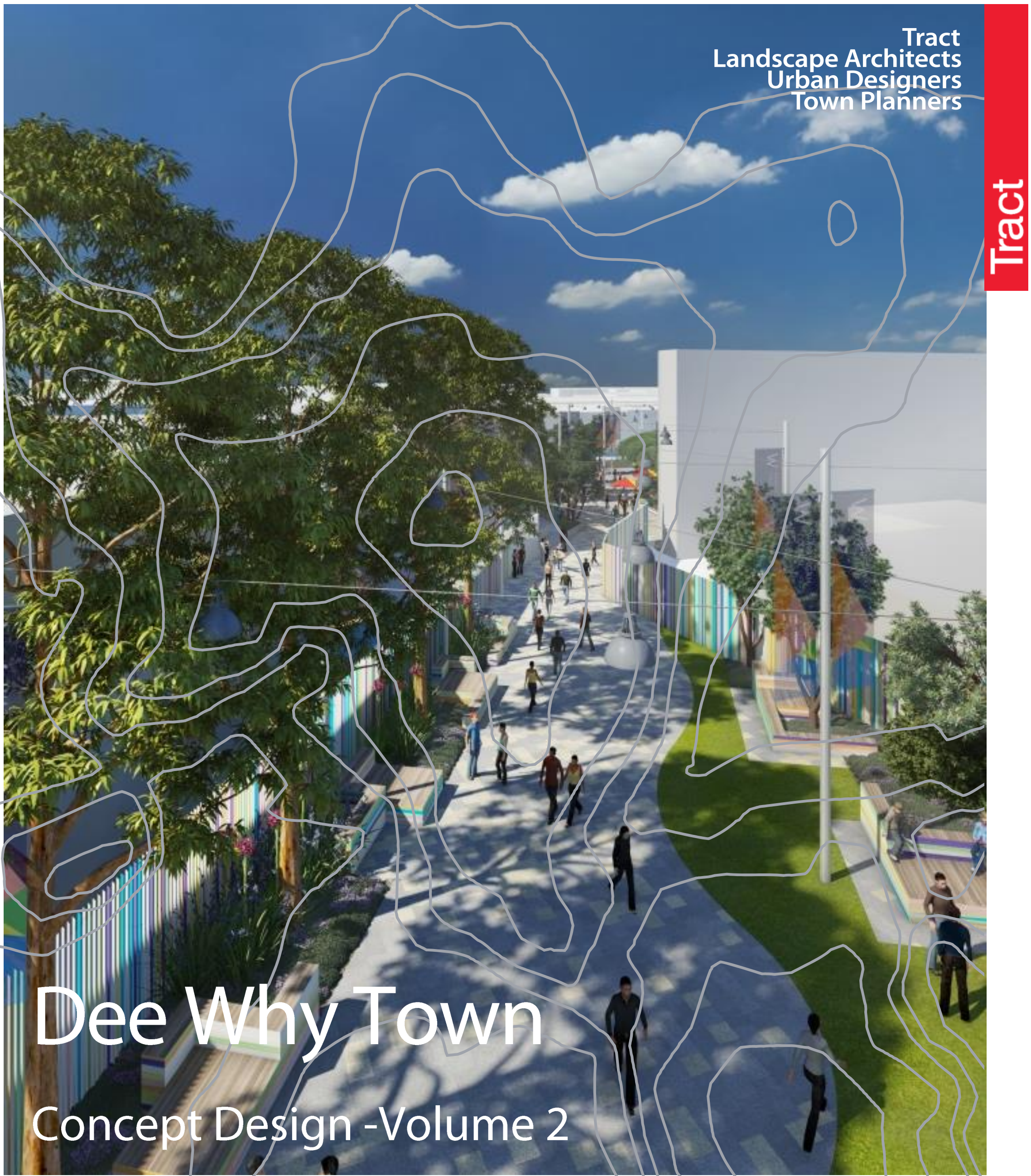

Dee Why Town

Concept Design -Volume 2

Dee Why Town Centre Public Infrastructure Upgrades Feasibility and Investigations Stage

Dee Why

Prepared by Tract Consultants
for Warringah Council

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Contamination report **EIS**

Traffic Report **Parsons Brinckerhoff**

Cost Plans **Wilde & Woollard**

Lighting report **Lighting Art+Science**

Stormwater report **Woolacotts**

ENVIRONMENTAL INVESTIGATION SERVICES

REPORT

TO

TRACT CONSULTANTS PTY LTD

ON

PRELIMINARY STAGE 1 ENVIRONMENTAL SITE ASSESSMENT

FOR

PROPOSED DEE WHY TOWN CENTRE PUBLIC INFRASTRUCTURE WORKS

AT

DEE WHY, NSW

20 AUGUST 2014 **REF: E27540KPrptFINAL**

AS/NZS ISO 9001 Certified
Davis Langdon Certification Services

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EXECUTIVE SUMMARY

Introduction

Tract Consultants Pty Ltd ('the client') commissioned Environmental Investigation Services (EIS)[1] to undertake a preliminary Stage 1 Environmental Site Assessment (ESA) for the proposed Dee Why Town Centre public infrastructure works at Dee Why, NSW. The ESA was generally confined to the Dee Why Town Centre area as shown on Figures 1 and 2.

The ESA has focussed on a number of 'key study areas' associated with the public infrastructure works for the Dee Why Town Centre Master Plan (2013[2]). The key study areas are described in **Section 1.1** and are shown on the attached Figure 2.

The aim of the ESA was to identify known or potential areas of soil/groundwater contamination and to assess the potential risks or impacts to the proposed public infrastructure works specified in the Master Plan.

The objectives of the ESA were to

- Identify (based on a desktop assessment) known or potential sources of contamination within the Dee Why Town Centre Master Plan area, with a focus on key study areas associated with the public infrastructure works;
- Prepare a preliminary conceptual site model (CSM);
- Provide a discussion in relation to potential contamination-related risks/constraints to the public infrastructure works proposed under the Master Plan; and
- Provide preliminary recommendations in relation to potential intrusive investigation requirements for the study areas.

The scope of work included: a review of previous EIS investigations in the Dee Why area; review of available site information; a limited site history assessment; and a site walkover inspection. This information was used to prepare the preliminary CSM.

Potential Contamination Sources and CSM

Imported fill soils and demolition of buildings were identified as potential contamination sources in most study areas. Study area specific potential contamination sources also included:

- A former dry cleaners and service station; and
- An existing dry cleaner.

Based on the site history assessment and observations made during the walkover inspection, there were no land uses or potential contamination sources identified immediately outside the Master Plan area that would be expected to impact the study areas (or Master plan area in general) via contaminant migration through soil or groundwater.

The preliminary CSM outlined the potential contamination sources, receptors and exposure pathways identified based on the site information and the proposed development details for each study area. Reference should be made to **Section 4** and the attached Figure 5 for further details.

Discussion

A number of potential contamination-related risks/constraints have been identified that may impact the public infrastructure works proposed under the Master Plan. A discussion of these risks/constraints follows:

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[1] Environmental consulting division of Jeffery & Katauskas Pty Ltd (J&K)

[2] Place Design Group 2013, *Dee Why Town Centre Master Plan* (Referred to as the Master Plan)

Asbestos in Soil
Suspected asbestos containing material (sACM) was identified in a number of the key study areas during this ESA. Based on the observations made during the walkover inspection, it would be reasonable to assume that the asbestos issue may be widespread across all study areas (and the Master Plan area in general) and therefore this will need to be considered in detail moving forward with the project.

The presence of asbestos will require further consideration in relation to work health and safety (WHS) requirements during the proposed development works and with regards to the future use of each area.

The sACM that was observed during the walkover inspection appeared to be bonded ACM (i.e. ACM that could not be crushed using hand pressure and was not powdery or significantly degraded). Management/remediation of bonded asbestos within the study areas would be relatively straight forward.

The presence of non-bonded (also known as friable) asbestos may have more significant implications for the works. The presence of friable asbestos would result in increased WHS measures, site assessment requirements and remedial requirements which would be expected to increase the cost of the works significantly.

Disposal of Excavated Material
The previous EIS investigations undertaken within the Dee Why area identified fill soil to various depths (typically 0.5-1m). This fill may have been imported from off-site sources or may have been formed by churning of the upper soil profiles.

The presence of fill material will require careful consideration with regards to soil disposal costs in the event that there is likely to be a surplus of excavated material during the works. As a guide, landfill fees for waste materials classified as 'general solid waste' or 'general solid waste containing asbestos' are currently in the order of $160/tonne. This does not include excavation or transport.

Acid Sulfate Soil (ASS)
A number of the key study areas may be underlain by potential ASS (PASS). Generally these soils would be expected to occur more towards the north-eastern sections of the Master Plan area.

Previous EIS investigations within the Dee Why area indicated that the occurrence of PASS may be more widespread than what the ASS risk map, geological map and Warringah Council Planning map suggest.

The presence of PASS may impact the management of excavated material and the disposal classification of the natural soils (i.e. natural soil classified as PASS cannot be considered virgin excavated natural material – VENM).

Former and Existing Land Uses
As the public infrastructure upgrades generally fall within the public domain (such as roads), former land uses were not a primary concern for most areas.

The Triangle Park north study area (Item 27) was a former service station and dry cleaners. However, this study area has been remediated and has been certified as suitable for use as a park by an EPA accredited site auditor. As the proposed works under the Master Plan do not include a change of use for this study area, further assessment of this area (in relation to contamination and site suitability) is not considered necessary.

The presence of the suspected former service station (the existing Avis car rental) and the existing United Service Station in the southern section of the Master Plan area (probably most applicable to the Pittwater Road south study area - Item 39) are unlikely to represent a major concern in relation to the proposed works. Similarly, the Victor Glass industrial building is unlikely to represent a major concern in relation to the works within the Pittwater Road study area (Item 17).

There were no obvious land uses identified immediately outside the Master Plan area that were considered to represent a potential off-site risk with regards to soil or groundwater contamination migration.

Recommendations

Based on the scope of work undertaken, a number of potential contamination-related risks/constraints have been identified that may impact the public infrastructure works proposed under the Master Plan. These include:

- Asbestos in soil which will have implications for assessment, remediation/management and work, health and safety (WHS);
- Disposal of surplus excavated material; and
- The presence of ASS/PASS.

EIS are of the opinion that the presence of actual or potential contamination is unlikely to be prohibitive to the implementation of the Dee Why Town Centre public infrastructure works under the Master Plan. However, careful consideration of the various risks/constraints will be required so that the assessment, remediation and/or management costs are minimised.

Preliminary Intrusive Investigations

The recommendations for intrusive investigations are outlined in the table below:

Study Area	Investigation Recommendations
All areas	A preliminary soil contamination screening should be undertaken for all areas in conjunction with the geotechnical drilling works (we anticipate that geotechnical drilling will be required in most areas for pavement design, light poles and other structures such as seating etc). The preliminary screening(s) should be designed to: • Make a preliminary assessment of the soil contamination conditions in relation to the proposed land use; • Provide waste classification data for soil disposal purposes; • Provide preliminary data in relation to asbestos in soil (this can be utilised to develop appropriate remediation and/or management strategies); and • Assess the potential for ASS occurrence (as applicable). The soil screening should target the primary potential contaminants of concern (PCC) in all areas. A reduced analysis schedule for the secondary PCC (such as pesticides and polychlorinated biphenyls) can be considered in consultation with the environmental consultant. The preliminary CSM should be reviewed in light of the soil contamination screening findings to assess whether further investigation work or remediation/management is required.
Stormwater easement (Item 16) Walter Gors Park (Item 18); St David Avenue Pocket Park (Item 19)	These key study areas are considered to represent a greater risk with regards to contamination when factoring in the proposed end use (i.e. parks and high use areas with significant landscaping). On this basis, a site specific, preliminary investigation should be undertaken in these areas. The investigation(s) should be designed to supplement/complement the data obtained during the preliminary screening (as described above). In the event that contamination is identified during the preliminary investigation(s), a study area-specific Remedial Action Plan (RAP) should be prepared. The presence of unexpected or significant contamination issues in

Study Area	Investigation Recommendations
Triangle Park south (Item 30) Mooramba Pocket Park (Item 34), including the adjacent area where the proposed stormwater detention basin is being considered	these areas may warrant consideration of a detailed (Stage 2) investigation prior to preparation of the RAP. The preliminary CSM should be reviewed in light of the investigation findings.
Howard Avenue (Item 28)	The investigation for the Howard Avenue key study area should include an assessment of the groundwater contamination conditions. This requirement is based on the presence of the existing Lawrence Dry Cleaners and the potential for relatively deep excavation works for stormwater infrastructure along Howard Avenue.

Acid Sulfate Soil Management Plan (ASSMP)

An ASSMP will be required for any key study areas where ASS or PASS is encountered and may be disturbed during the proposed development works. Consideration could be given to preparation of an ASSMP that encompasses all study areas, based on the outcome of the preliminary soil screening or other investigations.

Asbestos Management Plan (AMP)

Following completion of the intrusive investigation(s), an AMP should be prepared. The AMP should provide details regarding the management of asbestos during the site works. This could include an AMP that encompasses all of the public infrastructure works areas or a number of study area specific AMPs.

Environmental Management Plan (EMP)

A long term EMP (or post construction AMP) will be required to manage the asbestos issue within the public infrastructure work areas after construction is complete. The EMP/AMP would apply to all areas unless it can be demonstrated that an area is free of asbestos contamination.

General

EIS recommend that a suitably qualified environmental consultant be engaged to provide input in relation to the assessment, management and/or remediation requirements for the duration of the project. In our experience, suitable planning and on-going liaison within a designated project team can reduce costs associated with the assessment and management of contaminated sites.

Conclusions

EIS are of the opinion that the presence of actual or potential contamination is unlikely to be prohibitive to the implementation of the Dee Why Town Centre public infrastructure works under the Master Plan. However, careful consideration of the various risks/constraints will be required so that the assessment, remediation and/or management costs are minimised.

The recommendations outlined in this report should be implemented to minimise the potential for adverse human health or environmental impacts associated with potential contamination.

TABLE OF CONTENTS

ABBREVIATIONS

Asbestos Containing Material	**ACM**
Suspected Asbestos Containing Material	**sACM**
Area of Environmental Concern	**AEC**
Australian Height Datum	**AHD**
Acid Sulfate Soil	**ASS**
Above Ground Storage Tank	**AST**
Below Ground Level	**BGL**
Benzene, Toluene, Ethylbenzene, Xylene, Naphthalene	**BTEXN**
Benzene, Toluene, Ethylbenzene, Xylene	**BTEX**
Contaminated Land Management	**CLM**
Conceptual Site Model	**CSM**
Data Quality Indicator	**DQI**
Data Quality Objective	**DQO**
Environmental Management Plan	**EMP**
Excavated Natural Material	**ENM**
Environmental Protection Agency	**EPA**
Environmental Site Assessment	**ESA**
General Solid Waste	**GSW**
Light Non-Aqueous Phase Liquid	**LNAPL**
Local Government Authority	**LGA**
Map Grid of Australia	**MGA**
National Association of Testing Authorities	**NATA**
National Environmental Protection Measure	**NEPM**
Organochlorine Pesticides	**OCP**
Organophosphate Pesticides	**OPP**
Polycyclic Aromatic Hydrocarbons	**PAH**
Potential Contaminants of Concern	**PCC**
Quality Assurance	**QA**
Quality Control	**QC**
Remediation Action Plan	**RAP**
Restricted Solid Waste	**RSW**
Site Assessment Criteria	**SAC**
Site Audit Statement	**SAS**
Site Audit Report	**SAR**
Semi-Volatile Organic Compounds	**sVOC**
Standard Water Level	**SWL**
Toxicity Characteristic Leaching Procedure	**TCLP**
Total Recoverable Hydrocarbons	**TRH**
Underground Storage Tank	**UST**
Virgin Excavated Natural Material	**VENM**
Volatile Organic Compounds	**VOC**
Volatile Organic Chlorinated Compound	**VOCC**
Workplace, Health and Safety	**WHS**

1 INTRODUCTION

Tract Consultants Pty Ltd ('the client') commissioned Environmental Investigation Services (EIS)[3] to undertake a preliminary Stage 1 Environmental Site Assessment (ESA) for the proposed Dee Why Town Centre public infrastructure works at Dee Why, NSW. The ESA was generally confined to the Dee Why Town Centre area as shown on Figures 1 and 2.

The ESA has focussed on a number of 'key study areas' associated with the public infrastructure works for the Dee Why Town Centre Master Plan (2013[4]). The key study areas are described in **Section 1.1** below and are shown on the attached Figure 2.

1.1 Proposed Development Details

The works associated with the key study areas are summarised in the following table. The proposed development details described below may vary based on the outcome of the Stage 1 assessment, final design requirements and other project constraints.

Table 1-1: Proposed Development Works – Key Study Areas

Item[A]	Area	Proposed Development Details
1	Pittwater Road north	Entry sequence streetscape and arrival treatment. Streetscape treatment may include new lighting, road surface and median upgrades, median and roadside planting/landscaping, and new crossing points.
15	Drainage channel	Proposed boardwalk over the existing open stormwater channel to create a pedestrian link between the Dee Why Lagoon walk and the stormwater easement.
16	Stormwater easement	Pedestrian linkage with exposed, low-flow water filtration function diverted from main drainage channel, with a seamless edge to Walter Gors Park. Water sensitive urban design (WSUD) interventions, interpretation/contact and storage of treated water may also be considered. New lighting, fencing and landscaping will also be applied to this corridor.
17	Pittwater Road	Streetscape refurbishment works including alterations to the median strip, landscaping, new fencing, pedestrian and road surface finishes. An additional north-bound bus bay may be constructed in the vicinity of the Civic Centre (i.e. north of the Howard Avenue intersection).
18	Walter Gors Park	Demolition of the existing community buildings, and expansion of the existing park and facilities. This may include an on-site detention

[3] Environmental consulting division of Jeffery & Katauskas Pty Ltd (J&K)
[4] Place Design Group 2013, *Dee Why Town Centre Master Plan* (Referred to as the Master Plan)

Item[A]	Area	Proposed Development Details
		system/WSUD. There may be a rain garden demonstration area in the eastern section of the park in the short term.
19	St David Avenue Pocket Park (and bus stop)	Redesign of the existing park to complement the adjacent development.
24	Town Centre crossing	Upgrade pedestrian amenity. We have assumed this may include new road and footpath surfaces, kerbs and gutters.
26	Howard Avenue	Streetscape refurbishment as a primary boulevard linking Dee Why Beach, Town Square and Civic Plaza. The streetscape treatment may include alterations to the median strip, kerbs and gutters, new landscaping, WSUD features, pedestrian and road surface finishes as described for Item 28 below. There may be some relatively deep excavation required for the relocation of a stormwater main.
27	Triangle Park north	Riparian park typology corridor development with enhanced pedestrian connectivity and user amenity. There may be a pop-up dog park and cafe in the short term.
28	Howard Avenue east	Upgrade pedestrian walkway experience to the beach, new bus and cycle lane, and new tree planting. The works are likely to include conversion of the roadway for one-way traffic (heading west), comprising two lanes and parallel parking on both sides of the carriageway. WSUD rain gardens would be interspersed between the parking areas along with tree plantings and new lighting. A cycleway would also be constructed adjacent to the northern footpath.
30	Triangle Park south	Pedestrian plaza to support adjacent uses and enhance pedestrian connectivity.
31	Church Lane	Construction of a new laneway with one-way traffic flow and shared pedestrian and cycle access. The western edge of the lane may include a raised pedestrian boardwalk above a WSUD swale with integrated tree planting. New street lighting and permeable paving is also being considered.
33	Redman Pocket Plaza	Upgraded plaza space utilising existing mature tree planting with integrated WSUD functions and features.

Item[A]	Area	Proposed Development Details
		A pop-up community garden may be created in this area in the short term.
34	Mooramba Pocket Park	Upgraded park space with integrated WSUD functions and features. It is understood that an underground detention basin is also being considered in the adjacent car park. This may require excavation to a depth of approximately 2-3m below the existing ground levels.
35	Oaks Avenue streetscape	Significant streetscape refurbishment with alfresco dining, widened footpaths and WSUD integration. New street lighting is also proposed. The streetscape works are likely to include conversion of the roadway for one-way traffic (heading east), comprising two lanes and parallel parking on the northern edge. WSUD rain gardens would be interspersed between the parking areas along with tree plantings. Stormwater infrastructure works are also being considered for Oaks Avenue. This may include a new 900mm diameter main located centrally beneath roadway. This would extend from Pittwater Road to the stormwater culvert located in the vicinity of No. 33 Oaks Avenue. Excavation could be expected to depths of approximately 1.5-1.8m.
36	Woolworths Lane	Proposed shared lane with restaurant and retail activation. This is likely to include a new two-way traffic laneway catering for pedestrian and cycle movements. The western edge of the lane would provide for further pedestrian integration with a raised pedestrian boardwalk above a WSUD swale with integrated tree planting. New street lighting with banners is also proposed.
37	Pacific Parade streetscape	Significant streetscape refurbishment with alfresco dining widened footpaths and WSUD integration. The WSUD is likely to include rain gardens interspersed between the parking areas. New street lighting is also proposed.
38	Fisher Road streetscape	Streetscape refurbishment. This is likely to include WSUD/rain gardens interspersed between the parking areas, raised median strip with new planting, new lighting and additional vehicle turning lanes.
39	Pittwater Road south	Entry sequence with street tree and median treatment. Installation of signage for the promotion of community events and Dee Why as a whole may be undertaken in the short term.
General	All other roads within the Master Plan area	General streetscape refurbishment. We have assumed that this may include alterations to the median strip, kerbs and gutters, new landscaping, pedestrian and road surface finishes, WSUD/rain gardens, new lighting and seating.

A – Item numbers for the key study areas align with those described in the Master Plan

1.2 Aims and Objectives

The aim of the ESA was to identify known or potential areas of soil/groundwater contamination and to assess the potential risks or impacts to the proposed public infrastructure works specified in the Master Plan.

The objectives of the ESA were to

- Identify (based on a desktop assessment) known or potential sources of contamination within the Dee Why Town Centre Master Plan area, with a focus on key study areas associated with the public infrastructure works;
- Prepare a preliminary conceptual site model (CSM);
- Provide a discussion in relation to potential contamination-related risks/constraints to the public infrastructure works proposed under the Master Plan; and
- Provide preliminary recommendations in relation to potential intrusive investigation requirements for the study areas.

1.3 Scope of Work

The assessment was undertaken generally in accordance with an EIS proposal (Ref: EP7840KP1) dated 30 April 2014 and written acceptance from the client dated 20 June 2014.

The scope of work included the following:

- Limited review of available contamination investigation/assessment reports issued to EIS;
- Limited review of previous EIS projects undertaken within the Dee Why area in order to provide general information regarding subsurface conditions, potential contamination issues, waste classification and acid sulfate soil (ASS);
- Review of available geological information for the site including:
    - Site location and setting;
    - Topography and geology of the site and immediate surrounds;
    - ASS risk maps;
    - Hydro-geological information including registered groundwater bores in the immediate vicinity of the site;
- Review of historical aerial photographs;
- Search and review of contamination records and licenses available on the NSW Environment Protection Authority (EPA) website;
- A desktop search of readily available information from the internet and Warringah Library;
- Walkover inspection of the key study areas associated with the public infrastructure works (limited to publicly accessible areas); and
- Preparation of a preliminary Stage 1 ESA report.

The scope of work was designed with reference to the guidelines adopted by the NSW EPA under the *Contaminated Land Management Amendment Act* (2008[5]) (see http://www.epa.nsw.gov.au/clm/).

[5] NSW Government Legislation 2008, *Contaminated Land Management Amendment Act.* (referred to as CLM Amendment Act 2008)

2 SITE INFORMATION

2.1 Previous EIS Projects

A summary of relevant information from EIS projects completed within the Dee Why area (generally within or in close proximity to the Master Plan area) is presented in the following table. Reference should be made to the attached Figure 3 which indicates the locations of the assessment areas described below.

Table 2-1: Summary of Information from Previous EIS Projects

Identification	Area A – Pittwater and Mooramba Roads (E15440FK, 2002)
General scope	Preliminary soil and groundwater contamination assessment
Subsurface conditions	Sandy fill soils to depths of approximately 1-1.7m, underlain by natural clayey or silty sands to a maximum depth of approximately 4.1m. Groundwater was encountered at a depth of approximately 4.1m below ground level (BGL).
Discussion	Limited soil sampling and analysis was undertaken. A soil sample analysed for heavy metals, total recoverable hydrocarbons (TRHs), monocyclic aromatic hydrocarbons (BTEX), polycyclic aromatic hydrocarbons (PAHs) and phenols did not identify contamination above the criteria adopted for the assessment (i.e. a commercial/industrial land use setting). TRHs and BTEX were encountered in the groundwater.
Identification	Area B – Oaks Avenue (E18148FJ, 2006)
General scope	ASS assessment
Subsurface conditions	Sandy fill soils to depths of approximately 1-2m, underlain by deep sandy and clayey soils. Sandstone bedrock was identified at a depth of approximately 20m. Groundwater was encountered at depths of approximately 2-3mBGL.
Discussion	Potential ASS (PASS) was identified at depth within the natural soils.
Identification	Area C – Kingsway and Pittwater Road (E18660FK, 2004)
General scope	Preliminary ESA (soil contamination) and ASS assessment
Subsurface conditions	Sandy fill soils to depths of approximately 0.2-1.1m, underlain by residual sandy/clayey soil and relatively shallow sandstone bedrock. Groundwater was not identified to a depth of approximately 12mBGL.
Discussion	Soil samples were analysed for heavy metals, TRH, BTEX, PAHs, organochlorine pesticides (OCPs), polychlorinated biphenyls (PCBs) and asbestos. Contamination was not identified in the soils above the most sensitive residential land use criteria adopted for the assessment. There was considered to be a relatively low ASS risk based on the subsurface conditions.

Identification	Area D – Mooramba Road and Painters Parade (E21637K, 2007)
General scope	ESA (soil contamination) and waste classification assessment
Subsurface conditions	Sandy and clayey fill soils to depths of approximately 0.3-2.2m, underlain by residual sandy/clayey soil and relatively shallow sandstone bedrock. Groundwater seepage was encountered above the bedrock level at depths of approximately 1-1.5m.
Discussion	Soil analysis for heavy metals, TRH, BTEX, OCP, PCBs did not identify any significant issues. Asbestos containing materials (ACM) in the form of fibre cement fragments were identified in the fill along with relatively minor TRH impacts. The soil waste classification was 'general solid waste' (GSW) containing asbestos.
Identification	Area E – Dee Why Parade and Pittwater Road (E22150K, 2008)
General scope	ESA (soil and groundwater contamination), ASS and waste classification assessment
Subsurface conditions	Sandy fill soils to depths of approximately 0.3-2.2m, underlain by natural sandy/clayey soil and sandstone bedrock. The depth to bedrock ranged from approximately 3-13m. Groundwater was identified at depths ranging from approximately 1.3-3mBGL and was flowing towards the north-east and east.
Discussion	ACM was identified in the fill soil. A marginally elevated concentration of the PAH compound benzo(a)pyrene was also encountered above residential (with inaccessible soils) criteria adopted for the assessment. The soil waste classification was GSW. The ASS conditions were relatively complex and the site was divided into two areas (east and west). Generally the natural soils in the eastern section of the site were considered to be PASS. PASS was not considered to be present in the western section of the site (i.e. closest to Pittwater Road).
Identification	Area F – Pacific Parade (E22403K, 2009)
General scope	Preliminary ESA (soil contamination), ASS and waste classification assessment
Subsurface conditions	Sandy fill soils to depths of approximately 0.2-0.7m, generally underlain by shallow sandstone bedrock. Groundwater was not encountered to a depth of approximately 0.7mBGL.
Discussion	Analysis of fill soil samples for heavy metals, TRH, BTEX, PAHs, OCPs, PCBs and asbestos did not identify contamination.

	The soil waste classification was GSW. The potential for ASS occurrence was considered to be relatively low.
Identification	Area G – Oaks Avenue (E22598K, 2009)
General scope	Preliminary ESA (soil contamination) and ASS assessment
Subsurface conditions	Sandy fill soils to a depth of approximately 0.3-1m, underlain by sandstone bedrock. Groundwater was not identified by EIS to a depth of approximately 2.9mBGL.
Discussion	Analysis of fill soil samples for heavy metals, TRH, BTEX, PAHs, OCPs, PCBs and asbestos did not identify contamination. The potential for ASS occurrence was considered to be relatively low.

2.2 Report Provided to EIS

EIS were provided with a copy of a Site Audit Statement (SAS) and Site Audit Report (SAR) for 27 Howard Avenue, Dee Why. The SAS and SAR were prepared by Peter J Ramsay & Associates (2006[6]).

The SAS/SAR 2006 applies to the key study area referred to as Triangle Park north (key study area Item 27 on Figure 2). This area is identified as Lot 15 Section 16 in DP8172 and also includes part of the adjacent stormwater easement identified as part of Lot 2 in DP587690. For the purpose of the summary provided below, this area has been referred to as "the site".

A summary of relevant information is provided below:

- The site was formally utilised for residential purposes until it became vacant in the 1950s. Subsequently the site was occupied by a service station (which included a mechanics workshop) until approximately 1990 and then by a dry cleaners until approximately 2003;
- During use of the site as a service station, six underground storage tanks (USTs) were known to exist at the site;
- Tetrachloroethene (also known as perchloroethylene – PCE) was stored in drums at the site during the dry cleaners occupation. There was no known underground storage of PCE;

[6] Peter J Ramsay & Associates 2006, *Warringah Council Site Audit Report for Site Audit Pursuant to Part 4 of the Contaminated Land Management Act 1997, Volumes 1 to 3 of 3, 27 Howard Avenue, Dee Why, New South Wales* (referred to as SAR 2006 or SAS 2006)

- The site was progressively investigated and remediated starting around the year 2001. This work was completed by Douglas Partners (DP), Consulting Earth Scientists (CES) and GHD;
- The investigations identified soil and groundwater contamination impacts associated with the service station and dry cleaners. The contaminants identified included TRHs, BTEX (particularly ethylbenzene) and volatile organic compounds (VOCs), including chlorinated VOCs;
- The subsurface conditions encountered during the investigations generally identified relatively shallow fill soils (to approximately 1m), overlying sandy and clayey natural soils. Groundwater occurred at depths of approximately 2.1-2.5mBGL);
- The USTs were removed from the site. The soils were remediated by the excavation and off-site disposal methodology;
- The groundwater contamination was considered to be migrating off-site. However, fate and transport modelling suggested that the groundwater contamination would not adversely affect the nearest receptor which was Dee Why Lagoon; and
- The SAS certified that the site was suitable for a number of land uses including residential with minimal soil access, secondary schools, commercial/industrial and parks/open space.

2.3 Site Identification

Table 2-2: Site Identification

Lot & Deposited Plan:	1 - Pittwater Road north, unidentified road corridor 15 - Drainage channel, Lot 19 Section 20 in DP9102, Lot 1 in DP13762 and Lot 11 Section 3 in DP6953 16 - Stormwater easement, Lot 25 in DP7957 and Lot 3 in DP587690 17 - Pittwater Road, unidentified road corridor 18 - Walter Gors Park, Lots A to E (inclusive) in DP19489 and Lot 1 in DP844245 19 - St David Avenue Pocket Park and bus stop, Lot 1 in DP364010 24 - Town Centre crossing, unidentified road corridor 26 - Howard Avenue, unidentified road corridor 27 - Triangle Park north, Lot 15 Section 16 in DP8172 28 - Howard Avenue east, unidentified road corridor 30 - Triangle Park south, Lot A in DP350145 31 - Church Lane, Lot 2 in DP526306 and Lot 19 Section 16 in DP8172 33 - Redman Pocket Plaza, unidentified road corridor 34 - Mooramba Pocket Park, part of Lot 3 in DP805645 35 - Oaks Avenue Streetscape, unidentified road corridor 36 - Woolworths Lane, Lot B in DP326907 and part of Lot 1 in DP588603 37 - Pacific Parade streetscape, unidentified road corridor 38 - Fisher Road streetscape, unidentified road corridor 39 - Pittwater Road south, unidentified road corridor Streetscape upgrades to all other roads within the Dee Why Town Centre area, unidentified road corridors
Current and Proposed Land Uses (proposed land use in brackets):	1 - Pittwater Road north, road (unchanged)

	15 - Drainage channel, drainage channel (drainage channel with pedestrian access via elevated boardwalk) 16 - Stormwater easement, pedestrian thoroughfare (unchanged) 17 - Pittwater Road, road (unchanged) 18 - Walter Gors Park, park and community buildings (expanded park) 19 - St David Avenue Pocket Park, park and bus stop (unchanged) 24 - Town Centre crossing, road (unchanged) 26 - Howard Avenue, road (unchanged) 27 - Triangle Park north, park (predominantly unchanged, but may include a pop-up cafe) 28 - Howard Avenue east, road (unchanged) 30 - Triangle Park south, park (park/pedestrian plaza) 31 - Church Lane, car park (lane way with pedestrian access) 33 - Redman Pocket Plaza, pedestrian thoroughfare (upgraded plaza, possibly with a community garden in the short term) 34 - Mooramba Pocket Park, park (unchanged) 35 - Oaks Avenue streetscape, road (unchanged) 36 - Woolworths Lane, car park and retail shops (pedestrian laneway and shops) 37 - Pacific Parade streetscape, road (unchanged) 38 - Fisher Road streetscape, road (unchanged) 39 - Pittwater Road south, road (unchanged) Streetscape upgrades to all other roads within the Dee Why Town Centre area, unidentified road corridors, road (unchanged)
Local Government Authority (LGA):	Warringah Council
Estimated Size of Key Study Areas (m^2):	The area estimates detailed below should be confirmed during the design phase of the project once the extent of the work for each key study area is finalised: 1 - Pittwater Road north, 8,500m^2

	15 - Drainage channel, 1,700m^2 16 - Stormwater easement, 1,000m^2 17 - Pittwater Road, 17,000m^2 (assuming the works extend between Dee Why Parade and Sturdee Parades) 18 - Walter Gors Park, 5,800m^2 19 - St David Avenue Pocket Park and bus stop, 700m^2 24 - Town Centre crossing, 1,000m^2 26 - Howard Avenue, 6,200m^2 27 - Triangle Park north, 1,050m^2 28 - Howard Avenue east, 10,000m^2 (assuming the works extend from the eastern extent of the Master Plan area to The Strand) 30 - Triangle Park south, 500m^2 31 - Church Lane, 1,600m^2 33 - Redman Pocket Plaza, 1,650m^2 34 - Mooramba Pocket Park, 500m^2 35 - Oaks Avenue streetscape, 7,300m^2 36 - Woolworths Lane, 1,500m^2 37 - Pacific Parade streetscape, 5,500m^2 38 - Fisher Road streetscape, 10,000m^2 (assuming the works extend between the Pittwater Road to the Kingsway intersections) 39 - Pittwater Road south, 12,000m^2 (assuming the works extend between the Sturdee Parade intersection to the southern extent of the Master Plan area) Streetscape upgrades to all other roads within the Dee Why Town Centre area, area not estimated
Elevations (RL in mAHD) (approx.): Based on Google Earth	30-35m (Southern extent of Master Plan area) 5-10m (Northern extent of Master Plan area) 4-5m (Lowest point, northern section of key study area 15 - drainage channel, north of Richmond Avenue) 35-40m (Highest point, east of the intersection between Fisher Road and McIntosh Road in the central-western section of the Master Plan

	area)
Geographical Location (MGA 56) (approximate):	1 - Pittwater Road north, E: 341545 N: 6264218 15 - Drainage channel, E: 341752 N: 6264107 16 - Stormwater easement, E: 341607 N: 6263983 17 - Pittwater Road, E: 341539 N: 6264200 18 - Walter Gors Park, E: 341634 N: 6263957 19 - St David Avenue Pocket Park, E: 341278 N: 6263956 24 - Town Centre crossing, E: 341333 N: 6263963 26 - Howard Avenue, E: 341464 N: 6263942 27 - Triangle Park north, E: 341505 N: 6263911 28 - Howard Avenue east, E: 341822 N: 6263890 30 - Triangle Park south, E: 341471 N: 6263842 31 - Church Lane, E: 341574 N: 6263863 33 - Redman Pocket Plaza, E: 341082 N: 6263827 34 - Mooramba Pocket Park, E: 341002 N: 6263824 35 - Oaks Avenue streetscape, E: 341337 N: 6263839 36 - Woolworths Lane, E: 341373 N: 6263766 37 - Pacific Parade streetscape, E: 341253 N: 6263728 38 - Fisher Road streetscape, E: 341155 N: 6263971 39 - Pittwater Road south, E: 340899 N: 6263476 Streetscape upgrades to all other roads within the Dee Why Town Centre area, geographical location not provided
Site Location Plan:	Figure 1
Site Layout Plan:	Figure 2

2.4 Site Location and Regional Setting

The Dee Why Town Centre Study Area is broadly defined as the area between Stony Range Flora Reserve in the south and Hawkesbury Avenue in the north. The western boundary generally extends along Mooramba Road, Francis Street and part of Fisher Road. The eastern boundary is staggered and lies to the west of Avon Road and Clarence Avenue.

2.5 Topography

The regional topographic setting is undulating and is characterised by an east-facing hillside. Pittwater Road roughly extends along the toe of the hillside and the areas to the east of Pittwater Road are relatively flat. A secondary hillside is located to the east of Stony Range Reserve and falls towards the north and north-west in this vicinity. Sandstone outcrops were observed in the southern and western sections of the Master Plan area.

The site has a general fall towards the east and north-east, towards Dee Why Lagoon (which is located to the north-east of the Master Plan area). The areas to the east of Pittwater Road were estimated to fall towards the north-east at approximately 2-4°.

2.6 Site Inspection

A walkover inspection of the Master Plan area (with a focus on the key study areas) was undertaken on 10 and 11 July 2014. The inspection was limited to publically accessible areas.

An inspection summary for each of the key study areas is presented below and a selection of photographs is included in the appendices. Reference should also be made to the attached Figure 4 which indicates the approximate locations of the notable observations made during the inspection.

1 - Pittwater Road north

The Pittwater Road north study area is located at the toe of a hillside that generally falls towards the east. The roadway comprised a concrete carriageway with pedestrian footpaths along the road reserve to the east and west.

Grassed areas or exposed soils were observed either side of the footpaths. The soils appeared to include silty sand fill material with inclusions of sandstone and igneous gravels, tile and concrete fragments. Several fragments of suspected asbestos containing material (sACM), in the form of bonded fibre cement, were observed at the ground surface adjacent to the footpath on the western side of the roadway.

The areas to the west of the roadway predominantly included medium to high density residential dwellings/apartments, with the exception of the building at the corner of Pittwater Road and the Kingsway which included a medical centre. A pharmacy, residential apartment buildings and an RSL club were located to the east of the study area. A service station was located to the north, beyond Hawkesbury Avenue.

15 - Drainage channel

The drainage channel study area was viewed from Dee Why Parade. The land in the vicinity of the channel is relatively flat, with on a minor fall towards the north-east.

The channel appeared to be approximately 2.5m deep and had a concrete base. The walls of the channel were near-vertical and appeared to be of brick construction.

A relatively small volume of water was observed at the base of the channel which was flowing towards the north-east (the channel was orientated in a south-west to north-east direction).

Residential apartment buildings were located to the east and west of the channel.

16 - Stormwater easement

The stormwater easement currently forms a pedestrian thoroughfare that extends towards the north-east and gently slopes in this same direction.

The area comprised a concrete footpath with adjacent grassed areas. The grass cover was generally good across this area with the exception of some exposed soil patches in the vicinity of Dee Why Parade. The exposed soil comprised silty sand fill with inclusions of sandstone gravel/cobbles, concrete and igneous gravels.

A sewer vent pipe was observed approximately midway along the easement, between Howard Avenue and Dee Why Parade.

A retail development and residential apartment building were located to the west of the easement. Several residential-type buildings (currently utilised for various community functions) and a residential apartment building were located to the east of the easement.

17 - Pittwater Road

The Pittwater Road study area between Sturdee Parade in the south and Dee Why Parade in the north is relatively flat. The road corridor may have undergone some levelling works to account for the regional slopes towards the east and north-east.

The roadway comprised a concrete carriageway with pedestrian footpaths in the road reserves to the east and west. The areas to the south of the junction with Howard

Avenue were almost entirely paved with the exception of some minor landscaping along the median strips.

Grassed areas and areas of exposed soil were located adjacent to the footpath on the western side of the road between St David Avenue and Kingsway. The exposed soil appeared to comprise sandy/silty fill with asphaltic concrete (AC) and concrete fragments, and sandstone gravel inclusions. Several fragments of sACM were observed at the ground surface in the vicinity of the intersection with Kingsway.

Pittwater Road was lined with various retail outlets. None of the retail outlets appeared to be utilised for activities that were expected to cause soil or groundwater contamination.

The only industrial land use identified along this section of Pittwater Road was Victor Glass which is located on the western side of the road, to the south of the intersection with Pacific Parade. It is understood that this property has been utilised for glass manufacturing processes for many years.

The areas to the west of Pittwater Road between St David Avenue and Kingsway were occupied by a car park, the Warringah Council chambers and a medical centre.

18 - Walter Gors Park

The Walter Gors Park study area is relatively flat and falls gently towards the north/north-east.

At the time of the inspection the eastern section of the study area was occupied by an existing park. The park was predominantly grassed, however, sections of exposed soil were observed beneath the existing trees and in the more shaded areas. The soil appeared to comprise sandy fill soils with inclusions of demolition rubble such as bricks, tile and clay pipes. Several fragments of sACM were observed at the ground surface.

The western section of the study area was occupied by five residential-type buildings and associated shads/garages that were being utilised for community-related services. The areas around the buildings were generally grassed or included concrete driveways. There were no obvious signs of chemical or waste storage in these areas when viewed from Howard Avenue.

A stormwater easement (key study area 16) and several residential apartment buildings were located to the west of the study area. Residential apartment buildings were also located to the north, south and east of the study area.

19 - St David Avenue Pocket Park

At the time of the inspection the St David Avenue Pocket Park study area was occupied by a park. A grassed batter slope was located along the northern side of the park and fell towards the south/south-east, away from St David Avenue.

The existing park comprised several AC and brick paved walkways, grassed areas and garden beds. A mature tree was located in the central section of the park and a public toilet block was located in the western corner.

The park was retained along its eastern boundary by a sandstone block retaining wall that was approximately 1m high. It was considered likely that at least part of the park had been filled to create the existing levels (particularly the areas behind the retaining wall).

The St David Avenue Pocket Park study area was generally bounded by St David Avenue and Pittwater Road to the north and east respectively. A vacant, former commercial/retail building was located to the south. A commercial building and church were located to the west.

24 - Town Centre crossing

At the time of the inspection the Town Centre crossing study area formed part of the Pittwater Road carriageway. The carriageway was concrete and AC paved.

The area was located towards the toe of the east-facing regional hillside and generally fell towards the east.

The surrounding areas were occupied by retail shops, a park and a car park.

26 - Howard Avenue

The Howard Avenue study area generally extends from the Pittwater Road intersection to the area in the vicinity of Walter Gors Park. The western end of Howard Avenue falls gently towards the east before flattening out approximately 40m to east of the Pittwater Road intersection.

At the time of the inspection the Howard Avenue carriageway was paved with AC and the footpaths located in the adjacent road reserve were concrete. Grassed areas or areas of bare soil were located adjacent to the footpaths towards the eastern end of the study area. The soils appeared to comprise sand fill material. A fragment of sACM was observed at the ground surface adjacent to the footpath in the vicinity of the stormwater easement.

Retail outlets were located on the northern and southern sides of Howard Avenue. An existing Lawrence Dry Cleaners was located on the southern side of the road, approximately 50m to the east of the Pittwater Road intersection. An inspection of the dry cleaners from the footpath and adjacent car park did not identify any obvious indicators of chemical storage within the property.

27 - Triangle Park north

The Triangle Park north study area falls gently towards the north-east. At the time of the inspection the area was occupied by a grassed park and several relatively small trees. A concrete paved footpath extended along the eastern boundary.

Several patches of exposed soil were observed in the park. The soils appeared to comprise sandy/clayey fill with gravel inclusions.

Multi-storey, mixed retail/commercial and residential buildings were located to the east and west of the park. The stormwater easement also extended along the eastern boundary. A post office and relatively small medical centre were located to the south of the park. Commercial/retail areas were located to the north beyond Howard Avenue. None of the commercial/retail outlets appeared to be utilised for activities that would be expected to cause soil or groundwater contamination.

28 - Howard Avenue east

The Howard Avenue east study area is relatively flat. This study area generally extends in an east-west direction from the eastern extent of the Master Plan area towards Dee Why Beach.

At the time of the inspection the Howard Avenue east carriageway was AC paved. Concrete footpaths extended adjacent to the carriageway in the road reserve. The areas adjacent to the footpaths were either grassed or included exposed soils at the ground surface. A thorough visual inspection of the ground surface areas was not undertaken.

Residential apartment buildings were located to the north and south of Howard Avenue. Restaurants/Cafes were located towards the eastern end of the study area (at the intersection with The Strand).

30 - Triangle Park south

The Triangle Park south study area is relatively flat. At the time of the inspection this area was occupied by a two storey, brick building that was being utilised as a medical centre. The area to the west of the building included a pedestrian thoroughfare with a concrete footpath and adjacent grassed areas.

Oaks Avenue bounded the Triangle Park study area to the south. Commercial/retail buildings (post office and pharmacy) were located to the east and west. A driveway and retail/residential building were located to the north. None of the commercial/retail outlets appeared to be utilised for activities that would be expected to cause soil or groundwater contamination.

An area of exposed gravel and soil was observed to the north of the study area. This material contained demolition rubble including sACM fragments.

31 - Church Lane

The Church Lane study area is relatively flat and falls towards the north-east at approximately 3-4°. At the time of the inspection the study area was occupied by an on-grade car park that was paved with AC. The eastern extent of the area was unpaved and included a number of medium-sized trees and some grass cover towards Oaks Avenue.

Patches of exposed soil were observed beneath the trees along the eastern boundary of the study area. Leaf litter cover prevented a thorough visual assessment of the ground surface in this area. A fragment of sACM was identified at the ground surface along the eastern boundary in the south-eastern section of the study area.

Howard Avenue and Oaks Avenue bounded the Church Lane study area to the north and south respectively. A church and a residential apartment building were located to the east. The car park extended further to the west of the study area.

33 - Redman Pocket Plaza

The Redman Pocket Plaza study area is relatively flat and slopes gently towards the east. At the time of the inspection the area was occupied by the Redman Road cul-de-sac and a pedestrian thoroughfare.

The Redman Road carriageway was AC paved and concrete or brick-paved footpaths extended adjacent to the roadway in the road reserve. The pedestrian thoroughfare was surfaced with concrete and brick pavers.

Commercial and retail outlets, and a car park, were located to the north and south of the study area. Redman Road extended to the west and the Pittwater and Fisher Road intersection was located to the east. None of the retail outlets appeared to be utilised for activities that were expected to cause soil or groundwater contamination.

One of the businesses on the northern side of Redman Road included a Laundry. The laundry signage indicated that they also offered dry cleaning services, however, a discussion with one of the employees confirmed that dry cleaning was outsourced and was not undertaken on-site.

34 - Mooramba Pocket Park

The Mooramba Pocket Park study area was relatively flat and level. At the time of the inspection the study area was occupied by an existing playground and community area.

The playground was surfaced with rubber soft fall matting and a mature tree was located in this area.

The community area was either grassed or surfaced with exposed patches of soil. Concrete footpaths and seating areas were located around the edges of this area. The surface soils appeared to comprise sandy fill material with inclusions of sandstone, igneous and concrete gravels. Several relatively small trees were located in the vicinity of the concrete seating.

The Mooramba Pocket Park study area was bounded by Redman Road and Mooramba Road to the north and east respectively. An on-grade public car park was located to the south of the area. A childcare centre was located to the west.

35 - Oaks Avenue Streetscape

The Oaks Avenue study area falls gently towards the east in the vicinity of Pittwater Road, before levelling out. Due to the natural slope of the land towards the north-east, some areas along the southern side of the study area are slightly elevated above the level of the Oaks Avenue carriageway.

At the time of the inspection the study area was occupied by the Oaks Avenue carriageway, and paved footpaths and parking areas along the adjacent road reserve.

The majority of the study area was paved. However, relatively small grassed areas or areas of exposed soils were observed towards the eastern end of the study area (generally adjacent to the footpaths within the road reserve). A number of mature trees were located along the roadway and exposed soil was also evident at the base of some trees. The soils appeared to comprise sandy fill with inclusions of concrete, brick and tile fragments, sandstone and igneous gravels.

Commercial/retail outlets and residential apartment buildings were located to the south of the study area. Commercial/retail outlets were also located to the north of the study area. None of these outlets appeared to be utilised for activities that were expected to cause soil or groundwater contamination.

36 - Woolworths Lane

The Woolworths Lane study area is relatively flat and falls gently towards the north. At the time of the inspection the study area was occupied by an existing arcade lined with retail outlets (generally food outlets). This area was paved with concrete.

37 - Pacific Parade Streetscape

The Pacific Parade study area is relatively flat. The area slopes gently away from the Pittwater Road intersection, however is predominantly level.

At the time of the inspection the study area was occupied by an AC paved carriageway with concrete footpaths in the adjacent road reserve. Grassed areas or exposed soils were evident adjacent to the footpaths towards the central and eastern sections of the study area. The exposed soils appeared to include sandy fill material with inclusions of sandstone and igneous gravels. Numerous fragments of sACM were identified at the ground surface adjacent to the footpaths.

Commercial/retail outlets were located to the north and south of the study area in the vicinity of the Pittwater Road Intersection. None of these outlets appeared to be utilised for activities that were expected to cause soil or groundwater contamination. Further to the east of the intersection, vacant land and residential apartment buildings were located to the north and south of the study area.

38 - Fisher Road streetscape

The Fisher Road study area generally falls towards the south and south. At the time of the inspection the study area was occupied by an AC paved carriageway with concrete footpaths and grassed areas in the adjacent road reserve. Exposed soils were observed in some areas.

A number of mature trees were located along the eastern side of the study area, towards the St David Avenue intersection.

Various commercial and retail outlets with some residential apartments on the upper levels were located to the west of the study area. None of these outlets appeared to be utilised for activities that would be expected to cause soil or groundwater contamination.

A KFC restaurant and Fire Station were located at the corner of the Lewis Street intersection.

A church, Salvation Army buildings and a police station were located to the east of the study area.

Numerous fragments of sACM were observed at the ground surface in a patch of exposed soil towards the south-eastern section of the study area. The soil was exposed adjacent to the footpath.

39 - Pittwater Road south

The Pittwater Road south study area is located towards the crest of a localised hillside and generally falls towards the north-east. The roadway has been cut into the hillside and exposed sandstone bedrock is evident along the extent of the cut.

At the time of the inspection the study area was occupied by a concrete paved carriageway with concrete footpaths along the adjacent road reserve. Limited areas adjacent to the footpaths were grassed.

The Stony Range Reserve was located to the east of the study area. An Avis Car Rental, commercial complex and various commercial/retail outlets were also located to the east. The Avis Car Rental property had an existing workshop and a canopy over the forecourt. The general layout of this property, including the canopy/forecourt, was considered to be indicative of a former service station.

A construction site, existing service station and various commercial/retail outlets were located to the west of the study area.

Streetscape upgrades to all other roads within the Dee Why Town Centre area

The remaining streetscape areas throughout the Master plan area were similar to those described above. sACM fragments were observed at the ground surface in the road reserves in the following areas:

- Along the Kingsway; and
- The northern section of Fisher Road in the vicinity of the intersection with McIntosh Road.

It should be noted that due to the extensive nature of the Master Plan area, completing a thorough visual inspection of all ground surface areas was not undertaken.

2.7 Surrounding Land Use

The Master Plan area was generally surrounded by medium to high density residential properties that included free standing dwellings or apartment blocks. A service station was located beyond the northern extent of the Master Plan area (at the corner of Pittwater Road and Hawkesbury Avenue. A commercial/industrial complex was located to the south of Stony Range Reserve beyond the southern extent of the Master Plan area.

2.8 Regional Geology

A review of the regional geological map of Sydney (1983[7]) indicates that the majority of the Master Plan area is underlain by Hawkesbury Sandstone, which typically consists of medium to coarse grained quartz sandstone with minor shale and laminite lenses.

Quaternary aged alluvial deposits of silty to peaty quartz sand, silt and clay with ferruginous cementation and common shell layers are mapped along the northern extent of the stormwater easement/drainage channel. The map indicates that these deposits generally occur to the north-east of Howard Avenue (in the northern section of the Master Plan area) and to the east of Clarence Avenue.

2.9 Acid Sulfate Soil (ASS) Risk

A review of the ASS risk map for Sydney Heads, prepared by Department of Land and Water Conservation (1997[8]), indicates that the Master Plan area is mapped as having "no known occurrence" of ASS.

The nearest mapped area with ASS occurrence is located in the vicinity of Dee Why lagoon, at the eastern end of Hawkesbury Avenue, and to the north of Hawkesbury Avenue. These areas are mapped as having a "high probability" of ASS occurrence within 1m of the ground surface, or between 1-3m below the ground surface.

The Warringah Council ASS Planning Map[9] indicates that a relatively small portion of the Master Plan area is located within a Class 5 ASS risk area. The Class 5 risk area also includes the drainage channel study area.

2.10 Hydrogeology

A review of groundwater bore records available on the NSW Office of Water[10] (NOW) online database was undertaken on 4 August 2014. The search was limited to registered bores located within the Master Plan area and the immediate surrounds.

The search identified the presence of three registered bores. Two of these (GW105849 and GW105850) were located in the southern section of the Master Plan area and were registered for monitoring purposes.

[7] Department of Mineral Resources, (1983), *1:100,000 Geological Map of Sydney (Series 9130)*

[8] Department of Land and Water Conservation, (1997), *1:25,000 Acid Sulfate Soil Risk Map – Sydney Heads (Series 9130N2, Ed 2)*

[9] Warringah Council (2011), *Acid SUlfate Soils Map – Sheet ASS_010A,* Warringah Local Environmental Plan

[10] http://www.waterinfo.nsw.gov.au/gw/

The third registered bore (GW110660) was located to the north of the Master Plan area. This bore was also registered for monitoring purposes and was associated with the Seven Eleven service station.

Based on the geological maps and previous EIS projects, the hydrogeoloical conditions are likely to comprise:

- A relatively shallow soil profile (fill and residual soils) overlying sandstone bedrock in the western and southern sections of the Master Plan area. Groundwater would be expected in an unconfined aquifer perched above the bedrock, or within the bedrock itself;
- A deeper soil profile (fill and residual or alluvial soils) overlying relatively deeper sandstone bedrock in the central and north-eastern sections of the Master Plan area. Groundwater would be expected to occur in an unconfined aquifer within the natural soils.

The groundwater bore search suggested that the groundwater is not currently utilised as a resource within the Master Plan area.

2.11 Receiving Water Bodies

Surface water bodies were not identified within the Master Plan area. The following receiving waters have been identified:

- Dee Why Lagoon and the adjacent wetlands that are located approximately 100-150m to the north-east of the Master Plan area;
- The Tasman Sea (Dee Why Beach) that is located approximately 650m to the east of the Master Plan area; and
- The open drainage channel that extends north-east from Dee Why Parade. This channel flows into an unlined channel in the vicinity of Dee Why Lagoon.

3 SITE HISTORY INFORMATION

3.1 Review of Historical Aerial Photographs

Historical aerial photographs available at the NSW Department of Lands were reviewed for the assessment.

The review focussed on identifying general land use trends within the Master Plan area, with a focus on the key study areas. A summary of the relevant information is presented in the following table. A copy of the aerial photographs is also included in the appendices.

Table 3-1: Summary of Historical Aerial Photos

Year	Details
1930	1 - Pittwater Road north – roadway with residential-type buildings to the west and vacant/vegetated areas or scattered buildings to the east. 15 - Drainage channel – the drainage channel was evident and appeared to be open/unpaved (however it is noted that the quality of the photograph was relatively poor). The areas adjacent to the channel appeared to be vacant or occupied by scattered residential-type buildings. 16 - Stormwater easement – the stormwater easement was evident, however, specific features were not discernible. Scattered residential-type buildings and smaller structures (likely to be sheds) were located in the surrounds. 17 - Pittwater Road – roadway lined with various buildings and vacant land. The buildings ranged in size and may have included a mix of commercial/retail buildings, residences and sheds. 18 - Walter Gors Park – a relatively small residential-type building was located in the western section of this study area. The remaining areas appeared to be vacant and vegetated. 19 - St David Avenue Pocket Park – St David Avenue had not yet been constructed. The study area may have been occupied by a relatively small building. 24 - Town Centre crossing – roadway with vacant areas generally to the east and west. A relatively large commercial/retail-type building was located to the south-east. 26 - Howard Avenue – roadway with residential-type buildings and smaller sheds to the north and south. 27 - Triangle Park north – the study area appeared to be occupied by several relatively small objects (possibly sheds). The majority of the area appeared to be vegetated/grassed. 28 - Howard Avenue east – roadway with scattered residential-type buildings to the north and south (note that the photograph does not extend east beyond Avon Road). 30 - Triangle Park south – the study area appeared to be vacant and vegetated/grassed.

Year	Details
	Several small objects (possibly sheds) and residential-type buildings were located n the immediate surrounds. 31 - Church Lane – the study area appeared to form part of several residential-type properties that were occupied by small buildings and sheds. 33 - Redman Pocket Plaza – roadway with various buildings to the north and south. The building may have included residential and commercial/retail properties. 34 - Mooramba Pocket Park – the study area formed part of several residential-type properties that were occupied by buildings and yard areas. 35 - Oaks Avenue streetscape – roadway with scattered residential-type buildings and sheds to the north and south. 36 - Woolworths Lane – the study area appeared to form part of several residential-type properties that were occupied by buildings, sheds and associated yard areas. 37 - Pacific Parade streetscape – as per study area number 35. 38 - Fisher Road streetscape – roadway with vacant areas to the east. Residential and commercial/retail properties, and vacant land, were located to the west. 39 - Pittwater Road south – roadway with a mixture of vacant areas, residential and commercial/retail-type properties to the east and west. General: the Dee Why Master Plan area appeared to predominantly include residential-type developments interspersed with vacant land. Several larger buildings along Pittwater road may have been for commercial/retail purposes. These buildings did not appear consistent with industrial-type land uses.
1943[11]	1 - Pittwater Road north – as per 1930 photograph. 15 - Drainage channel – the drainage channel appeared to have been modified (possibly concrete lined). There was an increase in residential-type land uses adjacent to the channel. 16 - Stormwater easement – the stormwater easement appeared to form part of the lined (open) drainage channel. The photograph was not entirely clear, however, the channel commenced to the east of the Pittwater Road and Fisher Road intersection, and extended eastwards (approximately halfway between Oaks Avenue and Pacific Parade). Approximately 240m to the east of Pittwater Road, the channel turned towards the north-east and extended in this direction (along its present day alignment). 17 - Pittwater Road – as per 1930 photograph. There were additional buildings adjacent to the roadway. 18 - Walter Gors Park – additional residential-type buildings were located in the northern section of this study area.

[11] https://six.maps.nsw.gov.au/wps/portal/SIXViewer, visited on 4 August 2014

Year	Details
	19 - St David Avenue Pocket Park – the study area was occupied by a number of trees. 24 - Town Centre crossing – as per 1930 photograph. There was an additional commercial/retail-type building on the north-eastern corner of the intersection. 26 - Howard Avenue – as per1930 photograph. Additional buildings were evident to the north and south of the roadway. 27 - Triangle Park north – the study area appeared to be vacant and grassed. A residential-type property was located to the west and the stormwater easement/channel was located to the east. 28 - Howard Avenue east – as per 1930 photograph. 30 - Triangle Park south – as per 1930 photograph. 31 - Church Lane – as per 1930 photograph. 33 - Redman Pocket Plaza – as per 1930 photograph. 34 - Mooramba Pocket Park – as per 1930 photograph. 35 - Oaks Avenue streetscape – as per 1930 photograph. 36 - Woolworths Lane – as per 1930 photograph. Part of what appeared to be an open/lined drainage channel extended through the central section of the study area (in an east-west) direction. 37 - Pacific Parade streetscape – as per 1930 photograph. 38 - Fisher Road streetscape – as per 1930 photograph. 39 - Pittwater Road south – as per 1930 photograph. General: there was an increase in residential-type development in the form of free-standing dwellings throughout the Master Plan area. Additional commercial/retail-type developments were located along Pittwater Road. Some of these buildings may have been utilised for small-scale industrial purposes, however, such uses were not obviously evident.
1951	1 - Pittwater Road north – as per 1943 photograph. There were additional residential-type buildings to the east and west. 15 - Drainage channel – as per 1943 photograph. 16 - Stormwater easement – as per 1943 photograph. 17 - Pittwater Road – as per 1943. There were additional buildings adjacent to the roadway. These buildings were generally larger than residential-type buildings and were most likely associated with commercial/retail-type land uses. 18 - Walter Gors Park – as per 1943 photograph.

Year	Details
	19 - St David Avenue Pocket Park – several trees had been removed and the areas appeared to be occupied by a number of relatively small objects that were unable to be identified. 24 - Town Centre crossing – as per 1943 photograph. 26 - Howard Avenue – as per 1943 photograph. There were additional residential-type buildings to the north and south. 27 - Triangle Park north – as per 1943 photograph. 28 - Howard Avenue east – as per 1943 photograph. There were additional residential-type buildings to the north and south. 30 - Triangle Park south – as per 1943 photograph. 31 - Church Lane – an additional residential-type building and shed with a surrounding yard were located in the northern section of the study area. 33 - Redman Pocket Plaza – as per 1943 photograph. 34 - Mooramba Pocket Park – as per 1943 photograph. 35 - Oaks Avenue streetscape – as per 1943 photograph. 36 - Woolworths Lane – as per 1943 photograph. 37 - Pacific Parade streetscape – as per 1943 photograph. 38 - Fisher Road streetscape – as per 1943 photograph. Several new buildings were located to the east of the roadway. 39 - Pittwater Road south – as per 1943 photograph. General: there was an increase in development throughout the Dee Why Master Plan area. These developments appeared consistent with the land uses described for the 1943 photograph.
1961	1 - Pittwater Road north – the carriageway appeared to have been widened. 15 - Drainage channel – as per 1951 photograph. 16 - Stormwater easement – as per 1951 photograph. 17 - Pittwater Road – as per 1951 photograph. 18 - Walter Gors Park – the study area was occupied by several residential-type properties with associated sheds and yard areas. 19 - St David Avenue Pocket Park – St David Avenue had been constructed and the park

Year	Details
	was evident. The general layout of this area appeared similar to the existing (2014) park and bus stop. 24 - Town Centre crossing – as per 1951 photograph. 26 - Howard Avenue – as per 1951 photograph. There was an increase in development to the north and south of the roadway. 27 - Triangle Park north – the study area had been redeveloped and was occupied by a building with associated driveways. The building did not appear consistent with residential land use. 28 - Howard Avenue east – as per 1951 photograph. There was an increase in residential-type development to the north and south of the roadway. 30 - Triangle Park south – the study area was occupied by a building and possible a smaller shed. 31 - Church Lane – as per 1951 photograph. 33 - Redman Pocket Plaza – as per 1951 photograph. There was an increase in commercial/retail-type development to the north and south of the roadway. 34 - Mooramba Pocket Park – as per 1951 photograph. 35 - Oaks Avenue streetscape – as per 1951 photograph. There may have been some streetscape works since the 1951 photograph. 36 - Woolworths Lane – as per 1951 photograph. Part of the open drainage channel may have been in filled. 37 - Pacific Parade streetscape – as per 1951 photograph. There may have been some streetscape works since the 1951 photograph. 38 - Fisher Road streetscape – as per 1951 photograph. There were additional buildings to the east of the roadway. 39 - Pittwater Road south – as per 1951 photograph. The land at the corner of Mooramba Road and Pittwater Road had been redeveloped. This area was occupied by a building with surrounding paved areas and appeared consistent with the layout of a service station. General: there was a significant increase in development throughout the Dee Why Master Plan area. The land uses appeared to include commercial/retail-type properties along Pittwater Road and residential-type properties further to the east and west.
1970	1 - Pittwater Road north – as per 1961 photograph. A number of the smaller free-standing residential dwellings to the west of the roadway had been demolished and replaced with higher density, residential-type apartment buildings. Additional commercial-type buildings were located to the east of the roadway. 15 - Drainage channel – as per 1961 photograph. A number of the smaller free-standing

Year	Details
	residential dwellings to the east and west of the channel had been demolished and replaced with higher density, residential-type apartment buildings. 16 - Stormwater easement – as per 1961 photograph. The areas to the east and west of the easement had been redeveloped (as noted for Item 15 above). A relatively large commercial/retail-type building was located to the west of the easement in the vicinity of Oaks Avenue. 17 - Pittwater Road – as per 1961 photograph. 18 - Walter Gors Park – as per 1961 photograph, except that part of the northern section of the study area may have been redeveloped for residential-type land use. 19 - St David Avenue Pocket Park – several trees were visible within the study area and a bus shelter (canopy type structure) was located adjacent to Pittwater Road. 24 - Town Centre crossing – as per 1961 photograph. 26 - Howard Avenue – as per 1961 photograph. There was a significant increase in commercial/retail-type development to the north and south of roadway. This included a number of car parks. 27 - Triangle Park north – the former building appeared to have been demolished and a new building was visible. The areas that surrounded the building appeared to be paved. 28 - Howard Avenue east – as per 1961 photograph. A number of the smaller free-standing residential dwellings to the north and south of the roadway had been demolished and replaced with higher density, residential-type apartment buildings. 30 - Triangle Park south – the former building and shed appeared to have been demolished and the site was occupied by a larger building (of unknown use). 31 - Church Lane – the northern section of the study area was occupied by a residential-type property. The former buildings in the southern section of the study area had been demolished and this area had been redeveloped as a car park. The car park extended further to the west of the study area. 33 - Redman Pocket Plaza – as per 1961 photograph. 34 - Mooramba Pocket Park – the buildings in one of the former residential lots appeared to have been demolished. 35 - Oaks Avenue streetscape – as per 1961 photograph. There was an increase in commercial/retail-type development to the north and south of the roadway. 36 - Woolworths Lane – as per 1961 photograph. 37 - Pacific Parade streetscape – as per 1961 photograph. A number of the smaller free-standing residential dwellings to the north of the roadway had been demolished and replaced with higher density, residential-type apartment buildings.

Year	Details
	38 - Fisher Road streetscape – as per 1961 photograph. There was an increase in commercial/retail-type developments to the east and west of the roadway. 39 - Pittwater Road south – as per 1961 photograph. The property that is currently (2014) occupied by the Avis car rental was occupied by development that appeared similar in layout to a service station. General: there was a significant increase in higher density, residential apartment buildings throughout Dee Why. Commercial/retail-type land use in the vicinity of Pittwater Road started spreading further to the east and west.
1978	1 - Pittwater Road north – as per 1970 photograph. 15 - Drainage channel – as per 1970 photograph. 16 - Stormwater easement – as per 1970 photograph. 17 - Pittwater Road – as per 1970 photograph. 18 - Walter Gors Park – three of the former residential properties had been demolished (one in the north-east and two in the south-east section of the study area). These areas appeared to be grassed and formed part of a park 19 - St David Avenue Pocket Park – as per 1970 photograph. 24 - Town Centre crossing – as per 1970 photograph. 26 - Howard Avenue – as per 1970 photograph. 27 - Triangle Park north – the building may have been altered. 28 - Howard Avenue east – as per 1970 photograph. 30 - Triangle Park south – as per 1970 photograph. 31 - Church Lane – the former residential building in the north section of the study area had been demolished and this area appeared to be vacant and vegetated. 33 - Redman Pocket Plaza – as per 1970 photograph. 34 - Mooramba Pocket Park – the former residential buildings had been demolished. The study area appeared to form part of a park. 35 - Oaks Avenue streetscape – as per 1970 photograph. 36 - Woolworths Lane – several of the former residential properties in the northern section of the study area, and one in the southern section of the study area, had been demolished. The northern section of the study area was occupied by part of a large commercial/retail-type building. 37 - Pacific Parade streetscape – as per 1970 photograph.

Year	Details
	38 - Fisher Road streetscape – as per 1970 photograph. 39 - Pittwater Road south – as per 1970 photograph.
1986	1 - Pittwater Road north – as per 1978 photograph. 15 - Drainage channel – as per 1978 photograph. 16 - Stormwater easement – the former open channel was no longer visible. The easement appeared to include a mixture of paved and grassed areas that formed a pedestrian thoroughfare. 17 - Pittwater Road – as per 1978 photograph. 18 - Walter Gors Park – as per 1978 photograph. 19 - St David Avenue Pocket Park – as per 1978 photograph. 24 - Town Centre crossing – as per 1978 photograph. 26 - Howard Avenue – as per 1978 photograph. 27 - Triangle Park north – as per 1978 photograph. 28 - Howard Avenue east – as per 1978 photograph. 30 - Triangle Park south – as per 1978 photograph. 31 - Church Lane – the northern section of the study area had been redeveloped to be incorporated into the car park. A vegetated area extended along the eastern boundary of the study area. 33 - Redman Pocket Plaza – as per 1978 photograph. 34 - Mooramba Pocket Park – as per 1978 photograph. Part of a building may have occupied a portion of the eastern section of the study area. 35 - Oaks Avenue streetscape – as per 1978 photograph. 36 - Woolworths Lane – The southern section of the study area had been redeveloped and appeared to be occupied by a large building and rooftop car park (associated with the commercial/retail building to the north) 37 - Pacific Parade streetscape – as per 1978 photograph. 38 - Fisher Road streetscape – as per 1978 photograph. 39 - Pittwater Road south – as per 1978 photograph.
1994	1 - Pittwater Road north – as per 1986 photograph.

Year	Details
	15 - Drainage channel – as per 1986 photograph. 16 - Stormwater easement – as per 1986 photograph. 17 - Pittwater Road – as per 1986 photograph. 18 - Walter Gors Park – as per 1986 photograph. 19 - St David Avenue Pocket Park – as per 1986 photograph, except at least one tree was visible in the central section of the study area. 24 - Town Centre crossing – as per 1986 photograph. 26 - Howard Avenue – as per 1986 photograph. 27 - Triangle Park north – as per 1986 photograph. 28 - Howard Avenue east – as per 1986 photograph. 30 - Triangle Park south – as per 1986 photograph. 31 - Church Lane – as per 1986 photograph. 33 - Redman Pocket Plaza – as per 1986 photograph, except several trees were visible in the eastern section of the study area 34 - Mooramba Pocket Park – the study area appeared to be occupied by several relatively large trees. The western section appeared to be vacant. A car park had been constructed to the south of the study area. 35 - Oaks Avenue streetscape – as per 1986 photograph. 36 - Woolworths Lane – as per 1986 photograph. 37 - Pacific Parade streetscape – as per 1986 photograph. 38 - Fisher Road streetscape – as per 1986 photograph. 39 - Pittwater Road south – as per 1986 photograph.
2002	1 - Pittwater Road north – as per 1994 photograph. 15 - Drainage channel – as per 1994 photograph. 16 - Stormwater easement – as per 1994 photograph. 17 - Pittwater Road – as per 1994 photograph. 18 - Walter Gors Park – as per 1994 photograph.

Year	Details
	19 - St David Avenue Pocket Park – as per 1994 photograph. 24 - Town Centre crossing – as per 1994 photograph. 26 - Howard Avenue – as per 1994 photograph. 27 - Triangle Park north – as per 1994 photograph. 28 - Howard Avenue east – as per 1994 photograph. 30 - Triangle Park south – as per 1994 photograph. 31 - Church Lane – as per 1994 photograph. 33 - Redman Pocket Plaza – as per 1994 photograph. 34 - Mooramba Pocket Park – the study area appeared to have been reconfigured. Some of the trees in the eastern section of the study area had been removed. 35 - Oaks Avenue streetscape – as per 1994 photograph. 36 - Woolworths Lane – as per 1994 photograph. 37 - Pacific Parade streetscape – as per 1994 photograph. 38 - Fisher Road streetscape – as per 1994 photograph. 39 - Pittwater Road south – as per 1994 photograph.
2012 (SIX Maps)	The study areas generally appeared to be similar to 2002 photograph. The layout for each area reflected the observations made during the site inspection. The most significant change included the areas to the east of the Pittwater Road north (Item 1) which appeared to have been redeveloped for higher density, residential use.

3.2 Limited Review of Warringah Library Information and Internet Resources

The limited review of Warringah Library information and internet resources provided anecdotal information regarding the history of land uses within Dee Why. In summary, the review indicated the following:

- The land in and around Dee Why was granted to various individuals in the early 1800s;
- The majority of Dee Why was bushland until around 1906-1912;
- Large parcels of land (some of which form the current suburb of Dee Why) were passed on from the Jenkins family to the Salvation Army around 1900. The Salvation Army established a farm and hostels for boys and girls;
- The Salvation Army progressively sold off their land from the early 1900s onwards; and

- Most of Dee Why had been subdivided by the 1920s. The land was predominantly utilised for residential purposes, with the exception of commercial/retail in the vicinity of Pittwater Road.

The above information was obtained from Swancott (1967[12]), Muir (1992[13]), Manly Warringah and Pittwater Historical Society (1992[14]), Prentis (ed) (1988[15]) and Wikipedia[16].

3.3 NSW EPA Records

The NSW EPA records available online were reviewed for the assessment. Copies of relevant documents are attached in the appendices. A summary of the relevant information is provided in the following table:

Table 3-2: Summary of NSW EPA Online Records

Source	Details
CLM Act 1997[17]	There were no notices for any of the study areas, or any other property in Dee Why, under Section 58 of the CLM Act 1997.
NSW EPA List of Contaminated Sites[18]	None of the study areas were listed on the EPA Contaminated Sites register. The "Dee Why Town Centre" has been notified to the EPA as a contaminated site. EIS understand that the notified area applies to the land to the east of Pittwater Road, between Oaks and Howard Avenues. The nature of the contamination issue is unknown. The records indicated that the contamination issues in this area are currently being assessed by the EPA. The Caltex Service Station at 793-797 Pittwater Road is also listed on the EPA Contaminated Sites register. This property is located approximately 430m to the north-east of the Master Plan area and would not be expected to impact any of the study areas.
POEO Register[19]	There were no notices for any of the study areas on the POEO register.

[12] Swancott, C. 1967, *Dee Why to Barrenjoey and Pittwater*, D. S. Ford Printers, Sydney
[13] Muir, D. K. 1992, *The Jenkins Road: The Storey of James Jenkins c1776-1835, His Family's Life in Australia and their Legacy to the Salvation Army*, DK Muir
[14] Manly, Warringah and Pittwater Historical Society 1992, *Manly Warringah Journal of Local History*, Vol. 5 No. 1
[15] Prentis, M. D. (ed) 1988, *Warringah History*, The HouseWith No Steps, Belrose
[16] http://en.wikipedia.org/wiki/Dee_Why,_New_South_Wales, visited on 4 August 2014
[17] http://www.epa.nsw.gov.au/prclmapp/searchregister.aspx, visited on 8 July 2014
[18] http://www.epa.nsw.gov.au/clm/publiclist.htm, visited on 8 July 2014
[19] http://www.epa.nsw.gov.au/prpoeoapp/, visited on 8 July 2014

3.4 Summary of Historical Land Uses

A summary of historical land uses for each of the study areas is outlined in the following table:

Table 3-3: Summary of Historical Land Uses

Item[A]	Area	Possible or Known Historical Land Uses
1	Pittwater Road north	Roadway.
15	Drainage channel	Drainage channel. This channel may have previously formed part of several residential properties.
16	Stormwater easement	Stormwater easement, formerly an open channel. This channel may have previously formed part of several residential properties.
17	Pittwater Road	Roadway.
18	Walter Gors Park	Open space and residential. The western section of the study area is currently utilised by various community facilities (within the former residential cottages).
19	St David Avenue Pocket Park (and bus stop)	Open space, which possibly formed part of a former residential property.
24	Town Centre crossing	Roadway.
26	Howard Avenue	Roadway.
27	Triangle Park north	Formerly a service station and dry cleaners. This study area was subsequently remediated and is currently used as a park (public open space).
28	Howard Avenue east	Roadway.
30	Triangle Park south	It is possible that this area was formerly utilised for residential or commercial/retail-type purposes. This study area is currently occupied by a small medical centre.
31	Church Lane	Formerly residential then subsequently a car park.
33	Redman Pocket Plaza	Roadway.
34	Mooramba Pocket Park	Formerly residential then subsequently a park. This study area was occupied by part of a building (of unknown use) in the 1980s.
35	Oaks Avenue	Roadway.

Item[A]	Area	Possible or Known Historical Land Uses
	streetscape	
36	Woolworths Lane	Formerly residential then subsequently commercial/retail.
37	Pacific Parade streetscape	Roadway.
38	Fisher Road streetscape	Roadway.
39	Pittwater Road south	Roadway.
General	All other roads within the Master Plan area	Roadways. The St David Avenue roadway was constructed sometime around the 1960s. Prior to this time the area appeared to be vacant.

A – Item numbers for the key study areas align with those described in the Master Plan

3.5 Integrity of Site History Information

The site history information has predominantly been obtained from government organisations or previous investigation reports. The veracity of the information from these sources is considered to be relatively high.

Anecdotal information has been utilised to provide a general background regarding historical land uses in the Dee Why area.

4 PRELIMINARY CONCEPTUAL SITE MODEL

The potential contamination sources, receptors and exposure pathways identified below are based on the site information outlined previously in this report and the proposed development details for each study area. A graphic preliminary CSM has also been attached as Figure 5.

Table 4-1: Potential Contamination, Receptors and Exposure Pathways

Study Area	Potential Contaminant Source and Potential Contaminants of Concern (PCC)	Potential Receptors	Potential Exposure Pathways
1 - Pittwater Road north	Demolition of structures adjacent to the roadway: PCC include asbestos and lead (from lead-based paint).	Human receptors: construction workers and contractors, site users and adjacent land users.	Inhalation of airborne asbestos fibres, direct dermal contact and ingestion of lead contaminated soils, inhalation of dust.
	Fill soils: PCC include asbestos, heavy metals, TRH/BTEX and PAHs. Secondary PCC in fill soils (which are considered less likely to occur) include OCPs, organophosphorous pesticides (OPPs) and PCBs.	Human receptors: as above. Environmental receptors: Dee Why Lagoon, plants and terrestrial animals in proposed landscaped areas.	Dermal contact, ingestion and inhalation. Migration of contaminated groundwater into Dee Why Lagoon, direct contact and uptake by plants and animals.
15 - Drainage channel	Demolition of structures adjacent to the channel: PCC include asbestos and lead (from lead-based paint).	Human receptors: construction workers and contractors, site users and adjacent land users.	Inhalation of airborne asbestos fibres, direct dermal contact and ingestion of lead contaminated soils, inhalation of dust.
	Fill soils: PCC include asbestos, heavy metals, TRH/BTEX and PAHs. Secondary PCC in fill soils (which are considered less likely to occur) include OCPs, OPPs and PCBs.	Human receptors: construction workers and contractors, and adjacent land users. Environmental receptors: Dee Why Lagoon.	Inhalation of airborne asbestos fibres, direct dermal contact and ingestion. Migration of contaminated groundwater into Dee Why Lagoon.
16 - Stormwater easement	Demolition of structures adjacent to the easement: PCC include asbestos and lead (from lead-based	Human receptors: construction workers and contractors, site users and adjacent land users.	Inhalation of airborne asbestos fibres, direct dermal contact and ingestion of lead

Study Area	Potential Contaminant Source and Potential Contaminants of Concern (PCC)	Potential Receptors	Potential Exposure Pathways
	paint).		contaminated soils, inhalation of dust.
	Fill soils: PCC include asbestos, heavy metals, TRH/BTEX and PAHs. Secondary PCC in fill soils (which are considered less likely to occur) include OCPs, OPPs and PCBs.	Human receptors: construction workers and contractors, site users and adjacent land users. Environmental receptors: Dee Why Lagoon	Inhalation of airborne asbestos fibres, direct dermal contact and ingestion. Migration of contaminated groundwater into Dee Why Lagoon.
17 - Pittwater Road	Demolition of structures adjacent to the roadway: PCC include asbestos and lead (from lead-based paint).	Human receptors: construction workers and contractors, site users and adjacent land users.	Inhalation of airborne asbestos fibres, direct dermal contact and ingestion of lead contaminated soils, inhalation of dust.
	Fill soils: PCC include asbestos, heavy metals, TRH/BTEX and PAHs. Secondary PCC in fill soils (which are considered less likely to occur) include OCPs, OPPs and PCBs.	Human receptors: construction workers and contractors, and adjacent land users. Environmental receptors: Dee Why Lagoon.	Inhalation of airborne asbestos fibres, direct dermal contact and ingestion. Migration of contaminated groundwater into Dee Why Lagoon.
	Former service station and dry cleaners: groundwater down gradient (north-east) of the Triangle Park north (Item 27) study area may be impacted with VOCs, BTEX and TRH.	Human receptors: construction workers and contractors.	Vapour inhalation or direct contact with contaminated groundwater during excavation works.
18 - Walter Gors Park	Demolition of the former residential structures: PCC include asbestos and lead (from lead-based paint).	Human receptors: construction workers and contractors, site users and adjacent land users.	Inhalation of airborne asbestos fibres, direct dermal contact and ingestion of lead contaminated soils, inhalation of dust.
	Fill soils: PCC include asbestos, heavy metals, TRH/BTEX and PAHs. Secondary PCC in fill soils (which are considered less likely to occur) include OCPs, OPPs and PCBs.	Human receptors: construction workers and contractors, and adjacent land users. Environmental receptors: Dee Why Lagoon.	Inhalation of airborne asbestos fibres, direct dermal contact and ingestion. Migration of contaminated groundwater

Study Area	Potential Contaminant Source and Potential Contaminants of Concern (PCC)	Potential Receptors	Potential Exposure Pathways
			into Dee Why Lagoon.
	Former service station and dry cleaners: groundwater down gradient (north-east) of the Triangle Park north (Item 27) study area may be impacted with VOCs, BTEX and TRH from the former service station and dry cleaners	Human receptors: construction workers and contractors.	Vapour inhalation or direct contact with contaminated groundwater during excavation works.
19 - St David Avenue Pocket Park (and bus stop)	Demolition of former structures: PCC include asbestos and lead (from lead-based paint).	Human receptors: construction workers and contractors, site users and adjacent land users.	Inhalation of airborne asbestos fibres, direct dermal contact and ingestion of lead contaminated soils, inhalation of dust.
	Fill soils: PCC include asbestos, heavy metals, TRH/BTEX and PAHs. Secondary PCC in fill soils (which are considered less likely to occur) include OCPs, OCPs and PCBs.	Human receptors: as above. Environmental receptors: Dee Why Lagoon, plants and terrestrial animals in proposed landscaped areas.	Dermal contact, ingestion and inhalation. Migration of contaminated groundwater into Dee Why Lagoon, direct contact and uptake by plants and animals.
24 - Town Centre crossing	Demolition of structures adjacent to the roadway: PCC include asbestos and lead (from lead-based paint).	Human receptors: construction workers and contractors and adjacent land users.	Inhalation of airborne asbestos fibres, direct dermal contact and ingestion of lead contaminated soils, inhalation of dust.
	Fill soils: PCC include asbestos, heavy metals, TRH/BTEX and PAHs. Secondary PCC in fill soils (which are considered less likely to occur) include OCPs, OCPs and PCBs.	Human receptors: as above. Environmental receptors: Dee Why Lagoon.	Dermal contact, ingestion and inhalation. Migration of contaminated groundwater into Dee Why Lagoon.
26 - Howard Avenue	Demolition of structures adjacent to the roadway: PCC include asbestos and lead (from lead-based paint).	Human receptors: construction workers and contractors, site users and adjacent land users.	Inhalation of airborne asbestos fibres, direct dermal contact and ingestion of lead contaminated soils, inhalation of dust.

Study Area	Potential Contaminant Source and Potential Contaminants of Concern (PCC)	Potential Receptors	Potential Exposure Pathways
	Fill soils: PCC include asbestos, heavy metals, TRH/BTEX and PAHs. Secondary PCC in fill soils (which are considered less likely to occur) include OCPs, OPPs and PCBs.	Human receptors: construction workers and contractors, site users and adjacent land users. Environmental receptors: Dee Why Lagoon, plants and terrestrial animals in proposed landscaped areas.	Inhalation of airborne asbestos fibres, direct dermal contact and ingestion. Migration of contaminated groundwater into Dee Why Lagoon. Direct contact and uptake by plants and animals.
	Former service station and dry cleaners: groundwater down gradient (north-east) of the Triangle Park north (Item 27) study area and to the north/north-east of the existing Lawrence Dry Cleaners may be impacted with VOCs, BTEX and TRH.	Human receptors: construction workers and contractors.	Vapour inhalation or direct contact with contaminated groundwater during excavation works.
27 - Triangle Park north	Former service station and dry cleaners: TRH/BTEX and VOCs were previously identified in the groundwater within this study area.	Human receptors: construction workers and contractors, adjacent land users within buildings.	Vapour inhalation or direct contact with contaminated groundwater during excavation works.
28 - Howard Avenue east	Demolition of structures adjacent to the roadway: PCC include asbestos and lead (from lead-based paint).	Human receptors: construction workers and contractors, site users and adjacent land users.	Inhalation of airborne asbestos fibres, direct dermal contact and ingestion of lead contaminated soils, inhalation of dust.
	Fill soils: PCC include asbestos, heavy metals, TRH/BTEX and PAHs. Secondary PCC in fill soils (which are considered less likely to occur) include OCPs, OCPs and PCBs.	Human receptors: as above. Environmental receptors: Dee Why Lagoon, plants and terrestrial animals in proposed landscaped areas.	Dermal contact, ingestion and inhalation. Migration of contaminated groundwater into Dee Why Lagoon. Direct contact and uptake by plants and animals.
30 - Triangle Park south	Demolition of former structures: PCC include asbestos and lead (from lead-based paint).	Human receptors: construction workers and contractors, site users and adjacent land users.	Inhalation of airborne asbestos fibres, direct dermal contact and ingestion of lead contaminated soils, inhalation of dust.

Study Area	Potential Contaminant Source and Potential Contaminants of Concern (PCC)	Potential Receptors	Potential Exposure Pathways
	Fill soils: PCC include asbestos, heavy metals, TRH/BTEX and PAHs. Secondary PCC in fill soils (which are considered less likely to occur) include OCPs, organophosphorus pesticides (OPPs) and PCBs.	Human receptors: as above. Environmental receptors: Dee Why Lagoon, plants and terrestrial animals in proposed landscaped areas.	Dermal contact, ingestion and inhalation. Migration of contaminated groundwater into Dee Why Lagoon. Direct contact and uptake by plants and animals.
31 - Church Lane	Demolition of former residential structures: PCC include asbestos and lead (from lead-based paint). Fill soils: PCC include asbestos, heavy metals, TRH/BTEX and PAHs. Secondary PCC in fill soils (which are considered less likely to occur) include OCPs, OCPs and PCBs.	Human receptors: construction workers and contractors, site users and adjacent land users. Human receptors: as above. Environmental receptors: Dee Why Lagoon, plants and terrestrial animals in proposed landscaped areas.	Inhalation of airborne asbestos fibres, direct dermal contact and ingestion of lead contaminated soils, inhalation of dust. Dermal contact, ingestion and inhalation. Migration of contaminated groundwater into Dee Why Lagoon. Direct contact and uptake by plants and animals.
33 - Redman Pocket Plaza	Demolition of former structures adjacent to the roadway: PCC include asbestos and lead (from lead-based paint). Fill soils: PCC include asbestos, heavy metals, TRH/BTEX and PAHs. Secondary PCC in fill soils (which are considered less likely to occur) include OCPs, OCPs and PCBs.	Human receptors: construction workers and contractors, site users and adjacent land users. Human receptors: as above. Environmental receptors: Dee Why Lagoon, plants within the proposed community garden and landscaped areas.	Inhalation of airborne asbestos fibres, direct dermal contact and ingestion of lead contaminated soils, inhalation of dust. Dermal contact, ingestion and inhalation. Migration of contaminated groundwater into Dee Why Lagoon. Direct contact and uptake by plants and animals.
34 - Mooramba Pocket Park	Demolition of former residential structures: PCC include asbestos and lead (from lead-based paint). Fill soils: PCC include asbestos, heavy metals,	Human receptors: construction workers and contractors, site users and adjacent land users.	Inhalation of airborne asbestos fibres, direct dermal contact and ingestion of lead contaminated soils, inhalation of dust.

Study Area	Potential Contaminant Source and Potential Contaminants of Concern (PCC)	Potential Receptors	Potential Exposure Pathways
	TRH/BTEX and PAHs. Secondary PCC in fill soils (which are considered less likely to occur) include OCPs, OCPs and PCBs.	Human receptors: as above. Environmental receptors: Dee Why Lagoon, plants within the proposed landscaped areas.	Dermal contact, ingestion and inhalation. Migration of contaminated groundwater into Dee Why Lagoon. Direct contact and uptake by plants and animals.
35 - Oaks Avenue streetscape	Demolition of former structures adjacent to the roadway: PCC include asbestos and lead (from lead-based paint). Fill soils: PCC include asbestos, heavy metals, TRH/BTEX and PAHs. Secondary PCC in fill soils (which are considered less likely to occur) include OCPs, OCPs and PCBs.	Human receptors: construction workers and contractors, site users and adjacent land users. Human receptors: as above. Environmental receptors: Dee Why Lagoon, plants within the proposed landscaped areas.	Inhalation of airborne asbestos fibres, direct dermal contact and ingestion of lead contaminated soils, inhalation of dust. Dermal contact, ingestion and inhalation. Migration of contaminated groundwater into Dee Why Lagoon. Direct contact and uptake by plants and animals.
36 - Woolworths Lane	Demolition of former residential structures: PCC include asbestos and lead (from lead-based paint). Fill soils: PCC include asbestos, heavy metals, TRH/BTEX and PAHs. Secondary PCC in fill soils (which are considered less likely to occur) include OCPs, OCPs and PCBs.	Human receptors: construction workers and contractors, site users and adjacent land users. Human receptors: as above. Environmental receptors: plants within the proposed landscaped areas.	Inhalation of airborne asbestos fibres, direct dermal contact and ingestion of lead contaminated soils, inhalation of dust. Dermal contact, ingestion and inhalation. Direct contact and uptake by plants and animals.
37 - Pacific Parade streetscape	Demolition of former structures adjacent to the roadway: PCC include asbestos and lead (from lead-based paint). Fill soils: PCC include asbestos, heavy metals, TRH/BTEX and PAHs. Secondary PCC in fill soils	Human receptors: construction workers and contractors, site users and adjacent land users. Human receptors: as above.	Inhalation of airborne asbestos fibres, direct dermal contact and ingestion of lead contaminated soils, inhalation of dust. Dermal contact, ingestion and inhalation.

Study Area	Potential Contaminant Source and Potential Contaminants of Concern (PCC)	Potential Receptors	Potential Exposure Pathways
	(which are considered less likely to occur) include OCPs, OCPs and PCBs.	Environmental receptors: plants within the proposed landscaped areas.	Direct contact and uptake by plants and animals.
38 - Fisher Road streetscape	Demolition of former structures adjacent to the roadway: PCC include asbestos and lead (from lead-based paint).	Human receptors: construction workers and contractors, site users and adjacent land users.	Inhalation of airborne asbestos fibres, direct dermal contact and ingestion of lead contaminated soils, inhalation of dust.
	Fill soils: PCC include asbestos, heavy metals, TRH/BTEX and PAHs. Secondary PCC in fill soils (which are considered less likely to occur) include OCPs, OCPs and PCBs.	Human receptors: as above. Environmental receptors: plants within the proposed landscaped areas.	Dermal contact, ingestion and inhalation. Direct contact and uptake by plants and animals.
39 - Pittwater Road south	Demolition of former structures adjacent to the roadway: PCC include asbestos and lead (from lead-based paint).	Human receptors: construction workers and contractors, site users and adjacent land users.	Inhalation of airborne asbestos fibres, direct dermal contact and ingestion of lead contaminated soils, inhalation of dust.
	Fill soils: PCC include asbestos, heavy metals, TRH/BTEX and PAHs. Secondary PCC in fill soils (which are considered less likely to occur) include OCPs, OCPs and PCBs.	Human receptors: as above. Environmental receptors: plants within the proposed landscaped areas.	Dermal contact, ingestion and inhalation. Direct contact and uptake by plants and animals.
	Former service station (existing Avis car rental) and existing United Service Station: PCC in groundwater include TRH/BTEX.	Human receptors: construction workers and contractors	Vapour inhalation or direct contact with contaminated groundwater during excavation works.
All other roads within the Master Plan area	Demolition of former structures adjacent to the roadways: PCC include asbestos and lead (from lead-based paint).	Human receptors: construction workers and contractors, site users and adjacent land users.	Inhalation of airborne asbestos fibres, direct dermal contact and ingestion of lead contaminated soils, inhalation of dust.
	Fill soils: PCC include asbestos, heavy metals, TRH/BTEX and PAHs. Secondary PCC in fill soils	Human receptors: as above.	Dermal contact, ingestion and inhalation.

Study Area	Potential Contaminant Source and Potential Contaminants of Concern (PCC)	Potential Receptors	Potential Exposure Pathways
	(which are considered less likely to occur) include OCPs, OCPs and PCBs.	Environmental receptors: plants within the proposed landscaped areas.	Direct contact and uptake by plants and animals.

The primary PCC for the fill soils have been identified based on the following considerations: the fill soils may be a result of on-site churning of the surficial soils or may have been imported from other areas. Asbestos, PAHs, TRH/BTEX and heavy metals are commonly encountered in fill material (and surficial soils) due to localised fuel spills from motor vehicles and gardening equipment, inclusions such as ash and slag from burning of organics and other industrial processes, and from demolition of buildings that contained ACM or lead-based paints.

Based on the site history assessment and observations made during the walkover inspection, there were no land uses or potential contamination sources identified immediately outside the Master Plan area that would be expected to impact the study areas (or Master plan area in general) via contaminant migration through soil or groundwater.

4.1 Fate and Transport

The following fate and transport has been considered in relation to the study areas:

- With the exception of asbestos, non-volatile contaminants such as heavy metals, high molecular weight PAHs, pesticides and PCBs are predominantly confined to the soil and groundwater medium. The mobility of these contaminants varies depending on: the nature and type of contaminant present (e.g. leachability, viscosity, density etc.); soil type/porosity; surface water infiltration; groundwater levels; and the rate of groundwater movement;
- Volatile contaminants are usually more mobile when compared to the non-volatile compounds and can impact soil, groundwater and air (or soil vapour). The potential for migration of volatile contaminants such as naphthalene (a PAH compound), BTEX and TRH is relatively high in sandy soil with a high water table;
- Disturbance of asbestos contaminated soils may increase the migration potential for asbestos fibres. The potential for migration would be limited in the event that the asbestos is only present in bonded form (i.e. fibre cement fragments in sound condition); and
- The mobile contaminants would be expected to move down to the rock surface or groundwater table and migrate down-gradient from the source. The mobility would depend on a range of factors such as: contaminant mass and release mechanism; soil type/porosity; surface water infiltration; groundwater levels; confining layers within the aquifer; solubility in groundwater; and density of the product (for liquid products).

5 DISCUSSION

A number of potential contamination-related risks/constraints have been identified that may impact the public infrastructure works proposed under the Master Plan. A discussion of these risks/constraints is provided in the following subsections. Recommendations to address these risks/constraints have been provided in **Section 6**.

5.1 Asbestos in Soil

sACM was identified in a number of the key study areas during this ESA. Based on the observations made during the walkover inspection, it would be reasonable to assume that the asbestos issue may be widespread across all study areas (and the Master Plan area in general) and therefore this will need to be considered in detail moving forward with the project.

The presence of asbestos will require further consideration in relation to work health and safety (WHS) requirements during the proposed development works and with regards to the future use of each area.

The sACM that was observed during the walkover inspection appeared to be bonded ACM (i.e. ACM that could not be crushed using hand pressure and was not powdery or significantly degraded). Management/remediation of bonded asbestos within the study areas would be relatively straight forward.

The presence of non-bonded (also known as friable) asbestos may have more significant implications for the works. The presence of friable asbestos would result in increased WHS measures, site assessment requirements and remedial requirements which would be expected to increase the cost of the works significantly.

5.2 Disposal of Excavated Material

The previous EIS investigations undertaken within the Dee Why area identified fill soil to various depths (typically 0.5-1m). This fill may have been imported from off-site sources or may have been formed by churning of the upper soil profiles.

The presence of fill material will require careful consideration with regards to soil disposal costs in the event that there is likely to be a surplus of excavated material during the works. As a guide, landfill fees for waste materials classified as 'general solid waste' or 'general solid waste containing asbestos' are currently in the order of $160/tonne. This does not include excavation or transport.

5.3 Acid Sulfate Soil (ASS)

A number of the key study areas may be underlain by potential ASS (PASS). Generally these soils would be expected to occur more towards the north-eastern sections of the Master Plan area.

Previous EIS investigations within the Dee Why area indicated that the occurrence of PASS may be more widespread than what the ASS risk map, geological map and Warringah Council Planning map suggest.

The presence of PASS may impact the management of excavated material and the disposal classification of the natural soils (i.e. natural soil classified as PASS cannot be considered virgin excavated natural material – VENM).

5.4 Former and Existing Land Uses

As the public infrastructure upgrades generally fall within the public domain (such as roads), former land uses were not a primary concern for most areas.

The Triangle Park north study area (Item 27) was a former service station and dry cleaners. However, this study area has been remediated and has been certified as suitable for use as a park by an EPA accredited site auditor. As the proposed works under the Master Plan do not include a change of use for this study area, further assessment of this area (in relation to contamination and site suitability) is not considered necessary.

The presence of the suspected former service station (the existing Avis car rental) and the existing United Service Station in the southern section of the Master Plan area (probably most applicable to the Pittwater Road south study area - Item 39) are unlikely to represent a major concern in relation to the proposed works. Similarly, the Victor Glass industrial building is unlikely to represent a major concern in relation to the works within the Pittwater Road study area (Item 17).

There were no obvious land uses identified immediately outside the Master Plan area that were considered to represent a potential off-site risk with regards to soil or groundwater contamination migration.

6 RECOMMENDATIONS

6.1 Preliminary Intrusive Investigations

The recommendations for intrusive investigations are outlined in the table below:

Study Area	Investigation Recommendations
All areas	A preliminary soil contamination screening should be undertaken for all areas in conjunction with the geotechnical drilling works (we anticipate that geotechnical drilling will be required in most areas for pavement design, light poles and other structures such as seating etc). The preliminary screening(s) should be designed to: • Make a preliminary assessment of the soil contamination conditions in relation to the proposed land use; • Provide waste classification data for soil disposal purposes; • Provide preliminary data in relation to asbestos in soil (this can be utilised to develop appropriate remediation and/or management strategies); and • Assess the potential for ASS occurrence (as applicable). The soil screening should target the primary PCC in all areas. A reduced analysis schedule for the secondary PCC (such as pesticides and PCBs) can be considered in consultation with the environmental consultant. The preliminary CSM should be reviewed in light of the soil contamination screening findings to assess whether further investigation work or remediation/management is required.
Stormwater easement (Item 16) Walter Gors Park (Item 18); St David Avenue Pocket Park (Item 19) Triangle Park south (Item 30) Mooramba Pocket Park (Item 34), including the adjacent area where the proposed stormwater detention basin is being considered	These key study areas are considered to represent a greater risk with regards to contamination when factoring in the proposed end use (i.e. parks and high use areas with significant landscaping). On this basis, a site specific, preliminary investigation should be undertaken in these areas. The investigation(s) should be designed to supplement/complement the data obtained during the preliminary screening (as described above). In the event that contamination is identified during the preliminary investigation(s), a study area-specific Remedial Action Plan (RAP) should be prepared. The presence of unexpected or significant contamination issues in these areas may warrant consideration of a detailed (Stage 2) investigation prior to preparation of the RAP. The preliminary CSM should be reviewed in light of the investigation findings.

Study Area	Investigation Recommendations
Howard Avenue (Item 28)	The investigation for the Howard Avenue key study area should include an assessment of the groundwater contamination conditions. This requirement is based on the presence of the existing Lawrence Dry Cleaners and the potential for relatively deep excavation works for stormwater infrastructure along Howard Avenue.

6.2 Acid Sulfate Soil Management Plan (ASSMP)

An ASSMP will be required for any key study areas where ASS or PASS is encountered and may be disturbed during the proposed development works. Consideration could be given to preparation of an ASSMP that encompasses all study areas, based on the outcome of the preliminary soil screening or other investigations.

6.3 Asbestos Management Plan (AMP)

Following completion of the intrusive investigation(s), an AMP should be prepared. The AMP should provide details regarding the management of asbestos during the site works. This could include an AMP that encompasses all of the public infrastructure works areas or a number of study area specific AMPs.

6.4 Environmental Management Plan (EMP)

A long term EMP (or post construction AMP) will be required to manage the asbestos issue within the public infrastructure work areas after construction is complete. The EMP/AMP would apply to all areas unless it can be demonstrated that an area is free of asbestos contamination.

6.5 General

EIS recommend that a suitably qualified environmental consultant be engaged to provide input in relation to the assessment, management and/or remediation requirements for the duration of the project. In our experience, suitable planning and on-going liaison within a designated project team can reduce costs associated with the assessment and management of contaminated sites.

7 CONCLUSIONS

In general, the public infrastructure works areas have not historically been utilised for activities that would be expected to result in significant soil or groundwater contamination. This is primarily due to the fact that many of these areas have been utilised as public roads for some time.

The primary contamination sources within the study areas were considered to include potentially contaminated fill soils and contamination from demolition of former buildings.

Based on the scope of work undertaken, a number of potential contamination-related risks/constraints have been identified that may impact the public infrastructure works proposed under the Master Plan. These include:

- Asbestos in soil which will have implications for assessment, remediation/management and WHS;
- Disposal of surplus excavated material; and
- The presence of ASS/PASS.

EIS are of the opinion that the presence of actual or potential contamination is unlikely to be prohibitive to the implementation of the Dee Why Town Centre public infrastructure works under the Master Plan. However, careful consideration of the various risks/constraints will be required so that the assessment, remediation and/or management costs are minimised.

The recommendations outlined in this report should be implemented to minimise the potential for adverse human health or environmental impacts associated with potential contamination.

7.1 Regulatory Requirement

The regulatory requirements applicable for the site are outlined in the following table:

Table 7-1: Regulatory Requirement

Guideline	Applicability
Duty to Report Contamination 2008	The requirement to notify the NSW EPA regarding site contamination should be assessed once the results of the preliminary screening/investigation work have been interpreted. The duty to report requirements are not typically triggered for bonded asbestos contamination issues. This will require further consideration following the preliminary screening/investigation work.
POEO Act 1997	Section 143 of the POEO Act 1997 states that if waste is transported to a place that cannot lawfully be used as a waste facility for that waste, then the transporter and owner of the waste are each guilty of an offence. The

Guideline	Applicability
	transporter and owner of the waste have a duty to ensure that the waste is disposed of in an appropriate manner.
Managing Asbestos in or on Soil (2014[20])	The management of asbestos in or on soils within the study areas should be undertaken with reference to this document.
Work Health and Safety Code of Practice 2011[21]	Sites contaminated with asbestos become a 'workplace' when work is carried out there and require a register and asbestos management plan.

[20] WorkCover NSW 2014, *Managing Asbestos In or On Soils*

[21] WorkCover NSW, (2011), *WHS Regulation: Code of Practice – How to Manage and Control Asbestos in the Workplace.*

8 LIMITATIONS

The report limitations are outlined below:

- EIS accepts no responsibility for any unidentified contamination issues at the site. Any unexpected problems/subsurface features that may be encountered during development works should be inspected by an environmental consultant as soon as possible;
- Previous use of this site may have involved excavation for the foundations of buildings, services, and similar facilities. In addition, unrecorded excavation and burial of material may have occurred on the site. Backfilling of excavations could have been undertaken with potentially contaminated material that may be discovered in discrete, isolated locations across the site during construction work;
- This report has been prepared based on site conditions which existed at the time of the investigation; scope of work and limitation outlined in the EIS proposal; and terms of contract between EIS and the client (as applicable);
- The conclusions presented in this report are based on investigation of conditions at specific locations, chosen to be as representative as possible under the given circumstances, visual observations of the site and immediate surrounds and documents reviewed as described in the report;
- Subsurface soil and rock conditions encountered between investigation locations may be found to be different from those expected. Groundwater conditions may also vary, especially after climatic changes;
- The investigation and preparation of this report have been undertaken in accordance with accepted practice for environmental consultants, with reference to applicable environmental regulatory authority and industry standards, guidelines and the assessment criteria outlined in the report;
- Where information has been provided by third parties, EIS has not undertaken any verification process, except where specifically stated in the report;
- EIS has not undertaken any assessment of off-site areas that may be potential contamination sources or may have been impacted by site contamination, except where specifically stated in the report;
- EIS accept no responsibility for potentially asbestos containing materials that may exist at the site. These materials may be associated with demolition of pre-1990 constructed buildings or fill material at the site;
- EIS have not and will not make any determination regarding finances associated with the site;
- Additional investigation work may be required in the event of changes to the proposed development or landuse. EIS should be contacted immediately in such circumstances;
- Material considered to be suitable from a geotechnical point of view may be unsatisfactory from a soil contamination viewpoint, and vice versa; and

- This report has been prepared for the particular project described and no responsibility is accepted for the use of any part of this report in any other context or for any other purpose.

LIST OF IN-TEXT TABLES

IMPORTANT INFORMATION ABOUT THIS REPORT

These notes have been prepared by EIS to assist with the assessment and interpretation of this report.

The Report is Based on a Unique Set of Project Specific Factors:
This report has been prepared in response to specific project requirements as stated in the EIS proposal document which may have been limited by instructions from the client. This report should be reviewed, and if necessary, revised if any of the following occur:

- the proposed land use is altered;
- the defined subject site is increased or sub-divided;
- the proposed development details including size, configuration, location, orientation of the structures or landscaped areas are modified;
- the proposed development levels are altered, eg addition of basement levels; or
- ownership of the site changes.

EIS/J&K will not accept any responsibility whatsoever for situations where one or more of the above factors have changed since completion of the assessment. If the subject site is sold, ownership of the assessment report should be transferred by EIS to the new site owners who will be informed of the conditions and limitations under which the assessment was undertaken. No person should apply an assessment for any purpose other than that originally intended without first conferring with the consultant.

Changes in Subsurface Conditions
Subsurface conditions are influenced by natural geological and hydrogeological process and human activities. Groundwater conditions are likely to vary over time with changes in climatic conditions and human activities within the catchment (e.g. water extraction for irrigation or industrial uses, subsurface waste water disposal, construction related dewatering). Soil and groundwater contaminant concentrations may also vary over time through contaminant migration, natural attenuation of organic contaminants, ongoing contaminating activities and placement or removal of fill material. The conclusions of an assessment report may have been affected by the above factors if a significant period of time has elapsed prior to commencement of the proposed development.

This Report is Based on Professional Interpretations of Factual Data
Site assessments identify actual subsurface conditions at the actual sampling locations at the time of the investigation. Data obtained from the sampling and subsequent laboratory analyses, available site history information and published regional information is interpreted by geologists, engineers or environmental scientists and opinions are drawn about the overall subsurface conditions, the nature and extent of contamination, the likely impact on the proposed development and appropriate remediation measures.

Actual conditions may differ from those inferred, because no professional, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than an assessment indicates. Actual conditions in areas not sampled may differ from predictions. Nothing can be done to prevent the unanticipated, but steps can be taken to help minimise the impact. For this reason, site owners should retain the services of their consultants throughout the development stage of the project, to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

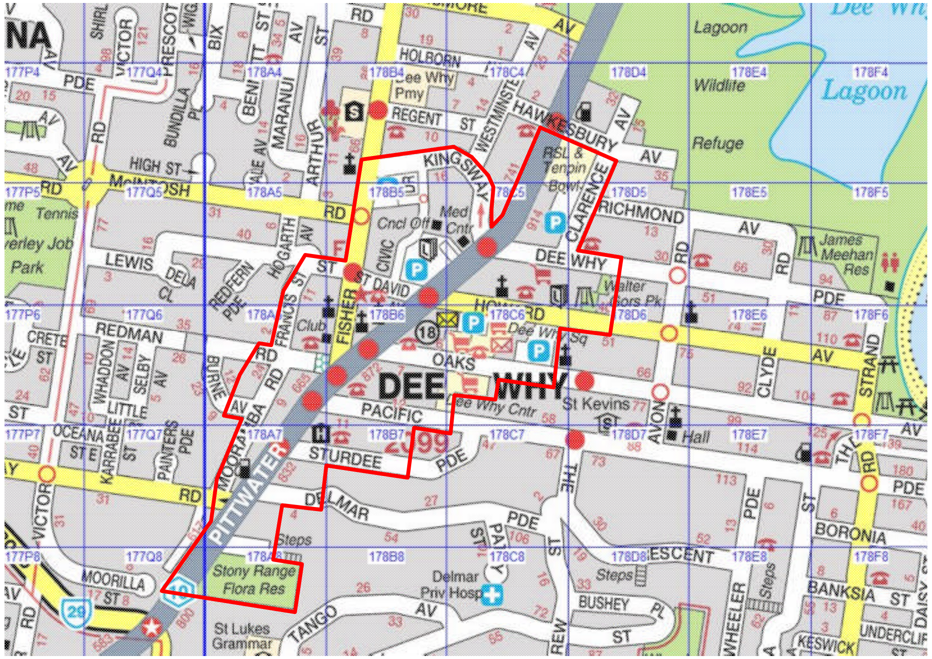
Assessment Limitations

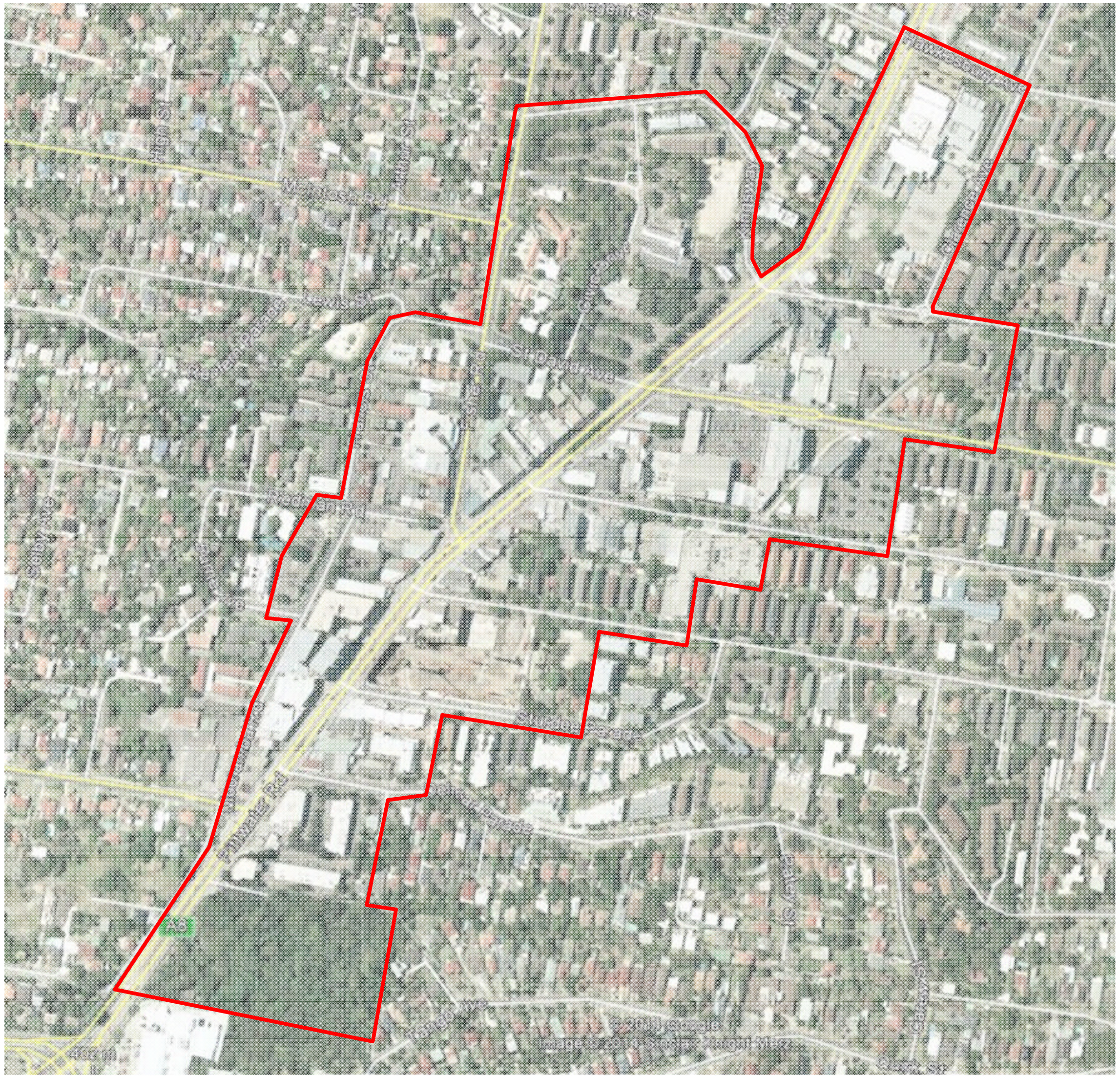
Although information provided by a site assessment can reduce exposure to the risk of the presence of contamination, no environmental site assessment can eliminate the risk. Even a rigorous professional assessment may not detect all contamination on a site. Contaminants may be present in areas that were not surveyed or sampled, or may migrate to areas which showed no signs of contamination when sampled. Contaminant analysis cannot possibly cover every type of contaminant which may occur; only the most likely contaminants are screened.

Misinterpretation of Site Assessments by Design Professionals
Costly problems can occur when other design professionals develop plans based on misinterpretation of an assessment report. To minimise problems associated with misinterpretations, the environmental consultant should be retained to work with appropriate professionals to explain relevant findings and to review the adequacy of plans and specifications relevant to contamination issues.

Read Responsibility Clauses Closely
Because an environmental site assessment is based extensively on judgement and opinion, it is necessarily less exact than other disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, model clauses have been developed for use in written transmittals. These are definitive clauses designed to indicate consultant responsibility. Their use helps all parties involved recognise individual responsibilities and formulate appropriate action. Some of these definitive clauses are likely to appear in the environmental site assessment, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to any questions.

REPORT FIGURES





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NOTES:
Figure 1 has been recreated from UBD on disc (version 5.0) and http://maps.six.nsw.gov.au/

Figure is not to scale. UBD map references as shown.

Reference should be made to the report text for a full understanding of this plan.

EIS ENVIRONMENTAL INVESTIGATION SERVICES	Project Number: E27540KP	Title: SITE LOCATION PLAN
	Figure: 1	Address: DEE WHY TOWN CENTRE, DEE WHY, NSW

N

LEGEND:

	Dee Why Town Centre Area
	Key study areas -
1	Pittwater Road north
15	Drainage channel
16	Stormwater easement
17	Pittwater Road
18	Walter Gors Park
19	St David Avenue Pocket Park and bus stop
24	Town Centre crossing
26	Howard Avenue
27	Triangle Park north
28	Howard Avenue east
30	Triangle Park south
31	Church Lane
33	Redman Pocket Plaza
34	Mooramba Pocket Park
35	Oaks Avenue Streetscape
36	Woolworths Lane
37	Pacific Parade streetscape
38	Fisher Road streetscape
39	Pittwater Road south
	Streetscape upgrades to all other roads within the Dee Why Town Centre Area

NOTES:
Figure 2 has been recreated from the Dee Why Town Centre Masterplan, prepared by Place Design Group for Warringah Council (July 2013).

Reference should be made to the report text for a full understanding of this plan.

Approximate Scale (m): 0 40 80 120 160 200

EIS ENVIRONMENTAL INVESTIGATION SERVICES	Project Number: E27540KP	Title: SITE LAYOUT PLAN
	Figure: 2	Address: DEE WHY TOWN CENTRE, DEE WHY, NSW

N

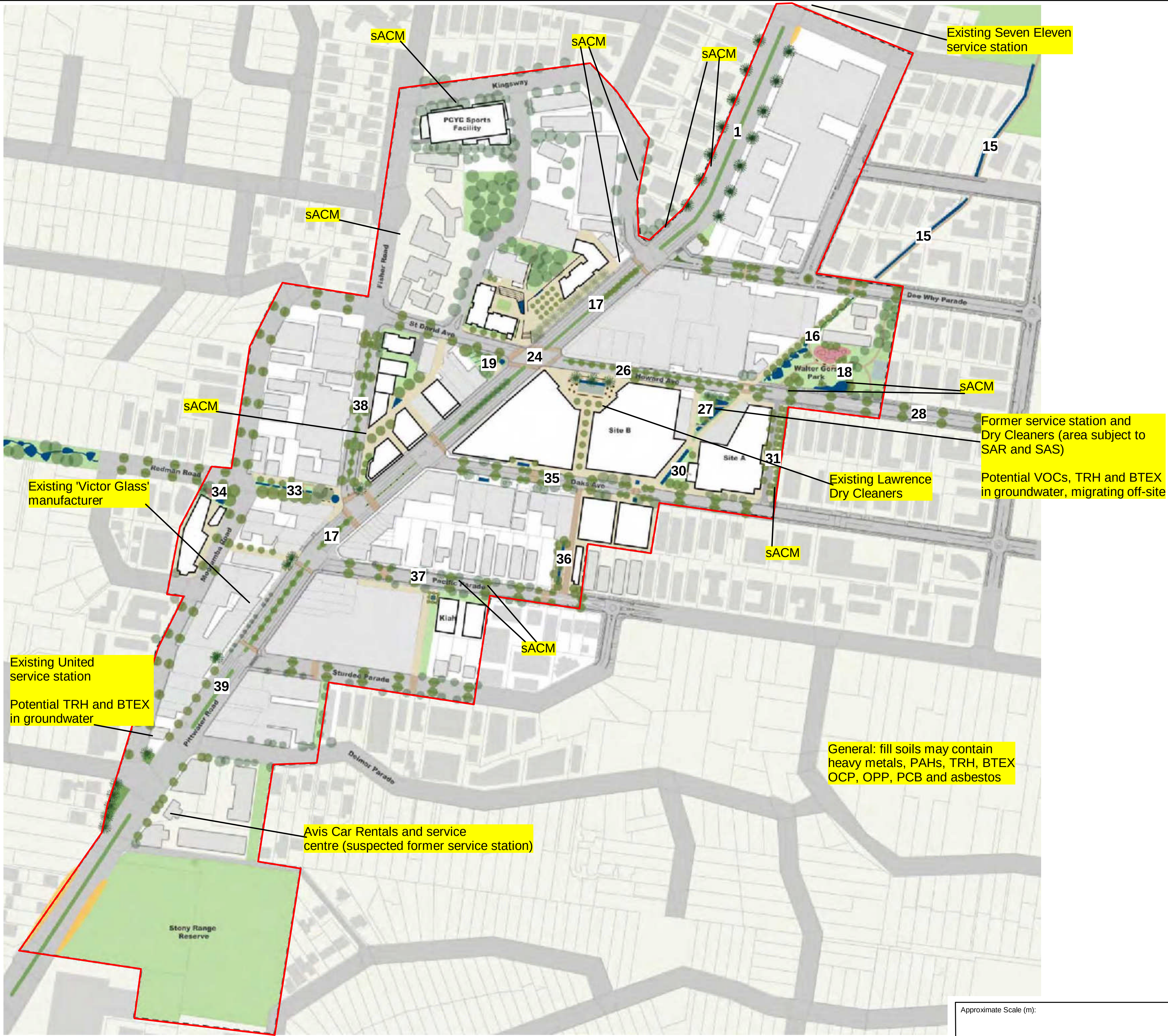
LEGEND:

	Dee Why Town Centre Area
	Key study areas -
1	Pittwater Road north
15	Drainage channel
16	Stormwater easement
17	Pittwater Road
18	Walter Gors Park
19	St David Avenue Pocket Park and bus stop
24	Town Centre crossing
26	Howard Avenue
27	Triangle Park north
28	Howard Avenue east
30	Triangle Park south
31	Church Lane
33	Redman Pocket Plaza
34	Mooramba Pocket Park
35	Oaks Avenue Streetscape
36	Woolworths Lane
37	Pacific Parade streetscape
38	Fisher Road streetscape
39	Pittwater Road south
	Streetscape upgrades to all other roads within the Dee Why Town Centre Area

NOTES:
Figure 3 has been recreated from the Dee Why Town Centre Masterplan, prepared by Place Design Group for Warringah Council (July 2013).

Reference should be made to the report text for a full understanding of this plan.

Approximate Scale (m): 0 40 80 120 160 200	EIS ENVIRONMENTAL INVESTIGATION SERVICES	Project Number: E27540KP	Title: PREVIOUS EIS PROJECTS
		Figure: 3	Address: DEE WHY TOWN CENTRE, DEE WHY, NSW



LEGEND:

Dee Why Town Centre Area

Key study areas -

1	Pittwater Road north
15	Drainage channel
16	Stormwater easement
17	Pittwater Road
18	Walter Gors Park
19	St David Avenue Pocket Park and bus stop
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34	Mooramba Pocket Park
35	Oaks Avenue Streetscape
36	Woolworths Lane
37	Pacific Parade streetscape
38	Fisher Road streetscape
39	Pittwater Road south

Streetscape upgrades to all other roads within the Dee Why Town Centre Area

NOTES:
Figure 4 has been recreated from the Dee Why Town Centre Masterplan, prepared by Place Design Group for Warringah Council (July 2013).

The notable feature locations are approximate. Reference should be made to the report text for a full understanding of this plan.

Approximate Scale (m): 0 40 80 120 160 200

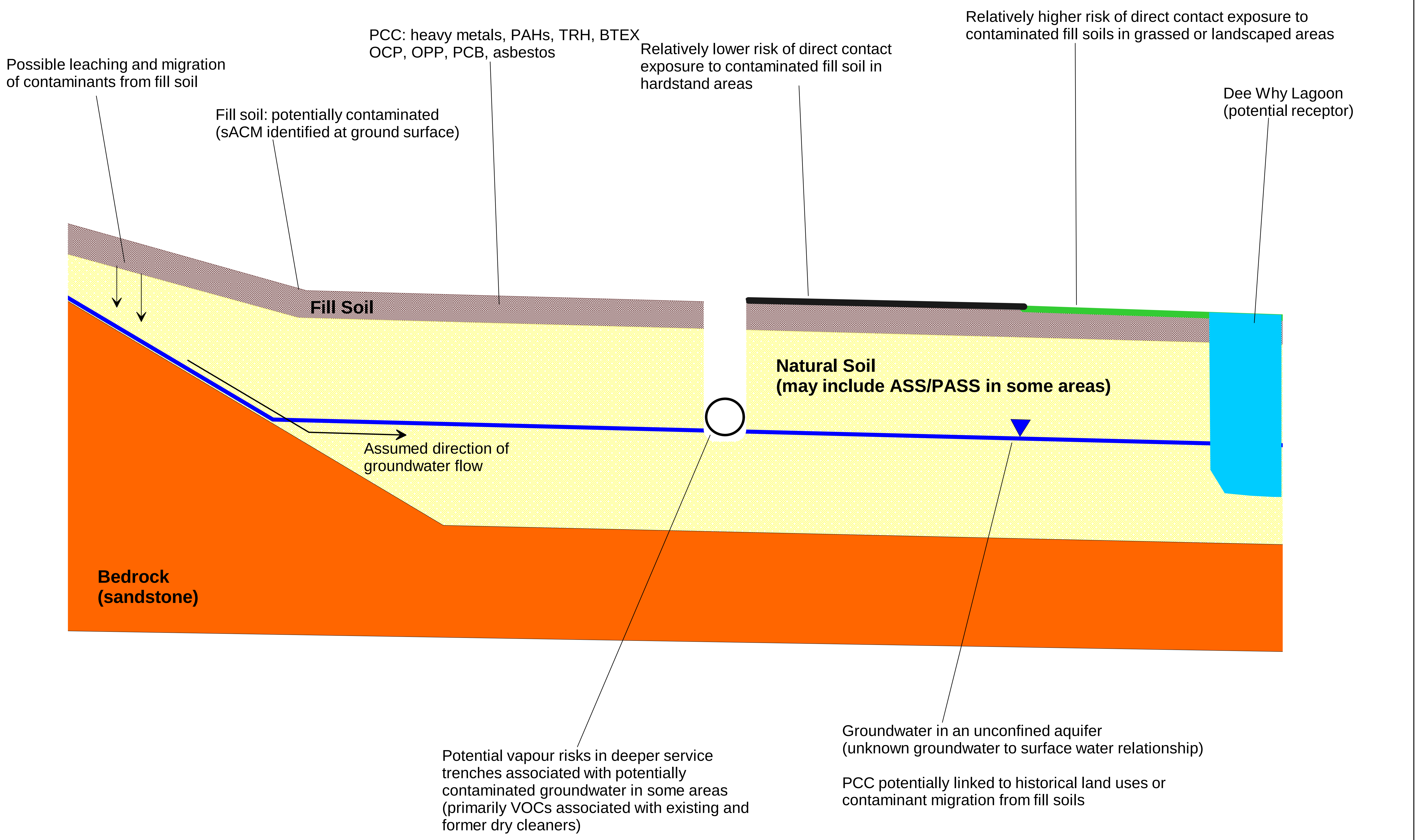
EIS
ENVIRONMENTAL INVESTIGATION SERVICES

Project Number: E27540KP

Title: NOTABLE FEATURES

Figure: 4

Address: DEE WHY TOWN CENTRE, DEE WHY, NSW



NOTES:
The graphical CSM is a generalised model for the Master Plan area based on information obtained during preparation of the preliminary Stage 1 ESA.

Reference should be made to the report text for a full understanding of this plan.

Approximate Scale (m):	EIS	Project Number:	Title:
Not to Scale	ENVIRONMENTAL INVESTIGATION SERVICES	E27540KP	GRAPHICAL CSM
		Figure: 4	Address: DEE WHY TOWN CENTRE, DEE WHY, NSW

Appendix A: Selected Site Photographs

Selected Site Photos taken on 10 and 11 July 2014

Photograph 1:
Pittwater Road north (1), road reserve to the west of the carriageway

Photograph 2:
Pittwater Road north (1), road reserve to the east of the carriageway

Photograph 3:
Pittwater Road north (1), sACM identified

Photograph 4:
Drainage channel (15), looking north from Dee Why Parade

Photograph 5:
Stormwater easement (16), looking north-east

Photograph 6:
Pittwater Road (17), looking north in the vicinity of the St David Avenue intersection

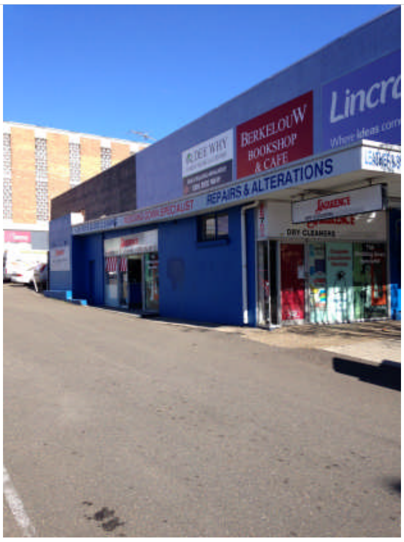
	**Photograph 7:** Pittwater Road (17), sACM in the vicinity of the Kingsway intersection
	**Photograph 8:** Walter Gors Park (18)
	**Photograph 9:** Walter Gors Park (18), exposed soil with demolition rubble at the base of a tree

Photograph 10:
Walter Gors Park (18), sACM at the ground surface

Photograph 11:
St David Avenue Pocket park and bus stop (19)

Photograph 12:
St David Avenue Pocket park and bus stop (19)

Photograph 13:
Town Centre crossing (24)



Photograph 14:
Howard Avenue (26), showing the Lawrence Dry Cleaners on the south side of the roadway

Photograph 15:
Howard Avenue (26), looking east

Photograph 16:
Triangle Park north (27)

Photograph 17:
Triangle Park south (30)

Photograph 18:
Church Lane (31), looking south

Photograph 19:
Church Lane (31), sACM identified at the ground surface in the vicinity of Oaks Avenue

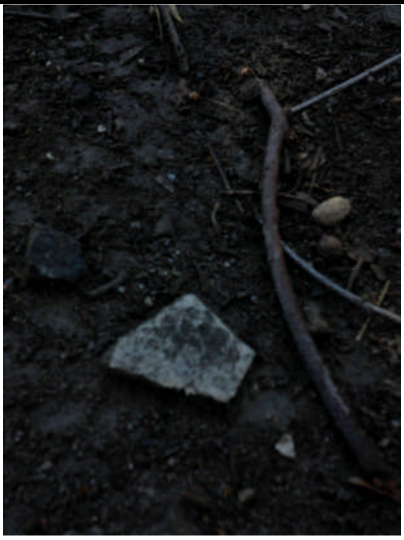
Photograph 20:
Redman Pocket Plaza (33), looking east

Photograph 21:
Mooramba Pocket Park (34)

Photograph 22:
Oaks Avenue streetscape (35), looking west

Photograph 23:
Woolworths Lane (36), looking north from Pacific Parade

Photograph 24:
Pacific Parade streetscape (37), looking east



Photograph 25:
Pacific Parade streetscape (37), sACM

Photograph 26:
Pacific Parade streetscape (37), sACM

Photograph 27:
Fisher Road streetscape (38), looking south

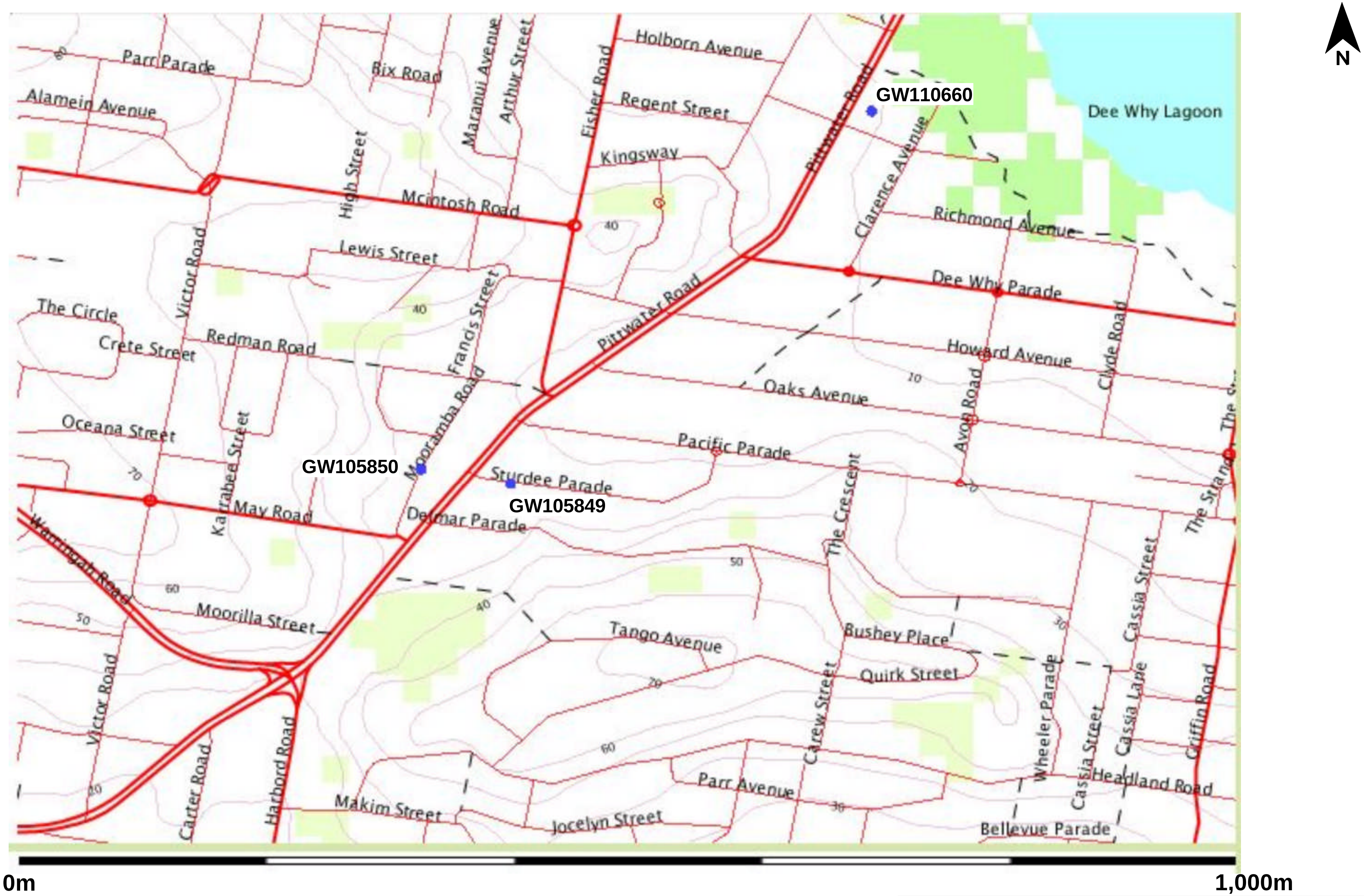
Photograph 28:
Fisher Road streetscape (38), sACM in the road reserve to the east of the carriageway

Photograph 29:
Pittwater Road south (39), existing united service station

Photograph 30:
Pittwater Road south (39), existing Avis Car rental (suspected former service station)

Appendix B: Site Information and Site History Documents

Appendix B1: Groundwater Bore Records



NOTES:
This Figure has been recreated from the NSW Government NR Atlas website www.nratlas.nsw.gov.au visited on 4 August 2014. The scale on the figure is approximate only.

Reference should be made to the report text for a full understanding of this plan.

ENVIRONMENTAL INVESTIGATION SERVICES	Project Number: E27540KP	Title: GROUNDWATER BORE RECORDS
	Figure: APPENDIX	Address: DEE WHY TOWN CENTRE, DEE WHY, NSW

Groundwater Works Summary

For information on the meaning of fields please see Glossary Document Generated on Monday, August 4, 2014	

Works Details	Site Details	Form A	Licensed	Construction	Water Bearing Zones	Drillers Log

Work Requested -- GW105850

Works Details (top)

GROUNDWATER NUMBER	GW105850
LIC-NUM	10BL160121
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	
COMMENCE-DATE	
COMPLETION-DATE	2001-05-01
FINAL-DEPTH (metres)	15.00
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	N/A
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	1.47
SALINITY	
YIELD	

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	213 - SYDNEY COAST - GEORGES RIVER
AREA-DISTRICT	
CMA-MAP	9130-2N
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	(Unknown)
NORTHING	6263666.00

EASTING	340947.00
LATITUDE	33 45' 19"
LONGITUDE	151 16' 58"
GS-MAP	
AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	MANLY COVE
PORTION-LOT-DP	1 703127

Licensed (top)

COUNTY	CUMBERLAND
PARISH	MANLY COVE
PORTION-LOT-DP	1 703127

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	15.00				
1	1	Casing	P.V.C.	0.00	0.00	50			

Water Bearing Zones (top)

no details

Drillers Log (top)

no details

Warning To Clients: This raw data has been supplied to the Department of Infrastructure, Planning and Natural Resources (DIPNR) by drillers, licensees and other sources. The DIPNR does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, August 4, 2014

Works Details | Site Details | Form A | Licensed | Construction | Water Bearing Zones | Drillers Log

Work Requested -- GW105849

Works Details (top)

GROUNDWATER NUMBER	GW105849
LIC-NUM	10BL160121
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	
COMMENCE-DATE	
COMPLETION-DATE	2001-01-01
FINAL-DEPTH (metres)	15.00
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	N/A
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	1.47
SALINITY	
YIELD	

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	213 - SYDNEY COAST - GEORGES RIVER
AREA-DISTRICT	
CMA-MAP	9130-2N
GRID-ZONE	56/1

SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	(Unknown)
NORTHING	6263641.00
EASTING	341087.00
LATITUDE	33 45' 19"
LONGITUDE	151 17' 3"
GS-MAP	
AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	MANLY COVE
PORTION-LOT-DP	1 703127

Licensed (top)

COUNTY	CUMBERLAND
PARISH	MANLY COVE
PORTION-LOT-DP	1 703127

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter; ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	15.00				
1	1	Casing	P.V.C.	0.00	0.00	50			

Water Bearing Zones (top)

no details

Drillers Log (top)

no details

Warning To Clients: This raw data has been supplied to the Department of Infrastructure, Planning and Natural Resources (DIPNR) by drillers, licensees and other sources. The DIPNR does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, August 4, 2014

Works Details | Site Details | Form A | Licensed | Construction | Water Bearing Zones | Drillers Log

Work Requested -- GW110660

Works Details (top)

GROUNDWATER NUMBER	GW110660
LIC-NUM	10BL603243
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Well
WORK-STATUS	
CONSTRUCTION-METHOD	Auger
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2009-08-19
FINAL-DEPTH (metres)	7.50
DRILLED-DEPTH (metres)	7.50
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	7 ELEVEN - DEE WHY
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST

RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6264347.00
EASTING	341639.00
LATITUDE	33 44' 57"
LONGITUDE	151 17' 25"
GS-MAP	
AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	MANLY COVE
PORTION-LOT-DP	100//628909

Licensed (top)

COUNTY	CUMBERLAND
PARISH	MANLY COVE
PORTION-LOT-DP	100 628909

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE -NO	PIPE -NO	COMPONENT -CODE	COMPONENT-TYPE	DEPTH -FROM (metres)	DEPTH -TO (metres)	OD (mm)	ID (mm)	INTERVA L	DETAI L
1		Hole	Hole	0.00	7.50	150			Auger
1	1	Casing	P.V.C.	0.00	5.00	60			Other
1	1	Opening	Screen	5.00	7.50	60			PVC; A: .5mm; Other

1		Annulus	Waterworn/Rounded	0.00	0.00				Graded; GS: 2-4mm
1		Annulus	Concrete	0.00	3.00	150			

Water Bearing Zones (top)

no details

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.15	0.15	CONCRETE		
0.15	0.90	0.75	CLAY YELLOW BLACK SANDY		
0.90	6.00	5.10	CLAY RED SANDY		
6.00	7.50	1.50	CLAY SANDY SATURATED RED		

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Appendix B2: NSW EPA Records

List of NSW Contaminated Sites Notified to the EPA, search date 8.7.14

www.epa.nsw.gov.au/clm/publiclist.htm

exhaustive.

The EPA may, without notice, change any or all of the information in the list at any time.

You should obtain independent advice before you make any decision based on the information in the list.

The list is made available on the understanding that the EPA, its servants and agents, to the extent permitted by law, accept no responsibility for any damage, cost, loss or expense incurred by you as a result of:

1. any information in the list; or
2. any error, omission or misrepresentation in the list; or
3. any malfunction or failure to function of the list;
4. without limiting (2) or (3) above, any delay, failure or error in recording, displaying or updating information.

EPA site management class	Explanation
A	The contamination of this site is being assessed by the EPA. Sites which have yet to be determined as significant enough to warrant regulation may result in no further regulation under the Contaminated Land Management Act 1997.
B	The EPA is awaiting further information to progress its initial assessment of this site.
C	The contamination of this site is or was regulated under the Contaminated Land Management Act 1997. Information about current or past regulatory action on this site can be found on the Record of EPA notices.
D	The contamination of this site is or was regulated under the Protection of the Environment Operations Act 1997. Information about current or past regulatory action on this site can be found on the POEO public register.
E	This is a premises with an operational underground petroleum storage system, such as a service station or fuel depot. The contamination of this site is managed under the Protection of the Environment Operations Act 1997 and the Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2008.
F	The contamination of this site is managed by a planning approval process. The consent authority is either the local council or a government agency, such as the Department of Planning.
G	Based on the information made available to the EPA to date, the contamination of this site is considered by the EPA to be not significant enough to warrant regulatory intervention under the Contaminated Land Management Act 1997.
H	Initial assessment completed. The contamination of this site is to be regulated by the EPA.

The following information is also available in pdf format which is best for printing (Publiclist.pdf, 424KB).

List current as of 1 July 2014.

Suburb/City	Site description and address	Activity that caused contamination	s60 form received?	EPA initial assessment	EPA site management class see explanations
Abbotsford	Former Gasworks	Gasworks	Yes	Completed	C

SIX Maps | List of NSW contaminated

www.epa.nsw.gov.au/clm/publiclist.htm

Apps | SIX viewer | Groundwater Bore S... | Google Calendar | SIX Maps | NSW Legislation | Google | POEO Search | CLM Register | EPA Notified Sites

Culcairn	Caltex Service Station Olympic Way	Service Station	Yes	In progress	B
Cullen Bullen	Baal Bone Colliery Castlereagh Highway	Other Industry	Yes	In progress	A
Cundletown	Caltex Service Station Old Pacific Highway	Service Station	Yes	In progress	B
Curl Curl and North Curl Curl	John Fisher Park Corner Harbord and Abbot Roads	Landfill	Yes	In progress	A
Daceyville	Astrolabe Park Cook Avenue	Landfill	Yes	Completed	H
Dapto	12-14 Hamilton Street	Other Industry	Yes	Completed	G
Dapto	RailCorp Dapto 2-14 Hamilton Street (Rear of property)	Other Industry	Yes	Completed	G
Darlinghurst	139-155 Palmer Street	Unclassified	Yes	In progress	A
Dee Why	Caltex Service Station 793-797 Pittwater Rd	Service Station	Yes	In progress	B
Dee Why	Dee Why Town Centre Pittwater Road	Other Industry	Yes	In progress	A
Deniliquin	BP Depot Corner Harding and Sloane Streets	Service Station	Yes	In progress	A
Deniliquin	Caltex Service Station 116-118 Harding Rd	Service Station	Yes	In progress	B
Deniliquin	Deniliquin Gasworks 365 and 369 George St and 380 Charlotte Street	Gasworks	No	In Progress	B
Deniliquin	Former Shell Depot 143-147 Napier Street	Other Petroleum	Yes	In progress	A
Deniliquin	Landmark Chemicals Storage 90-101 Davidson Street	Chemical Industry	Yes	In progress	A
Deniliquin	Shell Coles Express Service Station 336 Victoria Street	Service Station	Yes	Completed	C
Denman	Former Industrial Site 10 Fontana Way	Metal Industry	Yes	Completed	G
Denman	Former Industrial Site 9 Fontana Way	Metal Industry	Yes	Completed	G
Doyalson	Mannering Colliery (formerly Wyee) Rutleys Road	Other Industry	Yes	In progress	A
Doyalson	Munmorah Colliery Scenic Drive	Other Industry	Yes	In progress	A
Doyalson	Munmorah Power Station	Unclassified	Yes	In Progress	A D

1:53 PM
8/07/2014

EPA CLM Register, search date 8.7.14

SIX Maps | DECCW | Search results

www.epa.nsw.gov.au/prclmapp/searchresults.aspx?&LGA=8000&Suburb=&Notice=&Name=&Text=&DateFrom=&DateTo=

Apps | SIX viewer | Groundwater Bore S... | Google Calendar | SIX Maps | NSW Legislation | Google | POEO Search | CLM Register | EPA Notified Sites

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Healthy Environment, Healthy Community, Healthy Business

NSW EPA

Home | Protecting your environment | For business and industry | About the NSW EPA | Media and information | Contact us

Contaminated land

- + Management of contaminated land
- + Consultants and site auditor scheme
- + Underground petroleum storage systems
- Guidelines under the CLM Act
- NEPM amendment
- + Further guidance
- − Record of notices
  - About the record
  - Search the record
  - Search tips
  - Disclaimer
- List of NSW contaminated sites notified to EPA
- Frequently asked questions
- Forms
- + Other contamination issues

You are here: Home > Contaminated land > Record of notices

Search results

Your search for: LGA: Warringah Council

Matched 13 notices relating to 4 sites.

Search Again | Refine Search

Suburb	Address	Site Name	Notices related to this site
Belrose	56-58 Glen Street	Glenrose Shopping Centre	2 current and 5 former
Forestville	632-634 Warringah Road	BP Service Station	2 current
Forestville	667 Warringah Road	Shell Service Station - Forestville	2 current
Narrabeen	Wakehurst Parkway	NSW Academy of Sport	1 current and 1 former

Page 1 of 1

8 July 2014

Connect	Feedback	Contact	Government	About
	Web support	Contact us	NSW Government	Accessibility
	Public consultation	Offices	jobs.nsw	Disclaimer
		Report pollution		Privacy
				Copyright

1:54 PM 8/07/2014

EPA POEO Register, search date 8.7.14

Environment protection licences

- + Licensing under the POEO Act
- Guide to licensing
- Licence forms
- Licence fees
- + Risk-based licensing
- + Load-based licensing
- + Emissions trading
- − POEO Public Register
  - Terms of use: POEO public register
  - Search for licences, applications and notices
  - Search for penalty notices
  - Search for prosecutions and civil proceedings
  - Enforceable undertakings
  - Exemptions and approvals
  - Licensing FAQs
  - List of licences
  - Unlicensed premises still regulated by the EPA
- National Pollutant Inventory
- + Compliance audit program
- + Reporting and managing incidents
- + Wind farm regulation
- + Coal seam gas regulation
- + Native forest bio-fuel

You are here: Home > Environment protection licences > POEO Public Register > Search for licences, applications and notices

Search results

Your search for: **General Search** with the following criteria

Suburb - DEE WHY

returned 7 results

Export to excel   1 of 1 Pages   Search Again

Number	Name	Location	Type	Status	Issued date
12312	DYNAMIC PRESS PTY LTD	156 South Creek Road, DEE WHY, NSW 2099	POEO licence	No longer in force	03 May 2005
622	METROMIX PTY LIMITED	158 SOUTH CREEK ROAD, DEE WHY, NSW 2099	POEO licence	No longer in force	27 Jun 2000
1020	ROCHE PRODUCTS PTY LTD	4-10 INMAN ROAD, DEE WHY, NSW 2099	POEO licence	Surrendered	19 Jun 2000
1019496	ROCHE PRODUCTS PTY LTD	4-10 INMAN ROAD, DEE WHY, NSW 2099	s.58 Licence Variation	Issued	13 Aug 2002
1057327	ROCHE PRODUCTS PTY LTD	4-10 INMAN ROAD, DEE WHY, NSW 2099	s.58 Licence Variation	Issued	07 Apr 2006
1072213	ROCHE PRODUCTS PTY LTD	4-10 INMAN ROAD, DEE WHY, NSW 2099	s.58 Licence Variation	Issued	24 Jul 2007
12988	ROCHE PRODUCTS PTY LTD	4-10 Inman Road, DEE WHY, NSW 2099	POEO licence	Surrendered	19 Dec 2008

08 July 2014

Appendix B3: Aerial Photographs

178 B6
Dee Why

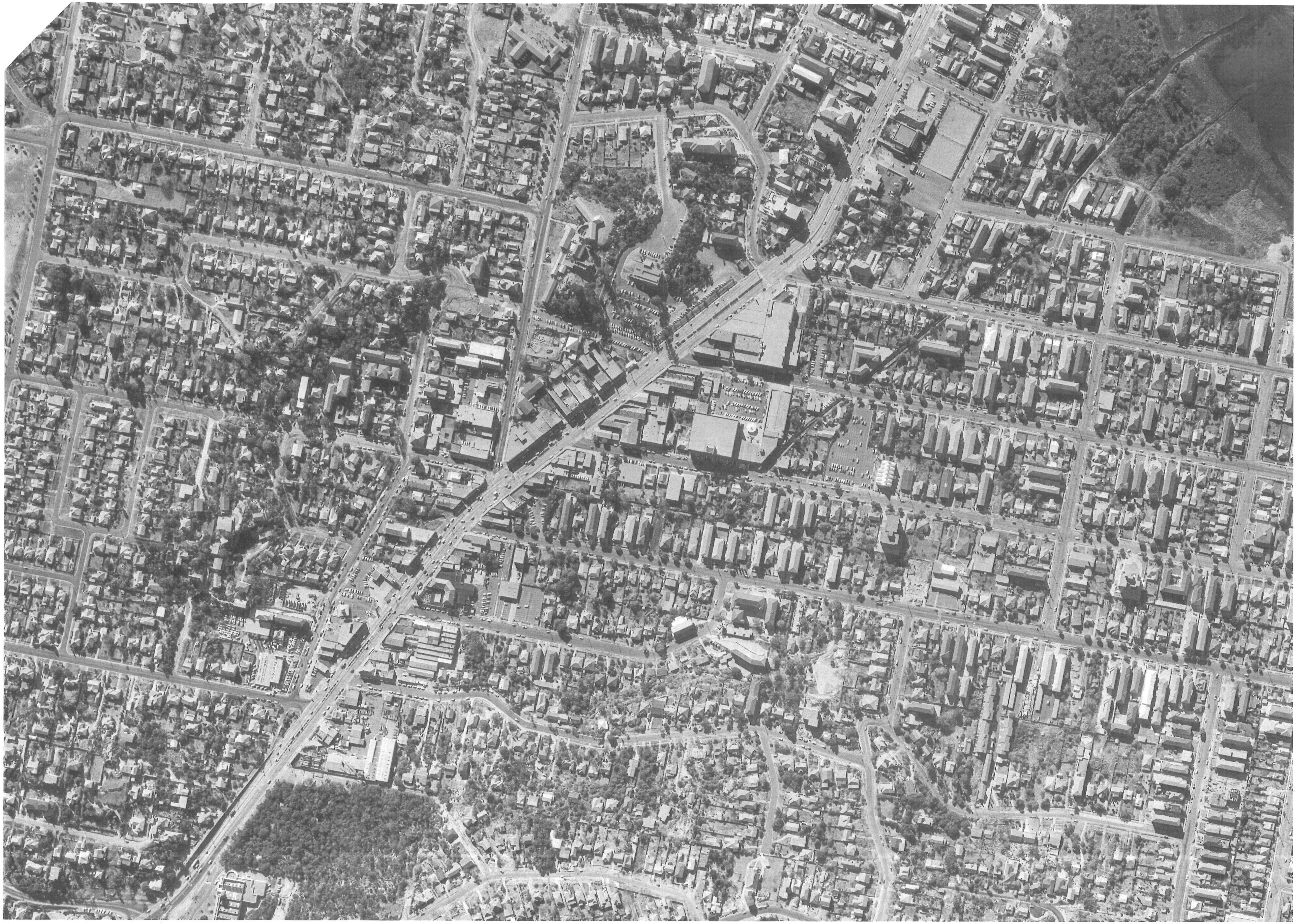
1930

178
B6
Dee Why

1951

1961

1970



1978

1986

1994

2002

Tract Consultants Pty Ltd

Dee Why Town Centre Public Infrastructure Upgrades - Investigation and Design - Stage 1 Research and Investigation

Traffic, Transport, Parking and Access Impact Assessment

26 November 2014

PARSONS BRINCKERHOFF
A BALFOUR BEATTY COMPANY

Document information
Client: Tract Consultants Pty Ltd Title: Dee Why Town Centre Public Infrastructure Upgrades - Investigation and Design - Stage 1 Research and Investigation Subtitle: Traffic, Transport, Parking and Access Impact Assessment Document No: 2196793A-ITP-RPT-3735-RevA Date: 26 November 2014

Rev	Date	Details
	16/09/2014	Draft Report
A	26/11/2014	Final Report

Author, Reviewer and Approver details			
Prepared by:	Claire Mead	Date: 26/11/2014	Signature: Claire Mead
Reviewed by:	Ryan Miller	Date: 26/11/2014	Signature: R. Miller
Approved by:	Richard West	Date: 26/11/2014	Signature:

Distribution
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Glossary

AADT	Annual Average Daily Traffic
AS	Australian Standard
BRT	Bus Rapid Transit
CBD	Central Business District
LGA	Local Government Area
LoS	Level of Service
km/h	Kilometres per hour
m	metres
P	Parking
PAMP	Pedestrian and Mobility Plan
RMS	Roads and Maritime Services
STA	State Transit Authority
TCS	Traffic Control Signal
TfNSW	Transport for NSW
WSUD	Water Sensitive Urban Design

1. Introduction

Tract Consultants Pty Ltd on behalf of Warringah Council has commissioned Parsons Brinckerhoff to undertake research, investigation and preliminary design for the Dee Why Town Centre Public Infrastructure Upgrades. The primary services relating to this commission include the review of previous project reporting and documents, assessment of the current road network, road user operation and provision of specialist traffic engineering and transport planning related advice to inform the preliminary designs.

1.1 Background

In 2013, Warringah Council adopted the Dee Why Town Centre Master Plan (Master Plan) as the guiding document to make 'Dee Why a highly liveable town centre and the focus for civic and cultural activities'. The Master Plan predominantly covers the commercial precinct of Dee Why, and provides a coordinated overall plan to address major public infrastructure upgrades, land use planning and development issues.

The Master Plan aims to:

- reconnect Dee Why with its natural environment
- create a well-connected town centre
- foster community sense of pride of place
- enhance open spaces
- consolidate buildings for the future
- provide safe and enjoyable public spaces
- generate investment through creating an attractive and vibrant town centre.

Key features of the Master Plan include:

- a Civic centre 'community hub' with an attractive outdoor plaza, amphitheatre and new library facilities
- a new Police Citizens and Youth Club
- 560 new car parking spaces
- new trees, paving, water features, landscaping and street furniture
- new bicycle lanes
- road changes to improve traffic flow
- new open spaces including the expansion of Walter Gors Park
- a new plaza at Redman Road
- use of Water-Sensitive Urban Design (WSUD)
- better accessibility
- buildings will generally remain at the current permissible floor space and heights. However, in selected areas, taller buildings may be considered on larger sites, subject to strict conditions and in return for connected open public spaces at the ground level.

1.2 Study area

The study area for this project is shown in Figure 1.1 on the following page. The study area is generally bounded by Fisher Road to the west, Dee Why Parade to the north, Avon Road to the east and Sturdee Parade to the south.

Figure 1.1 Study area

1.3 Study scope

The scope of this study includes:

- the review of previous project reporting, related documents, consultation and traffic modelling reporting completed to date
- undertaking a site inspection to inform the development of potential concept schemes by identifying constraints and opportunities and to gain an understanding of existing land uses, road network operation, parking circumstances, pedestrian and cyclist desire lines and facilities
- consideration of future development planning and proposed interchange upgrades
- providing advice and assistance to the project team to inform concept designs of the road network, intersections, pedestrian and cycle facilities
- prepare a report which documents the existing and future situations and the likely impacts of the proposed infrastructure upgrade changes.

1.4 Site inspection

Parsons Brinckerhoff conducted a site inspection during the afternoon of Thursday 10 July 2014 for site familiarisation, assessment of existing conditions and identification of opportunities and constraints in the preparation of future road network design and infrastructure upgrades. The site inspection was undertaken in fine and sunny conditions.

1.5 Document review

The following documents were reviewed as part of this study:

- Warringah Bike Plan, Warringah Council
- Dee Why Town Centre Traffic Study Final Traffic, Transport and Parking Report, GTA (2008)
- Dee Why Town Centre Traffic Model Update Traffic Modelling Report, GHD (2014)
- Guidelines for the Development of Public Transport Interchange Facilities, NSW Ministry of Transport (2008)
- Northern Beaches Transport Action Plan Flyer, NSW Government (2014)
- Brookvale and Dee Why Transport Management and Accessibility Study, GHD (2012)
- Dee Why Town Centre Traffic Management Proposals and Staging Plans, GTK Consulting
- Dee Why Town Centre Construction Drawings, Northrop and GTA (2012)
- Dee Why – 40 km/h Speed Limit and Pedestrian Access and Mobility Plan, URaP TTW (2007)
- Warringah Pedestrian Access and Mobility Plan, Aurecon (2011)
- Interchange Program Scoping Study Dee Why/Brookvale Transport Interchanges, GHD (2012)
- Crash Data July 2008 to June 2013, Transport for NSW (2014).

1.6 Stakeholder consultation

The following stakeholders were consulted by Parsons Brinckerhoff in preparation of this report:

- Warringah Council
- Transport for NSW (TfNSW)
- State Transit Authority (STA)
- Roads and Maritime Services (RMS)
- GHD.

1.7 Structure of the report

The report has been structured to describe the existing conditions for key roads within the study area, what is proposed for future infrastructure upgrades and the likely impacts of the proposed upgrades on road users. The report has the following structure:

- section 2 describes the study methodology, research and document review undertaken
- section 3 describes the existing conditions
- section 4 describes the proposed future conditions and anticipated impacts from the upgrades
- section 5 describes the proposed design of the New Link Road between Howard Avenue and Oaks Avenue
- section 6 describes the proposed design of the New Link Lane between Oaks Avenue and Pacific Parade
- section 7 provides a conclusion to the study and recommended next steps.

2. Methodology, research and investigation

The following methodology has been applied to this study:

2.1 Study process

The following general study process has been undertaken:

- review of previous study documents including reports, drawings, traffic modelling reports, development applications and bike plans
- inception meeting with the client
- site inspection of the study area to gain familiarisation of the area and to complete and existing condition review
- ongoing liaison with the client
- consultation with key stakeholders
- preparation of report.

2.2 Proposed road network changes

The proposed road network changes as modelled by GTA and GHD under Scenario 2A2 are shown in Figure 2.1 on the following page.

2.3 Assumptions

It has been assumed that the traffic modelling undertaken by GTA and GHD in earlier stages of this study have been calibrated and validated in accordance with RMS traffic modelling guidelines and that these traffic models are fit for purpose. It has also been assumed that Warringah Council had previously endorsed the traffic modelling outcomes and results, including the proposed road network layout (Scenario 2A2) and subsequent design changes which have been utilised to inform the preliminary design stage. It is also assumed that RMS have endorsed and approved the traffic modelling undertaken and the adopted proposed future road network.

2.4 Traffic modelling review

On review of the traffic modelling undertaken by both GTA and GHD the following comments should be noted:

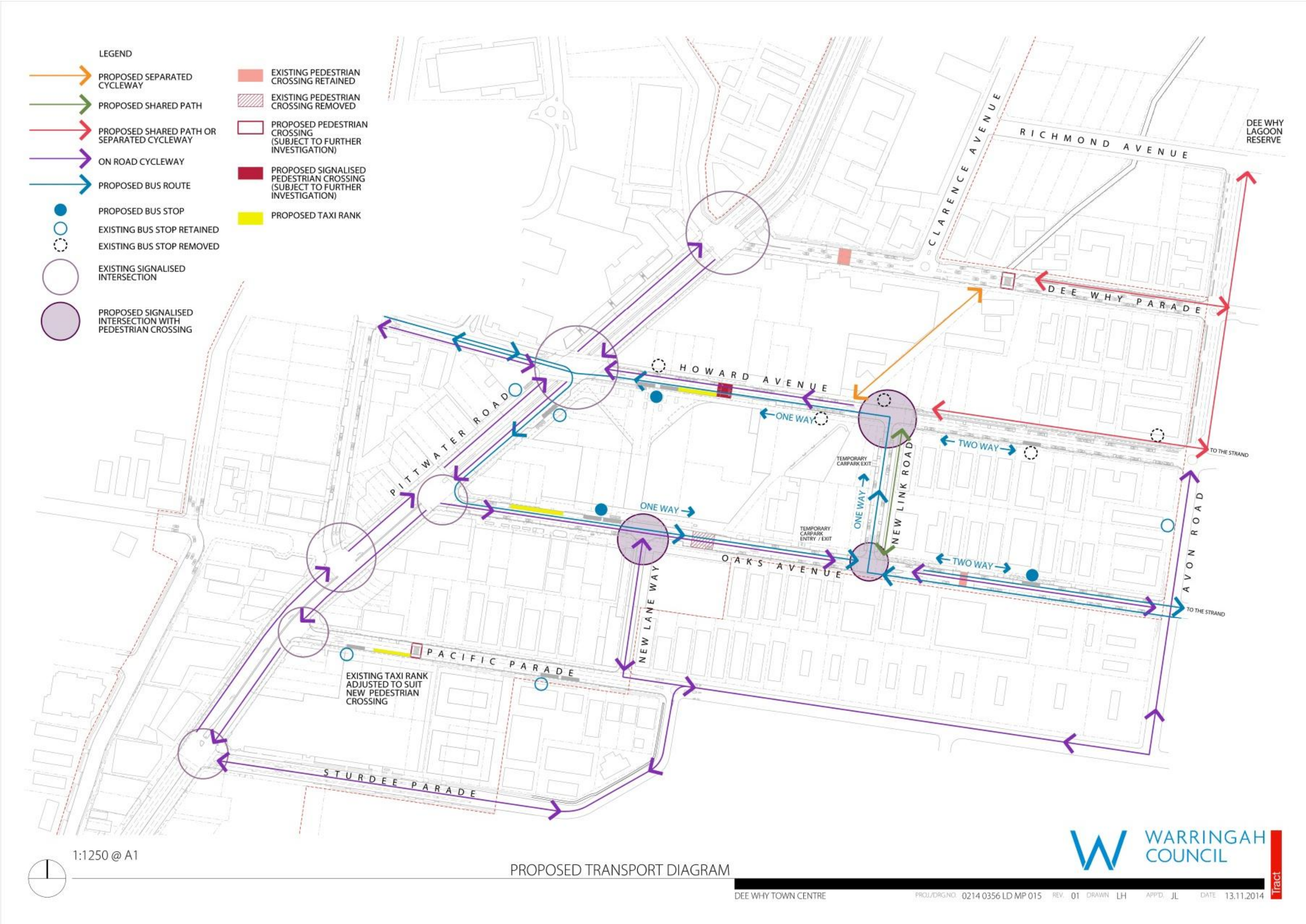
- Neither GTA nor GHD modelled mid-block pedestrian traffic signals on Oaks Avenue or Howard Avenue. The provision of signal control in lieu of marked zebra crossings has been necessitated by the proposed one way operation and the consequential introduction of two trafficable lanes in a single direction. No signalised intersections were modelled at either end of the proposed one-way link road (New Link Road) with both Oaks Avenue and Howard Avenue. No queue lengths or vehicle volumes were provided for the one-way anti-clockwise road system.
- GHD did not model the proposed two-way link road (New Link Lane) between Oaks Avenue and Pacific Parade.

No traffic modelling has been undertaken by Parsons Brinckerhoff for this study. Parsons Brinckerhoff has sourced information from the traffic modelling reports prepared by both GTA and GHD to inform this study. It is likely that additional traffic modelling would be required once the concept design is further developed.

Figure 2.1 Proposed road network changes

2.5 Proposed road network modifications

The proposed road network modifications and infrastructure upgrades for Dee Why Town Centre are shown in Figure 2.2 on the following page.



Source: Tract Consultants Pty Ltd (2014)

Figure 2.2 Proposed road network modifications for Dee Why Town Centre

2.6 Cycle facilities considered

Warringah Council have identified a preference for separated (user-friendly) cycle facilities within Dee Why, which would be considered safe and appealing for all members of the community, including parents with children. Such provisions would be separated from vehicular traffic and designed to reduce the potential for conflict with pedestrians or driveway traffic, to facilitate safe cycle connections to key town centre destinations. The provision of secure and user-friendly end-of-trip facilities also further support cycling to the Town Centre.

The hierarchy of cycling facilities considered for inclusion within the Master Plan is as follows:

1. separated cycleways for long-distance connections from the town centre perimeter
2. shared paths to provide local connections around the town centre precinct
3. bicycle crossings incorporated with pedestrian crossings on inner Town Centre streets
4. kerb ramp transitions from the road way or cycleway to shared paths
5. sheltered and secure bicycle parking with water fountains and designed for passive surveillance.

2.7 Connections with existing cycle network

The current cycle network through Dee Why Town Centre includes the Dee Why Lagoon trail connecting to shared paths on the western side of Pittwater Road and on road bicycle lanes from The Strand at Dee Why along Pacific Parade and Sturdee Parade to a shared path on Pittwater Road. These routes are shown in Figure 2.3 overleaf.

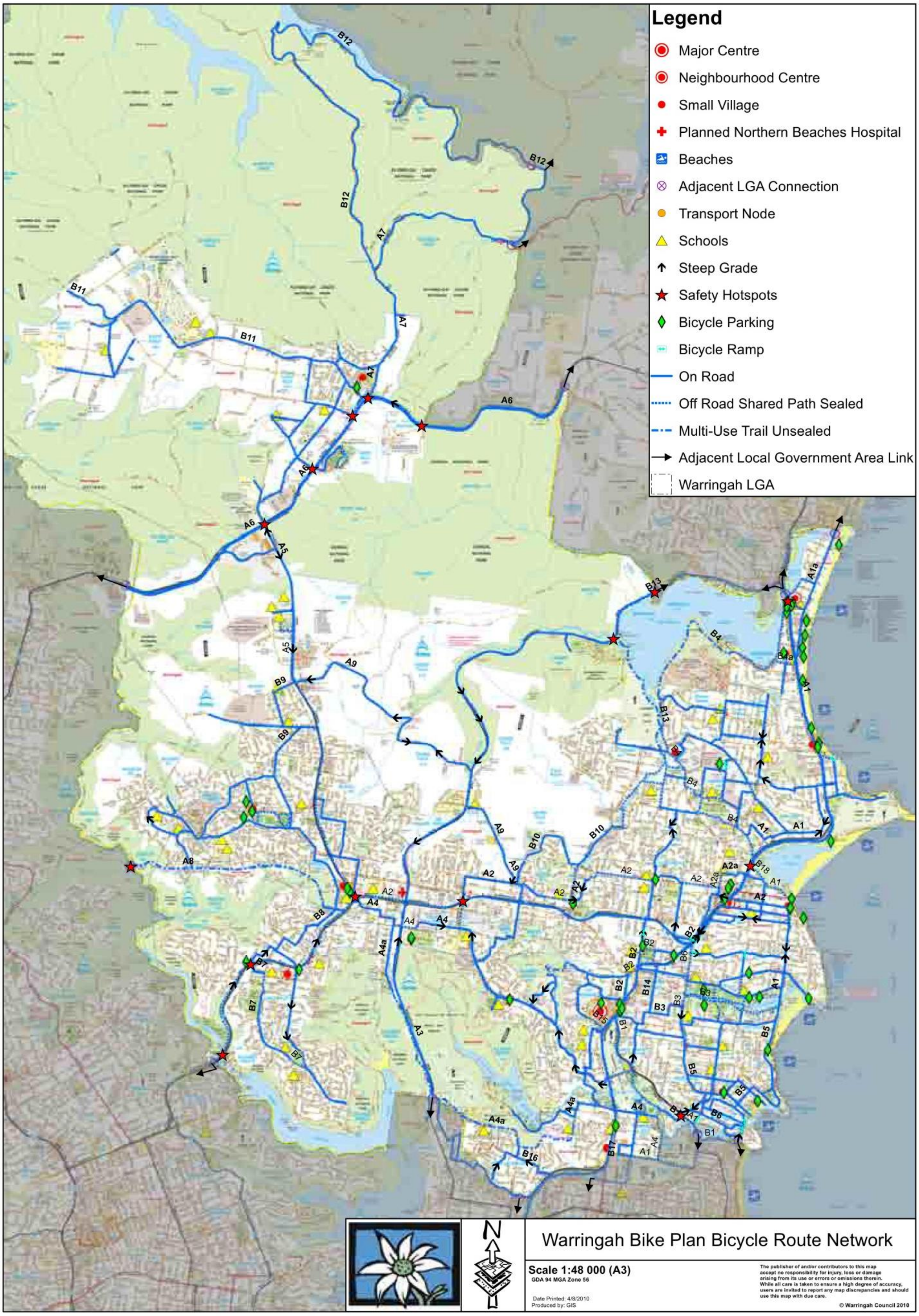


Figure 2.3 Warringah Council Cycle Network

Figure 2.3 also highlights a number of missing links or opportunities to improve the cycle network connections to the Town Centre for local trips and also through the local area for commuting cyclists.

The Warringah Bike Plan identifies some of the deficiencies of the existing cycle network, including quality and frequency of connections and facilities. There are also opportunities for improved open space corridors through the town centre and a direct cycling connection from the Town Centre to Dee Why Beach along Howard Avenue or Oaks Avenue.

A north-south cycling corridor could be incorporated within the Master Plan. The cycling corridor would link the Dee Why Lagoon trail to city-bound cycling routes to the south and utilise existing bicycle friendly streets and potential shared connections through the Town Centre.

2.8 Northern Beaches Transport Action Plan

The NSW Government is investing $125 million to deliver kerbside Bus Rapid Transit (BRT) on the Northern Beaches between Mona Vale and the Sydney CBD. BRT will deliver faster, more reliable, bus journeys and reduce door to door travel times with an average five minute wait times for buses.

Five new key public transport interchanges will be built including Dee Why with modern facilities that are convenient, offer good levels of security, information, weather protection and accessibility to all bus services.

At the time of writing this report, Transport for NSW have indicated support for the provision of an indented bus interchange on the eastern side of Pittwater Road for southbound (city bound) bus services. Proposed infrastructure changes at the Dee Why interchange are described in Figure 2.4 overleaf.

2.9 Stakeholder workshop

A stakeholder workshop was held on 15 September 2014 at TfNSW Lee Street offices to discuss the proposed Dee Why Town Centre project and the proposed Northern Beaches Bus Rapid Transit and associated upgrades to the bus interchange on Pittwater Road. This workshop was attended by key stakeholders including Warringah Council, TfNSW, RMS, Sydney Buses and the project team. Stakeholders will continue to work in close collaboration moving forward to make sure both these projects integrate with one another.

2.10 Advice from TfNSW on the proposed design scheme

The following comments relating to active transport and bus services are described below.

2.10.1 Active transport

The following comments were provided by TfNSW on active transport in the study area:

- The width of a shared path facility should be determined on the basis of expected pedestrian and cycle volumes. Having said this, a minimum clear path width of 3 metres is desirable to allow safe passing and negotiation of oncoming pedestrians and bicycle riders.
- Consideration needs to be given to the provision of on-road cycle lanes and the proximity to parked vehicles. Concerns include:
  - conflict with drivers opening doors adjacent to the on-road cycle lane
  - parked vehicles that straddle the on-road cycle lane.

- The provision of a separated bi-directional cycle facility might provide a better safety and connectivity outcome for cyclists as well as enhance street amenity.
- Consideration needs to be given to the continuation of on-road cycle facilities at roundabouts and intersections, using bus priority and bicycle lanterns.
- The location of bicycle parking racks at bus stops should not 'squeeze' the pedestrian thoroughfare. Bus stop areas should maintain not only sufficient waiting area to provide for public transport patrons based on expected queues, but should also be sufficient to accommodate passing pedestrian movements (including mobility impaired persons in wheelchairs).
- Pedestrian crossings shall be incorporated at every leg of signalised intersections.

2.10.2 Bus services

The following comments were provided by TfNSW on bus servicing in the study area:

- The route 136 service is the most significantly affected by the proposal. Routes E76, 176 and 159 are also affected.
- Apart from the customer legibility challenge presented by split routes, the proposal potentially provides for faster travel times for the 136.
- Once the eastbound 136 service is operating on Oaks Avenue, it will not be optimal to turn the bus into either the new link road or Avon Road onto Howard Avenue (due to the additional turns required, and the common occurrence of queuing at the right turn from Howard Avenue to The Strand) as opposed to operating on Oaks Avenue to The Strand. Using this alignment, buses from St David Avenue will turn will turn right into Pittwater Road, left into Oaks Avenue, and then turn right at The Strand.
- TfNSW will require the provision of eastbound stops on Oaks Avenue to replace the stops currently on Howard Avenue:
  - this can be the stop on Oaks Avenue just east of Pittwater Road
  - an additional stop near the intersection of Avon Road and Oaks Avenue (preferably closer to the intersection than as proposed by Council).
- The preferred route for westbound buses is to turn left from The Strand into Oaks Avenue, the right at the new link road, then left into Howard Avenue. This will require an additional westbound bus stop in the vicinity of the Oaks Avenue and Avon Road intersection.
- The stop proposed by Council westbound on Howard Avenue between the new link road and Avon Road is not required.
- Existing bus stops on both sides of Howard Avenue east of the new link road can be removed.
- It is acceptable to provide fewer bus stops on the proviso that average spacing between stops is in the order of 400 metres, as per *Sydney's Bus Future* and TfNSW Integrated Service Planning guidelines.
- It is preferable that bus stops are located as close as practicable to intersections where pedestrians can cross safely, rather than mid-block, so as to maximise the walkable catchment of bus stops.
- It is preferable for bus stops to be 40 metres long to accommodate two rigid 12.5 metre buses, including draw-in and draw-out spaces, and where necessary, a gap between buses for independent operation.

2.11 Crash data review

A review of RMS crash data for the latest five year period (July 2008 to June 2013) of data was undertaken to gain an understanding of accidents relating to pedestrians and cyclists within the study area. Detailed crash data is provided in Appendix A and summarised in the following:

- 71 crashes occurred on Pittwater Road between Dee Why Parade and Sturdee Parade with 7 pedestrian and 2 bicycle crashes:
  - nine crashes at the intersection of Pittwater Road and Dee Why Parade
  - 19 crashes at the intersection of Pittwater Road and Fisher Road
  - 11 crashes at the intersection of Pittwater Road and Howard Avenue
  - 10 crashes at the intersection of Pittwater Road and Oaks Avenue
  - three crashes at the intersection of Pittwater Road and Pacific Parade
  - three crashes at the intersection of Pittwater Road and St David Avenue
  - 13 crashes at the intersection of Pittwater Road and Sturdee Parade
- 11 crashes have been recorded over the 5 year period on Dee Why Parade between Pittwater Road and Avon Road with no pedestrian and 1 bicycle crash
- 11 crashes occurred on Howard Avenue between Pittwater Road and Avon Road with 4 pedestrian and no bicycle crashes
- one crash was recorded on St David Avenue between Fisher Road and Pittwater Road with no pedestrian or bicycle crashes
- seven crashes have occurred on Fisher Road between St David Avenue and Pittwater Road with no pedestrian or bicycle crashes
- 10 crashes have been recorded in the five year period on Oaks Avenue between Pittwater Road and Avon Road of which 4 involved a pedestrian and 2 involving cyclists
- 12 crashes on Pacific Parade between Pittwater Road and Sturdee Parade of which 5 involved a pedestrian and 1 involving a cyclist
- seven crashes on Sturdee Parade between Pittwater Road and Pacific Parade of which 1 involved a pedestrian.

Not surprisingly the data shows that the majority of crashes within Dee Why Town Centre occur along Pittwater Road and adjoining intersections. The Pittwater Road and Fisher Road intersection recorded the highest number of crashes.

The following information on pedestrian safety has been sourced from the *Warringah Pedestrian Access and Mobility Plan (PAMP)*:

> *Pedestrian safety in the Dee Why focus area, particularly on Pittwater Road, has been identified in this PAMP as a major concern. Over the 5 year period for which pedestrian crash data was analysed (2004–2008 inclusive), the suburb with the most pedestrian crashes occurring within it was Dee Why, with over 20% of all pedestrian crashes in Warringah LGA. Dee Why also contained 3 of the 6 largest pedestrian crash clusters in Warringah LGA, and one pedestrian fatality. This crash history highlights the need to significantly improve pedestrian safety in Dee Why, particularly along Pittwater Road.*

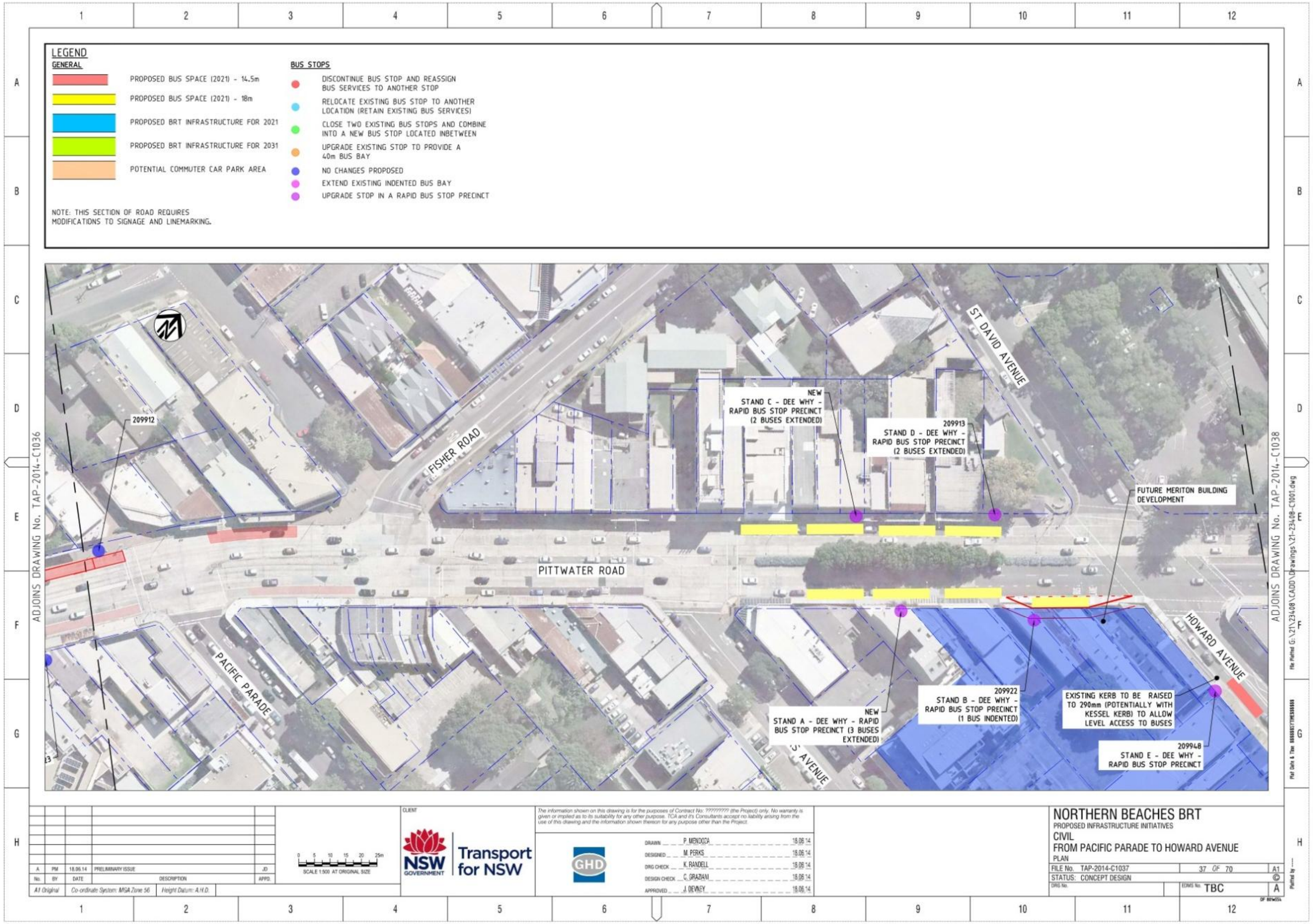


Figure 2.4 Northern Beaches BRT – Proposed Infrastructure Initiatives (GHD for Transport for NSW June 2014)

3. Existing conditions

This section describes the existing road, parking, public and active transport conditions in the study area.

3.1 Road network and hierarchy

Roads within a network are classified according to a road hierarchy relating closely to their functional role and volume of traffic they carry. Roads and Maritime Services have defined four classes for the classification of roads:

- Arterial roads – predominantly carry through traffic from one region to another forming a principal avenue for urban traffic environments. Typically traffic volumes would be in excess of 15,000 vehicles per day (vpd).
- Sub-arterial roads – connect the arterial roads to areas of development or carry traffic directly from one part of a region to another, they may also relieve traffic on arterial roads in some circumstances. Typically traffic volumes would range from 5,000 vpd to 20,000 vpd.
- Collector roads – connect the sub-arterial roads to the local road system in developed areas. Typically traffic volumes would be in the range from 2,000 vpd to 10,000 vpd but residential amenity would begin to decline with volumes in excess of 5,000 vpd.
- Local roads – are the sub-divisional roads within a particular developed area. These are solely to provide local access, and typically carry low traffic volumes, usually less than 2,000 vpd.

The key roads within the study area include:

Pittwater Road

Pittwater Road is a six lane, separated arterial road which connects suburbs along the Northern Beaches between Manly and Mona Vale. Pittwater Road has an AADT of over 41,000 vehicles. Pittwater Road south of Howard Avenue carries approximately 2,500 vehicles during both the weekday AM and PM peaks with flows split 70% southbound and 30% northbound in the AM peak and 45% southbound and 55% northbound in the PM peak. The posted speed limit on Pittwater Road through Dee Why is 60 km/h, and there are six signalised intersections in the vicinity of the Town Centre connecting collector and local roads to the corridor.

Howard Avenue

Howard Avenue is two lane two-way with on-street parking on both sides of the road in selected locations. Howard Avenue is a local collector street which connects Pittwater Road to Dee Why beach via Dee Why Town Centre. Howard Avenue east of Pittwater Road carries approximately 650 vehicles during a weekday AM peak and 750 vehicles during a weekday PM peak with evenly split traffic flows. The posted speed limit is 50 km/h.

St David Avenue

St David Avenue is two lane two-way with on street parking on both sides of the road in selected locations. St David Avenue is a local collector street which connects Pittwater Road to Fisher Road. St David Avenue west of Pittwater Road carries approximately 550 vehicles during a weekday AM peak and 580 vehicles during a weekday PM peak with flows split 60% eastbound and 40% westbound in both peaks. The posted speed limit is 50 km/h.

Oaks Avenue

Oaks Avenue is two lane two-way with on street parking on both sides of the road in selected locations. Oaks Avenue is a local collector street which connects Pittwater Road to Dee Why beach via Dee Why Town Centre. Oaks Avenue east of Pittwater Road carries approximately 380 vehicles during a weekday AM peak and 590 vehicles during a weekday PM peak with flows split 60% eastbound and 40% westbound in the AM peak and 70% eastbound and 30% westbound in the PM peak. The posted speed limit is 50 km/h.

Fisher Road

Fisher Road is two lane two-way with on street parking on both sides of the road in selected locations. Fisher Road is a local collector road which connects Pittwater Road to the Cromer area. Fisher Road west of Pittwater Road carries approximately 800 vehicles during a weekday AM peak and 1000 vehicles during a weekday PM peak with flows split 50% southbound and 50% northbound in the AM peak and 45% southbound and 55% northbound in the PM peak. The posted speed limit is 50 km/h.

Pacific Parade

Pacific Parade is two lane two-way with on street parking on both sides of the road. Pacific Parade is a local collector street which connects Pittwater Road to Dee Why beach south of the Dee Why Town Centre. Pacific Parade east of Pittwater Road carries approximately 400 vehicles during a weekday AM peak and 580 vehicles during a weekday PM peak with flows split 35% eastbound and 65% westbound in the AM peak and 30% eastbound and 70% westbound in the PM peak. The posted speed limit is 50 km/h.

Sturdee Parade

Sturdee Parade is two lane two-way with on street parking on both sides of the road. Sturdee Parade is a local collector street which connects Pittwater Road to Pacific Parade. Sturdee Parade east of Pittwater Road carries approximately 520 vehicles during a weekday AM peak and 680 vehicles during a weekday PM peak with flows split 40% eastbound and 60% westbound in the AM peak and 60% eastbound and 40% westbound in the PM peak. The posted speed limit is 50 km/h.

Dee Why Parade

Dee Why Parade is two lane two-way with on street parking on both sides of the road. Dee Why Parade is a local collector street which connects Pittwater Road to Avon Road. Dee Why Parade east of Pittwater Road carries approximately 520 vehicles during a weekday AM peak and 670 vehicles during a weekday PM peak with flows split 20% eastbound and 80% westbound in both the AM and PM peaks. The posted speed limit is 50 km/h.

3.1.1 Intersection performance

Intersection performance has been sourced from the *Dee Why Town Centre Traffic Model Update Traffic Modelling Report* (GHD 2014) utilising 2013 traffic count data. Intersection performance along Pittwater Road intersections is documented in Table 3.1 for the various scenarios analysed in the morning, evening and Saturday peaks.

Table 3.1 Intersection performance

Intersection	Morning peak		Evening peak		Saturday peak	
	Av Delay (s)	LoS	Av Delay (s)	LoS	Av Delay (s)	LoS
Scenario 1: Base Case (Existing)						
Pittwater Road and Sturdee Parade	17	B	32	C	16	B
Pittwater Road and Pacific Parade	12	A	17	B	16	B
Pittwater Road and Fisher Road	24	B	16	B	20	B
Pittwater Road and Oaks Avenue	13	A	8	A	16	B
Pittwater Road and Howard Avenue/St David Avenue	20	B	19	B	32	C
Pittwater Road and Dee Why Parade	21	B	18	B	19	B
Pittwater Road and Hawkesbury Street	21	B	25	B	20	B
Fisher Road and St David Avenue/Lewis Street	27	B	27	B	20	B
Scenario 2: Option 2A2 + Pending and Approved DA's						
Pittwater Road and Sturdee Parade	29	C	42	C	25	B
Pittwater Road and Pacific Parade	27	B	14	A	7	A
Pittwater Road and Fisher Road	30	C	21	B	15	B
Pittwater Road and Oaks Avenue	32	C	13	A	17	B
Pittwater Road and Howard Avenue/St David Avenue	40	C	19	B	22	B
Pittwater Road and Dee Why Parade	39	C	19	B	20	B
Pittwater Road and Hawkesbury Street	21	B	20	B	18	B
Fisher Road and St David Avenue/Lewis Street	39	C	22	B	29	C
Scenario 3: Option 2A2 + Pending and Approved DA's + LEP FSR 100%						
Pittwater Road and Sturdee Parade	32	C	48	D	26	B
Pittwater Road and Pacific Parade	26	B	15	B	10	A
Pittwater Road and Fisher Road	30	C	26	B	19	B
Pittwater Road and Oaks Avenue	32	C	15	B	25	B
Pittwater Road and Howard Avenue/St David Avenue	46	D	22	B	41	C
Pittwater Road and Dee Why Parade	49	D	20	B	34	C
Pittwater Road and Hawkesbury Street	24	B	19	B	19	B
Fisher Road and St David Avenue/Lewis Street	46	D	35	C	45	D
Scenario 4: Option 2A2 + Pending and Approved DA's + LEP FSR 105%						
Pittwater Road and Sturdee Parade	30	C	46	D	29	B
Pittwater Road and Pacific Parade	26	B	14	B	10	A
Pittwater Road and Fisher Road	31	C	26	B	19	B
Pittwater Road and Oaks Avenue	33	C	16	B	24	B
Pittwater Road and Howard Avenue/St David Avenue	45	D	24	B	39	C
Pittwater Road and Dee Why Parade	48	D	21	B	30	C
Pittwater Road and Hawkesbury Street	24	B	19	B	18	B
Fisher Road and St David Avenue/Lewis Street	45	D	38	C	44	D
Scenario 5: Option 2A2 + Pending and Approved DA's + LEP FSR 110%						
Pittwater Road and Sturdee Parade	32	C	47	D	26	B
Pittwater Road and Pacific Parade	29	C	15	B	8	A
Pittwater Road and Fisher Road	31	C	28	B	19	B
Pittwater Road and Oaks Avenue	33	C	16	B	25	B
Pittwater Road and Howard Avenue/St David Avenue	41	C	18	B	33	C
Pittwater Road and Dee Why Parade	49	D	15	B	31	C
Pittwater Road and Hawkesbury Street	30	C	28	B	31	C
Fisher Road and St David Avenue/Lewis Street	43	D	46	D	39	C

LEGEND

LoS A	Delay < 14 sec	LoS B	Delay < 15 to 28 sec	LoS C	Delay < 29 to 42 sec	LoS D	Delay < 43 to 56 sec	LoS E	Delay < 57 to 70 sec	LoS F	Delay > 70

Source: GHD (2014)

3.2 Parking

On street parking is provided in some form on all key roads within the study area. Based on information sourced from the *Dee Why Town Centre Traffic Study* (GTA 2008), peak parking utilisation in Dee Why during weekdays was approximately 80% and 60% on weekends. This suggests that the parking supply adequately meets parking demand in Dee Why. Having said this, observations indicate that during certain periods of the day, the demand does exceed supply, particularly at those locations in close proximity to key trip generating land uses in the Town Centre.

A summary of the existing on street parking situation is provided below.

Pittwater Road

Short term restricted parking is provided on both sides of Pittwater Road between Dee Why Parade and Sturdee Parade. No parking is permitted during peak period clearway operation (southbound in the AM peak and northbound in the PM peak). There are approximately 74 parking spaces located within this section of Pittwater Road.

Howard Avenue

Short term restricted and unrestricted parking is provided on Howard Avenue between Pittwater Road and Avon Road. Taxi and mail zones are located near Pittwater Road. There are approximately 69 parking spaces located within this section of Howard Avenue. There are 105 off-street car parking spaces located in the public car park 60 m from Pittwater Road including 2 disabled car spaces. There are a further 210 off-street car parking spaces located in Council’s public car park including 3 disabled car spaces which is accessed from both Howard Avenue and Oaks Avenue.

St David Avenue

Short term restricted parking is provided on the southern side of St David Avenue between Fisher Road and Pittwater Road. Dedicated police parking is also provided on both sides of St David Avenue. There are approximately 14 general car parking spaces at this location.

Oaks Avenue

Short term restricted and unrestricted parking is provided on Oaks Avenue between Pittwater Road and Avon Road. There are approximately 131 parking spaces located within this section of Oaks Avenue including both parallel and ninety degree angled parking. As indicated previously, there are a further 210 off-street car parking spaces located in Council’s public car park including 3 disabled car spaces which is accessed from both Howard Avenue and Oaks Avenue.

Fisher Road

Short term restricted parking is provided on both sides of Fisher Road between St David Avenue and Pittwater Road. There are approximately 37 parking spaces located within this section of Fisher Road.

Pacific Parade

Short term restricted and unrestricted parking is provided on Pacific Parade between Pittwater Road and Avon Road. There are approximately 44 parking spaces located within this section of Pacific Parade.

Sturdee Parade

Short term restricted and unrestricted parking is provided on Sturdee Parade between Pittwater Road and Pacific Parade. There are approximately 72 parking spaces located within this section of Sturdee Parade.

Dee Why Parade

Unrestricted parking is provided on both sides of Dee Why Parade between Clarence Avenue and Avon Road and on the northern side between Pittwater Road and Clarence Avenue.

3.3 Buses

The following bus services operate on Pittwater Road within the study area as shown in Table 3.2.

Table 3.2 Bus services on Pittwater Road

Bus stop location	Route no	Route description	Frequency
EASTERN SIDE			
Pittwater Road near Pacific Parade	151, 153, 155, 156, 169, 178, 179, 180, 183, 184, 185, 188, 190, E78	To City from Dee Why To Manly from Dee Why	Regular
Pittwater Road near St David Avenue (main interchange)	151, 153, 155, 156, 169, 178, 179, 180, 183, 184, 185, 188, 190, E78	To City from Dee Why To Manly from Dee Why	Regular
WESTERN SIDE			
Pittwater Road near Howard Avenue (main interchange)	151, 153, 155, 156, 158, 169, 178, 179, 180, 183, 184, 185, 187, 188, 190	To Dee Why from City To Dee Why from Manly	Regular
Pittwater Road near Pacific Parade	151, 153, 155, 156, 158, 169, 178, 179, 180, 183, 184, 185, 187, 188, 190	To Dee Why from City To Dee Why from Manly	Regular

Howard Avenue is a key bus corridor for services operated by Sydney Buses travelling between Chatswood, Manly and Dee Why, including a late night bus loop operating between Manly and Northern Beaches suburbs.

There are three bus stops on each side of Howard Avenue between Pittwater Road and Avon Road. Bus stops on Howard Avenue are used primarily during peak periods on weekdays with infrequent services during the off-peak periods. Bus services on Howard Avenue are described in Table 3.3.

Table 3.3 Bus services on Howard Avenue

Bus stop location	Route no	Route description	Frequency
NORTHERN SIDE			
Howard Avenue near Pittwater Road	136	To Manly via Dee Why Beach	2 services per hour during AM peak and off-peak 4 services per hour during PM peak
Howard Avenue 230 m east of Pittwater Road	136	To Manly via Dee Why Beach	As above
Howard Avenue near Avon Road	176, E76	To the city via Dee Why Beach	176: 2 services at 5.25 am and 6:26am on weekdays only E76: 5 services between 6.50 am and 8.10 am on weekdays only
	136	To Manly via Dee Why Beach	As above
SOUTHERN SIDE			
Howard Avenue near Pittwater Road	130	Manly late night bus (local area stops)	4 services between 1.50 am and 3.15 am only
	136	To Chatswood via Frenchs Forest	5 services per hour during AM peak 2 services per hour during off-peak and PM peak
	L60	To Chatswood via Frenchs Forest	3 services between 6.45 am and 8.05 am on weekdays only
Howard Avenue 200 m east of Pittwater Road	136	To Chatswood via Frenchs Forest	4 services per hour during AM peak 2 services per hour during off-peak and PM peak
	L60	To Chatswood via Frenchs Forest	As above
Howard Avenue near Avon Road	130, 136	As above	As above
	159	To Pacific Parade, Dee Why	1 services per hour during off-peak and 2 services during PM peak hour
	E76	Terminating from Dee Why Beach and the city	5 services between 5.10 pm and 7.30 pm on weekdays only

Currently there are no bus stops on St David Avenue between Fisher Road and Pittwater Road.

There are no current bus services or bus stops on Fisher Road between Pittwater Road and St David Avenue.

There are no current bus services or bus stops on Oaks Avenue between Pittwater Road and Avon Road.

There are no current bus services or bus stops on Dee Why Parade between Pittwater Road and Avon Road.

The bus services which operate on Pacific Parade as described in Table 3.4.

Table 3.4 Bus services on Pacific Parade

Bus stop location	Route no	Route description	Frequency
NORTHERN SIDE			
Pacific Parade near Sturdee Parade	159 E77	To Dee Why from Manly To Dee Why from City	4 services in weekday AM, 7 services in weekday PM and weekend services. 4 services in weekday PM.
Pacific Parade near The Crescent	159 E77	To Dee Why from Manly To Dee Why from City	As above
Pacific Parade near Avon Road	159 E77	To Dee Why from Manly To Dee Why from City	As above
SOUTHERN SIDE			
Pacific Parade near Pittwater Road	159	To Manly from Dee Why	4 services in weekday AM, 5 services in weekday PM and weekend services.
Pacific Parade near Sturdee Parade	159 E77	To Manly from Dee Why To City from Dee Why	4 services in weekday AM, 5 services in weekday PM and weekend services. 6 services in weekday AM.
Pacific Parade near The Crescent	159 E77	To Manly from Dee Why To City from Dee Why	As above
Pacific Parade near Avon Road	159 E77	To Manly from Dee Why To City from Dee Why	As above

The bus services which operate on Sturdee Parade are described in Table 3.5.

Table 3.5 Bus services on Sturdee Parade

Bus stop location	Route no	Route description	Frequency
NORTHERN SIDE			
Sturdee Parade near Pittwater Road	159 E77	To Dee Why from Manly To Dee Why from City	4 services in weekday AM, 7 services in weekday PM and weekend services. 4 services in weekday PM.

3.4 Taxis

An existing taxi rank is located approximately 60 m east of Pittwater Road on the southern side of Howard Avenue. This rank provides for six taxi spaced and two seating shelters.

A taxi zone is also located on the southern side of Pacific Parade adjacent to Dee Why Grand Shopping Centre. This taxi zone allows for two taxis.

3.5 Pedestrians

The following pedestrian facilities are provided within the study area:

Pittwater Road – concrete footpaths are provided on both sides of the road and signalised pedestrian crossings are provided at all intersections.

Howard Avenue – concrete footpaths are provided on both sides of the road and a mid-block pedestrian zebra crossing located approximately 110 m east of Pittwater Road.

St David Avenue – concrete footpaths are provided on both sides of the road and signalised pedestrian crossings are provided at all intersections.

Oaks Avenue – concrete footpaths are provided on both sides of the road, a mid-block pedestrian signal outside of St Kevin's Primary School and Church, and a mid-block pedestrian zebra crossing located outside Woolworths.

Fisher Road – concrete footpaths are provided on both sides of the road and signalised pedestrian crossings are provided at all intersections.

Pacific Parade – concrete footpaths are provided on both sides of the road and signalised pedestrian crossings are provided at Pittwater Road. A pedestrian zebra crossing is also located just west of the Sturdee Parade intersection.

Sturdee Parade – concrete footpaths are provided on both sides of the road and signalised pedestrian crossings are provided at Pittwater Road.

Dee Why Parade – concrete footpaths are provided on both sides of the road and a mid-block pedestrian zebra crossing located approximately 80 m east of Pittwater Road.

3.6 Cyclists

The following cycle facilities are provided within the study area:

- Pacific Parade is a designated on-road cycle route. Designated bicycle lanes are provided on both sides of Pacific Parade between Sturdee Parade and Avon Road.
- Sturdee Parade is a designated on-road cycle route. Designated bicycle lanes are provided on both sides of Sturdee Parade close to Pittwater Road. Further east the facility becomes a mixed traffic lane on both sides of the road.
- A shared path facility on the eastern side of Pittwater Road between Sturdee Parade and Harbord Road.

3.7 Planned future changes

Bus interchange

The existing bus interchanges on either side of Pittwater Road at Dee Why Town Centre are proposed to be upgraded as part of the Northern Beaches Bus Rapid Transit project. Information supplied by Transport for NSW indicates that an indented bus zone with in-lane bus zone will be positioned on the eastern side of Pittwater Road between Howard Avenue and Oaks Avenue, and an in-lane bus zone on the western side of the road. The proposed layout is conceptually described in Figure 2.4.

The eastern side bus stop would cater for three buses within the in-lane bus zone and one indented bus zone. The western side bus stop would cater for four buses within the in-lane bus zone. One kerbside bus zone would be retained on Howard Avenue.

Proposed developments adjacent to Pittwater Road

The following proposed developments need to be considered in future design with regard to access, use and road interfaces:

- the Cobalt development on the corner of Pittwater Road and St David Avenue, Dee Why
- the Meriton development at 888 Pittwater Road, Dee Why
- Council's proposed Community Hub on the corner of Pittwater Road and St David Avenue, Dee Why.

Special events and markets

Council proposes to close off sections of Howard Avenue and Walter Gors Park for special events and markets. A separate traffic impact assessment and traffic management plan is recommended for special event and market days.

4. Description of the proposal

The proposed road network modifications and infrastructure upgrades are shown in Figure 4.1 on the following page (and within Appendix B). A description of the proposal and changes to the affected sections of road follow.

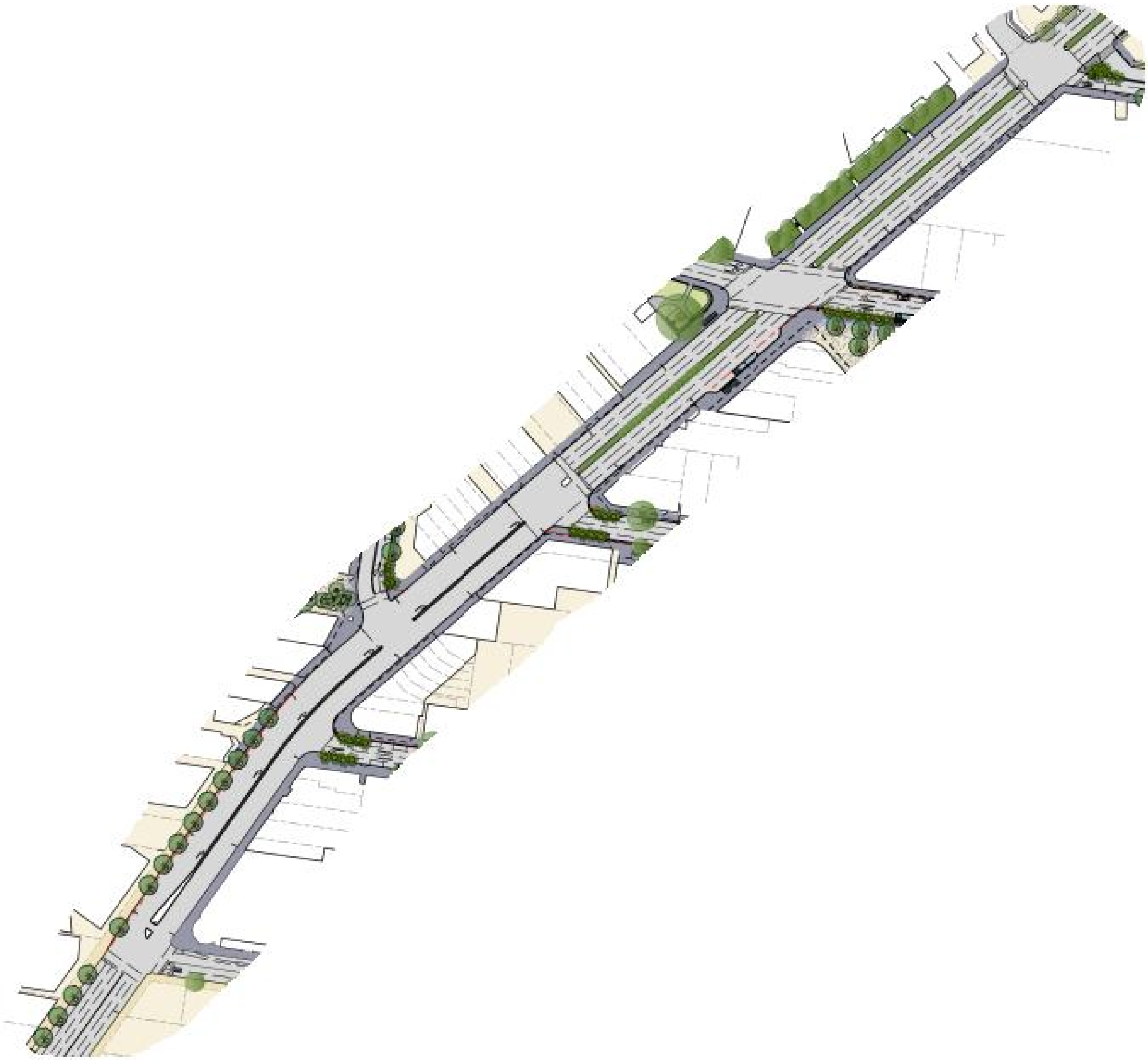
Source: Tract Consultants Pty Ltd (2014)

Figure 4.1 Proposed Dee Why Town Centre Infrastructure Upgrades

Pittwater Road

The following works are proposed on Pittwater Road between Sturdee Parade and Howard Avenue:

- extension of the right turn bay on Pittwater Road from Oaks Avenue to Sturdee Parade
- adjust lane widths/line marking on both the north and south bound carriageways due to road widening
- modification of the central median and install pedestrian fencing between Oaks Avenue and Sturdee Parade
- removal of the traffic signal control at the Pacific Parade intersection
- removal of signalised pedestrian crossing on the northern side of the Fisher Road intersection
- adjustment to the kerb radius at the intersection of Oaks Avenue and Pittwater Road to permit buses to turn left into Oaks Avenue
- modification to the TCS operation at Sturdee Parade, Fisher Road, St David Avenue and Howard Avenue
- installation of an indented bus bay on the eastern side for southbound buses, south of Howard Avenue.



Source: Tract Consultants Pty Ltd (2014)

Figure 4.2 Pittwater Road concept plans

Dee Why Parade

The following works are proposed on Dee Why Parade between Pittwater Road and Avon Road:

- construction of a pedestrian refuge to assist pedestrians and cyclists crossing Dee Why Parade from Walter Gors Park. The pedestrian refuge would be positioned away from the right turn lane entry into the Coles car park and so as to not impede sight lines for drivers, cyclists or pedestrians.
- provision of a separated on road cycleway or shared path facility on the northern side of the road between canal and Avon Road (connecting with Dee Why Lagoon Reserve).

Source: Tract Consultants Pty Ltd (2014)

Figure 4.3 Dee Why Parade concept plans

Howard Avenue

The following works are proposed on Howard Avenue between Pittwater Road and Avon Road:

- creation of a two lane one-way (westbound) road with parking on both sides between Pittwater Road and New Link Road
- lane configuration changes on approach to the Pittwater Road intersection
- creation of a two lane two-way road with parking on both sides between New Link Road and Avon Road or alternatively the option of having parking on only the southern side
- new bus zone and taxi interchange provisions on the southern side near to Pittwater Road
- relocation of the existing westbound bus stop near the Council car park, further west to between New Link Road and Avon Road
- relocation of the eastbound bus stops (northern side of Howard Avenue) to Oaks Avenue
- installation of mid-block pedestrian signals approximately 130 m east of Pittwater Road
- installation of a signalised T junction with New Link Road
- provision of a separated on road cycleway between New Link Road and Avon Road
- provision of an on road cycleway between Pittwater Road and New Link Road.

Source: Tract Consultants Pty Ltd (2014)

Figure 4.4 Howard Avenue concept plans

St David Avenue

The following works are proposed on St David Avenue between Pittwater Road and Fisher Road:

- modified lane configuration on St David Avenue including lane configuration changes to the intersections with Fisher Road and Pittwater Road
- provision of three lanes westbound and one lane eastbound including a dedicated bus only right turn bay from St David Avenue onto Pittwater Road
- implementation of a shared left and through lane and two right turning lanes westbound on St David Avenue
- removal of all on street parking
- modification to the kerb return on the north-eastern corner of the Fisher Road intersection to accommodate left turning buses from Fisher Road.

Source: Tract Consultants Pty Ltd (2014)

Figure 4.5 St David Avenue concept plans

Oaks Avenue

The following works are proposed on Oaks Avenue between Pittwater Road and Avon Road:

- creation of a two lane one-way (eastbound) road with parking on both sides between Pittwater Road and New Link Road
- creation of a two lane two-way road with parking on both sides between New Link Road and Avon Road

- installation of two bus stops on the northern side (relocated from Howard Avenue), one between Pittwater Road and New Link Lane and the other between New Link Road and Avon Road
- installation of a signalised T junction with New Link Lane approximately 120 m east of Pittwater Road
- installation of a signalised T junction with New Link Road
- adjustment to the kerb radius at intersection of Oaks Avenue and Pittwater Road to permit buses to turn left into Oaks Avenue.

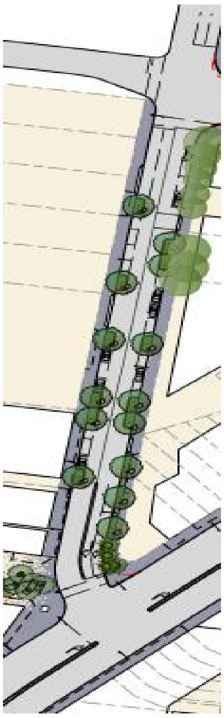
Source: Tract Consultants Pty Ltd (2014)

Figure 4.6 Oaks Avenue concept plans

Fisher Road

The following works are proposed on Fisher Road between Pittwater Road and St David Avenue:

- modified kerb radius at the intersection of Fisher Road and St David Avenue to allow buses to turn left into St David Avenue comfortably
- removal of the left turn movement from Fisher Road onto Pittwater Road
- modification to the TCS operation due to the removal of the left turn from Fisher Road.



Source: Tract Consultants Pty Ltd (2014)

Figure 4.7 Fisher Road concept plans

Pacific Parade

The following works are proposed on Pacific Parade between Pittwater Road and Sturdee Parade:

- relocation of the existing raised pedestrian zebra crossing westerly, from adjacent to the Woolworths site to towards Pittwater Road (outside Dee Why Grand Shopping Centre)
- removal of the right turn movement out of Pacific Parade onto Pittwater Road
- removal of the traffic signal control at the Pittwater Road intersection and installation of priority sign control
- installation of priority sign control on traffic exiting from the New Link Lane.

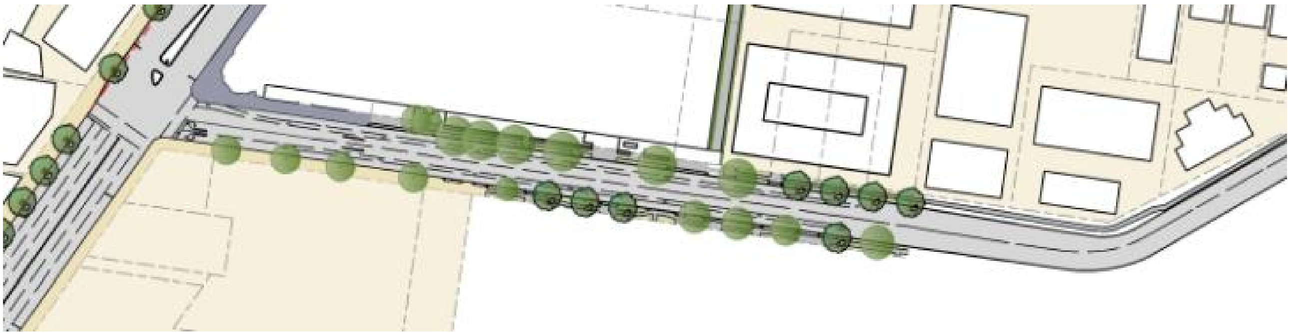
Source: Tract Consultants Pty Ltd (2014)

Figure 4.8 Pacific Parade concept plans

Sturdee Parade

The following works are proposed on Sturdee Parade between Pittwater Road and Pacific Parade:

- removal of on street parking on the southern side of Sturdee Parade on approach to Pittwater Road during peak periods to accommodate increased traffic demand to this intersection
- modification to the existing cycle facilities from a dedicated cycle lane westbound to a mixed traffic lane on approach to Pittwater Road.



Source: Tract Consultants Pty Ltd (2014)

Figure 4.9 Sturdee Parade concept plans

4.1 Impact assessment

The following assessment outlines the impact of the proposal on key roads within the study area:

- Road geometry
- Turning restrictions
- Intersection performance
- Bus operations
- On street parking
- Off street loading and service vehicle access
- Pedestrians
- Cyclists.

As discussed earlier, no intersection modelling has been undertaken by Parsons Brinckerhoff for this study. Previous traffic modelling completed by GTA and GHD has been reviewed and sourced for this study which is understood to be endorsed by both Warringah Council and the RMS. Additional traffic modelling is likely to be required once the concept design is further detailed.

Table 4.1 Impact assessment – Pittwater Road summary

Item	Description
Road geometry	Footpath narrowing and provision of indented bus bay on the eastern side of Pittwater Road between Howard Avenue and Oaks Avenue.
Turning restrictions	No right turn from Pittwater Road onto Pacific Parade. No left turn from Pittwater Road onto Howard Avenue.
Intersection performance	The intersection of Pittwater Road and Pacific Parade will no longer be signalised.
Bus operations	New bus interchanges at Dee Why on both sides of Pittwater Road near Howard Avenue and St David Avenue.
On street parking (Gain/Loss)	Loss of parking on both sides of Pittwater Road at the bus interchange.
Off street loading and service vehicle access	No changes anticipated.
Pedestrians	Signalised pedestrian crossings at Pittwater Road and Pacific Parade removed. Removal of signalised pedestrian crossing at the Fisher Road intersection.
Cyclists	No change.

Table 4.2 Impact assessment – Howard Avenue summary

Item	Description
Road geometry	Howard Avenue reconfigured to one-way road westbound between New Link Road and Pittwater Road. Howard Avenue to be two lanes wide with dedicated bus zone and taxi interchange area on the southern side and general parking on both sides of the road. The section between the New Link Road and Avon Road remains two-way.
Turning restrictions	No entry into Howard Avenue from Pittwater Road or St David Avenue. All vehicle entry and exit movements to and from driveway and property accesses to be in the westbound direction in this section of Howard Avenue. No left turn into New Link Road from Howard Avenue.
Intersection performance	Changes to intersection performance with Pittwater Road and the new intersection operation with pedestrian mid-block signals and New Link Road intersection.
Bus operations	Similar provision and position of the bus zone as per the existing situation for Howard Avenue westbound stop near Pittwater Road. Relocation of westbound stop to between New Link Road and Avon Road. Removal of eastbound bus services and stops on the northern side to Oaks Avenue.
On street parking (Gain/Loss)	Gain in parking spaces between Pittwater Road and New Link Road although this will be offset to some extent with a loss of parking spaces between New Link Road and Avon Road.
Off street loading and service vehicle access	All vehicle entry and exit movements to and from driveway and property accesses to be in the westbound direction on Howard Avenue between Pittwater Road and New Link Road.
Pedestrians	Removal of existing mid-block pedestrian zebra crossing.
Cyclists	Dedicated separated cycleway on the northern side of Howard Avenue between New Link Road and Avon Road. On road cycleway between Pittwater Road and New Link Road. Cyclists would have to cross at the signalised crossing with New Link Road to travel between the northern and southern sides of Howard Avenue.
Taxi	Similar provision and position of the taxi zone as per the existing situation.

Table 4.3 Impact assessment – St David Avenue summary

Item	Description
Road geometry	Changed traffic conditions. Three travel lanes westbound and one travel lane eastbound. Provision of combined left/through and dual right turn lanes westbound at Fisher Road intersection and left and short right turn lane (buses only) for eastbound at Pittwater Road intersection. Modified kerb return on north-east corner of St David Avenue and Fisher Road intersection to accommodate left turn buses from Fisher Road.
Turning restrictions	No entry to Howard Avenue and buses only permitted to undertake right turn from St David Avenue onto Pittwater Road.
Intersection performance	The reconfigured road arrangements on St David Avenue will inevitably alter the phasing and performance of the Pittwater Road and Fisher Road intersections.
Bus operations	No change, however the right turning swept path for buses from Fisher Road into the indented bus bay on Pittwater Road will need to be reviewed.
On street parking (Gain/Loss)	Loss of all (25) parking spaces. The majority of this parking is allocated for police vehicles. Alternative parking for police vehicles will need to be identified.
Off street loading and service vehicle access	Consideration of future access to Council's Community Hub and the proposed Cobalt development.
Pedestrians	No change.
Cyclists	No change.

Table 4.4 Impact assessment – Oaks Avenue summary

Item	Description
Road geometry	Changed traffic conditions and one –way eastbound travel between Pittwater Road and New Link Lane. The section between the New Link Road and Avon Road remains two-way.
Turning restrictions	All vehicle entry and exit movements to and from driveways and property accesses to be in the eastbound direction between Pittwater Road and New Link Road. No through movement westbound on Oaks Avenue at New Link Road.
Intersection performance	Changes to intersection operation at Pittwater Road and new signalised intersection operation with New Link Lane and New Link Road intersections.
Bus Operations	Existing eastbound bus services and stops on Howard Avenue relocated to Oaks Avenue.
On street parking (Gain/Loss)	Loss of parking spaces on both sides between Pittwater Road and Avon Road.
Off street loading and service vehicle access	Increased service vehicle demand and movements as a consequence of the proposed Meriton development. New Link Road needs to be capable of accommodating the largest design vehicle for Meriton and Woolworths sites.
Pedestrians	Removal of existing mid-block pedestrian zebra crossing.
Cyclists	No change.
Access	The removal of the left turn movement from Fisher Road onto Pittwater Road will mean that vehicles travelling from the western side of Pittwater Road to the eastern side will be required to turn left into Pacific Parade to access Oaks Avenue.

Table 4.5 Impact assessment – Fisher Road summary

Item	Description
Road geometry	Modified kerb return on north-east corner of St David Avenue and Fisher Road intersection to accommodate left turning buses from Fisher Road.
Turning restrictions	Introduction of no left turn from Fisher Road onto Pittwater Road.
Intersection performance	St David Avenue reconfigured road arrangements would alter the phasing and performance of the Fisher Road intersection.
Bus operations	No change.
On street parking (Gain/Loss)	No change.
Off street loading and service vehicle access	N/A
Pedestrians	No change.
Cyclists	No change.

Table 4.6 Impact assessment – Pacific Parade summary

Item	Description
Road geometry	Kerb return modifications at Pacific Parade intersection with Pittwater Road. New intersection with New Link Lane.
Turning restrictions	The implementation of a centre median on Pittwater Road adjacent to Pacific Parade will remove the right turn movement out of Pacific Parade.
Intersection performance	Removal of the signalised intersection and replacement with priority controlled intersection at Pittwater Road. Priority control intersection with New Link Lane.
Bus operations	No change.
On street parking (Gain/Loss)	Loss of parking spaces on both sides of the road.
Off street loading and service vehicle access	N/A
Pedestrians	Relocation of existing pedestrian zebra crossing further west towards Pittwater Road. Removal of the signalised pedestrian crossing on the southern and eastern side of the Pittwater Road/Pacific Parade intersection.
Cyclists	No change.
Access	Increased vehicle demand eastbound from western side of Pittwater Road (from Fisher Road).

Table 4.7 Impact assessment – Sturdee Parade summary

Item	Description
Road geometry	Minor change to the westbound lane configuration on approach to Pittwater Road – kerbside left turn lane to be extended through removal of on street parking during peak periods and bicycle lane becomes mixed traffic lane.
Turning restrictions	No change.
Intersection performance	Increased right turning demand from Sturdee Parade onto Pittwater Road.
Bus operations	N/A
On street parking (Gain/Loss)	Loss of parking spaces on the southern side to accommodate increased vehicle demand towards Pittwater Road intersection.
Off street loading and service vehicle access	No change.
Pedestrians	No change.
Cyclists	Shortening of westbound bicycle lane to a mixed traffic lane on approach to Pittwater Road.

Table 4.8 Impact assessment – Dee Why Parade summary

Item	Description
Road geometry	No change to road geometry.
Turning restrictions	No change.
Intersection performance	No change.
Bus operations	N/A
On street parking (Gain/Loss)	Loss of parking spaces to accommodate pedestrian refuge facility.
Off street loading and service vehicle access	No change.
Pedestrians	Installation of pedestrian refuge facility adjacent to Walter Gors Park connection and canal to assist pedestrians crossing.
Cyclists	Installation of pedestrian refuge facility adjacent to Walter Gors Park connection and canal to assist cyclists crossing.

4.2 Recommendations and mitigation measures

The following recommendation and mitigation measures are proposed to ameliorate project related impacts:

- the new link roads and lanes should be designed to accommodate articulated vehicles
- pedestrian crossings to be provided at all new signalised intersections
- adequate connections between pedestrian and cycle facilities
- access to property and service vehicles driveways to be maintained.

5. New Link Road

This section describes the proposed conditions on the New Link Road between Howard Avenue and Oaks Avenue. The proposed New Link Road road reservation will bisect the existing off street Council car park.

5.1 Description of the proposal

The following works are proposed on New Link Road between Howard Avenue and Oaks Avenue:

- two lane one-way road with indented parallel parking on both sides
- pedestrian footpath on the western side and a shared path facility on the eastern side
- signalised intersections with Howard Avenue and Oakes Avenue
- council car park exit onto New Link Road.

5.1.1 Street design characteristics and requirements

The following design characteristics are required for New Link Road:

- swept path and kerb radii to accommodate largest design vehicle (articulated vehicle of 19 m length)
- right turning movement from New Link Road onto Howard Avenue to potentially accommodate bus services.

5.1.2 Street concept plans

Source: Tract Consultants Pty Ltd (2014)

Figure 5.1 New Link Road concept plans

5.1.3 Intersection layouts

Two signalised intersections are proposed with Howard Avenue and Oaks Avenue.

5.1.4 Intersection performance

Further intersection traffic modelling will be required to determine intersection operation for New Link Road with Howard Avenue and Oaks Avenue intersections.

5.2 Impact assessment

The following assessment sets out the impact of the proposal on:

- Road geometry
- Turning restrictions
- Intersection performance
- Bus operations
- On street parking
- Off street loading and service vehicle access
- Pedestrians
- Cyclists.

5.2.1 Impact assessment – street summary

Table 5.1 Impact assessment – New Link Road summary

Item	Description
Road geometry	Two lanes one-way northbound with indented parking bays on either side. New exit driveway from the adjacent Council car park on the New Link Road frontage.
Turning restrictions	Egress from Council car park onto New Link Road. No left turn from Howard Avenue onto New Link Road due to the one way restriction.
Intersection performance	To be determined.
Bus operations	To be determined.
On street parking (Gain/Loss)	Loss of parking spaces from Howard Avenue, Oaks Avenue and Council car park to accommodate New Link Road would be offset by additional parking spaces on the New Link Road.
Off street loading and service vehicle access	N/A
Pedestrians	Footpaths on both sides of the road (shared path on eastern side of the road).
Cyclists	Shared path on eastern side of the road.

6. New Link Lane

This section describes the existing and proposed conditions on the New Link Lane between Oaks Avenue and Pacific Parade. The proposed New Link Lane road reservation will be positioned adjacent to the western side of the Woolworths site.

6.1 Description of the proposal

The following works are proposed on New Link Lane between Pacific Parade and Oaks Avenue:

- two lane two-way road with no parking provision
- pedestrian footpaths on both sides of the road
- on-road mixed traffic lane with cycle provision
- signalised intersection with Oaks Avenue and priority sign controlled intersection with Pacific Parade.

6.1.1 Street design characteristics and requirements

The following design characteristics are required for New Link Lane:

- swept path and kerb radii to accommodate largest design vehicle (waste collection vehicle of 9 m length).

6.1.2 Street concept plans

Source: Tract Consultants Pty Ltd (2014)

Figure 6.1 New Link Lane concept plans

6.1.3 Intersection layouts

One sign controlled priority intersection at Pacific Parade and one signalised intersection with Oaks Avenue is proposed.

6.1.4 Intersection performance

Further intersection traffic modelling will be required to determine intersection operation for New Link Lane with Pacific Parade and Oaks Avenue intersections.

6.2 Impact assessment

The following assessment sets out the impact of the proposal on:

- Road geometry
- Turning restrictions
- Intersection performance
- Bus operations
- On street parking
- Off street loading and service vehicle access
- Pedestrians
- Cyclists.

6.2.1 Impact assessment – street summary

Table 6.1 Impact assessment – New Link Lane summary

Item	Description
Road geometry	Two lane two-way road.
Turning restrictions	No left turn onto Oaks Avenue.
Intersection performance	To be determined.
Bus operations	N/A
On street parking (Gain/Loss)	Loss of parking to accommodate Oaks Avenue and Pacific Parade intersections.
Off street loading and service vehicle access	N/A
Pedestrians	Footpaths on both sides of the road.
Cyclists	On-road mixed traffic lane.

7. Conclusion

The infrastructure upgrades proposed for Dee Why Town Centre aim to create a well-connected and vibrant Town Centre. The several upgrades proposed will impact on the operation of the Town Centre with regards to vehicle, pedestrian and cycle movements. Impacts are anticipated to property access, general accessibility, parking, and road and intersection operation. Several recommendations and mitigation measures are proposed to ameliorate project related impacts.

7.1 Next steps

The following tasks are recommended in taking the next steps with this project:

- further traffic modelling to determine the impacts of the installation of new signalised and priority controlled intersections and signalised mid-block intersections
- further consultation with regards to relocated bus stops and servicing requirements, the proposed Dee Why bus interchange and interchange facilities on Pittwater Road
- swept path analyses of the largest design vehicles at new intersections to be completed
- liaison with RMS regarding proposed signalised intersection and signalised mid-block pedestrian crossings and adjustments to existing Pittwater Road signal operation
- integration of the construction planning and staging of both the Town Centre upgrades and Northern Beaches Rapid Transit project
- review of road safety concerns on Pittwater Road
- provide further detailed impacts to on street parking provision and accessibility once a design is adopted
- preparation of a traffic management plan for special events which incorporate road closures on Howard Avenue and New Link Road
- preparation of a construction traffic management plan for staging of works.

Appendix A

RMS crash data

Summary Crash Report

# Crash Type		
Car Crash	134	92.4%
Light Truck Crash	16	11.0%
Rigid Truck Crash	1	0.7%
Articulated Truck Crash	0	0.0%
'Heavy Truck Crash	(1)	(0.7%)
Bus Crash	6	4.1%
"Heavy Vehicle Crash	(7)	(4.8%)
Emergency Vehicle Crash	0	0.0%
Motorcycle Crash	20	13.8%
Pedal Cycle Crash	8	5.5%
Pedestrian Crash	22	15.2%

' Rigid or Artic. Truck " Heavy Truck or Heavy Bus
These categories are NOT mutually exclusive

Location Type		
*Intersection	85	58.6%
Non intersection	60	41.4%

* Up to 10 metres from an intersection
~ 07:30-09:30 or 14:30-17:00 on school days

Collision Type		
Single Vehicle	5	3.4%
Multi Vehicle	140	96.6%

Road Classification		
Freeway/Motorway	0	0.0%
State Highway	0	0.0%
Other Classified Road	86	59.3%
Unclassified Road	59	40.7%

Contributing Factors		
Speeding	3	2.1%
Fatigue	5	3.4%
Alcohol	3	2.1%

Weather		
Fine	117	80.7%
Rain	16	11.0%
Overcast	11	7.6%
Fog or mist	0	0.0%
Other	0	0.0%

Road Surface Condition		
Wet	16	11.0%
Dry	129	89.0%
Snow or ice	0	0.0%

Natural Lighting		
Dawn	1	0.7%
Daylight	98	67.6%
Dusk	4	2.8%
Darkness	42	29.0%

Crash Movement		
Intersection, adjacent approaches	19	13.1%
Head-on (not overtaking)	1	0.7%
Opposing vehicles; turning	10	6.9%
U-turn	2	1.4%
Rear-end	53	36.6%
Lane change	4	2.8%
Parallel lanes; turning	3	2.1%
Vehicle leaving driveway	5	3.4%
Overtaking; same direction	0	0.0%
Hit parked vehicle	0	0.0%
Hit railway train	0	0.0%
Hit pedestrian	15	10.3%
Permanent obstruction on road	0	0.0%
Hit animal	0	0.0%
Off road, on straight	0	0.0%
Off road on straight, hit object	6	4.1%
Out of control on straight	2	1.4%
Off road, on curve	0	0.0%
Off road on curve, hit object	0	0.0%
Out of control on curve	0	0.0%
Other crash type	25	17.2%

Speed Limit			~ 40km/h or less	0	0.0%
40 km/h or less	0	0.0%	80 km/h zone	0	0.0%
50 km/h zone	67	46.5%	90 km/h zone	0	0.0%
60 km/h zone	76	52.8%	100 km/h zone	0	0.0%
70 km/h zone	1	0.7%	110 km/h zone	0	0.0%

CRASHES	145	
Fatal crash	0	0.0%
Injury crash	81	55.9%
Non-casualty crash	64	44.1%

CASUALTIES	85	
Killed	0	0.0%
Injured	85	100.0%
^ Unrestrained	3	3.5%

^ Belt fitted but not worn, No restraint fitted to position OR No helmet worn

Time Group		% of Day	
00:01 - 02:59	4	2.8%	12.5%
03:00 - 04:59	0	0.0%	8.3%
05:00 - 05:59	0	0.0%	4.2%
06:00 - 06:59	2	1.4%	4.2%
07:00 - 07:59	8	5.5%	4.2%
08:00 - 08:59	13	9.0%	4.2%
09:00 - 09:59	12	8.3%	4.2%
10:00 - 10:59	7	4.8%	4.2%
11:00 - 11:59	6	4.1%	4.2%
12:00 - 12:59	8	5.5%	4.2%
13:00 - 13:59	11	7.6%	4.2%
14:00 - 14:59	7	4.8%	4.2%
15:00 - 15:59	13	9.0%	4.2%
16:00 - 16:59	9	6.2%	4.2%
17:00 - 17:59	7	4.8%	4.2%
18:00 - 18:59	12	8.3%	4.2%
19:00 - 19:59	12	8.3%	4.2%
20:00 - 21:59	12	8.3%	8.3%
22:00 - 24:00	2	1.4%	8.3%

Street Lighting Off/Nil		% of Dark
2	of 42 in Dark	4.8%

Crashes		Casualties
16	2013	9
27	2012	18
39	2011	27
25	2010	13
25	2009	11
13	2008	7

~ School Travel Time		
Involvement	38	26.2%

McLean Periods			% Week
A	21	14.5%	17.9%
B	2	1.4%	7.1%
C	38	26.2%	17.9%
D	9	6.2%	3.5%
E	4	2.8%	3.6%
F	21	14.5%	10.7%
G	21	14.5%	7.1%
H	13	9.0%	7.1%
I	4	2.8%	12.5%
J	12	8.3%	10.7%

Day of the Week								
Monday	20	13.8%	Thursday	24	16.6%	Sunday	16	11.0%
Tuesday	16	11.0%	Friday	24	16.6%	WEEKDAY	111	76.6%
Wednesday	27	18.6%	Saturday	18	12.4%	WEEKEND	34	23.4%

# Holiday Periods								
New Year	0	0.0%	Queen's BD	3	2.1%	Easter SH	6	4.1%
Aust. Day	1	0.7%	Labour Day	1	0.7%	June/July SH	3	2.1%
Easter	2	1.4%	Christmas	4	2.8%	Sept./Oct. SH	7	4.8%
Anzac Day	1	0.7%	January SH	8	5.5%	December SH	5	3.4%

Crashid dataset 6048 - Crashes within the study area July08 to June13

Percentages are percentages of all crashes. Unknown values for each category are not shown on this report.

NOTES: 6048 - Crashes within the study area July08 to June13

Sydney Region

Warringah LGA

Dee Why

Avon Rd

Crash No.	Date	Day of Week	Time	Distance	ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors S F
829491	25/01/2013	Fri	20:25	at	OAKS AVE	RDB	STR	Unk	Dry	50	2	TRK	F30	W in OAKS AVE	40	Proceeding in lane	I	0	1	
E50144730						RUM:	10	Cross traffic				CAR	F34	S in AVON RD	20	Proceeding in lane				
811003	16/09/2012	Sun	08:30	10 m S	OAKS AVE	RDB	STR	Raining	Wet	50	2	CAR	F52	S in AVON RD	20	Incorrect side	N	0	0	F
E48667525						RUM:	20	Head on				CAR	F60	N in AVON RD	20	Proceeding in lane				
824080	20/01/2013	Sun	15:00	20 m S	OAKS AVE	2WY	STR	Overcast	Dry	50	2	P/C	F20	S in AVON RD		Veering right	I	0	1	
E50654062						RUM:	34	Lane change right				OMV	M49	S in AVON RD	25	Proceeding in lane				
721961	19/08/2010	Thu	17:50	at	PACIFIC PDE	RDB	STR	Fine	Dry	50	2	CAR	M20	S in AVON RD	5	Turning right	I	0	1	
E42601341						RUM:	2	Ped far side				TOY	M33	E in PACIFIC PDE		In/on toy vehicle				
743575	14/02/2011	Mon	13:45	at	PACIFIC PDE	RDB	STR	Fine	Dry	50	2	4WD	M80	S in AVON RD	10	Proceeding in lane	I	0	1	
E44541516						RUM:	10	Cross traffic				P/C	M26	E in PACIFIC PDE		Proceeding in lane				
745043	10/03/2011	Thu	15:50	at	PACIFIC PDE	RDB	STR	Fine	Dry	50	2	CAR	M80	S in AVON RD	20	Proceeding in lane	N	0	0	
E44542278						RUM:	10	Cross traffic				CAR	M37	E in PACIFIC PDE	50	Proceeding in lane				
788741	17/03/2012	Sat	01:00	at	PACIFIC PDE	RDB	STR	Fine	Dry	50	6	CAR	F17	S in AVON RD	25	Proceeding in lane	N	0	0	
E47537966						RUM:	10	Cross traffic				OMV	M70	E in PACIFIC PDE	40	Proceeding in lane				
												CAR		E in PACIFIC PDE	0	Parked				
												CVN		E in PACIFIC PDE		Parked				
												CAR		E in PACIFIC PDE	0	Parked				
												4WD		E in PACIFIC PDE	0	Parked				
830071	10/03/2013	Sun	02:52	15 m N	PACIFIC PDE	2WY	STR	Fine	Dry	50	2	CAR	F31	S in AVON RD	50	Proceeding in lane	N	0	0	
E51012019						RUM:	73	Off rd rght => obj				4WD		N in AVON RD	0	Parked				

Dee Why Pde

Crash No.	Date	Day of Week	Time	Distance	ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors S F
805292	01/08/2012	Wed	18:58	at	AVON RD	RDB	STR	Fine	Dry	50	3	CAR	F26	W in DEE WHY PDE	Unk	Proceeding in lane	N	0	0	
E48462911						RUM:	10	Cross traffic				CAR	M26	S in AVON RD	Unk	Proceeding in lane				
												CAR	M51	N in AVON RD	0	Stationary				
818408	04/11/2012	Sun	20:50	at	AVON RD	RDB	STR	Fine	Dry	50	2	CAR	F17	E in DEE WHY PDE	Unk	Proceeding in lane	I	0	1	
E50127374						RUM:	10	Cross traffic				M/C	M27	N in AVON RD	Unk	Proceeding in lane				
842431	26/06/2013	Wed	18:45	at	AVON RD	RDB	STR	Raining	Wet	50	2	OMV	U U	S in AVON RD	Unk	Proceeding in lane	I	0	1	
E52013846						RUM:	10	Cross traffic				M/C	M22	E in DEE WHY PDE	10	Proceeding in lane				

Detailed Crash Report

Crash No.	Date	Day of Week	Time	Distance	ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors
																				S F
768436	23/09/2011	Fri	23:00	100 m	W AVON RD	2WY	STR	Fine	Dry	50	2	UTE	U U	E in DEE WHY PDE	Unk	Proceeding in lane	N	0	0	F
E45581623						RUM:	71	Off rd left => obj				CAR		E in DEE WHY PDE	0	Parked				
795658	22/05/2012	Tue	14:50		at CLARENCE AVE	RDB	STR	Fine	Dry	50	2	M/C	M29	S in DEE WHY PDE	20	Turning right	I	0	1	
E47796232						RUM:	11	Right far				CAR	M79	W in CLARENCE AVE	20	Proceeding in lane				
813898	28/09/2012	Fri	18:15		at CLARENCE AVE	RDB	STR	Fine	Dry	50	2	CAR	F34	S in CLARENCE AVE	10	Turning right	N	0	0	
E51781481						RUM:	11	Right far				4WD	F32	W in DEE WHY PDE	10	Proceeding in lane				
635704	23/08/2008	Sat	16:47	20 m	E CLARENCE AVE	2WY	STR	Overcast	Dry	50	2	CAR	U U	S in DEE WHY PDE	1	Forward from drive	N	0	0	
E36689580						RUM:	47	Emerging from drive				M/C	M52	E in DEE WHY PDE	30	Proceeding in lane				
705221	31/01/2010	Sun	21:15	5 m	E PITTWATER RD	XJN	STR	Fine	Dry	50	2	CAR	F36	W in DEE WHY PDE	25	Proceeding in lane	I	0	1	
E41770787						RUM:	31	Left rear				CAR	M72	W in DEE WHY PDE	0	Waiting turn left				
830860	24/03/2013	Sun	16:10	20 m	E PITTWATER RD	2WY	STR	Fine	Dry	50	3	CAR	F66	W in DEE WHY PDE	10	Proceeding in lane	I	0	1	
E51047526						RUM:	30	Rear end				CAR	F31	W in DEE WHY PDE	0	Stationary				
												CAR	F55	W in DEE WHY PDE	0	Stationary				
792127	13/03/2012	Tue	15:30	30 m	E PITTWATER RD	2WY	STR	Fine	Dry	50	2	CAR	F66	W in DEE WHY PDE	Unk	Proceeding in lane	I	0	1	
E47308712						RUM:	30	Rear end				CAR	M37	W in DEE WHY PDE	0	Stationary				
634771	20/08/2008	Wed	16:00	100 m	E PITTWATER RD	2WY	STR	Fine	Dry	50	2	CAR	F76	N in DEE WHY PDE	20	Forward from drive	I	0	1	
E501712790						RUM:	47	Emerging from drive				P/C	M21	W in DEE WHY PDE		Proceeding in lane				
Fisher Rd																				
724820	18/09/2010	Sat	10:20		at LEWIS ST	XJN	STR	Fine	Dry	50	2	CAR	F17	E in LEWIS ST	Unk	Turning right	N	0	0	
E43044808						RUM:	21	Right through				CAR	M29	W in LEWIS ST	30	Proceeding in lane				
759233	06/07/2011	Wed	11:15	5 m	N MCINTOSH RD	RDB	STR	Fine	Dry	50	5	WAG	M43	S in FISHER RD	Unk	Proceeding in lane	I	0	2	S
E45915708						RUM:	30	Rear end				TRK	M31	S in FISHER RD	0	Stationary				
												CAR	M44	W in MCINTOSH RD	0	Stationary				
												CAR	M43	W in MCINTOSH RD	60	Proceeding in lane				
												CAR	F48	W in MCINTOSH RD	50	Proceeding in lane				
731590	09/11/2010	Tue	12:30	15 m	S MCINTOSH RD	2WY	STR	Fine	Dry	50	3	CAR	M21	N in FISHER RD	40	Proceeding in lane	N	0	0	
E44433285						RUM:	30	Rear end				4WD	F53	N in FISHER RD	0	Stationary				
												TRK	M46	N in FISHER RD	0	Stationary				
830528	04/03/2013	Mon	14:15	25 m	N PITTWATER RD	2WY	CRV	Fine	Dry	50	2	CAR	M60	N in FISHER RD	5	Pulling out	N	0	0	
E50881461						RUM:	42	Leaving parking				CAR	F28	N in FISHER RD	Unk	Proceeding in lane				
671122	14/06/2009	Sun	15:50		at ST DAVID AVE	XJN	STR	Raining	Wet	60	1	CAR	F21	W in ST DAVID AVE	20	Turning right	N	0	0	S
E37886103						RUM:	81	Off left/rt bnd=>obj				Fence (prior to 2014)								

Detailed Crash Report

Crash No.	Date	Day of Week	Time	Distance	ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors
																				S F
682520	21/09/2009	Mon	18:45	at	ST DAVID AVE	XJN	STR	Fine	Dry	60	2	CAR	F18	W in ST DAVID AVE	40	Turning right	N	0	0	
E38939377						RUM:	21	Right through				4WD	M22	E in ST DAVID AVE	Unk	Proceeding in lane				
729017	13/10/2010	Wed	19:40	at	ST DAVID AVE	XJN	STR	Raining	Wet	50	2	CAR	M22	W in ST DAVID AVE	30	Turning right	I	0	1	
E254203692						RUM:	21	Right through				M/C	M52	E in ST DAVID AVE	30	Proceeding in lane				
631126	12/07/2008	Sat	19:00	100 m S	ST DAVID AVE	2WY	STR	Fine	Dry	60	2	CAR	F84	W in FISHER RD	20	Reverse from drive	N	0	0	
E34611073						RUM:	46	Reversing into obj				4WD		N in FISHER RD	0	Parked				
790972	04/04/2012	Wed	10:45	100 m S	ST DAVID AVE	2WY	STR	Fine	Dry	60	2	OMV	U U	FISHER RD	Unk	Other forward	N	0	0	
E47884077						RUM:	49	Other manoeuvring				M/C		N in FISHER RD	0	Parked				
	Howard Ave																			
670244	10/06/2009	Wed	10:15	at	AVON RD	RDB	STR	Fine	Dry	50	2	CAR	F47	N in AVON RD	10	Proceeding in lane	I	0	1	
E37910749						RUM:	10	Cross traffic				CAR	F52	E in HOWARD AVE	20	Proceeding in lane				
707311	22/04/2010	Thu	19:50	at	AVON RD	RDB	STR	Fine	Dry	50	2	4WD	F28	W in HOWARD AVE	10	Proceeding in lane	N	0	0	
E78376102						RUM:	10	Cross traffic				4WD	F43	S in AVON RD	40	Proceeding in lane				
756071	10/06/2011	Fri	09:40	at	AVON RD	RDB	STR	Fine	Dry	50	2	TRK	F29	N in AVON RD	10	Turning right	N	0	0	
E45257351						RUM:	21	Right through				CAR	M82	S in AVON RD	5	Proceeding in lane				
772224	14/10/2011	Fri	19:25	at	AVON RD	RDB	STR	Overcast	Dry	50	4	CAR	F56	W in HOWARD AVE	50	Proceeding in lane	I	0	1	
E663671490						RUM:	10	Cross traffic				CAR	M41	S in AVON RD	50	Proceeding in lane				
												CAR		N in AVON RD	0	Parked				
												CAR		S in AVON RD	0	Parked				
821935	16/12/2012	Sun	19:45	at	AVON RD	RDB	CRV	Fine	Dry	50	2	CAR	F81	S in AVON RD	Unk	Proceeding in lane	I	0	1	
E51349455						RUM:	10	Cross traffic				CAR	M23	E in HOWARD AVE	10	Proceeding in lane				
756119	12/06/2011	Sun	07:45	at	NUMBER 39 HN	2WY	STR	Raining	Wet	50	2	CAR	F25	W in HOWARD AVE	40	Proceeding in lane	N	0	0	
E44301609						RUM:	71	Off rd left => obj				WAG		W in HOWARD AVE	0	Parked				
822514	09/01/2013	Wed	15:50	60 m E	PITTWATER RD	2WY	STR	Fine	Dry	50	2	CAR	M64	N in HOWARD AVE	2	Forward from drive	I	0	1	
E51085639						RUM:	7	Driveway				PED	M51	W in HOWARD AVE		Ped not on carriageway				
674991	10/07/2009	Fri	17:30	100 m E	PITTWATER RD	2WY	STR	Fine	Dry	50	2	CAR	M34	W in HOWARD AVE	10	Reversing in lane	I	0	1	
E39974584						RUM:	0	Ped nearside				PED	F53	HOWARD AVE		Walk across carriageway				
707326	23/04/2010	Fri	19:30	100 m E	PITTWATER RD	2WY	STR	Fine	Dry	50	2	OMV	M62	E in HOWARD AVE	20	Pulling out	N	0	0	
E40569427						RUM:	42	Leaving parking				CAR	M26	E in HOWARD AVE	20	Proceeding in lane				
756105	11/06/2011	Sat	18:40	120 m E	PITTWATER RD	2WY	STR	Raining	Wet	60	3	CAR	M22	W in HOWARD AVE	30	Proceeding in lane	I	0	2	
E45092773						RUM:	0	Ped nearside				PED	M31	N in HOWARD AVE		Walk across carriageway				
												PED	F37	N in HOWARD AVE		Walk across carriageway				

Detailed Crash Report

Crash No.	Date	Day of Week	Time	Distance	ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors
																				S F
821773	26/10/2012	Fri	13:00	120 m E	PITTWATER RD	DIV	STR	Fine	Dry	50	2	TRK	M53	E in HOWARD AVE	10	Proceeding in lane	I	0	1	
E96689802						RUM:	2	Ped far side				PED	F65	N in HOWARD AVE		Walk across carriageway				
Mcintosh Rd																				
811579	04/09/2012	Tue	07:20	5 m W	FISHER RD	RDB	STR	Fine	Dry	60	2	CAR	M51	E in MCINTOSH RD	Unk	Proceeding in lane	I	0	1	
E48886872						RUM:	31	Left rear				CAR	F74	E in MCINTOSH RD	0	Waiting turn left				
Oaks Ave																				
838207	21/05/2013	Tue	19:00	at	NUMBER 21 HN	2WY	STR	Fine	Dry	50	2	CAR	U U	E in OAKS AVE	20	Proceeding in lane	N	0	0	F
E52052643						RUM:	71	Off rd left => obj				M/C		E in OAKS AVE	0	Parked				
776781	31/10/2011	Mon	09:30	5 m E	PITTWATER RD	TJN	STR	Fine	Dry	50	2	4WD	F73	W in OAKS AVE	30	Proceeding in lane	I	0	1	
E45747720						RUM:	31	Left rear				CAR	F45	W in OAKS AVE	0	Waiting turn left				
782343	01/02/2012	Wed	12:15	50 m E	PITTWATER RD	2WY	STR	Raining	Wet	50	2	P/C	M50	E in OAKS AVE		Proceeding in lane	I	0	1	
E47034426						RUM:	63	Vehicle door				CAR	M56	E in OAKS AVE	0	Parked				
764494	19/08/2011	Fri	09:01	55 m E	PITTWATER RD	2WY	STR	Overcast	Dry	50	2	4WD	F53	N in OAKS AVE	Unk	Reverse parking	I	0	1	
E45092412						RUM:	9	Ped other				PED	F84	S in OAKS AVE		Walk across carriageway				
803787	21/06/2012	Thu	17:30	100 m E	PITTWATER RD	2WY	STR	Fine	Dry	50	2	P/C	M27	E in OAKS AVE		Proceeding in lane	I	0	1	
E48270354						RUM:	63	Vehicle door				CAR	M49	E in OAKS AVE	0	Parked				
736187	12/12/2010	Sun	15:15	200 m E	PITTWATER RD	2WY	STR	Fine	Dry	50	2	CAR	F41	W in OAKS AVE	15	Reverse parking	I	0	1	
E45496086						RUM:	3	Ped on carriageway				PED	F36	OAKS AVE		Stand on carriageway				
757321	19/05/2011	Thu	13:15	375 m E	PITTWATER RD	2WY	STR	Fine	Dry	50	2	TRK	M28	W in OAKS AVE	2	Reverse parking	I	0	1	
E44531576						RUM:	0	Ped nearside				PED	F40	S in OAKS AVE		Walk across carriageway				
781550	09/01/2012	Mon	15:05	390 m E	PITTWATER RD	2WY	STR	Fine	Dry	50	3	TRK	M18	E in OAKS AVE	50	Proceeding in lane	I	0	2	
E46865850						RUM:	31	Left rear				CAR	F19	E in OAKS AVE	0	Waiting turn left				
												CAR	M77	E in OAKS AVE	5	Turning left				
794492	13/05/2012	Sun	14:00	200 m S	PITTWATER RD	2WY	STR	Fine	Dry	50	2	CAR	F49	S in OAKS AVE	3	Reverse parking	I	0	1	
E47496025						RUM:	3	Ped on carriageway				PED	F82	S in OAKS AVE		Stand on carriageway				
782525	29/12/2011	Thu	21:50	Unk Unk	UNKNOWN UK	2WY	STR	Fine	Dry	50	1	CAR	F38	S in OAKS AVE	50	Other forward	N	0	0	
E402813191						RUM:	99	Unknown												
Oaks Rd																				
650360	16/10/2008	Thu	19:30	30 m E	PITTWATER RD	2WY	STR	Fine	Dry	50	2	CAR	M22	E in OAKS RD	20	Turning right	I	0	1	S
E35655728						RUM:	21	Right through				M/C	M24	W in OAKS RD	60	Proceeding in lane				
738624	08/01/2011	Sat	09:15	200 m E	PITTWATER RD	2WY	STR	Fine	Dry	50	2	CAR	F39	W in OAKS RD	10	Pulling out	N	0	0	
E43448379						RUM:	42	Leaving parking				WAG	F44	W in OAKS RD	25	Proceeding in lane				
Pacific Pde																				

Detailed Crash Report

Crash No.	Date	Day of Week	Time	Distance	ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors
																				S F
818696	28/11/2012	Wed	11:00	at	NUMBER 53 HN	2WY	STR	Overcast	Dry	50	1	P/C	M24	W in PACIFIC PDE		Proceeding in lane	I	0	1	
E49970407						RUM:	69	Other on path				Falling object								
768923	15/08/2011	Mon	10:49	at	NUMBER 56 HN	2WY	STR	Fine	Dry	Unk	2	CAR	M20	W in PACIFIC PDE	5	Other reversing	N	0	0	
E45669162						RUM:	93	Pkd veh runaway=>obj				CAR		E in PACIFIC PDE	0	Parked				
766900	07/09/2011	Wed	18:00	15 m E	PITTWATER RD	2WY	STR	Fine	Dry	50	2	CAR	F76	N in PACIFIC PDE	20	Forward from drive	N	0	0	
E45627076						RUM:	47	Emerging from drive				CAR	F26	E in PACIFIC PDE	20	Proceeding in lane				
757840	24/06/2011	Fri	18:00	40 m E	PITTWATER RD	2WY	STR	Fine	Dry	50	2	CAR	M35	W in PACIFIC PDE	30	Proceeding in lane	I	0	1	
E44170210						RUM:	2	Ped far side				PED	F12	S in PACIFIC PDE		Run across carriageway				
777828	12/12/2011	Mon	08:55	40 m E	PITTWATER RD	2WY	STR	Raining	Wet	60	2	4WD	F48	E in PACIFIC PDE	5	Forward from drive	I	0	1	
E46537361						RUM:	7	Driveway				PED	M78	N in PACIFIC PDE		Ped not on carriageway				
761063	21/07/2011	Thu	16:15	100 m E	PITTWATER RD	2WY	STR	Raining	Wet	50	2	WAG	M33	W in PACIFIC PDE	10	Perform U-turn	I	0	1	
E44884552						RUM:	40	U turn				4WD	F45	E in PACIFIC PDE	40	Proceeding in lane				
773951	02/11/2011	Wed	14:15	100 m E	PITTWATER RD	2WY	STR	Fine	Dry	50	2	CAR	M61	N in PACIFIC PDE	Unk	Forward from drive	I	0	1	
E45725970						RUM:	1	Ped emerging				PED	F U	S in PACIFIC PDE		Run across carriageway				
771650	07/10/2011	Fri	12:04	110 m E	PITTWATER RD	2WY	STR	Fine	Dry	50	2	4WD	F45	N in PACIFIC PDE	5	Forward from drive	I	0	1	
E46732965						RUM:	0	Ped nearside				PED	F69	S in PACIFIC PDE		Walk across carriageway				
692955	17/12/2009	Thu	21:54	at	STURDEE PDE	RDB	STR	Raining	Wet	50	2	UTE	M28	E in PACIFIC PDE	50	Proceeding in lane	N	0	0	F
E39468661						RUM:	73	Off rd rght => obj				TRK		W in PACIFIC PDE	0	Parked				
772498	01/11/2011	Tue	17:30	at	STURDEE PDE	RDB	STR	Fine	Dry	60	2	CAR	F U	N in STURDEE PDE	5	Turning right	I	0	1	
E46629269						RUM:	0	Ped nearside				PED	F28	E in PACIFIC PDE		Walk across carriageway				
633079	26/07/2008	Sat	12:00	50 m E	STURDEE PDE	2WY	STR	Fine	Dry	60	3	WAG	M37	E in PACIFIC PDE	50	Proceeding in lane	I	0	1	
E34202109						RUM:	30	Rear end				CAR	F31	E in PACIFIC PDE	0	Stationary				
												WAG	F41	E in PACIFIC PDE	0	Stationary				
807177	14/08/2012	Tue	18:00	20 m W	STURDEE PDE	2WY	STR	Fine	Dry	50	3	CAR	F34	W in PACIFIC PDE	10	Proceeding in lane	I	0	1	
E50876689						RUM:	30	Rear end				M/C	M31	W in PACIFIC PDE	0	Stationary				
												CAR	M24	W in PACIFIC PDE	0	Stationary				
796219	05/01/2012	Thu	13:15	at	THE CRESCENT MS	TJN	STR	Fine	Dry	50	3	CAR	F29	E in PACIFIC PDE	5	Proceeding in lane	I	0	1	
E47209074						RUM:	30	Rear end				CAR	M80	E in PACIFIC PDE	0	Stationary				
												CAR	M34	E in PACIFIC PDE	0	Stationary				

Pittwater Rd

Crash No.	Date	Day of Week	Time	Distance	ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors
692967	17/12/2009	Thu	09:20	at	DEE WHY PDE	XJN	STR	Fine	Dry	60	2	CAR	M23	S in PITTWATER RD	Unk	Turning left	N	0	0	
E41344489						RUM:	37	Left turn sideswipe				CAR	M68	S in PITTWATER RD	Unk	Proceeding in lane				

Crash No.	Date	Day of Week	Time	Distance	ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors
																				S F
744604	07/03/2011	Mon	08:10	at	DEE WHY PDE	XJN	STR	Fine	Dry	60	3	UTE	M24	W in DEE WHY PDE	Unk	Turning right	I	0	1	
E44349242						RUM:	13	Right near				STA	M46	S in PITTWATER RD	40	Proceeding in lane				
												4WD	F48	W in DEE WHY PDE	5	Turning right				
771296	27/07/2011	Wed	09:15	at	DEE WHY PDE	XJN	STR	Fine	Dry	60	2	CAR	F60	S in PITTWATER RD	40	Proceeding in lane	I	0	1	
E45657235						RUM:	2	Ped far side				PED	F55	E in PITTWATER RD		Walk across carriageway				
806451	03/08/2012	Fri	17:10	at	DEE WHY PDE	XJN	CRV	Fine	Dry	60	2	CAR	F41	W in PITTWATER RD	10	Turning right	N	0	0	
E94229302						RUM:	32	Right rear				4WD	F54	W in PITTWATER RD	10	Turning right				
773768	20/10/2011	Thu	08:10	5 m N	DEE WHY PDE	XJN	STR	Fine	Dry	60	2	CAR	F24	S in PITTWATER RD	Unk	Proceeding in lane	I	0	1	
E46804241						RUM:	30	Rear end				CAR	M50	S in PITTWATER RD	0	Stationary				
724854	20/09/2010	Mon	08:20	10 m N	DEE WHY PDE	XJN	STR	Fine	Dry	60	2	CAR	F23	S in PITTWATER RD	Unk	Proceeding in lane	N	0	0	
E43059108						RUM:	30	Rear end				CAR	F18	S in PITTWATER RD	Unk	Proceeding in lane				
772430	28/10/2011	Fri	16:20	50 m S	DEE WHY PDE	DIV	STR	Fine	Dry	60	2	CAR	F30	S in PITTWATER RD	10	Pulling out	I	0	1	
E46492368						RUM:	42	Leaving parking				LOR	M24	S in PITTWATER RD	55	Proceeding in lane				
766346	03/09/2011	Sat	19:25	100 m S	DEE WHY PDE	DIV	STR	Fine	Dry	60	2	CAR	M22	N in PITTWATER RD	40	Proceeding in lane	N	0	0	
E189309494						RUM:	30	Rear end				4WD	M49	N in PITTWATER RD	0	Stationary				
776858	29/11/2011	Tue	08:35	100 m S	DEE WHY PDE	DIV	STR	Fine	Dry	60	2	4WD	M80	S in PITTWATER RD	40	Veering left	I	0	1	
E46362434						RUM:	35	Lane change left				CAR	F84	S in PITTWATER RD	60	Proceeding in lane				
662688	21/03/2009	Sat	21:40	at	FISHER RD	TJN	STR	Fine	Dry	60	2	P/C	M31	E in PITTWATER RD		Along footpath	I	0	1	
E36638336						RUM:	48	From footpath				4WD	M32	S in PITTWATER RD	5	Proceeding in lane				
660571	23/03/2009	Mon	08:15	at	FISHER RD	TJN	STR	Fine	Dry	50	2	CAR	F54	E in FISHER RD	30	Turning right	N	0	0	
E37681753						RUM:	11	Right far				CAR	F34	S in PITTWATER RD	30	Proceeding in lane				
691619	02/12/2009	Wed	15:00	at	FISHER RD	TJN	STR	Fine	Dry	60	3	CAR	F28	S in PITTWATER RD	20	Proceeding in lane	N	0	0	
E38988024						RUM:	30	Rear end				CAR	M U	S in PITTWATER RD	10	Proceeding in lane				
												CAR	F30	S in PITTWATER RD	20	Proceeding in lane				
765367	25/08/2011	Thu	14:45	at	FISHER RD	TJN	STR	Fine	Dry	60	2	TRK	M29	S in PITTWATER RD	40	Proceeding in lane	N	0	0	
E44733010						RUM:	30	Rear end				4WD	F39	S in PITTWATER RD	15	Proceeding in lane				
823381	27/12/2012	Thu	15:10	at	FISHER RD	TJN	STR	Fine	Dry	60	2	CAR	M24	S in PITTWATER RD	40	Veering right	N	0	0	
E49924506						RUM:	34	Lane change right				CAR	F21	S in PITTWATER RD	40	Proceeding in lane				
661119	24/03/2009	Tue	15:15	10 m E	FISHER RD	TJN	STR	Fine	Dry	60	3	CAR	F23	S in PITTWATER RD	10	Proceeding in lane	N	0	0	
E38555787						RUM:	30	Rear end				CAR	F45	S in PITTWATER RD	Unk	Proceeding in lane				
												4WD	M46	S in PITTWATER RD	0	Stationary				
821826	30/11/2012	Fri	13:00	1 m N	FISHER RD	TJN	STR	Fine	Dry	60	2	CAR	F74	S in PITTWATER RD	30	Proceeding in lane	I	0	1	
E49400270						RUM:	0	Ped nearside				PED	M40	W in PITTWATER RD		Run across carriageway				

Detailed Crash Report

Crash No.	Date	Day of Week	Time	Distance	ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors
																				S F
640463	09/10/2008	Thu	07:00	5 m N	FISHER RD	TJN	STR	Fine	Dry	60	2	CAR	M29	S in PITTWATER RD	50	Proceeding in lane	N	0	0	
E68133401						RUM:	30	Rear end				CAR	M57	S in PITTWATER RD	40	Proceeding in lane				
671650	29/05/2009	Fri	08:50	5 m N	FISHER RD	TJN	STR	Fine	Dry	60	2	CAR	M29	S in PITTWATER RD	30	Proceeding in lane	I	0	1	
E37936251						RUM:	30	Rear end				CAR	F50	S in PITTWATER RD	0	Stationary				
749400	12/04/2011	Tue	11:55	5 m N	FISHER RD	TJN	STR	Fine	Dry	60	2	CAR	M25	S in PITTWATER RD	5	Proceeding in lane	I	0	1	
E44527877						RUM:	30	Rear end				CAR	F53	S in PITTWATER RD	0	Stationary				
807074	10/08/2012	Fri	15:45	10 m N	FISHER RD	TJN	STR	Raining	Wet	60	2	CAR	F85	S in PITTWATER RD	60	Proceeding in lane	N	0	0	
E49033262						RUM:	30	Rear end				CAR	F23	S in PITTWATER RD	0	Stationary				
681776	09/09/2009	Wed	15:00	15 m N	FISHER RD	DIV	STR	Fine	Dry	50	4	CAR	M21	S in PITTWATER RD	Unk	Proceeding in lane	N	0	0	
E40845288						RUM:	30	Rear end				CAR	F40	S in PITTWATER RD	0	Stationary				
												WAG	M42	S in PITTWATER RD	0	Stationary				
												CAR	M44	S in PITTWATER RD	0	Stationary				
705417	01/04/2010	Thu	10:30	20 m N	FISHER RD	DIV	STR	Fine	Dry	60	2	CAR	M22	N in PITTWATER RD	50	Proceeding in lane	N	0	0	
E40346854						RUM:	30	Rear end				TRK	M23	N in PITTWATER RD	50	Veering left				
745828	23/03/2011	Wed	07:58	20 m N	FISHER RD	DIV	STR	Fine	Dry	60	3	CAR	F24	S in PITTWATER RD	10	Proceeding in lane	N	0	0	
E44300577						RUM:	30	Rear end				CAR	F67	S in PITTWATER RD	0	Stationary				
												CAR	M26	S in PITTWATER RD	0	Stationary				
718990	29/07/2010	Thu	09:20	10 m S	FISHER RD	TJN	STR	Fine	Dry	60	2	M/C	F20	S in PITTWATER RD	20	Proceeding in lane	I	0	1	
E42223642						RUM:	63	Vehicle door				CAR	F39	S in PITTWATER RD	0	Parked				
773328	29/10/2011	Sat	12:13	10 m S	FISHER RD	TJN	CRV	Fine	Dry	60	2	VAN	M21	N in PITTWATER RD	10	Veering left	I	0	1	
E45722015						RUM:	35	Lane change left				STA	M50	N in PITTWATER RD	15	Proceeding in lane				
836750	09/05/2013	Thu	21:45	10 m S	FISHER RD	TJN	STR	Fine	Dry	60	3	4WD	M36	N in PITTWATER RD	60	Proceeding in lane	N	0	0	
E181621796						RUM:	30	Rear end				CAR	F22	N in PITTWATER RD	0	Stationary				
												CAR	M48	N in PITTWATER RD	0	Stationary				
670767	28/05/2009	Thu	07:05	10 m W	FISHER RD	TJN	STR	Fine	Dry	60	2	CAR	F23	W in PITTWATER RD	Unk	Proceeding in lane	I	0	1	
E37959168						RUM:	30	Rear end				CAR	M31	W in PITTWATER RD	0	Stationary				
829022	19/02/2013	Tue	13:02	30 m W	FISHER RD	DIV	CRV	Fine	Dry	50	2	CAR	F48	W in PITTWATER RD	5	Reverse parking	N	0	0	
E50703056						RUM:	43	Entering parking				CCH	M47	E in PITTWATER RD	40	Proceeding in lane				
639491	27/09/2008	Sat	09:30	at	HOWARD AVE	XJN	STR	Fine	Dry	60	2	UTE	M32	S in PITTWATER RD	20	Proceeding in lane	I	0	1	
E130292695						RUM:	6	Ped on footpath				PED	F57	PITTWATER RD		Ped not on carriageway				
693450	21/12/2009	Mon	07:15	at	HOWARD AVE	XJN	STR	Fine	Dry	60	2	4WD	M54	N in PITTWATER RD	50	Proceeding in lane	N	0	0	
E38932560						RUM:	10	Cross traffic				CAR	F33	W in HOWARD AVE	40	Proceeding in lane				

Detailed Crash Report

Crash No.	Date	Day of Week	Time	Distance	ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors S F
700180	19/02/2010	Fri	08:30	at	HOWARD AVE	XJN	STR	Fine	Dry	60	3	CAR	M65	S in PITTWATER RD	10	Proceeding in lane	I	0	1	
E40072464						RUM:	30	Rear end				CAR	M17	S in PITTWATER RD	5	Proceeding in lane				
												WAG	F53	S in PITTWATER RD	5	Proceeding in lane				
765401	25/08/2011	Thu	11:55	at	HOWARD AVE	XJN	STR	Fine	Dry	60	3	CAR	F41	S in PITTWATER RD	40	Proceeding in lane	N	0	0	
E47363680						RUM:	30	Rear end				CAR	F66	S in PITTWATER RD	0	Stationary				
												WAG	M37	S in PITTWATER RD	0	Stationary				
779622	25/12/2011	Sun	21:00	at	HOWARD AVE	XJN	STR	Fine	Dry	60	3	CAR	M29	S in PITTWATER RD	50	Turning left	N	0	0	
E46366836						RUM:	12	Left far				CAR	M31	W in HOWARD AVE	0	Stationary				
												CAR	M49	W in HOWARD AVE	0	Stationary				
639456	26/09/2008	Fri	21:27	5 m N	HOWARD AVE	XJN	STR	Fine	Dry	60	2	CAR	F18	S in PITTWATER RD	35	Proceeding in lane	N	0	0	
E37366681						RUM:	30	Rear end				CAR	F33	S in PITTWATER RD	0	Stationary				
703180	19/03/2010	Fri	15:00	10 m N	HOWARD AVE	XJN	STR	Fine	Dry	60	3	CAR	F59	S in PITTWATER RD	35	Proceeding in lane	N	0	0	
E40474626						RUM:	30	Rear end				CAR	F20	S in PITTWATER RD	Unk	Proceeding in lane				
												OMV	U U	S in PITTWATER RD	Unk	Proceeding in lane				
729163	20/10/2010	Wed	09:20	20 m N	HOWARD AVE	DIV	STR	Fine	Dry	60	4	4WD	F48	S in PITTWATER RD	40	Proceeding in lane	N	0	0	
E42744958						RUM:	30	Rear end				VAN	M82	S in PITTWATER RD	0	Stationary				
												CAR	F51	S in PITTWATER RD	0	Stationary				
												4WD	F33	S in PITTWATER RD	0	Stationary				
686034	19/10/2009	Mon	17:20	50 m N	HOWARD AVE	DIV	STR	Fine	Dry	50	4	CAR	M30	N in PITTWATER RD	30	Proceeding in lane	I	0	1	
E160730094						RUM:	30	Rear end				CAR	M24	N in PITTWATER RD	0	Stationary				
												CAR	M25	N in PITTWATER RD	30	Veering left				
												CAR	F47	N in PITTWATER RD	20	Proceeding in lane				
717408	09/07/2010	Fri	19:00	10 m S	HOWARD AVE	XJN	STR	Fine	Dry	60	1	CAR	M25	S in PITTWATER RD	15	Proceeding in lane	N	0	0	
E79911002						RUM:	69	Other on path												
756517	05/06/2011	Sun	19:25	5 m N	HOWARDS AVE	XJN	STR	Fine	Dry	60	2	CAR	M42	S in PITTWATER RD	40	Proceeding in lane	I	0	1	
E185800194						RUM:	30	Rear end				4WD	M U	S in PITTWATER RD	0	Stationary				
656344	18/02/2009	Wed	09:30	5 m S	KINGSWAY MS	XJN	STR	Raining	Wet	60	2	CAR	M25	N in PITTWATER RD	50	Proceeding in lane	N	0	0	
E36203652						RUM:	30	Rear end				STA	M56	N in PITTWATER RD	0	Stationary				
681213	07/09/2009	Mon	08:30	5 m S	KINGSWAY MS	XJN	STR	Overcast	Dry	60	2	CAR	M68	N in PITTWATER RD	40	Proceeding in lane	N	0	0	
E38489834						RUM:	30	Rear end				TRK	M58	N in PITTWATER RD	0	Stationary				
697995	01/02/2010	Mon	11:50	200 m S	MAY RD	DIV	STR	Fine	Dry	60	3	CAR	F78	N in PITTWATER RD	50	Proceeding in lane	I	0	1	F
E39923818						RUM:	71	Off rd left => obj				UTE		N in PITTWATER RD	0	Parked				
												PED	M51	PITTWATER RD		Stand on carriageway				

Detailed Crash Report

Crash No.	Date	Day of Week	Time	Distance	ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors
																				S F
829067	22/02/2013	Fri	16:11	at	NUMBER 910 HN	DIV	STR	Overcast	Dry	60	2	CAR	F39	N in PITTWATER RD	2	Reverse parking	I	0	1	
E170963897						RUM:	2	Ped far side				PED	F74	E in PITTWATER RD		Walk across carriageway				
727159	09/10/2010	Sat	13:50	15 m N	OAK AVE	DIV	STR	Fine	Dry	60	2	CAR	F33	S in PITTWATER RD	50	Proceeding in lane	N	0	0	
E41693960						RUM:	30	Rear end				CAR	F20	S in PITTWATER RD	5	Proceeding in lane				
733971	01/12/2010	Wed	13:10	10 m S	OAKES AVE	TJN	STR	Raining	Wet	60	3	4WD	M40	N in PITTWATER RD	Unk	Proceeding in lane	N	0	0	
E43167471						RUM:	30	Rear end				WAG	M82	N in PITTWATER RD	Unk	Proceeding in lane				
												TRK	M40	N in PITTWATER RD	Unk	Proceeding in lane				
683413	29/09/2009	Tue	09:30	at	OAKS AVE	TJN	STR	Fine	Dry	60	2	CAR	M21	N in PITTWATER RD	15	Turning right	I	0	1	
E41036388						RUM:	21	Right through				OMV	M51	S in PITTWATER RD	45	Proceeding in lane				
810940	06/09/2012	Thu	08:15	at	OAKS AVE	TJN	STR	Fine	Dry	50	2	TRK	F30	N in PITTWATER RD	15	Turning right	I	0	1	
E49394428						RUM:	21	Right through				M/C	M24	S in PITTWATER RD	45	Proceeding in lane				
647131	26/11/2008	Wed	08:48	10 m N	OAKS AVE	TJN	STR	Fine	Dry	60	2	CAR	M61	S in PITTWATER RD	45	Proceeding in lane	I	0	1	
E35573759						RUM:	2	Ped far side				PED	F42	E in PITTWATER RD		Walk across carriageway				
646835	26/11/2008	Wed	09:00	10 m N	OAKS AVE	TJN	STR	Fine	Dry	60	3	CAR	F20	S in PITTWATER RD	20	Proceeding in lane	N	0	0	
E148062394						RUM:	30	Rear end				CAR	M20	S in PITTWATER RD	0	Stationary				
												CAR	M31	S in PITTWATER RD	0	Stationary				
645524	31/10/2008	Fri	01:20	5 m S	OAKS AVE	TJN	STR	Overcast	Dry	60	2	OMV	M57	N in PITTWATER RD	60	Proceeding in lane	I	0	1	
E35650519						RUM:	30	Rear end				CAR	F24	N in PITTWATER RD	0	Stationary				
650619	11/12/2008	Thu	16:55	10 m S	OAKS AVE	TJN	STR	Overcast	Dry	60	2	P/C	M28	S in PITTWATER RD		Proceeding in lane	I	0	1	
E35952479						RUM:	63	Vehicle door				TRK	M29	S in PITTWATER RD	0	Parked				
725760	22/09/2010	Wed	18:30	20 m S	OAKS AVE	DIV	STR	Fine	Dry	60	4	OMV	M23	S in PITTWATER RD	10	Proceeding in lane	N	0	0	
E43002953						RUM:	30	Rear end				CAR	M20	S in PITTWATER RD	0	Stationary				
												CAR	F22	S in PITTWATER RD	0	Stationary				
												4WD	F28	S in PITTWATER RD	0	Stationary				
716149	27/06/2010	Sun	13:23	25 m S	OAKS AVE	DIV	STR	Overcast	Dry	60	6	WAG	M22	S in PITTWATER RD	50	Proceeding in lane	I	0	1	
E41267206						RUM:	30	Rear end				CAR	F26	S in PITTWATER RD	0	Stationary				
												CAR	M34	S in PITTWATER RD	0	Stationary				
												WAG		S in PITTWATER RD	0	Parked				
												4WD		S in PITTWATER RD	0	Parked				
												CAR		S in PITTWATER RD	0	Parked				
663545	15/04/2009	Wed	21:40	at	PACIFIC PDE	TJN	STR	Fine	Dry	60	2	CAR	M25	S in PITTWATER RD	45	Proceeding in lane	I	0	1	
E36556710						RUM:	30	Rear end				M/C	M30	S in PITTWATER RD	35	Proceeding in lane				
771692	11/10/2011	Tue	14:50	5 m N	PACIFIC PDE	TJN	STR	Fine	Dry	60	2	CAR	M88	S in PITTWATER RD	50	Proceeding in lane	I	0	1	
E45673417						RUM:	30	Rear end				CAR	F29	S in PITTWATER RD	0	Stationary				

Detailed Crash Report

Crash No.	Date	Day of Week	Time	Distance	ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors S F
733980	01/12/2010	Wed	06:50	15 m N	PACIFIC RD	DIV	STR	Raining	Wet	60	2	CAR	F37	S in PITTWATER RD	30	Proceeding in lane	N	0	0	
E43324767						RUM:	30	Rear end				CAR	M25	S in PITTWATER RD	0	Stationary				
638401	13/09/2008	Sat	00:05	at	ST DAVID AVE	XJN	STR	Fine	Dry	60	2	CAR	M22	N in PITTWATER RD	50	Proceeding in lane	N	0	0	
E67089102						RUM:	10	Cross traffic				CAR	M20	W in ST DAVID AVE	20	Proceeding in lane				
771024	13/10/2011	Thu	22:40	at	ST DAVID AVE	XJN	STR	Fine	Dry	60	2	CAR	M65	N in PITTWATER RD	40	Proceeding in lane	I	0	1	
E48484288						RUM:	2	Ped far side				PED	M24	W in PITTWATER RD		Run across carriageway				
828809	04/03/2013	Mon	06:20	at	ST DAVID AVE	XJN	STR	Fine	Dry	70	2	CAR	M24	N in PITTWATER RD	55	Proceeding in lane	I	0	1	
E52531982						RUM:	10	Cross traffic				CAR	F43	W in ST DAVID AVE	Unk	Proceeding in lane				
732086	04/11/2010	Thu	07:16	at	STURDEE PDE	TJN	STR	Raining	Wet	60	2	CAR	M28	N in PITTWATER RD	5	Turning right	I	0	1	
E42287817						RUM:	21	Right through				4WD	M34	S in PITTWATER RD	40	Proceeding in lane				
779758	31/12/2011	Sat	12:30	at	STURDEE PDE	TJN	STR	Fine	Dry	60	2	4WD	F40	N in PITTWATER RD	15	Proceeding in lane	I	0	1	
E149301398						RUM:	30	Rear end				CAR	F39	N in PITTWATER RD	0	Stationary				
781838	23/01/2012	Mon	07:45	at	STURDEE PDE	TJN	STR	Fine	Dry	60	2	M/C	M48	S in PITTWATER RD	40	Proceeding in lane	I	0	1	
E177193995						RUM:	74	On road-out of cont.				TRK	M45	N in PITTWATER RD	0	Wait turn right				
810792	18/09/2012	Tue	19:15	at	STURDEE PDE	TJN	STR	Raining	Wet	60	2	CAR	F29	N in PITTWATER RD	10	Turning right	N	0	0	
E49222503						RUM:	21	Right through				CAR	M73	S in PITTWATER RD	60	Proceeding in lane				
813181	26/09/2012	Wed	12:15	at	STURDEE PDE	TJN	STR	Fine	Dry	60	2	M/C	M27	S in PITTWATER RD	Unk	Turning left	I	0	1	
E95243902						RUM:	37	Left turn sideswipe				STA	M55	S in PITTWATER RD	15	Turning left				
826981	09/02/2013	Sat	10:15	at	STURDEE PDE	TJN	STR	Fine	Dry	60	3	CAR	F31	N in PITTWATER RD	Unk	Proceeding in lane	N	0	0	
E51015568						RUM:	30	Rear end				4WD	M42	N in PITTWATER RD	Unk	Proceeding in lane				
												CAR	F30	N in PITTWATER RD	Unk	Proceeding in lane				
835887	08/04/2013	Mon	18:35	at	STURDEE PDE	TJN	STR	Fine	Dry	60	2	4WD	M20	N in PITTWATER RD	15	Turning right	I	0	1	
E51591168						RUM:	21	Right through				M/C	M25	S in PITTWATER RD	40	Proceeding in lane				
833631	13/04/2013	Sat	18:35	at	STURDEE PDE	TJN	STR	Fine	Dry	60	3	4WD	M26	S in PITTWATER RD	Unk	Proceeding in lane	N	0	0	
E98780701						RUM:	30	Rear end				WAG	M68	S in PITTWATER RD	30	Proceeding in lane				
												CAR	F26	S in PITTWATER RD	10	Proceeding in lane				
783372	05/02/2012	Sun	13:10	5 m N	STURDEE PDE	TJN	STR	Fine	Dry	60	2	CAR	F31	S in PITTWATER RD	50	Proceeding in lane	N	0	0	
E46886947						RUM:	30	Rear end				4WD	M22	S in PITTWATER RD	0	Stationary				
673032	17/01/2009	Sat	11:45	25 m N	STURDEE PDE	DIV	STR	Fine	Dry	60	3	CAR	M43	S in PITTWATER RD	Unk	Proceeding in lane	N	0	0	
E35764360						RUM:	30	Rear end				CAR	M30	S in PITTWATER RD	0	Stationary				
												TRK	U U	S in PITTWATER RD	0	Stationary				
687130	23/10/2009	Fri	16:15	5 m S	STURDEE PDE	TJN	STR	Fine	Dry	60	2	CAR	F26	N in PITTWATER RD	10	Proceeding in lane	I	0	1	
E38865806						RUM:	30	Rear end				M/C	M27	N in PITTWATER RD	0	Stationary				

Detailed Crash Report

Crash No.	Date	Day of Week	Time	Distance	ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors
																				SF
757980	27/06/2011	Mon	12:55	10 m	S STURDEE PDE	TJN	STR	Fine	Dry	60	2	CAR	F44	N in PITTWATER RD	40	Proceeding in lane	I	0	1	
E45466942						RUM:	30	Rear end				4WD	F27	N in PITTWATER RD	0	Stationary				
679645	26/08/2009	Wed	10:00		at STURDEE ST	TJN	STR	Fine	Dry	60	2	STA	M44	S in PITTWATER RD	5	Turning left	N	0	0	
E38342948						RUM:	37	Left turn sideswipe				WAG	M25	S in PITTWATER RD	50	Turning left				
St David Ave																				
748538	11/04/2011	Mon	17:00	10 m	E FISHER RD	XJN	STR	Fine	Dry	50	3	CAR	M63	E in ST DAVID AVE	10	Proceeding in lane	N	0	0	
E152368296						RUM:	30	Rear end				CAR	M U	E in ST DAVID AVE	0	Stationary				
												CAR	F39	E in ST DAVID AVE	0	Stationary				
Sturdee Pde																				
730530	10/09/2010	Fri	21:45	10 m	E PITTWATER RD	TJN	STR	Fine	Dry	50	3	CAR	M42	S in PITTWATER RD	40	Turning left	I	0	2	
E41946154						RUM:	0	Ped nearside				PED	M45	S in STURDEE PDE		Walk across carriageway				
												PED	F47	S in STURDEE PDE		Walk across carriageway				
731176	09/10/2010	Sat	16:44	20 m	E PITTWATER RD	2WY	STR	Fine	Dry	60	3	CAR	F28	S in STURDEE PDE	50	Forward from drive	I	0	1	
E42168132						RUM:	47	Emerging from drive				M/C	M27	E in STURDEE PDE	Unk	Proceeding in lane				
												OMV		W in STURDEE PDE	0	Parked				
660732	17/02/2009	Tue	21:03	40 m	E PITTWATER RD	2WY	STR	Fine	Dry	50	2	CAR	F32	W in STURDEE PDE	Unk	Pulling out	I	0	1	
E36510734						RUM:	43	Entering parking				M/C	M46	W in STURDEE PDE	50	Proceeding in lane				
663927	12/04/2009	Sun	14:30	100 m	E PITTWATER RD	2WY	STR	Fine	Dry	50	2	CAR	F25	E in STURDEE PDE	Unk	Perform U-turn	I	0	1	
E37127118						RUM:	40	U turn				WAG	M18	E in STURDEE PDE	Unk	Proceeding in lane				
686909	27/10/2009	Tue	08:20	100 m	E PITTWATER RD	2WY	STR	Overcast	Dry	50	2	CAR	M21	E in STURDEE PDE	Unk	Pull out opposite	N	0	0	
E160930294						RUM:	50	Head on (overtake)				CAR	F U	W in STURDEE PDE	Unk	Proceeding in lane				
838045	29/04/2013	Mon	13:40	100 m	E PITTWATER RD	2WY	STR	Fine	Dry	50	1	M/C	M44	E in STURDEE PDE	30	Proceeding in lane	I	0	1	
E51256247						RUM:	74	On road-out of cont.												
729616	20/10/2010	Wed	18:50	110 m	E PITTWATER RD	2WY	STR	Fine	Dry	50	2	CAR	M26	S in STURDEE PDE	5	Forward from drive	I	0	1	
E42347413						RUM:	47	Emerging from drive				M/C	M37	E in STURDEE PDE	30	Proceeding in lane				

Report Totals: Total Crashes: 145 Fatal Crashes: 0 Injury Crashes: 81 Killed: 0 Injured: 85

Crashid dataset 6048 - Crashes within the study area July08 to June13

Appendix B

Concept design drawing

BUDGET DESIGN ESTIMATE

DEE WHY TOWN CENTRE

Wilde and Woollard
Lvl 1, 815 Pacific Highway
Chatswood, NSW 2067

Tel: 02 9411 2777
Fax: 02 9411 7645

e-mail: mail@wwsydney.com
www.wildeandwoollard.com

Issue	Description	Date
1	Budget Design	09-09-14

WILDE AND WOOLLARD

CONTENTS

1. BASIS OF COST PLAN

Introduction

The proposed works comprises of a refurbishment to existing streets in Dee Why Town Centre.

We note that the Architectural documentation, Engineering and Services components have not been developed and will require further design input from the Engineers.

We note that this should be regarded as an indicative high level cost estimate at this stage as it is based on preliminary sketches and information only. We recommend this estimate will be further refined in concept estimate.

This budget estimate is based on a competitive fixed lump sum contract price.

We have also allowed for two further option for Dee Why Parade Cycleway

- Dee Why Parade (separated cycle path) - $2,106,727
- Dee Why Parade (shared path) - $2,086,977

Drawings

The review is based on the following architectural drawing;
Drawing Number:
- Cost Plan Masterplan.

2. EXCLUSIONS

1. Goods and services tax (GST)
2. Legal costs
3. Finance costs
4. Escalation costs
5. DA/Construction Certificate Fees/Long Service Levy
6. Authority contributions

PROJECT SUMMARY

Project: Dee Why Town Centre
Cost Plan: EST FINAL

No.	Item Description	Total Cost %	Quantity	Unit	$/m2	Total
1	PITTWATER ROAD NORTH (GATEWAY)	3.80				2,179,629
2	PITTWATER ROAD CENTRAL (INCLUDING TOWN CENTRE CROSSING)	4.60				2,639,602
3	PITTWATER ROAD SOUTH (GATEWAY)	6.32				3,630,543
4	ST DAVIDS AVENUE POCKET PARK	1.31				751,850
5	FISHER ROAD STREETSCAPE	2.38				1,363,626
6	REDMAN POCKET PARK	2.65				1,521,400
7	MOORAMBA ROAD POCKET PARK	0.00				0
8	MOORAMBA ROAD	0.66				376,750
9	STURDEE PARADE	3.56				2,044,997
10	PACIFIC PARADE	3.84				2,201,904
11	OAKS AVENUE (PITTWATER ROAD TO NEW LINK ROAD)	3.69				2,116,343
12	OAKS AVENUE (NEW LINK ROAD TO AVON ROAD)	6.60				3,787,665
13	NEW LINK ROAD	2.76				1,581,563
14	HOWARD AVENUE (PITTWATER ROAD TO NEW LINK ROAD)	5.20				2,983,352
15	HOWARD AVENUE (NEW LINK ROAD TO AVON ROAD	5.91				3,390,164
16	DEE WHY PARADE	3.76				2,155,997
17	TRIANGLE PARK NORTH	3.04				1,744,723
18	TRIANGLE PARK SOUTH	2.19				1,252,968
19	WOOLWORTHS LANE	2.25				1,290,890
20	WALTER GORS PARK	9.92				5,694,021
21	WALTER GORS PARK STORMWATER EASEMENT	0.53				300,000
22	DRAINAGE CHANNEL	1.42				810,000
23	BUILDERS PRELIMINARIES	11.45	15	%	0	6,572,698
	TOTAL ESTIMATED CONSTRUCTION COST				**0**	**50,390,685**
24	FEES	3.51			0	2,015,627
25	CONTINGENCIES	8.78			0	5,040,000
	TOTAL ESTIMATED CONSTRUCTION END COST				**0**	**57,446,312**
	GFA: 0.00 m2	**100.00**			**3,829,754**	**57,446,312**

ELEMENTAL SUMMARY

Project: Dee Why Town Centre
Cost Plan: EST FINAL

Code	Description	% of Cost	Quantity	Unit	$/m2	Total
PITTWATER ROAD NORTH (GATEWAY)						
1	SITE PREPARATION	0.65			0	369,670
2	HARD LANDSCAPING	1.06			0	606,379
3	SOFT LANDSCAPING	0.42			0	239,500
4	EXTERNAL SERVICES	1.68			0	964,080
	PITTWATER ROAD NORTH (GATEWAY) TOTAL					**2,179,629**
PITTWATER ROAD CENTRAL (INCLUDING TOWN CENTRE CROSSING)						
1	SITE PREPARATION	0.87			0	494,510
2	HARD LANDSCAPING	1.53			0	877,382
3	SOFT LANDSCAPING	0.50			0	287,170
4	EXTERNAL SERVICES	1.71			0	980,540
	PITTWATER ROAD CENTRAL (INCLUDING TOWN CENTRE CROSSING) TOTAL					**2,639,602**
PITTWATER ROAD SOUTH (GATEWAY)						
1	SITE PREPARATION	3.79			0	2,174,470
2	HARD LANDSCAPING	0.61			0	346,693
3	SOFT LANDSCAPING	0.43			0	241,600
4	EXTERNAL SERVICES	1.52			0	867,780
	PITTWATER ROAD SOUTH (GATEWAY) TOTAL					**3,630,543**
ST DAVIDS AVENUE POCKET PARK						
1	SITE PREPARATION	0.96				548,250
2	SOFT LANDSCAPING	0.36				203,600
	ST DAVIDS AVENUE POCKET PARK TOTAL					**751,850**
FISHER ROAD STREETSCAPE						
1	SITE PREPARATION	0.44			0	250,730
2	HARD LANDSCAPING	0.70			0	400,116
3	SOFT LANDSCAPING	0.05			0	26,300
4	EXTERNAL SERVICES	1.20			0	686,480
	FISHER ROAD STREETSCAPE TOTAL					**1,363,626**
REDMAN POCKET PARK						
1	SOFT LANDSCAPING	2.05				1,172,900
2	SERVICES	0.61				348,500
	REDMAN POCKET PARK TOTAL					**1,521,400**
MOORAMBA ROAD POCKET PARK						
1	SOFT LANDSCAPING	0.00				0
	MOORAMBA ROAD POCKET PARK TOTAL					**0**

WILDE AND WOOLLARD

Project: Dee Why Town Centre
Cost Plan: EST FINAL

Code	Description	% of Cost	Quantity	Unit	$/m2	Total
MOORAMBA ROAD						*(Continued)*
1	SOFT LANDSCAPING	0.66				376,750
	MOORAMBA ROAD TOTAL					**376,750**
STURDEE PARADE						
1	SITE PREPARATION	0.51			0	290,660
2	HARD LANDSCAPING	1.29			0	739,997
3	SOFT LANDSCAPING	0.03			0	14,300
4	EXTERNAL SERVICES	1.75			0	1,000,040
	STURDEE PARADE TOTAL					**2,044,997**
PACIFIC PARADE						
1	SITE PREPARATION	0.63			0	357,920
2	HARD LANDSCAPING	1.47			0	838,764
3	SOFT LANDSCAPING	0.13			0	73,900
4	EXTERNAL SERVICES	1.63			0	931,320
	PACIFIC PARADE TOTAL					**2,201,904**
OAKS AVENUE (PITTWATER ROAD TO NEW LINK ROAD)						
1	SITE PREPARATION	0.45			0	257,440
2	HARD LANDSCAPING	1.14			0	652,153
3	SOFT LANDSCAPING	0.42			0	240,250
4	EXTERNAL SERVICES	1.69			0	966,500
	OAKS AVENUE (PITTWATER ROAD TO NEW LINK ROAD) TOTAL					**2,116,343**
OAKS AVENUE (NEW LINK ROAD TO AVON ROAD)						
1	SITE PREPARATION	1.50			0	859,635
2	HARD LANDSCAPING	2.91			0	1,668,150
3	SOFT LANDSCAPING	0.30			0	171,340
4	EXTERNAL SERVICES	1.90			0	1,088,540
	OAKS AVENUE (NEW LINK ROAD TO AVON ROAD) TOTAL					**3,787,665**
NEW LINK ROAD						
1	SITE PREPARATION	0.46			0	260,465
2	HARD LANDSCAPING	1.16			0	665,998
3	SOFT LANDSCAPING	0.08			0	45,480
4	EXTERNAL SERVICES	1.07			0	609,620
	NEW LINK ROAD TOTAL					**1,581,563**

Project: Dee Why Town Centre
Cost Plan: EST FINAL

Code	Description	% of Cost	Quantity	Unit	$/m2	Total

HOWARD AVENUE (PITTWATER ROAD TO NEW LINK ROAD) *(Continued)*

1	SITE PREPARATION	0.72			0	413,185
2	HARD LANDSCAPING	2.41			0	1,379,717
3	SOFT LANDSCAPING	0.41			0	233,950
4	EXTERNAL SERVICES	1.67			0	956,500
	HOWARD AVENUE (PITTWATER ROAD TO NEW LINK ROAD) TOTAL					**2,983,352**

HOWARD AVENUE (NEW LINK ROAD TO AVON ROAD

1	SITE PREPARATION	0.96			0	551,180
2	HARD LANDSCAPING	2.89			0	1,656,884
3	SOFT LANDSCAPING	0.42			0	240,600
4	EXTERNAL SERVICES	1.64			0	941,500
	HOWARD AVENUE (NEW LINK ROAD TO AVON ROAD TOTAL					**3,390,164**

DEE WHY PARADE

1	SITE PREPARATION	0.62			0	351,610
2	HARD LANDSCAPING	1.35			0	772,637
3	SOFT LANDSCAPING	0.13			0	69,250
4	EXTERNAL SERVICES	1.68			0	962,500
	DEE WHY PARADE TOTAL					**2,155,997**

TRIANGLE PARK NORTH

1	SITE PREPARATION	0.25			0	138,253
2	HARD LANDSCAPING	0.76			0	435,110
3	SOFT LANDSCAPING	1.29			0	737,360
4	EXTERNAL SERVICES	0.76			0	434,000
	TRIANGLE PARK NORTH TOTAL					**1,744,723**

TRIANGLE PARK SOUTH

1	SOFT LANDSCAPING	2.19				1,252,968
	TRIANGLE PARK SOUTH TOTAL					**1,252,968**

WOOLWORTHS LANE

1	SITE PREPARATION	0.37			0	209,880
2	HARD LANDSCAPING	0.78			0	446,690
3	SOFT LANDSCAPING	0.06			0	31,900
4	EXTERNAL SERVICES	1.05			0	602,420
	WOOLWORTHS LANE TOTAL					**1,290,890**

Project: Dee Why Town Centre
Cost Plan: EST FINAL

Code	Description	% of Cost	Quantity	Unit	$/m2	Total
WALTER GORS PARK						*(Continued)*
1	SITE PREPARATION	0.91			0	518,644
2	HARD LANDSCAPING	1.26			0	721,822
3	SOFT LANDSCAPING	5.55			0	3,182,555
4	EXTERNAL SERVICES	2.22			0	1,271,000
	WALTER GORS PARK TOTAL					**5,694,021**
WALTER GORS PARK STORMWATER EASEMENT						
1	Allowance for drainage channel	0.53	1	item	300,000.00	300,000
	WALTER GORS PARK STORMWATER EASEMENT TOTAL					**300,000**
DRAINAGE CHANNEL						
1	Allowance for 3000 wide deck system for cyclists and pedestrians including balustrade to one side and structure to be cantilevered	0.95	90	m	6,000.00	540,000
2	Allowance for stormwater easement	0.35	1	item	200,000.00	200,000
3	Allowance for ligting to deck	0.13	1	item	70,000.00	70,000
	DRAINAGE CHANNEL TOTAL					**810,000**
BUILDERS PRELIMINARIES						
1	SPECIAL PROVISIONS	11.45				6,572,698
	BUILDERS PRELIMINARIES TOTAL				**0**	**6,572,698**
FEES						
1	CONSULTANT'S FEES	2.64	3	%	**0**	1,511,721
2	AUTHORITY FEES	0.88	1	%	**0**	503,907
	FEES TOTAL				**0**	**2,015,627**
CONTINGENCIES						
1	CONSTRUCTION CONTINGENCY	8.78	10	%	**0**	5,040,000
	CONTINGENCIES TOTAL				**0**	**5,040,000**

Project: Dee Why Town Centre
Cost Plan: EST FINAL

Code	Description	Quantity	Unit	$/m2	Total

PITTWATER ROAD NORTH (GATEWAY)

SITE PREPARATION

	DEMOLITION AND PREPATORY WORKS				
1	Remove existing asphalt to footpath	2,312	m2	25.00	57,800
2	Remove existing concrete base underneath asphalt footpath	2,312	m2	35.00	80,920
3	Demolish and remove existing pram ramps	30	m2	120.00	3,600
4	Demolish and remove gutter	687	m	50.00	34,350
5	Allow to remove traffic pole	30	no	1,000.00	30,000
6	Allow for capping-off / removing existing services	1	item		35,000
7	Allowance for working around existing services in footpaths	1	item		30,000
8	Make good grass verges	1	item		10,000
9	Remove trees	5	no	800	4,000
	Contamination Removal				
10	Allow for the removal and disposal of the asbestos materials from site by a registered contractor	168	t	500	84,000
	SITE PREPARATION TOTAL			0	369,670

HARD LANDSCAPING

	FOOTPATH AND FINISHES				
	Surface finishes				
1	Regrade subgrade to suit new levels	2,312	m2	17.00	39,304
2	110 reinforced concrete paving	2,312	m2	95.00	219,640
3	85 resin bonded porous paving to existing tree pits	23	m2	120.00	2,760
4	Allow for sealing pavers	2,312	m2	15.00	34,680
5	Allow for expansion joints	450	m	50.00	22,500
6	Allowance to reconstruct including adjusting levels to pram/kerb ramp pits	6	no	3,500.00	21,000
	Gutters				
7	200 wide kerb to suit profile of kerb	687	m	125.00	85,875
8	450 wide concrete gutter	687	m	110.00	75,570
	Miscellaneous Items				
9	Galvanised / steel edges to existing tree pits	45	m	50.00	2,250
10	Tactile indicators	36	m2	1,800.00	64,800
11	Allow to make good road marking	1	item	10,000.00	10,000
	SIGNAGE				
12	Allow for new signage including concrete footing and single pole	1	item	20,000.00	20,000
	LINEMARKING				

Code	Description	Quantity	Unit	$/m2	Total

PITTWATER ROAD NORTH (GATEWAY) *(Continued)*

HARD LANDSCAPING *(Continued)*

Code	Description	Quantity	Unit	$/m2	Total
13	Allow for line marking	1	item	8,000.00	8,000
	HARD LANDSCAPING TOTAL			0	606,379

SOFT LANDSCAPING

Code	Description	Quantity	Unit	$/m2	Total
	TREES				
1	Allowance for 200 litre trees	40	no	800.00	32,000
2	Allow garden beds in median	1	item	40,000.00	40,000
	BUS SHELTERS				
3	Allowance for 4000 long glazed bus shelter including seating	1	no	28,000.00	28,000
	FURNITURE				
4	Allowance for cycle racks	5	no	1,000.00	5,000
5	Allowance for bench seating	6	no	3,000.00	18,000
6	Allowance for bollards	10	no	1,650.00	16,500
	ART				
7	Allowance for street art	1	item	100,000.00	100,000
	SOFT LANDSCAPING TOTAL			0	239,500

EXTERNAL SERVICES

Code	Description	Quantity	Unit	$/m2	Total
	STORMWATER DRAINAGE				
1	Allow for stormwater pits	12	no	2,500	30,000
2	Allow for pipework including trenching	439	m	220	96,580
	WATER SUPPLY				
3	Allow for cold water supply including connection to existing	1	item	6,000	6,000
	ELECTRIC LIGHT AND POWER				
4	Allow for external mains, pits and main swichboard	1	item	150,000	150,000
5	Allow for service pit adjustments for paving installation	1	item	30,000	30,000
6	Allow for 12000 long multi function lighting poles	30	no	15,000	450,000
7	Allowance for traffic lights	1	no	200,000.00	200,000
8	Allowance to adjust existing levels of telecommunication & traffic signal	1	item	1,500.00	1,500
	EXTERNAL SERVICES TOTAL			0	964,080
	PITTWATER ROAD NORTH (GATEWAY) TOTAL				**2,179,629**

PITTWATER ROAD CENTRAL (INCLUDING TOWN CENTRE CROSSING)

Code	Description	Quantity	Unit	$/m2	Total

PITTWATER ROAD CENTRAL (INCLUDING TOWN CENTRE CROSSING) *(Continued)*

SITE PREPARATION *(Continued)*

	DEMOLITION AND PREPATORY WORKS				
1	Remove existing asphalt to footpath	3,531	m2	25.00	88,275
2	Remove existing concrete base underneath asphalt footpath	3,531	m2	35.00	123,585
3	Demolish and remove existing pram ramps	30	m2	120.00	3,600
4	Demolish and remove gutter	1,041	m	50.00	52,050
5	Allow to remove traffic pole	30	no	1,000.00	30,000
6	Allow for capping-off / removing existing services	1	item		35,000
7	Allowance for working around existing services in footpaths and roads	1	item		30,000
8	Remove trees	5	no	800	4,000
	Contamination Removal				
9	Allow for the removal and disposal of the asbestos materials from site by a registered contractor	256	t	500	128,000
	SITE PREPARATION TOTAL			0	494,510

HARD LANDSCAPING

	FOOTPATH AND FINISHES				
	Surface finishes				
1	Regrade subgrade to suit new levels	3,531	m2	17.00	60,027
2	110 reinforced concrete paving	3,531	m2	95.00	335,445
3	85 resin bonded porous paving to existing tree pits	23	m2	120.00	2,760
4	Allow for sealing pavers	3,531	m2	15.00	52,965
5	Allow for expansion joints	450	m	50.00	22,500
6	Allowance to reconstruct including adjusting levels to pram/kerb ramp pits	6	no	3,500.00	21,000
	Gutters				
7	200 wide kerb to suit profile of kerb	1,041	m	125.00	130,125
8	450 wide concrete gutter	1,041	m	110.00	114,510
9	Allowance for concrete median	132	m2	250.00	33,000
	Miscellaneous Items				
10	Galvanised / steel edges to existing tree pits	45	m	50.00	2,250
11	Tactile indicators	36	m2	1,800.00	64,800
12	Allow to make good road marking	1	item	10,000.00	10,000
	SIGNAGE				
13	Allow for new signage including concrete footing and single pole	1	item	20,000.00	20,000

Project: Dee Why Town Centre
Cost Plan: EST FINAL

Code	Description	Quantity	Unit	$/m2	Total

PITTWATER ROAD CENTRAL (INCLUDING TOWN CENTRE CROSSING) *(Continued)*

HARD LANDSCAPING *(Continued)*

Code	Description	Quantity	Unit	$/m2	Total
	LINEMARKING				
14	Allow for line marking	1	item	8,000.00	8,000
	HARD LANDSCAPING TOTAL			0	877,382

SOFT LANDSCAPING

Code	Description	Quantity	Unit	$/m2	Total
	TREES				
1	Allowance for 200 litre trees	20	no	800.00	16,000
2	Allow garden beds in median	1	item	40,000.00	40,000
	LANDSCAPE				
3	Allowance for landscaping to median	132	m2	60.00	7,920
	BUS SHELTERS				
4	Allowance for 8000 long glazed bus shelter including seating	1	no	68,000.00	68,000
	FURNITURE				
5	Allowance for cycle racks	15	no	1,000.00	15,000
6	Allowance for bench seating	6	no	3,000.00	18,000
7	Allowance for bollards	5	no	1,650.00	8,250
8	Allowance for drinking fountains	1	no	8,000.00	8,000
9	Allowance for water filling stations	3	no	2,000.00	6,000
	ART				
10	Allowance for street art	1	item	100,000.00	100,000
	SOFT LANDSCAPING TOTAL			0	287,170

EXTERNAL SERVICES

Code	Description	Quantity	Unit	$/m2	Total
	STORMWATER DRAINAGE				
1	Allow for stormwater pits	12	no	2,500	30,000
2	Allow for pipework including trenching	132	m	220	29,040
	SEWER DRAINAGE				
3	Allow for sewer pipework including connection to existing	1	item	80,000	80,000
	WATER SUPPLY				
4	Allow for cold water supply including connection to existing	1	item	5,000	5,000
	ELECTRIC LIGHT AND POWER				
5	Allow for uplighting to existing araucaria trees	1	item	5,000.00	5,000
6	Allow for service pit adjustments for paving installation	1	item	30,000	30,000
7	Allow for external mains, pits and main swichboard	1	item	150,000	150,000

W I L D E A N D W O O L L A R D

Project: Dee Why Town Centre
Cost Plan: EST FINAL

Code	Description	Quantity	Unit	$/m2	Total

PITTWATER ROAD CENTRAL (INCLUDING TOWN CENTRE CROSSING) *(Continued)*

EXTERNAL SERVICES *(Continued)*

Code	Description	Quantity	Unit	$/m2	Total
8	Allow for 12000 long multi function lighting poles	30	no	15,000	450,000
9	Allowance for traffic lights	1	no	200,000.00	200,000
10	Allowance to adjust existing levels of telecommunication & traffic signal	1	item	1,500.00	1,500
	EXTERNAL SERVICES TOTAL			0	980,540
	PITTWATER ROAD CENTRAL (INCLUDING TOWN CENTRE CROSSING) TOTAL				**2,639,602**

PITTWATER ROAD SOUTH (GATEWAY)

SITE PREPARATION

Code	Description	Quantity	Unit	$/m2	Total
	DEMOLITION AND PREPATORY WORKS				
1	Remove existing asphalt to footpath	817	m2	25.00	20,425
2	Remove existing concrete base underneath asphalt footpath	817	m2	35.00	28,595
3	Demolish and remove existing pram ramps	30	m2	120.00	3,600
4	Demolish and remove gutter	297	m	50.00	14,850
5	Allow to remove traffic pole	18	no	1,000.00	18,000
6	Allow for capping-off / removing existing services	1	item		15,000
7	Allowance for working around existing services in footpaths and roads	1	item		30,000
8	Make good grass verges	1	item		10,000
9	Remove trees	5	no	800	4,000
10	Allowance for Master Plan treatment	1	item	2,000,000.00	2,000,000
	Contamination Removal				
11	Allow for the removal and disposal of the asbestos materials from site by a registered contractor	60	t	500	30,000
	SITE PREPARATION TOTAL			0	2,174,470

HARD LANDSCAPING

Code	Description	Quantity	Unit	$/m2	Total
	FOOTPATH AND FINISHES				
	Surface finishes				
1	Regrade subgrade to suit new levels	454	m2	17.00	7,718
2	110 reinforced concrete paving	817	m2	95.00	77,615
3	85 resin bonded porous paving to existing tree pits	23	m2	120.00	2,760
4	Allow for sealing pavers	817	m2	15.00	12,255
5	Allow for expansion joints	200	m	50.00	10,000
6	Allowance to reconstruct including adjusting levels to pram/kerb ramp pits	6	no	3,500.00	21,000

Project: Dee Why Town Centre
Cost Plan: EST FINAL

Code	Description	Quantity	Unit	$/m2	Total

PITTWATER ROAD SOUTH (GATEWAY) *(Continued)*

HARD LANDSCAPING *(Continued)*

	Gutters				
7	200 wide kerb to suit profile of kerb	297	m	125.00	37,125
8	450 wide concrete gutter	297	m	110.00	32,670
9	Allowance for concrete median	162	m2	250.00	40,500
	Miscellaneous Items				
10	Galvanised / steel edges to existing tree pits	45	m	50.00	2,250
11	Tactile indicators	36	m2	1,800.00	64,800
12	Allow to make good road marking	1	item	10,000.00	10,000
	SIGNAGE				
13	Allow for new signage including concrete footing and single pole	1	item	20,000.00	20,000
	LINEMARKING				
14	Allow for line marking	1	item	8,000.00	8,000
	HARD LANDSCAPING TOTAL			0	346,693

SOFT LANDSCAPING

	TREES				
1	Allowance for 200 litre trees	10	no	800.00	8,000
2	Allow mature palms trees	5	no	10,000.00	50,000
3	Allow garden beds in median	1	item	40,000.00	40,000
	FURNITURE				
4	Allowance for cycle racks	5	no	1,000.00	5,000
5	Allowance for bench seating	4	no	3,000.00	12,000
6	Allowance for bollards	4	no	1,650.00	6,600
	ART				
7	Allowance for street art	1	item	120,000.00	120,000
	SOFT LANDSCAPING TOTAL			0	241,600

EXTERNAL SERVICES

	STORMWATER DRAINAGE				
1	Allow for stormwater pits	12	no	2,500	30,000
2	Allow for pipework including trenching	324	m	220	71,280
	SEWER DRAINAGE				
3	Allow for sewer pipework including connection to existing	1	item	80,000	80,000

Code	Description	Quantity	Unit	$/m2	Total

PITTWATER ROAD SOUTH (GATEWAY) *(Continued)*

EXTERNAL SERVICES *(Continued)*

	WATER SUPPLY				
4	Allow for cold water supply including connection to existing	1	item	5,000	5,000
	ELECTRIC LIGHT AND POWER				
5	Allow for external mains, pits and main swichboard	1	item	150,000	150,000
6	Allow for service pit adjustments for paving installation	1	item	30,000	30,000
7	Allow for 12000 long multi function lighting poles	20	no	15,000	300,000
8	Allowance for traffic lights	1	no	200,000.00	200,000
9	Allowance to adjust existing levels of telecommunication & traffic signal	1	item	1,500.00	1,500
	EXTERNAL SERVICES TOTAL			0	867,780
	PITTWATER ROAD SOUTH (GATEWAY) TOTAL				**3,630,543**

ST DAVIDS AVENUE POCKET PARK

SITE PREPARATION

1	Allowance for landscaping, site preparation and external sevices as required	1,953	m2	250.00	488,250
2	Allow new sandstone walls and edging	1	item	60,000.00	60,000
	SITE PREPARATION TOTAL			_	548,250

SOFT LANDSCAPING

	FURNITURE				
1	Allowance for cycle racks	5	no	1,000.00	5,000
2	Allowance for bench seating	6	no	3,000.00	18,000
3	Allowance for bollards	4	no	1,650.00	6,600
4	Allowance for drinking fountains	1	no	8,000.00	8,000
5	Allowance for water filling stations	3	no	2,000.00	6,000
	MAINTENANCE				
6	Allowance for maintenance and management costs	1	item	40,000.00	40,000
	ART				
7	Allowance for street art	1	item	120,000.00	120,000
	SOFT LANDSCAPING TOTAL			_	203,600
	ST DAVIDS AVENUE POCKET PARK TOTAL				**751,850**

FISHER ROAD STREETSCAPE

Project: Dee Why Town Centre
Cost Plan: EST FINAL

Code	Description	Quantity	Unit	$/m2	Total

FISHER ROAD STREETSCAPE *(Continued)*

SITE PREPARATION *(Continued)*

	DEMOLITION AND PREPATORY WORKS				
1	Remove existing asphalt to footpath	1,533	m2	25.00	38,325
2	Remove existing concrete base underneath asphalt footpath	1,533	m2	35.00	53,655
3	Demolish and remove existing pram ramps	10	m2	120.00	1,200
4	Demolish and remove gutter	409	m	50.00	20,450
5	Allow to remove traffic pole	15	no	1,000.00	15,000
6	Allow for capping-off / removing existing services	1	item		20,000
7	Allowance for working around existing services in footpaths and roads	1	item		15,000
8	Remove trees	2	no	800	1,600
9	Allowance for adjustment to existing carpark	1	item	30,000.00	30,000
	Contamination Removal				
10	Allow for the removal and disposal of the asbestos materials from site by a registered contractor	111	t	500	55,500
	SITE PREPARATION TOTAL			0	250,730

HARD LANDSCAPING

	FOOTPATH AND FINISHES				
	Surface finishes				
1	Regrade subgrade to suit new levels	1,533	m2	17.00	26,061
2	110 reinforced concrete paving	1,533	m2	95.00	145,635
3	85 resin bonded porous paving to existing tree pits	23	m2	120.00	2,760
4	Allow for sealing pavers	1,533	m2	15.00	22,995
5	Allow for expansion joints	400	m	50.00	20,000
6	Allowance to reconstruct including adjusting levels to pram/kerb ramp pits	5	no	3,500.00	17,500
	Gutters				
7	200 wide kerb to suit profile of kerb	409	m	125.00	51,125
8	450 wide concrete gutter	409	m	110.00	44,990
	Miscellaneous Items				
9	Galvanised / steel edges to existing tree pits	45	m	50.00	2,250
10	Tactile indicators	16	m2	1,800.00	28,800
11	Allow to make good road marking	1	item	10,000.00	10,000
	SIGNAGE				
12	Allow for new signage including concrete footing and single pole	1	item	20,000.00	20,000

Code	Description	Quantity	Unit	$/m2	Total

FISHER ROAD STREETSCAPE *(Continued)*

HARD LANDSCAPING *(Continued)*

	LINEMARKING				
13	Allow for line marking	1	item	8,000.00	8,000
	HARD LANDSCAPING TOTAL			0	400,116

SOFT LANDSCAPING

	TREES				
1	Allowance for 200 litre trees	15	no	800.00	12,000
	FURNITURE				
2	Allowance for cycle racks	2	no	1,000.00	2,000
3	Allowance for bench seating	3	no	3,000.00	9,000
4	Allowance for bollards	2	no	1,650.00	3,300
	SOFT LANDSCAPING TOTAL			0	26,300

EXTERNAL SERVICES

	STORMWATER DRAINAGE				
1	Allow for stormwater pits	18	no	2,500	45,000
2	Allow for pipework including trenching	409	m	220	89,980
	SEWER DRAINAGE				
3	Allow for sewer pipework including connection to existing	1	item	40,000	40,000
	WATER SUPPLY				
4	Allow for cold water supply including connection to existing	1	item	5,000	5,000
	ELECTRIC LIGHT AND POWER				
5	Allow for external mains, pits and main swichboard	1	item	95,000	95,000
6	Allow for service pit adjustments for paving installation	1	item	30,000	30,000
7	Allow for 9600 long multi function lighting poles	15	no	12,000	180,000
8	Allowance for traffic lights	1	no	200,000.00	200,000
9	Allowance to adjust existing levels of telecommunication & traffic signal	1	item	1,500.00	1,500
	EXTERNAL SERVICES TOTAL			0	686,480
	FISHER ROAD STREETSCAPE TOTAL				**1,363,626**

REDMAN POCKET PARK

SOFT LANDSCAPING

	ART				
1	Allowance for street art	1	item	80,000.00	80,000
	FURNITURE				

Project: Dee Why Town Centre
Cost Plan: EST FINAL

Code	Description	Quantity	Unit	$/m2	Total

REDMAN POCKET PARK *(Continued)*

SOFT LANDSCAPING *(Continued)*

Code	Description	Quantity	Unit	$/m2	Total
2	Allowance for cycle racks	5	no	1,000.00	5,000
3	Allowance for bench seating	6	no	3,000.00	18,000
4	Allowance for bollards	6	no	1,650.00	9,900
5	Allowance for drinking fountains	1	no	8,000.00	8,000
6	Allowance for water filling stations	3	no	2,000.00	6,000
	SIGNAGE				
7	Allow for new way finding & interpretative signage including concrete footing and single pole	1	item	20,000.00	20,000
	MAINTENANCE				
8	Allowance for maintenance and management costs	1	item	26,000.00	26,000
	LANDSCAPING				
9	Allowance for landscaping, site preparation and external sevices as required	2,000	m2	500.00	1,000,000
	SOFT LANDSCAPING TOTAL			-	1,172,900

SERVICES

Code	Description	Quantity	Unit	$/m2	Total
	SEWER DRAINAGE				
1	Allow for sewer pipework including connection to existing	1	item	35,000	35,000
	WATER SUPPLY				
2	Allowance for water feature	1	item	40,000.00	40,000
3	Allow for cold water supply including connection to existing	1	item	15,000	15,000
4	Allow for underground storage tanks for the irrigation system	1	item	35,000.00	35,000
	ELECTRIC LIGHT AND POWER				
5	Allow for external mains, pits and main swichboard	1	item	70,000	70,000
6	Allow for 7000 long multi function lighting poles	10	no	8,000	80,000
	STORMWATER DRAINAGE				
7	Allow for stormwater pits	5	no	2,500	12,500
8	Allow for pipework including trenching	50	m	220	11,000
9	Allow WSUD elements	1	item	50,000.00	50,000
	SERVICES TOTAL			-	348,500
	REDMAN POCKET PARK TOTAL				**1,521,400**

MOORAMBA ROAD POCKET PARK

Code	Description	Quantity	Unit	$/m2	Total

MOORAMBA ROAD POCKET PARK *(Continued)*

SOFT LANDSCAPING *(Continued)*

1	Allowance for landscaping, site preparation and external sevices as required		note		excl
	MAINTENANCE				
2	Allowance for maintenance and management costs		note		excl
	SOFT LANDSCAPING TOTAL			_	0
	MOORAMBA ROAD POCKET PARK TOTAL				**0**

MOORAMBA ROAD

SOFT LANDSCAPING

1	Allowance for landscaping, site preparation and external sevices as required	1,507	m2	250.00	376,750
	SOFT LANDSCAPING TOTAL			_	376,750
	MOORAMBA ROAD TOTAL				**376,750**

STURDEE PARADE

SITE PREPARATION

	DEMOLITION AND PREPATORY WORKS				
1	Remove existing asphalt to footpath	1,731	m2	25.00	43,275
2	Remove existing concrete base underneath asphalt footpath	1,731	m2	35.00	60,585
3	Demolish and remove existing pram ramps	20	m2	120.00	2,400
4	Demolish and remove gutter	912	m	50.00	45,600
5	Allow to remove traffic pole	40	no	1,000.00	40,000
6	Allow for capping-off / removing existing services	1	item		20,000
7	Allowance for working around existing services in footpaths and roads	1	item		15,000
8	Remove trees	1	no	800	800
	Contamination Removal				
9	Allow for the removal and disposal of the asbestos materials from site by a registered contractor	126	t	500	63,000
	SITE PREPARATION TOTAL			0	290,660

HARD LANDSCAPING

	FOOTPATH AND FINISHES				
	Surface finishes				
1	Regrade subgrade to suit new levels	1,731	m2	17.00	29,427
2	110 reinforced concrete base to paving areas	1,731	m2	95.00	164,445
3	Urbanstone precast paving including mortar base to pedestrian path	866	m2	120.00	103,920
4	85 resin bonded porous paving to existing tree pits	51	m2	120.00	6,120

Code	Description	Quantity	Unit	$/m2	Total

STURDEE PARADE *(Continued)*

HARD LANDSCAPING *(Continued)*

5	Allow for sealing pavers	1,731	m2	15.00	25,965
6	Allow for expansion joints	1,200	m	50.00	60,000
7	Allowance to reconstruct including adjusting levels to pram/kerb ramp pits	9	no	3,500.00	31,500
	Gutters				
8	200 wide kerb to suit profile of kerb	912	m	125.00	114,000
9	450 wide concrete gutter	912	m	110.00	100,320
	Miscellaneous Items				
10	Galvanised / steel edges to existing tree pits	30	m	50.00	1,500
11	Tactile indicators	36	m2	1,800.00	64,800
12	Allow to make good road marking	1	item	10,000.00	10,000
	SIGNAGE				
13	Allow for new signage including concrete footing and single pole	1	item	20,000.00	20,000
	LINEMARKING				
14	Allow for line marking	1	item	8,000.00	8,000
	HARD LANDSCAPING TOTAL			0	739,997

SOFT LANDSCAPING

	FURNITURE				
1	Allowance for cycle racks	2	no	1,000.00	2,000
2	Allowance for bench seating	3	no	3,000.00	9,000
3	Allowance for bollards	2	no	1,650.00	3,300
	SOFT LANDSCAPING TOTAL			0	14,300

EXTERNAL SERVICES

	STORMWATER DRAINAGE				
1	Allow for stormwater pits	18	no	2,500	45,000
2	Allow for pipework including trenching	857	m	220	188,540
	WATER SUPPLY				
3	Allow for cold water supply including connection to existing	1	item	60,000	60,000
	ELECTRIC LIGHT AND POWER				
4	Allow for external mains, pits and main swichboard	1	item	90,000	90,000
5	Allow for service pit adjustments for paving installation	1	item	15,000	15,000
6	Allow for 9600 long multi function lighting poles	40	no	10,000	400,000
7	Allowance for traffic lights	1	no	200,000.00	200,000

Project: Dee Why Town Centre
Cost Plan: EST FINAL

Code	Description	Quantity	Unit	$/m2	Total

STURDEE PARADE *(Continued)*

EXTERNAL SERVICES *(Continued)*

Code	Description	Quantity	Unit	$/m2	Total
8	Allowance to adjust existing levels of telecommunication & traffic signal	1	item	1,500.00	1,500
	EXTERNAL SERVICES TOTAL			0	1,000,040
	STURDEE PARADE TOTAL				**2,044,997**

PACIFIC PARADE

SITE PREPARATION

Code	Description	Quantity	Unit	$/m2	Total
	DEMOLITION AND PREPATORY WORKS				
1	Remove existing asphalt to footpath	2,572	m2	25.00	64,300
2	Remove existing concrete base underneath asphalt footpath	2,572	m2	35.00	90,020
3	Demolish and remove existing pram ramps	20	m2	120.00	2,400
4	Demolish and remove gutter	648	m	50.00	32,400
5	Allow to remove traffic pole	40	no	1,000.00	40,000
6	Allow for capping-off / removing existing services	1	item		20,000
7	Allowance for working around existing services in footpaths and roads	1	item		15,000
8	Remove trees	1	no	800	800
	Contamination Removal				
9	Allow for the removal and disposal of the asbestos materials from site by a registered contractor	186	t	500	93,000
	SITE PREPARATION TOTAL			0	357,920

HARD LANDSCAPING

Code	Description	Quantity	Unit	$/m2	Total
	FOOTPATH AND FINISHES				
	Surface finishes				
1	Regrade subgrade to suit new levels	2,572	m2	17.00	43,724
2	110 reinforced concrete base to paving areas	2,572	m2	95.00	244,340
3	Urbanstone precast paving including mortar base to pedestrian path	1,286	m2	120.00	154,320
4	85 resin bonded porous paving to existing tree pits	51	m2	120.00	6,120
5	Allow for sealing pavers	2,572	m2	15.00	38,580
6	Allow for expansion joints	1,200	m	50.00	60,000
7	Allowance to reconstruct including adjusting levels to pram/kerb ramp pits	9	no	3,500.00	31,500
	Gutters				
8	200 wide kerb to suit profile of kerb	648	m	125.00	81,000
9	450 wide concrete gutter	648	m	110.00	71,280
	Miscellaneous Items				

Code	Description	Quantity	Unit	$/m2	Total

PACIFIC PARADE *(Continued)*

HARD LANDSCAPING *(Continued)*

10	Galvanised / steel edges to existing tree pits	102	m	50.00	5,100
11	Tactile indicators	36	m2	1,800.00	64,800
12	Allow to make good road marking	1	item	10,000.00	10,000
	SIGNAGE				
13	Allow for new signage including concrete footing and single pole	1	item	20,000.00	20,000
	LINEMARKING				
14	Allow for line marking	1	item	8,000.00	8,000
	HARD LANDSCAPING TOTAL			0	838,764

SOFT LANDSCAPING

	TREES				
1	Allowance for 200 litre trees	34	no	800.00	27,200
	FURNITURE				
2	Allowance for cycle racks	5	no	1,000.00	5,000
3	Allowance for bench seating	3	no	3,000.00	9,000
4	Allowance for bollards	2	no	16,350.00	32,700
	SOFT LANDSCAPING TOTAL			0	73,900

EXTERNAL SERVICES

	STORMWATER DRAINAGE				
1	Allow for stormwater pits	18	no	2,500	45,000
2	Allow for pipework including trenching	581	m	220	127,820
	WATER SUPPLY				
3	Allow for cold water supply including connection to existing	1	item	5,000	5,000
	ELECTRIC LIGHT AND POWER				
4	Allow for external mains, pits and main swichboard	1	item	90,000	90,000
5	Allow for service pit adjustments for paving installation	1	item	30,000	30,000
6	Allow for 9600 long multi function lighting poles	36	no	12,000	432,000
7	Allowance for traffic lights	1	no	200,000.00	200,000
8	Allowance to adjust existing levels of telecommunication & traffic signal	1	item	1,500.00	1,500
	EXTERNAL SERVICES TOTAL			0	931,320
	PACIFIC PARADE TOTAL				**2,201,904**

OAKS AVENUE (PITTWATER ROAD TO NEW LINK ROAD)

Code	Description	Quantity	Unit	$/m2	Total

OAKS AVENUE (PITTWATER ROAD TO NEW LINK ROAD) *(Continued)*

SITE PREPARATION *(Continued)*

	DEMOLITION AND PREPATORY WORKS				
1	Remove existing asphalt to footpath	1,739	m2	25.00	43,475
2	Remove existing concrete base underneath asphalt footpath	1,739	m2	35.00	60,865
3	Demolish and remove existing pram ramps	20	m2	120.00	2,400
4	Demolish and remove gutter	406	m	50.00	20,300
5	Allow to remove traffic pole	30	no	1,000.00	30,000
6	Allow for capping-off / removing existing services	1	item		20,000
7	Allowance for working around existing services in footpaths and roads	1	item		15,000
8	Remove trees	3	no	800	2,400
	Contaminated Removal				
9	Allow for the removal and disposal of the asbestos materials from site by a registered contractor	126	t	500	63,000
	SITE PREPARATION TOTAL			0	257,440

HARD LANDSCAPING

	FOOTPATH AND FINISHES				
	Surface finishes				
1	Regrade subgrade to suit new levels	1,739	m2	17.00	29,563
2	110 reinforced concrete base to paving areas	1,739	m2	95.00	165,205
3	Urbanstone precast paving including mortar base to pedestrian path	870	m2	120.00	104,400
4	85 resin bonded porous paving to existing tree pits	17	m2	120.00	2,040
5	Allow for sealing pavers	1,739	m2	15.00	26,085
6	Allow for expansion joints	1,200	m	50.00	60,000
7	Allowance to reconstruct including adjusting levels to pram/kerb ramp pits	6	no	3,500.00	21,000
	Gutters				
8	200 wide kerb to suit profile of kerb	406	m	125.00	50,750
9	450 wide concrete gutter	406	m	110.00	44,660
10	Allowance for concrete median	176	m2	250.00	44,000
	Miscellaneous Items				
11	Galvanised / steel edges to existing tree pits	33	m	50.00	1,650
12	Tactile indicators	36	m2	1,800.00	64,800
13	Allow to make good road marking	1	item	10,000.00	10,000
	SIGNAGE				

Code	Description	Quantity	Unit	$/m2	Total

OAKS AVENUE (PITTWATER ROAD TO NEW LINK ROAD) *(Continued)*

HARD LANDSCAPING *(Continued)*

Code	Description	Quantity	Unit	$/m2	Total
14	Allow for new signage including concrete footing and single pole	1	item	20,000.00	20,000
	LINEMARKING				
15	Allow for line marking	1	item	8,000.00	8,000
	HARD LANDSCAPING TOTAL			0	652,153

SOFT LANDSCAPING

Code	Description	Quantity	Unit	$/m2	Total
	TREES				
1	Allowance for 200 litre trees	20	no	800.00	16,000
	BUS SHELTERS				
2	Allowance for 8000 long glazed bus shelter including seating	1	no	68,000.00	68,000
	ART				
3	Allowance for art street furnishings	1	item	100,000.00	100,000
	FURNITURE				
4	Allowance for cycle racks	10	no	1,000.00	10,000
5	Allowance for bench seating	6	no	3,000.00	18,000
6	Allowance for bollards	5	no	1,650.00	8,250
7	Allowance for drinking fountains	1	no	8,000.00	8,000
8	Allowance for water filling stations	2	no	2,000.00	4,000
9	Allow bins	8	no	1,000.00	8,000
	SOFT LANDSCAPING TOTAL			0	240,250

EXTERNAL SERVICES

Code	Description	Quantity	Unit	$/m2	Total
	STORMWATER DRAINAGE				
1	Allow for stormwater pits	12	no	2,500	30,000
2	Allow for pipework including trenching	500	m	220	110,000
	SEWER DRAINAGE				
3	Allow for sewer pipework including connection to existing	1	item	80,000	80,000
	WATER SUPPLY				
4	Allow for cold water supply including connection to existing	1	item	5,000	5,000
	ELECTRIC LIGHT AND POWER				
5	Allow for external mains, pits and main swichboard	1	item	150,000	150,000
6	Allow for service pit adjustments for paving installation	1	item	30,000	30,000
7	Allow for 9600 long multi function lighting poles	30	no	12,000	360,000
8	Allowance for traffic lights	1	no	200,000.00	200,000

Project: Dee Why Town Centre
Cost Plan: EST FINAL

Code	Description	Quantity	Unit	$/m2	Total

OAKS AVENUE (PITTWATER ROAD TO NEW LINK ROAD) *(Continued)*

EXTERNAL SERVICES *(Continued)*

Code	Description	Quantity	Unit	$/m2	Total
9	Allowance to adjust existing levels of telecommunication & traffic signal	1	item	1,500.00	1,500
	EXTERNAL SERVICES TOTAL			0	966,500
	OAKS AVENUE (PITTWATER ROAD TO NEW LINK ROAD) TOTAL				**2,116,343**

OAKS AVENUE (NEW LINK ROAD TO AVON ROAD)

SITE PREPARATION

Code	Description	Quantity	Unit	$/m2	Total
	DEMOLITION AND PREPATORY WORKS				
1	Remove existing asphalt to road	4,566	m2	25.00	114,150
2	Remove existing asphalt to footpath	3,079	m2	25.00	76,975
3	Remove existing concrete base underneath asphalt footpath & road	7,645	m2	35.00	267,575
4	Demolish and remove existing pram ramps	30	m2	120.00	3,600
5	Demolish and remove existing concrete kerb	827	m	55.00	45,485
6	Demolish and remove gutter	827	m	50.00	41,350
7	Allow to remove traffic pole	40	no	1,000.00	40,000
8	Allow for capping-off / removing existing services	1	item		35,000
9	Allowance for working around existing services in footpaths and roads	1	item		30,000
10	Remove trees	50	no	800	40,000
	Contaminated Removal				
11	Allow for the removal and disposal of the asbestos materials from site by a registered contractor	331	t	500	165,500
	SITE PREPARATION TOTAL			0	859,635

HARD LANDSCAPING

Code	Description	Quantity	Unit	$/m2	Total
	FOOTPATH AND FINISHES				
	Surface finishes				
1	Regrade subgrade to suit new levels	7,645	m2	17.00	129,965
2	110 reinforced concrete paving	3,079	m2	95.00	292,505
3	200 reinforced concrete base to vehicular paved areas	4,566	m2	125.00	570,750
4	Asphalt paving to road		m2	75.00	0
5	Allow for sealing pavers	3,079	m2	15.00	46,185
6	Allow for expansion joints	1,200	m	50.00	60,000
7	Allowance to reconstruct including adjusting levels to pram/kerb ramp pits	6	no	3,500.00	21,000
8	Allow for adjustment to private property to achieve design levels	1	item	150,000.00	150,000

WILDE AND WOOLLARD

Project: Dee Why Town Centre
Cost Plan: EST FINAL

Code	Description	Quantity	Unit	$/m2	Total

OAKS AVENUE (NEW LINK ROAD TO AVON ROAD) *(Continued)*

HARD LANDSCAPING *(Continued)*

	Kerbs & Gutters				
9	200 wide kerb to suit profile of kerb	827	m	125.00	103,375
10	450 wide concrete gutter	827	m	110.00	90,970
11	Allowance for concrete median	382	m2	250.00	95,500
	Miscellaneous Items				
12	Galvanised / steel edges to existing tree pits	102	m	50.00	5,100
13	Tactile indicators	36	m2	1,800.00	64,800
14	Allow to make good road marking	1	item	10,000.00	10,000
	SIGNAGE				
15	Allow for new signage including concrete footing and single pole	1	item	20,000.00	20,000
	LINEMARKING				
16	Allow for line marking	1	item	8,000.00	8,000
	HARD LANDSCAPING TOTAL			0	1,668,150

SOFT LANDSCAPING

	TREES				
1	Allowance for 200 trees	34	no	800.00	27,200
2	Allow for 1000 wide planted garden bed to both sides	1,564	m2	60.00	93,840
	BUS SHELTERS				
3	Allowance for 4000 long glazed bus shelter including seating	1	no	28,000.00	28,000
	FURNITURE				
4	Allowance for cycle racks	3	no	1,000.00	3,000
5	Allowance for bench seating	2	no	3,000.00	6,000
6	Allowance for bollards	2	no	1,650.00	3,300
7	Allowance for drinking fountains	1	no	8,000.00	8,000
8	Allowance for water filling stations	1	no	2,000.00	2,000
	SOFT LANDSCAPING TOTAL			0	171,340

EXTERNAL SERVICES

	STORMWATER DRAINAGE				
1	Allow for stormwater pits	12	no	2,500	30,000
2	Allow for pipework including trenching	782	m	220	172,040
	SEWER DRAINAGE				
3	Allow for sewer pipework including connection to existing	1	item	80,000	80,000

Code	Description	Quantity	Unit	$/m2	Total

OAKS AVENUE (NEW LINK ROAD TO AVON ROAD) *(Continued)*

EXTERNAL SERVICES *(Continued)*

	WATER SUPPLY				
4	Allow for cold water supply including connection to existing	1	item	5,000	5,000
	ELECTRIC LIGHT AND POWER				
5	Allow for external mains, pits and main swichboard	1	item	90,000	90,000
6	Allow for service pit adjustments for paving installation	1	item	30,000	30,000
7	Allow for 9600 long multi function lighting poles	40	no	12,000	480,000
8	Allowance for traffic lights	1	no	200,000.00	200,000
9	Allowance to adjust existing levels of telecommunication & traffic signal	1	item	1,500.00	1,500
	EXTERNAL SERVICES TOTAL			0	1,088,540
	OAKS AVENUE (NEW LINK ROAD TO AVON ROAD) TOTAL				**3,787,665**

NEW LINK ROAD

SITE PREPARATION

	DEMOLITION AND PREPATORY WORKS				
1	Remove existing asphalt to road	1,161	m2	25.00	29,025
2	Remove existing asphalt to footpath	814	m2	25.00	20,350
3	Remove existing concrete base underneath asphalt footpath & road	1,974	m2	35.00	69,090
4	Allow to remove traffic pole	15	no	1,000.00	15,000
5	Allow for capping-off / removing existing services	1	item		20,000
6	Allowance for working around existing services in footpaths and roads	1	item		15,000
7	Remove trees	25	no	800	20,000
8	Allowance for adjustment to existing carpark	1	item	30,000.00	30,000
	Contaminated Removal				
9	Allow for the removal and disposal of the asbestos materials from site by a registered contractor	84	t	500	42,000
	SITE PREPARATION TOTAL			0	260,465

HARD LANDSCAPING

	FOOTPATH AND FINISHES				
	Surface finishes				
1	Regrade subgrade to suit new levels	1,974	m2	17.00	33,558
2	110 reinforced concrete base to paving areas	814	m2	95.00	77,330
3	200 reinforced concrete base to vehicular paved areas	1,161	m2	125.00	145,125

Code	Description	Quantity	Unit	$/m2	Total

NEW LINK ROAD *(Continued)*

HARD LANDSCAPING *(Continued)*

4	Urbanstone precast paving including mortar base to pedestrian path	814	m2	180.00	146,520
5	Asphalt paving to road	1,161	m2	75.00	87,075
6	85 resin bonded porous paving to existing tree pits	3	m2	120.00	360
7	Allow for sealing pavers	814	m2	15.00	12,210
8	Allow for expansion joints	400	m	50.00	20,000
9	Allowance to reconstruct including adjusting levels to pram/kerb ramp pits	5	no	3,500.00	17,500
	Kerbs & Gutters				
10	200 wide kerb to suit profile of kerb	252	m	125.00	31,500
11	450 wide concrete gutter	252	m	110.00	27,720
	Miscellaneous Items				
12	Galvanised / steel edges to existing tree pits	6	m	50.00	300
13	Tactile indicators	16	m2	1,800.00	28,800
14	Allow to make good road marking	1	item	10,000.00	10,000
	SIGNAGE				
15	Allow for new signage including concrete footing and single pole	1	item	20,000.00	20,000
	LINEMARKING				
16	Allow for line marking	1	item	8,000.00	8,000
	HARD LANDSCAPING TOTAL			0	665,998

SOFT LANDSCAPING

	LANDSCAPE				
1	Allowance for 200 trees	12	no	800.00	9,600
2	Allowance for landscaping	193	m2	60.00	11,580
	FURNITURE				
3	Allowance for cycle racks	2	no	1,000.00	2,000
4	Allowance for bench seating	3	no	3,000.00	9,000
5	Allowance for bollards	2	no	1,650.00	3,300
6	Allowance for drinking fountains	1	no	8,000.00	8,000
7	Allowance for water filling stations	1	no	2,000.00	2,000
	SOFT LANDSCAPING TOTAL			0	45,480

EXTERNAL SERVICES

	STORMWATER DRAINAGE				
1	Allow for stormwater pits	18	no	2,500	45,000

Project: Dee Why Town Centre
Cost Plan: EST FINAL

Code	Description	Quantity	Unit	$/m2	Total

NEW LINK ROAD *(Continued)*

EXTERNAL SERVICES *(Continued)*

2	Allow for pipework including trenching	196	m	220	43,120
	SEWER DRAINAGE				
3	Allow for sewer pipework including connection to existing	1	item	40,000	40,000
	WATER SUPPLY				
4	Allow for cold water supply including connection to existing	1	item	5,000	5,000
	ELECTRIC LIGHT AND POWER				
5	Allow for external mains, pits and main swichboard	1	item	95,000	95,000
6	Allow for 9600 long multi function lighting poles	15	no	12,000	180,000
7	Allowance for traffic lights	1	no	200,000.00	200,000
8	Allowance to adjust existing levels of telecommunication & traffic signal	1	item	1,500.00	1,500

EXTERNAL SERVICES TOTAL 0 609,620

NEW LINK ROAD TOTAL 1,581,563

HOWARD AVENUE (PITTWATER ROAD TO NEW LINK ROAD)

SITE PREPARATION

	DEMOLITION AND PREPATORY WORKS				
1	Remove existing asphalt to road	2,557	m2	25.00	63,925
2	Remove existing asphalt to footpath	2,130	m2	25.00	53,250
3	Remove existing concrete base underneath asphalt footpath & road	4,686	m2	35.00	164,010
4	Allow to remove traffic pole	35	no	1,000.00	35,000
5	Allow for capping-off / removing existing services	1	item		20,000
6	Allowance for working around existing services in footpaths and roads	1	item		15,000
7	Remove trees	15	no	800	12,000
	Contaminated Removal				
8	Allow for the removal and disposal of the asbestos materials from site by a registered contractor	1	item		50,000

SITE PREPARATION TOTAL 0 413,185

HARD LANDSCAPING

	FOOTPATH AND FINISHES				
	Surface finishes				
1	Regrade subgrade to suit new levels	4,686	m2	17.00	79,662
2	110 reinforced concrete base to paving areas	2,130	m2	95.00	202,350
3	200 reinforced concrete base to vehicular paved areas	2,557	m2	125.00	319,625

Project: Dee Why Town Centre
Cost Plan: EST FINAL

Cod e	Description	Quantity	Unit	$/m2	Total

HOWARD AVENUE (PITTWATER ROAD TO NEW LINK ROAD) *(Continued)*

HARD LANDSCAPING *(Continued)*

4	Urbanstone precast paving including mortar base to pedestrian path	1,065	m2	120.00	127,800
5	Asphalt paving to road	2,557	m2	75.00	191,775
6	85 resin bonded porous paving to existing tree pits	23	m2	120.00	2,760
7	Allow for sealing pavers	2,130	m2	15.00	31,950
8	Allow for expansion joints	1,200	m	50.00	60,000
9	Allowance to reconstruct including adjusting levels to pram/kerb ramp pits	9	no	3,500.00	31,500
	Kerbs & Gutters				
10	200 wide kerb to suit profile of kerb	967	m	125.00	120,875
11	450 wide concrete gutter	967	m	110.00	106,370
	Miscellaneous Items				
12	Galvanised / steel edges to existing tree pits	45	m	50.00	2,250
13	Tactile indicators	36	m2	1,800.00	64,800
14	Allow to make good road marking	1	item	10,000.00	10,000
	SIGNAGE				
15	Allow for new signage including concrete footing and single pole	1	item	20,000.00	20,000
	LINEMARKING				
16	Allow for line marking	1	item	8,000.00	8,000
	HARD LANDSCAPING TOTAL			0	1,379,717

SOFT LANDSCAPING

	TREES				
1	Allowance for 200 litre trees	15	no	800.00	12,000
	BUS SHELTERS				
2	Allowance for 8000 long glazed bus shelter including seating	1	no	68,000.00	68,000
3	Allowance for 4000 long glazed bus shelter including seating	1	no	28,000.00	28,000
	ART				
4	Allowance for art street furnishings	1	item	100,000.00	100,000
	FURNITURE				
5	Allowance for cycle racks	2	no	1,000.00	2,000
6	Allowance for bench seating	3	no	3,000.00	9,000
7	Allowance for bollards	3	no	1,650.00	4,950

Code	Description	Quantity	Unit	$/m2	Total

HOWARD AVENUE (PITTWATER ROAD TO NEW LINK ROAD) *(Continued)*

SOFT LANDSCAPING *(Continued)*

8	Allowance for drinking fountains	1	no	8,000.00	8,000
9	Allowance for water filling stations	1	no	2,000.00	2,000
	SOFT LANDSCAPING TOTAL			0	233,950

EXTERNAL SERVICES

	STORMWATER DRAINAGE				
1	Allow for stormwater pits	18	no	2,500	45,000
2	Allow for pipework including trenching	500	m	220	110,000
	SEWER DRAINAGE				
3	Allow for sewer pipework including connection to existing	1	item	80,000	80,000
	WATER SUPPLY				
4	Allow for cold water supply including connection to existing	1	item	5,000	5,000
	ELECTRIC LIGHT AND POWER				
5	Allow for external mains, pits and main swichboard	1	item	95,000	95,000
6	Allow for 9600 long multi function lighting poles	35	no	12,000	420,000
7	Allowance for traffic lights	1	no	200,000.00	200,000
8	Allowance to adjust existing levels of telecommunication & traffic signal	1	item	1,500.00	1,500
	EXTERNAL SERVICES TOTAL			0	956,500
	HOWARD AVENUE (PITTWATER ROAD TO NEW LINK ROAD) TOTAL				**2,983,352**

HOWARD AVENUE (NEW LINK ROAD TO AVON ROAD

SITE PREPARATION

	DEMOLITION AND PREPATORY WORKS				
1	Remove existing asphalt to road	3,512	m2	25.00	87,800
2	Remove existing asphalt to footpath	1,195	m2	25.00	29,875
3	Remove existing concrete base underneath asphalt footpath & road	4,707	m2	35.00	164,745
4	Demolish and remove existing pram ramps	20	m2	120.00	2,400
5	Demolish and remove existing concrete kerb	512	m	55.00	28,160
6	Demolish and remove gutter	512	m	50.00	25,600
7	Allow to remove traffic pole	25	no	1,000.00	25,000
8	Allow for capping-off / removing existing services	1	item		20,000
9	Allowance for working around existing services in footpaths and roads	1	item		15,000
10	Remove trees	32	no	800	25,600

Project: Dee Why Town Centre
Cost Plan: EST FINAL

Code	Description	Quantity	Unit	$/m2	Total

HOWARD AVENUE (NEW LINK ROAD TO AVON ROAD *(Continued)*

SITE PREPARATION *(Continued)*

Code	Description	Quantity	Unit	$/m2	Total
	Contaminated Removal				
11	Allow for the removal and disposal of the asbestos materials from site by a registered contractor	254	t	500	127,000
	SITE PREPARATION TOTAL			0	551,180

HARD LANDSCAPING

Code	Description	Quantity	Unit	$/m2	Total
	FOOTPATH AND FINISHES				
	Surface finishes				
1	Regrade subgrade to suit new levels	4,707	m2	17.00	80,019
2	110 reinforced concrete base to paving areas	1,195	m2	95.00	113,525
3	200 reinforced concrete base to vehicular paved areas	3,512	m2	125.00	439,000
4	Urbanstone precast paving including mortar base to pedestrian path	1,195	m2	120.00	143,400
5	Asphalt paving to road	3,512	m2	75.00	263,400
6	85 resin bonded porous paving to existing tree pits	23	m2	120.00	2,760
7	Allow for sealing pavers	1,195	m2	15.00	17,925
8	Allow for expansion joints	700	m	50.00	35,000
9	Allow to adjust private property boundaries to suit new levels	1	item	150,000.00	150,000
10	Allowance to reconstruct including adjusting levels to pram/kerb ramp pits	9	no	3,500.00	31,500
	Kerbs & Gutters				
11	200 wide kerb to suit profile of kerb	963	m	125.00	120,375
12	450 wide concrete gutter	963	m	110.00	105,930
13	Allowance for concrete median	216	m2	250.00	54,000
	Miscellaneous Items				
14	Galvanised / steel edges to existing tree pits	45	m	50.00	2,250
15	Tactile indicators	36	m2	1,800.00	64,800
16	Allow to make good road marking	1	item	10,000.00	10,000
	SIGNAGE				
17	Allow for new signage including concrete footing and single pole	1	item	15,000.00	15,000
	LINEMARKING				
18	Allow for line marking	1	item	8,000.00	8,000
	HARD LANDSCAPING TOTAL			0	1,656,884

SOFT LANDSCAPING

Code	Description	Quantity	Unit	$/m2	Total
	TREES				

Project: Dee Why Town Centre
Cost Plan: EST FINAL

Code	Description	Quantity	Unit	$/m2	Total

HOWARD AVENUE (NEW LINK ROAD TO AVON ROAD *(Continued)*

SOFT LANDSCAPING *(Continued)*

1	Allowance for 200 litre trees	25	no	800.00	20,000
	LANDSCAPE				
2	Allowance for landscaping	1	item	50,000.00	50,000
	BUS SHELTERS				
3	Allowance for 4000 long glazed bus shelter including seating	1	no	28,000.00	28,000
	FURNITURE				
4	Allowance for cycle racks	10	no	1,000.00	10,000
5	Allowance for bench seating	3	no	3,000.00	9,000
6	Allowance for bollards	4	no	1,650.00	6,600
7	Allowance for drinking fountains	2	no	2,500.00	5,000
8	Allowance for water filling stations	2	no	2,000.00	4,000
9	Allowance for bins	8	no	1,000.00	8,000
	ART				
10	Allowance for art street furnishings	1	item	100,000.00	100,000
	SOFT LANDSCAPING TOTAL			0	240,600

EXTERNAL SERVICES

	STORMWATER DRAINAGE				
1	Allow for stormwater pits	20	no	2,500	50,000
2	Allow for pipework including trenching	500	m	220	110,000
	SEWER DRAINAGE				
3	Allow for sewer pipework including connection to existing	1	item	80,000	80,000
	WATER SUPPLY				
4	Allow for cold water supply including connection to existing	1	item	5,000	5,000
	ELECTRIC LIGHT AND POWER				
5	Allow for external mains, pits and main swichboard	1	item	150,000	150,000
6	Allow for service pit adjustments for paving installation	1	item	30,000	30,000
7	Allow for 7000 long multi function lighting poles	35	no	9,000	315,000
8	Allowance for traffic lights	1	no	200,000.00	200,000
9	Allowance to adjust existing levels of telecommunication & traffic signal	1	item	1,500.00	1,500
	EXTERNAL SERVICES TOTAL			0	941,500
	HOWARD AVENUE (NEW LINK ROAD TO AVON ROAD TOTAL				**3,390,164**

WILDE AND WOOLLARD

Project: Dee Why Town Centre
Cost Plan: EST FINAL

Code	Description	Quantity	Unit	$/m2	Total

DEE WHY PARADE *(Continued)*

SITE PREPARATION

	DEMOLITION AND PREPATORY WORKS				
1	Remove existing asphalt to footpath	2,601	m2	25.00	65,025
2	Remove existing concrete base underneath asphalt footpath	2,601	m2	35.00	91,035
3	Demolish and remove existing pram ramps	20	m2	120.00	2,400
4	Demolish and remove gutter	557	m	50.00	27,850
5	Allow to remove traffic pole	35	no	1,000.00	35,000
6	Allow for capping-off / removing existing services	1	item		20,000
7	Allowance for working around existing services in footpaths and roads	1	item		15,000
8	Remove trees	1	no	800	800
	Contaminated Removal				
9	Allow for the removal and disposal of the asbestos materials from site by a registered contractor	189	t	500	94,500
	SITE PREPARATION TOTAL			0	351,610

HARD LANDSCAPING

	FOOTPATH AND FINISHES				
	Surface finishes				
1	Regrade subgrade to suit new levels	2,601	m2	17.00	44,217
2	110 reinforced concrete base to paving areas	2,601	m2	95.00	247,095
3	Urbanstone precast paving including mortar base to pedestrian path	1,301	m2	120.00	156,120
4	85 resin bonded porous paving to existing tree pits	23	m2	120.00	2,760
5	Allow for sealing pavers		m2	15.00	0
6	Allow for expansion joints	1,200	m	50.00	60,000
7	Allowance to reconstruct including adjusting levels to pram/kerb ramp pits	9	no	3,500.00	31,500
	Gutters				
8	200 wide kerb to suit profile of kerb	557	m	125.00	69,625
9	450 wide concrete gutter	557	m	110.00	61,270
	Miscellaneous Items				
10	Galvanised / steel edges to existing tree pits	45	m	50.00	2,250
11	Tactile indicators	36	m2	1,800.00	64,800
12	Allow to make good road marking	1	item	10,000.00	10,000
	SIGNAGE				
13	Allow for new signage including concrete footing and single pole	1	item	15,000.00	15,000

Project: Dee Why Town Centre
Cost Plan: EST FINAL

Code	Description	Quantity	Unit	$/m2	Total

DEE WHY PARADE *(Continued)*

HARD LANDSCAPING *(Continued)*

	LINEMARKING				
14	Allow for line marking	1	item	8,000.00	8,000
	HARD LANDSCAPING TOTAL			0	772,637

SOFT LANDSCAPING

	FURNITURE				
1	Allowance for cycle racks	2	no	1,000.00	2,000
2	Allowance for bench seating	3	no	3,000.00	9,000
3	Allowance for bollards	5	no	1,650.00	8,250
	ART				
4	Allowance for street art	1	item	50,000.00	50,000
	SOFT LANDSCAPING TOTAL			0	69,250

EXTERNAL SERVICES

	STORMWATER DRAINAGE				
1	Allow for stormwater pits	18	no	2,500	45,000
2	Allow for pipework including trenching	500	m	220	110,000
	WATER SUPPLY				
3	Allow for cold water supply including connection to existing	1	item	60,000	60,000
	ELECTRIC LIGHT AND POWER				
4	Allow for external mains, pits and main swichboard	1	item	96,000	96,000
5	Allow for service pit adjustments for paving installation	1	item	30,000	30,000
6	Allow for 9600 long multi function lighting poles	35	no	12,000	420,000
7	Allowance for traffic lights	1	no	200,000.00	200,000
8	Allowance to adjust existing levels of telecommunication & traffic signal	1	item	1,500.00	1,500
	EXTERNAL SERVICES TOTAL			0	962,500
	DEE WHY PARADE TOTAL				**2,155,997**

TRIANGLE PARK NORTH

SITE PREPARATION

	DEMOLITION WORKS				
1	Allow to demolish and remove from site existing timber platform & ramps including any associated works	184	m2	35	6,440
	Allow to demolish and remove from site the following items including any associated works:				
2	Timber/steel fences	67	m	25	1,675

WILDE AND WOOLLARD

Project: Dee Why Town Centre
Cost Plan: EST FINAL

Code	Description	Quantity	Unit	$/m2	Total

TRIANGLE PARK NORTH *(Continued)*

SITE PREPARATION *(Continued)*

3	Allow for capping-off / removing existing services	1	item		20,000
	Asbestos Removal				
4	Allow for the removal and disposal of the asbestos materials from site by a registered contractor	1	item		30,000
	RETAINING WALL				
5	Retaining wall	122	m	500.00	61,000
	SITE CLEARANCE				
6	Clear site of any debris and vegetation and remove from site (Site area)	1,236	m2	3	3,708
7	Strip turf and topsoil and remove from site (Site area)	1,236	m2	5	6,180
8	Remove trees	15	no	150	2,250
	Contamination Removal				
9	Allow for the removal and disposal of the asbestos materials from site by a registered contractor	14	t	500	7,000
	SITE PREPARATION TOTAL			0	138,253

HARD LANDSCAPING

	CONCRETE PAVING				
1	60 thick urbanstone	1,250	m2	120	150,000
2	Paving in two colours	60	m2	86	5,160
3	200 reinforced concrete base to paved areas	1,250	m2	125.00	156,250
4	Extra over concrete paving for pram crossing	6	no	1,500	9,000
5	Allow for concrete stair including handrails	3	no	20,000	60,000
6	Concrete edges to oval planters	49	m	300.00	14,700
7	Allow for adjustments/painting to adjoining properties	1	item	40,000.00	40,000
	HARD LANDSCAPING TOTAL			0	435,110

SOFT LANDSCAPING

	SEATING				
1	Timber seating areas with painted slats	56	m2	1,500.00	84,000
2	Sun lounges	11	no	600.00	6,600
	UMBRELLAS				
3	Removable umbrellas 3000 x 3000 two tone colour	4	no	3,000.00	12,000
	GARDEN BEDS				
4	Allowance for planting to garden beds	189	m2	60.00	11,340
	LANDSCAPING				

Code	Description	Quantity	Unit	$/m2	Total

TRIANGLE PARK NORTH *(Continued)*

SOFT LANDSCAPING *(Continued)*

5	Allow for 200mm shrubs and groundcover landscaping (6no x m2)	7,412	no	35	259,420
	ART				
6	Allowance for art	1	item	100,000.00	100,000
	TREES				
7	Allowance for 200l trees	56	no	800.00	44,800
	PROTECTIVE FENCING				
8	2400 high angled coloured fencing	81	m	300	24,300
	FURNITURE				
9	Allowance for cycle racks	5	no	1,000.00	5,000
10	Allowance for bench seating	6	no	3,000.00	18,000
11	Allowance for bollards	6	no	1,650.00	9,900
12	Allowance for drinking fountains	1	no	8,000.00	8,000
13	Allowance for water filling stations	2	no	2,000.00	4,000
	SIGNAGE				
14	Allow for new way finding & interpretative signage including concrete footing and single pole	1	item	20,000.00	20,000
	MAINTENANCE				
15	Allowance for maintenance and management costs	1	item	130,000.00	130,000
	SOFT LANDSCAPING TOTAL			0	737,360

EXTERNAL SERVICES

	STORMWATER DRAINAGE				
1	Allow for stormwater pits	8	no	2,500	20,000
2	Allow for pipework including trenching	250	m	220	55,000
3	Allow for rainwater harvesting system including tanks, overflow pipework, etc	1	item	60,000	60,000
4	Allow for subsoil drains to all garden beds	1	item	5,000.00	5,000
	WATER SUPPLY				
5	Allow for cold water supply including connection to existing	1	item	5,000	5,000
6	Allow for irrigation system	1	item	10,000.00	10,000
7	Allow for underground storage tanks for the irrigation system	1	item	35,000.00	35,000
	ELECTRIC LIGHT AND POWER				
8	Allow for external mains, pits and main swichboard	1	item	34,000	34,000

Code	Description	Quantity	Unit	$/m2	Total

TRIANGLE PARK NORTH *(Continued)*

EXTERNAL SERVICES *(Continued)*

9	Allow for external catenary lighting including footings	1	item	180,000	180,000
10	Allow for power supply for market events	1	item	30,000	30,000
	EXTERNAL SERVICES TOTAL			0	434,000
	TRIANGLE PARK NORTH TOTAL				**1,744,723**

TRIANGLE PARK SOUTH

SOFT LANDSCAPING

1	Allowance for landscaping, site preparation and external sevices as required	888	m2	1,411.00	1,252,968
	SOFT LANDSCAPING TOTAL			-	1,252,968
	TRIANGLE PARK SOUTH TOTAL				**1,252,968**

WOOLWORTHS LANE

SITE PREPARATION

	DEMOLITION AND PREPATORY WORKS				
1	Remove existing asphalt to road	759	m2	25.00	18,975
2	Remove existing asphalt to footpath	497	m2	25.00	12,425
3	Remove existing concrete base underneath asphalt footpath & road	1,255	m2	35.00	43,925
4	Demolish and remove existing pram ramps	10	m2	120.00	1,200
5	Demolish and remove existing concrete kerb	231	m	55.00	12,705
6	Demolish and remove gutter	231	m	50.00	11,550
7	Allow to remove traffic pole	15	no	1,000.00	15,000
8	Allow for capping-off / removing existing services	1	item		20,000
9	Allowance for working around existing services in footpaths and roads	1	item		15,000
10	Remove trees	2	no	800	1,600
11	Allowance for adjustment to existing carpark	1	item	30,000.00	30,000
	Contaminated Removal				
12	Allow for the removal and disposal of the asbestos materials from site by a registered contractor	55	t	500	27,500
	SITE PREPARATION TOTAL			0	209,880

HARD LANDSCAPING

	FOOTPATH AND FINISHES				
	Surface finishes				
1	Regrade subgrade to suit new levels	1,255	m2	17.00	21,335
2	110 reinforced concrete base to paving areas	497	m2	95.00	47,215

Code	Description	Quantity	Unit	$/m2	Total

WOOLWORTHS LANE *(Continued)*

HARD LANDSCAPING *(Continued)*

3	200 reinforced concrete base to vehicular paved areas	759	m2	125.00	94,875
4	Urbanstone precast paving including mortar base to pedestrian path	497	m2	120.00	59,640
5	Asphalt paving to road	759	m2	75.00	56,925
6	85 resin bonded porous paving to existing tree pits	3	m2	120.00	360
7	Allow for sealing pavers	497	m2	15.00	7,455
8	Allow for expansion joints	400	m	50.00	20,000
9	Allowance to reconstruct including adjusting levels to pram/kerb ramp pits	5	no	3,500.00	17,500
	Kerbs & Gutters				
10	200 wide kerb to suit profile of kerb	231	m	125.00	28,875
11	450 wide concrete gutter	231	m	110.00	25,410
	Miscellaneous Items				
12	Galvanised / steel edges to existing tree pits	6	m	50.00	300
13	Tactile indicators	16	m2	1,800.00	28,800
14	Allow to make good road marking	1	item	10,000.00	10,000
	SIGNAGE				
15	Allow for new signage including concrete footing and single pole	1	item	20,000.00	20,000
	LINEMARKING				
16	Allow for line marking	1	item	8,000.00	8,000
	HARD LANDSCAPING TOTAL			0	446,690

SOFT LANDSCAPING

	TREES				
1	Allowance for 200l trees	10	no	800.00	8,000
	FURNITURE				
2	Allowance for cycle racks	2	no	1,000.00	2,000
3	Allowance for bench seating	4	no	3,000.00	12,000
4	Allowance for bollards	6	no	1,650.00	9,900
	SOFT LANDSCAPING TOTAL			0	31,900

EXTERNAL SERVICES

	STORMWATER DRAINAGE				
1	Allow for stormwater pits	12	no	2,500	30,000
2	Allow for pipework including trenching	186	m	220	40,920
	SEWER DRAINAGE				

WILDE AND WOOLLARD

Project: Dee Why Town Centre
Cost Plan: EST FINAL

Code	Description	Quantity	Unit	$/m2	Total

WOOLWORTHS LANE *(Continued)*

EXTERNAL SERVICES *(Continued)*

Code	Description	Quantity	Unit	$/m2	Total
3	Allow for sewer pipework including connection to existing	1	item	40,000	40,000
	WATER SUPPLY				
4	Allow for cold water supply including connection to existing	1	item	15,000	15,000
	ELECTRIC LIGHT AND POWER				
5	Allow for external mains, pits and main swichboard	1	item	95,000	95,000
6	Allow for 9600 long multi function lighting poles	15	no	12,000	180,000
7	Allowance for traffic lights	1	no	200,000.00	200,000
8	Allowance to adjust existing levels of telecommunication & traffic signal	1	item	1,500.00	1,500
	EXTERNAL SERVICES TOTAL			0	602,420
	WOOLWORTHS LANE TOTAL				**1,290,890**

WALTER GORS PARK

SITE PREPARATION

Code	Description	Quantity	Unit	$/m2	Total
	DEMOLITION WORKS				
1	Allow for demolition and removal of existing brick buildings	5	no	40,000.00	200,000
2	Allow to demolish and remove from site existing timber platform including any associated works	200	m2	35	7,000
	Allow to demolish and remove from site the following items including any associated works:				
3	Timber/steel fences	1	item	7,500	7,500
4	Allow for capping-off / removing existing services	1	item		35,000
	Asbestos Removal				
5	Allow for the removal and disposal of the asbestos materials from site by a registered contractor	1	item		50,000
	RETAINING WALL				
6	Retaining wall	1	item	50,000.00	50,000
	SITE CLEARANCE				
7	Clear site of any debris and vegetation and remove from site (Site area)	7,143	m2	3	21,429
8	Strip turf and topsoil and remove from site (Site area)	7,143	m2	5	35,715
9	Remove trees	35	no	800	28,000
	Contamination Removal				
10	Allow for the removal and disposal of the asbestos materials from site by a registered contractor	168	t	500	84,000
	SITE PREPARATION TOTAL			0	518,644

Project: Dee Why Town Centre
Cost Plan: EST FINAL

Code	Description	Quantity	Unit	$/m2	Total

WALTER GORS PARK *(Continued)*

HARD LANDSCAPING *(Continued)*

	CONCRETE PAVING				
1	60 thick urbanstone	487	m2	120	58,440
2	60 thick granite paving around lake on 150 thick reinforced concrete with SL 82 mesh	331	m2	380	125,780
3	Paving in two colours	1,728	m2	86	148,608
4	Allow for concrete cycle lane	654	m2	86	56,244
5	Extra over concrete paving for pram crossing	6	no	1,500	9,000
6	Allow for concrete ramp including handrails and landings	1	item	40,000	40,000
7	Allow 200 reinforced concrete base to water feature	56	m2	125.00	7,000
8	Allow 200 reinforced concrete base to paving	2,214	m2	125.00	276,750
	HARD LANDSCAPING TOTAL			0	721,822

SOFT LANDSCAPING

	SEATING				
1	Granite seating areas with painted slats	45	m2	2,500.00	112,500
2	Sun lounges	11	no	600.00	6,600
	UMBRELLAS				
3	Removable umbrellas 3000 x 3000 two tone colour	8	no	3,000.00	24,000
	WATER FEATURE				
4	Allow for water feature including excavation, membrane etc	312	m2	2,000.00	624,000
	GARDEN BEDS				
5	Allowance for planting to garden beds	1,401	m2	60.00	84,060
	LANDSCAPING				
6	Allow for 200mm shrubs and groundcover landscaping (6no x m2)	8,403	no	35	294,105
7	Allow 300 layer sandy soil and washed turf	1,313	m2	80.00	105,040
	TOILET FACILITY				
8	Allow exceloo double	1	item	280,000.00	280,000
	TREES				
9	Allowance for 200 litre trees	56	no	800.00	44,800
	PROTECTIVE FENCING				
10	2400 high angled coloured fencing	22	m	300	6,600
11	800 high fence	134	m	150.00	20,100
12	Allow 4000 high panels next to cycle way & in front of toilets	50	m	450.00	22,500
	BUILDING				

Code	Description	Quantity	Unit	$/m2	Total

WALTER GORS PARK *(Continued)*

SOFT LANDSCAPING *(Continued)*

13	Storage building	1	item	200,000.00	200,000
14	Pump building	1	item	200,000.00	200,000
	ART				
15	Allow for art	1	item	180,000.00	180,000
	FURNITURE				
16	Allowance for cycle racks	20	no	1,000.00	20,000
17	Allowance for bench seating	6	no	3,000.00	18,000
18	Allowance for bollards	5	no	1,650.00	8,250
19	Allowance for drinking fountains	1	no	8,000.00	8,000
20	Allowance for water filling stations	3	no	2,000.00	6,000
21	Allowance for special long tables	1	item	30,000.00	30,000
22	Allow 1000 x 1000 small feature bolder	1	item	20,000.00	20,000
23	Allow 4000 x 3000 x 2000 large feature bolder	1	item	10,000.00	10,000
24	Allow playground	1	item	500,000.00	500,000
25	Outdoor multfunctional kitchen	1	item	200,000.00	200,000
26	Stage with large format screen (by others)		note		excl
27	Allow for bins	8	no	1,000.00	8,000
	SIGNAGE				
28	Allow for new way finding & interpretative signage including concrete footing and single pole	1	item	20,000.00	20,000
	MAINTENANCE				
29	Allowance for maintenance and management costs	1	item	130,000.00	130,000
	SOFT LANDSCAPING TOTAL			0	3,182,555

EXTERNAL SERVICES

	STORMWATER DRAINAGE				
1	Allow for stormwater pits	12	no	2,500	30,000
2	Allow for pipework including trenching	350	m	220	77,000
3	Allow for rainwater harvesting system including tanks, overflow pipework, etc	1	item	60,000	60,000

Code	Description	Quantity	Unit	$/m2	Total

WALTER GORS PARK *(Continued)*

EXTERNAL SERVICES *(Continued)*

Code	Description	Quantity	Unit	$/m2	Total
4	Allow for subsoil drains to all garden beds	1	item	10,000.00	10,000
	SEWER DRAINAGE				
5	Allow sewer drainage to toilets	1	item	15,000.00	15,000
	WATER SUPPLY				
6	Water feature	1	item	100,000.00	100,000
7	Allow for cold water supply including connection to existing	1	item	45,000	45,000
8	Allow for pump enclosure including plant equipment	1	item	200,000.00	200,000
9	Allow for pumps	1	item	120,000.00	120,000
10	Allow for irrigation system	1	item	100,000.00	100,000
11	Allow for underground storage tanks for the irrigation system	1	item	150,000.00	150,000
	ELECTRIC LIGHT AND POWER				
12	Allow for external mains, pits and main swichboard	1	item	34,000	34,000
13	Allow for external park lighting	1	item	300,000	300,000
14	Allow for power supply for market events	1	item	30,000	30,000
	EXTERNAL SERVICES TOTAL			0	1,271,000
	WALTER GORS PARK TOTAL				**5,694,021**

BUILDERS PRELIMINARIES

SPECIAL PROVISIONS

Code	Description	Quantity	Unit	$/m2	Total
	PRELIMINARIES				
1	Allow for builder's preliminaries		item		6,572,698
	SPECIAL PROVISIONS TOTAL			-	6,572,698
	BUILDERS PRELIMINARIES TOTAL			**0**	**6,572,698**

FEES

CONSULTANT'S FEES

Code	Description	Quantity	Unit	$/m2	Total
	CONSULTANT'S FEES				
1	Allow for Consultant's Fees		item		1,511,721
	CONSULTANT'S FEES TOTAL			0	1,511,721

AUTHORITY FEES

Code	Description	Quantity	Unit	$/m2	Total
	AUTHORITY FEE				

Code	Description	Quantity	Unit	$/m2	Total
FEES					*(Continued)*
AUTHORITY FEES					*(Continued)*
1	Allow for Authority Fee		item		503,907
	AUTHORITY FEES TOTAL			0	503,907
	FEES TOTAL			**0**	**2,015,627**
CONTINGENCIES					
CONSTRUCTION CONTINGENCY					
	CONSTRUCTION CONTINGENCY				
1	Allow for Construction Contingency		item		5,040,000
	CONSTRUCTION CONTINGENCY TOTAL			0	5,040,000
	CONTINGENCIES TOTAL			**0**	**5,040,000**

DETAILED COST PLAN

Project: Dee Why Town Centre
Cost Plan: EST FINAL

Item No.	Item Description	Quantity	Unit	Rate	Amount
BUILDERS PRELIMINARIES					
SPECIAL PROVISIONS					
Allow for builder's preliminaries					
1	SITE WORKS AND EXTERNAL SERVICES TOTA				6,572,698
	Allow for builder's preliminaries TOTAL				**6,572,698**
	SPECIAL PROVISIONS TOTAL				**6,572,698**
	BUILDERS PRELIMINARIES TOTAL				**6,572,698**

WILDE AND WOOLLARD

Project: Dee Why Town Centre
Cost Plan: EST FINAL

Item No.	Item Description	Quantity	Unit	Rate	Amount
FEES					
CONSULTANT'S FEES					
Allow for Consultant's Fees					
2	TOTAL ESTIMATED CONSTRUCTION COST				1,511,721
	Allow for Consultant's Fees TOTAL				**1,511,721**
	CONSULTANT'S FEES TOTAL				**1,511,721**
AUTHORITY FEES					
Allow for Authority Fee					
3	TOTAL ESTIMATED CONSTRUCTION COST				503,907
	Allow for Authority Fee TOTAL				**503,907**
	AUTHORITY FEES TOTAL				**503,907**
	FEES TOTAL				**2,015,627**

Project: Dee Why Town Centre
Cost Plan: EST FINAL

Item No.	Item Description	Quantity	Unit	Rate	Amount
	CONTINGENCIES				
	CONSTRUCTION CONTINGENCY				
	Allow for Construction Contingency				
4	TOTAL ESTIMATED CONSTRUCTION COST				5,039,069
5	CONSTRUCTION CONTINGENCY				0
6					931
	Allow for Construction Contingency TOTAL				**5,040,000**
	CONSTRUCTION CONTINGENCY TOTAL				**5,040,000**
	CONTINGENCIES TOTAL				**5,040,000**

ELEMENTAL SUMMARY

Project: Dee Why Town Centre
Cost Plan: Dee Why Parade (seperated cycle)

Code	Description	% of Cost	Quantity	Unit	$/m2	Total
	DEE WHY PARADE					
1	SITE PREPARATION	16.69			0	351,610
2	HARD LANDSCAPING	36.71			0	773,367
3	SOFT LANDSCAPING	0.92			0	19,250
4	EXTERNAL SERVICES	45.69			0	962,500
	DEE WHY PARADE TOTAL					**2,106,727**

ELEMENTAL SUMMARY

Project: Dee Why Town Centre
Cost Plan: Dee Why Parade (seperated cycle)

Code	Description	Quantity	Unit	$/m2	Total

DEE WHY PARADE

SITE PREPARATION

	DEMOLITION AND PREPATORY WORKS				
1	Remove existing asphalt to footpath	2,601	m2	25.00	65,025
2	Remove existing concrete base underneath asphalt footpath	2,601	m2	35.00	91,035
3	Demolish and remove existing pram ramps	20	m2	120.00	2,400
4	Demolish and remove gutter	557	m	50.00	27,850
5	Allow to remove traffic pole	35	no	1,000.00	35,000
6	Allow for capping-off / removing existing services	1	item		20,000
7	Allowance for working around existing services in footpaths and roads	1	item		15,000
8	Remove trees	1	no	800	800
	Contaminated Removal				
9	Allow for the removal and disposal of the asbestos materials from site by a registered contractor	189	t	500	94,500
	SITE PREPARATION TOTAL			0	351,610

HARD LANDSCAPING

	FOOTPATH AND FINISHES				
	Surface finishes				
1	Regrade subgrade to suit new levels	2,601	m2	17.00	44,217
2	110 reinforced concrete base to paving areas	2,601	m2	95.00	247,095
3	Concrete paving including mortar base to pedestrian path	1,301	m2	100.00	130,100
4	85 resin bonded porous paving to existing tree pits	23	m2	120.00	2,760
5	Allow for sealing pavers		m2	15.00	0
6	Allow for expansion joints	1,200	m	50.00	60,000
7	Allowance to reconstruct including adjusting levels to pram/kerb ramp pits	9	no	3,500.00	31,500
	Gutters				
8	200 wide kerb to suit profile of kerb	557	m	125.00	69,625
9	450 wide concrete gutter	557	m	110.00	61,270
10	400 wide seperated median strip	79	m	250.00	19,750
	Miscellaneous Items				
11	Galvanised / steel edges to existing tree pits	45	m	50.00	2,250
12	Tactile indicators	36	m2	1,800.00	64,800
13	Allow to make good road marking	1	item	10,000.00	10,000
	SIGNAGE				
14	Allow for new signage including concrete footing and single pole	1	item	18,000.00	18,000

Project: Dee Why Town Centre
Cost Plan: Dee Why Parade (seperated cycle)

Code	Description	Quantity	Unit	$/m2	Total
DEE WHY PARADE					*(Continued)*
HARD LANDSCAPING					*(Continued)*
	LINEMARKING				
15	Allow for line marking	1	item	12,000.00	12,000
	HARD LANDSCAPING TOTAL			0	773,367
SOFT LANDSCAPING					
	FURNITURE				
1	Allowance for cycle racks	2	no	1,000.00	2,000
2	Allowance for bench seating	3	no	3,000.00	9,000
3	Allowance for bollards	5	no	1,650.00	8,250
	SOFT LANDSCAPING TOTAL			0	19,250
EXTERNAL SERVICES					
	STORMWATER DRAINAGE				
1	Allow for stormwater pits	18	no	2,500	45,000
2	Allow for pipework including trenching	500	m	220	110,000
	WATER SUPPLY				
3	Allow for cold water supply including connection to existing	1	item	60,000	60,000
	ELECTRIC LIGHT AND POWER				
4	Allow for external mains, pits and main swichboard	1	item	96,000	96,000
5	Allow for service pit adjustments for paving installation	1	item	30,000	30,000
6	Allow for 9600 long multi function lighting poles	35	no	12,000	420,000
7	Allowance for traffic lights	1	no	200,000.00	200,000
8	Allowance to adjust existing levels of telecommunication & traffic signal	1	item	1,500.00	1,500
	EXTERNAL SERVICES TOTAL			0	962,500
	DEE WHY PARADE TOTAL				**2,106,727**

ELEMENTAL SUMMARY

Project: Dee Why Town Centre
Cost Plan: Dee Why Parade (shared path)

Code	Description	% of Cost	Quantity	Unit	$/m2	Total
DEE WHY PARADE						
1	SITE PREPARATION	16.85			0	351,610
2	HARD LANDSCAPING	36.12			0	753,617
3	SOFT LANDSCAPING	0.93			0	19,250
4	EXTERNAL SERVICES	46.12			0	962,500
	DEE WHY PARADE TOTAL					**2,086,977**

ELEMENTAL SUMMARY

Project: Dee Why Town Centre
Cost Plan: Dee Why Parade (shared path)

Code	Description	Quantity	Unit	$/m2	Total

DEE WHY PARADE

SITE PREPARATION

	DEMOLITION AND PREPATORY WORKS				
1	Remove existing asphalt to footpath	2,601	m2	25.00	65,025
2	Remove existing concrete base underneath asphalt footpath	2,601	m2	35.00	91,035
3	Demolish and remove existing pram ramps	20	m2	120.00	2,400
4	Demolish and remove gutter	557	m	50.00	27,850
5	Allow to remove traffic pole	35	no	1,000.00	35,000
6	Allow for capping-off / removing existing services	1	item		20,000
7	Allowance for working around existing services in footpaths and roads	1	item		15,000
8	Remove trees	1	no	800	800
	Contaminated Removal				
9	Allow for the removal and disposal of the asbestos materials from site by a registered contractor	189	t	500	94,500
	SITE PREPARATION TOTAL			0	351,610

HARD LANDSCAPING

	FOOTPATH AND FINISHES				
	Surface finishes				
1	Regrade subgrade to suit new levels	2,601	m2	17.00	44,217
2	110 reinforced concrete base to paving areas	2,601	m2	95.00	247,095
3	Concrete paving including mortar base to pedestrian path	1,301	m2	100.00	130,100
4	85 resin bonded porous paving to existing tree pits	23	m2	120.00	2,760
5	Allow for sealing pavers		m2	15.00	0
6	Allow for expansion joints	1,200	m	50.00	60,000
7	Allowance to reconstruct including adjusting levels to pram/kerb ramp pits	9	no	3,500.00	31,500
	Gutters				
8	200 wide kerb to suit profile of kerb	557	m	125.00	69,625
9	450 wide concrete gutter	557	m	110.00	61,270
	Miscellaneous Items				
10	Galvanised / steel edges to existing tree pits	45	m	50.00	2,250
11	Tactile indicators	36	m2	1,800.00	64,800
12	Allow to make good road marking	1	item	10,000.00	10,000
	SIGNAGE				
13	Allow for new signage including concrete footing and single pole	1	item	18,000.00	18,000

WILDE AND WOOLLARD

Project: Dee Why Town Centre
Cost Plan: Dee Why Parade (shared path)

Code	Description	Quantity	Unit	$/m2	Total

DEE WHY PARADE *(Continued)*

HARD LANDSCAPING *(Continued)*

Code	Description	Quantity	Unit	$/m2	Total
	LINEMARKING				
14	Allow for line marking	1	item	12,000.00	12,000
	HARD LANDSCAPING TOTAL			0	753,617

SOFT LANDSCAPING

Code	Description	Quantity	Unit	$/m2	Total
	FURNITURE				
1	Allowance for cycle racks	2	no	1,000.00	2,000
2	Allowance for bench seating	3	no	3,000.00	9,000
3	Allowance for bollards	5	no	1,650.00	8,250
	SOFT LANDSCAPING TOTAL			0	19,250

EXTERNAL SERVICES

Code	Description	Quantity	Unit	$/m2	Total
	STORMWATER DRAINAGE				
1	Allow for stormwater pits	18	no	2,500	45,000
2	Allow for pipework including trenching	500	m	220	110,000
	WATER SUPPLY				
3	Allow for cold water supply including connection to existing	1	item	60,000	60,000
	ELECTRIC LIGHT AND POWER				
4	Allow for external mains, pits and main swichboard	1	item	96,000	96,000
5	Allow for service pit adjustments for paving installation	1	item	30,000	30,000
6	Allow for 9600 long multi function lighting poles	35	no	12,000	420,000
7	Allowance for traffic lights	1	no	200,000.00	200,000
8	Allowance to adjust existing levels of telecommunication & traffic signal	1	item	1,500.00	1,500
	EXTERNAL SERVICES TOTAL			0	962,500
	DEE WHY PARADE TOTAL				**2,086,977**

PROJECT SUMMARY

Project: Dee Why Town Centre
Cost Plan: Walter Gors Park Concept

No.	Item Description	Total Cost %	Quantity	Unit	$/m2	Total
1	WALTER GORS PARK	40.52				5,919,999
2	BUILDERS PRELIMINARIES	6.22	15	%	0	908,195
3	**TOTAL ESTIMATED CONSTRUCTION COST**	**46.73**			**0**	**6,828,194**
4	FEES	1.87			0	273,128
5	CONTINGENCIES	4.68			0	683,000
	TOTAL ESTIMATED CONSTRUCTION END COST				**0**	**7,784,322**
		100.00				

ELEMENTAL SUMMARY

Project: Dee Why Town Centre
Cost Plan: Walter Gors Park Concept

Code	Description	% of Cost	Quantity	Unit	$/m2	Total
WALTER GORS PARK						
1	SITE PREPARATION	3.53			0	515,060
2	HARD LANDSCAPING	5.40			0	788,526
3	SOFT LANDSCAPING	17.17			0	2,508,135
4	CAFE/KIOSK ZONE	5.73			0	837,278
5	EXTERNAL SERVICES	8.70			0	1,271,000
	WALTER GORS PARK TOTAL					**5,919,999**
BUILDERS PRELIMINARIES						
1	SPECIAL PROVISIONS	6.22				908,195
	BUILDERS PRELIMINARIES TOTAL				**0**	**908,195**
FEES						
1	CONSULTANT'S FEES	1.41	3	%	**0**	204,846
2	AUTHORITY FEES	0.47	1	%	**0**	68,282
	FEES TOTAL				**0**	**273,128**
CONTINGENCIES						
1	CONSTRUCTION CONTINGENCY	4.68	10	%	**0**	683,000
	CONTINGENCIES TOTAL				**0**	**683,000**

ELEMENTAL SUMMARY

Project: Dee Why Town Centre
Cost Plan: Walter Gors Park Concept

Code	Description	Quantity	Unit	$/m2	Total

WALTER GORS PARK

SITE PREPARATION

	DEMOLITION WORKS				
1	Allow for demolition and removal of existing brick buildings	5	no	40,000.00	200,000
2	Allow to demolish and remove from site existing timber platform including any associated works	200	m2	35	7,000
	Allow to demolish and remove from site the following items including any associated works:				
3	Timber/steel fences	1	item	7,500	7,500
4	Retaining wall	1	item	50,000.00	50,000
5	Allow for capping-off / removing existing services	1	item		35,000
	Asbestos Removal				
6	Allow for the removal and disposal of the asbestos materials from site by a registered contractor	1	item		50,000
	Contamination Removal				
7	Allow for the removal and disposal of the asbestos materials from site by a registered contractor	168	t	500	84,000
	SITE CLEARANCE				
8	Clear site of any debris and vegetation and remove from site (Site area)	6,695	m2	3	20,085
9	Strip turf and topsoil and remove from site (Site area)	6,695	m2	5	33,475
10	Remove trees	35	no	800	28,000
	SITE PREPARATION TOTAL			0	515,060

HARD LANDSCAPING

	CONCRETE PAVING				
1	60 thick urbanstone	534	m2	125	66,750
2	60 thick granite paving around lake on 150 thick reinforced concrete with SL 82 mesh	528	m2	380	200,640
3	Asphalt concrete in two colours	733	m2	105	76,965
4	Allow for concrete cycle lane	436	m2	86	37,496
5	Allow rubber surface to playground	118	m2	80.00	9,440
6	Extra over concrete paving for pram crossing	6	no	1,500	9,000
7	Allow for concrete ramp including handrails and landings	1	item	40,000	40,000
8	Allow 200 reinforced concrete base to water feature	168	m2	125.00	21,000
9	Allow 200 reinforced concrete base to paving	2,229	m2	125.00	278,625
	STEPS/STAIRS				
10	Concrete base to steps	23	m2	320.00	7,360
11	390 x 170 exfolated granite step	50	m	750.00	37,500

Project: Dee Why Town Centre
Cost Plan: Walter Gors Park Concept

Code	Description	Quantity	Unit	$/m2	Total

WALTER GORS PARK *(Continued)*

HARD LANDSCAPING *(Continued)*

Code	Description	Quantity	Unit	$/m2	Total
12	Allow handrails including balustrade to steps	5	m	750.00	3,750
	HARD LANDSCAPING TOTAL			0	788,526

SOFT LANDSCAPING

Code	Description	Quantity	Unit	$/m2	Total
	SEATING				
1	Granite seating areas with painted slats	45	m2	2,500.00	112,500
2	Sun lounges	11	no	600.00	6,600
	UMBRELLAS				
3	Allow for removable umbrellas 3000 x 3000 two tone colour		note		excl
	WATER FEATURE				
4	Allow for water feature including excavation, membrane etc	168	m2	2,000.00	336,000
	GARDEN BEDS				
5	Allowance for planting to garden beds	1,122	m2	75.00	84,150
	LANDSCAPING				
6	Allow for 200mm shrubs and groundcover landscaping (6no x m2)	6,727	no	35	235,445
7	Allow 300 layer sandy soil and washed turf	2,484	m2	30.00	74,520
8	Allow 300 layer sandy soil and washed turf to cafe area	404	m2	30.00	12,120
	TIMBER DECKING				
9	Allow timber decking including framing	22	m2	350.00	7,700
10	Allow balustrade to decking	30	m	750.00	22,500
	TOILET FACILITY				
11	Allow exceloo double	1	item	280,000.00	280,000
	TREES				
12	Allowance for 200 litre trees	83	no	800.00	66,400
	PROTECTIVE FENCING				
13	2400 high angled coloured fencing	22	m	300	6,600
14	800 high fence	134	m	150.00	20,100
15	Allow 4000 high panels next to cycle way & in front of toilets	50	m	450.00	22,500
	BUILDING				
16	Pump building including toilet	1	item	250,000.00	250,000
	ART				
17	Allow for art	1	item	100,000.00	100,000
	FURNITURE				

Project: Dee Why Town Centre
Cost Plan: Walter Gors Park Concept

Code	Description	Quantity	Unit	$/m2	Total

WALTER GORS PARK *(Continued)*

SOFT LANDSCAPING *(Continued)*

18	Table with chairs	7	no	2,000.00	14,000
19	Allowance for cycle racks	30	no	1,000.00	30,000
20	Allowance for bench seating	12	no	3,000.00	36,000
21	Allowance for bench tables with chairs	5	no	3,500.00	17,500
22	Allowance for bollards	10	no	1,650.00	16,500
23	Allowance for drinking fountains	1	no	8,000.00	8,000
24	Allowance for water filling stations	3	no	2,000.00	6,000
25	Allowance for special long tables	1	item	30,000.00	30,000
26	Allow 1000 x 1000 small feature bolder	1	item	20,000.00	20,000
27	Allow 4000 x 3000 x 2000 large feature bolder	1	item	10,000.00	10,000
28	Allow playground	1	item	350,000.00	350,000
29	Allow additional extra over for the water play area	1	item	75,000.00	75,000
30	Outdoor multfunctional kitchen	1	item	100,000.00	100,000
31	Stage with large format screen (by others)		note		excl
32	Allow for bins	8	no	1,000.00	8,000
	SIGNAGE				
33	Allow for new way finding & interpretative signage including concrete footing and single pole	1	item	20,000.00	20,000
	MAINTENANCE				
34	Allowance for maintenance and management costs	1	item	130,000.00	130,000
	SOFT LANDSCAPING TOTAL			0	2,508,135

CAFE/KIOSK ZONE

	CAFE/KIOSK				
1	Allow for a Cafe/Kiosk Zone	100	m2	6,500.00	650,000
	CAFE SERVICES				
2	Submains cabling on cable tray external to the builidng	170	m	85.00	14,450
3	Allowance for 800 x 300 x 1200 power distribution board with 36 way, 1xAUMS energy meter & RCD's for all lighting and power circuits to be installed to cafe	1	item	4,000.00	4,000
4	Allowance external lighting	1	item	10,000.00	10,000

Project: Dee Why Town Centre
Cost Plan: Walter Gors Park Concept

WALTER GORS PARK *(Continued)*

CAFE/KIOSK ZONE *(Continued)*

Code	Description	Quantity	Unit	$/m2	Total
5	Allowance for new trade waste, grease trap and associated connections	1	item	40,000.00	40,000
6	Allowance for gas and water supply including meter	1	item	5,000.00	5,000
7	Allowance for builders work in connection to services	1	item	10,000.00	10,000
	CONCRETE PAVING				
8	Site preparation to turf areas	404	m2	7	2,828
9	60 thick urbanstone	404	m2	125	50,500
10	Allow 200 reinforced concrete base to paving	404	m2	125.00	50,500
	CAFE/KIOSK ZONE TOTAL			0	837,278

EXTERNAL SERVICES

Code	Description	Quantity	Unit	$/m2	Total
	STORMWATER DRAINAGE				
1	Allow for stormwater pits	12	no	2,500	30,000
2	Allow for pipework including trenching	350	m	220	77,000
3	Allow for rainwater harvesting system including tanks, overflow pipework, etc	1	item	60,000	60,000
4	Allow for subsoil drains to all garden beds	1	item	10,000.00	10,000
	SEWER DRAINAGE				
5	Allow sewer drainage to toilets	1	item	15,000.00	15,000
	WATER SUPPLY				
6	Water feature	1	item	100,000.00	100,000
7	Allow for cold water supply including connection to existing	1	item	45,000	45,000
8	Allow for pump enclosure including plant equipment	1	item	200,000.00	200,000
9	Allow for pumps	1	item	120,000.00	120,000
10	Allow for irrigation system	1	item	100,000.00	100,000
11	Allow for underground storage tanks for the irrigation system	1	item	150,000.00	150,000
	ELECTRIC LIGHT AND POWER				
12	Allow for external mains, pits and main swichboard	1	item	34,000	34,000
13	Allow for external park lighting	1	item	300,000	300,000
14	Allow for power supply for market events	1	item	30,000	30,000
	EXTERNAL SERVICES TOTAL			0	1,271,000

Project: Dee Why Town Centre
Cost Plan: Walter Gors Park Concept

Code	Description	Quantity	Unit	$/m2	Total
	WALTER GORS PARK				*(Continued)*
	WALTER GORS PARK TOTAL				**5,919,999**
	BUILDERS PRELIMINARIES				
	SPECIAL PROVISIONS				
	PRELIMINARIES				
1	Allow for builder's preliminaries		item		908,195
	SPECIAL PROVISIONS TOTAL			_	908,195
	BUILDERS PRELIMINARIES TOTAL			**0**	**908,195**
	FEES				
	CONSULTANT'S FEES				
	CONSULTANT'S FEES				
1	Allow for Consultant's Fees		item		204,846
	CONSULTANT'S FEES TOTAL			0	204,846
	AUTHORITY FEES				
	AUTHORITY FEE				
1	Allow for Authority Fee		item		68,282
	AUTHORITY FEES TOTAL			0	68,282
	FEES TOTAL			**0**	**273,128**
	CONTINGENCIES				
	CONSTRUCTION CONTINGENCY				
	CONSTRUCTION CONTINGENCY				
1	Allow for Construction Contingency		item		683,000
	CONSTRUCTION CONTINGENCY TOTAL			0	683,000
	CONTINGENCIES TOTAL			**0**	**683,000**

DEE WHY CBD

PUBLIC DOMAIN LIGHTING

Prepared by

Lighting, Art + Science

Lighting and Electrical Consultants

Tract

Landscape Architects

Prepared for

WARRINGAH COUNCIL

CONTENTS

A. INTRODUCTION

This report addresses the existing and lighting options for the masterplan for the urban redevelopment of the Dee Why Central Business District.

The study area is shown on Figure 1 and includes a combination of main roads, high traffic council roads, residential streets that are progressively increasing density, public spaces, parkland and laneways.

Figure 1 Study area for the masterplan

We have carried out a general assessment of the existing lighting, however as we believe that all the lighting will be replaced as part of the works we have not carried out a detailed assessment of each street to determine the level of compliance with the standards of the existing lighting.

We have carried out some lighting studies for typical sections of road to determine typical spacing and pole configurations for different lighting options. The calculation and design for each street would be part of the detailed design.

B. EXISTING LIGHTING

The existing lighting in the space is Ausgrid Streetlighting supplemented by ad-hoc under-awning lighting.

The streetlighting is standard Ausgrid lighting.

All the streets are lit using steel poles and underground power. The poles are in reasonable condition however the lights fittings are a mixture of High Pressure Sodium and Mercury Vapour. The lighting installation dates from before the current standard and although it provides reasonable light levels it would not comply with the current requirements. In addition as fittings have failed over the years they have been replaced by what is available. As a result there is an inconsistency in the uniformity and quality of the lighting.

The lighting provided by Ausgrid is purely functional and does little to improve the night environment.

C. BACKGROUND INFORMATION

To understand the light technical parameters it is necessary to understand some fundamental lighting concepts:

Luminous Flux: This is the total amount of light that leaves a light source, independent of direction and is measured ***lumens***. The lumen is related to the sensitivity of the eye rather that the incident radiant flux. As a result one watt at 555nm (green), (produces around 680 lumens whereas one watt at 700nm (red) produces only 3 lumens.

Luminous Intensity: This is a measure of the amount of light that leaves a light source in a given direction and is used to define the light distribution of a light source. This is measured in ***Candelas***.

Illuminance: This is a measure of the amount of light that falls onto a surface. It is independent of the reflectivity of the surface. It is measured in ***lux*** or lumens /m^2.

This is the normal parameter that is used for compliance as it is the easiest to measure. It does not necessarily mean that it is the most important.

Luminance: This is a measure of light that is leaving a surface. With a reflective surface it is dependent on the reflectivity of the surface. It is measured in ***Candelas/m²***. The eye reacts to the luminance of the objects in the field of view.

Efficacy: As the output of a light source is measured in lumens, where as its input is **measured** in Watts the term efficacy is used rather than efficiency. It is still an indication of the efficiency of the conversion from electrical energy to light and it is measured in ***lumens/Watt***.

Luminaire

This is the technical term for the complete light fitting including the light source and any control gear.

Colour Appearance or **Correlated Colour Temperature** (CCT) is a measure of the colour appearance of a white light source. It is expressed as the equivalent temperature of a black body radiator or object heated to that temperature. It is expressed in absolute temperature in degrees ***Kelvin***.

As an indication of the scale an incandescent lamp has a CCT of 2700K whereas daylight is anywhere between 5000 and 7000K. For night public spaces we believe that the CCT should usually be between 3000 and 4000K.

Light is made up of the energy in the visible spectrum between 380nm and 780nm. Each wavelength of light comprises a different colour of light with 380nm being blue, 500nm being orange and 700nm being red.

All light sources do not produce all wavelengths or colours of light, in the same relative quantities. Colours and white light are produced by the presence of specific proportions of certain wavelengths of light.

The mechanism for seeing colour is that the surface of an object reflects the wavelengths that make up the colour of the object and absorb all other wavelengths.

As a result a colour object will not appear to have the correct colour if the relevant colours needed are not in the incident light.

Colour Rendering Index is a measure of how accurately a light source renders a range of colours. It is expressed as an index where 100 is a perfect match and 0 represents no match. Colour rendering is important because it affects how the space appears. Good colour rendering not only makes the space appear more visually interesting and brighter, but it assists with the colour recognition of clothes on the CCTV and generally makes people look healthier.

Figure 2 Difference in effect of colour rendering *(2)*

Figure 2 shows the difference colour rendering makes to the perception of a space or object.

Glare is light that inhibits vision rather than enabling it. Glare results when the relative luminance of a light source is significantly higher than the background luminance. Glare is particularly significant in outdoor environments as the background often approaches black. There are several glare indices that can be calculated but none are relevant to this application.

C. SAFETY AND SECURITY

Safety and security is an important consideration in the lighting of city centres.

There needs to be delineation between safe movement with respect to trips and falls and personal security.

The lighting levels that are required for safe movement are much lower than the levels generally specified for public spaces. This is reflected in the minimums that are recommended in residential streets, in AS/NZS 1158.3, of 0.14 Lux.

The major criterion for public pedestrian lighting is personal security. This is a combination of a deterrent to the perpetrator, the feeling of personal safety and confidence to the person.

If a path is well lit then there is a perception that it is safe. It is therefore important that people are not encouraged to use paths that lead to locations with minimal public surveillance as this can result in attracting people to an unsafe area. In some situations it may be better to not light a path to discourage its use.

There has been a long standing acceptance that there is a relationship between the rate of crime and the presence of public lighting.

Most of the evidence for this is based on sociological studies that relate crime statistics to the presence of the public lighting. In lighting terms these studies are reasonably simplistic as they do not relate the crime level to the actual level of illuminance nor look at the quality aspects of the lighting, such as glare and visual comfort, or the visibility within the space. We are not aware of any research that indicates that once a reasonable level of illumination has been achieved, further increase in the illumination will further reduce the level of crime.

It is important to understand the mechanism by which public lighting reduces crime:

- Public lighting increases the likelihood that the perpetrator will be observed and identified. This increases the risk to the perpetrator.
- Where public lighting generates a comfortable environment it encourages people to meet and utilise the space. This increases the number of people in the space and therefore increases the chance of a perpetrator being observed.

- High levels of lighting in areas that have very limited natural surveillance can assist the crime rather than discourage it. It can assist the perpetrator to select their victim or enable illegal deals to be carried out where the merchandise can be inspected.
- Public lighting that has controlled glare provides good distant views so that the person has the ability to recognise a potential risk at a distance and take evasive action. Lower illumination levels with good glare control and lighting of peripheral areas may be more effective than simple increases in illumination.
- Finally lighting does not generally prevent crime. The result is usually relocation of the crime to a site safer for the perpetrator.

Nevertheless there is evidence that in general adequate public lighting will reduce the incidence of crime in that area.

D. AUSTRALIAN STANDARD COMPLIANCE

There is an Australian Standard for public lighting, **AS/NZS1158 *Lighting of roads and public spaces***. The standard is not mandatory but gives a good yardstick for the design of lighting installations and it will invariably be used as a benchmark if there is a compensation claim made against the Council associated with public lighting.

The standard has several sections relating to lighting for vehicular traffic (V- Category) pedestrian traffic (P-Category) and supplementary lighting for pedestrian crossings.

The V-Category lighting is designed from the perspective of the driver and endeavours to identify objects on the road by seeing them in silhouette against the illuminated road surface. This is generally only applied to main roads and feeder roads.

P-Category lighting is designed from the perspective of the pedestrian and is designed to enable the pedestrian to safely navigate the space.

It is not necessary to have a V and P category for every road. Residential and minor roads usually only have a P category. There is also a provision in the standard that if a road is lit to a V category then is can be assumed that the verge will be adequately lit, provided that there are not significant trees or awnings to obstruct the light.

The standard divides lighting requirements into different Categories based on the nature of the space and the level of usage and recommends different lighting levels and parameters for each Category. With both V and P Category lighting, the lower the number, the more stringent the requirements.

The V Categories are based on the level of vehicular and pedestrian traffic in the street, the speed of the traffic, whether there are parked cars and the source of the traffic.

P- Categories are based on the ‘level of pedestrian usage’, ‘the risk of crime’ and the ‘need to enhance the prestige’ of the space. With the lower categories, P3, P4 & P5 the concentration is purely on safe movement and as a result the only requirements are illuminance on the horizontal plane and the uniformity of the illumination.

The P Category is more relevant to public amenity.

In the higher categories, P1, P2 & P3, other than P3 on a residential street, then there is an additional requirement for vertical illuminance 1.5 metres above the ground. This is designed to assist identification of a person. It was originally designed to give a person advanced warning to assess whether someone else on the path was a friend of foe, while still at a reasonable distance to take evasive action and to increase the natural surveillance of the area. It also improves the functionality of CCTV.

The standard does not include inter-reflected light in the calculations so the compliance point is generally higher under the adjacent light fitting facing the other light. With modern fittings that limit the light leaving the fitting above the horizontal plane, the vertical illuminance usually becomes the critical design criteria on the basis that it complies, then all other criteria are met.

As the compliance criteria is the minimum vertical illuminance then it directly effects the spacing of the poles and as a result a path that is designed to comply with P3 category lighting will comply with P2 for about 80% of its length and P1 for about 60% of its length. In the area where the formal non-compliance occurs there will generally be adequate vertical illuminance in the direction of the nearest pole. In the other direction, even though the calculated vertical illuminance will not comply there will be significant light reflected from the ground plane. It is therefore often better to allow some small areas of non-compliance rather than reduce the spacing of the poles.

In CBD areas however it is not uncommon to recommend a P category as well as a V category as the pedestrian requirements are often higher than the vehicle ones.

Table 2.1 from AS/NZS1158.1 and Tables 2.1 to 2.5 from AS/NZS1158.3.1 show the criteria for the Categories are included in Appendices 1 and 2 respectively.

The City of Sydney not only applies V and P categories through the Sydney CBD, but also specifies an increased vertical illumination of 4 lux compared with the highest P Category requirement of 2 lux for the CCTV monitoring. This requirement is relatively old and with the improvement in camera technology, it may no longer be necessary.

The Council's CCTV consultant should provide the illumination requirements for the cameras.

We have prepared a table for the roads indicating a V category and P Category for each road space within the area based on the assessment of the relevant criteria.

Normally the council and the RMS nominate the lighting categories that apply. In the absence of any instructions we have assumed the following categories:

Road	Lighting Category
Pittwater Road	V2
Howard Avenue, Oaks Avenue, Pacific Parade, Fisher Road	V3
Public Pathways, Parks	P2
Dee Why Parade, Clarence Avenue, St Davids Avenue	P3
Richmond Avenue, Avon Road	P4

Table 1 – Assumed Streetlighting Categories

We have assumed the P2 level due to a lower perceived risk of crime. We assume that the Council will undertake a Safer-By-Design report with the police. Based on their report we may need to amend the categories in some streets.

Complying with the standard may provide adequate lighting for safe movement but does not necessarily provide a comfortable space that people will enjoy occupying. If the spaces are to be revitalised then it is important that the space be comfortable.

E. LIGHT SOURCES

We have limited our assessment to three light sources:

HIGH PRESSURE SODIUM (HPS)

This is the standard lamp used by Ausgrid. A high pressure sodium lamp is a discharge lamp that has a combination of a small quantity of mercury and sodium in the arc tube. This converts to gas when operating. The gas mixture and the pressure at which the lamp operates, determines the colour. High pressure sodium lamps have the highest efficacy of high pressure discharge lamps. As explained the lumen is weighted to the frequency response of the human eye. The HPS lamp produces the majority of its light in the orange and yellow part of the spectrum which is where the eye is the most sensitive. This results in the major advantage and disadvantage of the lamps. The advantage is high efficacy. The disadvantage is that as all the light is generated in the orange and yellow part of the spectrum the light lacks red and blue light. As a result the lamps have very poor colour rendering.

METAL HALIDE

This is a higher quality light source with superior colour rendering and white appearance.

This is a high pressure mercury lamp that has some additional rare earth metal gases included that broadens the frequency response. As a result the lamp has a much better colour rendering than high pressure sodium however as a consequence of generating light in the blue and red spectrum the overall efficacy of the lamp is lower than high pressure sodium. In smaller wattages however, less than 150 Watts the metal halide lamp has a higher efficacy than the HPS.

Prior to the roll out of the LEDs in the City of Sydney, metal halide was the standard light source for the Smartpoles as the improved colour performance was considered more important than the energy difference.

There are two basic types of metal halide lamps; quartz arc and ceramic arc. The quartz arc is traditionally used in the US while the ceramic arc is a European development. The ceramic arc lamps is more expensive but has better efficacy, colour rendering, colour constancy through life and from lamp to lamp and better lumen maintenance. Ceramic Arc lamps are only available in wattages up to 150 Watts and recently 250 Watts have also become available.

Quartz arc lamps have traditionally been used for street lighting and by supply authorities for public domain lighting. Prior to the roll out of LEDs the City of Sydney used ceramic arc lamps for all their public domain lighting.

LIGHT EMITTING DIODES (LED)

Lighting emitting diodes are not a lamp as such, but rather a semi-conductor device. They are based on traditional semi-conductor diode used to rectify electricity. All diodes emit light, however in most cases the amount of light is relatively small and the housing prevents the light from escaping.

The first LEDs were produced as low level indicator lights on electronic equipment.

In recent years they have been developed to produce white light and with increasing efficacy. As LEDs are not lamps it cannot be assumed that they will behave similarly to lamps in luminaires.

LEDs have similar efficacies to fluorescent and metal halide lamps. A tubular fluorescent or metal halide lamp produces around 100 lumens per watt. This only accounts for around 25% of the power consumption. The majority of the remaining energy is produced as heat. Most of this is emitted in the infrared as radiant energy as part of the output of the luminaire.

With LEDs the light produced is much more wavelength specific so that the LED does not necessarily produce infrared as part of its beam distribution. As the overall efficiency of the LED is of a similar order of magnitude to fluorescent and metal halide lamps, the waste energy must be removed from the LED by conduction.

For a LED to operate efficiently then the junction of the LED must be maintained at a low temperature. If the junction temperature exceeds around 80^0C the efficacy and life of the LED are significantly reduced. The power densities of LEDs are extremely high and are increasing as the output of LEDs increase. There are now commercial LEDs running at currents as high as 2 Amps in a LED that is approximately $1mm^2$. This is a current density of 2 million Amps per m^2 compared with a 100 Amp power cable which is around 6000 Amps per m^2. As a result the design of the heatsinks and the luminaire is critical to the efficacy and the life of the LED.

With a conventional lamp the life and lumens output is relatively independent of the luminaire.

There are still no international standards for the testing and measurement of the lighting performance of LEDs at present due to the difficulty in getting consistent results between testing facilities and the dependency of the LED on the luminaire performance.

As a result the selection of the luminaires is just as important as the selection of the LED in achieving an efficient lighting installation.

LAMP LIFE

The life of a lamp can be expressed in two ways:

- **Lamp Life** has traditionally been expressed in terms of **survival rate**. That is the rated life is the 50% failure rate of the lamp. The standard life for fluorescent fittings as quoted in data is based on a 3 hour switching cycle. If the switching cycle is increased to 10 hours the life is increased by 30% and for 24 hour operation it is increased by 50%. The 10 hour life is probably more applicable to the public lighting mode of operation.
- The luminous flux of all lamps decreases through life. This is called the **lumen maintenance** of the converse, **lumen depreciation**.

The useful life of a lamp is when the luminous flux reaches a point where the lamp is no longer economically viable. This is often called the **useful life**. With most conventional lamps there is not a large difference between the lamp life and the useful life.

It has traditionally been the case that the useful life of a lamp tended to be around the 70% depreciation level. Modern fluorescent lamps and some ceramic arc metal halide lamps have a lumen maintenance >90% at the end of their rated life.

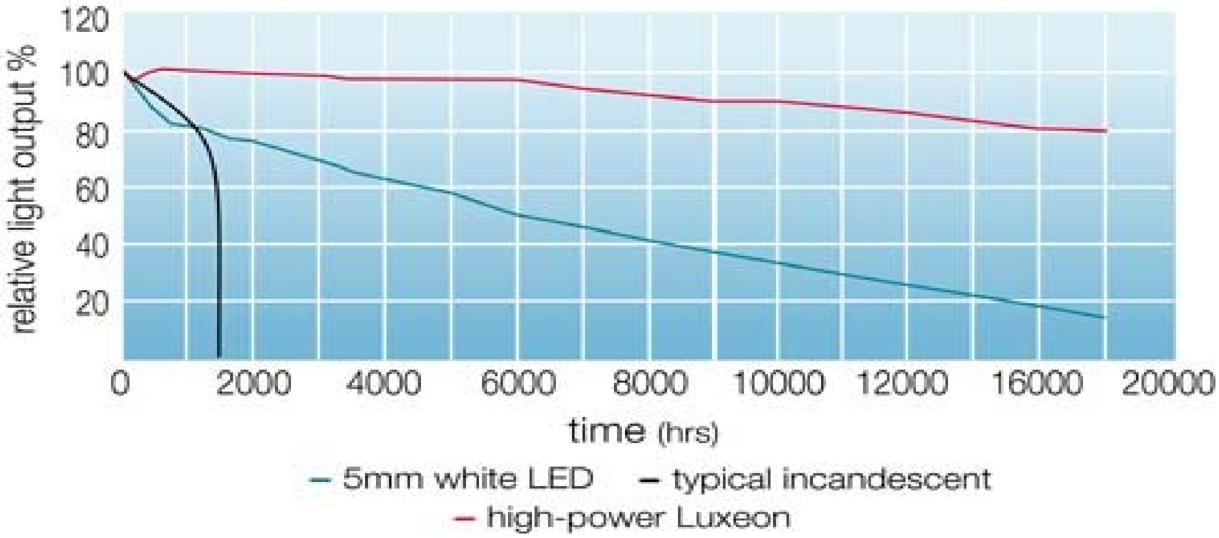


***Figure 3 comparison of the lumen maintenance of a good and poor quality LED.** (3)*

With LEDs it is possible to have a long life with very poor lumen maintenance. Figure 3 shows a comparison of lumen maintenance of a poor quality LED against a higher quality LED. The high quality LEDs have improved, however there are still LEDs similar to the poor quality ones used in cheaper downlights and replacement lamps for domestic reflector lamps.

To protect against this the North American IES have prepared a technical standard IES-LM80 which specifies tests for a **L_{70}** life rating which is the life defined at the point that the lumen maintenance drops to 70% of the initial lumens.

Table 2 gives a comparison of the major properties for each lamp.

Light Source	Efficacy Lumens/Watt	Rated Life	Lumen maintenance at end of life	Colour Rendering index	Correlated colour temperature
High Pressure Sodium	110	20000	70%	25	2000
Metal Halide Quartz Arc	84	15000	70%	60	3000 or 4500
Light Emitting Diode (note 1)	60 to 100	50000	70%	60 to 90	3000 to 6000

Table 2 Comparison of light sources

Note 1: There is a wide range of LED quality and performance. The data included in the table represents the higher quality units.

F. QUALITY OF LIGHTING

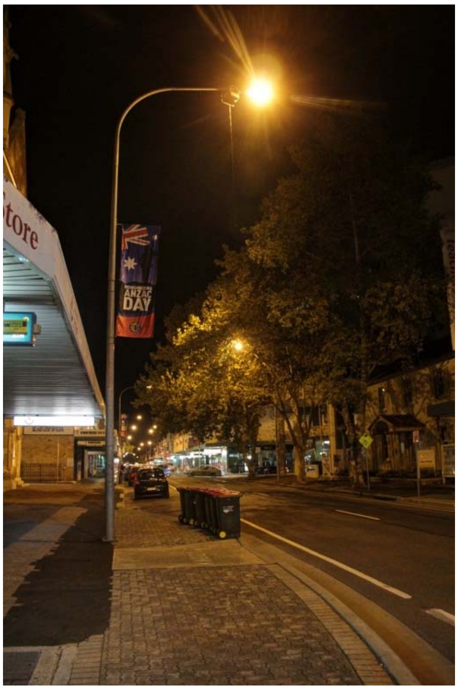
Compliance with the Public Lighting standard may give some control to ensure a minimum standard but will not necessarily deliver a quality or comfortable lighting installation.

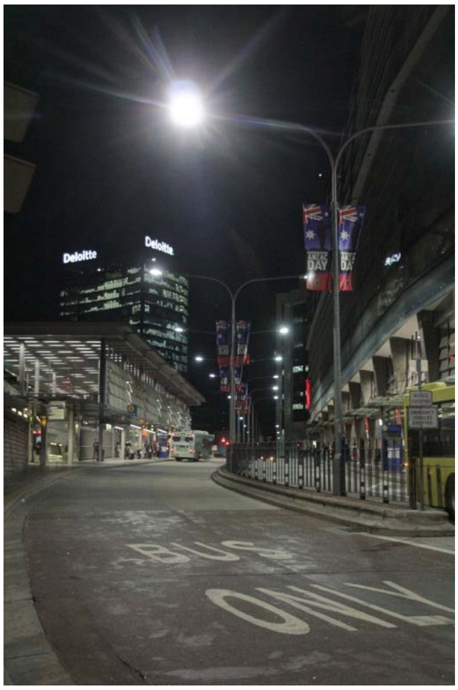
The standard limits the light technical parameters of illuminance in the horizontal and vertical planes, luminance in the horizontal plane and uniformity in the horizontal plane.

Our experience in Australia, United States and Europe has shown that if a space is to be successful as a night environment, then it needs to have the following quality aspects:

a) The colour rendering of the light needs to be high so that peoples skin tones are flattering and the space appears colourful and alive.

b) The colour appearance of the light is warm as cold light makes a space appear harsh and sterile.



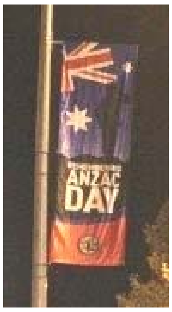


Picture 1 HPS

Picture 2 Metal Halide

Picture 1 is a street lit with high pressure sodium lighting. This light has a very yellow correlated colour temperature and poor colour rendering. Note yellow/brown appearance of the space and the lack of colour in the Anzac Day banner in picture 3 which is an enlargement of the banner in Picture 1.

Picture 2 is a street lit with metal halide lights. This is a relatively high colour rendering and a whiter colour appearance. Note the increased colour in the Anzac Day banner in picture 4 and the general crispness of the space.



Picture 3 Banner under HPS

Picture 4 Banner under Metal Halide

c) Glare from the lights should be minimised.

Glare is a major factor in night environments. Glare is a measure of the contrast between the light source and the background and the direction of view: The greater the difference, the greater the glare. The greater the offset between the direction of view and the glare source, the less the glare.

As the night background is often very dark it is very hard to control glare in external environments. The retina of the eye changes its sensitivity to suit the ambient lighting conditions. The presence of glare in an external installation causes the eye to overestimate the ambient light and therefore the space looks darker than it should. The lighting may be adequate by the standard, but the space will still look under illuminated. Increasing the light level may not improve the situation if the glare increases as well.

In addition glare tends to mask the ability to see past the glare source. People's perception of personal safety in a space is related to their distant views and the confidence that there is not a threat in the area they are approaching. With glaring sources the night view is claustrophobic as people's views are limited to the immediate area within the surrounding lights. Again, even if the installation has adequate illumination the perception is that it is a dark or an under lit space.

In many of the spaces within the Dee Why CBD the glare will not be as significant a problem as there is a higher level of ambient light and light reflected from facades. While this reduces the impact compared to a black background it is still a major problem, particularly with lower mounting heights and areas with high pedestrian activity.

Pictures 5 and 6 show the difference between a high colour rendering light with good glare control and poor colour rendering lighting with poor glare control. Note that with the good glare control fitting the person at the end of the path is visible.

Picture 5- high colour rendering and low glare

Picture 6 – low colour rendering, poor glare control

Many LED fittings generate significantly more glare than conventional fittings. The selection of the fittings should take this into account.

The introduction of LEDs into external lighting has highlighted a problem in the definition of glare in the standards. The glare control was introduced into the standard when streetlights used large coated mercury vapour lamps in large fittings with diffuse reflectors. Glare was defined in these standards as the luminance of the fittings and is calculated as the luminous Intensity of the fitting divided by the projected area of the optical opening.

As lamps have developed the light output of the lamps has increased and with clear lamps the physical size of the light source has reduced.

With LED lights there are two basic ways of designing a light; they can either be based on an array of bare LEDs that are directed into different parts of the distribution, or the LEDs can be fitted with lenses so that all the LEDs have the same distribution. Because the physical size of the light emitting part of the LED is very small the resulting luminance is very high.

Refer to Table 3 extracted for *"The relevance of current Standards when using LEDs in public lighting" Peter McLean, Warren Julian – Lighting, August/September 2103*

Luminaire type	Light source	Typical luminance at peak intensity kcd/m²
Streetlight	250W MV	23
Streetlight Aeroscreen	150W HPS	79
Streetlight Semi-cutoff	150W HPS	145
Streetlight Aeroscreen	250W HPS	140
Streetlight Semi-cutoff	250W HPS	250
LED streetlight direct view	High performance 350mA	48000
LED streetlight direct view	High performance 750mA	69000
LED streetlight direct view	High performance 1000mA	120000
LED streetlight Lens 65˚	High performance 750mA	330
LED streetlight Lens 65˚	High performance 1000mA	390

Table 3 Approximate peak intensity luminance of typical luminaires

As can be seen the luminance of lensed LED fittings is much lower than direct LED lights.

We are not aware of any research that has examined the visual impact of extremely intense very small light sources.

Pictures 7, 8 and 9 show the difference between a metal halide, a direct LED and a lensed LED streetlight.

The pictures show how a traditional light put a moderate amount of light at the base of the pole. This was the distribution that was expected when the standards were written.

The introduction of LEDs gave greater ability to direct the light into specific areas on the distribution. As a result the fitting can be designed to specifically meet the requirements of the standard rather than necessarily effectively lighting the space.

With some of the LED fittings the light is specifically aimed to achieve the vertical illuminance at the expense of light under the fitting. The fittings achieve excellent uniformity on the horizontal plane; however they do not provide the light directly under the fitting. As a result they generate glare, make the space look dark and hide people and objects directly under the fitting.

Picture 7 shows a conventional metal halide fitting.

Picture 8 shows a direct LED fitting. Note the difficulty in seeing the person under the pole.

Picture 9 shows a lensed LED fitting. Note the glare is less and the person under the pole is more visible.

Picture 7 – Discharge lamp luminaire

Picture 8 – Direct LED luminaire

Picture 9 – Lens LED luminaire

None of these quality aspects are addressed by the standards and rarely are they considered in lighting designs for supply authority owned assets.

LUMINAIRE OPTIONS

Although there are many LED streetlighting options available, not all have the flexibility to suite a variety of applications. We cannot recommend lights that use direct LEDs as we believe that the glare is excessive. Many of the fittings only come in a limited range of sizes and although they may be quite acceptable for some of the minor roads, do not have an adequate output to light the major roads and the associated intersections.

Based on our previous investigations we believe that the major options are:

- Philips XCeed LED range
- WE-EF VFL Range
- WE-EF RFL Range - the RFL range is more expensive than the VFL but has a round profile if it is preferred for aesthetics.

Picture 10 - Sylvania Roadster HID Lamp – Ausgrid Standard Streetlight

Picture 11 - Philips XCeed LED Range

Picture 12 - We-ef VFL LED Range

Picture 13 - We-ef RFL LED Range

The Philips XCeed fittings are generally less expensive than the WE-EF range, though still of high quality and are well engineered. The Philips fittings however only come in a street lighting distribution. As European street lighting is generally located at the property line they are generally designed with very little back throw behind the fitting. In Australia the footpaths are wider and the lights are generally mounted behind the kerb. As a result in some instances the lighting does not provide adequate light on the verge to achieve compliance with the standard. In these instances it may be necessary to provide some supplementary lighting.

In the trial calculations that we did this was only the case in a few isolated areas.

The WE-EF fittings come in a variety of distributions and cut off angles. The lens modules can be mixed and matched to provide the distribution required. As well as the ‘S’ distribution for streetlighting and ‘A’ distribution for area lighting they have an ‘R’ distribution that has been specifically designed for Australian conditions and throws additional light behind the pole.

Although the Philips fitting is considerably cheaper than the WE-EF, if multifunction poles are to be used the cost of either light is considerably less than the pole.

G. POLES

Ausgrid use sheet steel, cylindrical or hexagonal poles.

There are a few concrete poles left in the area. These are generally around 40 years old and a lot have developed concrete cancer. These are generally replaced where there is an opportunity.

If the Council opts for private poles there are basically two main options:

a) Use a standard sheet steel pole, similar to the Ausgrid standard. Although similar to the existing it would allow consistent appearance and fitting of banner arms etc. This will give the Council free choice of luminaire and the ability to include CCTV equipment etc.

b) Use a decorative pole. These can be a variation of the standard steel pole.

c) Use a multi-function pole. Whereas standard sheet poles are designed for a specific outreach arm and function the multi-function pole is a pole where the pole and the footing are designed to bolt on a range of additional equipment, either initially or in the future, without the need to redesign the pole or the footing.

The selection of the light is paramount to the compliance and quality of the visual experience, from a lighting aspect the pole is little more than a reliable mechanism of holding the light in the correct position and connecting power to it.

The selection of the pole however is important to the daytime visual environment and the other services that they support. The selection of the pole has a significant impact on the cost of the installation.

There are several manufacturers of standard poles. We have used Ingal EPS as representative rather than a preference.

Most manufacturers of standard poles also make decorative poles. These can either be from their standard decorative range or they will produce special designs. It should be noted that these are only decorative and not multi-functional poles.

Although the multi-function poles are generally a standard suite of components, it is possible have the poles provided in a Dee Why specific colour and in the past Smartpoles were provided in different colours for different areas and with a special designed cladding for the base of the poles for Taylor Square.

H. ASSESSMENT OF POLES

STANDARD POLES

The standard pole is a sheet metal pole that is post galvanised. The poles are a standard design and are used generally by supply authorities and the RMS. The poles are designed for general lighting and are capable of taking standard street lighting and pedestrian crossing lights and standard banner poles. They can also take mobile phone transponders.

The pole is a standard pole and the addition of other equipment while functionally adequate does little for the aesthetics on the pole.

A standard pole is generally made from rolled or folded sheet steel that is seam welded and hot dipped galvanised.

The quality of the finish of the pole will generally depend on the neatness of the weld, the amount of surplus build-up of metal and the welding dags.

The standard pole is generally not acceptable for CCTV as the pole is not rigid enough and the image is deteriorated due to camera shudder. The movement also negates image compression and therefore increases the data traffic and storage capacity required for the images.

If these poles are to be used for CCTV it is normal to construct special poles of the same dimensions but with increased wall thickness.

DECORATIVE POLES

This covers a broad range of poles that are modified in their construction to improve their appearance. They are still a standard pole that is designed to basically support a street light and a banner arm.

The variations between the poles that fall into this category are large and include:

- painted steel poles
- stainless steel poles
- aluminium poles
- steel or aluminium poles with metal or timber embellishments

The cost variation of these poles can also be considerable depending on the design.

Many of the decorative poles are fabricated in the same manner as standard poles except that the welds are ground back and the poles have a paint finish after galvanising. One of the limitations with decorative poles is that if another arm or accessory is to be mounted at a later date then it either needs to be strapped on with stainless steel packing straps or the paint work and galvanising will be damaged and will need to be repaired.

If the poles are to accommodate CCTV, Wi-Fi, interactive signage etc. then the poles design will need to be modified to accommodate them. This may involve increasing the diameter of some or all of the poles.

MULTI-FUNCTION POLES

Multi-function poles are designed as a base pole with accessories that can be added initially or at a future date. These accessories can include:

- Variable length outreach arms for streetlights
- Multiple outreach arms
- Outreach arms to support electronic signage
- Mobile phone transponders
- CCTV cameras
- Traffic Signals
- General Signage
- Banner Poles
- High and low level power outlets for events
- Wi-Fi nodes
- Interactive signage

There are several versions of the multifunction pole available.

- The City of Sydney owns the Smartpole design. We have contacted Hub Streetlight for a quote and have been told that they have been instructed by the City of Sydney that, until the court case over the poles has been concluded they are not to quote to supply the fittings to other organisations.

  The Smartpole is a steel structural element with an aluminium shroud. All the accessories attach to the steel structure. This gives a high degree of flexibility.

  In addition there is a distribution board in the base of each pole so that there is separate control of the light and other power for accessories.

  The Smartpole is approved by the RMS for the attachment of traffic signals.

  The disadvantages of the Smartpole are that as they can take accessories at a future date the pole structure and footing has to be significantly overdesigned with respect to its normal duty. In addition from an embodied energy aspect, the pole not only has more steel in it than a conventional pole, but there is also a significant amount of extruded aluminium that is only decorative.

- HUB also makes another multifunction pole, the MFP, which is their own design. This is similar in principal to the Smartpole but has a different assembly method and appearance.

- Fyntrim make a multi-function pole that is different to the others in that it is an all-aluminium pole. It does not have the same load capability as other multifunction poles but will still perform the majority of functions.

  The Fyntrim pole is less expensive than the others as it has less material.

Fyntrim poles were used in the Castle Hill main street upgrade.

Number	Manufacturer	Description	Supply price per unit
1	Ingal EPS	Standard Pole Galvanised Sheet steel (Ausgrid Compliant)	$500
2	Ingal EPS	Decorative Pole	$1500
3	Fyntrim Poles	All aluminium multi-function pole	$4450
4	Hub Furniture	Aluminium Clad, steel, 'Smartpole' (City of Sydney)	No price provided
5	Hub Furniture	MFP	$5842

Table 4 Pole Options

Picture 14 – Ausgrid Standard Poles

Picture 15 – Typical Decorative Poles

Picture 16 – Hub and Fyntrim Multifunction poles

More details of multifunction poles are included in Appendix

I. OWNERSHIP OF PUBLIC LIGHTING

Traditionally public lighting has been supplied, installed, maintained and owned by the supply authority and leased by the local government on a fitting by fitting basis.

This appears to be a unique situation in Australia. Overseas it is more normal for the public lighting to be owned and operated by the city. They are generally much larger than our local government areas, particularly at the time when this arrangement was conceived.

The advantage of this arrangement, particularly for small councils, is that the council does not have to fund the capital cost of the works or be responsible for the maintenance of the lighting. The main disadvantage is that the supply authority has many councils that they are dealing with and in the interests of cost efficiency attempt to have a consistent approach to all. This severely limits the ability to do something special and limits the speed of change.

The supply authority therefore has a limited range of poles and fittings that they will accept. This is done to reduce their maintenance costs, but it also imposes limitations on the ability for the council to improve the quality of the visual environment or the urban environment.

Ausgrid is among the more flexible supply authorities with respect to the public lighting.

There are other options that are available to the Council with respect to Public Lighting:

1. The council can opt to privately own the poles and lights. This means that the poles, lights and cabling are owned and maintained by the council. This involves the installation of main switchboards at regular points through the installation for the connection to the power grid and to meter the energy usage.

   This has the advantage that the council can use whatever light and pole they desire. It also allows the Council freedom to attach banners, CCTV and other equipment to the poles. They will however become responsible for the maintenance of the lights and poles, including out of hours emergency calls.

   The council also has to buy the power from the supply authority at commercial rates, whereas when the supply authority owned the lighting they would be paying at wholesale rates.

   Ausgrid did have an arrangement where they would provide limited maintenance including lamp, fuse and photocell replacement. This is now available for installations prior to 2009.

2. There is some precedent for Councils purchasing existing streetlighting assets from the supply authority. This has occurred in some parks and streets in the City of Sydney. The City of Sydney has also done this with the majority of Smartpoles that were installed in the Sydney CBD prior to 2000. They were originally installed as an Energy Australia asset, however Ausgrid decided that they no longer wanted to be involved and the City of Sydney has taken them back.

   This could be considered in Dee Why for significant streets that the Council would like to upgrade.

   This has the advantage that the Council can use whatever equipment they like while retaining the infrastructure and any equipment that is not affected. There may be some complications in effecting the changeover of the ownership:

   a) There would need to be main switchboards installed at regular points in the installation to meter the power usage.

   b) There may be lights in adjacent areas that come off the same lighting circuit as the purchased assets. These would need to be rewired to a new point of supply.

   c) A supply authority is exempt from AS3000 *SAA Wiring Rules* for their distribution systems. This will mean that their cabling may not meet the earthing regulations and fault-loop-impedance limits. This may involve some rewiring of the installation.

d) There are still some timber poles with aerial cabling within the City Centre. As these are supplying local customers it would not be possible to take them over as Council assets. The only option is if the lighting were to be upgraded would be for Ausgrid to underground the mains and the council install private lighting. Most of these situations occur on the peripheral of the City Centre

e) Mobile phone companies often lease pole space from the supply authorities to mount their transponders. The Council will need to include the reassignment of these leases to them with the poles and if they are to remove or replace the pole, they will need to renegotiate the lease with the telephone service provider.

d) There are a few streets where the lighting has been upgraded in a reasonable section of road, usually as part of undergrounding or pavement treatment. In these cases there is usually consistency in set out of the poles and the style of the poles. In many of the areas the poles have been upgraded on an ad-hoc basis and there is a wide variety of style of pole within a relatively small area.

e) Some of the poles have Nightwatch floodlights mounted on them. These are floodlights that Ausgrid provides to light private facilities from the street. These are generally provided as security lighting, but are also used for façade floodlighting. Ausgrid charge an annual rental for the supply, energy usage and maintenance of the fitting. If the Council takes over the ownership of the poles they will need to address whether and how they are going to continue this service.

PRIVATE OWNERSHIP OF PUBLIC LIGHTING

There are some proposals available for a separate company to supply, install, maintain and operate the streetlights. The contractual details would need to be negotiated however a typical arrangement may be an annual fee per light and an energy cost charge. The fees may be more or less than currently charged by Ausgrid.

While the contract would supply lighting for the streets it would also entitle the owner to lease the uses of the pole for additional uses to the council or other organisations for decorative banners, advertising, mobile transponders, CCTV cameras, Wi-Fi etc.

Before the council enters into such an arrangement it is important that the Councils rights and responsibilities are clarified. This is not an exhaustive list but highlights some of the things that the council should consider:

- What happens to the assets if the company ceases to trade for some reason?
- Is there an escalation in the maintenance of lighting energy costs over the contract period? This could be a high risk to the company given the rate of increase in energy costs at the moment. Increase in interest rates could also have an effect.
- Can the company sell off the assets to another operator?
- What are the performance criteria for the design and maintenance of the system? E.g. Quality of Lighting equipment installed, compliance with non-mandatory standards, minimum outage time.

- If the company fails to meet the performance criteria what comeback does the Council have?
- Does the company intend to set up a maintenance unit within its organisation to manage the lamp replacement, call outs etc. or will they subcontract it to someone else?
- Is the contractor responsible for repair and replacement of accidental or malicious damaged equipment other than general wear and tear?
- Does the company's capital cost include the cost of removal and the residual value of Ausgrid's assets?
- If there is currently an aerial power reticulation system who pays for the undergrounding?
- What happens to the assets at the end of the contract period? Do they vest to the council or do they remain the property of the company?
- Does the council have to pay extra to mount banners and Christmas decorations on the poles?
- Does the council have to pay extra to have CCTV on the poles?
- Does the company have the right to install advertising, illuminated or not, on the poles? If so does the council have any control over the extent and the content?
- Does the offer include the integration of traffic control signals on the poles?
- Is the contract viewed as a lease and does it affect the Council's loan ceiling?

J. DECORATIVE LIGHTING

Although the streetlighting has a predominately functional purpose, the selection of higher quality equipment can add to the general urban design of the space and create a more comfortable and visually interesting space.

There are other areas in the masterplan areas where, although they still need to provide adequate lighting, they are predominately people spaces and there is a greater priority on making them attractive as well as comfortable.

In these areas it is important that the lighting has a scale that relates better to people. This tends to make the space more interment and relaxing. This also provides the opportunity to use lights and poles that are more decorative.

POSTTOP FITTINGS

Posttop lights are normally between 4 and 5 metres high as this gives a good compromise between human scale, spacing of poles and protection against vandalism.

With poles of this height it is more important that the glare be controlled as the lights are much closer to people's heads.

The postop fittings can be a smaller or related fitting to the streetlights or can be totally unique.

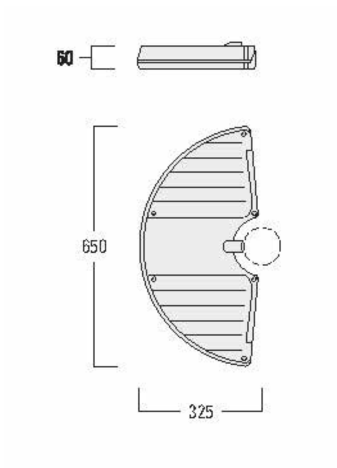
Although there is a broad range of fittings that are available, in addition to the aesthetic requirements, the selected fittings need to achieve the desired level of glare control, energy efficiency, control of the light distribution and cost.

As a general guide the fitting should have a flat glass so that no light is emitted in or above the horizontal plane.

With some brands of metal halide and LED fittings it is possible to get a range of fittings that can have path lighting, forward throw area lighting, or symmetrical distributions and different wattages, all in fittings that have the same external appearance.

The postop lights can be provided with smaller versions of the Philips or WE-EF fittings.

There is also the opportunity for some more unique fittings such as the WE-EF RMC Family. One of the advantages of LEDs is that the shape of the fitting is now less controlled by the distribution.



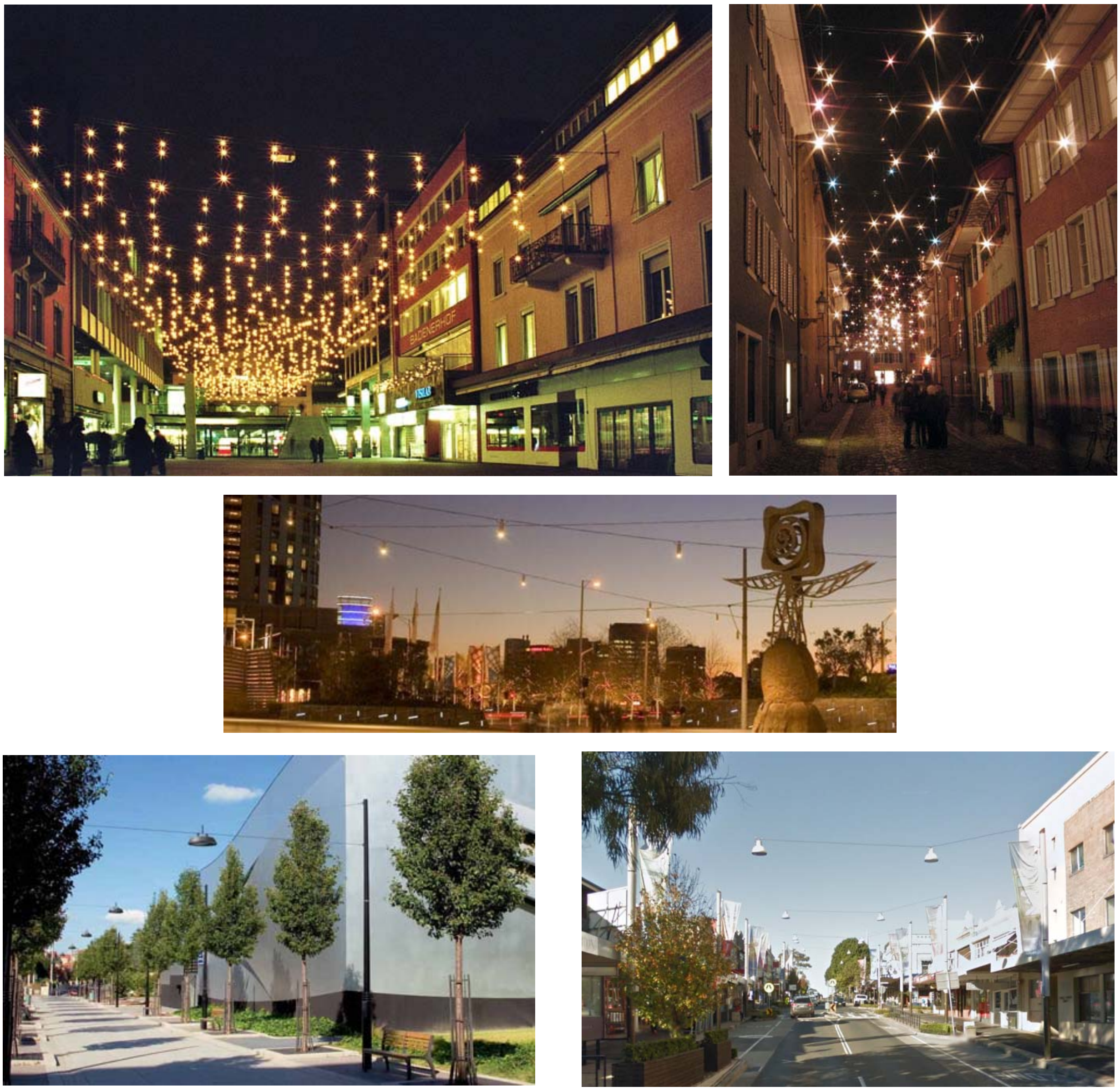
Picture 17- WE-EF RMC Family

There is also an opportunity to provide different lighting solutions in different spaces to create a unique experience for the space.

There are several options that are available to change the atmosphere of specific space.

CATENARY LIGHTING

Catenary lighting moves the lights from poles and creates a ceiling of lights over the space. Depending on the size and light output this can vary from a few larger fittings to a ceiling of stars. The effect defines the area as something special and intimate.



Pictures 18 – Catenary Examples

DIRECTIONAL LIGHTING

Another way of lighting an open space is to use slightly higher poles with a series of narrow beam floodlights. This enables an open space to be lit without a myriad of poles. It also enables different areas to be accented.

Pictures 19 – Directional Examples

UPLIGHTING AND LIGHTING OF VERTICAL SPACES

Uplighting and lighting of vertical surfaces has a significant effect on and outside public space. Both increase the visual size of the space and reduce the extent and intensity of shadows. This improves peoples feeling of safety and comfort as they can identify the presence of other people and objects in the space.

Although uplights have often been considered a maintenance liability, particularly if poor quality fittings were used, with the introduction of LED fittings it is possible to get factory sealed fittings that can be plugged into an inground socket without the need for the electrician to open the fitting. The fittings are therefore guaranteed against ingress of water as long as they are not opened. When the lamps eventually fail the fitting can be returned to the manufacturer to be re-lamped and re-guaranteed.

Vertical illumination can also be added through the lighting of the facades.

UNDER-AWNING LIGHTING

One of the problems experienced in lighting of strip shopping is the night shadowing effect of awnings and trees. This can be addressed either by the addition of lower level postop fittings or the provision of under-awning lighting.

Under-awning lights, although providing a good lighting solution have inherent problems that need to be addressed.

The first is ownership of the lighting. If the lighting is privately owned then there has to be some regulation or incentive to encourage people to install the lights and run them all night. For new installations this can be done through inclusion in the LEP. There also needs to be some regulation to encourage consistency in the designs. The City of Sydney has two requirements for under-awning lights. One specifies a minimum lighting level while the other a maximum level to prevent convenience stores lining the soffit of the awning with bare lamps.

The City of Sydney also has a suite of acceptable luminaires for under-awning lighting.

With existing awnings there is probably the need for the Council to subsidise a private installation or supply the lighting as a council owned and maintained asset.

If the lights are owned, maintained and operated by the building owner there needs to be some method of ensuring that the lights will be maintained and operated for the required hours.

If the council owns the lighting there is the difficulty that the awnings are owned privately. When the City of Sydney redeveloped Darlinghurst Road in Kings Cross they replaced around 30% of the awnings as the awnings were structurally suspect. The other awnings had lights installed. In both cases the wiring had to be brought down the front of the building to link back to the cables in the street. The continuity of the cabling will be affected if there is a building without an awning or if there is an owner that does not give permission for the lighting and cabling to be attached to their awning.

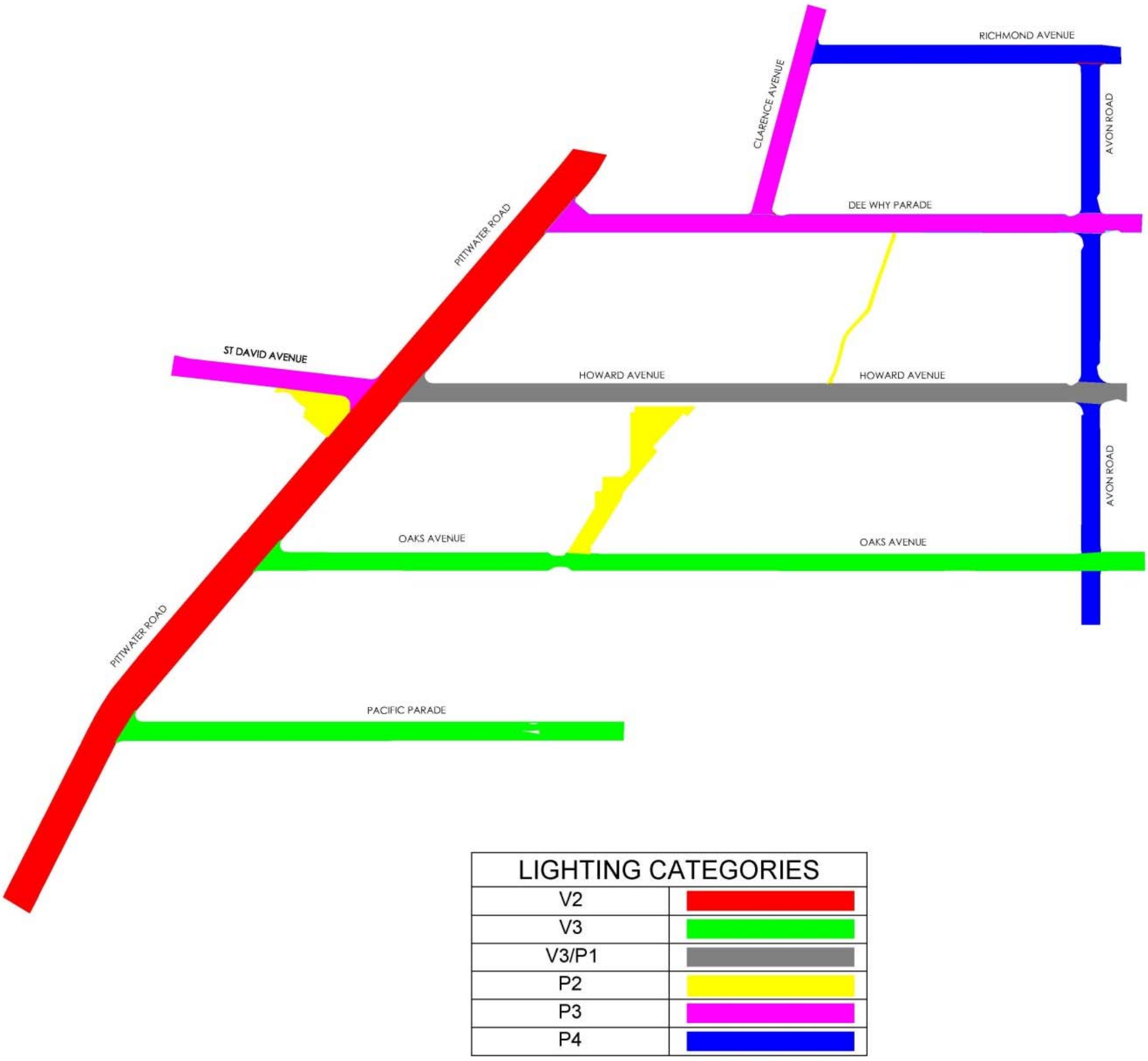
If the lighting is council owned then it is possible to make the lighting a feature of the space such as the line of pearls in King Street Newtown or Sydney Road Manly.

K. RECOMMENDATIONS

Installing a private network of public lighting allows the flexibility to change the lighting from the existing high pressure sodium and mercury vapour streetlights to the latest technology LED streetlights, saving energy and reducing grennhouse gas emissions. The use of multi-function poles (MFP's) has the advantage of reducing street clutter by incorporating streetlights, banners, Wi-Fi antennas, CCTV's and signage. By standardising on a mutli-function pole uniformity throughout the precinct is maintained. By comparison if standard poles are used either special poles need to be made for each situation where additional equipment is to be added or the equipment will just be strapped to the pole with stainless steel packing straps.

The RMS have categorised Pittwater Road as a 'V2' road. Input from traffic division within council and the local police should determine the categories for the minor roads, parks, carparks, cycleways and public spaces. Appendix 1 and 2 detail the criteria for selection of the V and P Categories.

We have made suggestions of the possible V and P category for each of the roads and paths in the masterplan area based upon our experience, the outcomes are depicted below. The council should review these suggestions and nomilate the categories to be used in the design.



Possible V and P Category Public Lighting Options

L. APPENDICES

APPENDIX 1 – EXTRACTS FROM AS/NZS1158.1

TABLE 2.1

CATEGORY V LIGHTING AND TYPICAL APPLICATIONS

Typical applications		Lighting subcategory
Description of road or area type	**Operating characteristics**	
Arterial or main roads in central and regional activity centres of capital and major provincial cities, and other areas with major abutting traffic generators	—Mixed vehicle and pedestrian traffic —High to very high vehicle volume —High to very high pedestrian volume —Moderate to low vehicle speeds —Stationary vehicles alongside the carriageway —Through and local traffic —High traffic generation from abutting properties	V1
Arterial roads that predominantly carry through traffic from one region to another, forming principal avenues of communication for traffic movement, with major abutting traffic generators	—Mixed vehicle and pedestrian traffic —High vehicle volume —High pedestrian volume —Moderate to high vehicle speeds —Stationary vehicles alongside the carriageway —Through and local traffic —High traffic generation from abutting properties	V2
Freeways, motorways and expressways consisting of divided highways for through traffic with no access for traffic between interchanges and with grade separation at all intersections	—Vehicle traffic only —High to very high vehicle volume —High speeds	V3
Arterial roads that predominantly carry through traffic from one region to another, forming principal avenues of communication for traffic movements	—Mixed vehicle and pedestrian traffic —Moderate to high vehicle volume —High pedestrian volume —Moderate to low vehicle speeds —Stationary vehicles alongside the carriageway —Through and local traffic —Moderate traffic generation from abutting properties	
Sub-arterial or principal roads which connect arterial or main roads to areas of development within a region, or which carry traffic directly from one part of a region to another part	—Mixed vehicle and pedestrian traffic —Moderate traffic volume —Low pedestrian volume —Moderate to low vehicle speeds —Low traffic generation from abutting properties	V4* or V5

* V4 is the minimum subcategory recommended for application in New Zealand.

APPENDIX 2 – EXTRACTS FROM AS/NZS1158.3

TABLE 2.1

LIGHTING CATEGORIES FOR ROAD RESERVES IN LOCAL AREAS

1	2	3	4	5	6
Type of road or pathway		**Selection criteria[a,b]**			**Applicable lighting subcategory[c,d]**
General description	**Basic operating characteristics**	**Pedestrian/ cycle activity**	**Risk[f] of crime**	**Need to enhance prestige**	
Collector roads or non-arterial roads which collect and distribute traffic in an area, as well as serving abutting properties	Mixed vehicle and pedestrian traffic	N/A	High	N/A	P1
		High	Medium	High	P2
		Medium	Low	Medium	P3
		Low	Low	N/A	P4
Local roads or streets used primarily for access to abutting properties, including residential properties	Mixed vehicle and pedestrian traffic	N/A	High	N/A	P1
		High	Medium	High	P2
		Medium	Medium	Medium	P3
		Low	Low	N/A	P4
		Low	Low	N/A	P5[e]
Common area, forecourts of cluster housing	Mixed vehicle and pedestrian traffic	N/A	High	N/A	P1
		High	Medium	High	P2
		Medium	Low	Medium	P3
		Low	Low	N/A	P4

TABLE 2.2

LIGHTING CATEGORIES FOR PATHWAYS (INCLUDING CYCLEWAYS)

1	2	3	4	5	6
Type of pathway		**Selection criteria[a,b]**			**Applicable lighting subcategory**
General description	**Basic operating characteristics**	**Pedestrian/ cycle activity**	**Risk of crime[f]**	**Need to enhance prestige**	
Pedestrian or cycle orientated pathway, e.g. footpaths, including those along local roads[d] and arterial roads[e], walkways, lanes, park paths, cycleways	Pedestrian/cycle traffic only	N/A	High	N/A	P1[c]
		High	Medium	High	P2[c]
		Medium	Low	Medium	P3
		Low	Low	N/A	P4

TABLE 2.3

LIGHTING CATEGORIES FOR PUBLIC ACTIVITY AREAS (EXCLUDING CAR PARKS)

1	2	3	4	5	6
Type of area or activity		**Selection criteria[a,b]**			**Applicable lighting subcategory**
General description	**Basic operating characteristics**	**Night time vehicle movements**	**Risk of crime[c]**	**Need to enhance prestige**	
Areas primarily for pedestrian use, e.g. city, town, suburban centres, including outdoor shopping precincts, malls, open arcades, town squares, civic centres	Generally pedestrian movement only	N/A	High	High	P6
		Medium	Medium	Medium	P7
		Low	Low	N/A	P8
Transport terminals and interchanges, service areas	Mixed pedestrian and vehicle movement	High	High	High	P6
		Medium	Medium	Medium	P7
		Low	Low	N/A	P8

TABLE 2.4

LIGHTING CATEGORIES FOR CONNECTING ELEMENTS

Type of area	Applicable lighting subcategory
Steps and stairways, ramps, footbridges, pedestrian ways	P9
Subways, including associated ramps or stairways	P10

NOTE: Subways are listed as a separate subcategory because of a high risk of crime.

TABLE 2.5

LIGHTING CATEGORIES FOR OUTDOOR CAR PARKS (INCLUDING ROOF-TOP CAR PARKS)

1	2	3	4	5
	Selection criteria[a)]			
Type of area	**Night time vehicle or pedestrian movements**	**Night time occupancy rates (NTOR)**	**Risk of crime[b)]**	**Applicable lighting subcategory [c)]**
Parking spaces, aisles and circulation roadways	High	>75%	High	P11a
	Medium	≥25%, ≤75%	Medium	P11b
	Low	<25%	Low	P11c
Designated parking spaces specifically intended for people with disabilities	N/A	N/A	N/A	P12

a) The selection criteria of Columns 2 to 4 should be separately evaluated. The highest level of any of the selection criteria that is deemed appropriate for the area type will determine the applicable lighting subcategory.

b) The risk levels 'High', 'Medium' and 'Low' correspond to the classifications of the same names in HB 436.

c) Providing a lighting scheme that meets the requirements of more than one subcategory by the use of switching is permitted.

APPENDIX 3 - MULTI-FUNCTION POLES

Multipole™

Multifunction Pole Design Systems

Use the system that fulfills all pole requirements.

Customize the design to deliver unique solutions.

Multipole™ Advantages

- Multipole™ comprises a new generation of extruded aluminium street poles; more efficient and less expensive than earlier versions of multi-function street poles.

- Applications utilize an all aluminium pole without the disadvantage of a heavy steel spigot. An all aluminium Multipole™ is inherently energy absorbing frangible, thereby eliminating the need for inherently dangerous slip base arrangements for highway applications.

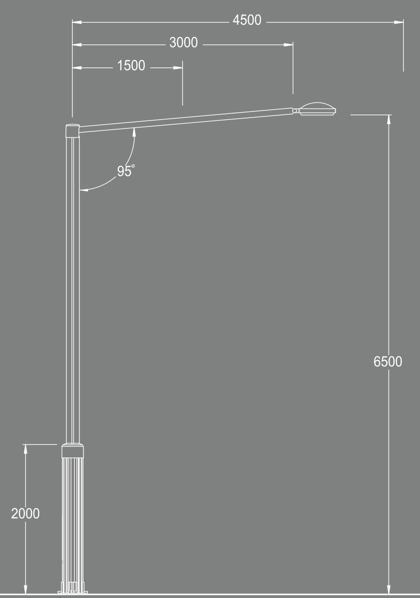
- Aluminium construction is about one third the mass of comparable steel products; therefore, installation and transport costs are much lower.

- The standard anodized finish virtually eliminates oxidation; consequently Multipole™ has an exceptional life span generally exceeding 60 years.

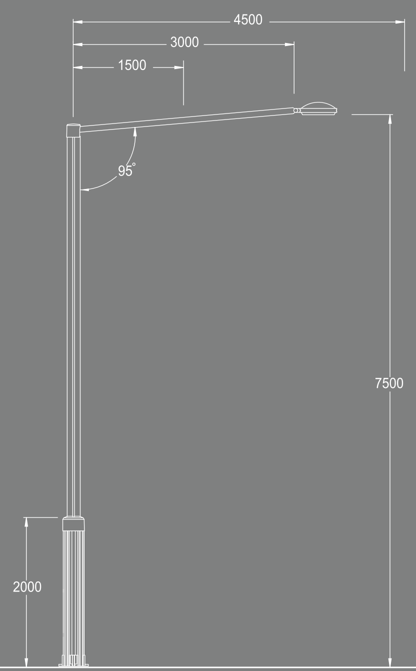
- Outreach arms are made in various lengths and spigot sizes; suitable to attach virtually all available outdoor lights. Stylish conical tapered arms are also available.

- Ventilation system to minimize internal humidity and moisture build up that can corrode switch gear.

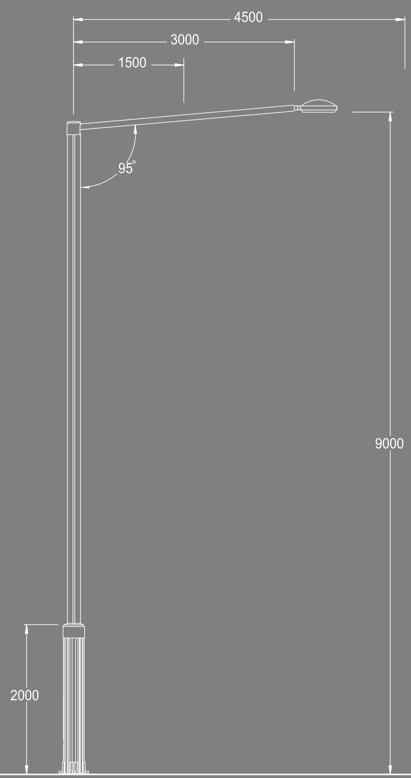
- The patented extrusion profiles with integral external tracks include internal grooves to aid in the mounting of switch gear and electric panels.



Street Light



Street Light



Street Light
Major Road

The Macarthur Range. Low cost Multipole™ System with angled outreach arms. Integral Energy Approved.

- Vandal resistant patented deformable clamps are used to securely fit various items to the Multipole™ external tracks at almost any desired height. Items include but are not limited to promotional banners, traffic lights, street name signs, parking signs, CCTV cameras, solar panels, bicycle racks, pole mounted bus shelters and seats.

- Installation choices include direct bury or a robust patented extruded foot assembly, with mounting slots ready for installation via foundation bolts.

- An optional prefabricated pit mounting foundation design simplifies installation and inspection of foundation bolts.

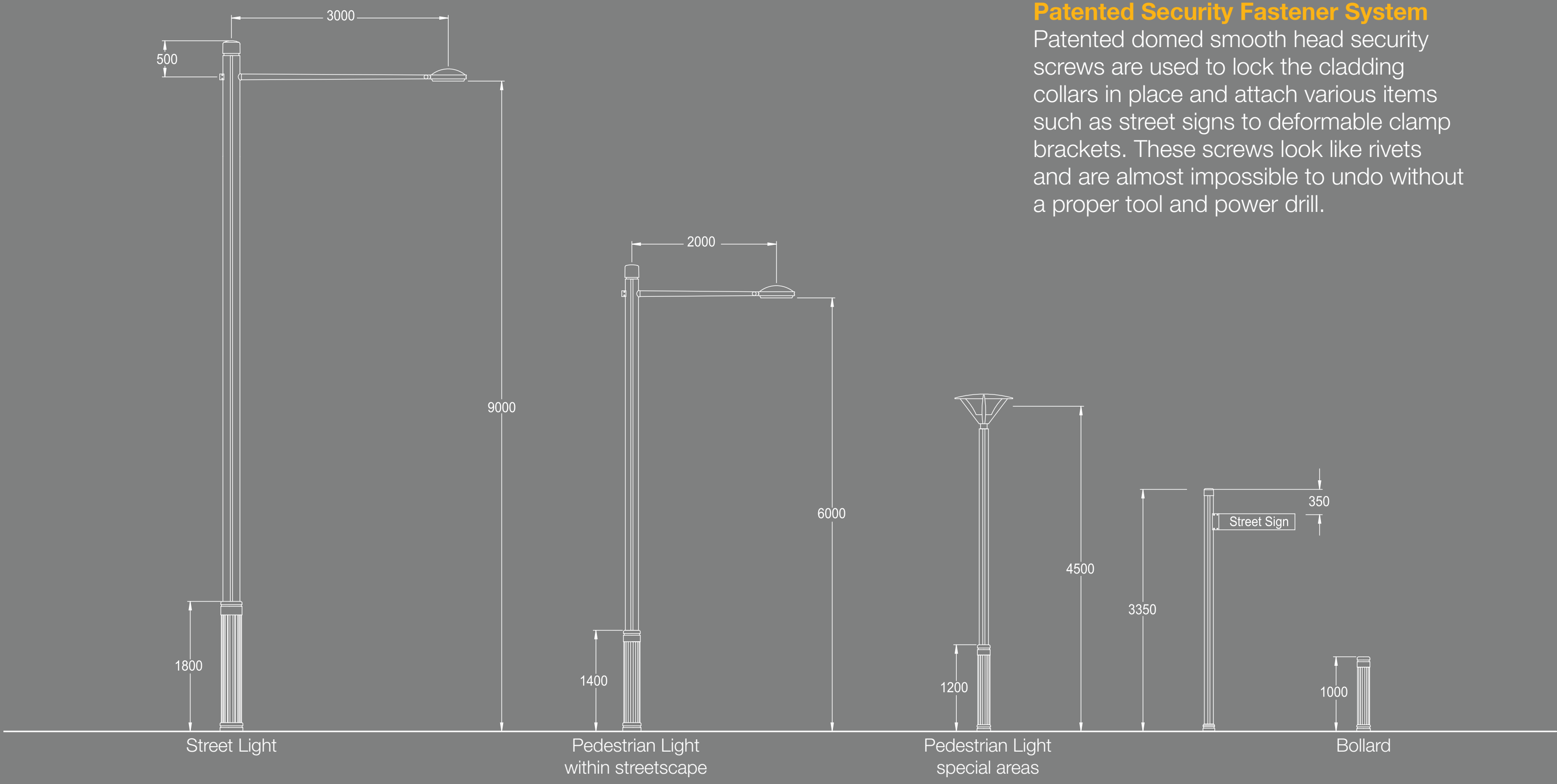
- Multipole™ is water proof rated IP23.

Patented Adjustable Cladding System

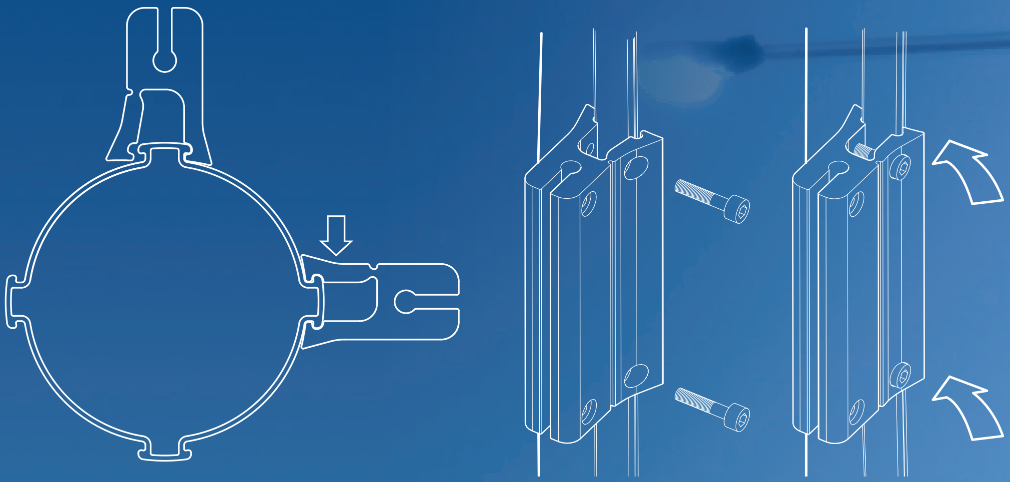
The four pieces of heavy gauge 4mm thick inter-locking extruded cladding are held in place top and bottom by robust cast aluminium collars. The cladding assembly can be adjusted in height so the bottom collar casting sits neatly on the pavement. The cladding hides the electrical hatch that is isolated by a clip on PVC cover. The collar castings are hard anodized to minimize scratching.

Patented Security Fastener System

Patented domed smooth head security screws are used to lock the cladding collars in place and attach various items such as street signs to deformable clamp brackets. These screws look like rivets and are almost impossible to undo without a proper tool and power drill.

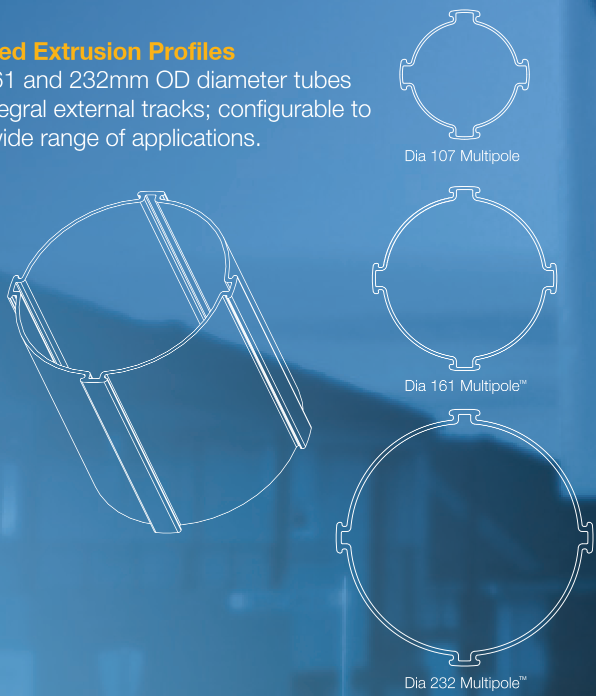


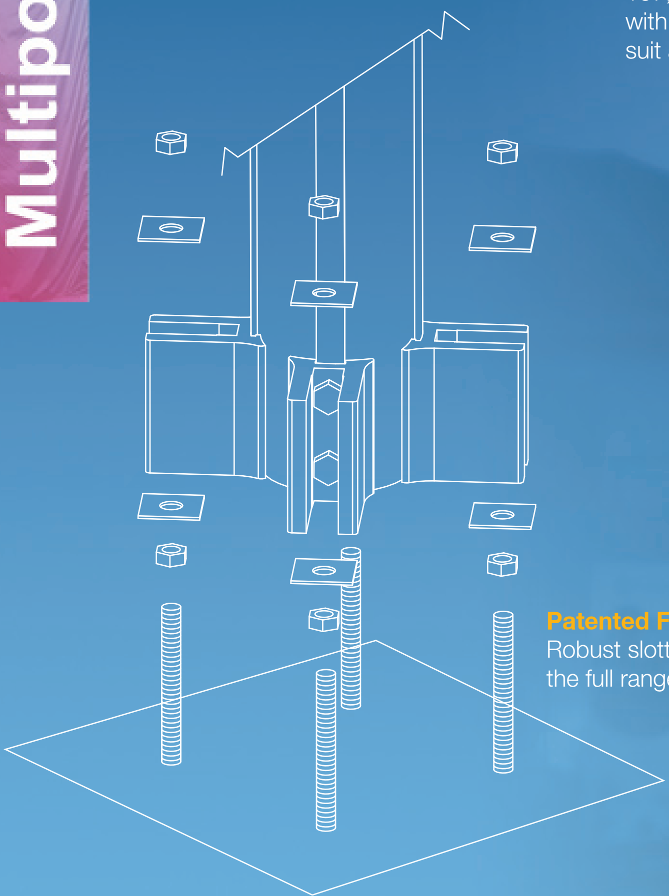
The Canberra Range. Multipole™ System with cast transitions and removable cladding. ACTEW Approved. Roads ACT Approved.



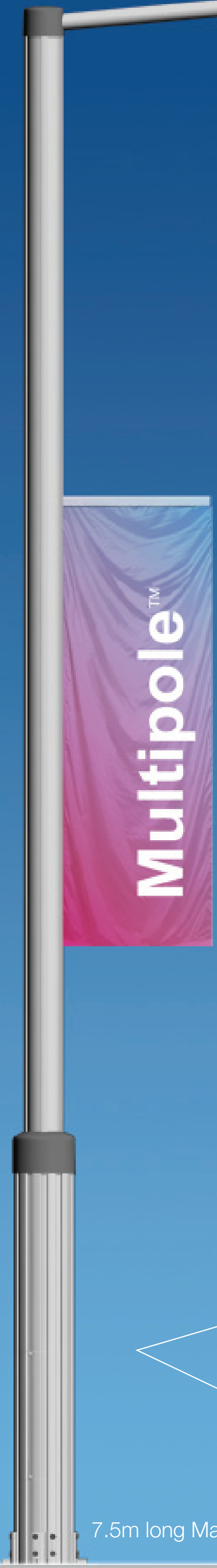
Patented Deformable Clamps
Enable secure vandal resistant attachment of various items including signs, traffic lights and CCTV at almost any angle.

Patented Extrusion Profiles
107, 161 and 232mm OD diameter tubes with integral external tracks; configurable to suit a wide range of applications.





Patented Footing System
Robust slotted foot extrusions are available to suit the full range of Multipole™ extrusion profiles.



7.5m long Macarthur Multipole™ with banner arm and 1.5m outreach arm

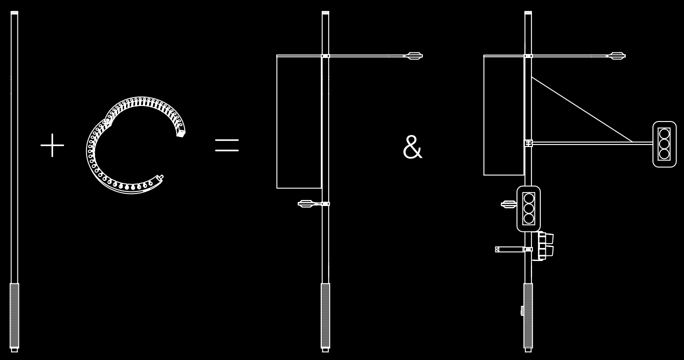
Fyntrim Pty Ltd

PO Box 588 Mona Vale NSW 2017 Australia
Telephone +61 2 9997 1278 Facsimile +61 2 9997 3533 Email sales@lightpole.com.au
www.lightpole.com

HUB MFP
Multi Function Pole System

Beautiful Functional Robust™

HUB MFP
Key Benefits



HUB-MFP REDUCES STREET CLUTTER

The HUB Multi Function Street Pole System combines all Street Pole Functions onto one beautifully designed structural urban element.

HUB-MFP IS A MODULAR SYSTEM

The HUB MFP System is a fully modular System that can be adapted to the needs of any modern city. It is completely flexible in terms of:

1. Pole Height
2. Pole diameters
3. Accessories accommodated immediately
4. Accessories accommodated in the future
5. Ability to customise the aesthetics to suit the character of each city

HUB UNIVERSAL MOUNTING SYSTEM (UMS)

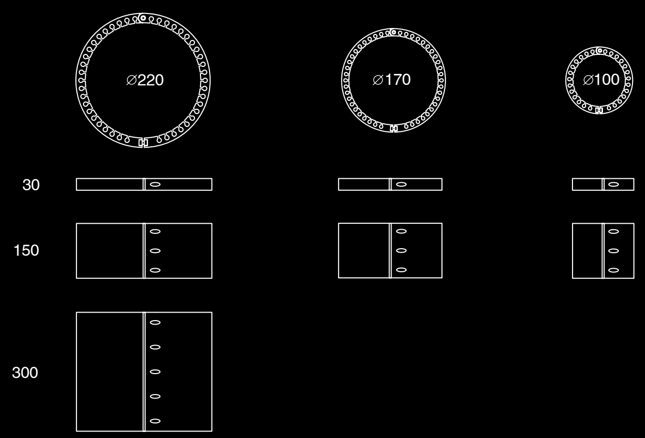
Functionality of the HUB MFP is delivered by an ingeniously simple and inexpensive Universal Mounting System (HUB UMS), designed as a single beautifully resolved extrusion which is docked and post machined. The HUB UMS ensures that the HUB MFP system is:

FUTURE PROOF
The system allows for all current and future street pole requirements as needs evolve.

COST EFFECTIVE
The elegance and simplicity of the system minimises all related costs.

COMPLETELY FLEXIBLE
All accessories can be mounted at any height and in any orientation through 360 degrees

RETRO-FITTABLE
The HUB UMS can also be retro fitted to existing poles. This means that the premium HUB Pole System can be deployed for the highest profile streets in a city while the functional core of the system, the HUB UMS, can be extended onto an existing pole infrastructure.



UMS - GEOMETRY

The design of this extrusion not only provides maximum flexibility in regards to mounting orientation but the mounting detail ensures that when the HUB UMS is attached to the pole the assembly actually flexes and conforms to the often imperfect circular shape of the pole.

POLE - RANGE OF SIZES
The HUB MFP System comes in a range of sizes:
1. Diameter 220mm
2. Diameter 170mm
3. Diameter 100mm

UMS - RANGE OF SIZES
The HUB UMS comes in 3 sizes:
1. Mini HUB - 25mm (all on-pole accessories)
2. Minor HUB - 100mm (Street lighting and banners)
3. Major HUB - 200mm (Traffic outreaches)

HUB MFP
Details

BEAUTIFUL DESIGN DETAILS

Inherent beauty in the details, finishes and forms
Discrete aluminium to steel connection
Integrated Pedestrian Push Button assembly ensures no rubbish build-up
Minimal architectural styling
Discrete HUB UMS fixing detail
Bold and robust hinge detail
Maximum surface contact / Maximum grip
Material + Process consistency

HUB-UMS VS TRACK BASED MFP'S

The benefits of the HUB-UMS over traditional track based systems is that the track on track-based systems is predominately redundant. The majority of poles (mid block) require only a streetlight, a banner and some minor signage. The majority of the track on these poles is not required. Further, track based systems limit orientation of accessories to 4 directions (90 degree increments).

Whereas the HUB-UMS is only used / applied when multi functionality is required making it a more appropriate and more efficient approach. The HUB-UMS offers orientation of accessories through 360 degrees.

CUSTOM OPTIONS

LED fittings deployed on high profile streets:
1. Pole Cap LED
2. Base Cladding LED

Cladding relfects the character of each city

HUB MFP
Features

HUB MFP ACCESSORIES

LIGHTING
Street Lighting
Pedestrian Lighting
Feature Lighting

TRAFFIC
Traffic Signals
Pedestrian Signals
Variable Message Signs (VMS)

SIGNAGE
Banners
Street Name
Traffic Control
Parking Control
Advertising

TELECOMMUNICATIONS
Panel Antenna
Microcell
Omni Antenna

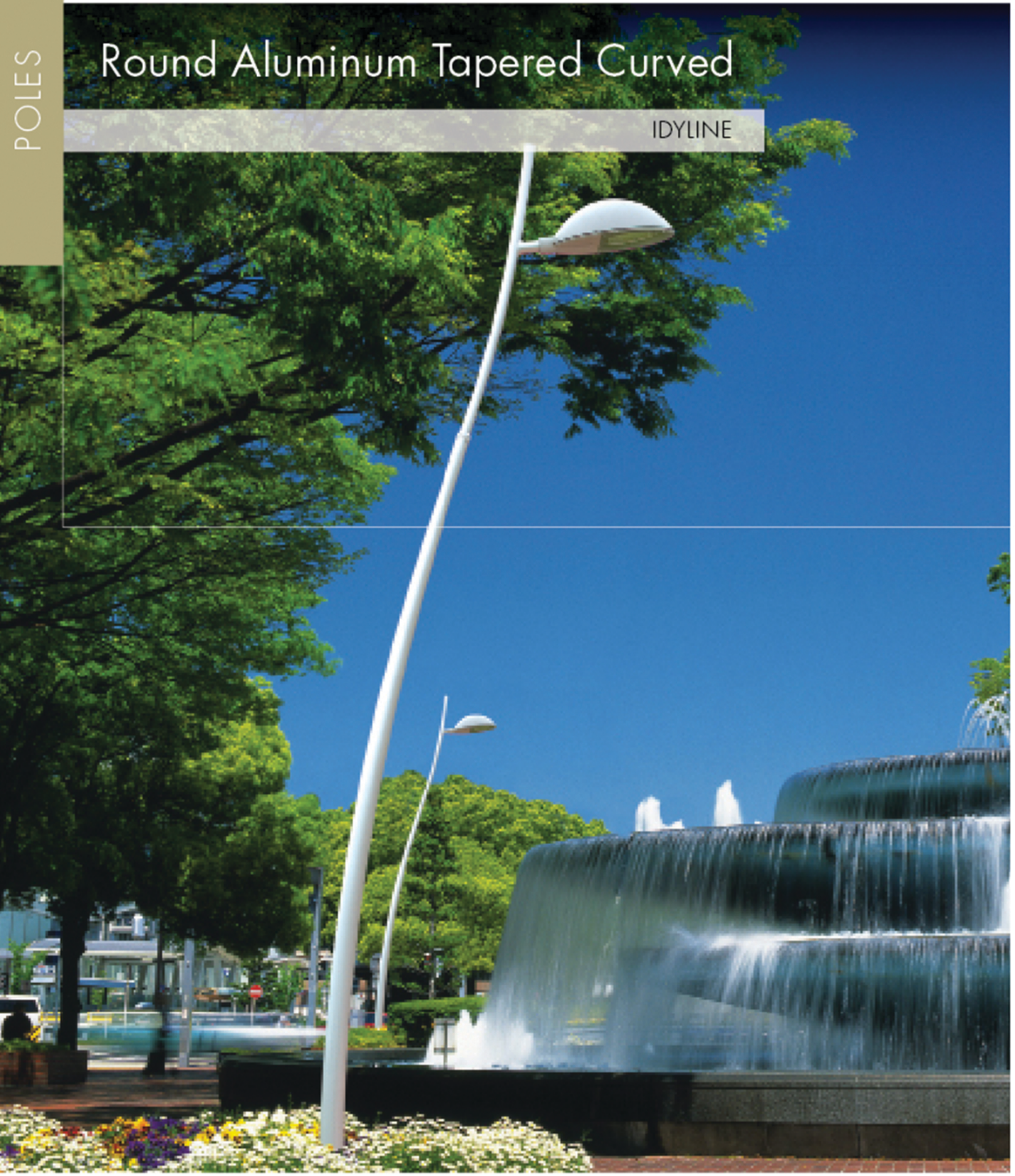
STANDARDS

The standards to which this design complies are:

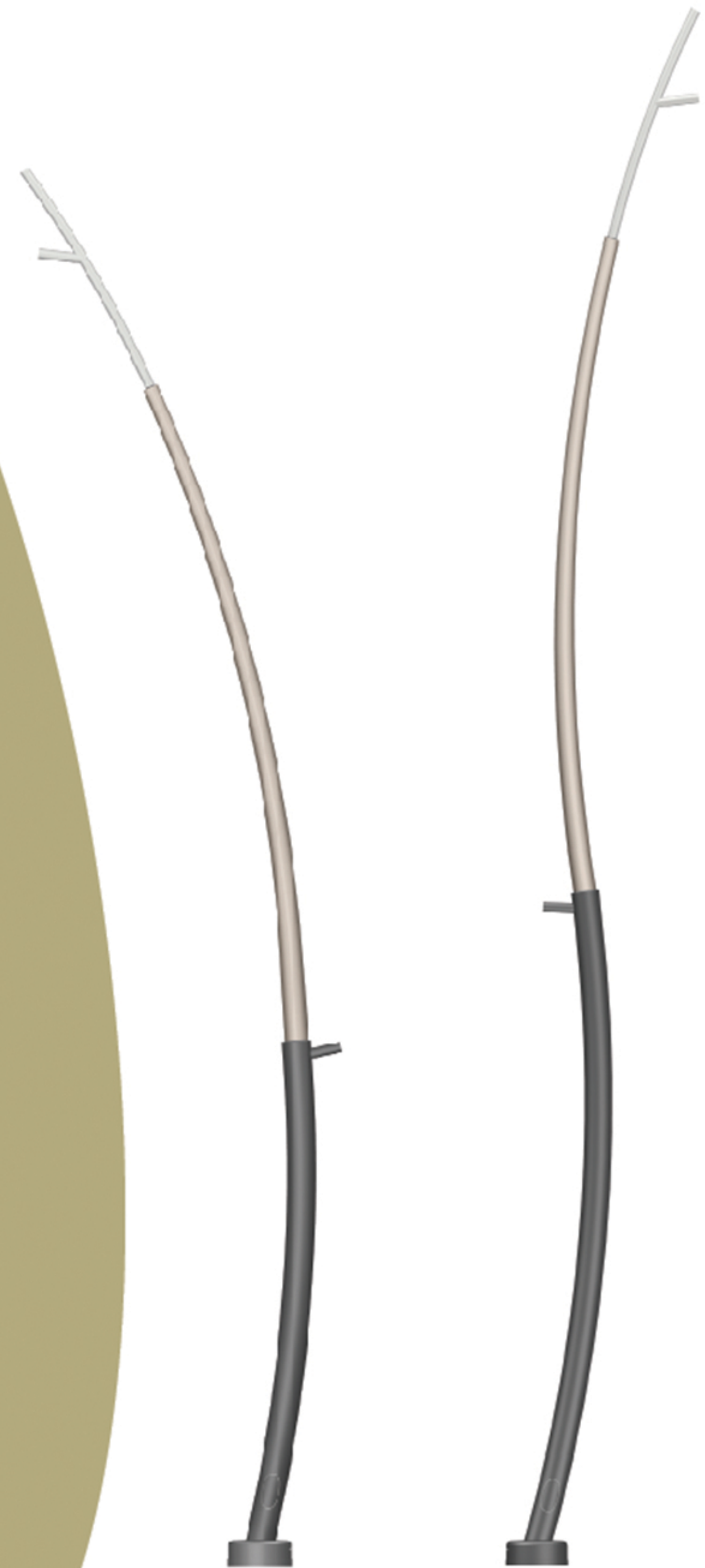
AS 1170.2 - 2002 Structural Design Actions, Wind Actions
AS 2979 Traffic Signal Mast Arms
AS/NZS 4676 – 2000 Structural Design Requirements for Utility Service Poles
AS 4100 – 1998 Steel Structures
AS/NZS 1664 – 1997 Aluminium Structures
AS/NZS 3000:2000 Australia / New Zealand Wiring Rules
AS/NZS 2276.1 Cables for Traffic Signal Installations, Part 1- Multicore Power Cables
NZS 3404 – 1997 Steel Structures
NZS 4701:1981 Metal-arc Welding of Steel Structures

Round Aluminum Tapered Curved

IDYLINE



The contemporary, sleek design of Idyline is just the beginning of their appeal. Choose from Valmont's Sanded Black, Sanded Brown, Natural Aluminum or additional colors to create an iconic design. Also recyclable, lightweight and corrosion resistant.



ROUND TAPERED
IDYLINE CURVE
APPROX. 16.5'-28.0'

ROUND TAPERED
IDYLINE SIGMA
APPROX. 17.5'-31.5'

Woolacotts.
CONSULTING ENGINEERS

Dee Why Town Centre Upgrade

Report of civil engineering implications

12 September 2014 | 14-106

Contents

Document control

Rev No	Date	Revision details	Approved	Verified	Prepared
A	5.9.14	Draft Issue		AP	AP
B	12.9.14	Approved Issue	CMW	AP	AP

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Introduction

Warringah Council is currently preparing a Master Plan for the Dee Why Town Centre. The area covered by the Master Plan is approximately 36ha in size, with the extent shown in Figure 1.

This report has been prepared to document the civil engineering implications of the works proposed in the Master Plan. It considers issues such as the impact on overland flow paths, the need for additional stormwater drainage and new civil infrastructure that may be required due to the works.

Council's records have indicated that flooding occurs within this precinct during major storm events. This has been further reinforced by Cardno's 2013 "Stage 3: Flood Study Report – Dee Why South Catchment Flood Study" (referred to as the Cardno Flood Study) and Cardno's 2014 "Floodplain Risk Management Study – Dee Why South Catchment Floodplain Risk Management Study" (referred to as the Cardno Risk Management Study). As such, the potential impact of the proposed works on flooding need to be considered.

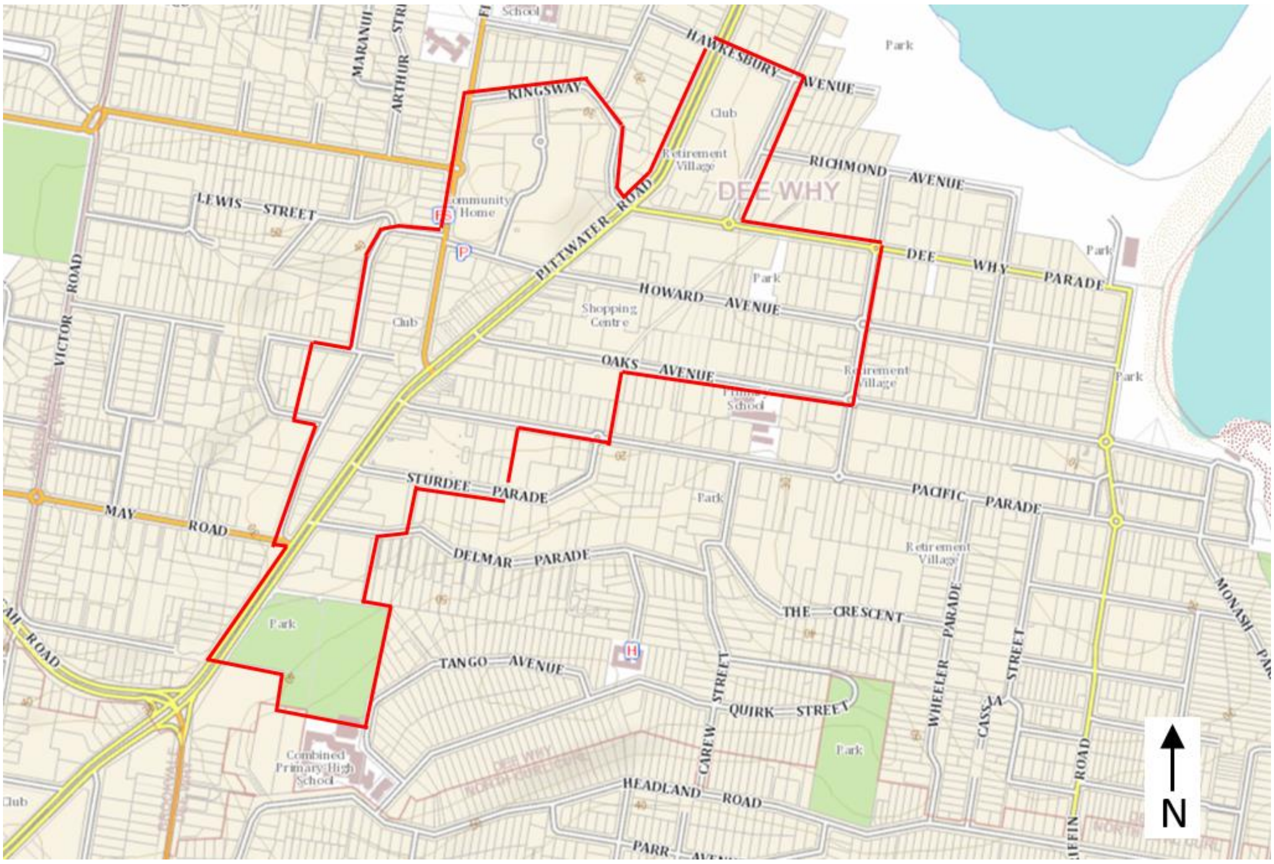


Figure 1 – Area of works

Within the overall area of the Master Plan, the proposed works and their impacts will be considered in separate areas. These areas are:

- Dee Why Parade
- Howard Avenue
- Oaks Avenue
- Avon Road
- New Link Road
- New Link Lane
- Pacific Parade
- St David Avenue
- Fisher Road
- Redman Road Plaza
- Pittwater Road South
- Walter Gors Park
- Triangle Park North and South

Refer to Figure 2 for the location of these streets / areas.

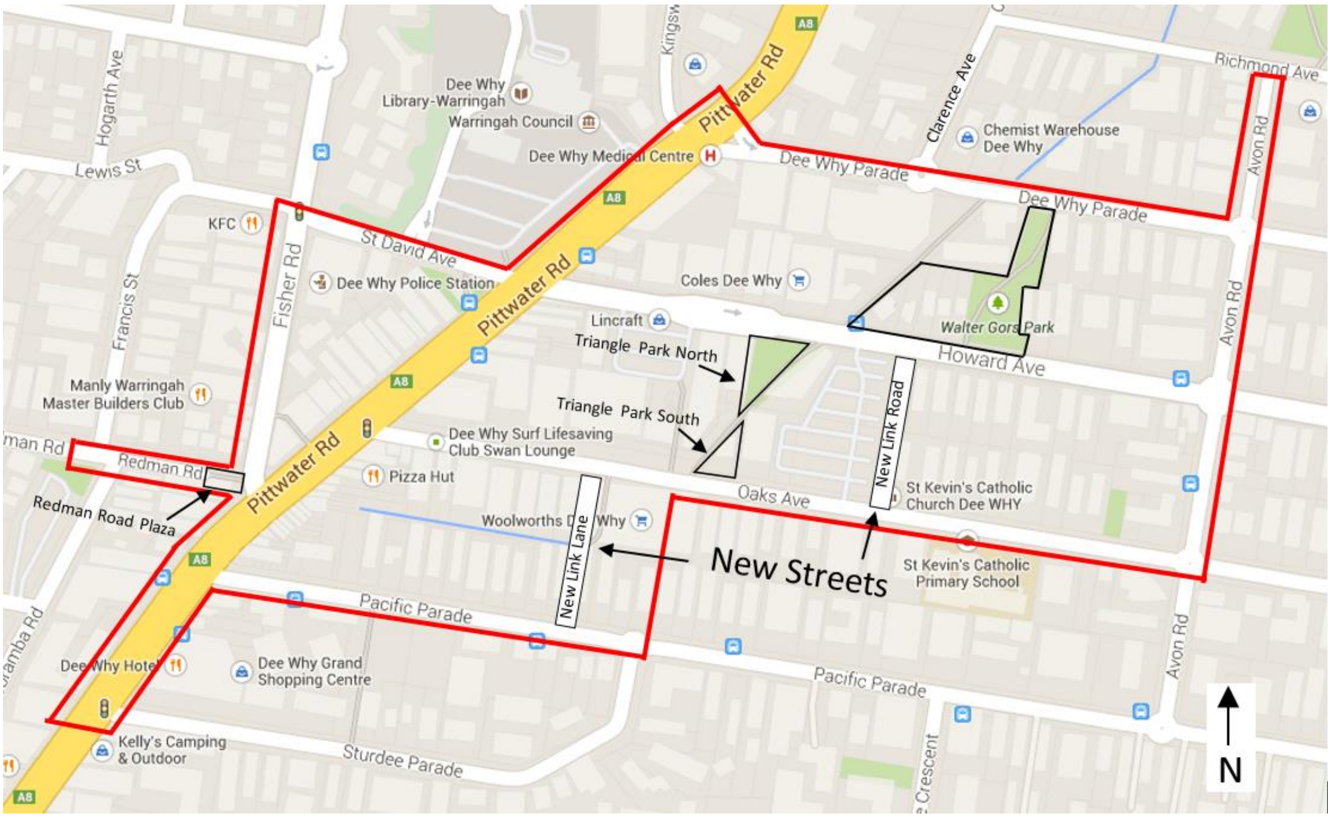


Figure 2 – Locations of streets / areas

Proposed Works

The revitalisation of Dee Why Town Centre as proposed by the Master Plan involves various works, which include:

- New bicycle lanes
- New streets and lane reconfigurations to improve traffic flow
- New car parking spaces
- Kerb extensions and realignments
- New pedestrian crossings and refuges
- Separated medians
- New landscaping and paving
- New open spaces including the expansion of Walter Gors Park

The following section details the works along each street / area and the civil implications of these works. Refer to Appendix A for drawings showing the proposed works.

Civil Implications of Proposed Works

Dee Why Parade

Proposed works

The works along Dee Why Parade occur between Clarence Avenue and Avon Road. They consist of:

- a new pedestrian crossing with kerb extensions located 60m east of Clarence Avenue
- a separated cycleway on the northern side of the road, from the crossing to Avon Road, and
- a reconstructed kerb at Avon Road.

Potential impacts

Dee Why Parade falls from Pittwater Road to Avon Road. The Cardno Flow Study shows that Dee Why Parade, from 140m east of Clarence Avenue to Avon Road, is part of the major overland flow path for the catchment and experiences significant flooding during major flood events, with depths of 0.3-0.5m near Avon Road and 0.15-0.3m in other areas during a 1% AEP storm event. Refer to the Catchment Plan in Appendix B and extracts from the Flood Study in Appendix C for further details.

The proposed pedestrian crossing is located within this major overland flow path, in a location where existing flood depths are 0.15-0.3m deep. As it will consist of kerb extensions and possibly a raised threshold, it will reduce the area available within the road for water flow, resulting in a rise in flood levels. The actual extent of the rise is beyond the scope of this report, and would need to be considered as part of the overall flood mitigation measures proposed for the catchment.

In smaller storm events, the kerb extension proposed for the crossing will block stormwater flows along the gutter. This will require new stormwater pits, to prevent ponding of water.

The separated cycleway involves relocation of the kerb 0.7-0.8m to the south, which reduces the roadway width within the overland flow path, and hence its capacity for flood flows, in a section of the road that experiences flood depths of 0.3-0.5m. If no flood mitigation works are undertaken, this will result in an increase in flood levels.

The relocation of the kerb up to Avon Road will have other minor civil engineering implications, as it will require driveways and kerb ramps to be reconstructed and a stormwater pit to be extended / replaced or an additional pit provided.

Mitigation measures

Both the pedestrian crossing and the kerb relocation for the cycleway will result in a rise in flood level if no mitigation works are undertaken. The extent of this rise is beyond the scope of this report, as it forms part of the overall flood analysis for the catchment. However, mitigation works will be required to offset this rise, and will need to be considered during the design phase for these works, so as not to increase flood levels.

Howard Avenue

Proposed works

Howard Avenue, from Pittwater Road to New Link Road, will be converted into a one way system with two lanes of traffic flow in a westerly direction. For this section of road, the proposed works include:

- parallel parking on both sides of the road,
- relocation of the kerb
- a raised pedestrian crossing with kerb extensions and
- blisters within parking lanes

Howard Avenue, from New Link Road to Avon Road, will remain as a two way system with one lane of traffic in each direction. For this section of road, the proposed works include:

- parallel parking on both sides of the road,
- relocation of the kerb
- a separated cycleway on the northern side of the road and
- kerb extensions at various locations.

Potential impacts

Howard Avenue from Pittwater Road to Avon Road falls to a low point approximately 60m west of Avon Road. The Cardno Flood Study shows that Howard Avenue acts as a major floodway during 1% AEP storm event. The Cardno Risk Management Study classifies this floodway as a high hazard based on the flood depths and velocities. Flood depths in a 1% AEP storm are generally 0.15-0.3m deep along Howard Ave, with the depth increasing to 0.3-0.5m near New Link Road and towards Avon Road. Refer to extracts from the Cardno Flood Study and the Cardno Risk Management Study in Appendix C for further details.

The proposed pedestrian crossing is located in a position where the flood depths are between 0.3-0.5m. As the crossing will involve kerb extension and potentially a raised threshold, it will restrict the flow path and raise flood levels.

From Pittwater Road to New Link Road, on the southern side of the road, the kerb will be relocated 1.2-1.6m. From New Link Road to Avon Road the kerb will be relocated 0.8m. These relocations will reduce the capacity of the roadway to carry overland flows, particularly during major storm events, and will result in an increase in flood levels. This will be exacerbated at locations where there are blisters or kerb extensions along the road.

Mitigation measures

The potential rise in flood levels due to the pedestrian crossing, kerb relocations and blisters will require mitigation measures to reduce the impact. The extent of the measures required is beyond the scope of this report, and needs to be considered in detailed design and as part of the overall flood mitigation works proposed for the catchment, as detailed in the Cardno Risk Management Study. The measures may include changes to the road crossfall to create a larger overland flow path, or additional in-ground pipes.

Oaks Avenue

Proposed works

Oaks Avenue, from Pittwater Road to New Link Road, will be converted into a one way system with two lanes of traffic flow in an easterly direction. For this section of road, the proposed works include:

- parallel parking on both sides of the road,
- relocation of the kerb
- a new pedestrian crossing, located between the new link road and the new link lane'
- a reconstructed driveway approximately 40m west of New Link Road and
- kerb extensions at the Pittwater Road / Oaks Avenue intersection and Oaks Avenue / New Link Lane intersection.

Oaks Avenue, from New Link Road to Avon Road, will remain as a two way system with one lane of traffic in each direction. For this section of road, the proposed works include:

- parallel parking on both sides of the road, and
- relocation of the kerb

Potential impacts

Oaks Avenue, from Pittwater Road to New Link Road, falls to a low point approximately 105m west of New Link Road. The Cardno Flood Study shows that the Oaks Avenue acts as a floodway during 1% AEP storm event, while the Cardno Risk Management Study classifies the western end of this floodway as a high hazard due to its depth and velocity. From the Cardno Flood Study, flood depths at the western end are generally up to 0.5m deep. The deepest locations are in the vicinity of the proposed new link road and new link lane. Refer to extracts from the Cardno Flood Study and the Cardno Risk Management Study in Appendix C for further details.

Between Pittwater Road and Oaks Ave, the relocation of the kerb is minor, and will have minimal impact on flood areas. The new blisters / kerb extension at Pittwater Road will restrict flows into Oaks Ave, potentially increasing flows or flood depth in Pittwater Road. This will require further consideration during detailed design, to minimise the impact.

The proposed pedestrian crossing, located between the link road and link lane, is in the section of the street with the greatest flood depths at present. If no other works occur, the crossing will potentially increase these depths, as the kerb extensions and raised threshold reduce the flood path available. However, the new link road will form a new flood path, which will assist in offsetting the increase.

Between New Link Road and Avon Road the kerb relocations are minor and there are no existing flood paths. Consequently, the works in this area will have no impact on flood levels.

Mitigation measures

The works proposed at the eastern end of Oaks Ave will require mitigation measures, to reduce the impact on flood levels, particularly due to the pedestrian crossing. The proposed new link road may provide sufficient overland flow capacity to offset the pedestrian crossing. However, this will need to be considered as part of all flood mitigation measures proposed for the area by the Cardno studies and further investigation undertaken during the detailed design phase.

Avon Road

Proposed works

The works along Avon Road occur between Howard Avenue and Richmond Avenue. They consist of:

- A separated cycleway on the western side of the road
- A relocated kerb between Howard Avenue and Richmond Avenue

Potential impacts

Avon Road falls to the north from Howard Avenue to Richmond Avenue. The Cardno Flood Study shows that Avon Road, from Dee Why Parade to Richmond Avenue, acts as a floodway during 1% AEP storm events, with flood depths of up to 0.5m at the Dee Why Parade / Richmond Avenue intersection. Refer to extracts from the Cardno Flood Study and the Cardno Risk Management Study in Appendix C for further details.

The separated cycleway will have negligible impact on the floodway, as the separator median contains numerous breaks for the stormwater to flow through.

The kerb relocation between Howard Avenue and Richmond Avenue will not affect flooding, but will have other minor civil engineering implications. This includes reconstructing kerb ramps and extending / replacing stormwater pits.

Mitigation measures

The works proposed will have minimal effects and are not likely to reduce mitigation measures. However this will need to be confirmed during detailed design.

New Link Road

Proposed works

New Link Road will be a new north-south connecting road between Howard Avenue and Oaks Avenue. It will be a four lane carriage way with two lanes of traffic flow in a northerly direction and one lane of parking on either side of the road. Numerous 2.5m wide kerb extensions will be located on both sides of the road.

Potential impacts

New Link Road is located just to the east of the existing flow path between Howard Ave and Oaks Parade. It will provide an alternate route for existing overland flows, which currently have depths of 0.5-1.0m between these two streets. Due to the width of the proposed road, the total depth of flow should be reduced by the roadway.

The blisters / kerb extension proposed for the new link road will require pits located in suitable positions, to minimise ponding.

New Link Lane

Proposed works

New Link Lane will be a new north-south connecting road between Pacific Parade and Oaks Avenue. It will be a two lane carriage way with one lane of traffic flow in each direction.

Potential impacts

New Link Lane is located in a similar location to the existing overland flow path / flood storage area between Pacific Parade and Oaks Avenue. It will provide a formalised route for overland flows between the two streets. The depth of flow along the lane will need to be considered during detailed design,

Pacific Parade

Proposed works

The works along Pacific Parade occur between Pittwater Road and Sturdee Parade. They include:

- removal of the traffic signals at the Pittwater Road intersection
- relocation of kerbs
- kerb extensions / blisters at Pittwater Road
- a raised pedestrian crossing with kerb extensions.

Potential impacts

Between Pittwater Road and Sturdee Parade there are two low points on Pacific Parade. The first low point is located approximately 150m east of Pittwater Road, while the second low point is located approximately 250m east of Pittwater Road. The Cardno Flood Study details both low points providing flood storage during a 1% AEP storm event, with flood depths of 0.15-0.3m. Refer to extracts from the Cardno Flood Study in Appendix C for further details.

The proposed raised pedestrian crossing is situated west of the first low point in a position clear of the flood. However as the crossing will contain kerb extensions and potentially a raised threshold, it has potential to impact flood flows in this area. Further analysis will be required during the detailed design.

From Pittwater Road to Sturdee Parade, the kerbs will be relocated by 0.5 – 1m on both sides of the road. However as there is no flood flow along the majority of the street, these changes will have minimal impact on flood levels. The relocations will require adjustments to existing stormwater pits and other services.

Mitigation measures

As the street has minimal flood issues, mitigation measures may not be necessary. This will need to be further assessed during the detailed design, to confirm that measures are not required.

St David Avenue

Proposed works

The works on St David Avenue include lane reconfigurations and a kerb realignment at the Fisher Road intersection.

Potential impacts

The works in St David Avenue will have no impact on flooding in the area, as they do not change flow paths or flood areas. The kerb realignment at the Fisher Street intersection will require modifications to service pits.

Fisher Road

Proposed works

The proposed works for Fisher Road occur between St David Avenue and Pittwater Road. They consist of a 1.3m-1.5m wide separated median and a kerb extension at Pittwater Road.

Potential impacts

Fisher Road falls to the south from St David Avenue to Pittwater Road. The Cardno Flood Study shows that the southern end of Fisher Road is a floodway during the 1% AEP storm event, with flood depths up to 1m. Refer to extracts from the Cardno Flood Study in Appendix C for further details.

At the southern end of Fisher Road the kerb extension and median will result in a minor reduction in the roadway width. This will potentially result in an increase in flood levels.

The kerb extension at Pittwater Road will require a stormwater pit to be extended / replaced.

Mitigation measures

The works proposed at the southern end of Fisher Road will require mitigation measures, to reduce the impact on flood levels. The extent of the measures required is beyond the scope of this report and needs to be considered during detailed design, in conjunction with the flood mitigation measures detailed in the Cardno Risk Management Study.

Redman Road Plaza

Proposed works

The proposed works for Redman Road Plaza include:

- relocation of kerbs
- upgrades to the plaza space, including paving, landscaping and seating and planting
- shutting off Redman Road at Mooramba Road / Francis Street

Potential impacts

Redman Road falls towards Pittwater Road. The Cardno Flood Study shows that the eastern end of Redman Road is a floodway during 1% AEP storm events, with maximum flood depths between 0.3-0.5m. The Cardno Risk Management Study classifies this floodway as a high hazard due to its depth and velocity. Refer to extracts from the Cardno Flood Study and the Cardno Risk Management Study in Appendix C for further details.

Redman Road will be closed to public traffic at Francis Street / Mooramba Road through the construction of a new kerb. The new kerb will require flood flows to pond at this location until they can overtop the kerb. This will potentially locally increase flood levels, and will need consideration of the kerb profile to minimise the impacts.

The landscape works proposed for the Plaza will have potential to reduce floodway capacity, depending on the scale of structures proposed.

Mitigation measures

The rise in flood levels due to the kerb realignments and upgrades to plaza space will require mitigation measures to reduce the impact. The extent of the measures is beyond the scope of this report, and needs to be considered during detailed design, in conjunction with mitigation methods proposed in the Cardno Risk Management Study.

Pittwater Road

Proposed works

The proposed works for Pittwater Road occur between Sturdee Parade and Howard Avenue. They include:

- kerb relocations
- replacement / relocation and extension of an existing median
- a new 45m long bus bay

Potential impacts

As detailed by the Cardno Flood Study, Pittwater Road is a floodway during 1% AEP storm events, with the section between Redman Road and Howard Avenue showing a greater width of flooding. Flood depths are generally 0.15-0.3m deep, increasing to 0.3-0.5m along the eastern side between Redman Road and Howard Avenue.

In the section between Redman Road and Howard Avenue, which currently has the greater flow path, the proposed works consist of a new median and a bus bay. These works will have no impact on flooding in the area, as they do not reduce the flood path.

Between Redman Road and Sturdee Parade, the works consist of a new median and relocation of the kerb, which increases roadway width. These works will either have negligible effect or reduce flood levels in this section.

The kerb relocations and bus bay will potentially require modifications to service pits, which will need to be considered during detailed design.

Mitigation measures

The works may potentially impact service pits, which will need to be considered during detailed design. During this phase, investigation will be required to confirm works do not negatively impact on flood levels.

Walter Gors Park

Proposed works

Walter Gors Park is to be extended and upgraded. The proposed works include:

- removing existing council cottages
- new landscaping
- market stalls

Potential impacts

Walter Gors Park, including the proposed extension, falls to the east. The Cardno Flood Study details that this location provides flood storage during the 1% AEP storm event, with flood depths between 0.15-0.3m. Refer to extracts from the Cardno Flood Study in Appendix C for further details.

The works proposed for this area include demolition of existing cottages, construction of a new water feature / WSUD area, new landscaping and an area for market stalls along the southern boundary. As the area provides flood storage, and is adjacent to an existing floodway, there is potential for the works to affect flood levels. This will require consideration and investigation during detailed design.

Mitigation measures

Consideration will be required during detailed design on the extent of the flood storage area, so that the works do not negatively impact on flooding.

Triangle Park North and South

Proposed works

The proposed works for Triangle Park North and South include:

- new stairs and seating
- new landscaping
- market stalls
- the removal of an existing building (Triangle Park South) and construction of a new park area

Potential impacts

Triangle Park North and South falls to the north-east. The Cardno Flood Study shows that this entire area is part of a floodway during the 1% AEP, with flood depths generally between 0.15-0.3m. Refer to extracts from the Cardno Flood Study in Appendix C for further details.

The proposed works are located within the floodway and have the potential to increase flood levels if they block the floodway or reduce the flowpath. The removal of the existing building will potentially increase the floodway area.

Mitigation measures

The detailed design of the works in the parks will require careful consideration to ensure that floodways are not blocked and the flood capacity is not reduced. Mitigation measures may be required and will need to be determined during detailed design.

Summary

Many of the proposed works are located within existing floodways or flood affected areas of the catchment. This will require consideration, during detailed design, of mitigation measures, which may be required and which will need to be considered in conjunction with the works recommended by the Cardno Risk Management Study. The works proposed in the new parks, New Link Road and New Link Lane may also mitigate the effects.

All the new blisters / extensions will need new stormwater pits to prevent water ponding at the kerb. Kerb relocations will require existing stormwater pits to be replaced or modified, and may require alterations to other existing service pits.

Appendix A

Drawings


1
D. P. 5 7 7 0 6 2
100
D. P. 1 0 4 1 8 2 3
ST. DAVID AVENUE
2 STOREY BRICK BUILDING 'POLICE STATION'
BRICK CHURCH 'ST DAVID'S UNITING CHURCH'
AREA NOT SURVEYED
S.P. 1 9 0 2

2

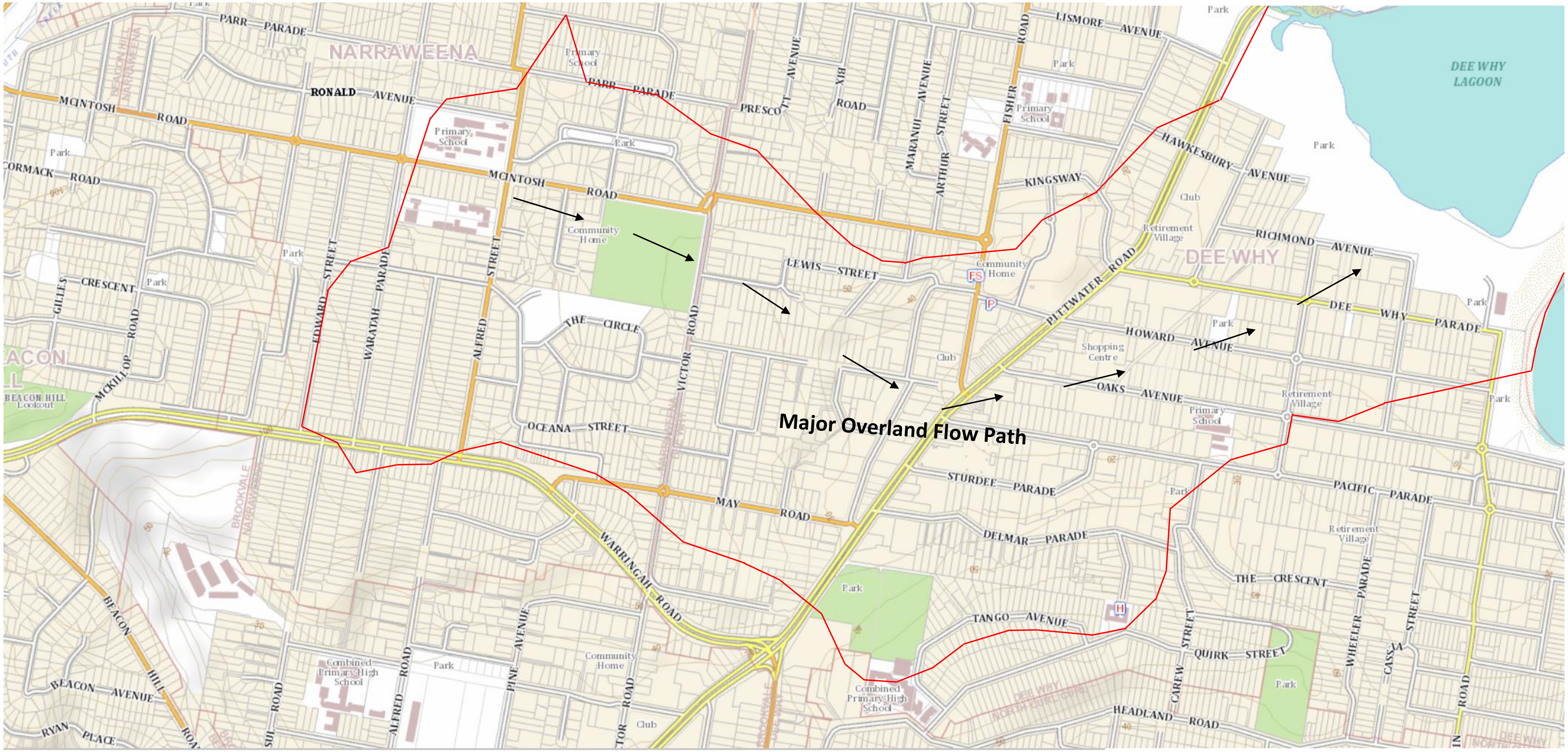
3


4
OAKS
AVENUE
PACIFIC
PARADE
S.P. 5858
S.P. 4189
S.P. 7471
S.P. 8000
S.P. 10951
S.P. 5876
S.P. 7795
S.P. 4020
S.P. 4469
D.P. 1109355
D.P. 313845

Appendix B

Catchment Area

Dee Why South Catchment Plan



Appendix C

Extracts from Cardno Reports

Figure 6-7 Design Event 1% AEP Peak Depth

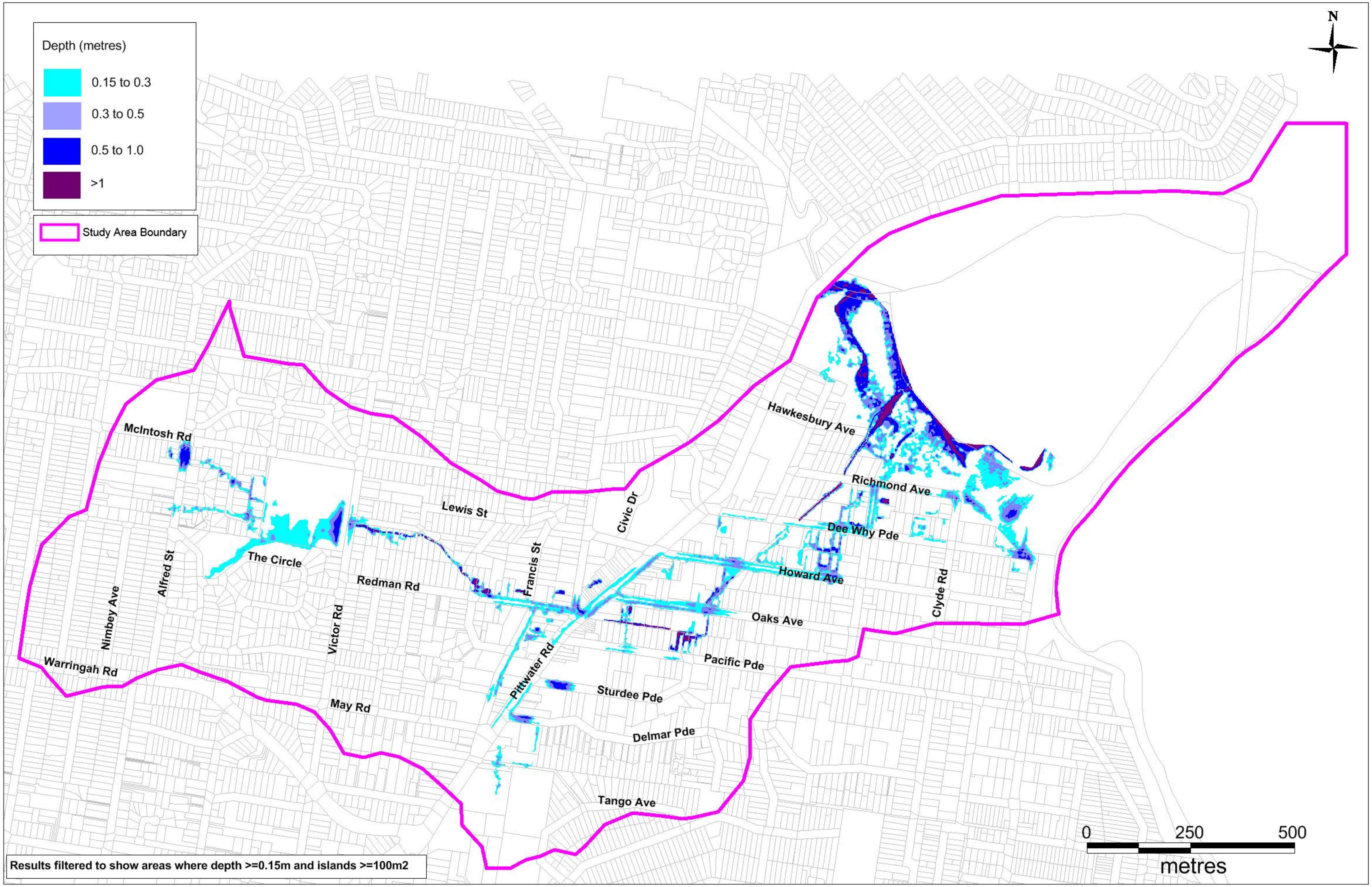
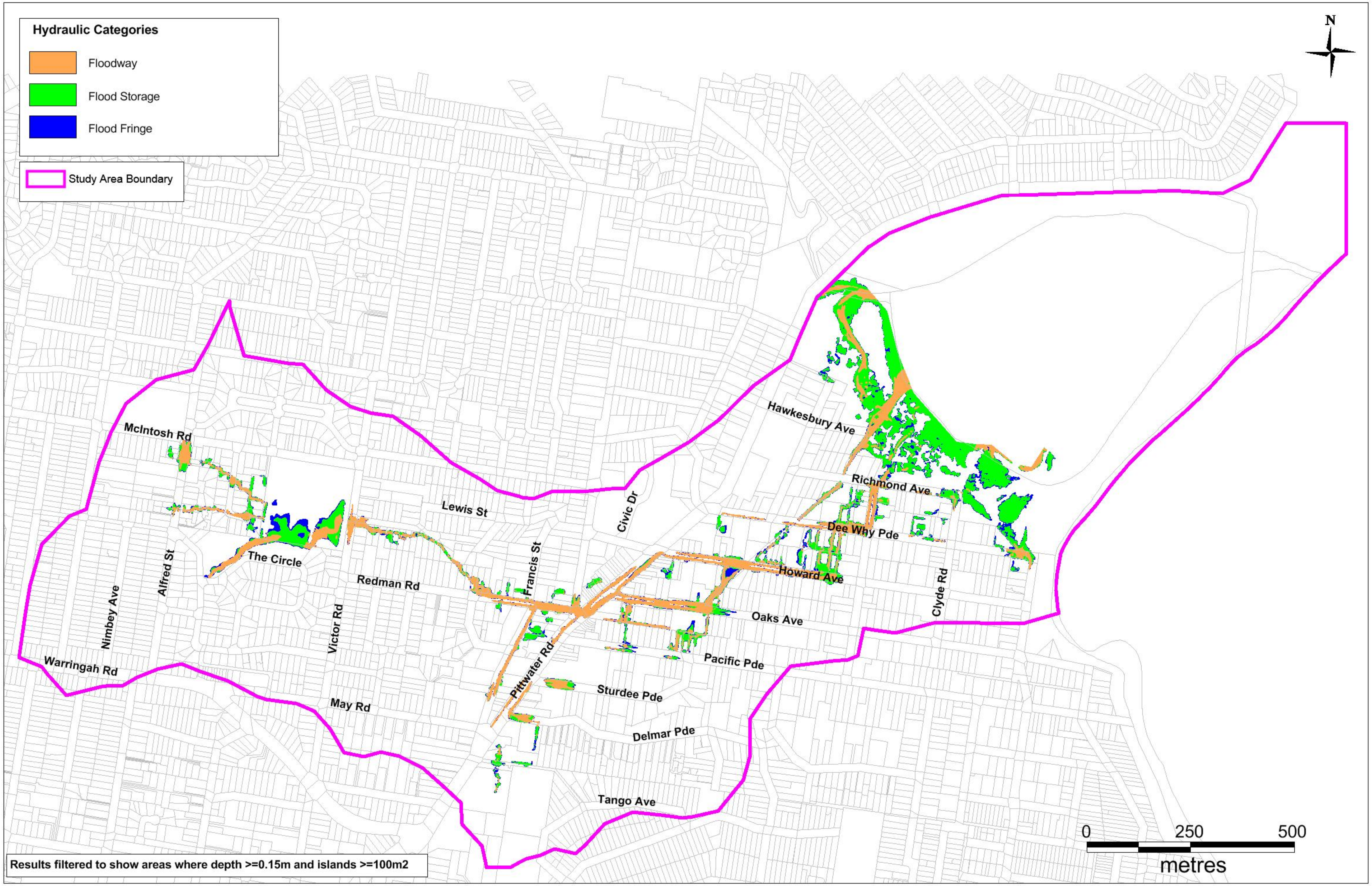


Figure 8-2 Hydraulic Categorisation 1% AEP Event



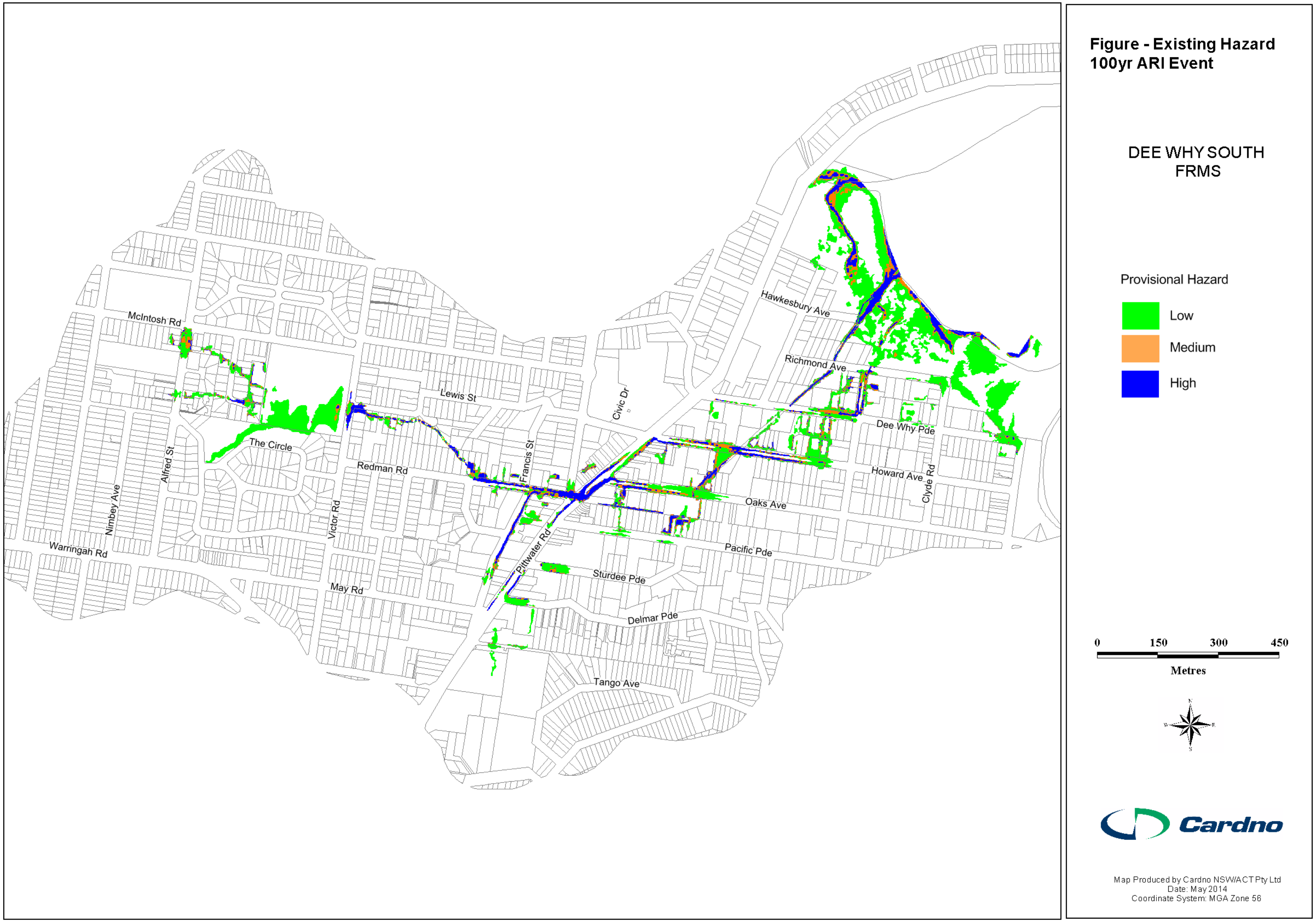


Figure 5-4 – 100y ARI Provisional Hazard – Existing Conditions