Appendix F

Aboriginal heritage assessment

BIOSIS
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Water and Wastewater Servicing of the West Dapto Urban Release Area and Adjacent Growth Areas:

Aboriginal Heritage Assessment and Impact Management

July 2012

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DOCUMENT CONTROL SHEET

PROJECT	Water and Wastewater Servicing of the West Dapto Urban Release Area and Adjacent Growth Areas: Aboriginal Heritage Assessment and Impact Management
BIOSIS PROJECT NO	s11633
REPORT FOR	Sydney Water
REPORT TITLE:	Water and Wastewater Servicing of the West Dapto Urban Release Area and Adjacent Growth Areas: Aboriginal Heritage Assessment and Impact Management
AUTHOR(S):	Georgia Roberts and Melanie Thomson

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Sydney Water has removed information from this copy of the assessment about Aboriginal objects, sites and places, and information on Aboriginal community consultation, to protect and manage cultural sensitive information, out of respect to the Aboriginal community.

ACKNOWLEDGMENTS

Biosis Research acknowledges the contribution of the following people and organisations in preparing this report:

- Peta Lilburne, Yvonne Kaiser-Glass, Murray Johnson and Jenny Rogers (Sydney Water) and
- Lou Ewins, Fran Scully, Miranda Morton, Shannon Freeburn and Eva Day (OEH)
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ABBREVIATIONS

AGA	Adjacent Growth Area
AHC	Australian Heritage Council
AHIMS	Aboriginal Heritage Information Management System
ATSIC	Aboriginal and Torres Strait Islander Commission
BP	Before Present
CHL	Commonwealth Heritage List
DEH	Department of Environment and Heritage
DEC	Department of Environment and Conservation
DECCW	Department of Environment, Climate Change and Water NSW (formerly Department of Environment and Climate Change & DEC)
DECC 2006	
DEC 2004	*Part 6 Approvals – Interim Community Consultation Requirements for Applicants (2004) DRAFT*
DECCW ACHCR 2010	*Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 (2010)*
DECCW CoP 2010	*Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales (2010)*
DEC 2005a	*Draft Guidelines for Aboriginal Cultural Impact Assessment and Community Consultation (2005)*
DEC 2005b	
DGR	Director-General's Requirements
DoP	Department of Planning
EA	Environmental Assessment
EP& A Act NSW	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1979*
ESC	Effective Survey Coverage
FSG	Fine Grained Siliceous
GSV	Ground surface visibility
ICOMOS	International Council on Monuments and Sites
ILALC	Illawarra Local Aboriginal Land Council
LEP	Local Environmental Plan
LGA	Local Government Area
MGA	Map Grid of Australia
n	Number
NHL	National Heritage List
NNTT	National Native Title Tribunal
NPW Act	*National Parks and Wildlife Act 1974*
NPWS	National Parks and Wildlife Service (now part of DECCW)
OEH	Office of Environment and Heritage (formerly Department of Environment, Climate Change and Water NSW)
PAD	Potential Archaeological Deposit

PEA	Preliminary Environmental Assessment
REP	Regional Environment Plan
RNE	Register of the National Estate
SEPP	State Environmental Planning Policy
SHI	State Heritage Inventory
SHR	State Heritage Register
WCC	Wollongong City Council
WWTP	Wastewater Treatment Plant
Water	Drinkable Water

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EXECUTIVE SUMMARY

CONTEXT

Biosis Research Pty. Ltd. has been commissioned by Sydney Water to undertake an Aboriginal archaeological assessment and impact management study for the proposed water and wastewater servicing of the West Dapto Urban Release Area (WDURA) and Adjacent Growth Areas (AGA) (Figure 1).

The Proposal Area (Figure 1) stretches across both the Wollongong and Shellharbour Local Government Areas (LGAs), from Farmborough Heights in the north, Tullimbar Village in the south, Lake Illawarra to the east and the Illawarra Escarpment to the west.

Sydney Water is seeking Concept and Project approval under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Sydney Water will prepare an Environmental Assessment, including an Aboriginal archaeological assessment. Aboriginal community consultation has been carried out in accordance with *Draft Guidelines for Indigenous Cultural Heritage Assessment and Community Consultation* (DEC [now OEH], 2005a), as specified in the Director-General's Requirements (DGR) for the Proposal. Consultation is also consistent with the *Interim Community Consultation Requirements for Applicants* [DEC 2004] and *Indigenous Cultural Heritage Consultation Requirements for Proponents* (DECCW [now OEH], ACHCR 2010).

Context of Registered Aboriginal Archaeological Sites (AHIMS)	*Number of Sites*
Total Number of Sites within the Concept Area	139
Total Number of Sites within the Project Approval Area	50

ASSESSMENT

This Aboriginal archaeological assessment was deliberately carried out at the engineering concept stage to optimise options to reduce impacts to both sites and areas of archaeological sensitivity. A number of routes have been realigned to avoid known/ registered Aboriginal archaeological sites.

The Project Approval Area assessment was based on surveys of the service corridors, generally between 50 and 65 m wide, which will house the proposed infrastructure. The extra width allows for the alignment to be changed should an existing or a potential archaeological deposit (PAD) be found. Additional land was surveyed around associated infrastructure, like reservoirs.

RESULTS

A number of new and existing sites were identified within the water and wastewater pipeline corridors. Of the 50 Aboriginal archaeological sites located within the Project Approval Area 16% (7) were located within the proposed water and wastewater pipeline corridors. In addition to these known sites, three (3) new Aboriginal archaeological sites were identified during the field survey within the project Approval Area but located outside the current pipeline corridor alignments.

RECOMMENDATIONS

A summary of the report recommendations are outlined within the following section. Details of specific recommendations can be found in Section 16.

Subject	*Refer to Section:*
Conservation through Avoidance	16.1
Direct Impacts to known archaeological sites	16.2
Aboriginal Stakeholder Consultation	16.3
Cultural Heritage Awareness Training	16.4
Unanticipated Aboriginal Sites	16.5
Discovery of human remains	16.6

Part 1:
Concept Area

1.0 INTRODUCTION

Biosis Research Pty. Ltd. has been commissioned by Sydney Water to undertake an Aboriginal heritage assessment and impact management study for the proposed water and wastewater servicing of the West Dapto Urban Release Area (WDURA) and Adjacent Growth Areas (AGA). It will form part of the Environmental Assessment (EA) (Figure 1 following). The WDURA and the AGA areas are major green-field sites identified in the Department of Planning's (DoP) Illawarra Regional Strategy (IRS) to meet the future housing needs of the region over the next 40 years. Sydney Water is responsible for the planning of drinking water and wastewater for the new development areas.

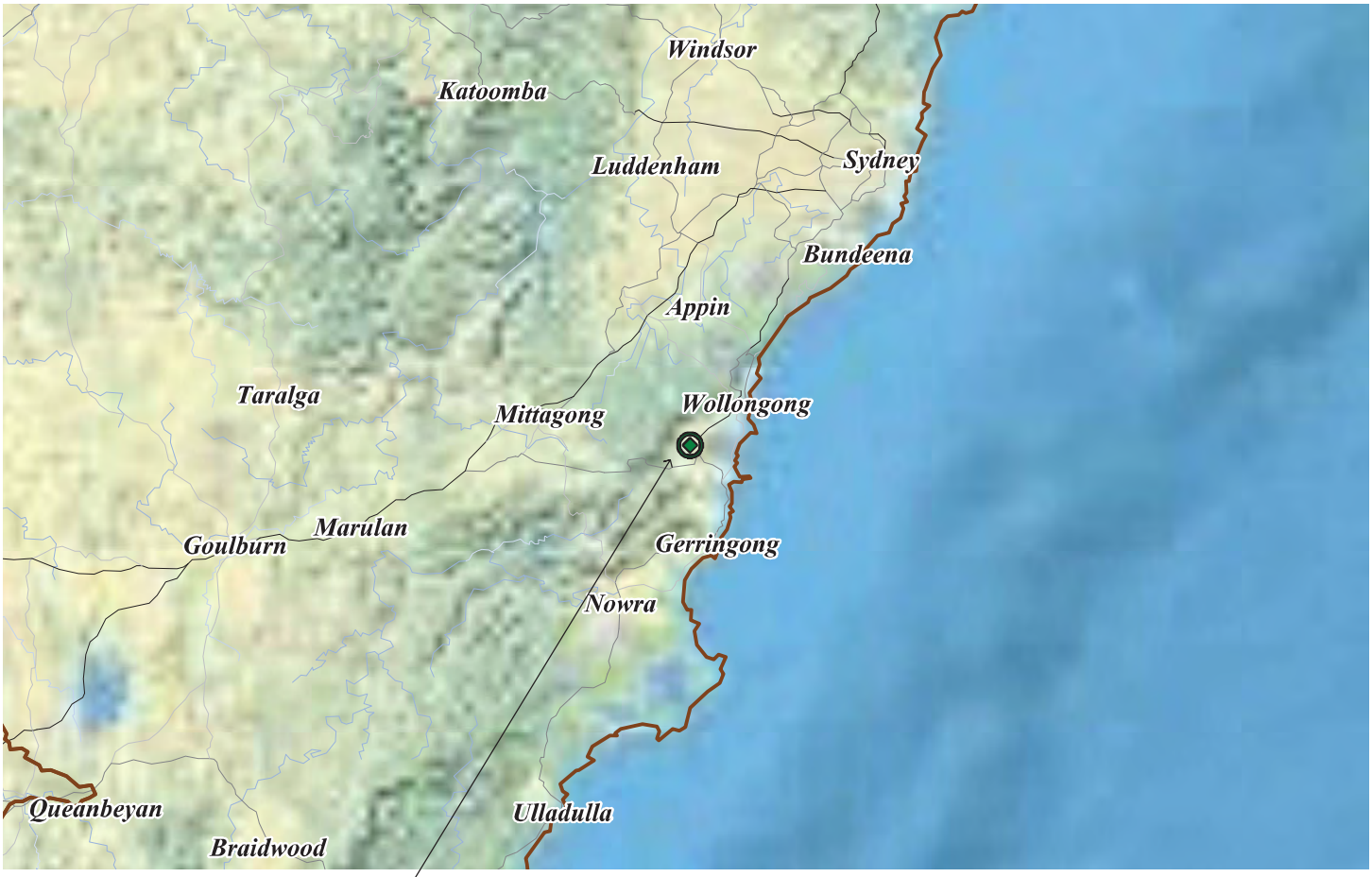
The proposed infrastructure works will involve the design, construction and operation (including commissioning and maintenance) of drinking water and wastewater services. Infrastructure components include:

- water and wastewater main pipelines
- water and wastewater pumping stations
- reservoirs (potentially four sites)
- support assets (e.g. wet weather overflow points, vent shafts, odour dosing units).

The Proposal is predicated upon the extension of both the Illawarra Water System and Wollongong and Shellharbour Wastewater Treatment Systems. The Proposal is limited to the provision of trunk pipelines and bulk storage of drinking water and wastewater services.

In October 2009, the Minister for Planning made a declaration under Section 75B (1) of the EP&A Act, that the Proposal is to be assessed under Part 3A of the EP&A Act. A Major Project Application and Preliminary Environmental Assessment (PEA) have been completed and Director-General's Requirements (DGR) have been issued. The PEA and DGR identified that the Proposal could potentially have an impact on the Aboriginal archaeological heritage.

Sydney Water is seeking Concept Plan approval for the entire Proposal Area under Part 3A of the EP&A Act. It is also seeking concurrent Project Approval for some components in response to development timeframes. Sydney Water will prepare an Environmental Assessment under Part 3A which will include Aboriginal heritage assessment. The purpose of this study is to assess and report on Aboriginal heritage values within both the Concept Area and the Project Approval Area and to provide recommendations for managing the potential impacts of the Proposal on those heritage values. The report must meet the Concept and Project approval requirements under Part 3A of the EP&A Act.



Study Area

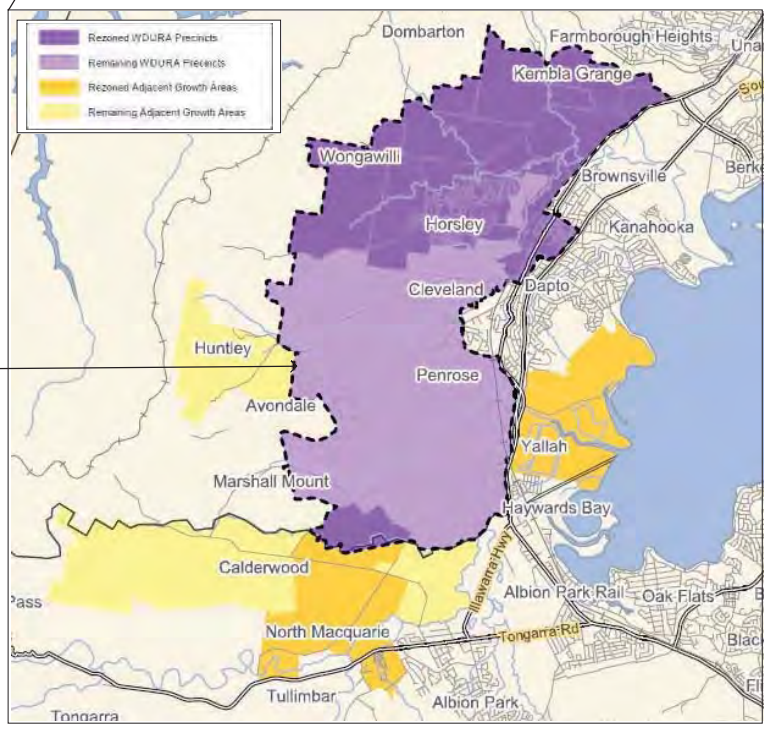


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Figure 1: Location of the Study Area in a regional context.

Date: 14 April 2011	Drawn by: ANP
File number: 11633	Checked by: MT

Location: P:\11600s\11633\Mapping\FINAL_Report Figures April 2011\11633 F1_Locality.WOR

Scale: 0 1.6 3.2 4.8 6.4 kilometres

N W E S

1.1 Project Background

Urban development in the West Dapto area began over 20 years ago with the release of the suburb of Horsley. Due to high infrastructure costs and low housing demand further development did not proceed. In 2004 the then Department of Infrastructure Planning and Natural Resources announced in its Illawarra Urban Development Program Update that the Dapto Release Area would proceed. The Wollongong City Council (WCC) working with the Department of Planning (DoP) exhibited a draft Local Environment Plan (LEP) for the West Dapto Urban Release Area (WDURA) in 2007 to facilitate new residential development in this area (Parsons Brinkerhoff 2010:11).

The *Illawarra Regional Strategy* was prepared by the DoP as one of the regional strategies for areas of high growth in NSW. The strategy aims to ensure the projected housing and employment needs of the region over the next 25 years are adequately accommodated and appropriately located. The *Illawarra Regional Strategy* reflects the *Illawarra Urban Development Program* (IUDP). The IDUP was established in 1982 to coordinate planning, servicing and development of new urban areas in Wollongong, Kiama and Shellharbour.

Numerous planning studies have been undertaken by the NSW State Government and by Wollongong City Council in relation to the assessment area. In 2006, MG Planning produced the *West Dapto Release Area Draft Local Environmental Study*. It was prepared for Wollongong City Council (WCC) as a background study for the draft West Dapto Local Environmental Plan (LEP) 2007. It was based on a number of specialist studies which are also available on the Wollongong City Council website.

A Major Project Application and Preliminary Environmental Assessment (PEA) for the Proposal were completed by Sydney Water and submitted to DoP. In November 2009, the Minister for Planning made a declaration under Section 75B (1) of the (EP&A Act), that the Sydney Water proposal is to be assessed under Part 3A of the EP&A Act.

The PEA and DGR identified that the Sydney Water proposal could potentially have an impact on Aboriginal archaeological heritage. Therefore a detailed assessment of the potential impacts on Aboriginal heritage was required. Sydney Water commissioned Biosis Research to undertake the detailed archaeological and cultural heritage assessment for the proposal.

Sydney Water is now seeking Concept Plan Approval for the entire proposal and concurrently seeking proposal approval for those components required for early development in response to development timeframes.

1.2 Terminology and definitions of the Proposal

Name	Definition
The Proposal	Water and wastewater servicing in the WDURA and AGA
WDURA	That area defined by Wollongong LEP 2009
AGA	Those areas in Shellharbour identified in green or orange on the Concept map
Study Area	Those areas that impact or could be impacted by the Proposal
Concept Area	That area comprising the WDURA and AGA and synonymous with Proposal area
Project Approval Area	Those areas identified: 1. rezoned for development in the Wollongong LEP (West Dapto) 2010 2. where water infrastructure will be required prior to developing the land
Rezoned WDURA Precincts	Those areas rezoned in the Wollongong LEP (West Dapto) 2010
Remaining WDURA Precincts	Those areas identified as WDURA in the Wollongong LEP 2009 but not rezoned in the Wollongong LEP (West Dapto) 2010

1.2.1 Key Archaeological Terminology

Outlined below is a summary of some of the key archaeological terminology used within the report to describe the recommendations relating to the Aboriginal archaeology for the Proposal Area.

Archaeological Integrity includes the state of preservation of archaeological objects, as well as the stratigraphic integrity of the site, the taphonomic processes acting on the site (i.e. the factors that affect a site after its original use), and the impact of past artefact collections made at the site (the level to which the site and its artefacts have been preserved since their creation).

Archaeological Potential is used to describe the overall conclusion to a number of assessments, including site integrity, connectedness of the site to other sites, chronological potential, representativeness, rarity, research potential, and aesthetic values. Each of these values is assessed, allowing an overall conclusion to be made concerning the archaeological potential of the Proposal.

1.2.2 Key Geological/ geomorphological Terminology

A glossary of geological and geomorphological terminology used within this report has been listed within Appendix 1.

1.3 WDURA and AGA Study Area

The Proposal and Project Approval Area for the Sydney Water proposal are generally bounded by Farmborough Heights in the north, Tullimbar Village in the south, Lake Illawarra to the east and Illawarra Escarpment to the west. Figure 1 shows the location of the WDURA and AGA in the Illawarra Region. It will contain the equivalent of about 23,000 dwellings to cater for growth up to 2050 (Parsons Brinkerhoff 2010:11). The water and wastewater servicing areas include the following development and adjoining growth areas.

The WDURA consists of the following Precincts:

- Kembla Grange
- Sheaffes/Wongawilli
- West Horsley
- Dapto Sub-regional Centre
- Horsley Industrial
- Cleveland
- Avondale
- Yallah/Marshall Mount
- East Horsley

The following Precincts have been identified to date within the AGA:

- Tallawarra
- Huntley
- Calderwood
- Tullimbar Village

The Sydney Water proposal involves constructing and operating (including commissioning and maintenance) water and wastewater services for the WDURA and AGA. Infrastructure components include:

- water trunk pipelines

- wastewater pipelines
- new water pumping stations and upgrades to existing water pumping stations
- new sewage pumping stations and upgrades to existing sewage pumping stations
- transferring wastewater flows from the new growth areas to Wollongong or Shellharbour Wastewater Treatment Plants for treatment and either reuse or ocean discharge
- amplifying, and/or upgrading Wollongong and Shellharbour Sewage Treatment Plants
- potentially four new water reservoirs.

Stand alone pumping stations will be situated at various locations in the network and pumping facilities (and other support assets) may be co-located at the reservoir sites. Sydney Water has indicative locations of pipelines, reservoirs, and pumping stations. The final alignments will be done as design progresses and will take environmental constraints and opportunities identified in this study into account. Some components will be constructed outside the WDURA and AGAs in order to link the new services with existing infrastructure. The proposed water and wastewater elements for these development precincts are shown in Figure 2.

1.3.1 Assessment Approach

1.3.1.1 Concept Area

The Concept Area is made up of both the WDURA and AGA.

The assessment of the Concept Area involved the development of broad scale Aboriginal archaeological predictive modelling. The model was formulated using the location of known Aboriginal sites and the results of previous archaeological studies that indicated those landforms with the potential to contain Aboriginal archaeological sites.

1.3.1.2 Project Approval Area

The Project Approval Area refers to areas within the Concept Area where all proposed infrastructure locations were subjected to detailed archaeological investigation.

Environmental assessment within the Project Approval Area utilises a corridor approach to the impact assessment, meaning that a wider area or corridor will be assessed to allow the final infrastructure locations to move within the assessed parameters, subject to the recommended environmental management measures and consultation with the landowner. This includes a 200m radius for reservoir and pumping station sites and 25m either side of water and wastewater pipeline

alignments, and other ancillary infrastructure sites. Proposed corridors and buffers were therefore surveyed in detail as the proposed infrastructure may be located anywhere within these buffers.

1.4 Planning Approvals

1.4.1 Major Project Declaration

The Sydney Water Proposal has been declared by the Minister for Planning as a 'Major Project' under the provisions of the *EP&A Act* and *State Environmental Planning Policy (Major Development) 2005* (Major Project SEPP), and is therefore subject to the provisions of Part 3A of the *EP&A Act*. Assessment, reporting and Aboriginal community consultation has been carried out in accordance with the DGR and guidelines prepared for Projects being assessed and approved under Part 3A of the *EP&A Act*.

1.4.2 Director-General's Requirements

The Director-General's Requirements (DGR) for the Project identified Aboriginal Heritage as a key issue to be considered in the EA. The DGR state:

> 'the Environmental Assessment shall include an assessment of Aboriginal heritage value that may be impacted by the proposed with details on any subsurface archaeological investigations undertaken for the potential archaeological deposits. Consideration should be given to the significance of the impacts of the Project and any mitigation measures. The assessment must address the information and consultation requirement of the draft *Guidelines for Aboriginal Cultural Heritage Assessment and Community Consultation (*DEC, 2005a)'.

1.4.3 OEH Guidelines and Compliance Requirements

The information provided in this Aboriginal archaeological and Cultural Heritage Assessment will support the EA application to the Department of Planning, in accordance with the requirements of Part 3A of the *EP&A Act*.

Part 3A, Section 75U of the *EP&A Act* specifies approvals and legislation not applicable to Major Projects.

75U (1) The following authorisations are not required for an approved Project (and accordingly the provisions of any Act that prohibit an activity without such an authority do not apply):

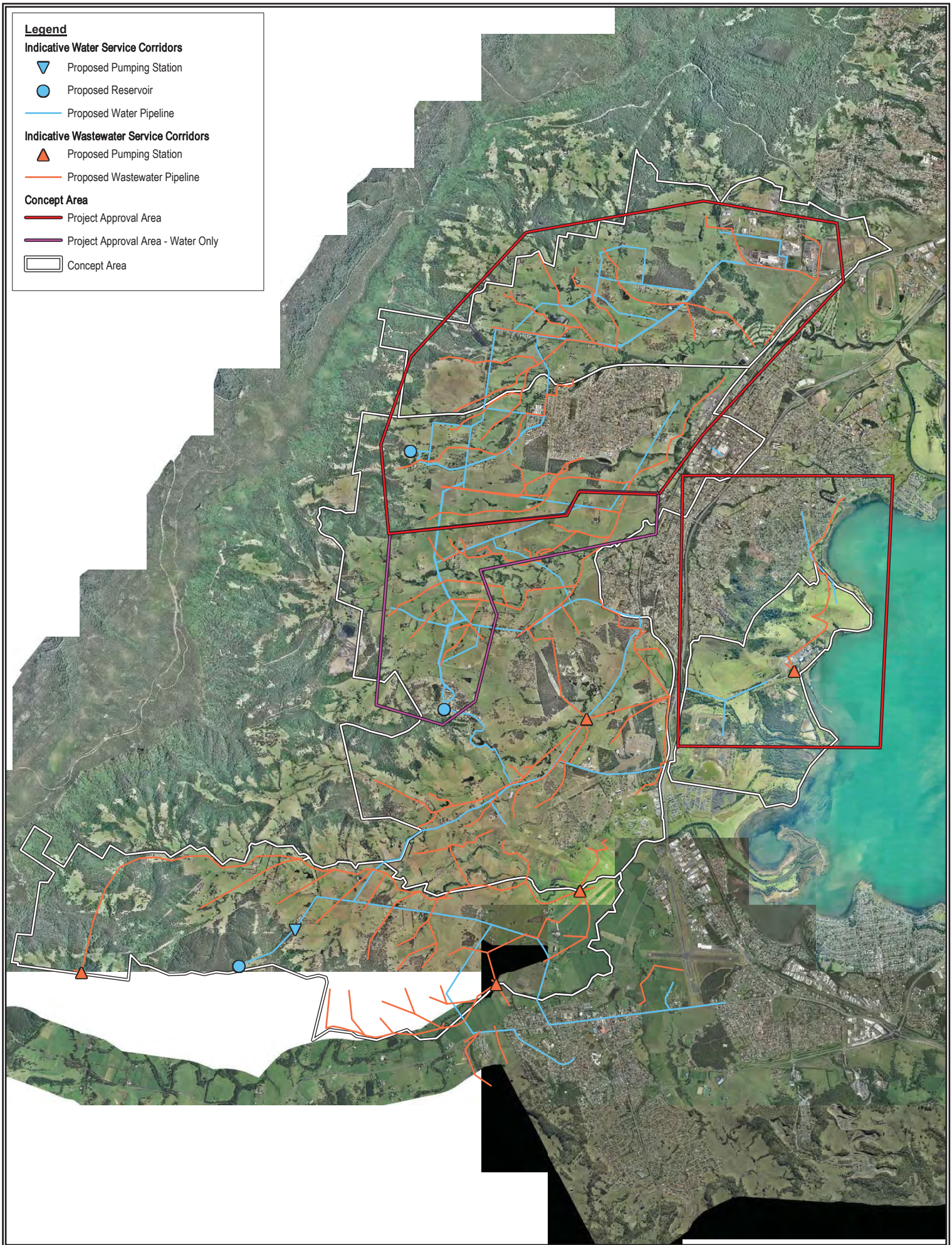
(d) a permit under section 87 or a consent under section 90 of the *National Parks and Wildlife Act 1974* (*NSW NPW Act*)

For this Project, the DGR specify that Aboriginal Community Consultation will be carried out in conformance with the draft guidelines for Aboriginal Consultation issued by OEH in 2005. This document, *Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation*, identifies the important factors and/or heads of consideration that need to be considered by proponents and consultants when assessing potential impacts on Aboriginal cultural heritage for development applications assessed under Part 3A. This Aboriginal Cultural heritage Assessment is based on the community consultation guidelines developed under Part 6 of the NSW NPW Act.

Since the development of these guidelines, OEH released new guidelines under Part 6 of the NSW NPW Act in April 2010. Although the consultation process for the Proposal will follow the requirements outlined in the DGR, where the new consultation guidelines provide more robust outcomes, these processes have also been undertaken.

1.4.4 Conclusion

Sydney Water is seeking Concept and Project approval under Part 3A of the EP&A Act. Sydney Water will prepare an Environmental Assessment that includes Aboriginal Heritage Assessment and Management. Aboriginal community consultation has been carried out in accordance with *Draft Guidelines for Aboriginal Cultural Heritage Assessment and Community Consultation* (DEC [now OEH], 2005a), as specified in the Director General Requirements (DGR) for the Proposal. Consultation is also consistent with the *Interim Community Consultation Requirements for Applicants* [DEC 2004] and *Aboriginal cultural heritage consultation requirements for proponents* (DECCW, April 2010).



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Acknowledgements:
Aerial Imagery - Courtesy of Sydney Water

Figure 2: The WDURA and AGA Concept Area.

Date: 22 June 2011	Drawn by: ANP
File number: 11633	Checked by: GLR

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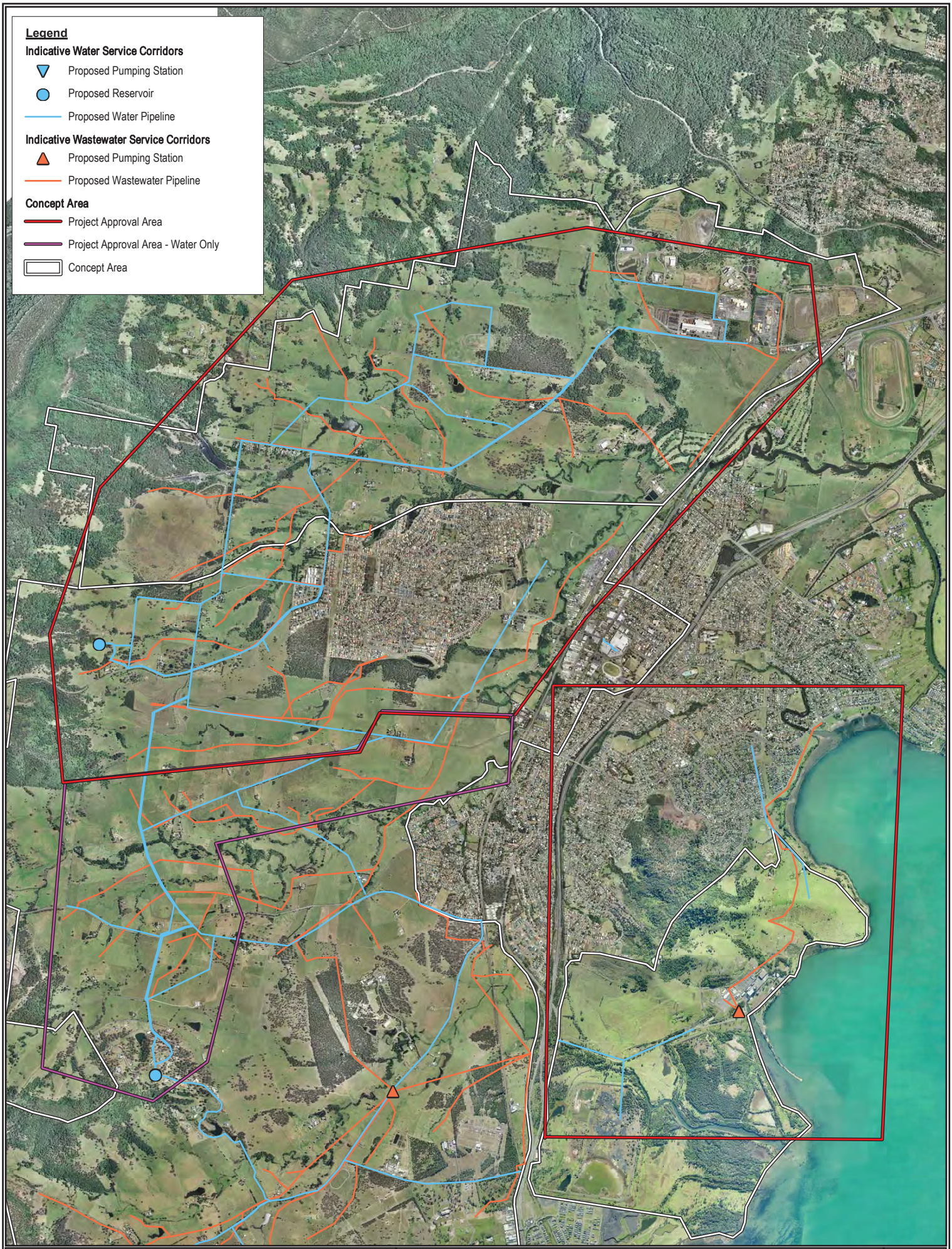
N W E S



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Acknowledgements:
Aerial Imagery - Courtesy of Sydney Water

Figure 3: The WDURA and AGA Concept Area - Project Approval Area.

Date: 22 June 2011	Drawn by: ANP
File number: 11633	Checked by: GLR

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Map Projection: Universal Transverse Mercator
Horizontal Datum: Geodetic Datum of Australia 1994
Map Grid: Map Grid of Australia Zone 56

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1.5 Aims and Objectives of Aboriginal Heritage Assessment and Impact Management Study

The aim of this report is to assist Sydney Water in demonstrating to the Minister for Planning that this Aboriginal heritage assessment has considered the following requirements of the DGR:

- the assessment of Aboriginal heritage cultural values in the WDURA and AGA including details of subsurface investigations, if any
- the impact mitigation measures
- has addressed DEC 2005 requirements.

In accordance with the **DGR**, this assessment of Aboriginal heritage values has appropriately considered the following (DEC 2005 1.2):

- *information regarding the significance to those Aboriginal people with a cultural association with the land of any Aboriginal cultural heritage values on which the proposed activity is likely to have an impact;*
- *the view of those Aboriginal people regarding the likely impact of the Proposal on their Aboriginal cultural heritage;*
- *any measures which could be implemented to avoid, mitigate or offset the likely impact(s); and*
- *any justification for the likely impact(s), including any alternatives considered for the Proposal.*

This assessment has addressed the six steps in **DEC 2005** as follows:

STEP 1: Preliminary assessment

The preliminary assessment was documented in Sydney Water's PEA. It included a review of desktop information including the cultural landscape and history of the WDURA and AGA. It identified a potential for significant impacts to Aboriginal heritage values given the nature of the components of the proposed water and wastewater services.

This assessment provides a more detailed assessment of heritage values than that of the PEA and Step 1 was addressed as follows:

- a description of the location and nature of the proposed development is provided in Chapter 1: Introduction and Chapter 15: Impact Assessment

- a description of social landscape was addressed in Chapter 6, Section 6.1: Ethnohistory; cultural landscape values were addressed in Chapter 5: Environmental Context; Aboriginal spiritual and other attachments to the land are addressed in Chapter 3, Section 3.1: Previously identified cultural values and Chapter 14, Section 14.3: Aboriginal Cultural Values;

- an assessment of which Aboriginal cultural heritage values that are known or likely to occur to be directly or indirectly affected by the Proposal are addressed in Chapters 6 to 9.

STEP 2: Information requirements

This assessment has addressed a 'multi-value' approach and includes a range of methods to satisfy data and information reporting needs as follows:

- social/ cultural information as provided in Chapter 6

- information from Aboriginal community meetings as identified in Chapter 2: Aboriginal Heritage Assessment Methodology, Chapter 3: Aboriginal Consultation and in Appendix 2

- landscape, the physical setting and its resources as addressed in Chapter 5 Environmental Context

- archival documentation as discussed in Chapter 6

- archaeological investigation from previous studies as addressed in Chapter 6 and archaeological investigation methodology as addressed in Chapter 2 and its findings in Chapter 13.

STEP 3: Integration of information and identification of heritage values

The study identified a number of previous studies (Chapter 6). The information supplied by these studies was synthesised to help provide the basis for the present heritage values.

STEP 4: Information regarding the proposed development

The nature and extent of the proposed development and its impacts, both direct and indirect, are identified in Chapter 15: Impact Assessment.

STEP 5: Integration of assessment with proposed development

An integration of Aboriginal heritage values and the proposed development enabled potential impacts to be defined in Chapter 15, Section 15.2: Potential Impacts.

STEP 6: Management strategy for Aboriginal heritage

Chapter 16: Management and Recommendations, identifies impact mitigation measures and outcomes. It addresses measures to be undertaken to ensure objects or places of significance are conserved.

The objectives of this report include:

- to undertake Aboriginal consultation to adequately assess the cultural values and cultural significance of the Concept Area, and afford all stakeholders the opportunity to influence the management of cultural heritage within the Concept Area

- to understand the regional archaeological modelling of the Concept Area through detailed background research and gap analysis, and identify constraints and opportunities at the planning stages

- to undertake field surveys of proposed alignment corridors within the Project Approval Area to help shape the final pipeline routes

- to develop detailed management and mitigation strategies to manage the archaeological and cultural values within the Proposal Area.

Based on DGR and OEH guidelines, the specific tasks undertaken were to:

- conduct searches of the relevant heritage registers to identify previously recorded sites within the Concept Area. In this case these registers are the Aboriginal Heritage Information Management System (AHIMS), the National Heritage List, Commonwealth Heritage List, the Register of the National Estate and the State Heritage Register/State Heritage Inventory

- undertake background research in order to recognise any identifiable trends in site distribution and location, and to accurately quantify the cultural heritage resources present

- consult with identified Aboriginal stakeholders in the area regarding the cultural values of the study area based on the guidelines endorsed by the OEH for project approvals under Part 3A of the EP&A Act

- conduct site inspections of previously recorded sites, focusing on sites determined to be of high and moderate significance, to collect baseline information and gauge the veracity of site records and the condition of the sites present

- provide representatives of the contemporary Aboriginal community the opportunity to inspect the Concept Area and any Aboriginal sites of particular cultural significance or interest

- conduct surveys to locate and record sites in areas deemed to be archaeologically sensitive but which have been previously subject to less intensive survey
- identify and assess all sites identified or relocated during the survey in compliance with the guidelines issued by OEH
- conduct an archaeological significance assessment for all sites within the Project Approval Area
- present the Aboriginal communities views in regard to cultural significance of the area and Aboriginal sites/places
- describe potential impacts to all identified Aboriginal sites within the Project Approval Area
- develop recommendations to avoid, minimise, mitigate and/or manage potential impacts to cultural heritage values within the Project Approval Area.

1.6 Structure of the Aboriginal Heritage and impact Management Report

This report presents the following information that provides site context for archaeological assessment work undertaken for this particular study. Part 1 of the report details the general methodologies and regional background material associated with the larger Concept Area. Part 2 deals with the specific predictive modelling, AHIMS and survey results within the Project Approval Area. Part 3 deals specifically with the management and recommendations associated with both the Concept Area (Part 3a) and the Project Approval Area (Part 3b).

Part 1 (Concept Plan Area) details the following chapters:

1. Introduction
2. Aboriginal Heritage Assessment Methodology – Part 3A
3. Aboriginal Consultation
4. Heritage Registers and Information Management
5. Environmental Context
6. Aboriginal Archaeological Context
7. Aboriginal Archaeological Site Definitions and Predictive Model

Part 2 (Project Approval Area) details the following sections:

1. Heritage Registers and Information Management
2. Environmental Context
3. Aboriginal Archaeological Context
4. Aboriginal Archaeological Site Definitions and Predictive Model
5. Aboriginal Archaeological Field Survey
6. Significance Assessment
7. Impact Assessment

Part 3 (Recommendations) details the following sections:

1. Management and Recommendations

2.0 ABORIGINAL HERITAGE ASSESSMENT METHODOLOGY – PART 3A

2.1 Context

According to Allen and O'Connell (2003), Aboriginal people have inhabited the Australian continent for the last 50,000 years, and the NSW area, according to Bowler et al (2003), for over 42,000 years. These dates are subject to continued revision as further evidence of Aboriginal cultural heritage is discovered and as more research of this evidence is conducted.

It is not appropriate for the authors to comment on the significance Aboriginal people place on their material culture and the natural landscape. It is the opinion of the authors however, that Aboriginal people consistently place great significance on any physical remains of their past.

With this preface Aboriginal cultural heritage broadly refers to things that relate to Aboriginal culture and hold cultural meaning and significance to Aboriginal people (DEC 2005a: 1; DECCW 2010: 3). There is an understanding in Aboriginal culture that everything is interconnected. In essence Aboriginal cultural heritage can be viewed as potentially encompassing any part of the physical and/or intangible landscape, that is, 'Country' (DEC 2005a: 1; DECCW 2010: 3).

Aboriginal peoples interpretation of cultural value is based on their "traditions, observance, lore, customs, beliefs and history" (DEC 2005a: 1; DECCW 2010: 3). The things associated with Aboriginal cultural heritage are continually / actively being defined by Aboriginal people (also see DEC 2005a: 1; DECCW 2010: 3). These things can be associated with traditional, historical or contemporary Aboriginal culture (also see DEC 2005a: 1; 3; DECCW 2010: 3).

2.1.1 Tangible Aboriginal Cultural Heritage

Three categories of tangible Aboriginal cultural heritage may be defined:

- things that have been clearly modified by Aboriginal people
- things that may have been modified by Aboriginal people but no discernable traces of that activity remain
- things never physically modified by Aboriginal people (who were not the Dreamtime Ancestors associated with shaping those things)

Specific examples would include (Table 1 following):

Table 1: Categories of tangible Aboriginal cultural heritage and specific examples

Things observably modified by Aboriginal people		
Objects	Specific examples	Animals, modified trees, art, grinding grooves, stone, wood or shell artefacts, earth mounds, fish traps, habitation structures, stone arrangements, quarries
Places		Massacre or Ceremonial sites with material evidence
Things modified by Aboriginal people but no discernable traces of that activity remain		
Objects	Specific examples	A cultural scar on a tree that has since grown over the scar
Places		Massacre or Ceremonial sites with material evidence; rock walls previous covered by art that has since washed away
Things never physically modified by Aboriginal people (who were not the Dreamtime Ancestors associated with shaping those things)		
Objects	Specific examples	Animals, for example, totems
Places		Dreaming sites

2.1.2 Intangible Aboriginal Cultural Heritage

Examples of intangible Aboriginal cultural heritage would include memories of stories and 'ways of doing', which would include language and ceremonies (DEC 2005a: 1; DECCW 2010: 3).

2.1.3 Statutory definition

Currently Aboriginal cultural heritage, as statutorily defined by the *National Parks and Wildlife Act 1974*, consists of objects and places.

Aboriginal objects are defined as:

> "*any deposit, object or material evidence…relating to the Aboriginal habitation of the area that comprises NSW, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains*"

Aboriginal places are defined as:

> "*a place that is or was of special Aboriginal cultural significance".*

Places are declared under section 84 of the *NPW Act 1974.*

2.1.4 Values

In general Aboriginal cultural heritage is valued by Aboriginal people as it is used to define their identity as both individuals and as part of a group (also see DEC 2005a: 1; 3; DECCW 2010: iii). More specifically Aboriginal Cultural Heritage is used:

- To provide:
    - a "connection and sense of belonging to Country" (DECCW 2010: iii)
    - a link between the present and the past (DEC 2005a: 2-3; and DECCW 2010: 3)
- As a learning tool to teach Aboriginal culture to younger Aboriginal generations and the general public (DECCW 2010: 3)
- As further evidence of Aboriginal occupation prior to European settlement for people who do not understand the scale to which Aboriginal people occupied the continent (also see DECC 2010: 1; DECCW 2010: 3).

2.2 Consultation Guidelines

Consultation for this Project has followed the guidelines outlined in both documents:

- *Interim Community Consultation Requirements for Applicants* (DEC 2004)
- *Draft Guidelines for Aboriginal Cultural Impact Assessment and Community Consultation* (DEC 2005)
- *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW 2010).

Together these documents provide the structure and mechanisms for current best practice consultation with the Aboriginal community. Apart from added steps introduced with the new consultation guidelines, one of the significant differences between these two consultation guidelines was an additional week review time for the Aboriginal parties for both the methodology and draft cultural heritage assessment report. Given the importance of due diligence, the longer review period time was applied for this Project.

In line with these documents, the consultation protocol acknowledges the following principles:

- input from those Aboriginal people with a cultural association with the land is an essential part of assessing the significance of Aboriginal heritage objects and values that could be impacted by an activity

- Aboriginal heritage can have both cultural and scientific/archaeological significance and both should be the subject of assessment

- Aboriginal people are the primary determinants of the significance of their heritage

- Aboriginal community involvement needs to take place early in the assessment process to ensure that their values and concerns are fully taken into account, and that their own decision-making structures are able to function

- consideration should be given to any measures that could be implemented to avoid, mitigate or offset likely impacts.

Stated in the DEC ICCR (2004), the community consultation process ensures that Aboriginal communities have the opportunity to positively influence assessment outcomes by:

- influencing the design of the assessment of cultural and scientific significance
- providing relevant information in relation to cultural significance values
- contributing to the development of cultural heritage management recommendations.

2.3 Objectives of the Consultation Process

The objectives of the Aboriginal community consultation undertaken by Biosis Research, and outlined in this methodology, were to:

- gain the Aboriginal community's view on the methodology for cultural and archaeological assessment, and refine the methodology to incorporate these views as required
- obtain the Aboriginal community's views and determinations of cultural value of the Concept and Project Approval Areas and any cultural heritage sites therein
- gain the Aboriginal community's views about potential impacts on the cultural heritage values of the Concept and Project Approval Areas and the wider landscape
- discuss mitigation and management strategies for sites that may potentially be impacted
- discuss mitigation and management strategies for potential impacts to the cultural landscape
- discuss their views regarding further involvement in future mitigation and management works (if required) relating to cultural heritage impacts
- provide comprehensive and realistic management recommendations to Sydney Water. These recommendations integrate Aboriginal community views and current cultural heritage management best practice.

2.4 WDURA + AGA Aboriginal Consultation Methodology

2.4.1 Consultation Process

The objectives of the consultation process were to ensure that an opportunity was given to a broad range of Aboriginal stakeholders to express their cultural heritage values of the Proposal and Project Approval Areas, including spiritual connections, recorded archaeological sites, and the natural environment and landscape values.

The cultural consultation process involved the following:

- newspaper advertisements
- distribution of a Project information pack
- face to face meetings. The key themes discussed during community consultation meetings included:
    a. affiliation to country - being traditional and/or contemporary
    b. places, sites, traditional resources and landscape values that are identified as significant
    c. identified connection to place, sites or landscape - physical or spiritual
    d. related stories - historical or contemporary that reinforce the significance of place
    e. management issues and recommendations relating to cultural values within the Concept and Project Approval Areas including:
        1) identification of places and sites that are significant to stakeholders and discussion of options for avoidance by the proposed works
        2) identification and acknowledgment of community management strategies for physical and spiritual sites and places
        3) discussion of requirements or restrictions within the Proposal and Project Approval Areas that may occur if Aboriginal objects or places are identified within the impact area of the Proposal.

Following the completion of the Aboriginal archaeological assessment of the Proposal, further consultation will be undertaken with key stakeholders to discuss the findings of the field survey. This will also involve requests for comments on the draft report and the formulation of management recommendations.

2.4.2 Standard Part 3A Archaeological Assessment Methodology

The archaeological assessment involved the following tasks:

- a search of the OEH's AHIMS, the National Heritage List, Commonwealth Heritage List, the Register of the National Estate and the State Heritage Register
- literature review of relevant cultural heritage and archaeological reports and publications for the local area and region
- consultation of historical source material (including historical maps and aerial photography) to determine land-use history.

A search was requested of AHIMS and the results mapped and forwarded to registered stakeholders. An archaeological survey of the Project components within the Project Approval Area was undertaken as described in Section 13.0.

3.0 ABORIGINAL CONSULTATION

The DEC 2005 *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* states that guidance for Aboriginal community consultation for Projects being assessed under Part 3A of the *EP&A Act* can be found in DEC ICCR 2004. Consultation for this Project has also complied with OEH ACHCR 2010. Together these documents provide the structure and mechanisms for current best practice consultation with the Aboriginal community.

3.1 Previously Identified Cultural Values

Cultural Values within both the Concept Area and Project Approval Area have been noted as part of previous archaeological studies. These have broadly been summarised in Table 2.

Table 2: Known Aboriginal Cultural Values with the Concept Area

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3.2 Consultation Process

3.2.1 Notification to Interested Parties

In accordance with the DEC ICCR 2004 and OEH ACHCR 2010, Biosis Research notified the following bodies regarding the Sydney Water Proposal:

- Wollongong City Council (WCC)
- Shellharbour City Council (SCC)
- Department of Planning (DoP)
- Office of Environment and Heritage (formerly DECCW)
- NSW Native Title Services Corporation Limited (NTSCORP Limited)
- The Registrar, *Aboriginal Land Rights Act 1983* of Aboriginal Owners
- National Native Title Tribunal (NNTT)
- Southern Rivers Catchment Management Authority
- Illawarra Local Aboriginal Land Council (ILALC).

A list of known Aboriginal stakeholders in the Illawarra was provided by Sydney Water on the 13.05.2010. These groups were also notified directly on the 01.09.2010 and include:

- Northern Illawarra Aboriginal Corporation (Woronora Plateau, Gundungurra and Wulungulu Elders Group)
- Comaditchie United Aboriginal Corporation
- Wodi Wodi Elders Council
- Korewal Elouera Jerrungarugh Tribal Elders Aboriginal Corporation
- Wadi Wadi Comaditchie Aboriginal Corporation
- D'harawal Knowledge Holders
- Peter Falk Consultancy
- Illawarra Aboriginal Corporation.

Of these notified bodies, OEH, the Department of Aboriginal Affairs Registrar and the Shellharbour City Council Aboriginal Community Liaison Officer responded, specifying

the names and contact details of Aboriginal groups or individuals that might have an interest in the Project. These groups were then also notified of the Project.

Public Notices

In accordance with the DEC's ICCR 2004 and DECCW ACHCR 2010, public notifications were in the following newspapers:

- The Illawarra Mercury (02.09.2010 and 09.09.2010)
- Wollongong Advertiser (08.09.2010).

The advertisements invited Aboriginal people who hold cultural knowledge to aid in determining the significance of Aboriginal object(s) and/or places in the vicinity of the Sydney Water Proposal to register their interest in a process of community consultation. The closing date for registration was the 16.09.2010.

3.2.2 Registration of Interested Aboriginal Parties

The following Aboriginal groups have registered an interest in the Proposal:

- Kullila Welfare and Housing Corporation
- National Koorie Site Management
- Tocomwall
- Wodi Wodi Elders Corporation
- La Perouse Botany Bay Aboriginal Corporation
- Peter Falk Consultancy
- Northern Illawarra Aboriginal Corporation (Woronora Plateau, Gundungara and Wulungu Elders Group)
- Illawarra LALC
- Wadi Wadi Comaditchie Aboriginal Corporation
- Korewal Elouera Jerrungarugh Tribal Elders Aboriginal Corporation

Consultation undertaken to date is summarised in Appendix 2. This includes notification, provision of the methodology, field work and provision of the draft report.

3.2.3 Fieldwork

An invitation to participate in the field survey investigation program was extended to all registered Aboriginal stakeholders due to the large area that needed to be surveyed.

Representatives from the following registered stakeholders participated in the fieldwork, conducted during November 2010 and January 2011. Additional details regarding registered stakeholder participation in the Aboriginal archaeological survey and site inspections is provided in Appendix 2.

Fieldwork Participation
Illawarra Local Aboriginal Land Council
Korewal Elouera Jerrungarugh Tribal Elders Aboriginal Corporation
Wadi Wadi Comaditchie Aboriginal Corporation
Peter Falk Consultancy
Kullila Welfare & Housing Aboriginal Corporation
National Koorie Site Management
Tocomwall
La Perouse Botany Bay Aboriginal Corporation
Northern Illawarra Aboriginal Corporation (Woronora Plateau, Gundungara and Wulungulu Elders Group)

3.2.4 Aboriginal Cultural Values within the Proposal Area

Two field trips (by Bus) were organised with the stakeholders to undertake a survey of cultural sites in the area. However, due to illness and other issues, no stakeholder was able to participate in the scheduled trips.

3.2.5 Consideration of All Comments

The following general comments were received regarding the draft version of this report. Comments are presented and considered (where required) in alphabetical order according to the relevant Aboriginal stakeholder group (Table 3; see Appendix 2).

Table 3: Aboriginal stakeholder comments and general recommendations for the Proposal.

Aboriginal stakeholder	General Comments / Recommendations
Illawarra Local Aboriginal Land Council	All cultural heritage sites are of high significance to the community. Agreement is held with the archaeological report that avoidance of sites is preferable with sub surface testing and salvage of sites that are to be impacted.
Wodi Wodi Elders Council	
Korewal Elouera Jerrungarugh Tribal Elders Aboriginal Corporation	
Wadi Wadi Comaditchie Aboriginal Corporation	
Peter Falk Consultancy	
Kullila Welfare & Housing Aboriginal Corporation	
National Koorie Site Management	
Tocomwall	
La Perouse Botany Bay Aboriginal Corporation	
Northern Illawarra Aboriginal Corporation (Woronora Plateau Gundungara and Wulungulu Elders Group)	

4.0 HERITAGE REGISTERS AND INFORMATION MANAGEMENT

4.1 Commonwealth Registers

4.1.1 National Heritage Registers

The Commonwealth *Australian Heritage Commission Act* was repealed in 2003 and in its place amendments were made to the *EPBC Act*.

Under the EPBC Act Amendments (No 88, 2003) two mechanisms have been created for protection of heritage places of National or Commonwealth significance. The National Heritage List provides protection to places of cultural significance to the nation of Australia. The Commonwealth Heritage List comprises natural, Aboriginal and historical heritage places owned and controlled by the Commonwealth and therefore mostly include places associated with defence, communications, customs and other government activities.

Nominations to these two lists are assessed by the Australian Heritage Council (AHC), who also administers the Register of the National Estate (RNE), a list of places identified as having national estate values. There are no management constraints associated with listing on the RNE unless the listed place is owned by a commonwealth agency.

APPLICATION TO THE CONCEPT AREA – NATIONAL HERITAGE REGISTERS
A search of the National Heritage List, Commonwealth Heritage List and Register of the National Estate was conducted on 05.10.2010. The Concept Area contains no items listed on the NHL, CHL or RNE.

4.1.2 National Native Title Register

The *Commonwealth Native Title Act 1993* establishes the principles and mechanisms for the preservation of Native Title for Aboriginal people.

Under Subdivision P of the Act, Right to negotiate, Native Title claimants can negotiate about some proposed developments over land and waters (known as 'Future Acts'), if they have the right to negotiate. Claimants gain the right to negotiate if their native title claimant application satisfies the registration test conditions.

The right to negotiate applies over some proposed developments or activities that may affect native title. Native title claimants only have the right to negotiate over certain types of future acts. The right to negotiate is not a right to stop projects going ahead — it is a right to have a say about how the development takes place. In some situations, the right to negotiate does not apply. In these circumstances, claimants may have the right to be notified, to be consulted, to object and to be heard by an independent umpire.

APPLICATION TO THE CONCEPT AREA – NATIONAL NATIVE TITLE REGISTER LISTINGS

A search of the National Native Title Register, the Register of Native Title Claims and the Register of Aboriginal Land Use Agreements in the Wollongong Local Government Area was completed for the Sydney Water Concept Area on 12.09.2010.

National Native Title Register	Nil
Register of Native Title Claims	NC98/23
Unregistered Claimant applications	Nil
Register of Aboriginal Land Use Agreements	Nil

NC98/23 is Native Title Claim lodged by the Cubbitch Barta Clan of the Dharawal People #3. This claim is situated near Helensburgh.

There are no lands determined to have native title, and no registered native title claims or Aboriginal land use agreements within the Concept Area or the immediate vicinity.

4.2 State Registers

4.2.1 National Parks and Wildlife Act Registers

The OEH maintains AHIMS register of Aboriginal heritage sites under the auspices of the NSW NPW Act. All Aboriginal sites in NSW are required to be registered on the AHIMS register under s89A. A search of the AHIMS register was undertaken at the commencement of the Project. The AHIMS database is maintained by the OEH and contains a list of Aboriginal objects, Aboriginal places and other Aboriginal heritage values in NSW that have been registered as required under the NSW NPW Act. The AHIMS database only includes Aboriginal sites registered with AHIMS and is not complete list of Aboriginal sites within any given area.

The area searched on the AHIMS database was larger than the Proposal Area, as Aboriginal sites recorded within the wider area provides a regional perspective on the types of sites that may be expected to occur within the Concept Area.

APPLICATION TO THE CONCEPT AREA – AHIMS DATABASE

A search of the AHIMS Database, completed in October 2010, identified **196** previously recorded Aboriginal sites within a 16 x 18 km search area encompassing the Concept Area. **139** Aboriginal sites were located within the Concept Area (Figure 4).

4.2.2 Heritage Act Registers

The *State Heritage Register* (SHR) contains items that have been assessed as being of State Significance to New South Wales. The *State Heritage Inventory (SHI)* contains items that are listed on Local Environmental Plans and/or on a State Government Agency's Section 170 registers. Items on the SHI have been identified as having heritage significance, but have not been included on the SHR.

If an item or place does not appear on either the SHR or SHI this may not mean that the item or place does not have heritage or archaeological significance; many items have not been assessed to determine their heritage significance. An assessment is required for items that are 50 years or older. Items that appear on either the SHR or SHI have a defined level of statutory protection.

APPLICATION TO THE STUDY AREA – NSW STATE HERITAGE REGISTER LISTINGS
There are no items within the Concept Area listed on the NSW State Heritage Register of listings.

APPLICATION TO THE STUDY AREA – NSW STATE HERITAGE INVENTORY LISTINGS
There are no items within the Concept Area that are listed on the NSW State Heritage Inventory Listings.

4.2.3 Environmental Planning and Assessment Act Registers

The EP&A Act includes provisions for local government authorities to consider environmental impacts in land-use planning and decision making. Such impacts are generally considered in relation to the planning provisions contained in the Local Environment Plan (LEP).

Local Environmental Plans: Each Local Government Area (LGA) is required to create and maintain a LEP that conserves Aboriginal and historic heritage items. Local Councils identify items that are of significance within their LGA, and these items are listed on heritage schedules in the LEP. The items are protected under the EP&A Act 1979 and Heritage Act 1977.

APPLICATION TO THE CONCEPT AREA – WOLLONGONG LEP 2009, WOLLONGONG LEP (WEST DAPTO) 2010, SHELLHARBOUR LEP 2000
A search of the Wollongong LEP 2009 and the Shellharbour LEP 2000 was undertaken on 28.10.2010. The current Concept Area contains no listed Aboriginal items. A search of the Wollongong LEP (West Dapto) 2010 was undertaken on 28.10.2010. The current Concept Area contains no listed Aboriginal items.

State Environmental Planning Policies (SEPP): Under the EP&A Act 1979, broad scale regional plans have also been developed that address cultural heritage resources that may extend beyond the geographic limit of one LGA. The Illawarra SEPP applies to the Wollongong, Shellharbour, Kiama, Shoalhaven and Wingecarribee local government areas and provides a planning and decision making framework for how to best use land resources, improve quality of life and protect regional interests and investment. The Regional Environmental Plan (REP) identifies the Illawarra region as possessing unique characteristics worth preserving and distinguishes items of cultural heritage.

APPLICATION TO THE CONCEPT AREA – ILLAWARRA REP 2009
No items within the Concept Area previously listed on the heritage schedule of this document.

4.3 Management Documents

The following sub-section briefly describes heritage management documents relevant to the Concept Area.

4.3.1 Aboriginal Archaeological Heritage

Aboriginal Heritage Planning Study *Dallas & Sullivan (1995)*

Dallas and Sullivan (1995) prepared an Aboriginal heritage planning study of the Wollongong LGA. This document describes the landforms of the Wollongong LGA and specifies the site type likely to be encountered in each landform unit. Recommendations were made regarding specific planning policies that Wollongong City Council should adopt to protect Aboriginal cultural heritage within the LGA.

Shellharbour City Council Area Aboriginal Heritage Study *Navin Officer 2000*

The Tallawarra Lands is located immediately north of the Shellharbour LGA and predictive models within this report are applicable. Navin Officer examines background information to generate predictive site modelling for Aboriginal Cultural Heritage in the Shellharbour LGA. Site location predictions from this report are discussed further in Section 4.3.

Wollongong City Wide Development Control Plan –
Part E – General Controls – Environmental Controls Chapter E10: Aboriginal Heritage

Wollongong City Council has developed an Aboriginal Heritage section in the new Development Control Plan (DCP) for the new Wollongong LEP (2009). Section E10 provides a brief outline of the requirements for any development proposal upon a known or potential Aboriginal site containing Aboriginal objects or a place of Aboriginal cultural heritage significance. These requirements are to be considered in conjunction

with the *NSW National Parks and Wildlife Act 1974*, and other relevant planning instruments.

4.4 Summary of Heritage Listings in the Concept Area

Of all the heritage registers searched, Aboriginal archaeological sites were only listed on the OEH AHIMS database. 139 Aboriginal archaeological sites are currently registered within the Concept Area (Figure 4).

LISTING	RNE	CHL	NHL	AHIMS	SHLEP 2000	WLEP 2009	WEST DAPTO LEP 2010	IREP 1986	SHR	SHI
▪ Previously recorded Aboriginal Archaeological Sites	N	N	N	Y	N	N	N	N	N	N

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5.0 ENVIRONMENTAL CONTEXT

A description of the environmental background to the Concept Area is provided in order to give context to the cultural heritage assessment. The environmental conditions of the Concept Area may have influenced the land use by people in the past, and conditions would also determine the processes by which sites are preserved. Environmental values of an area can also contribute to the cultural significance and attachments people have to a place.

The following is a brief summary of environmental information relevant to the assessment of the cultural values of the Concept Area.

5.1 Geology

The Illawarra region forms part of the Sydney Basin; a geological basin filled with near horizontal sandstones and shales of Permian to Triassic age overlying older basement rocks of the Lachlan Fold Belt. The Illawarra subregion of the Sydney Basin is characterised by Permian siltstones, shale, sandstones and interbedded volcanics on and below the coastal escarpment.

The Concept Area contains six geological units; Berry Formation, Bumbo Latite Member, Dapto Latite Member, Berry Siltstone, Budgong Sandstone and alluvium. The Dapto Latite Member, Berry Siltstone and Budgong Sandstone form part of the Shoalhaven Group. Illawarra Coal Measures are located to the west of the Concept Area along the length of the Illawarra Escarpment..

5.2 Geomorphology

The Concept Area is situated on the Coastal Plain between Lake Illawarra and the Escarpment. This physiographic unit has formed from the gradual recession westward of the Plateau (Bowman 1971). The Coastal Plain is widest at the points where Macquarie Rivulet has entrenched into the Plateau at Macquarie Pass and where other waterways provide the catchment area of Lake Illawarra, such as Duck and Wollingurry Creek systems, have carved into the Escarpment (Bowman 1971).

The Coastal Plain is characterised as a mosaic of foothills, ridges, spurs, hillocks and floodplains with slopes varying from very gently inclined to steep with the occasional low cliff. It is dissected by easterly flowing streams at intervals that become more frequent towards the north (Fuller 1982:18).

Geomorphological assessments within the Lake Illawarra catchment have identified the presence of a number of Pleistocene and Holocene alluvial deposits (AMBS 2006:19). Hean and Nanson (1985) identified five alluvial units within the catchment and mapped the distribution of the Pleistocene, Holocene and stratified Holocene/Pleistocene sediments. Following detailed field investigations, Hean and

Nanson (1985) suggest that, in the lowlands of the Lake Illawarra catchment, stream power is greatest in the upper reaches of the creek systems resulting in more recent Holocene alluvium cutting through the Pleistocene alluvium.

5.3 Soil Landscapes

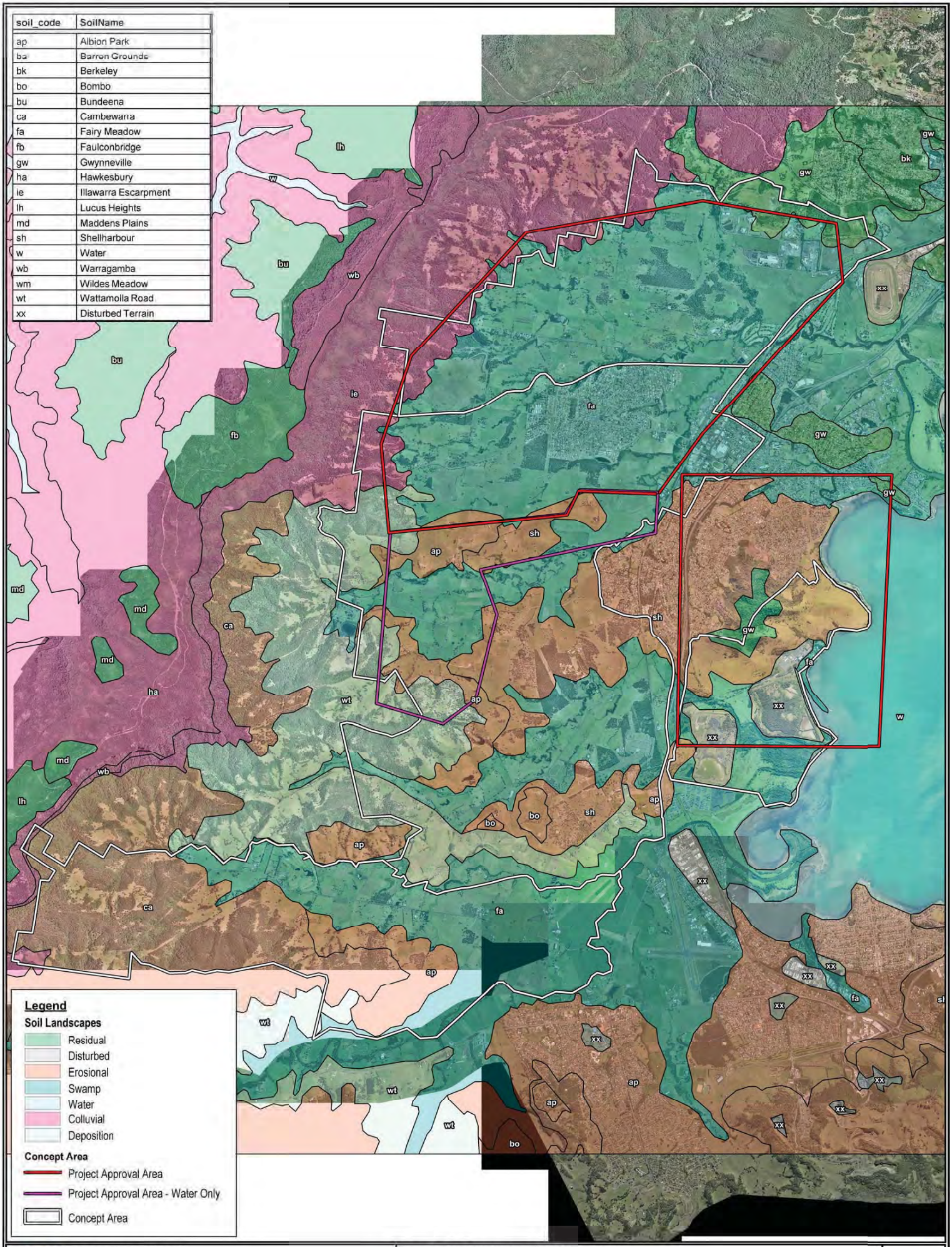
The Concept Area contains eight soil landscapes including Gwynneville, Albion Park, Bombo, Cambewarra, Shellharbour, Wattamolla Road, Fairy Meadow and Disturbed Terrain (Hazleton & Tille 1990). The soil landscapes are shown on Figure 5 and the description for each of these soil landscapes has been summarised in Table 3 below. Each soil landscape has distinct morphological and topographical characteristics. This results in each soil landscape having different archaeological potential (Figure 5; Table 3).

Table 3: Summary of Soil Landscapes within the Concept Area (Hazleton & Tille 1990).

SOIL LANDSCAPE	*LANDSCAPE*	*LIMITATIONS*
Fairy Meadow (Swamp)	Alluvial plains, floodplains, valley flats and terraces below the Illawarra Escarpment. Slopes <5% incline.	Flood hazard, water-logging, permanently high water table, high organic content, low permeability, shrink-swell potential (topsoil and subsoils), strongly acid, and sodicity.
Gwynneville (Residual)	Undulating to steep hills on the Illawarra Coal Measures and Dapto Latite Member on the coastal plain. Slopes 3% to 25% incline.	Extreme erosion hazard, steep slopes, mass movement hazard, local flooding, reactive impermeable and low wet bearing strength clay subsoils.
Albion Park (Erosional)	Short steep upper slopes with long gentle foot slopes on the Berry Former. Foot slopes 5% to 15% incline; upper slopes 15% to 25% incline.	Water-logging, seasonally high water tables, shink-swell, hardsetting topsoil, low wet bearing strength clay subsoils, and high available water-holding capacity (topsoil and subsoil)
Shellharbour (Erosional)	Rolling low hills with long side slopes and broad drainage plains on the Budgong Sandstone. Slopes <20% incline.	Mass movement (localised), shallow soil (localised), water erosion hazard (localised), sodicity, hardsetting, low permeability, low wet bearing strength (subsoil), and high shrink-swell (subsoil).
Bombo	Rolling low hills with benched slopes and sea cliffs with extensive rock platforms on Bumbo Latite. Relief 40-100m. Slope gradients 15-25%.	Rock fall hazard, wave erosion hazard, rock outcrop, hardsetting, low wet bearing strength, sodicity.

SOIL LANDSCAPE	LANDSCAPE	LIMITATIONS
Cambewarra	Steep to very steep hills with broad colluvial benches on latite. Relief 100-200m. Slope gradients >30%	Steep slopes, mass movement hazards, rock fall hazard, extreme water erosion hazard, shallow soil, rock outcrop, stoniness, low available water-holding capacity (topsoil), low wet bearing strength (subsoil) and sodicity.
Wattamolla Road	Long gently to moderately inclined sideslopes and undulating to rolling hills with broad benches on Budgong Sandstone. Relief <200m. Slopes 5-15%	Rock outcrop, run-on, mass movement (localised), hardsetting, high organic matter, low wet bearing strength, strongly acid, sodicity.
Disturbed Terrain	The topography varies between level plains to undulating terrain, disturbed by human activity to a depth of at least 1m. The original soil has been removed, greatly disturbed or buried. These areas have been typically filled with soil, rock, building and waste material. The limitations include subsidence, poor drainage, low fertility and toxic material.	

The formation characteristics of each of these soil landscapes will affect the survival of archaeological material. Residual and erosional soil landscapes are generally subject to movement of shallow soils, resulting in poor preservation of archaeological material. With little cover, archaeological material is likely to occur at shallow depths or will be exposed where there is little or no vegetation cover. Swamp soil landscapes behave in the opposite manner, and accumulate parent soils and deposition of transported soils, particularly along water lines. This process would therefore preserve archaeological material.



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Acknowledgements:
Aerial Imagery - Courtesy of Sydney Water

Figure 5: Soils landscapes within the Concept Area.

Date: 23 June 2011	Drawn by: ANP
File number: 11633	Checked by: GLR

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kilometres

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Map Projection: Universal Transverse Mercator
Horizontal Datum: Geodetic Datum of Australia 1994
Map Grid: Map Grid of Australia Zone 56

N W E S

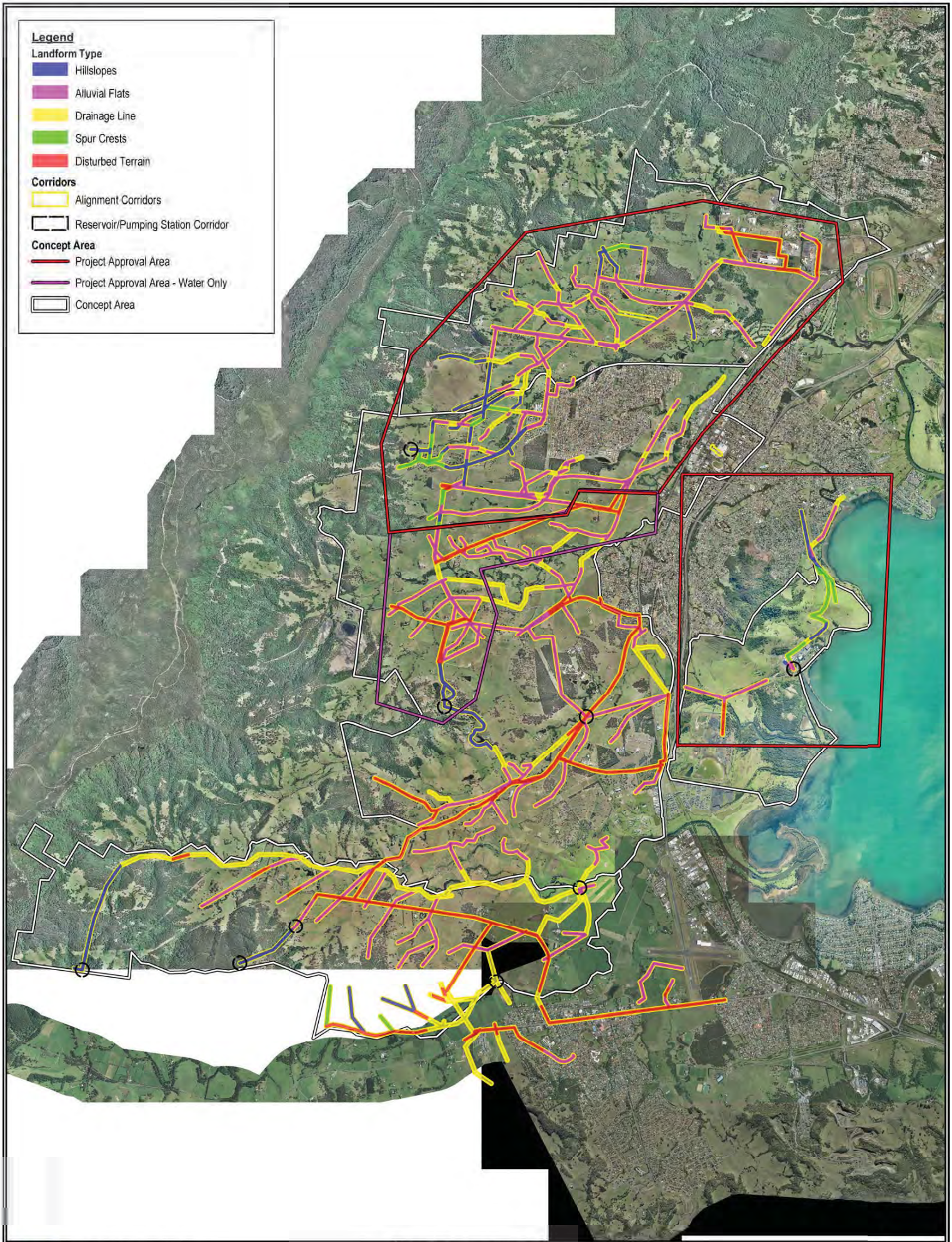

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Figure 6: Landforms located within the Concept Area - Overview.

Date: 23 June 2011	Drawn by: ANP
File number: 11633	Checked by: GLR

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Scale: 1:50,000 at A3
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geodetic Datum of Australia 1994
Map Grid: Map Grid of Australia Zone 56

N W E S

5.4 Hydrology

The Concept Area contains numerous hydrological features, primarily in the form of small creeks and streams, as well as the dominant easterly feature of Lake Illawarra. The main creeks are Mullet Creek, Dapto Creek, Robins Creek, Duck Creek, Marshall Mount Creek, Macquarie Rivulet, Yellow Rock Creek and Hazelton Creek.

Lake Illawarra was formed from the drowning of the Macquarie Rivulet valley during the raising of Holocene sea levels (6-7,000 years ago), the estuary was subsequently formed behind the large sand barrier that now forms the Windang Peninsula. Lake Illawarra is the largest estuarine lagoon on the south coast of NSW, covering an area of 33 square kilometres and extending over 9 kilometres in length and 5 kilometres in width. It receives salt water from the Pacific Ocean and fresh water from the Illawarra Escarpment (Roy 1984).

Lake Illawarra is classified as an early Intermediate Barrier Estuary or an estuarine lagoon. Barrier estuaries are characterised by *'narrow elongated entrance channels with broad tidal and back barrier sand flats'* (Roy 1984:5).

Streams and creeks on the gently sloping coastal plains are unconfined by topography and have extensive floodplains. The topography of the area, combined with the available surface water and a high water table, has created associated swamp/wetland environments, particularly those areas south of Duck Creek.

Watercourses within the Concept Area would have been used by Aboriginal people for a variety of purposes. They were a source of water and supported animals and plants, a number of which would have been utilised by Aboriginal people - particularly for food. Water would have been used as a cleaning agent and in the construction of material technologies, for example, as an abrasive and dust reducing agent in stone axe sharpening. Aboriginal people would have travelled along the larger watercourses via watercraft, typically in bark canoes. In addition watercourses may have had and continue to have a social / spiritual value to Aboriginal people.

5.4.1 Stream Order Analysis

Strahler's method has been used to determine watercourse order within the Concept Area. These numbers were first developed for use in hydrological analysis by Robert E. Horton and Arthur Newell Strahler and is commonly used to define stream size based on a hierarchy of tributaries (Plate 1, Table 4).

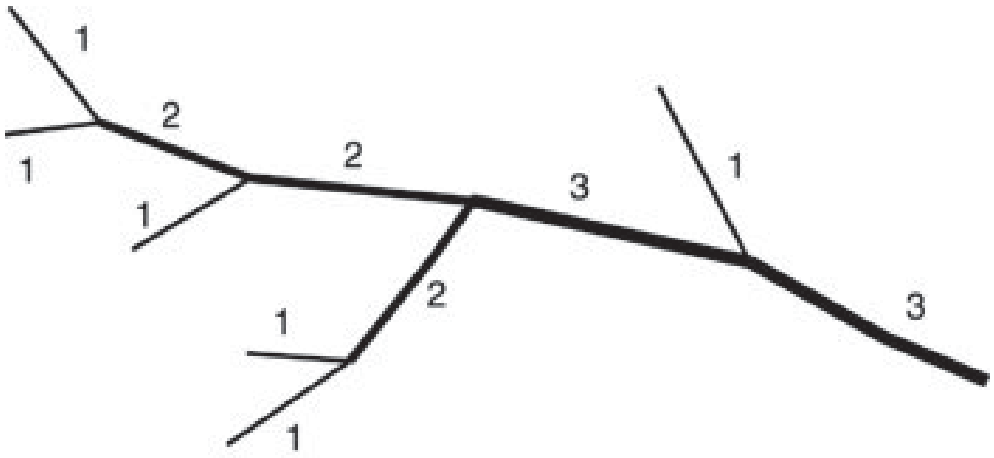

Plate 1: Diagram showing Strahler's Stream Order (Strahler 1957).

Table 4: Summary of stream order analysis and hierarchical ranking within the Concept Area.

STREAM ORDER	*HERIARCHICAL RANKING*
1-3	Low order
4-5	Moderate order
>6	High order

In the application of the Strahler stream order to hydrology, each segment of a stream or river within a river network is treated as a node within a branching framework, with the next segment downstream as its parent (Stahler 1957). When two first-order streams come together, they form a second-order stream. When two second-order streams come together, they form a third-order stream. Streams of lower order joining a higher order stream do not change the order of the higher stream. Thus, if a first-order stream joins a second-order stream, it remains a second-order stream. It is not until a second-order stream combines with another second-order stream that it becomes a third-order stream (Stahler 1957).

Stream order analysis will be used to indicate the potential distribution of Aboriginal sites across the Concept Area. There can be some inaccuracies in stream order identification using a 1:25,000 map, particularly in relation 1st order streams (Figure 7).

Figure 7 shows the distribution of sites registered with AHIMS in relation to stream order. The majority of Aboriginal sites within the Concept Area are located along 3rd and 4th order streams, with an easterly trend of increasing site densities towards Lake Illawarra.

Duck Creek is a permanent northeast flowing creek with a low water velocity that meanders across the coastal plain. The creek discharges into Lake Illawarra south of Wollingurry Point. Wollingurry Creek is a tributary draining the south of the site, which joins Duck Creek 1.5 km upstream of Lake Illawarra. Both Creeks have aggraded since historic occupation patterns have increased sediment loads in the water.

Mullet Creek is a fourth order stream which makes up the major creek catchment within the Concept Area, covering most of the northern section of the Dapto floodplain. The system incorporates numerous minor creek systems which originate at the base of the Illawarra Escarpment, and flow east towards Lake Illawarra. These creeks include Gibsons Creek, Dapto Creek, Forest Creek, Shaeffes Creek, Robins Creek and an unnamed tributary creek system (AMBS 2006: 24).

Marshall Mount Creek is a third order streams that defines the southern boundary of the WDURA. The creek system is relatively thin, with its greatest extent being 800m between boundary braches (AMBS 2006). Again, Marshall Mount Creek links together a number of first and second order streams flowing east from the escarpment.

Macquarie Rivulet flows within a west-east direction thought the southern portion of the WDURA, draining into Lake Illawarra. Macquarie Rivulet features two main tributaries, the first of which is Yellow Rock Creek, draining from what is locally referred to as the "Western Valley" (near Yellow Rock Road). The eastern most tributary is named Hazleton Creek and drains the area covering the recent subdivision at Tullimbar.

Wollingurry Creek System is a second order stream that originates at the southeast boundary of the Concept Area.

This page of the assessment contains culturally sensitive information. Sydney Water has removed the contents to protect and manage culturally sensitive information out of the respect to the Aboriginal community.

5.5 Climate

The climate within the Concept Area is generally temperate with a maritime influence. Summers in the coastal regions are generally warm, while winters are mild. In the escarpment areas to the west, winters are cold. Moderate to high temperatures, high humidity, onshore winds and peak rainfall characterise summer and autumn (Hazelton 1992). One third of the mean annual rainfall occurs between January and March, with a secondary rainfall peak in June. Winter winds are predominantly westerly, producing drier, cooler conditions.

5.6 Flora & Fauna

5.6.1 Flora

The Coastal Plains of the Illawarra region are characterised by mixed warm temperate and subtropical rainforest complexes on rich shale soils and alluvium under the escarpment, interspersed with patches of sclerophyll forest and woodland and estuarine and swamp communities. A number of vegetation communities have been identified throughout the current Concept Area that reflects those communities that occurred prior to European land use (Table 5). Many species within these vegetation communities would have been utilised by the Aboriginal groups inhabiting the region as a source of food and materials.

Table 5: Vegetation communities currently found within the Proposal Area (NPWS 2002).

VEGETATION COMMUNITY	*DOMINANT PLANT SPECIES*
Alluvial Swamp Mahogany Forest	Swamp Mahogany *(Eucalyptus robusta),* Southern Mahogany *(Eucalyptus botryoides),* Swamp Oak (*Casuarina glauca),* Cheese Tree (*Glochidion ferdinandi),* Flax-leaved Paperbark (*Melaleuca linariifolia),* Native Daphne (*Pittosporum undulatum), and* Wild Yellow Jasmine *(Pittosporum revolutum).*
Coastal Grassy Red Gum Forest	Forest Red Gum (*Eucalyptus tereticornis),* Thin-leaved Stingybark *(Eucalyptus eugenioides),* Rough-barked Apple (*Angophora floribunda),* Coast Grey Box *(Eucalyptus bosistoana),* Native Daphne (*Pittosporum undulatum),* Coffee Bush *(Breynia oblongifolia),* Maidens Wattle (*Acacia maidenii),* Prickly-leaved Tea Tree (*Melaleuca styphelioides)* and Kangaroo Grass *(Themeda australis)*
Coastal Swamp Oak Forest	Swamp Oak (*Casuarina glauca),* Commone Reed *(Phragmites australis),* Sea Rush (*Juncus kraussii* subsp. *Australiensis),* Bermudagrass (*Cynodon dactylon),* Native Wandering Jew (*Commelina cyanea), Samolus repens, Alternanthera denticulata*
Estuarine Alluvial Wetland	Swamp Oak (*Casuarina glauca),* Prickly-leaved Tea Tree *(Melaleuca styphelioides),* Common Reed *(Phragmites australis),* Broadleaf Cumbungi *(Typha orientalis),* Swamp Dock *(Rumex brownie),* Tall Sedge *(Carex appressa),* Sea Rush (*Juncus kraussii* subsp. *Australiense)* and Red-fruit Saw-sedge *(Gahnia sieberiana)*

Saltmarsh	Swamp Oak (*Casuarina glauca),* Grey Mangrove (*Avicennia marina* subsp. *Australasica),* Glasswort *(Sarcocornia quinqueflora* subsp. *Quinqueflora),* Sand Couch *(Sporobolus virginicus)* and Sea Rush (*Juncus kraussii* subsp. *Australiensis)*
Floodplain Wetland	Broadleaf Cumbungi *(Typha orientalis)*, Common Reed *(Phragmites australis)* and (*Eleocharis sphacelata)*
Lowland Dry – Subtropical Rainforest	Rusty Fig *(Ficus rubiginosa),* Forest Red Gum (*Eucalyptus tereticornis), Toona australis,* Giant Stinging Tree *(Dendrocnide Excelsa), Cassine australis var. australis*, Whalebone Tree (*Streblus brunonianus*), Smooth Mock-olive (*Notelaea venosa*), Green Native Cascarilla (*Croton verreauxii*), Native Quince, (*Alectryon subcinereus*), Black Apple (*Planchonella australis),* Maiden's Wattle *(Acacia maidenii), Rapanea variabilis, Clerodendrum tomentosa,* Black Plum (*Diospyros australis),* Myrtle Ebony *(Diospyros pentamera),* Red Ash *(Alphitonia excelsa),* Grey Myrtle *(Backhousia myrtifolia),* Native Daphne *(Pittosporum undulatum),* Hairy-leaved Doughwood *(Melicope micrococca)* and Willow Bottlebrush *(Callistemon salignus).*
Lowland Woollybutt – Melaleuca Forest	Woollybutt *(Eucalyptus longifolia),* Swamp Paperbark (*Melaleuca decora),* White Stringybark *(Eucalyptus globoidea),* Thin-leaved Stringybark *(Eucalyptus eugenioides),* Forest Red Gum *(Eucalyptus tereticornis),* Prickly Beard-heath *(Leucopogon juniperinus),* Rice Flower *(Ozothamnus diosmifolius), Acacia falcata,* Notched Bush-pea *(Pultenaea retusa),* Broom Bitter Pea *(Daviesia genistifolia),* Sticky Hop-bush (*Dodonaea viscosa* var. *angustifolia),* Wiry Panic *(Entolasia stricta),* Weeping Grass *(Microlaena stipoides* var. *stipoides),* Whiteroot *(Pratia purpurascens),* Mulga Fern *(Cheilanthes sieberi* subsp. *Sieberi),* Bushy Hedgehog-grass (*Echinopogon caespitosus* var. *caespitosus), Lepidosperma laterale,* Blue Flax-Lily *(Dianella longifolia),* Small-flowered Finger Grass *(Digitaria parviflora),* Paddock Lovegrass (*Eragrostis leptostachya),* Barbed Wire Grass *(Cymbopogon refractus)* and Spiny-headed Mat-rush *(Lomandra longifolia).*
Moist Box – Red Gum Foothills Forest	Forest Red Gum *(Eucalyptus tereticornis),* Coast White Box *(Eucalyptus quadrangulata),* Sydney Blue Gum *(Eucalyptus saligna),* Prickly-leaved Tea Tree *(Melaleuca styphelioides),* Green Native Cascarilla *(Croton verreauxii), Cassine australis* var. *australis,* Grey Myrtle *(Backhousia myrtifolia), Streblus brunonianus,* Native Daphne *(Pittosporum undulatum),* Wild Yellow Jasmine *(Pittosporum revolutum),* Lilly Pilly *(Acmena smithii),* Mock-olive *(Notelaea venosa),* Red Ash *(Alphitonia excelsa), Rapanea variabilis,* Prickly Rasp Fern *(Doodia aspera),* Rock Felt Fern *(Pyrrosia rupestris),* Sickle Fern *(Pellaea falcate)* and Settlers' Twine, Boorgay *(Gymnostachys anceps)*

5.6.2 Fauna

These vegetation communities supported a range of faunal resources that would have been utilised by Aboriginal peoples. Terrestrial and avian resources were not only used for food, but also provided (and often continue to provide) a significant contribution to the social and ceremonial aspects of Aboriginal life (Table 6). Several species of animal were utilised including molluscs, fish, birds and terrestrial animals (Chafer 1997).

Table 6: Faunal species found in habitats that would be found in the Concept Area (Chafer 1997; Lake Illawarra Authority 1999).

FAUNA	FAUNA SPECIES
Mammals	Swamp wallaby (*Wallabia bicolor)*, long-nosed bandicoot (*Perameles nasuta)*, eastern pygmy possum (*Cercartetus nanus)*, sugar glider (*Petaurus breviceps)*, common ringtail possum (*Pseudocheinus peregrinus)*, Mountain brush-tailed possum (*Trichosurus cunninghamii)* common wombat (*Vombatus ursinus)*, brown antechinus (*Antechinus stuartii)*, bush rat (*Rattus fuscipes)* and grey-headed flying fox (*Pteropus poliocephalus)* water rats (*Hydromys chrysogaster*) and the short-beaked echidna (*Tachyglossus aculeatus*).
Reptiles	Eastern Water Skink (Eulamprus quoyii), Pale Sun-skink (*Lampropholis guichenoti)*, Dark Sun-skink (Lampropholis delicate), Weasel Skink (*Saproscincus mustelina)*, She-oak Skink (*Cyclodomorphus casuarinae)*, Common Blue Tongue (*Tiliqua scincoides scincoides)*, Red-bellied Black Snake (***Pseudechis porphyriacus***)and Black-bellied Swamp Snake (Hemiaspis signata).
Birds	Brown Quail (*Coturnix ypsilophora)*, Australian Shell-duck (*Tadorna tadornoides)*, Great Crested Grebe (*Podiceps cristatus)*, Great Cormorant (*Phalacrocorax carbo)*, Great Egret (*Ardea alba)*, Black Bittern (*Ixobrychus flavicollis)*, Purple Swamphen (*Porphyrio porphyrio)*, Curlew Sandpiper (*Calidris ferruginea)*, Sacred Kingfisher (*Todiramphus sanctus)*, Fairy Martin (*Hirundo ariel)*, Australian Pelican (*Pelecanus conspicillatus)*, Intermediate Egret (*Egretta garzetta)*, Black-necked Stork (*Ephippiorhynchus asiaticus)*, Dusky Moorhen (*Gallinula tenebrosa)*, Whimbrel (*Numenius phaeopus)*, Pied Oystercatcher (*Haematopus longirostris)*, Caspian Tern (*Sterna caspia)*, Plumed Whistling-Duck (*Dendrocygna eytoni)*, Pacific Black Duck (*Anas superciliosa)*, Whistling Kite (*Haliastur sphenurus)*, Red-kneed Dotterel (*Erythrogonys cinctus)*, Crested Tern (*Sterna bergii)*, Musk Duck (*Biziura lobata)*, White-fronted Chat (*Epthianura albifrons)*, Little Egret (*Egretta garzetta)*, Striated Heron (*Butorides striatus)*, Straw-necked Ibis (*Threskiornis spinicollis)*, White-bellied Sea-eagle (*Haliaeetus leucogaster)*, Common Greenshank (*Tringa nebularia)*, Masked Lapwing (*Vanellus miles)*, Little Tern (*Sterna albifrons)*, Black Swan (*Cygnus atratus)*, Grey Teal (*Anas gracilis)*, Pacific Heron (*Ardea pacifica)*, Royal Spoonbill (*Platalea regia*) and Kelp Gull (*Larus dominicanus*) (reference should be made to Chafer 1997:77).
Fish	Yellowfin Bream (Acanthopagrus australis), Black Bream (Acanthopagrus butcheri), Short-finned Eel (Anguilliformes), Long-finned Eel (*Anguilla australis*), Mulloway (*Argyrosomus hololepidotus)*, Australian Salmon (*Arripis trutta* & *Arripis truttaceus)*, Silver trevally (*Pseudocaranx dentex* & *Pseudocaranx wrighti)*, Snapper (*Pagrus auratus)*, Whitebait (*Lovettia sealii* & *Galaxias* spp*)*, Sea and River Garfish (Hemiramphidae - undiferentiated), Mullet (Mugilidae – undifferentiated), Australian Bass (*Macquaria novemaculeata*), Estuary Perch (*Macquaria colonorum)*, Yellow-finned Leatherjacket (Meuschenia trachylepis), Trumpeter Whiting (*Sillago maculata*), Large-toothed Flounder (Pleuronectidae spp), Blue mackerel (*Scomber australasicus)*, Sand Whiting (*Sillago*

FAUNA	FAUNA SPECIES
	ciliate) and Black Sole (*Brachirus nigra)* (Chafer 1997:43, reference should be made to this work for a more complete list of fish species found within Lake Illawarra).
Molluscs	*AnAGAra trapezia, Batiillaria australis, Bedeva paivae, Hydrobia buccinoides, Irus crenutus, Laternula tasmanical, Liloa hordeacea, Macoma deltoidalis, Nassarius burchardi, Pyrazus ebeninus, Salinator fragilis and Spisula Trigonella.*

5.7 Resource Statement

The Coastal Plain of the Illawarra region provides a number of resources used by Aboriginal inhabitants. While previous archaeological work within the region has not identified any specific stone sources, the presence of the volcanic Dapto Latite Member in the region may have provided a suitable source of raw material, providing lithic material for stone axes. Lithic (stone) resources would have been accessible in the outcrops of quartz, andesite and other volcanics found within the Budgong Sandstone suitable for small tool manufacture (Comber 2009:7). Resources would have been accessible in the outcrops of siltstone, shale and tuffaceous sandstones of the Berry Siltstone formation. Angular cobbles and pebbles of fossilised wood have been recorded in the bed of Robins Creek (Sefton 1990:4) to the north east of the current Concept Area. The geomorphology of the Concept Area indicates that Pleistocene deposits will be buried by more recent Holocene deposits along Duck Creek.

A number of edible plant species would have been available. The general area includes several distinct resource zones including open forest, estuarine lagoon, alluvial swamp and rainforest communities. Each resource zone hosted different floral and faunal species, many of which would have been utilised according to seasonal availability. Aboriginal inhabitants of the region would have had access to a wide range of avian, terrestrial and marine fauna and repeated firing of the vegetation would have cleared vegetation, allowing ease of access through and between different resource zones.

Both floral and faunal species would have provided many resources in addition to food. For example, animals such as Brush-tailed Possums were highly prized for their fur, with possum skin cloaks recorded by the first settlers in the area (Comber 2009). The cloaks were worn fastened over one shoulder and under the other. Kangaroo teeth were incorporated into decorative items, such as head bands and beads were made from reeds and teeth. Plant resources were used in a variety of ways. Fibres were twisted into string, which was used for a many purposes including the weaving of nets, baskets and fishing lines. String was also used for personal adornment. Bark was used in the provision of shelter; a large sheet of bark being propped against a stick to form a gunyah.

Many plant species were also used as indicators for the availability of other resources. For example, the ripening of Apple Berry fruit indicated that the python could be caught hunting at that time of year or the flowering of the Coastal Tea Tree indicates that pipis are ready for collecting from the beaches (DEC 2005b:42,49).

It is worth noting that species collected from differing areas (Table 7) were probably used in more open areas outside or adjacent to the rainforest. Given this, it is likely that the interfaces of ecological zones were preferred places to collect resources, because they provided a richer variety of resources. Areas where the vegetation was easier to move through appear to have been desirable locations for the preparation and processing of resources.

Table 7: Resources utilised by Aboriginal people on the Coastal Plain (DEC 2005b:42-65)

RESOURCE SPECIES	PART USED	PURPOSE
Apple Berry (*Billardiera scandens)*	Fruit, stem and fibre	The vine from this plant is used to make thin fibrous string, while the rotten, ripe fruit is used for infected scratches.
Illawarra Flame Tree (*Brchychiton acerifollus)*	Wood and bark	Soft, spongy wood and bark were used to make nets and fishing lines.
Kurrajong (*Brachychiton populneus)*	Barks, seeds, root, wood and fruit	The inner bark was used for making string and also used for clothing. The timber was burnt for cooking coals. The seeds were roasted and ground and eaten.
Pig Face (*Carpobrotus glaucescens)*	Fruit and leaves	The leaves were used for blisters and burns. The flowers can be eaten, as can the ripe purple fruit.
Red Bloodwood (*Corymbia gummifera)*	Gum, sap and flower	The sap from this tree can be used for toothache and mouth wash, or used for mixing with paints to stain artefacts and rock art. It was also used to tan fishing nets and ropes.
Snake Whistle (*Dianella caerulea and reovluta)*	Fruit, leaves and flowers	The fruit is eaten raw when ripe and is also used to treat ulcers. The flower petals are used as an ingredient in medicines. The leaves were used to make a whistle to keep snakes away from camp sites.
Grey Ironbark (*Eucalyptus paniculata)*	Bark and wood	The bark is mixed with bloodwood gum to tan fishing nets.
Coast Tea Tree (*Leptospernum laevigatum)*	Stems, leaves, sees, flowers and timber	This plant was used as a frame for making gunyahs and mia-mias, and as a broom for sweeping. It was also used as an insect repellent. The leaves and seed capsules were crushed and used as an antiseptic.
Cabbage Tree Palm (*Livistona australis)*	Leaves, heart, gun, barks, stem fibre	The centre of the large leaf bulb was eaten, particularly during ceremonies. Fibres were used to make fishing lines and the leaves were used to patch canoes. The leaves were

RESOURCE SPECIES	PART USED	PURPOSE
		used as mats and thatching.
Bangalay (*Eucalyptus botryoides*), Thin leaved stringybark (*Eucalyptus eugenioides*)	Outer and inner bark, wood	Bark was removed using various tool types, such as ground edge awes, and was used for a range of purposes such as coolamons, canoes and shields.
White stringybark (*Eucalyptus globoidea*)		
Wollybutt (*Eucalyptus longifolia*)		
Yellow stringybark (*Eucalyptus muellerana*)		
Blackbutt (*Eucalyptus pililaris*)		
White topped box/ Coast White box (*Eucalyptus quadrangulata*)		
Eucalyptus saligna - (Eucalyptus botryoides		
Melaleuca decora		
Melaleuca linariifolia		
Prickly leaved paperbark *(Melaleuca styphelioides)*		
Plum Pine/ Brown Pine (*Podocarpus elatus)*		
Turpentine (*Syncarpia glomulifera)*		
Spiny Headed Mat-rush (*Lomandra longafolis)*	Flower, stem, fibre and seeds	String, armbands and necklaces were made from this plant. The leaf shoot was eaten raw, and the seeds are also crushed and eaten. It was also used for making baskets and dilly bags.
Black Apple (*Planchonella australis)*	Fruit	The ripe fruit of this plant was eaten.
Illawarra Plum (*Podocarpus elatus)*	Fruit and wood	The fruit is quite sweet and was eaten fresh or cooked. The wood is resistant to termites and marine borers.
Banksia (*Banksia sp.)*	Flower	When in flower, the Aboriginal people would collect the early morning nectar soaked dew and collect the liquid in coolamons.
Long-necked Tortoise (*Chelondin longicollis)*	Eggs	Eggs were collected, cooked and eaten
Goanna (*Varanus varius)*	Eggs and meat	Eggs were collected and eaten. Goanna meat was also cooked and eaten.
Eastern Grey Kangaroo (*Macropus giganteus)*	Meat, bone, skin, pelt, tail sinews, and teeth	The meat from the kangaroo was cooked and eaten. Bones were fashioned into barbs for fish spears, and the teeth were used as ornaments. The tail sinew and raw hide were

RESOURCE SPECIES	PART USED	PURPOSE
		used to bind the end of canoes, and to sew kangaroo and possum skin rugs.
Ringtail Possum (*Pseudocherius peregrinus)*	Meat	Possum meat was cooked and eaten.
Grey-headed Flying Fox (*Pteropus pollocephalus)*	Meat	The meat was cooked and eaten.
Wombat (*Vombatus ursinus)*	Meat and fat	The meat was cooked and eaten, while the fat was rubbed on the skin of newborns to keep them warm.

5.8 Land use history

5.8.1 Summary of Post-Contact History within the Proposal Area

The Concept Area was initially settled around 1815, with initial agricultural pursuits focused on timber clearing and mixed farming. A summary of the post-contact history of the Concept Area is outlined within the following sections. A more detailed history of the Concept Area is described by AMBS (2006). For more detailed information on the European History of the Concept Area, refer to AECOM (2011).

Timber Cutters

Cedar cutters were the first to open up the Illawarra area as early as 1805. When they had exhausted the easily accessible timber by 1820, cattle grazing took over and the coastal plain was extensively settled and cleared for pastoral estates and farms. Many early houses were built of rough slab or timber construction (Kass 2010:66).

Impacts of this industry not only included the removal of the trees, but also the creation of numerous access tracks for transport. These tracks often became impassable due to their poor state, resulting in the creation of alternative tracks and effectively carving up the forests (Fuller 1982:9). It is highly likely that some of these tracks now form some of the transport network located within the Concept Area.

Railways

Three railway lines have been constructed within the Concept Area – two of these remain today (Wongawilli colliery line and the Moss Vale – Unanderra line), located on an east-west axis, linking Kembla Grange and Wongawilli with lands to the north and south.

The Wongawilli colliery was connected to the main southern line in 1916 and in 1917 coal was being transported from the mine to Hoskins Iron and Steel Co. Lithgow works, via a rather circuitous route, up the South Coast line to Sydney, then back down the Main Southern Line to Lithgow (Biosis Research 2007b:20).

The Moss Vale - Unanderra railway line that runs via Kembla Grange, is in many ways responsible for the industrial development of the Wollongong region. Proposals for a railway link from the Southern Highlands to the Illawarra region had been put forward from as early as 1880s, when residents of the Moss Vale district sent a deputation to the Minister for Works (Southern, 1978; Jacobson, 1977). However, the line was not opened until 20 August, 1932.

The third railway served to link the Kanahooka Smelting Works with Fleming's Mine in the escarpment. The 5.5 mile railway line was completed in 1893 however was never used as a working rail line when the Lake Illawarra harbour scheme was dropped. Although the line has since been removed, remnants of the track line and cuttings are clearly visible in the Dapto landscape.

Residential Subdivisions

Prior to the completion of the Dapto-Bombo railway line in 1887, Dapto consisted of 'homesteads and tenant dwellings scattered over a 2–3 mile [3.2–4.8km] section of the highway' (Secomb 1999:3.1). Since this time, Dapto has expanded to include much of the land to the east of the railway line, with future subdivisions on the Tallawarra lands set to continue this trend.

Two main concentrations of residential estates are located within the Concept Area – Wongawilli Village in the northwest and Horsley in the south of the Concept Area. Wongawilli village, a discrete row of houses running along West Dapto Road at the base of the escarpment was initially developed in 1930 in response to the development of the Wongawilli Mine located to the west. Horsley, a recent subdivision which occurred during the 1990s, presents as a comparatively large impact to the natural landscape to the Concept Area, covering an area of roughly 2km^2.

Dairying

The use of cattle for producers of beef and milk increased after 1887, when wheat was no longer considered a viable option for the region. Producers supplied various local butter and cheese factories located close by to the transport link provided by the railway. Dairying and beef production remain important local industries in the Dapto area today.

Industry

The Concept Area has been affected by the development of industry, primarily with the development of the Tallawarra Power Station. Large sections of this area have been classed as disturbed terrain. Initial land clearing (including removing of trees) would have disturbed soil profiles to a limited depth, with the construction of the power station and its associated infrastructure much more likely to have caused significant impact. In addition, the Tallawarra Lands have been used as an agistment property for horses for a number of years, grazing on a mixture of pasture grasses, native

grasses and weeds within the paddocks. Although such grazing may have impacted surface contexts, it is unlikely that the density of animals would have ever been such that they would have destroyed sites. As well as vegetation clearing for pasture, other land disturbances within the property include the construction of dams across drainage tributaries, modification of access tracks, the building of residential properties and farming.

Mining interests within the Concept Area increased in the early part of last century with the development of coal mines at Avondale, Wongawilli and Kembla Grange (AMBS 2006). The original Wongawilli Mine was originally purchased by Hoskins Iron and Steel Company of Light in 1916, where it reached production maximum of around 1600 tonnes of coke a month before closing in the 1920s.

5.8.2 Summary of Landscape Modification

The landscape within the Concept Area has been modified through a variety of mechanisms, including residential subdivisions, industry, railways and farming. Of these, residential subdivisions and the beef and dairy industry play the greatest role in the continued modification of the West Dapto Area. The key mechanisms by which this is done is through the removal of native vegetation, the displacement and introduction of topsoil and the disruption of natural waterways and landforms.

5.8.3 Implications for the archaeological Predictive Model

The result of much of this landscape modification has been the burial, removal and destruction of many Aboriginal archaeological sites. In addition, the increased density and volume of grass cover within the area has lead to a dramatic decrease in the ability of artefacts to be identified within surface exposures.

These changes are reflected in the predictive model through the recognition of disturbed/modified landscapes, which have been assigned a decreased level of archaeological potential as a result.