Appendix A – Summary of comments received from stakeholders

A summary of the issues raised by the community during various consultation activities. These comments include those received via email and letter correspondence, as well as through the facilitated stakeholder meetings held early in the process.

It should be noted that consultation also occurred on the management options for the Wollongong Dunes in the form of an interactive discussion at the stakeholder workshops held in December 2012. These management options fell under the broad headings of; maintain current management actions, manage vegetation, reshape dunes, structural solutions, education, improved ongoing maintenance of dunes and other. The input received from the community and stakeholder consultation was used to form the long list of options.

Issue	Sub-categories	
Safety	Beach erosion / Scarping (Scarping or erosion caused by storm events, stormwater flow, changed wave conditions and high tide activity. Scarping caused by *Acacia* spp.)	• Vegetation roots in dunes form steep scarps after large storms have eroded away the base of the scarp. By preventing the dune from collapsing, these roots hinder the formation of a gradual wind profile, necessary for the beach to repair its damage. • Woonona, Bulli and Wollongong City Beaches are high risk beaches and require management of the scarping dunes. There is a risk that children may tunnel into the face of the dunes and this could make it collapse (fatality risk). • Coastal Dune system erosion at Woonona Beach is at extreme levels now. The Coastal Zone Management Plan states in matrix 6.11.2 'Treatment Options' that nothing should be done which the club concedes is unacceptable. The extreme beach erosion needs to be controlled by removing the vegetation as far back as the original containment fence. • Council should consider pro-active management of beaches and coastal dunes to maximise the volume of sand in front of existing development to protect the shoreline especially where existing council assets exist (e.g. cycle ways). • A detailed risk assessment should be undertaken on a site specific basis. Future shoreline recession as a result of sea level rise in the CZMP is questionable. • Most beaches identified in the Public Safety Risk Assessment report have suffered erosion as a result of storm events and wave action. As a result there is a scarp affecting some parts of the beaches. There are stormwater outlets where runoff is also causing a scarp. This has a high risk factor in relation to collapse and falls. This may affect walkers and children that may dig into the walls of the scarp. Temporary signage, barriers and surveillance could help to manage these

Issue	Sub-categories	
		issues for the time being. More sustainable and effective mitigation measures, however, are required.
	Line of sight impediment (Impaired visibility from the 'crow's nest', Surf Life Saving Club (SLSC), tower or other beach facilities)	• Vegetation within 200m either side of a SLSC or Lifesaver 'Crow's Nest' should be lopped to a height of no more than 4ft to improve line of sight down to the water's edge. • Line of sight issues at Towradgi, Bellambi, Windang and Fairy Meadow beaches. The height of the vegetation makes it difficult to view the beach and water line from the observation areas in and around the SLSC clubhouses. • The increased vegetation is causing loss of sight issued for lifesavers and Woonona patrolling members, who cannot watch swimmers from the shelter of the Woonona SLSC during inclement weather. This is similar for all nine beaches with line of sight issues, during the beach season the majority of the patrols by SLSC are undertaken from the shore. Unless they have access to the towers most patrols are moved back to the shelter of the SLSC in inclement weather which is often too far back from the shoreline to be effective. Ideally where towers are present (Woonona, Corrimal, Fairy Meadow, Port Kembla) both WCC Lifeguards and SLSC could share these facilities • Dune vegetation has impacts on the surveillance ability of lifeguards and lifesavers. To address this issue dune management programmes need to ensure that species selected for planting do not adversely impact on the sight lines of emergency services and lifeguards. Species that have been planted should be regularly monitored to ensure that they are not negatively impacting on the provision of safety and emergency services at a location. • Dune vegetation/surveillance hazard has been identified on Perkins Beach. This is considered to be a very high risk area due to the limited line of sight caused by poor dune vegetation management. • Line of sight issues along the cycle way. • Line of sight issues impacting on kite boarders, particularly in high tide near the launch area. Hazard of kites getting tangled in bushes.

Issue	Sub-categories	
		• Line of sight issues for holiday makers, in particular the caravan parks. • There should be less reliance on the ideas of new towers. • There is no line of sight from Corrimal SLSC. • The tall vegetation needs to be removed to improve the line of sight which should be 100m north and 200m south of the beaches. • The water at high tide mark needs to be visible from the SLSC at all times. • There is no line of sight at the north end of Bulli beach, this needs to be corrected.
	Swimming conditions (Changed shoreline currents causing the formations of strong rips. *Acacia* spp. trapping sand and changing currents causing rips)	• Conditions are dangerous due to the changed shoreline currents. The vegetation makes the safe shoreline gradient non-existent, only deep gutters in their place. • The formations of strong rips, which are not only perilous to people, but accelerate the loss of sand out to sea in the wave zone. • Rips and gullies are occurring which can impact the safety of holiday makers, especially those from the caravan parks.
	Anti-social or Illegal behaviour (Behaviour that disturbs others at the site, such as alcohol and drug use and offensive or intimidating behaviour)	• New towers would encourage vandalism. • Vegetation hides anti-social behaviour such as rape, theft, drugs and homicide.
	Snakes (Presence of snakes posing a threat to safety)	• The excessive vegetation encourages snakes. • Snakes are a cause of concern for nippers.
Vegetation and Ecology	Overgrown vegetation (Specific mention to native or planted vegetation that has encroached beyond the existing fence line or the overgrowing of the beach)	• Request for Council to consider a Vegetation Management Plan. Stakeholder has claimed that the 'out of control' vegetation is one of the most significant contributors to beach erosion. • The forward progression of secondary vegetation towards the shoreline need to be stopped. If the incipient dune becomes over-run by secondary vegetation, the sand which this vegetation

Issue	Sub-categories	
		'locks up' is no longer available to aid natural beach repair mechanisms and erosion results. • Concerns surrounding the uncontrolled spread of dune vegetation plants that affect the Lifesaving Club. • The containment fences at Woonona Beach have not been successful in containing the spread of vegetation which is now out of control. This makes the beach space unusable during high tide periods. • City beach is in poor condition because of the shoreward encroachment of vegetation. Vegetation has forces scarping to occur on the front of the beach meaning that sand is always wet and cannot be blown and wave action becomes reflective and erosive. • All vegetation larger than 1m should be removed.
	Dune replanting (Native or planted vegetation that has been introduced or replanted on the dune surfaces. Inappropriate species have been planted and should be replaced by other species)	• All beaches and beach dunes are under 'high' or 'extreme' risk at the current timeframe, and as such, dune revegetation works need to be given the highest priority. • Dune planting has very serious long-term effects and should be halted immediately. Where the dunes have been planted, the vegetation should be removed or thinned. Wind blow-outs should be left undisturbed. • Dune re-vegetation plants hold the shoreline so tightly that the wave action causes steep shoreline drop-offs. The public is put at risk of being washed into the sea by plunging or surging breaker. High risk for young children. • Dunes do not need to be stabilised.
	Vegetation removal (Existing dune vegetation needs to be removed to leave bare sand)	• Vegetation must be cleared from intertidal zones, a wide beach berm must be maintained, only appropriate beach grasses should be planted on the incipient dune and Council should acknowledge only a narrow width of secondary vegetation to protect land assets from sand blow-outs. • Immediately remove the vegetation back to the original fence. Shape the beach slope at the

Issue	Sub-categories	
		dangerous locations at the beaches in question. • The vegetation should be removed from out the front of the SLSCs. • Reduce the vegetation 250m either side of SLSCs. • The vegetation should be removed south of the bridge at Bellambi. • SLSCs are willing to assist in removing vegetation where needed. • All non-complying vegetation should be removed.
	Acacia sophorae should be removed (Specific mention of the need to remove Coastal Wattle *Acacia sophorae*)	• There should be regular maintenance to protect the dunes. • SLSCs should be involved in the maintenance of the dunes. • All large plants should be removed. • Coastal wattle should be removed.
	Vegetation protecting from erosion/dune stability (The role of vegetation in stabilising the dunes and providing protection from erosion)	• The dunes used to be held together by spinifex and pigface. • Vegetation should be maintained south facing towards Fairy Meadow at Towradgi.
	Education about the role of vegetation and dunes (The community lack of understanding of the positive function of vegetation or natural beach processes)	• Dune vegetation maintenance needs to be conducted in an educated manner by the SLSCs and community groups. • A dune care group should be established for beach maintenance. • Defined management plans should be developed and maintained.

Issue	Sub-categories	
Weeds and Vermin	Weed encroachment (Introduction/encroachment of weed vegetation inhibiting natural beach repair. Weed defined as what the community considered to be a weed i.e. Can include *Acacia sophorae*)	• *Acacia longifolia* subsp. *sophorae* is a bush tucker plant and is identified as a weed in the Dune Management manual and should be treated as such. This weed runs horizontally over sandy beach soils. It is aggressive and all-consuming on beach environments, devouring beach grasses. Council should not seek to legitimise the presence of this weed on the beaches for cost reasons. • Coastal Wattle has disfigured the regions beaches as it has accidentally spread to where it is not supposed to be. It totally covers the intertidal zone on Bulli, Woonona, Corrimal, Towradgi, Fairy Meadow, City Beach and Port Kembla Beaches down to The Lake Entrance.
	Vermin (Feral animals and pests (e.g. rats, rabbits)	• Rats and vermin, including poisonous snakes infest the dune vegetation. • The excessive vegetation encourages rats and rabbits and they then encroach on the Bulli Caravan Park.
Access	Impaired access (Access to the beach is restricted)	• Impaired access for kite surfers. • It is impossible to walk over the dunes near Bellambi Lagoon. • There needs to be rear access for ATV patrols above the high tide mark.
Beach Amenity	Recreational use (Reduced beach width impacts on recreational use. Recreational use of the beach is inhibited at high tide and/or during times of increased wave activity)	• Saving lives and dune protection for beach amenity should be the first priority. • The dunes need to be maintained at Towradgi to enable the beach to be used for SLSC activities.
	Litter (Beach users leave litter on the beach)	• Wind borne litter gets trapped in the vegetation, and it's unsightly.
Property and Assets	Property Value (Perception of changes to property values as a result of changed beach conditions or proposed coastal management plans. e.g.	• Council should reject the proposal retreat as an option for Woonona Beach. Instead there should be a draft Implementation Plan that highlights management of the dunes. • Council may decide to reduce the rates of those properties that will be listed in the new Coastal

Issue	Sub-categories	
	Negative Impact on private views)	DCP Chapter, causing significant property devaluations.
	Property Impacts/Damage (Damage or perceived potential damage as a result of changed beach conditions or proposed coastal management plans. Positive asset protection value of dunes)	• The frontal dunes (e.g. at Fairy Meadow) has no ability to wash up and lose energy. Therefore, it hits property with full force. • Property damage along the fence line at the northern end of Corrimal Beach, due to the encroaching vegetation. • The dunes changes at Bulli have exposed the sandstone wall.
Coastal Processes	Dune abnormalities (Any abnormal/unusual dune formation as a result of changed environmental conditions (e.g. dune deflation hollows). e.g. sand building up in the wrong place)	• Prior to the revegetation in the area the dunes were nice and undulating. The vegetation has caused the dunes to now grow and have deflation hollows form.
Out of Scope	Non-related (Any comment or query unrelated to the project or out of scope	• The whole beach should be assessed not just the 100m area in front of the SLSCs.

Appendix B – Online survey - community responses

Prepared by Wollongong City Council May 2013

Wollongong Dune Management Strategy

Online Survey – Summary of Results

Prepared by Wollongong City Council 9 May 2013

INTRODUCTION

The Wollongong Dune Management Strategy was available on the Council website from 19 December 2012 until 28 February 2013, during which time 234 responses were received.

The survey involved four questions. Some components were prescriptive; asking respondents to respond to provided lists (Question 1a and Question 4); others were of an open ended nature (Questions 1b, 2 and 3). Due to the range of responses received for the open questions, responses were grouped into a series of categories and sub-categories. One set, shown in Table 3, related to 'issues'; and were adapted from the Wollongong Coastal Zone Management Plan (2010). The other set, shown in Table 4, related to 'management actions' derived from the survey responses.

Responses that did not fit into a category but still had relevance to the project have been grouped as 'other'. Responses that were beyond the scope of the project were also noted.

Question 1a

Below is a list of issues that have been raised regarding dune management. Please rank the issues in order of importance, where 1 is the most important.

- *Accumulation of sand in vegetated areas*
- *Aesthetic value of dune vegetation*
- *Biodiversity value of dune vegetation*
- *Dune scarps after storms*
- *Line of sight for surf lifesavers (dune height and vegetation)*
- *Loss of beach (width) amenity*
- *Presence of Coastal Wattle (Acacia sophorae)*
- *Role of dunes in asset protection*
- *Vermin/fire*

Note: You do not have to include all issues in your ranking

The survey defined nine issues for ranking. Of the 234 responses, 227 (97%) ranked at least one issue, with 186 (79%) respondents ranking all nine categories. In order to define an overall rank, a simple weighting system was applied. A score of 9 was allocated for a number one ranking, a score of 8 for a number two ranking, and so on until an aggregate score for each priority was established. The aggregate score for each priority was then calculated as a percentage of the total and is displayed in Table 1 as the "Weighted Proportion".

Issues were prioritised relatively evenly, with issues ranked three through to eight separated by a maximum of 0.6% between adjacent ranks. The response indicates that each of these priority areas have at least moderate support across the survey group. The largest differences in responses occurred with the first two ranked priorities which were separated from the adjacent rankings by a 1% and 2% margin respectively.

'Loss of beach (width) amenity' or 'Line of sight for surf lifesavers (dune height and vegetation)' was favoured for ranking as either the number one or number two issue. 'Vermin/fire' and 'Presence of Coastal Wattle (*Acacia sophorae*)' were favoured for the lowest ranking of ninth.

'Biodiversity value of the dune vegetation' scored highly as a number one priority. However, its aggregate weighted score was below 'Dune scarps after storms' and 'Accumulation of sand in vegetated areas'.

Table 1. List of dune management issues and ranking.

		RANK								
PRIORITY	Weighted Proportion	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Loss of beach (width) amenity	14.5%	58	49	27	12	16	15	12	14	8
Line of sight for surf lifesavers (dune height and vegetation)	13.5%	50	31	25	25	20	21	15	11	12
Dune scarps after storms	11.5%	6	26	41	30	28	32	20	17	4
Accumulation of sand in vegetated areas	11.3%	21	18	31	28	29	23	20	24	14
Biodiversity value of dune vegetation	10.8%	38	27	8	20	18	15	28	23	22
Role of dunes in asset protection	10.3%	22	24	23	17	19	22	26	23	25
Aesthetic value of dune vegetation	9.8%	6	21	31	25	23	21	25	23	24
Vermin/fire	9.2%	9	13	19	32	26	28	14	25	40
Presence of Coastal Wattle (*Acacia sophorae*)	9.2%	17	14	15	23	24	20	26	26	37
TOTAL		227	223	220	212	203	197	186	186	186

Question 1b

Are there any other important issues you feel need to be addressed in the strategy that were not listed above? If so, please list them below.

Responses to Question 1b were grouped into categories of issues with accompanying definitions. The number and percentage of responses within each category were noted and the types of responses are listed for each sub-category in Table 3. The categories used in interpreting Question 1b (Table 3) did not directly correspond to

the issues stated in Question 1a (Table 1), although there is significant overlap (Table 2). The categories and sub-categories listed in Table 3 provide a more comprehensive framework for considering the survey responses than the nine issues stated in Question 1a. Additional categories are included for comments related to beach access and the study itself. These categories are then explored in further detail through an additional 31 sub-categories.

Table 2. Comparison of categories of issues used in Question 1a and those generated for interpretation of responses to Question 1b.

Question 1b Category of Issue	**Question 1a Issue**
Safety	Line of sight for surf lifesavers (dune height and vegetation) Dune scarps after storms
Vegetation and ecology	Biodiversity value of dune vegetation
Weeds and vermin	Vermin/fire
Access	
Beach amenity	Loss of beach (width) amenity
Property and assets	Role of dunes in asset protection
Study process	
Coastal processes	Accumulation of sand in vegetated areas
Tourism value/loss of business	

A total of 317 issues were mentioned in the 234 survey responses. No single issue emerged significantly more frequently than others. Of the 317 issues raised, only 29 were beyond the nine categories and 31 sub-categories outlined in Table 3. Significant additional issues identified involved the scope and timing of the Dune Management Strategy, the relationship between dune management and tourism, local employment and property values. Also, additional mention was made relating to vandalism and anti-social behaviour.

Table 3: Issues: Categories, sub categories, definitions, number of mentions, percentage of survey responses , percentage of the total number of times an issue was mentioned and a summary of the responses. Note: Survey respondents could suggest multiple issues.

Issue (total)	Sub-categories	Definition	No. mentions	% of total issues raised (n = 317)	Summary of the responses
1. Safety (63)	a. Beach Erosion / Scarping	Scarping or erosion caused by storm events, stormwater flow, changed wave conditions and high tide activity. Scarping caused by Acacia spp.	21	6.6%	• Dune vegetation causes erosion scarps that lead to an increase in beach erosion due to reflected energy from wave run up. • Sand cliffs present after moderate storms indicate that beach width is insufficient. • Unintended erosion and presence of unstable dune system which wouldn't have happened if Council followed the Coastal Dune Management Manual. Scarps remain present for months even after moderate swell, not just storms. • Sand scarps are formed as the sand builds up in the Coastal Wattle at the back of the beach, depriving the foreshore of sand. The sand deposits become higher at the back of the beach as sand cannot return to the foreshore. • Safety issue for small children playing on dune scarps in back wash area. • Sand scarps could collapse due to tunnelling by children. • Council is risking legal action from the unsafe conditions created. • Dangers of sitting close to unstable dune scarps. • Dangers of walking at high tides under drops offs. • If there is human traffic, the sand dunes should be tapered. • Our beaches are eroding at an increased rate due to the scarps. • Spinifex grass and Coastal Rosemary would be effective dune stabilisers. • Deep rooted vegetation which has been planted along our beaches is causing erosion. e.g. Loss of beach between Flagstaff Hill and Bank Street, Wollongong, where current dune management is taking place compared with the large amount of beach/sand along Coniston Beach between Bank Street and the coal loader breakwater, which has never received dune management or planted vegetation (SLSC member for 56 years, many observations). • There is a 35 degree slope on City Beach.
	b. Line of Sight impediment	Impaired visibility from the 'crow's nest', Surf Life Saving Club (SLSC), tower or other beach	17	5.4%	• Existing tall vegetation and height of dunes prohibits view of ocean and beach. • Large amount of beach/sand and lowest height of sand dunes in the area along Coniston Beach between Bank Street and coal loader breakwater, which has never received dune management or planted vegetation.

Issue (total)	Sub-categories	Definition	No. mentions	% of total issues raised (n = 317)	Summary of the responses
		facilities.			• Dune vegetation height allows almost nil view of City Beach shoreline from Steelers Stadium to the ramp at Wollongong City SLSC. • You can't see the shoreline from either the Lifeguard or SLSC observation towers at City Beach. • Lifesavers can't see the beach from most club houses. • Restricted sight for lifesavers who sit in the club room during wet weather. • Risk of someone walking onto beach and entering the water and not being seen by lifeguards.
	c. Swimming Conditions	Changed shoreline currents causing the formations of strong rips. *Acacia* spp. trapping sand and changing currents causing rips.	8	2.5%	• Vegetation has prevented natural movement of sand and made safe swimming locations dangerous. • Dangerous inshore conditions have developed e.g. rips, deep gutters, troughs, holes and stronger wave action caused by steep beaches and loss of sand banks. • Dangerous conditions even on calm days influenced by lack of sand on the beach. • Beach width is insufficient to dissipate wave energy which in turn causes stronger backwash and consequently strong rips along the beach. e.g. Fairy Meadow and Woonona. • Increase in rip strength may have contributed to drownings on City and Puckey's beaches.
	d. Anti social or illegal behaviour	Behaviour that disturbs others at the site, such as alcohol and drug use and offensive or intimidating behaviour.	11	3.5%	• Camping in bushes on dunes. • Alcohol consumption included underage binge drinking. • Drugs e.g. shooting up and dealing of drugs. • Risk of assaults because the vegetation height restricts sight. • Loitering, vagrants, perverts, sexual predators, flashers, thugs, drunks and a murderer. • Fire crackers and noise. • Dumping of stolen property. • SLSC members have been approached by people about these issues e.g. at Port Kembla Beach. • Beaches specifically mentioned are Woonona, Puckeys and Port Kembla.

Issue (total)	Sub-categories	Definition	No. mentions	% of total issues raised (n = 317)	Summary of the responses
	e. Snakes	Presence of snakes posing a threat to safety.	6	1.9%	• Overgrown dune vegetation has increased the snake population. • Brown snakes have ready meals of rodents and rabbits. • SLSC members have been approached by people about increased sighting of snakes e.g. at Port Kembla Beach.
2. Vegetation and Ecology (81)	a. Overgrown Vegetation	Specific mention to native or planted vegetation that has encroached beyond the existing fence line or the overgrowing the beach.	16	5.0%	• The beaches are disappearing. • Our award winning beaches are compromised by excessive and uncontrolled vegetation growth. • The plants should be maintained within the fenced areas, not the fences moved as the vegetation encroaches. • There is no maintenance program to control overgrowth. • Sand needs space to have its natural movements, introducing so much vegetation destroys that space. • Man made vegetation is spreading towards the water causing unsafe steep sand dunes, loss of natural flow of sand and loss of once gentle sloped beaches. • Vegetation is encroaching on the use of the beach during high tide. • We have lost 50% of our local beach to vegetation (specific beach not mentioned). • Council has failed to maintain a wide beach berm as required in the Coastal Dune Management Manual as it has let the beaches become overgrown with Coastal Wattle. • Massive reduction in size and width of the beach (Port Kembla). • Some areas are well managed for vegetation encroachment onto beach, others are not and there is little beach left. Sandon Point seems to work but Bulli does not. • Woonona and Port Kembla beaches are specifically mentioned.
	b. Dune Replanting	Native or planted vegetation that has been introduced or replanted on the dune surfaces. Inappropriate species have been	11	3.5%	• Planting on the front of the dune has seen the dune advance, reducing beach width, sometimes by more than 50 metres. • Question the appropriateness of current planting regime to natural dune processes. • Improper use of non local vegetation. • Grasses should be planted not large trees.

Issue (total)	Sub-categories	Definition	No. mentions	% of total issues raised (n = 317)	Summary of the responses
		planted and should be replaced by other species.			• The dunes should have Spinifex grass only, which has less visual impact, is more salt resistant that wattle and will re-establish its growth in newly deposited sand quicker than wattle. • The current planted vegetation has done more damage in 20 years than the hundreds of years beforehand. • Species planted by volunteers are too large and block sunlight to properties. • Deep rooted vegetation has caused erosion on Wollongong City Beach (see above in 1a).
	c. Vegetation Removal	Existing dune vegetation needs to be removed to leave bare sand.	5	1.6%	• Remove vegetation from the beaches. • Beaches have been sustaining themselves before Council planted vegetation. • Vegetation will not protect the coast from tsunamis. • Vegetation has been planted where it did not exist before. • Vegetation is unnecessary; sand should flow to the ocean from westerly winds and return to the beach via surf. • Vegetation is causing more problems than what is supposed to protect. • Austinmer, Thirroul and North Wollongong beaches are the widest and least eroded so why is vegetation needed to stabilise the dunes?
	d. *Acacia sophorae* should be removed	Specific mention of the need to remove Coastal Wattle *Acacia sophorae.*	7	2.2%	• Coastal Wattle and other introduced plants are causing the beaches to become increasingly narrow. • Coastal Wattle (secondary dune vegetation) is not supposed to cover the incipient dune or beach berm. • Coastal Wattle can become a weed. • Stop the Wattle creep now. • Wattle is an unsuitable plant.
	e. Ecological function	Importance of vegetation, habitat and biodiversity value. Need for native vegetation.	10	3.2%	• Concern that vegetation will be cleared without due consideration of ecological function and the future generation's use of beaches. • *Acacia sophorae* is a coloniser of dune vegetation – conditions soil, provides the microclimate suitable for other coast species such as *Leucopogan parviflorus, Leptosperum laevegatum, Pelargonium australis* etc. to become established. The habitat value of *Acacia sophorae* for birds, lizards, insects etc should not be

Issue (total)	Sub-categories	Definition	No. mentions	% of total issues raised (n = 317)	Summary of the responses
					under-estimated. The role of coastal sand scrub, (MU45), including *A. sophorae* provides other important amenity values such as windbreak, salt screen and shade. This vegetation often traps windblown plastic litter that would otherwise be blown into the ocean. • *Acacia sophorae* is a bush tucker and medicine plant. • Importance of protection of habitat for small birds, reptiles - provide fresh air, shade, protection from salt spray and wind. e.g. Blue Tongue Lizards and Black Shouldered Kites near Woonona. • It is the ocean cycles, weather patterns, climatic changes that will dictate the overall management capacity for the coastal zone, including the dunes, e.g. growth during wet summers and dieback during drought. • Dynamic system that must have the ability to adjust to the prevailing conditions. • As a lifeguard, the conditions change season to season – line of sight, beach width etc, with no intervention. • Port Kembla – before vegetation, sand was lost as it was blown across the road and taken away in trucks or dumped in one corner of the beach where after one storm it was back on the road. • Accounts from botanist from the first fleet describe dunes systems completely covered by vegetation, most notably Coastal Wattle. Wattle provides habitat and stops sand from being lost forever. • Original vegetation was destroyed and the current situation is the best compromise. • Ecological and cultural value far outweighs need for greater space or views. • Infrastructure and recreation needs should be designed so as to minimise impact on these fragile and important areas. There is more value in a healthy intact dunal system than a wide beach with minimal diversity. • *Acacia longifolia* var. *sophorae* is native to the Illawarra. Even if it was planted on some beaches a long time ago, it has great value, providing habitat for plants and animals, protecting Aboriginal cultural heritage and helping to stabilise dune systems.

Issue (total)	Sub-categories	Definition	No. mentions	% of total issues raised (n = 317)	Summary of the responses
	f. Vegetation protecting from erosion/dune stability	The role of vegetation in stabilising the dunes and providing protection from erosion.	16	5.0%	• The coastal vegetation traps sand and prevents wind blown movement of sand particles into parks, private property and adjacent roads. • Preservation of vegetation for dune stability. • Would rather see dune maintenance by vegetation than hard engineering solutions. • Concern that vegetation will be cleared without consideration for asset protection. • Coastal Wattle is a good dune stabiliser. • Scarps indicate dune is stable, otherwise it would collapse. • Dunes need vegetation to accrete and provide stability. • Sand depletion and accumulation is a natural process. • If vegetation was removed at Towradgi or City beaches, the SLSCs will be washed away, filled with seaweed after storms. • There are many images showing adverse impacts before dunes were stabilised by vegetation (blowouts on road, SLSCs undermined etc). • Following, recent storm evens on 28th and 29th January 2013, I believe plants and trees must remain to provide necessary barrier against such events. • Stability of the coastline is more important than lines of sight. • Some systems can recover naturally - Port Kembla has changed recently due to a series of large storms, sand was washed 200m out to sea. It has since moved slowly back to shore, currently at 50m from the shore. Scarps have collapsed and the beach has changed from 30 degrees slope to flat. Other beaches (Towradgi and City Beach) are narrow, with assets built too close, so dunes are not able to readjust. • Wave and wind action will strip vegetation off beaches if the system needs to; it is not for Council to keep intervening in nature. With rising sea levels and extreme storm events likely to have a major impact on the region, dune vegetation will be a critical first line of defence for Council infrastructure and homes built along the coastal strip.

Issue (total)	Sub-categories	Definition	No. mentions	% of total issues raised (n = 317)	Summary of the responses
	g. Provision of shade	The role of vegetation in providing shade. Need for more shade.	3	0.9%	• Acacia provides shade. • Provide shade, possibly with mechanical structures but preferably high pruned banksias to minimise sun exposure to beach users and users of adjacent pathways.
	h. Protection from vandalism	Vandalism of dune vegetation.	6	1.9%	• Vandalism, illegal clearing and poisoning of dune vegetation for views. • Protect vegetation from vandalism using fence areas. • Leaving vegetation debris after vandalism of vegetation, leaving mess, attracting pests/vermin.
	i. Education about the role of vegetation and dunes	The community lack an understanding of the positive function of vegetation or natural beach processes.	7	2.2%	• Public awareness of dunes, dune vegetation, their importance, role and history of disturbance. Include biodiversity values and role on asset protection. • Education needed about the role of dune vegetation will play in stabilising beach areas as beaches migrate landward. • Signage to inform public about native vegetation growing on the dune, e.g. *Acacia sophorae* is a bush tucker plant. • Don't take coastal management back to the 1970s because people lack the knowledge of dune stabilisation.
3. Weeds and Vermin (23)	a. Weed removal	Removal of existing weeds. Specific mention of *Acacia sophorae* is included in 2d above however some community members consider *Acacia sophorae* a weed but have not identified a weed species.	16	5.0%	• Moth Vine, Turkey Rhubarb, Bitou Bush, Asparagus Fern, Lantana, and many other environmental weed species threaten the integrity of native coastal vegetation on the dunes. • We will have no beach left if the weeds keep growing. • Council should control weed infestation on the Blue Mile. • Weeds are invading; fences are caging in ugly weeds. • The dunes are under a canopy of feral plants/weeds. • Its weed infestation in the name of the green movement.
	b. Vermin	Feral animals and pests (e.g. rats, rabbits).	7	2.2%	• The overgrown vegetation has brought vermin and pests in huge numbers. • The build up of rubbish in the vegetation causes odour and attracts vermin. • Rodents and rabbits attract snakes.

Issue (total)	Sub-categories	Definition	No. mentions	% of total issues raised (n = 317)	Summary of the responses
					• Rats, rabbits and foxes are seen on a weekly basis near WEC and Stadium and in the thick bush at Woonona and Bellambi beaches. • Vermin at City Beach and Woonona due to the scale of dunes and vegetation.
4. Access (15)	a. Impaired Access	Access to the beach is restricted.	12	3.8%	• Need well maintained and controlled access. • Need easy access for SLSC lifesavers, fire fighters, dune managers and public. Includes wide access on cycle paths behind dunes as well. • Unable to transport necessary safety/rescue equipment up and down the beach efficiently. • WCC Lifeguards & Wollongong City SLSC patrols on many occasions can't access the beach with motorised rescue equipment. The past two seasons it has been necessary to travel along the Blue Mile walkway to the Crown Street ramp to place/remove IRB & Patrol equipment on the beach. • Maintenance on the pathway at Port Kembla beach has not been done for some time, it's unsafe. • Entry tracks onto the beach between Woonona and Bellambi are so overgrown that it is very easy to become tangled in the outgrowth of the Acacia and trip over.
	b. Need for access for less able	Access for less able people and wheelchair access.	3	0.9%	• Access for those less mobile. • Recreational value of bicycle/wheelchair/walking paths.
5. Beach Amenity (20)	a. Recreational use	Reduced beach width impacts on recreational use. Recreational use of the beach is inhibited at high tide and/or during times of increased wave activity.	10	3.2%	• In 1960 the beach had sufficient space to hold a surf carnival, now only beaches without vegetation on the dunes, e.g. North Wollongong Beach can do that. • SLSCs struggle to hold events due to limited space. • Need for structures to be able to watch beach events (e.g. steps). • Need improved recreational areas surrounding populated SLSC beach areas. • Vegetation of dunes has led to reduction in the size of beach which reduces the availability of space for people to conduct activities. • At Woonona Beach, you used to be able to sit on grass and watch children playing on the beach, this is no longer possible. • Dune height reduces public activity in the area.

Issue (total)	Sub-categories	Definition	No. mentions	% of total issues raised (n = 317)	Summary of the responses
					• The beaches are currently not a pleasant place to visit.
	b. Litter	Beach users leave litter on the beach.	10	3.2%	• Build up of rubbish in vegetation, causing odour and attracting vermin. • Dunes allow dumping of rubbish. • Council management of rubbish. • Dog faeces. • Syringes. • Rubbish can harm sea and bird life and people.
6. Property and Assets (6)	a. Property Value	Perception of changes to property values as a result of changed beach conditions or proposed coastal management plans. e.g. Negative Impact on private views.	2	0.6%	• Property views being blocked by inappropriate vegetation planting.
	b. Property Impacts / Damage	Damage or perceived potential damage as a result of changed beach conditions or proposed coastal management plans. Positive asset protection value of dunes.	4	1.3%	• Any further loss of sand from the foreshore zone is a recipe for disaster in relation to coastal recession and the loss of infrastructure. Dune vegetation provides the stability and protection needed for much of the infrastructure foolishly built too close to the coastline. • Protection of public infrastructure.
7. Study (17)	a. Scope and timing of study	Any queries relating to scope, timing of the study or project milestones.	13	4.1%	• The project should not be tailored only to please the vested interests of developers or some the residents living in the very front rows of houses along the coast - about house prices rather than the proper use of public land. • I urge you to heed reason and research, not anecdotes given as "evidence" by an angry mob.

Issue (total)	Sub-categories	Definition	No. mentions	% of total issues raised (n = 317)	Summary of the responses
					• This survey seems to be pitched towards the vocal minority that want dune vegetation removed. • This strategy seems overly focused on a problem that is perceived by a small community at one location along the Wollongong coast. • Council is confusing healthy environmental growth with issues of tree hating. • The strategy must be independent. Political influences should not come into play. • Council lifeguards work as paid lifeguard six days a week, surf lifesavers volunteer one day a week. • The study should be whole of beach, not just SLSC areas. • Waiting could cost lives. No more studies, time for action, delays and inactivity is frustrating.
	b. Inadequate consultation	Comments made relating to a perceived lack of consultation with stakeholders and/or the broader community.	4	1.3%	• Get input from locals who know their local beaches. • Recommendations from lifeguards who work six days a week on the beaches should be taken seriously. • Tick a box survey does not allow room to say anything. • Study should be available online, not just in the library to allow better accessibility.
8. Coastal Processes (33)	a. Changed surf conditions or currents	Changed coastal conditions/shoreline currents such as rips. Changed surf conditions (negative changes).	13	4.1%	• Increased rip strength. • Decreased wave quality. Many surf locations changed from excellent to poor for surfing. Only surf is a shore dump. • Degraded surfability of beaches where revegetation has occurred. • Changing of the immediate ocean floor topography affecting the way the waves hit the sand banks. • Need some of the dunes to be mobile to provide sand for surf banks. • At Woonona, Towradgi, East Corrimal and City beaches surfability has noticeably declined in the last 20 years (due to planting of Coastal Wattle).
	b. Dune Repair	Natural dune repair is hindered due to other environmental causes. e.g. Scarp repair.	4	1.3%	• The Acacia have taken away beaches and created unnatural systems where eroding beach fronts are not repairing naturally after storm events. • Previously dunes and the sand width and depth have generally recovered after huge tides and storms, but not anymore.

Issue (total)	Sub-categories	Definition	No. mentions	% of total issues raised (n = 317)	Summary of the responses
	c. Dune Abnormalities	Any abnormal/unusual dune formation as a result of changed environmental conditions (e.g. dune deflation hollows). e.g. sand building up in the wrong place.	16	5.0%	• Vegetation has prevented the natural movement and transfer of sand. • Loss of sand after huge tides and storms. • Sand cannot return to the beach because it is locked up in vegetation. • Accumulation of sand on the sea floor instead of on the once wider beach. • Loss of beach has affected the total structure of most beaches. • Correlation of sand locked in the dunes and the absence of sand banks. • Bellambi Beach - one of the main suppliers of sand to the north has been stagnated; sand cannot reach the creek because impeding wattle which has stopped flow of sand to Bellambi Creek. • Stanwell Park Beach dune has gone from a small mound to a hill that hang gliders fly off, about 300mm per year and accelerating.
9. Business/ Tourism Value (19)	Reduced business/ tourism value	Reduced business and tourism value of the beach, including scenic views from walkways and cycle tracks.	19	6.0%	• Lower wave quality contributes to loss of tourism. • Quality of surf has clear economic impact. • Commercial and recreational value of Puckeys/Stuart Park/North Wollongong. • Height of vegetation reduces views, leading to loss of public viewing amenity of beach and ocean from beach-side picnic areas and cycleway. • People now prefer north coast as holiday destination because of their pristine beaches and the way in which they are managed. • Woonona used to be a good tourist drawcard. • The Blue Mile is an eyesore; you cannot see the beach from the pathways. • Businesses suffer – e.g. kiosk closing (Wollongong City Beach). • Council-owned holiday parks, e.g. Corrimal, running risk of losing tourist dollar.
10. Other (29)		See below for summary of 'other' issues.	29	9.1%	These issues are detailed below.
11. Out of Scope (11)	a. Non-related	Any comment or query unrelated to the project or out of scope. See below for a summary.	11	3.5%	These issues are detailed below.

Other Issues

There were many issues suggested that did not fit into the above categories and are included here for the consideration within the Dune Management Strategy:

- Overdevelopment in coast zone, including development encroachment onto the beach and the need to maintain buffer zones behind the dunes;
- Council has not followed Coastal Dune Management Manual;
- Preservation of Aboriginal heritage, e.g. middens;
- Protection of natural visual amenity;
- Sand was exported out of the region in the past;
- Need for guidance on what/where people can plant;
- Dunecare/Bushcare work is not appropriate and groups move on with no follow up maintenance;
- Removal of marine life from rock platforms and the beach;
- Vegetation traps litter;
- Tidal erosion;
- Pesticide use;
- Wildlife attracted by vegetation wrongly planted on the beach will be washed out to sea in a storm;
- Fire hazard posed by leaf litter under the canopy of Coastal Wattle and Tea Tree at Towradgi Beach;
- It's a 'furphy' that dune vegetation makes a beach unsafe. Beaches can be unsafe due to currents, dumping surf, rips, swimmer competence and surf awareness but are not less safe due to dune vegetation;
- Beach patrols should be done from the beach;
- Lack of disabled access to viewing tower at City Beach;
- Council's flimsy method of closing off unsafe beaches out of patrol and lifeguards hours;
- Wollongong City SLSC's dunes are the result of the fill from the new club house/function centre;
- Why are SLSI getting priority over lifeguards?
- SLSCs are essentially sporting clubs, providing 'life saving' services on Sundays and public holidays. Efforts to manage the environment to meet their needs need to be proportionate to their contribution. Would we be better off with professional lifeguards who need far less infrastructure?
- Need to understand who are GHD and what are their qualifications; and
- A specific recommendation to contact an ex Woonona High School teacher who carried out his thesis back in the 1970's on sand bank setup at Woonona and Bulli Beach.

Out of scope issues

A range of issues have been categorised as out of scope of this project, including matters at specific locations (e.g. East Corrimal Beach, Bellambi Lagoon, Sharkey's

Beach, MM Beach, Wollongong Golf Course, Towradgi Pool (boulders), Port Kembla Harbour) or relating to other issues (e.g. urban development and sediment runoff, smoking, and studies on predicted sea level rise along the coast (the latter is already done)).

Question 2

What management activities do you think Council should consider to address these important issues? Please list them below.

A total of 401 management options were mentioned in the 234 surveys submitted to Council. The following management options were drawn from responses to Question 2 as well as where management options were mentioned in answers to Question 3.

The most common response related to options involving the management of vegetation on the dunes (189 responses). Other management activities suggested by respondents included further research and education on dune management and coastal zone processes, increased services and maintenance activities around dunes, modifications to existing lifesaving facilities and modifications of the dunes.

A number of comments related to the consultation process and the study itself. These comments are detailed in the 'Other Management Activities' section.

Table 4: Management Activities; Categories, subcategories, definitions, number of responses matching the subcategory, percentage of the total number of times activities were mentioned and a summary of the responses. Note; Survey respondents could suggest several activities.

Management Activity (total)	Sub Categories (where relevant)	Definition	No. of Responses	% of total Suggested Activities (N = 401)	Summary of the types of responses
1. Do nothing (adapt) (13)		Leave the dunes as they currently are and adapt to the existing conditions.	13	3.2%	• Maintain dune vegetation to continue to stabilise dunes. Without this planting Wollongong would have lost its beaches. • Support for current vegetation to provide seed banks for natural dynamic dune cycles. • Vegetation and dunes provide protection of our coastal biodiversity. Removal would threaten our coastal communities. • Maintain good work already done. • Vegetation catches litter rather than it going in ocean. • *Acacia longifolia var. sophorae* is native to the Illawarra. • Leave the dunes alone. Let them return to natural state.
2. Manage Vegetation (189)	a. Remove all vegetation	Removal of all dune vegetation.	21	5.2%	• Remove all vegetation from in front of SLSCs. • Remove all vegetation so beaches will return to their natural state. • Let the beaches do their own remediation. • Restore beaches to how they were 40 years ago, no trees or grass. • Bulldoze the vegetation. • In the short term, removal of vegetation to allow the dunes to obtain a greater height. As it stands the dunes are too low to withstand a major storm • Removal of the encroaching vegetation on our beaches, and a return to the dunes that were just as effective at keeping the sand stable over the long term. Bulli beach, between Bulli and Sandon Point, has none of the vegetation we see at Woonona beach yet it is very stable and the beach has a nice width. • Remove all the vegetation - Even though there are no sand dunes, Coastal Wattle or vegetation at North Wollongong Beach and there is a long concrete wall along most of the length of the beach, it has

Management Activity (total)	Sub Categories (where relevant)	Definition	No. of Responses	% of total Suggested Activities (N = 401)	Summary of the types of responses
					been proven time and time again that after very big seas when the Bombora is sending high waves onto the beach, the beach always recovers. This helps in the reasoning that high sand dunes with high vegetation are not required in front of the Wollongong City SLSC building. • North Wollongong and Thirroul beaches don't have the vegetation. They are two of the Illawarra's best beaches.
	b. Manage the vegetation species type	Manage the species of vegetation on the dunes by determining appropriate species, removal of inappropriate species and regeneration with appropriate species. This includes specific references to *Acacia sophorae*.	67	16.7%	• Remove Coastal Wattle (29 mentions). • Remove all the Coastal Wattle – this can be achieved by letting the community help. • Remove excess grass and undergrowth. • Remove inappropriate vegetation and plant species that would have naturally occurred there. • Use historically appropriate vegetation. • Use appropriately heighted vegetation. • Replace with ground covers, grasses such as Spinifex and Marram Grass and Coastal Rosemary. • Use salt resistant grasses. • Maintain some natural structure to dune vegetation including Banksia/Tea Tree for the hind dune. • Establish greater diversity of species in the dunes. • Do not plant tall trees. • Replant everything that grows above 1m in front of lifeguard facilities. • Remove all planted/imported vegetation. • Follow Coastal Dune Management Manual and remove non-complying vegetation. • Investigate dune vegetation that allows sand to be redirected to where it is needed. • Investigate current research of UoW Biology Department. • Publish a list of acceptable native plants, no planting outside this list.

Management Activity (total)	Sub Categories (where relevant)	Definition	No. of Responses	% of total Suggested Activities (N = 401)	Summary of the types of responses
					• Specific mention to remove of trees between Port Kembla beach and the SLSC. • Planting of trees that can obtain a height of >25m on maturity and preferably within 30 years that can form a wind break for sand being blown off the beach. The trees need to be planted at the back of the natural line for the pre 1960 dunes. • Vegetation on the sand dunes should be low growing to allow a clear line of sight for any beach users.
	c. Trim the height of vegetation	Trim the height of the existing vegetation to maintain sightlines.	15	3.7%	• Trim vegetation to a height that does not obstruct view of the beach for lifeguards. • Prune only in front of patrol locations. • Trim where appropriate. • Regularly survey vegetation height.
	d. Remove weeds	Remove weeds, including Bitou Bush and Lantana.	25	6.2%	• Remove Bitou Bush, Lantana, Sassafras Grass. • Remove noxious and environmental weeds. • Specific reference to removal of Bitou Bush and other non native plant from Bellambi, Woonona, East Corrimal, City, Port Kembla and Bulli beaches. • Note - This category does not include <u>specific</u> references to *Acacia sophorae* (these are included above in 'Manage the vegetation species type'). This includes only the weeds listed above or 'weeds' in general (i.e. some respondents may be referring to Acacia because they believe it is a weed but it is impossible for this to be confirmed).
	e. Reduce the area of vegetation encroachment onto beach	Remove the vegetation that has encroached onto the beach.	25	6.2%	• Set defined vegetation area and maintain it within boundaries. • Reduce encroachment to widen beaches. • Reduce area of vegetation that traps sand to prevent steep gradients. • Remove all vegetation back to the vegetation line of 1965. Move the top 2m of the sand that was planted to the surf to reduce the seed load in the sand. • Specific mention to Port Kembla and encroachment of marram grass

Management Activity (total)	Sub Categories (where relevant)	Definition	No. of Responses	% of total Suggested Activities (N = 401)	Summary of the types of responses
					30m past fence line. • Council needs to determine a defined dune width (e.g.5-10m of vegetation) and maintain this width. This is opposed to the current policy of constructing a fence line and letting the dunes grow freely over time, then simply constructing a new fence line to meet the extended growth of the dune. • Each beach should have a specified distance (width) that the vegetation covers. • Any vegetation needs to be kept to the sand dunes only. It should not invade the beach and normal tidal area.
	f. Undertake bush regeneration activities on cleared areas of dunes	Revegetate cleared areas with appropriate dune species.	21	5.2%	• Larger buffer zones and more planting. • Continued planting to prevent erosion. • Plant more vegetation. • Re-vegetate cleared dunes. • Fencing off of native vegetation from human activities. Limiting the area in which people could disrupt ecological processes of the dunes. Planting of native vegetation to stabilise dunes.
	g. Support community involvement in dune vegetation maintenance	Provide support to community groups to assist in dune vegetation maintenance, including Bushcare, Dunecare, and SLSCs.	15	3.7%	• A lot of people want to help with physical work and fundraising. • Includes Landcare, Bushcare, Dunecare, and SLSCs. • Continued and expanded Bushcare activities. Ongoing and adequate Bushcare education. • Vocal support of Landcare and Bushcare groups. • Fund groups to restore the dunes and clean up rubbish. • Allow Dunecare groups to replant and maintain. • Allow SLSCs to maintain vegetation with their machinery and members to help. • Organise community working bees to target specific areas. • Allow SLSC volunteers to replant the area around the SLSCs with Spinifex and low growing species.

Management Activity (total)	Sub Categories (where relevant)	Definition	No. of Responses	% of total Suggested Activities (N = 401)	Summary of the types of responses
					• Organise mass volunteer days to target small areas at a time to better garner broad support.
3. Reshaping dunes (18)		Change the height and/or width of dunes and reduce steep scarps.	18	4.5%	• Flatten the dune into a useable area. • Reduce height of dunes. • Create a tapered sand dune. • Level dunes to an appropriate level in areas around SLSCs. • Dunes to be levelled at street/path height, and then shaped at a slight angle eastward towards the ocean, following this small ground cover to be added. It is universally recognised that large/heavy seas, should be able to wash up on a slight gradient without encountering hard/stubborn objects including root systems from large vegetation. • Dune profiling to maintain sand on the beach not the vegetation. • Push sand into water before, during and after summer season. • Profile the beaches to give a 'beach' as defined in the Coastal Dune Management Manual. • City Beach dunes are the result of fill from the old club house and should be flattened into a useable area and perhaps grassed. • Redistributing sand to correct areas when needed.
4. Structural (37)	a. Changes to existing or new buildings/ structures	Modify structures to allow improved sightlines.	9	2.2%	• Use towers such as at Towradgi Beach. • New towers to be prepared so they cannot be blocked by vegetation. • Consider structures e.g. steps, to provide access and sightlines. • Relocate life saving towers.
	b. Construction/ maintenance of access points and pathways	Construct and maintain access points and pathways through the dunes to the beach.	20	5.0%	• Fencing of dunes bordering pathways. • Create many walkways through dunes from cycleway to beach. • Better and longer lasting walkways. • Structured environmentally sensitive walkways. • Greater expenditure and maintenance of walkways. • Clearly indicated walkways. • Maintenance and widening of pathways.

Management Activity (total)	Sub Categories (where relevant)	Definition	No. of Responses	% of total Suggested Activities (N = 401)	Summary of the types of responses
					• Allow vehicular access near SLSCs. • Ensure access points do not contribute to erosion. • Specific mention of the access path between Port Kembla SLSC and the beach needing repair. • City Beach - It is completely unsafe to use a number of walkways and there is a duty of care as Council has provided these walkways using government money and should maintain them to a certain standard.
	c. Construct retaining walls and grass	Remove dunes and construct retaining wall and grasses areas, e.g. what exists at North Wollongong Beach.	8	2.0%	• Dunes flattened into useable turfed area. • Construct retaining walls. • Replace with lawn. • Retaining walls like at North Beach. • Removal of the overgrown weeds and replace with usable lawn areas with retaining walls holding back sand like North Beach, Thirroul and Austinmer beaches. • This would result in good recreational areas, improved commercial prospects, and good sightlines. • In front of City Beach SLSC, retaining wall and grassed area like North Beach. • Also proposed for Woonona Beach.
5. Education/ Research (38)		Provide education to the community about dune processes, management and the purpose of dune vegetation. Education on caring for dunes and activities that are not appropriate. Conduct additional research on coastal processes and issues.	38	9.5%	• Present the facts e.g. Coastal Wattle is not a weed. • Educate about the ecological role and significance of dune systems, sustainability of coastal areas and importance of beach dune systems in protecting human and natural environments, biodiversity values, natural coastal processes such as sand erosion and accumulation. • Visual representations of pre-European, post storm event and future (raised sea level) coastal zone states. • Signage about the correct use of dunes and importance of protecting dunes. • Anti-litter signage.

Management Activity (total)	Sub Categories (where relevant)	Definition	No. of Responses	% of total Suggested Activities (N = 401)	Summary of the types of responses
					• Experts should present facts during consultation so the community is informed. • Better public awareness campaigns about why dune vegetation is important. Education is key. Have expert consultants/coastal management scientists available at public meetings who will address confrontational community members who are spreading not entirely correct information throughout the community and gaining support without hard science.
6. Coastal Zone Planning (8)		Develop policy related to planning and management of assets near dunes.	8	2.0%	• Buy back currently developed land and return to dune. • Prioritise beaches most at risk. • Work with the State Government to plan for the medium to long term. • Develop a setback strategy. • Manage dunes in the context of coastal hazards.
7. Improved Services (50)	Improve ongoing maintenance	Improved maintenance of overall dune areas, including vegetation.	25	6.2%	• Maintain any vegetation that is introduced. • Maintain vegetation in front of lifeguard facilities. • Monitoring dunes to ensure necessary maintenance is done. • Establish clear boundaries for dune vegetation and maintain that width. • Active control not 'plant and forget'. • Properly funded workable maintenance program. • Dune stabilisation has been effective, but neglected in last decade. • Maintenance to ensure visibility and amenity. • Maintenance of fences, pathways and amenities. • Maintenance is also essential to ensure that species composition remains in a balanced state. It would appear that very little of this type of management occurs.

Management Activity (total)	Sub Categories (where relevant)	Definition	No. of Responses	% of total Suggested Activities (N = 401)	Summary of the types of responses
	Manage Pests	Undertake pest control	10	2.5%	• Remove feral rabbits. • Remove Myna Birds. • Control snakes and vermin.
	Increase Regulation and Enforcement	Increase the regulation and enforcement of dunes	8	2.0%	• Prosecute vegetation vandalism. • Enforce dogs on beaches policy. • Erect signage to deter vandalism. • Increase patrols.
	More Bins and Litter Collection		7	1.7%	• Make more bins available at beaches. • Increase litter collection activities.
7. Other (46)		See below for details of 'other' management activities.	46	11.5%	• See section below for full details.
8. Out of scope (2)			2	0.5%	• Remove Bitou Bush at MM Beach. • Support Federal Government policies which seek to reduce reliance on the use of fossil fuels.

'Other' Management Activities

There were many specific suggestions for management activities that did not fit into the above categories and are included here for the consideration within the Dune Management Strategy:

- The role of Lifeguards – review the compatibility of their infrastructure and process with healthy dune systems, surveillance from the beach not the clubhouse with appropriate facilities/equipment, lifeguards should be on the beach; use of camera surveillance, duties to include dune management activities such as vermin control and litter collection (Note - litter collection is already part of the Lifeguard's role);
- More community consultation – including local community near beach, Bushcare groups, Aboriginal tent embassy elders, beach users and staff that work on the beaches, have experts available at consultation forums to better inform community while engaging and include the study online for accessibility. Suggestion that Council facilitate opposing sides in a room together (bush regenerators and Woonona SLSC) rather than favouring one side. It was also mentioned to inform community of the issues and the pros and cons of solutions then seek comment;
- Safety – suggestions related to emergency vehicle access, blue lights, signage about scarps, installing shoring to prevent scarps collapsing, levelling of scarps after storm fronts have passed, disaster recovery plans for severe storm scarps and the consideration of 'Crime Prevention Through Environmental Design';
- Sand Nourishment – consider redistributing sand; investigate dumping or replacing sand (similar to the Burleigh Heads/ Snapper rocks). The removal of dunes from East Corrimal and Port Kembla should be factored back into this long term plan. A suggestion is to put back the sand that was shipped off shore.
- Planning and research – there were some specific comments related to the way in which Council should be undertaking the development of the Dune Management Strategy, including:
    - Prioritising beaches more at risk;
    - Plan for the medium to long term;
    - Undertaken science based study of sand movement and impact of development, prior to making recommendations;
    - Survey beach profile changes over time, e.g. Bulli, Woonona and City Beaches;
    - Research what conditions were pre-European settlement and how the local original inhabitants managed the coast;
    - Look at management of dunes in other council areas;
    - Seek expert advice on sand movement along the WCC coast;
    - Utilise the knowledge of coastal zone experts like Professor Short (Sydney University) and experts from UoW;

- People's personalities and personal agendas should not be a factor in decision making, and these should be recognised and eliminated from decision making processes;
- Study the effects of local inshore sand banks;
- Consider science behind coastal processes;
- Study whether the vegetation helps erosion or whether is it changing the balance;
- Undertake studies that measure the amount of sediment that moves through the various compartments within the WCC jurisdiction. This could be done during periods of accretion as well as erosion. It is also important to know where the sediment is stored and how long it stays there (on average). If we don't know how much sediment is on the move and where it moves to, making changes to dune management could result in the net loss of sediment from our beaches;
- Look at the historical positions of the dunes particularly the back and height of the dune, the slope on the front of the dune (to determine the minimum width of the dune) to allow for sand to be blown up the dune to build its height to a level near the height of the dunes in 1960. Also consider the width of the beach to absorb a storm wave run up in a 1-in-10 year event (nominally at least 50m above the berm) and the height and type of vegetation to hold the back of the dune and intermediate positions. The use of artificial high dunes as per Coniston beach should be considered as a back dune to form the initial barrier whilst the trees are growing behind them;
- At Towradgi Beach there is the remains of a fence which has been overgrown by vegetation up to about 20m towards the sea. Council should say where the dunes are meant to end and maintain this as it can cause animosity between Bushcare groups and SLSC members;
- Better information on just what is occurring at our beaches in regards to sand movement, recent building and other developments in the City Beach area and the effect they have had on the way the weather and seas affect the sand and dunes;
- Survey what vermin and wildlife are present;
- The strategy needs to ensure the coastal zone (beach, dune, vegetation) is reviewed at regular intervals (e.g. annually) and recommendations from the review are incorporated into the management plan for next twelve months.
- Council should think of the long term consequences of coastal management in terms of climate change and sea level rise - how this will threaten aboriginal heritage (middens and burial grounds), important EECs (behind dune systems) and community assets (SLSCs, roads, bike paths etc);
- Outcomes need to clearly reflect a respect for biodiversity and habitat value with solid scientific backing, understand geological and coastal zone processes and the dynamic nature of these processes in dune evolution, consider climate change and sea level rise and acknowledge past disturbance due to anthropological impacts,

acknowledge and respect Aboriginal and cultural heritage in the management of coastal sites. Education and examples of areas where vegetation has been removed and what can happen to assets and beaches after major storm events could be effective;
    - Look at the whole dune system (whole of beach);
    - Considering strategies in context of coastal hazards;
    - Remove vegetation on the dunes least exposed to high tidal ranges and study the effects on the local inshore sand banks;
    - Develop clear vegetation management plans;
    - Adopt correct use of NSW Government guidelines (e.g. Coastal Dune Management Manual generally and specifically page 44, 4.2.2, page 3, Figure 2.1, page 93, 6.8.2.);
    - Council should follow the State Government Coastal Dune Management Manual and stop allowing the Bushcare groups to plant species that are not on the approved dune management list.
    - New dune vegetation works should not be undertaken until a complete review is undertaken as to the effectiveness of dunal vegetation. Era and Burning Palms beaches at the north of the City boundary are still in their natural state and are surviving quite well without the intrusion of dunal vegetation. Remove all existing dunal vegetation from a strip of beach say 200-300 metres long and compare the long term performance of this section of beach to that of adjoining sections that retain their vegetation.
    - Avoid the use of out of date reports,
    - Concerns regarding the costly nature of studies,
    - Generally let nature take care of everything, generally for dune and specifically after scarps (natural repair);
    - Use Port Kembla Beach and dune system as a model for other dunes areas; and
    - Return to pre-European conditions.

- Other suggestions included preserve Aboriginal middens, lookout platforms, a step structure like at Scarborough Beach in Perth, artificial reefs to protect foreshores, coastal development setbacks, controlled back burning, plant Norfolk Pines, minimise plastic use near beaches, monitor creek flows, don't remove sand from the region, clear development 1km back from the dunes, remove infrastructure that interferes with natural sand movement, establish an agreement with the State Government authorisation bodies regarding dune management so it doesn't take so long for works to be approved, lobbying the State Government to revise their dune management guidelines as it was felt that the authors were too biased towards bush regeneration, consider the proposals of GHD, remove the fences; and generally changing the dune system back to how it used to be (with no specific strategy mentioned).

Question 3

If you have any additional comments or suggestions regarding the Wollongong Dune Management Strategy, please list them below.

The responses to this question were considered in conjunction with questions 1b and 2 above. Each response has been included as either an issue or a management activity or both, where relevant.

Question 4

Which of the below best described you?
Check any that apply (Y/N)

Surf life saving club member
Surfer
Local resident
Bushcare member
Swimmer
Beach walker
Other…

Table 3: What best describes the respondent.

What best describes the respondent	Number of Responses (out of 226)	% of responses
Local resident	187	79.9%
Swimmer	132	56.4%
Beach walker	127	54.3%
Surfer	105	44.9%
Surf Life Saving Club member	68	29.1%
Other	36	15.4%
Bushcare member	28	12.0%

Other responses provided:

- Local business owner (2);
- Environmentalist (2);
- Marine scientist;
- Student (3);
- Geography teacher;
- Windsurfer;
- Dog owner;
- Tourist (2);
- Fisherman (3);
- Lifeguard (7);
- Ratepayer sick of the mismanagement of our beaches;

- Bird watcher;
- Ex Branch President of the Surfrider Foundation;
- Born and raised in Woonona;
- Ex local resident;
- Bike track walker;
- Concerned Australian;
- Beach user;
- Coast Care advocate;
- Coffee drinker;
- Parent;
- I wanted to be a bushcare worker until they started planting at Sandon Point against their grants conditions, and I am not the only one who thinks this way; and
- Stud.

Question 1a

Below is a list of issues that have been raised regarding dune management. Please rank the issues in order of importance, where 1 is the most important.

Accumulation of sand in vegetated areas
Aesthetic value of dune vegetation
Biodiversity value of dune vegetation
Dune scarps after storms
Line of sight for surf lifesavers (dune height and vegetation)
Loss of beach (width) amenity
Presence of Coastal Wattle (Acacia sophorae)
Role of dunes in asset protection
Vermin/fire

Note: You do not have to include all issues in your ranking

Question 1b

Are there any other important issues you feel need to be addressed in the strategy that were not listed above? If so, please list them below.

Question 2

What management activities do you think Council should consider to address these important issues? Please list them below.

Question 3

If you have any additional comments or suggestions regarding the Wollongong Dune Management Strategy, please list them below.

Question 4

Which of the below best described you?
Check any that apply (Y/N)

Surf life saving club member
Surfer
Local resident
Bushcare member
Swimmer
Beach walker
Other…

Appendix C – Threatened communities and species listed under the EPBC and TSC Acts

A desktop assessment was undertaken to determine Endangered Ecological Communities (EECs) and threatened flora and fauna within a 10 kilometre radius of the study area. The following tables show the EECs (Table A), threatened flora and fauna (Table B) that are 'present', 'likely' or 'possible' to occur within the study area, based on field surveys and observations. Tables C and D show the EECs, threatened flora and fauna that have been determined 'unlikely' to occur or do not occur ('nil').

All information in these tables taken from NSW OEH and Commonwealth DSEWPaC Threatened Species profiles (OEH, 2012b; DSEWPaC, 2012b) unless otherwise stated. The codes used in these tables are: CE – Critically Endangered; E – Endangered; V – Vulnerable; EP – Endangered Population; CEEC – Critically Endangered Ecological Community; EEC – Endangered Ecological Community; M - Migratory.

Table A: Endangered Ecological Communities that are present, likely or possible to occur within the study area

Community	TSC Act	EPBC Act	Habitat Association	Details of record	Presence in study areas
Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions	EEC		Currently known from parts of the LGAs of Sutherland, Wollongong, Shellharbour, Kiama, Shoalhaven, Eurobodalla and Bega Valley but may occur elsewhere in these bioregions (OEH, 2012b).	Recorded at several locations	Present. Examples near Windang Beach and within the study area.
Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	EEC		Occurs in coastal areas subject to periodic flooding with standing fresh water for at least part of the year. Typically on silts, muds or humic loams below 20m elevation in low-lying parts of floodplains, alluvial flats, depressions, drainage lines, backswamps, lagoons and lakes. Structure and composition varies spatially and temporally depending on the water regime, though is usually dominated by herbaceous plants and has few woody species.	**Recorded** within 10km (OEH, 2012b)	Present. Recorded at several locations, e.g. where creeks and lagoons occur near dunes.
Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East	EEC	CEEC	Occurs along the NSW coast, usually within 2km of the ocean on a variety of substrates. Variable structure and composition, typically with closed canopy. Generally	**Recorded** within 10km (OEH, 2012b) **Predicted** to occur	Present. Some small examples within native vegetation

Community	TSC Act	EPBC Act	Habitat Association	Details of record	Presence in study areas
Corner Bioregions			rainforest species with vines a major component.	within 10km (DSEWPaC, 2012b)	surrounding the beaches at Stanwell Park, Coalcliff Wombarra and Scarborough (NPWS, 2002).
Swamp Oak Floodplain forest of the NSW North Coast, Sydney basin and South East Corner Bioregions	EEC		Typically occurs below 20m asl on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes on coastal floodplains of NSW. Associated with grey-black clay-loams and sandy loams, saline or sub-saline groundwater. Structure variable from open forests to scrubs or reedlands with scattered trees. Canopy dominated by *Casuarina glauca* (north of Bermagui) or *Melaleuca ericifolia* (south of Bermagui). Understorey characterised by frequent occurrences of vines, a sparse cover of shrubs, and a continuous groundcover of forbs, sedges, grasses and leaf litter.	**Recorded** within 10km (OEH, 2012b)	Present. Examples occur at several beaches where creeks flow out to sea; e.g. Stanwell Park, Bellambi, Corrimal, Puckey's (near Fairy Meadow and North Wollongong) (NPWS, 2002).
Swamp Sclerophyll forest on Coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	EEC		Usually occurs below 20m asl (sometimes up to 50m). Associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Characterised by open to dense tree layer of eucalypts and paperbarks, with trees up to or higher than 25m. Includes areas of fern land and tall reed or sedge land, where trees are sparse or absent.	**Recorded** within 10km (OEH, 2012b)	Present. Examples occur at Bellambi (NPWS, 2002).
Sydney Turpentine-Ironbark Forest	EEC	CEEC	Occurs on the Cumberland Plain, with most remnants in Baulkham Hills, Hawkesbury, Hornsby, Ku-ring-gai, Parramatta, Ryde, Sutherland and Wollondilly LGAs. Open forest characterised by *Syncarpia glomulifera, Eucalyptus*	**Recorded** within 10km (OEH, 2012b) **Predicted** to occur within 10km	Present. One example at MacCauley's Beach, but this is not near a

Community	TSC Act	EPBC Act	Habitat Association	Details of record	Presence in study areas
			punctata, Eucalyptus paniculata and E. eugenoides. In areas of high rainfall (over 1050mm per annum) E. saligna is more dominant. Sparse shrub stratum of *Pittosporum undulatum* and *Polyscias sambucifolia*.	(DSEWPaC, 2012b)	study area.
Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions	EEC		*Themeda australis* is the dominant species in the *Themeda* Grassland on seacliffs and coastal headlands EEC. The EEC is found on a range of substrates *Themeda australis* is an extremely widespread species, but in this community it may have a distinctive appearance, being prostrate and having glaucous leaves. *Banksia integrifolia* subsp. *integrifolia, Westringia fruticosa* and *Acacia sophorae* occurs as an emergent shrub or as a dense cover where they have recruited over grasslands. Smaller shrubs occur often as prostrate to dwarf forms.	**Recorded** within 10km (OEH, 2012b)	Present. Small patches occur, although inappropriately maintained at north Austinmer, Brickyard Point and City Beach.
Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions	EEC		Occurs on landward side of mangrove stands in intertidal zones along the shores of estuaries and lagoons that are permanently or intermittently open to the sea. Characterised by *Baumea juncea, Juncus kraussii, Sarcocornia quinqueflora, Sporobolus virginicus, Triglochin striata, Isolepis nodosa, Samolus repens, Selliera radicans, Suaeda australis and Zoysia macrantha*, with occasional scattered mangroves occurring throughout the saltmarsh. Saltpans and tall reeds may also occur.	**Recorded** within 10km (OEH, 2012b)	Likely. Some appropriate habitat at mouths of creeks and Lake Illawarra near Windang and Port Kembla Beach, not recorded inside the study area.

Table B: Threatened Flora and Fauna that are present or likely to occur within the study area

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence within the study areas
Flora						
Callistemon linearifolius	Netted Bottlebrush	V		Recorded from the Georges to Hawkesbury Rivers in Sydney, and north to Nelson Bay. There is also a recent record from the northern Illawarra. In Sydney, recent records are limited to the Hornsby Plateau area near the Hawkesbury River. Grows in dry sclerophyll forest on the coast and adjacent ranges.	**2 records** within 10km (OEH, 2012b)	Possible. No individuals recorded.
Chorizema parviflorum		EP; in Wollongong and Shellharbour LGAs		Recorded from between Austinmer and Albion Park in the local government areas of Wollongong and Shellharbour. All known sites occupy woodland or forest dominated by Forest Red Gum (*Eucalyptus tereticornis*) and/or Woollybutt (*E. longifolia*). May occur on coastal heathland (OEH, 2012b).	**4 records** within 10km (OEH, 2012b)	Possible. Small population occurs at Garie Beach which is not in study area.
Cryptostylis hunteriana	Leafless Tongue Orchid	V	V	Occurs in coastal areas from East Gippsland to southern Queensland. Habitat preferences not well defined. Grows mostly in coastal heathlands, margins of coastal swamps and sedgelands, coastal forest, dry woodland, and lowland forest. Prefers open areas in the understorey and is often found in association with *Cryptostylis subulata* and the *Cryptostylis erecta.* Soils include moist sands, moist to dry clay loam and occasionally in accumulated eucalypt leaves. Flowers November-February.	**Predicted** to occur within 10km (DSEWPaC, 2012b)	Possible. No individuals of this or associated species recorded.
Cynanchum elegans	White-flowering Wax Plant	E	E	Occurs from Gerroa (Illawarra) to Brunswick Heads and west to Merriwa in the upper Hunter. Most common near Kempsey. Usually occurs on the edge of dry rainforest or littoral rainforest, but also occurs in Coastal Banksia Scrub, open forest and woodland, and Melaleuca scrub. Soil and	**60 records** within 10km (OEH, 2012b) **Predicted** to occur within	Possible. No individuals recorded.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence within the study areas
				geology types are not limiting.	10km (DSEWPaC, 2012b)	
Pimelea spicata	Spiked Rice Flower	E	E	Disjunct populations within the Cumberland Plain (from Mount Annan and Narellan Vale to Freemans Reach and Penrith to Georges Hall) and Illawarra (from Mt Warrigal to Gerroa) (DEC, 2005a). In the Cumberland Plain region, restricted to areas which support or historically supported Cumberland Plain Woodland. Grows on well-structured clay soils derived from Wianamatta Shale. In the Illawarra, grows on variable soils in close proximity to the coast on hills or coastal headlands. Inhabits coastal woodland or grassland with emergent shrubs (DEC, 2005a).	**16 records** within 10km (OEH, 2012b) **Predicted** to occur within 10km (DSEWPaC, 2012b)	Possible. No individuals recorded.
Prostanthera densa	Villous Mint-bush	V	V	This species has been recorded from the Currarong area in Jervis Bay, Royal National Park, Cronulla, Garie Beach and Port Stephens (Gan Gan Hill, Nelson Bay). Also recorded in Bass and Flinders Point in Cronulla (OEH, 2012b). Generally grows in sclerophyll forest and shrubland on coastal headlands and near coastal ranges, chiefly on sandstone, and rocky slopes near the sea (OEH, 2012b).	**Predicted** to occur within 10km (DSEWPaC, 2012b)	Possible. No individuals recorded.
Senna acclinis	Rainforest Cassia	E		Coastal districts and adjacent tablelands of NSW from the Illawarra in NSW to Queensland. Grows in or on the edges of subtropical and dry rainforest (OEH, 2012b).	**1 record** within 10km (OEH, 2012b)	Possible. No individuals recorded.
Streblus pendulinus	Siah's backbone		E	Siah's Backbone occurs from Cape York Peninsula to Milton, south-east New South Wales (NSW), as well as Norfolk Island (ATRP, 2010; Jessup, 2003; RBGT, 2011). Siah's Backbone is found in warmer rainforests, chiefly along watercourses. The species grows in well-developed rainforest, gallery forest and drier, more seasonal	**Predicted** to occur within 10km (DSEWPaC, 2012b)	Possible. No individuals recorded.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence within the study areas
				rainforest (ATRP, 2010).		
Syzygium paniculatum	Magenta Lilly Pilly	V	V	Occurs in narrow coastal strip from Bulahdelah to Conjola State Forest. Grows in rainforest on sandy soils or stabilised Quaternary sand dunes at low altitudes in coastal areas, often in remnant littoral or gallery rainforests.	**2 records** within 10km (OEH, 2012b)	Possible; no individuals recorded. One specimen known in creekline upslope of Coalcliff.
Thesium australe	Austral Toadflax	V	V	ound in small, scattered populations along the east coast, orthern and southern tablelands. Occurs in grassland or rassy woodland, and is often found in association with angaroo Grass (*Themeda australis*).	**Predicted** to occur within 10km (DSEWPaC, 2012b)	Possible. No individuals or populations recorded.
Birds						
Botaurus poiciloptilus	Australasian Bittern	E	E	Widespread but uncommon over most NSW except the northwest. Favours permanent freshwater wetlands with tall dense reedbeds particularly *Typha spp*.and *Eleocharis* spp., with adjacent shallow, open water for foraging. Roosts during the day amongst dense reeds or rushes and feeds mainly at night on frogs, fish, yabbies, spiders, insects and snails.	**7 records** within 10km (OEH, 2012b) Sighted within Swamp Oak forest along the banks of Tramways Creek (WCC, 2010). Council field surveys (2001) Bird flushed north of pumping station on Woodlands	Likely. Records from several surveys within the study areas including nearby Sandon Point study area and Bellambi Beach. May refuge within other study areas, or use parts of a movement corridor.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence within the study areas
					Creek (nearby Sandon Point), flew south west up Tramway Creek until disappeared behind vegetation. OEH, 2012b records at Bellambi Beach.	
Ixobrychus flavicollis	Black Bittern	V		Occurs from southern NSW to Cape York and the Kimberley, and southwest WA. Inhabits terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. May occur in flooded grassland, forest, woodland, rainforest and mangroves as long as there is permanent water. Roosts by day in trees or within reeds on the ground. Nests in branches overhanging water and breeds from December to March.	**15 records** within 10km (OEH, 2012b)	Likely. Records present from Bulli Beach and Woonona Beach. May forage within study area, or use parts of study area as a movement corridor.
Haematomus longirostris	Pied Oystercatcher	E		Scattered along NSW coast. Favours intertidal flats of inlets and bays, open beaches and sandbanks. Forages on exposed sand, mud and rock at low tide. Nests mostly on coastal or estuarine beaches; occasionally saltmarsh or grassy areas.	**15 records** within 10km (OEH, 2012b), records on Austinmer Beach. **Known habitat** on several beaches within	Likely. Breeding record at Windang Island 2011

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence within the study areas
					the Wollongong LGA (WCC, 2010).	
Haematopus fuliginosus	Sooty Oystercatcher	V	M	Evenly distributed along NSW coast, including offshore islands. Favours rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries. Forages on exposed rock or coral at low tide. Breeds almost exclusively on offshore islands, and occasionally on isolated promontories.	**68 records** within 10km (OEH, 2012b), records on Coledale, Austinmer, Sandon Point Beaches. Records from McCauley's Beach Thirroul, 2010 (WCC, 2010). Field survey observations of individuals at Sandon Point.	Likely. Known habitat on several beaches and rocky shores within the Wollongong LGA (WCC 2010). Including Towradgi Beach, McCauley's Beach, Thirroul and Sandon Point.
Sternula nereis nereis	Australian Fairy Tern		V	Occurs along NSW coast. Inhabit offshore, estuarine or lake islands, wetlands, beaches and spits. Nests on coral shingle on continental islands or coral cays, on sandy islands and beaches inside estuaries and on open sandy beaches.	**Predicted** to occur within 10km (DSEWPaC, 2012b)	Possible. Previously occurred along the east coast of NSW, but unknown whether it persists in NSW (DSEWPaC, 2012).

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence within the study areas
Rostratula australis	Australian Painted Snipe	E	V, M	Normally found in permanent or ephemeral shallow inland wetlands, either freshwater or brackish. Nests on the ground amongst tall reed-like vegetation near water. Feeds on mudflats and the water's edge taking insects, worm and seeds. Prefers fringes of swamps, dams and nearby marshy areas with cover of grasses, lignum, low scrub or open timber.	**Predicted** to occur within 10km (DSEWPaC, 2012b)	Possible. Beaches such as Bellambi and Corrimal Beach study areas adjoin waterbodies and riparian vegetation potentially suitable for foraging for this species.
Ninox connivens	Barking Owl	V		Occurs from coast to inland slopes and plains, though is rare in dense, wet forests east of the Great Dividing Range and sparse in higher parts of the tablelands and in the arid zone. Inhabits eucalypt woodlands, open forest, swamp woodlands, and, especially in inland areas, timber along watercourses. Roosts along creek lines in dense, tall understorey foliage (e.g. in Acacia and Casuarina), or dense eucalypt canopy. Nests in hollows of large, old eucalypts including *Eucalyptus camaldulensis, Eucalyptus albens, Eucalyptus polyanthemos* and *Eucalyptus blakelyi*. Birds and mammals important prey during breeding. Territories range from 30 to 200 hectares.	**4 records** within 10km (OEH, 2012b)	Possible. Beaches such as Bellambi and Corrimal Beach study areas adjoin watercourses potentially suitable for foraging for this species. Dune vegetation continuous with wet forest vegetation may also provide foraging habitat. Unlikely to roost or breed in the study area given the lack of suitable hollows.
Esacus neglectus	Beach Stone-curlew	CE	Marine	In NSW occurs regularly from the Manning River north, with occasional vagrants to SE NSW and Victoria. Inhabit a range of beaches, islands, reefs and in estuaries. Often seen near mangroves. Forage in the intertidal zone of beaches and estuaries, on islands, flats, banks and spits of sand, mud, gravel or rock, and among mangroves. Nests area shallow scrape above the littoral zone, among low	**1 record** within 10km (OEH, 2012b)	Possible Could forage in the intertidal zones of the study areas. Preferred breeding habitat (low vegetation; as described in habitat association) also

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence within the study areas
				vegetation of grass, scattered shrubs or low trees; also among open mangroves or on sandbanks.		available within study areas containing dune vegetation such as Windang Beach.
Ephippiorhynchus asiaticus	Black-necked Stork	E		In NSW, becomes increasingly uncommon south of the Northern Rivers region, and rarely occurs south of Sydney. Breeding recorded as far south as Buladelah, though most breeding in NSW occurs in the north-east. Primarily inhabits permanent freshwater wetlands and surrounding vegetation including swamps, floodplains, watercourses and billabongs, freshwater meadows, wet heathland, farm dams and shallow floodwaters. Will also forage in inter-tidal shorelines, mangrove margins and estuaries. Feeds in shallow, still water. Breeds during summer, nesting in or near a freshwater swamp.	**1 record** within 10km (OEH, 2012b)	Possible. Beaches such as Bellambi and Corrimal Beach study areas adjoin or encompass waterbodies and riparian vegetation potentially suitable for foraging for this species.
Dasyornis brachypterus	Eastern Bristlebird	E	E	Occurs in three disjunct areas of south-eastern Australia: southern Queensland/northern NSW, the Illawarra Region and in the vicinity of the NSW/Victorian border. Illawarra population comprises an estimated 1600 birds, mainly from Barren Grounds Nature Reserve, Budderoo National Park and the Jervis Bay area. Habitat characterised by dense, low vegetation including heath and open woodland with a heathy understorey. The fire history of habitat is important, and the Illawarra and southern populations reach maximum densities in habitat	34 records within 10km (OEH, 2012b) **Predicted** to occur within 10km (DSEWPaC, 2012b)	Possible. Suitable heath vegetation within the study areas such as Bulli Beach, Port Kembla and Sandon Point. May use parts of study areas as a movement corridor.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence within the study areas
				that have not been burnt for over 15 years.		
Stictonetta naevosa	Freckled Duck	V		Breeds in large, ephemeral swamps in the Murray-Darling, particularly along the Paroo and Lachlan Rivers and other Riverina rivers. In drier times moves to more permanent waters. Disperses during extensive inland droughts and may be found in coastal areas during such times. Prefers freshwater swamps/creeks with dense Cumbungi, Lignum or tea-tree. Nests in dense vegetation at or near water level.	**7 records** within 10km (OEH, 2012b)	Possible Beaches such as Bellambi and Corrimal Beach study areas adjoin or encompass waterbodies and riparian vegetation potentially suitable for foraging for this species.
Callocephalon fimbriatum	Gang-gang Cockatoo	V		Restricted to SE coast and highlands south from the Hunter Valley. Spends summer in tall mountain forests and woodlands, usually heavily timbered and mature wet sclerophyll forests. Winters at lower altitudes in drier more open eucalypt forest and woodlands, particularly in coastal areas. Nests in summer in large tree hollows, often close to water, usually in tall mature sclerophyll forests with a dense understorey, and occasionally in coastal forests. Feeds on seeds, particularly Eucalyptus and Acacia, also berries, fruit and insects (Higgins, 1999).	**83 record** within 10km (OEH, 2012b)	Possible. May forage in the study areas such as Stanwell Park, Coalcliff Beach, Sandon Point and Bulli Beach. Unlikely to roost or breed in the study area given the lack of suitable hollows sited during GHD surveys.
Calyptorhynchus lathami	Glossy Black-Cockatoo	V		Widespread but uncommon from coast to southern tablelands and central western plains. Feeds almost exclusively on the seeds of Allocasuarina species. Prefers woodland and open forests, rarely away from Allocasuarina. Roost in leafy canopy trees, preferably eucalypts, usually <1km from feeding site. Nests in large	**14 records** within 10km (OEH, 2012b)	Possible. May forage in tall trees adjoining continuous vegetation in some study areas. Unlikely to roost or breed in the study area

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence within the study areas
				(approx. 20cm) hollows in trees, stumps or limbs, usually in Eucalypts (Higgins, 1999).		given the lack of suitable hollows.
Tyto novaehollandiae	Masked Owl	V		Occurs across NSW except NW corner. Most common on the coast. Inhabits dry eucalypt woodlands from sea level to 1100m. Roosts and breeds in large (>40cm) hollows and sometime caves in moist eucalypt forested gullies. Hunts along the edges of forests and roadsides. Home range between 500ha and 1000ha. Prey mostly terrestrial mammals but arboreal species may also be taken.	**11 records** within 10km (OEH, 2012b)	Possible. Beaches such as Bellambi and Corrimal Beach study areas adjoin watercourses potentially suitable for foraging for this species. Dune vegetation continuous with wet forest vegetation may also provide foraging habitat. Unlikely to roost or breed in the study area given the lack of suitable hollows.
Ninox strenua	Powerful Owl	V		Occurs from the coast to the western slopes. Solitary and sedentary species. Inhabits a range of habitats from woodland and open sclerophyll forest to tall open wet forest and rainforest. Prefers large tracts of vegetation. Nests in large tree hollows (> 0.5m deep), in large eucalypts (dbh 80-240cm) that are at least 150 years old. Pairs have high fidelity to a small number of hollow-bearing nest trees and defend a large home range of 400 - 1,450ha. Forages within open and closed woodlands as well as open areas.	**42 records** within 10km (OEH, 2012b)	Possible. Dune vegetation continuous with wet forest vegetation may also provide foraging habitat. Unlikely to roost or breed in the study area given the lack of suitable hollows.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence within the study areas
Charadrius ruficapillus	Red-capped Plover		Marine	This species is widespread throughout Australia and is vagrant in New Zealand. Found in pairs or small groups along sandy beaches, coastal lagoons, estuaries, bays and inland saline wetlands	**Predicted** to occur within 10km (DSEWPaC, 2012b)	Possible. Could potentially forage in some patches. Records have been observed outside the study area of Windang Beach.
Xanthomyza phrygia	Regent Honeyeater	E	E	In NSW confined to two known breeding areas: the Capertee Valley and Bundarra-Barraba region. Non-breeding flocks occasionally seen in coastal areas foraging in flowering Spotted Gum and Swamp Mahogany forests, presumably in response to drought. Inhabits dry open forest and woodlands, particularly Box-Ironbark woodland and riparian forests of River Sheoak, with an abundance of mature trees, high canopy cover and abundance of mistletoes.	**2 records** within 10km (OEH, 2012b)	Possible. May forage in native vegetation within study areas such as Coledale Beach, Bulli Beach and Woonona or use parts of study area as a movement corridor.
Ptilinopus regina	Rose-crowned Fruit-Dove	V		Occurs along the coast and ranges of eastern NSW and Queensland, from Newcastle to Cape York; occasionally found further south to Victoria. Occur mainly in sub-tropical and dry rainforest and occasionally in moist eucalypt forest and swamp forest, where fruit is plentiful (OEH, 2012b).	**8 records** within 10km (OEH, 2012b)	Possible. Some suitable fig trees present at Thirroul Beach. May forage on occasion. Suitable breeding habitat not present.
Tyto tenebricosa	Sooty Owl	V		Occurs in the coastal, escarpment and tablelands regions of NSW. More common in the north and absent from the western tablelands and further west. Inhabits tall, moist	**77 records** within 10km	Possible. May forage in the study

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence within the study areas
				eucalypt forests and rainforests, and are strongly associated with sheltered gullies, particularly those with tall rainforest understorey. Roosts in tree hollows, amongst dense foliage in gullies or in caves, recesses or ledges of cliffs or banks. Nests in large (>40cm wide, 100 cm deep) tree hollows in unlogged/unburnt gullies within 100m of streams or in caves.	(OEH, 2012b)	area. Unlikely to roost or breed in the study area given the lack of suitable hollows.
Ptilinopus superbus	Superb Fruit-Dove	V	Marine	Occurs mainly north from NE NSW, much less common further south and largely confined to pockets of habitat south to Moruya. Vagrants occur south to Victoria and Tasmania. Inhabits rainforest and closed forests, may also forage in eucalypt or acacia woodland with fruit-bearing trees. Nests 5-30m above ground in rainforest/rainforest edge tree and shrub species. Part of the population migratory/nomadic.	**2 records** within 10km (OEH, 2012b)	Possible. May forage on occasion. Suitable breeding habitat not present. Some suitable fig trees present at Thirroul Beach. May forage on occasion. Suitable breeding habitat not present.
Lathamus discolor	Swift Parrot	E	E	Migratory, travelling to the mainland from March to October. Breeds in Tasmania from September to January. On the mainland, it mostly occurs in the southeast foraging on winter flowering eucalypts and lerps, with records of the species between Adelaide and Brisbane. Principal over-winter habitat is box-ironbark communities on the inland slopes and plains. *Eucalyptus robusta, Corymbia maculata* and C*. gummifera* dominated coastal forests are also important habitat.	31 records within 10km (OEH, 2012b) Predicted to occur within 10km (DSEWPaC, 2012b)	Possible. May forage on occasion within study areas such as Woonona Beach. Suitable breeding habitat not present.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence within the study areas
Neophema pulchella	Turquoise Parrot	V		Occurs from coast to inland slopes. In coastal area, most common between Hunter and Northern Rivers, and further south in S Coast. Inhabits open eucalypt woodlands and forests, typically with a grassy understorey. Favours edges of woodlands adjoining grasslands or timbered creek lines and ridges. Feeds on the seeds of native and introduced grasses and other herbs. Grasslands and open areas provide important foraging habitat for this species while woodlands provide important roosting and breeding habitat. Nests in tree hollows, logs or posts from August to December.	**4 records** within 10km (OEH, 2012b)	Possible. May forage on occasion within grasslands present at various sites. Suitable breeding habitat not present.
Daphoenositta chrysoptera	Varied Sittella	V		Sedentary, occurs across NSW from the coast to the far west. Inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Sensitive to habitat isolation and loss of structural complexity, and adversely affected by dominance of Noisy Miners. Cleared agricultural land is potentially a barrier to movement. Builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.	**9 records** within 10km (OEH, 2012b)	Possible. Where dune vegetation is continuous with forest vegetation may provide foraging habitat such as Macauley's Beach and Sandon Point.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence within the study areas
Epthianura albifrons	White-fronted Chat	V		This species occurs from southern Queensland to Western Australia and down to Tasmania, mostly in temperate to arid climates and very rarely in sub-tropical areas. It is found in damp open habitats, particularly wetlands containing saltmarsh areas that are bordered by open grasslands. Along the coast they are found in estuarine and marshy habitats with vegetation <1m tall, and in open grasslands and areas bordering wetlands. Inland, they are often observed in grassy plains, saltlakes and saltpans along waterway margins.	**8 records** within 10km (OEH, 2012b)	Possible. May forage in dune vegetation on occasion. Suitable Coastal Saltmarsh nearby Windang.
Mammals						
Petauroides volans	Greater Glider	EP; Eurobodalla LGA		Occurs in Eucalypt forests and woodlands along the east coast from North Queensland to the Central Highlands of Victoria. Feed predominantly on eucalypt leaves, buds, flowers and mistletoe. Shelters in tree hollows, and can use up to 18 hollows within their range (OEH, 2012b).	Records as far south as Austinmer Beach. Gary Leonard *pers. Comm*, 2013.	Possible. Foraging habitat available in heath vegetation at Austinmer Beach, Bulli Beach, Port Kembla and Stanwell Park.
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V		Generally occurs east of the Great Dividing Range along NSW coast (Churchill, 2008). Inhabits various habitats from open grasslands to woodlands, wet and dry sclerophyll forests and rainforest. Essentially a cave bat but may also roost in road culverts, stormwater tunnels and other man-made structures. Only four known maternity caves in NSW, near Wee Jasper,	**47 records** within 10km (OEH, 2012b).	Possible. May fly over and forage within the study area on occasion; vegetation within Bulli Beach, Coledale Beach, Woonona, North Wollongong Beach

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence within the study areas
				Bungonia, Kempsey and Texas. Females may travel hundreds of kilometres to the nearest maternal colony (Churchill, 2008).		and Port Kembla Beach may provide foraging habitat.
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V		Occurs on southeast coast and ranges. Prefers tall (>20m) and wet forest with dense understorey. Absent from small remnants, preferring continuous forest but can move through cleared landscapes and may forage in open areas. Roosts in hollow trunks of Eucalypts, underneath bark or in buildings. Forages in gaps and spaces within forest, with large foraging range (12km foraging movements recorded) (Churchill, 2008, Law et al., 2008).	**8 records** within 10km (OEH, 2012b)	Possible. May forage within study area, or use parts of study area as a movement corridor along study areas within continuous vegetation.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence within the study areas
Cercartetus nanus	Eastern Pygmy-possum	V		Occurs along the east coast of NSW, and inland to the Pillaga, Dubbo, Parkes and Wagga Wagga. Inhabits range of habitats from coastal heath and woodland though open and closed forests, subalpine heath and rainforest (Tulloch and Dickman, 1995). Inhabits rainforest, sclerophyll forests and heath. Banksia spp. and myrtaceous shrubs and trees are favoured food sources and nesting subject sites in drier habitats. Diet mostly pollen and nectar from *Banksia* spp., *Eucalyptus* spp., *Callistemon* spp. and insects (Ward and Turner, 2008). Nests in hollows in trees, under the bark of Eucalypts, forks of tea-trees, abandoned bird nests and *Xanthorrhoea* bases (Ward and Turner, 2008, Tulloch and Dickman, 2006).	**63 records** within 10km (OEH, 2012b)	Possible. Suitable foraging habitat present within the study areas such as Bulli Beach and Sandon Point Beach.
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Roosts in camps within 20km of a regular food source, typically in gullies, close to water and in vegetation with a dense canopy. Forages in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths, swamps and street trees, particularly in eucalypts, melaleucas and banksias. Highly mobile with movements largely determined by food availability (Eby and Law, 2008). Will also forage in urban gardens and cultivated fruit crops.	**58 records** within 10km (OEH, 2012b) **Predicted** to occur within 10km (DSEWPaC, 2012b)	Possible. Could forage throughout the study areas.
Arctocephalus pusillus doriferus	Australian Fur Seal	V		Reported from New South Wales to South Australia. Breeds at ten known locations in Bass Strait, may have historically bred at Seal Rocks. Haul out sites are present	**Predicted** to occur within 10km	Possible. Possible use of beaches in

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence within the study areas
				along the NSW coast, notably Montague Island, Steamers Beach and Green Cape. Uses flat or sloping rocky sites for breeding and haul out sites. Preys on squid, school fish and bottom-dwelling fish, octopus and crustaceans.	(DSEWPaC, 2012b)	Wollongong LGA for resting or if injured or tired.
Myotis macropus	Southern Myotis	V		Mainly coastal but may occur inland along large river systems. Usually associated with permanent waterways at low elevations in flat/undulating country, usually in vegetated areas. Forages over streams and watercourses feeding on fish and insects from the water surface. Roosts in a variety of habitats including caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage, typically in close proximity to water (Campbell, 2011). Breeds November or December (Churchill, 2008).	**44 records** within 10km (OEH, 2012b)	Possible. May forage within study area, or use parts of study area as a movement corridor.
Dasyurus maculatus	Spotted-tailed Quoll	V	E	Inhabits a range of environments including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Den sites are in hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces. Females occupy home ranges of up to 750ha and males up to 3,500ha, usually traversed along densely vegetated creek lines.	**7 records** within 10km (OEH, 2012b) **Predicted** to occur within 10km (DSEWPaC, 2012b)	Possible. May forage within study area, or use parts of study area as a movement corridor. Unlikely to breed in these habitats.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence within the study areas
Reptiles						
Chelonia mydas	Green Turtle	V	V	Typically found in tropical waters around Australia but also occurs in coastal waters of NSW, where it is generally seen on the north or central coast, with occasional records from the south coast (OEH, 2012b). Ocean-dwelling species spending most of its life at sea. Eggs laid in holes dug in beaches throughout their range (OEH, 2012b).	**Predicted** to occur within 10km (DSEWPaC, 2012b)	Possible use of beaches in Wollongong LGA for resting or if injured.
Frogs						
Litoria aurea	Green and Golden Bell Frog	E	V	Formerly occurred from Brunswick Heads to Victoria, but >80% populations now extinct. Inhabits marshes, natural and artificial freshwater to brackish wetlands, dams and in stream wetlands (DEC, 2005b). Prefers sites containing cumbungi *(Typha* spp.) or spike rushes (*Eleocharis* spp.), which are unshaded and have a grassy area and/or rubble as shelter/refuge habitat nearby. *Gambusia holbrooki* is a key threat as they feed on Green and Golden Bell Frog eggs and tadpoles.	**485 records** within 10km (OEH, 2012b) **Predicted** to occur within 10km (DSEWPaC, 2012b) Three records of individuals at Hewitts and Woodlands Creeks (WCC, 2010).	Possible. May forage within study area, or use parts of study area as a movement corridor. Records nearby Sandon Point. Wetland vegetation types nearby Bellambi Beach, Corrimal Beach and Towradgi Beach. Bellambi Lagoon Reserve may also contain suitable habitat.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence within the study areas
Litoria littlejohni	Littlejohns Tree frog	V	V	Occurs on plateaus and eastern slopes of the Great Dividing Range south from Watagan State Forest. Occurs along permanent rocky streams with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops, hunting either in shrubs or on the ground.	**10 records** within 10km (OEH, 2012b) **Predicted** to occur within 10km (DSEWPaC, 2012b)	Possible. Heath based vegetation present within Bulli Beach Port Kembla and Sandon Point. May forage on occasion. Suitable breeding habitat not present.

Table C: Endangered Ecological Communities that are unlikely to or do not occur within the study area

Community	TSC Act	EPBC Act	Habitat Association	Details of record	Presence in study areas
Kurnell Dune Forest in the Sutherland Shire and City of Rockdale	EEC		Occurs within Sutherland and Rockdale LGAs. Occurs on coastal dune sand. Kurnell Dune Forest has a forest structure rather than the predominantly scrub structure of Eastern Suburbs Banksia Scrub (ESBS); and KDF occurs on younger sands than those of ESBS.	**Recorded** within 10km (OEH, 2012b)	Unlikely. Study area does not extend into these LGAs.
Agnes Banks Woodland in the Sydney Basin Bioregion	EEC		Most remnants occur near Agnes Banks in Penrith LGA, on eastern bank of the Hawkesbury River. Occurs on aeolian sands overlaying Tertiary alluviums. Structure varies from low woodland on higher ridges to sedgeland in low-lying depressions. Characteristic species include *Eucalyptus sclerophylla*, *Angophora bakeri* and *Banksia serrata*.	**Recorded** within 10km (OEH, 2012b)	Nil. Not recorded; no appropriate habitat.
Blue Gum High Forest in the Sydney Basin Bioregion	EEC	CEEC	Occurs on the Hornsby Plateau, north eastern edge of the Cumberland Plain with most remnants in Hornsby, Ku-ring-gai and Baulkham Hills LGAs. Typically occurs in high rainfall areas on fertile soils derived from Wianamatta shale. Grades into Sydney Turpentine-Ironbark Forest at lower rainfall areas. Moist, tall open forest characterised by *Eucalyptus saligna* and E. *pilularis*. Usually has small tree layer of *Pittosporum undulatum*, *Elaeocarpos reticulatus* and *Allocasuarina torulosa* over a low, open shrub layer and an understorey of grasses, herbs and ferns.	**Recorded** within 10km (OEH, 2012b)	Nil. Not recorded; no appropriate habitat.

Community	TSC Act	EPBC Act	Habitat Association	Details of record	Presence in study areas
Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion	VEEC		Occurs almost exclusively on soils derived from Tertiary alluvium, or on sites located on adjoining shale or Holocene alluvium, with known occurrences in the Bankstown, Blacktown, Campbelltown, Hawkesbury, Liverpool and Penrith LGAs. Typically on sandy soils and on slightly higher ground than Castlereagh Ironbark Forest or Shale Gravel Transition Forest (Tozer, 2003). Dominated by *Eucalyptus parramattensis subsp. parramattensis*, *Angophora bakeri* and *E. sclerophylla*. A small tree stratum of *Melaleuca decora* is sometimes present, generally in areas with poorer drainage. It has a well-developed sclerophyllous shrub stratum over a diverse range of forbs.	**Recorded** within 10km (OEH, 2012b)	Nil. Not recorded; no appropriate habitat.
Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion	EEC		Occurs on the Cumberland Plain with the most extensive stands in Castlereagh and Holsworthy areas. Smaller remnants in Kemps Creek area and eastern section of the Cumberland Plain. Ranges from open forest to low woodland, with a canopy dominated by *Eucalyptus fibrosa* and *Melaleuca decora* along with other species of eucalypt. Dense shrubby understorey of *Melaleuca nodosa*, *Lissanthe strigosa* and *Fabaceae sp* over sparse ground layer of grasses and herbs.	**Recorded** within 10km (OEH, 2012b)	Nil. Not recorded; no appropriate habitat.
Cumberland Plain Woodland in the Sydney Basin Bioregion	EEC	CEEC	Grassy woodland/forest endemic to the hills and plains of the Cumberland Plain. Canopy typically dominated by *Eucalyptus moluccana*, and *E. tereticornis*, with *E. crebra*, *Corymbia maculata* and *E. eugenoides* occurring less frequently. Shrub layer dominated by *Bursaria spinosa*, and	**Recorded** within 10km (OEH, 2012b)	Nil. Not recorded; no appropriate habitat.

Community	TSC Act	EPBC Act	Habitat Association	Details of record	Presence in study areas
			grasses such as *Themeda australis* and *Microlaena stipoides* var *stipoides*.		
Elderslie Banksia Scrub Forest	EEC		Occurs only in the Elderslie area, near Camden, in Sydney's south-west (15ha in total). Unique as includes plants, such as coastal Banksia and other sandstone region species, which do not occur in the surrounding Cumberland Plain communities (OEH, 2012b.) Occurs only on sand deposits on the old terraces deposited by ancient river systems of what is now the Nepean River and requires deep sand soils to regenerate (OEH, 2012b).	**Recorded** within 10km (OEH, 2012b)	Nil. Not recorded; no appropriate habitat.
Illawarra subtropical rainforest in the Sydney Basin Bioregion	EEC		Occurs on Illawarra coastal plain and foothills and rarely upper escarpment slopes. NPWS (2002) vegetation mapping demonstrates the occurrence of some Coastal Sand Scrub to the Shoalhaven in the south and Kangaroo Valley in the west. Canopy height and density varies greatly depending on disturbance and some stands may be scrub. Characteristic tree species include *Baloghia inophylla, Brachychiton acerifolius, Dendrocnide excelsa, Diploglottis australis, Ficus* spp., *Pennantia cunninghamii*, and *Toona ciliata*.	**Recorded** within 10km (OEH, 2012b)	Nil. Not recorded; no appropriate habitat.
Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion	EEC		Occurs in Shellharbour and Kiama LGAs, on very dry rocky ridges away from the coast, usually where volcanic soils overlay latite. Typically a dense, dry shrubland to 5m tall, dominated *by Melaleuca armillaris*. Does not include dense stands of *M. armillaris* on coastal headlands.	**Recorded** within 10km (OEH, 2012b)	Nil. Not recorded; no appropriate habitat.

Community	TSC Act	EPBC Act	Habitat Association	Details of record	Presence in study areas
Moist Shale Woodland in the Sydney Basin Bioregion	EEC		Occurs on clay soils from Wianamatta Shale in the southern half of the Cumberland Plain, and is intermediate between Cumberland Plain Woodland and Western Sydney Dry Rainforest. Similar to Cumberland Plain Woodland but with more mesic shrub understorey. Dominant canopy trees include Forest Red Gum *Eucalyptus tereticornis*, Grey Box *E. moluccana*, Narrow-leaved Ironbark *E. crebra* and Spotted Gum *Corymbia maculata*. Small trees, such as Hickory Wattle *Acacia implexa* and Sydney Green Wattle *A. parramattensis ssp parramattensis* are also common. The shrub layer includes *Breynia oblongifolia*, *Hairy Clerodendrum Clerodendrum tomentosum* and *Indian Weed Siegesbeckia orientalis ssp orientalis.*	**Recorded** within 10km (OEH, 2012b)	Nil. Not recorded; no appropriate habitat.
Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions	EEC		Occurs above 4-500m asl on undulating tablelands and plateaus, typically on basic volcanic , fine grained sedimentary substrates or occasionally granite. Associated with accumulations of peaty or organic mineral sediments on poorly drained flats in stream headwaters. Dense, open or sparse layer of shrubs with soft-leaved sedges, grasses and forbs. Only type of wetland that may contain more than trace amounts of mosses (*Sphagnum* spp.). Small trees may be absent, or present as scattered emergent.	**Recorded** within 10km (OEH, 2012b)	Nil. Not recorded; no appropriate habitat.

Community	TSC Act	EPBC Act	Habitat Association	Details of record	Presence in study areas
Mount Gibraltar Forest in the Sydney Basin Bioregion	EEC	EEC	Confined to a small number of pockets in the Southern Highlands region mainly near Bowral and Mittagong. Occurs in the Wingecarribee LGA, but may occur elsewhere in the Sydney Basin Bioregion. Restricted to clay soils on microsyenite intrusions in the central parts of the Southern Highlands. Occurs on gentle to steep slopes with correspondingly deep and shallow soils respectively; combined with aspect, these factors contribute to the variability evident in the floral composition of this community (OEH, 2012b).	**Recorded** within 10km (OEH, 2012b)	Nil. Not recorded; no appropriate habitat.
O'Hares Creek Shale Forest	EEC		The community occupies approximately 286ha within the LGAs of Campbelltown, Wollondilly and Wollongong between the Cataract Special Area and Appin Road to Helensburgh (OEH, 2012b). Forms part of a network of vegetation communities that occupy the remnant shales soils that lie above the sandstone plateau. The community is a component of the more broadly occurring Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateau, Sydney Basin community (OEH, 2012b).	**Recorded** within 10km (OEH, 2012b)	Nil. Not recorded; no appropriate habitat.
River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	EEC		Occurs on flats, drainage lines and river terraces of coastal floodplains where flooding is periodic and soils generally rich in silt, lack deep humic layers and have little or no saline (salt) influence. Occurs south from Port Stephens in the NSW North Coast, Sydney Basin and South East Corner bioregions. Characterised by a tall open canopy layer of eucalypts with	**Recorded** within 10km (OEH, 2012b)	Unlikely. This community is more common in the broader floodplain of West Dapto, on heavier clay soils. It shares some similarities with Swamp Sclerophyll Forest which is

Community	TSC Act	EPBC Act	Habitat Association	Details of record	Presence in study areas
			variable species composition.		found within the study area on the coastline.
Robertson Basalt Tall Open-forest in the Sydney Basin Bioregion	EEC		Typically restricted to occurrences of Robertson Basalt in the southern highlands, also on Cambewarra range to the south. Grows on highly fertile soils derived from basalt, on the slopes of rolling hills in areas of 1000-1600mm annual rainfall. Open forest or woodland to 30m tall with a sparse to moderately dense shrub layer and a dense herbaceous ground layer. Dominant tree species include *Eucalyptus fastigata, E. viminalis, E. radiata* and *E. cypellocarpa. Acacia melanoxylon* is a common small tree species in this community.	**Recorded** within 10km (OEH, 2012b)	Nil. Not recorded; no appropriate habitat.
Robertson Rainforest in the Sydney Basin Bioregion	EEC		Occurs mainly on the Robertson Plateau, also on the higher parts of the Cambewarra Range. Grows between 500-700m asl and appears to be restricted to Robertson Basalt. Warm or cool temperate rainforest with generally dense structure. Dominated by *Quintinia sieberi, Polyosma cunninghamii, Doryphora sassafras* and *Acacia melanoxylon*.	**Recorded** within 10km (OEH, 2012b)	Nil. Not recorded; no appropriate habitat.

Community	TSC Act	EPBC Act	Habitat Association	Details of record	Presence in study areas
Shale gravel Transition Forest in the Sydney Basin Bioregion	EEC	CEEC	Primarily in the northern section of the Cumberland Plain, also found in Liverpool/Holsworthy, Bankstown, Yennora, Villawood and Kemps Creek areas. Occurs primarily where shallow deposits from ancient river systems overlay shale soils, but also associated with localised concentrations of iron-hardened gravel. Open forest with canopy dominated by *Eucalyptus fibrosa*, *E. moluccana* and *E. tereticornis*, often with small tree layer of *Melaleuca decora* over a sparse shrub layer. Grades into Cumberland Plain Woodland where the influence of gravel soil declines, and into Cooks River/Castlereagh Ironbark Forest or Castlereagh Scribbly Gum Woodland where gravel deposits are thick.	**Recorded** within 10km (OEH, 2012b)	Nil. Not recorded; no appropriate habitat.
Shale/Sandstone Transition Forest	EEC	EEC	Occurs mainly in the north of the Cumberland Plain in Richmond, Marsden Park and Windsor districts, but is also found in Liverpool/Holsworthy, Bankstown, Yennora, Villawood and the Kemps Creek areas. Open forest structure with canopy dominated by *Eucalyptus fibrosa*, *E. moluccana* and *E. tereticornis*, with *Melaleuca decora* also common. Shrub layer characterised by *Bursaria spinosa*, *Daviesia ulicifolia*, and *Lissanthe strigosa*.	**Recorded** within 10km (OEH, 2012b)	Nil. Not recorded; no appropriate habitat.
Southern Highlands Shale Woodlands in the Sydney Basin Bioregion	EEC		Restricted to sheltered heads and upper slopes of gullies on transitional zones where sandstone outcrops may exist, but where soils are influenced by lateral movement of moisture, nutrients and sediment from more fertile substrates in an area bounded by Hurstville, Carss Park, Bundeena, Otford, Stanwell Tops, Darkes Forest, Punchbowl Creek and Menai.	**Recorded** within 10km (OEH, 2012b)	Nil Not recorded; no appropriate habitat

Community	TSC Act	EPBC Act	Habitat Association	Details of record	Presence in study areas
			Open forest dominated by *Angophora costata*, *Eucalyptus piperita* and occasional *E. pilularis* over scattered subcanopy trees, a diverse shrub layer and well-developed groundcover of ferns, forbs, grasses and graminoids. Variable species composition.		
Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion	EEC		Restricted to sheltered heads and upper slopes of gullies on transitional zones where sandstone outcrops may exist, but where soils are influenced by lateral movement of moisture, nutrients and sediment from more fertile substrates in an area bounded by Hurstville, Carss Park, Bundeena, Otford, Stanwell Tops, Darkes Forest, Punchbowl Creek and Menai. Open forest dominated by *Angophora costata, Eucalyptus piperita* and occasional *E. pilularis* over scattered subcanopy trees, a diverse shrub layer and well-developed groundcover of ferns, forbs, grasses and graminoids. Variable species composition.	**Recorded** within 10km (OEH, 2012b)	Nil. Not recorded; no appropriate habitat.
Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions	EEC		Occurs on plateaus and tablelands between 600-900m asl with loam or clay soils derived primarily from basalt, but may also be derived from mudstones, granites, alluvium and other substrates. Known from Bathurst Regional, Goulburn Mulwaree, Oberon, Palerang, Shoalhaven, Upper Lachlan and Wingecarribee LGAs. Open, variable canopy which may include Ribbon Gum, Narrow-leaved Peppermint, Mountain Gum and Snow Gum, over a sparse shrub layer and dense groundcover of herbs and grass. Community also includes	**Recorded** within 10km (OEH, 2012b)	Nil. Not recorded; no appropriate habitat.

Community	TSC Act	EPBC Act	Habitat Association	Details of record	Presence in study areas
			derived native grasslands where trees have been removed.		
Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion		EEC	Generally confined to the Sydney Basin IBRA Bioregion although some occurrences may extend outside the Sydney Basin Bioregion boundary, e.g. the southern extent at Sassafras, east of Nerriga NSW, and patches on the Boyd Plateau and Mt Werong. Generally tall open eucalypt forests found on igneous rock (predominately Tertiary basalt and microsyenite) in, or adjacent to, the Sydney Basin Bioregion.	**Predicted** to occur within 10km (DSEWPaC, 2012b)	Nil. Not recorded; no appropriate habitat.
Western Sydney Dry Rainforest in the Sydney Basin Bioregion	EEC		Restricted to hilly country where it occurs on clay soils derived from Wianamatta shale on sheltered lower slopes and gullies. Very restricted and occurs mostly in the Razorback Range near Picton. Outlying occurrences at Grose Vale and Cattai. Canopy trees include *Melaleuca styphelioides*, *Acacia implexa* and A*lectryon subcinereu*s. Shrub layer includes rainforest species *Notolaea longifolia, Clerodendrum tomentosum* and *Pittosporum* revolutum. The shrub layer combines with vines to form dense thickets in sheltered locations.	**Recorded** within 10km (OEH, 2012b)	Nil. Not recorded; no appropriate habitat.

Table D: Threatened Flora and Fauna that are unlikely occur within the study area

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of Record	Likelihood of occurrence within the study area
Flora						
Acacia baueri subsp. aspera		V		Restricted to the Sydney region; Kings Tableland in the central Blue Mountains and with sporadic occurrences on the Woronora Plateau in the Royal National Park, Mt. Keira district and at Wedderburn, Woronora Plateau in the Flat Rock Junction and Stanwell Tops area of the Illawarra. Occurs in low, damp heathlands, often on exposed rocky outcrops over a wide range of climatic and topographical conditions (OEH, 2012b).	**8 records** within 10km (OEH, 2012b)	Unlikely. Not recorded; no appropriate habitat.
Acacia bynoeana	Bynoe's Wattle	E	V	Endemic to central eastern NSW, currently known from only 34 locations, many of only 1-5 plants. Grows mainly in heath/ dry sclerophyll forest on sandy soils, prefers open, sometimes slightly disturbed sites such as trail margins, road edges, and in recently burnt open patches. Flowers September to March, and fruit matures in November.	**41 records** within 10km (OEH, 2012b)	Unlikely. Not recorded; no appropriate habitat.
Arthropteris palisotii	Lesser Creeping Fern	E		Occurs on the Illawarra Escarpment, North-eastern NSW and also in Queensland. Occurs in rainforest, mainly on tree trunks (OEH, 2012b).	**1 record** within 10km (OEH, 2012b)	Unlikely. Not recorded; no appropriate habitat.
Astrotricha crassifolia	Thick-leaf Star-hair	V	V	Occurs near Patonga (Gosford LGA), and in Royal NP and on the Woronora Plateau (Sutherland and Campbelltown LGAs). There is also a record from near Glen Davis (Lithgow LGA). Grows on dry ridge tops to 30m altitude, associated	**155 records** within 10km (OEH, 2012b) **Predicted** to	Unlikely. Not recorded; no appropriate habitat.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of Record	Likelihood of occurrence within the study area
				with very rich heath, or dry sclerophyll woodland on sandstone.	occur within 10km (DSEWPaC, 2012b)	
Boronia deanei	Deane's Boronia	V	V	This small erect shrub is found in scattered populations between the far south-east of NSW and the Blue Mountains (including the upper Kangaroo River near Carrington Falls, the Endrick River near Nerriga and Nalbaugh Plateau), mainly in conservation reserves. The species grows on the margins of high altitude swamps, in wet heath on sandstone, and in drier open forest.	**Predicted** to occur within 10km (DSEWPaC, 2012b)	Unlikely. Not recorded; no appropriate habitat.
Caladenia tessellata		E	V	Occurs from Central Coast NSW to southern Victoria. Mostly coastal but extends inland to Braidwood in southern NSW. In NSW grows in grassy dry sclerophyll woodland on clay loam or sandy soils, and less commonly in heathland on sandy loam soils (Duncan, 2010).	**Predicted** to occur within 10km (DSEWPaC, 2012b)	Unlikely. Not recorded; no appropriate habitat.
Callitris endlicheri	Black Cypress Pine, Woronora Plateau population	EP		Occurs on Woronora Plateau, in the Wollongong LGA, represents the coastal limit of the species' range and is disjunct from other known populations of the species. Restricted to a single outcrop of sandstone (2ha). Usually found on stony hills or ridges from both plains and coastal ranges (OEH, 2012b)	**4 records** within 10km (OEH, 2012b)	Unlikely. Not recorded; no appropriate habitat

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of Record	Likelihood of occurrence within the study area
Daphnandra johnsonii	Illawarra Socketwood	E	E	Rainforest tree to 20 metres tall. Restricted to the Illawarra region where it has been recorded from the local government areas of Shoalhaven, Kiama, Shellharbour and Wollongong. Occupies the rocky hillsides and gullies of the Illawarra lowlands, occasionally extending onto the upper escarpment slopes.	**Predicted** to occur within 10km (DSEWPaC, 2012b)	Unlikely. Not recorded; no appropriate habitat.
Daphnandra sp. C Illawarra	Illawarra Socketwood	E	E	Rainforest tree to 20 metres tall. Restricted to the Illawarra region where it has been recorded from the local government areas of Shoalhaven, Kiama, Shellharbour and Wollongong. Occupies the rocky hillsides and gullies of the Illawarra lowlands, occasionally extending onto the upper escarpment slopes.	**6 records** within 10km (OEH, 2012b)	Unlikely. Not recorded; no appropriate habitat.
Epacris purpurascens var. purpurascens		V		Occurs from Gosford in the north, Narrabeen in the east, Silverdale in the west and Avon Dam vicinity in the South. Grows in a range of sclerophyll forest, scrubs and swamps, most of which have a strong shale soil influence.	**20 records** within 10km (OEH, 2012b)	Unlikely. Not recorded; no appropriate habitat.
Eucalyptus camfieldii	Camfield's Stringybark	V	V	Occurs from Raymond Terrace to Waterfall, with populations known from Norah Head (Tuggerah Lakes), Peats Ridge, Mt Colah, Elvina Bay Trail (West Head), Terrey Hills, Killara, North Head, Menai and the Royal NP. Occurs in exposed situations on sandstone plateaus, ridges and slopes near the coast, often on the boundary of tall coastal heaths or low open woodland. It grows in shallow sandy soils overlying Hawkesbury sandstone.	**Predicted** to occur within 10km (DSEWPaC, 2012b)	Unlikely. Not recorded; no appropriate habitat.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of Record	Likelihood of occurrence within the study area
Eucalyptus corticosa	Creswick Apple Box	V		Restricted to a small area near Mount Coricudgy in the Rylstone area on the Central Tablelands. Occurs in sclerophyll woodland on shallow infertile soils on sandstone ridges associated with the upper reaches of the Cudgegong River; often associated with *Eucalyptus rossii* (OEH, 2012b).	**1 record** within 10km from 1994; location details not released (OEH, 2012b)	Unlikely. Not recorded; no appropriate habitat.
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	V	V	Occurs between Moss Vale/Bargo and lower Hunter Valley, with most occurrences in Appin, Wedderburn, Picton and Bargo. Broad habitat range including heath, shrubby woodland and open forest on light clay or sandy soils, and often in disturbed areas such as on the fringes of tracks.	**Predicted** to occur within 10km (DSEWPaC, 2012b)	Unlikely. Not recorded; no appropriate habitat.
Irenepharsus trypherus	Illawarra Irene	E	E	Recorded from 18 sites within the Kiama, Shellharbour, Shoalhaven, Tallaganda, Wingecarribee and Wollongong LGAs. Typically occurs on steep rocky slopes near cliff lines and ridge tops. Associated vegetation includes moist sclerophyll forest, *Backhousia myrtifolia* thicket and rainforest. Typically occurs on steep rocky slopes near cliff lines and ridge tops. Associated vegetation includes moist sclerophyll forest, *Backhousia myrtifolia* thicket and rainforest.	**Predicted** to occur within 10km (DSEWPaC, 2012b)	Unlikely. Not recorded; no appropriate habitat.
Lespedeza juncea subsp. sericea		EP; in the Wollongong LGA		Occurs south of Dapto in the Wollongong LGA. Disjunct from the other non-endangered populations which occur in western Sydney. The known population comprised about 200 plants; located in a small strip of open forest	**1 record** within 10km (OEH, 2012b) **Predicted** to	Unlikely. Not recorded; no appropriate habitat.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of Record	Likelihood of occurrence within the study area
				dominated by *Eucalyptus tereticornis* (Forest Red Gum), *E. longifolia* (Woollybutt), and *Melaleuca decora* (White Feather Honeymyrtle), on Budgong Sandstone (OEH, 2012b).	occur within 10km (DSEWPaC, 2012b)	
Leucopogon exolasius	Woronora Beard-heath	V	V	Occurs along the upper Georges River and in Heathcote NP, Royal NP and is also known from the Blue Mountains along the Grose River. Grows in woodland on sandstone and prefers rocky hillsides along creek banks up to 100m altitude. Associated species include *Eucalyptus piperita* and *E. sieberi* and *Pultenaea flexilis, Leptospermum trinervium* and *Dillwynia retorta.*	**27 records** within 10km (OEH, 2012b)	Unlikely. Not recorded; no appropriate habitat.
Melaleuca biconvexa	Biconvex Paperbark	V	V	Only found in NSW, with scattered and dispersed populations exist in the Jervis Bay area in the south and the Gosford-Wyong area in the north. Generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects (OEH, 2012b).	**Predicted** to occur within 10km (DSEWPaC, 2012b)	Unlikely. Not recorded; no appropriate habitat.
Melaleuca deanei	Deane's Paperbark	V	V	Occurs from Nowra-St Albans and west to the Blue Mountains, with most records in Ku-ring-gai/Berowra and Holsworthy/Wedderburn areas. Mostly grows on broad flat ridge tops, dry ridges and slopes and strongly associated with low nutrient sandy loam soils, sometimes with ironstone. Grows in heath-open forest, often in sandstone ridge top woodland communities.	**4 records** within 10km (OEH, 2012b) **Predicted** to occur within 10km (DSEWPaC, 2012b)	Unlikely. Not recorded; no appropriate habitat.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of Record	Likelihood of occurrence within the study area
Pelargonium sp Striatellum	Omeo's Storkbill	E	E	Omeo Storksbill *Pelargonium* sp. (G.W. Carr 10345), syn. *P. striatellum*, is a tufted perennial forb known from only three locations in NSW, with two on lake-beds on the basalt plains of the Monaro and one at Lake Bathurst. It has a narrow habitat that is usually just above the high-water level of irregularly inundated or ephemeral lakes, in the transition zone between surrounding grasslands or pasture and the wetland or aquatic communities.	**Predicted** to occur within 10km (DSEWPaC, 2012b)	Unlikely. Not recorded; no appropriate habitat.
Persoonia hirsuta	Hairy Geebung	E	E	Occurs within the Blue Mountains, Southern Highlands and Sydney coastal regions from Hilltop to Glen Davis and Royal NP to Gosford. Population within the Hills Shire particularly important due to high density of plants. Grows on sandy soils in dry sclerophyll open forest, woodland and heath on sandstone up to 600m above sea level.	**1 record** within 10km (OEH, 2012c)	Unlikely. Not recorded; no appropriate habitat.
Pimelea curviflora var. curviflora	Pimelea curviflora var. curviflora	V	V	Confined to area between north Sydney in the south and Maroota in the north-west. Former range extended to Parramatta River including Five Dock, Bellevue Hill and Manly. Grows on shale/lateritic soils over sandstone and shale/sandstone transition soils on ridge tops and upper slopes amongst woodlands. Often grows amongst dense grasses and sedges. Flowers October to May.	**Predicted** to occur within 10km (DSEWPaC, 2012b)	Unlikely. Not recorded; no appropriate habitat.
Pomaderris adnata	Sublime Point Pomaderris	E		Known from Sublime Point (north of Wollongong). Occurs near the edge of the plateau behind the Illawarra escarpment; associated with *Eucalyptus sieberi* (Silver-top Ash) - *Corymbia gummifera* (Red Bloodwood) forest with	**27 records** within 10km (OEH, 2012b)	Unlikely. Not recorded during GHD field surveys; no

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of Record	Likelihood of occurrence within the study area
				occasional *Hakea salicifolia* (Willow-leaved Hakea).		appropriate habitat.
Prostanthera marifolia	Seaforth Mintbush	CE	CE	Only known from a 2 x 2km area in Seaforth, North Sydney. Associated with the endangered Duffys Forest ecological community. Grows on deeply weathered clay-loam soils associated with ironstone and scattered shale lenses.	**9 records** within 10km (OEH, 2012b)	Unlikely. Not recorded during GHD field surveys; no appropriate habitat.
Pterostylis gibbosa	Illawarra Greenhood	E	E	Known from a small number of populations in the Illawarra, Nowra and Hunter regions. First collected in western Sydney. Only visible above the ground between late summer and spring, and only when soil moisture levels can sustain its growth. Grows in open forest or woodland, on flat or gently sloping land with poor drainage. In the Illawarra region, *the* species grows in woodland dominated by *Eucalyptus tereticornis, E. longifolia* and *Melaleuca decora*. Near Nowra, the species grows in an open forest of *Corymbia maculata, E.tereticornis* and *E. paniculata*.	**12 records** within 10km (OEH, 2012b) **Predicted** to occur within 10km (DSEWPaC, 2012b)	Unlikely. Not recorded during GHD field surveys; no appropriate habitat.
Pterostylis saxicola	Sydney Plains Greenhood	E	E	Occurs in western Sydney between Picton and Freemans Reach. Grows in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. Associated vegetation above these rock shelves is sclerophyll forest or woodland on shale or shale/sandstone transition soils.	**Predicted** to occur within 10km (DSEWPaC, 2012b)	Unlikely. Not recorded during GHD field surveys; no appropriate habitat.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of Record	Likelihood of occurrence within the study area
Pultenaea aristata	Prickly Bush-pea	V	V	Restricted to the Woronora Plateau, a small area between Helensburgh, south of Sydney, and Mt. Keira above Wollongong (OEH, 2012b). Occurs in either dry sclerophyll woodland or wet heath on sandstone.	**4980 records** within 10km (OEH, 2012b) **Predicted** to occur within 10km (DSEWPaC, 2012b)	Unlikely. Not recorded during GHD field surveys; no appropriate habitat.
Pultenaea glabra	Smooth Bush-pea	V	V	In NSW restricted to higher Blue Mountains in the Katoomba-Hazelbrook and Mt Victoria areas. Unconfirmed sightings in Mt. Wilson and Mt. Irvine areas. Grows in swamp margins, hillslopes, gullies and creekbanks and occurs within dry sclerophyll forest and tall damp heath on sandstone.	**1 record** within 10km (OEH, 2012b)	Unlikely. Not recorded during GHD field surveys; no appropriate habitat.
Sarcochilus fitzgeraldii	Ravine Orchid	V		Occurs north-east NSW, north of the Macleay River, to Maleny in south-east Queensland. Grows mainly on rocks, amongst organic matter, in cool, moist, shady ravines, gorges and on cliff faces in dense subtropical rainforest at altitudes between 500 and 700m (OEH, 2012b). Occasional clumps are found on the bases of fibrous-barked trees (OEH, 2012b).	**1 record** within 10km from 1994; location notes withheld (OEH, 2012b)	Unlikely. Not recorded during GHD field surveys; no appropriate habitat.
Thelymitra sp. Kangaloon	Kangaloon Sun-orchid		CE	Only known from three locations near Robertson in the Southern Highlands. Grows in seasonally swampy sedgeland on grey silty clay loam at 600–700m above sea level. Flowers in late October and early November.	**Predicted** to occur within 10km (DSEWPaC, 2012b)	Unlikely. Not recorded during GHD field surveys; no appropriate habitat.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of Record	Likelihood of occurrence within the study area
Zieria granulata	Illawarra Zieria	E	E	A tall bushy shrub that grows to 6m. Restricted to the Illawarra region where it is recorded from a number of sites. The species primarily occupies the coastal lowlands between Oak Flats and Toolijooa. The typical habitat is dry ridge tops and rocky outcrops on shallow volcanic soils, usually on Bombo Latite. Less frequently found on the moist slopes of the Illawarra escarpment and in low-lying areas on Quaternary sediments.	**54 records** within 10km (OEH 2012c) **Predicted** to occur within 10km (DSEWPaC, 2012b)	Unlikely. Not recorded during GHD field surveys; no appropriate habitat.
Birds						
Sternula nereis nereis	Australian Fairy Tern		V	Occurs along NSW coast. Inhabit offshore, estuarine or lake islands, wetlands, beaches and spits. Nests on coral shingle on continental islands or coral cays, on sandy islands and beaches inside estuaries and on open sandy beaches.	**Predicted** to occur within 10km (DSEWPaC, 2012b)	Possible. Previously occurred along the east coast of NSW, but unknown whether it persists in NSW (DSEWPaC, 2012b).
Coracina lineata	Barred Cuckoo-shrike	V		Coastal eastern Australia from Cape York to the Manning River in NSW. Generally uncommon in their range, and are rare in NSW. Prefers rainforest, eucalypt forests and woodlands, clearings in secondary growth, swamp woodlands and timber along watercourses (OEH, 2012b).	**2 records** within 10km from 1998 from the Wollongong Botanical Gardens (OEH, 2012b)	Unlikely. Outside of known distribution (OEH, 2012b) May forage within study areas, or use parts of study area as a movement corridor.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of Record	Likelihood of occurrence within the study area
Oxyura australis	Blue-billed Duck	V		Partly migratory, travels short distances between breeding swamps and over-wintering lakes. Young birds disperse in April-May from breeding swamps in inland NSW to Murray River system and coastal lakes. Prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. Nests in Cumbungi over deep water or in trampled Lignum, sedges or spike-rushes. Completely aquatic, swimming along the edge of dense cover.	**4 records** within 10km (OEH, 2012b)	Unlikely. May forage within study area, or use parts of study area as a movement corridor.
Pezoporus wallicus wallicus	Eastern Ground Parrot	V		Occurs in high rainfall coastal and near coastal low heathlands and sedgelands, generally below one metre in height and very dense (up to 90% projected foliage cover). Ground Parrots can re-colonise burnt habitat after 1-2 years and reach maximum densities after 15-20 years without fire. Home ranges of adult birds is typically 10ha and overlapping with other birds, while juveniles have a significantly larger home range. Ground Parrots feed mostly on seeds from a large range of plant species, which varies seasonally. Eggs are laid in a shallow bowl of fine sticks and grass, well hidden under overhanging tall, coarse grass, sedge or low, heathy shrubs.	**5 records** within 10km (OEH, 2012b)	Unlikely. Limited suitable habitat present.
Petroica phoenicea	Flame Robin	V		Breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. Migrates in winter to more open lowland habitats such as grassland with scattered trees and open woodland on the inland slopes and plains. Forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs	**1 record** within 10km (OEH, 2012b)	Unlikely. Limited suitable habitat present.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of Record	Likelihood of occurrence within the study area
				and other coarse woody debris. Fallen logs and coarse woody debris are important habitat components. Open cup nest of plant fibres and cobweb is often built near the ground in a sheltered niche, ledge or shallow cavity in a tree, stump or bank.		
Hieraaetus morphnoides	Little Eagle	V		Occurs throughout NSW except most densely forested parts of the Dividing Range escarpment. Occupies habitats rich in prey within open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. For nest sites it requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring.	**11 records** within 10km (OEH, 2012b)	Unlikely. May fly over, refuge and forage within study areas on occasion. Unlikely to rely on habitats present in study areas.
Glossopsitta pusilla	Little Lorikeet	V		Occurs from coast to western slopes of the Great Dividing Range. Inhabits dry, open eucalypt forests and woodlands. Occurrence is positively associated with patch size, and with components of habitat complexity including canopy cover, shrub cover, groundcover, logs, fallen branches and litter. Feed primarily on profusely-flowering eucalypts and a variety of other species including melaleucas and mistletoes. On the western slopes and tablelands *Eucalyptus albens* and E. *melliodora* are particularly important food sources for pollen and nectar respectively. Mostly nests in small (opening approx. 3cm) hollows in living, smooth-barked eucalypts, especially *Eucalyptus viminalis*, E. *blakelyi* and E. *dealbata*.	**3 records** within 10km (OEH, 2012b)	Unlikely. Could potentially occur in some patches. Unlikely to rely on habitats present in study areas.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of Record	Likelihood of occurrence within the study area
				Most breeding records are from the western slopes.		
Pachycephala olivacea	Olive Whistler	V		Has a disjunct distribution along NSW predominantly occupying areas around Barrington Tops, the Macpherson Ranges and from the Illawarra south to Victoria (OEH, 2012b).Mostly inhabit wet forests above about 500m and during the winter months they may move to lower altitudes (OEH, 2012a).Forage in trees and shrubs and on the ground, feeding on berries and insects. Make nests of twigs and grass in low forks of shrubs.	**2 records** within 10km (OEH, 2012b)	Unlikely. May fly over and forage within the study area on occasion.
Grantiella picta	Painted Honeyeater	V		Nomadic, occurring in low densities across most of NSW. Highest concentrations and almost all breeding occur on inland slopes of the Great Dividing Range. Inhabits Boree, Brigalow and Box Gum woodlands and Box-Ironbark forests. Specialist forager on the fruits of mistletoes, preferably of the *Amyema* genus. Nests in outer tree canopy.	**1 record** within 10km (OEH, 2012b)	Unlikely. Limited suitable habitat present.
Petroica rodinogaster	Pink Robin	V		In NSW occurs mainly in the South Coast and Southern Tablelands regions. It is vagrant in the Sydney and Illawarra areas, with generally only individual birds recorded in these areas. It prefers a dense shrub layer in damp or wet forests or rainforests. It generally breeds in wet gullies. It forages for insects on the ground or in low undergrowth. It may be partly migratory or dispersive in autumn and winter. It is generally seen in pairs, occasionally small flocks.	3 records within 10km (OEH, 2012b)	Unlikely. Limited suitable habitat present.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of Record	Likelihood of occurrence within the study area
Erythrotriorchis radiatus	Red Goshawk	CE	V	Typically occurs in coastal and subcoastal areas, with 90% of recent records in NSW confined to the Northern Rivers and Northern Tablelands regions, north of the Clarence River. Formerly occurred south to Port Stephens. Prefer woodlands and forests with a mosaic of vegetation types that are open enough for fast manoeuvring flight, avoiding very open or very dense habitats. In NSW inhabits mixed subtropical rainforest, Melaleuca swamp forest and open eucalypt forest along coastal rivers. Nests built within 1km of a permanent freshwater body in a large, tall tree (>20m) within a remnant stand. Home ranges large (120-200km^2).	**Predicted** to occur within 10km (DSEWPaC, 2012b)	Unlikely. May fly over and forage on occasion, although no records are present in the study area.
Polytelis anthopeplus monarchoides	Regent Parrot (eastern subspecies)	E	V	Restricted to areas around the Murray River in South Australia, Victoria and NSW. In NSW it occurs along the Murray River downstream of Tooleybuc, the Wakool River downstream of Kyalite, and the Murrumbidgee River immediately upstream from the junction with the Murray River and adjoining areas of mallee (OEH, 2012b). Foraging habitat is mallee woodlands and occasionally riverine forests and woodlands. Nests within River Red Gum forests along the Murray, Wakool and lower Murrumbidgee Rivers, and possibly the Darling River downstream of Pooncarie. Typical nest trees are large, mature healthy trees with many spouts (though dead trees are used) and are usually located close to a watercourse (OEH, 2012b).	**1 record** within 10km from 1990 (OEH, 2012b)	Unlikely. Outside of known distribution. Unlikely to roost or breed in the study area given the lack of suitable River Red Gum.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of Record	Likelihood of occurrence within the study area
Petroica boodang	Scarlet Robin	V		In NSW occurs from coast to inland slopes. Breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within open understorey of shrubs and grasses and sometimes in open areas. In autumn and winter it migrates to more open habitats such as grassy open woodland or paddocks with scattered trees. Abundant logs and coarse woody debris are important habitat components.	**8 records** within 10km (OEH, 2012b)	Unlikely. Limited suitable habitat present.
Circus assimilis	Spotted Harrier	V		Occurs throughout Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. Individuals disperse widely in NSW and comprise a single population. Inhabits grassy open woodland including acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe (e.g. chenopods). Most commonly in native grassland, but also in agricultural land, foraging over open habitats including edges of inland wetlands. Builds a stick nest in a tree and lays eggs in spring (or sometimes autumn).	**1 record** within 10km (OEH, 2012b)	Unlikely. May fly over and forage within the study area on occasion. Unlikely to rely on the habitats present within the study areas.
Lophoictinia isura	Square-tailed Kite	V		Occurs across NSW, resident in North, northeast and along west-flowing rivers. Summer breeding migrant to southeast of state. Inhabits a variety of habitats including woodlands and open forests, with preference for timbered watercourses. Favours productive forests on the coastal plain, box-ironbark-gum woodlands on the inland slopes, and Coolibah River Red Gum on the inland plains. In Sydney area nests in mature living trees within 100m of	**6 records** within 10km (OEH, 2012b)	Unlikely. May fly over study area on occasion – particularly where continuous vegetation is present. Suitable breeding habitat not present.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of Record	Likelihood of occurrence within the study area
				ephemeral/permanent watercourse. Large home range > 100km^2.		Unlikely to rely on the habitats present within the study areas.
Polytelis swainsonii	Superb Parrot	V	V	Occurs as a single population in the South-west Slopes and Riverina bioregions. Two core breeding areas: between Cowra and Yass – Grenfell, Cootamundra and Coolac in the SW Slopes, and along the Murray, Edward and Murrumbidgee Rivers in the Riverina. Birds breeding in the SW slopes migrate north to the Namoi/Gwydir Rivers for winter. Inhabits Box Gum, Box – Cypress Pine and Boree woodlands and River Red Gum Forest. Nest in hollow trees, in tall riparian River Red Gum communities (Riverina area) or open Box Gum woodland or isolated paddock trees (SW Slopes). Mainly forages in grassy box woodlands, up to 10km from breeding sites.	**1 record** within 10km (OEH, 2012b)	Unlikely. Outside of known distribution. Unlikely to roost or breed in the study areas given the lack of suitable hollows.
Mammals						
Petrogale pencillata	Brush-tailed Rock-wallaby	E	V	Occurs from the Shoalhaven north to the Queensland border. Now mostly extinct west of the Great Dividing Range, except in the Warrumbungles and Mt Kaputar. Occurs on rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north. Diet consists of vegetation in adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees.	**Predicted** to occur within 10km (DSEWPaC, 2012b)	Unlikely. No suitable habitat present and study area is outside of known distribution.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of Record	Likelihood of occurrence within the study area
Mormopterus norfolkensis	Eastern Freetail-bat	V		Occurs in dry sclerophyll forest and woodland east of the Great Dividing Range. Forages in natural and artificial openings in vegetation, typically within a few kilometres of its roost. Roosts primarily in tree hollows but also recorded from man-made structures or under bark (Churchill, 2008).	**8 records** within 10km (OEH, 2012b)	Unlikely. May forage within study area, or use parts of study area as a movement corridor. Unlikely to roost or breed in the study area given the lack of suitable hollows.
Scoteanax rueppellii	Greater Broad-nosed Bat	V		Occurs on the east coast and Great Dividing Range. Inhabits a variety of habitats from woodland to wet and dry sclerophyll forests and rainforest, also remnant paddock trees and timber-lined creeks, typically below 500m asl. Forages in relatively uncluttered areas, using natural or man-made openings in denser habitats. Usually roosts in tree hollows or fissures but also under exfoliating bark or in the roofs of old buildings. Females congregate in maternal roosts in suitable hollow trees (Hoye and Richards, 2008, Churchill, 2008).	**6 record** within 10km (OEH, 2012b).	Unlikely. May forage in the study area. Unlikely to roost or breed in the study area given the lack of suitable hollows.
Petaurus norfolcensis	Squirrel Glider	V		Occurs along the drier inland slopes as well as coastal habitats. Inhabits woodland and open forest with a Eucalyptus, Corymbia or Angophora overstorey and a shrubby understorey of Acacia or Banksia. Key habitat components include reliable winter and early-spring flowering Eucalypts, Banksia or other nectar sources, and hollow-bearing trees for roost and nest sites (van der Ree	**1 record** within 10km (OEH, 2012b).	Unlikely. Suitable foraging habitat present within the study areas such as Bulli Beach and Sandon Point Beach, although unlikely to breed given

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of Record	Likelihood of occurrence within the study area
				and Suckling, 2008, Quin et al., 1996), with social groups moving between multiple hollows. Social groups include one or two adult males and females with offspring, and have home ranges of 5-10ha within NSW (van der Ree and Suckling, 2008, Kavanagh, 2004).		the lack of hollow-bearing trees.
Phascolarctos cinereus	Koala	V	V	Occurs from coast to inland slopes and plains. Restricted to areas of preferred feed trees in eucalypt woodlands and forests. Home range varies depending on habitat quality, from < 2 to several hundred hectares.	**23 records** within 10km (OEH, 2012b) **Predicted** to occur within 10km (DSEWPaC, 2012b)	Unlikely. May forage on occasion. Most study areas are too fragmented for this species. Suitable breeding habitat not present.
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Occurs from the coast to the western slopes of the divide. Largest numbers of records from sandstone escarpment country in the Sydney Basin and Hunter Valley (Hoye and Schulz, 2008). Roosts in caves and mines and most commonly recorded from dry sclerophyll forests and woodlands. An insectivorous species that flies over the canopy or along creek beds (Churchill, 2008). In southern Sydney appears to be largely restricted to the interface between sandstone escarpments and fertile valleys.	**15 records** within 10km (OEH, 2012b) **Predicted** to occur within 10km (DSEWPaC, 2012b)	Unlikely. Limited suitable habitat present.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of Record	Likelihood of occurrence within the study area
Potorous tridactylus	Long-Nosed Potoroo	V	V	Restricted to east of the Great Dividing Range, with annual rainfall >760mm. Inhabits coastal heath and dry and wet sclerophyll forests. Requires relatively thick groundcover and appears restricted to areas of light and sandy soil (Johnston 2008). Feeds on fungi, roots, tubers, insects and their larvae, and other soft-bodied animals in the soil.	**Predicted** to occur within 10km (DSEWPaC, 2012b)	Unlikely. Could potentially occur in some patches, although no records present in the study area.
Pseudomys novaehollandiae	New Holland Mouse		V	Occurs in disjunct, coastal populations from Tasmania to Queensland. In NSW inhabits a variety of coastal habitats including heathland, woodland, dry sclerophyll forest with a dense shrub layer and vegetated sand dunes (Wilson and Bradtke, 1999). Populations may recolonise/increase in size in regenerating native vegetation after wildfire, clearing and sandmining. Presence strongly correlated with understorey vegetation density, and high floristic diversity in regenerating heath (Lock and Wilson, 1999).	**Predicted** to occur within 10km (DSEWPaC, 2012b)	Unlikely. Could potentially occur in some patches, although no records present in the study area.
Pseudomys fumeus	Smoky Mouse	E	E	In NSW recorded from Kosciuszko NP and adjacent areas, and Mt Poole, Nullica SF and South East Forests NP near Eden. Occurs from subalpine regions to sea-level. Appears to prefer heath habitat on ridge tops and slopes in sclerophyll forest, heathland and open-forest from the coast, characterised by floristically diverse shrub layer including abundance of *Epacridaceae, Fabaceae* and *Mimosaceae* spp. Also occurs in damp fern gullies. Nesting burrows have been recorded in rocky areas and under *Xanthorrhoea* bases.	**Predicted** to occur within 10km (DSEWPaC, 2012b)	Unlikely. Could potentially occur in some patches, although no records present in the study area.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of Record	Likelihood of occurrence within the study area
Isoodon obesulus obesulus	Southern Brown Bandicoot	E	E	Occurs mainly in two areas: Ku-ring-gai Chase and Garigal National Parks north of Sydney, and far south-east NSW including Ben Boyd National Park, East Boyd State Forest, Nadgee Nature Reserve, Nadgee State Forest, South East Forest and Yambulla State Forest but also occurs between these areas. Inhabits scrubby vegetation, including heath, shrubland, and heathy forest and woodland. Often associated with well-drained soils and dry heathland communities, and prefers periodically burnt areas as this increases insect abundance.	**Predicted** to occur within 10km (DSEWPaC, 2012b)	Unlikely. Could potentially occur in some patches, although no records present in the study area.
Reptiles						
Hoplocephalus bungaroides	Broad-Headed Snake	E	V	Nocturnal, sheltering in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter, and spring, moving to shelters in hollows of large trees within 200m of escarpments in summer. Feeds mostly on geckos and small skinks, and occasionally on frogs and small mammals.	**33 records** within 10km (OEH, 2012b) **Predicted** to occur within 10km (DSEWPaC, 2012b)	Unlikely. May forage within study area, or use parts of study area as a movement corridor.
Varanus rosenbergi	Rosenberg's Goanna	V		In NSW mainly occurs on the mid coast region from Wollemi NP to Nowra; the ACT and Goulburn regions and the South-west Slopes. Inhabits coastal heathlands, wet and dry sclerophyll forests, woodlands and mallee communities. Termite mounds are an important habitat feature: eggs are	**24 records** within 10km (OEH, 2012b)	Unlikely. May forage within study area, or use parts of study area as a

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of Record	Likelihood of occurrence within the study area
				laid in the mounds in summer and incubate till spring, when the young dig themselves out. Young may return to the mound as a refuge for some months, while adults shelter in burrows dug under rocks or logs, or in rock crevices, hollow logs or even rabbit burrows (Sass, 2008).		movement corridor.
Frogs						
Mixophyes iteratus	Giant Barred Frog	E	E	Occurs on the coast and ranges from south-eastern Queensland to the Hawkesbury River in NSW, particularly in Coffs Harbour - Dorrigo area. Forage and live amongst deep, damp leaf litter in rainforest, moist eucalypt forest and nearby dry eucalypt forest. Breed in shallow, flowing rocky streams. Within Sydney Basin, confined to small populations in tall, wet forest in the Watagan Mountains north of the Hawkesbury and the lower Blue Mountains (White, 2008a).	**Predicted** to occur within 10km (DSEWPaC, 2012b)	Unlikely. Could potentially occur in some patches, although no records present in the study area
Heleioporus australiacus	Giant Burrowing Frog	V	V	Occurs along the coast and eastern slopes of the Great Dividing Range south from Wollemi National Park. Appears to exist as two populations with a 100km gap in records between Jervis Bay and Eden. Northern population occurs on sandy soils supporting heath, woodland or open forest. Breeds in ephemeral to intermittent streams with persistent pools. Only infrequently moves to breeding sites, most commonly found on ridges away from creeks, several hundred metres from water.	**44 records** within 10km (OEH, 2012b) **Predicted** to occur within 10km (DSEWPaC, 2012b)	Unlikely. May forage within study area, or use parts of study area as a movement corridor.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of Record	Likelihood of occurrence within the study area
Pseudophryne australis	Red-crowned Toadlet	V		Restricted to Sydney Basin, from Nowra to Pokolbin and west to Mt. Victoria. Inhabits heathland and open woodland on Hawkesbury and Narrabeen Sandstones, within 100m of ridgelines. Breeds in ephemeral feeder creeks or flooded depressions, requiring unpolluted water between 5.5 and 6.5pH. Shelters under rocks, amongst masses of dense vegetation or leaf litter. Populations restricted to immediate vicinity of breeding areas.	**88 records** within 10km (OEH, 2012b)	Unlikely Limited preferred sandstone ridges within study area. May forage on occasion. Suitable breeding habitat not present.
Litoria raniformis	Growling Grass Frog, Southern Bell Frog, Green and Golden Frog		V	Currently, the species is known to exist only in isolated populations in the Coleambally Irrigation Area, the Lowbidgee floodplain and around Lake Victoria. Usually found in or around permanent or ephemeral Black Box/Lignum/Nitre Goosefoot swamps, Lignum/Typha swamps and River Red Gum swamps or billabongs along floodplains and river valleys. They are also found in irrigated rice crops, particularly where there is no available natural habitat (OEH, 2012b).	**Predicted** to occur within 10km (DSEWPaC, 2012b)	Unlikely. Outside of known distribution. Could potentially occur in some patches, although no records present in the study area.
Mixophyes balbus	Stuttering Barred Frog	E	V	Occurs along the east coast of Australia. Found in rainforest and wet, tall, open forest. Shelter in deep leaf litter and thick understorey vegetation on the forest floor. Feeds on insects and smaller frogs, breeding in streams during summer after heavy rain. Within Sydney Basin the species is now confined to populations in the Watagan Mountains, the southern Blue Mountains and Macquarie Pass (White, 2008b).	**Predicted** to occur within 10km (DSEWPaC, 2012b)	Unlikely. Could potentially occur in some patches, although no records present in the study area.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of Record	Likelihood of occurrence within the study area
Fish						
Prototroctes mairaena	Australian Grayling		V, M	Occurs in coastal rivers and streams south from the Shoalhaven River. Inhabits estuarine waters and coastal seas as larvae/juveniles, and freshwater rivers and streams as adults. Most of their lives are spent in freshwater rivers and streams in cool, clear waters with a gravel substrate and alternating pool and riffle zones, however can also occur in turbid water. The species can penetrate well inland, being recorded over 100km inland from the sea. (Backhouse et al., 2008).	**Predicted** to occur within 10km (DSEWPaC, 2012b)	Unlikely. No rivers and streams within the area of impact. No records present in the study area.
Epinephelus daemelii	Black Rockcod, Black Cod, Saddled Rockcod		V	Occurs from southern Queensland through NSW to northern Victoria. Generally inhabits near-shore rocky and offshore coral reefs at depths down to 50m (DSEWPaC, 2012b)	**Predicted** to occur within 10km (DSEWPaC 2012); Records within Southern Rivers CMA (DPI, 2007)	Unlikely. No rivers and streams within the area of impact. No records present in the study area.
Macquaria australasica	Macquarie Perch	V	E	Occurs in the upper reaches of the Lachlan, Murrumbidgee and Murray Rivers, and in parts of the Hawkesbury and Shoalhaven catchment areas. Inhabits river and lake habitats, especially the upper reaches of rivers and their tributaries. Requires clear water with deep, rocky holes and abundant cover (including aquatic vegetation, woody debris, large boulders and overhanging banks). Spawning	**Predicted** to occur within 10km (DSEWPaC 2012) Records within	Unlikely. No rivers and streams within the area of impact. No records present in the study area.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of Record	Likelihood of occurrence within the study area
				occurs in spring and summer in shallow upland streams or flowing sections of river systems.	Wollongong LGA between 1994-2006. (DPI, 2012a)	
Maccullochella macquariensis	Trout Cod	E	E	There are three known breeding populations in NSW: a naturally occurring population below Yarrawonga Weir in the Murray River, a stocked population in the Murrumbidgee River at Narrandera and a translocated population in Cataract Dam in coastal NSW. There are stocked (breeding unconfirmed) populations within the Murray, Murrumbidgee and Macquarie Rivers, and in Talbingo Dam in Koscisuko NP (DPI, 2006). The species occurs in a range of habitats, but is strongly associated with the presence of woody debris and snags (DPI, 2006).	**Predicted** to occur within 10km (DSEWPaC, 2012b)	Unlikely. No rivers and streams within the area of impact. No records present in the study area.
Invertebrates						
Austrocordulia leonardi	Sydney Hawk Dragonfly	E (FM Act)		The Sydney Hawk Dragonfly has a very restricted distribution. The known distribution of the species includes three locations in a small area south of Sydney, from Audley to Picton. The species is known from the Hawkesbury-Nepean, Georges River, Port Hacking and Karuah drainages. The Sydney Hawk Dragonfly has specific habitat requirements, and has only ever been collected from deep and shady riverine pools with cooler water. Larvae are found under rocks where they co-exist with *Austrocordulia refracta*.	Recorded within the Southern Rivers CMA (DPI, 2013b)	Unlikely. Limited suitable habitat present.