

Appendix G

Flora and Fauna Impact Assessment Report

FINAL REPORT

Woy Woy Alternative Waste Technology and Composting Facilities Flora and Fauna Assessment

Prepared for

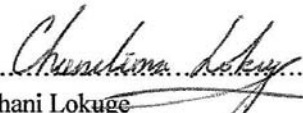
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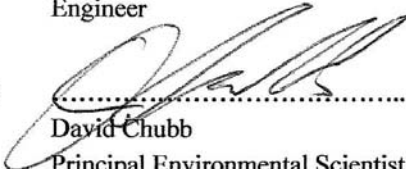
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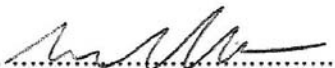
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Executive Summary

URS Australia Pty Ltd (URS) was engaged by Gosford City Council to conduct a flora and fauna survey and assessment for the expansion of the Woy Woy Waste Management Facility (WMF), on the Central Coast of New South Wales. The proposed development will be to provide a 3-4ha area for a Composting Facility and subsequent Alternative Waste Technology (AWT) Facility (the 'Site').

A desktop literature review was undertaken by URS to identify the representative spectrum of threatened species, populations and ecological communities listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environmental Protection and Biodiversity Conservation Act, 1999* (EPBC Act) that could be expected to occur within the study area. Flora and fauna surveys were also conducted at and within the vicinity of the Site (the study area) on 11 and 12 July 2006. Due to the seasonal constraints of the survey timing and the habitat provided on site, additional surveys were undertaken from 22 to 26 November 2006 in order to satisfy guidelines of the NSW Department of Environment and Climate Change (DECC) and the Lower Hunter Central Coast Regional Environmental Management Strategy (LHCCREMs). The combined survey effort for the July and November 2006 surveys is generally consistent with the DEC (2004) draft guideline for threatened species surveys and the LHCCREMS (2002) ecological survey guide for the Central Coast and Hunter regions.

The desktop literature review indicates that 20 threatened plant species and approximately 85 threatened fauna species listed under the EPBC Act and/or the TSC Act have been previously recorded within the locality of the Site. During the July and November 2006 surveys, a total of 131 flora species (including weed species), 13 species of reptile, 39 species of bird, nine species of amphibian, 17 native mammals and one species of invertebrate (a dragonfly) were recorded at and within the vicinity of the Site. The majority of these species are generally common and widespread species. However six threatened species listed under the TSC Act, including the Red-crowned Toadlet, Grey-headed Flying-fox, Eastern Freetail Bat, Little Bent-wing Bat, Large-footed Myotis and the South-eastern Petal-tail Dragonfly (Giant Dragonfly), were recorded on the Site.

Significant infestations of noxious and environmental weeds were recorded within the disturbed parts of the Site; however the surrounding natural vegetation is relatively weed-free.

Construction of the proposal will result in the removal of approximately 1.5ha of native vegetation, including 1ha of Exposed Hawkesbury Sandstone Woodland and 0.5ha of Sheltered Dry Hawkesbury Woodland. Neither of these vegetation types is listed as of conservation significance and both are well represented in nearby conservation reserves. The removal of this vegetation will reduce the distributional area of these communities within the locality, but will not cause the local extinction of any flora species recorded on the site. No threatened flora species or endangered ecological communities listed under the TSC Act were recorded on the Site, although there are previous records of the TSC-listed *Callistemon linearifolius* from an area adjacent to the proposed facility.

The vegetation to be removed contains habitat features such as feed trees, tree hollows, rock outcrop and ground debris and represents potential habitat for a range of fauna, including threatened species. Several TSC Act-listed species, including threatened microbats, nocturnal birds and the Bush Stone-curlew could be affected by this loss of habitat. Section 5A Assessments (7-part tests) for these species concluded that only minor impacts were likely due to the relatively small area of habitat to be removed, limited evidence of local populations or core breeding or roosting habitat and presence of superior habitat in the area surrounding the Site. Therefore a Species Impact statement (SIS) for these species is not required.

Executive Summary

A biodiversity offset package is presented as a means to mitigate against the impacts on flora and fauna of the proposed facility. The package describes the vegetation and habitats of the area to be affected by construction of the proposed facilities and those of the area proposed as an offset. A rectangular area of land slightly larger (1.58ha) than the impacted area (1.5ha) has been identified at the southern end of the Council landfill site, which is bounded on three sides by the adjoining National Park. This offset area contains threatened species habitats, vegetation types, habitat types and landscape features similar or equivalent to those found within the impacted area. Council has agreed to set aside the area for conservation purposes in perpetuity, and will negotiate a suitable administrative arrangement, which could be in the form of a Voluntary Conservation Agreement, Section 88D instrument or land divestment, with DECC. The proposed offset is consistent with the DECC guidelines for offsets and meets the key criterion for like-for-like trade-offs of biodiversity values. Adoption of the offset would adequately compensate for the loss of threatened species habitat associated with construction of the proposed AWT facility.

The proposal in its current configuration and design is likely to result in impacts to important habits in Patonga Creek and a hanging swamp. Assessments pursuant to Section 5A of the EP&A Act (7-part tests) for the Red-crowned Toadlet and the Giant Dragonfly conclude that the proposal could result in significant impacts on local populations of these species if surface hydrology and water quality is adversely affected by the facility. Therefore an SIS could be required for these species depending on the final drainage design and the surface water treatments proposed. Appropriate construction and operational mitigation measures must be incorporated into the final detailed design in a manner that minimises alteration of natural flows and pollution run-off into downstream habitats.

A monitoring and environmental management program is recommended as part of the construction and operational phases of the proposal, including control of environmental weeds, to avoid impacts on the adjoining Brisbane Water National Park. The program would be detailed in a vegetation management plan (or equivalent) that would be included as part of a site Environmental Management Plan prior to commencement of construction.

1.1 Scope of Report

URS Australia Pty Ltd (URS) was engaged by Gosford City Council to conduct a flora and fauna survey and assessment for the expansion of the Woy Woy Waste Management Facility (WMF), on the central coast of New South Wales. Baseline flora and fauna surveys were undertaken in July 2006 with additional targeted surveys undertaken in November 2006. The November 2006 targeted surveys were undertaken in order to coincide with the optimal detection period for the majority of fauna which may occur at the Site and following recommendations by the NSW Department of Environment and Conservation (DECC) based in their correspondence dated 30 October 2006 (Alan Henderson – Area Manager Gosford).

This report assesses the flora and fauna impacts of the Project with regards to Commonwealth and NSW State planning and environmental legislation (including the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), the *Environmental Planning and Assessment Act 1979* (EP&A Act), the *Threatened Species Conservation Act 1995* (TSC Act), *Native Vegetation Act 2003* (NV Act), *State Environmental Planning Policy (SEPP 44)* and the *Noxious Weeds Act 1993* (NW Act).

1.2 Site Description and Surrounding Landuse

The WMF is owned and operated by Council, and is located off Nagari Road, Woy Woy South, approximately 45km north of Sydney and 75km south of the Newcastle CBD, and consists of Lot 110 DP 755251, Lot 1 DP 126813 and Lot 1 DP 654885 and is wholly within Gosford Local Government Area. The site is zoned 5(a) Special Uses under the Gosford Planning Scheme Ordinance. The site is currently licensed by the EPA as a Solid Waste Class 1 Landfill (Licence number 6053), and able to receive up to 100,000 tonnes of waste per year.

The WMF is bounded to the west, east and south by Brisbane Water National Park (N.P.). The proposed facilities would be located within 100m of the Park boundary. Nearby waterways include Patonga Creek (south of the site) and Woy Woy Creek (north-west of the site). The Woy Woy Sewage Treatment works are located to the north of the WMF. Patonga Creek is located within the landfill site, approximately 20m from the southern boundary of the proposed facilities. The closest residence to the WMF is approximately 600m to the east, however the nearest residence to the proposed composting/AWT facilities, is located approximately 750m to the east of the site. Civil works are currently being proposed to fill and level the southern end of the site, where an existing stormwater pond is located. This will provide a 3-4ha area for the proposed facilities.

Approximately one half of the site is relatively intact vegetation associated with Hawkesbury Sandstone geology within the Sydney Basin region. The other half of the site is highly disturbed and consists of grasses used for bank stabilisation of the existing landfill; regrowth typical of Dry Hawkesbury Woodland and invasive weeds.

The location of the WMF is shown in **Figure 1**.

1.3 Proposed Development

The site is currently licensed by the DECC as a Solid Waste Class 1 Landfill (Licence number 6053), and able to receive up to 100,000 tonnes of waste per year. Operations currently undertaken on the site include waste receipt at the gatehouse, land filling of putrescible waste, and collection and sorting of construction and demolition waste and green waste. Active extraction of landfill gas from the closed areas of the landfill commenced in January 2007.

To extend the operating life of Woy Woy, civil works are currently being proposed to fill and level the southern end of the site, which is essentially located within a creek valley, to provide a 3-4ha area for the development of a composting facility and subsequent Alternative Waste Technology (AWT) Facility (the 'Site'). The infilling operation will result in the removal of an existing sedimentation stormwater pond and the production of a flat area joining two sandstone ridge tops.

The proposed facilities are expected to reduce the volume of waste going to landfill in line with Councils Future Waste Disposal Strategy. The footprint of the proposed development is shown in **Figure 1**.

1.4 Geology, Soils and Topography

The regional geology has been interpreted based on a 1:500,000 scale geological map of the Sydney Basin prepared by the Geological Survey of New South Wales, division of Regional Geology 1967. Based on this mapping and associated review, the WMF site is underlain by Hawkesbury Sandstone. Typically this formation comprises of multi coloured sandstone, quartzose sandstone, with interbedded shale and mudstone.

The landfill is located within a steep sided gully orientated in a north-south direction. Elevations across the site ranges from 60mADH at the northern end to 160mAH on the eastern side of the site. The sedimentation pond at the southern end of the site sits within a depression which was formally part of a quarry and is approximately 105mAH.

The WMF site is located on a natural saddle. The drainage from most of the WMF site is to the north through sedimentation or clearway ponds to Woy Woy Creek which drains to Brisbane Water. However the water falling on the south of the WMF site and including the Site is to the headwaters of Patonga Creek via a series of sedimentation dams which drains directly into Broken Bay.

Patonga Creek is located approximately 20m from the south boundary of the proposed Site. This creek runs through the Brisbane Water N.P. for over 2km before it becomes tidal, joining the Hawkesbury River. The Patonga Creek catchment is largely undisturbed and varies little from its natural state.

1.5 Existing Drainage System

The Site has been significantly altered with cutting of the hill sides and the construction of a large sedimentation pond. Much of the area of the proposed development now drains towards this pond, but the south-west corner drains towards Patonga Creek and a small section of the proposed access road drains towards the landfill drainage system. The dam has an outlet that discharges water towards Patonga Creek. There is some soil erosion downstream of this outlet.

A small drainage channel catches runoff from part of the hillside north-east of the site, and directs this into an unnamed creek which flows through the north of the WMF site. In peak events this is likely to overflow and flow into Patonga Creek, possibly attenuated by the sedimentation pond. That is, existing peak flows in Patonga Creek are likely to be higher than “natural”.

2.1 Threatened Species Conservation Act 1995

On 31 October 2005, the majority of the provisions under the *Threatened Species Legislation Amendment Act 2004* and all the remaining provisions under the *Threatened Species Conservation Amendment Act 2002* commenced. A key amendment, which affects this Flora and Fauna Assessment, include the replacement of the Eight Part Test of Significance with a Seven Part Assessment of Significance. This amendment affects both Section 5A of the EP&A Act and Section 94 of the TSC Act. The revised factors retain the same intent in assessing the potential impacts of a proposed development on a threatened species, population (including their habitats) or EEC, however the new Seven Part test requires assessment of significance at a local scale rather than at a regional scale.

Should the Seven Part Assessment of Significance conclude that there may be a potentially significant impact on a listed species, population or EEC, a Species Impact Statement (SIS) must be prepared. An SIS must be prepared under the Terms of Reference issued by the Director General (DG) of the DECC. Approval for the proposal is also required by the DECC DG.

In light of changes to NSW legislation, a Seven Part Test was carried out for those TSC Act listed species and communities recorded and/or predicted to occur at times on the Site or within adjoining remnants. The Seven Part Tests are provided in **Appendix A**.

2.2 Native Vegetation Act 2003

The NSW Government released the regulations for the *NV Act* on 14 November 2005, which came into effect on 1 December 2005. The *NV Act* regulates the clearing of native vegetation on all land in NSW except for land listed in Schedule 1 of the Act. Excluded land under Schedule 1 of the Act includes National Parks and other conservation areas, State forests and reserves, and urban areas. Specifically, urban areas, which are excluded, include areas zoned residential (but not rural residential), village, township, industrial or business.

A central feature of the *NV Act* is the requirement for the implementation of a Property Vegetation Plan (PVP) before the clearing of any vegetation, including a single paddock tree. The PVP is a voluntary system and are negotiated agreements between individual landholders and their local Catchment Management Authority.

The Site is currently zoned 5(a) Special Uses under the Gosford Planning Scheme Ordinance and is currently licensed by DECC as a Solid Waste Class 1 Landfill (Licence number 6053). Under Schedule 1 of the *NV Act* land within a zone designated “industrial” under an environmental planning instrument or, having regard to the purpose or substantial character of such as zone is exempt from the operation of the Act. This proposal is therefore considered exempt from the *NV Act*.

2.3 Noxious Weeds Act 1993

Under the *Noxious Weeds Act 1993 (NW Act)*, Gosford City Council is responsible for the control of noxious weeds in its local government area (LGA). The *NW Act* provides for the declaration of noxious weeds by the Minister of Agriculture. Noxious weeds may be considered noxious on a National, State, Regional or Local scale. All private landowners, occupiers, public authorities and Councils are required to control noxious weeds on their land under Part 3 Division 1 of the *NW Act*.

2.4 State Environmental Planning Policy 44 – Koala Habitat Protection

This Policy aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas. SEPP 44 applies to land with Local Government Areas listed in SEPP 44, Schedule 1 for which a development application has been made and Council is the determining authority. As the study area exists within the Gosford Local Government Area (listed in Schedule 1 of SEPP 44) SEPP 44 applies to this assessment.

Under this policy the distinction between ‘potential’ and ‘core’ koala habitat is made. “Potential Koala Habitat” means area of native vegetation where the trees of the types listed in Schedule 2 of the Policy constitute at least 15% of the total number of trees in the upper or lower strata of the tree component. “Core Koala Habitat” means an area of land with a resident population of Koalas, evidenced by attributes such as breeding females and recent sightings of and historical records of a population.

Where potential habitat is identified, the area must be investigated for core koala habitat. Where core koala habitat is found to occur, SEPP 44 requires that a site-specific Koala Plan of Management be prepared.

2.5 Environment Protection and Biodiversity Conservation Act 1999

The purpose of the Commonwealth EPBC Act is to ensure that actions likely to cause a significant impact on a matter of national environmental significance undergo an assessment and approval process.

Under the EPBC Act, an action includes a project, undertaking, development or activity.

An action that “*has, will have or is likely to have a significant impact on a matter of national environmental significance*” may not be undertaken without prior approval from the Commonwealth Minister for the Environment and Heritage.

The EPBC Act identifies matters of national environmental significance as:

- World heritage properties;
- National heritage places;

- Wetlands of international importance (Ramsar wetlands);
- Threatened species and ecological communities;
- Migratory species;
- Commonwealth marine areas; and
- Nuclear actions (including uranium mining).

The Administrative Guidelines for the EPBC Act set out criteria intended to assist in determining whether an action requires approval. In particular, the Guidelines contain criteria for determining whether a proposed action is likely to have a “significant impact” on a matter of national environmental significance. Should the proponent deem the proposal to have a significant potential impact on a matter of NES, a referral to the Commonwealth Minister of Environment and Heritage would be undertaken to obtain a confirmation as to whether the Commonwealth considers the proposal a “controlled action” requiring Commonwealth approval.

EPBC Act listed species recorded or predicted to occur on the Site are also listed under the TSC Act and have been assessed in relation to the current proposal under Section 5A of the EP&A Act (see **Appendix A**).

3.1 Methodology

3.1.1 Literature Review

A desktop literature review was undertaken by URS to identify the representative spectrum of Threatened species, populations and ecological communities listed under the TSC Act and the Commonwealth EPBC Act that could be expected to occur within the study area, based on habitats present. To this end, the following documentation was reviewed prior to the conduct of the field investigations:

- a search of the NSW NPWS Wildlife Atlas database (Selected area for Flora on coordinates 151.27000, -33.60000, 151.43000, -33.44000 and selected area for Fauna on coordinates 151.33000, -33.57000, 151.50000, -33.34000 – June 2006);
- EPBC online Protected Matters Database Search (February 2006 - 10 km radius search centred on the Site);
- GHD (2005a). *Development of Western Edge of Woy Woy Landfill. Landfill Design*;
- GHD (2005b). *Conservation Management Plan for Callistemon linearifolius. Woy Woy Landfill*; and
- Golder (2006), Annual Report on Environmental Monitoring (25th January 2006, to 24th October, 2006) Gosford City Council Waste Depot, Nagari Road, Woy Woy, Golder Associates Pty Ltd for Gosford City Council, NSW.

3.1.2 Botanical Survey

Flora surveys were conducted at and within the vicinity of the Site (the study area) on the 11 and 12 July 2006. The primary objectives of the survey were to:

- map and describe the vegetation communities occurring within the study area;
- compile a flora list of those species occurring within the vegetation communities, identifying any threatened, nationally, regionally or locally significant species and communities; and
- assess the likely impacts of the proposed development and provide recommendations to assist in minimising impacts to flora in the study area.

The botanical surveys were generally consistent with the *DEC Threatened Biodiversity and Assessment; Guidelines for Developments and Activities Working Draft* (2004), the Lower Hunter Central Coast Regional Environmental Management Strategy (LHCCREMS) (2002) *Survey Guide to the Threatened Species of the Lower Hunter Central Coast Region Volume 2* and DEC Scientific licence (S11381) conditions under clause 22 of the *National Parks and Wildlife Regulations 2002* and section 132C of the *National Parks and Wildlife Act 1974*.

Transect and Random Meander Surveys

On the basis of the initial site walkover and habitat assessment the study area was divided into two stratification units i.e. functionally similar units for the purposes of environmental assessment according to the Draft DECC (2004) survey guidelines. The study area consists of:

- 1) approximately 2.7Ha of relatively undisturbed natural vegetation;
- 2) approximately 2.0Ha of highly disturbed land incorporating a sediment containment pond; and
- 3) approximately 0.5Ha of natural vegetation immediately downslope and adjacent to the proposed site.

Vegetation surveys were undertaken on 11 and 12 July 2006 (as shown on **Figure 2**), to inventory and map plant taxa and target vegetation communities within the study area. Two 100m survey transects were assessed in the natural vegetation consistent with the Draft DEC (2004) survey guidelines. The location of transects was based on the distribution of vegetation types present within the study area such that the extent of vegetation which may be disturbed as a result of the proposal was appropriately assessed. The survey incorporated concentrated searches of 10x10m quadrats adjacent to each survey transect. The smaller size of the quadrats was necessary for this study due to the difficulty of the terrain along the rocky ridges and the location of the creekline which is confined by the Site's fenced boundary.

Whilst the above sampling method provides a broad inventory of species present and enables description of the vegetation community, it does not account for threatened flora that occur at much lower densities than widespread or common species. Therefore the random meander technique was employed in an effort to capture any species overlooked during quadrat surveys recording any species not found within previous quadrat surveys. This technique involved traversing a much wider area along each transect in addition to traversing the entire Site. This survey methodology is considered appropriate by the Department of Environment and Climate Change (DEC, 2004) for targeting threatened flora.

A random meander search was considered more appropriate for the disturbed portion of the site. Targeted surveys for *Callistemon linearifolius* which is listed as Vulnerable under the TSC Act and other threatened plant species were also undertaken across the entire Site. Further targeted and opportunistic searches for threatened flora were conducted during all stages of fauna and weed surveys conducted in November 2006 (see below).

Sampling techniques are summarised in **Table 3.1** (below):

Table 3.1 Vegetation Sampling Techniques

Sample ID	Survey Technique	Location	Vegetation Communities Traversed
T1	100m transect	Along Patonga Ck, South of the site	Sheltered Dry Hawkesbury Woodland
T1 Q1	10m x10m quadrat	Adjacent to 90m to 100m points on T1	
T2	100m transect	Through natural vegetation in eastern portion of site	Exposed Hawkesbury Woodland, Sheltered Dry Hawkesbury Woodland and Disturbed Regrowth
T2 Q1	10m x10m quadrat	Adjacent to 10m to 20m points on T2	
T2 Q2	10m x10m quadrat	Adjacent to 50m to 60m points on T2	
T2 Q3	10m x10m quadrat	Adjacent to 90m to 100m points on T2	
RM1	Random meander	Central and western portions of site	Disturbed Regrowth including open scrub, exotic grassland and open wetland.

All vascular taxa observed were recorded on appropriate proforma field data sheets.

Plant specimens not readily identifiable in the field were collected and subsequently identified using standard botanical texts and where required were compared with voucher specimens held in the National Herbarium of New South Wales Online Reference Collection (PlantNET). Flora is described according to classifications made by Specht (1970). Plant identifications were made according to nomenclature in Harden (1990-1993). Plant specimens which were difficult to identify (either insufficient sample collected or buds/fruitlet bodies were not available at the time of the survey) were submitted to the NSW National Herbarium for identification.

Conservation status of species and communities recorded across the study area were determined with reference to relevant legislation including the TSC Act and the EPBC Act.

3.1.3 Fauna Survey

Baseline fauna surveys were carried out by URS Ecologists on 11 and 12 July with further targeted surveys carried out from 22nd to 26th November 2006. Surveys were generally consistent with the DEC (2004) working draft survey guidelines. Methodologies employed to survey fauna included Random Meander (Cropper 1993), opportunistic observations, diurnal bird counts, call recognition, track and scat analyses, spotlighting, stag watches, and diurnal and nocturnal active searches. Bat and herpetological surveys were undertaken by specialist subcontractors and are presented as **Appendix B** and **Appendix C** respectively.

Weather experienced during the July surveys comprised dry, warm days (14-20°C) and cool nights (10-14°C). There was a full moon on the evening of 11 July 2006. Weather experienced during the November

surveys comprised dry, warm to hot days (25-37°C) and mild nights (15-23°C). There was a waxing crescent moon on the evenings of 22nd to 24th November 2006. A southerly weather change was experienced on the night of the 22nd November which resulted in very light rainfall at the Site.

Diurnal Bird Counts

Opportunistic observations of bird species were recorded throughout the day and across the whole site. Species and bird numbers were recorded by visual observation and call and were documented on proforma data sheets.

Spotlighting

Spotlighting surveys were undertaken in areas including the proposed footprint of the AWT facility and within adjoining vegetation as shown in **Figures 3** and **5**. A 55 watt spotlights and battery packs were used over an approximate four hour period to detect any active fauna within these areas.

Call Playbacks

Call playbacks for threatened listed frog species were broadcast across the two sedimentation ponds at the Site, along Patonga Creek to the south of the Site and within the hanging swamp located to the south east of the Site. Playback of calls from the Giant Burrowing Frog, Little John's Tree Frog, Green and Golden Bell Frog and Red-crowned Toadlet were undertaken using a portable compact disc player attached to a megaphone. Playbacks were undertaken after dusk and were followed by a quiet listening period for responding males. Rain periods were experienced immediately prior to the July 2006 survey with approximately 13.5 mm of rain experienced within the vicinity of the Site seven days prior to the conduct of the call playback survey work. Only light rain was experienced on the night of 22 November 2006 with little or no rain experienced seven days prior to the conduct of the November survey work. Rainfall had been minimal for several seasons preceding the July and November 2006 surveys due to prevailing drought conditions.

The July and November 2006 call playback locations are shown in **Figures 3** and **5** respectively.

Call playbacks were also undertaken in November 2006 at a nearby reference site for the Giant Burrowing Frog and Red Crowned Toadlet located within the locality of Warrah Trig, Patonga NSW.

Systematic Searches

Systematic Daytime Searches for tadpoles and adult frogs were conducted at the sedimentation pond, the adjoining small pond and within Patonga Creek for up to one hour over the July and November 2006 survey period. All aspects of the ponds and creekline including under rocks, leaf litter, logs, under adjoining shrubs, and under bark were searched. Nocturnal searches alongside the ponds, Patonga Creek and within the hanging swamp were also undertaken at the Site during the July and November 2006 using a 55 watt spotlight.

Opportunistic Observations

Opportunistic and incidental observations of fauna species were recorded during the conduct of the July and November 2006 field surveys.

Bat Survey

Due to the corresponding winter torpor period, targeted bat surveying was not carried out as part of the July 2006 flora and fauna survey, however a habitat assessment undertaken at the Site indicated that the ponded areas, natural caves, tree hollows and adjacent creek may provide foraging or perhaps breeding habitat for a number of micro bats such as the listed Large-eared Pied Bat, Eastern False Pipistrelle Myotis and Little Bent-wing Bat. It is likely that other areas within the Brisbane Water National Park would also provide the main habitat for any location bat populations.

As a result of the habitat assessment, targeted surveys for micro bats were undertaken in November 2006 to confirm the presence of threatened bat species and to assess the potential impacts of removing the small area of habitat available on the Site within the context of the neighbouring national park and local bat populations.

Fly By Night Surveys Pty Ltd were engaged by URS to undertake the bat survey at and within the vicinity of the Site between the 22nd the 24th November 2006. Harp traps were placed at four (4) locations within the site. Two traps were set side by side on the edge of the national park adjacent to Patonga Creek near a small weir. Another set was placed within a large sandstone cave overhang located along the adjoining edge of the national park and below rocky outcrops of sandstone within the North West portion of the Site. The fourth location was under an overhang area overlooking the green waste area of the current facility.

Ultrasonic echolocation (anabat) recording for microchiropteran bats was also undertaken as part of the targeted survey. Echolocation calls of microchiropteran bats were recorded at seven locations within representative habitat on the site. Calls were recorded over the entire night using Anabat II bat detectors for subsequent computer analysis. Detectors were located adjacent to harp traps where possible. In total, 80 hours of echolocation call sampling was undertaken on the site.

The locations of the harp traps and anabat call recordings are shown within the accompanying microchiropteran bat survey report at **Appendix B**.

Reptile and Amphibian Survey

URS engaged Molino Stewart Pty Ltd to undertake a reptile and amphibian survey at and within the vicinity of the Site between the 22nd the 26th November 2006 (refer **Appendix C**). Survey methodology comprised of random and selective searching of shelter sites including: lifting, searching beneath and careful replacement of exfoliated sandstone sheets, turning of sandstone boulders on soil, turning of logs, searching in crevices, raking amongst leaf litter, searching beneath decorticated bark and bark deposits

on the ground and visual scanning of vegetation for active and foraging specimens along nearby creeklines, around the sedimentation ponds and amongst vegetation.

Fauna Habitat Assessment

An assessment of the quality of habitats present for both TSC/EPBC listed species was made during both the July and November 2006 surveys. Habitat quality was based on the level of breeding, nesting, feeding and roosting resources available. This technique is important in assisting in the compilation of a comprehensive list of fauna that are predicted within the vicinity of the Site, rather than relying solely on one off surveys that are subject to seasonal limitations and only represent a snapshot of assemblages present.

Koala feed tree species were also identified across the Site and mapped by GPS. All identified Koala feed trees were assessed for scratching and the bases searched for scats and other remains.

The Site and immediate surrounds were also traversed during the November 2006 surveys in order to map all hollows (both tree and branch) across the study area. Hollows were assessed for signs of use (both old and current) by observing scratch marks, white wash and presence of scats under the base and canopy of each hollow containing tree.

Significant fauna habitat including caves, hollows (habitat tree) and Koala feed tree species are shown on **Figure 6**.

Other Methods Considered

Ground debris searches, including active searches for scats, were undertaken during the entire survey period while incidentally traversing the Site. Targeted searches for *Allocasuarina* was also undertaken to assess the quality and potential feed habitat for the Glossy Black Cockatoo (GBC).

No mammal trapping (terrestrial/arboreal) or call playbacks for large forest owls were undertaken during the July or November 2006 surveys as their presence on and within the vicinity of the site was established from previous records (DECC, 2006; R Payne, pers comm., 22 November 2006).

3.1.4 Weed Survey

A weeds survey was conducted on the Site and in the surrounding Brisbane Water N.P. during the November 2006 targeted flora and fauna surveys. Areas of weed infestation were surveyed using a Random Meander survey technique. The locations of significant infestations were recorded on aerial photos of the site and dominant species and severity of infestation were recorded on pro forma field sheets. The locations of spot infestations in native vegetation were captured using a hand held GPS unit. Details of patch size, dominant species and severity of infestation were recorded in data tables.

4.1 Literature Review

4.1.1 Flora

The results of the desktop literature review indicate that 20 threatened plant species listed under the EPBC Act and/or the TSC Act have been previously recorded within the vicinity of the Site. This list of threatened plant species, including their conservation status, is presented in **Table 1**.

A review of the specific habitat requirements of these species, and the habitat offered by the Site and its surrounds allowed a number of these species to be immediately eliminated as having any (or low) likelihood of occurrence at the Site. Those that remain as having a potential medium to high likelihood of occurrence at the Site and immediate surrounds are indicated in **Table 1** and are listed below:

- *Acacia bynoeana*;
- *Astrotricha crassifolia*;
- *Caladenia tessellata*;
- *Callistemon linearifolius*;
- *Cryptostylis hunteriana*;
- *Darwinia glaucophylla*;
- *Diuris bracteata*;
- *Eucalyptus camfieldii*;
- *Hibbertia procumbens* ;
- *Kunzea rupestris* ;
- *Melaleuca deanei*; and
- *Micromyrtus blakelyi*.

Netted Bottlebrush (*Callistemon linearifolius*) was recorded in the western portion of the landfill site during the environmental assessment for the proposed western expansion of the landfill (GHD, 2005a).

There is one previous record for the inconspicuous terrestrial orchid *Diuris bracteata* within 10km of the Site. The flowering period for this species is noted as September (NSW Scientific Committee, 2005), so the current field surveys are unlikely to have detected it.

4.1.2 Fauna

Results from fauna desktop reviews indicate the potential presence of approximately eighty-five Threatened fauna species as listed under the TSC Act and/or the EPBC Act which have been previously recorded within the vicinity of the Site. This list of threatened fauna species, including their conservation status, is presented in **Table 2**.

Of the 85 threatened fauna species, 32 species are regarded as having a potential occurrence at the Site and immediate vicinity based on habitat values. These species are indicated in **Table 2** and are listed below:

- Giant Burrowing Frog;
- Littlejohn's Tree Frog;
- Stuttering Frog
- Giant Barred Frog
- Green and Golden Bell Frog;
- Red-crowned Toadlet;

- Broad-headed Snake;
- Stephens' Banded Snake;
- Rosenberg's Goanna;
- Powerful Owl;
- Barking Owl;
- Turquoise Parrot;
- Swift Parrot;
- Glossy Black-Cockatoo;
- Gang-gang Cockatoo;
- Bush Stone-curlew;
- Speckled Warbler;
- Australian Painted Snipe;
- Masked Owl;
- Eastern Pygmy-possum;
- Large-eared Pied Bat;
- Spotted-tailed Quoll;
- Eastern False Pipistrelle;
- Little Bent-wing Bat;
- Eastern Bent-wing Bat;
- Eastern Freetail-bat;
- Large-footed Myotis;
- Squirrel Glider;
- Long-nosed Potoroo;
- Grey-headed Flying Fox;
- Yellow-bellied Sheath-tail Bat; and
- Greater Broad-nosed Bat.

4.1.3 Aquatic habitats

Council undertakes environmental monitoring at the Woy Woy WMF in accordance with its Environment Protection Licence (issued under the *Protection of the Environment Operations Act 1997*). Surface water monitoring is conducted, with two monitoring sites within Patonga Creek, located to the south of the proposed development area, while a third is located within the existing sedimentation pond. The results of the quarterly monitoring, carried out in 2006, are summarised in **Chapter 9** of the Environmental Assessment Report with reference to ANZECC's Guidelines for the Protection of Aquatic Ecosystems – 95% Fresh Water, (ANZECC 2000) criteria (where applicable). The environmental monitoring report for the period 25th January 2006 to 24th October, 2006 (Golder, 2006) found that Ammonia as N, other organics and all metals except Al were well below the adopted guidelines. Al exceeded the adopted guidelines however concentrations did not differ between sample locations up- and downstream of the Site suggesting that this is a natural feature of the aquatic environment. Similarly pH, Total Dissolved Solids, Redox Potential and temperature were within the expected natural range.

Based on these surface water quality results there are unlikely to be any limitations to the quality of aquatic habitats on Site due to contamination or other environmental factors.

4.2 Field Assessment

4.2.1 Flora

Conservation significance

No TSC or EPBC Act-listed species were recorded from the targeted field surveys conducted in July and November 2006 by URS.

There is a local population of *Callistemon linearifolius* in the western portion of the Woy Woy landfill Site as shown in **Figure 7** (GHD 2005b). Potentially suitable habitat for the species is present in the stands of Hawkesbury Sandstone woodland and forest present on the Site and the species could (theoretically) be present in the soil seed bank. Accordingly a Section 5A assessment for the species was performed and is included in **Appendix A**.

The inconspicuous terrestrial orchids *Caladenia tessellata* and *Cryptostylis hunteriana* (listed as Vulnerable under the EPBC and TSC Acts) were not recorded during surveys. The timing of the flora surveys was appropriate to detect these orchid species, given that their flowering times are noted as September to November for *C. tessellata* and November to February for *C. hunteriana* (DECC, 2007). The EPBC Act Protected Matters search tool predicts that habitat for these species may occur in the study area. However there are no previous records for these species on the NPWS Atlas within 10km of the Site. Moreover, consultation with a local orchid expert indicates that these species are not known to occur within the Woy Woy area (A Dash, A, *pers. comm.* 2006). Hence, the likelihood of these species occurring at the site is considered low.

There is a previous record for the terrestrial orchid *Diuris bracteata* in Brisbane Water N.P. within 10km of the Site (DECC, 2006). The flowering period for this species occurs in September (NSW Scientific Committee, 2005) and so the current surveys are unlikely to have detected it. Known populations of the species occur at Duffys Forest, Sydney and in the vicinity of Mt White and Kulnura, approximately 30km to the south and west of the Site (P Eygelshoven, *pers. comm.* 20 July 2007; A Dash, *pers. comm.* 7 August 2007). Suitable habitat for *D. bracteata* is present at the Site and so, despite the low likelihood of occurrence at the site, targeted surveys for this species should be carried out during September if possible.

Species

A total of 134 flora species were identified during field surveys conducted in July and November 2006 by URS Ecology Personnel. The species recorded are tabulated in **Table 3**.

A detailed weed survey, as detailed in **Section 4.2.3**, was undertaken at and within the vicinity of the Site during the November 2006, which identified a further 14 exotic flora species.

Communities

Descriptions of the three main vegetation communities recorded during the field surveys are summarised below. Their distribution is represented in **Figure 4**.

Community No. 1 Sheltered Dry Hawkesbury Woodland

Floristic and Structure Summary

Number of Transects:	1
Number of Quadrats:	1
Number of Random Meanders:	1
Listed flora:	Nil
Legislative listing:	None
Areas on Site:	Approximately 4, 900 m ² across the site
Corresponding Map Units:	MU25 (LHCCREMS 2003). Hawkesbury Peppermint Apple Forest (Bell, 2004).

Sheltered Dry Hawkesbury Woodland is widespread across Hawkesbury Sandstone geologies of the Sydney Basin. This community is dominated by *Eucalyptus piperita* in sheltered gullies with *Angophora costata* present as a co-dominant or sub dominant canopy species. The mid-storey is characteristically comprised of *Allocasuarina torulosa* and in deeper gullies, *Pittosporum undulatum* and *Glochidion ferdinandi* above a shrubby layer of *Dodonaea triquetra*, *Notolea longifolia* and *Rapanea variaibilis*. The ground layer vegetation comprises *Pteridium esculentum*, *Adiantum aethiopicum*, *Poa affinis* and a diversity of other herbaceous species (LHCCREMS, 2003).

Sheltered Dry Hawkesbury Woodland was recorded immediately adjacent to the proposed AWT facility southern site boundary at an elevation of between 100m and 105 AHD. This community was recorded along the moist sheltered south facing gully and along Patonga Creek which generally runs in a west to east direction (See **Plate 1** and **Figure 4**).

This community was an open forest structure and consisted of a canopy layer to twenty metres in height containing *Angophora costata*, *Eucalyptus piperita*, *Eucalyptus umbra*, *Corymbia gummifera*, *Syncarpia glomulifera* and *Livistona australis*. The mid canopy consisted of shrubs and ferns including *Dodonaea triquetra*, *Todea barbara*, *Solanum aviculare*, *Ceratopetalum gummiferum*, *Elaeocarpus reticulatus*, *Logania albiflora*, and *Exocarpos strictu*, and the cycad *Macrozamia communis*. The ground layer was moderately dense and healthy particularly adjacent to the creek line with characteristic species including consisted of *Lomandra cylindrica*, *Xanthorrhoea arborea*, ferns including *Adiantum aethiopicum*, *Calochlaena dubia*, *Pteridium esculentum*, *Doodia aspera* and herbs such as *Gonocarpus teucroides* and *Dianella caerulea*.

This vegetation community was found to be moderately to significantly disturbed by wild fires which affected the Brisbane Water N.P. and the local area in early 2006. The wild fires resulted in a significant reduction to the ground cover including the leaf litter layer and a significant disturbance to the shrub layer in the mid to lower stratum. Despite the recent disturbance to this vegetation community, a substantial amount of regrowth was observed during the July and November 2006 surveys.

Community No 2 Exposed Hawkesbury Woodland

Floristic and Structure Summary

Number of Transects:	1
Number of Quadrats:	3
Number of Random Meanders:	1
Listed flora:	Nil
Legislative listing:	None
Areas on Site:	Approximately 15, 700 m ² across the site
Corresponding Map Units:	MU26 (LHCCREMS 2003). Exposed Hawkesbury Sandstone Woodland (Bell, 2004).

Exposed Hawkesbury Woodland represents a widespread vegetation type, generally occurring on crests, ridges and exposed slopes on sandy soils of the Hawkesbury Sandstone series. Within this assemblage, canopy height is typically low and density is highly variable, leading to structural fluctuations between scrubs, woodland and low open forest. Height of this assemblage rarely exceeds 15 metres. *Corymbia gummifera*, *Eucalyptus haemastoma* and *Angophora costata* are the dominant canopy species, over a dense shrubby understorey of *Leptospermum trinervium*, *Lambertia umbella*, *Phyllota phyllicoides*, and *Banksia serrata*. The ground cover forms the densest and most diverse stratum, combining small shrubs, such as *Platysace linearifolia* and *Xanthorrhoea media*, with sedges such as *Cyathochaeta diandra* and *Lepyrodia scariosa*, and grasses such as *Entolasia stricta* and *Anisopogon avenaceus* (LHCCREMS 2000).

Exposed Hawkesbury Woodland covers large areas across crests and flat open plateaux over northern Brisbane Water N.P., Strickland State Forest and onto the Somersby Plateau. As elevation and rainfall increases *Eucalyptus sieberi* tends to dominate the canopy (LHCCREMS 2000).

Exposed Hawkesbury Woodland was recorded on the eastern crest of the proposed AWT facility site at an elevation of between 105m to 135m AHD. This community generally consisted of open woodland to low forest with exposed areas containing higher densities of scrub and ground cover with species characteristic of heath communities (See **Plate 2** and **Figure 4**).

The Hawkesbury Woodland community recorded at the Site consisted of a canopy layer to fifteen metres in height containing *Angophora costata*, *Eucalyptus umbra* and *Syncarpia glomulifera* with a mid to low canopy consisting of shrubs such as *Allocasuarina littoralis*, *Banksia ericifolia*, *mbellate rata*, *Banksia spinulosa*, *Dilwynnia retorta*, *Leptospermum polygalifolium*, *Acacia ulicifolia*, *Amperea xiphoclada*, *Boronia ledifolia*, *Bossiaea heterophylla*, *Callistemon linearis*, *Dilwynnia retorta* subsp.

retorta, *Grevillea buxifolia*, *Grevillea sericea*, *Isopogon anemonefolius*, *Leucopogon microphyllus*, *Persoonia lanceolata*, *Persoonia levis*, *Persoonia lineararis*, *Persoonia pinifolia*, *Xanthorhoea arborea*, *Xanthorhoea media* and *Tetradlea thymifolia*. Groundcover consisted of sub shrubs and herbs including *Dampiera stricta*, *Actinotus helianthi*, *Desmodium rhytidophyllum*, *Dianella caerulea* var *producta*, *Dianella prunina*, *Epacris pulchella*, *Kunzea ambigua*, *Pelargonium inodorum* and *Pelargonium australe*. Groundcover also comprised of grasses and sedges such as *Andropogon virginicus*, *Aristida vagans*, *Gahnia sieberiana*, *Imperata cylindrical*, *Panicum simile*, *Entolasia stricta* and *Lepyrodia scariosa* and creepers including *Kennedia rubicunda* and *Hardenbergia violacea*.

A disturbance to the ground cover and low to mid stratum was also observed in this community as a result of the January 2006 wild fires however a substantial amount of regrowth was also observed during the July and November 2006 surveys.

Community No 3 Disturbed Regrowth

Floristic and Structure Summary

Number of Transects:	0
Number of Quadrats:	0
Number of Random Meanders:	1
Listed flora:	Nil
Legislative listing:	None
Areas on Site:	Approximately 21, 600 m ² across the site
Corresponding Map Units:	Not applicable

This community was recorded across the majority of the disturbed area at the base of the proposed AWT facility site within the vicinity of the sedimentation pond and extended onto previously benched sandstone rock faces on both the east and west facing slopes. The disturbed regrowth was widespread was found at elevations from 105 to 125m AHD.

The disturbed regrowth consisted of open scrub with a dense ground layer of grasses, herbs and exotic weeds and aquatic vegetation within and adjacent to the sedimentation pond (See **Plate 3**). The shrub layer was generally up to five metres in height and was dominated by *Acacia irrorata* and other successional species such as *Acacia floribunda*, *Acacia longifolia sophorae* and *Acacia elongata*.

The dense ground layer comprised of grasses including *Zoysia macrantha* and *Pennisetum clandestinum*, herbs including *Desmodium rhytidophyllum*, *Dianella caerulea*, *Dichondra repens*, *Lotus* spp., creepers including *Hardenbergia violacea* and *Kennedia rubicunda* and weeds including *Bidens pilosa*, *Oxalis* spp., *Plantago lanceolata*, *Senecio madagascariensis*, *Stachys arvensis*, *Verbena bonariensis*, *Conyza sumatrensis* and *Hypochaeris radicata*. Vegetation located adjacent to or within the sedimentation pond included *Juncus continuus*, *Schoenoplectus validus* and *Schoenus melanostachys*.

4.2.2 Fauna

The July and November 2006 targeted fauna surveying recorded 13 species of reptile, 39 species of bird, nine species of amphibian, 17 native mammals (including nine species of microchiropteran bat) and one species of dragonfly. These species are listed in **Table 4**, the majority of which are generally common and widespread within the region. Six species listed under the TSC and/or EPBC Acts, including the Red-crowned Toadlet, Grey-headed Flying-fox, Eastern Freetail Bat, Little Bent-wing Bat, Large-footed Myotis and the Giant Dragonfly, were recorded during the November 2006 surveys.

The Site and immediate surrounds has been moderately to significantly affected by the December 2005 wildfires. Most fauna species are seriously impacted by wildfire from its direct effects and also post fire from increased predation and lack of food resources. This is likely to have contributed to a decrease in the diversity of fauna recorded than otherwise might be expected on the Site.

The 39 species of bird were recorded during both targeted surveys or whilst incidentally traversing the Site (see **Table 4**). The majority were woodland and forest birds, including the Bar-shouldered Dove, Black-faced Cuckoo Shrike, Common Koel, Diamond Dove, Eastern Yellow Robin, Golden Whistler, Grey Strike-thrush, Noisy Friarbird, Red-browed Firetail, Sacred Kingfisher, Spotted pardalote, Superb Fairy-wren, Striated Pardalote and Variegated Wren. Waterbirds including Australian Wood Duck, Australasian Grebe and Grey Teal were observed within the sedimentation pond. Opportunistic birds such as Ravens, Silver Gull and Sacred Ibis were abundant in operating sections of the landfill. No large forest owls were heard or spotlighted at the Site or immediate surrounds during the targeted surveys. The Southern Boobook Owl, which is the smallest and most common owl in Australia, was heard calling within the vicinity of the Site during the November 2006.

Scats and white wash was observed over the boulders surrounding the sedimentation pond, which were observed to contain fine bone fragments. Given the size and content of the scats, they are likely to belong to a predatory species such as the Australian Kestrel, which was observed flying over the site during the July 2006 surveys.

The majority of hollows observed at the Site were within mature *Angophora costata* trees the location of which is shown on **Figure 6**. The hollows present in mature *Angophora costata* individuals were inspected for white wash and pellets, however only one hollow was observed to contain whitewash (see **Plate 8**). There was no direct evidence of the use of this tree by any large forest owl in the form of regurgitated pellets or prey remains. Further, its relatively small size and sparse splattering pattern suggest the whitewash was produced by a bird considerably smaller than a forest owl.

The 17 native mammal species, including 10 bat species, were recorded either by direct observation during the spotlighting survey, whilst incidentally traversing the Site, indirectly by scat identification or by harp trapping and echolocation recordings. Species included the Bush Rat, Common Brushtail Possum, European Red Fox, Red-necked Wallaby, Common Ringtail Possum, Short-beaked Echidna, Swamp Wallaby, Little Forest Bat, Large-footed Myotis, Little Bent-wing Bat, Gould's Wattled Bat, Chocolate Wattled Bat, Eastern Horseshoe Bat, East Coast Freetail Bat, Eastern Freetail Bat, White-striped Mastiff Bat and the Grey-headed Flying-fox.

One species of invertebrate, the Giant Dragonfly, which is listed as Endangered under the TSC Act, was directly observed on the southern boundary of the Site within the hanging swamp vegetation community (see **Appendix B**).

A herpetological survey was undertaken on the Site to specifically target threatened reptile and amphibian species identified in the July 2006 habitat assessment. A copy of the report prepared by Molino Stewart is at **Appendix C**. A total of 13 reptile species were recorded on Site, including the Copper-tail Skink, Wall Skink, Delicate Litter Skink, Diamond Python, Eastern Water Skink, Lace Monitor, Leaf-tailed Gecko, Lesueurs Gecko, Mountain Dragon, Red-bellied Black Snake, Water Dragon, Whites Skink and the Yellow-faced Whip Snake. They were recorded primarily within rocky habitat on the eastern ridge of the Site. None of the reptile species recorded are listed under the TSC or EPBC Acts.

The Common Eastern Froglet, the only species of amphibian recorded at the Site during the July 2006 surveys, was recorded calling from within the sedimentation pond, the small adjoining pond and along Patonga Creek to the south of the Site. A further eight species of amphibian, including the Broad-palmed Frog, Brown Tree Frog, Dwarf Green Tree Frog, Eastern Dwarf Tree Frog, Freycinet's Frog, Green Leaf Tree Frog, Red-crowned Toadlet and the Dusky Toadlet, were either spotlighted or recorded by vocalisation during the November 2006 surveys. The Red-crowned Toadlet is listed as Vulnerable under the TSC Act. The location of the Red-crowned Toadlets observed during the November 2006 surveys is shown in **Figure 7**.

A total of 10 species of bat, including the Grey-headed Flying-fox, White-striped Mastiff Bat, Eastern Freetail Bat, East Coast Freetail Bat, Eastern Horseshoe Bat, Gould's Wattled Bat, Chocolate Wattled Bat, Little Bent-wing Bat, Large-footed Myotis and the Little Forest Bat, were recorded on the Site (**Appendix B**). Of these, four are listed as threatened species. The Grey-headed Flying Fox is listed as Vulnerable under the TSC and EPBC Acts and the Eastern Freetail Bat, Little Bent-wing Bat and the Large-footed Myotis are listed as Vulnerable under the TSC Act.

The introduced Red Fox was observed on the northern boundary of the Site during the November 2006 surveys.

4.2.3 Weeds

The November 2006 targeted weed surveying recorded thirty four (34) noxious and environmental weeds at the Site and immediate surrounds. These species including those which are listed under the NSW *Noxious Weeds Act 1993* and their status are presented in **Table 5**. The distribution and severity of weed infestations at the Site and immediate surrounds is presented in **Figure 8**.

Native vegetation on ridges to the west and east of the Site are relatively weed-free. Cleared areas around the sedimentation pond and landfill feature severe infestations with a diverse range of exotic grasses, shrubs and herbaceous weeds. South of this area, between the rock wall and Patonga Creek, there are varying degrees of weed infestation with concentrations peaking in cleared areas and especially along the overflow drain.

The south bank of Patonga Creek is relatively free of weeds. This reflects the relatively undisturbed vegetation and also the topography, with the slope upwards from Patonga Creek potentially limiting weed expansion. This area was burnt in December 2005 which is likely to have removed many adult weeds and favoured the regeneration of native vegetation. However weed propagules may be present in the soil seed bank and weeds may successfully recolonise this area. The potential role of the fire in limiting weed infestation should be considered when assessing any future departure from the baseline condition observed in this study.

Patonga Creek featured minor weed invasion on its north bank for approximately 100m upstream of the Site. Downstream weed infestation was patchy, minor and largely confined to the creek channel and banks. The December 2005 bushfire may have limited weeds in this area however sheltered (unburnt) areas of native vegetation were also relatively weed-free.

The surrounding area was relatively weed free with infestations generally consisting of isolated individuals of the herbs *Phytolacca octandra* and *Conyza sumatrensis*.

5.1 Habitat Descriptions

Habitat features considered in assigning the quality of habitat on Site include:

- native diversity in ground flora;
- structural and floristic diversity of vegetation layers, particularly presence or absence of midstorey vegetation in areas of remnant vegetation (shrubs and regenerating eucalypts) and presence of native tussock grasses;
- presence and quantity of litter layer and fallen dead timber;
- level of shelter, breeding, roosting and nesting resources available;
- presence of stem hollows and quantity of mature hollow bearing trees;
- exfoliated bark, feed trees and shrubs;
- fauna movement corridors;
- position in the landform, connectivity or value as a habitat corridor;
- presence of rocky outcrops or scattered partially buried rocks; and
- presence, size and ecological integrity of remnant communities.

5.1.1 Disturbed Area

Over 50% of the proposed AWT facility site has been previously disturbed and according to site personnel this area was previously cleared for the purpose of a quarry (B Leslie, *pers. comm.* 11 July 2006). The disturbed area currently comprises of a sedimentation pond, cleared areas, roads and other access tracks (see **Plate 4**). The vegetation recorded across the disturbed area primarily comprises of regrowth including open scrub with a dense ground layer of grasses, herbs and exotic weeds.

The vegetative regrowth also extended onto both the east and west facing benched faces of the Site and was dominated by recolonising species and exotic species including listed noxious weeds for the Gosford City Council LGA (NV Act).

Although no flora or fauna listed as threatened under the TSC Act and/or the EPBC Act were observed within the cleared areas of the Site, these areas do support native flora species including grasses and given their close proximity to large stands of native vegetation these areas would provide feeding habitat for native fauna species such as macropods, echidnas, and bandicoots and birds such as the Willie Wagtail, White-faced Heron and the Australian Kestrel.

5.1.2 Sedimentation Pond

Aquatic vegetation was recorded within and adjacent to the sedimentation pond and included species such as *Juncus continuus*, *Schoenoplectus validus*, *Schoenus melanostachys* and *Ludwigia peploides* subsp. *montevidensis*.

The sedimentation pond was observed to provide habitat for a number of water birds such as the Australian Wood Duck and the Grey Teal, and a number of amphibian species (see **Plates 5 and 6b**). Further, the sedimentation pond is considered to provide potential habitat for a number of TSC/EPBC Act-listed frog species including the Green and Golden Bell Frog with its unshaded areas of shallow still water with nearby shrubby areas (see **Plate 6**). The Green and Golden Bell Frog is known to historically occur in the area at the Woy Woy-Umina sandplain swamps and from Pearl Beach Lagoons. However whilst the Site contains habitat that could be colonised by the Green and Golden Bell Frog, the most recent records of this species in the area are from Pearl Beach and are around thirty years old. Since this time this population appears to have become extinct and as a result it is unlikely that the Green and Golden Bell Frog is present in the area nor is likely to colonise the Site from the nearest known location population at Davistown (**Appendix C**).

Although the EPBC online Protected Matters Database Search predicted that habitat for the Australian Painted Snipe, which is listed under both the TSC/EPBC Acts, occurred within the locality of the Site, there are no sightings recorded within the Gosford LGA. This species prefers areas of tussock grass, or reeds or sedges or rushes within 500m and including shallow wetlands or ephemeral or permanent waterbodies, or inundated grasslands or paddocks. Due to the relatively narrow band of fringing vegetation around the sedimentation pond and the presence of predators such as raptors and the Red Fox it is considered highly unlikely that this species would utilise the Site (DECC, 2007).

The sedimentation pond is also likely to provide suitable foraging habitat for micro bats, noting that five of the 10 species recorded, including the TSC/EPBC Act listed Eastern Freetail Bat and Large-footed Myotis, were recorded flying over the sedimentation pond. Nearby waterways including Patonga Creek, located approximately 20m south of the Site (see **Plate 7**), is likely to provide local microbat populations with the main habitat in the area, noting that five microbat species were recorded in this area (**Appendix B**).

The Eastern Free-tail Bat roosts predominantly in tree hollows; however the Site and immediate vicinity have relatively low densities of suitable hollow bearing trees. Given its presence at the Site, individuals of this species however must roost either within or in close proximity to the Site (**Appendix B**).

The Little Bent-wing Bat and the Eastern Bent-wing Bat predominantly roosts in caves but also utilise man-made structures including drains, bridges, tunnels and mines. Maternity roosts are normally located in limestone cave systems where temperature and humidity are elevated by the high number of bats present. The nearest known Little Bent-wing Bat maternity roost to the Site occurs at Willi Willi Cave, near Kempsey, almost three hundred kilometres to the north. The nearest known maternity roost for the Eastern Bent-wing Bat occurs at Drum Cave, Bungonia, almost two hundred kilometres to the south west. These species would utilise the Site foraging purposes and diurnal roosts which could be located in natural caves either within the Site or surrounding area. While no individuals were observed in caves in

the eastern portion of the proposed development area or the adjoining national park to the south. However it was not possible to examine all potential roosts. Bats can roost within narrow cracks and crevices, and these are relatively plentiful in the low sandstone cliff lines present in the eastern portion of the Site (**Appendix B**).

The Large-footed Myotis feeds predominantly over still water including creeks, rivers, lakes and lagoons. It roosts both within tree hollows as well as caves and manmade structures such as culverts, bridges, tunnels and mines (**Appendix B**).

There are several other threatened bat species are known from the area and are likely to occur within the study area at times. In particular the following species are likely based on available records and habitat within the study area and its surrounds;

- Yellow-bellied Sheathtail Bat;
- Large-eared Pied Bat;
- Eastern Falsistrelle;
- Golden-tipped Bat; and
- Greater Broad-nosed Bat.

5.1.3 Rock Outcrops

The east and west facing benched faces of the Site with its rocky outcrops of sandstone and adjoining sandstone caves provides optimal habitat for a range of reptile species (See **Plates 9** and **10**). A total of thirteen reptile species were directly observed in these areas during the July and November 2006 (see **Plates 10** and **11**). It is likely that the rocky outcrops provide habitat for other reptile species potentially including the TSC/EPBC Act listed Rosenbergs Goanna, Broad-headed Snake and Stephens Banded Snake.

The Rosenberg's Goanna is a wide ranging species and has been detected within the vicinity of the Site. Possible over-wintering rock crevice refuge appear to be absent from the development footprint area. Suitable over wintering habitat is present along other sections of the same ridgeline to the north and on the opposite ridgeline to the west located outside of the development footprint (**Appendix C**).

The Broad-headed Snake and the Stephens' Banded Snake are arboreal for the warmer months of the year where they shelter and forage in the tree tops. During the cooler months of the year both species, (at least in the case of Stephens' Banded Snake at the southern limit of its distribution), utilise rocks and crevices for shelter and foraging. Neither species are common in the Gosford Local Government Area (LGA) and there is doubt regarding their viable persistence in the locality (**Appendix C**).

Stephens' Banded Snake prefers moist gully forest and rainforest that is known to occur further downstream of the Site. However a historical recording from the vicinity of the Site (an 1860's Australian Museum specimen) and a recent record, with a further possible local sighting, means that it cannot be

discounted as occurring on or in the immediate vicinity of the Site. The possible local sighting was from a sandstone crevice that was excavated on another part of the Woy Woy Landfill site (**Appendix C**).

The Broad-headed Snake is an obligate rock user during winter over much of its distribution, however there has been some suggestion that the species may be more an opportunistic rock user in the warmer areas of its northerly limit of distribution on the coast. This could be a partial explanation for the paucity of records of the species in the Gosford LGA where its distributional limit is reached and despite extensive areas of apparently suitable habitat being available. The area of the subject land to be lost as a result of the current proposal is not considered ideal habitat but such habitat is present along the eastern ridge margin of the existing waste facility operations and just north of the proposal footprint.

The rocky outcrops which provide a large number of crevices are also likely to provide habitat for ground dwelling mammals and other fauna species such as micro bats. Microbat scats were observed within sandstone rock crevices, approximately 150 m to the south of the proposed AWT facility (see **Plates 13 and 14**).

Sandstone benches and ridges also featured excellent quantities of rock fragments which would provide further shelter for native reptiles and other fauna.

5.1.4 Forest and Woodlands

The Sheltered Dry Hawkesbury Woodland and Exposed Hawkesbury Woodland vegetation communities were found to support a large range of flora species and a large structural and floristic diversity of vegetation layers. These communities are known to support TSC/EPBC Act listed flora species such as *Tetratheca glandulosa*, *Acacia bynoeana*, *Eucalyptus camfieldii* and *Prostanthera junonis* however these were not recorded during the July or November 2006 survey period.

There are a number of important nectar bearing plants at and within the vicinity of the Site in the genera *Eucalyptus*, *Banksia*, *Leptospermum* and *Callistemon*. These plants would provide food for nectarivorous birds including the Little Wattlebird, Rainbow Lorikeet, Red Wattlebird and the White-eared Honeyeater which were recorded at the Site during the July and November 2006 surveys. These species may provide foraging resources for the TSC/EPBC Act listed Swift Parrot, Turquoise Parrot and the Regent Honeyeater. These birds would move locally in response to variation in the availability of nectar and or pollen, which are important components of their diet.

Given the lack of a mesophytic understorey, the vegetation at the Site is likely to have low habitat value for frugivorous birds (soft billed birds and fruit eaters).

5.1.5 Ground Debris

Despite recent bushfire damage, the Sheltered Dry Hawkesbury Woodland and Exposed Hawkesbury Woodland communities were found to provide a significant number of ground dwelling hollow bearing logs, some areas of leaf litter and a structural and floristically diverse understorey which would provide habitat for a number of fauna species including woodland birds (see **Plates 15 and 16**).

5.1.6 Banksia

Native vegetation at the Site would typically provide an excellent food resource for a number of nectar-feeding mammal species, including the Eastern Pygmy-possum which is listed as Vulnerable under the TSC Act, due to the presence of a large number of *Banksia* spp. and other understorey plants (See **Plate 17**). However due to the December 2005 wildfires which significantly affected the vegetation at the Site and immediate surrounds, the amount of food source currently available is limited.

5.1.7 Hollows

A number of hollows particularly within mature *Angophora costata* trees (see **Plate 18**) were observed within the Sheltered Dry Hawkesbury Woodland and Exposed Hawkesbury Woodland vegetation. These hollows may provide shelter and roosting habitat for large forest owls, micro bats, some local reptile species and a number of arboreal fauna species including the Squirrel Glider which is listed as Vulnerable under the TSC Act. Consultation with a local flora and fauna expert indicates that there is no known population of the Yellow-bellied Glider on the Woy Woy peninsula (R. Payne, *pers comm.* 22 November 2006).

5.1.8 Allocasuarina

Targeted surveys for *Allocasuarina littoralis* were undertaken at the Site during the July 2006 surveys as they are a known food resource for the Glossy Black Cockatoo (GBC). However only a small number of *Allocasuarina* trees were recorded at the Site with the nearest significant group located approximately 40m to the west of the Site. No direct or indirect evidence of the presence of Glossy black cockatoos was recorded during the July and November 2006 surveys. Typically this species feeds exclusively on *Allocasuarina littoralis* and *A. torulosa* and feeds intensively on trees carrying good numbers of high quality cones. The *Allocasuarina* spp recorded at and within the vicinity of the Site are in very small numbers and were found to be of low feeding quality with little or no cones observed on the trees. Further, no fresh or aged cones showing signs of Glossy Black Cockatoo feeding were observed under the canopy of the *Allocasuarinas* and as such it is unlikely that this species has foraged at the Site during recent times (See **Plate 19**).

5.1.9 Koala habitat

The nearest known local population of Koala occurs as a small colony in the Pearl Beach section of Brisbane Water N.P. located approximately 5km from the Site. As such, Koala feed tree species were identified across the Site, mapped by GPS and assessed for scratching and scats and other remains.

No direct or indirect evidence (scats or scratch marks) of Koalas were observed during the July and November 2006 surveys and only a small number of *Eucalyptus punctata* (Grey Gum) and *Eucalyptus haemastoma* (Broad Leaved Scribbly Gum) individuals, which are listed Koala feed trees under SEPP 44, were recorded within the vicinity of the Site. These species were recorded in densities less than 15% of the total number of trees in the upper or lower strata of the tree component and as such the Site is not

considered 'potential' Koala habitat under SEPP 44. Determination whether the Site is 'Core' Koala is therefore not required under SEPP 44.

Further, the July and November 2006 surveys identified only four sub-adult *Eucalyptus punctata* individuals within the boundaries of the Site. Given the limited number of suitable feed trees at the Site, the presence of the Red Fox, the noise from heavy machinery, and the expanse of more suitable habitat provided by the surrounding Brisbane Water N.P., it is considered unlikely that the Site and immediate surrounds would be utilised by the Koala. The proposal is also unlikely to impact on Koala movement corridors as the Brisbane Water N.P. would provide adequate connectivity for peripatetic Koalas to adjoining areas.

5.1.10 Patonga Creek

The Patonga Creek catchment contains rocky banks and thick fringing vegetation. The Creek drains to the south and enters Broken Bay at its lower reaches. The southern catchment has little development and the remainder of the catchment is contained within Brisbane Water N.P. and is managed by DECC. The Creek reflects this protected position and shows no recent evidence of degradation or pollution (see **Plates 7 and 20**) and as such can be considered pristine. Water quality testing confirms there has been no detectable contamination or other impacts from the operating landfill (Golder, 2006). Accordingly Patonga Creek would be expected to contain the suite of aquatic flora and fauna expected of an intact environment.

Patonga Creek, is likely to provide local microbat populations with the main habitat in the area, noting that five microbat species were recorded at the Creek (**Appendix B**).

5.1.11 Hanging Swamp

A hanging swamp is situated approximately 10 metres to the south and south east of the Site. It is situated within the Upper Patonga Creek catchment, upstream of the Site on sandy soils adjacent to the rocky drainage line. The swamp contains numerous small waterfalls and is likely to be subject to a constant supply of water. It would appear to be predominantly groundwater-fed but would also receive significant surface runoff. The groundwater which feeds the swamp is likely to seep out of the surrounding sandstone rock faces. The hanging swamp is likely to feed and maintain the flow within the upper reaches of Patonga Creek.

5.2 Conservation significance

5.2.1 Disturbed Area

The cleared areas of the Site are unlikely to support threatened flora and fauna species. The disturbed area is up to 20m below the natural land surface and contains no intact topsoil so threatened flora are unlikely to have persisted in the seed bank. Threatened fauna species are likely to favour undisturbed habitats

which contain feed species, shelter and other resources absent from degraded areas. Further, the disturbed areas of the Site are likely to provide optimal foraging habitat for the Red Fox which would limit the number of fauna species inhabiting these areas.

5.2.2 Sedimentation Pond

The sedimentation pond and the small adjoining pond are likely to provide habitat for a number of amphibian and microbat species including the including the TSC/EPBC Act listed Eastern Freetail Bat and Large-footed Myotis.

5.2.3 Rock Outcrops

The sandstone rock crevices are likely to provide optimal habitat for a range of reptile species potentially including the TSC/EPBC Act listed Broad-headed Snake, Rosenberg's Goanna and Stephens' Banded Snake.

The Rosenberg's Goanna is a wide ranging species and has been detected within the vicinity of the Site. There is a lower probability of the Broad-headed Snake on Site as there have been no previous records in the locality. The Site contains only marginal habitat for Stephan's Banded Snake which prefers rainforest gullies (**Appendix C**).

5.2.4 Forest and Woodlands

Exposed Hawkesbury Woodland and Sheltered Dry Hawkesbury Woodland vegetation communities provide the highest quality habitat on Site. Habitat value is due to a combination of relatively intact native vegetation, structural diversity, extensive rock outcrop and continuity with large areas of intact vegetation of the Brisbane Water N.P.. It is likely that these communities provide significant habitat for native flora and fauna potentially including the TSC Act and EPBC Act listed species *Callistemon linearifolius*, Barking Owl, Masked Owl, Powerful Owl, Eastern Freetail Bat and Large-footed Myotis.

5.2.5 Hanging Swamp

The hanging swamp is considered to provide optimal habitat for the TSC/EPBC Act listed Red-crowned Toadlet, the Giant Burrowing Frog and the Giant Dragonfly.

5.2.6 Patonga Creek

The upper reaches of Patonga Creek are considered to provide optimal habitat for the TSC/EPBC Act listed Giant Burrowing Frog, Red-crowned Toadlet and the Littlejohn's Tree Frog. The lower reaches are considered to provide optimal habitat for the TSC/EPBC Act Stuttering Frog and the Giant Barred Frog.

6.1 Areas to be cleared

The proposed Site, the boundaries of which are shown in **Figures 1** and **2**, will encompass an area of approximately 3 to 4ha. This will result in the removal of approximately 15,000m² of intact vegetation primarily belonging to the Sheltered Dry Hawkesbury Woodland and Exposed Hawkesbury Woodland vegetation communities. The proposed development will also result in the removal of the sedimentation pond and the adjoining small pond. A number of rock crevices and sandstone caves situated within the eastern portion of the Site will also be removed as part of the proposed development.

6.2 Flora

One hundred and thirty four (134) flora species were recorded at the Site from the field surveys conducted in July and November 2006. None of these species are listed as threatened under the TSC or EPBC Act.

The threatened plant *Callistemon linearifolius*, listed under Schedule 2 of the TSC Act, was previously recorded within the western portion of the WMF landfill site (see **Figure 7**). However, no individuals were recorded within the Site during the July or November 2006 surveys. Although the proposal will not remove any individuals of *C. linearifolius*, a 7-part test was completed as a precautionary measure and is included in **Appendix A**.

Potential habitat for cryptic terrestrial orchids occurs within the study area. This includes three TSC/EPBC Act-listed species, *Cryptostylis hunteriana*, *Diuris bracteata* and *Caladenia tessellata*. No populations of these species are recognised within the study area (P Eygelshoven, pers. comm. 20 July 2007; A Dash, pers. comm. 7 August 2007). The area of habitat to be impacted is small (1.5ha), well represented in surrounding reserves and equivalent to habitat contained in the proposed offset area that will be set aside and managed (**Appendix D**). Therefore it is unlikely that the proposal will result in significant impacts upon these species.

Although vegetation will be removed as a result of the proposed development, it is unlikely that the development will result in the fragmentation of flora species habitat in the local area as the Site is surrounded by the Brisbane Water N.P. to the west, east and south of the Site which provides connectivity to adjoining areas.

However the area of intact Sheltered Dry Hawkesbury Woodland and Exposed Hawkesbury Woodland vegetation within the south eastern portion of the Site which will be removed as part of the proposal are likely to currently act as a buffer from the WMF site to the hanging swamp and the upper reaches of Patonga Creek.

6.3 Fauna

6.3.1 Bats

A total of ten (10) species of bat were recorded during the November 2006 targeted bat surveying. Four of these species including the Eastern Freetail Bat, Little Bent-wing Bat, Large-footed Myotis and the Grey-headed Flying Fox are listed as Vulnerable under the TSC/EPBC Acts. A further species, the Eastern Bent-wing Bat (also known as Large Bent-wing Bat), which is listed as Vulnerable under the TSC Act, was tentatively recorded by echolocation at the Site.

The proposal will result in the removal of significant foraging resources for microbats over the sedimentation pond and in surrounding forest and woodland. Vegetated areas also contain potential roosting habitat in tree hollows, rock fissures and caves. Relatively low quantities of these resources were present on Site and will be removed by the proposal. It is likely that local microbat populations predominantly rely on resources in the surrounding Brisbane Water N.P.

A Seven Part assessment (see **Appendix A**) for microbat species including the Eastern Freetail Bat, Little Bent-wing Bat, Large-footed Myotis, Eastern Bent-wing Bat, Yellow-bellied Sheath-tail Bat, Large-eared Pied Bat, Eastern Falsistrelle, Golden-tipped Bat and the Greater Broad-nosed Bat was conducted which concluded that there should be no significant impact on these species.

6.3.2 Diurnal Birds

The proposal would result in the loss of a number of important nectar bearing plants which may impact upon nectarivorous species recorded at the Site and potentially also migratory TSC Act listed species. These birds would move locally in response to variation in the availability of nectar and or pollen, which are important components of their diet. The Site and immediate vicinity has been subject to severe wildfires in December 2005, resulting in a relative shortage of nectar currently provided by the Site. This, combined with the relatively small area of vegetation to be removed, means that the proposal is likely to result in a minor loss of food resources.

The *Allocasuarina* spp recorded at and within the vicinity of the Site are in very small numbers and were found to be of low feeding quality with little or no cones observed on the trees. The loss of this resource would not constitute a significant impact on the TSC Act listed Glossy Black Cockatoo.

A number of raptor species and other carnivorous birds were recorded at and within the vicinity of the Site during the July and November 2006 surveys including the Australian Kestrel, Black-shouldered Kite, Peregrine Falcon, Wedge-tailed Eagle, White-bellied Sea-eagle, Whistling Kite, Australian Raven, Grey Butcherbird and the Kookaburra. The presence of a large number of carnivorous birds at the Site and immediate surround is likely the result of a higher density of prey species (rodents) utilising the landfill wastes. The proposal will not result in a significant loss of foraging habitat for these species given that the majority of habitat is likely to be provided by the adjoining WMF.

The proposal is also unlikely to have a significant impact on forest and woodland dwelling birds recorded at and within the vicinity of the Site given the relatively small area of suitable habitat that the Site provides in comparison to the surrounding area.

The removal of the sedimentation pond is likely to affect water birds recorded at the Site including the Australasian Grebe, Australian Wood Duck and Grey Teal. However as all species of water bird recorded at the Site are common and highly mobile, it is unlikely that the removal of the pond will have a significant affect on these common and widespread species.

Anecdotal evidence (Wellington, R, 2006, pers. comm. 27 November) infers that a Bush Stone Curlew mating pair was once present at the Woy Woy Landfill site. One of the pair was reportedly predated by a Red Fox and the remaining individual subsequently disappeared from the landfill site. On the basis of this anecdotal evidence a Seven Part test for the Bush-stone Curlew was conducted (see **Appendix A**) which concluded that there is unlikely be significant impact on this species as a result of the proposal.

6.3.3 Large Forest Owls

The Barking Owl and Powerful Owl are known to occur in the Woy Woy area with known roost sites located at Woy Woy Bay. Although no large forest owls were recorded at the Site or immediate surrounds during the July and November 2006 surveys, the presence of rats associated with the landfill indicates that parts of the Site may provide potential foraging habitat for large forest owls.

Potentially more suitable roosting habitat without noise from machinery is provided within the Brisbane Water N.P. which surrounds the Site. Regardless of the hollow potential, the Site would be considered to offer supplementary or additional feeding opportunities to owls given the likelihood of a higher density of prey species (rodents) utilising the landfill wastes. The removal of the vegetation required for the current proposal is not expected not impact on these feeding opportunities.

A Seven Part assessment (see **Appendix A**) for large forest owls such as the Barking Owl and Powerful Owl was conducted and concluded that there unlikely to be a significant impact on these species.

6.3.4 Mammals

The cleared areas of the Site are unlikely to provide optimal habitat for native mammals expected to occur in the surrounding habitat. Accordingly the development of these areas is unlikely to impact on native mammals.

The proposal will result in the removal of significant habitat for native fauna in woodland and forest including dense and undisturbed vegetation adjacent to cleared areas, suitable feed trees, rock crevices and hollows. These impacted areas may provide opportunistic foraging and breeding habitat for TSC/EPBC Act listed species including the Long-nosed Potoroo, Southern Brown Bandicoot, Squirrel Glider, Spotted-tailed Quoll and the Eastern Pygmy-possum.

The presence of more suitable foraging and breeding habitat without noise from machinery and less likelihood of predation by the Red Fox however would be provided within intact vegetation within the Brisbane Water N.P. which surrounds the Site. Given the relatively small area of potential habitat that will be removed as part of the proposal and given that the Long-nosed Potoroo, Southern Brown Bandicoot, Squirrel Glider, Spotted-tailed Quoll and the Eastern Pygmy-possum are highly mobile species, it is considered highly unlikely that the proposed development will have an impact on these species. Seven Part tests for the Long-nosed Potoroo, Southern Brown Bandicoot, Squirrel Glider, Spotted-tailed Quoll and the Eastern Pygmy-possum were therefore not considered necessary. Further, no latrine sites for the Spotted-tailed Quoll were recorded at or within the vicinity of the Site and therefore are unlikely to utilise these areas at the present time.

Although the Site may provide habitat to a number of glider species, it is highly unlikely that the Yellow Bellied Glider would occur at the Site or immediate surrounds given the lack of suitable habitat namely tall mature eucalypts. The Yellow Bellied Glider prefers tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils.

6.3.5 Reptiles

The east and west facing benched faces of the Site with rocky outcrops of sandstone and adjoining sandstone caves provides optimal habitat for a range of reptile species potentially including the TSC Act listed Rosenberg's Goanna. The loss of this habitat is likely to have an impact on a range of native reptile species.

Other threatened reptile species, including the Broad-headed Snake and Stephan's Banded Snake were considered unlikely to occur on Site, due to the absence of previous records and the lack of suitable habitat. Consequently the current proposal is unlikely to directly impact on important habitat of either species on the subject land [Molino Stewart Pty Ltd (November 2006)].

The Rosenberg's Goanna is a wide ranging species and no over-wintering rock crevice refuges were recorded within the development footprint area. Accordingly the loss of the portion of habitat proposed for removal by this proposal is unlikely to have significant impact on the local population of this species [Molino Stewart Pty Ltd (November 2006)].

6.3.6 Frogs

Targeted surveys for frogs including call playbacks were undertaken at the Site during the July and November 2006 surveys which targeted threatened species including the Giant Burrowing Frog, Red-crowned Toadlet, Littlejohn's Tree Frog and the Green and Golden Bell Frog. Although no listed frog species were recorded at the Site during the July and November 2006 surveys, the November 2006 survey identified the presence of the Red-crowned Toadlet approximately 40-50m from the eastern site boundary within a small ponded area of the upper reaches of Patonga Creek.

The Patonga Creek catchment which contains rocky banks and thick fringing vegetation and associated habitat including the hanging swamp vegetation community is considered to provide optimal habitat for

other threatened frog species including Littlejohn's Tree Frog, Giant Burrowing Frog, Stuttering Frog and Giant Barred Frog. Both the Giant Burrowing Frog and the Red-crowned Toadlet have been previously detected within the upper reaches of the Patonga Creek catchment which is situated within the immediate vicinity of the Site. No suitable habitat for the Stuttering Frog and Giant Barred Frog was recorded at the Site; however potential habitat for these species exists in the lower section of the Patonga Creek catchment (**Appendix C**).

Given that the proposal is likely to impact on the current drainage system at the Site and immediate surrounds and is also likely to increase the pollutant load into Patonga Creek, a 7-Part test examining secondary impacts on the Red-crowned Toadlet, Giant Burrowing Frog, Littlejohn's Tree Frog, Stuttering Frog and the Giant Barred Frog (see **Appendix A**) was conducted.

There are currently uncertainties surrounding the significance of flow alterations which may occur at the Site as a result of the proposal. Further, engineering of flows at the Site have not yet been determined and will be subject to later detailed design. The design phase will therefore need to ensure how to minimise to the greatest extent possible impacts on the habitat and species identified in this report, to this end, no change to the natural flow regime (quality and quantity) will be required to ensure that threatened species are not significantly impacted as a result of the proposal.

The Seven Part Tests (**Appendix A**) concluded that the proposal in its current configuration and design is likely to result in significant impacts to amphibian habitat at and within the vicinity of the Site and therefore significant impacts to the Red-crowned Toadlet, Giant Burrowing Frog, Littlejohn's Tree Frog, Stuttering Frog and the Giant Barred Frog. As such a Species Impact Statement (SIS) may be required should the detailed design process identify that engineering controls are unable to mimic natural flows currently experienced at the Site both in quantity and quality.

6.3.7 Giant Dragonfly

The Giant Dragonfly lives in permanent swamps and bogs with some free water and open vegetation. This species was recorded within the vicinity of the hanging swamp just upstream from the site (approx 10-20m from the Site boundary) and is a significant local record as relatively few known locations of this species have been recorded on the Central Coast previously.

The 7-Part Test (**Appendix A**) concluded that the proposal in its current configuration and design is likely to result in significant impacts to the Giant Dragonfly habitat within the vicinity of the Site. As such a Species Impact Statement (SIS) may be required should the detailed design process identify that engineering controls are unable to mimic natural flows currently experienced at the Site both in quantity and quality.

6.4 Weeds

The November 2006 weeds survey revealed relatively minor weed infestation in undisturbed native vegetation on and adjoining the Site. Notably the bird-spread noxious weeds *Lantana camara* and *Chrysanthemoides monilifera* subsp. *rotundata*, which are serious and widespread environmental weeds

in coastal NSW, were absent from native vegetation and only small numbers were observed in cleared areas. However areas of natural vegetation adjoining Patonga Creek to the south of the existing sedimentation pond featured moderate to major weed infestations. *Lantana camara* occurred near the DECC access trail on the southern slope above Patonga Creek. Areas of native vegetation have highly significant habitat values and are continuous with Brisbane Water NP.

Cleared areas of the Site featured some major infestations of environmental weeds including those which are listed as Noxious. These were most abundant in cleared/regrowth areas, however *Ageratina adenophora* and *Chrysanthemoides monilifera* subsp. *rotundata* was located along the southern fenceline and adjacent to Patonga Creek.

Active management on site during construction and operation is required to ensure noxious weed species do not colonise native vegetation. It is also recommended that Gosford City Council utilise the development period to control environmental weeds present on Site.

The Class 3 weed *Ulex europaeus* must be fully and continuously suppressed and destroyed. For the Class 4 weeds *Ageratina adenophora*, *Chrysanthemoides monilifera* and *Cortaderia selloana*, the growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority, in this case Gosford City Council.

The Class 5 weeds such as *Lantana camara* and *Oxalis* sp.* are all of NSW declarations and are notifiable weeds. The requirements in the *Noxious Weeds Act* for a notifiable weed must be complied with. Landholders must notify the local control authority after finding it on their land and must also continuously suppress and destroy the infestation.

6.5 Construction and Operational Impacts

During the construction of the proposed AWT site, it is estimated that approximately 3 to 4ha of land will be disturbed in order to construct the AWT footprint and access road. This will require the removal of 1.5ha of existing native vegetation, excavation of a substantial amount of sandstone ridgeline and removal of the sedimentation pond at the Site. Heavy machinery and other vehicles should not be used or parked on any areas outside the current development footprint.

Should heavy rainfall occur during the construction period then it is likely that any disturbance to the ground will cause soil erosion and runoff. If appropriate mitigation measures are implemented then this is unlikely to result in erosion and resulting sedimentation of the natural drainage system and reduce the mobilisation of contaminants found at the Site.

The sedimentation pond is likely to contain contaminants and possibly chytrid fungus (a fungus capable of causing sporadic deaths in some amphibian populations and 100% mortality in others). Any large volumes which may be discharged into the natural drainage system through infilling of the pond is likely to have significant impacts on the natural drainage system particularly Patonga Creek which is considered a pristine watercourse.

Once the construction of the AWT facility is complete, then the Site will be utilised for the recycling and treatment of various wastes.

Runoff from waste receiving and processing areas could potentially contain high concentrations of pollutants including gross pollutants, oils and grease, heavy metals, nutrients, pathogens, oxygen demanding substances and others. All runoff from waste processing and receiving areas should be collected and reused in the process and/or discharged to the existing leachate management system. Stormwater runoff from roof tops should be contained within rainwater tanks onsite and also reused in the process. Runoff from roads and car parking areas are also likely to contain pollutants. As a result, runoff from these areas, along with any excess stormwater runoff from the roofs, should be collected in detention basins on site, treated and the effluent used in the AWT or composting process. Any treated effluent discharged into Patonga Creek should meet stringent water quality guidelines and should not exceed levels currently found within the Creek. Stormwater flowing onto the Site which may be directed into Patonga Creek should also meet stringent water quality guidelines.

The impacts on Patonga Creek have not been quantified as part of this report. Due to the amphibian and Giant Dragonfly habitat within close proximity to the Site, runoff from Site and treated flows to Patonga Creek would need to be similar to the receiving waters in quantity and quality in order to mimic natural flows.

6.5.1 Visual Screening/Earth mound

The proposed earth works including bunding on the southern boundary of the Site are proposed in areas cleared of native vegetation, however mitigation measures for erosion, sedimentation and weed control will need to be implemented for these associated works due to nearby Patonga Creek and the habitat provided by the adjoining Sheltered Dry Hawkesbury Woodland vegetation community.

6.5.2 Artificial Lighting

Night-time security or operational lighting can potentially discourage habitat use where diffuse light penetrates into adjoining areas of vegetation. Nocturnal foraging regimes could be disrupted and may advantage predators such as cats, dogs and foxes as they are not strictly nocturnal foragers.

Nocturnal species' (such as owls, gliders and possums) eyesight is hindered by bright lights, and where they are affected by this, they become more susceptible to predation.

Large floodlights should generally not be used, although it is likely that some lighting may be required for emergencies, maintenance or security. Such lighting should be designed not to spill light outside the areas of disturbance proposed by the development.

6.5.3 Roads and Access

Access via road will be within the current footprint of the Site and should not impact on any additional areas of native vegetation or habitat.

7.1 Planning & Offsets

It is recommended that the Construction Environmental Management Plan (CEMP) and Operational Environment Management Plan (OEMP) be developed for the site and include the mitigation measures outlined below. These plans should be prepared in consultation with an appropriately qualified ecologist.

An offset package is proposed as a means to mitigate against the impacts on flora and fauna of the proposed facility. The Offset Package Report is presented as **Appendix D** and describes the vegetation and habitats of the area to be affected by construction of the proposed facilities and those of the area proposed as an offset. This comparison is summarised in **Table 7-1** below.

Table 7-1 Comparison of Impacted Area and Offset Area

Vegetation Type	Impacted Area (ha)	Offset Area (ha)
Hawkesbury Peppermint Apple Forest*	0.51	0.94
Hawkesbury Banksia Scrub–Woodland	0	0.55
Hawkesbury Rock Pavement Heath	0	0.09
Exposed Hawkesbury Sandstone Woodland	1.04	0
Hollow-bearing trees	√	√
Caves	√	√
SEPP 44 Koala Feed Trees	√	√
Total Area	1.55	1.58

√ = present but quantity and density not known

* equivalent to 'Sheltered Dry Hawkesbury Woodland' (LHCCREMS, 2003) as described in this Report. Nomenclature of Bell (2004) was preferred for the offsets package as LHCCREMS (2003) mapping did not cover the proposed offset area.

As shown in **Table 7-1**, there is not an exact like-for-like match of vegetation types between the two areas. However, it is evident from field surveys and from the floristic data of Bell (2004) that the floristic diversity and structural features of the offset area have a high correlation to those within the impacted area. This relationship is described fully in **Appendix D**. Overall the offset area contains vegetation types and habitat features that are equivalent to or highly correlated (floristically and structurally) to those within the impacted area.

The offset will protect and conserve, in perpetuity, threatened species habitats, vegetation types, habitat types and landscape features similar or equivalent to those found within the impacted area. Moreover, the proposed offset area is 300m² larger than the impacted area, has superior connectivity with intact vegetation and habitats and contains higher quality habitats that are in better condition.

On the basis of the above assessment, the proposed offset is consistent with the DECC guidelines for offsets and meets the key criterion for like-for-like trade-offs of biodiversity values. Adoption of the offset would adequately compensate for the loss of threatened species habitat associated with construction of the proposed AWT facility.

Gosford City Council is committed to providing an appropriate offset area as discussed in **Appendix D**, and a commitment describing this is provided in the Draft Statement of Commitments provided in the main body Environmental Assessment report.

7.2 Tree Clearance Protocol

The removal of larger habitat trees (>60cms diameter breast height or any trees with hollows) should occur under a Tree Clearance Protocol (TCP). This measure is recommended to reduce direct impacts to any tree dwelling fauna species, particularly bats. The TCP involves the following stages:

- Day 1 – Pre-clearing survey by qualified expert/s identifies habitat trees (those that have potential roost hollows for bats or arboreal mammals, bird nests in branches, hollows suitable for hole-nesting birds). Bird observations at potential roosts are made during the day.
- Night 1 – Habitat trees are assessed for fauna presence (bat detectors operated for one hour after dusk, trees with large hollows are spotlighted at dusk).
- Day 2 – Trees with fauna present are felled with a heavy bulldozer that pushes from the same side as the roost in question so that the roost entrance is uppermost when the tree is lying on the ground. The tree is “tapped” several times with the bulldozer blade to alert any resident fauna and is then pushed using the base of the blade at approximately 1 -2 metres from the ground until it starts to lean. The blade is then lowered to the base of the trunk where major roots protrude, and the tree is then held in position. The tree is then gently lowered to the ground by raising the blade and the machine operator can control the rate of fall to reduce damage. It is assumed that resident fauna will depart of its own accord.
- Habitat trees with nesting birds are not felled until they are fledged, but if this is not possible they are taken to a WIRES wildlife carer.

7.3 Weed and Pest Management

To limit the spread of weeds into adjoining remnant vegetation during construction it is recommended that intact areas be fenced. This should be done prior to construction, restricting access by construction crew and machinery to remnant vegetation. Additionally, stockpiles of fill or vegetation should not be placed in areas of adjoining remnant vegetation but instead within existing cleared areas.

A weed and pest management plan should be undertaken as part of the Construction Environmental Management Plan and Operation Environmental Management Plan for the Site. Active control of Fox and noxious weeds will be required.

Overall the November 2006 baseline weeds survey revealed relatively minor weed infestation in undisturbed native vegetation on and adjoining the Site. Notably the noxious weeds *Lantana camara* and *Chrysanthemoides monilifera* subsp. *rotundata*, which are serious and widespread environmental weeds

in coastal NSW, were absent from native vegetation and only small numbers were observed in cleared areas.

Cleared areas featured serious infestations with environmental weeds including noxious weeds. More active management should be undertaken to ensure these species do not colonise native vegetation. It is recommended that Council utilise the development period to control environmental weeds present on Site. Areas of natural vegetation adjoining Patonga Creek to the south of the existing sedimentation pond featured moderate to severe weed infestation. It is recommended that active control of weeds in these areas take place prior to development and that the design of the proposed development utilise control measures to limit the spread of weed propagules to the south of the Site.

The following weed management measures are recommended for the proposed development:

- Incorporate control measures in the design of the proposed development to limit the spread of weed propagules to the south/downstream of the Site.
- Hard-paved buffer zones around areas used for the storage or processing of green wastes
- installation of silt fences and other mitigation measures to isolate runoff during construction; and immediate rehabilitation of disturbed vegetation to limit the potential for colonisation by weeds
- fence off areas of vegetation to be retained during construction , restricting access by construction crew and machinery to remnant vegetation. Additionally, stockpiles of fill should not be placed in areas of remnant vegetation but instead in adjacent cleared areas.
- Post-construction landscape any open areas with indigenous native vegetation to limit the potential for colonisation by weeds
- removal and/or control of noxious weeds in accordance with the requirements of the *Noxious Weeds Act*, with particular focus on the following species: *Ageratina adenophora*, *Chrysanthemoides monilifera* subsp. *rotundata*, *Ulex europaeus*, *Cortaderia selloana* and *Lantana camara* ; and
- Perform ongoing monitoring of weed infestation on and adjoining the Site utilising the baseline weeds survey of the Site and its surrounds conducted on 23 and 24 November 2006.

7.4 Fauna Management

Surface exfoliations of sandstone that occur within the development footprint should be manually removed and offered to DECC as micro-habitat enhancement materials for the Broad-headed Snake recovery program. This rock material could then be installed within other reserves of the DECC Central Coast Hunter Range Region or used for habitat enhancement or rehabilitation in areas that have experienced bushrock theft. This would offset any possible impact to marginal Broad-headed Snake habitat caused by the proposal.

Consideration should be given to re-establishment of an alternative pond to that proposed for removal as part of the proposal. This would replace this part of the habitat removed by the proposal. The pond should

be constructed prior to infilling and removal of the sedimentation pond which will allow for the translocation of existing frog species. Translocation of existing frogs to a suitable habitat should occur prior to any proposed activities in any instance.

Water from the existing sedimentation pond is likely to be contaminated and of unsuitable quality for release to the Patonga Creek system.

7.5 Bushfire Management

Any APZ will need to be included within the internal footprint design and should not be the justification for additional clearing. From an ecological perspective this ensures that vegetation adjacent to the current site boundary is not subject to increased fire regimes as a result of the proposed development and maintains its role as a filter to Patonga Creek and the upstream habitats.

7.6 Soil Erosion / Runoff

As noted in **Section 6** and **Appendix A** the proposal in its current configuration and design is likely to result in impacts to habits within Patonga Creek and the hanging swamp. Appropriate construction and operational mitigation measures should be incorporated into the detailed design in a manner that minimises soil erosion, sedimentation and run-off into downstream habitats. The design must provide detail on the current surface and groundwater flow regime at the Site and incorporate engineering measures which will mimic the current situation as closely as possible. The proposed footprint must avoid intercepting groundwater seep flowing into the hanging swamp headwaters of Patonga Creek and associated frog habitat.

The following mitigation measures are presented as a minimum for the construction and operation for the Site.

All construction works would be undertaken in a manner to minimise the potential for soil erosion and sedimentation. At a minimum, construction activities would comply with Gosford City Council's D6.46 *Erosion Sedimentation Control* and the measures outlined in the *Managing Urban Stormwater – Vol 1 Soils and Construction* (the Blue Book) would be implemented. Prior to commencement of construction, a soil erosion and sedimentation control plan would be prepared by the Contractor and submitted to Council for approval. This plan would, amongst other issues, provide for the following mitigation measures:

- Minimisation of the time that disturbed land is exposed;
- Placement of temporary surface water diversion barriers along the active excavation areas to prevent run-off entering the construction site;
- The stormwater outlet points for site run off shall be identified and the drain(s) would be banded with a combination of sandbags and hay bales wrapped in silt fencing material to minimise sediment entry into the storm drains or creek system. These would also capture gross pollutants. Any hay bales

used at the site would be selected and maintained to avoid propagation of non-indigenous seeds that could otherwise be contained in the hay bales;

- Early installation of permanent stormwater drainage structures;
- Early revegetation or installation of non-erodable surfaces;
- Installation of silt fences around the perimeter of the temporary soil stockpiles and downstream slopes of the construction site to minimise potential migration of sediment. Silt fence construction shall consist of geofabric strung between steel or timber posts with the geofabric extending into the soil excavation. Hay bales may be required if the anticipated volume of sediment is large. The silt fences would be inspected regularly by the Contractor for damage throughout construction phase. Inspections would also be required immediately after rain to ensure that the effectiveness of the system is maintained. Deposited sediment shall be removed by the Contractor and disposed of either directly into the excavation or to temporary soil stockpiles;
- All possible pollutant materials would be stored well clear of site boundaries and stormwater drainage lines. They would be stored in a designated covered area. Containment bunds would be constructed with provision for collection of any spilt material. Waste collection areas would be designated and appropriate bunding would be installed and appropriated containers would be provided. Waste disposal and collection would be properly undertaken. All vehicle and equipment washing and maintenance would be undertaken offsite; and
- Vehicles leaving the site shall be inspected to ensure that soil is not transported off site through wheel treads.

Appropriate ongoing maintenance and mitigation measures to minimise soil erosion, sedimentation, alterations of flows and pollution run-off would also be incorporated into the CEMP and OEMP.

7.7 Surface water management and monitoring

Council undertakes environmental monitoring at the Woy Woy WMF in accordance with the Environment Protection Licence. Surface water monitoring would be continued in accordance with this program throughout the construction and operation of the facility.

As noted in **Section 6** and **Appendix A** the proposal is likely to result in impacts to significant aquatic habitats and the final detailed should minimise to the greatest extent possible alteration of natural flows and pollution run-off. The design must provide detail on the current surface and groundwater flow regime at the Site and incorporate engineering measures which will mimic the current situation as closely as possible. The proposed footprint must avoid intercepting groundwater seep flowing into the hanging swamp headwaters of Patonga Creek and associated frog habitat.

The following mitigation measures are presented as a minimum for the construction and operation for the Site.

Management of surface water during the construction phase is mainly concerned with potential impacts of erosion and runoff, which are addressed above. In addition construction staff would use the existing facilities at the landfill so that pollutants, including wash water are not conveyed from the site in stormwater.

Operational surface water control measures are likely to include:

- Clean runoff flowing onto the development area from the south would be directed to Patonga Creek and energy dissipation measures would be constructed at the southern outlet to minimise the effects of the concentration of this flow;
- During the detailed design phase the spare capacity of the existing landfill's stormwater system would be assessed, compared to the additional flow directed into the system, and augmented if required;
- During the detailed design phase, appropriate detention basins would be sized and located on site;
- Flows from the waste receipt, storage and processing areas would be collected, treated and reused in the Composting or AWT treatment processes.
- Stormwater runoff from roof tops, roads and car parking areas would be collected in detention basins on site, treated as required and the effluent used in the AWT or Composting treatment process;
- Any excess treated stormwater runoff would be discharged into Patonga Creek, mimicking natural flows.

Further details of surface water management is provided in **Chapter 9** of the Environmental Assessment Report.

Due to the potential habitat for TSC Act listed frogs and other species downstream, runoff from site and treated flows to Patonga Creek would need to be similar to the receiving waters in quantity and quality in order to mimic natural flows. Therefore the stormwater runoff discharged to Patonga Creek would be treated to a standard which meets the existing water quality within the creek. The treatment device would be selected and/or designed during the detailed design phase and a maintenance, monitoring and operations plan written at this time.

The water quality and quantity criteria for discharge to Patonga creek would be outlined in the Operational Environmental Management Plan (OEMP) and Environmental Protection Licence (EPL) for the proposed facilities.

7.8 Aquatic habitat management

The proposal would not have direct impact upon aquatic habitats in Patonga Creek or the hanging swamp. Accordingly no specific aquatic habitat management is recommended for the CEMP and OEMP. Soil and erosion (**Section 7.6**) and surface water quality (**Section 7.7**) management is likely to be sufficient to ensure no significant impacts on aquatic habitats adjacent to the Site.

7.9 Dust suppression

Appropriate construction and operational mitigation measures must be incorporated into the final detailed design to minimise the generation of dust and associated impacts on adjacent natural environments. These are likely to include:

- Setting maximum speed limits for construction and operational traffic on Site to limit dust generation;
- Use of a water tanker or similar to spray unpaved roads during construction;
- Hard paving of the operational areas of the facility;
- Installation of sprinkler systems or similar to suppress dust generated by stockpiling and management of wastes during the operation of the facility; and
- Use of a water tanker or similar to spray unpaved sections of the access road and facility during operation.

7.10 Site Management

The following mitigation measures are suggested to minimise operational impacts of the proposed development:

- Setting maximum speed limits for construction and operational traffic on Site to reduce fauna road fatalities;
- Limit vehicular and personnel entry into adjacent remnant vegetation during construction and operation through appropriate fencing;
- Using down-lights and motion sensor lighting in order to reduce light spill and the associated secondary impact on nocturnal fauna species potentially utilising the adjoining vegetation; and
- Safeguard measures to reduce soil erosion and pollutant and sediment run-off during both construction and operation phases.

A total of 134 flora species were identified during field surveys conducted in July and November 2006. None of these species are listed under the TSC or EPBC Acts. Two vegetation communities, Sheltered Dry Hawkesbury Woodland and Exposed Hawkesbury Woodland, were recorded at the Site. Neither of these communities is listed as an endangered ecological community under the TSC Act and both are well represented in conservation reserves within the region. There are previous records of the threatened plant *Callistemon linearifolius* from the Site, in an area upstream and to the west of the proposed development footprint. No individuals of this species were recorded during the current surveys and none will be affected by the proposed works.

Disturbed areas of the Site feature significant infestations with noxious and environmental weeds, although the surrounding bushland is relatively weed-free. The construction and operation of the Site must include ongoing surveys and management of environmental weeds to avoid impacts on the adjoining Brisbane Water N.P.

Although approximately 1.5ha of native vegetation will be removed as a result of the proposed development, the clearing will occur adjacent to an existing cleared area. Continuity of extant vegetation will be maintained to the east of the development site providing for north-south connectivity of habitat. East-west connectivity is substantially disrupted by the existing landfill footprint. Accordingly the proposed development will not fragment or isolate an area of habitat.

A total of 13 species of reptile, 39 species of bird, nine species of amphibian, 17 native mammals and one species of dragonfly were recorded on the Site. Six of these species are listed as threatened under the TSC Act, including the Red-crowned Toadlet, Grey-headed Flying-fox, Eastern Freetail Bat, Little Bent-wing Bat, Large-footed Myotis and the Giant Dragonfly. One species, the Grey-headed Flying-fox, is also listed as nationally threatened under the EPBC Act.

The proposal will result in the removal of habitat for native flora and fauna, including threatened species. The most significant impacts are associated with the removal of native vegetation and associated habitat features, such as feed trees, tree hollows, rock outcrops and caves and ground debris (leaf litter). This habitat is known to be utilised by several threatened fauna species previously recorded from the Site and the locality, including threatened microbats, forest owls, the Bush Stone-curlew. Assessments under Section 5A of the EP&A Act (7-part tests) for these species conclude that only minor impacts are likely due to the relatively small area of habitat to be removed, limited evidence of local populations or core breeding or roosting habitat and presence of superior habitat in the area surrounding the Site. Therefore a Species Impact Statement for these species is not required.

A biodiversity offset package is presented as a means to mitigate against the impacts on flora and fauna of the proposed facility. The package describes the vegetation and habitats of the area to be affected by construction of the proposed facilities and those of the area proposed as an offset. This offset area contains threatened species habitats, vegetation types, habitat types and landscape features similar or equivalent to those found within the impacted area. Council has agreed to set aside the area for conservation purposes in perpetuity, and will negotiate a suitable administrative arrangement, which could be in the form of a Voluntary Conservation Agreement, Section 88D instrument or land divestment, with DECC. The proposed offset is consistent with the DECC guidelines for offsets and meets the key criterion for like-for-like trade-offs of biodiversity values. Adoption of the offset would adequately

compensate for the loss of threatened species habitat associated with construction of the proposed AWT facility.

The proposal in its current configuration and design is likely to result in impacts to habitats in Patonga Creek and an adjacent hanging swamp, depending on the final drainage and stormwater design. 7-part tests for the Red-crowned Toadlet and the Giant Dragonfly are inconclusive, as the detailed design for surface water management from the facility is not yet complete. If the water management structures and systems proposed as part of the final design are unable to mimic the existing hydrological regime of Patonga Creek, then the proposal could have a significant impact on these species. Therefore a Species Impact Statement for these species may be required. This issue will have to be reviewed during detailed design phase.

Construction and operational mitigation measures must be incorporated into the final detailed design in a manner that minimises to the greatest extent possible alteration of natural flows and pollution run-off into downstream habitats.

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- DEC (2006). *NSW Recovery Plan for the Large Forest Owls: Powerful Owl (*Ninox strenua*), Sooty Owl (*Tyto tenebricosa*) and Masked Owl (*Tyto novaehollandiae*)*. NSW Department of Environment & Conservation, Sydney.
- DECC (2006). *NPWS Wildlife Atlas data*, Department of Environment and Conservation (NSW).
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(<http://www.gosford.nsw.gov.au/customer/forms/trees/noxiousplants.pdf/view>)
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- LHCCREMS (2003) *Lower Hunter Regional Biodiversity Conservation Strategy, Technical Report, Digital Aerial Photo Interpretation & Updated Extant vegetation Community Map*, Lower Hunter and Central Coast Regional Environmental Management System, Callaghan, NSW. Lower Hunter Central Coast Regional Environmental Management Strategy
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- Simpson, K., Day, N. (1995) *Field Guide to the Birds of Australia*. Penguin Books. Strahan, R. (2002) *The Mammals of Australia*. New Holland.
- Specht R.L. (1970) vegetation. In: *The Australian environment*. (Ed. G.W. Leeper). pp. 44-67. CSIRO and Melbourne University Press, Melbourne.
- Triggs, B (2004) *Tracks, scats and other traces. A Field Guide to Australian Mammals*. Oxford Press.

Surveys were undertaken outside the optimal survey period for some species and therefore it is possible that some species utilise the Site but were not detected during the survey period. These species are likely to include cryptic species and threatened flora species such as orchids not in flower during winter. Some fauna species are also mobile and transient in their use of resources and it is likely that not all species (resident or transitory) were recorded during the survey period. The habitat assessment conducted for the Site allows for identification of habitat resources for such species. As such the survey was not designed to detect all species, rather to provide an overall assessment of the ecological values on Site in order to predict potential impacts of the proposal.

URS Australia Pty Ltd (URS) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of GCC and only those third parties who have been authorised in writing by URS to rely on the report. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in our Proposal.

The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

This report was prepared between August – December 2006 and revised in July – August 2007 and is based on the conditions encountered and information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

Tables

Tables

Table 1: Threatened plants recorded or predicted to occur within the locality

Botanical Name	Common Name	TSC Act Status	EPBC Act Status	Potential Occurrence at the Site
<i>Acacia bynoeana</i> ²	Bynoe's Wattle	E1	V	✓
<i>Acacia pubescens</i> ¹	Downy Wattle	V		X
<i>Astrotricha crassifolia</i> ^{1 2}	Thick-leaf Star Hair	V	V	✓
<i>Bothriochola biloba</i> ²	Lobed Blue Grass		V	X
<i>Caladenia tessellata</i> ²	Thick-lipped Spider-orchid	E1	V	X
<i>Callistemon linearifolius</i> ¹	Netted Bottle Brush	V		✓
<i>Cryptostylis hunteriana</i> ²	Leafless Tongue-orchid	V	V	X
<i>Darwinia glaucophylla</i> ¹		V		✓
<i>Diuris bracteata</i> ¹		E1	Extinct	✓
<i>Eucalyptus camfieldii</i> ¹	Camfield's Stringybark	V		✓
<i>Grevillea shiressii</i> ^{1 2}		V	V	X
<i>Haloragodendron lucasii</i> ²	Hal	E1	E	X
<i>Hibbertia procumbens</i> ¹	Spreading Guinea Flower	E1		✓
<i>Kunzea rupestris</i> ²		V	V	✓
<i>Melaleuca biconvexa</i> ¹	Biconvex Paperbark	V		X
<i>Melaleuca deanei</i> ²	Deanes Melaleuca	V	V	✓
<i>Micromyrtus blakelyi</i> ²		V	V	✓
<i>Prostanthera junonis</i> ²	Somersby Mintbush	E1	E	X
<i>Syzygium paniculatum</i> ^{1 2}	Magenta Lily Pily	V	V	X
<i>Tetradlea glandulosa</i> ^{1 2}		V	V	X

Bold = recorded on or near the site

✓ = Possible

X = Unlikely

1 = Threatened species listed under TSC Act 1995 previously recorded within 10km of the Site

2 = Threatened species listed under EPBC Act 1999 or species habitat predicted to occur within 10km of the Site.

* = SEPP 44 Koala habitat/feed tree

Tables

Table 2: Threatened fauna species recorded or predicted to occur within the locality

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Potential Occurrence at the Site
Amphibians				
<i>Crinia tinula</i>	Wallum Froglet ¹	V		X
<i>Heleioporus australiacus</i>	Giant Burrowing Frog ^{1 2}	V	V	✓
<i>Litoria littlejohni</i>	Littlejohn's Tree Frog ^{1 2}	V	V	✓
<i>Litoria aurea</i>	Green and Golden Bell Frog ^{1 2}	E1	V	✓
<i>Mixophyes balbus</i>	Stuttering Frog ^{1 2}	E1	V	X
<i>Mixophyes iteratus</i>	Giant Barred Frog ^{1,2}	E1	V	X
<i>Pseudophryne australis</i>	Red-crowned Toadlet ¹	V		✓
Reptiles				
<i>Chelonia mydas</i>	Green Turtle ^{1 2}	V	V	X
<i>Dermochelys coriacea</i>	Leatherback Turtle ²	V	V	X
<i>Hoplocephalus bungaroides</i>	Broad-headed Snake ²	V	V	✓
<i>Hoplocephalus stephensii</i>	Stephens' Banded Snake ¹	V		✓
<i>Hoplocephalus bitorquatus</i>	Pale-headed Snake ¹	V		X
<i>Varanus rosenbergi</i>	Rosenberg's Goanna ¹	V		✓
Birds				
<i>Botaurus poiciloptilus</i>	Australasian Bittern ¹	V		X
<i>Burhinus grallarius</i>	Bush Stone-curlew ¹	E1		✓
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo ¹	V		✓
<i>Calyptorhynchus lathamii</i>	Glossy Black-Cockatoo ¹	V		✓
<i>Charadrius mongolus</i>	Lesser Sand-plover ¹	V		X
<i>Diomedea amsterdamensis</i>	Amsterdam Albatross ²		E	X
<i>Diomedea antipodensis</i>	Antipodean Albatross ²	V		X
<i>Diomedea dabbenana</i>	Tristan Albatross ²	E		X
<i>Diomedea exulans</i>	Wandering Albatross ^{1 2}	E1	V	X
<i>Diomedea gibsoni</i>	Gibsons Albatross ²	V		X
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork ¹	E1		X
<i>Gygis alba</i>	White Tern ¹	V		X
<i>Haematopus fuliginosus</i>	Sooty Oystercatcher ¹	V		X
<i>Haematopus longirostris</i>	Pied Oystercatcher ¹	V		X
<i>Hamirostra melanosternon</i>	Black-breasted Buzzard ¹	V		X
<i>Irediparra gallinacea</i>	Comb-crested Jacana ¹	V		X
<i>Ixobrychus flavicollis</i>	Black Bittern ¹	V		X
<i>Lathamus discolor</i>	Swift Parrot ^{1 2}	E1	E	✓

Tables

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Potential Occurrence at the Site
<i>Macronectes giganteus</i>	Southern Giant Petrel ²	E		X
<i>Macronectes hallii</i>	Northern Giant Petrel ²	V		X
<i>Neophema pulchella</i>	Turquoise Parrot ¹	V		✓
<i>Ninox connivens</i>	Barking Owl ¹	V		✓
<i>Ninox strenua</i>	Powerful Owl ¹	V		✓
<i>Pandion haliaetus</i>	Osprey ¹	V		X
<i>Phaethon rubicunda</i>	Red-tailed Tropicbird ¹	V		X
<i>Pomastomus temporalis temporalis</i>	Grey-crowned Babbler ¹	V		X
<i>Pterodroma leucoptera leucoptera</i>	Gould's Petrel ²	E		X
<i>Pterodroma neglecta neglecta</i>	Kermadec Petrel ²	V		X
<i>Pterodroma solandri</i>	Providence Petrel ¹	V		X
<i>Ptilinopus superbus</i>	Superb Fruit Dove ¹	V		X
<i>Puffinus assimiles</i>	Little Shearwater ¹	V		X
<i>Puffinus carneipes</i>	Flesh-Footed Shearwater ¹	V		X
<i>Pyrrholaemus sagittatus</i>	Speckled Warbler ¹	V		✓
<i>Rostratula australis</i>	Australian Painted Snipe ^{1 2}	E1	V	✓
<i>Sterna albifrons</i>	Little Tern ¹	E1		X
<i>Sterna fuscata</i>	Sooty Tern ¹	V		X
<i>Thalassarche bulleri</i>	Buller's Albatross ²	V		X
<i>Thalassarche cauta</i>	Shy Albatross ²	V		X
<i>Thalassarche impavida</i>	Black-browed Albatross ²	V		X
<i>Thalassarche melanophris</i>	Black-browed Albatross ^{1 2}	V	V	X
<i>Thalassarche salvini</i>	Salvin's Albatross ²	V		X
<i>Thalassarche steadi</i>	White Capped Albatross ²	V		X
<i>Tyto novaehollandiae</i>	Masked Owl ¹	V		✓
<i>Tyto tenebricosa</i>	Sooty Owl ¹	V		✓
<i>Xanthomyza phrygia</i>	Regent Honeyeater ^{1 2}	E1	E	X
<i>Xenus cinereus</i>	Terek Sandpiper ¹	V		X
Mammals				
<i>Cercartetus nanus</i>	Eastern Pygmy-possum ¹	V		✓
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat ^{1 2}	V,	V	✓
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll ^{1 2}	V	E	✓
<i>Dasyurus viverrinus</i>	Eastern Quoll ¹	E1		X
<i>Dugong dugon</i>	Dugong ¹	E1		X
<i>Eubalaena australis</i>	Southern Right Whale ^{1 2}	E	E	X
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle ¹	V		✓

Tables

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Potential Occurrence at the Site
<i>Isoodon obesulus obesulus</i>	Southern Brown Bandicoot ^{1 2}	E1	E	✓
<i>Macropus parma</i>	Parma Wallaby ¹	V		X
<i>Megaptera novaengliaea</i>	Humpback Whale ^{1 2}	V	V	X
<i>Miniopterus australis</i>	Little Bent-wing Bat ¹	V		✓
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bent-wing Bat ¹	V		✓
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat ¹	V		✓
<i>Myotis adversus</i>	Large-footed Myotis ¹	V		✓
<i>Petaurus australis</i>	Yellow-bellied Glider ¹	V		X
<i>Petaurus norfolcensis</i>	Squirrel Glider ¹	V		✓
<i>Phascolarctos cenereus</i>	Koala ¹	V		X
<i>Physester macrocephalus</i>	Sperm Whale ¹	V		X
<i>Potorous tridactylus</i>	Long-nosed Potoroo ^{1 2}	V	V	✓
<i>Pseudomys gracilicaudatus</i>	Eastern Chestnut Mouse ¹	V		X
<i>Pteropus poliocephalus</i>	Grey-headed Flying Fox ^{1 2}	V	V	✓
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail Bat ¹	V		✓
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat ¹	V		✓

Bold = recorded on site

✓ = Possible

X = Unlikely

1 = Threatened species listed under TSC Act 1995 previously recorded within 10km of the Site

2 = Threatened species listed under EPBC Act 1999 or species habitat predicted to occur within 10km of the Site (excluding migratory species).

Tables

Table 3: Plant species recorded during the July and November 2006 surveys

Botanical name	Common Name
Adiantaceae	
<i>Adiantum aethiopicum</i>	Maidenhair Fern
Alismataceae	
Apiaceae	
<i>Actinotus helianthi</i>	Flannel Flower
<i>Daucus carota</i> *	Wild Carrot
<i>Hydrocotyle bonariensis</i> *	Kurnell Curse
<i>Platysace lanceolata</i>	Shrubby Platysace
Apocynaceae	
<i>Gomphocarpus physocarpus</i> *	Balloon Cotton Bush
<i>Tylophora barbata</i>	Bearded Tylophora
Arecaceae	
<i>Livistona australis</i>	Cabbage Tree Palm
Asteraceae	
<i>Ageratina adenophora</i> **	Crofton Weed
<i>Alopecurus pratensis</i> *	
<i>Bidens pilosa</i> **	Cobblers Pegs
<i>Chrysanthemoides monilifera</i> subsp. <i>rotundata</i> **	Bitou Bush
<i>Cirsium vulgare</i> *	Spear Thistle
<i>Conyza sumatrensis</i> *	Tall Fleabane
<i>Gamochaeta americana</i> *	Cudweed
<i>Hypochaeris radicata</i> *	Flatweed
<i>Ozothamnus diosmifolius</i>	
<i>Senecio madagascariensis</i> *	Fireweed
<i>Taraxacum officinale</i>	Dandelion
Bignoniaceae	
<i>Pandorea pandorana</i>	Wonga Wonga Vine
Blechnaceae	
<i>Doodia aspera</i>	Rasp Fern
Casuarinaceae	
<i>Allocasuarina littoralis</i>	Black She-oak
Convolvulaceae	

Tables

Botanical name	Common Name
<i>Dichondra repens</i>	Kidney Weed
Commelinaceae	
<i>Commelina cyanea</i>	
Cunionaceae	
<i>Ceratopetalum gummiferum</i>	Christmas Bush
Cyperaceae	
<i>Schoenoplectus validus</i>	River Club Rush
<i>Schoenus melanostachys</i>	
Dennstaedtiaceae	
<i>Histiopteris incisa</i>	Bats Wing Fern
<i>Pteridium esculentum</i>	Common Bracken
Dicksoniaceae	
<i>Calochlaena dubia</i>	Common Ground Fern
Dilleniaceae	
<i>Hibbertia monogyna</i>	Leafy Guinea Flower
Eleocarpaceae	
<i>Elaeocarpus reticulatus</i>	Blueberry Ash
<i>Tetradlea thymifolia</i>	Thyme Pink-Bells
Epacridaceae	
<i>Epacris pulchella</i>	NSW Coral Heath
<i>Leucopogon microphyllus</i>	Prickly Beard-Heath
<i>Monotoca scoparia</i>	
<i>Styphelia laeta</i>	Five-Corners
Euphorbiaceae	
<i>Amperea xiphoclada</i>	Broom Spurge
<i>Phyllanthus hirtellus</i>	
<i>Ricinocarpus pinifolius</i>	Wedding Bush
Fabaceae	
Subf. Faboides	
<i>Bossiaea heterophylla</i>	Variable Bossiaea
<i>Dillwynia floribunda</i>	
<i>Dillwynia retorta</i> subsp. <i>retorta</i>	Heathy Parrot-Pea
<i>Desmodium rhytidophyllum</i>	
<i>Hardenbergia violacea</i>	False Sarsparilla

Tables

Botanical name	Common Name
<i>Kennedia rubicunda</i>	Dusky Coral Pea
<i>Lotus</i> sp.*	
<i>Pultenaea</i> sp.	
<i>Trifolium</i> sp.*	Clover
<i>Ulex europaeus</i> **	Gorse
Subf. Mimosoides	
<i>Acacia elongate</i>	Slender Wattle
<i>Acacia floribunda</i>	
<i>Acacia longifolia</i> var <i>sophorae</i>	Golden Wattle
<i>Acacia ulicifolia</i>	Prickly Moses
Geraniaceae	
<i>Pelargonium inodorum</i>	
<i>Pelargonium australe</i>	Wild Geranium
Gleicheniaceae	
<i>Gleichenia dicarpa</i>	Coral Fern
<i>Sticherus flabellatus</i>	Umbrella Fern
Goodeniaceae	
<i>Dampiera stricta</i>	
<i>Goodenia ovata</i>	Hop Goodenia
Haloragaceae	
<i>Gonocarpus teucroides</i>	Raspwort
Iridaceae	
<i>Watsonia meriana</i> var <i>bulbillifera</i> *	Bulbil Watsonia
Juncaceae	
<i>Juncus continuus</i>	
Lamiaceae	
<i>Stachys arvensis</i> *	Stagger Weed
Liliaceae	
<i>Dianella caerulea</i> var <i>producta</i>	Blue Flax Lily
<i>Dianella pruinina</i>	
Lobeliaceae	
<i>Lobelia dentata</i>	
Loganiaceae	
<i>Logania albiflora</i>	

Tables

Botanical name	Common Name
Malvaceae	
<i>Modiola caroliniana</i> *	
<i>Sida rhombifolia</i> *	Paddys Lucerne
Osmundaceae	
<i>Todea barbara</i>	King Fern
Myrtaceae	
<i>Angophora costata</i>	Smooth-Barked Apple
<i>Callistemon linearis</i>	Narrow-leaved Bottlebrush
<i>Corymbia gummifera</i>	Red Bloodwood
<i>Eucalyptus haemastoma</i>	Broad Leaved Scribbly Gum
<i>Eucalyptus piperita</i>	Sydney Peppermint
<i>Eucalyptus umbra</i>	Broad-leaved White Mahogany
<i>Kunzea ambigua</i>	Tick Bush
<i>Leptospermum polygalifolium</i>	Tantoon
<i>Leptospermum trinervium</i>	Slender Tea-tree
<i>Syncarpia glomulifera</i>	Turpentine
<i>Tristanopsis laurina</i>	Water Gum
Nyctaginaceae	
<i>Boerhavia erecta</i> *	Tar Vine
Onagraceae	
<i>Ludwigia peploides</i> subsp.. <i>montevidensis</i>	
Oxalidaceae	
<i>Oxalis</i> sp.*	
Philesiaceae	
<i>Eustrephus latifolius</i>	Wombat Berry
Phytolaccaceae	
<i>Phytolacca octandra</i> *	Inkweed
Plantaginaceae	
<i>Plantago lanceolata</i> *	Lamb's Tongues
Poaceae	
<i>Andropogon virginicus</i> *	Whiskey Grass
<i>Aristida vagans</i>	Three Awn Spear Grass
<i>Briza maxima</i> *	Shaking Grass
<i>Cortaderia selloana</i> **	Pampass Grass

Tables

Botanical name	Common Name
<i>Entolasia stricta</i>	Wiry Panic
<i>Eragrostis brownii</i>	Brown's Lovegrass
<i>Holcus lanatus</i> *	Yorkshire Fog
<i>Imperata cylindrica</i>	Bladey Grass
<i>Panicum simile</i>	Two-coloured Panic
<i>Paspalum urvillei</i> *	
<i>Pennisetum clandestinum</i> *	Kikuya Grass
<i>Poa affinis</i>	
<i>Setaria gracilis</i> *	Slender Pigeon Grass
<i>Zoysia macrantha</i>	Coast Couch
Polygonaceae	
<i>Muehlenbeckia gracillima</i>	Slender Lignum
Proteaceae	
<i>Banksia ericifolia</i>	Heath Banksia
<i>Banksia serrata</i>	Old Man Banksia
<i>Banksia spinulosa var spinulosa</i>	Hairpin Banksia
<i>Grevillea buxifolia</i>	Red Spider Flower
<i>Grevillea sericea</i>	Grey Spider Flower
<i>Isopogon anemonefolius</i>	Drumsticks
<i>Persoonia lanceolata</i>	Lance Leaf Geebung
<i>Persoonia levis</i>	Broad-Leaved Geebung
<i>Persoonia linearis</i>	Narrow-Leaved Geebung
<i>Persoonia pinnifolia</i>	Pine-Leaved Geebung
<i>Xanthosia pilosa</i>	Woody Pear
Restionaceae	
<i>Gahnia sieberiana</i>	Saw Sedge
<i>Lepyrodia scariosa</i>	
Rutaceae	
<i>Boronia ledifolia</i>	Sydney Boronia
<i>Eriostemon australasicus</i>	Pink Wax Flower
Sapindaceae	
<i>Dodonaea triquetra</i>	Large-Leaf Hop Bush
<i>Cardiospermum grandiflorum</i>	Balloon Vine
Santalaceae	

Tables

Botanical name	Common Name
<i>Exocarpos strictus</i>	Pale-fruit Ballart
Solanaceae	
<i>Boerhavia erecta</i> *	Tar Vine
<i>Solanum avicular</i>	
<i>Solanum nigrum</i> *	Blackberry Nightshade
<i>Solanum pungetium</i>	
Sterculaceae	
<i>Lasiopetalum</i> sp.. (possibly <i>ferruginum</i>)	
Stylideaceae	
<i>Stylidium productum</i>	Trigger Plant
Verbenaceae	
<i>Lantana camara</i> **	Lantana
<i>Verbena bonariensis</i> *	Purple Top
Xanthoroeaceae	
<i>Lomandra cylindrica</i>	
<i>Lomandra obliqua</i>	Fishbones
<i>Xanthoroea arborea</i>	Broadleaf Grass-Tree
<i>Xanthoroea media</i>	Forest Grass-Tree
Zamiaceae	
<i>Macrozamia communis</i>	Burrawang

- Exotic

** Declared noxious weed for Gosford Local Government Area

Table 4: Fauna species recorded during the July and November 2006 surveys

Common Name	Scientific Name
Aves	
Grey Teal	<i>Anas gracilis</i>
Red Wattlebird*	<i>Anthochaera carnunculata</i>
Little Wattlebird	<i>Anthochaera chrysoptera</i>
Wedge-tailed Eagle*	<i>Aquila audax</i>
Sulfur Crested Cockatoo*	<i>Cacatua galerita</i>
Australian Wood Duck	<i>Chenonetta jubata</i>
Grey Strike-thrush	<i>Colluricincla harmonica</i>
Black-faced Cuckoo Shrike	<i>Coracina novaehollandiae</i>
Australian Raven	<i>Corvus coronoides</i>
Grey Butcherbird*	<i>Cracticus torquatus</i>
Kookaburra*	<i>Dacelo novaeguineae</i>
White-faced Heron	<i>Egretta novaehollandiae</i>
Black-shouldered Kite*	<i>Elanus axillaris</i>
Eastern Yellow Robin	<i>Eopsaltria australis</i>
Common Koel*	<i>Eudynamys scolopacea</i>
Australian Kestrel	<i>Falco cenchroides</i>
Peregrine Falcon*	<i>Falco peregrinus</i>
Diamond Dove*	<i>Geopelia cuneata</i>
Bar-shouldered Dove*	<i>Geopelia humeralis</i>
White-bellied Sea-eagle*	<i>Haliaeetus leucogaster</i>
Whistling Kite*	<i>Haliastur sphenurus</i>
Welcome Swallow	<i>Hirundo neoxena</i>
White-eared Honeyeater*	<i>Lichenostomus leucotis</i>
Superb Fairy-wren*	<i>Malurus cyaneus</i>
Variegated Wren*	<i>Malurus lamberti</i>
Red-browed Firetail*	<i>Neochmia temporalis</i>
Boo-book Owl*	<i>Ninox boobook</i>
Southern Boobook Owl*	<i>Ninox novaeseelandiae</i>
Golden Whistler	<i>Pachycephala pectoralis</i>
Spotted pardalote*	<i>Pardalotus punctatus</i>
Striated Pardalote*	<i>Pardalotus striatus</i>
Australian Pelican	<i>Pelecanus conspicillatus</i>

Tables

Common Name	Scientific Name
Noisy Friarbird*	<i>Philemon corniculatus</i>
Willie Wagtail	<i>Rhipidura leucophrys</i>
Spotted Turtle-Dove*	<i>Streptopelia chinensis</i>
Australasian Grebe*	<i>Tachybaptus novaehollandiae</i>
Australian White Ibis	<i>Threskiornis aethiopica</i>
Sacred Kingfisher	<i>Todiramphus sanctus</i>
Rainbow Lorikeet	<i>Trichoglossus haematodus</i>
Reptilia	
Copper tail skink	<i>Ctenotus taeniolatus</i>
Wall Skink*	<i>Cryptoblepharus virgatus</i>
Delicate Litter Skink*	<i>Lampropholis delicata</i>
Diamond Python	<i>Morelia spilota spilota</i>
Eastern Water Skink*	<i>Eulamprus quoyii</i>
Lace Monitor*	<i>Varanus varius</i>
Leaf-tailed Gecko*	<i>Phyllurus platurus</i>
Lesueurs Gecko*	<i>Oedura lesueurii</i>
Mountain Dragon*	<i>Rankinia diemensis</i>
Red-bellied Black Snake*	<i>Pseudechis porphyriacus</i>
Water Dragon*	<i>Physignathus lesuerurii</i>
Whites Skink*	<i>Egernia whitii</i>
Yellow-faced Whip Snake*	<i>Demansia psammophis</i>
Amphibia	
Broad-palmed Frog*	<i>Litoria latopalmata</i>
Brown Tree Frog*	<i>Litoria peronii</i>
Common Eastern Froglet	<i>Crinia signifera</i>
Dwarf Green Tree Frog*	<i>Litoria fallax</i>
Eastern Dwarf Tree Frog*	<i>Litoria fallax</i>
Freycinet's Frog*	<i>Litoria freycineti</i>
Green Leaf Tree Frog*	<i>Litoria phyllochroa</i>
Red-crowned Toadlet**	<i>Pseudophyrne australis</i>
Dusky Toadlet*	<i>Uperoleia fusca</i>
Mammalia	
Bush Rat*	<i>Rattus fuscipes</i>
Common Brush Tail Possum	<i>Trichosurus vulpercula</i>

Tables

Common Name	Scientific Name
European Red Fox*	<i>Vulpes vulpes</i>
Grey-headed Flying-fox**	<i>Pteropus poliocephalus</i>
White-striped Mastiff Bat*	<i>Tadarida australis</i>
Eastern Freetail Bat*+	<i>Mormopterus norfolkensis</i>
Eastern Horseshoe Bat*	<i>Rhinolophus megaphyllis</i>
Gould's Wattled Bat*	<i>Chalinolobus gouldii</i>
Chocolate Wattled Bat*	<i>Chalinolobus morio</i>
Little Bent-wing Bat*+	<i>Miniopterus australis</i>
Large Bent-wing Bat*	<i>Miniopterus schreibersii</i>
Large-footed Myotis**	<i>Myotis adversus/macropus</i>
Little Forest Bat*	<i>Vespadelus vulturnus</i>
Red-necked Wallaby ^x	<i>Macropus rufogriseus</i>
Ringtailed Possum*	<i>Pseudocheirus peregrinus</i>
Short-beaked Echidna ^x	<i>Tachyglossus aculeatus</i>
Swamp Wallaby ^x	<i>Wallabia bicolor</i>
Invertebrates	
Giant Dragonfly⁺	<i>Petalura gigantea</i>

Bold = recorded on site

- X = Observed by scat identification
- * = Additional species observed during November 2006 surveys
- + = Denotes a TSC and/or EPBC Act listed species.

Table 5: Weed species recorded during the November 2006 surveys

Botanical name	Common Name	Status
Apiaceae		
<i>Daucus carota</i> *	Wild Carrot	U
<i>Hydrocotyle bonariensis</i> *	Kurnell Curse	U
Apocynaceae		
<i>Gomphocarpus physocarpus</i> *	Balloon Cotton Bush	U
Asteraceae		
<i>Ageratina adenophora</i> **	Crofton Weed	Class 4
<i>Alopecurus pratensis</i> *		
<i>Bidens pilosa</i> *	Cobblers Pegs	U
<i>Chrysanthemoides monilifera</i> **	Bitou Bush	Class 4
<i>Cirsium vulgare</i>*	Spear Thistle	U
<i>Conyza sumatrensis</i> *	Tall Fleabane	U
<i>Gamochaeta americana</i>*	Cudweed	U
<i>Hypochaeris radicata</i> *	Flatweed	U
<i>Senecio madagascariensis</i> *	Fireweed	U
<i>Taraxacum officinale</i> *	Dandelion	U
Fabaceae		
Subf. Faboides		
<i>Lotus</i> sp.*		U
<i>Trifolium</i> sp.*	Clover	U
<i>Ulex europaeus</i> **	Gorse	Class 3
Iridaceae		
<i>Watsonia meriana</i> var <i>bulbillifera</i> *	Bulbil Watsonia	
Lamiaceae		
<i>Stachys arvensis</i> *	Stagger Weed	U
Malvaceae		
<i>Modiola caroliniana</i> *	Red-flowered Mallow	U
<i>Sida rhombifolia</i> *	Paddys Lucerne	U
Nyctaginaceae		
<i>Boerhavia erecta</i> *	Tar Vine	U
Oxalidaceae		
<i>Oxalis</i> sp.*		Class 5 (NSW)

Tables

Botanical name	Common Name	Status
Phytolaccaceae		
<i>Phytolacca octandra</i> *	Inkweed	U
Plantaginaceae		
<i>Plantago lanceolata</i> *	Lamb's Tongues	U
Poaceae		
<i>Andropogon virginicus</i> *	Whiskey Grass	U
<i>Briza maxima</i> *	Shaking Grass	U
<i>Cortaderia selloana</i> **	Pampas Grass	Class 4
<i>Holcus lanatus</i> *	Yorkshire Fog	U
<i>Paspalum urville</i> *	Vasey Grass	U
<i>Pennisetum clandestinum</i> *	Kikuyu Grass	U
<i>Setaria gracilis</i> *	Slender Pigeon Grass	U
Solanaceae		
<i>Solanum nigrum</i> *	Blackberry Nightshade	U
Verbenaceae		
<i>Lantana camara</i> **	Lantana	Class 5 (NSW)
<i>Verbena bonariensis</i> *	Purple Top	

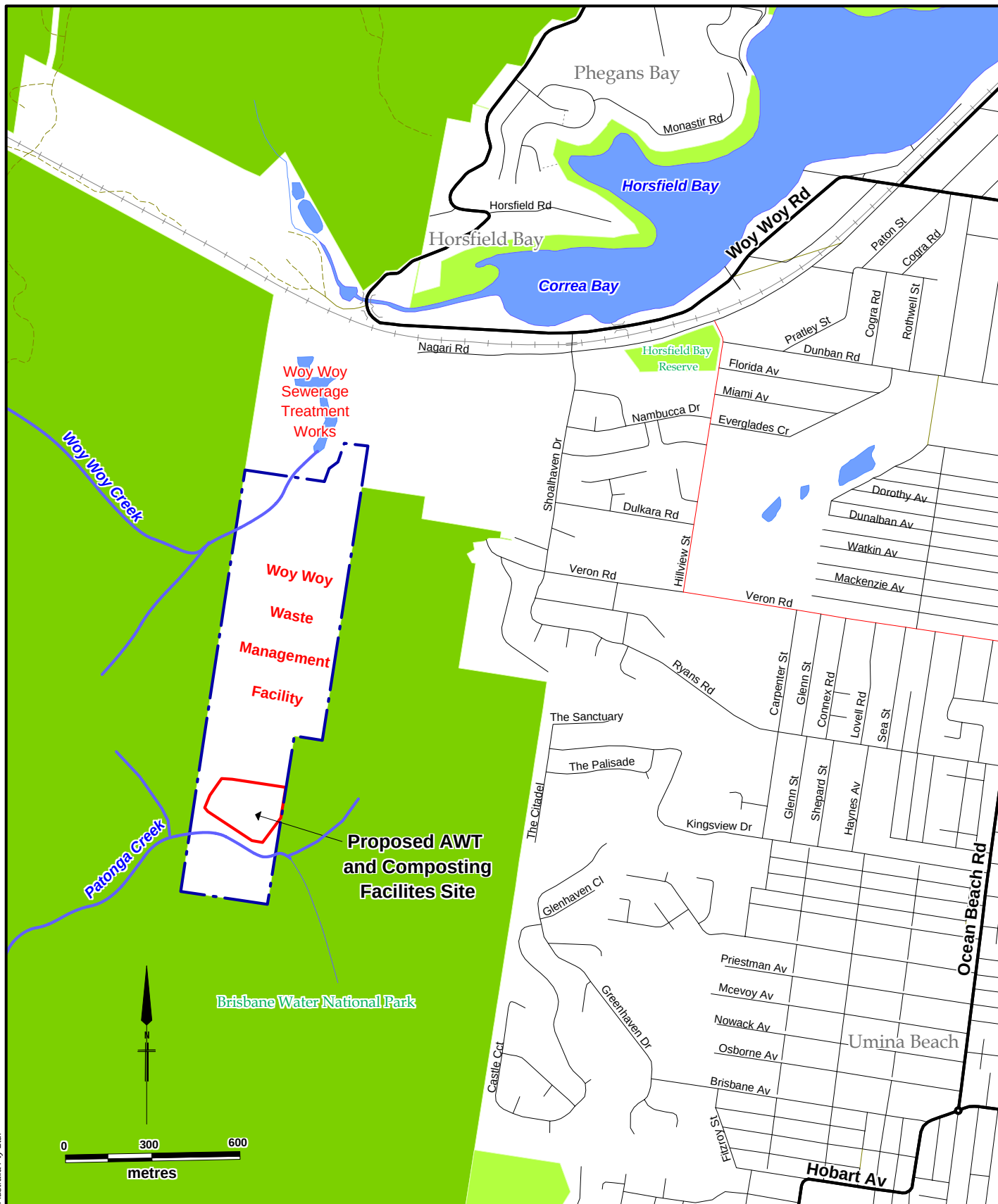
* Exotic

** Declared noxious weed for Gosford Local Government Area

U – Unlisted

(NSW) – all of NSW declaration.

Figures



Legend

- Property Boundary
- Project Boundary

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Datum: GDA94, Projection: UTM, Grid: MGA Zone 56

Client GOSFORD CITY COUNCIL	Project WOY WOY WASTE MANAGEMENT FACILITY	Title SITE LOCATION						
	<table border="1"> <tr> <td>Drawn: AJW</td><td>Approved: FINAL</td><td>Date: 21.08.06</td></tr> <tr> <td>Job No: 43177409</td><td colspan="2">File No: 43177409-034.wor</td></tr> </table>	Drawn: AJW	Approved: FINAL	Date: 21.08.06	Job No: 43177409	File No: 43177409-034.wor		Figure: 1
Drawn: AJW	Approved: FINAL	Date: 21.08.06						
Job No: 43177409	File No: 43177409-034.wor							

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Proposed AWT Facility Site 10m x 10m Vegetation Survey Quadrat Vegetation Area Search Vegetation Transects Random Meander Survey Area* Source: Aerial Photography Supplied by Gosford City Council * performed during July 2006 flora survey as well as November 2006 weeds and fauna surveys		Client	Project		Title
URS		GOSFORD CITY COUNCIL		WOY WOY WASTE MANAGEMENT FACILITY	FLORA SURVEY EFFORT
		Drawn: AJW		Approved: FINAL	Date: 17/08/2007
		Job No: 43177409		File No: 43177409-002.wor	