

City West Cable Tunnel

Submissions Report

September 2006

EnergyAustralia



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1. Introduction

1.1 Purpose of this report

The City West Cable Tunnel project (the proposed development) involves the construction and operation of an electricity transmission cable tunnel to link the Haymarket Bulk Supply Point in Thomas Street, Ultimo, with the City North Substation at the corner of Sussex and Erskine Streets, Sydney.

The proposed development is the result of a detailed examination of options to upgrade the Sydney central business district (CBD) electricity supply system to ensure that projected demand can be met post 2008.

The proposed development is being assessed under Part 3A of the Environmental Planning and Assessment Act 1979. In accordance with that Act, an Environmental Assessment was prepared on behalf of the proponent, EnergyAustralia, to assess the potential environmental effects of the proposed development on the surrounding environment.

The Environmental Assessment was publicly exhibited from 24 May to 7 July 2006, and submissions on the proposed development and the Environmental Assessment were invited from government agencies, key stakeholders and the general public. A total of 11 Submissions were received. This report analyses and responds to those submissions.

1.2 Background

During the next decade, EnergyAustralia must replace its ageing and critical infrastructure in the Sydney CBD in order to comply with new licence for operation of its substations and transmission feeders. The new licence requirements specify that all city zone substations and transmission feeders (three individual electrical transmission cables (phases) bundled together) must achieve "N-2" capacity by 2012. That is, they must be able to supply the full electricity demand with any two transformers or feeders out of service.

EnergyAustralia has developed an integrated replacement strategy to reconstruct or refurbish its existing electricity distribution infrastructure, while maintaining sufficient spare capacity to ensure an ongoing and reliable electricity supply.

EnergyAustralia's aim is to replace and construct new substations and associated equipment between 2005 and 2019. Its strategy would commence with the construction of a new 132 kilovolt (kV) substation to replace the existing 33 kV City North Substation on Sussex Street (see *Figure 1.1* and *Figure 1.2*), together with the installation of new 132 kV feeders to replace the existing 33 kV feeders that supply the substation.

The proposed new City North Substation would provide an 'N-2' level of security. Initially, three transformers and three 132 kV feeders would be required to maintain this level of security in electricity supply, with a further two transformers and two 132 kV feeders installed by 2010 to facilitate the substation redevelopment. This increase in capacity would be required to ensure adequate supply to the Sydney CBD during the proposed upgrade and refurbishment of EnergyAustralia's city network.

As part of its upgrade strategy, therefore, EnergyAustralia proposes to install five 132 kV feeders in parallel with the development of the new City North Substation. EnergyAustralia's preferred method for installing the 132 kV feeders along the western edge of the Sydney CBD is via a cable tunnel called the City West Cable Tunnel.

Three of the tunnel's five feeders would be replacement feeders. For cost reasons, it is proposed to install all five feeders concurrently due to the very low marginal additional cost of installing all feeders at once, and the relatively high cost of installing feeders in two separate operations.

The planning, design, and construction of the City West Cable Tunnel would be carried out as a separate project to the City North Substation works, with the ultimate aim to construct and commission both projects by 2010.

1.3 Overview of the proposed development

1.3.1 The proponent

EnergyAustralia (the proponent) is a NSW state-owned corporation, and constituted under the NSW Energy Services Corporations Act 1995 as an energy distributor. EnergyAustralia purchases electricity from energy transmission operators such as TransGrid, and distributes energy to electricity customers.

The principal objectives of EnergyAustralia, as an energy distributor, are prescribed by the NSW Energy Services Corporations Act 1995. The principal objectives are:

- to be a successful business
- to protect the environment
- to facilitate regional development and de-centralisation
- to operate safe and reliable electricity distribution systems
- to be an efficient and responsible supplier of electricity
- to participate in the wholesale and retail markets for electricity and other forms of energy.

The powers and duties of EnergyAustralia relating to the acquisition of land, construction of electricity works and powers of entry, are set out in Part 5 of the NSW *Electricity Supply Act 1995*. This Act allows EnergyAustralia to construct electricity works within public roads and reserves with exemption from approval under the NSW *Local Government Act 1993*.

EnergyAustralia meets the definition of a public authority under the NSW *Environmental Planning and Assessment Act 1979*, and for the purposes of that Act, its developments are Crown developments.

1.3.2 Objectives of the proposed development

The objectives of the proposed development are derived from the need to upgrade the electricity supply network in the Sydney CBD, and in particular, the need to upgrade the City North Substation. These objectives are:

- to provide infrastructure for connection of the Haymarket Bulk Supply Point, the City Central and City North Substations, via five 132 kV feeders
- to install, connect and commission three 132 kV feeders to the City North Substation by mid 2009 in order to supply the newly reconstructed substation
- to facilitate the upgrading of the new City North Substation.

1.3.3 The proposed development

The proposed cable tunnel alignment and features of the proposed development are shown in *Figures 1.1* and *1.2*. In summary, the proposed development comprises:

- construction of an electricity transmission cable tunnel to link Haymarket Bulk Supply Point in Thomas Street, Ultimo, to the new City North Substation at the corner of Sussex and Erskine Streets, Sydney
- construction of a suitable interface with the City Central Substation. This interface would be via a vertical shaft adjacent to the main tunnel alignment
- installation of five 132 kV electricity transmission feeders from the Haymarket Bulk Supply Point and the City Central Substation, to distribute electricity to the City North Substation
- construction of a permanent tunnel adit (entrance) and ventilation intake at the eastern end of Mary Ann Street (the ventilation exhaust would be integrated with the City North Substation).

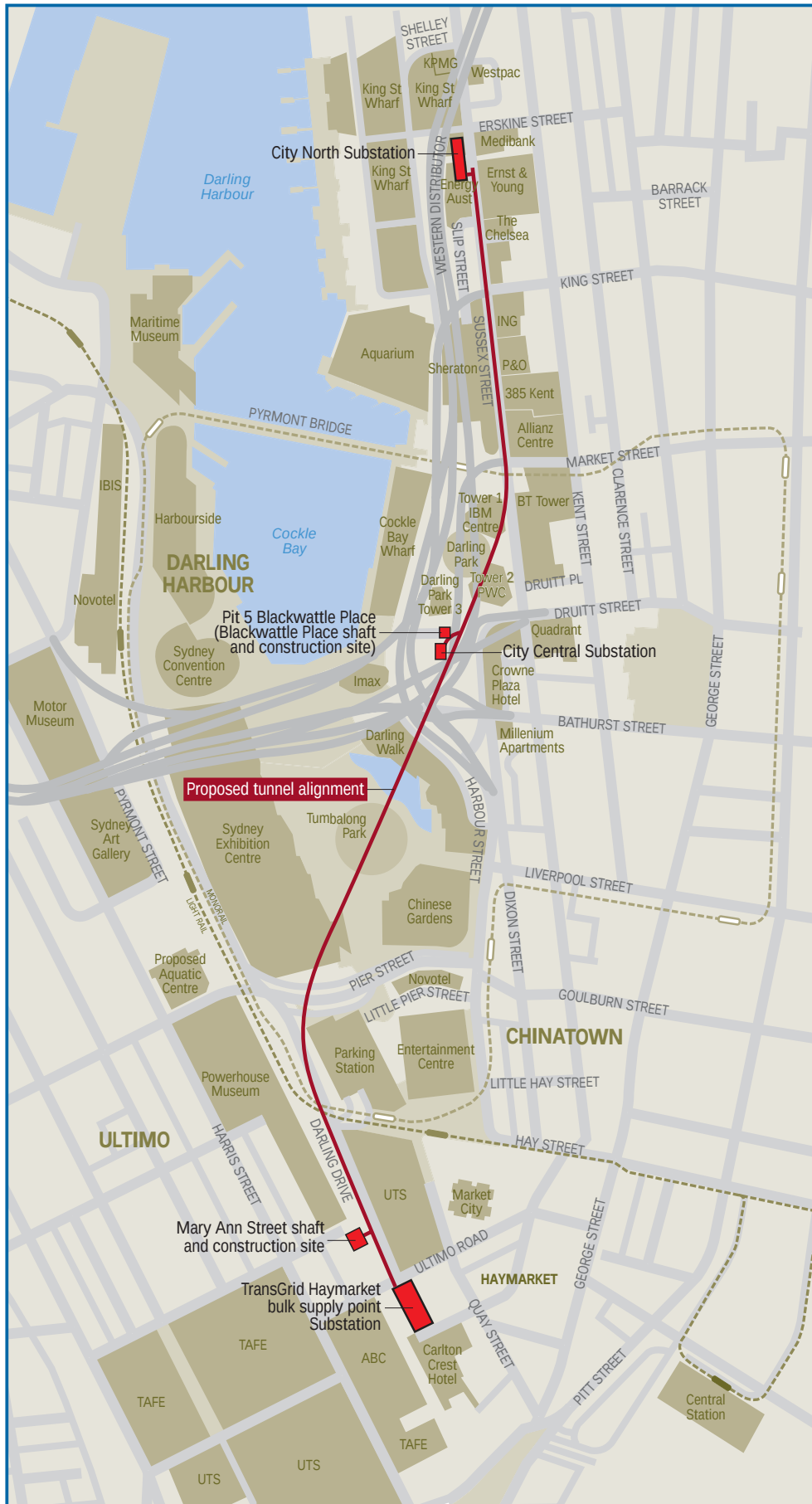


Figure 1.1 Proposed City West Cable Tunnel alignment

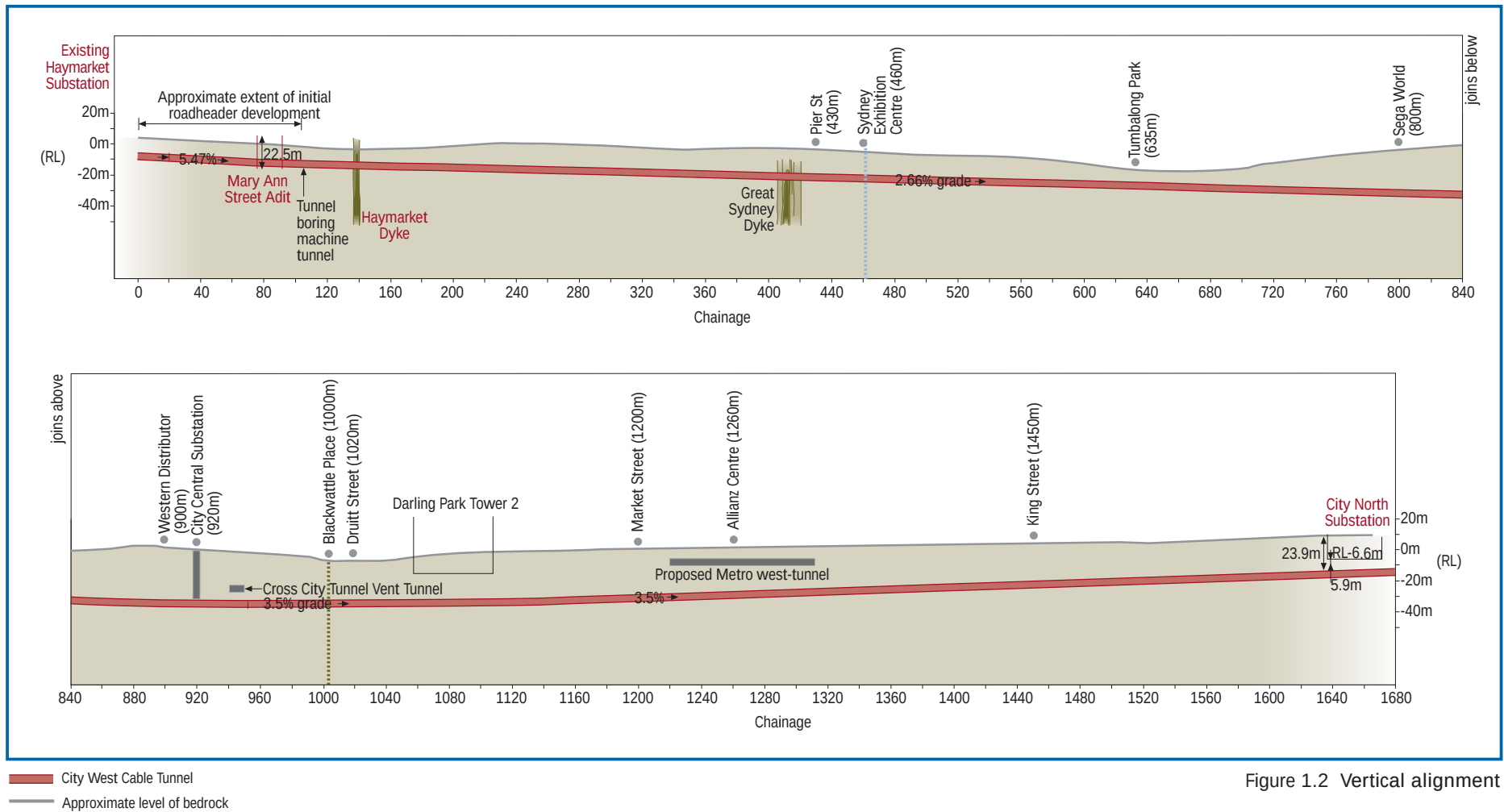


Figure 1.2 Vertical alignment

1.4 The approval process

1.4.1 Application of Part 3A of the Environmental Planning and Assessment Act 1979

The Minister for Planning has declared the proposed development a 'major project' under Part 3A of the Environmental Planning and Assessment Act 1979.

Part 3A applies to major NSW Government infrastructure projects previously classified as 'state significant', projects that were Part 5 Division 4 and other major or significant projects, plans or programmes of works. The proposed development falls within Part 3A as a result of the State Environmental Planning Policy (Major Projects) 2005 (the Major Projects SEPP), which provides:

development that, in the opinion of the Minister, is development of a kind:

(a) *that is described in Schedule 1 or 2,*

...

is declared to be a project to which Part 3A applies.

Clause 10 of Schedule 2 of the Major Projects SEPP states that development with a capital investment value of more than \$5 million within the Darling Harbour area identified on Map 9 in the Major Projects SEPP, is a project to which Part 3A applies. Parts of the proposed development would be constructed in this area, and the capital investment costs of those parts of the development within Darling Harbour would exceed \$5 million.

1.4.2 Approvals process

Part 3A of the *Environmental Planning and Assessment Act 1979* provides for the assessment and approval of major infrastructure projects in NSW. The Minister for Planning is the approval authority for all projects assessed under Part 3A.

EnergyAustralia submitted a 'Project Application' report and associated Preliminary Environmental Assessment in December 2005, seeking Environmental Assessment Requirements for the proposed development from the Minister for Planning. The Project Application report, which is distinct from the Environmental Assessment, outlines the proposed development and provides a preliminary assessment of its expected impacts.

Based on the Project Application, the Director-General of the Department of Planning issued EnergyAustralia with specific Environmental Assessment Requirements to be addressed as part of the detailed Environmental Assessment for the proposed development. The Environmental Assessment also included a Statement of Commitments identifying the various environmental management and mitigation measures incorporated into the proposed development to manage potential environmental impacts.

This Environmental Assessment was lodged with the Department of Planning for public exhibition.

The public exhibition period was from 24 May to 7 July 2006. A total of 11 public submissions were received. The responses to issues are set out in this Submissions Report. The proposed modifications to the proposed development and an assessment of the corresponding environmental impacts of these modifications, are also set out in a Preferred Project Report, which forms a chapter of the Submissions Report.

In accordance with the Act, the Submissions Report would be publicly available on the Department of Planning and EnergyAustralia websites for community information only (no further submissions would be received during this period).

The Department of Planning evaluates this Environmental Assessment, the Submissions Report, and any Preferred Project Report, giving consideration to submissions received during the exhibition period.

The Minister's approval and the Director-General's Assessment Report would be published on the Department of Planning website. The proposed planning approval process is shown in *Figure 1.3*.

1.4.3 Post-approval activities

Should the proposed development proceed, EnergyAustralia would:

- notify the local community of the decision to proceed by correspondence, newspaper notices and/or a newsletter
- notify affected property owners of the decision soon after the announcement to clarify the anticipated timing and staging of construction works
- consult with property owners about potential impacts on individual properties
- keep directly affected property owners informed of progress and key milestones during the design and construction process.

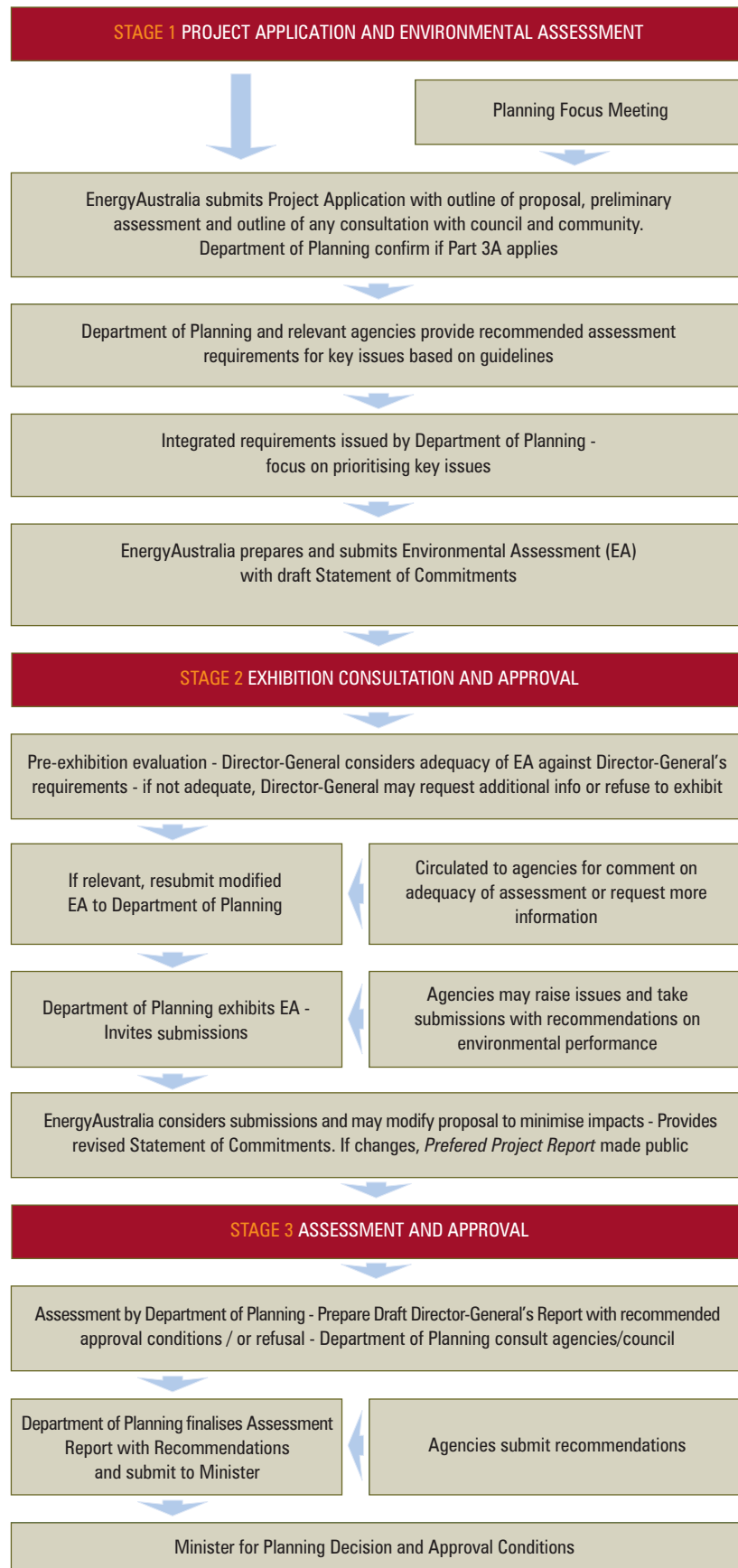


Figure 1.3 Planning approval process

1.4.4 Other approvals

Part 3A of the *Environmental Planning and Assessment Act 1979* removes the need for some separate approvals previously required for activities assessed under Part 4 or Part 5 of the Act. Part 3A consolidates relevant approval requirements and environmental management provisions into a single assessment process, where the Minister's approval incorporates other relevant approvals and permits that would otherwise be required.

Approval would be required under the *Crown Lands Act 1989*. Section 46 of this Act requires a licence to be obtained for the extraction of mineral substances.

1.5 Stakeholder consultation

The following consultation activities were carried out to inform community and stakeholders of the proposed development, and to receive and address issues and concerns raised.

Planning focus meetings

Two formal planning focus meetings were undertaken by EnergyAustralia and the assessment team on 10 December 2004 and on 27 July 2005, with key government agencies.

Planning consultation meeting

A planning consultation meeting was held on 15 February 2006 with key government agencies and other key stakeholders in response to changes to the planning system and approval process.

Stakeholder meetings

Individual meetings were held with stakeholders that are potentially directly affected by the proposed development.

Notification letters

Letters were sent to potentially affected stakeholders to notify them of the proposed development, provide them with information about the proposed development and offer them an opportunity to obtain further information.

Information package

An information package was prepared for the proposed development, including an information sheet, a drawing of the proposed development route and details of construction sites and permanent access shafts. These were disseminated to government, business, residents and community stakeholders.

Newsletter

In February 2006, a newsletter was distributed to the Mary Ann Street construction site neighbours, as well as residents and properties in the vicinity of Blackwattle Place (such as those in the Darling Park Towers). The purpose of the newsletter was to provide information to the potentially affected stakeholders about the proposed development.

Website and information contact number

Upon announcement of the proposed development via notice in the local press information relating to the design and assessment was made available to the public on EnergyAustralia's website, and via a link on the Department of Planning's website to EnergyAustralia's website. A community contact line was also established for general enquires.

Exhibition of the Environmental Assessment report

The Environmental Assessment report was placed on exhibition from 24 May 2006 to 7 July 2006 at the following locations:

- Department of Planning, Information Centre, 23-33 Bridge Street, Sydney
- Sydney Harbour Foreshore Authority, Level 6, 66 Harrington Street, The Rocks
- EnergyAustralia, Customer Service Centre, ground floor, 570 George Street Sydney
- Nature Conservation Council of NSW, Level 5, 362 Kent Street, Sydney
- City of Sydney Council – CBD Office, Level 2, Town Hall House, 456 Kent Street, Sydney.

The Environmental Assessment was available during the exhibition period, (and is currently available) on EnergyAustralia's website.

A total of 11 submissions were received from members of the community and government agency stakeholders.

1.6 Structure of the Submissions Report

The Submissions Report is set out in the following five chapters:

- Chapter 2 – Consideration of the Environmental Assessment - provides an analysis of and assessment of the Environmental Assessment prepared for the proposed development.
- Chapter 3 – Consideration of Submissions - provides an analysis, assessment, and response to the issues raised in Submissions made on the Environmental Assessment.
- Chapter 4 – Preferred project report – describes a proposed modification to the proposed development, and assesses the environmental effects of the modification.
- Chapter 5 – Conclusions – sets out the conclusions of the Submissions Report and the next steps in the approval process.

2. Consideration of the Environmental Assessment

2.1 Statutory compliance

A letter was sent to the Minister for Planning seeking confirmation that the project is one to which Part 3A applies. The Minister has subsequently formed the opinion that Part 3A applies.

An application for approval from the Minister for Planning was lodged with the Department of Planning on 21 December 2005, in accordance with Section 75E of the *Environmental Planning and Assessment Act 1979*. The application also sought Environmental Assessment Requirements for the preparation of an Environmental Assessment referred to in 1.4.2. The Environmental Assessment would be used to seek project approval.

The Environmental Assessment Requirements of the Director-General of the Department of Planning are set out in *Appendix A* of the Environmental Assessment. As part of these requirements, the Director-General identified relevant government agencies for consultation, in addition to consulting with the community.

Government agencies and authorities who were consulted and provided further requirements were:

- City of Sydney Council
- Sydney Harbour Foreshore Authority
- NSW Department of Environment and Conservation
- NSW Roads and Traffic Authority
- RailCorp
- State Transit Authority
- Sydney Water
- NSW Heritage Office
- Power House Museum
- NSW Fire Brigade
- State Chamber of Commerce
- Property Council of Australia
- Department of Energy Utilities and Sustainability
- TransGrid
- AGL, Telstra and any relevant utilities
- Any other relevant agencies and service providers/utilities.

EnergyAustralia has consulted with all of the stakeholders listed above, either prior to, during or following the exhibition of the Environmental Assessment. Records key stakeholder consultation activities are provided in *Appendices E* and *F* of the Environmental Assessment.

A checklist of the key issues to be addressed in the Environmental Assessment, as required by government agencies and authorities is provided in *Appendix D* of the Environmental Assessment.

The Environmental Assessment was lodged with the Department of Planning in April 2006 for an adequacy review, prior to exhibition, in accordance with Section 75H(1) of the *Environmental Planning and Assessment Act 1979*.

The Environmental Assessment was exhibited from 24 May to 7 July 2006, a period of more than 30 days, in accordance with Section 75H(3) of the *Environmental Planning and Assessment Act 1979*.

2.2 Description of the proposed development

The proposed development comprises:

- construction of an electricity transmission cable tunnel to link the Haymarket Bulk Supply Point in Thomas Street, Ultimo, to the new City North Substation at the corner of Sussex and Erskine Streets, Sydney
- construction of an interface with City Central Substation via a shaft adjacent to the main tunnel alignment
- installation of five electricity transmission feeders to transmit electricity to City North Substation
- construction of a permanent tunnel adit (entrance) and ventilation intake at the eastern end of Mary Ann Street. The ventilation exhaust would be integrated within the City North Substation building.

As identified in *Figure 1.1*, the cable tunnel would be aligned in a generally north–south direction beneath Darling Drive, Tumbalong Park, Darling Walk at Darling Harbour, and Sussex Street in the Sydney CBD. The tunnel would be approximately 1.7 kilometres long and at a depth ranging from approximately 10 to 40 metres below the ground surface (see *Figure 1.2*).

Predominantly, two different construction methods are proposed for different sections of the tunnel:

- excavation using a shielded tunnel boring machine (TBM) for the majority of the length of the tunnel
- excavation using a roadheader (rock-grinding machine) for the underground cavern at the Mary Ann Street shaft (see *Figure 2.3*) and the tunnel back to the Haymarket Bulk Supply Point.

Typical tunnel cross-sections for these construction methods are provided in *Figures 2.1* and *2.2*. The bored tunnel would be approximately four metres in diameter and circular in shape. The bored tunnel would be tanked (lined) with precast concrete segments to provide structural support and limit the ingress of groundwater to provided an effectively dry tunnel. The concrete segments would be installed within the tail end of a shielded TBM. The roadheader tunnel would have a ‘sugar loaf’ shape and be lined with cast in situ reinforced concrete and waterproof membrane to limit the ingress of groundwater.

The tunnel and interfaces would be constructed mainly via the Mary Ann Street shaft and construction site (*Figure 2.3*), with a second construction site for construction of the connection to City Central Substation. Following consideration of construction impacts, this connection is now proposed from within the City Central Substation. Details of this modification to the proposed development are provided in Section 4 of this report.

The cable tunnel would interface with the Haymarket Bulk Supply Point basement (approximately 10 metres below ground level) and the City North Substation sub-basement (approximately 15 metres below ground level). A permanent tunnel adit (entrance) and ventilation intake would be constructed at the eastern end of Mary Ann Street. The ventilation exhaust would be integrated within the City North Substation building.

Further details of the proposed development design, operation and construction are provided in the following Sections.

2.3 Options considered

2.3.1 Cable route options

EnergyAustralia prepared an assessment of feeder route options for City North Substation. Eight feeder route options were developed. Options 1 to 7 proposed installation of the cables in new and existing ductlines in public roads, with some options using sections of tunnel. These options would involve trench excavations in public roads in the Sydney CBD, including Day Street, Sussex Street, Darling Drive, Kent Street and the Western Distributor.

Option 8 proposed the use of a full length cable tunnel to link Haymarket Bulk Supply Point, City Central Substation and City North Substation, with a minimum of surface work.

EnergyAustralia also investigated alternative routes using the combination of horizontal directional drill technology and the use of new and existing ductlines.

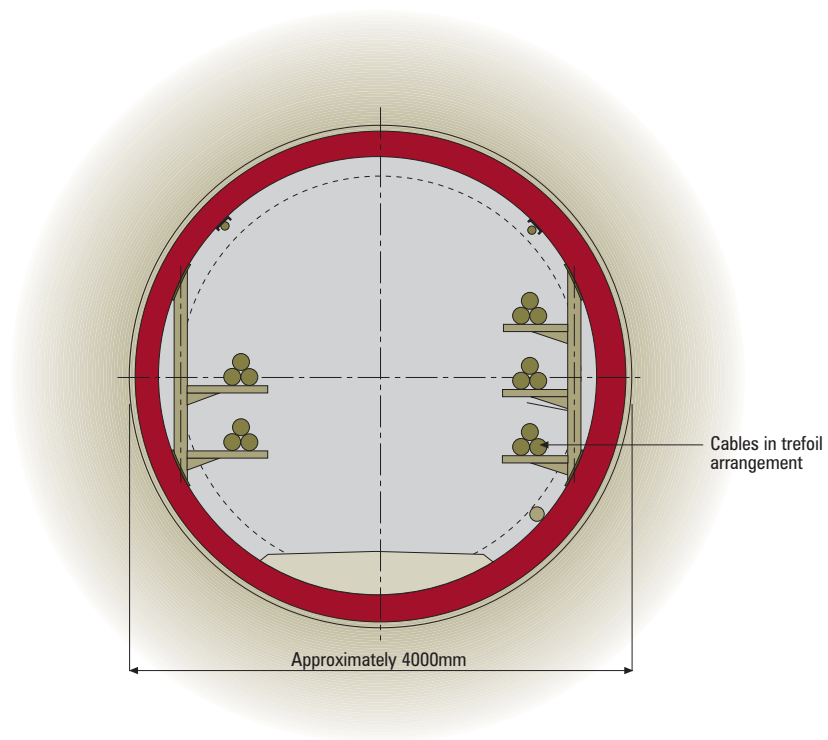


Figure 2.1 Typical TBM tunnel cross-section

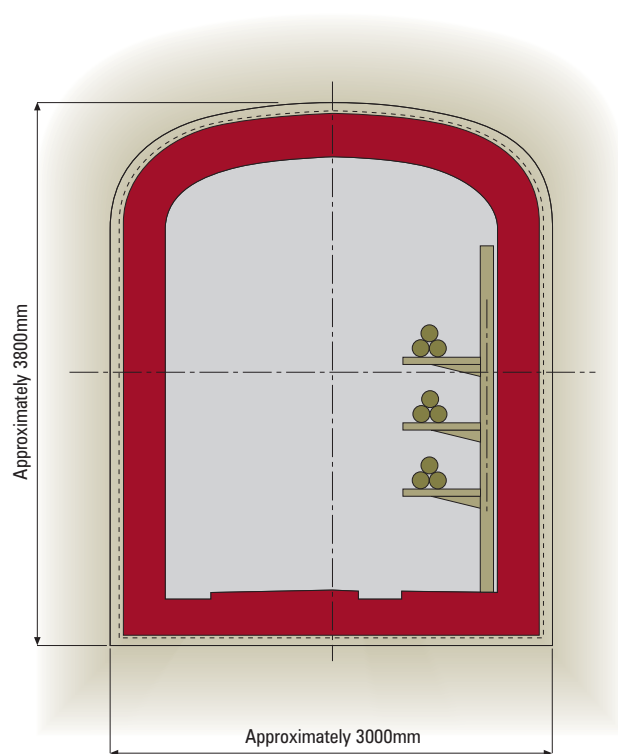


Figure 2.2 Typical roadheader tunnel cross-section

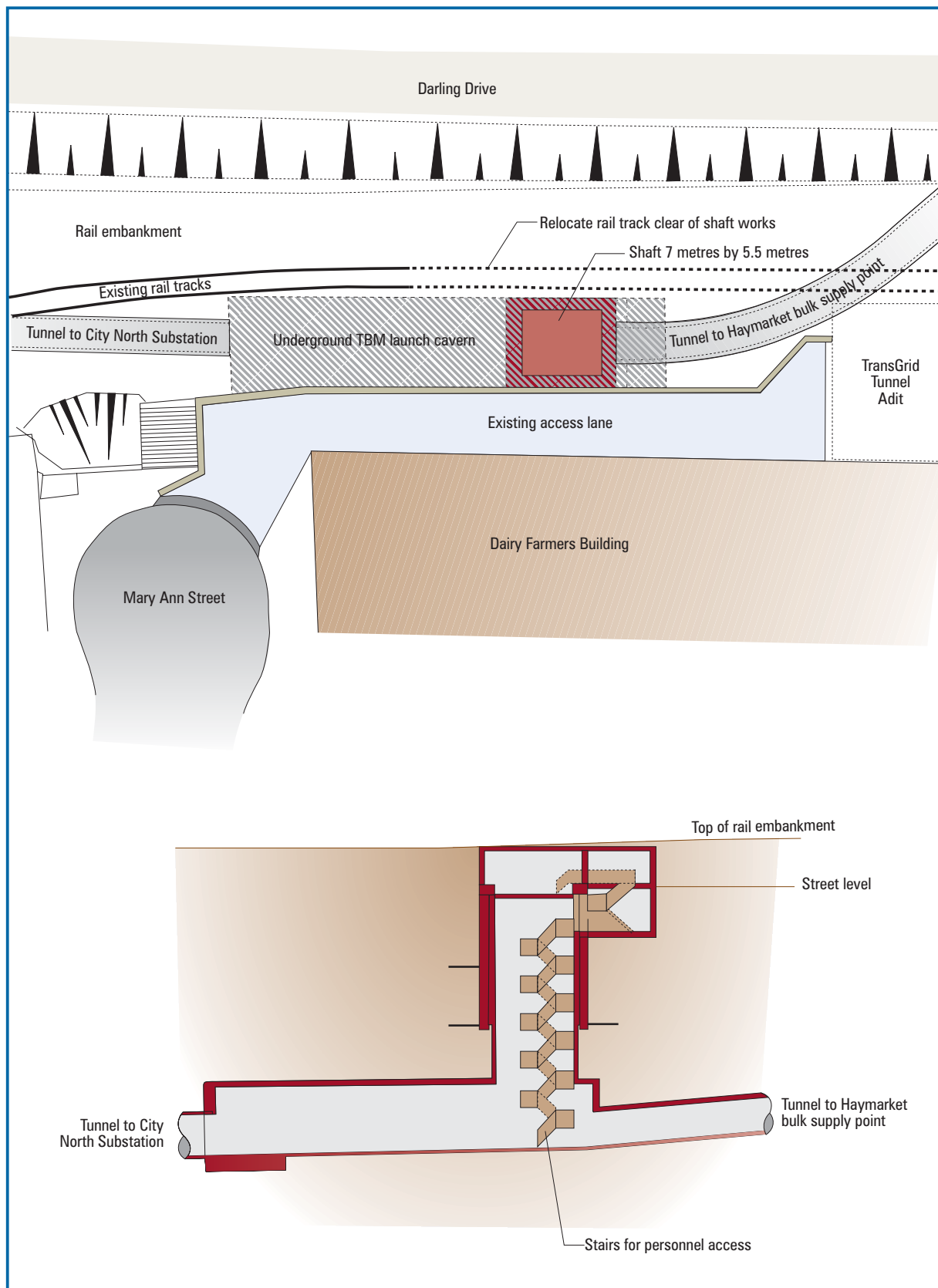


Figure 2.3 Mary Ann Street shaft

It was concluded that Option 8 (the full length cable tunnel option) had substantial potential advantages over the other options. Specifically, the cable tunnel option would:

- meet EnergyAustralia's project timeframe
- provide a cost effective solution
- provide a technically sound and reliable option providing capacity for the predicted energy demands of the northern CBD
- avoid (relative to the other options) significant disruption to the road network, pedestrian network, business and social environs of the Sydney CBD.

In view of the potential advantages of a full length cable tunnel, Option 8 (the cable tunnel) was selected as the preferred option.

2.3.2 Mary Ann Street construction site options

Two options were considered for the proposed main construction site located at the eastern end of Mary Ann Street, as discussed below.

Option A – Rail embankment - The first option was to utilise the rail embankment at the eastern end of Mary Ann Street.

Option B – The 'Dairy Farmers building' - This option would involve the use of the Dairy Farmers distribution centre at the end of Mary Ann Street (with part use of the rail embankment).

The location of construction equipment and facilities within an existing building would significantly reduce the potential for adverse visual, noise, vibration, access and parking effects of the construction site on the local community. The building would also allow for one-way traffic flow through the construction site. This would avoid the need for manoeuvring and reduce the incidence of truck reversing alarms. The use of the Dairy Farmers building was, therefore, selected as the preferred option for the Mary Ann Street construction site.

2.3.3 City Central Substation connection options

Four options were considered for the connection of City Central Substation to the cable tunnel:

- Option 1 — shaft at Day Street (Day Street construction site)
- Option 2 — shaft and tunnel at vault 22 (vault 22 construction site)
- Option 3 — horizontal directional drill via vault 22 (vault 22 construction site)
- Option 4 — Blackwattle Place shaft (Blackwattle Place construction site).

Technical and engineering feasibility investigations of these options identified that Option 4 (Blackwattle Place shaft) would have a number of advantages over the other options. These advantages can be summarised as follows:

- Blackwattle Place is a dead-end street, and as such the potential for adverse effects from construction traffic or access is minimised.
- There are no sensitive receivers (residential land uses or hotels) in the immediate vicinity of the Blackwattle Place construction site.
- No tunnelling would be required.
- The interface works between the shaft and main tunnel could be concentrated at a specific location, thus minimising costs and construction time.

Option 4 — Blackwattle Place shaft was, therefore, selected as the preferred option for the City Central Substation connection.

2.4 Overview of environmental issues

2.4.1 Land use and property

The proposed development is located within the City Centre zone of the City of Sydney local environmental plan, and is consistent with the objectives of this zone.

The route of the cable tunnel has been refined to avoid potential developments identified during consultation for the proposed development, such as the MetroWest rail proposal.

2.4.2 Effect on building basements and foundations

The distance between the tunnel and building basements and foundations along the tunnel route was calculated to identify whether there was a potential for interaction between the tunnel and the buildings. The calculations identified that there were four building basements and/or footings that could be within 15 metres of the proposed tunnel; Darling Park 1 and 2, Pier Street Car Park and the Exhibition Centre. The potential interactions between these buildings and the tunnel would be further addressed as part of an on-going investigation, monitoring and mitigation measures.

2.4.3 Property acquisition

EnergyAustralia would acquire an underground stratum easement for the tunnel, to protect the tunnel from future development and to allow EnergyAustralia to access, maintain the cables and the tunnel once constructed. The easement would be acquired in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* and would include an appropriate 'buffer' around the tunnel.

2.4.4 Settlement and other direct interactions

Groundwater drawdown induced settlement refers to ground settlement within the upper soil profile that can occur as a result of lowering of surrounding groundwater levels.

Stress relaxation induced settlement can occur when a hollow space, such as the proposed tunnel, is created within a rock mass and stresses in the rock cause the rock mass to move.

The proposed tunnel would have a pre-cast segmental concrete lining installed immediately behind the tunnel boring machine as it progresses, and a cast in situ liner in the roadheader section. This would minimise short and long-term impacts on groundwater systems, and movement in the rock mass. The proposed excavation and support measures would be designed to limit ground surface settlements adjacent to buildings, structures and services.

2.4.5 Noise and vibration

A number of varying source emission scenarios were considered with impact potential (and loss of residential amenity/noise intrusion) compared with site-specific noise design criteria derived in accordance with NSW Department of Environment and Conservation guidelines.

Construction noise-planning criteria may be exceeded at the closest residential receivers if suitable noise-control measures or construction management practices are not implemented. The construction activities at the proposed Mary Ann Street works site have the greatest potential for construction noise impacts. A number of construction noise management options are proposed to address this issue.

No operational noise issues are anticipated. Acoustic design of the tunnel ventilation system to meet the operational noise criteria would ensure the existing acoustic amenity of the surrounding area is maintained.

No sleep disturbance or construction-related road traffic noise impacts are anticipated on the surrounding road network.

Vibration impacts with low probability of adverse comment are expected at separation distances of 20 metres from rock breaking and 15 metres from tunnelling works from residential receptors during the day time period. Tunnelling works within 15 metres of residences during the night time period may cause higher levels of adverse comments. This is unlikely to be an issue as tunnelling works are further than 15 metres from areas where human comfort would be affected.

Rock breaking activities would pose minimal risk of structural damage at distances greater than 10 metres for residential and commercial buildings and at distances greater than 15 metres from sensitive (heritage) structures. Rock breaking is not proposed during the night time. During the day time, rock breaking would result in vibration related annoyance within distances of 20 metres of the shaft. There are no residential or commercial buildings within 20 metres of the proposed shaft at Mary Ann Street and therefore vibration related annoyance is not expected.

Regenerated noise impacts with the potential to cause annoyance may occur at residential locations within 30 metres of the proposed tunnel route during construction.

Residential buildings within 30 metres of the initial day time surface rock breaking works at Mary Ann Street surface works would be monitored. Residential buildings including hotels and services apartment buildings, located within 10 metres of the tunnel works would be monitored during night time construction. If required, work practices would be modified to ensure compliance with project and regulatory requirements. Assessment of regenerated noise within sleeping areas would also need to be made.

2.4.6 Heritage

As most of the tunnelling would be conducted through bedrock, the majority of the proposed works are unlikely to uncover archaeological structural features or cultural deposits, or affect any features that do exist. There is, however, high potential for discovery of archaeological structural features and cultural deposits in two main areas of the surface works:

- the Blackwattle Place shaft and construction site
- the Mary Ann Street shaft and construction site.

There is potential for some disturbance of or removal of existing archaeological features in these areas during the construction. In order to minimise impacts, the proposed tunnelling would be undertaken in a manner that ensures that the research potential of these remains is realised through appropriate recording and/or physical investigation including monitoring by an archaeologist during initial excavation at the above two sites.

The proposed development is unlikely to result in settlement related effects on listed heritage buildings and other heritage listed items along the tunnel route. Predictive modelling of construction vibration effects on buildings along the tunnel route concluded that the proposed development is unlikely to damage any heritage structures.

2.4.7 Spoil management

The excavation of the Mary Ann Street and Blackwattle Place shafts and the excavation of the tunnel would generate approximately 40,000 cubic metres of spoil over a period of approximately eight months. The vast majority of the spoil would be mixed crushed rock, varying from clay and sand to lumps of rock with an approximate diameter of 150 millimetres.

The tunnel spoil would be loaded into trucks at the Mary Ann Street construction site and transported off site for re-use or storage until there is demand for re-use of the material. A small volume of material from the Blackwattle Place shaft would be loaded and transported directly from Blackwattle Place.

Material excavated from the upper layers of the shafts at Mary Ann Street and Blackwattle Place would be tested to determine the presence of contaminants. Material from Blackwattle Place would be tested for acid sulphate soils. If acid sulphate or contaminated soils are detected, these would be segregated and treated and disposed of in accordance with relevant legislation, regulations and guidelines.

A Spoil Management Plan would be developed and implemented by the construction contractor to detail the methods of handling, transporting and storage / re-use of tunnel spoil.

2.4.8 Air quality

Dust control measures would be implemented at the Mary Ann Street and Blackwattle Place construction sites to prevent an adverse impact on the ambient air quality.

The operation of the tunnel is unlikely to result in any effect on air quality.

An air quality management plan would be developed by the construction contractor to set out in detail the legislation, guidelines, criteria, dust control measures, reporting and corrective actions to be implemented for the two construction sites throughout the duration of the construction works.

2.4.9 Surface and ground water management

During construction, stormwater runoff, surface water, groundwater ingress and water used in the tunnelling works would be pumped from the tunnel to a water treatment plant at the Mary Ann Street construction site for treatment and subsequent re-use or disposal via the stormwater system to Darling Harbour. The water would be treated to meet relevant water quality criteria prior to discharge into the stormwater system. A soil and water management plan would be developed and implemented by the construction contractor to set out in detail the measures to manage surface and groundwater issues during construction.

The tunnel lining would be designed to prevent, as much as is practicable, the ingress of groundwater into the tunnel. No lining would be completely water proof, and it is anticipated that during operation, approximately 6,000 litres of water would accumulate in the tunnel each day. The groundwater ingress would drain to a sump at the lowest point in the tunnel (near the Blackwattle Place shaft) and would be pumped to the Southern CBD tunnel sump. The water would then be pumped to an existing water treatment plant at the Campbell Street Substation for treatment (to meet the required water quality criteria) and discharge to the stormwater system.

2.4.10 Health, safety and risk

The construction and commissioning of the cable tunnel would not interfere with the existing power supply system in the Sydney CBD. The cable tunnel would be constructed at significant depths below existing utility services.

The construction sites are located away from busy areas, and would be fenced and made secure against unauthorised access. An occupational health and safety plan would be developed to ensure the construction works are carried out safely.

In response to an absence of scientific certainty regarding electric and magnetic fields, EnergyAustralia has adopted a policy of prudent avoidance in the design and siting of its new transmission facilities. This policy was also applied to this proposed development. Electric fields associated with the operation of the proposed development would be negligible. Prudent avoidance measures to minimise exposure to magnetic fields have been applied to this proposed development through location of the cable tunnel at a distance of 10 to 40 metres below the surface of the ground. Magnetic fields are predicted to be well below National Health and Medical Research Council good practice guideline levels.

The cable tunnel would be located at significant depth below ground level and is unlikely to be damaged by excavations or other small scale developments.

During operation, the tunnel would be secured to prevent unauthorised access.

3. Consideration of submissions

3.1 Overview

The Department of Planning received 11 submissions from the exhibition of the Environmental Assessment. These consisted of two letters from individuals, six submissions from government agencies, and three letters or emails from private companies. Copies of the submissions from Government Agencies are provided in *Appendix A*.

EnergyAustralia's responses to the issues raised in the submissions received form the basis of this section.

3.2 Analysis of submissions and issues raised

Upon receipt, each submission was assigned a unique number and analysed to determine the key issues it raised (these are listed in *Table 3.1*).

Each of the submissions received were analysed to create a list of specific or unique issues. These issues were then analysed and a response prepared. A list of specific issues raised is provided in *Table 3.2*. EnergyAustralia's response to each issue is provided in Section 3.3.

3.2.1 List of issues

A breakdown of the key issues raised by the 11 submissions is displayed in *Table 3.1*. Each number represents the number of submissions that raised the key issue at least once.

Table 3.1 Key issue count

Key Issue	Number of submissions ¹
Construction/general amenity (noise, air quality)	5
Operation/ general amenity (including landscaping/ street trees)	4
Consultation/ Community Liaison Group	3
Traffic and parking	5
Property and infrastructure impacts:	7
Construction impacts – Cross City Tunnel	2
Monitoring of construction and operation	2
Compensation	2
Archaeology/ heritage	2
Darling Harbour Precinct impacts	1
Support proposal	1
Groundwater/ drainage	1
Aboriginal heritage	1

Table 3.2 Analysis of submissions and issues raised

Number	Respondent	Issues raised	Where addressed in the Environmental Assessment	Where addressed in the Submissions Report
1	Resident submission	a. Concern regarding construction fatigue (Noise). Request that construction be timed to not occur on Sundays or public holidays.	4.3.13	3.3.1
		b. Request for noise mitigation strategies if construction is occurring 24 hours per day. This might include not using reversing 'beepers' on vehicles, quiet communication methods etc.	Chapter 11 – Generally	3.3.1
		c. Request for community consultation process as part of approval conditions.	1.4, Appendix B	S 3.3.1
		d. Request that EnergyAustralia not park or set-up worksites in inappropriate spaces (such local green spaces).	4.3, and S 9.5.6	S 3.3.1
2	Resident submission	a. Concern regarding construction fatigue (noise). Request that residents are consulted and works timetabled to minimise exposure of residential properties.	4.3.13	3.3.2
		b. Request for use of noise mitigation strategies where possible, including not using reversing beepers after midnight and before 7am.	Chapter 11 – Generally	3.3.2
		c. Request for routine community consultation process to be incorporated into the approval.	1.4, Appendix B	3.3.2
		d. Request that the grassed area in Day Street outside Millennium Towers Apartments (Corner Day and Bathurst Streets) not be used as a worksite or EnvironmentAustralia staff/ contractor parking area.	4.3, and S 9.5.6	3.3.2
3	Roads and Traffic Authority	a. RTA is currently negotiating with CrossCity Motorway (owner and operator of the Cross City Tunnel) to provide a 5 metre lease boundary for the Cross City Tunnel below the floor of the ventilation shaft. Discussions are underway to establish an easement/property agreement. The City West Cable Tunnel would pass within 3.5 metres of the floor of the Cross City Tunnel ventilation shaft and would therefore encroach on the proposed lease.	4.2.2	3.3.3
		b. Construction of City West Cable Tunnel may have impacts on operation and integrity of the Cross City Tunnel. Requests real time monitoring system is employed.	8.6.1, 8.7.2	3.3.3
		c. RTA recommends establishment of a multi-party agreement on proposed easement and tunnel operation between RTA, CrossCity Motorway and EnergyAustralia during construction.	Not applicable	3.3.3

Number	Respondent	Issues raised	Where addressed in the Environmental Assessment	Where addressed in the Submissions Report
4	RailCorp	a. The proposed tunnel and shafts may impact on existing and proposed rail infrastructure and existing power cables. Request for surveys which indicate proximity to existing and proposed infrastructure to establish potential areas of conflict.	8.6.3	3.3.4
5	University of Technology Sydney	a. Proposed tunnel alignment is located within 12.8 metres of the basement and 5 metres of the building footings of UTS Markets 5 Building (identified as 41 in the Environmental Assessment). Request for tunnel alignment to be relocated at least 20 metres away from the basement or footings.	8.7.1	3.3.5
		b. UTS Building Markets 5 has air intakes which face the proposed Mary Ann Street construction site. Request for implementation of appropriate controls in the CEMP to restrict dust emissions.	13.7	3.3.5
		c. The Environmental Assessment identifies minimal traffic impacts around the UTS City Campus. Request for monitoring of traffic environment during construction to maintain acceptable traffic conditions.	Chapter 9 generally	3.3.5
6	CrossCity Motorway	a. Proposed tunnel alignment would pass 3.5 metres below the Cross City Tunnel Ventilation Tunnel. Clarification is sought on EnergyAustralia's intention to acquire any part of the stratum leased property rights and requires	4.2.2	3.3.6
		b. CrossCity Motorway supports RTA's submission (dated 6/7/06) that EnergyAustralia should be required to negotiate an agreement for property rights and compensation.	5.3.2 and 8.6.5 Generally	3.3.6
		c. Request that detailed design of the proposed tunnel in the vicinity of Cross City Tunnel be provided for comment. The Environmental Assessment does not contain details of the zone of influence.	Not applicable	3.3.6
		d. Request that the construction method statement specifically mentions work in proximity of Cross City Tunnel and be submitted to the CrossCity Motorway for comment. Specific concerns include whether the tunnel requires closing, possible impact on the integrity of the Ventilation Tunnel.	Not applicable	3.3.6
		e. Request for real-time vibration monitoring, settlement monitoring and monthly updates on the tunnel's progress	8.7.1	3.3.6
		f. If tunnel is to be closed, request that Cross City Tunnel and RTA be indemnified for loss of toll revenue, costs associated with monitoring of design and construction of the tunnel, and fines if air emissions exceed applicable limits.	Not applicable	3.3.6
			Not applicable	

Number	Respondent	Issues raised	Where addressed in the Environmental Assessment	Where addressed in the Submissions Report
		g. Planned vehicular movements do not utilise the Cross City Tunnel. This may contradict the State Government's objective of limiting traffic in the CBD. Request that the Traffic Management Plan considers traffic utilising the Cross City Tunnel.		3.3.6
7	Department of Planning – Heritage Office	a. Request that any historical relics be managed in accordance with measures and strategies identified in the Environmental Assessment.	2.8 of Appendix B	3.3.7
		b. All historical relics revealed by works be assessed, recorded and catalogued in accordance with best practice and a qualified archaeologist be present when relics are 'disturbed'.	11.5	3.3.7
		c. A Cultural Heritage and Archaeological Management Sub-Plan is incorporated within the Construction Environmental Management Plan.	11.5	3.3.7
8	Sydney Harbour Foreshore Authority	a. Demonstrate no adverse impacts on the Darling Harbour Precinct in terms of amenity, power supply, noise and vibration. Specific reference is made to the Sydney Convention and the Entertainment Centre	Chapter 8 generally	3.3.8
		b. Request that ventilation outlet for the tunnel be sited to minimise visual impacts and maintain amenity.	4.2.6	3.3.8
		c. Demonstrate no adverse impacts on the Darling Walk precinct, and particularly the proposed underground car park, including associated structural supports.	Chapter 8 generally	3.3.8
		d. Request that approval conditions be introduced to manage impacts on residents and businesses in Pyrmont and Ultimo in relation to dust, noise, hours of operations and general construction issues.	Appendix B	3.3.8
		e. Request for a landscape strategy covering the Ultimo Pedestrian Network including schedule of finishes, expressed ground level and access to the EnergyAustralia site following completion of works.	Not applicable	3.3.8
		f. Confirmation that the heritage drain (currently in storage) for Mary Ann Street would be reinstated at the Mary Ann Street cul-de-sac following construction at EnergyAustralia's expense	Not applicable	3.3.8
		g. Seek confirmation that groundwater seepage would be used as 'grey water' for irrigation purposes instead of being discharged into Darling Harbour.	Not applicable	3.3.8

Number	Respondent	Issues raised	Where addressed in the Environmental Assessment	Where addressed in the Submissions Report
9	Department of Environment and Conservation	a. Request for more specific detailed assessment of Aboriginal Cultural Heritage issues, possible impacts and mitigation measures.	Chapter 11	3.3.9
10	City of Sydney Council	a. Request that the proposed Construction Traffic Management Plan be referred to the City of Sydney for comment and approval. This should occur a minimum of 90 days before construction, and include spoil disposal routes, program of works, costs of traffic management works, and road closures.	9.6	3.3.10
		b. Other issues which should be clarified include:		
		▶ Drainage and water treatment	Chapter 8 generally	3.3.10
		▶ Significant street trees		
		▶ Footpath remediation works		
		c. Request that the effect of any underground strata acquisition be clarified in relation to Council's assets.	Chapter 8 generally	3.3.10
		d. Request for further information on the Community Liaison Group and Council's involvement in this group.	Appendix B	3.3.10
		e. A Construction Noise Environmental Management Plan should be submitted to Council. Monitoring is encouraged throughout the life of the project.	Chapter 16 generally	3.3.10
11	Darling Park Office Complex	a. Concern raised in relation to the size and depth of the proposed tunnel, the proximity of the tunnel, and potential settlement issues.	Chapter 8 generally	3.3.11
		b. Request to review the structural analysis to ensure the soundness of the proposal.	Not applicable	

3.3 Responses to issues raised in submissions

3.3.1 No 1 Resident submission

a. Concern regarding construction fatigue (Noise). Request that construction be timed to not occur on Sundays or public holidays.

Above ground construction activities are intended to be scheduled between Monday to Friday, 7.00 am to 6.00 pm, and Saturdays, 8.00 am to 1.00 pm. No works are currently proposed on Sundays or Public holidays, however, oversize trucks and certain other equipment and material deliveries may need to be made outside of standard construction hours from time to time. Local residents would be notified prior to any planned construction activities outside normal construction times.

b. Request for noise mitigation strategies if construction is occurring 24 hours per day. This might include not using reversing 'beepers' on vehicles, quiet communication methods etc.

In general, only underground construction works would be carried out on a continuous (24 hour per day) basis. The underground works are unlikely to be audible at street level. Spoil stockpiling or other surface works would be contained within the acoustic enclosure and the Dairy Farmers building.

Overnight construction works may not require the use of heavy machinery and reversing beepers. However, if heavy machinery is required, occupational health and safety laws must be complied with, and reversing alarms would need to be used.

Quiet communication methods would be encouraged to minimise noise impacts.

All these measures would be detailed in a Noise and Environmental Management Plan as part of the Construction Environmental Management Plan.

c. Request for community consultation process as part of approval conditions.

EnergyAustralia is committed to undertake consultation with relevant stakeholders and the Community Liaison Group (refer *Section 1.4* and *Attachment A* of *Appendix B – Statement of Commitments* of the Environmental Assessment). This Group would be formed prior to the commencement of substantial construction to discuss methods of minimising the impacts of the proposed works on the local community and businesses during the construction stage.

The conditions of approval are likely to include a requirement that the Statement of Commitments made by EnergyAustralia (in Appendix B of the Environmental Assessment) be adhered to.

Further, interested members of the community would be kept informed of the project at regular intervals via relevant local newspapers, leaflets, community notice boards etc. A project Internet website would be established prior to the commencement of construction and would be maintained for 12 months after commencement of operation. This Internet website would contain monthly updates of work progress and consultation activities.

d. Request that EnergyAustralia not park or set-up worksites in inappropriate spaces (such local green spaces).

The Mary Ann Street construction site would be set up within the boundaries of the "Dairy Farmer's Building. The Blackwattle Place construction site would be set up within City Central Substation. EnergyAustralia does not propose to set up work sites in public areas such as green spaces.

Provision would be made within the Traffic Management Plan for parking of contractor vehicles and establishment of construction zones. Apart from short-stay vehicles (for example, a concrete mixer), public parking areas would not be utilised without prior approval from the relevant roads authority and only under the supervision of the contractor. Further, all proposed traffic control measures would be installed and removed in accordance with procedures outlined in the Roads and Traffic Authority's Traffic Control at Work Sites Manual (2003).

Construction personnel would be instructed to avoid using on-street parking in the vicinity of the Mary Ann Street site, to minimise the potential to affect existing on-street parking. It is not expected that the works at the Mary Ann Street construction site would necessitate the temporary closure or possession of any parking spaces.

3.3.2 No 2 Resident submission

a. Concern regarding construction fatigue (Noise). Request that construction be timed to not occur on Sundays or public holidays.

Refer to response 3.3.1 a above.

b. Request for use of noise mitigation strategies where possible, including not using reversing beepers after midnight and before 7am.

Refer to response 3.3.1 b above.

c. Request for routine community consultation process to be incorporated into the approval.

Refer to response 3.3.1 c above.

d. Request that the grassed area in Day Street outside Millennium Towers Apartments (Corner Day and Bathurst Streets) not be used as a worksite or EnvironmentAustralia staff/ contractor parking area.

This area would not be used for contractor parking or construction activities. Construction activities in this locality would be located within the City Central Substation (refer Section 4).

3.3.3 No 3 Roads and Traffic Authority

- a. **Roads and Traffic Authority (RTA) is currently negotiating with the CrossCity Motorway (owner and operator of the Cross City Tunnel) to provide a 5 metre lease boundary for Cross City Tunnel below the floor of the ventilation shaft. Discussions are underway to establish an easement/property agreement. The City West Cable Tunnel would pass within 3.5 metres of the floor of the Cross City Tunnel ventilation shaft and would therefore encroach on the proposed lease.**

EnergyAustralia would continue to liaise with the RTA and the CrossCity Motorway to arrange a suitable property arrangement between the three parties.

- b. **Construction of the City West Cable Tunnel may have impacts on operation and integrity of the Cross City Tunnel. A real time monitoring system should be employed.**

EnergyAustralia proposes to monitor vibration and ground movement at sensitive locations including, if necessary, inside the Cross City Tunnel ventilation tunnel, where the City West Cable Tunnel interfaces at a 3.5 metre separation. It is confirmed that ground movement and vibration levels would be monitored within a zone of influence to the Cross City Tunnel ventilation tunnel.

- c. **RTA recommends establishment of a multi-party agreement on proposed easement and tunnel operation between RTA, CrossCity Motorway and EnergyAustralia during construction.**

EnergyAustralia would continue to liaise with all parties concerned in relation to the impacts of the construction excavation works and operational methodology. Further, a tri-partite agreement would be considered in light of the fact that the Cross City Tunnel easement would have to be given by the RTA to CrossCity Motorway.

3.3.4 No 4 RailCorp

- a. **The proposed tunnel and shafts may impact on existing and proposed rail infrastructure and existing power cables. Request for surveys which indicate proximity to existing and proposed infrastructure to establish potential areas of conflict.**

No impacts are expected on existing rail infrastructure. EnergyAustralia has carried out surveys and has had recent discussions with RailCorp in relation to the 33kV RailCorp power cables and infrastructure in proximity to the location of the Mary Ann Street shaft. The tunnel would be in rock, and remote from existing rail infrastructure. A Safety Interface Agreement (under the Rail Safety Act 2002) would be adhered to during the construction and operational phase of the tunnel works.

The proposed development would allow for the design and construction of RailCorp's proposed MetroWest rail tunnel considered under *SEPP63 – Major Transport Projects*, which may be constructed below Sussex Street after the cable tunnel has been completed. The current alignment of the MetroWest rail tunnel would deviate eastwards from Sussex Street towards Wynyard Railway Station at around Market Street. The horizontal and vertical alignment of the proposed development takes account of this possible future tunnel and would be separated from it by a minimum of 3 metres. Presently, the design includes for a

separation of approximately 11 metres at its closest point. However, further liaison would take place with RailCorp in terms of EnergyAustralia providing details to RailCorp, through the various stages of design (i.e. concept design, final design and as-built details).

3.3.5 No 5 University of Technology Sydney

- a. Proposed tunnel alignment is located within 12.8 metres of the basement and 5 metres of the building footings of UTS Markets 5 Building (identified as 41 in the Environmental Assessment). Request for tunnel alignment to be relocated at least 20 metres away from the basement or footings.**

The horizontal alignment of the tunnel is constrained by the connection to the Haymarket Bulk Supply Point; two existing cable tunnels located either side of the proposed tunnel, and the location of the Mary Ann Street construction site. As such, a realignment of the tunnel would not be practicable.

The wall of the proposed tunnel would be approximately 2 metres from the corner (the closest point) of the property boundary, and approximately 4 metres from the edge of the building and its footings. The majority of the property would be horizontally further away from the UTS Market 5 Building. The roof of the tunnel would be approximately 3 metres below the depth of the footings of the building.

EnergyAustralia and its construction contractor would carry out detailed assessment of the risk of structural effects on the UTS Markets 5 building. Pre-condition surveys, settlement, noise, and vibration monitoring, and post condition surveys would be carried out. Studies undertaken to date indicate that it is highly unlikely that construction works would adversely affect the building structure. The proposed surveys would be used to verify these studies and for due diligence purposes. Corrective measures would be investigated if required.

- b. UTS Building Markets 5 has air intakes which face the proposed Mary Ann Street construction site. Request for implementation of appropriate controls in the CEMP to restrict dust emissions.**

An Air Quality Management Subplan would be developed and implemented for the proposed development to control dust emissions from the construction works. In general, the following measures would be implemented to limit dust emissions:

- Dust generation would be minimised at the source by the use of mitigation measures such as water sprays at the excavation face, when undertaking rock-drilling, or above ground at spoil storage and loading areas. Application rates would be related to atmospheric conditions and the intensity of construction operations.
- A wheel wash would be used at Mary Ann Street to reduce the deposition of material by spoil trucks on surrounding roads. Where applicable, sealed roads around the Mary Ann Street construction site may need to be swept to remove deposited material that could generate dust.
- Vehicles transporting material to and from the site would be covered immediately after loading to prevent wind blown dust emissions and spillages. Tailgates of road transport trucks would be securely fixed prior to loading and immediately after unloading. Trucks would be cleaned (for example, using a wheel wash) to prevent spoil from being deposited on roads or to the surrounding environment.

c. The Environmental Assessment identifies minimal traffic impacts around the UTS City Campus. Request for monitoring of traffic environment during construction to maintain acceptable traffic conditions.

A detailed Construction Traffic Management Plan would be developed and incorporated into the construction programme for the proposed development. The Traffic Management Plan would cover civil works, changing of signage, line-marking and management of traffic generating activities. All proposed traffic control measures would be installed and removed in accordance with procedures outlined in the Roads and Traffic Authority's Traffic Control at Work Sites Manual (2003).

The following measures are proposed to manage traffic/transport impacts at the Mary Ann Street construction site entrance:

- The Dairy Farmers building would house construction of the tunnel shaft, assembly cavern and tunnel. This would significantly reduce potential transport and parking-related effects of the tunnel construction site at Mary Ann Street.
- The construction traffic would flow through the Dairy Farmers building in one direction, to avoid congestion and the need for reversing or turning.
- Advance warning signs of construction traffic and changed traffic conditions would be placed on Harris Street (North) and Mary Ann Street (West).
- Access for larger vehicles turning into Mary Ann Street from Harris Street would be maintained at all times during construction. Traffic management details would be confirmed by the contractor prior to commencing works.
- The entrance would be secured against unauthorised entry and would include a driveway for vehicle access.

Further to the traffic management measures outlined above, EnergyAustralia and its construction contractors would monitor the traffic environment surrounding the construction sites to identify the need for additional traffic management.

Other road users would be able to instigate the investigation of additional traffic management measures through the complaints management system to be established for the project.

3.3.6 No 6 CrossCity Motorway

a. Proposed tunnel alignment would pass 3.5 metres below the CrossCity Tunnel Ventilation Tunnel. Clarification is sought on EnergyAustralia's intention to acquire any part of the stratum leased property rights and requires

Refer to response 3.3.3 a.

b. CrossCity Motorway supports RTA's submission (dated 6/7/06) that EnergyAustralia should be required negotiate an agreement for property rights and compensation.

EnergyAustralia has discussed compensation for legal fees with RTA. Discussions regarding property rights are continuing with RTA and CrossCity Motorway.

c. Request that detailed design of the proposed tunnel in the vicinity of CrossCity Tunnel be provided for comment. The Environmental Assessment does not contain details of the zone of influence.

EnergyAustralia would provide the RTA and the CrossCity Motorway with the detailed design and zone of influence for comment, furthermore, interface meetings would be set up to discuss issues of concern in respect of the design and interaction of the tunnels, in relation to potential changes induced by the excavation.

d. Request that the construction method statement specifically mentions work in proximity of Cross City Tunnel and be submitted to the CrossCity Motorway for comment. Specific concerns include whether the tunnel requires closing, and possible impact on the integrity of the Ventilation Tunnel.

The proposed development would run at depth beneath the Cross City Tunnel eastbound tunnel, and is not expected to have any significant impact on the tunnel structure or its integrity. This has been examined in a preliminary report sent to the CrossCity Motorway and the RTA, pre-exhibition of the Environmental Assessment. The proposed development would run directly under the Cross City Tunnel ventilation tunnel, and would be separated from this tunnel by at least 3.5 metres to prevent any impact on that structure.

Given the magnitude and the modelling of the loads, it is considered that the City West Cable Tunnel would not impact on the stability of the Cross City Tunnel ventilation tunnel, however, further review would be carried out during the detailed design and construction phases of the project. Specific construction work method statements would be submitted to the RTA and the CrossCity Motorway for review prior to excavation work in the proximity of the Cross City Tunnel.

Displacements are considered unlikely to damage the structure and services typically associated with the road tunnel and it unlikely that the Cross City Tunnel would require closing.

Close liaison with the RTA and CrossCity Motorway will ensure that the parties interests are considered and arrangements made to secure settlement monitoring equipment within the ventilation tunnel can be accommodated during times of maintenance shutdown of the ventilation equipment or when traffic flows are low (i.e. night time).

e. Request for real-time vibration monitoring, settlement monitoring and monthly updates on the tunnel's progress.

EnergyAustralia and its construction contractor would carry out detailed assessment of the risk of structural effects on the Cross City Tunnel ventilation tunnel. Pre-condition surveys, settlement, noise, and vibration monitoring, and post condition surveys would be carried out. Additional corrective measures would be investigated if required.

EnergyAustralia is committed to undertake consultation with relevant stakeholders and the Community Liaison Group. A project internet website would be established prior to the commencement of construction and would be maintained for 12 months after commencement of operation. This internet website would contain monthly updates of work progress and consultation activities.

- f. If tunnel is to be closed, request that CrossCity Motorway and RTA be indemnified for loss of toll revenue, costs associated with monitoring of design and construction of the tunnel, and fines if air emissions exceed applicable limits.**

It is not expected that the operation of the Cross City Tunnel would be impacted on at any time during construction or operation, by the proposed development of the City West Cable Tunnel. An interface agreement would be negotiated with CrossCity Motorway and the RTA prior to works commencing. Also refer to Section 3.3.6 d. above.

- g .Planned vehicular movements do not utilise the Cross City Tunnel. This may contradict the State Government's objective of limiting traffic in the CBD. Request that the Traffic Management Plan considers traffic utilising the Cross City Tunnel.**

A detailed Construction Traffic Management Plan would be developed and incorporated into the construction programme for the proposed development. The Plan would include detailed consideration of preferred haulage routes, and may include the Cross City Tunnel depending on the location of spoil disposal sites.

3.3.7 No 7 Department of Planning – Heritage Office

- a. Request that any historical relics be managed in accordance with measures and strategies identified in the Environmental Assessment.**

The conditions of approval for the proposed development are likely to specify that the works are carried out in accordance with the strategies and measures set out in the Environmental Assessment.

Furthermore, EnergyAustralia has made a commitment (*Section 2.8, Appendix B – Statement of Commitments*) to prepare a Heritage Management Subplan including the mitigation measures set out in the Environmental Assessment.

- b. All historical relics revealed by works be assessed, recorded and catalogued in accordance with best practice and a qualified archaeologist be present when relics are 'disturbed'.**

A programme of archaeological monitoring would be undertaken wherever the tunnelling is not through bedrock. The monitoring would be conducted by a qualified archaeologist during tunnelling. The construction of the Mary Ann Street and City Central Substation shafts are the only areas that would be constructed through fill and soil materials.

The outcomes of this archaeological monitoring would result in the recording and documentation of all archaeological features within the study area. Management strategies for any structural remains identified within the area would be subject to a range of options from the removal of all structural remains to in situ conservation of structural remains dependant upon their significance.

- c. A Cultural Heritage and Archaeological Management Sub-Plan is incorporated within the Construction Environmental Management Plan..**

EnergyAustralia has made a commitment (*Section 2.8, Appendix B – Statement of Commitments*) to prepare a Heritage Management Subplan including the mitigation measures set out in the Environmental Assessment.

3.3.8 No 8 Sydney Harbour Foreshore Authority

- a. Demonstrate no adverse impacts on the Darling Harbour Precinct in terms of amenity, power supply, noise and vibration. Specific reference is made to the Sydney Convention and the Entertainment Centre**

Amenity

The surface construction sites are more than 200 metres from the Sydney Entertainment Centre and Sydney Convention Centre, and are unlikely to affect the amenity of these areas.

Power supply

Services searches, including power supply services, would be carried out for the areas of the Mary Ann Street and Blackwattle Place shafts. Any existing services would be relocated or avoided. The proposed tunnel would be below any existing power supply services that service the Darling Harbour Precinct, therefore no adverse impacts in terms of power supply would result from the City West Cable Tunnel works.

The commissioning of the cable tunnel would not necessitate any interruptions to the electricity supply in the Sydney CBD.

Settlement, noise and vibration

The distance between the tunnel and building basements and foundations along the tunnel route was calculated to identify whether there was a potential for interaction between the tunnel and the buildings. The calculations identified that there were a small number of building basements and/or footings that could be within 15 metres of the proposed tunnel; of which the Pier Street Car Park (Sydney Convention and the Entertainment Centre) was one. The potential interactions between these buildings and the tunnel would be further addressed as part of an ongoing investigation, monitoring and mitigation measures.

A Construction Noise and Vibration Management Sub Plan would be prepared as part of the Construction Environmental Management Plan in consultation with relevant stakeholders. The Sub Plan would provide details of general noise and vibration control and management measures to be undertaken during the construction stage.

- b. Request that ventilation outlet for the tunnel be sited to minimise visual impacts and maintain amenity.**

Air from the tunnel would be exhausted from the City North Substation via a ventilation shaft located approximately 20 metres above street level. The design of the exhaust shaft would be integrated into the design of the City North Substation building (to be designed and constructed separately and in parallel with this proposed development). Two small exhaust relief vents are provided, one each side at the Mary Ann Street adit and Blackwattle Place shaft. No emissions would be produced during the operation of the tunnel. The purpose of the ventilation system is to regulate the temperature within the tunnel.

c. Demonstrate no adverse impacts on the Darling Walk precinct, and particularly the proposed underground car park, including associated structural supports.

EnergyAustralia met with SHFA in July 2006 to discuss the impacts on the proposed development on the Darling Walk precinct. EnergyAustralia will continue to work with SHFA to determine the impact (if any) SHFA's proposal for an underground car park may have on the City West Cable Tunnel, in the event the underground car park proceeds.

d. Request that approval conditions be introduced to manage impacts on residents and businesses in Pyrmont and Ultimo in relation to dust, noise, hours of operations and general construction issues.

Impact mitigation measures have been set out in the Environmental Assessment. These are likely to be a integral component of the approval conditions for the proposed development.

Prior to the commencement of construction, a Construction Environmental Management Plan (CEMP) would be prepared, following consultation with relevant stakeholders.

The CEMP would be prepared in accordance with the Conditions of Approval, the Statement of Commitments, and all relevant Acts and Regulations.

The CEMP would be certified by the Environmental Management Representative (EMR) as being in accordance with the Conditions of Approval prior to seeking approval of the Director-General. The CEMP would be submitted to the Director-General prior to the commencement of substantial construction works.

The CEMP would:

- a) address construction activities associated with all key construction sites, including staging and timing of the proposed works
- b) clearly identify on a map the location of the proposal
- c) cover specific environmental management objectives and strategies for the main environmental system elements.

EnergyAustralia would undertake consultation with relevant stakeholders and the Community Liaison Group. This Group would be formed prior to the commencement of substantial construction to discuss methods of minimising the impacts of the proposed works on the local community and businesses during the construction stage.

e. Request for a landscape strategy covering the Ultimo Pedestrian Network including schedule of finishes, expressed ground level and access to the EnergyAustralia site following completion of works.

EnergyAustralia would prepare an Urban Design and Landscape Sub Plan in consultation with relevant stakeholders for the Mary Ann Street adit. Suitably qualified urban designers and landscape specialists would be utilised to develop the Sub Plan.

f. Confirmation that the heritage drain (currently in storage) for Mary Ann Street would be reinstated at the Mary Ann Street cul-de-sac following construction at EnergyAustralia's expense.

The heritage drain alignment would not be impacted as a result of the City West Cable Tunnel works, The successful contractor would, prior to excavating, liaise with "Dial Before You Dig" to ensure full knowledge of all existing services, when carrying out the works.

Close inspection and precautionary measures would be undertaken around any services uncovered to ensure the integrity and appropriate reinstatement works would be carried out following the completion of construction works.

EnergyAustralia has not previously been approached by SHFA regarding the reinstatement of the heritage drain. EnergyAustralia does not consider reinstatement of the drain to be a matter for this Submissions Report, as the drain appears to have been removed and placed in storage as a result of a previous development that was not carried out by EnergyAustralia.

g. Seek confirmation that groundwater seepage would be used as 'grey water' for irrigation purposes instead of being discharged into Darling Harbour.

It is anticipated that up to 6,000 litres of groundwater (including shafts and interfaces), would collect in the tunnel each day. A concrete slab would be installed in the floor of the tunnel, with drains either side of the slab to collect and channel any groundwater seeping into the tunnel. A sump and pump-out facility would be included at the lowest point of the tunnel, with drainage channels throughout the tunnel length to direct seepage water to the pump-out point. Water from the sump would then be pumped into EnergyAustralia's existing Southern CBD Cable Tunnel via a rising main, through the Haymarket substation, and into the existing tunnel sump. This water would be treated at the existing water treatment plant located at the Campbell Street substation.

Re-use of the collected groundwater is impractical due to the anticipated low volume collected. Furthermore, use as 'grey' water' is impracticable due to the high concentration of, amongst other analytes, iron, manganese, and in particular chloride (*chloride inferring saline water occurring in the groundwater*). Water is currently treated in order to meet ANZECC standards and comply with the Protection of Environment Operations Act, 1997. Treated water is currently discharged into Cockle Bay, which is a saline environment, hence it would be impracticable to use as a 'grey water' solution.

3.3.9 No 9 Department of Environment and Conservation

a. Request for more specific detailed assessment of Aboriginal Cultural Heritage issues, possible impacts and mitigation measures.

The potential for the discovery of intact remains associated with the Aboriginal occupation and use of the study area is very much dependant on the extent of past European land use activities. Areas of Aboriginal archaeological potential are therefore likely to occur in areas where there is evidence of mangroves such as those recorded in the creek bed area during the Capitol Theatre and KENS site archaeological excavations. It is likely that significant mangrove remains are still in evidence in the Darling Harbour area. If the proposed tunnel disturbs this level, substantial mangrove remains, along with associated micro-flora and remnant deposits, are likely to be exposed. It is concluded that the mangrove areas around Darling Harbour would have a high archaeological potential for evidence of the pre-European environment.

However, any impact on these remnant mangrove areas needs to be considered in light of the proposed construction methodology for the City West Cable Tunnel project. The majority of the work would involve tunnel boring through bedrock and is unlikely to uncover and impact on Aboriginal archaeological features and/or cultural deposits.

The main areas of potential impact are likely to be the two construction sites at Mary Ann Street shaft and the City Central Substation. The works at Mary Anne Street involve the excavation of a cavern whilst the City Central works require the boring of a 2 metre diameter

shaft. Both these sites would be bored directly into mostly exposed bedrock with minimal soil cover. Historical activities at both sites have included extensive clearing and levelling of the natural land surface. This has significantly reduced the potential for remains associated with Aboriginal activities to be present at either the Mary Ann Street or City Central sites.

Mitigation measures for the proposed tunnel works (including the Mary Ann Street and City Central Substation sites) includes a *Stop Work* provision if unanticipated Aboriginal cultural deposits are encountered. Specifically, the *Stop Work* provision requires that in the event unanticipated Aboriginal cultural deposits are encountered, work must cease immediately to allow the project archaeologist to make an assessment of the finds. The project archaeologist may then need to consult with the Department of Environment and Conservation (DEC) concerning the significance of the material.

The *Stop Work* provision would also be triggered in the event that a greater than anticipated soil profile is encountered during the boring works.

Workers and contractors on the project would also be subject to a heritage induction on commencement of the project. The aim of the heritage induction will be to ensure that all project staff are aware of their responsibilities under the *National Parks and Wildlife Act 1974* with regards to Aboriginal sites and places.

A more detailed Aboriginal archaeological heritage assessment is contained in *Appendix B*.

3.3.10 No 10 City of Sydney Council

- a. **Request that proposed the Construction Traffic Management Plan be referred to the City of Sydney for comment and approval. This should occur, a minimum of 90 days before construction, and include spoil disposal routes, program of works, costs of traffic management works, and road closures.**

A Construction Traffic Management Sub Plan would be prepared prior to the commencement of construction works and incorporated into the construction programme. The Sub Plan would be prepared in consultation with relevant stakeholders, including City of Sydney Council. While 90 days advance notice may not be achievable within the proposed schedule for the delivery of the works, EnergyAustralia would provide as much notice as possible.

A detailed Construction Traffic Management Plan would be developed and incorporated into the construction programme for the proposed development. The Plan would include detailed consideration of the following:

- preferred haulage routes
- access routes, signage and access arrangements at each site
- measures to ensure that relevant intersections would not be affected
- procedures for loading/unloading from the carriageway
- queuing
- reversing manoeuvres during construction
- the need for measures to protect pedestrians, cyclists and other motorists in the vicinity of the sites.

Road dilapidation reports would be prepared, prior to commencement of construction and after construction is complete, for all local roads nominated in the Construction Traffic Management Sub Plan likely to be used by construction traffic. Road/footpath damage that may be attributable to the construction traffic and aside from that resulting from normal wear and tear, would be repaired to a standard at least equivalent to that existing prior to the damage.

b. Other issues which should be clarified include:

- **Drainage and water treatment**
- **Significant street trees**
- **Footpath remediation works**

Drainage and water treatment

A Soil and Water Management Plan would be prepared as part of the Construction Environmental Management Plan for the proposed development to detail the proposed implementation of soil and water-related mitigation measures at the various construction sites.

The Plan would aim to achieve best practice soil and water management and would be updated as the project progresses. The Plan would set out a water quality monitoring programme for the construction and operation of the proposed development. The Plan would be developed to ensure that appropriate mitigating measures and safeguards are incorporated.

Significant street trees

The proposed development would not impact any significant street trees.

Footpath remediation works

See response 3.3.10 b above.

c. Request that the effect of any underground strata acquisition be clarified in relation to Council's assets.

As noted in 2.4.3 sub-surface stratum easement would be acquired for the tunnel and associated infrastructure. The City West Cable Tunnel horizontal alignment covers an area predominantly in land owned by the Sydney Harbour Foreshore Authority (SHFA) and a small parcel of land owned by TransGrid. However, as the tunnel approaches the City North Substation, the alignment follows the road along Sussex Street, being a road that is controlled and maintained by Council. The depth of the City West Cable Tunnel under this part of Sussex Street is such that Council's assets would not be affected.

Wherever practical, impacts on potentially affected properties would be avoided or reduced by design measures. The acquisition of any land would be undertaken in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*. EnergyAustralia would notify the owner of any property that is to be adjusted, acquired or for which an easement or stratum is to be obtained. This notice would contain sufficient details to identify the land of interest being adjusted/acquired and is to include dimensions, location with respect to boundaries and any other information necessary to enable the identification of the land in relation to the development.

d. Request for further information on the Community Liaison Group and Council's involvement in this group.

EnergyAustralia would undertake consultation with relevant stakeholders and the Community Liaison Group. This Group would be formed prior to the commencement of substantial construction to discuss methods of minimising the impacts of the proposed works on the local community and businesses during the construction stage.

The Group would comprise at least two (2) representatives of EnergyAustralia (the independent Environmental Management Representative and the Community Liaison Representative), at least one (1) representative of the City of Sydney Council, at least two (2) community representatives and one (1) business representative.

Interested members of the community would be kept informed of the project at regular intervals via relevant local newspapers, leaflets, community notice boards etc. A project Internet website would be established prior to the commencement of construction and would be maintained for 12 months after commencement of operation. This Internet website would contain monthly updates of work progress and consultation activities.

e. A Construction Noise Environmental Management Plan should be submitted to Council. Monitoring is encouraged throughout the life of the project.

EnergyAustralia would undertake site specific ambient noise level monitoring to ascertain background levels at closest noise receivers, construction sites, and site compounds. Detailed noise assessments would also be undertaken prior to the completion of the Construction Noise and Vibration Management Sub Plan.

A Construction Noise and Vibration Management Sub Plan would then be prepared as part of the CEMP in consultation with relevant stakeholders (including City of Sydney Council). The Sub Plan would provide details of general noise and vibration control and management measures to be undertaken during the construction stage.

It is proposed that post commissioning source emission and ambient background monitoring is undertaken to confirm the noise source levels and associated received noise levels. An Operational Environmental Management Plan (noise issues) would outline procedures that specifically address potential noise impacts and the requirements for corrective measures in the event of elevated off-site noise levels or residential complaints.

3.3.11 No 11 Darling Park Office Complex

a. Concern raised in relation to the size and depth of the proposed tunnel, the proximity of the tunnel, and potential settlement issues.

EnergyAustralia has liaised and will liaise further with the property agent/manager for the Darling Park Development. An appraisal of the works and the construction methodology has been given. Further, an assessment of the City West Cable Tunnel's interaction with the Darling Park Development located along that part of the route has been handed over to Jones Lang La Salle (refer Appendix C). Given the approximate 15 metre separation in rock from the crown of the tunnel and the basement car park slab, the magnitude and the conservative modelling of building loads, it is considered that the excavation of the proposed City West Cable Tunnel would not impact on the stability of the Darling Park Development. The changes in displacements in the basement are considered highly unlikely to damage either the structure or services typically associated with commercial developments.

b. Request to review the structural analysis to ensure the soundness of the proposal.

The property agent/manager for the Darling Park Development have been provided with details of the structural analysis and a meeting was convened to discuss this issue a copy of that report is attached as *Appendix C*. Refer to comments in 3.3.11 a. above.

4. Preferred project report

4.1 Modifications to the proposed development

4.1.1 City Central substation connection

EnergyAustralia has further investigated the design of the City Central Substation connection. These investigations have identified the option of boring the connection shaft from within the basement levels of the City Central Substation. This modified design could potentially reduce construction impacts at this location. Details of the design proposed in the Environmental Assessment, and the modified design are provided below.

4.1.2 Design proposed in the Environmental Assessment

The Environmental Assessment proposed construction of the cable connection shaft to City Central Substation from Pit 5 located at the eastern end of Blackwattle Place (a dead-end street). *Figure 4.1* provides an indicative layout of the construction site.

A pile boring rig would be set up to bore a 1.8 metre diameter shaft through the base of Pit 5, which is an existing cable pit adjacent to the north-east corner of City Central Substation. A protective sleeve would be inserted into the pit before boring to protect existing cables within the pit from falling debris and other construction works. The shaft would then be bored down to meet the main cable tunnel, approximately 37 metres below street level.

An interface niche would then be constructed between the bored tunnel and the shaft. A sump would be constructed as part of the interface works. Once the interface structure has been excavated, a steel lining, complete with fixings for cables and associated services, would be lowered into the bore and fixed in position.

The steel lining would be site welded to create one complete shaft and lowered into position as one unit to maintain integrity and watertightness. Fixings for cables would be connected to the lining before it is lifted by mobile crane into position. The interface niche structure would be tanked (waterproof lining) and concrete lined once the steel lining is in place.

The cables would be installed within the shaft using mechanical cable installation equipment. Once installed the cables would be clamped to the shaft lining by personnel via the use of abseiling equipment. The head of the shaft within Pit 5 would be covered and sealed to limit water ingress and a sealed hatch installed.

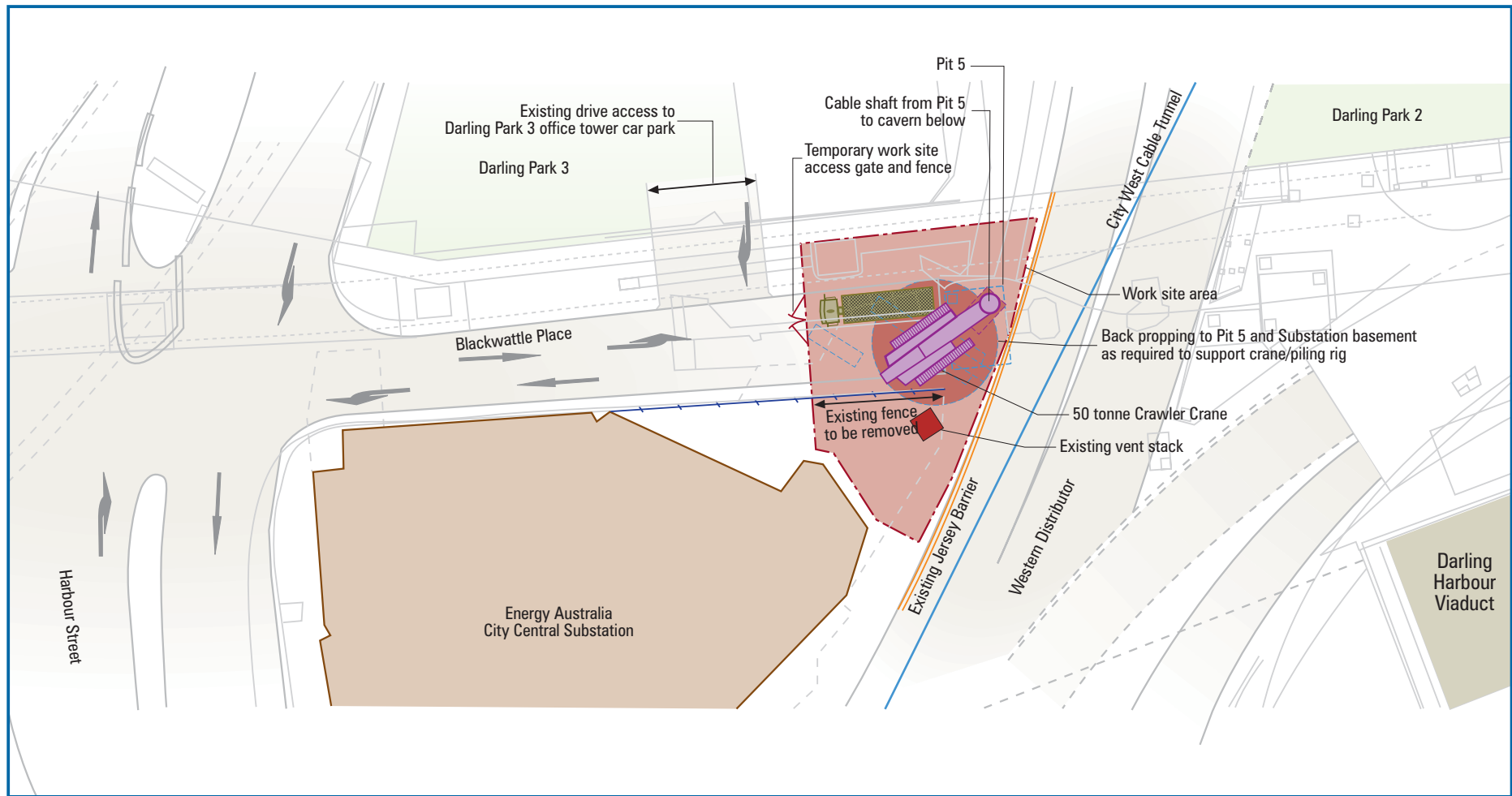


Figure 4.1 Original City Central Substation connection at Blackwattle Place

4.1.3 Modified design

The construction site for the modified would also be located at the eastern end of Blackwattle Place as originally proposed in the Environmental Assessment. However, the City Central Substation connection would form part of the substation proper by means of a shaft located within the roof and floor slab of the cable basement. *Figure 4.2* provides an indicative layout of the construction site.

An opening would be created in the ground slab of the hard stand area of City Central Substation. This is the roof of the cable basement of the substation, and is located entirely within the property boundary of the substation. Within the cable basement, the roof and floor slabs would be broken out in preparation for a pile boring rig that would be set up to bore a 1.8 metre diameter shaft through the substation. The cable sorting area would be protected by means of marine plywood or steel hoarding, from roof to floor, in order to protect existing services and live electricity cables from the construction works.

The shaft would then be bored down to meet the main cable tunnel in a similar fashion to the original design. It is anticipated that the steel lining would be fabricated in two separate parts and would be welded on site to create a fully lined shaft, as one unit, to maintain integrity and watertightness.

The cables would be installed within the shaft using mechanical cable installation equipment. Once installed the cables would be clamped to the shaft lining by personnel via the use of a purpose built elevator/man-cage and other equipment. Once the cables are in their final position, this shaft would not be accessed by personnel during operation.

A lockable gatic cover or concrete cover would be installed at ground slab level, outside the substation (roof of the cable basement area); this would facilitate access in the case of emergency repairs to the cables. At the floor slab of the cable basement (inside the substation) the shaft would rise above the floor in order to turn the cables from the shaft into the substation proper and then onto the respective jointing or termination locations; this approach would assist with waterproofing and sealing to maintain the integrity of the substation basement.

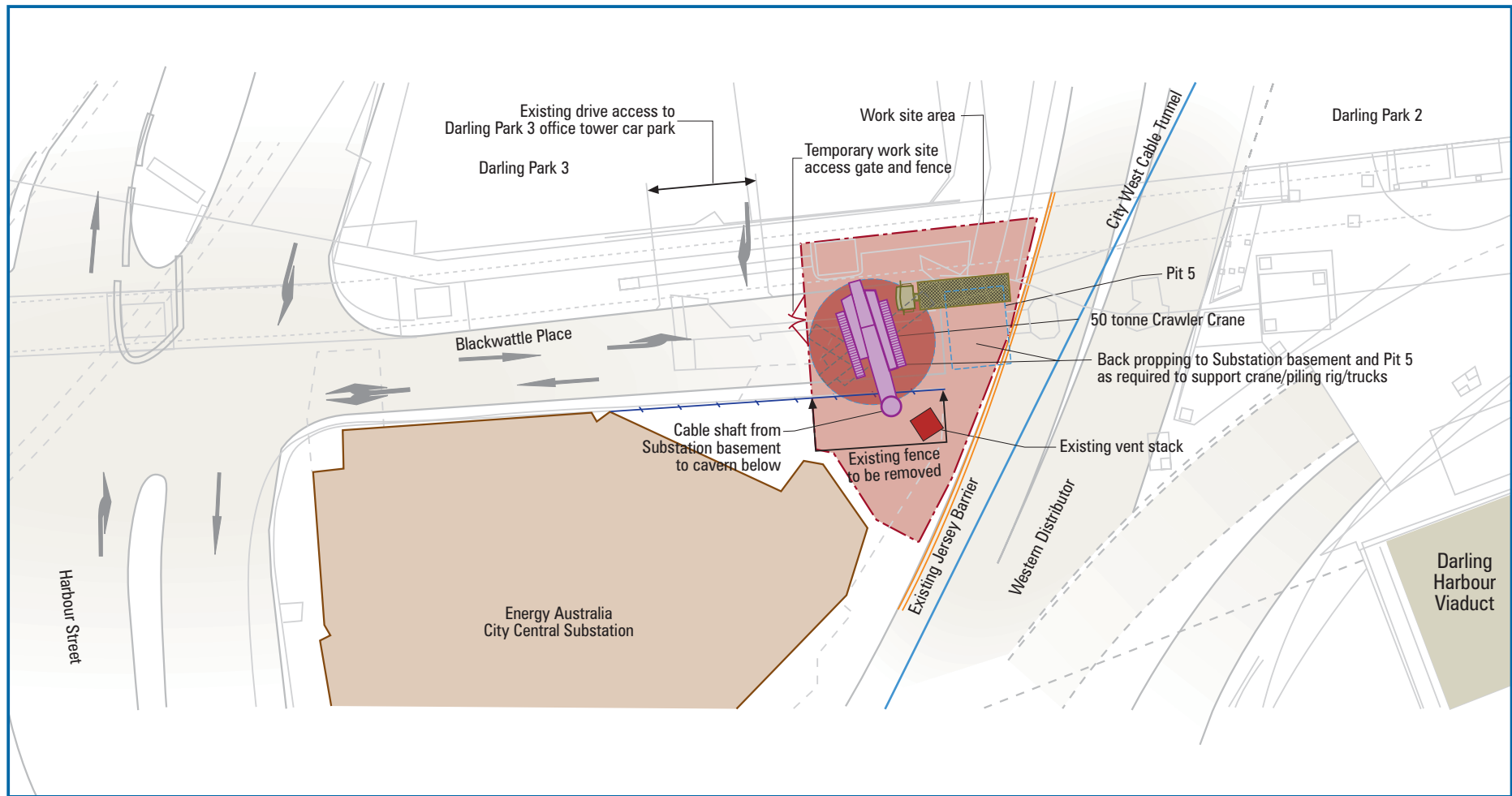


Figure 4.2 Modified Blackwattle Place construction site layout

4.2 Environmental assessment of proposed modifications

The majority of surface works in Blackwattle Place would no longer be necessary, as these would be carried out within the cable basement of City Central Substation. The boring machine would be located on the ground surface; however boring would take place from the floor of the cable basement of City Central Substation.

The majority of construction works activity would be within the cable basement of City Central Substation. Therefore there is likely to be a reduction in construction impacts from containment of the works within the substation basement. Specifically this would lead to:

- reduced noise emissions from the site
- improved control of dust emissions
- improved security for the works
- reduced risk in relation to heritage as the shaft would be bored from an existing basement through ground already disturbed by construction of the substation.

It is therefore assessed that the environmental impacts from the proposed modification are either equivalent or less than those from the proposal set out in the Environmental Assessment.

5. Conclusion

The Environmental Assessment has met the legal obligations of Part 3A of the Environmental Planning and Assessment Act 1979, and this Submissions Report is the next stage in the planning approval process.

A total of 11 Submissions were received on the Environmental Assessment, from private residents, and government stakeholders. These Submissions sought clarifications on the proposed development, the Environmental Assessment, and EnergyAustralia's commitment to management of environmental issues throughout the delivery of the proposed development. There were no objections to the proposed development.

The Submissions Report addresses the majority of these requests for clarification based on information set out in the Environmental Assessment, or readily available from other project related documents. A number of issues raised the requirement for additional investigations and discussions with project stakeholders. EnergyAustralia has committed to continuing to liaise with these stakeholders throughout the delivery of the project.

The potential environmental impacts of the proposed modifications to the City Central Substation connection concluded that the modification would result in a reduction in potential noise, dust, traffic access, security and visual amenity issues when compared to that presented in the Environmental Assessment.

EnergyAustralia has reviewed the Statement of Commitments provided in the Environmental Assessment and has concluded that no amendment or additional commitments are required based on the issues raised in the submissions.

Based on the extent of issues, and absence of objections to the proposed development, EnergyAustralia intend to seek approval of the City West Cable Tunnel under Part 3A of the *Environmental Planning and Assessment Act 1979*.

Appendix A

Copies of submissions from
Government agencies

3

File No: 99M5307
Our Ref: CCT/LB/Let078



6 July 2006

Major Infrastructure Assessment
Department of Planning
GPO Box 39
Sydney NSW 2001

Attention: Mark Turner

Dear Sir,

SUBJECT: City West Cable Tunnel (05_0178) – Submission to the Exhibition of Environmental Assessment Report

The Roads and Traffic Authority ("RTA") would like to take this opportunity to comment on the proposed City West Cable Tunnel ("CWCT") as described in the CWCT Environmental Assessment report dated May 2006. This submission deals specifically with the interaction between the proposed CWCT and the existing Cross City Tunnel ("CCT") infrastructure.

The RTA supports the proposed project and the principle of securing the power supply to the Sydney CBD. The impact of the CWCT on the existing infrastructure of the CCT needs to be taken in consideration.

The proposed alignment of the CWCT as described in chapter four of the Environment Assessment will be 3.5 meters below the floor of the CCT ventilation shaft that connects the main east/west bores of the CCT to the ventilation stack located in Darling Harbour.

The RTA is currently in the process of defining a lease boundary for the CCT that will be 5m below the floor of the ventilation shaft. The proposed CWCT will encroach on RTA land leased to CrossCity Motorway (the owner and operator of the CCT). Discussions are currently underway to negotiate a property agreement and it will be necessary to agree an easement with both RTA and CrossCity Motorway.

Energy Australia has produced a detailed engineering report on the construction impacts of the proposed CWCT tunnel on the CCT. The report predicts the settlement will be minor and there will be no structural impact on the CCT. However RTA and CrossCity Motorway have concerns regarding the possible construction impacts on the operation and integrity of the CCT. It is expected that a real time monitoring system will be required, together with a CCT operations plan.

The property issue and construction impact may have cost implications for both RTA and Crosscity Motorway and we will be seeking full reimbursement of all costs associated with this proposal.

Roads and Traffic Authority
ABN 64 480 155 255



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Rozelle NSW 2039

PO Box 380
Rozelle NSW 2039

T 02 9352 9500

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I recommend the negotiation of a multi-party agreement on the proposed easement and tunnel operation terms and conditions for the project interaction with the CCT infrastructure during construction.

Yours faithfully,



 **Paul Goldsmith**
Project Services Manager
Cross City Tunnel

cc: Wilma Penrose (EA), Graham Mulligan (CCM)



RailCorp

Rail Corridor Management Group
Level 16, 55 Market Street
Sydney NSW 2000
Tel: (02) 9224 2349 Fax: (02) 9224 4805

12 July 2006

Mr Mark Turner
Environmental Planning Officer
Major Infrastructure Assessment
Department of Planning
GPO Box 39
Sydney NSW 2001

Dear Mr Turner

City West Cable Tunnel (CWCT) Project – Environmental Assessment

We refer to your letter of 30 May 2006 (ref: S04/00197-02) concerning the Environmental Assessment Report (EAR) prepared for the above project by Parsons Brinckerhoff for Energy Australia. The following is RailCorp's initial response to the EAR.

The CWCT is in part of the Metropolitan Rail Expansion Program (MREP) area identified in the maps gazetted on 17 February 2006 under *SEPP 63 – Major Transport Projects*. RailCorp has sought comment on any impacts from the CWCT on Metrowest from Transport Infrastructure Development Corporation (TIDC) which has responsibility for investigating the Metrowest Rail Link as part of the MREP.

The proposed tunnel boring machine (TBM) entry shaft may affect major underground power cables owned by RailCorp in the embankment adjoining Darling Drive, Ultimo. Information is being gathered about the location of the cables which provide power for train operations. It will be necessary for Energy Australia to provide advice on the impacts of the proposed TBM entry shaft on those cables to RailCorp for review and approval prior to commencement of the works.

RailCorp is meeting Energy Australia this week to progress these issues. It is intended to provide your Department, as soon as possible, with a final submission including recommended conditions to ensure that the Metrowest Rail Link corridor and the cables are protected once it has received the necessary information and advice.

Should you wish to contact the writer at any time during normal working hours please call on telephone number (02) 9224 2352.

Yours faithfully,

Peter Boyden

Access Coordinator

Rail Corridor Management Group, RailCorp.



NSW GOVERNMENT
Department of Planning

Contact: Siobhan Lavelle
Telephone: 02 9873 8546
siobhan.lavelle@heritage.nsw.gov.au
File: S90/06569
Our Ref: HRL40432
Your Ref: n/a

Mr Mark Turner
Environmental Planning Officer
Major Infrastructure Assessment
Department of Planning
GPO Box 39
SYDNEY NSW 2001

FAX to: 02 9228 6335

Dear Mr Turner,

**Re: Environmental Assessment Report – MAJOR PROJECT REFERRAL
ENERGY AUSTRALIA, CITY WEST CABLE TUNNEL**

Thank you for your letter dated 30 May 2006 and received by this office on 2 June 2006 referring the subject Environmental Assessment Report to the Heritage Office, Department of Planning, under the Part 3A process of the Environmental Planning & Assessment Act. It is noted that the application is for a major project as described in Schedule 2 to State Environmental Planning Policy (Major Projects) 2005 relating to development with a value greater than \$5 million within the Darling Harbour Area, as identified within Map 9 to clause 10 of the SEPP. Previous advice from the Heritage Office, Department of Planning, was provided by letter dated 20 January 2006 and heritage matters were included in the Director-General's requirements for the project.

It is understood that the purpose of the project is to provide a 1.7 km long electricity transmission cable tunnel link from the Haymarket to the new City North Substation and ancillary components, such as electricity transmission feeders and a permanent tunnel entrance at Mary Ann Street, the overall project being described as The City West Cable Tunnel. The Heritage Office has now reviewed the Environmental Assessment, prepared by Parsons Brinckerhoff and dated May 2006 in particular: 'Chapter 11 – Cultural Heritage' and also Appendix I relating to the heritage impact and archaeological assessment of the proposal which was prepared by Heritage Concepts Pty Ltd in March 2006. Other relevant sections of the Environmental Assessment include 'Chapter 8 – Land Use, Property and Settlement' and 'Chapter 10 – Noise and Vibration'.

It is noted that the assessment of Potential Heritage Impacts in Section 11.4 has concluded that because most of the tunnelling would occur through bedrock at depths of 10 to 40 metres below ground level that most of the works are unlikely to uncover any archaeological deposits or features except in the areas of the Mary Ann Street and Blackwattle Place shafts. Mitigation measures proposed include archaeological monitoring wherever the tunnelling is not through bedrock, with the recording and documentation of all archaeological features within the study area. Four main areas of archaeological potential have been identified through background research and field inspection and the report proposes that a qualified archaeologist would monitor the excavation works in particular locations such as Blackwattle Place and the Mary Ann Street shaft. A research design for that work has been supplied.

The Environmental Assessment report also indicates that some 23 sites of cultural (built) heritage have been identified along the tunnel route, but that it is considered unlikely that the proposal would significantly affect any heritage listed buildings through either vibration or ground settlement. Chapter 8 indicates that the tunnel is intended to be located within Hawkesbury Sandstone which occurs along its full length. Most of the structures situated adjacent to the tunnel are founded on bedrock and in those areas of upper fill or marine sediments the risk of measurable settlements is assessed as low. In the areas affected by the works the predicted consolidation settlements would be negligible. Nevertheless mitigation measures have been proposed in Section 8.7 including further investigations and commencement of a monitoring programme.

Heritage Office, 3 Marist Place, Parramatta NSW 2150 | Locked Bag 5020, Parramatta NSW 2124 | DX 8225
PARRAMATTA



Heritage Office

9873 8599 Email heritageoffice@heritage.nsw.gov.au Website www.heritage.nsw.gov.au

Working with the community to know, value and care for our heritage

The Heritage Office considers that the Environmental Assessment report has satisfactorily addressed the likely impacts of the proposed City West Cable Tunnel on the heritage significance of the items in the vicinity of the project.

As stated above, it is noted that Appendix I of the Parsons Brinckerhoff report has supplied an Archaeological Research Design by Heritage Concepts Pty Ltd (March 2006, Section 9.0). The Archaeological Research Design has recommended that the appropriate strategy would be for a staged archaeology program dealing with the ground disturbance by instituting an archaeological monitoring programme. The strategy recommended in the Archaeological Research Design is considered appropriate by the Heritage Office.

It is understood that the proposed project will be an "approved project" for the purposes of Part 3A of the EP&A Act and section 75U of the Act therefore suspends the requirement for an excavation permit under section 139 of the Heritage Act. However it is requested that the following conditions be included within the conditions of consent should approval be granted:

- Historical archaeological 'relics' disturbed by the proposal should be managed in accordance with the mitigation measures, strategies and Research Design supplied in Chapter 11 and Appendix I of the document *City West Cable Tunnel Environmental Assessment* May 2006 prepared for Energy Australia by Parsons Brinckerhoff Pty Ltd.
- All historical archaeological deposits, artefacts or 'relics' revealed by the works should be assessed, recorded, catalogued, and analysed in accordance with usual professional archaeological practice. Project works which may disturb 'relics' should be monitored by a qualified historical archaeologist. At the conclusion of the archaeological works a final report should be prepared and should be lodged with the Heritage Office, Department of Planning and an appropriate local repository.
- A Construction Cultural Heritage and Archaeology Management Sub-Plan should be prepared by the proponent and implemented in consultation with the Heritage Office, Department of Planning.

Thank you for the opportunity to comment on the Environmental Assessment for this project. For further information please contact Dr Siobhan Lavelle on 9873 8546.

Yours sincerely

Vincent Sicari
Manager
Conservation Team
Heritage Office
Department of Planning



7 July 2006

Mark Turner
Environmental Planning Officer
Major Infrastructure Assessment
Department of Planning
GPO Box 39
Sydney NSW, 2001

Dear Sir

Subject : Energy Australia - City West Cable Tunnel Project.

The Sydney Harbour Foreshore Authority gives its "in principle" agreement to the project given consideration to the following issues.

- The proponents should demonstrate that there will be no adverse impacts on the Darling Harbour Precinct amenity in terms of noise, vibration or power supply reliability. The precinct contains sites used for international conferences and exhibitions such as the Sydney Convention & Exhibition Centre. The tunnel passes directly under this facility, and this raises particular concerns with regards potential vibrations. The applicant should demonstrate that its tunneling activities and long term use of the tunnel will not disrupt this business. Other key parties who may be similarly affected include major performing artists (Sydney Entertainment Centre), multiple international accommodation providers and other businesses that rely on tourism and precinct amenity for attracting visitation to their respective businesses.
- Whilst it is accepted there is a need for a ventilation outlet along the tunnel corridor, careful consideration is required to ensure that the site selected minimises any impact upon the visual amenity of surrounding businesses.
- The proponent should consult with the Sydney Harbour Foreshore Authority to determine the design and location of the above mentioned ventilation outlet.
- The proponents should demonstrate that there will be no adverse impacts on the Darling Walk site that the tunnel is to pass below. This site is currently in the initial planning stages for redevelopment which is to include an underground car park. Ensuring the tunnel does not impact on this car park or the structural supports for the building to go above it is critical to the Authority.
- Appropriate conditions should be placed on any approval for the Tunnel Project to ensure that there is no adverse impact on the residents and businesses in the Pyrmont/Ultimo precinct with regards noise, dust, hours of operation and other construction related processes. As a guide/ suggestion, perhaps similar operational constraints as applied to the construction of the Cross City Tunnel would be appropriate for consideration.

Sydney Harbour Foreshore Authority
Level 6, 66 Harrington Street, The Rocks 2000
PO Box N408, Grosvenor Place NSW 1220
Telephone 02 9240 8500 Facsimile 02 9240 8899
www.shfa.nsw.gov.au ABN 51 437 725 177

Page 2

Energy Australia – City West Cable Tunnel Project

7 July 2006

- A Landscape strategy should be provided, for approval by the Sydney Harbour Foreshore Authority, for the Ultimo Pedestrian Network at the Mary Ann Street access point showing what structures will be expressed at ground level following construction and thus the proposed general arrangement for the UPN public walkway and railway tracks, the quality of finishes for the UPN corridor after remediation and how the tunnel will be accessed for maintenance going forward.
- Confirmation that the heritage drain (currently in storage) will be reinstated and interpreted at the Mary Anne Street cul-de-sac during construction, as a consent condition, to be performed to the satisfaction of the Sydney Harbour Foreshore Authority, at EA's cost.
- Confirmation that the proponent will recycle the groundwater seepage (planned to be treated and discharged to stormwater) to be used as 'grey water' recycling for irrigation purposes in Darling Harbour.

It is anticipated that further meetings will be held between senior representatives of Energy Australia and Sydney Harbour Foreshore Authority to resolve and refine the above issues. Your continuing cooperation in regard to impacts on the Darling Harbour precinct is appreciated.

Yours sincerely,



Bob Deacon

General Manager, Darling Harbour



Department of
Environment and Conservation (NSW)

Your reference : SO4/00197-2
Our reference : SRF15434, SR498/07
Contact : Debbie Cole, 9995 6846

Mark Turner
Department of Planning
GPO Box 39
Sydney NSW 2001

Dear Mr Turner,

RE: Energy Australia, City West Cable Tunnel Environmental Assessment – May 2006

I refer to your letter to the Department of Environment and Conservation NSW (DEC) dated 30 May 2006 regarding the exhibition of the Environmental Assessment of the proposal by Energy Australia for the development of an underground electricity transmission cable tunnel running between the Haymarket Bulk Supply Point to the City Central Substation and the city North Substation.

The Department's letter of 30 March 2006 outlined the key issues and assessment requirements for inclusion in the Environmental Assessment. Attached were the General Guidelines for Aboriginal Heritage Impact Assessment.

The DEC has reviewed the Environmental Assessment. DEC is unable to determine from the assessment the potential impacts of the proposal on Aboriginal cultural heritage. While there is mention of Aboriginal cultural heritage in Section 11, DEC feels that more specific detailed assessment should have been included as a subsection in Section 11. The proponent should outline the specific Aboriginal cultural heritage studies that were conducted. If required they would also need to outline the possible impacts as well as mitigation measures.

Please forward any questions on the matter to Debbie Cole on 9995 6846.

Yours sincerely

KEVIN ROBERTS
A/Manager Infrastructure
Environment Protection and Regulation Division

City of Sydney

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18 July 2006

Department of Planning
GPO Box 39,
Sydney NSW
2001



Attention: Mark Turner
Major Infrastructure Assessment

Dear Mark,

RE: CITY WEST CABLE TUNNEL PROJECT – S045484

I refer to your letter received 7 June 2006 regarding the City West Cable Tunnel Project requesting comments on the underground cabling route in the Sydney CBD and inner suburbs.

The submitted report did not appear to have any proposal involving the use public streets as construction area, however please be advised that if any streets including the pedestrian footway are proposed to be closed Energy Australia will be required to pay a fee for any works zones in accordance with Council's Standard fees and charges schedule. Any construction areas will be required to be declared work zones. An application should be submitted to Council's Transport Access Unit with the appropriate fees to be calculated. Payment of the Work Zone fees are required prior to the commencement of construction. Any Work Zone areas are to be clearly identified on plans.

Access to properties is to be maintained at all times so has to minimise any impacts on residents and businesses in all areas where work is proposed.

Traffic and Road Works – Traffic and Transport

A construction Traffic Management Plan is to be developed and incorporated into the construction programme for the proposed development - this is to be referred to the City for comment and approval.

Traffic Management Plan

A Traffic Management Plan for each construction site/ works zone and traffic management generally is to be prepared for the approval of the Sydney Traffic Committee. The plan should address various traffic issues including:

- Vehicle ingress and egress arrangements.
- On site stockpiling of spoil and construction materials.
- Queuing spaces for construction and delivery of vehicles.
- Protection of pedestrians.
- Alternative safe access to premises.
- Proposed route of construction vehicles to and from the site.

City of Sydney

Spoil Disposal Routes

A plan for the preferred truck access routes for each construction site/ work zone shall be submitted to the Sydney Traffic Committee for approval. These routes are to be designed to avoid going through residential precincts. *(This is to form part of the Traffic Management Plan submission above).*

Program of Works.

When on street activities are required to facilitate the tunnel construction, a Traffic Management Plan is to be submitted to Council a minimum of 90 days, prior to the commencement of work to allow sufficient time to assess construction activities in consultation with other authorities if necessary and to apply conditions.

Energy Australia should be aware that construction times can be restricted due to traffic, pedestrian and public transport requirements.

Any construction program is to take into account the general ban of construction activities in the City over the month of December.

Costs of Traffic Management Works

All costs of the traffic management measures associated with the use of any construction site/work zones and any other project related activities are to be borne by Energy Australia or its agents.

Road Closures

The City recommends that any proposed closures of road not be put into effect until Council has considered and approved an appropriate Traffic and Pedestrian Management Plan.

STA Bus Services

Plans for the diversion of STA bus routes affected by the works should be prepared in consultation with STA.

Action under S115 of the Roads Act 1993 (Advertising)

If any construction sites/ work zones are proposed, action under S115 of the Roads Act 1993 requires the proposal to be advertised. *(Such action is only applicable to closing off public streets to general traffic and not for any closure within private properties)* In addition Council requests that Energy Australia notify all businesses and residents. Any objections received as a result of public consultation are to be resolved before submission to the Sydney Traffic Committee. The results of the action for the committee's consideration are to be submitted as part of any determination process.

Drainage and Water Treatment

Further detail is required in regard to drainage and water treatment and disposal and water quality monitoring of discharge water.

Significant Street Trees

All Streets trees shall be protected at all times during construction, in accordance with Council's Tree Preservation Order. An audit of all significant trees for the full length of the proposed tunnel route that will be impacted by the proposed work is to be undertaken. Significant trees identified by the audit shall require a bond per street tree. The bond shall be calculated on the basis of the age species and location of the street tree and approved by Council prior to the commencement of construction.

Remediation Works Footpaths

Any damage arising to the footpaths as a result of the proposed construction works is to be made good and reinstated in accordance with the City of Sydney's public domain standards and specifications. Full costs are to be borne by Energy Australia or its agents. A bond to be determined by Council shall be lodged with Council for this element. You are advised to contact the City in this regard prior to any construction of the proposed route.

Property Acquisition

Greater detail is required in regard to the process for acquisition of strata of underground three dimensional parcels of land and its effects on Council's assets.

Tunnel Alignment

The City requires details of the "As Built" tunnel alignment in three dimensions to be supplied to Council for inclusion into the City's GIS program. The format of such information should be to the satisfaction of Council.

Community Consultation

Letter box drops, advertising, the community liaison group, contact telephone number and complaints register are supported. Further detail is required regarding the community liaison group and Council's involvement with this group.

Construction Noise and Vibration

A Noise Management Plan as part as part of the Construction Environmental Management Plan should be submitted to Council.

Monitoring of noise levels is encouraged throughout the project (not just at the beginning of the project) to verify noise limits through the life of the project and also to be available for any resident complaints.

A copy of the CMP and EMP are requested to be submitted to the City of Sydney.

Should you wish to discuss these matters further please contact the Council Officer dealing with this matter **Chris Corradi** on **9246 7592** or ccorradi@cityofsydney.nsw.gov.au

Regards



BILL MACKAY
Area Planning Manager CBD

Appendix B

Supplementary archaeological
assessment

The Natural Setting

Geology and Soils

The Sydney CBD region is situated on the Hawkesbury Sandstone geologic unit, characterised by medium to coarse grained quartz sandstone with minor shale and laminate lenses (Sydney 1:250,000 Geology Map). The topography of the area includes undulating to rolling rises and low hills with local relief varying from sea level to 80 m and slope gradients ranging from 10% to 25%. The area has broad convex crests, moderately inclined sideslopes with wide benches and localised rock outcrops on low broken scarps.

Sydney Harbour foreshore is located within the erosional GyMEA soil landscape. There are several soil types within the GyMEA landscape, many of these being associated with particular topographies. Along crests and the inside of benches shallow to moderately deep (30 – 100 cm) Yellow Earths and Earthy Sands are found. On the leading edges of benches are shallow (< 20 cm) Siliceous Sands. Localised Gleyed Podzolic Soils and Yellow Podzolic Soils are found on shale lenses, whilst along drainage lines are shallow to moderately deep (<100 cm) Siliceous Sands and Leached Sands. The GyMEA soil landscape is subject to high soil erosion hazard, localised steep slopes, rock outcrops, shallow highly permeable soils, very low soil fertility and soil acidity (Chapman and Murphy 1989).

Vegetation

At the time of contact, vegetation patterns would have been different to those currently observable in the Sydney Basin.

Ridges and upper slopes would have been characterised by a low, dry sclerophyll open-woodland. Species such as red bloodwood *Eucalyptus gummifera*, yellow bloodwood *E. eximia*, scribbly gum *E. haemostoma*, brown stringybark, *E. capitellata* and old man banksia *Banksia serrata* were found in these areas. Sheltered side slopes hosted dry sclerophyll open-forest containing black ash *E. siberi*, Sydney peppermint *E. piperita* and smooth-barked apple *Angophora costata*. A shrubby understorey would have been formed of species such as Christmas Bush *Ceratopetalum gummiferum*, *Kunzea ambigua*, *Platysace lanceolata*, *Leptospermum attenuatum*, Deep-blue Flax Lily *Dianella caerulea* and Kangaroo Grass *Themeda australis* (Benson and Howell, 1995:44).

On the alluvial flats at the heads of bays such as Rushcutters Bay, Double Bay and Woolloomooloo Bay would have been forest with trees of Forest Red Gum, *Eucalyptus tereticornis*, Swamp Mahogany *E. robusta*, and Bangalay *E. botryoides*, with shrubs of *Kunzea ambigua*, *Leptospermum flavescens* and *Melaleuca ericifolia* and small 'rainforest-type' patches with Cabbage Palms, *Livistona australis* used for constructing the first settlement's huts (Benson and Howell 1995:100).

Fauna

Vegetation communities in the Sydney Basin supported a wide variety of terrestrial and avian resources, whilst the marine environment of Port Jackson hosted a range of fish, shellfish and crustaceans. The lists which follow are not meant to be exhaustive, but are designed to reflect the diversity of faunal resources available within the Port Jackson area. For fuller descriptions reference should be made to Attenbrow 2002: chapter 7.

Mammals within the area included native rats and mice (*antechinus*), kangaroo, wallaby, pademelon, bandicoots, sugar glider, brush-tail and ring-tail possum, and echidnas. Reptiles would have included pythons, skinks, blue tongue lizard, monitor lizard and water dragons. Birds included brush turkey, crested hawk, muttonbird, petrel and little penguin.

Fish found within the Sydney area include yellowtail kingfish, shark, parrotfish, garfish, leatherjacket, flathead, whiting, bream, snapper and flounder. Shellfish native to the area include hairy mussel, rock oyster and Sydney cockle, whilst crustacea such as mud crab, blue swimmer crab, crayfish and lobsters were also present.

Each of the species listed above has been recovered in an archaeological context in the Sydney Basin; most are thought to represent food and/or raw material resources utilised by the local Aboriginal inhabitants.

Aboriginal Archaeology – Background

Ethnohistorical Descriptions of the Aboriginal Peoples of the Sydney Region

With the arrival and permanent settlement of Europeans in the region surrounding the study area in 1788 began a massive disruption and transformation of the lifestyle of the local Aboriginal people. The section below presents a brief outline of some of the aspects of this lifestyle as it was recorded by early European observers. It should be kept in mind, however, that this information is flawed on many levels, being, for example, recorded by observers who would not have had a full understanding of the culture that they observed, and consisting of observations of a culture which, by that time, was probably already experiencing severe disruption.

Languages and Population

A number of dialects were spoken in the region that is now the Greater Sydney area. While the boundaries, in some cases, the status of these are somewhat uncertain, Attenbrow, in a recent review, has suggested the following distribution of languages and dialects:

- Darug, coastal dialect/s – [spoken on] the Sydney Peninsula (north of Botany Bay, south of Port Jackson, west to Parramatta) as well as the country to the north of Port Jackson, possibly as far as Broken Bay
- Darug, hinterland dialect – [spoken on] the Cumberland Plain from Appin in the south to the Hawkesbury River in the north; west of the Georges River, Parramatta, the Lane Cove River and Berowra Creek
- Dharawal – [spoken] from the south side of Botany Bay extending as far as the Shoalhaven River
- Gundungurra – [spoken on] the southern rim of the Cumberland Plain west of the Georges River (Attenbrow 2002: 34).

It is with the people of what is now known as Sydney Harbour that the Europeans had the most contact in the early years of the settlement at Sydney Cove. Writing in 1798 David Collins of the First Fleet described the Aboriginal people of the North Shore as follows:

Those who live on the north shore of Port Jackson are called Cam-mer-ray-gal, that part of the harbour being distinguished by the name Cam-mer-ray. Of this last family, or tribe, the settlers had heard Ben-nil-long and other natives speak (long before they were otherwise known) as of a very powerful people...They were afterwards found to be the most numerous tribe yet discovered (quoted in Russell 1970: 9).

The pre-contact population numbers for the area are not known; in the early days of the Sydney Cove settlement Governor Phillip estimated that about 1500 Aboriginal people lived in the Sydney district; more recent estimates of the contact period population of the greater Sydney region place the number between five and eight thousand, although other estimates are much lower (Turbet 2001: 25-26).

The Aboriginal population of the Sydney district declined dramatically following European settlement; some lives would have been lost in clashes with Europeans, many more were killed by the smallpox which spread through the population in 1789. The epidemic is thought to have caused the deaths of well over half of the Aboriginal population of the Sydney district (Attenbrow 2002: 21). The Aboriginal people of the district also suffered from declining resources caused by European fishing, hunting and land clearing. It should be noted, however, that the Aboriginal communities of the Sydney region survive and are represented by the members of a number of Local Aboriginal Land Councils.

Material Culture

The material culture of the Aboriginal people of the Sydney region was diverse, utilising materials derived from a variety of plants, birds and animals as well as stone. Below is only a short summary of the types of material used by the Aboriginal people of the Sydney region.

Spears in the Sydney region were usually made of a grasstree spike (for the shaft) with a hardwood point. Stone, bone, shell or wood were sometimes used as barbs (Turbet 2001: 40). Thin and straight spear-throwers were made from wattle (Turbet 2001: 40). Fishing spears were usually tipped with four hardwood prongs with bone points (Attenbrow 2002: 117, 119, Turbet 2001: 42). Fish were also caught by means of shell or bird talon fish hooks (Attenbrow 2002: 117, Turbet 2001: 45). Archaeological evidence from the Mt Trefle rockshelter/midden suggests that tidal traps or nets might have also been used for fishing in the Sydney region (Attenbrow and Steele 1995).

Bark of various types were used for making such diverse items as wrappings for new-born babies, shelters, canoes, paddles, shields and torches (Attenbrow 2002: table 10.1).

Resin from the grasstree was used as an adhesive for tool and weapon making (Attenbrow 2002: 116, Turbet 2001: 36).

Stone was commonly used for tools and, apart from discarded shell in middens, is the most common material found in archaeological sites of the region. Stone was used for axe heads, for spear barbs, as mentioned above, and as woodworking tools, amongst other things. A sequence of changes in stone tool types in eastern NSW was identified by archaeologist F.D. McCarthy who named it the 'Eastern Regional Sequence' (McCarthy 1976: 96-98). McCarthy identified 'Capertian,' 'Bondaian' and 'Eloueran' phases of the sequence which together appear to span the last 15,000 years in the Sydney region. Broadly, Capertian assemblages contain tool which are generally larger in size than later assemblages but also contain smaller tools, such as thumbnail scrapers and dentated saws.

In the late Holocene (from approximately 5,000 years ago) backed artefacts such as Bondi points, Elouera and geometric microliths appear in archaeological assemblages, and these tools are characteristically much smaller than those of earlier phases. Edge ground implements appear in Sydney region assemblages for the first time at about 4,500 to 4,000 years ago

Bondi points and geometric microliths, thought to possibly be spear barbs (although they may have had other uses), are found in large quantities at coastal sites in the region. Eloueras are believed to be wood-working tools.

From about 1,600 year ago Bondi points and geometric microliths began to drop out of use in the coastal parts of the Sydney region, although the Elouera continued to be used. In coastal areas both the use of quartz and the use of the bipolar flaking technique increased (Attenbrow 2002: 153-159).

Food

Fish and shellfish were important food resources to the people of the Port Jackson area as evidenced by both the observations of the first European settlers and by the numerous shell middens found along the shorelines of the coast and bays.

Marine mammals were eaten when available, but were relatively rare. The beaching of a whale was used as an opportunity for a large gathering of people and a feast. Seal bones have been found in some coastal archaeological sites in the Sydney region (Attenbrow 2002: 63-69).

A range of land mammals were also hunted for food, including kangaroos, possums, wombats and echidnas as well as native rats and mice (Attenbrow 2002: 70). Birds, such as the muttonbird and brush turkey, were eaten and it is recorded that eggs were a favourite food (Attenbrow 2002: table 7.3, p75-76).

Attenbrow has noted that “Sydney vegetation communities include over 200 species that have edible parts, such as seeds, fruits, tubers/roots/rhizomes, leaves, flowers and nectar (Attenbrow 2002: 76). Observations from the earliest European settlers describe Aboriginal people in the Sydney region roasting fern-roots, eating small fruits the size of a cherry as well as a type of nut and the root of “a species of the orchid” amongst other types of plant food. As Attenbrow points out, however, the settlers’ lack of knowledge of the local plant species make identification of the various plants used difficult (Attenbrow 2002: 76-79).

Previous Archaeological Work

Although European observers recorded various aspects of the lifestyles of Aboriginal people in the Sydney region from the beginning of white settlement in the late eighteenth century, it wasn’t until the late nineteenth century that archaeological investigations of Aboriginal archaeological sites were undertaken (Attenbrow 2002:5).

Since then over 4,000 archaeological sites have been recorded across the region, and hundreds have been excavated (Attenbrow 2002: 48). Most commonly these contain engraved or pigmented images, midden material, or open scatters of archaeological material such as stone artefacts (Attenbrow 2002: figure 5.6).

Currently the oldest accepted date for an archaeological site in the Sydney region is a date of approximately 14,700 years ago which was obtained from Shaws Creek Rock shelter K2, located to the north of Penrith (Attenbrow 2002: 20).

Both the academic research and development-led archaeological investigations undertaken over the last 30 years have contributed to a greater understanding of the Aboriginal archaeology of the Sydney Basin. A search has been lodged with the NSW Department of Environment and Conservation (formerly NSW National Parks and Wildlife Service) Aboriginal Heritage Information Management System. Results from this search are pending and will be included once received.

At a broader level, the Port Jackson region has been subject to a number of significant studies. In particular the Port Jackson Archaeological Project – Stage II carried out between January 1990 and 30 June 1992 by Val Attenbrow. A summary of this and other studies are provided below.

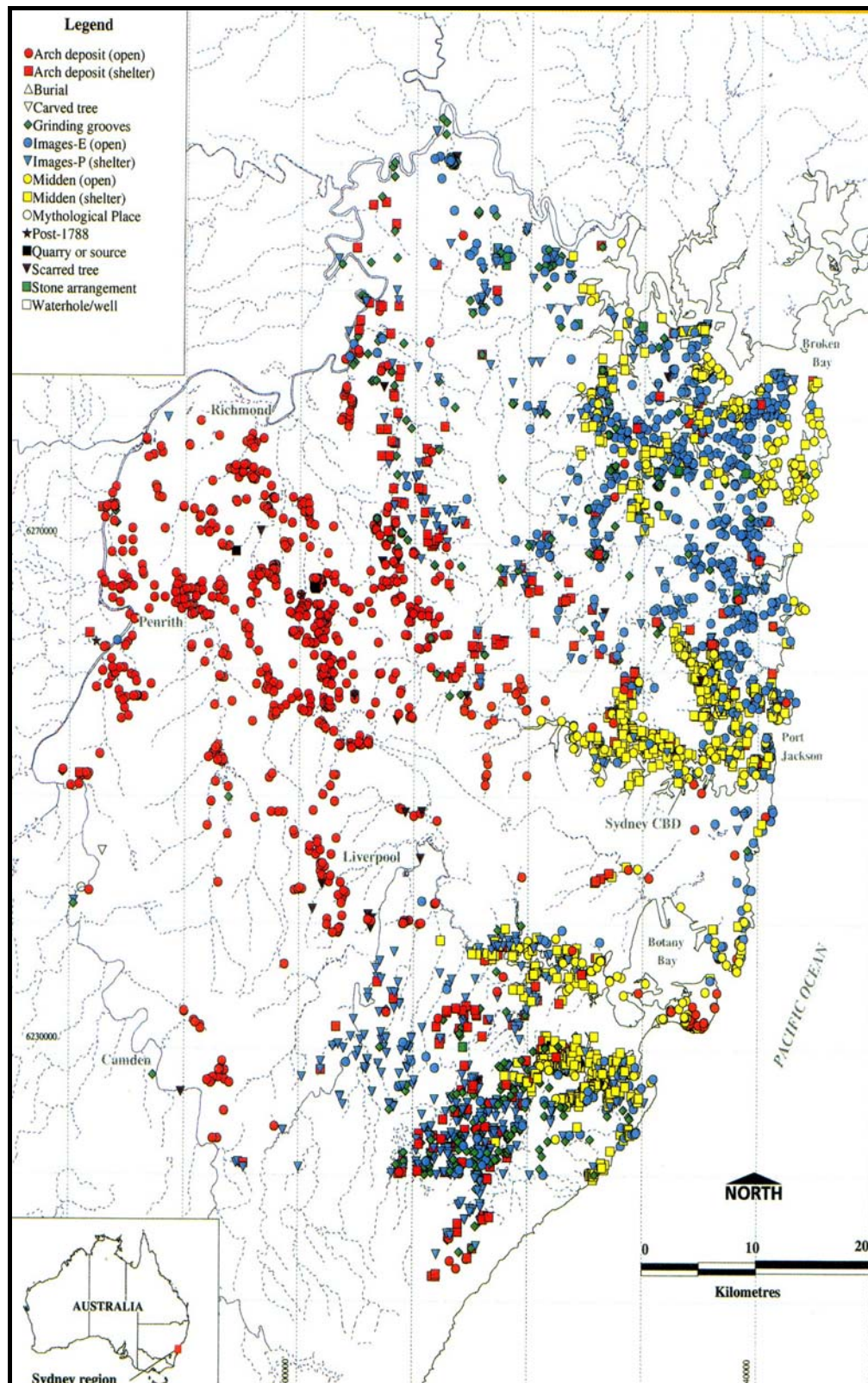


Figure 1 Distribution of recorded Aboriginal archaeological sites in the Sydney region (from Attenbrow 2002: figure 12)

Port Jackson Archaeological Project – Stage II. Report on work carried out between January 1990 and 30 June 1992. V Attenbrow 1992.

One of the largest archaeological surveys in Port Jackson was undertaken by Val Attenbrow. Focused on identifying and recording occupation, diet and subsistence patterns within the entire Port Jackson area, the project ran for several years in two stages; the first being survey and assessment of the archaeological resource, the second being the test excavation of select archaeological sites. The project placed individual test excavation results in a broader regional picture allowing inferences which may be broadly applicable to the current study area.

The faunal assemblages analysed throughout the project suggest that the Aboriginal diet varied from that noted in historic documentation. Historic records which mention the dietary dominance of fish and shellfish and the use of spears and hooks to catch fish have been supplemented by the information retrieved from sites such as Mt Trefle. At this site, the faunal record indicates that fish and shellfish were supplemented by land mammals (predominantly kangaroo and wallaby), birds (brush turkey) and reptiles (unidentified species). Analysis of the fish remains noted that species size was indicative of procurement methods other than angling and spearing. The high proportion of smaller fish sizes suggest that drum nets and fixed gill nets were probably employed as both these methods are selective towards smaller fish (Steele 1992).

Mt Trefle is a shell midden in a rockshelter located in Sydney Harbour National Park, near Vaucluse. The shelter measures 20 x 5 x 1.9 m, although much of the area is not habitable as the back half of the rockshelter has a ceiling height of 60 cm. The shelter faces west-south-west and is located on a forested sandstone ridgeline 20 m above sea level and 40 m from the shore (Attenbrow 1992:9).

During the excavation of the Mt Trefle site, other Aboriginal materials retrieved included stone, bone and shell artefacts, bone and shell (discussed above), charcoal and ochre. 2502 stone artefacts were retrieved from the excavation, with quartz the dominant material. Silcrete, chert, undifferentiated fine grained siliceous, quartzite and basalt were also present, and one sandstone artefact was recovered. The stones were worked into flakes and flaked pieces with retouch and/or usewear, cores, flakes, flaked pieces, bipolar cores and other bipolar pieces. Usewear analysis on the assemblage noted that several of the artefacts had evidence of soft tissue processing consistent with scraping skins and soft wood/barks. Attenbrow noted some minor changes in the stone tool assemblage over the occupation period of the shelter, but overall these differences were minor; no substantial changes being observed. The stone tools were representative of the Late Bondian Phase, which began c. 1600 years ago and continued until contact (Attenbrow 1992:14).

Other sites excavated as part of the project include Hydrofoil, a north-west facing rockshelter with midden measuring 11 x 4 x 2.3 m, also located at Vaucluse. One .5 x .5 m test pit was test excavated at the site. This test trench showed that the deposit was 80 cm deep, but so highly disturbed that further excavations were unwarranted (Attenbrow 1992:22).

John Curtain Reserve, located on a creekline at Northmead, was also excavated as part of this project. A large rockshelter with archaeological deposit, the site yielded radiocarbon dates of ca 5500 years BP at the base of the deposit and ca 1600 years BP at the top. Artefacts excavated at the site included stone artefacts, charcoal, ochreous material, plant remains and insect remains. Only the stone tools were definitely of Aboriginal origin, given that the site experienced heavy water erosion and some material may have washed into the site. At this site, most of the artefacts were of silcrete, though some chert, quartz, quartzite, and basalt pieces were recovered. The assemblage included bondi points, geometric microliths, flakes, flaked pieces, bipolar pieces and cores (Attenbrow 1992:27). Both artefact type and radiocarbon dates concur with an identification of the assemblage as Early-Middle Bondian.

Excavations at the Darling Mills State Forest 2 site, also at North Rocks, provided further corroborative information on the types of material culture present in the Port Jackson area. The rockshelter with archaeological deposit was located in a small cliffline on a gently sloping forested ridgeline above a tributary of the Darling Mills Creek (a freshwater creek). The area under the shelter measured 20 x 5.5 m and although the top sediments were highly disturbed, below were secure contexts. The site was rich in

stone artefacts, which were generally quite small (< 5 cm) with raw material including silcrete, chert, quartz, quartzite, and basalt utilised. These were manufactured into flakes, flaked pieces, cores and bipolar pieces. The faunal assemblage included Eastern Grey Kangaroo and Brush-tailed Rock Wallaby (Attenbrow 1992:30).

Archaeological Investigation of the Grace Brothers Aboriginal PAD Broadway, Sydney. D Steele 1997.

Situated on Broadway, the old Grace Brothers stores were the focus of an archaeological assessment as part of the redevelopment of the site. Although heavily developed, the original landscape of the area was gently sloping open forest community leading down towards the estuarine environment of Blackwattle Bay. Several other resource communities are within easy access of the site and it was predicted that the original landscape provided a variety of resources.

During the assessment a large area of intact surface was identified within one of the Lots. This area was designated an Aboriginal PAD and test excavation was recommended. During the assessment for the research design, the area of PAD was refined and reduced (to exclude areas of disturbance associated with pipes and services). The final PAD measured approximately 7 m x 37 m 9p. 22). Ten 1 x 1 m squares were hand excavated in 5 cm spits.

No Aboriginal artefacts were recovered during the excavation of the PAD. In addition there was no other evidence for Aboriginal use of the PAD (p. 34)

Salvage Excavation of a Potential Aboriginal Site, NPWS # 45-6-2637, 589 – 593 George St, Sydney. D Steele 2002.

During the historical excavation of a row of terraces situated in Brickfield Hill, a band of shell was identified in section. The shells were sitting on a relict topsoil and were covered by introduced European deposits. It was determined that the shell dated to some time prior to European occupation of the area and there was potential it was Aboriginal in origin. The subject area was declared a PAD and was test excavated to clarify the origin of the shell as either Aboriginal, European or historic.

The area of shell was exposed, grided and excavated. During excavation it became apparent that the shell was part of a sandy mortar matrix which was sitting above the B-horizon basal clay, there being no remnant topsoil (p. 17). No flaked stone tools were identified in the excavation, and it was determined that the shell represented historic activity on the site.

Excavation Report on Morts Bond Store, Appendix 1, Aboriginal Site 45-6-0519. R Lampert n.d.

During historic archaeological excavations below Morts Bond Store, a thin layer of shell was identified in a remnant topsoil unit. The midden deposit was approximately 10 cm thick, below which was a dark brown compact sand containing flaked stone. This unit was associated with a natural depression in the bedrock and was approximately 30 cm thick.

Shell remains were from species including Sydney Rock Oyster, Mud Oyster, Hairy Mussel, Hercules Club Whelk and Sydney Cockle (Table 1). The vast majority of the shell was oyster shell, although the sample size was small (112.5 g of shell).

Artefacts recovered from the site were made from red and grey silcrete, quartz, quartzite and chert. All the pieces were small and the cores recovered suggest that the artefacts were derived from small pebbles, possibly of a local origin in the Hawkesbury Sandstone. The small size of the flakes is consistent with the local stone sourced from Hawkesbury sandstone (p.2). The red silcrete, however, reached the site from quarries in the Cumberland Plain (some 50 km inland). Red silcrete is present only as small flakes, there are no cores. Locally sourced stone has been modified into scrapers, edge polished flakes with wear patterns indicative of hafting, fabricators (or scalar cores) and a fish hook file (p. 3-4).

Below the deposit with the flaked stone, there was an intact unit with four pieces of blue transfer ware. These lower deposits contained no faunal remains (shell or bone) and no other organic material. The site appeared to have undergone little disturbance, presenting as stratigraphically intact. Lampert interpreted this as evidence of differential rates of organic decay, rather than no deposition of organic material in the lower units. The excavation concluded that there was Aboriginal exploitation of marine resources well into historic times (p. 7).

Archaeological Excavations of the KENS Site, Sussex St. Thorp, W. 1999.

This assessment was carried out by Wendy Thorp on behalf of Sunlord Pty Ltd on an area known as the KENS site. This site consisted of a block of land bound by Kent, Erskine, Napoleon and Sussex St. An assessment conducted by Edward Higginbotham in 1996 on an area of car parks in the northern section of the site revealed that there was a high probability for intact archaeological material in this area. Subsequent excavation confirmed this. This material took the form of environmental, structural and cultural deposits resulting from residential and commercial activities. A later assessment conducted by Godden Mackay in 1998 determined that it was likely that material of the same integrity would have survived across the site except in areas of deep excavation for basements or footings. Excavations in mid-2003 revealed a remarkably complete and intact record of both Aboriginal and European habitation in this area and it is likely that similar material has been preserved to a comparable degree in the surrounding areas.

Site types prevalent in the Region

On the basis of registered archaeological sites in the region and the results of past archaeological investigations, a number of site types may have been present within the study area. The following descriptions are based on definitions provided by the Department of Environment and Conservation.

Occupation Sites (rock shelters with deposit, middens and open campsites)

Hawkesbury Sandstone can sometimes weather into sizable overhangs forming an area large enough to inhabit. Rock shelters often contain evidence of occupation in the form of a camp site (including surface artefact scatters) and/or art. If the shelter was occupied, sediments from fires, roof fall, discarded stone tools and food remains may form an archaeological deposit. This deposit provides archaeologists with information about past patterns of Aboriginal life.

Middens occur along the coast and the edges of rivers and lakes. Middens contain the remains of edible shellfish; most generally also contain fish and animal bones. The presence of stone tools and charcoal are also indicative of a cultural (rather than natural) shell deposit.

Surface sites, commonly referred to as open artefact scatters, may include archaeological remains such as stone artefacts, faunal and shell remains, charcoal and baked clay. Occasionally, such sites contain hearths. Surface scatters are usually exposed by erosion, agricultural events and vehicle and animal tracks in areas where surface visibility is increased due to lack of vegetation. Surface sites can also be indicators of associated subsurface archaeological deposits which may remain intact dependant on the degree of land disturbance which has occurred in the past.

Art sites (rock paintings and engravings)

Aboriginal paintings may be found on suitable wall and ceiling surfaces of rock shelters. Images are made with white, red, yellow or black ochre and/or charcoal, and may be drawn, stencilled or painted. Dominant motifs may include hands, humans, animals, animal tracks and grid patterns.

These generally occur on exposures of fairly flat, soft rock, or in rock overhangs. Shapes were made by hitting rock surfaces with a sharp stone, creating lines of pits. These pit marks are sometimes joined to form a groove, by rubbing with a stone. Motifs are similar to those found in Aboriginal rock paintings.

Burials

Aboriginal burials may occur in caves, middens, and campsites. In inland areas especially, they are likely to be found in sand dunes or other types of soft ground which were easy to dig. A burial site has been recorded near the study area; although there is only low potential for a burial site to be present within the study area.

PADs

Potential Archaeological Deposit is identified in areas where predictive modelling and current site information suggest that there is potential for archaeological resources to be present. PADs can be identified in disturbed areas, where there is a likelihood of intact substrates (eg in areas which have been disturbed through the placement of fill). They can also be identified in association with surface scatters of artefacts.

Land-use History

The study area has seen a myriad of uses since European settlement and occupation in the late 18th century. Initially parts of the area were sufficiently remote from Sydney Cove to be used first for recreational, then military purposes, but for much of its history, it has had a commercial character. The area of Sussex Street south to the headwaters of Darling Harbour has been associated with maritime trade and many important industrial innovations of the growing settlement. Early attempts to plan for the future needs of the colony led to the establishment of a wharf by Governor Macquarie in 1811, which directed the flow of produce away from the more congested Sydney Cove to the newly established central produce markets. Over the following decades, commercial maritime activity continued to increase and the surrounding area developed a mixed industrial and domestic character that was to remain until major resumption works were undertaken in the early twentieth century. Following the redevelopment of the former working harbour in the 1980s and its conversion to a recreational and tourist facility, much of the evidence for the important early history of the region has diminished.

It is highly probable that the settlement history and its past land use history has played a significant role in the destruction if not disturbance of intact subsurface Aboriginal archaeological deposits within the study area. Although some excavations in the Sydney CBD region have unearthed Aboriginal archaeological remains, in most cases, these remains are located stratigraphically beneath the remains of European activities or in natural horizons that have not been disturbed by past European activities.

Conclusion

The potential for the discovery of intact remains associated with the Aboriginal occupation and use of the study area is very much dependant on the extent of past European land use activities. Areas of Aboriginal archaeological potential are therefore likely to occur in areas where there is evidence of mangroves such as those recorded in the creek bed area during the Capitol Theatre and KENS site archaeological excavations. It is likely that significant mangrove remains are still in evidence in the Darling Harbour area. If the proposed tunnel disturbs this level, substantial mangrove remains, along with associated micro-flora and remnant deposits, are likely to be exposed. It is concluded that the mangrove areas around Darling Harbour would have a high archaeological potential for evidence of the pre-European environment.

However, any impact on these remnant mangrove areas needs to be considered in light of the proposed construction methodology for the City West Cable Tunnel project. The majority of the work will involve tunnel boring through bedrock and is unlikely to uncover and impact on Aboriginal archaeological features and/or cultural deposits.

The main areas of potential impact are likely to be the two construction sites at Mary Anne Street shaft and the City Central Substation. The works at Mary Anne Street involve the excavation of a cavern whilst the City Central works require the boring of a 2 metre diameter shaft. Both these sites will be bored directly into mostly exposed bedrock with minimal soil cover. Historical activities at both sites have included extensive clearing and levelling of the natural land surface. This has significantly reduced the potential for remains associated with Aboriginal activities to be present at either the Mary Anne Street or City Central sites.

Mitigation measures for the proposed tunnel works (including the Mary Anne Street and City Central Substation sites) includes a Stop Work provision if unanticipated Aboriginal cultural deposits are encountered. Specifically, the Stop Work provision requires that in the event unanticipated Aboriginal cultural deposits are encountered, work must cease immediately to allow the project archaeologist to make an assessment of the finds. The project archaeologist may then need to consult with the Department of Environment and Conservation (DEC) concerning the significance of the material.

The Stop Work provision will also be triggered in the event that a greater than anticipated soil profile is encountered during the boring works.

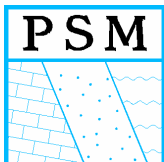
Workers and contractors on the project will also be subject to a heritage induction on commencement of the project. The aim of the heritage induction will be to ensure that all project staff are aware of their responsibilities under the National Parks and Wildlife Act 1974 with regards to Aboriginal sites and places.

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Appendix C

CWCT Interaction with Darling Park
Development
(Geotechnical investigation)



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Our Ref: PSM828.TL49
Date: 26 July 2006

The Project Manager
City North Cable Tunnel
37 Ann Street
SURRY HILLS NSW 2010

ATTENTION: MS W PENROSE

Dear Madam,

RE: CWCT INTERACTION WITH DARLING PARK DEVELOPMENT

1. INTRODUCTION

The letter presents the results of our assessment of the City West Cable tunnels interaction with the Darling Park Development located along Sussex Street, Sydney. In particular we have assessed the impact excavation of the CWCT would have on settlement of the rock below the development and its basement.

2. SITE LOCATION, GEOMETRY AND LOADING

Figure 1 shows the location of the Darling Park development and the proposed tunnel alignment. The tunnel is shown as passing beneath Stages 1 and 2 of Darling Park. The Figure is based on Drawing PSM828-202 Rev 4.

According to the site investigation report for Tower 2¹ the basement excavation was to be taken down to about RL -9m. However, the URS Geotechnical Data Report prepared for the RTA for the CCT² states that the approximate basement level is RL -15.9m.

PSM has not confirmed the true basement excavation RL for Tower 2 but has taken it as being RL -15.9m.

¹ Coffey Partners International Report S9476/9-AC of 26 June 1996.

² URS Cross City Tunnel, Geotechnical Data Report, February 2001.

PSM does not have any information on the building column spacing nor loads for the Towers. Notwithstanding this we have assumed a typically column spacing of 8m and allowed for a range of loads based on the rock conditions we have assessed to be present at about foundation level.

- Three load cases - 5MPa, 10MPa and 15MPa
- Loads acting on 2m wide foundation zones at 8m centres.

The geometry of the basement for the Stage 2 Tower and the load locations are shown on Figure 2. The obvert of the circular, TBM excavated CWCT is taken from drawing PSM828-206 Rev 2 reported in PSM828.R12 from March 2006 and is RL-28.5m.

3. INTERPRETED GEOTECHNICAL MODEL

The interpreted geotechnical model adopted for the assessment was based on available borehole logs for the Darling Park development, the CCT and investigations for the CWCT. The interpreted model below Darling Park Stage 2 is shown on Figure 2.

The rock mass units adopted are as reported in our interpretative report for the CWCT project PSM828.R12 dated 24 march 2006. The relevant Unit descriptions are repeated below for completeness.

TABLE 1
GEOTECHNICAL DEFINITIONS OF TYPICAL PROPERTIES OF UNITS

UNIT	DEFINITION	SUB-UNIT	DEFINITION
UNIT 1	Uncontrolled fill and Quaternary Sediments. Filling up to about 3m deep in places overlying quaternary sediments comprising predominantly sandy clays, inorganic and organic clays (old mangrove muds), and sand layers.	1a	Fill varying from clayey sand, to crushed sandstone, to building debris, and possibly old waste dating from the early years of Sydney
		1b	Marine sediments, comprising typically firm to stiff sandy clays and clays, but with some horizons of soft clays; and medium dense silty sands and sands, with some loose horizons.
UNIT 3	Hawkesbury sandstone, predominantly sheet facies (i.e. cross bedded), ranging from highly to slightly weathered and having saturated compressive strength in the range 10 MPa to 30 MPa. Bedding planes spaced about 0.1m to about 0.8m ranging from slightly weathered to comprising clay seams from <2mm to >20mm. Orthogonal jointing, near vertical, dominantly oriented NNE, spaced <1m to about 5m. Some joint surfaces weathered to sandy clay. Broadly equivalent to Class III sandstone as illustrated by Bertuzzi & Pells (2002, page 50).	3a	Zones of more closely spaced NNE joints and some near vertical faults associated with GPO Fault Zone.

TABLE 1
GEOTECHNICAL DEFINITIONS OF TYPICAL PROPERTIES OF UNITS

UNIT	DEFINITION	SUB-UNIT	DEFINITION
UNIT 6	Slightly weathered and fresh Hawkesbury Sandstone. Saturated compressive strength 20MPa to 40MPa, dry strength up to double these values. Quartz content from 65% to 80%. Sub-horizontal undulating bedding planes, spaced typically 0.6m to 1.5m, with occasional seams of sandy clay to about 10mm. Two sub-vertical, orthogonal joint sets with the dominant oriented approximately NNE, spaced 1m to 5m; secondary joint set more widely spaced. Broadly equivalent to Class I/II sandstone as illustrated by Bertuzzi & Pells (2002, p 49).	6a	Predominantly Massive Facies sandstone.
		6b	Predominantly Sheet Facies sandstone (cross bedded)
		6c	Unit 6 affected by GPO Fault Zone resulting in lengths of more closely spaced joints of the dominant NNE joint set, i.e. spacings of 0.1m to 0.3m over intermittent lengths/widths of 5m to 10m.
UNIT 7	Mudstone Facies of the Hawkesbury Sandstone; closely interbedded, slightly weathered to fresh, sandstone and siltstone (laminite) with beds of slightly weathered sandstone. Laminite saturated compressive strength in range 20MPa to 30MPa. Sandstone saturated compressive strength 20MPa to 40MPa. Quartz content as per Unit 6. Jointing as per Unit 6.	7a	Unit 7 affected by GPO Fault Zone in same manner as per Unit 6.
<u>Reference:</u> Bertuzzi, R and Pells, P.J.N. (2002). Geotechnical parameters of Sydney sandstone and shale. Australian Geomechanics Journal, V37, No 5, 2002.			

4. ASSESSMENT

4.1. Design Parameters

Soil and rock mass parameters adopted for the design assessment are presented in Table 2 and are repeated on Figure 2.

TABLE 2
DESIGN MATERIAL PARAMETERS

PARAMETER	UNIT 1a	UNIT 1b	UNIT 3	UNIT 6b	UNIT 7
Unit Weight (γ) - kN/m ³	18	20	24	24	24
Modulus (E) - MPa	30	50	1000	2000	1500
Poissons Ratio (ν)	0.4	0.3	0.25	0.2	0.25
Friction Angle ($^\circ$)	20	20	40	50	45
Peak Strength - kPa	5	5	750	1500	1000

4.2. In-situ Horizontal Stress Field in Rock

The magnitude of any in-situ horizontal stress field that may be present in the rock below Darling Park is not known, nor the extent of stress relief as a result of the basement excavation. PSM have adopted the following stress field in the Hawkesbury Sandstone and Laminate rock.

$$\sigma_1 = \sigma_{NS} = 1.5 + 2.0\sigma_v \quad \text{MPa} \quad \text{.....①}$$

$$\sigma_2 = \sigma_{WE} = 0.7\sigma_1 \quad \text{MPa} \quad \text{.....②}$$

$$\sigma_3 = \sigma_v = 0.024H \quad \text{MPa} \quad \text{.....③}$$

where H = depth below surface in metres

4.3. Phase² Modelling and Results

The finite element programme Phase² modelled the interpreted ground conditions and tunnel geometry discussed previously with the parameters and stress field values presented above. Selected output from the modelling are presented in Appendix A. Results of the Phase² modelling are presented in Table 3.

Two points should be noted in considering the results given in Table 3. Firstly the values reported are the level of additional movement and stress generated in the basement of the Darling Park development above the tunnel arising from excavation of the tunnel void. No tunnel support has been applied.

Secondly, the 2m wide loaded zone is two dimensional, that is it is continuous in the out of plane direction. This load scenario is conservative and we would expect the impacts of isolated pad/column loadings to be less than those reported below by as much as half.

TABLE 3
CHANGES INDUCED BY CITY WEST TUNNEL EXCAVATION

LOAD CASE	DEFLECTION CHANGE (mm)	STRESS CHANGE (MPa)	
		MAJOR	MINOR
5MPa	1.5	0.19	0.07
10MPa	2.7	0.2	0.15
15MPa	4.0	0.3	0.2

Note that the changes reported in Table 3 are the maximum values found in the FE modelling. Maximum changes occurred in the floor of the existing Darling Park basement and were typically located above the CWCT alignment. Outside of the zone above the proposed tunnel, there was no discernable impact on the Darling Park development from the tunnel excavation.

5. CONCLUSION

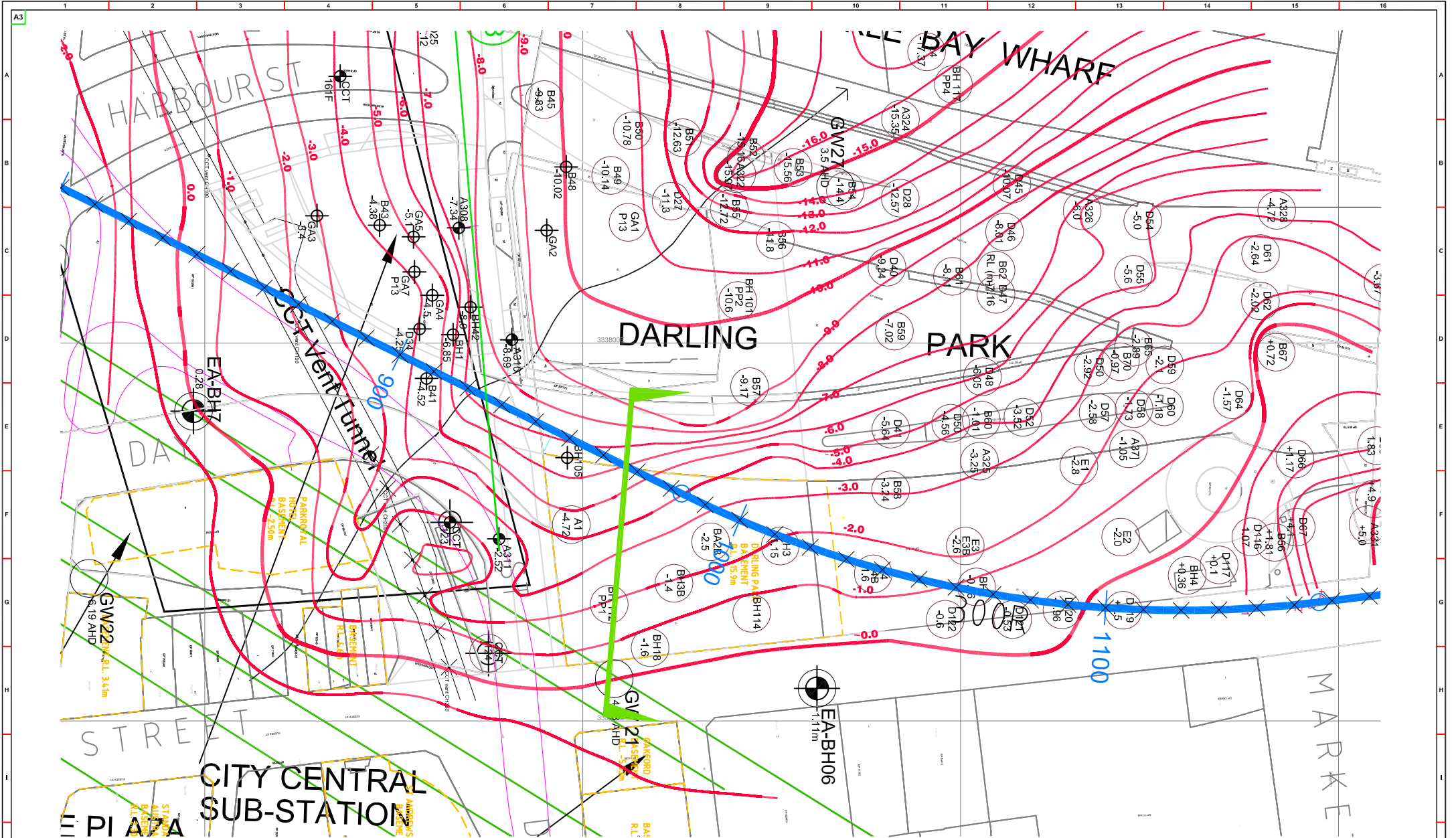
Given the magnitude and the conservative modelling of building loads, PSM consider that the excavation of the proposed City West Cable tunnel will not impact on the stability of the Darling Park development. Further, the changes in displacements in the basement are considered highly unlikely to damage either the structure or services typically associated with commercial developments.

For and on behalf of
PELLS SULLIVAN MEYNINK PTY LTD

D.ANDERSON

Figure 1 Site Location and Tunnel Alignment
Figure 2 Section and Interpreted Geotechnical Model

Appendix A Results of FE Analysis



Section - See Figure 2

NOTE:
ARUP BOREHOLE LOCATIONS ARE TAKEN FROM THEIR ORIGINAL JOB REPORTS.
THESE LOCATIONS ARE DIFFERENT TO THOSE SHOWN ON THEIR COMPILED
SK3 DRAWING PROVIDED IN NOV. 2005

MGA coordinate system used in this drawing.

REV	DATE	REVISION DESCRIPTION	REV BY	CHKD
1	26.07.06	Issued with PSM828.TL49 - Based on Dwg 828-202 Rev 4	MM	DA

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TITLE:

Energy Australia
City West Tunnel

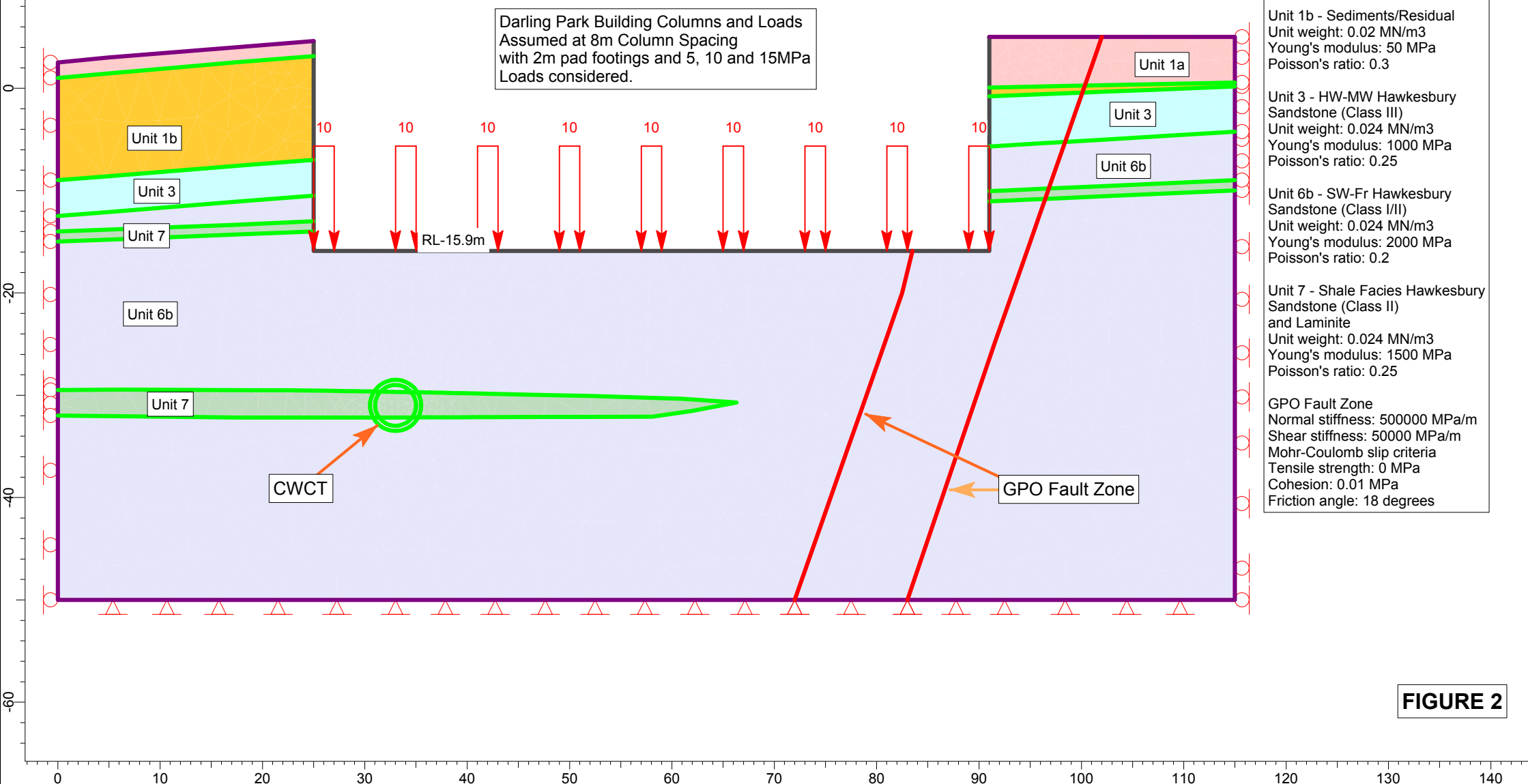
DARLING PARK AND CWCT LOCATION

DESIGNED: AGS	APPROVED: DA
DRAWN: MM	DATE: 25.07.06
SCALE: 1:2000 @ A3	PLOT DATE: 26.07.06
XREF:	CAD FILE:
DRAWING NO: FIGURE 1	REV: 1

PSM828 - Darling Park

Impact of CWCT on Existing Structure

Section and Interpreted Geotechnical Model



APPENDIX A
SELECTED PHASE² OUTPUT

