approximately 3 – 22m of silty sand. Further south in close proximity to the existing pier 4 and 5, clayey silt and silty sand overlay sandstone. The existing fourth pier is situated on the downside of a rock shelf towards the south. The rock formation indicates adjacent peaks and troughs may have a difference of approximately 15m. It is expected that the proposal would require a pier placed with a similar variability.

The southern shore (Mosman side) is enclosed to the west by a vertical, or near vertical sandstone retaining wall with a variable (but usually limited) intertidal area and shallow sandy sea floor. The channel bed is dominantly very soft to firm silty clays and silty sands. This may be of alluvial origin or extremely eroded weathered sandstone. Sandstone can be located starting at 43 – 50m. The depth of the sandstone generally increases from the north bank to the south bank. Existing piers on the Mosman side of the bridge are founded in sand and this is expected to be similar for the proposed bridge.

15.2 Assessment of potential impacts

The proposal would involve disturbance to the channel bed and sediments.

The proposal would involve minor excavation works for construction/widening of the approach roads north and south of the bridge. This work would be minimal due to the existing road and paved surfaces either end of the bridge. The existing pavement would be removed and replaced with an upgraded pavement.

During the construction of the approach roads there is potential for erosion as a result of exposed soil, if adequate mitigation measures are not put in place.

Placement of the piers would result in some disturbance of the channel bed, and as discussed in section 16, have the potential to increase turbidity levels in the water column if adequate mitigation measures are not implemented.

Construction of piers at the southern end would occur in sands. The loose nature of sands and underlying soft clays on the southern side would require a foundation system that would have negligible impact on the existing piles so as to prevent damage to the structure and foundations of the bridge.

Acid sulfate soils

Works along the shore banks could expose potential acid sulfate soils (ASS). ASS are soils and sediments that contain significant amounts of pyrite (iron sulfide) and when exposed to oxygen, oxidises producing sulfuric acid (battery acid). ASS are associated with water bodies including estuaries, floodplains and lakes. ASS soils are benign in a waterlogged environment until exposed.

Disturbance of ASS can lead to acidic conditions if not effectively managed. Concrete structures and steel may deteriorate if exposed to ASS. Aluminium, iron and other elements may be released potentially impacting the environment.

15.3 Mitigation measures

The following mitigation measures would be implemented to minimise the potential for impacts to the environment. These would be implemented in conjunction with the Soil and Water Management Plan (as part of the EMP) outlined in section 16.5.

Disturbance of the ground surface during earthworks exposes unprotected soil surfaces and has the potential to increase erosion. The design of the upgrade would incorporate a drainage system to limit overflow of runoff and direct stormwater into piped drainage systems that discharge at appropriate locations.

Recommendations include:

- Implement erosion, sediment and pollution control measures and practices during site preparation works and construction;
- Monitor erosion during site preparation works and construction;
- Rehabilitate exposed areas and implement the measures described in section 16.5;
- Develop maintenance programs for long-term steep batters;
- Retaining walls (founded on bedrock) may be utilised to support road embankments so as to limit land resumption by embankment batters;
- Installation of drainage measures and foundation replacement may be required where seepage and soft/weak strata are present; and
- Use best practice construction techniques to minimise disturbance particularly for pile driving (as described in sections 3 and 16).

Acid sulfate soils

Prior to construction, as part of the detailed design process, a preliminary assessment would be undertaken in accordance with the New South Wales Acid Sulfate Soils Management Advisory Committee publication, Acid Sulfate Soils – Assessment Guidelines (1998). The preliminary assessment would determine the presence of potential ASS and the likelihood to disturb potential ASS.

Should testing indicate that any potential or actual acid sulfate soils may be disturbed during site preparation works or construction, an Acid Sulfate Soil Management Plan would be prepared.

16. Water quality

16.1 Guidelines and policies

Legislative requirements are outlined in section 4. Guidelines and policies specific to water quality are outlined below.

16.1.1 ANZECC 2000 Guidelines

The Australian and New Zealand Environment and Conservation Council (ANZECC) 2000 Guidelines provide a framework for recognising and protecting water quality. The guidelines set benchmark criteria for a wide range of pollutants in all waters such as rivers, estuaries and oceans. The NSW EPA has considered these guidelines and developed scientific criteria for the more commonly identified pollutants in Sydney Harbour.

16.1.2 RTA Water Policy

The NSW Roads and Traffic Authority's (RTA) commitment to water management is outlined in the RTA Water Policy, which states:

'The RTA would use the most appropriate water management practices in the planning, design, construction, operation and maintenance of the roads and traffic system in order to:

- *conserve water;*
- *protect the quality of water resources;*
- *preserve ecosystems.*

This Code of Practice for water management outlines the principles the RTA would work within to meet the objectives of the RTA's Environment Policy, Water Policy and RTA's 5 Year Environment Plan, 'Caring for the Environment', which is a Business Support Strategic Plan for 1999-2004 (Environment Plan).'

The main objective of the Code of Practice is to provide the links between the outcomes required in the Water Policy and implementation guidelines. It aims to guide staff to the principles that need to be maintained for effective management of water quality during the various stages of road development and management.

The proposal would be conducted in accordance with the RTA Water Policy.

16.2 Description of the existing environment

16.2.1 Background

The Spit Bridge is located in the Middle Harbour catchment, northern Sydney. The Middle Harbour Catchment is approximately 100 km^2 with a population of approximately 200,000 people.

A desktop study was undertaken with respect to existing surface water conditions of Middle Harbour. Water quality in the vicinity of the Spit Bridge was also measured as part of the aquatic ecology impact assessment.

16.3 Middle Harbour catchment

Literature review

Water quality in the harbour is monitored and reported as part of the Harbourwatch Program (established in November 1994). Prior to this, Beachwatch conducted a pilot Harbour Beaches Monitoring Program from May 1992 to July 1993.

Numerous stormwater drains and sewage overflow outlets drain into the Middle Harbour. The closest monitoring point to the bridge is Clontarf Pool (to the east) where a stormwater drain is located.

Parameters used to determine water quality include pH, temperature, dissolved solids, tubidity, phosphates, nitrates, faecal coliforms, dissolved oxygen and biological oxygen demand. Marine life is also an indicator of the water quality and habitat condition (refer to section 11).

Generally, water quality in Middle Harbour is good and complies with relevant guidelines. Water parameters for Middle Harbour indicating water quality conditions are briefly discussed below:

Faecal coliforms

- Faecal coliform levels complied with the swimming guidelines 100% of the time at Clontarf Pool. The level of compliance at most Middle Harbour sites was 87% (EPA 2002[1]);
- Enterococcal compliance was generally lower, with 90% for Clontarf Pool (EPA 2002);
- Levels of faecal coliforms and enterococci tend to be within the range measured in other areas of the harbour (EPA 2002); and
- Faecal coliform levels generally increase with increasing upstream distance along Middle Harbour and during and after rainfall.

Water quality conditions below are summarised from SKM 1996 sighted in the Premiers Department report 1997[2].

Sewage overflows

Middle Harbour is affected by sewage overflows. The Lower Middle Harbour is moderately affected whilst the open water section of Middle Harbour downstream of the Spit Bridge, is least affected by sewage overflows.

Turbidity

Turbidity levels are generally low in the lower section of Middle Harbour. Moderate increases in turbidity levels have occurred after rainfall in the upstream section of Middle Harbour (at Davidson Reserve) as a result of urban stormwater.

---

1 NSW EPA (2002) Beachwatch and Harbourwatch State of the Beaches 2001-2002

2 Premiers Department (1997) Sewage Overflow Abatement in Sydney Harbour Waterways Advisory Panel Report.

Dissolved oxygen

All dissolved oxygen measurements in surface waters of Middle Harbour are better than the ANZECC minimum values, during both dry and wet weather conditions.

pH (acidity/alkalinity)

Measured pH values in Middle Harbour have complied with the ANZECC guidelines for aquatic protection. Rainfall appears to have little effect on pH values.

Nutrients and chlorophyll-a

Elevated levels of nutrients result in excessive growths of plants, of which algae cause most concern. Chlorophyll-a is a pigment which occurs in all photosynthetic plants and it is used to measure algae levels.

Nutrient and chlorophyll-a measurements have been made at only a few sites in Middle Harbour. Wet weather concentrations of total nitrogen in Quakers Hat Bay were higher than dry weather concentrations, suggesting an impact of sewage overflows.

Some higher nutrient values have been measured during warmer summer months in Middle Harbour and the upper estuarine sections.

Ranking

Some harbour and ocean beach swimming locations were ranked on the basis of their compliance with swimming guidelines during summer 2001-2002. A total of 19 rankings were determined for 129 sites, with many sites ranked equally (EPA 2002). Clontarf Pool was ranked 4 (100% compliance faecal and 90% enteroccoi).

The rankings for swimming areas in the Middle Harbour catchment ranged from 4 to 14.

16.3.1 Field study

As part of the aquatic ecology assessment, AMBS tested water quality parameters. The general water quality parameters sampled were averaged for each of the sub-sites to provide a figure for the site as a whole. This was compared with default trigger values from the ANZECC guidelines (2000) (refer to Table 16.1).

The ANZECC guidelines do not state default values for temperature because of diurnal, seasonal and regional variations. The temperatures during sampling ranged between 13.93°-15.75°C and were consistent between sub-sites. The average pH values were within the guideline values for estuarine and marine waters. Turbidity readings were higher than the recommended default values. The ANZECC guidelines state that higher turbidity values than recommended are often found in estuaries due to wind-induced re-suspension of materials. Turbidity is not considered a useful indicator in these habitats and the measurement of light attenuation is recommended in such areas. Dissolved oxygen values recorded (between 80-90%) were below the recommended saturation level values. However, dissolved oxygen levels may vary widely over a 24 hour period and spot sampling has limited value due to these diurnal variances. Conductivity and salinity values are not included in the guidelines but were consistent throughout the site.

Table 16.1 Water quality results

Water quality parameters	Survey sites					ANZECC (2000) Guideline
	NE	NW	SE	SW	Site average	Default trigger values
Temperature (°C)	15.22	13.93	15.75	14.84	14.93	not applicable
pH	8.49	7.97	8.04	7.89	8.10	7-8.5
Turbidity (NTU)	27.09	19.23	25.94	23.77	24.01	5-10
Salinity	34.11	34.21	34.27	34.04	34.16	not applicable
Dissolved Oxygen (mg/L)	6.83	6.93	7.08	6.88	6.93	80-110% saturation
Conductivity (uS/cm2)	51.80	52.03	52.10	51.82	51.94	not stated

The water quality parameters sampled during the survey indicate that conditions generally fall within the ANZECC Guidelines recommended for estuarine and marine habitats. The dissolved oxygen levels were slightly depressed however; diurnal variations associated with spot sampling need to be considered when assessing the results on a broad scale.

Overall, the water quality in Middle Harbour, particularly in close proximity to the study area, is acceptable and meets guideline requirements.

16.4 Assessment of potential impacts

16.4.1 Construction

Potential impacts to water quality during construction would be minimised as a consequence of construction techniques employed by the contractor. In general, construction would follow best practice techniques, and no appreciable impacts are anticipated.

During the construction period, there is the potential for a decline in water quality in the study area and the surrounding catchment, if disturbance of the land for the construction of abutments and approaches, and disturbance of sediments during piling activities is inadequately controlled. Suspended sediments and nutrients would be the main pollutants present in the water, especially during high rainfall events. The implementation of appropriate and rigorous erosion and sediment control measures during construction would minimise the potential for water quality impacts.

There is potential for impacts to water quality associated with the replacement of the bridge abutments on the banks of the waterway. This has the potential to result in an increase in sediment and pollutants as a result of the use of the pile driver and associated construction equipment if uncontrolled.

Potential impacts on aquatic ecology are addressed in section 11.

Provided that appropriate mitigation measures are implemented and monitored during the construction phase, there is not expected to be any appreciable impact on water quality during the construction phase.

16.4.2 Operation

As the piers for the new section of the bridge would be in identical longitudinal locations to the existing piers, flows within the waterway would not be impacted.

No increases to uncontrolled overland flows are predicted, as there would be no increase in the total area of sealed road surfaces (widening of the approaches would impact on existing sealed surfaces).

The proposal involves an increase in the paved area by no more than 200m². As a result the increase in run off will be negligible. Gross pollutant traps would be incorporated into the existing pipe networks to treat road runoff before discharging into Middle Harbour.

During the operation phase potential pollutants include:

- Fuel, lubricants, hydraulic fluids and coolants;
- Foreign particles worn off tyres, clutches and brake linings;
- Particular exhaust emissions;
- Vehicle components broken by vibration or impacts such as glass, plastic and metals;
- Dirt, rust and decomposing coatings; and
- Litter.

During operation of the bridge, there is the potential for pollutants to accumulate during dry periods and be washed downstream into waterways during wet periods. However, there is considered to be minimal potential for appreciable impacts, as only a small increase in the amount of roadway (the additional bridge lanes) would occur.

16.5 Mitigation measures

Potential impacts to water quality during construction would be minimised as a consequence of construction techniques employed by the contractor. In general, construction would follow best practice techniques, and no appreciable impacts are anticipated. During the construction phase, best practice methods would be specific to the contractor chosen. Gross pollutant traps would be incorporated into the existing pipe networks to treat operational road runoff prior to discharge into Middle Harbour.

It is imperative that best practice management strategies be put in place during both the construction and operational life of the proposal to minimise the impact and pollutant load entering the catchments. To further manage the potential for adverse impacts on water quality, construction works would be subject to controls documented prior to commencement of construction in a Soil and Water Management Plan, which would form a component of the overall Environmental Management Plan for the proposal.

The plan would document the controls to limit the generation of sediment and the removal of sediment and nutrients from runoff. The plan would be prepared in accordance with the principles and practices contained with the:

- EPA Managing Urban Stormwater: Treatment Techniques (1997);
- EPA Managing Urban Stormwater: Council Handbook (draft) 1997;

- NSW Department of Housing's 'Managing Urban Stormwater' (1998); and
- The RTA's 'Guidelines for the Control of Erosion and Sedimentation in Roadworks' (1992).

The types of activities the plan would specify include:

- Minimising the disturbance of the land surface including using defined access tracks and minimising the movement of vehicles and construction plant on unsealed areas;
- Locating stockpiles on flat areas, away from areas subject to run on and away from drainage flow paths;
- Use of silt curtains as a minimum during construction;
- Use of sediment ponds to collect excess sediment;
- Progressively stabilise disturbed areas to ensure that no areas remain unstable for any extended length of time;
- Use of reinforced earth retaining walls to limit embankment construction and potential erosion;
- Limiting the height and slope of stockpiles;
- Diversion of overland flow from construction sites,
- Use of water quality and erosion control measures such as geotextile fabrics, silt fences and sandbags;
- Providing sediment traps across drainage lines and stormwater channels; and
- Regular inspections of all erosion and sedimentation controls during the construction period to ensure their continued effectiveness.

In addition to the mitigation measures listed above, other safeguards to minimise pollution of the waterway include:

- Installation of permanent water quality devices and gross pollutant traps to provide collection of rubbish, sediments and other pollutants including oil, brake dust etc;
- Storage of hazardous liquids such as fuels and chemicals in secure compounds in accordance with EPA requirements;
- Development of contingency plans to deal with any spills, which might occur during construction;
- In the event of any lead paint being discovered on the bridge, the requirements of Australian Standard AS:4631.1 - 1995 Guide to lead paint management; Part 1: Industrial Application must be considered;
- Check machinery daily to ensure there are no oil, fuel or other liquids leaking from the machinery; and
- Refuelling of equipment to occur in appropriately bunded areas if on site.

17. Climate and air quality

17.1 Description of the existing environment

Meteorological data was obtained from the Bureau of Meteorology for the recording station at Observatory Hill. The data reveals that the average maximum temperature ranges from 25.8°C in January to 16.2°C in July. The average minimum temperature ranges from 18.7°C in February to 8°C in July.

Sydney experiences an average of 1,222 mm of rain per year over an average of 138 rainy days. The rainfall is seasonal with the highest volumes on average in Summer and Autumn (between January and June). On average, the lowest rainfall in experienced from September to December.

The local air quality of the study area is likely to be fair and influenced by pollution from the urban area, with cars on the surrounding roads the main contributor.

17.2 Assessment of potential impacts

17.2.1 Climate

During construction, the main climate issues are those likely to cause delays. The probability of these events is dependant on seasonal factors and inter-annual variations that are affected in part by large scale phenomena such as the El Nino Southern Oscillation.

Stoppages and delays due to rain

Heavy rain is a potential cause of disruption. These events have the potential to increase erosion, nutrient and sediment levels in the waterway, as well as make actual construction activities more difficult. Extended construction delays may result from persistent but less intense rainfall.

The likelihood of extremely intense events in the study area is greatest during summer and autumn.

The likelihood of disruption depends not only on the amount of rainfall received on any given day, but also its timing, the existing moisture levels and the rate of evaporation. For example, smaller amounts of rain in winter can give rise to similar impacts on construction activity as greater amounts in summer. The most adverse ground conditions due to rainfall are likely to be in winter, because of the low winter evaporation. The summer period is least likely to present persistent construction delays due to excessive rain and soil moisture.

Effects of temperature extremes

Extremes of temperature have adverse effects on some activities, such as the construction of concrete structures and asphalting. The setting of concrete is adversely affected by cold temperatures. Also, rapid drying in hot dry conditions can result in less than optimum concrete strength. Maximum concrete strength is obtained in conditions where moisture is maintained at a high level for a long period, with moderate temperatures.

Sub-zero surface temperatures rarely occur in the study area. Extreme high temperatures are also rarely experienced. Given the local climatic conditions, it is therefore unlikely that either high or low temperatures would impact on construction of the proposal.

Surface drying and dust formation

The likelihood of dry surface conditions is greater in winter and early spring than at other times. At this time of the year, construction activities could be expected to generate more dust than at other times. In extreme conditions with strong winds and low surface moisture, dust generation could potentially be sufficient to cause stoppage of construction until conditions subside.

17.2.2 Air quality

The main air quality impacts resulting from the proposal would be associated with dust during construction. Dust is likely to be generated when the existing land surface is disturbed to construct the abutments and widen the approaches, however this impact is considered to be minimal.

Minor increase in vehicle emissions would also be experienced as a result of construction equipment such as excavators and piling machinery.

Air quality impacts associated with the operation of the proposal would be limited to hydrocarbon emissions from traffic using the bridge. The potential increase in traffic flows and subsequent vehicle emissions would marginally reduce the local air quality.

17.3 Mitigation measures

In order to mitigate impacts on air quality resulting from the proposal, the sediment and erosion controls outlined in section 16.5 would be implemented to minimise generation of dust. Additional measures include:

- Covering stockpiled material to prevent generation of dust;
- Staging clearing activities to minimise the area exposed; and
- Dust suppression by a water tanker on dry windy days.

The potential for disruptions as a result of heavy rain should be considered during scheduling of the works period.

18. Waste management

18.1 Background

The construction environmental management plan (EMP), which would be prepared prior to commencement of construction, would detail aspects of waste minimisation and management that would be employed throughout the proposed upgrade. The EMP would specifically outline waste management measures that would be followed for the construction period by the contractor as a condition of the contract. The construction contractor would be required to demonstrate to the RTA that waste minimisation activities are to be incorporated into the construction program for the proposed upgrade in accordance with the *Construction and Demolition Waste Action Plan* released by the EPA (1998). In addition to the Construction and Demolition Waste Action Plan, the NSW Government also requires agencies to:

- Progressively minimise their major wastes by avoiding, reusing and recycling;
- Purchase material with recycled content wherever possible (eg. asphalt, concrete, recycled paper and toner etc); and
- Report on the progress of the above every two years, particularly for the following major items of waste (vegetation waste, concrete, fill/virgin excavation natural material (VENM), asphalt and office waste such as paper and toner).

It is proposed that there would be a requirement of the construction contractor to reuse material wherever possible and incorporate recycling programs as appropriate.

A temporary construction site compound/s would be erected in the vicinity of the bridge. Any waste generated by the site would be contained within the site compound. Waste that could not be reused or recycled would be removed at regular intervals to a licensed waste disposal depot.

18.1.1 Protection of the Environment and Operations Act, 1999

The requirements of the Protection of the Environment and Operations Act 1999 for non-licensed waste activities, which are relevant to the proposed upgrade include:

- Any hazardous waste must be stored in an environmentally safe manner and not come into contact with any incompatible waste;
- Waste must be transported only to a controlled waste facility, or to a waste facility that can lawfully receive waste;
- Transport vehicles must be kept in a clean condition and be constructed and maintained so as to prevent waste spillage;
- Transport vehicles must be covered when loaded so as to prevent spilling and loss of waste and to prevent emission of odours; and
- The waste transporter must have a licence to transport waste.

18.2 Impact assessment

Construction

During the construction phase, the proposed upgrade would generate the following wastes:

- Construction/demolition waste including excavation materials such as rock and topsoil, scrap metals, piping, asphalt, concrete and other construction/demolition materials;
- Minimal cleared vegetation and landscaping materials;
- Surplus materials used during site establishment such as safety fencing and barriers which may include plastics and metals;
- Wastewater including site run-off and water used to control dust;
- Domestic waste including food scraps, aluminium cans, glass bottles, plastic and paper containers and putrescible waste generated by site construction personnel;
- Ablution waste including waste from toilets and basins; and
- Waste oil and fuels.

The EPA's *Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes (1999)* classifies wastes into the following five categories:

- Inert – including virgin excavated material, vegetation, building and demolition waste, and asphalt;
- Solid – such as food waste and litter;
- Industrial – such as asbestos ;
- Hazardous – such as flammable liquids; and
- Liquid – such as sewage.

The majority of waste is expected to be construction waste, which is likely to be classified as inert. This material would be treated in accordance with the resource management hierarchy principles as follows:

- Waste avoidance;
- Reuse of waste materials;
- Recycling of waste materials; and
- Disposal of material.

The manner in which these principles would be applied to the proposal is outlined in the mitigation measures presented below.

Operation

Waste created during operation of the proposal would consist of vehicle emissions and general waste, such as food packaging thrown from vehicles. Wastes such as asphalt and pavement materials would be generated during routine maintenance activities. There is also the potential for hazardous materials to be spilt on the road during operation. These incidents would be managed in accordance with the RTA spill management and

contaminated waste handling guidelines, and would be stored and removed in accordance with EPA guidelines and procedures.

18.3 Mitigation measures

Mitigation measures focussing on waste minimisation and management fall into the three principles of reducing, reusing and recycling materials:

Reduce

- Ensuring that the quality of the roads used to access the site remain intact to reduce the need for further new paving materials; and
- Erecting signs within the construction area with information about minimising waste and encouraging employees to avoid and reduce waste wherever possible.

Reuse

- Chipping and mulching and vegetation which is required to be cleared, and reusing the chipped material as part of the landscaping in the vicinity of the site;
- Ensuring that the topsoil to be removed is free of weeds prior to being stripped, stockpiled and stored;
- Reusing existing road signs wherever practicable; and
- Spreading, levelling and seeding any excess material that is unsuitable for use in road embankments or landscaping over cleared areas of land owned by the RTA.

Recycle

- Provision of separate bins on site to promote the recycling of materials such as paper and cardboard, glass, plastics and metals;
- Demolition wastes would be offered for appropriate recycling, including recycling as firewood;
- Recycling as much material as practicable including concrete, steel, glass and timber. These items would be sorted, collected and taken to a recycling depot in the region; and
- Require the EMP to refer to the NSW Waste Board's Construction and Demolition Waste Recycling Directory (1999) to ensure ready access to information about professional recycling businesses operating in the surrounding areas.

Other

Disposal of surplus materials such as bitumen, asphalt, concrete, demolition waste and cleared vegetation would not be permitted on any land on or around the site.

Waste management procedures would include the following:

- All site sewage to be collected and disposed off-site in accordance with the relevant regulations;
- Construction vehicles be securely covered to prevent spilling, loss of waste and emission of odours during transportation;
- Leaving the work site tidy and free of rubbish upon completion of the project; and

- Waste from routine maintenance works during operation would be appropriately reused, recycled or disposed of in accordance with legislative requirements.

The RTA has also recently revised their technical specifications for roadworks and permit the purchase of materials such as asphalt and concrete for road construction that contain recycled content. Where available, the purchase of materials, which include allowable limits of recycled content, would be permitted for use on the project.

Any surplus materials would be disposed of appropriately. The disposal of bituminous products, green waste and domestic type refuse would need to be addressed appropriately in the EMP.

19. Ecologically sustainable development

The RTA is required to consider the principles of ecologically sustainable development (ESD) when assessing its activities. Each of the four principles of ESD, as established by the EP&A Regulation 2000, is described below with a comment regarding how the proposal contributes towards each principle.

19.1 Precautionary principle

This principle states that *'if there are threats of serious or irreversible damage, lack of scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation'.*

The assessment of the potential impacts of the proposal is considered to be consistent with the precautionary principle. The environmental assessments undertaken for this SEE/REF are consistent with accepted scientific and assessment methodologies. The detailed investigations undertaken have identified a range of potential impacts. A number of safeguards have been recommended to minimise potential impacts. These safeguards would be implemented during construction and operation of the proposal. No safeguards have been postponed as a result of lack of scientific certainty.

The selected contractor would be required to prepare a detailed environment management plan (EMP) prior to commencing construction. This requirement would ensure that the proposal achieves a high level of environmental performance. No mitigation measures or management mechanisms would be postponed as a result of a lack of information.

It is recommended that environmental performance in relation to the EMP be regularly assessed through external environmental audits. The audits would also assist in assessing the adequacy of safeguards implemented to minimise environmental impacts.

19.2 Intergenerational equity

The principle states, *'the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations'.* In other words, we should ensure that future generations do not inherit a degraded environment.

Consistent with this principle, the REF/SEE has identified that the proposal would not result in significant long terms impacts that would lead to degradation of the environment.

The safeguards and management mechanisms recommended within the REF/SEE, and the design features relating to water quality, would minimise the potential for environmental impact and degradation.

19.3 Conservation of biological diversity and ecological integrity

This principle states that the *'diversity of genes, species, populations and communities, as well as the ecosystems and habitats to which they belong, must be maintained and improved to ensure their survival'.*

The study area has been highly modified and is intensively used. The flora and fauna assessment did not identify any significant potential impacts to terrestrial flora and fauna.

Water management mechanisms during construction and operation would ensure that the potential for impacts to aquatic ecology is effectively mitigated.

19.4 Improved valuation and pricing of environmental resources

This principle requires that '*costs to the environment should be factored into the economic costs of a project*'.

The SEE/REF has examined the environmental consequences of the proposal and identified mitigation measures where the potential to experience adverse impacts exists. Construction of the proposal would be required to conform to a high level of environmental performance, guided by the development and implementation of a rigorous and detailed EMP. Requirements imposed in terms of implementation of these mitigation measures would result in an economic cost to the RTA and construction contractor. The implementation of mitigation measures would increase both the capital and operating costs of the proposal. This signifies that environmental resources have been given appropriate valuation.

The concept design for the proposal has been developed with an objective of minimising potential impacts on the surrounding environment. This indicates that the concept design for the proposal has been developed with an environmental objective in mind.

Part E Environmental management

20. Summary of mitigation measures

The key mitigation measures identified throughout this REF are summarised in Table 19.1. These mitigation measures would be incorporated into the detailed design phase of the proposal and as part of its construction and operation by way of environmental management plans (EMPs), thereby reducing any adverse impacts to the surrounding environment.

Table 20.1 Summary of mitigation measures

Issue	Mitigation measure
Land use and property impacts	◗ Further liaison with landowners and tenants would be carried out during the approvals process; ◗ The acquisition of any land required would be undertaken in accordance with the RTA's Land Acquisition Policy and compensation undertaken in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*; ◗ Any changes to access arrangements for land uses in the area (such as access to reserves, car parks, businesses etc) would be clearly signposted; ◗ Signage would also indicate the availability of access to all businesses in the vicinity of the bridge during the construction period; ◗ Restrictions to access to Ellery park during the construction period, and the potential use of areas within existing reserves and car parks as construction work sites, would be negotiated with Mosman and Manly Council; and ◗ Arrangements and requirements in terms of the relocation of services would be negotiated with the operators of D'Albora Marina.
Heritage (non-Aboriginal)	◗ The design of the new bridge components would remain fundamentally sympathetic to the form, function and design ethic of the existing structure and adhere to the principles of the 'Australia ICOMOS Burra Charter 1999' (refer Appendix D); ◗ The new design would be consistent with the form of the western face of pier four and other major visual components of the bridge structure; ◗ There would be no significant impact upon the appearance of the control tower, as this forms a major visual component of the bridge; ◗ As depicted in the concept drawing, the handrails and light stanchions from the western side of the existing bridge should be re-erected along the western side of the new structure; ◗ It is recommended that an archival quality photographic essay of the Spit Bridge should be carried out prior to any works taking place. In addition, construction of the new section of bridge would also be archivally recorded, as well as the way in which it interacts with the original structure. Following completion of construction, this information could form part of the interpretation of the overall bridge complex; ◗ All photography and other recording would comply with the standards of the NSW Heritage Office (refer Appendix D) ◗ During the construction works, the cultural resources within the surrounding landscape would be protected as far as practicable. Prior to any site works taking place, these items should be identified and fenced off. Controls regarding protection of these items would be included within the construction EMP; ◗ The EMP would include a requirement that works associated with the proposal must cease if historic artefacts are uncovered during the construction process, regardless of whether archaeological monitoring is taking place. The NSW Heritage Office must be contacted if historic

Issue	Mitigation measure
	remains are uncovered; ◗ The EMP would include information about the statutory legislation protecting sites and places of cultural heritage, the process required when remains are uncovered, and responsibilities in this regard. ◗ Interpretation, in the form of information and educational boards, would be provided as follows: – The significance of the cultural landscape as an important transport corridor and crossing place should be interpreted with respect to the thematic topics identified by the NSW Heritage Office, and the recently revised Australian Heritage Commission 'Australian Historic Themes' (2001) and the Australia ICOMOS Burra Charter (1999) (refer Appendix D for more information); – The information presented should inform the visitor of the individual and group significance of the cultural resources according to the NSW heritage legislation and assessment criteria. It should educate the visitor about the heritage framework that protects heritage resources, such as these bridges; – The interpretive information should discuss the technology of bridge design and its context in the immediate region and the broader landscape. In particular, the interpretation should address the way in which the bridge came into being and the role it, and the crossing in general, has played in the general development of the area; and – Some interpretation should be installed prior to the commencement of the works, to inform the public of what is going on and what efforts are being made to protect significant items of cultural heritage.
Aboriginal heritage and archaeology	◗ Given the presence of Aboriginal archaeological sites nearby, particularly the shelter with midden to the north west of the bridge (45-6-1022), the shell midden near Fisher Bay (45-6-1027) and the artefact scatter site at Fisher Bay (45-6-2351) on a flat grassy area adjacent to the water, care would be taken to avoid any ground disturbance in these areas which potentially retain buried Aboriginal archaeological material. ◗ All 'Aboriginal objects' are protected under the *National Parks and Wildlife Act 1974*, as outlined above. It is an offence to destroy, deface or damage an Aboriginal object or Place without a consent issued by the National Parks and Wildlife Service. ◗ Controls regarding protection of these items would be included within the construction EMP; ◗ The EMP would include a requirement that works associated with the proposal must cease if an Aboriginal archaeological site is uncovered during the construction process. The Indigenous Heritage Division of the NPWS must be contacted if Indigenous artefacts are uncovered; ◗ The EMP would include information about the statutory legislation protecting sites and places of cultural heritage, the process required when remains are uncovered, and responsibilities in this regard. ◗ The local Aboriginal community, through the Metropolitan LALC, would continue to be consulted in any future decisions regarding the study area. Continued liaison should ensure that any works do not compromise the Aboriginal heritage value of the place. Any specific recommendations made by the Metropolitan LALC should be incorporated.
Traffic, public transport and access	◗ Provide adequate traffic management, including temporary speed restrictions, precautionary signs, illuminated warning devices, manual traffic control and temporary barriers and markers; ◗ The boating community, including yachting clubs and marinas, would be consulted regarding the period of closure of the bridge's bascule span. At least three months notice of the proposed closure would be provided; ◗ Property owners in the immediate vicinity of the bridge would be consulted regarding proposed access arrangements during both construction and operation; ◗ The modification of the bascule span would occur in a period of least interruption to yachting traffic. It is expected that this would be the winter months. ◗ Maintain a thoroughfare for emergency vehicles at all times, with priority given to these movements when required;

Issue	Mitigation measure
	◗ Establish safe access points to work areas from the adjacent road network including safety measures such as barriers, appropriate visibility and signage and the provision of traffic management measures such as those identified above; ◗ Ensuring property access is maintained at all times. This may require the temporary relocation of property access while permanent improvement works are made; ◗ Only the minimum practicable length and width would be under construction at any one time, to minimise disruption and inconvenience to road users during the works; ◗ Schedule disruptive works to take place outside peak commuting hours; and ◗ All traffic management measures would be undertaken in accordance with AS 1742.3 1996, Manual of Uniform Traffic Control Devices, Part 3: Traffic control devices for work on roads.
Noise	The timing and type of night time construction activities would be carefully considered at the detailed design stage of the proposal. The construction EMP would include a noise management strategy, which would consider the methodology proposed by the construction contractor and the relative phasing of different construction activities in different areas. The timing of construction activities with respect to rise and fall of background noise levels would serve as a primary means by which impacts are managed. As a result, additional baseline noise measurements at all residences potentially affected by construction noise is recommended. It is recommended that the noise management strategy incorporate the following: ◗ The use of quietest plant available, regularly maintained and fitted with appropriate mufflers. In particular, consideration should be given to the use of bored rather than driven piling where possible; ◗ Possible restrictions in construction hours (beyond EPA requirements), where noise impacts are likely; ◗ Minimising the potential for impact type noise events (such as girders impacting the bridge structure) during night time periods; ◗ Notification of residents prior to noisy or vibration generating activities; and ◗ Noise monitoring to ensure best practice is being implemented. ◗ It is possible that some activities may be required beyond the EPA recommended construction hours. Contact with the EPA, Manly and Mosman Councils and residents would be undertaken prior to these activities. These procedures are outlined in the RTA document 'Consultation Procedure for Roadworks Undertaken Outside of Normal Working Hours'.
Aquatic flora and fauna	◗ The construction EMP would specify that construction vessels not span the width of the waterway at any time; ◗ A threshold level of turbidity would be determined and specified within the construction EMP. Monitoring of turbidity would be undertaken during construction. Further monitoring of nutrient levels would be undertaken if any turbidity exceedances are identified. The EMP would require cessation of construction activities in the event of any exceedance of this level; ◗ Monitoring of physical water quality parameters such as sediment, turbidity and nutrients would determine whether the safeguards are adequate. Threshold levels for these parameters, and responses should these levels be exceeded, would be specified within the EMP. Monitoring during construction would be particularly important during and following rainfall events; ◗ An emergency contingency plan for dealing with accidental spills on the bridge would be developed; and ◗ The speed and movement of all barges and support vessels would be kept to a minimum and comply at all times with Waterways regulations.
Terrestrial flora and fauna	◗ The proposal would avoid disturbance to the bushland below Avona Crescent. If a worksite is established in the reserve near this bushland, vegetated areas should be fenced off, and access to the work site clearly

Issue	Mitigation measure
	defined to avoid impacts to the bushland; ◗ Works at the northwestern approach, including excavation of the sandstone cliff, would minimise disturbance of existing vegetation at the top of the cliff; ◗ A targeted survey for the red-crowned toadlet in suitable conditions is recommended to confirm the presence or absence of this species; ◗ The location of construction worksites, facilities and plants would avoid the root zones for significant trees in the study area (including the ficus spp and Norfolk Island pines) in order to avoid long-term damage to the trees through soil compaction in the root zones; ◗ The following measures would be implemented if unpaved or grassed areas are used to locate facilities: – aeration of soil following use; – strict controls to prevent any release of chemicals or pollutants; and – re-establishment of vegetation following construction work. ◗ Significant disturbance to flying fox foraging behaviour would be avoided. Recommended measures include: – locating facilities and plant away from the Ficus trees; – preventing light spill into these areas; and – minimising the amount of noise and activity in these areas at night. ◗ Any landscape work proposed for the northern approach would utilise suitable local indigenous species.
Socio-economic considerations	It is recommended that a community consultation and communication plan be developed covering local businesses and clubs, surrounding residents and the wider community. The plan should detail activities to be implemented in the lead up to, and during, the construction period. Recommended consultation tools include: ◗ A nominated and dedicated consultation manager responsible for ongoing liaison with the community and businesses/clubs on the Spit; ◗ A community hotline – operating 24 hours during the construction period – to enable response to questions, complaints etc; ◗ Regular meetings with key stakeholders and surrounding residents. This should include discussions with sailing clubs, marinas, restaurants and other businesses in the area regarding access and other requirements to identify potential issues and develop appropriate management mechanisms. Other key stakeholders include Mosman and Manly Councils and state agencies; ◗ Consult with yachting clubs and marinas regarding the period of closure of the bridge's bascule span and provide at least three months notice of the proposed closure; ◗ Widely advertising changes to bridge opening times; ◗ Project newsletters/information sheets distributed to residents of surrounding suburbs; ◗ Regular project updates in the Manly Daily and the Mosman Daily; ◗ Use of signboards, directional signage and electronic signs in the vicinity of the bridge providing updates on traffic conditions, changes to access arrangements etc; and ◗ A project information signboard erected in the vicinity of the construction site providing regular update on the progress of the project, contact details etc. In addition, the following measures are recommended to minimise the potential for socio-economic impacts: ◗ Ensuring that access to businesses and sailing clubs is maintained throughout the construction period; ◗ Careful placement of construction worksites to minimise the potential for disruption of access to businesses and recreation activities; ◗ Minimising loss of carparking during construction periods; and ◗ Any temporary lane closures should occur during the periods of lowest traffic flow and, as far as practicable, outside operating hours for

Issue	Mitigation measure
	businesses in the area.
Landscape, urban design and visual quality	It is recommended that the following design criteria be incorporated in the detailed design. Most of these criteria have already been incorporated into the concept design, and should be maintained in the development of the detailed design. ◗ The existing bridge has an eclectic nature that arises from the topography at the two approaches. The proposed widened section should not add any complexity to the visual qualities of the overall bridge. The simplicity of the existing bridge should be maintained in the detailed design of the bridge. It should be as simple and as unobtrusive as practicable; ◗ Piers should be located in line with existing piers. It is not necessary for the piers to be dimensionally the same as existing piers, however they should have a consistent geometric shape with a widening taper from top to bottom (on the side elevation). Edge chamfers should be minimised; ◗ Headstocks should not disrupt the line of the proposed edge beam. Headstocks should have minimal overhang from piers; ◗ The longitudinal slope on the proposed existing deck should match that on the existing deck. The deck should cantilever from the edge beam by at least one metre to ensure that the deck is visually dominant. The edge beam of the deck should appear as thin as practicable to avoid making the bridge look too 'heavy'. There should be no substructural girders to support this cantilever. The edge beam of the superstructure should be a continuous beam (straight line), interrupted only by the central pylon, and should be in a continuous line on the bascule section of the bridge; ◗ The central pylon should be extended to form a turret on the western façade, emphasising the change in pier type from north to south and accentuating the bascule section of the bridge; ◗ There should be no additional above deck structures beyond the existing situation; ◗ Light poles and handrails should be finished in an inorganic zinc silicate which matches the finishes on the eastern balustrade; ◗ Edges should be detailed to avoid streaking or staining on exposed concrete surfaces; and ◗ Disturbance to existing vegetation, and the sandstone cliffs near the northern abutment, should be minimised.
Topography, soils and geotechnical issues	The following mitigation measures would be implemented to minimise the potential for impacts to the environment. These would be implemented in conjunction with the Soil and Water Management Plan (as part of the EMP) outlined in section 16.5. The design of the upgrade would incorporate a drainage system to limit overflow of runoff and direct stormwater into piped drainage systems that discharge at appropriate locations. Recommendations include: ◗ Minimise the impact on soil stability and susceptibility to erosion; ◗ Implement erosion, sediment and pollution control measures and practices during site preparation works and construction; ◗ Monitor erosion during site preparation works and construction; ◗ Rehabilitate exposed areas and implement the measures described in section 16.5; ◗ Develop maintenance programs for long-term steep batters; ◗ Retaining walls (founded on bedrock) may be utilised to support road embankments so as to limit land resumption by embankment batters; ◗ Installation of drainage measures and foundation replacement may be required where seepage and soft/weak strata are present; and ◗ Use best practice construction techniques to minimise disturbance particularly for pile driving (as described in sections 3 and 16). Acid sulfate soils Prior to construction, as part of the detailed design process, a preliminary

Issue	Mitigation measure
	assessment would be undertaken in accordance with the New South Wales Acid Sulfate Soils Management Advisory Committee publication, Acid Sulfate Soils – Assessment Guidelines (1998). The preliminary assessment would determine the presence of potential ASS and the likelihood to disturb potential ASS. Should testing indicate that any potential or actual acid sulfate soils may be disturbed during site preparation works or construction, an Acid Sulfate Soil Management Plan would be prepared.
Water quality	To manage the potential for adverse impacts on water quality, construction works would be subject to controls documented prior to commencement of construction in a Soil and Water Management Plan, which would form a component of the overall Environmental Management Plan for the proposal. The plan would document the controls to limit the generation of sediment and the removal of sediment and nutrients from runoff. The plan would be prepared in accordance with the principles and practices contained with the: ◗ EPA Managing Urban Stormwater: Treatment Techniques (1997); ◗ EPA Managing Urban Stormwater: Council Handbook (draft) 1997; ◗ NSW Department of Housing's 'Managing Urban Stormwater' (1998); and ◗ The RTA's 'Guidelines for the Control of Erosion and Sedimentation in Roadworks' (1992). The types of activities the plan would specify include: ◗ Minimising the disturbance of the land surface including using defined access tracks and minimising the movement of vehicles and construction plant on unsealed areas; ◗ Locating stockpiles on flat areas, away from areas subject to run on and away from drainage flow paths; ◗ Use of silt curtains as a minimum during construction; ◗ Use of sediment ponds to collect excess sediment; ◗ Progressively stabilise disturbed areas to ensure that no areas remain unstable for any extended length of time; ◗ Use of reinforced earth retaining walls to limit embankment construction and potential erosion; ◗ Limiting the height and slope of stockpiles; ◗ Diversion of overland flow from construction sites, ◗ Use of water quality and erosion control measures such as geotextile fabrics, silt fences and sandbags; ◗ Providing sediment traps across drainage lines and stormwater channels; and ◗ Regular inspections of all erosion and sedimentation controls during the construction period to ensure their continued effectiveness. In addition to the mitigation measures listed above, other safeguards to minimise pollution of the waterway include: ◗ Installation of permanent water quality devices and gross pollutant traps to provide collection of rubbish, sediments and other pollutants including oil, brake dust etc; ◗ Storage of hazardous liquids such as fuels and chemicals in secure compounds in accordance with EPA requirements; ◗ Development of contingency plans to deal with any spills, which might occur during construction; ◗ In the event of any lead paint being discovered on the bridge, the requirements of Australian Standard AS:4631.1 - 1995 Guide to lead paint management; Part 1: Industrial Application must be considered; ◗ Check machinery daily to ensure there are no oil, fuel or other liquids leaking from the machinery; and ◗ Refuelling of equipment to occur in appropriately bunded areas if on site.
Climate and air quality	In order to mitigate impacts on air quality resulting from the proposal, the sediment and erosion controls outlined in section 16.5 would be implemented

Issue	Mitigation measure
	to minimise generation of dust. Additional measures include: ◗ Covering stockpiled material to prevent generation of dust; ◗ Staging clearing activities to minimise the area exposed; ◗ Dust suppression by a water tanker on dry windy days; and ◗ The potential for disruptions as a result of heavy rain should be considered during scheduling of the works period.
Waste minimisation and management	◗ Ensuring that the quality of the roads used to access the site remain intact to reduce the need for further new paving materials; ◗ Erecting signs within the construction area with information about minimising waste and encouraging employees to avoid and reduce waste wherever possible; ◗ Chipping and mulching and vegetation which is required to be cleared, and reusing the chipped material as part of the landscaping in the vicinity of the site; ◗ Ensuring that the topsoil to be removed is free of weeds prior to being stripped, stockpiled and stored; ◗ Reusing existing road signs wherever practicable; ◗ Spreading, levelling and seeding any excess material that is unsuitable for use in road embankments or landscaping over cleared areas of land owned by the RTA; ◗ Provision of separate bins on site to promote the recycling of materials such as paper and cardboard, glass, plastics and metals; ◗ Demolition wastes would be offered for appropriate recycling, including recycling as firewood; ◗ Recycling as much material as practicable including concrete, steel, glass and timber. These items would be sorted, collected and taken to a recycling depot in the region; ◗ Require the EMP to refer to the NSW Waste Board's Construction and Demolition Waste Recycling Directory (1999) to ensure ready access to information about professional recycling businesses operating in the surrounding areas; ◗ Disposal of surplus materials such as bitumen, asphalt, concrete, demolition waste and cleared vegetation would not be permitted on any land on or around the site; ◗ All site sewage to be collected and disposed off-site in accordance with the relevant regulations; ◗ Construction vehicles be securely covered to prevent spilling, loss of waste and emission of odours during transportation; ◗ Leaving the work site tidy and free of rubbish upon completion of the project; ◗ Any surplus materials would be disposed of appropriately. The disposal of bituminous products, green waste and domestic type refuse would need to be addressed appropriately in the EMP; and ◗ Waste from routine maintenance works be appropriately reused, recycled or disposed of in accordance with legislative requirements.

21. Environmental approvals, management and monitoring

21.1 Environmental management plans

The EMP is a project-specific source document detailing the environmental protection requirements to mitigate and minimise environmental impacts. The EMP's primary purpose is to ensure that the environmental requirements and commitments associated with a project are carried forward into the construction and operational phases of the project and are effectively managed.

The EMP would outline the environmental goals of the proposal, the safeguard measures to be implemented during design and construction, the timing of implementation in relation to the progress of the proposal, responsibilities for implementation and management and review process.

The EMP would be prepared in accordance with the RTA environmental management guidelines. In addition, any contractor employed to manage and construct the proposal would need an accredited environmental management system in place.

The main purposes of the EMP would be to:

- Ensure all safeguards outlined in the SEE/REF and conditions of approval are implemented on site;
- Ensure that all activities are carried out with due diligence; and
- Ensure that all activities comply with relevant environmental legislation including Acts, Regulations, Standards and Best Management Practices.

The EMP would be made available to government departments, statutory authorities, the community and all other interested organisations and individuals.

The EMP would address design and construction activities including pre-construction, construction and post construction activities.

21.1.1 Environmental management procedures

Management procedures would need to be detailed for each of the elements below:

- Soil and water quality;
- Traffic and access;
- Noise and vibration;
- Flora and fauna;
- Air quality;
- Heritage, visual and landscape;
- Waste minimisation and management;
- Hazards and risk management;

- Visual management procedures;
- Community involvement and communication;
- Record keeping and reporting;
- Monitoring (particularly monitoring of noise and water quality); and
- Auditing.

21.1.2 Occupational health and safety (OH&S)

Before detail design commences, an OH&S management plan would be developed to address the following:

- Generic OH&S risk related to the project;
- Specific OH&S risk related to the project;
- Objectives for construction; and
- Safety issues arising from working adjacent to traffic and traffic management.

21.2 Approvals and licences

Approvals and licences listed required from statutory authorities and other organisations prior to construction and operation include those listed in Table 20.1.

Table 21.1 Statutory approvals and licences

Legislation	Authority	Approval/Licence
Environmental Planning and Assessment Act 1979	Manly Council	Development consent
	Mosman Municipal Council	Development consent
	Waterways Authority	Development consent
Heritage Act 1977	Heritage Council of NSW	An excavation permit may be required if relics older than 50 years are to be disturbed

If the remains of the former timber bridge structure need to be removed at the harbour bed level, where there is a potential for interference with the piling for the proposal, dredging may need to be undertaken. If dredging is required, an application for approval would need to be made to NSW Fisheries.

The construction contractor would also be required to comply with all statutory requirements which relate directly to work practices such as:

- Trade Practices Act;
- Construction Safety Act; and
- Occupational Health and Safety Act.

21.2.1 Liaison

In addition to the above statutory approvals and licences, liaison would also need to occur with the following authorities and agencies prior to the proposal proceeding:

- DLWC, in relation to works on Crown land;
- NSW Fisheries must be notified under Section 199 of the Fisheries Management Act; and
- It is recommended that the RTA also continue to liase with the Heritage Office and the EPA.

Part F Conclusion

22. Justification of the proposal

The widening of the Spit Bridge would provide an increase in capacity for both the morning and evening contra peak flows.

The improvements to the contra peak flows would be particularly beneficial to bus passengers and to the efficient operation of STA buses.

There are major advantages for the weekend peak flows which are currently required to merge from three to two lanes at each approach. This merging would no longer be required and flows would be comparatively uninterrupted, allowing faster traverse times between Spit Junction and the Burnt Bridge Creek Deviation intersection at Seaforth. The provision of the additional lanes should also significantly reduce the time taken to clear the queues that build up during the opening of the bridge to allow navigation traffic.

The proposal has been the subject of an environmental impact assessment (as summarised by this SEE/REF), which has found that it would be achievable with no significant adverse environmental impacts.

The widening is also affordable at a preliminary estimated cost of approximately $30 million for the bridge widening and $5 million for the approach works. Preliminary economic assessment of the performance of the proposed bridge widening indicates a positive return on community investment in the proposal.

The potential social, environmental and economic impacts of the proposal are significantly less than the potential impacts associated with alternative options (such as tunnels).

In summary, the proposal would result in:

- Enhanced travel opportunities, with increased access to employment centres and work opportunities;
- Improved services to pedestrians and cyclists across the enhanced shared footway on the western side;
- Faster public transport travel times;
- More efficient use of both household financial resources and the time available for travel purposes; and
- A greater level of choice as to the use of regional facilities, including commercial and community services.

22.1 Future opportunities

It is intended that the widened bridge would initially operate with three lanes in each direction. This would be compatible with the existing three lanes at each approach.

It is not expected that there would be any significant immediate advantage to the morning peak flow travelling south. However, the proposal would facilitate the realisation of advantages that might be offered by existing and possible future projects such as:

- Reducing the weekend opening times and providing a clearway on the weekends along Spit Road;
- Proposed improvements to buses as part of the Better Buses North project;
- Removing the median barrier on the northern approach between the bridge and the Sydney Road intersection. It would then be possible to provide a four/two lane tidal flow arrangement at the northern approach to, and across the bridge. One of these lanes could be a bus only lane; and
- Remodelling the Parriwi Road junction. It would then be possible to extend the four/two lane tidal flow south up the Spit Hill as far as the intersection with Pearl Bay Road.

None of these measures form part of the current proposal. However, these measures may be explored as part of future improvements to access in the vicinity of the bridge. The current proposal provides to opportunity for this to occur.

23. Conclusion

The proposal addressed in this SEE/REF is the widening of the Spit Bridge by providing an additional two lanes for the movement of traffic. This would involve constructing a new two-lane bridge directly abutting the existing bridge to the west, and reconfiguring the lanes on the existing bridge. The proposal also involves widening the existing approaches to the west, at the northern and southern banks, to tie in the new section of bridge with Manly Road to the north and Spit Road to the south.

The SEE/REF has considered the potential positive and negative impacts of the proposal.

It is considered that the proposal would:

- Improve accessibility to the northern beaches/Warringah area by reducing travel time;
- Improve the operational viability of the bus network;
- Reduce bus transit times;
- Not significantly affect the high level of workforce containment on the Warringah peninsula;
- Assist in encouraging public transport patronage;
- Improve cycle and pedestrian access;
- Offer opportunities for future traffic management works;
- Allow the benefits of the STA's Better Buses North proposal to be more fully realised; and
- Allow the benefits from any other future works/proposals along the route (such as the current proposals to reduce the number of bridge openings and introduce a weekend afternoon clearway along Spit Road) to be more fully realised.

The visually significant row of Norfolk pines running parallel to Spit Road to the southwest of the bridge would *not* be impacted by the proposal. None of these trees would need to be removed.

A number of potentially negative impacts have been identified. The main negative impacts relate to construction, and include noise impacts to surrounding residents, the potential for generation of sediment and management of traffic and access arrangements. Other potential impacts relate to visual amenity and heritage. In particular, the SEE/REF identifies that:

- Water quality controls must be incorporated in the design, with best practice construction methods implemented to ensure that the potential for water quality impacts are adequately controlled;
- A detailed community consultation program would be required as part of the implementation of the works;
- The proposal must be designed with regard to the heritage and visual significance of the bridge; and

GHD Pty Ltd ABN 39 008 488 373

10 Bond Street Sydney NSW 2000

-

T: 2 9239 7100 F: 2 9239 7199 E: sydmail@ghd.com.au

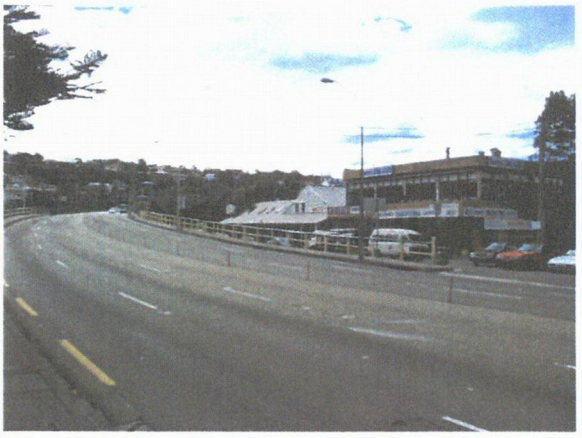
Document Status

Rev No.	Author	Reviewer	Approved for Issue		
		Name	Name	Signature	Date
0	A Raleigh	J Ardas	D Waddell	signed	19/2/03
1	A Raleigh	D Waddell	D Waddell	signed	28/2/03
2	A Raleigh	D Waddell	I Dawson		17/3/03

Appendix A

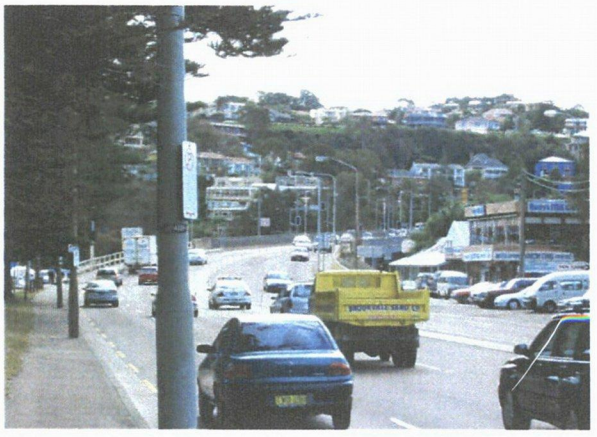
Photos and concept design

Views of the bridge and surrounds



Towards the southeastern approach (facing north)

The southeastern approach (facing north)

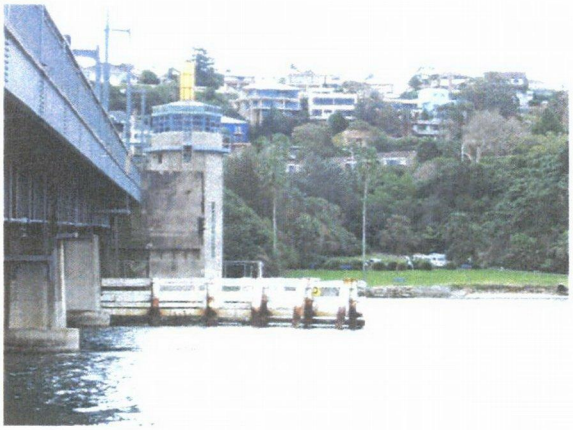


View over the bridge towards the north

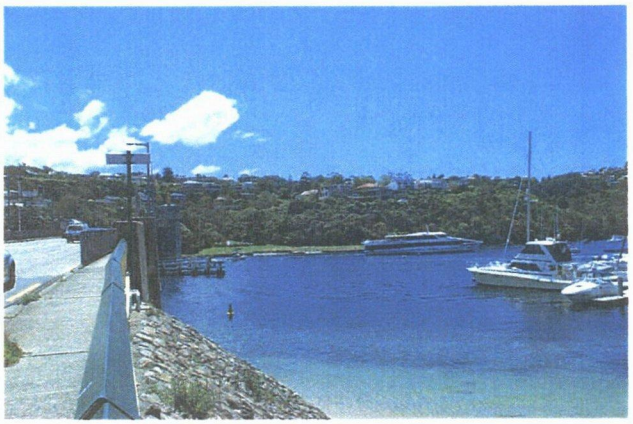
The southwestern approach (facing north)

The southwestern approach (facing south)

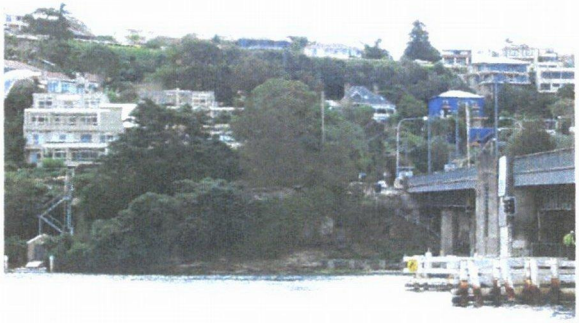
The southwestern approach (facing northwest)



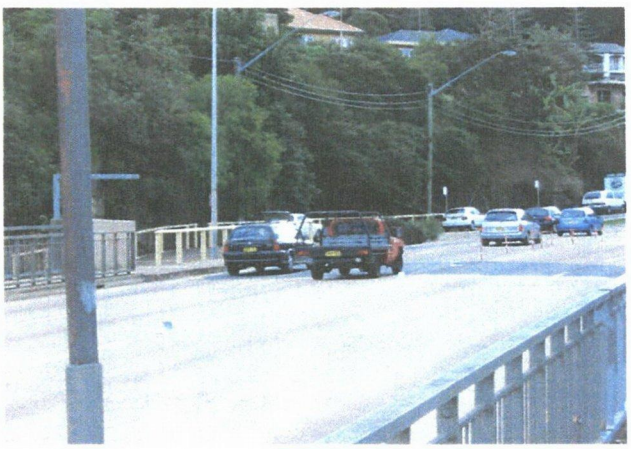
Facing northeast towards the lift tower and the reserve below Avona Crescent



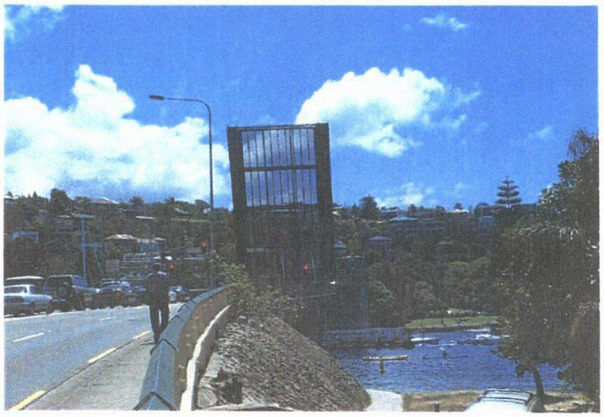
View towards the northeast approach.



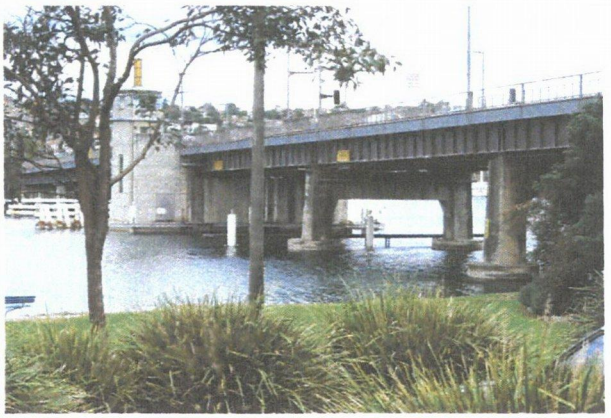
Residences to the northwest of the bridge's northern approach



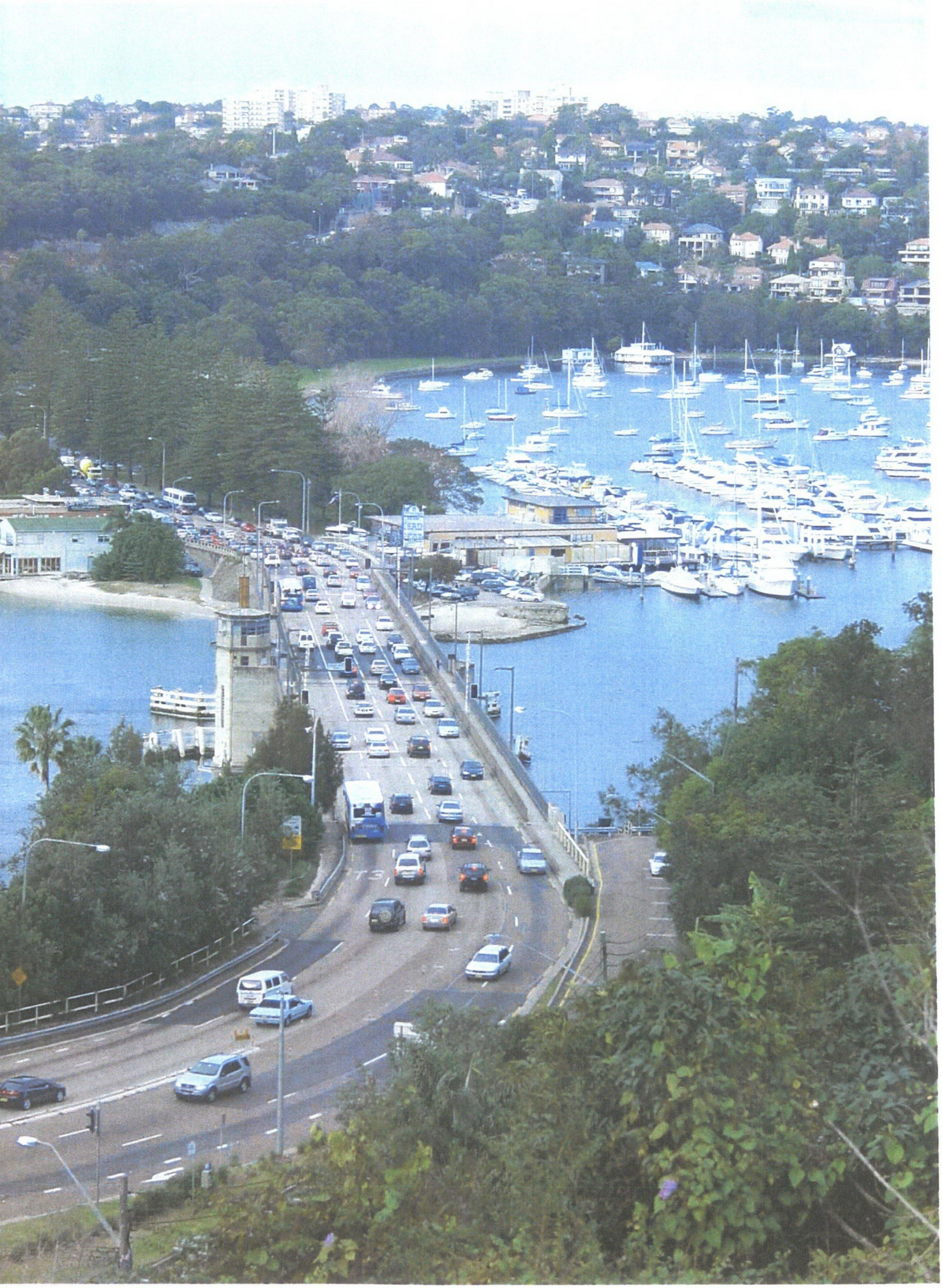
The northwest approach (facing northwest).



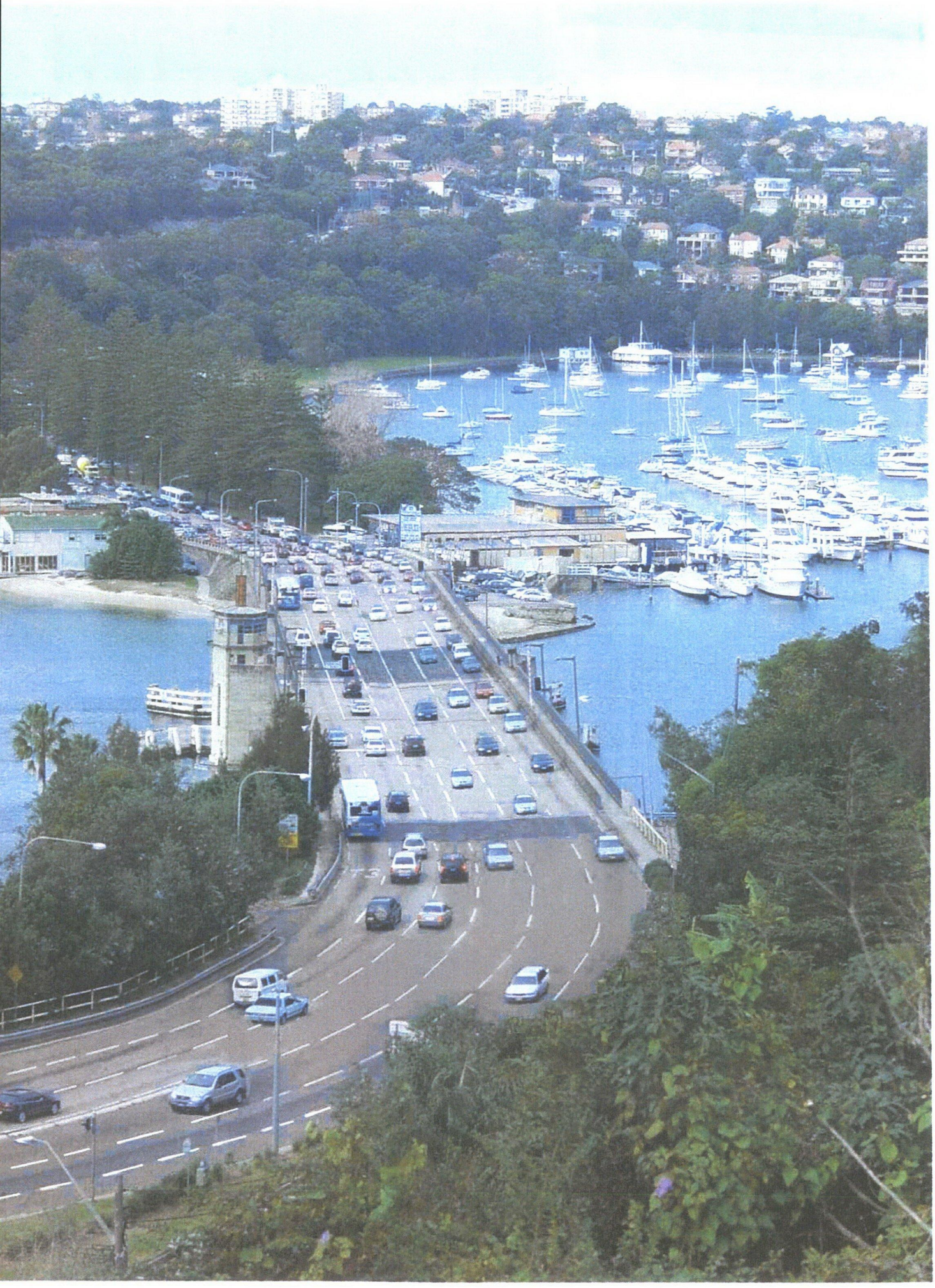
Opening of the bridge's lift span (taken from the southeastern approach, facing north)

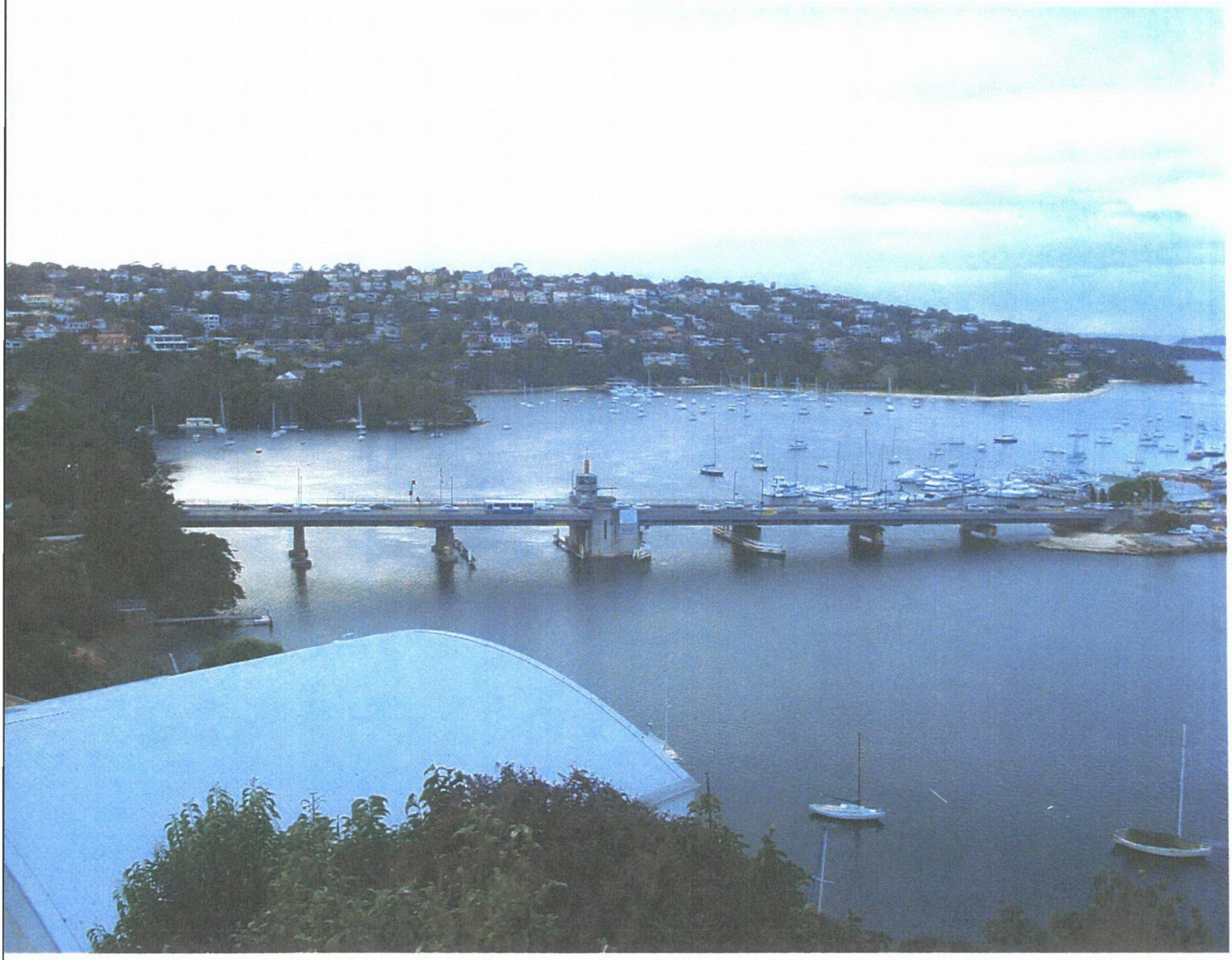


View of the bridge from the reserve below Avona Crescent, facing southwest



Artists impression of the proposed widening





A3

RTA

Roads and Traffic Authority
www.rta.nsw.gov.au

MOSMAN AND MANLY COUNCIL AREAS

MR164 MANLY ROAD - SPIT BRIDGE

WIDENING OF SPIT BRIDGE

AND APPROACHES TO SIX LANES

Quality System
Quality Endorsed Company
QEC 7443

PREPARED BY:
PROJECT DESIGN
TECHNICAL SERVICES
OPERATIONS

ADVANCE COPY ONLY
24/02/03

REGISTRATION NUMBER

0164.293.CD.0018

SHEET 1 OF 25 SHEETS

No	SHEET	ISSUE SUMMARY	AUTH	DATE
1	ALL	ORIGINAL ISSUE - UNAPPROVED	TH	

COMPUTER FILE REFERENCES

SURVEYOR: TONY DEGIORGIO
SURVEY MODEL: SURV SPIT RD SN2064 NTH, SURV SPIT RD SN2064 BDG, SURV SPIT RD SN2064 STH
DESIGN MODEL: DESIGN STEVE
DRAW FILE: -
CADD FILE: ...\Sheet_01.dgn
LEVELS USED: 1 & 63
ROADLOC: START: ?
FINISH: ?

DESIGNED
NAME. S. WIJESOMA
POSITION. PROJECT DESIGNER

CHECKED
NAME. T. HUFTON
POSITION. SENIOR PROJECT DEIGNER

THESE PLANS HAVE BEEN TAKEN TO THE SITE OF WORK AND ARE RECOMMENDED FOR APPROVAL

NAME. JOHN SULLINGS
POSITION. URBAN PROJECT DESIGN MANAGER
DATE.

APPROVED

F. D. REID
MANAGER
PROJECT DESIGN SERVICES
DATE.

ACCEPTED

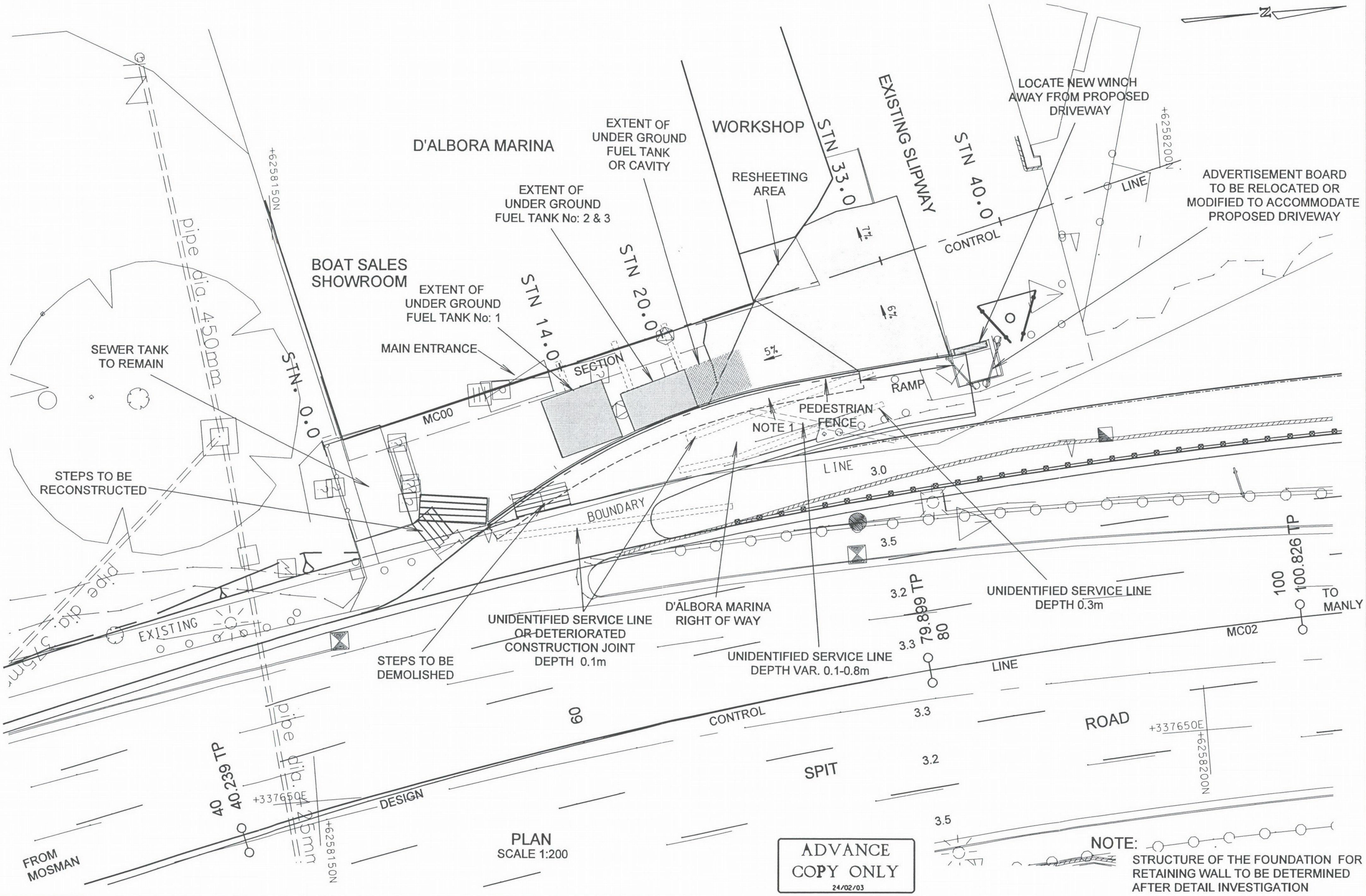
NAME.
POSITION.
DATE.

DRAWN BY CADD
DO NOT AMMEND MANUALLY

FILE: Sheet 1.dgn

PRINTED DATE: 24/02/03

A3



PLAN
SCALE 1:200

ADVANCE COPY ONLY
24/02/03

NOTE:
STRUCTURE OF THE FOUNDATION FOR RETAINING WALL TO BE DETERMINED AFTER DETAIL INVESTIGATION

No	ISSUE DETAIL	AUTH	DATE
1	ORIGINAL ISSUE - UNAPPROVED	TH	

COMPUTER FILE REFERENCES
SURVEYOR: TONY DEGIORGIO
SURVEY MODEL: SURV SPIT RD SN2054 NTH; SURV SPIT RD SN2064 BDG; SURV SPIT RD SN2054 STH
DESIGN MODEL: DESIGN STEVE
DRAW FILE: -
CADD FILE: ...\Sheet_26_Marina.dgn
LEVELS USED: -
ROADLOC: START: - FINISH: -

RTA PROJECT DESIGN TECHNICAL SERVICES OPERATIONS

DESIGNED S.WIJESOMA
CHECKED T. HUFTON

SCALES
AS SHOWN
0 2 4 6 8 10
SCALE 1:200
DATUM: AHD | GRID: MGA56
FILE: 293.1573
PRINTED DATE: 24/02/03

ROADS AND TRAFFIC AUTHORITY OF N.S.W.
MOSMAN AND MANLY COUNCIL AREAS
MR 164 MANLY ROAD - SPIT BRIDGE
WIDENING OF SPIT BRIDGE AND APPROACHES TO SIX LANES
PROPOSED PROPERTY ADJUSTMENT AT D'ALBORA MARINA
PLAN

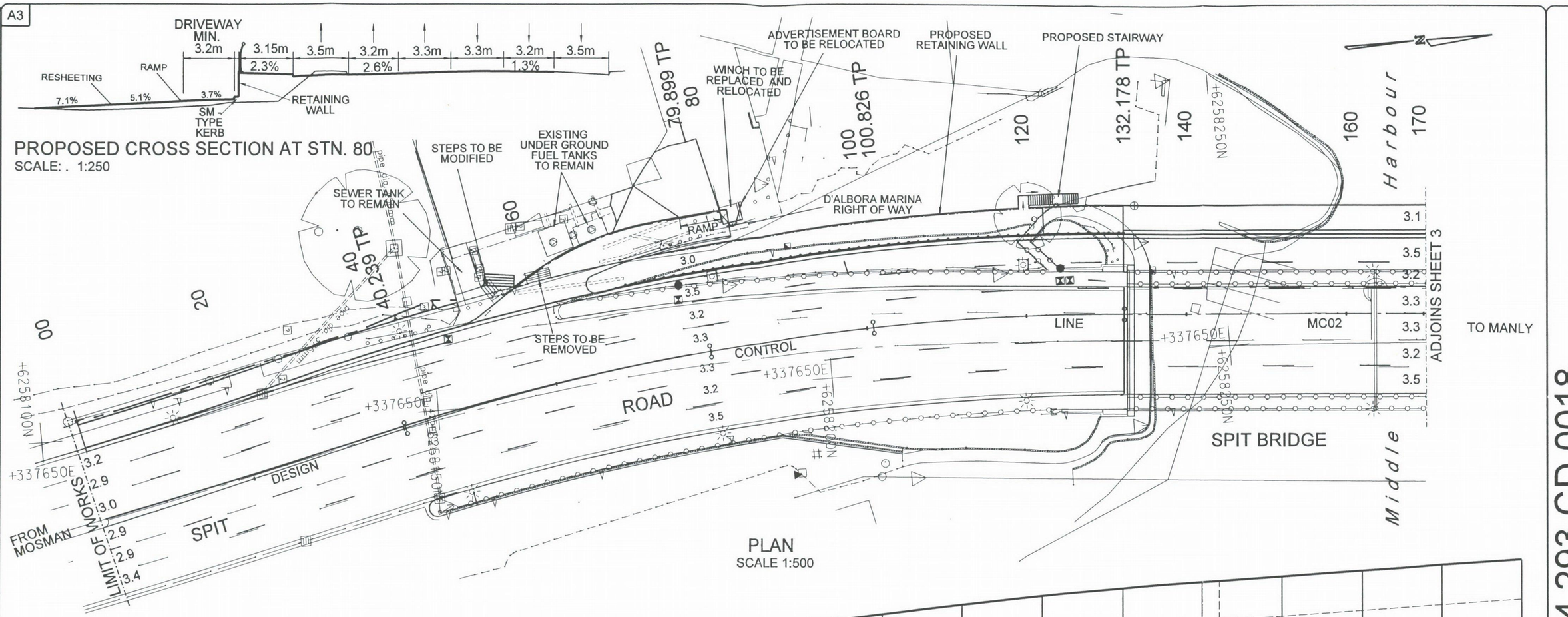
SHEET 01

0164.293.MD.0001

A3

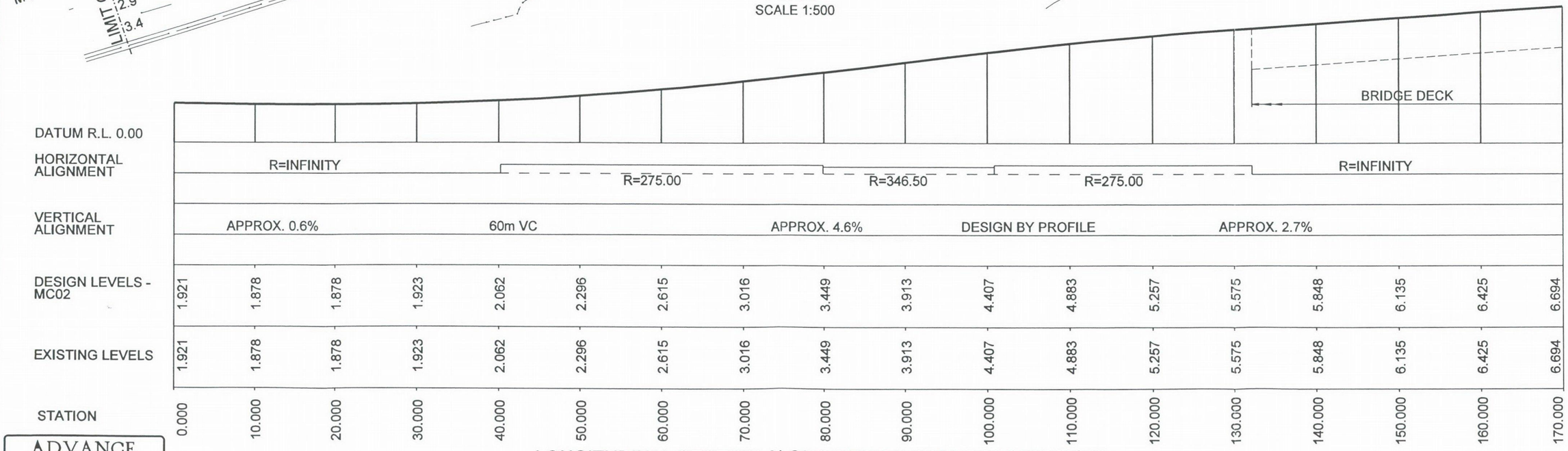
PROPOSED CROSS SECTION AT STN. 80

SCALE: . 1:250



PLAN

SCALE 1:500



LONGITUDINAL SECTION ALONG DESIGN CONTROL LINE MC02

SCALE: VER. 1:200
HOR. 1:500

ADVANCE COPY ONLY
24/02/03

No	ISSUE DETAIL	AUTH	DATE
1	ORIGINAL ISSUE - UNAPPROVED	TH	

COMPUTER FILE REFERENCES

SURVEYOR: TONY DEGIORGIO
SURVEY MODEL: SURV SPIT RD SN2064 NTH; SURV SPIT RD SN2064 BDG; SURV SPIT RD SN2064 STH
DESIGN MODEL: DESIGN STEVE
DRAW FILE: -
CADD FILE: ...\Sheet_02.dgn
LEVELS USED: -
ROADLOC: START:- FINISH:-

R T A PROJECT DESIGN TECHNICAL SERVICES OPERATIONS

DESIGNED S.WIJESOMA
CHECKED T. HUFTON

SCALES
AS SHOWN
0 5 10 15 20 25
SCALE 1:500

DATUM: AHD | GRID: MGA56
FILE: 293.1573
PRINTED DATE: 24/02/03

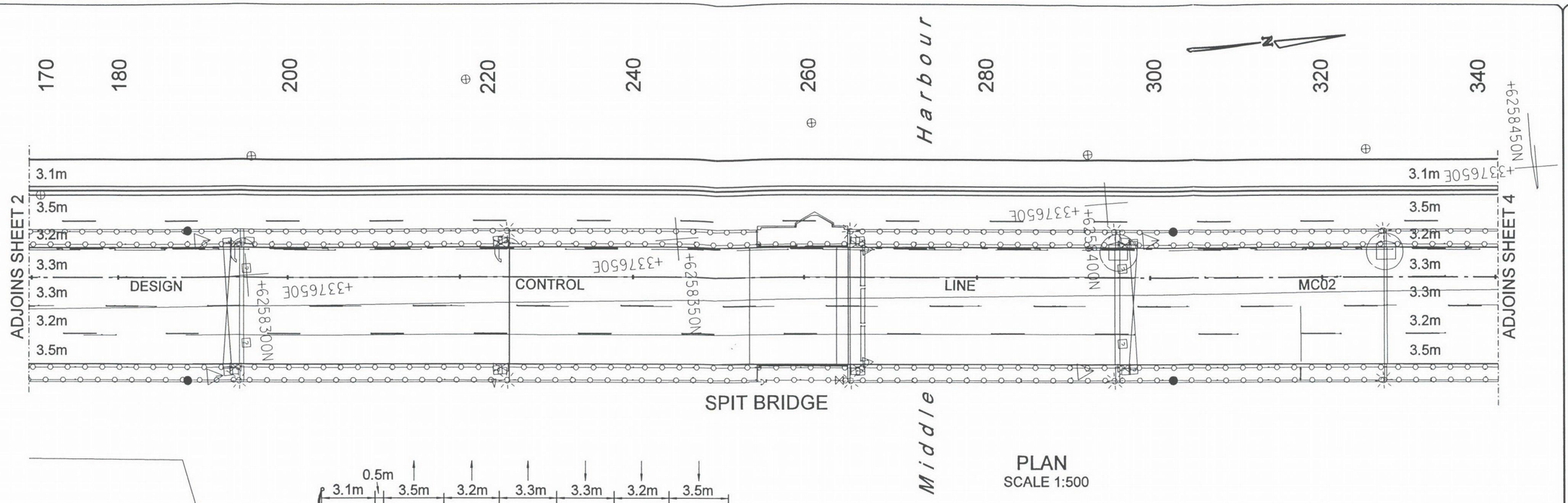
ROADS AND TRAFFIC AUTHORITY OF N.S.W.

MOSMAN AND MANLY COUNCIL AREAS
MR 164 MANLY ROAD - SPIT BRIDGE
WIDENING OF SPIT BRIDGE
AND APPROACHES TO SIX LANES
PLAN & LONGITUDINAL SECTION STN 0.00 - 170.00

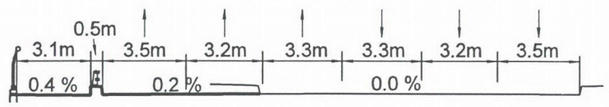
SHEET 02

0164.293.CD.0018

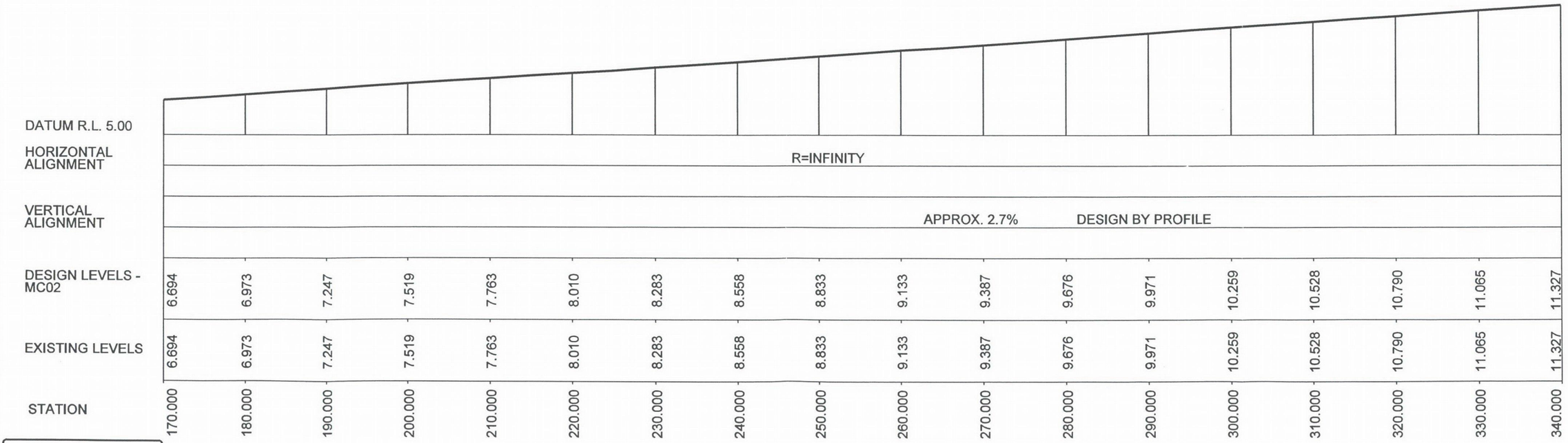
A3



PLAN
SCALE 1:500



PROPOSED CROSS SECTION AT STN. 270
SCALE: 1:250



LONGITUDINAL SECTION ALONG DESIGN CONTROL LINE MC02
SCALE: VER. 1:200
HOR. 1:500

ADVANCE COPY ONLY
24/02/03

No	ISSUE DETAIL	AUTH	DATE
1	ORIGINAL ISSUE - UNAPPROVED	TH	

COMPUTER FILE REFERENCES

SURVEYOR:	TONY DEGIORGIO
SURVEY MODEL:	SURV SPIT RD SN2064 NTH SURV SPIT RD SN2064 BDG
DESIGN MODEL:	SURV SPIT RD SN2064 STH DESIGN STEVE
DRAW FILE:	-
CADD FILE:	...\sheet_03.dgn
LEVELS USED:	-
ROADLOC: START:	-
FINISH:	-

RTA PROJECT DESIGN TECHNICAL SERVICES OPERATIONS

DESIGNED S.WIJESOMA
CHECKED T. HUFTON

SCALES
AS SHOWN
0 5 10 15 20 25
SCALE 1:500

DATUM: AHD | GRID: MGA56
FILE: 293.1573
PRINTED DATE: 24/02/03

ROADS AND TRAFFIC AUTHORITY OF N.S.W.
MOSMAN AND MANLY COUNCIL AREAS
MR 164 MANLY ROAD - SPIT BRIDGE
WIDENING OF SPIT BRIDGE
AND APPROACHES TO SIX LANES
PLAN & LONGITUDINALSECTION STN 170 .00 - 340.00

SHEET 03

0164.293.CD.0018

A3

Harbour

Middle

ROAD RESERVE

340

360

365.872 TP

STRATA PLAN
60087
Nos. 1-3

380

386.956 TP

LOT B
DP393053
OWNER MR.R.L.& MRS.R.PARKER

400

414.007 TP

420

440

460

465.940 TP

PROPOSED STAIRWAY

EXTENT OF LAND AQISITION

PROPOSED BOUNDARY

PROPOSED THRESHOLD

FOOTPATH WIDTH 2m.

ADDITIONAL PARKING LOTS

+6258450N

+6258500N

+6258550N

+6258600N

+337650E

+337700E

ADJOINS SHEET 3

4.0m
3.5m
3.1m
3.2m
3.2m
3.1m
3.5m

DESIGN

CONTROL

LINE

SPIT BRIDGE

365.872 TP

SERVICE ROAD

477.457 TP

480

487.135 TP

500

RECONSTRUCT BRIDGE POWER SUPPLY

ACCESS TO CAR PARK

FOOTPATH WIDTH 3m.

MANLY ROAD

MG62

BATTLE BOULEVARDE

LIMIT OF WORKS

3.0m
3.0m
3.0m
2.9m
3.0m
2.9m

TO MANLY

AVONA CRESCENT

TYPE F BARRIER

10.25
2.0 %
MIN. 4.0m
3.0 %
1.5 %

3.5m 3.2m 3.3m 3.3m 3.3m 3.5m

0.9% 0.9% 0.9% 0.6% 4.5% 7.6%

SA - TYPE KERB SM - TYPE KERB

PROPOSED CROSS SECTION AT STN. 380

SCALE: . 1:250

FOOTPATH WIDTH VAR. 2.0 - 3.0m

EXISTING SERVICE ROAD

TYPE F BARRIER

EXISTING RAISED MEDIAN WIDTH 0.9m

4.1 % 2.1 % 2.0%

3.2m 3.5m 3.2m 3.3m 2.8m 2.9m 3.3m 2.9m 2.3m

3.1% 3.2% 3.2% 4.5% 5.5%

PROPOSED CROSS SECTION AT STN. 465

SCALE: . 1:250

ADVANCE COPY ONLY
24/02/03

No	ISSUE DETAIL	AUTH	DATE
1	ORIGINAL ISSUE - UNAPPROVED	TH	

COMPUTER FILE REFERENCES

SURVEYOR: TONY DEGIORGIO
SURVEY MODEL: SURV SPIT RD SN2064 NTH; SURV SPIT RD SN2064 BDG; SURV SPIT RD SN2064 STH
DESIGN MODEL: DESIGN STEVE
DRAW FILE: -
CADD FILE: ...\sheet_04.dgn
LEVELS USED: -
ROADLOC: START: - FINISH: -

R T A PROJECT DESIGN TECHNICAL SERVICES OPERATIONS

DESIGNED S.WIJESOMA
CHECKED T. HUFTON

SCALES
AS SHOWN
0 5 10 15 20 25
SCALE 1:500

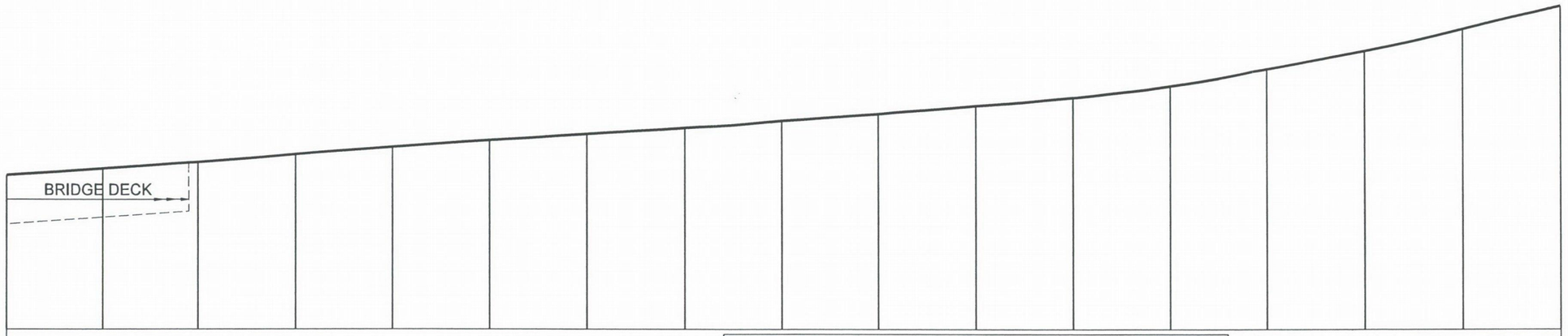
DATUM: AHD | GRID: MGA56
FILE: 293.1573
PRINTED DATE: 24/02/03

ROADS AND TRAFFIC AUTHORITY OF N.S.W.
MOSMAN AND MANLY COUNCIL AREAS
MR 164 MANLY ROAD - SPIT BRIDGE
WIDENING OF SPIT BRIDGE
AND APPROACHES TO SIX LANES
PLAN STN 340.00 - 500.00

SHEET 04

0164.293.CD.0018

A3



DATUM R.L. 15.00																			
HORIZONTAL ALIGNMENT	R=INFINITY		R=150.00		R=191.57			R=160.00						R=172.54	R=129.28		R=162.35		
VERTICAL ALIGNMENT	APPROX. 2.7%				APPROX. 3.0%					APPROX. 40m VC			DESIGN BY PROFILE					APPROX. 9.5%	
DESIGN LEVELS - MC02	11.327	11.599	11.870	12.195	12.487	12.768	13.030	13.284	13.567	13.861	14.181	14.527	15.012	15.702	16.434	17.314	18.266		
EXISTING LEVELS	11.327	11.599	11.870	12.195	12.487	12.768	13.030	13.284	13.567	13.861	14.181	14.527	15.012	15.702	16.434	17.314	18.266		
STATION	340.000	350.000	360.000	370.000	380.000	390.000	400.000	410.000	420.000	430.000	440.000	450.000	460.000	470.000	480.000	490.000	500.000		

LONGITUDINAL SECTION ALONG DESIGN CONTROL LINE MC02

SCALE: VER. 1:200
HOR. 1:500

ADVANCE COPY ONLY
24/02/03

No	ISSUE DETAIL	AUTH	DATE
1	ORIGINAL ISSUE - UNAPPROVED	TH	

COMPUTER FILE REFERENCES
SURVEYOR: TONY DEGIORGIO
SURVEY MODEL: SURV SPIT RD SN2094 NTH; SURV SPIT RD SN2094 BDG; SURV SPIT RD SN2094 STH
DESIGN MODEL: DESIGN STEVE
DRAW FILE: -
CADD FILE: ...\sheet_05.dgn
LEVELS USED: -
ROADLOC: START: -
FINISH: -

R T A PROJECT DESIGN TECHNICAL SERVICES OPERATIONS

DESIGNED S.WIJESOMA
CHECKED T. HUFTON

SCALES
AS SHOWN
0 5 10 15 20 25
SCALE 1:500

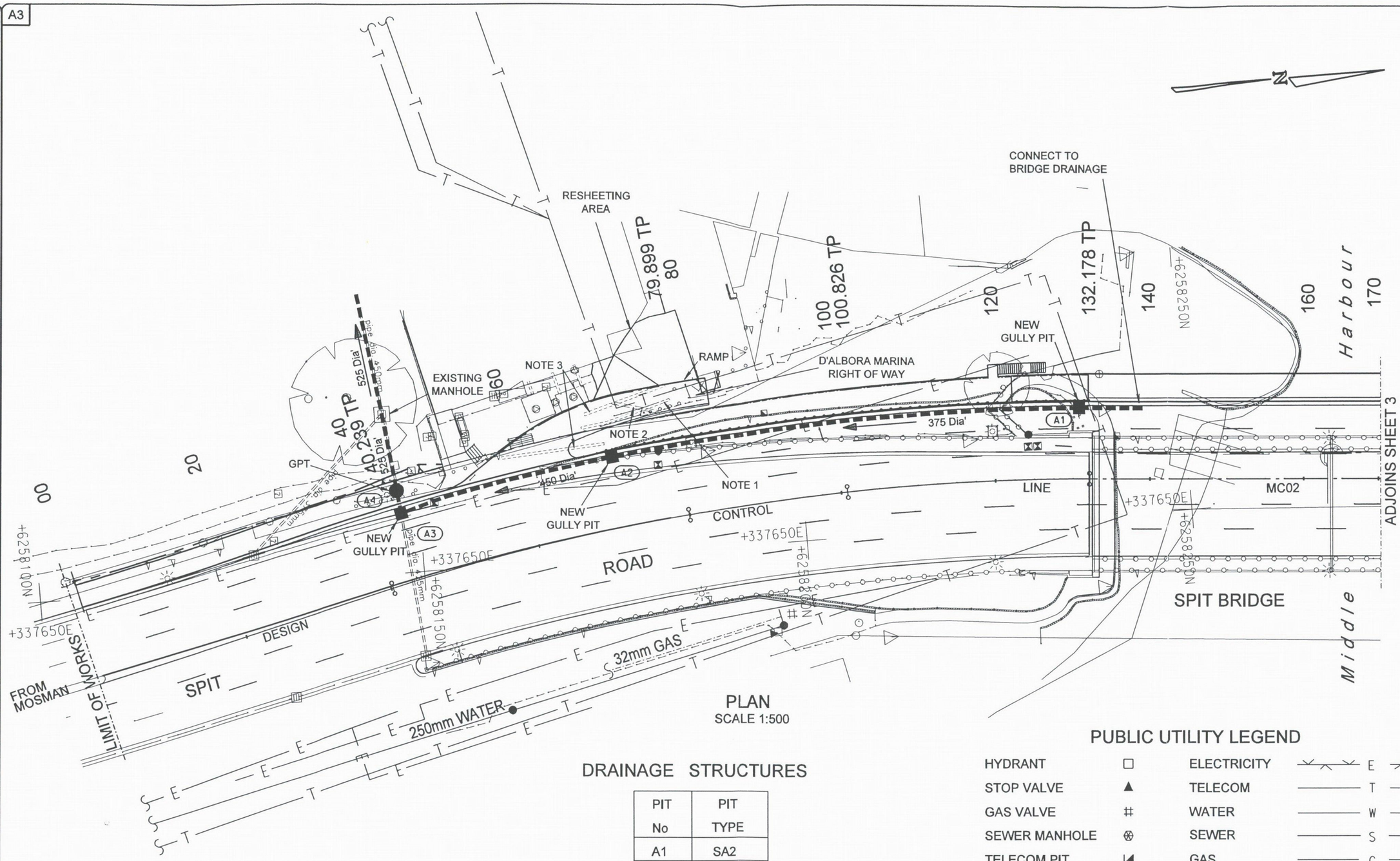
DATUM: AHD | GRID: MGA56
FILE: 293.1573
PRINTED DATE: 24/02/03

ROADS AND TRAFFIC AUTHORITY OF N.S.W.
MOSMAN AND MANLY COUNCIL AREAS
MR 164 MANLY ROAD - SPIT BRIDGE
WIDENING OF SPIT BRIDGE
AND APPROACHES TO SIX LANES
LONGITUDINAL SECTION STN 340.00 - 500.00

SHEET 05

0164.293.CD.0018

A3



PLAN
SCALE 1:500

DRAINAGE STRUCTURES

PIT No	PIT TYPE
A1	SA2
A2	SA2
A3	SA2
A4	GPT

PUBLIC UTILITY LEGEND

HYDRANT	□	ELECTRICITY	E
STOP VALVE	▲	TELECOM	T
GAS VALVE	#	WATER	W
SEWER MANHOLE	⊗	SEWER	S
TELECOM PIT	◪	GAS	G
ELECT. LIGHT POLE	○		
TELEPHONE POLE	●		
STAY POLE	⊘		
TELEPHONE BOX	T		
TELECOM PILLAR	○		

NOTE:

1. UNIDENTIFIED SERVICE LINE, DEPTH 0.3m.
2. UNIDENTIFIED SERVICE LINE, DEPTH VAR 0.1-0.8m.
3. UNIDENTIFIED SERVICE LINE OR DETERIORATED CONSTRUCTION JOINT, DEPTH 0.1m

ADVANCE COPY ONLY
24/02/03

No	ISSUE DETAIL	AUTH	DATE
1	ORIGINAL ISSUE - UNAPPROVED	TH	

COMPUTER FILE REFERENCES
SURVEYOR: TONY DEGIORGIO
SURVEY MODEL: SURV SPIT RD SN2064 NTH; SURV SPIT RD SN2064 BDG; SURV SPIT RD SN2064 STH
DESIGN MODEL: DESIGN STEVE
DRAW FILE: -
CADD FILE: ...\Sheet_06.dgn
LEVELS USED: -
ROADLOC: START: - FINISH: -

RTA PROJECT DESIGN TECHNICAL SERVICES OPERATIONS

DESIGNED S.WIJESOMA
CHECKED T. HUFTON

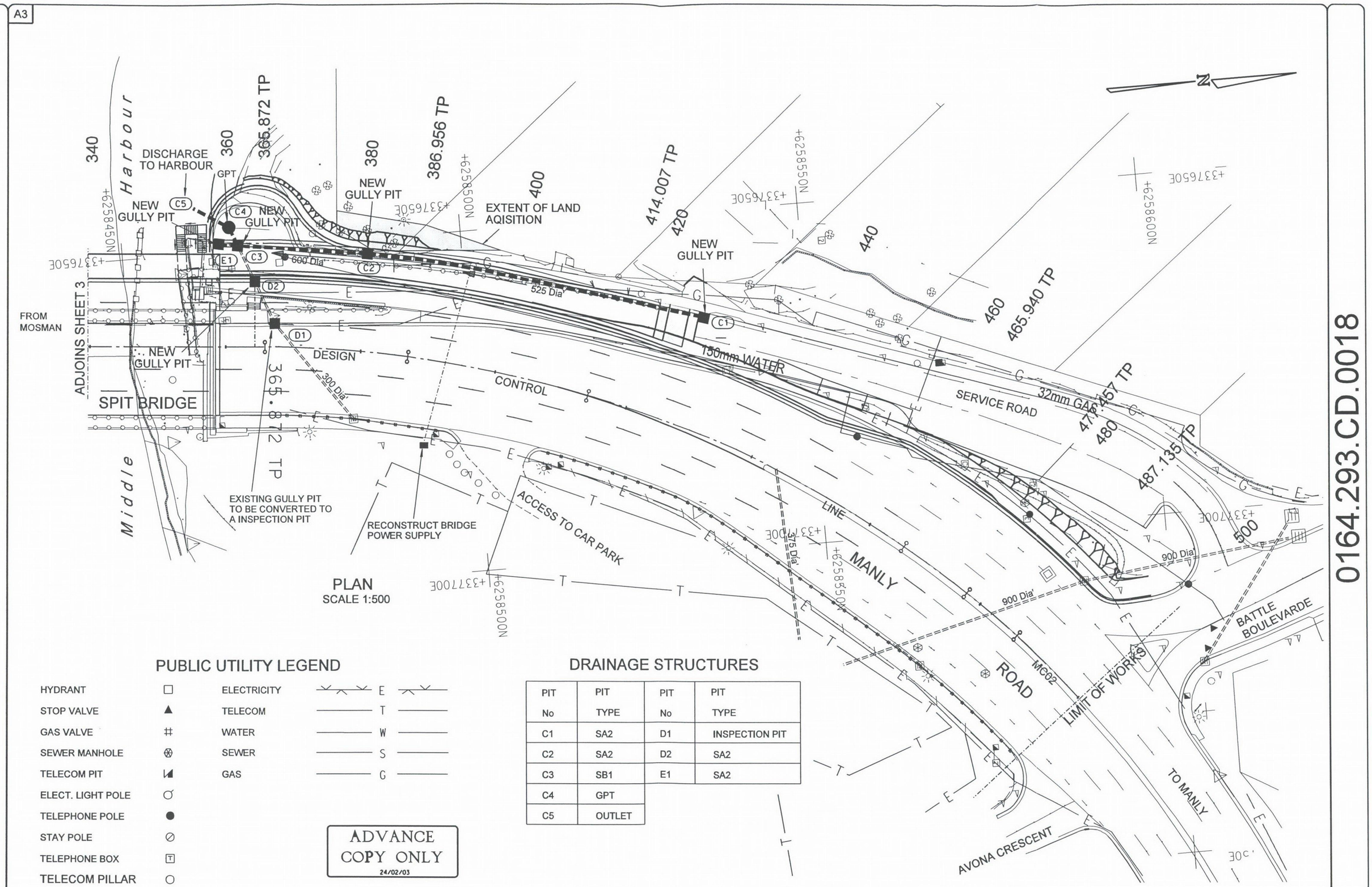
SCALES
AS SHOWN
0 5 10 15 20 25
SCALE 1:500
DATUM: AHD | GRID: MGA56
FILE: 293.1573
PRINTED DATE: 24/02/03

ROADS AND TRAFFIC AUTHORITY OF N.S.W.
MOSMAN AND MANLY COUNCIL AREAS
MR 164 MANLY ROAD - SPIT BRIDGE
WIDENING OF SPIT BRIDGE
AND APPROACHES TO SIX LANES
DRAINAGE AND UTILITIES STN 0.00 - 170.00

SHEET 06

0164.293.CD.0018

A3



PLAN
SCALE 1:500

PUBLIC UTILITY LEGEND

HYDRANT	□	ELECTRICITY	E
STOP VALVE	▲	TELECOM	T
GAS VALVE	#	WATER	W
SEWER MANHOLE	⊛	SEWER	S
TELECOM PIT	◣	GAS	G
ELECT. LIGHT POLE	○		
TELEPHONE POLE	●		
STAY POLE	⊘		
TELEPHONE BOX	T		
TELECOM PILLAR	○		

DRAINAGE STRUCTURES

PIT No	PIT TYPE	PIT No	PIT TYPE
C1	SA2	D1	INSPECTION PIT
C2	SA2	D2	SA2
C3	SB1	E1	SA2
C4	GPT		
C5	OUTLET		

ADVANCE COPY ONLY
24/02/03

No	ISSUE DETAIL	AUTH	DATE
1	ORIGINAL ISSUE - UNAPPROVED	TH	

COMPUTER FILE REFERENCES
SURVEYOR: TONY DEGIORGIO
SURVEY MODEL: SURV SPIT RD SN2084 NTH; SURV SPIT RD SN2084 BDG; SURV SPIT RD SN2084 STH
DESIGN MODEL: DESIGN STEVE
DRAW FILE: -
CADD FILE: ...\sheet_07.dgn
LEVELS USED: -
ROADLOC: START: - FINISH: -

RTA PROJECT DESIGN TECHNICAL SERVICES OPERATIONS

DESIGNED S.WIJESOMA
CHECKED T. HUFTON

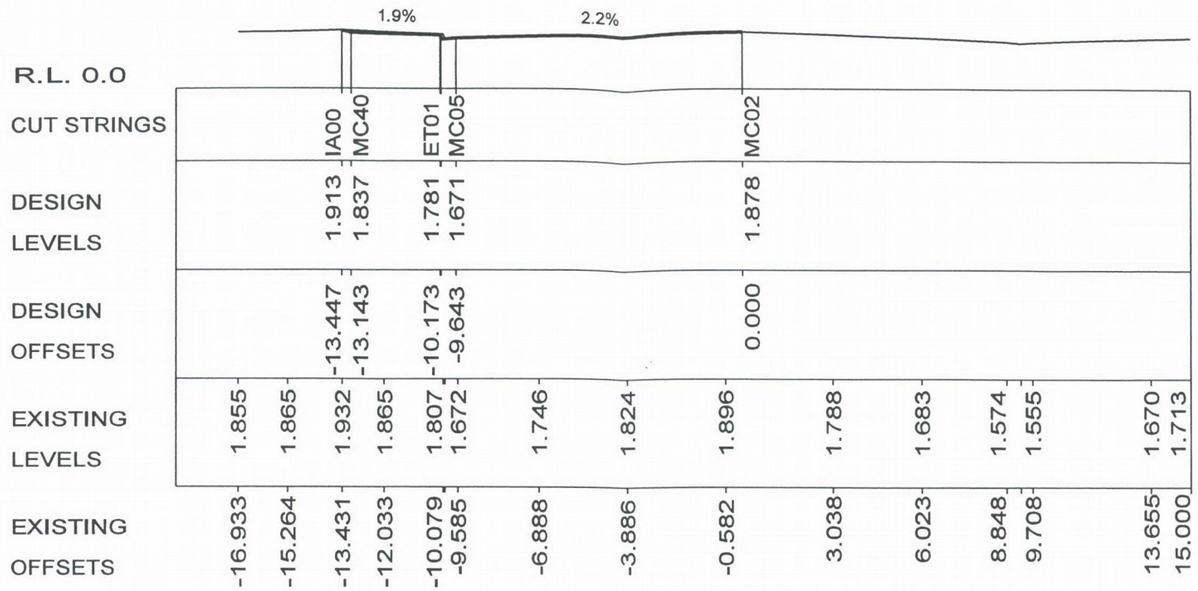
SCALES
AS SHOWN
0 5 10 15 20 25
SCALE 1:500
DATUM: AHD | GRID: MGA56
FILE: 293.1573
PRINTED DATE: 24/02/03

ROADS AND TRAFFIC AUTHORITY OF N.S.W.
MOSMAN AND MANLY COUNCIL AREAS
MR 164 MANLY ROAD - SPIT BRIDGE
WIDENING OF SPIT BRIDGE
AND APPROACHES TO SIX LANES
DRAINAGE AND UTILITIES STN 340.00 - 500.00

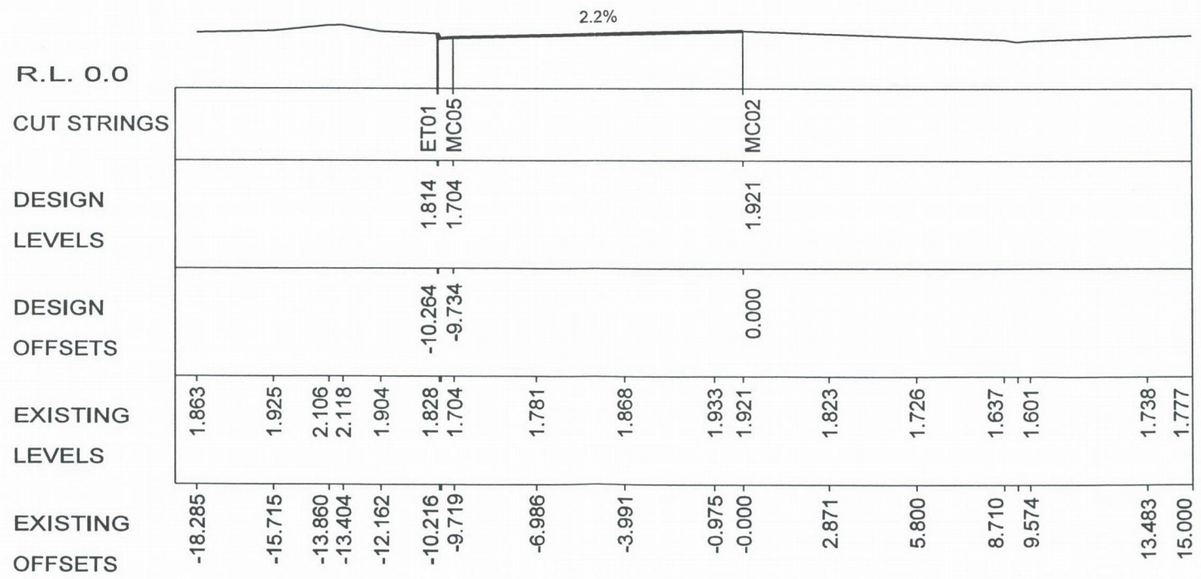
SHEET 07

0164.293.CD.0018

A3



10



0

ADVANCE COPY ONLY
24/02/03

No	ISSUE DETAIL	AUTH	DATE
1	ORIGINAL ISSUE - UNAPPROVED	TH	

COMPUTER FILE REFERENCES
SURVEYOR: TONY DEGIORGIO
SURVEY MODEL: SURV SPIT RBS SN2064 NTH; SURV SPIT RBS SN2064 BDG; SURV SPIT RBS SN2064 STH
DESIGN MODEL: DESIGN STEVE
DRAW FILE: -
CADD FILE: ...\sheet_08.dgn
LEVELS USED: -
ROADLOC: START: - FINISH: -

RTA PROJECT DESIGN TECHNICAL SERVICES OPERATIONS

DESIGNED S.WIJESOMA
CHECKED T. HUFTON

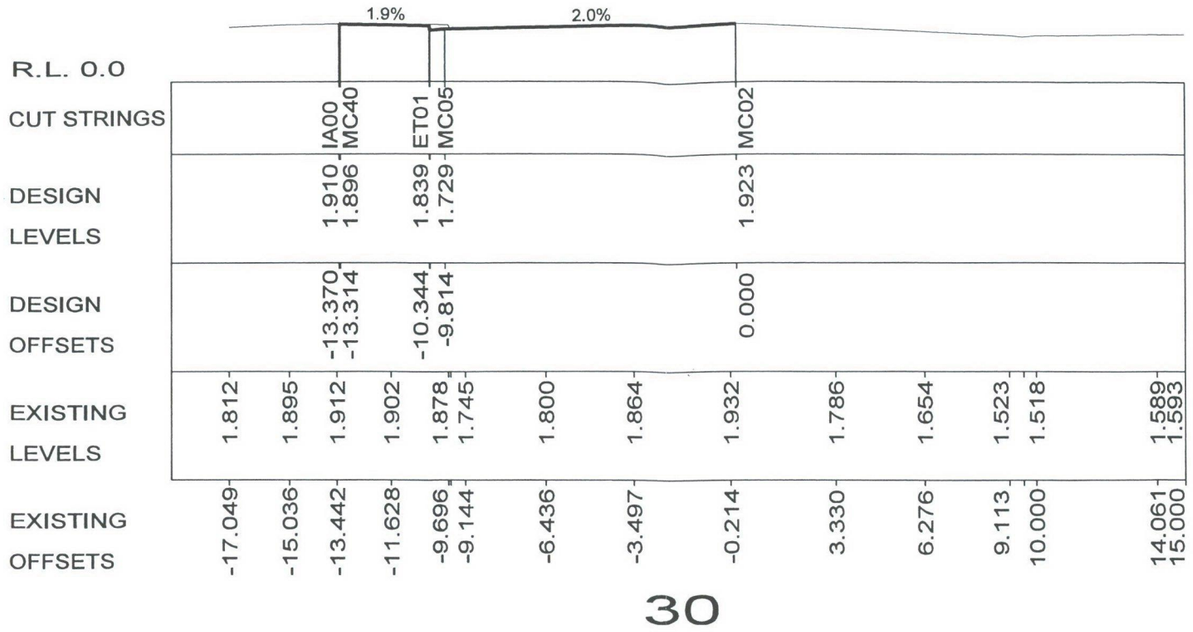
SCALES
0 2 4 6 8 10
SCALE 1:200
DATUM: AHD | GRID: MGA56
FILE: 293.1573
PRINTED DATE: 24/02/03

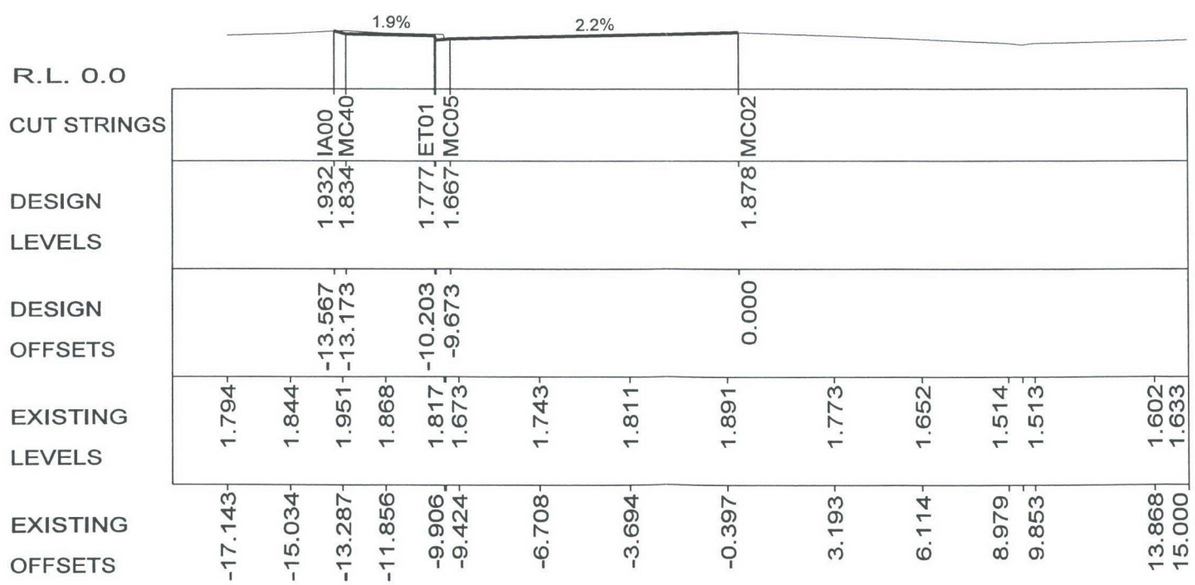
ROADS AND TRAFFIC AUTHORITY OF N.S.W.
MOSMAN AND MANLY COUNCIL AREAS
MR 164 MANLY ROAD - SPIT BRIDGE
WIDENING OF SPIT BRIDGE
AND APPROACHES TO SIX LANES
CROSS SECTIONS STN.0.00 TO STN.10.00

SHEET 08

0164.293.CD.0018

A3





ADVANCE COPY ONLY
24/02/03

No	ISSUE DETAIL	AUTH	DATE
1	ORIGINAL ISSUE - UNAPPROVED	TH	

COMPUTER FILE REFERENCES

SURVEYOR: TONY DEGIORGIO
SURVEY MODEL: SURV SPIT RBI SN2064 NTH; SURV SPIT RBI SN2064 BDG; SURV SPIT RBI SN2064 STH
DESIGN MODEL: DESIGN STEVE
DRAW FILE: -
CADD FILE: ...\sheet_09.dgn
LEVELS USED: -
ROADLOC: START: - FINISH: -

RTA PROJECT DESIGN TECHNICAL SERVICES OPERATIONS

DESIGNED S.WIJESOMA
CHECKED T. HUFTON

SCALES
0 2 4 6 8 10
SCALE 1:200
DATUM: AHD | GRID: MGA56
FILE: 293.1573
PRINTED DATE: 24/02/03

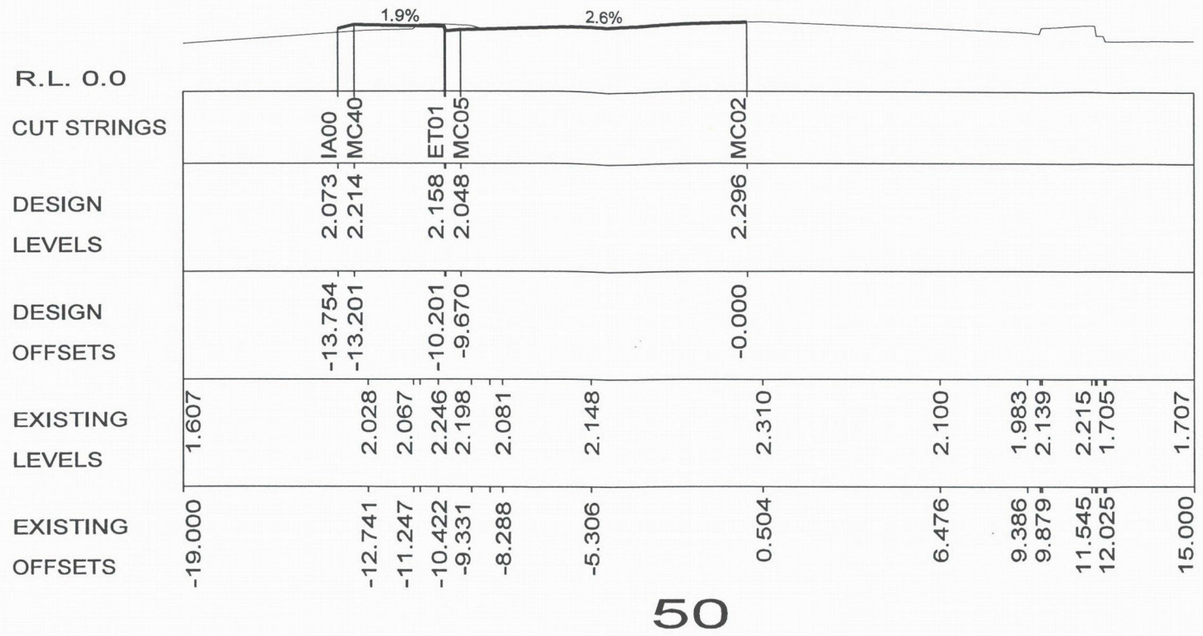
ROADS AND TRAFFIC AUTHORITY OF N.S.W.

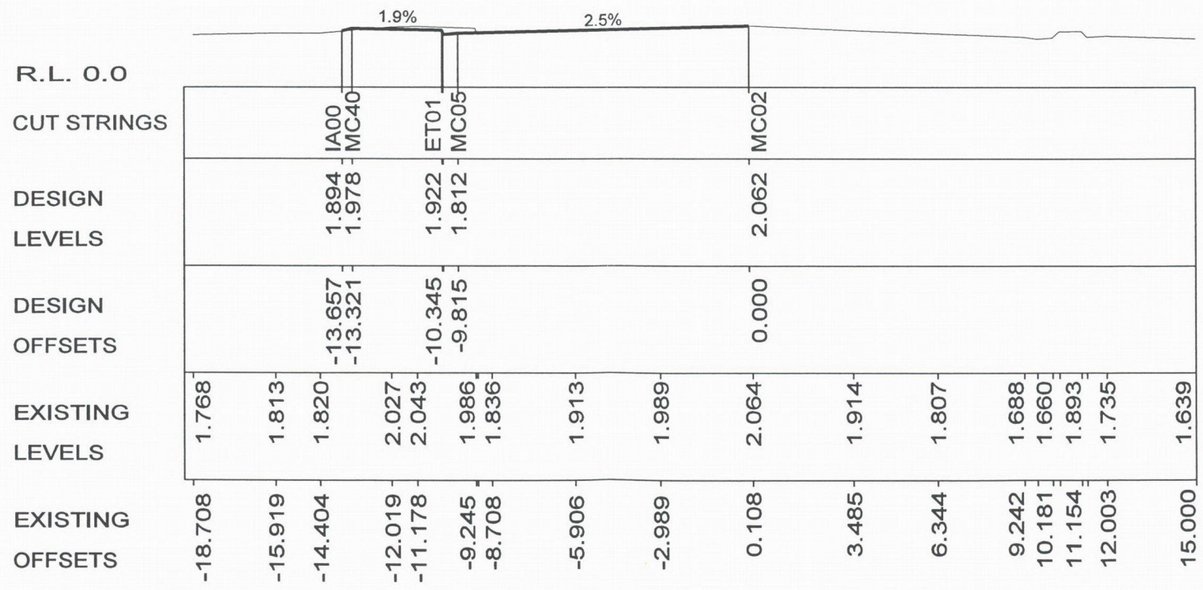
MOSMAN AND MANLY COUNCIL AREAS
MR 164 MANLY ROAD - SPIT BRIDGE
WIDENING OF SPIT BRIDGE
AND APPROACHES TO SIX LANES
CROSS SECTIONS STN.20.00 TO STN.30.00

SHEET 09

0164.293.CD.0018

A3





ADVANCE COPY ONLY
24/02/03

No	ISSUE DETAIL	AUTH	DATE
1	ORIGINAL ISSUE - UNAPPROVED	TH	

COMPUTER FILE REFERENCES

SURVEYOR: TONY DEGIORGIO
SURVEY MODEL: SURV SPIT RBS SK2064 NTH; SURV SPIT RBS SK2064 BDG; SURV SPIT RBS SK2064 STH
DESIGN MODEL: DESIGN STEVE
DRAW FILE: -
CADD FILE: ...\sheet_10.dgn
LEVELS USED: -
ROADLOC: START: -
FINISH: -

RTA PROJECT DESIGN TECHNICAL SERVICES OPERATIONS

DESIGNED S.WIJESOMA
CHECKED T. HUFTON

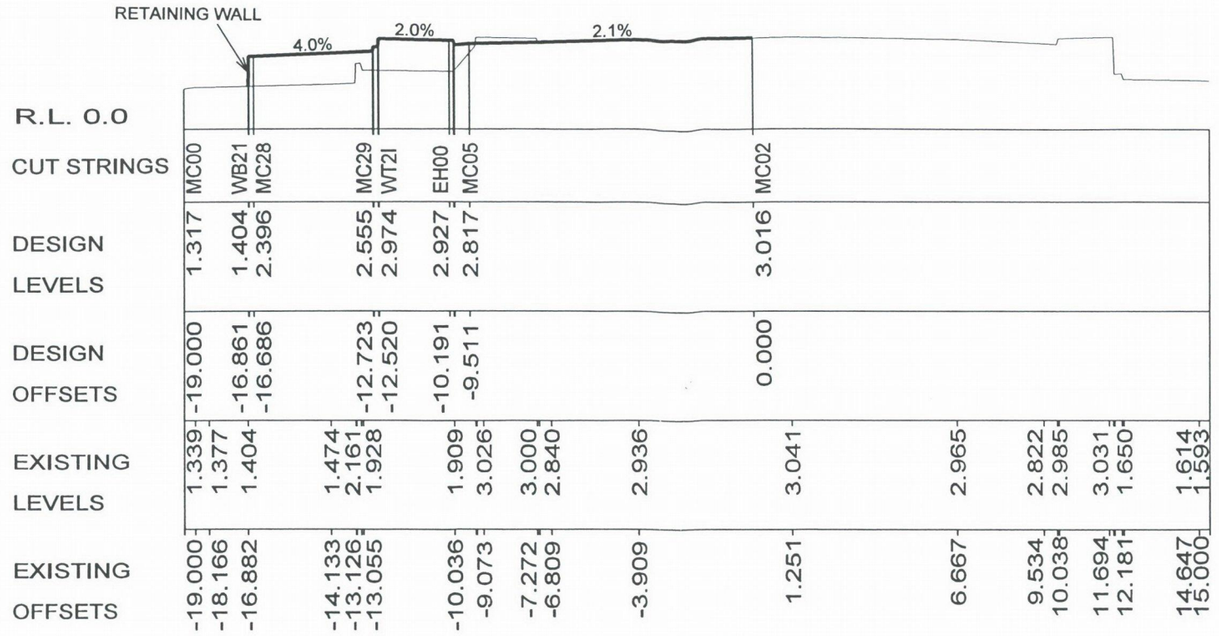
SCALES
0 2 4 6 8 10
SCALE 1:200
DATUM: AHD | GRID: MGA56
FILE: 293.1573
PRINTED DATE: 24/02/03

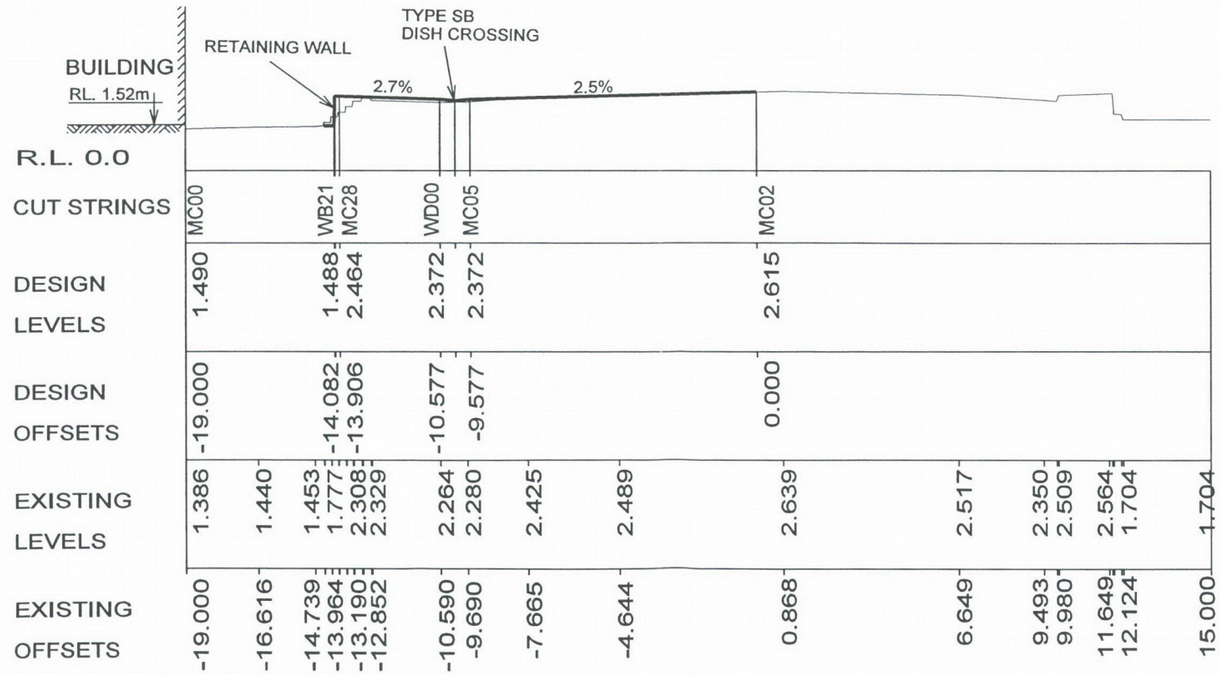
ROADS AND TRAFFIC AUTHORITY OF N.S.W.
MOSMAN AND MANLY COUNCIL AREAS
MR 164 MANLY ROAD - SPIT BRIDGE
WIDENING OF SPIT BRIDGE
AND APPROACHES TO SIX LANES
CROSS SECTIONS STN.40.00 TO STN.50.00

SHEET 10

0164.293.CD.0018

A3





ADVANCE
COPY ONLY
24/02/03

No	ISSUE DETAIL	AUTH	DATE
1	ORIGINAL ISSUE - UNAPPROVED	TH	

COMPUTER FILE REFERENCES

SURVEYOR: TONY DEGIORGIO
SURVEY MODEL: SURV SPIT RB SN2064 NTH; SURV SPIT RB SN2064 BDG; SURV SPIT RB SN2064 STH
DESIGN MODEL: DESIGN STEVE
DRAW FILE: -
CADD FILE: ...\sheet_11.dgn
LEVELS USED: -
ROADLOC: START: -
FINISH: -

RTA PROJECT DESIGN TECHNICAL SERVICES OPERATIONS

DESIGNED S.WIJESOMA
CHECKED T. HUFTON

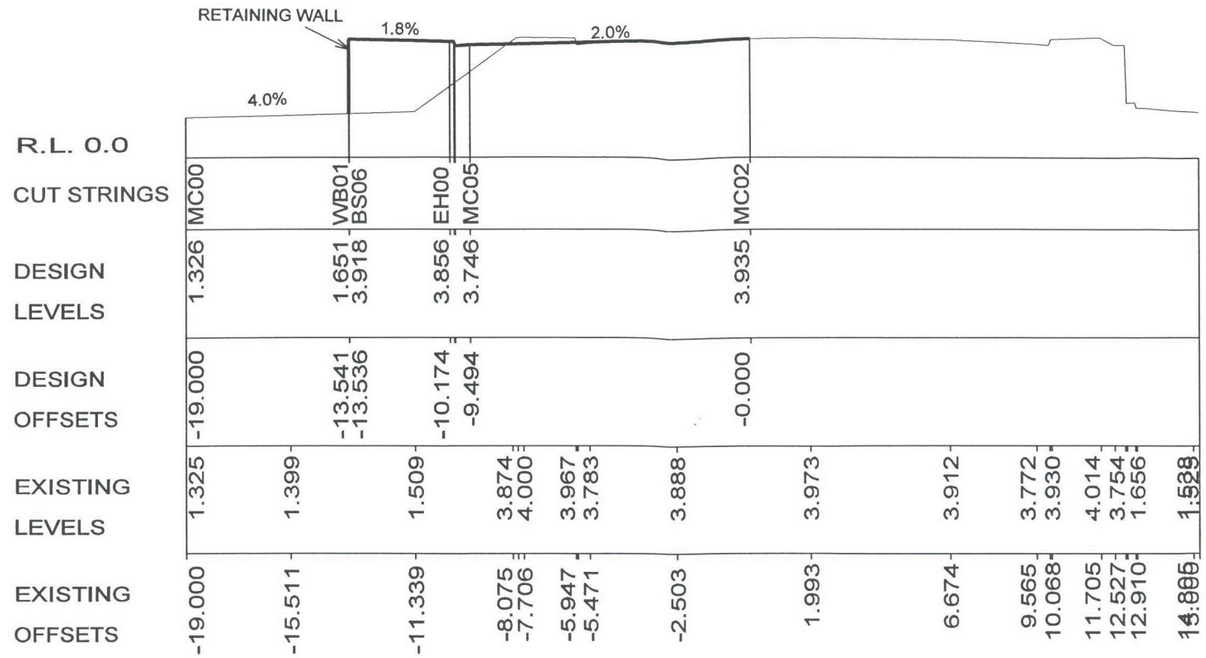
SCALES
0 2 4 6 8 10
SCALE 1:200
DATUM: AHD | GRID: MGA56
FILE: 293.1573
PRINTED DATE: 24/02/03

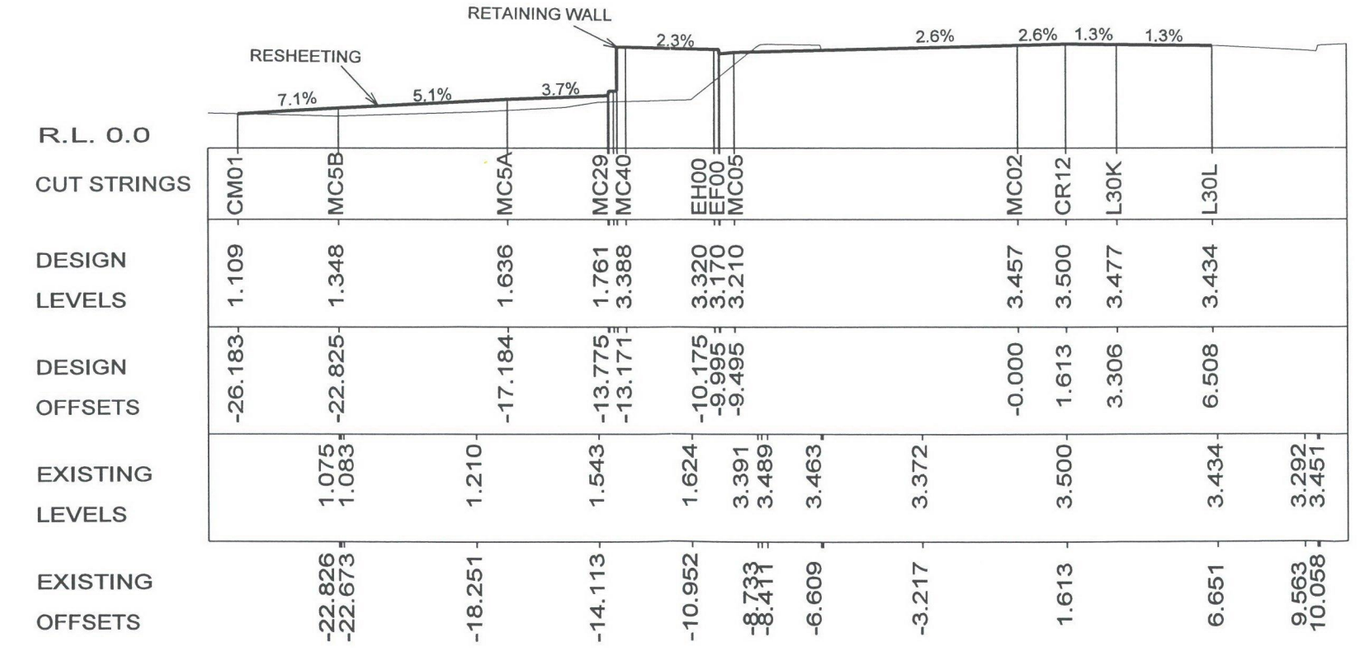
ROADS AND TRAFFIC AUTHORITY OF N.S.W.
MOSMAN AND MANLY COUNCIL AREAS
MR 164 MANLY ROAD - SPIT BRIDGE
WIDENING OF SPIT BRIDGE
AND APPROACHES TO SIX LANES
CROSS SECTIONS STN.60.00 TO STN.70.00

SHEET 11

0164.293.CD.0018

A3





ADVANCE COPY ONLY
24/02/03

No	ISSUE DETAIL	AUTH	DATE
1	ORIGINAL ISSUE - UNAPPROVED	TH	

COMPUTER FILE REFERENCES

SURVEYOR: TONY DEGIORGIO
SURVEY MODEL: SURV SPIT RM SN2094 NTH; SURV SPIT RM SN2094 BDG; SURV SPIT RM SN2094 STH
DESIGN MODEL: DESIGN STEVE
DRAW FILE: -
CADD FILE: ...\sheet_12.dgn
LEVELS USED: -
ROADLOC: START: -
FINISH: -

RTA PROJECT DESIGN TECHNICAL SERVICES OPERATIONS

DESIGNED S.WIJESOMA
CHECKED T. HUFTON

SCALES

0 2 4 6 8 10
SCALE 1:200

DATUM: AHD | GRID: MGA56
FILE: 293.1573
PRINTED DATE: 24/02/03

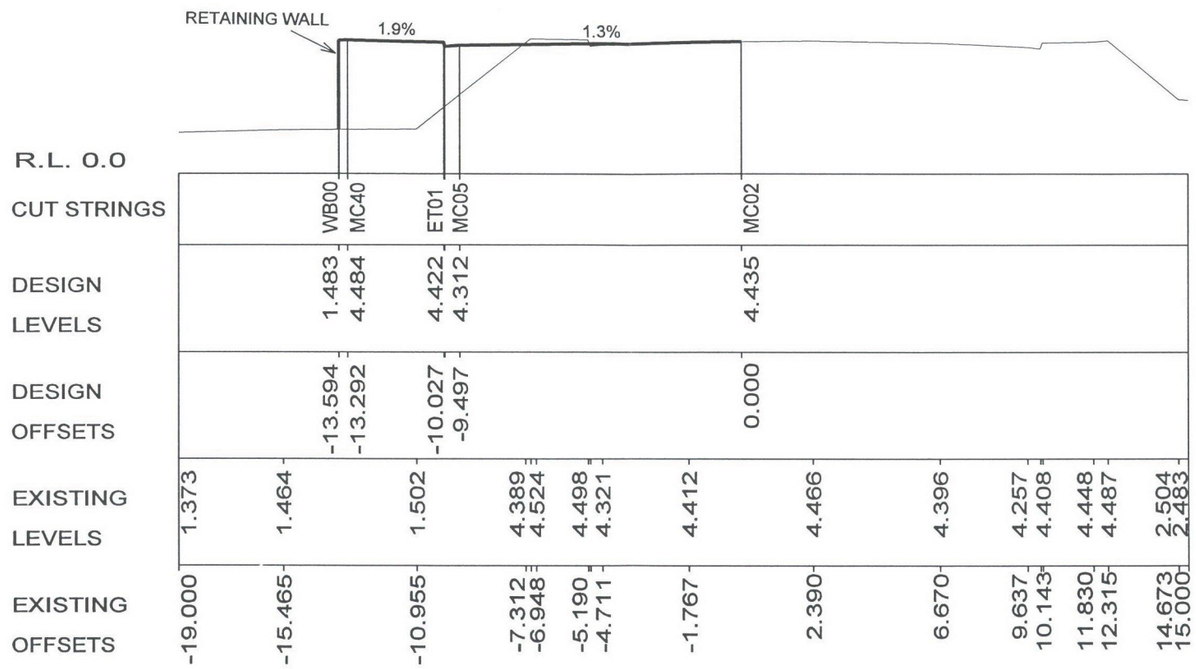
ROADS AND TRAFFIC AUTHORITY OF N.S.W.

MOSMAN AND MANLY COUNCIL AREAS
MR 164 MANLY ROAD - SPIT BRIDGE
WIDENING OF SPIT BRIDGE
AND APPROACHES TO SIX LANES
CROSS SECTIONS STN.80.00 TO STN.90.00

SHEET 12

0164.293.CD.0018

A3



100

ADVANCE COPY ONLY
24/02/03

No	ISSUE DETAIL	AUTH	DATE
1	ORIGINAL ISSUE - UNAPPROVED	TH	

COMPUTER FILE REFERENCES
SURVEYOR: TONY DEGIORGIO
SURVEY MODEL: SURV SPIT RB SN2004 NTH; SURV SPIT RB SN2004 BDG; SURV SPIT RB SN2004 STH
DESIGN MODEL: DESIGN STEVE
DRAW FILE: -
CADD FILE: ...\sheet_13.dgn
LEVELS USED: -
ROADLOC: START: - FINISH: -

R T A PROJECT DESIGN TECHNICAL SERVICES OPERATIONS

DESIGNED S.WIJESOMA
CHECKED T. HUFTON

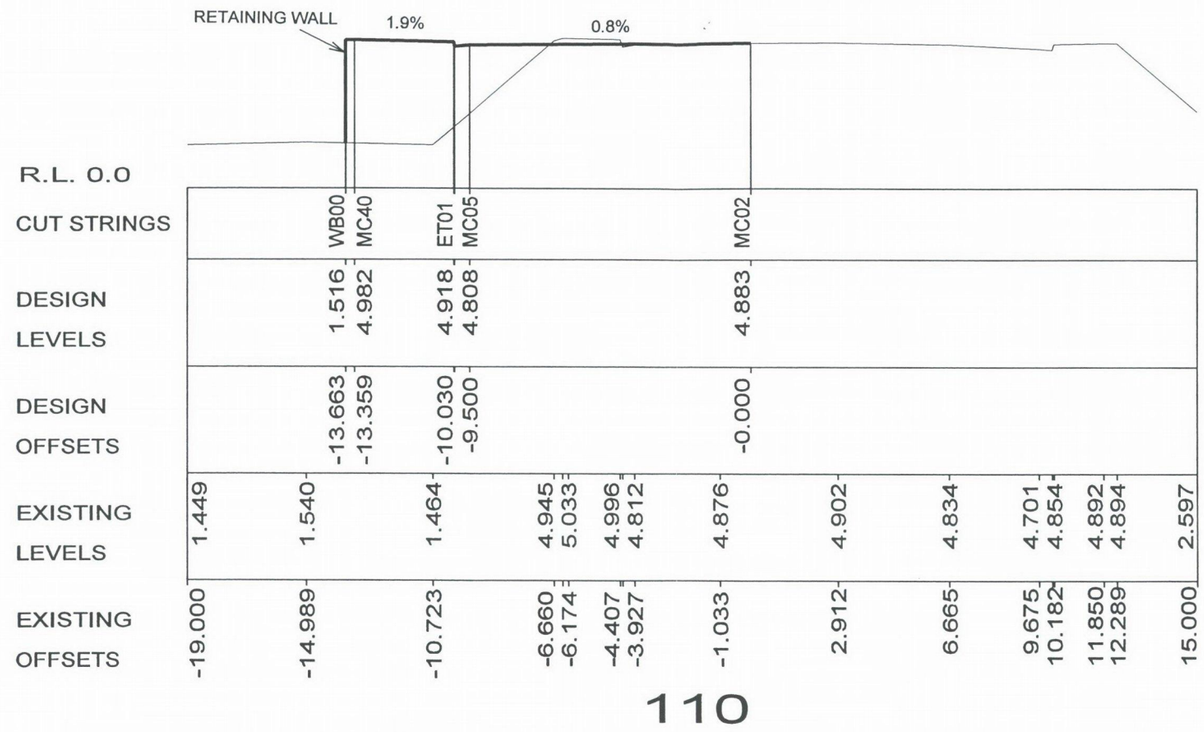
SCALES
0 2 4 6 8 10
SCALE 1:200
DATUM: AHD | GRID: MGA56
FILE: 293.1573
PRINTED DATE: 24/02/03

ROADS AND TRAFFIC AUTHORITY OF N.S.W.
MOSMAN AND MANLY COUNCIL AREAS
MR 164 MANLY ROAD - SPIT BRIDGE
WIDENING OF SPIT BRIDGE
AND APPROACHES TO SIX LANES
CROSS SECTIONS STN.100.00

SHEET 13

0164.293.CD.0018

A3



ADVANCE COPY ONLY
24/02/03

No	ISSUE DETAIL	AUTH	DATE
1	ORIGINAL ISSUE - UNAPPROVED	TH	

COMPUTER FILE REFERENCES

SURVEYOR: TONY DEGIORGIO
SURV SPIT SN2094 NTH
SURVEY MODEL: SURV SPIT SN2094 BDG
SURV SPIT SN2094 STH
DESIGN MODEL: DESIGN STEVE
DRAW FILE: -
CADD FILE: ...\sheet_14.dgn
LEVELS USED: -
ROADLOC: START: -
FINISH: -

RTA PROJECT DESIGN
TECHNICAL SERVICES
OPERATIONS

DESIGNED S.WJESOMA
CHECKED T. HUFTON

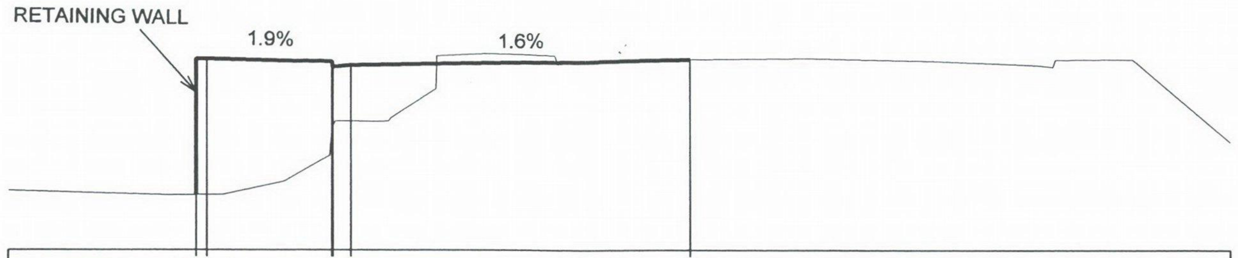
SCALES
0 2 4 6 8 10
SCALE 1:200
DATUM: AHD | GRID: MGA56
FILE: 293.1573
PRINTED DATE: 24/02/03

ROADS AND TRAFFIC AUTHORITY OF N.S.W.
MOSMAN AND MANLY COUNCIL AREAS
MR 164 MANLY ROAD - SPIT BRIDGE
WIDENING OF SPIT BRIDGE
AND APPROACHES TO SIX LANES
CROSS SECTIONS STN.110.00

SHEET 14

0164.293.CD.0018

A3



R.L. 0.0

CUT STRINGS	WB00	MC40	ET01	MC05	MC02
DESIGN LEVELS	1.518	5.278	5.212	5.102	5.257
DESIGN OFFSETS	-13.786	-13.481	-10.029	-9.499	0.000

EXISTING OFFSETS	EXISTING LEVELS
-19.000	1.636
-14.623	1.511
-13.035	1.525
-11.335	1.891
-10.093	2.603
-9.933	3.550
-8.648	3.547
-8.369	3.642
-7.092	5.369
-5.726	5.421
-5.527	5.420
-3.767	5.385
-3.256	5.186
-0.454	5.251
3.237	5.295
6.702	5.231
9.667	5.113
10.163	5.260
11.819	5.283
12.298	5.283
15.000	2.991

120

ADVANCE
COPY ONLY
24/02/03

No	ISSUE DETAIL	AUTH	DATE
1	ORIGINAL ISSUE - UNAPPROVED	TH	

COMPUTER FILE REFERENCES
SURVEYOR: TONY DEGIORGIO
SURVEY MODEL: SURV SPIT SN2064 NTH, SURV SPIT SN2064 BDG, SURV SPIT SN2064 STH
DESIGN MODEL: DESIGN STEVE
DRAW FILE: -
CADD FILE: ...\sheet_15.dgn
LEVELS USED: -
ROADLOC: START: -
FINISH: -

RTA PROJECT DESIGN TECHNICAL SERVICES OPERATIONS

DESIGNED S.WIJESOMA
CHECKED T. HUFTON

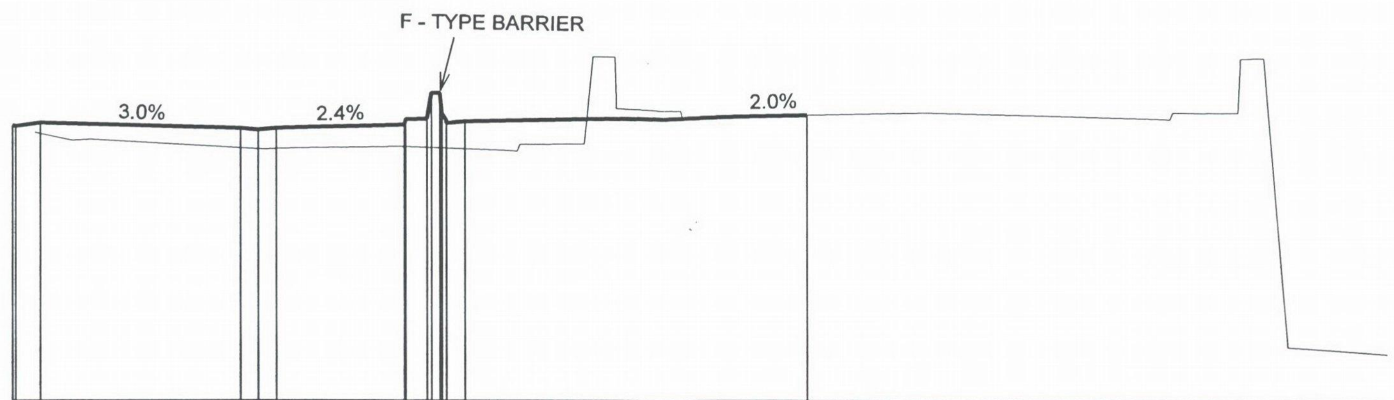
SCALES
0 2 4 6 8 10
SCALE 1:200
DATUM: AHD | GRID: MGA56
FILE: 293.1573
PRINTED DATE: 24/02/03

ROADS AND TRAFFIC AUTHORITY OF N.S.W.
MOSMAN AND MANLY COUNCIL AREAS
MR 164 MANLY ROAD - SPIT BRIDGE
WIDENING OF SPIT BRIDGE
AND APPROACHES TO SIX LANES
CROSS SECTIONS STN.120.00

SHEET 15

0164.293.CD.0018

A3



R.L. 4.0

CUT STRINGS	DESIGN LEVELS	DESIGN OFFSETS
EW01	11.597	-22.000
MC09	11.674	-21.230
WD01	11.505	-15.682
WD0I	11.505	-14.682
MC56	11.591	-11.155
BC10	12.464	-10.415
MC05	11.684	-9.500
MC02	11.870	0.000

EXISTING LEVELS	EXISTING OFFSETS
11.405	-21.389
11.186	-20.359
11.207	-19.836
10.948	-15.391
10.942	-14.573
11.000	-11.347
10.895	-8.494
11.060	-7.979
11.066	-6.207
13.465	-5.352
12.045	-5.304
12.004	-3.487
11.807	-2.999
11.866	-0.168
11.939	3.259
11.867	6.498
11.783	9.592
11.951	10.080
11.960	11.878
13.458	12.567
5.528	13.255
5.336	16.000

360

ADVANCE COPY ONLY
24/02/03

No	ISSUE DETAIL	AUTH	DATE
1	ORIGINAL ISSUE - UNAPPROVED	TH	

COMPUTER FILE REFERENCES
SURVEYOR: TONY DEGIORGIO
SURVEY MODEL: SURV SPIT RBB SN2064 NTH / SURV SPIT RBB SN2064 BDG / SURV SPIT RBB SN2064 STH
DESIGN MODEL: DESIGN STEVE
DRAW FILE: -
CADD FILE: ...\sheet_16.dgn
LEVELS USED: -
ROADLOC: START: -
FINISH: -

RTA PROJECT DESIGN TECHNICAL SERVICES OPERATIONS
DESIGNED S.WIJESOMA
CHECKED T. HUFTON

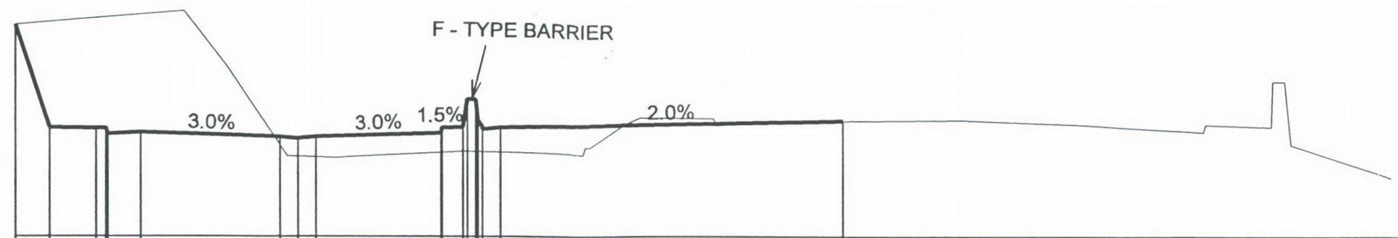
SCALES
0 2 4 6 8 10
SCALE 1:200
DATUM: AHD | GRID: MGA56
FILE: 293.1573
PRINTED DATE: 24/02/03

ROADS AND TRAFFIC AUTHORITY OF N.S.W.
MOSMAN AND MANLY COUNCIL AREAS
MR 164 MANLY ROAD - SPIT BRIDGE
WIDENING OF SPIT BRIDGE
AND APPROACHES TO SIX LANES
CROSS SECTIONS STN.360.00

SHEET 16

0164.293.CD.0018

A3



R.L. 9.0

CUT STRINGS	IA01	EX00	EH04	EF07	MC09	WD01	WD0I	MC56	BC10	MC05	MC02
DESIGN LEVELS	14.862	12.006	11.991	11.841	11.880	11.764	11.765	11.868	12.787	12.007	12.195
DESIGN OFFSETS	-22.944	-22.000	-20.715	-20.397	-19.502	-15.632	-14.632	-11.161	-10.422	-9.506	0.000

EXISTING LEVELS	EXISTING OFFSETS
14.862	-22.944
14.936	-22.000
15.225	-18.278
13.757	-17.141
11.382	-15.531
11.239	-15.422
11.176	-14.092
11.208	-13.701
11.361	-10.518
11.292	-7.631
11.455	-6.991
12.116	-5.974
12.280	-5.419
12.271	-3.566
12.101	-3.086
12.192	-0.275
12.231	3.328
12.103	6.623
11.932	9.561
12.106	10.041
12.049	11.852
11.555	12.396
10.637	15.185

370

ADVANCE
COPY ONLY
24/02/03

No	ISSUE DETAIL	AUTH	DATE
1	ORIGINAL ISSUE - UNAPPROVED	TH	

COMPUTER FILE REFERENCES
SURVEYOR: TONY DEGIORGIO
SURVEY MODEL: SURV SPIT [redacted] SN2064 NTH, SURV SPIT [redacted] SN2064 BDG, SURV SPIT [redacted] SN2064 STH
DESIGN MODEL: DESIGN STEVE
DRAW FILE: -
CADD FILE: ...\sheet_17.dgn
LEVELS USED: -
ROADLOC: START: -
FINISH: -

RTA PROJECT DESIGN TECHNICAL SERVICES OPERATIONS

DESIGNED S.WIJESOMA
CHECKED T. HUFTON

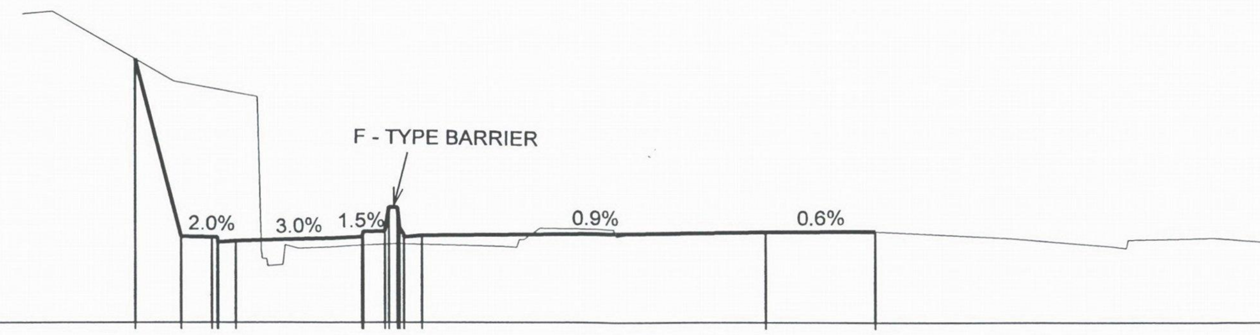
SCALES
0 2 4 6 8 10
SCALE 1:200
DATUM: AHD | GRID: MGA56
FILE: 293.1573
PRINTED DATE: 24/02/03

ROADS AND TRAFFIC AUTHORITY OF N.S.W.
MOSMAN AND MANLY COUNCIL AREAS
MR 164 MANLY ROAD - SPIT BRIDGE
WIDENING OF SPIT BRIDGE
AND APPROACHES TO SIX LANES
CROSS SECTIONS STN.370.00

SHEET 17

0164.293.CD.0018

A3



R.L. 10.0

CUT STRINGS	IA01	EX00	ET04	MC09	MC56	EW02	MC05	MC02	CR04
DESIGN LEVELS	17.460	12.381	12.364	12.254	12.360	12.519	12.401	12.487	12.504
DESIGN OFFSETS	-17.465	-16.196	-15.196	-14.666	-11.165	-10.539	-9.507	-0.000	3.007

EXISTING LEVELS	EXISTING OFFSETS
18.506	-20.595
18.576	-19.757
16.644	-16.391
16.220	-14.064
11.601	-13.362
12.045	-12.888
12.171	-10.222
12.109	-7.319
12.607	-6.265
12.594	-6.108
12.568	-4.237
12.432	-3.735
12.483	-0.827
12.504	3.007
12.326	6.713
12.106	9.528
12.274	10.017
12.324	11.589
12.339	12.382
12.235	13.780

380

ADVANCE COPY ONLY
24/02/03

No	ISSUE DETAIL	AUTH	DATE
1	ORIGINAL ISSUE - UNAPPROVED	TH	

COMPUTER FILE REFERENCES
SURVEYOR: TONY DEGIORGIO
SURVEY MODEL: SURV SPIT RB SN2064 NTH / SURV SPIT RB SN2064 BDG / SURV SPIT RB SN2064 STH
DESIGN MODEL: DESIGN STEVE
DRAW FILE: -
CADD FILE: ...\sheet_18.dgn
LEVELS USED: -
ROADLOC: START: - FINISH: -

RTA PROJECT DESIGN TECHNICAL SERVICES OPERATIONS

DESIGNED S.WIJESOMA
CHECKED T. HUFTON

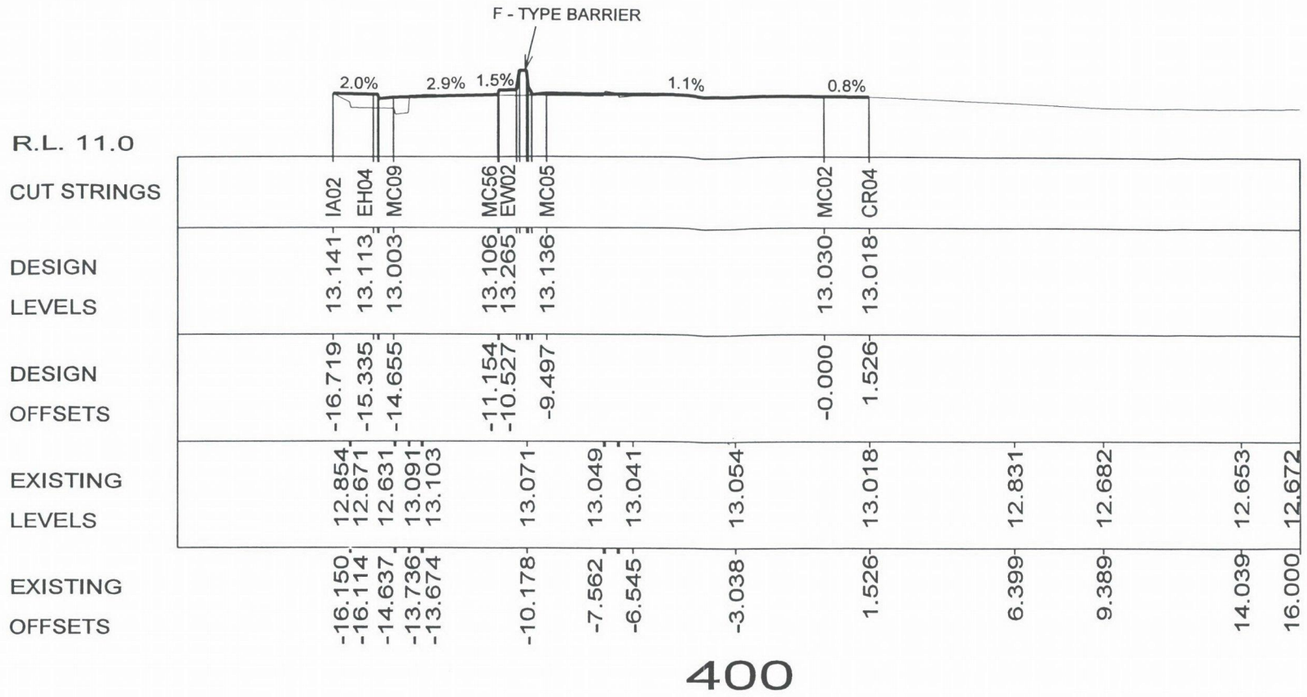
SCALES
0 2 4 6 8 10
SCALE 1:200
DATUM: AHD | GRID: MGA56
FILE: 293.1573
PRINTED DATE: 24/02/03

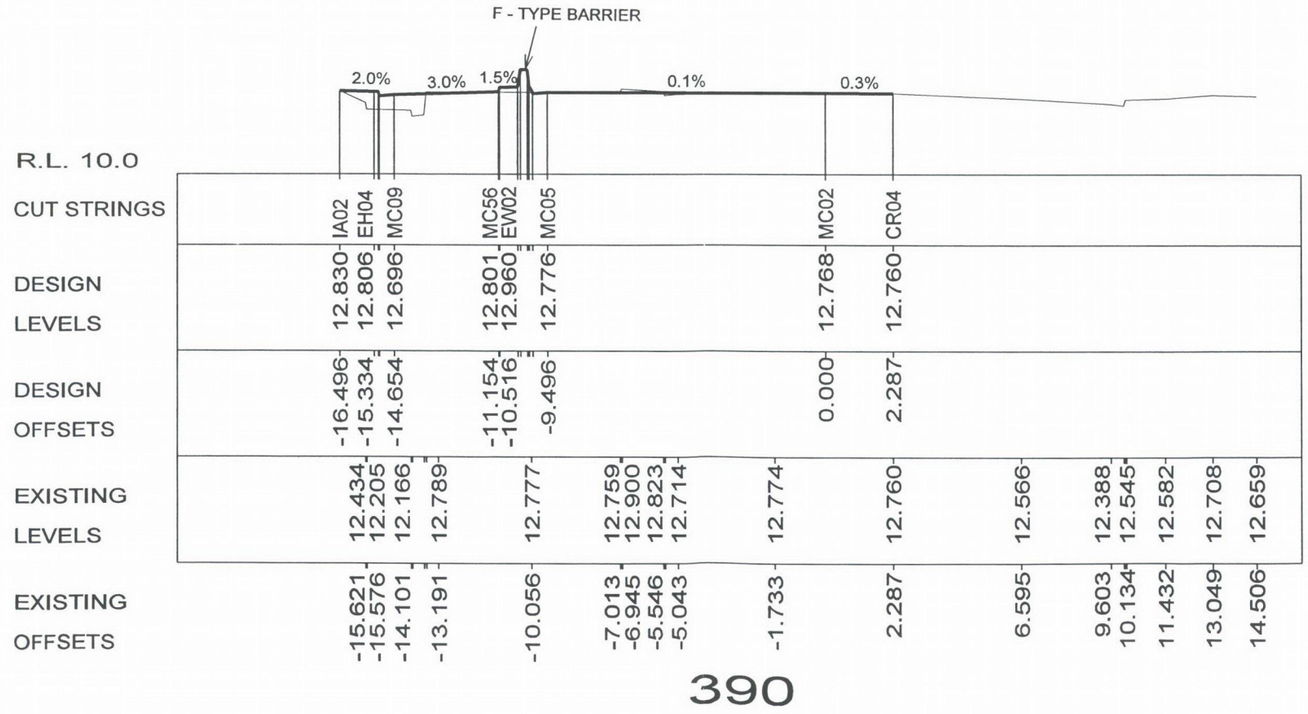
ROADS AND TRAFFIC AUTHORITY OF N.S.W.
MOSMAN AND MANLY COUNCIL AREAS
MR 164 MANLY ROAD - SPIT BRIDGE
WIDENING OF SPIT BRIDGE
AND APPROACHES TO SIX LANES
CROSS SECTIONS STN.380.00

SHEET 18

0164.293.CD.0018

A3





ADVANCE COPY ONLY
24/02/03

No	ISSUE DETAIL	AUTH	DATE
1	ORIGINAL ISSUE - UNAPPROVED	TH	

COMPUTER FILE REFERENCES
SURVEYOR: TONY DEGIORGIO
SURVEY MODEL: SURV SPIT RB SN2064 NTH; SURV SPIT RB SN2064 BDG; SURV SPIT RB SN2064 STH
DESIGN MODEL: DESIGN STEVE
DRAW FILE: -
CADD FILE: ...\sheet_19.dgn
LEVELS USED: -
ROADLOC: START: - FINISH: -

RTA PROJECT DESIGN TECHNICAL SERVICES OPERATIONS

DESIGNED S.WIJESOMA
CHECKED T. HUFTON

SCALES
0 2 4 6 8 10
SCALE 1:200

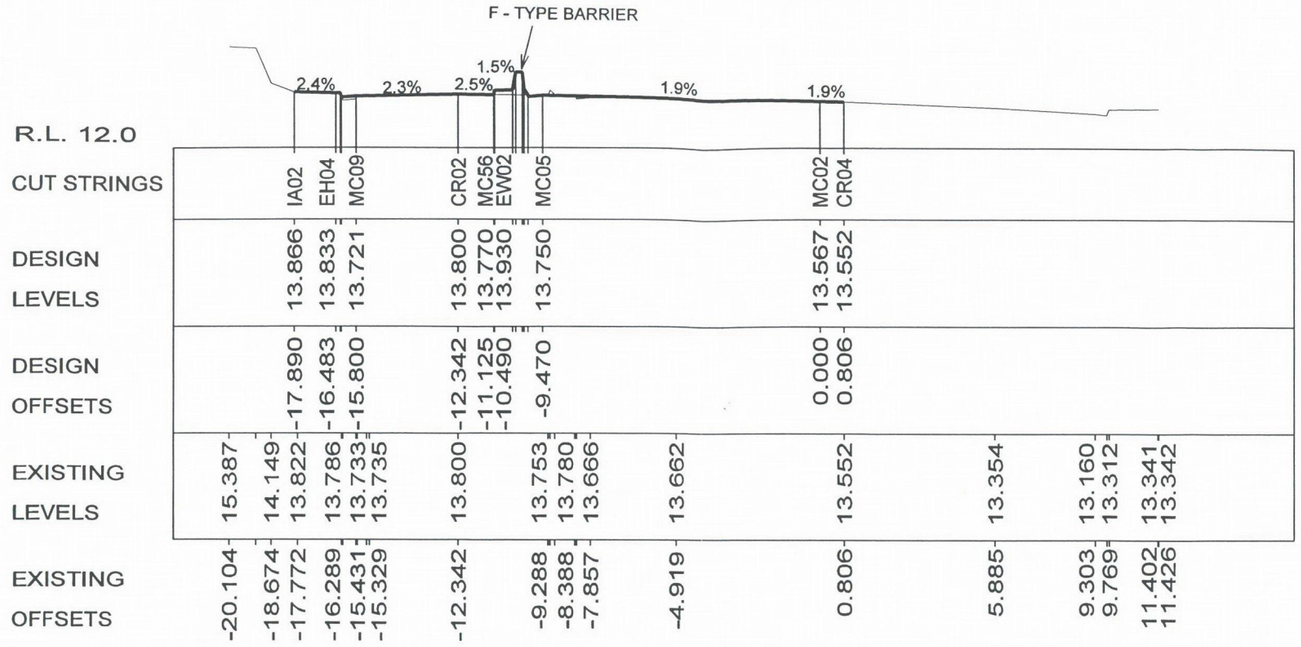
DATUM: AHD | GRID: MGA56
FILE: 293.1573
PRINTED DATE: 24/02/03

ROADS AND TRAFFIC AUTHORITY OF N.S.W.
MOSMAN AND MANLY COUNCIL AREAS
MR 164 MANLY ROAD - SPIT BRIDGE
WIDENING OF SPIT BRIDGE
AND APPROACHES TO SIX LANES
CROSS SECTIONS STN.390 TO STN.400

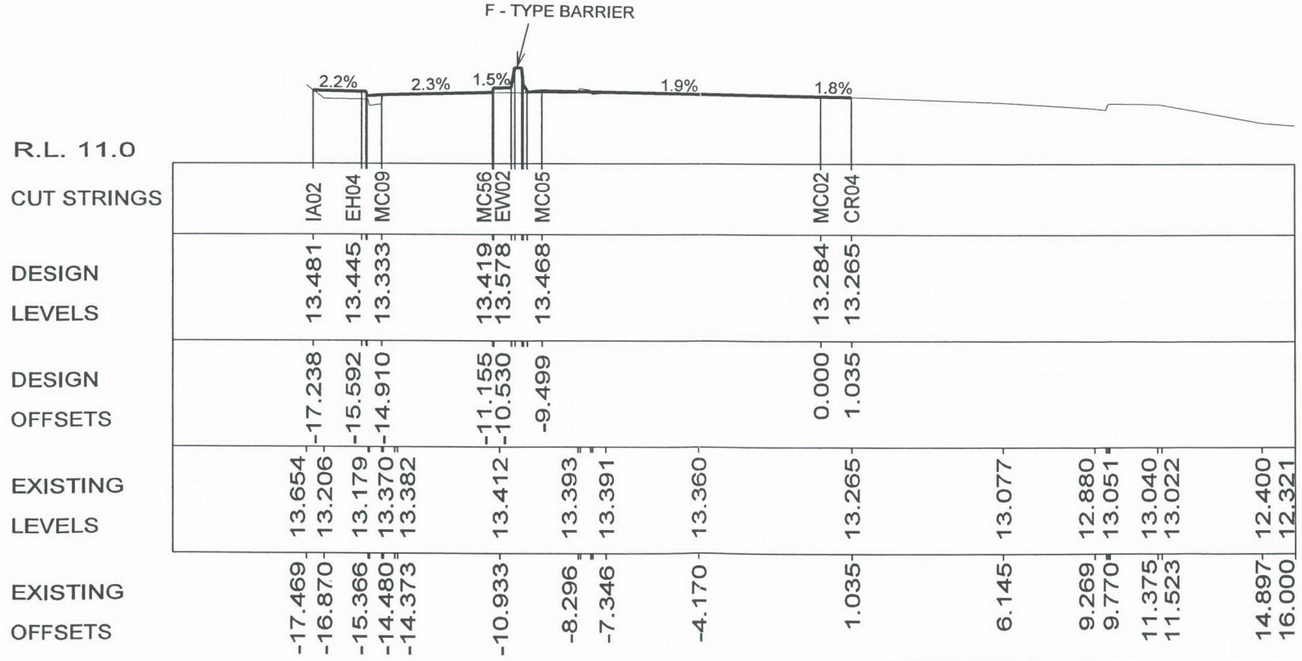
SHEET 19

0164.293.CD.0018

A3



420



410

ADVANCE COPY ONLY
24/02/03

No	ISSUE DETAIL	AUTH	DATE
1	ORIGINAL ISSUE - UNAPPROVED	TH	

COMPUTER FILE REFERENCES
SURVEYOR: TONY DEGIORGIO
SURVEY MODEL: SURV SPIT RBS SN2064 NTH; SURV SPIT RBS SN2064 BOQ; SURV SPIT RBS SN2064 STH
DESIGN MODEL: DESIGN STEVE
DRAW FILE: -
CADD FILE: ...\sheet_20.dgn
LEVELS USED: -
ROADLOC: START: -
FINISH: -

R T A PROJECT DESIGN TECHNICAL SERVICES OPERATIONS

DESIGNED S.WIJESOMA
CHECKED T. HUFTON

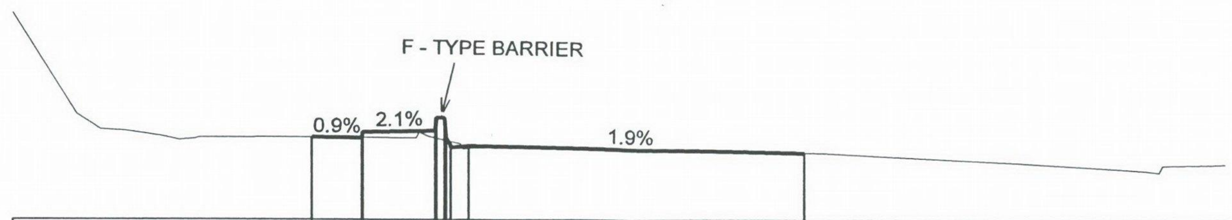
SCALES
0 2 4 6 8 10
SCALE 1:200
DATUM: AHD | GRID: MGA56
FILE: 293.1573
PRINTED DATE: 24/02/03

ROADS AND TRAFFIC AUTHORITY OF N.S.W.
MOSMAN AND MANLY COUNCIL AREAS
MR 164 MANLY ROAD - SPIT BRIDGE
WIDENING OF SPIT BRIDGE
AND APPROACHES TO SIX LANES
CROSS SECTIONS STN.410.00 TO STN.420.00

SHEET 20

0164.293.CD.0018

A3



R.L. 12.0

CUT STRINGS	DESIGN LEVELS	DESIGN OFFSETS
CR02	14.281	-13.707
MC57	14.268	-12.328
ET4I	14.418	-12.298
EW05	14.460	-10.296
MC05	14.038	-9.339
MC02	13.861	0.000

EXISTING LEVELS	EXISTING OFFSETS
17.716	-22.000
14.920	-20.230
14.490	-19.576
14.448	-18.911
14.310	-17.860
14.227	-16.929
14.269	-16.800
14.281	-13.707
14.254	-10.812
14.292	-10.420
13.992	-9.039
13.970	-5.523
13.850	0.544
13.596	5.788
13.374	9.382
13.531	9.872
13.565	11.507
13.566	11.602

430

ADVANCE COPY ONLY
24/02/03

0164.293.CD.0018

No	ISSUE DETAIL	AUTH	DATE
1	ORIGINAL ISSUE - UNAPPROVED	TH	

COMPUTER FILE REFERENCES
SURVEYOR: TONY DEGIORGIO
SURVEY MODEL: SURV SPIT R[illegible] SN2064 NTH; SURV SPIT R[illegible] SN2064 BDG; SURV SPIT R[illegible] SN2064 STH
DESIGN MODEL: DESIGN STEVE
DRAW FILE: -
CADD FILE: ...\sheet_21.dgn
LEVELS USED: -
ROADLOC: START: -
FINISH: -

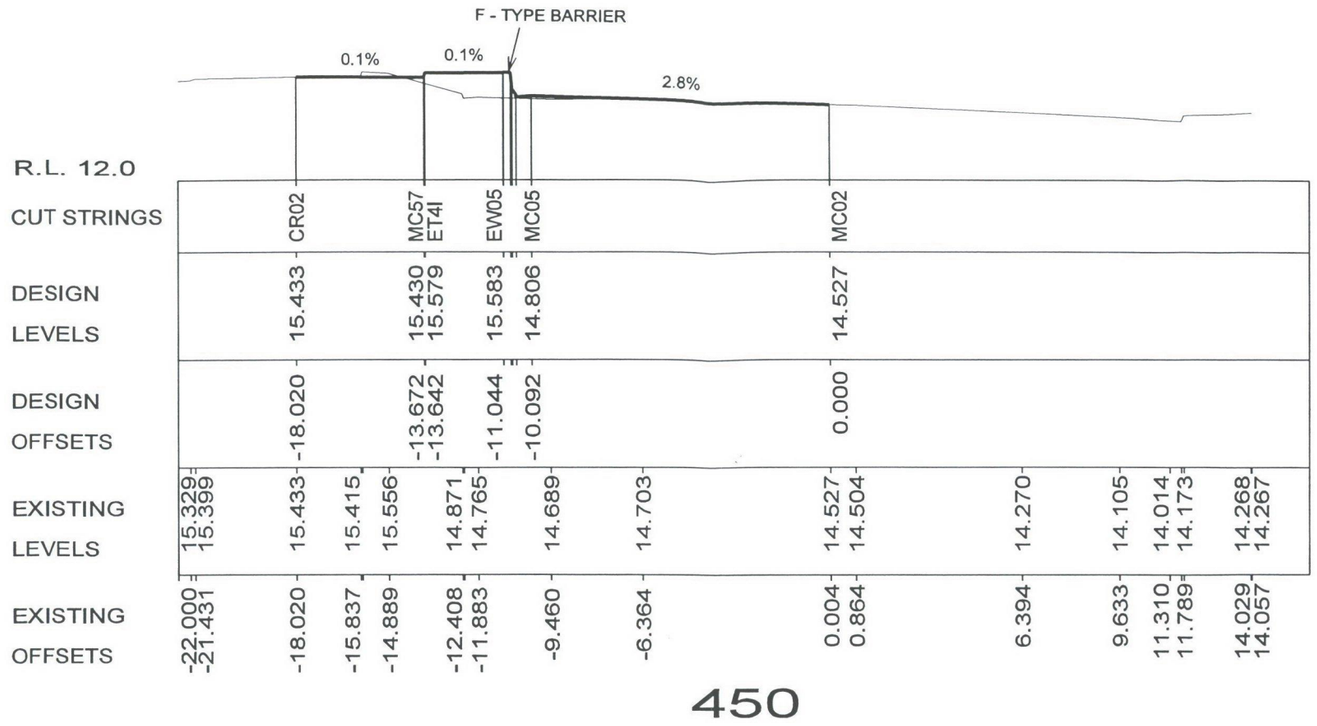
RTA PROJECT DESIGN TECHNICAL SERVICES OPERATIONS
DESIGNED S.WIJESOMA
CHECKED T. HUFTON

SCALES
0 2 4 6 8 10
SCALE 1:200
DATUM: AHD | GRID: MGA56
FILE: 293.1573
PRINTED DATE: 24/02/03

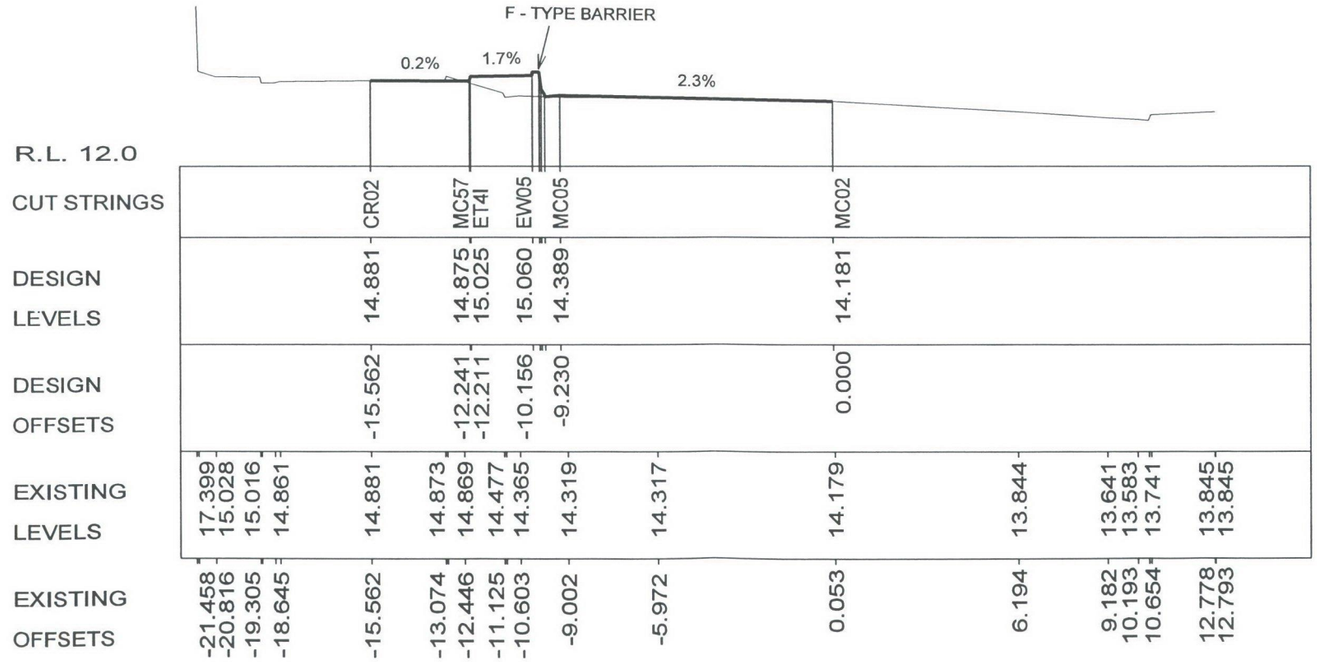
ROADS AND TRAFFIC AUTHORITY OF N.S.W.
MOSMAN AND MANLY COUNCIL AREAS
MR 164 MANLY ROAD - SPIT BRIDGE
WIDENING OF SPIT BRIDGE
AND APPROACHES TO SIX LANES
CROSS SECTIONS STN.430.00

SHEET 21

A3



450



440

ADVANCE COPY ONLY
24/02/03

No	ISSUE DETAIL	AUTH	DATE
1	ORIGINAL ISSUE - UNAPPROVED	TH	

COMPUTER FILE REFERENCES

SURVEYOR: TONY DEGIORGIO
SURVEY MODEL: SURV SPIT RBS SN2064 NTH; SURV SPIT RBS SN2064 BDG; SURV SPIT RBS SN2064 STH
DESIGN MODEL: DESIGN STEVE
DRAW FILE: -
CADD FILE: ...\sheet_22.dgn
LEVELS USED: -
ROADLOC: START: -
FINISH: -

R T A PROJECT DESIGN TECHNICAL SERVICES OPERATIONS

DESIGNED S.WIJESOMA
CHECKED T. HUFTON

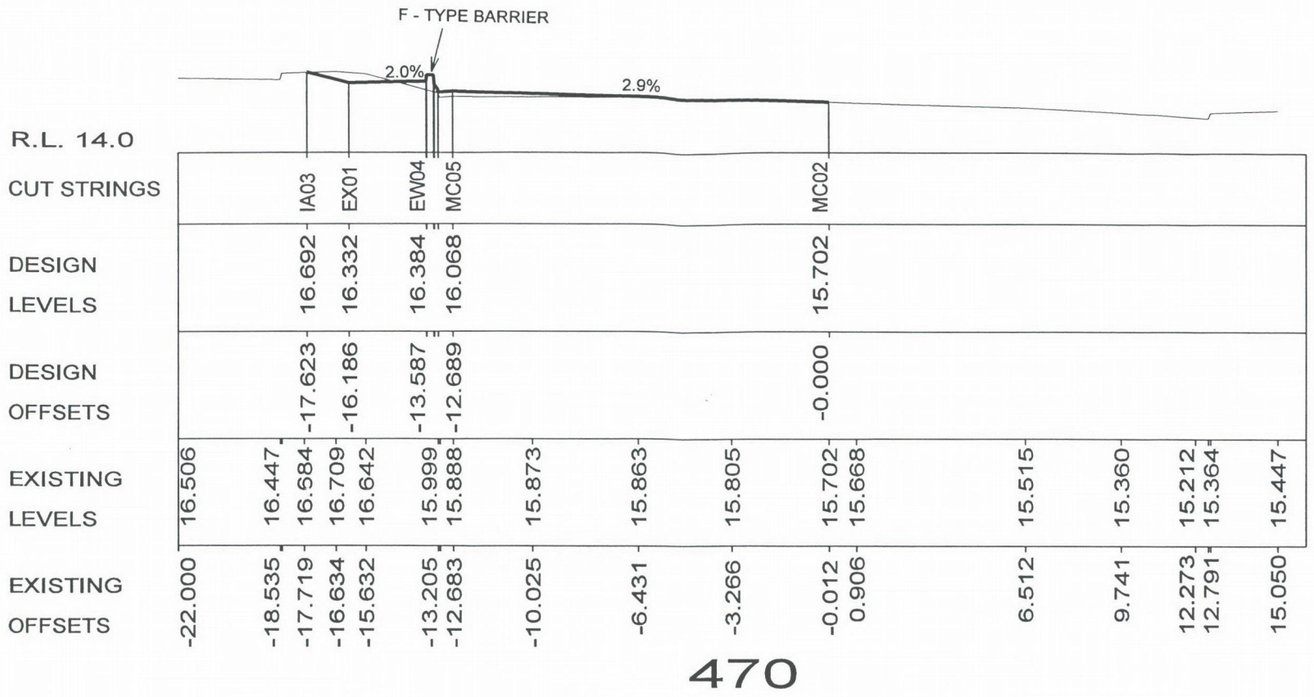
SCALES
0 2 4 6 8 10
SCALE 1:200
DATUM: AHD | GRID: MGA56
FILE: 293.1573
PRINTED DATE: 24/02/03

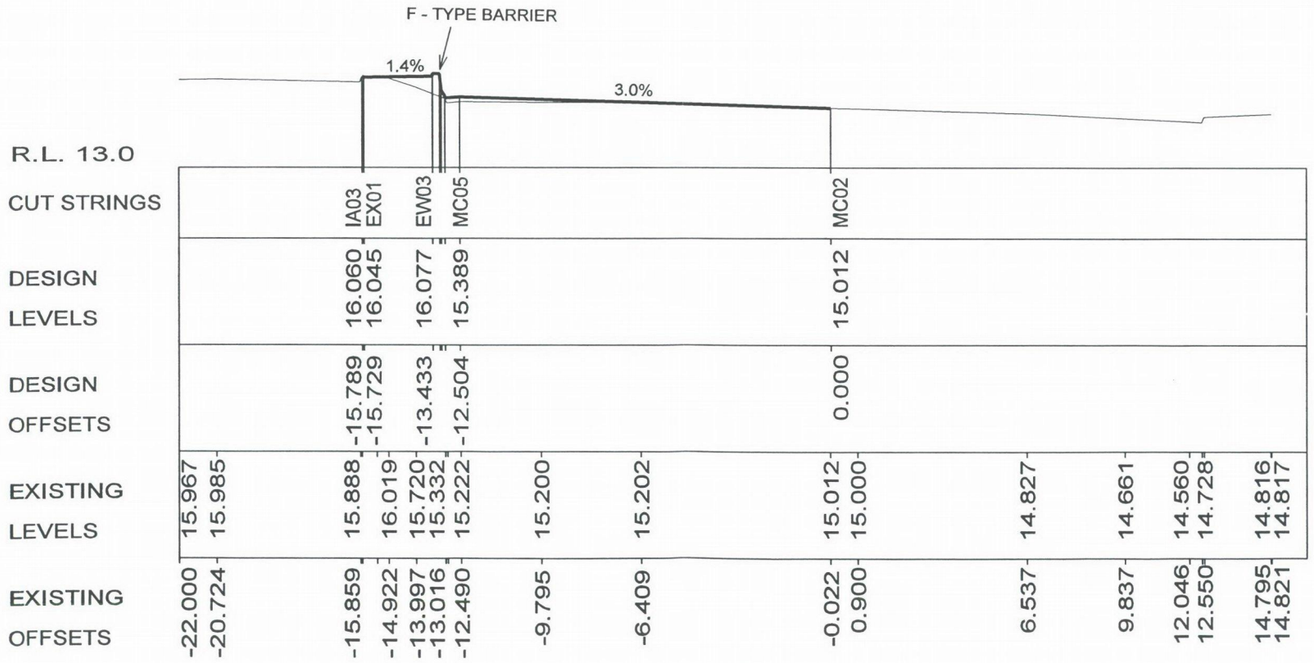
ROADS AND TRAFFIC AUTHORITY OF N.S.W.
MOSMAN AND MANLY COUNCIL AREAS
MR 164 MANLY ROAD - SPIT BRIDGE
WIDENING OF SPIT BRIDGE
AND APPROACHES TO SIX LANES
CROSS SECTIONS STN.440.00 TO STN.450.00

SHEET 22

0164.293.CD.0018

A3





ADVANCE COPY ONLY
24/02/03

No	ISSUE DETAIL	AUTH	DATE
1	ORIGINAL ISSUE - UNAPPROVED	TH	

COMPUTER FILE REFERENCES
SURVEYOR: TONY DEGIORGIO
SURVEY MODEL: SURV SPIT RB SN2064 NTH; SURV SPIT RB SN2064 BDG; SURV SPIT RB SN2064 STH
DESIGN MODEL: DESIGN STEVE
DRAW FILE: -
CADD FILE: ...\sheet_23.dgn
LEVELS USED: -
ROADLOC: START: -
FINISH: -

R T A PROJECT DESIGN TECHNICAL SERVICES OPERATIONS

DESIGNED S.WIJESOMA
CHECKED T. HUFTON

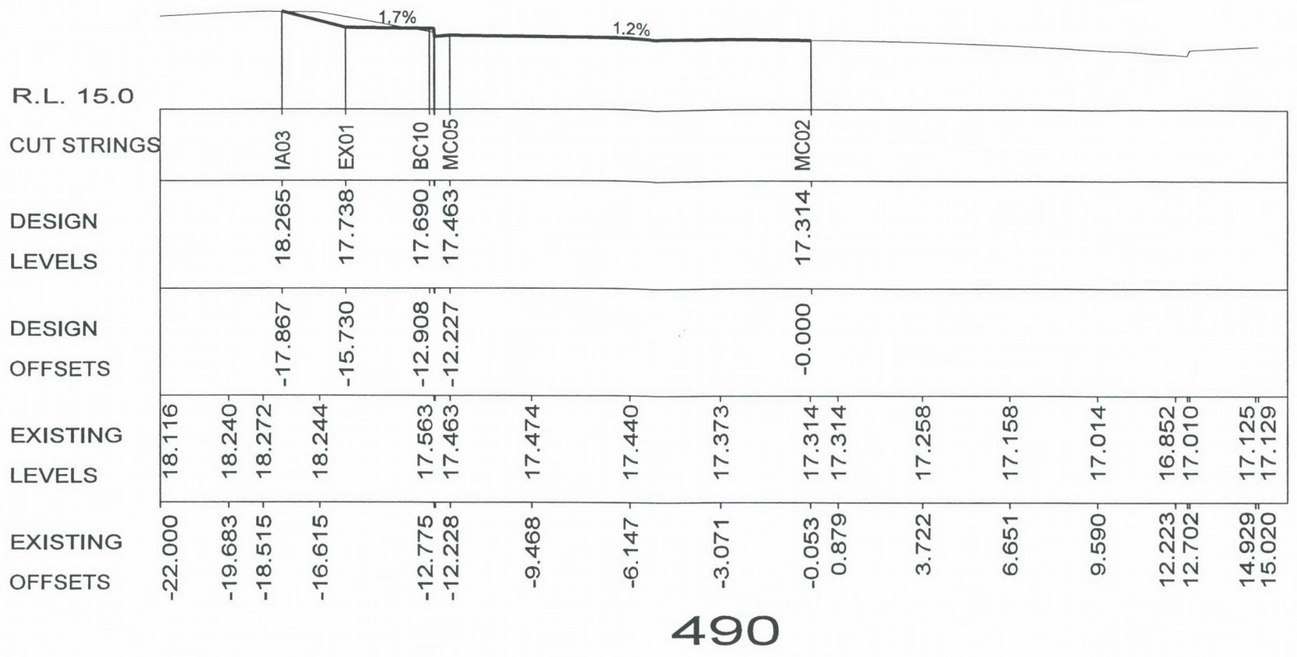
SCALES
0 2 4 6 8 10
SCALE 1:200
DATUM: AHD | GRID: MGA56
FILE: 293.1573
PRINTED DATE: 24/02/03

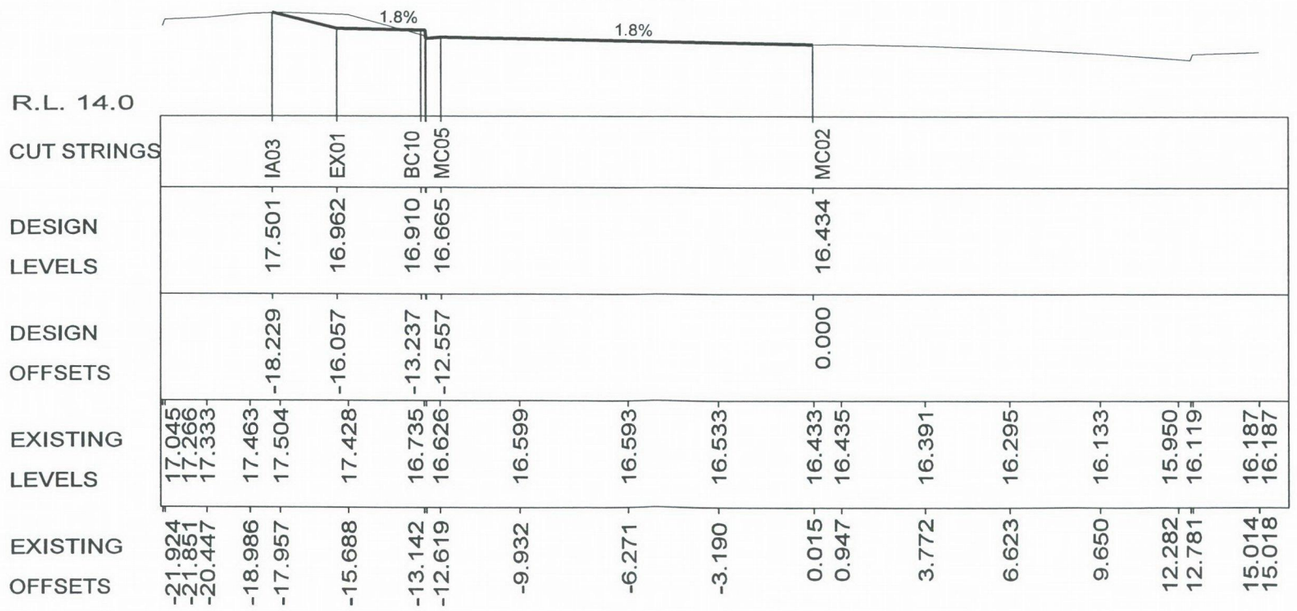
ROADS AND TRAFFIC AUTHORITY OF N.S.W.
MOSMAN AND MANLY COUNCIL AREAS
MR 164 MANLY ROAD - SPIT BRIDGE
WIDENING OF SPIT BRIDGE
AND APPROACHES TO SIX LANES
CROSS SECTIONS STN.460.00 TO STN.470.00

SHEET 23

0164.293.CD.0018

A3





ADVANCE COPY ONLY
24/02/03

No	ISSUE DETAIL	AUTH	DATE
1	ORIGINAL ISSUE - UNAPPROVED	TH	

COMPUTER FILE REFERENCES

SURVEYOR: TONY DEGIORGIO
SURVEY MODEL: SURV SPIT RBL SN2064 NTH; SURV SPIT RBL SN2064 BOO; SURV SPIT RBL SN2064 STH
DESIGN MODEL: DESIGN STEVE
DRAW FILE: -
CADD FILE: ...\sheet_24.dgn
LEVELS USED: -
ROADLOC: START: -
FINISH: -

R T A PROJECT DESIGN TECHNICAL SERVICES OPERATIONS

DESIGNED S.WIJESOMA
CHECKED T. HUFTON

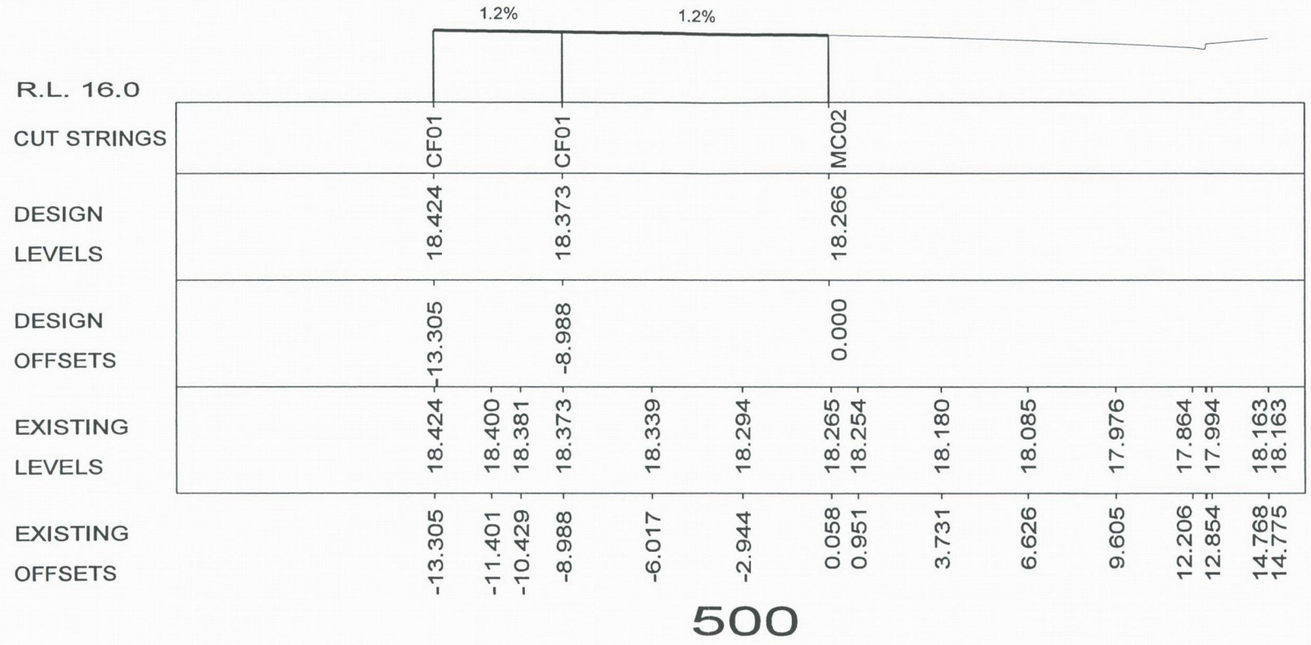
SCALES
0 2 4 6 8 10
SCALE 1:200
DATUM: AHD | GRID: MGA56
FILE: 293.1573
PRINTED DATE: 24/02/03

ROADS AND TRAFFIC AUTHORITY OF N.S.W.
MOSMAN AND MANLY COUNCIL AREAS
MR 164 MANLY ROAD - SPIT BRIDGE
WIDENING OF SPIT BRIDGE
AND APPROACHES TO SIX LANES
CROSS SECTIONS STN.480.00 TO STN.490.00

SHEET 24

0164.293.CD.0018

A3



0164.293.CD.0018

ADVANCE
COPY ONLY
24/02/03

No	ISSUE DETAIL	AUTH	DATE
1	ORIGINAL ISSUE - UNAPPROVED	TH	

COMPUTER FILE REFERENCES
SURVEYOR: TONY DEGIORGIO
SURVEY MODEL: SURV SPIT RD SN2064 NTH; SURV SPIT RD SN2064 BDG; SURV SPIT RD SN2064 STH
DESIGN MODEL: DESIGN STEVE
DRAW FILE: -
CADD FILE: ...\sheet_25.dgn
LEVELS USED: -
ROADLOC: START: -
FINISH: -

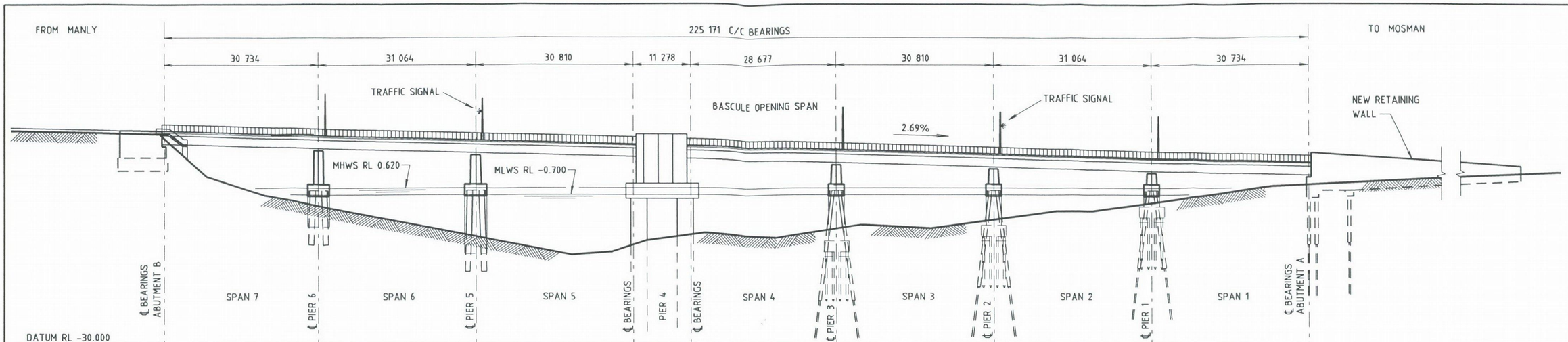
RTA PROJECT DESIGN TECHNICAL SERVICES OPERATIONS

DESIGNED S.WIJESOMA
CHECKED T. HUFTON

SCALES
0 2 4 6 8 10
SCALE 1:200
DATUM: AHD | GRID: MGA56
FILE: 293.1573
PRINTED DATE: 24/02/03

ROADS AND TRAFFIC AUTHORITY OF N.S.W.
MOSMAN AND MANLY COUNCIL AREAS
MR 164 MANLY ROAD - SPIT BRIDGE
WIDENING OF SPIT BRIDGE
AND APPROACHES TO SIX LANES
CROSS SECTIONS STN.500.00

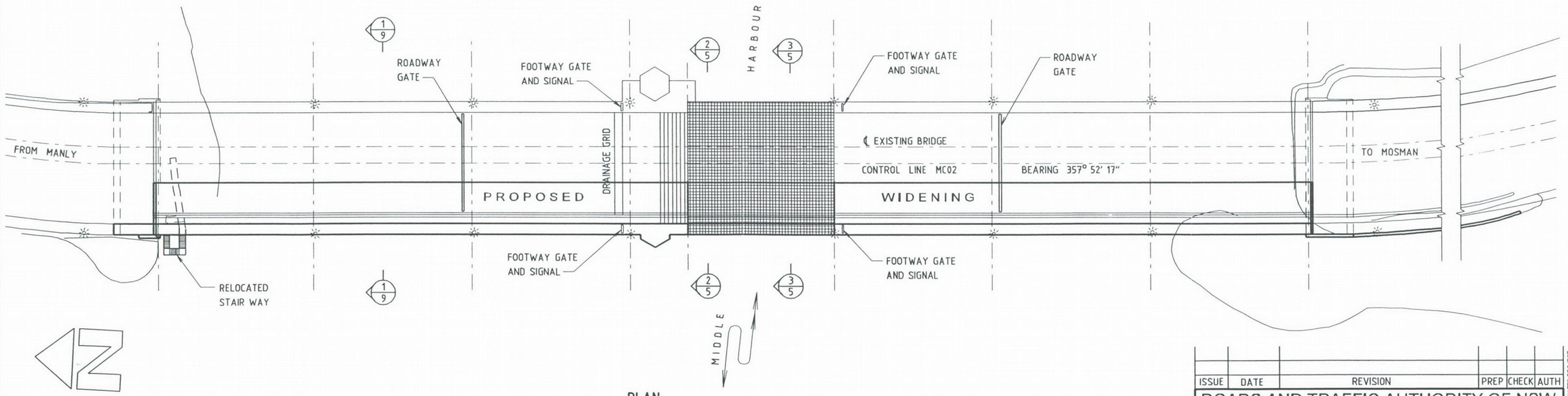
SHEET
25



DATUM RL -30.000

DESIGN SURFACE LEVEL ON CONTROL LINE MC02	11.818	10.994	10.163	9.256	8.958	8.145	7.378	6.526	5.652
APPROXIMATE EXISTING SURFACE LEVEL	11.0	-2.8	-8.4	-6.8		-5.1	-5.6	-1.7	2.0
CHAINAGE ON CONTOL LINE MC02	358.071	327.336	296.271	265.461	254.183	225.506	194.696	163.632	132.898

ELEVATION



PLAN

EXISTING FENDERS NOT SHOWN

GENERAL NOTES

SCALE 0 4 8 12 16 20m (4 2) OR AS SHOWN

DIMENSIONS ARE IN MILLIMETRES
CHAINAGES AND REDUCED LEVELS ARE IN METRES.
REDUCED LEVELS ARE RELATED TO AHD.
EXISTING BRIDGE DRAWINGS REGISTRATION No 0164 293 BC 0116.
THE SURVEY OF THE EXISTING BRIDGE LEVELS SHOWS NO CORRELATION WITH THE DESIGN LEVELS SHOWN ON THE WORK AS EXECUTED BRIDGE DRAWINGS.
COMBINED TRAFFIC PEDESTRIAN BARRIER -60% OF LEVEL 2 DESIGN LOAD TO AUSTROADS BRIDGE DESIGN CODE 1996.

ISSUE	DATE	REVISION	PREP	CHECK	AUTH

ROADS AND TRAFFIC AUTHORITY OF NSW

MAIN ROAD No 164 — MUNICS. OF MANLY AND MOSMAN

BRIDGE OVER MIDDLE HARBOUR AT THE SPIT WIDENING

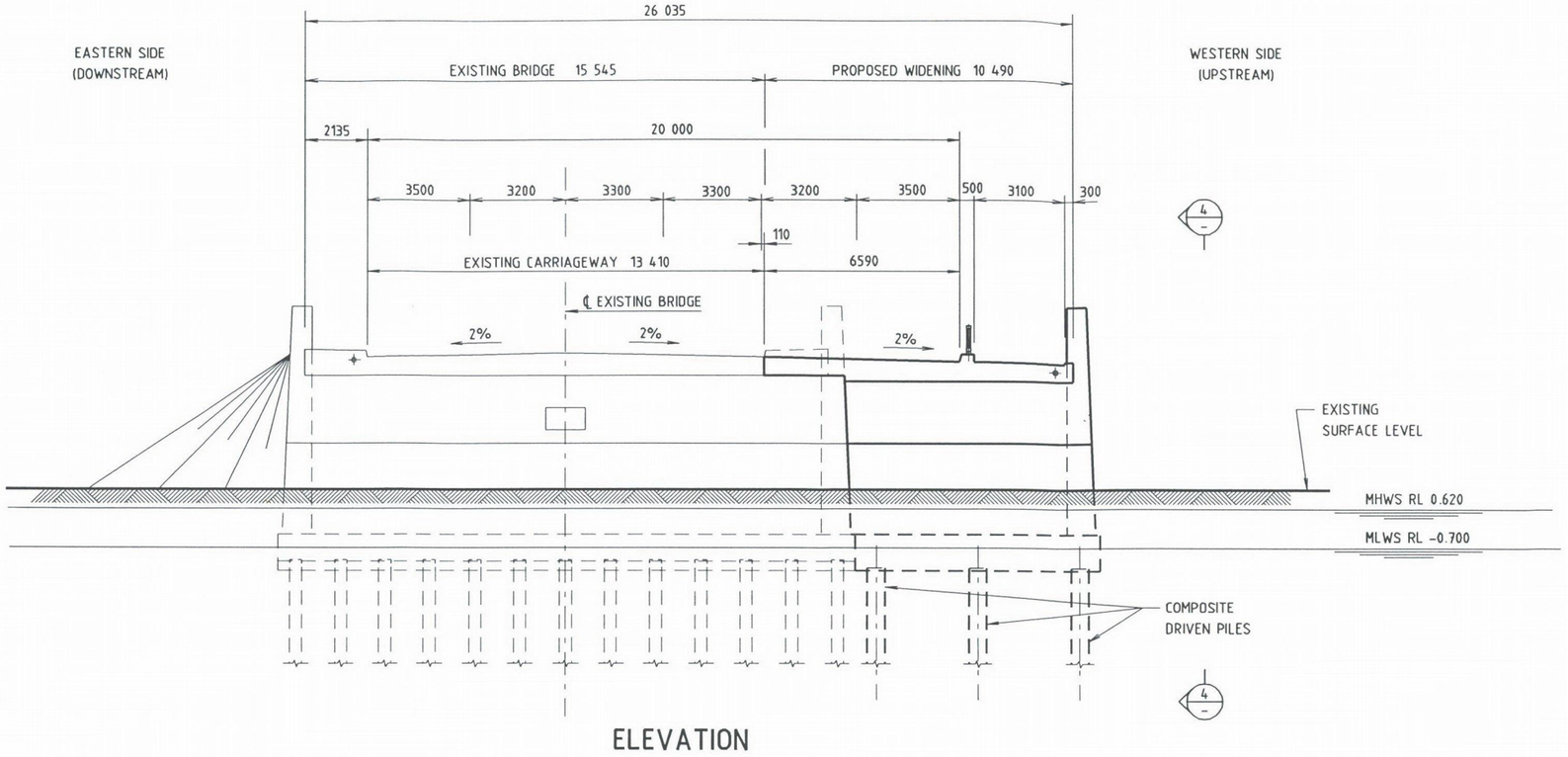
CONCEPT PROPOSAL - GENERAL ARRANGEMENT

PREPARED BY
BRIDGE SECTION
89 PHILLIP STREET
PARRAMATTA NSW 2150
PHONE (02) 8837-0800
FACSIMILE (02) 8837-0055

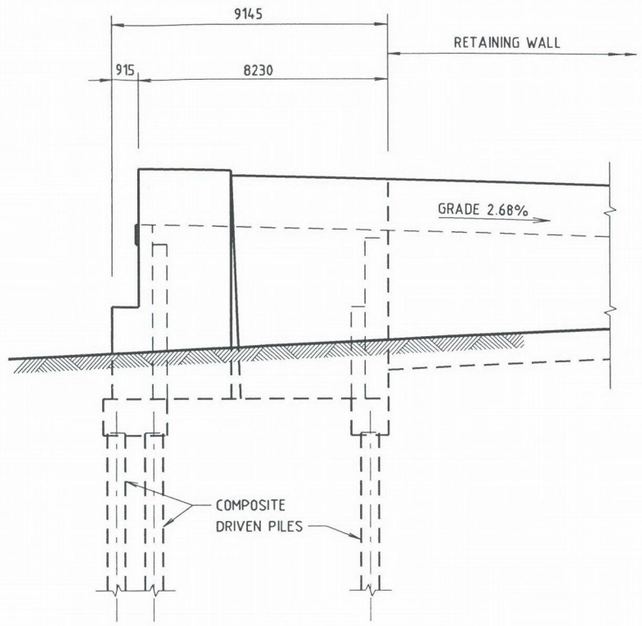
CLIENT
ROAD NETWORK INFRASTRUCTURE

PREPARED	CHECKED	SKETCH No
DESIGN		KD564CP1
DRAWING Reinhardt 29.08.02		
SENIOR MANAGER, BRIDGE DESIGN PROJECTS		SHEET No 1 / No OF SHEETS 9

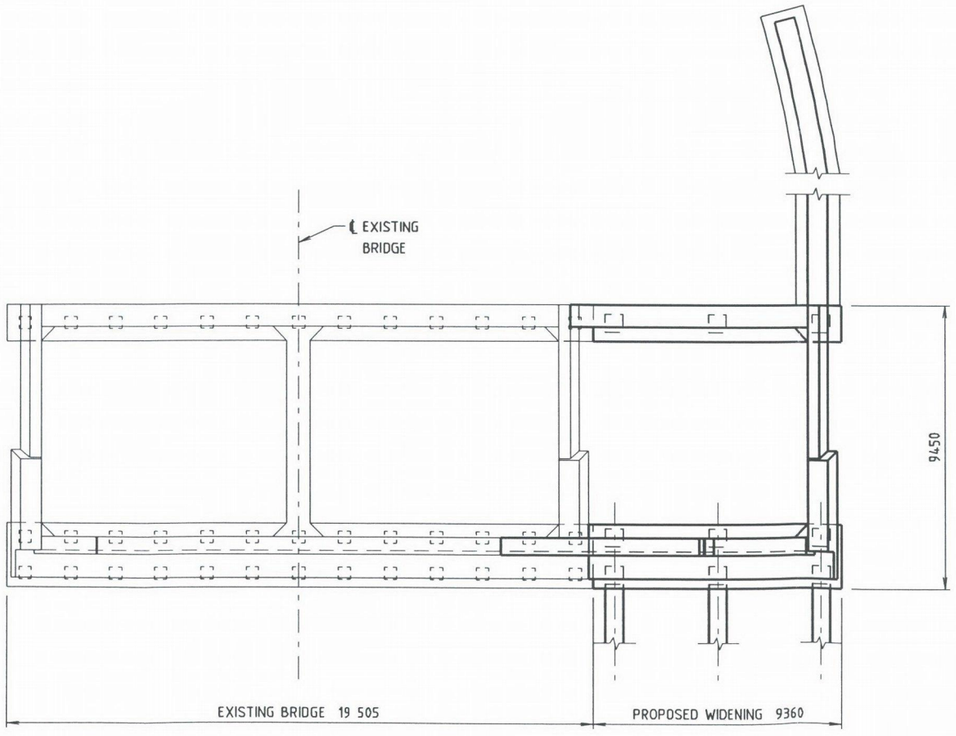
CAD No KD564CP1GA



ELEVATION



VIEW 4/-



PLAN

GENERAL NOTES

SCALE 0 1 2 3 4 5m
1 0 5 OR AS SHOWN

FOR OTHER GENERAL NOTES RELATING TO THIS SHEET, SEE SHEET No 1.

ISSUE	DATE	REVISION	PREP	CHECK	AUTH

ROADS AND TRAFFIC AUTHORITY OF NSW

MAIN ROAD No 164 MUNICS. OF MANLY AND MOSMAN

BRIDGE OVER MIDDLE HARBOUR
AT THE SPIT
WIDENING

CONCEPT PROPOSAL - ABUTMENT A

RTA

PREPARED BY
BRIDGE SECTION
99 PHILLIP STREET
PARRAMATTA NSW 2150
PHONE (02) 8837-0802
FACSIMILE (02) 8837 0055

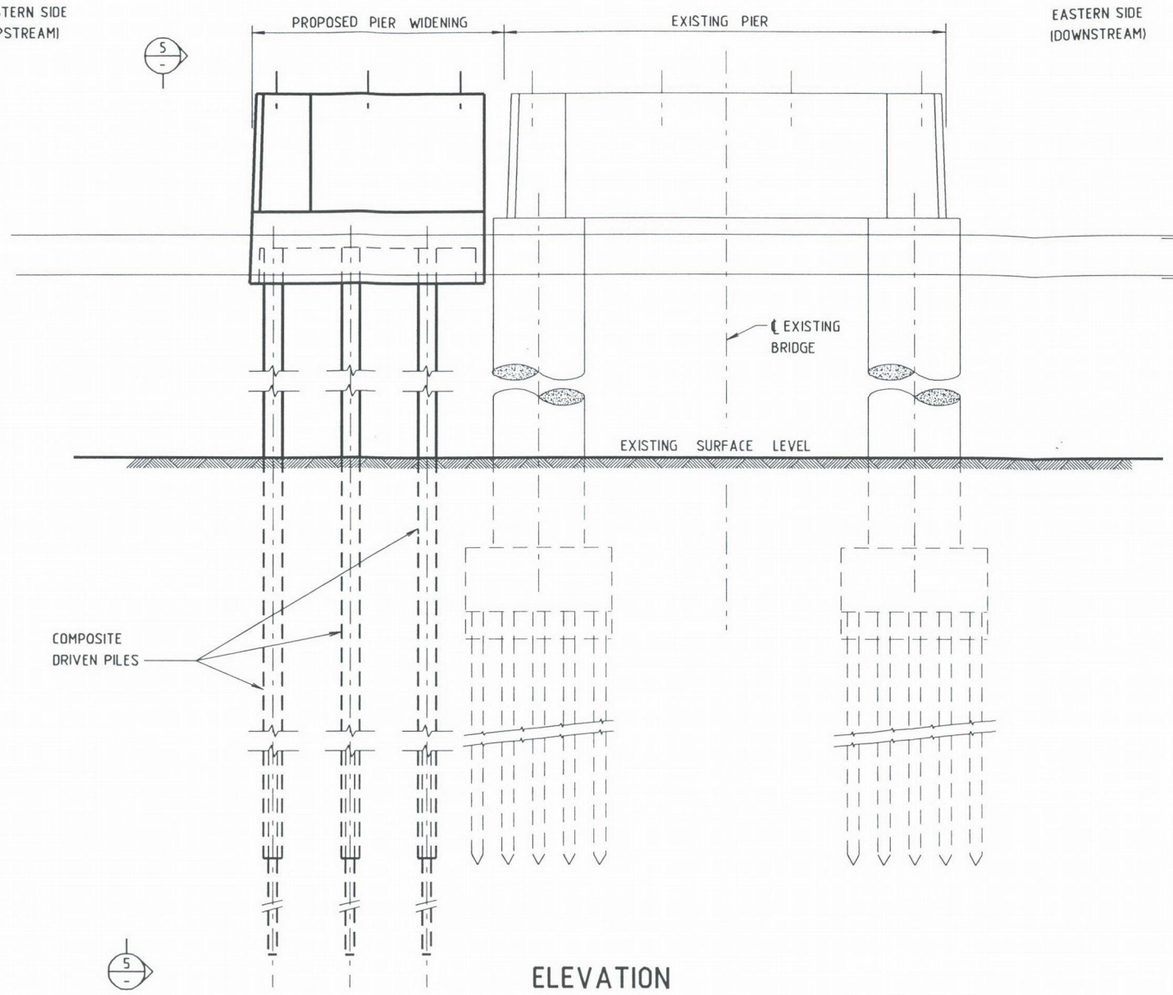
CLIENT
ROAD NETWORK INFRASTRUCTURE

PREPARED	CHECKED	SKETCH No
DESIGN		KD564CP1
DRAWING Reinhardt 13.06.02		
SENIOR MANAGER, BRIDGE DESIGN PROJECTS		SHEET No 2 / No OF SHEETS 9

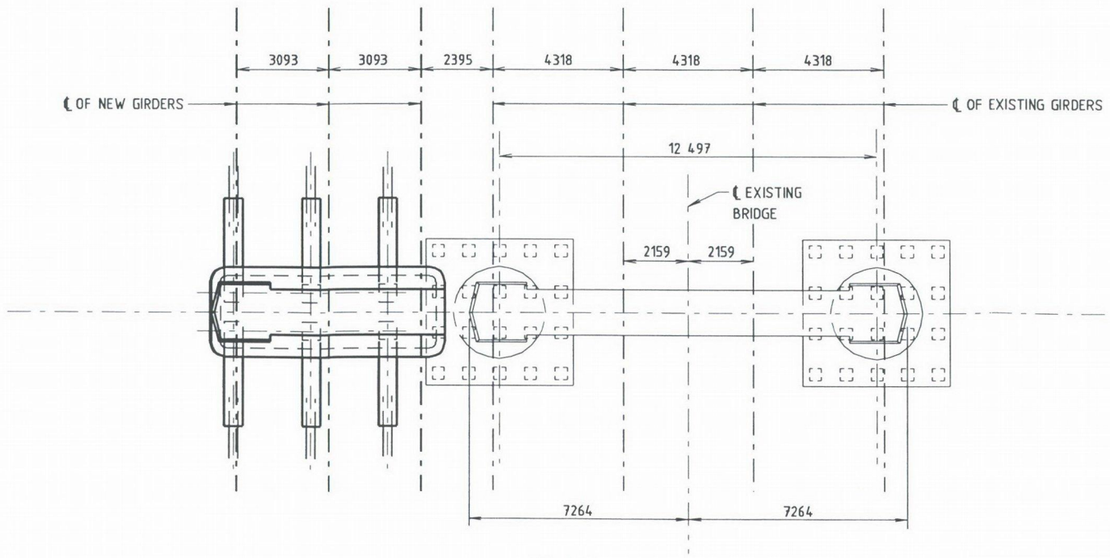
CAD No KD564CP1AA

WESTERN SIDE
(UPSTREAM)

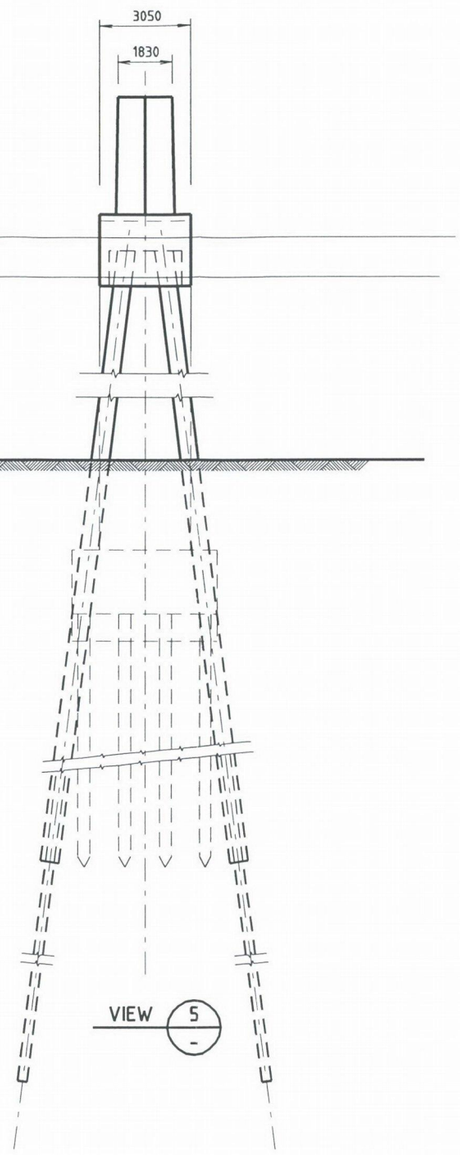
EASTERN SIDE
(DOWNSTREAM)



ELEVATION



PLAN



GENERAL NOTES

SCALE 0 1 2 3 4 5m (1 0.5) OR AS SHOWN

FOR OTHER GENERAL NOTES RELATING TO THIS SHEET, SEE SHEET No 1

ISSUE	DATE	REVISION	PREP	CHECK	AUTH

ROADS AND TRAFFIC AUTHORITY OF NSW

MAIN ROAD No 164 — MUNICS. OF MANLY AND MOSMAN

BRIDGE OVER MIDDLE HARBOUR
AT THE SPIT
WIDENING

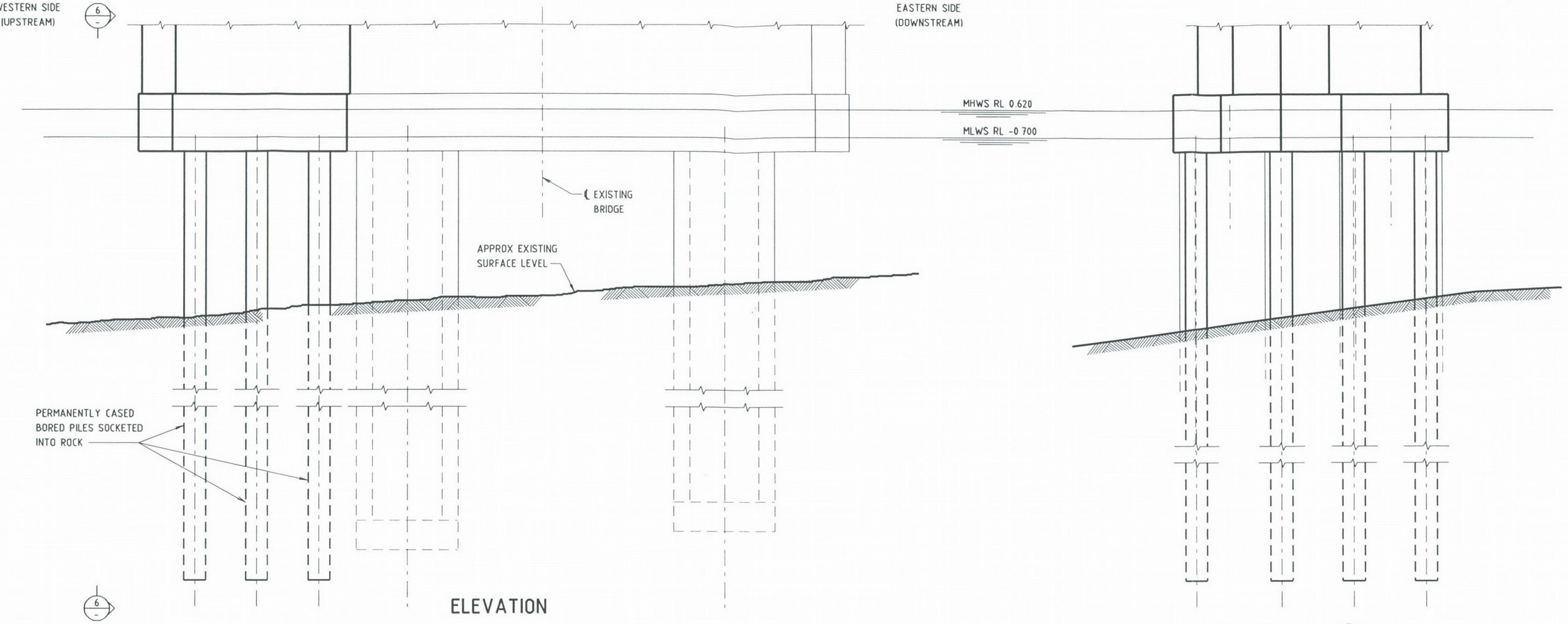
CONCEPT PROPOSAL - PIERS 1, 2 AND 3

PREPARED BY
BRIDGE SECTION
99 PHILLIP STREET
PARRAMATTA NSW 2150
PHONE (02) 8837-0800
FACSIMILE (02) 8837 0055

CLIENT
ROAD NETWORK INFRASTRUCTURE

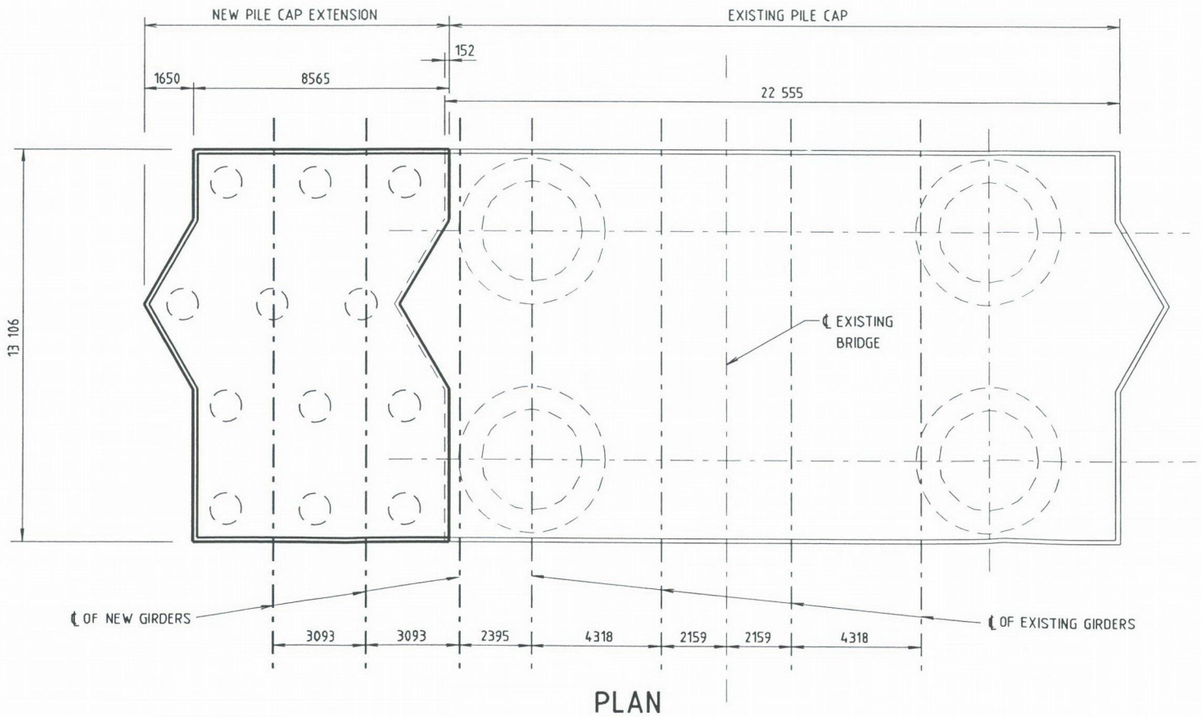
PREPARED	CHECKED	SKETCH No
DESIGN		KD564CP1
DRAWING Reinhardt 13.08.02		
SENIOR MANAGER, BRIDGE DESIGN PROJECTS		SHEET No 3 / No OF SHEETS 9

CAD No KD564CP1P1



ELEVATION

VIEW 6



PLAN

GENERAL NOTES

SCALE 1 0.5 0 1 2 3 4 5m OR AS SHOWN

FOR OTHER GENERAL NOTES RELATING TO THIS SHEET, SEE SHEET No 1.

ISSUE	DATE	REVISION	PREP	CHECK	AUTH

ROADS AND TRAFFIC AUTHORITY OF NSW

MAIN ROAD No 164 — MUNICS. OF MANLY AND MOSMAN

BRIDGE OVER MIDDLE HARBOUR
AT THE SPIT
WIDENING

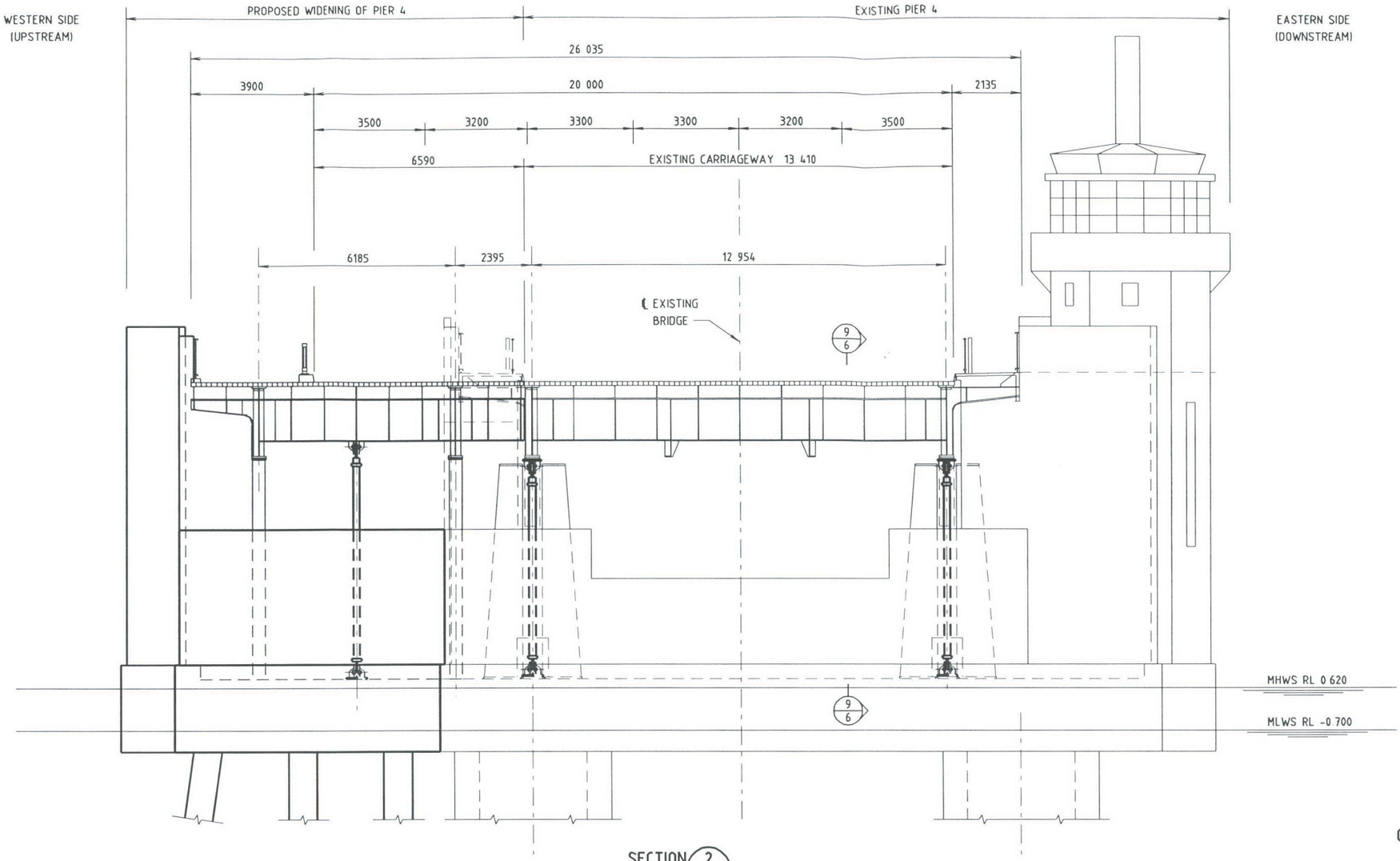
CONCEPT PROPOSAL - PIER 4

PREPARED BY
BRIDGE SECTION
99 PHILLIP STREET
PARRAMATTA NSW 2150
PHONE (02) 8837-0800
FACSIMILE (02) 8837 0055

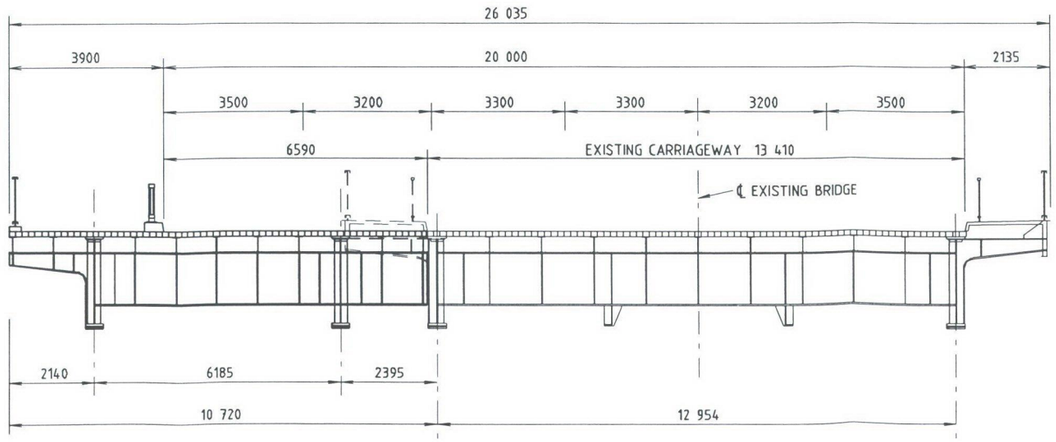
CLIENT
ROAD NETWORK INFRASTRUCTURE

PREPARED	CHECKED	SKETCH No
DESIGN		KD564CP1
DRAWING Reinhardt 13 08 02		
SENIOR MANAGER, BRIDGE DESIGN PROJECTS		SHEET No 4 / No OF SHEETS 9

CAD No KD564CP1P4



SECTION 2/1



SECTION 3/1

GENERAL NOTES

SCALE 0 1500 3000 4500mm (1500 750) OR AS SHOWN

FOR OTHER GENERAL NOTES RELATING TO THIS SHEET, SEE SHEET No 1.

ISSUE	DATE	REVISION	PREP	CHECK	AUTH

ROADS AND TRAFFIC AUTHORITY OF NSW

MAIN ROAD No 164 — MUNICS. OF MANLY AND MOSMAN

BRIDGE OVER MIDDLE HARBOUR
AT THE SPIT
WIDENING

CONCEPT PROPOSAL - BASCULE SPAN DECK DETAILS - SHEET A

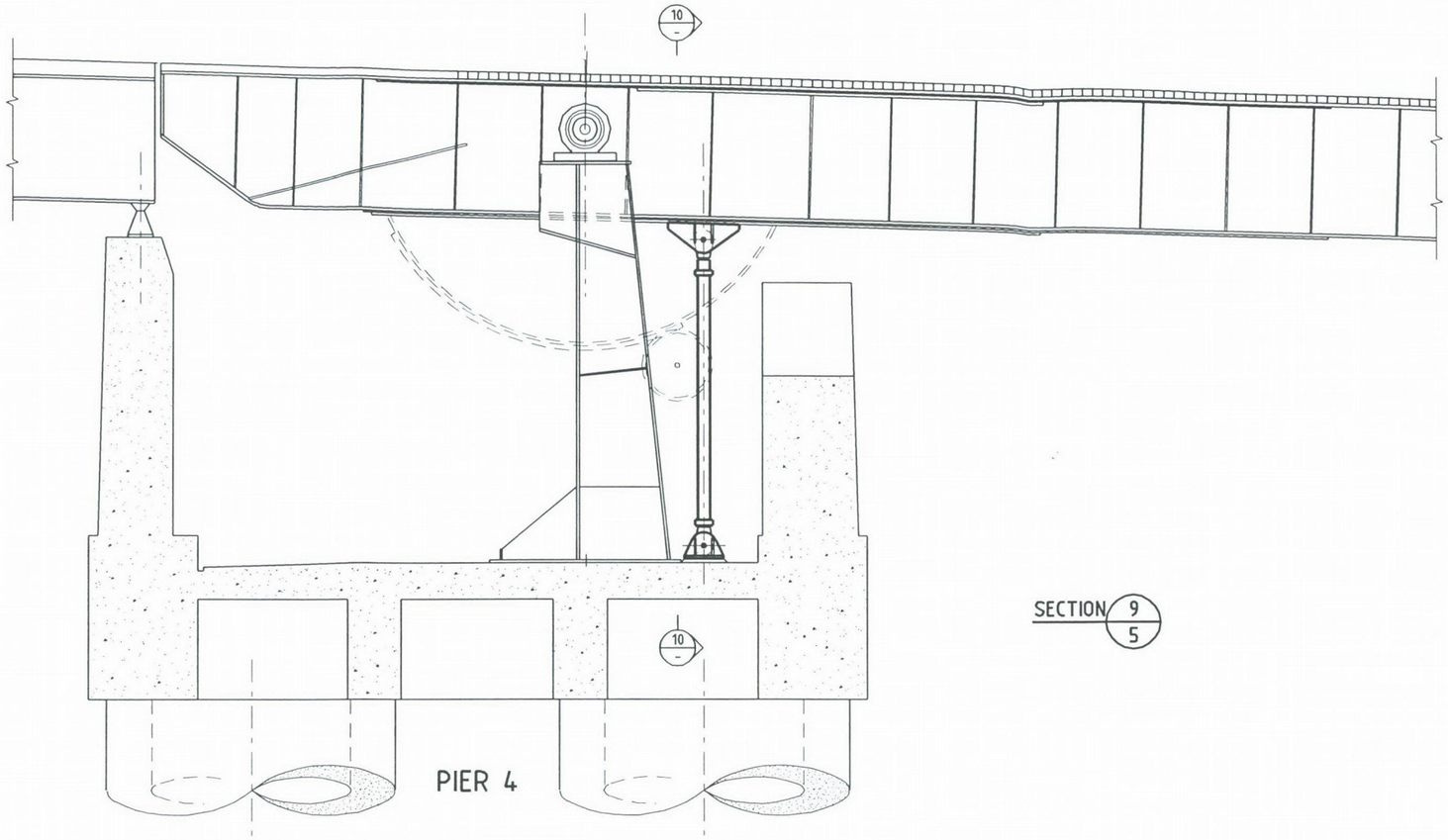
RTA
PREPARED BY
BRIDGE SECTION
99 PHILLIP STREET
PARRAMATTA NSW 2150
PHONE (02) 8837-0602
FACSIMILE (02) 8837 0055

CLIENT
ROAD NETWORK INFRASTRUCTURE

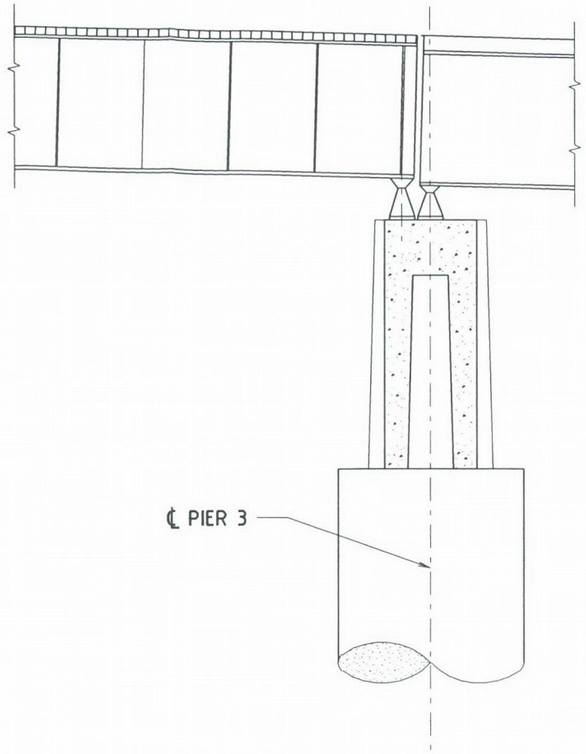
PREPARED	CHECKED	SKETCH No
DESIGN		KD564CP1
DRAWING Reinhardt 13 OCT 03		
SENIOR MANAGER, BRIDGE DESIGN PROJECTS		SHEET No 5 / No OF SHEETS 9

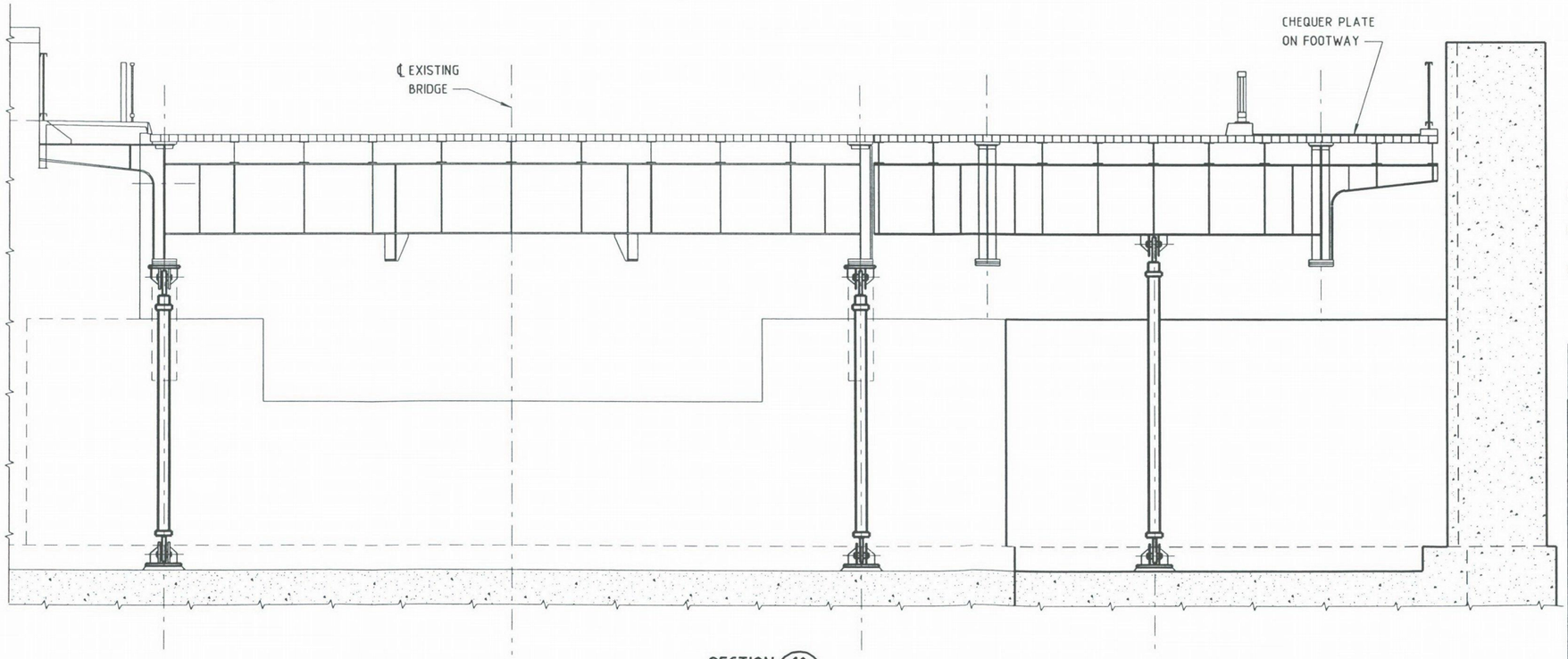
CAD No KD564CP1P4A

k:\Bridge\Current_Projects\Design\0564_Spit\KD564_Sketches\KD564CP1P4A.dgn 13/10/03



SECTION 9/5





SECTION 10/-

GENERAL NOTES

SCALE 0 1000 2000 3000mm
1000 500
OR AS SHOWN

FOR OTHER GENERAL NOTES RELATING TO THIS SHEET, SEE SHEET No 1.

ISSUE	DATE	REVISION	PREP	CHECK	AUTH

ROADS AND TRAFFIC AUTHORITY OF NSW

MAIN ROAD No 164 — MUNICS. OF MANLY AND MOSMAN

BRIDGE OVER MIDDLE HARBOUR
AT THE SPIT
WIDENING

CONCEPT PROPOSAL - BASCULE SPAN DECK DETAILS - SHEET B

RTA
PREPARED BY
BRIDGE SECTION
99 PHILLIP STREET
PARRAMATTA NSW 2150
PHONE (02) 8837-0800
FACSIMILE (02) 8837 0055

CLIENT
ROAD NETWORK INFRASTRUCTURE

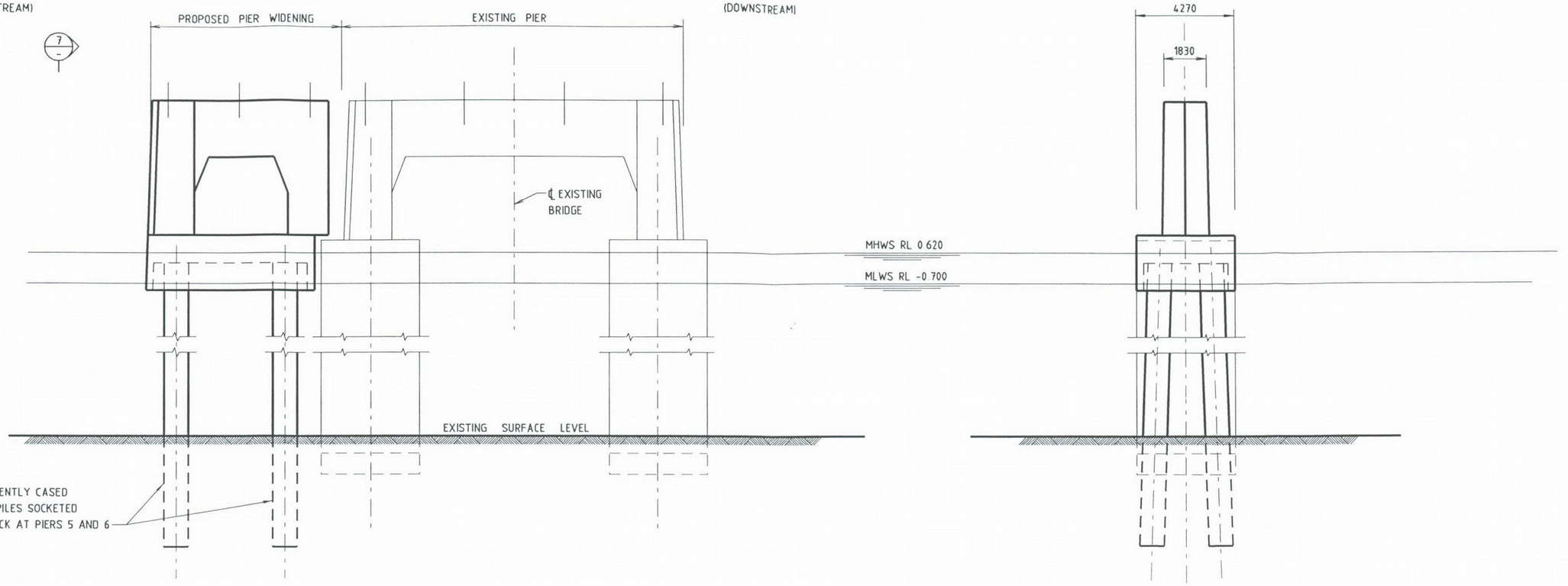
PREPARED	CHECKED	SKETCH No
DESIGN		KD564CP1
DRAWING Reinhardt 20.11.03		
SENIOR MANAGER, BRIDGE DESIGN PROJECTS	SHEET No 6	No OF SHEETS 9

CAD No KD564CP1P4B

K:\Bridge\Current_Projects\Design\D564_Spit\fnD564_Sketches\KD564CP1P4B.dgn 13/07/03

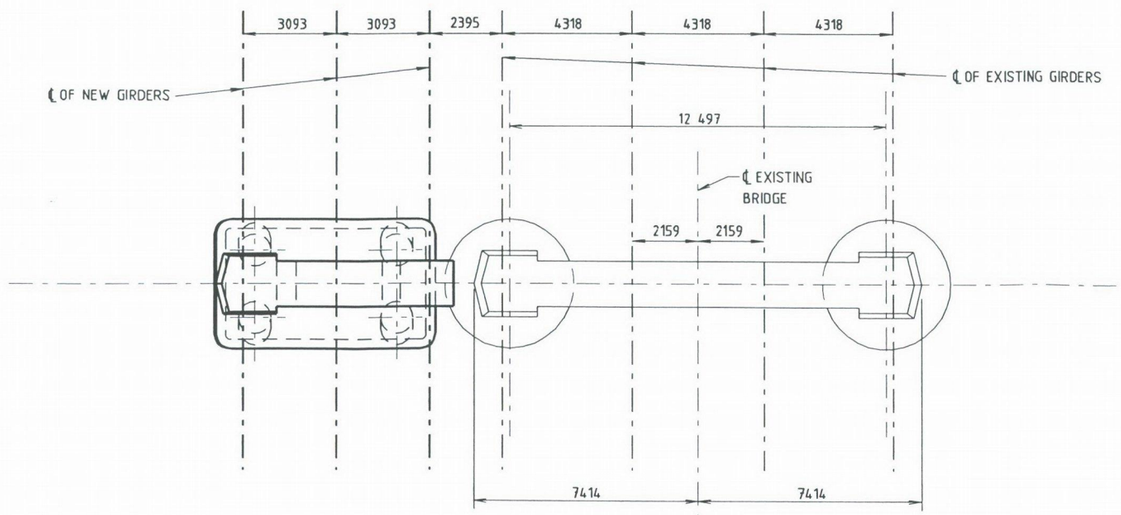
WESTER SIDE
(UPSTREAM)

EASTER SIDE
(DOWNSTREAM)



ELEVATION

VIEW 7/-



PLAN

GENERAL NOTES

SCALE 0 1 2 3 4 5m (1 0.5) OR AS SHOWN

FOR OTHER GENERAL NOTES RELATING TO THIS SHEET, SEE SHEET No 1.

ISSUE	DATE	REVISION	PREP	CHECK	AUTH

ROADS AND TRAFFIC AUTHORITY OF NSW

MAIN ROAD No 164 — MUNICS. OF MANLY AND MOSMAN

BRIDGE OVER MIDDLE HARBOUR
AT THE SPIT
WIDENING

CONCEPT PROPOSAL - PIERS 5 AND 6

PREPARED BY
BRIDGE SECTION
99 PHILLIP STREET
PARRAMATTA NSW 2150
PHONE (02) 8837-0602
FACSIMILE (02) 8837 0055

CLIENT
ROAD NETWORK INFRASTRUCTURE

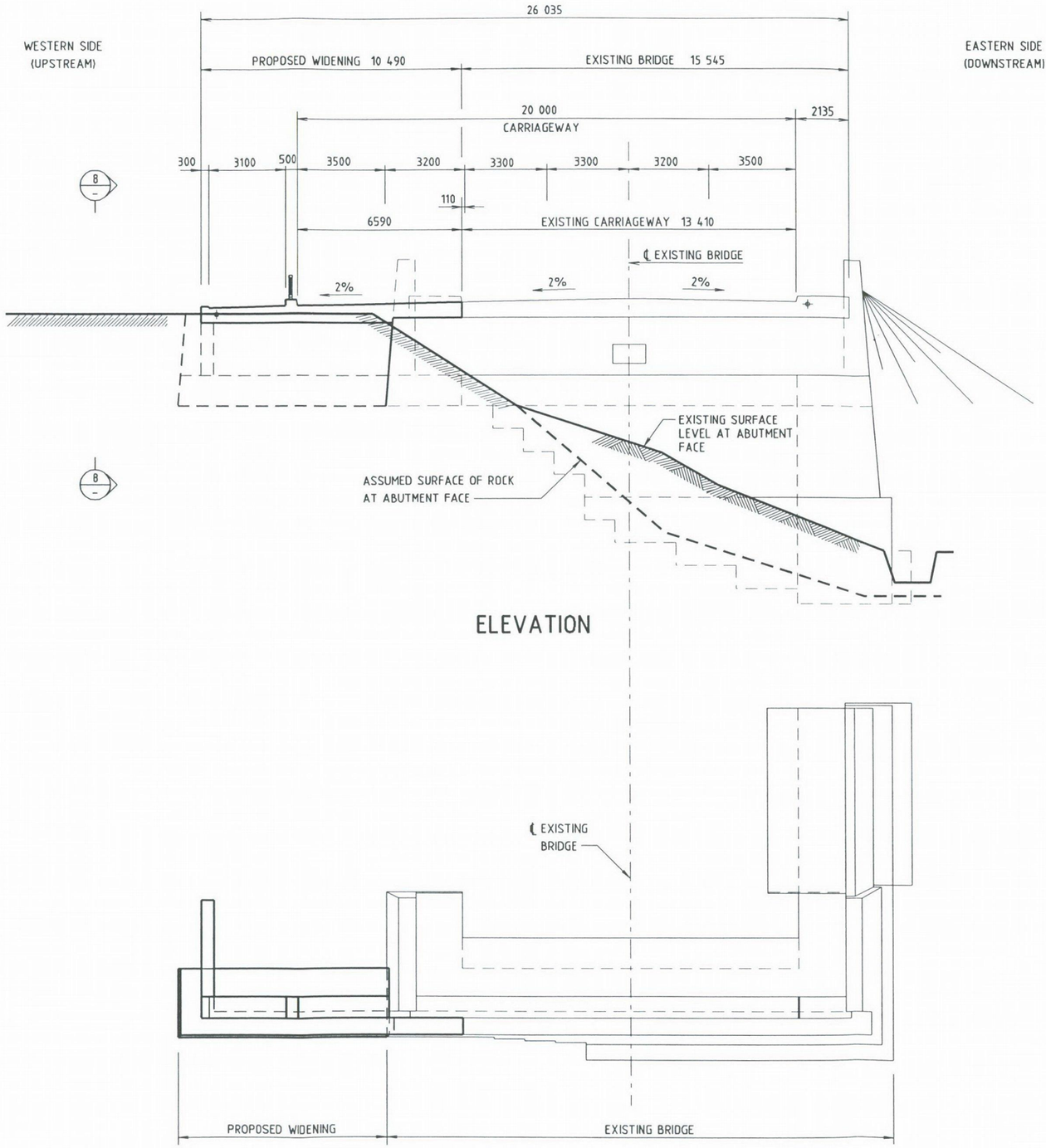
PREPARED	CHECKED	SKETCH No
DESIGN		KD564CP1
DRAWING Reinhardt 28.06.02		

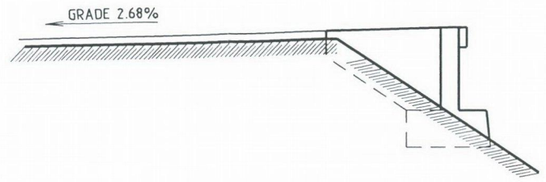
SENIOR MANAGER, BRIDGE DESIGN PROJECTS

SHEET No 7 | No OF SHEETS 9

CAD No KD564CP1P5

k:\Bridge\Current_Projects\Design\D564_SpitMB\D684_SkelChes\KD564CP1P5.dgn 13/01/03





VIEW 8

GENERAL NOTES

SCALE 0 1 2 3 4 5m
1 0.5
OR AS SHOWN

FOR OTHER GENERAL NOTES RELATING TO THIS SHEET, SEE SHEET No 1

ISSUE	DATE	REVISION	PREP	CHECK	AUTH

ROADS AND TRAFFIC AUTHORITY OF NSW

MAIN ROAD No 164 — MUNICS. OF MANLY AND MOSMAN

BRIDGE OVER MIDDLE HARBOUR
AT THE SPIT
WIDENING

CONCEPT PROPOSAL - ABUTMENT B

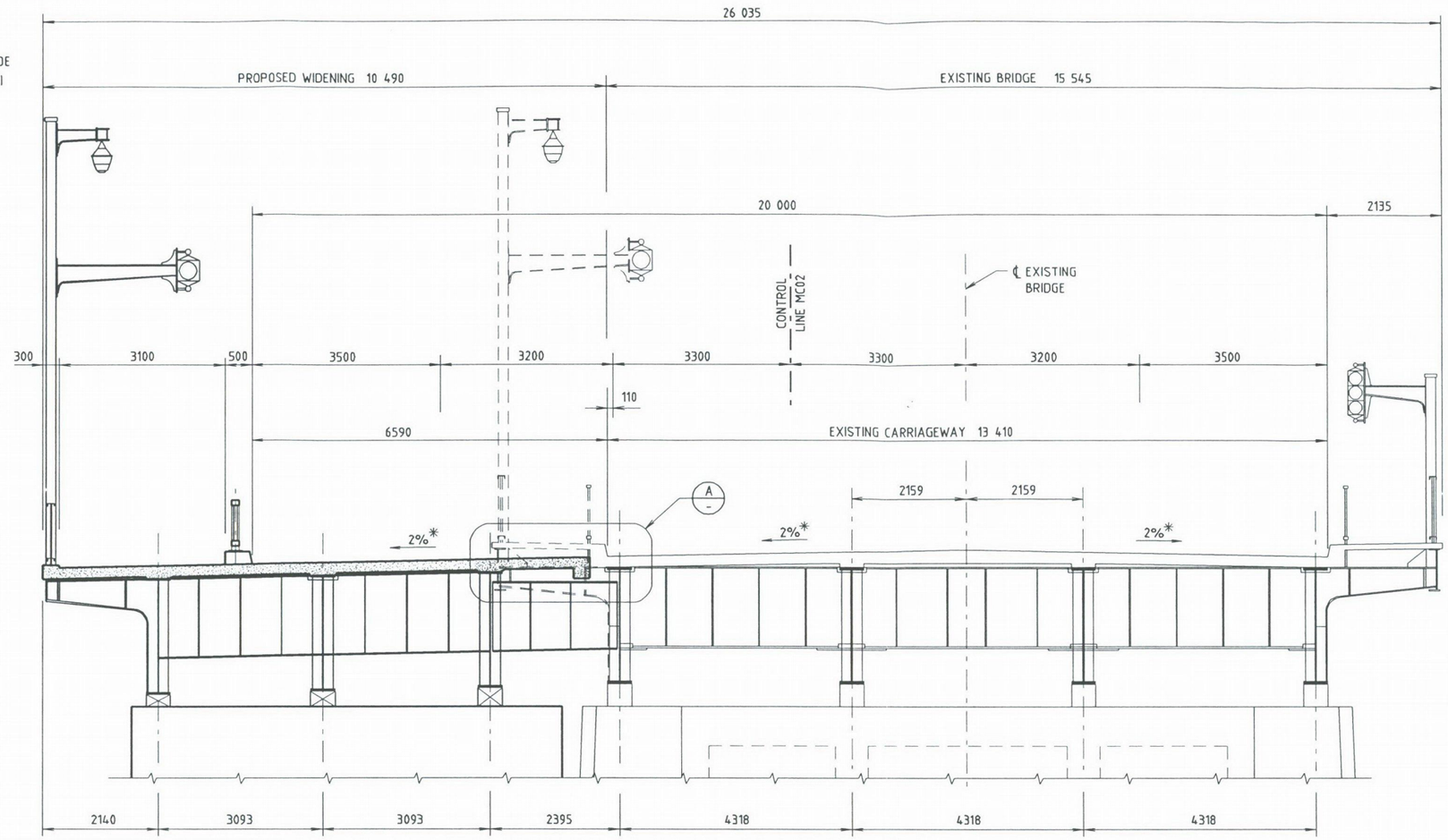
RTA

PREPARED BY
BRIDGE SECTION
99 PHILLIP STREET
PARRAMATTA NSW 2150
PHONE (02) 8837-0602
FACSIMILE (02) 8837 0055

CLIENT
ROAD NETWORK INFRASTRUCTURE

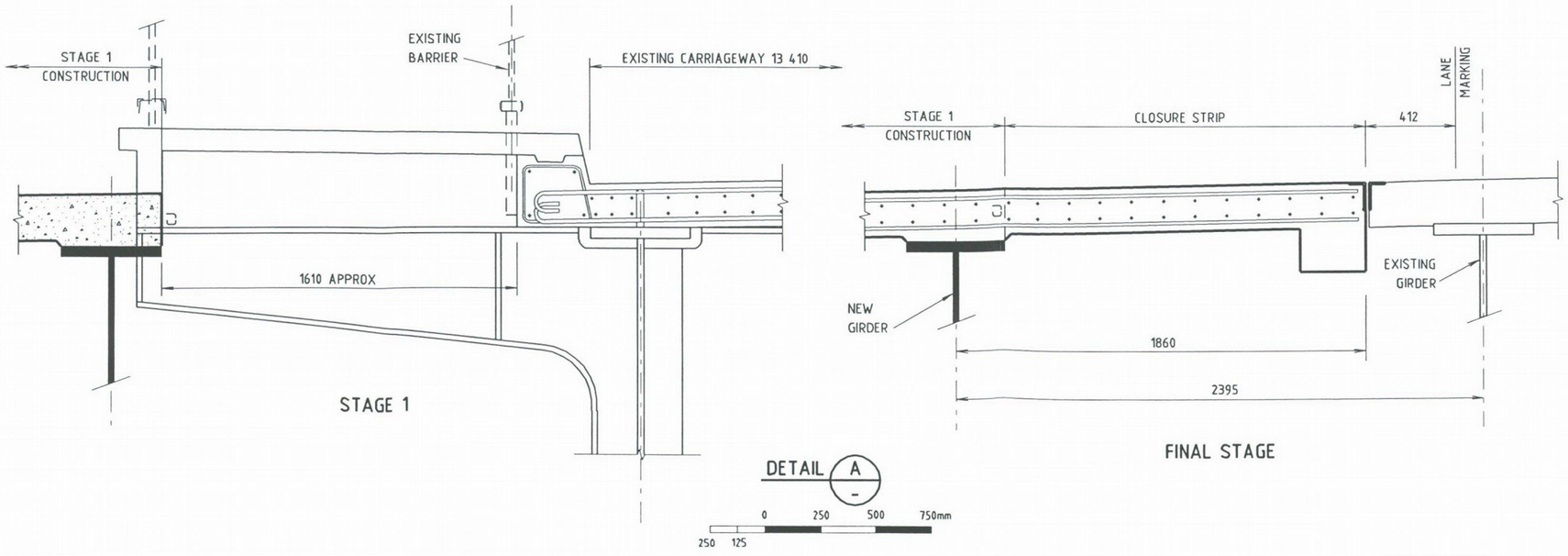
PREPARED	CHECKED	SKETCH No
DESIGN		KD564CP1
DRAWING Reinhardt 13.06.02		
SENIOR MANAGER, BRIDGE DESIGN PROJECTS		SHEET No 8 / No OF SHEETS 9

CAD No KD564CP1AB



SECTION 1/1

TYPICAL SECTION THROUGH DECK



GENERAL NOTES

SCALE 0 1000 2000 3000mm
1000 500 OR AS SHOWN

* VARIES ADJACENT TO BASCULE SPAN.
FOR OTHER GENERAL NOTES RELATING TO THIS SHEET, SEE SHEET No 1.

ISSUE	DATE	REVISION	PREP	CHECK	AUTH

ROADS AND TRAFFIC AUTHORITY OF NSW

MAIN ROAD No 164 MUNICS. OF MANLY AND MOSMAN

BRIDGE OVER MIDDLE HARBOUR
AT THE SPIT
WIDENING

CONCEPT PROPOSAL - FIXED SPAN DECK DETAILS

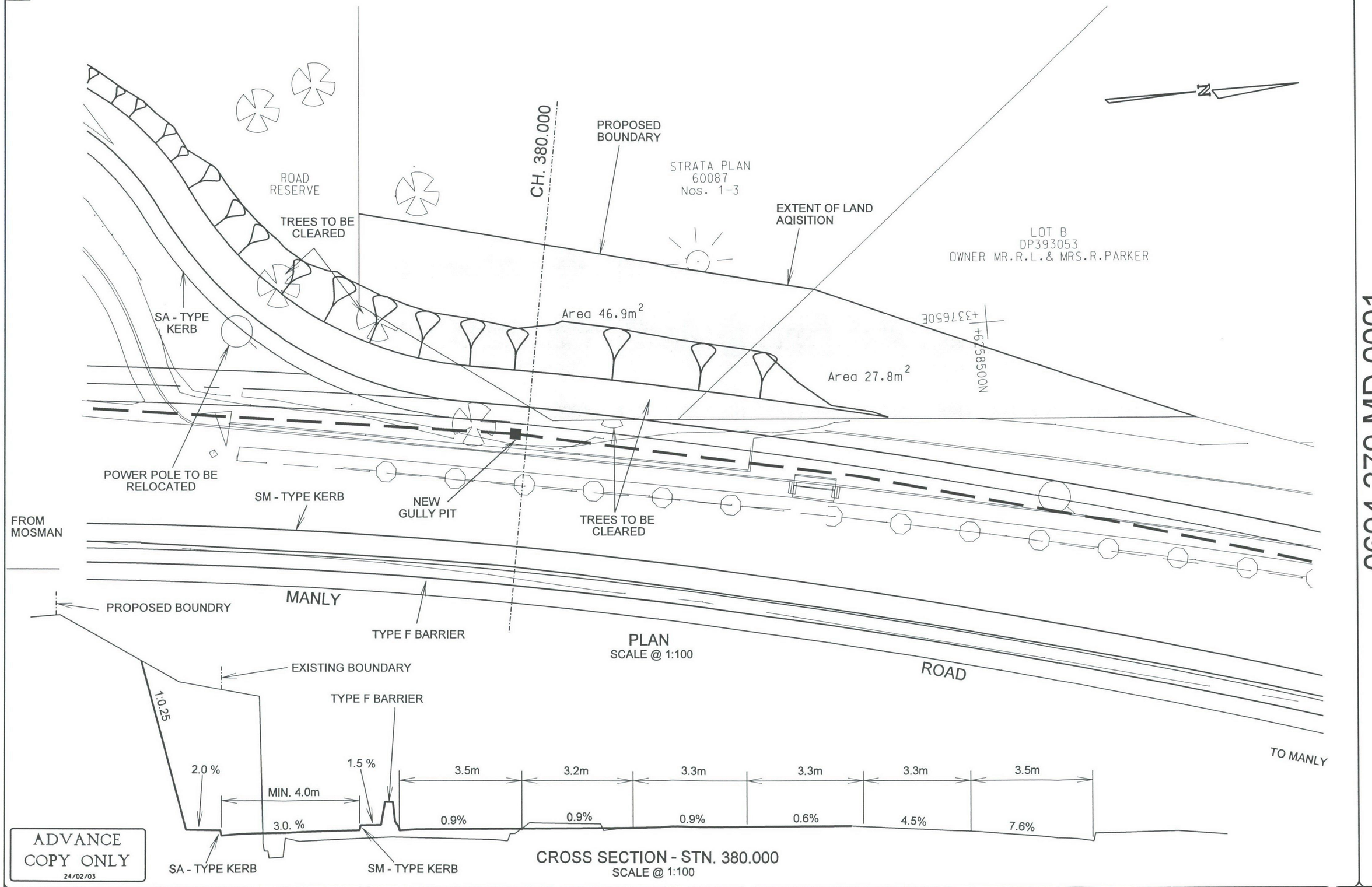
RTA
PREPARED BY
BRIDGE SECTION
99 PHILLIP STREET
PARRAMATTA NSW 2150
PHONE: (02) 8837-0602
FACSIMILE (02) 8837 0055

CLIENT
ROAD NETWORK INFRASTRUCTURE

PREPARED	CHECKED	SKETCH No
DESIGN		KD564CP1
DRAWING Reinhardt 13.06.02		
SENIOR MANAGER, BRIDGE DESIGN PROJECTS		SHEET No 9 / No OF SHEETS 9

CAD No KD564CP1DD

A3



CROSS SECTION - STN. 380.000
SCALE @ 1:100

ADVANCE COPY ONLY
24/02/03

No	ISSUE DETAIL	AUTH	DATE
1	ORIGINAL ISSUE - UNAPPROVED	TH	

COMPUTER FILE REFERENCES

SURVEYOR:	TONY DEGIORGIO SURV SPIT RD SN2064 NTH
SURVEY MODEL:	SURV SPIT RD SN2064 BDG SURV SPIT RD SN2064 STH
DESIGN MODEL:	DESIGN STEVE
DRAW FILE:	-
CADD FILE:	...\sheet_28_Cul_De_Sac.dgn
LEVELS USED:	-
ROADLOC: START:	-
FINISH:	-

RTA PROJECT DESIGN TECHNICAL SERVICES OPERATIONS

DESIGNED S.WIJESOMA
CHECKED T. HUFTON

SCALES
AS SHOWN
0 1 2 3 4 5
SCALE 1:100

DATUM: AHD | GRID: MGA56
FILE: 293.1573
PRINTED DATE: 24/02/03

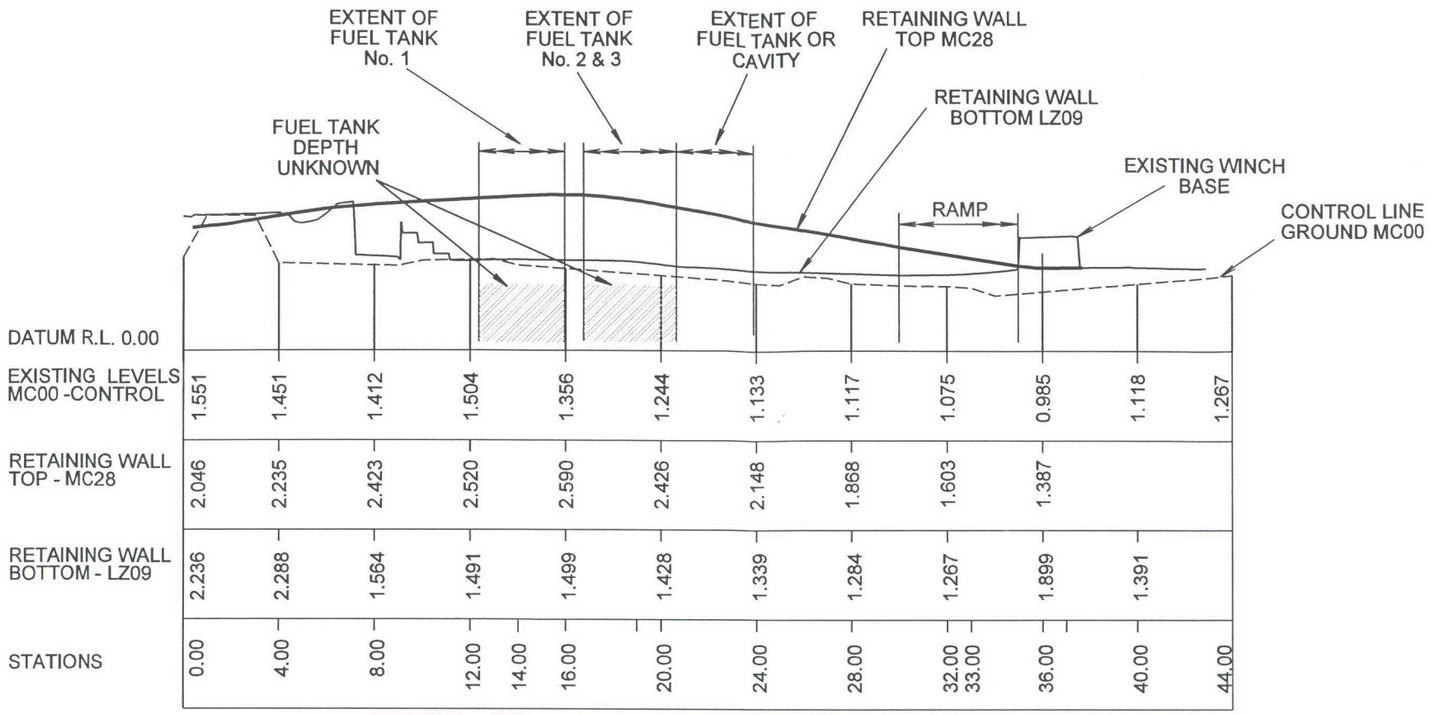
ROADS AND TRAFFIC AUTHORITY OF N.S.W.

MOSMAN AND MANLY COUNCIL AREAS
MR 164 MANLY ROAD - SPIT BRIDGE
WIDENING OF SPIT BRIDGE APPROACHES TO SIX LANES
PROPOSED PROPERTY ADJUSTMENT AT ST. PLAN 60087 & DP393053
PLAN & CROSS SECTION AT CH. 380.000

SHEET 01

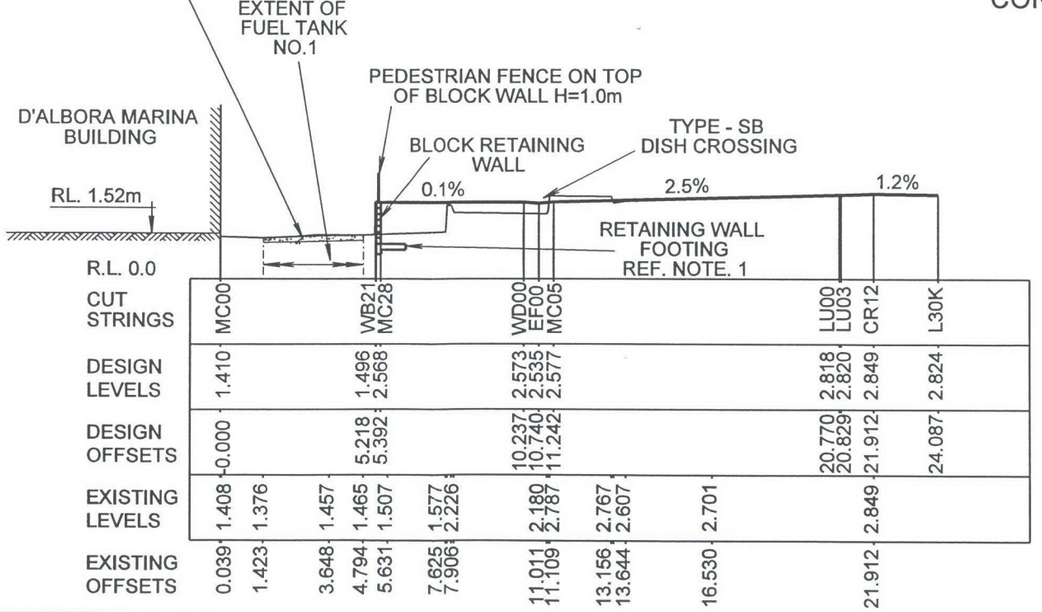
0694.279.MD.0001

A3



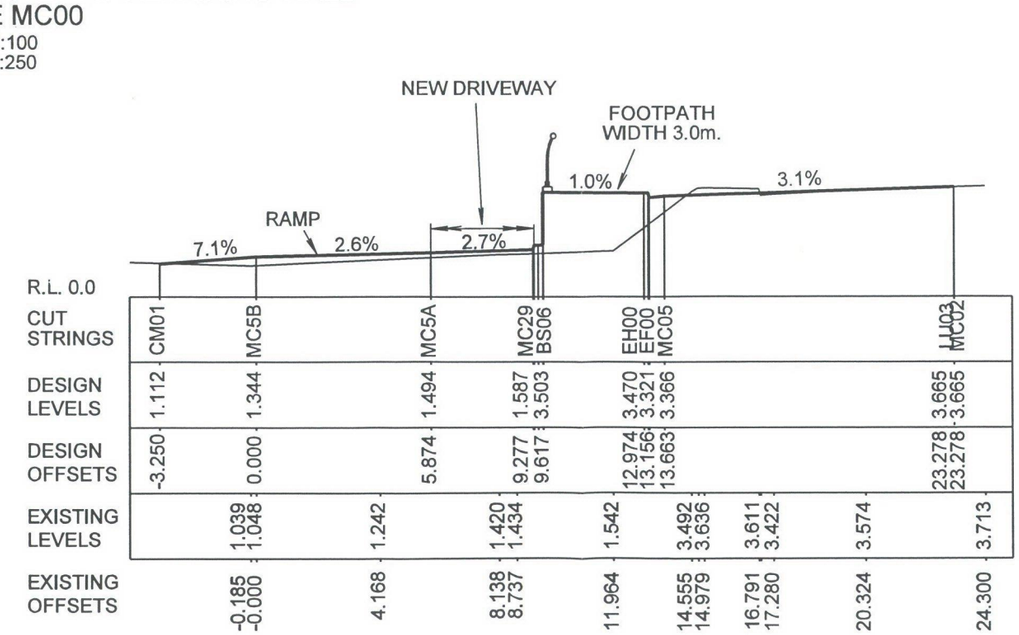
LONGITUDINAL SECTION ALONG DRIVEWAY RETAINING WALL CONTROL LINE MC00

SCALE: VER. 1:100
HOR. 1:250



CROSS SECTION - STN. 14.000

SCALE @ 1:200



CROSS SECTION - STN. 33.000

SCALE @ 1:200

ADVANCE COPY ONLY
24/02/03

No	ISSUE DETAIL	AUTH	DATE
1	ORIGINAL ISSUE - UNAPPROVED	TH	

COMPUTER FILE REFERENCES
SURVEYOR: TONY DEGIORGIO
SURVEY MODEL: SURV SPIT RD SN2064 NTH, SURV SPIT RD SN2064 BDG, SURV SPIT RD SN2064 STH
DESIGN MODEL: DESIGN STEVE
DRAW FILE: -
CADD FILE: ...\sheet_27_Marina.dgn
LEVELS USED: -
ROADLOC: START: - FINISH: -

R T A PROJECT DESIGN TECHNICAL SERVICES OPERATIONS

DESIGNED S.WIJESOMA
CHECKED T. HUFTON

SCALES
AS SHOWN

DATUM: AHD | GRID: MGA56
FILE: 293.1573
PRINTED DATE: 24/02/03

ROADS AND TRAFFIC AUTHORITY OF N.S.W.
MOSMAN AND MANLY COUNCIL AREAS
MR 164 MANLY ROAD - SPIT BRIDGE
WIDENING OF SPIT BRIDGE AND APPROACHES TO SIX LANES
PROPOSED PROPERTY ADJUSTMENT AT D'ALBORA MARINA
LONGITUDINAL SECTION & CROSS SECTIONS STN 14 & 33

SHEET 02

0164.293.MD.0001

Appendix B

EP&A Act – Section 79C and clause 228 checklists

Section 79C matters for consideration

Section 79C of the EP&A Act identifies matters that a consent authority must take into consideration when determining a development application under Part 4 of the EP&A Act. The matters to be taken into account and how they relate to the proposal are outlined below:

(a) the provisions of:(i) any environmental planning instrument,	Addressed in Section 4.
(ii) any draft environmental planning instrument that is or has been placed on public exhibition and details of which have been notified to the consent authority, and	Not applicable
(iii) any development control plan,	Addressed in Section 4.
(iv) the regulations (to the extent that they prescribe matters for the purposes of this paragraph),	Not applicable
(b) the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality,	Addressed in Part D.
(c) the suitability of the site for the development,	Having regard to the assessment in Part 5 of the likely impacts of the proposal, the site is considered to be suitable for the proposal. The site is already the location for a bridge, and the proposal involves, in effect, an intensification of this existing use.
(d) any submissions made in accordance with this Act or the regulations,	The consent authorities would consider any submissions made in determining the development application.
(e) the public interest.	The need for the proposal is considered in Section 2. The proposal would be significantly less expensive (involving significantly less expenditure of public money), and avoids the potentially detrimental impacts associated with alternative options (as outlined in Section 2.

Clause 228 factors

Clause 228 of the EP&A Regulation identifies factors that must be taken into account when consideration is being given to the likely impact of an activity on the environment under Part 5 of the EP&A Act 1979. The factors to be taken into account and how they relate to the proposal are provided below:

(a)	any environmental impact on a community	Potential environmental impacts have been assessed in Part D. The main potential impact identified is that of noise. This is considered in detail in Section 10.
(b)	any transformation of a locality	As identified in Section 14, the proposal would result in some degree of visual impact as a result of the widening of the bridge. However it is considered that the proposal would not result in transformation of the locality.
(c)	any environmental impact on the ecosystems of the locality	Sections 11 and 12 considers the potential impacts of the proposal on ecosystems of the locality. The main potential impact relates to aquatic ecology. This would be managed through the implementation of best practice construction methods, including the measures described within Sections 11 (aquatic ecology) and 16 (water quality).
(d)	any reduction of the aesthetics, recreational, scientific or other environmental quality or value of a locality	The proposal would not have a significant long-term impact on the aesthetics, recreational, scientific or environmental quality or value of the locality, as described in Part D,
(e)	any effect of a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations	The Spit Bridge is heritage listed. Potential heritage impacts were considered in Section 7. Implementation of the measures recommended in Sections 7 (heritage) and 14 (landscape, urban design and visual quality) would ensure that potential heritage impacts are minimised. Section 8 considers the potential impact of the proposal on Aboriginal heritage, and concludes that there would be no significant adverse impact.
(f)	any impact on the habitat of protected fauna (within the meaning of the National Parks and Wildlife Act 1974)	Section 12 indicates that there would be no adverse impact on the habitat of protected fauna.
(g)	any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air	Sections 11 and 12 considers the potential impacts of the proposal on flora and fauna, both terrestrial and aquatic. The main potential impact relates to aquatic ecology. This would be managed through the implementation of best practice construction methods, including the measures described within Sections 11 (aquatic ecology) and 16 (water quality).
(h)	any long-term effects on the environment	The proposal would not have any long-term effects on the environment. The main potential impact identified is that of noise. This is considered in detail in Section 10.
(i)	any degradation of the quality of the environment	The proposal has the potential for degradation of the environment in the short term during construction if not managed effectively. Appropriate mitigation measures have

		been recommended to minimise the potential for construction impacts. These measures are summarised in Section 20.
(j)	any risk to the safety of the environment	Potential risks to the safety of the environment would be minimised by the implementation of the proposed mitigation measures. These measures are summarised in Section 20.
(k)	any reduction in the range of beneficial uses of the environment	The proposal would not reduce the range of beneficial uses of the environment.
(l)	any pollution of the environment	The proposal has the potential to result in short term pollution of the environment during construction, however these potential impacts would be minimised by the recommended mitigation measures.
(m)	any environmental problems associated with the disposal of waste	No environmental problems associated with the disposal of waste from the proposal are anticipated.
(n)	any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply	The proposal would not result in a large increase in demand for resources that are or are likely to be in short supply.
(o)	any cumulative environmental effect with other existing or likely future activities	The proposal is unlikely to have any adverse cumulative impacts on the environment.

Appendix C

Statutory agency responses

NSW
NATIONAL
PARKS AND
WILDLIFE
SERVICE

ABN 30 841 387 271

Ms Amanda Raleigh
Senior Environmental Planner
GHD
10 Bond Street
SYDNEY NSW 2000

Fax: 9239 7193

Our Ref.: SYZ 96/155

Dear Amanda

RE: PROPOSED SPIT BRIDGE ROAD WIDENING

Thank you for your fax 30 September 2002 in which you consulted with the National Parks and Wildlife Service (NPWS) on the above proposal.

The NPWS has a statutory responsibility for the protection and care of native flora, native fauna and Aboriginal objects and places, and for the management of NPWS estate. Accordingly the NPWS has an interest in ensuring that potential impacts to these attributes are appropriately assessed.

To assist you in this regard, it is recommended that the matters referred to in the attached guidelines titled "General Guidelines for Impact Assessment" be addressed in your assessment where appropriate. These guidelines also provide information on any approvals that may be relevant under the National Parks and Wildlife Act and a summary of the NPWS' databases which may be of assistance to you in your assessment.

It is requested that any EIS forwarded to the NPWS for comment state the reasons for the referral. The NPWS typically comments on EIS's where there is a statutory concurrence or approval role for the NPWS, or where there is likely to be a threat to NPWS reserves or regionally significant conservation values. The attached guidelines may be used to assist in determining whether the EIS requires referral to the NPWS for comment, concurrence or an approval.

Please contact, Megan Phillips, A/ Conservation Planning Officer on (02) 9585-6007 if you have any questions concerning this matter.

Yours sincerely,

Lou Ewins 9/10/02

Lou Ewins
Manager, Conservation Planning Unit
Central Conservation Programs and Planning Division

Conservation Programs
& Planning Division
Central Directorate
Level 6
43 Bridge Street
P.O. Box 1967
Hurstville NSW
2220 Australia
Tel: (02) 9585 6678
Fax: (02) 9585 6442
www.npws.nsw.gov.au

NSW NATIONAL PARKS AND WILDLIFE SERVICE

GENERAL GUIDELINES FOR IMPACT ASSESSMENT

The National Parks and Wildlife Service (NPWS) has an interest in the potential impacts of proposals on the following:

- areas of native vegetation;
- areas of potential value as habitat for native fauna;
- sites and places of Aboriginal cultural heritage, including areas of archaeological potential; and
- land dedicated under the *National Parks and Wildlife Act 1974* (*NP&W Act*).

If these attributes are anticipated to be present in your study area and / or likely to be impacted, it is recommended that assessments by a suitably qualified person be undertaken to determine the extent of impact. The NPWS suggests that the following basic details be included in the assessments:

- the qualifications and experience of the person undertaking the work; and
- a detailed description of survey methodology including survey design, sampling methods, weather conditions, time and duration of surveys and location of any survey sites and transect lines.

Specific issues that are recommended to be addressed by the assessments are detailed below.

General information

- description of the proposal and the way in which the environment will be modified;
- map(s) placing the proposal in a regional and local setting;
- applicability of Local Environmental Plans, Regional Environmental Plans and State Planning Policies to the proposal;
- information on the current and past land uses of the site and that of the surrounding area; and

- appropriately scaled maps which identify the location and extent of any areas of native vegetation and fauna habitat and Aboriginal cultural heritage value in relation to the area of proposed development.

Impacts

- prediction of the likely impact of the proposal on land dedicated under the *NP&W Act*;
- prediction of the likely impacts of the proposal on areas and items of natural significance, such as native vegetation and fauna habitat, and on Aboriginal heritage sites and areas of cultural significance. This should include consideration of any off-site impacts; and
- assessment of measures available to minimise the impact of the proposal on these attributes, including potential conservation options, alternative development options and monitoring programs, if appropriate.

Native flora, fauna and threatened species

The following information is considered necessary to assess the potential impact of a proposal:

- detailed description and mapping of all vegetation communities in the study area;
- identification of any vegetation communities or plant species which are of local, regional or state conservation significance (including threatened species, populations, ecological communities or critical habitat listed under the *Threatened Species Conservation (TSC) Act*). The criteria for establishing significance should be documented;
- description of known or expected fauna assemblages within the study area;
- identification of fauna habitat likely to be of local, regional or state significance (including habitat of threatened species, populations, ecological communities or critical habitat listed under the *TSC Act*);
- identification of habitat corridors and linkages between areas of remnant native vegetation which may assist faunal movement through the area and an assessment of the conservation significance of these; and
- prediction of the likely impact of the proposal on the above attributes (quantification of the extent of impact where practical).

In addition to these general requirements, there are specific requirements relating to the assessment of a proposal and its potential impact on threatened species, populations, ecological communities, their habitats and critical habitat.

The provisions of the *TSC Act* and related provisions of the *Environmental Planning & Assessment Act* should be considered when undertaking the assessment of a proposal. In addition to the *TSC Act* itself, further information on the provisions of the *TSC Act* may be obtained from the Department of Urban Affairs and Planning Circular No. A13 (12 December 1995). The NPWS has also produced Information Circulars

on the *TSC Act* which may be obtained by contacting the NPWS Information Centre on (02) 9585 6333.

Concurrence provisions

Where a consent authority determines that a proposal is likely to have a significant effect on threatened species or their habitats, a species impact statement (SIS) must be prepared in accordance with the requirements of the Director-General of the National Parks and Wildlife Service. If, after considering the SIS, a consent authority intends to grant approval to a proposal that will have a significant effect on threatened species or their habitats then the concurrence of the NPWS is required. If the Minister for Urban Affairs and Planning is the consent authority the concurrence of the NPWS is not required, but consultation must occur with the Minister for the Environment before development consent is granted.

The process and timeframes for development applications that require concurrence are detailed in Division 2 of the *Environmental Planning and Assessment Regulation 1998*.

Aboriginal heritage

General issues

For the purposes of these guidelines Aboriginal heritage is considered to include "relics" and places of significance to Aboriginal communities.

Under the *NPW Act*, a 'relic' is defined as any deposit, object or material evidence (not being a handicraft made for sale) relating to indigenous and non-European habitation of the area that comprises NSW, being habitation both prior to and concurrent with the occupation of that area by persons of European extraction, and includes Aboriginal remains (as defined within the meaning of the *NPW Act*). Relics are confined to physical evidence. Aboriginal 'relics' are commonly referred to as Aboriginal sites.

An "Aboriginal place" is a place which has been declared so by the Minister for the Environment because he or she believes that the place is or was of special significance to Aboriginal culture. It may or may not contain physical relics.

It should also be noted that there are places in the landscape which have particular meaning for Aboriginal people, for example, spiritual areas or natural mythological areas. Although these areas are not protected under the *NPW Act*, unless they contain physical remains of Aboriginal occupation or have been declared an 'Aboriginal place', it is recommended that the potential impact of proposals on such places also be considered in the assessment process.

Assessment process

It is recommended that an assessment be conducted of the Aboriginal cultural values of the study area if the proposal involves disturbance to substantially unmodified ground surfaces. If the study area is considered to have archaeological potential or cultural significance then it is recommended that a survey and assessment be undertaken in accordance with NPWS guidelines. These guidelines are contained in the NPWS' publication "Aboriginal Cultural Heritage: Standards and Guidelines", which may be purchased by contacting the NPWS' Cultural Heritage Conservation Division on (02) 9585 6571.

Should any Aboriginal archaeological sites be present in the study area, you should consider the requirements of the *NP&W Act* with regard to Aboriginal relics. Under s90 of the *NP&W Act* it is an offence to knowingly damage or destroy relics without the prior permission of the Director-General of the NPWS.

In assessing Aboriginal heritage values, consideration should also be given to whether the study area is likely to contain places of cultural significance to the Aboriginal community. It should be noted that places of cultural significance to the Aboriginal community are not limited to archaeological sites. An assessment of cultural significance should involve consultation with community representatives and if necessary, documentary research to establish whether there are any places of traditional or historic significance to the Aboriginal community.

Integrated Development Assessment

Under recent amendments to the *EP&A Act*, a range of approvals and licences issued by various agencies have been integrated with the development approval process. Section 91 of the *Environmental Planning and Assessment Amendment Act 1997* lists the approvals of agencies which are included in the integrated development assessment (IDA) process.

This includes Section 90 approvals under the *NP&W Act* regarding consent to knowingly destroy, deface or damage or knowingly cause or permit the destruction or defacement of or damage to an Aboriginal relic or Aboriginal place. Where a relic or an Aboriginal place is known to occur on land prior to the lodgement of a development application, and the development proposal will damage, deface or destroy the relic or Aboriginal place, thereby requiring a consent to destroy from the Director-General of the NPWS, the NPWS will become an approval body.

It should be noted that where a relic or Aboriginal place is found to occur on land after a development application is lodged, separate NPWS approval will still be required under Section 90 of the *NP&W Act.*

The NPWS has prepared detailed guidelines to assist councils and applicants in the IDA process (copies available upon request). The guidelines outline the role of the NPWS in the IDA process and describe the information that needs to be submitted in an integrated development application. In summary, two types of information are required:

- Aboriginal cultural heritage assessment which involves consultation with the Aboriginal community groups. The NPWS is committed to working in partnership

with the Aboriginal community groups in the management of Aboriginal sites and requires community assessment of any Aboriginal site management; and

- Archaeological assessment which involves the assessment of Aboriginal sites and their management based on archaeological heritage criteria.

Environmental impact statements

Where an environmental impact statement (EIS) is required to be prepared for an integrated development, the Director-General of the Department of Urban Affairs and Planning (DUAP) must request each approval body to provide their requirements in relation to the EIS. If the approval body does not provide those requirements within 14 days then the Director-General of DUAP must inform the applicant and the applicant must consult with the approval body to obtain its requirements for the EIS.

If an EIS is to be prepared for an integrated development that involves a Section 90 approval under the *NP&W Act*, the NPWS will be requested to provide its requirements for the EIS. In this situation, the NPWS requirements for the EIS are the same as for any IDA proposal that requires a Section 90 approval under the *NP&W Act*. These requirements are detailed in the attached guidelines.

Databases

The NPWS has two GIS databases which may provide information of use to you if you proceed to undertake further assessment. These are:

- Atlas listing of fauna and flora records in NSW;
- Aboriginal Sites register.

The material from these databases is available upon written application and the receipt of the appropriate fee. If you are interested in obtaining access to the Atlas database, please contact the Data Licensing Officer, GIS Division, on (02) 9585-6684. Records from the Aboriginal Sites register may be obtained upon written application to the Registrar, Cultural Heritage Conservation Division, on (02) 9585-6471.

Further Information

For further information please contact:

Manager, Conservation Planning Unit
Conservation Programs and Planning Division
Central Directorate
NPWS
PO Box 1967
Hurstville NSW 2220

Ph - (02) 9585 6674
Fax - (02) 9585 6442

Our ref: RTA2-04-002

30 August 2002

NSW Fisheries

Ms Amanda Raleigh
Senior Environmental Planner
GHD
10 Bond Street
SYDNEY NSW 2000

Dear Ms Raleigh

Re: Proposed widening of the Spit Bridge

Thank you for your letter requesting EIS requirements from NSW Fisheries for the proposal cited above. The information listed below may be of some assistance in the preparation of the EIS for this proposal.

The main issues for this particular proposal include:

- Possible impact to marine vegetation – a permit to harm marine vegetation would be required if this proposal will affect marine vegetation including seagrasses, mangroves and macroalgae
- Presence of *Caulerpa taxifolia* - a noxious marine alga
- Presence of aquatic threatened species – see below
- Any obstruction to fish passage whether temporary or permanent needs to be assessed.
- Any dredging or reclamation as defined under the *Fisheries Management Act 1994.*

The remaining information is our general requirements.

Definitions

The definitions given below are relevant to these requirements:

Fish means any part of marine, estuarine or freshwater fish or other aquatic animal life at any stage of their life history (whether alive or dead). Fish include oysters and other aquatic molluscs, crustaceans, echinoderms and beachworms and other aquatic polychaetes.

Marine vegetation means any species of plant that at any time in its life must inhabit water (other than fresh water).

Waters refers to all waters including tidal waters to the Astronomical High Tide Level (AHTL) as well as flowing streams, irregularly flowing streams, gullies, rivers, lakes, coastal lagoons, wetlands and other forms of natural or man made water bodies on both private and public land.

HEAD OFFICE
202 Nicholson Parade ~ PO Box 21 CRONULLA NSW 2230
Telephone: (02) 9527 8411 Facsimile: (02) 9527 8576
Website: www.fisheries.nsw.gov.au
ABN 56 287 047 871

Useful Information
To help you in the preparation of an EIS, the publication "*Guidelines for the Assessment of Aquatic Ecology in EIA*" (Draft 1998) produced by the Department for Urban Affairs and Planning may prove useful in outlining appropriate procedures and methodologies for conducting aquatic surveys.

Matters to be Addressed

1. **General Requirements**

The EIS must include the information outlined below:
A topographic map of the locality at a scale of 1:25 000 should be provided. This map should detail the location of all component parts of the proposal, any areas locally significant for threatened species (such as aquatic reserves), and areas of high human activity (such as townships, regional centres and major roads).

A recent aerial photograph (preferably colour) of the locality (or reproduction of such a photograph) should be provided, if possible. This aerial photograph should clearly show the subject site and indicate the scale of the photograph.

GENERAL REQUIREMENTS

- Area which may be affected either directly or indirectly by the development or activity should be identified and shown on an appropriately scaled map (and aerial photographs).
- All waterbodies and waterways within the proposed area of development are to be identified.
- Description of aquatic vegetation, snags, gravel beds and any other protected, threatened or dominant habitats should be presented.
- Area, density and species composition should be included and mapped.
- Identification of recognised recreational and commercial fishing grounds, aquaculture farms and/or other waterway users.
- Presented maps or plans
- Description of proposal and study area
- Details of the location of all component parts of the proposal, including any auxiliary infrastructure, timetable for construction of the proposal with details of various phases of construction
- Size of the area affected
- Aspects of the management of the proposal, both during construction and after completion, which relate to impact minimisation eg Environment Management Plans
- Plan of study area
- Locations and types of landuses present
- Locations of streams and other waterbodies
- Land tenure details for all land parcels
- For each freshwater body identified on the plan, the plan should include, either by annotation or by an accompanying table, hydrological and stream morphology information such as: flow characteristics, including any seasonal variations, bed substrate, and bed width

- For each marine or estuarine area identified on the plan, the plan should include, either by annotation or by an accompanying table, hydrological and stream morphology information such as: tidal characteristics, bed substrate, and depth contours

DREDGING AND RECLAMATION ACTIVITIES

- Purpose of works
- Type(s) of marine vegetation in the vicinity of the proposed works
- Distance of adjacent marine vegetation from the outer boundary of the proposed works
- Method of dredging to be used
- Duration of dredging works
- Time of dredging works
- Dimension of area to be dredged
- Depth of dredging activities
- Nature of sediment to be dredged, including Acid Sulphate Soil
- Method of marking area subject to works
- Environmental safeguards to be used during and after works
- Measures for minimising harm to fish habitat under the proposal
- Spoil type and source location for reclamation activities
- Method of disposal of dredge material
- Location and duration of spoil stockpiling, if planned
- Volume of material to be extracted or placed as fill

ACTIVITIES THAT DAMAGE MARINE VEGETATION

- Type of marine vegetation to be harmed
- Amount of marine vegetation to be harmed, map distribution of marine vegetation
- Reasons for harming marine vegetation
- Methods of harming marine vegetation
- Construction details
- Duration of works/activities
- Measures for minimising harm to marine vegetation under the proposal
- Environmental measures to be employed, if necessary
- Method and location of transplanting activities or disposal of marine vegetation

ACTIVITIES THAT BLOCK FISH PASSAGE

- Type of activity eg works in a stream that change flow or morphological characteristics
- Length of time fish passage is to be restricted
- Timing of proposed restriction
- Remediation works

THREATENED SPECIES

- Threatened aquatic species assessment (Part 5C, EP&A Act 1979)
- Eight-Part Test
- Consultation with NSW Fisheries immediately the Eight-Part Test is completed and prior to the EIS being finalised.

2. **Initial assessment**

A list of threatened species, endangered populations and endangered ecological communities must be provided. In determining these species, consideration must be given

to the habitat types present within the study area, recent records of threatened species in the locality and the known distributions of these species.

In describing the locality in the vicinity of the proposal, discussion must be provided in regard to the previous land and water uses and the effect of these on the proposed site. Relevant historical events may include land clearing, agricultural activities, water abstraction/diversion, dredging, de-snagging, reclamation, siltation, commercial and recreational activities.

A description of habitat including such components as stream morphology, in-stream and riparian vegetation, water quality and flow characteristics, bed morphology, vegetation (both aquatic and adjacent terrestrial), water quality and tide/flow characteristics must be given. The condition of the habitat within the area must be described and discussed, including the presence and prevalence of introduced species. A description of the habitat requirements of threatened species likely to occur in the study area must be provided.

In defining the proposal area, discussion must be provided in regard to possible indirect effects of the proposal on species/habitats in the area surrounding the subject site: for example, through altered hydrological regimes, soil erosion or pollution. The study area must extend downstream and/or upstream as far as is necessary to take all potential impacts into account.

Please Note: Persons undertaking aquatic surveys may be required to hold or obtain appropriate permits or licences under relevant legislation. For example:

Fisheries Management Act 1994
- Permit to take fish or marine vegetation for research or other authorised purposes (Section 37)
- Licence to harm threatened (aquatic) species, and/or damage the habitat of a threatened species (Section 220ZW).

Animal Research Act 1985:
- Animal Research Authority to undertake fauna surveys.

It is recommend that, prior to any field survey activities taking place, those persons proposing to undertake those activities give consideration to their obligation to obtain appropriate permits or licences which may be required in the specific context of the proposed survey activities.

3. **Assessment of likely impacts**

The EIS must:
- describe and discuss significant habitat areas within the study area;
- outline the habitat requirements of threatened species likely to occur in the study area;
- indicate the location, nature and extent of habitat removal or modification which may result from the proposed action;
- discuss the potential impact of the modification or removal of habitat;
- identify and discuss any potential for the proposal to introduce barriers to the movement of fish species; and
- describe and discuss any other potential impacts of the proposal on fish species or their habitat.

For all species likely to have their lifecycle patterns disrupted by the proposal to the extent that individuals will cease to occupy any location within the subject site, the EIS must describe and discuss other locally occurring populations of such species. The relative significance of this location for these species in the general locality must be discussed in terms of the extent, security and viability of remaining habitat in the locality.

4. Ameliorative measures

The EIS must consider how the proposal has been or may be modified and managed to conserve fisheries habitat on the subject site and in the study area.

In discussing alternatives to the proposal, and the measures proposed to mitigate any effects of the proposal, consideration must be given to developing long term management strategies to protect areas within the study area which are of particular importance for fish species. This may include proposals to restore or improve habitat.

Any proposed pre-construction monitoring plans or on-going monitoring of the effectiveness of the mitigation measures must be outlined in detail, including the objectives of the monitoring program, method of monitoring, reporting framework, duration and frequency.

In the event of a request for concurrence or consultation of the Director of NSW Fisheries, one (1) copy of the EIS should be provided to NSW Fisheries in order for the request to be processed.

It should be noted that NSW Fisheries has no regulatory or statutory role to review draft EISs unless they are accompanied by or are requested as part of a licence application under Part 7A of the FM Act. However, NSW Fisheries is available to provide advice to consent and determining authorities regarding Fisheries' opinion as to whether the requirements have been met if requested, pending the availability of resources and other statutory priorities.

Should you require any further information on these requirements please contact me on 9492 9401.

Yours sincerely

LESLEY DIVER
Conservation Manager – Sydney Region

TRANSPORT NSW

Amanda Raleigh
Senior Environmental Planner
GHD
10 Bond Street
SYDNEY NSW 2000

Dear Amanda

I refer to your facsimile dated 30 August regarding GHD's Preliminary Environmental Impact Assessment for the RTA's proposal to widen Spit Bridge. It is understood that the RTA's proposal is to construct a two-lane bridge adjacent to the existing Spit Bridge, providing a combined, six lane road crossing. Transport NSW (TNSW) appreciates the opportunity to comment on this proposal. Initiatives that would improve public transport for the Northern Beaches are strongly encouraged.

The Spit Bridge is a critical barrier to the efficient operation of bus services on the Northern Beaches corridor. TNSW believes the Spit Bridge widening proposal would lead to improvements for public transport in the region.

In response to your query regarding the consistency of the RTA's proposal to the Government's strategic planning requirements for the corridor, please note the following planning documents:

- *Action for Transport 2010* is the Government's strategic integrated transport plan for Sydney. In the Northern Beaches region, *Action for Transport* identifies a rail link between Chatswood and Dee Why between 2010 and 2020;
- *Shaping our Cities* is a Government planning strategy in which a key objective is to develop and enhance transport corridors and centres;
- *Action for Air* is the Government's 25 year air quality management plan which aims at improving air quality in the Greater Sydney Metropolitan Region and to hold the growth in per capita vehicle kilometres travelled by 2021; and
- *Integrating Land Use and Transport (*including draft *SEPP 66)* is a NSW Government planning policy which aims to promote sustainable planning objectives by improving accessibility to housing, employment and services by walking, cycling and public transport, and improving the choice of public transport by reducing dependence on cars for travel purposes.

The Spit Bridge is just one part of the overall transport management task for the Northern Beaches corridor. While it is not expected or anticipated that the EIS/REF be expanded to include an analysis of the whole corridor, it is recommended that the section of the corridor between Spit Junction and the Burnt Bridge Creek Deviation should be reviewed. In particular, the assessment should address the following issues:

New South Wales Department of Transport • 227 Elizabeth St, Sydney, NSW, Australia • GPO Box 1620 Sydney 2001
61 2 9268 2800 • 61 2 9268 2900 • mail@transport.nsw.gov.au • www.transport.nsw.gov.au • ABN 93 706 081 778

1. Project Justification

Should the RTA be seeking to justify this project on the basis of public transport improvements, it should provide the following data:

- Diagrams of the existing and future lane configurations (including widths, continuity, merging points, bus stops, bus priority measures etc.);
- Likely total vkt before and after the proposal at Spit Bridge and alternative routes such as the Roseville Bridge;
- Anticipated number of people moved per lane in peak, non peak, and at weekends in both directions;
- Anticipated vehicle and bus travel times from a variety of points on the Northern Beaches in peak and non-peak times (including weekends);
- Likely improved infrastructure needs to accommodate any growth in the number of public transport users; and
- Proposed actions, should the anticipated public transport benefits not materialise.

2. Existing impediments and possible improvements to public transport services

The following key choke points, and possible alternative measures, should be examined;

- Sydney Road, Burnt Bridge Creek Deviation and Spit Road intersection;
- Both Spit Bridge approaches (including an assessment of Spit Bridge opening times);
- Medusa and Spit Road intersection;
- Ourimba Road and Spit Road intersection; and
- Spit Road and Military Road intersection;

Bus lanes and associated bus bays (sufficient to accommodate all buses stopping at any one time) should also be examined between Burnt Bridge Creek Deviation and Spit Junction.

Assessment of the optimum lane configuration for the six lanes, to ensure optimum bus flow, should be examined. An analysis of a 3/3 configuration with a bus lane should be conducted.

3. Cyclists/Pedestrians

Connections for pedestrians and cyclists to the north and south of the new pedestrian / cycleway are important. The EIA/REF should:

- Analyse current cycle and pedestrian access paths to the north and south of the new bridge and ensure the new pedestrian / cycle lane provides smooth connection to these paths; or
- If current cycle / pedestrian connections do not exist, analyse and propose an appropriate pedestrian and cycle network.

4. Other Traffic and Road Network Impacts

Induced traffic as a result of the increase in capacity on the Spit Bridge and possible preventative measures should be examined.

5. STA Issues

STA is the primary bus operator in this section of corridor and should be consulted in relation to bus priority improvements and analysis of bus operations. STA has already held initial discussions with RTA and TNSW, and its comments are as follows:

- STA has recently proposed changes to the route structure for its Northern Beaches bus services. Pending community input, changes would result in additional express type buses operating via the Burnt Bridge Creek Deviation and additional off peak services operating over the Spit Bridge.
- RTA's traffic analysis should take into account the new route structure and timetables.
- The project, as proposed, would benefit buses flows in the off peak and contra peak, regardless of the lane configuration of the Spit Bridge.
- Almost 50% of peak flow bus services operate back "in service" over the Spit Bridge. The Spit Bridge, with one contra flow lane at this time, is a critical choke point for these services.
- These contra peak buses have experienced a 10 – 15% increase in travel times over the last two years between the City and Balgowlah.
- Recently, eight minutes additional operating time was provided for contra flow peak services to reduce late running in the corridor, with peak direction bus services not adjusted.
- Accidents and breakdowns in the single contra peak Spit Bridge lane significantly effect contra peak bus services. One or two additional lanes would considerably enhance reliability.
- The increase in lane capacity on Spit Bridge would clear the backup of buses after Spit Bridge opening times considerably quicker, as there would be no need to merge.
- STA's preference is for a 3/3 lane configuration during peak times with the provision of a bus lane during the morning and afternoon peaks. Alternatively, a 4/2 lane configuration should also enable the provision of a bus lane during peak periods, although it would be to more to the motorists' advantage.
- Modifications to the approaches should allow for STA to operate 14.5 metre buses, allowing STA to increase capacity during peaks times.
- In the longer term, Military Road congestion also needs to be addressed. However, the section of the corridor between Spit Junction and the Burnt Bridge Creek Deviation should be reviewed as part of this EIA/REF. This could include the optimal placement of bus stops.
- EIA/REF should examine enforcement issues for illegal use of Transit Lanes and Bus Lanes within the study area.
- Construction of the new bridge should not hinder or delay bus services unduly. Mitigative measures should be put in place during construction to minimise delays.

7. TNSW

I request that you continue consultation with TNSW throughout the EIA process as it is the contractor of bus services and coordinates strategic planning in relation to public transport.

Please contact Matthew James on 9268 2967 or at matthew.james@transport.nsw.gov.au should you wish to discuss this matter further.

Yours sincerely

Stephen Alchin
Executive Director, Masterplanning and Infrastructure

5/10/02

Our Reference : SRF7366; SR381/04
Contact : David Gathercole, 9995 6840

NSW EPA

Sydney Regions

Ms Amanda Raleigh
Senior Environmental Planner
GHD Consultants
10 Bond Street
SYDNEY NSW 2000

Dear Ms Raleigh,

PROPOSED WIDENING OF THE SPIT BRIDGE, MOSMAN

Thank you for your facsimile to the Environment Protection Authority (EPA) requesting input into the development of a Review of Environmental Factors (REF) for the proposed widening of the Spit Bridge, Mosman.

The EPA has considered your request and suggests the following comments for review in the development of the REF.

I trust that this information is of assistance to you and if you have any enquiries please contact David Gathercole on 9995 6840.

Yours sincerely,

SMSavolainen 16/10/02

Susanna Savolainen
A/Principal Officer Sydney Planning

Environment Protection Authority
PO Box 668 Parramatta NSW 2124 Australia
Level 7 79 George Street Parramatta NSW 2150
Telephone 61 2 9995 5000
Facsimile 61 2 9995 6900
ABN 43 692 285 758
www.epa.nsw.gov.au

ENVIRONMENT PROTECTION ISSUES TO BE ADDRESSED IN THE PREPARATION OF A REVIEW OF ENVIRONMENTAL FACTORS (REF) FOR THE PROPOSED WIDENING OF SPIT BRIDGE, MOSMAN

GENERAL COMMENTS

The EPA has received limited information on this proposal. Therefore, the following environmental protection issues are stated in a broad context. The EPA would require further information, including *inter alia* whether the proposed widening of the bridge will incorporate dedicated bus lanes, construction methods and proposed hours of construction in order to identify specific environmental protection issues.

The EPA considers that the REF should provide an overall environment protection perspective. Some issues which should be addressed are listed below:

- the impact of the proposal on the existing road system, traffic congestion, public transport and induced traffic;
- the impact of the works on, and opportunities to improve, pedestrian and cycleway facilities and access to public transport;
- the environmental and cost savings possible by adopting energy efficiency measures;
- the possible cumulative environmental impacts and proposals to manage these cumulative impacts; and,
- the effects of the development of the road on land use planning in the area.

The Planning NSW *"EIS Guideline: Roads and Related Facilities"* (1996) is a useful background document. In particular see section 6E: Specific requirements for an EIS – The Environmental Issues.

ENVIRONMENTAL ISSUES

Noise and Vibration Issues

The primary objective is the maintenance of residential amenity. The assessment of impacts and discussion of mitigation measures should address both the construction and operational phases. An assessment of the impacts of maximum noise levels and the likely frequency of such events should be included.

The following guidelines may be useful in the preparation of the REF:

- EPA's *Environmental Noise Control Manual*;
- EPA's *Environmental Criteria for Road Traffic Noise*; and,
- Road and Traffic Authority's *Environmental Noise Management Manual*.

Baseline information should be provided for all properties likely to be affected in order to allow evaluation of the projected noise and vibration impacts of the proposal. This could include one week of valid noise data. Noise descriptors of LA_{90} (background noise levels), LA_{10} and LA_{eq} (equivalent continuous noise level) should be used and collected in a manner that is not affected by rain or winds greater that 5 m/s.

Guidelines for construction noise take into account the fact that these activities are transient and that noise from construction activities is often difficult to limit even with good control measures.

EPA target noise levels are:

- background + 20dB(A) for periods less than 4 weeks;
- background + 10dB(A) for periods between 4 and 26 weeks;
- background + 5dB(A) for periods greater than 26 weeks.

A noise management plan should consider aspects including: timing of noisy activities; selection of "quiet" equipment; use of noise barriers; scheduling of noisy activities to ensure that they are completed in a short time and do not occur at more noise sensitive times of the day; and communication strategies with residents.

Recommended construction hours are:

- Monday to Friday, 7am to 6pm
- Saturday, 8am to 1pm.
- No work on Sundays or Public Holidays

Where these hours may need to be varied, details should be provided of how work would be managed to minimise noise impacts.

The REF should include the following information:

- details of the potential noise and vibration impacts from construction activities, including noise from construction machinery;
- identification of noise sensitive sites;
- details of any proposed noise-monitoring program to demonstrate compliance;
- details of truck movements, road traffic management during the construction phase and any necessary parking facilities;
- the type of road surface to be used;
- information on changes in noise impacts due to changed traffic flows and patterns; and,
- options for noise mitigation.

Soils & Geology

The Department of Land and Water Conservation (DLWC) Acid Sulfate Soil Probability Maps *should be used to indicate whether the proposed excavation areas could contain Acid Sulfate Soils.*

It is recommended that the proponent conduct a preliminary assessment in accordance with the New South Wales Acid Sulfate Soils Management Advisory Committee publication, *Acid Sulfate Soils – Assessment Guidelines* (1998). This preliminary assessment should determine whether acid sulfate soils are present and if the proposed works are likely to disturb these soils.

If acid sulfate soils are likely to be disturbed by the works, an appropriate Acid Sulfate Soil Management Plan may be required. Relevant guidelines are outlined in the New South Wales Acid Sulfate Soils Management Advisory Committee publication, *Acid Sulfate Soils – Management Guidelines* (1998).

Water Issues

The REF should identify, describe and quantitatively assess the potential impacts of the development on water quality and the aquatic environment both during the construction and operational phase, and describe measures to avoid or minimise these impacts.

Potential impacts of the development upon Middle Harbour should be taken into careful consideration.

An integrated soil and water management plan should be developed to prevent an increase in pollutant loads being exported from the site both during construction and operation. The following documents will assist in the development of the plan:

- EPA *Managing Urban Stormwater: Treatment Techniques* (1997);
- EPA *Managing Urban Stormwater: Council Handbook (draft)* (1997);
- NSW Dept of Housing: *Managing Urban Stormwater, Soils and Construction (the blue book)* (1998).

Issues that should be considered are listed below:

- the potential for water pollutants to be generated;
- measures to be taken to collect, store and treat stormwater, wash down water, wheel wash water, etc;
- options for water re-use on the site;
- materials storage areas, ponds or beds for slurry or other materials;
- management methods to ensure that earthworks do not export sediment from the site;
- separating clean water from contaminated water;
- protect existing natural drainage lines and the banks of water bodies;
- measures to prevent litter entering water courses eg; trash racks, and details of permanent gross pollutant traps or other water pollution control devices proposed for the operational stage;
- proposed controls for refuelling facilities during construction eg, oil separators, emergency absorbent booms or pillows;
- identification of any significant effects on hydrological conditions and appropriate hydrological studies;
- monitoring proposals; and,
- consideration of the impact of the proposal on upstream and downstream flooding taking into account any existing flood plain management plans.

Air Quality Issues

Air quality issues that should be considered in the REF for the construction works include:

- emissions of dust generated by activities such as earthmoving, excavation, loading and vehicle traffic (particularly from unsealed roads and surfaces);
- wind erosion from exposed surfaces and stockpiles; and,
- assessment of the impact of exhaust emissions from vehicles and other motorised equipment being operated on-site.

An air quality management plan should be developed for the site to describe proposed mitigation measures and safeguards to control dust generation and to minimise impact on nearby receptors.

Mitigation measures and safeguards referred to in the REF should include:

- properly maintained equipment, designed and operated to control the emission of smoke, dust, fume and other objectionable material into the atmosphere;
- spraying of earthworks, roads and other surfaces as necessary with water or other suitable liquids and the provision of dust suppression equipment;
- all working areas, access roads and disturbed areas to be stabilised as soon as practicable to minimise the generation of wind blown dust;

- staging the clearing of the site so that the exposed area and the generation of wind blown dust is minimised;
- proposals for the resolution of air complaints and details of a complaints handling and recording system.

Dust is a major issue during the construction phase. For sites that contain contaminated materials, dust management controls are even more critical. A dust management plan should be prepared for potentially dusty developments or developments that contain contaminated material. This should include: identification of sensitive receptors (eg. residences, schools, nursing homes, hospitals); prediction of dust fall-out and dust concentrations using appropriate air dispersion modelling with the assumed "worst case scenario"; proposed mitigation measures and safeguards to minimise impacts; and details of any proposed public consultation program to inform nearby residents when particularly dusty activities are proposed.

In relation to the operational phase, information should be included on the projected changes in traffic volume and traffic type on the proposed road and the adjacent road network and likely changes to the existing air quality at various locations along the proposed route.

Waste Management

The REF should determine and classify the types of waste material generated and the different disposal strategies for each material in accordance with EPA guidelines (Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes (EPA 1999)). Waste management principles, starting with minimisation should be applied to each stage of the project's development, including the concept design and construction stages.

Where necessary to remove trees, the trees should preferably be chipped on site, and used for landscaping on adjacent areas. Alternatively, cleared timber may be sent to commercial processors or offered to the public. No trees should be bulldozed, burned in the open, or sent to landfills. Other green wastes should be sent for reprocessing, either directly to commercial composters or to transfer stations.

Suppliers of construction materials should be required to reduce unnecessary packaging or to use durable reusable packaging, pallets, crates and drums. Where packaging materials cannot be reused, recycling options should be thoroughly investigated.

Wastes should be source separated and sent to recycling outlets. Recycling facilities should be made available to site staff operating from temporary offices near the road or on the road corridor.

Spoil Management

The REF should fully investigate the cost of treatment and disposal of spoil before works commence so that adequate resources are available. Factors that need to be considered in the REF include:

- estimating the quantity of spoil material likely to be generated;
- avoiding clearing additional areas of land for the storage of spoil material;
- collecting, separating, storing and reusing topsoil;
- maximising the reuse of spoil material on site;
- proposed strategies for the handling, stockpiling reuse /recycling and disposal of spoil;
- identification of the history of spoil material and whether there is any likelihood of contaminated material, and if so, measures for the management of any contaminated material; and,

- ensuring that spoil storage areas are managed appropriately to minimise erosion and ensure that adequate sediment controls are in place.

Flora and Fauna

The REF should include a detailed assessment of the likely ecological impact of the proposal on both terrestrial and aquatic communities and individual species. Remnant and regenerated vegetative communities should be identified and assessed for their value as habitat, and wildlife corridors surveyed for rare or endangered flora and fauna species. For detailed advice, contact the National Parks and Wildlife Service and Department of Fisheries, but in general the following issues should be addressed:

- maximise retention of remnant native vegetation by minimising the area of vegetation disturbance;
- utilise local seed stock for planting wherever possible;
- maximise linkages between areas of biodiversity value;
- take special care where road corridors are adjacent to National Parks;
- consider the need for fauna corridors; and,
- rehabilitate sites when work is complete.

Environmental Management Plan

The EPA strongly recommends the preparation of an environmental management plan to guide environmental performance during the project. This plan should address environmental awareness and skills training for all workers, including contractors, working on the project. In addition, the EPA suggests that the Plan should cover the issues listed above, and include the following important components:

- appropriate mitigation measures to ensure that operations do not cause unacceptable pollution, cause an unacceptable risk to public health or impact on the amenity of surrounding residents;
- clearly defined and appropriate environmental objectives, referring to relevant guidelines and standards;
- adequate environmental monitoring and reporting programs to ensure that performance is assessed against environmental objectives; and,
- clear and appropriate contingency strategies.

Your Ref:
Our Ref: ERM 2003-2982

20 February 2003

LAND & WATER CONSERVATION

GDH
10 Bond Street
SYDNEY NSW 2000

Attention: amanda Ralelgh

Dear Madam,

Re: EIS Requirements.
Proposed widening of Spit Bridge

Thank you for your fax 12 February 2003, seeking this Departments comments and requirements for the above-proposed EIS.

The Department of Land and Water Conservation (DLWC) is responsible for managing the soil, water and vegetation resources in New South Wales.
The vision of the Department is to facilitate *clean, healthy and productive catchments for the twenty-first century*. As part of this vision, the Department advocates the principles of ecologically sustainable development, and intra and intergenerational equity.

The Departments comments are broad in nature to cover a variety of circumstances. Some of these comments may not be fully relevant to your proposal. It would appear that the department will have few issues relating to this proposal. There is however some Crown Land close to the proposal that could be affected. Crown Land issues are addressed below.

As part of the preparation of the EIS you will need to demonstrate how this proposal will meet the requirements of the various Acts and Policies within this letter.

NSW State Rivers and Estuaries Policy - General.

The NSW Government has a policy to encourage sustainable development of the natural resources of the State's rivers, estuaries, wetlands and adjacent riverine plains. This is to reduce and where possible halt;

- declining water quality,
- loss of riparian vegetation,
- damage to river banks and channels,
- loss of biodiversity, and
- declining natural flood mitigation;

and to encourage projects and activities which will restore the quality of the river and estuarine systems such as;

- rehabilitating remnant habitats,
- re-establishing vegetation buffer zones adjacent to streams and wetlands,
- restoring wetland areas,

- rehabilitating of estuarine foreshores, and
- ensuring adequate streamflows to maintain aquatic and wetland habitats.

This includes ensuring the construction of any wetland or detention structure off-line, so as not to degrade the functions of that natural resource.

NSW Estuary Management Policy - General

The NSW Government recognises the ecological, social and economic importance of the State's estuaries and is concerned about the long-term consequences of their accelerating degradation. The general goal of the policy is to achieve an integrated, balanced, responsible and ecologically sustainable use of the State's estuaries.

As such, proposals within the State's estuaries should ensure:

- The proposal will not adversely impact the physical processes operating within the estuary, for example:
  - a reduction in the existing tidal prism as a result of reclamation may affect an estuary's flushing and water quality characteristics and
  - any associated retaining wall construction may result in erosion of adjacent properties and destruction of foreshore flora and fauna
- Intertidal and aquatic flora and fauna are adequately protected
- Potential impacts on water quality during construction and operational phases are appropriately mitigated
- Conflict with other estuary users and uses are minimised
- The visual impact of potential development is assessed, for example, the length of jetties, the extent of foreshore walls, the form and colour of structures, the degree of land clearing, etc.
- The cumulative impact of a proposal is considered in terms of its contribution to overall habitat loss and disturbance, water quality degradation, alienation of intertidal areas, increase in boat traffic in the area etc.
- Consistency with Estuary Management Plans where they exist.

Floodplain Management - General

Any development on flood prone land should be considered in accordance with the NSW Government's Flood Policy (1984). These principles are further explained in the Government's Floodplain Management Manual (2001). The primary objective of the State Government's Flood Policy is to reduce the impact of flooding and flood liability on individual owners and occupiers, and to reduce the private and public losses resulting from all levels of potential flooding. As outlined in the Manual the Policy is merits based, in which the impacts of flooding are balanced against planning, social, environmental and economic issues. The consent authority needs to check that all considerations in the Manual are adequately addressed in making decisions.

The management of flood prone land is primarily the responsibility of local government. The State Government provides technical assistance and, in association with the Federal Government, financial assistance for flood related studies, mitigation works etc.

In assessing any development proposal, consideration needs to be given, where appropriate, to the potential impacts of flooding on the proposed development; the impact of the proposed development on flood behaviour both upstream and downstream of the site; and the possible impacts of flooding on residents and other users of the floodplain. Particular attention should also be given to availability of safe access and egress from the site in times of flood. In this

regard, the full range of potential flood events, up to the probable maximum flood (PMF) should be considered.

Impacts from development in isolation can be small. However, when considered in combination with other future development the impact might be significant. It is therefore prudent to assess the cumulative impacts of all likely development. A floodplain management study is an effective way of assessing these cumulative impacts.

Under the Government's Flood Policy, the determination of the acceptability of any afflux arising from proposed development should be merits based and would normally be a matter for the relevant consent authority. However, it should be noted that in some communities an afflux as small as 10 mm has needed to be addressed by way of providing some compensatory flood mitigation.

Should you wish to discuss any Floodplain Management matters further with the Department, please do not hesitate to contact David Avery on phone number 9895 6242.

NSW Biodiversity Strategy

The NSW Government has a strategy for protecting the native biodiversity of NSW and for maintaining ecological processes and systems. The following principles will be applied in reviewing any proposal;

- Ensuring that the proposal does not decrease native biodiversity of either individual species or communities of the site or area.
- Ensuring that the proposal is not part of any threatening process to the native biodiversity of the site or area.
- Determining if the proponent has been guided by the precautionary principle to show careful evaluation to avoid, wherever possible, serious or irreversible damage to native biodiversity, through an assessment of risk-weighted consequences of various options.

The proponent will need to demonstrate how this strategy will be met.

Crown Land Matters - General

Matters the proponent needs to consider when undertaking development adjoining Crown land include;

- Overland flows, including stormwater should not be concentrated or diverted from their natural flowline.
- Roofwater shall not be discharged directly onto Crown land.
- The velocity and volume of stormwater flows to Crown land must be no greater than those before the proposed development.
- Any stormwater control structure must be designed and constructed in accordance with, *Managing urban Stormwater, Soils and Construction*. NSW Dept of Housing, 3 Ed. (1998).
- Any excavation or fill is to be contained entirely on the proponents' property and shall not jeopardise the longevity of any vegetation on Crown land. Where fill is proposed adjoining the common boundary it shall be properly drained and retained or battered back and revegetated to prevent the escape of any material onto Crown land.
- Access to any part of the proponents property is not to be over Crown Land. Should the proponent wish to construct a Crown road, permission in writing must first be obtained from the Department.

- Any fire reduction zone that is required by a development, that adjoins Crown land is to be completely within that development boundary.
- Any other matters that may adversely impact upon the Crown land.

Crown Land Matters Adjoining or below mean high water mark

Matters the proponent needs to consider when undertaking development adjoining or below mean high water mark include;

- Ensure that Owners Consent has been obtained in the first instance.
- The potential for and impact upon public foreshore access.
- The effect on the viability and operation of Crown tenures.
- The use of the waterway.
- The displacement of swing moorings and the need for them to be replaced.
- Scouring and/or sedimentation on the bed of the waterway and the release or accumulation of sediments containing pollutants.
- Erosion and/or accretion of subject and nearby Crown lands below mean high water mark.
- Impacts upon aquatic and semi-aquatic vegetation.

Crown Land Matters - Specific

The EIS or SEE should :

- Identify the location and status of any Crown land directly or indirectly affected by the proposal. A detailed status search is recommended to confirm whether Crown land, as defined by the Crown Lands Act,1989 is involved and to identify any other interests in the land.
- Consider any potential impacts the development proposal may have on the current/future use, management or amenity of any identified Crown land, as defined by the Crown Lands Act, 1989.
- Include a rehabilitation plan that covers any disturbance to the Crown land during the construction/installation activities. The plan should address such matters as vegetation rehabilitation, soil erosion and sediment control and restoration to pre-existing levels. The Department prefers rehabilitation to be adaptive, progressive and designed into the course of the activity rather that being a post activity process.
- Address the interests of the Department and any trustee(s) in the event that the proposal is found to be within a Crown reservation.

(1). Native Title Interest

The introduction of the Commonwealth Native Title Act in 1993 has had far reaching ramifications for the administration and management of Crown land. Should Crown land be involved in the proposal, you need to address the issue of native title and establish if there are any native title interests in the land.

(2). Land Assessment

The Crown Lands Act, 1989 requires that before any parcel of Crown land can either be sold, leased, licensed or reserved for any purpose the land must first be subject to Land Assessment in terms of Part 3 of the Act. The objective of the Crown Land Assessment process is to ensure the ecologically sustainable use, development and management of Crown land in NSW in accordance with Sections 10 and 11 of the Crown Lands Act, 1989 and to provide the opportunity for public input and consideration of the views of other Government authorities.

The Minister may consider the waiver of the requirement for land assessment when it is in the public interest to do so and due regard has been given to the principles of Crown land management. Such a waiver may be appropriate where the proposed works are consistent with a formal management strategy such as an estuary management plan etc.

(3). Development Application (Owner's Consent)
Owner's consent is required for the lodgement of Development Applications with Councils and other consent authorities under Section 77(1)(b), Part IV of the Environmental Planning and Assessment Act, 1979.

If the proposal involves Crown land, the original Development Application form together with all supporting documentation are to be submitted to the Department for consideration. Consent to lodgement will only be given to development proposals which are "permissible with consent" under the relevant Environmental Planning Instrument.

(4). Protection of Foreshore Lands
A prime consideration of this Department is to ensure that any activity does not adversely affect any adjoining Crown foreshore reserve. The following issues should be addressed if the proposal impacts on such a reserve:

- No structures to be erected or works undertaken on the adjoining Crown reserve or below the Mean High Water Mark without the prior approval.
- Public access to and along the Crown foreshore reserve not be denied or unnecessarily restricted.

Crown Land- Major Public Authority Projects

Where Crown lands or Crown reserves are considered to be needed, as part of a major project, the land should be acquired using the provisions of the **Land Acquisition (Just Terms Compensation) Act 1991.**
Where tunnelling or deep excavation are to be undertaken as part of the project, a close examination of all the titles of the lands affected by the proposal is required. The titles for lands in some instances are restricted in depth. The lands below this depth restriction are considered to be Crown lands and as such compensation for the acquisition of these lands are payable.

Bushfire Protection and Crown Lands

Bushfire protection measures are not to be offset onto adjoining Crown lands, including Departmental lands. Bushfire protection measures should occur on the site of the proposed development, as per *NSW Planning for Bushfire Protection* page 15 and *The Rural Fires and Environmental Assessment Act 2002.*
In the case of in-fill developments that cannot progress without bushfire protection measures on Crown lands, owners consent to lodge the Development Application and covenant over the Crown land should be obtained prior to the consent authority assessing the development.

Sydney Regional Coastal Management Strategy

The proposal will need to be consistent with the aims and objectives of this Strategy. The local council should be able to give details of this strategy, as it relates to your location.

Soil Conservation Act (1938)

The Soil Conservation Act (1938) and amendments provides for the conservation of soil and farm water resources and for the mitigation of erosion within NSW. Any land use activity

that disturbs a vegetative ground cover creates an erosion hazard, which requires measures to minimise environmental degradation.

In relation to soil erosion, sedimentation and land degradation in general the Department advises that the EIS should address at least, but not be limited to the following issues:-

- ⇒ topography
- ⇒ landform
- ⇒ soil type
- ⇒ soil erodibility
- ⇒ site capability
- ⇒ potential for salinity problems.
- ⇒ acid sulfate and potential acid sulfate soils
- ⇒ vegetation management
- ⇒ erosion and sediment control strategy including techniques

Acid Sulfate Soils.

Deposited NSW coastal soils that are within one metre sea level (AHD) have a high potential to be affected by acid sulfate soil (PASS) materials.
If the site is within five metres AHD anywhere east of the Blue Mountains, a soil survey and soil analysis program should be conducted by the proponent to determine the potential, and extent of the problem. The EIS will need to provide the Consent Authority with a management plan illustrating how they will treat the material, if this soil will be disturbed.

The Department recommends that the level of assessment and details within the acid sulfate management plan are consistent with the NSW Government guidelines regarding Assessing and Managing Acid Sulfate soils from the *Acid Sulfate Soil Manual*, Department of Urban Affairs and Planning. (1998)

Erosion and Sediment control Plan

An integrated site development plan needs to be prepared, incorporating an Erosion and Sediment Control Plan, for the EIS. This plan shall cover the life of the proposed site extension, rehabilitation and closure, and ensure that the site land is stabilised to standards of the *Managing Urban Stormwater, Soils and Construction*. NSW Dept of Housing,, 1998, 3 Ed, and Consent Authority (which ever is the greater). The plan at the EIS stage should be detailed enough to enable any reviewer to determine that the concepts for control are sound and practical. The sizes and location of control works should be according to design and the accepted policies, and the revegetation/ landscape plan will enhance the native vegetation biodiversity of the site. It is expected that the following detail will be made available upon request, if required. This same detail is what will be required before the Construction Certificate stage.

- ⇒ Soils investigation to determine erosion and sediment control design
- ⇒ Details on proposed erosion control practices
- ⇒ Details on proposed sediment and pollution control practices
- ⇒ Discharge calculations for diversionary works
- ⇒ Design specifications for banks and sediment basins
- ⇒ Detailed rehabilitation practices including selection of tree, shrub and cover crop species and implementation method
- ⇒ Maintenance and monitoring program for sediment and pollution control structures
- ⇒ Assessment of off-site impacts for surface flow from the development
- ⇒ Rehabilitation proposal for existing erosion on or adjacent to the site

- ⇒ Plans at suitable scale and with diagrams and notation clearly displayed
- ⇒ Details of development works for sequence and staging
- ⇒ Location of critical areas (water bodies, drainage lines, unstable slopes, rock outcrops, hard cover areas, flood plains and wet areas).
- ⇒ Location of all earthworks including roads, areas of cut and fill or land regrading
- ⇒ Diversion of uncontaminated up-site runoff areas to be disturbed
- ⇒ Existing and final contours
- ⇒ Revegetation program

Native Vegetation Conservation Strategy.

The Commonwealth and NSW Governments have a strategy for protecting native vegetation. The performance indicator for this strategy is the concept of no net loss.
No net loss is the enhancement of both the quality and extent of native vegetation in the long term as a result of retention and adequate offsets for losses across a specified area.
To offset an activity means to compensate for the negative impacts of that activity, by taking a separate action with equal or greater positive impacts.

The proponent will need to demonstrate how this strategy will be met.

Vegetation - Endangered Ecological Communities

If there is any native vegetation upon the proposed development site\s, the proponent must check that there is no other Endangered Ecological Communities. There have been several recently listed, and an up to date listing, details of potential location, and description should be obtained from National Parks and Wildlife.

Vegetation - Native vegetation establishment near native vegetation areas.

The Department recommends that developments integrate an endemic native revegetation program. This is to minimise or prevent potential environmental weeds spreading into any existing nearby native vegetation areas and to minimise the fragmentation of any native vegetation by the development.

Vegetation - Native plant enhancement.

The Department recommends that developments, where applicable, integrate a bush regeneration program within the development. This is to minimise the on and off-site environmental weed invasion potential and enhance any native vegetation.

I trust the above comments will be useful in the preparation of the EIS. The Department will require a copy of the EIS to be sent to Greg Brady, Environmental Review Co-ordinator, at the address supplied. Should you have any questions please contact Greg Brady on (02) 9895 7441.

Yours sincerely,

for
Marwan El-Chamy
Resource Access Manager
Sydney/South Coast Region

Waterways Authority
Maritime Property & Assets Division

Waterway

Maritime Trade Tower
Level 1
207 Kent Stree
Sydney NSW 200

PO Box 1
Millers Point NSW 200

Facsimile Message

To: **Amanda Raleigh, GHD**
Fax: **9239 7193**
Phone: **9239 7203**

Date: **26 February 2003**
No. of pages **2** (including this page)

Subject: **RTA Proposed Spit Bridge Widening**

Thank you for your facsimile of 19 February 2003. I apologise that it has not been possible to respond to you sooner.

It is noted that RTA intends to lodge a DA and SEE for those works over the seabed of Middle Harbour. Please note that whilst any DA will be lodged with the Waterways Authority, the consent authority for 'water-based development' under SREP23 is the Minister for Transport. The Authority acts under delegation from the Minister.

Whilst it is not strictly necessary for the RTA (as a public authority) to seek the Authority's consent as land owner to lodge the DA(s), it is advisable that the Authority be consulted prior to lodgment with any consent authority. Especially as some of the proposed works are likely to affect Waterways land presently leased to D'Albora Marina.

As the DA is lodged by a public authority, the procedures for integrated development under Part 4 of the EP&A Act will not apply.

In relation to the matters that should be addressed in any Statement of Environmental Effects for the proposal. These include:

- Details of the proposal including additional waterway area to be traversed, scaled drawings including plans and cross-sections
- Outline of construction method and erosion and sediment control management measures
- Hydrographic survey of the waterway to be occupied and immediate surrounds, if not already done
- Any reduction in clearance beneath the bridge and impact on navigation during and post construction
- Impact on existing water-dependent facilities eg. marina and slipway
- Direct and indirect impacts on marine vegetation (a marine vegetation survey will need to be undertaken if not already done) and impacts on aquatic ecology
- Visual assessment

From: **Persephone Rougellis**
A/Manager Property Planning
PROPERTY PLANNING

Phone: 9364 2176 Fax: 9364 2444

- Potential impact on items of heritage significance
- Address SEPP56 Guiding Principles, SREP23 and DCP for Sydney Harbour and Parramatta River
- Justification for the proposal and consideration of alternative options

It also advised that as the RTA is a public authority, it is presently exempt from requiring any approvals from the Waterways Authority under Part 3A of the *Rivers and Foreshores Improvement Act* and section 13TA of the *Maritime Services Act*. However, the *Rivers and Foreshores Improvement Act* will be repealed with the gazettal of new regulations under the *Water Management Act* during 2003. Once these regulations have been gazetted, the RTA will be required to obtain a 'Controlled Activity Approval' for certain activities proposed in Sydney Harbour itself or within 40 metres of the waterway.

If you wish to discuss the above and/or arrange a meeting to discuss in further detail please call me on 9364 2176 or e-mail prougellis@waterways.nsw.gov.au .

Many regards,

Persephone.

From: **Persephone Rougellis**
A/Manager Property Planning
PROPERTY PLANNING

Phone: **9364 2176** **Fax:** **9364 2444**