Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
						structures.	rainforest, wet and dry sclerophyll forest, paperbark forest and open grasslands. Has a fast, direct flight and forages for flying insects (particularly moths) above the tree canopy and along waterways.
Mormopterus norfolkensis	Eastern Freetail-bat		V	2010	Low	Foraging may occur in the area, however unlikely to roost in the study area, due to the lack of hollows.	Distribution extends east of the Great Dividing Range from southern Queensland to south of Sydney. Most records are from dry eucalypt forests and woodland. Individuals tend to forage in natural and artificial openings in forests, although it has also been caught foraging low over a rocky river within rainforest and wet sclerophyll forest habitats. The species generally roosts in hollow spouts of large mature eucalypts (including paddock trees), although individuals have been recorded roosting in the roof of a hut, in wall cavities, and under metal caps of telegraph poles. Foraging generally occurs within a few kilometres of roosting sites.
Myotis macropus	Southern Myotis		V	2009	High	Likely to forage over the water body. Roost sites appeared to be absent from the study area, however suitable roosts do occur elsewhere in Raymond Terrace.	Scattered, mainly coastal distribution extending to South Australia along the Murray River. Roosts in caves, mines or tunnels, under bridges, in buildings, tree hollows, and even in dense foliage. Colonies occur close to water bodies, ranging from rainforest streams to large lakes and reservoirs. They catch aquatic insects and small fish with their large hind claws, and also catch flying insects.
Petaurus norfolcensis	Squirrel Glider		V	2013	Low	Habitat marginal and largely devoid of hollows for roosting or nesting.	Sparsely distributed along the east coast and immediate inland areas as far west as Coonabarabran in the northern part of the state and as far west as Tocumwal along the southern border of the state. Generally occurs in dry sclerophyll forests and

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
							woodlands but is absent from dense coastal ranges in the southern part of its range. Requires abundant hollow-bearing trees and a mix of eucalypts, banksias and acacias. Within a suitable vegetation community at least one species should flower heavily in winter and one species of eucalypt should be smooth barked. They live in family groups of 2-10 individuals and maintain home ranges of 0.65 and 10.5 ha, varying according to habitat quality and food resource availability. Family groups occupy multiple hollows over time.
Phascogale tapoatafa	Brush-tailed Phascogale		V	1992	Low	Habitat marginal and largely devoid of hollows for roosting or nesting.	The Brush-tailed Phascogale had a scattered distribution centred around the Great Dividing Range. It prefers open forests with a sparse ground cover, but also inhabits mallee and rainforests. It feeds on insects and nectar, particularly in rough-barked trees. The Brush-tailed Phascogale will Nests and shelter in tree hollows, tree stumps and occasionally birds nests, and can use more than 40 nests in a year. Suitable tree hollows have entrances 25-40 mm wide. Females have exclusive territories of approximately 20 - 60 ha, while males have overlapping territories of up to 100 ha.
Phascolarctos cinereus	Koala	VU	V, E2	2014#	Moderate	There are a few *Eucalyptus robutsa* present in the study area, but not in the subject site. Use by local Koalas is likely to be mainly as a movement corridor.	In NSW the Koala mainly occurs on the central and north coasts with some populations in the western region. Koalas feed almost exclusively on eucalypt foliage, and their preferences vary regionally. Primary feed trees include *Eucalyptus robusta, E. tereticornis, E. punctata, E. haemastoma* and *E. signata*. They are solitary with varying home ranges. In high quality habitat home ranges may be 1-2 ha and overlap, while in semi-arid country they are usually discrete and around

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
							100 ha.
Pseudomys novaehollandiae	New Holland Mouse	VU		2013#	Low	Habitat is likely to be too degraded for this species.	The New Holland Mouse currently has a disjunct, fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Across the species' range the New Holland Mouse is known to inhabit open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes. The home range of the New Holland Mouse can range from 0.44 ha to 1.4 ha. The New Holland Mouse is a social animal, living predominantly in burrows shared with other individuals. The species is nocturnal and omnivorous, feeding on seeds, insects, leaves, flowers and fungi, and is therefore likely to play an important role in seed dispersal and fungal spore dispersal. It is likely that the species spends considerable time foraging above-ground for food, predisposing it to predation by native predators and introduced species. Breeding typically occurs between August and January, but can extend into autumn.
Pteropus poliocephalus	Grey-headed Flying-fox	VU	V	2012#	High	The Grey-headed flying-fox is likely to forage in the study area. The Melaleuca during peak flowering times would be an important food resource for the local camp.	Occurs along the NSW coast, extending further inland in the north. This species is a canopy-feeding frugivore and nectarivore of rainforests, open forests, woodlands, melaleuca swamps and banksia woodlands. Roosts in large colonies (camps), commonly in dense riparian vegetation. Bats commute daily to foraging areas, usually within 15 km of the day roost although some individuals may travel up to 70 km.
Scoteanax rueppellii	Greater Broad-nosed Bat		V	2010	Low	Foraging may occur in the area, however unlikely to roost in the study area,	Occurs along the Great Dividing Range, generally at 500 m but up to 1200 m, and in coastal areas. Occurs in woodland and rainforest, but prefers open habitats or natural or human-

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
						due to the lack of hollows.	made openings in wetter forests. Often hunts along creeks or river corridors. Flies slowly and directly at a height of 30 m or so to catch beetles and other large, flying insects. Also known to eat other bats and spiders. Roosts in hollow tree trunks and branches.
Birds							
Anseranas semipalmata	Magpie Goose		V	2000	Low	Marginal wetland habitat	Mainly found in shallow wetlands (less than 1 m deep) with dense growth of rushes or sedges. They are often seen walking and grazing on land; feeds on grasses, bulbs and rhizomes. Breeding can occur in both summer and winter dominated rainfall areas and is strongly influenced by water level. Nests are formed in trees over deep water; breeding is unlikely in south-eastern NSW. Often seen in trios or flocks on shallow wetlands, dry ephemeral swamps, wet grasslands and floodplains; roosts in tall vegetation.
Anthochaera phrygia	Regent Honeyeater	CE	E4A	#	Low	May visit the site on the very odd occasion to feed on Swamp Mahogany, however there are only a few individuals and would only support individuals passing through.	A semi-nomadic species occurring in temperate eucalypt woodlands and open forests. Most records are from box-ironbark eucalypt forest associations and wet lowland coastal forests. Key eucalypt species include Mugga Ironbark, Yellow Box, Blakely's Red Gum, White Box and Swamp Mahogany. Also utilises: *E. microcarpa, E. punctata, E. polyanthemos, E. mollucana, Corymbia robusta, E. crebra, E. caleyi, C. maculata, E. mckieana, E. macrorhyncha, E. laevopinea* and *Angophora floribunda*. Nectar and fruit from the mistletoes A. miquelii, A. pendula, A. cambagei are also eaten during the breeding season. Regent Honeyeaters usually nest in horizontal branches or forks in tall mature eucalypts and sheoaks. Also

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
							nest in mistletoe haustoria. An open cup-shaped nest is constructed of bark, grass, twigs and wool by the female.
Botaurus poiciloptilus	Australasian Bittern	EN	E1	2000#	Moderate	Suitable habitat for this species is available around the edges of the lake, where there is some wetland habitat.	The Australasian Bittern is distributed across south-eastern Australia. Often found in terrestrial and estuarine wetlands, generally where there is permanent water with tall, dense vegetation including *Typha* spp. and *Eleocharis* spp. Typically this bird forages at night on frogs, fish and invertebrates, and remains inconspicuous during the day. The breeding season extends from October to January with nests being built amongst dense vegetation on a flattened platform of reeds.
Calyptorhynchus lathami	Glossy Black-Cockatoo		V	2007	Low	Habitat does not contain preferred *Allocasuarina* species.	Inhabits forest with low nutrients, characteristically with key *Allocasuarina* species. Tends to prefer drier forest types. Often confined to remnant patches in hills and gullies. Breed in hollows stumps or limbs, either living or dead.
Circus assimilis	Spotted Harrier		V	1987	Low	Habitat marginal, no recent records. No bird of prey nests observed in the study area.	The Spotted Harrier is found throughout Australia but rarely in densely forested and wooded habitat of the escarpment and coast. Preferred habitat consists of open and wooded country with grassland nearby for hunting. Habitat types include open grasslands, acacia and mallee remnants, spinifex, open shrublands, saltbush, very open woodlands, crops and similar low vegetation. The Spotted Harrier is more common in drier inland areas, nomadic part migratory and dispersive, with movements linked to the abundance of prey species. Nesting occurs in open or remnant woodland and unlike other harriers, the Spotted Harrier nests in trees.

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
Daphoenositta chrysoptera	Varied Sittella		V	2008	Moderate	Habitat may be suitable for this species, particularly in the paperbark forest.	The Varied Sittella is a sedentary species which inhabits a wide variety of dry eucalypt forests and woodlands, usually with either shrubby understorey or grassy ground cover or both, in all climatic zones of Australia. Usually inhabit areas with rough-barked trees, such as stringybarks or ironbarks, but also in mallee and acacia woodlands, paperbarks or mature Eucalypts. The Varied Sittella feeds on arthropods gleaned from bark, small branches and twigs. It builds a cup-shaped nest of plant fibres and cobweb in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.
Dasyornis brachypterus	Eastern Bristlebird	EN	E1	#	Negligible	Habitat unsuitable and no records for the locality.	The Eastern Bristlebird inhabits low dense vegetation in a broad range of habitat types including sedgeland, heathland, swampland, shrubland, sclerophyll forest and woodland, and rainforest. It occurs near the coast, on tablelands and in ranges. The Eastern Bristlebird is found in habitats with a variety of species compositions, but are defined by a similar structure of low, dense, ground or understorey vegetation.
Ephippiorhynchus asiaticus	Black-necked Stork		E1	2003	Low	Some possibility of this species visiting the lake and fringing vegetation for foraging.	Found in swamps, mangroves and mudflats. Can also occur in dry floodplains and irrigated lands and occasionally forages in open grassy woodland. Nests in live or dead trees usually near water.
Glossopsitta pusilla	Little Lorikeet		V	2013	Low	May visit the site to forage. No roosting habitat available.	Distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range in NSW, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Mostly occur in dry, open eucalypt forests and

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
							woodlands. They feed primarily on nectar and pollen in the tree canopy. Nest hollows are located at heights of between 2 m and 15 m, mostly in living, smooth-barked eucalypts. Most breeding records come from the western slopes.
Grantiella picta	Painted Honeyeater	VU	V	#	Negligible	Habitat unsuitable	Found mainly in dry open woodlands and forests, where it is strongly associated with mistletoe. Often found on plains with scattered eucalypts and remnant trees on farmlands.
Lathamus discolor	Swift Parrot	EN	E1	2007#	Low	A small amount of foraging habitat available. Only likely to visit on a rare occasion.	The Swift Parrot occurs in woodlands and forests of NSW from May to August, where it feeds on eucalypt nectar, pollen and associated insects. The Swift Parrot is dependent on flowering resources across a wide range of habitats in its wintering grounds in NSW. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*. Commonly used lerp infested trees include Grey Box *E. microcarpa*, Grey Box *E. moluccana* and Blackbutt *E. pilularis*. This species is migratory, breeding in Tasmania and also nomadic, moving about in response to changing food availability.
Lophoictinia isura	Square-tailed Kite		V	2010	Low	Marginal habitat. No bird of prey nests were observed in the study area.	Typically inhabits coastal forested and wooded lands of tropical and temperate Australia. In NSW it is often associated with ridge and gully forests dominated by *Eucalyptus longifolia, Corymbia maculata, E. elata*, or *E. smithii*. Individuals appear to occupy large hunting ranges of more than 100 km2. They require large living trees for breeding, particularly near water with surrounding woodland /forest close by for foraging

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				habitat. Nest sites are generally located along or near watercourses, in a tree fork or on large horizontal limbs.
Ninox strenua	Powerful Owl		V	2012	Low	No suitable nest hollows are present on the site. The lack of hollows and no evidence of ringtail possum dreys indicates that arboreal mammal abundance is low in the study are, reducing the likelihood of Powerful Owls foraging in the study area.	The Powerful Owl occupies wet and dry eucalypt forests and rainforests. It may inhabit both un-logged and lightly logged forests as well as undisturbed forests where it usually roosts on the limbs of dense trees in gully areas. Large mature trees with hollows at least 0.5 m deep are required for nesting. Tree hollows are particularly important for the Powerful Owl because a large proportion of the diet is made up of hollow-dependent arboreal marsupials. Nest trees for this species are usually emergent with a diameter at breast height of at least 100 cm. It has a large home range of between 450 and 1450 ha.
Pachyptila turtur subantarctica	Fairy Prion (southern)	VU		#	Negligible	No suitable habitat	Fairy Prions (including other subspecies) are often beachcast on the south-eastern coast of Australia, and are commonly seen offshore over the continental shelf and over pelagic waters. Observations are less common off Western Australia and Queensland than in south-eastern Australia. Beachcast birds are found along the whole coast of NSW, and the species is common offshore along the entire Victorian coast, where thousands are sometimes seen. In Tasmania, the Fairy Prion is an abundant visitor to all offshore waters. In South Australia, this species is regularly seen and often beachcast.
Pandion cristatus	Osprey		V	#	Moderate	Local Osprey may forage in the lake within the study area. No bird of prey nests	Found in coastal waters, inlets, estuaries and offshore islands. Occasionally found 100 km inland along larger rivers. It is water-dependent, hunting for fish in clear, open water. The

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
						were observed.	Osprey occurs in terrestrial wetlands, coastal lands and offshore islands. It is a predominantly coastal species, generally using marine cliffs as nesting and roosting sites. Nests can also be made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)		V	2015	Negligible	Unsuitable habitat	The Grey-crowned Babbler is found in dry, open forests, scrubby woodlands, trees bordering roads and farmland with isolated trees. The Grey-crowned Babbler is found in open forests, scrubby woodlands, trees bordering roads and farmland with isolated trees. This species favours inland plains with an open shrub layer, little ground cover and plenty of fallen timber and leaf litter. May be seen along roadsides and around farms.
Ptilinopus superbus	Superb Fruit-Dove		V	1973	Negligible	Unsuitable habitat	The Superb Fruit Dove's NSW distribution ranges from northern NSW to as far south as Moruya. It is found in rainforests, closed forests (including mesophyll vine forests) and sometimes in eucalypt and acacia woodlands where there are fruit-bearing trees. It forages in the canopy of fruiting trees such as figs and palms. Nests are constructed high in the canopy throughout September to January.
Rostratula australis	Australian Painted Snipe	EN	E1	1972#	Low	Habitat on the site may support this species, however the most recent record for the locality is 44 years old.	Usually found in shallow inland wetlands including farm dams, lakes, rice crops, swamps and waterlogged grassland. They prefer freshwater wetlands, ephemeral or permanent, although they have been recorded in brackish waters.
Tyto	Masked Owl		V	2001	Negligible	Habitat is largely	The Masked Owl may be found across a diverse range of

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
novaehollandiae						unsuitable for foraging. No suitable roost or nest hollows.	wooded habitat that provide tall or dense mature trees with hollows suitable for nesting and roosting. It has mostly been recorded in open forests and woodlands adjacent to cleared lands. They nest in hollows, in trunks and in near vertical spouts or large trees, usually living but sometimes dead. The nest hollows are usually located within dense forests or woodlands. Masked Owls prey upon hollow-dependent arboreal marsupials, but terrestrial mammals make up the largest proportion of the diet. It has a large home range of between 500 to 1000 ha.
Frogs							
Crinia tinnula	Wallum Froglet		V	2011	Moderate	Paperbark swamps are present in the study area and may provide some habitat, most likely around the fringes of the lake.	The Wallum Froglet is a coastal species, confined to acid, paperbark swamps and sedge swamps of the "wallum" country. The species occurs from near Noosa in southern Queensland south to the central coast of NSW, with a disjunct population on Kurnell Peninsula. The species is a late winter breeder and males call in choruses from within sedge tussocks or at the water edge.
Litoria aurea	Green and Golden Bell Frog	VU	E1	1973#	Moderate	Some of the fringing vegetation around the lake may provide suitable habitat for this species. The channel is less likely to provide suitable habitat.	Most existing locations for the species occur as small, coastal, or near coastal populations, with records occurring between south of Grafton and northern VIC. The species is found in marshes, dams and stream sides, particularly those containing bullrushes or spikerushes. Preferred habitat contains water bodies that are unshaded, are free of predatory fish, have a grassy area nearby and have diurnal sheltering sites nearby such as vegetation or rocks, although the species has also been recorded from highly disturbed areas including disused

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				industrial sites, brick pits, landfill areas and cleared land. Breeding usually occurs in summer. Tadpoles, which take approximately 10-12 weeks to develop, feed on algae and other vegetative matter. Adults eat insects as well as other frogs, including juveniles of their own species.

* - habitat descriptions have been adapted by qualified ecologists from the DoE Species Profile and Threats (SPRAT) Database, OEH Threatened Species online profiles and the NSW Scientific Committee final determinations for listed species, references within the above table are provided within the report reference list.

A.2 Migratory species (EPBC Act listed)

Includes records from the following sources:

- NSW BioNet Wildlife Atlas
- DEE database (accessed on 18/04/2016)
- BirdLife Australia data search
- Current survey

Bold denotes species recorded in the study area during the current assessment.

Table A.4 Migratory fauna species recorded or predicted to occur within five kilometres of the study area

Scientific name	Common name	Conservation status		Most recent record
		EPBC	TSC	
Birds				
Apus pacificus	Fork-tailed Swift	Mi		#
Ardea ibis	Cattle Egret	Mi		2015#
Ardea modesta	Eastern Great Egret	Mi		#
Ardea modesta	Eastern Great Egret	Mi		2016
Calidris acuminata	Sharp-tailed Sandpiper	Mi		2001
Cuculus optatus	Oriental Cuckoo	Mi		#
Gallinago hardwickii	Latham's Snipe	Mi		2009#
Hirundapus caudacutus	White-throated Needletail	Mi		2010#
Hydroprogne caspia	Caspian Tern	Mi		1987
Merops ornatus	Rainbow Bee-eater	Mi		#
Monarcha melanopsis	Black-faced Monarch	Mi		2000#
Motacilla flava	Yellow Wagtail	Mi		#
Myiagra cyanoleuca	Satin Flycatcher	Mi		#
Pandion cristatus	Osprey	Mi	V	#
Rhipidura rufifrons	Rufous Fantail	Mi		2005#
Symposiachrus trivirgatus	Spectacled Monarch	Mi		#
Tringa nebularia	Common Greenshank	Mi		#
Insects				
Danaus plexippus	Monarch Butterfly	Mi		2014

* - habitat descriptions have been adapted by qualified ecologists from the DSEWPaC Species Profile for listed migratory species, references within the above table are provided within the report reference list.

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Appendix 3 Plot and transect summary

Table A.5 Plot scores for each vegetation zone within the subject site

Red cells indicate the site attributes that are below benchmark, while blue cells represent those site attributes that are above benchmark. Non-shaded cells are within benchmark.

Benchmark details	Site attributes									
	Native plant species (no.)	Native over-storey cover %	Native mid-storey cover %	Native ground cover (grass) %	Native ground cover (shrubs) %	Native ground cover (other) %	Exotic plant cover %	Number of trees with hollows	Over-storey regen (out of 1)	Total length of fallen logs (m)
PCT 1717 (HU931)										
Benchmark values	>=24	15 to 70	10 to 60	5 to 50	5 to 30	5 to 40	-	>=0	1	>=5
Plot scores - Vegetation Zone 1 - PCT 1717_Moderate-Good										
Plot 5	15	31	13.5	2	0	40	50	0	1	24
Plot scores - Vegetation Zone 2 - PCT 1717_Low										
Plot 7	4	0	11.9	0	0	0	86	0	0.5	13
Plot 9	5	0	7	0	0	0	96	0	0.5	2
Average	**4.5**	**0**	**9.5**	**0**	**0**	**0**	**91**	**0**	**0.5**	**7.5**

Table A.6 Plot scores for each vegetation zone within the offset site

Red cells indicate the site attributes that are below benchmark, while blue cells represent those site attributes that are above benchmark. Non-shaded cells are within benchmark.

Benchmark details	Site attributes									
	Native plant species (no.)	Native over-storey cover %	Native mid-storey cover %	Native ground cover (grass) %	Native ground cover (shrubs) %	Native ground cover (other) %	Exotic plant cover %	Number of trees with hollows	Over-storey regen (out of 1)	Total length of fallen logs (m)
PCT 1717 (HU931)										
Benchmark values	>=24	15 to 70	10 to 60	5 to 50	5 to 30	5 to 40	-	>=0	1	>=5
Plot scores - Vegetation Zone 1 - PCT 1717_Moderate-Good										
Plot 2	13	26.2	12.5	10	0	36	0	0	1	102
Plot 4	9	23.5	0	18	0	16	8	0	1	32
Plot 8	11	17.5	2.5	0	2	56	60	0	1	10
Average	**11**	**22.4**	**5**	**9.3**	**0.7**	**36**	**22.7**	**0**	**1**	**48**
Plot scores - Vegetation Zone 2 - PCT 1717_Low										
Plot 3	6	2.5	1.2	10	0	0	10	0	0.5	0

Benchmark details	Site attributes									
	Native plant species (no.)	Native over-storey cover %	Native mid-storey cover %	Native ground cover (grass) %	Native ground cover (shrubs) %	Native ground cover (other) %	Exotic plant cover %	Number of trees with hollows	Over-storey regen (out of 1)	Total length of fallen logs (m)
PCT 1071 (HU673)										
Benchmark values	>=7	3 to 90	0 to 5	1 to 5	0 to 0	60 to 95	-	>=0	1	>=0
Plot scores - Vegetation Zone 3 - PCT 1071_Moderate-Good										
Plot 6	16	3.5	0.5	48	0	24	0	0	1	83

Appendix 4 Assessment of Significance

The following section provides for an Assessment of Significance according to the seven factors outlined in Section 5A of the EP&A Act for the only threatened entity that will be impacted in the subject site.

Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and SE corner bioregions

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

The proposed residential development would ultimately remove about 0.3 hectare of the ecological community in moderate-good condition, and 3.78 hectares of habitat consisting of a derelict Slash Pine planation with early regenerating elements of the ecological community. This part of the community is classified as low condition by the BBAM. Overall, the habitat to be removed includes the majority of the lowest condition habitat for the community within the study area. Like-for-like habitat to offset the area removed would be provided in a managed offset area adjacent to the subject site. Given the provision of this offset, together with the presence of large areas of similar habitat on adjoining land and beyond, the local occurrence of the ecological community is unlikely to be placed at risk of extinction.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

The proposed residential rezoning would result in the removal of about 0.3 hectare of the ecological community in moderate-good condition, and 3.78 hectares of habitat in low condition. This extent of removal represents 2.58% of the total habitat of the community in moderate-good condition within the study area, and approximately 60% of the total habitat in low condition from the site.

The design of the proposed residential rezoning footprint allows for a retained corridor of native habitat in moderate-good condition to the south of the subject site, thus maintaining connectivity with adjoining

habitat. No area of habitat will become fragmented or isolated from other areas of habitat as a result of the proposal.

Given its current condition, and the extent of much larger areas of habitat in moderate-good condition within the proposed offset area and in adjoining land beyond the study area, the habitat to be removed has little importance to the long-term survival of the ecological community in the locality.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

No currently declared critical habitat occurs in the vicinity of the study area. No assessment under this part is required.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

No draft or approved Recovery Plan has been prepared for this ecological community to date. However, a targeted strategy for managing this ecological community is being been developed by OEH under the Saving Our Species program. In the interim, the following management actions have been identified for this community:

- Undertake research to determine minimum fire frequency.
- Collate existing information on vegetation mapping and associated data for this EEC and identify gaps in knowledge. Conduct targeted field surveys and ground truthing to fill data gaps and clarify condition of remnants.
- Prepare identification and impact assessment guidelines and distribute to consent and determining authorities.
- Use mechanisms such as Voluntary Conservation Agreements to promote the protection of this EEC on private land.
- Liaise with landholders and undertake and promote programs that ameliorate threats such as grazing and human disturbance.
- Enhance the capacity of persons involved in the assessment of impacts on this EEC to ensure the best informed decisions are made.
- Undertake weed control for Bitou Bush and Boneseed at priority sites in accordance with the approved Threat Abatement Plan and associated PAS actions.
- Identify and prioritise other specific threats and undertake appropriate on-ground site management strategies where required.
- Investigate the ecology of Swamp sclerophyll forest species with particular emphasis on the importance of drying and wetting cycles in maintaining ecosystem health.
- Determine location, species composition and threats to remaining remnants to assist with prioritising restoration works.
- Collect seed for NSW Seedbank. Develop collection program in collaboration with BGT - all known provenances (conservation collection).
- Investigate seed viability, germination, dormancy and longevity (in natural environment and in storage).

The proposal is consistent with these actions, in regards to management of the community in an offset area.

(g) *whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

The following key threatening processes are potentially relevant to this proposal, with reference to the nature of the proposal and exotic species present within the study area:

- Clearing of native vegetation
- Invasion, establishment and spread of Lantana (*Lantana camara*)
- Invasion of native plant communities by exotic perennial grasses
- Invasion and establishment of exotic vines and scramblers
- Infection of native plants by *Phytophthora cinnamomi*
- Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae

These threatening processes can all be successfully managed or ameliorated during construction of the proposal and as part of a management plan for the offset area.

Conclusion

The removal of a small area of *Swamp Sclerophyll forest on Coastal Floodplain* in a degraded condition would not trigger a significant impact on the ecological community because of:

- The small proportion of the community removed from the study area.
- The generally poor condition of the community throughout the study area.
- Confinement of the development proposal to the lowest condition patch of the community in the study area.
- The potential to fully offset loss of the community with like-for-like habitat in an adjoining managed offset area.

Therefore, a Species Impact Statement is not required.

Appendix 5 BioBanking credit reports

BioBanking credit report

NSW GOVERNMENT Office of Environment & Heritage

This report identifies the number and type of credits required at a DEVELOPMENT SITE.

Date of report: 29/11/2016 Time: 11:33:08AM Calculator version: v4.0

Development details

Proposal ID:	0024/2016/4027D
Proposal name:	Rezoning to residential - land at Raymond Terrace
Proposal address:	251 Adelaide Street Raymond Terrace NSW 2324
Proponent name:	de Witt Consulting Pty Ltd
Proponent address:	PO Box 850 Charlestown NSW 2290
Proponent phone:	02 4942 5441
Assessor name:	Stefan Rose
Assessor address:	39 Platt St Waratah NSW 2298
Assessor phone:	49684901
Assessor accreditation:	0024

Improving or maintaining biodiversity

An application for a red flag determination is required for the following red flag areas

Red flag	Reason
Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast	Vegetation type being > 70% cleared; or it contains an endangered ecological community;

The application for a red flag determination should address the criteria set out in the BioBanking Assessment Methodology. Please note that a biobanking statement cannot be issued unless the determination is approved.

Additional information required for approval:

- ☐ Change to percent cleared for a vegetation type/s
- ☐ Use of local benchmark
- ☐ Change negligible loss
- ☐ Expert report...
- ■ Request for additional gain in site value
- ☐ Predicted threatened species not on site

■ Australian Painted Snipe	Rostratula australis
■ Black-tailed Godwit	Limosa limosa
■ Blue-billed Duck	Oxyura australis
■ Freckled Duck	Stictonetta naevosa
■ Little Lorikeet	Glossopsitta pusilla
■ Squirrel Glider	Petaurus norfolcensis
■ Swift Parrot	Lathamus discolor

■	Yellow-bellied Sheathtail-bat	Saccolaimus flaviventris

☐ Change threatened species response to gain (Tg value)

Ecosystem credits summary

Plant Community type	Area (ha)	Credits required	Red flag
Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast	3.78	82.04	No
Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast	0.30	16.56	Yes
Total	4.08	99	

Credit profiles

1. Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast, (HU931)

Number of ecosystem credits created	82
IBRA sub-region	Hunter

Offset options - vegetation types	Offset options - CMA sub-regions
Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion, (HU633) Prickly-leaved Paperbark forest on coastal lowlands of the Central Coast and Lower North Coast, (HU930) Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast, (HU931) Swamp Mahogany - Flax-leaved Paperbark swamp forest on coastal lowlands of the Central Coast, (HU932) Melaleuca biconvexa - Swamp Mahogany - Cabbage Palm swamp forest of the Central Coast, (HU937) Swamp paperbark - Baumea juncea swamp shrubland on coastal lowlands of the Central Coast and Lower North Coast, (HU944) Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley, (HU945)	Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

2. Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast, (HU931)

Number of ecosystem credits created	17
IBRA sub-region	Hunter

Offset options - vegetation types	Offset options - CMA sub-regions
Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast, (HU931) Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion, (HU633) Prickly-leaved Paperbark forest on coastal lowlands of the Central Coast and Lower North Coast, (HU930) Swamp Mahogany - Flax-leaved Paperbark swamp forest on coastal lowlands of the Central Coast, (HU932) Melaleuca biconvexa - Swamp Mahogany - Cabbage Palm swamp forest of the Central Coast, (HU937) Swamp paperbark - Baumea juncea swamp shrubland on coastal lowlands of the Central Coast and Lower North Coast, (HU944) Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley, (HU945)	Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

ITEM 11 - ATTACHMENT 1 PLANNING PROPOSAL - 251 ADELAIDE STREET RAYMOND TERRACE.

BioBanking credit report

Office of Environment & Heritage

This report identifies the number and type of credits required at a BIOBANK SITE

Date of report: 28/11/2016 Time: 4:41:29PM Calculator version: v4.0

Biobank details

Proposal ID:	0024/2016/4038B
Proposal name:	Rezoning to residential - offset at Raymond Terrace
Proposal address:	251 Adelaide Street Raymond Terrace NSW 2324
Proponent name:	de Witt Consulting Pty Ltd
Proponent address:	PO Box 850 Charlestown NSW 2290
Proponent phone:	02 4942 5441
Assessor name:	Stefan Rose
Assessor address:	39 Platt St Waratah NSW 2298
Assessor phone:	49684901
Assessor accreditation:	0024

Additional information required for approval:

- ☐ Use of local benchmark
- ☐ Expert report...
- ☐ Request for additional gain in site value

Ecosystem credits summary

Plant Community type	Area (ha)	Credits created
Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast	13.79	104.00
Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	1.67	8.00
Total	15.46	112

Credit profiles

1. Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion, (HU673)

Number of ecosystem credits created	8
IBRA sub-region	Hunter

2. Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast, (HU931)

Number of ecosystem credits created	22
IBRA sub-region	Hunter

3. Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast, (HU931)

Number of ecosystem credits created	82
IBRA sub-region	Hunter

Species credits summary

Additional management actions

Additional management actions are required for:

Vegetation type or threatened species	Management action details
Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast	Exclude commercial apiaries
Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast	Exclude miscellaneous feral species
Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast	Feral and/or over-abundant native herbivore control
Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast	Fox control
Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast	Slashing
Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	Control exotic pest fish species (within dams)
Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	Control of feral pigs
Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	Exclude miscellaneous feral species
Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	Feral and/or over-abundant native herbivore control
Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	Fox control
Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	Maintain or re-introduce natural flow regimes

Appendix 6 EPBC Act Protected Matters Report

Australian Government
Department of the Environment

EPBC Act Protected Matters Report

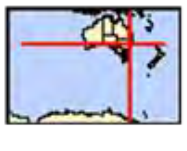
This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 18/04/16 09:39:40

Coordinates
Buffer: 0.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	16
Listed Migratory Species:	14

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	18
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	1
Invasive Species:	41
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)	[Resource Information]
Name	Proximity
Hunter estuary wetlands	Within 10km of Ramsar

Listed Threatened Ecological Communities		[Resource Information]
For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.		
Name	Status	Type of Presence
Central Hunter Valley eucalypt forest and woodland	Critically Endangered	Community may occur within area

Listed Threatened Species		
Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat likely to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat may occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Frogs		
Litoria aurea Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll	Endangered	Species or species

Name	Status	Type of Presence
(southeastern mainland population) [75184]		habitat likely to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Pseudomys novaehollandiae		
New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat likely to occur within area
Pteropus poliocephalus		
Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Plants		
Cryptostylis hunteriana		
Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat may occur within area
Phaius australis		
Lesser Swamp-orchid [5872]	Endangered	Species or species habitat may occur within area
Tetratheca juncea		
Black-eyed Susan [21407]	Vulnerable	Species or species habitat likely to occur within area

Listed Migratory Species [Resource Information]		
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cuculus optatus		
Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus		
White-throated Needletail [682]		Species or species habitat likely to occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis		
Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus		
Spectacled Monarch [610]		Species or species habitat may occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat likely to occur within area
Myiagra cyanoleuca		
Satin Flycatcher [612]		Species or species habitat likely to occur within area
Rhipidura rufifrons		
Rufous Fantail [592]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
Ardea alba		
Great Egret, White Egret [59541]		Breeding known to occur

Name	Threatened	Type of Presence within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Cuculus saturatus Oriental Cuckoo, Himalayan Cuckoo [710]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat likely to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat likely to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

Regional Forest Agreements	[Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
North East NSW RFA	New South Wales

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur

Name	Status	Type of Presence within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area

ITEM 11 - ATTACHMENT 1 PLANNING PROPOSAL - 251 ADELAIDE STREET RAYMOND TERRACE.

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-32.771769 151.743618,-32.772987 151.744058,-32.773636 151.74099,-32.772355 151.740657,-32.771769 151.743618

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Parks and Wildlife Commission NT, Northern Territory Government
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

Department of the Environment
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111

ITEM 11 - ATTACHMENT 1 PLANNING PROPOSAL - 251 ADELAIDE STREET RAYMOND TERRACE.

ATTACHMENT 10 – Review of Bushfire Constraints prepared by Newcastle Bushfire Consulting (2016)

Couch Family Trust T/A
Newcastle Bushfire Consulting

5 Chartley Street,
Warners Bay NSW 2282
Ph: 02 40230149

28th April, 2016

Phoenix Builders
C/- de Witt Consulting
PO Box 850
Charlestown NSW 2290

RE: REVIEW OF BUSHFIRE CONSTRAINTS 251 ADELAIDE STREET, RAYMOND TERRACE

Dear Sir or Madam,

Following my site visit at the above property I offer the below advice on Bushfire Planning Constraints:

1. In reviewing the site I have focused on the north-west corner of the site (north of the power line) as requested and the surrounding bushland.
2. The nearest bushland threat to the south is considered forest.
3. The vegetation to the north of the site is a small area of remnant vegetation on council parkland. It would be recommended to discuss with council the management of this very small area of vegetation or managing vegetation located south of the powerline easement where within 100 metres of the vegetation. It will become a non-threat if the above can occur.
4. The below asset protection zones and bushfire attack levels are measured from the southern forest vegetation. There is a varying slope within the bushland so I have measured a buffer for the differing slope transects:

Level Slope in Forest

a. Minimum Subdivision distance for forest – 20 metres (this is relevant for rezoning). Important note – Many councils require subdivision to BAL-29 which would be a minimum 25 metres.
b. BAL-40 - 19 to 25 metres
c. BAL-29 - 25 to 34 metres
d. BAL-19 - 35 to 47 metres
e. BAL-12.5 - 48 to 99 metres

0 to 5 degree downslope in Forest

a. Minimum Subdivision distance for forest – 25 metres (this is relevant for rezoning). Important note – Many councils require subdivision to BAL-29 which would be a minimum 32 metres.
b. BAL-40 - 24 to 31 metres
c. BAL-29 - 32 to 42 metres
d. BAL-19 - 43 to 56 metres
e. BAL-12.5 - 57 to 99 metres

Couch Family Trust T/A
Newcastle Bushfire Consulting

5 Chartley Street,
Warners Bay NSW 2282
Ph: 02 40230149

Note: The above minimum rezoning asset protection zones have been illustrated in the attached site constraints map. If the vegetation south of the powerline easement was cleared then the asset protection zone would be moved respectively.

5. Planning Principles for Rezoning to Residential Land in Bush Fire Prone Areas
    a. Provision of a perimeter road with two way access which delineates the extent of the intended development;
    b. Provision, at the urban bushland interface, for the establishment of adequate asset protection zones for future housing;
    c. Specifying minimum residential lot depths to accommodate asset protection zones for lots on perimeter roads;
    d. Minimising the perimeter of the area of land, interfacing the hazard, which may be developed;
    e. Introduction of controls which avoid placing inappropriate developments in hazardous areas; and
    f. Introduction of controls on the placement of combustible materials in asset protection zones.
6. Water supply - The future hydrant supply should be designed in accordance with AS2419.1 however this would be addressed at subdivision stage.
7. Electrical and gas supplies will be located underground require no further conditions. This would be addressed at subdivision stage.
8. At the commencement of building works and in perpetuity the entire property shall be managed as an inner protection area (IPA) as outlined within section 4.1.3 and Appendix 5 of Planning for Bush Fire Protection 2006 and the NSW Rural Fire Service's document Standards for asset protection zones.

If you have any questions regarding the above I am available for comment on 0423 923284 or 02 40230149.

Yours Sincerely
Phillip Couch

Phillip Couch GIFireE
Bach Info Science
Grad Dip Design for Bushfire Prone Areas
FPAA BPAD – Level 3 Certificate Number BPD-PA-16132
Director Newcastle Bushfire Consulting

BPAD Bushfire Planning & Design Accredited Practitioner Level 3

ITEM 11 - ATTACHMENT 1 PLANNING PROPOSAL - 251 ADELAIDE STREET RAYMOND TERRACE.

Couch Family Trust T/A
Newcastle Bushfire Consulting

5 Chartley Street,
Warners Bay NSW 2282
Ph: 02 40230149

ITEM 11 - ATTACHMENT 1 PLANNING PROPOSAL - 251 ADELAIDE STREET RAYMOND TERRACE.

ATTACHMENT 11 – Aboriginal Cultural Heritage Due Diligence Assessment (2016)

INSITE HERITAGE
PTY LTD

PO Box 98
Wangi Wangi NSW 2267
admin@insiteheritage.com.au
P 0249755818

Aboriginal Cultural Heritage Due Diligence Assessment
251 Adelaide Ave
Raymond Terrace, NSW

Prepared For
DeWitt Consulting

June 2016

Introduction

Insite Heritage Pty Ltd were commissioned by DeWitt Consulting on behalf of Phoenix Builders to provide an Aboriginal Cultural Heritage Assessment of potential impact on Aboriginal Cultural Heritage by the proposed rezoning of the site to allow for the establishment of residential and villa allotments.

The property, 251 Adelaide St Raymond Terrace (Lot 232 DP 593512), is a former quarry site. The north western portion of the lot is the subject of the proposed rezoning. The area of the rezoning proposal is approximately 7ha of the total approximately 43 ha block. The area of development relative to the total Lot is shown in Figure 1.

An AHIMS search for the study located two isolated finds located to the south of the site associated with road upgrades. An inspection of the study area was carried out with a representative of Worimi Local Aboriginal Land Council (LALC) on the 15th May 2016. No Aboriginal objects, or areas of potential archaeological deposit, were located. The survey was done in the northern section of the site and subsequently the study area was enlarged. An additional survey was not considered necessary as the additional area contained the quarry infrastructure and areas of low lying ground with dense vegetation. The initial survey results were extrapolated over the remainder of the site.

The history of quarrying on the site has reduced the archaeological potential of the site significantly. The site has been used for quarrying purposes since 1974 and this was reflected in the poorly developed soil profile on the site. The site is not considered to have archaeological potential.

The cultural heritage values assessment will be provided by the Worimi LALC and included in this report upon receipt.

ITEM 11 - ATTACHMENT 1 PLANNING PROPOSAL - 251 ADELAIDE STREET RAYMOND TERRACE.

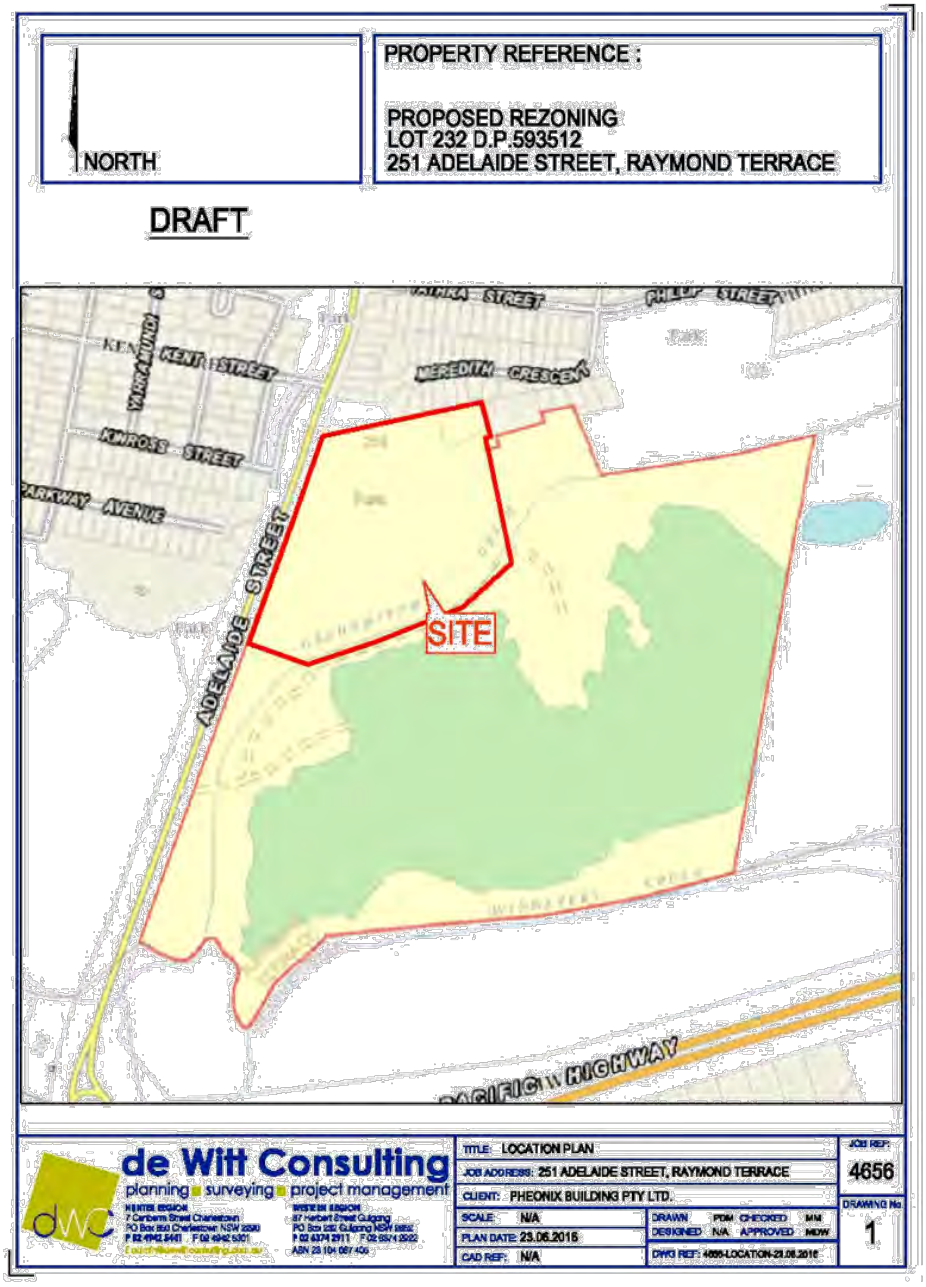


Figure 1 Location 251 Adelaide Ave Raymond Terrace

1. Introduction

DeWitt Consulting have been commissioned to prepare a rezoning application on behalf of Pheonix Builders. The rezoning of 251 Adelaide Ave Raymond Terrace, will be determined by Port Stephens Shire Council. Currently zoned RU2 (rural) the rezoning would allow the development of medium density housing. This assessment is intended to identify any potential impacts as a result of the rezoning, on Aboriginal cultural heritage and to provide recommendations regarding mitigation measures.

2. Environmental Landscape

The site is identified as flood prone land, and two tributaries to Windeyers Creek passed through the area prior to the impact of mining. Historically the site has been used for quarrying since the mid-1960's while information on the title of the land shows quarrying since at least 1974[1] the void acts as a storage area for flood waters from the Hunter River that then drains in to Windeyer Creek. The area of the rezoning has been historically quarried since the mid 1960's and is now revegetated predominately with Radiata Pine and remnant Swamp Oak forest.

The flora and fauna assessment identified a paucity of hollow bearing trees which is consistent with the size of the trees observed in the site inspection. In general the trees on site did not appear to be of sufficient age for Aboriginal modification and no evidence of cultural modification was observed. The 2004 Google Earth image clearly shows the straight line character of the planted Radiata in the north west portion of the site (Figure 2).

Figure 2 The subject area 2004 - Google Earth

The soil landscape map for the area also shows the area as disturbed (Figure 3). The soil landscape is Shoal Bay - Aeolian Pleistocene sand sheets with slope gradients generally <5% but on slopes of rolling dunes up to 15%, with local relieve generally <5m[2]. This particular soil landscape can be

[1] 2011 ERM 251 Adelaide Street Raymond Terrace, Ecological Due Diligence and BioBanking Assessment. Report to Rocla Quarry Products (p14)
[2] Murphy, C.L 1995 Soil Landscapes of the Port Stephens 1:100,000 Sheet. Published Soil Conservation Service of NSW,

archaeologically sensitive but the scale of disturbance at this site indicates that little archaeological value is likely to remain. The scale of disturbance can also in Figure 4 (Google Earth 2007).

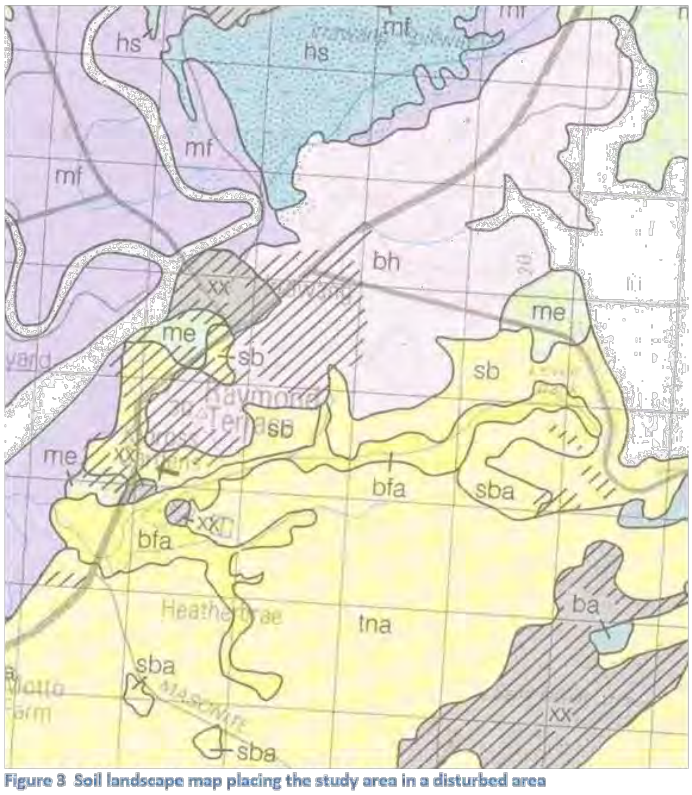


Figure 3 Soil landscape map placing the study area in a disturbed area

The southern boundary of the proposed rezoning area is bounded by the Grahamstown drain, an artificial drain constructed to take over flows upstream (Figure 4).

Figure 4 The subject site circa 2007 (Google Earth) – note the Grahamstown drain at the base of the area.

3. Archaeological Context

A search of the Aboriginal Heritage Information Management System (AHIMS) was undertaken with a 200m buffer in order to identify any previously recorded Aboriginal archaeological sites which may be impacted by the proposed works.

The search located two sites south of the site (refer Appendix A). The sites 38-4-0238 and 38-4-0320 The sites were located in the course of the Raymond Terrace Bypass archaeological assessment in 1990. 38-4-0320 comprised 7 artefacts located in two concentrations in disturbed areas. A total of 7 artefacts were recorded made from silcrete and indurated mudstone. Six of the artefacts were flakes and the other a large core. The sites are located 40m from Windeyers Creek on intact creek terraces. 38-4-0238 comprises 14 artefacts of a variety of raw material located 5m from Windeyers Creek on a terrace.

The subject area has been subject to the excavation of a large void that would have incorporated the two arms of Windeyers Creek and the associated terraces. The Grahamstown drain has also been excavated on the southern boundary of the proposed rezoning to relieve flooding. At the time of closure the site support a floating dredge, sand wash, mooring and pontoons, office/weighbridge and staff amenities and earthmoving operations. The historical infrastructure associated with the mining of the site from the mid 1960's is not known. There is negligible potential for creek terrace to remain on the site.

The bio-banking assessment of the site prepared by ERM reviewed historical photographs of the site and found that the site had been quarried since the mid-1960s. The review found that "the north-west of the site, which has the highest potential for redevelopment to residential use ..... was

historically quarried and now appears vegetated"[3]. A site visit found that there is evidence of disturbance with a steep un-natural cut along the northern boundary and a similarly steep western margin possibly due to fill under Adelaide proposed rezoning is located on the margins of a sand quarry site. The tree cover is generally introduced (Radiata Pine) with a some remnant Swamp Oak Floodplain Forest.

Plate 1 The north- west corner of the site view east

There are two sites recorded on AHIMS to the south of the study area. The two sites are open sites located on the terrace of Windeyers Creek. There are no other archaeological records relevant to the study area.

[3] (ibid) Page 15

Figure 5 AHIMS locations relative to the study area – area in red was surveyed

The desktop assessment did not locate any Aboriginal objects. The site was inspected with Richard Kime of Worimi Local Aboriginal Land Council, on the 17th of May 2016. The inspection focused on the area marked in red (Figure 4) as this was the initial rezoning proposal area. The area has been extended to that shown in Figure 1. Additional survey was not considered necessary given the disturbance on the site, and the results of the survey extrapolated over the additional area.

No archaeological objects or areas of potential archaeological deposit.

It was noted that the soil profile appeared poorly developed unlike the top of slope in the adjacent park. The northern margins of the site with a slope of approximately 45% is clearly not natural or consistent with the soil landscape description of typical slopes (Plate 1). In addition the trees within the study area appeared to be no more than approx. 30 years old, which is consistent with the ERM assessment of sandmining in the area in the 1960's – 1970's (Plates 2&3).

Plate 2 The brown A horizon of the sandy soil in the park to the north of the study area.

Plate 3 the soil beneath pine needles, note the poorly developed humic layer

Archaeological visibility was provided by the powerline transect across the block (Plate 4). The easement provided 20% archaeological visibility (260m x 5m of easement inspected) providing 260 sqm of archaeological visibility (Plate 5). No cultural heritage objects were located.

As shown in Plates 1, 3 & 4, surface visibility was very limited by a deep cover of pine needles. Three areas of exposure within the forested areas of the site provided by exposures (total of 5 x 10m with 10% archaeological visibility) totalling 5 sqm of effective exposure (Plate 6). A total of 265 sqm of the 1.8ha included in the survey area provided the opportunity to locate heritage objects. There is no potential for modified trees given the younger age of the trees and the introduction of radiate pine.

Plate 4 The approx 45 degree slope - northern margin

Plate 5 View west across the southern end of the study area along the powerline easement

Plate 6 Surface visibility in an exposure mid section of the site

Plate 7 Typical surface visibility

Plate 8 Access track to the WWTP on the northern boundary of the study area

Cultural Heritage Impact Assessment

Based upon the historic landuse assessment (ERM 2011), and the site inspection the study area has been highly impacted by at least 40 years of sandmining. The potential for items of Aboriginal heritage to remain in- situ is very low.

Recommendations

There were sufficient sample areas of surface visibility at the time of inspection to determine that the subject area has been substantially disturbed. The soil profile was observed to be poorly developed which is consistent with a history of sandmining. Whilst overall the surface visibility was low due to the ground cover of pine needles, there were no objects found in those areas that did present the opportunity for objects to be located.

There are no constraints to the rezoning, given that the likelihood of sites of significance remaining within the study area being low.

References

Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales. NSW Office of Environment & Heritage 2010.

ERM 2011 251 Adelaide Street Raymond Terrace, Ecological Due Diligence and BioBanking Assessment. Report to Rocla Quarry Products (p14)

Murphy, C.L 1995 Soil Landscapes of the Port Stephens 1:100,000 Sheet. Published Soil Conservation Service of NSW,

Yours sincerely

ITEM 11 - ATTACHMENT 1 PLANNING PROPOSAL - 251 ADELAIDE STREET RAYMOND TERRACE.

Insite Heritage Pty Ltd

Angela Besant
Senior Archaeologist
Insite Heritage Pty Ltd

ITEM 11 - ATTACHMENT 1 PLANNING PROPOSAL - 251 ADELAIDE STREET RAYMOND TERRACE.

Appendix A– AHIMS Search

Office of Environment & Heritage NSW

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : dewitt raymond terrace

Client Service ID : 223135

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
38-4-0238	RT 3;	AGD	56	381900	6372150	Open site	Valid	Artefact : -	Open Camp Site	1916,1983,2199,102116
	Contact	**Recorders**	Doctor.Jo McDonald,Elizabeth Rich					**Permits**		
38-4-0320	RT 5;	AGD	56	382220	6372230	Open site	Valid	Artefact : -	Open Camp Site	1983,102116
	Contact	**Recorders**	Doctor.Jo McDonald					**Permits**		

Report generated by AHIMS Web Service on 29/04/2016 for Angela Besant for the following area at Lot : 232, DP:DP593512 with a Buffer of 200 meters. Additional Info : to inform and impact assessment. Number of Aboriginal sites and Aboriginal objects found is 2

This information is not guaranteed to be free from error omission. Office of Environment and Heritage (NSW) and its employees disclaim liability for any act done or omission made on the information and consequences of such acts or omission.

Page 1 of 1

Appendix B Worimi LALC report

(to be included after review)

ATTACHMENT 12 – Flood Assessment prepared by BMT WBM (2017)

BMT WBM Pty Ltd
126 Belford Street
Broadmeadow NSW 2292
Australia
PO Box 266
Broadmeadow NSW 2292

Tel: +61 2 4940 8882
Fax: +61 2 4940 8887

ABN 54 010 830 421

www.bmtwbm.com.au

Our Ref: DJL: L.N20202.005.docx

28 March 2017

Pheonix Builders Pty Ltd
PO Box 342
Earlwood NSW 2206

Attention: Chris Xistouris

Dear Chris,

RE: FLOOD ASSESMENT 251 ADELAIDE ST, RAYMOND TERRACE

This letter report provides a review of the existing flood conditions and identifies risks associated with flooding which may pose constraints on the potential for development of the disused quarry site at 251 Adelaide St, Raymond Terrace. The assessment updates previous reporting investigating different potential development footprints.

Background

The disused quarry site at 251 Adelaide St, Raymond Terrace is located on the low-lying floodplain of Windeyers Creek, just upstream of the Hunter River. The site is positioned just south of the Raymond Terrace township and is bounded by the elevated road embankments of Adelaide Street and the Pacific Highway. A sewage treatment plant adjacent to the site is raised well above the floodplain.

Windeyers Creek is characterised by wide, low-lying swamp areas where ground levels are typically 1.0-1.5m AHD. Within the site boundary, the creek separates into two branches. The northern creek branch has been realigned into a well-defined channel running along the north and west boundaries of the site. Across the remaining site, elevations are generally below 2.5m AHD, with the exception of the north western corner of the block which is raised to around 3.0m AHD. The site boundary and local topography of the area is presented in Figure 1.

The site is subject to two flooding mechanisms:

- Backwater inundation from the wider Hunter River system; and
- Local flooding of Windeyers Creek catchment.

The site is located within the low-lying floodplain area bounded by Adelaide Street and the Pacific Highway, and provides major storage area for flooding of both Windeyers Creek and the Hunter River. There are two major flood flow paths either side of the disused quarry, being the main Windeyers Creek channel running around the north and west perimeter of the quarry lake and a secondary tributary channel along the southern perimeter. A levee is constructed along the Hunter River floodplain offering some protection from elevated water levels associated with Hunter River flood events. The proposed development at the site will be concentrated to the north-western corner, as indicated on Figure 1.

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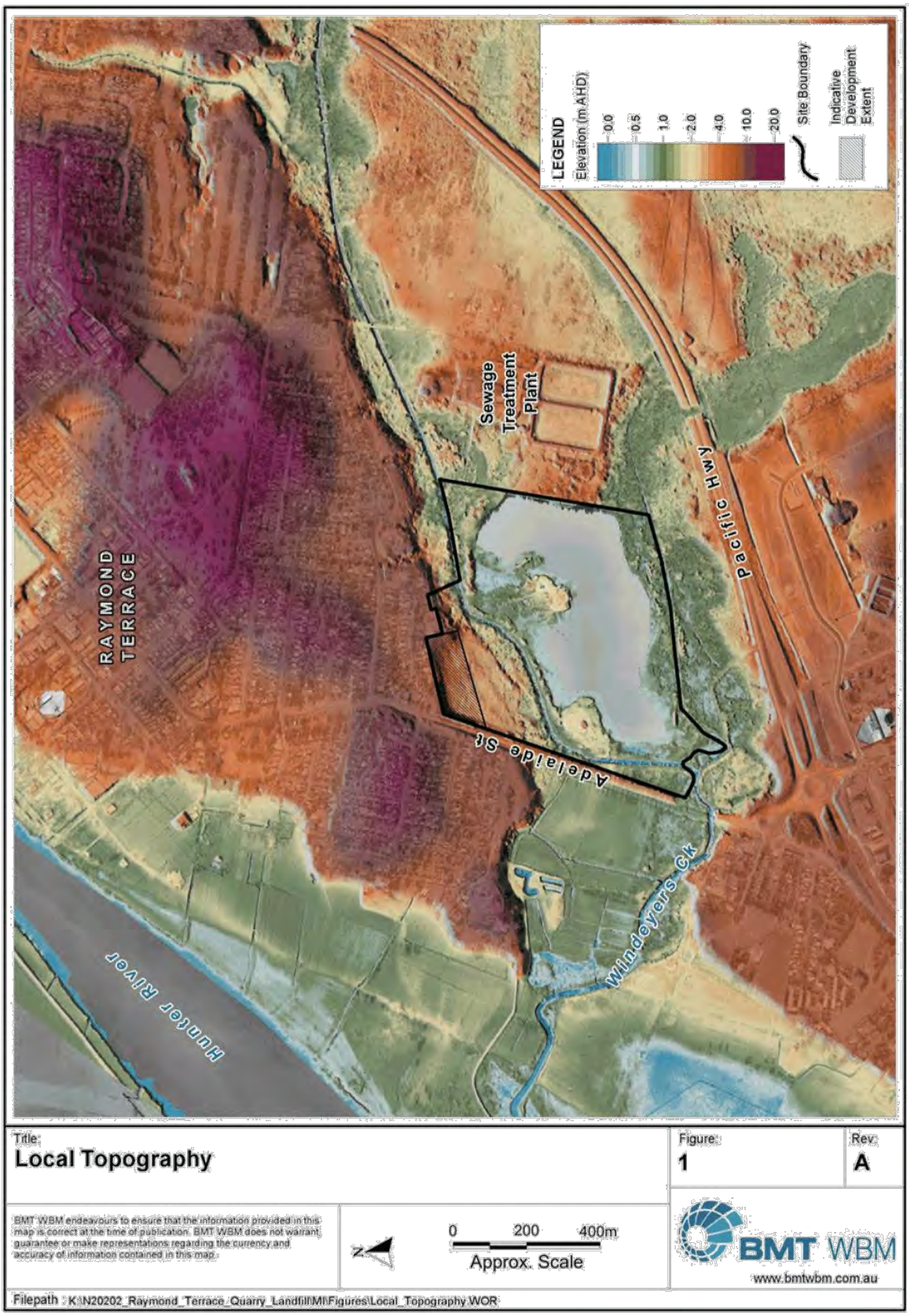

Model Development

The flooding constraints applicable to the site have been defined through computer modelling of typical flood behaviour. Modelling was completed for the 1% AEP event (100yr ARI), which is typically used to define flood planning levels. The lower Hunter River model (developed by BMT WBM on behalf of Port Stephens Council) defines Hunter River design flood conditions and was utilised for this assessment.

To simulate local catchment flooding of Windeyers Creek, separate hydrologic and hydraulic models were developed.

An XP-RAFTS hydrological model was developed to simulate the rate at which rainfall runs off the catchment. The amount of rainfall runoff and the attenuation of the flood wave as it travels down the catchment are dependent on:

- The catchment slope, area, vegetation and other characteristics;
- Variations in the distribution, intensity and amount of rainfall; and
- The antecedent conditions (dryness/wetness) of the catchment.

Catchment properties were determined from the high resolution (2m grid size) Digital Elevation Model (DEM) derived from LiDAR data and aerial photography. Rainfall intensity-frequency-duration values and temporal patterns were adopted in accordance with the standard procedures outlined in AR&R (2001). An initial loss of 20mm and a continuing loss of 2.5mm/hr were adopted for this study and are within the limits recommended by AR&R for a catchment in eastern NSW.

In developing the hydraulic model, BMT WBM has applied the fully 2D software modelling package TUFLOW. The 2D model has distinct advantages over 1D and quasi-2D models in applying the full 2D unsteady flow equations. This approach is necessary to model the complex interaction between rivers, creeks and floodplains and converging and diverging of flows through structures.

As the study area is relatively small, a high resolution model cell size (5m) was adopted, providing for an accurate representation of flow distribution over the floodplain. Key hydraulic control structures including the Pacific Highway and Adelaide Street bridges were represented as layered flow constrictions where the flow impediment influence of the abutments, piers and bridge deck is modelled. Culverts within the study area (under the Pacific Highway and through the Hunter River levee) were also included within the 2D domain as 1D structures.

Existing Flood Conditions

The inundation extents for 1% AEP flooding events including peak flood depths and velocities in the vicinity of the site are shown in Figure 2 and Figure 3 for Hunter River and Windeyers Creek flooding respectively.

The relative impacts at the site of local flooding of Windeyers Creek are far outweighed by mainstream Hunter River flooding. For the 1% AEP Hunter River flood event, there is extensive overtopping of the levee protection system, with large scale inundation extending upstream into the Windeyers Creek floodplain.

Being the dominant mechanism in terms of peak flood levels, the Hunter River flooding condition would be adopted in the derivation of flood planning levels (FPLs).

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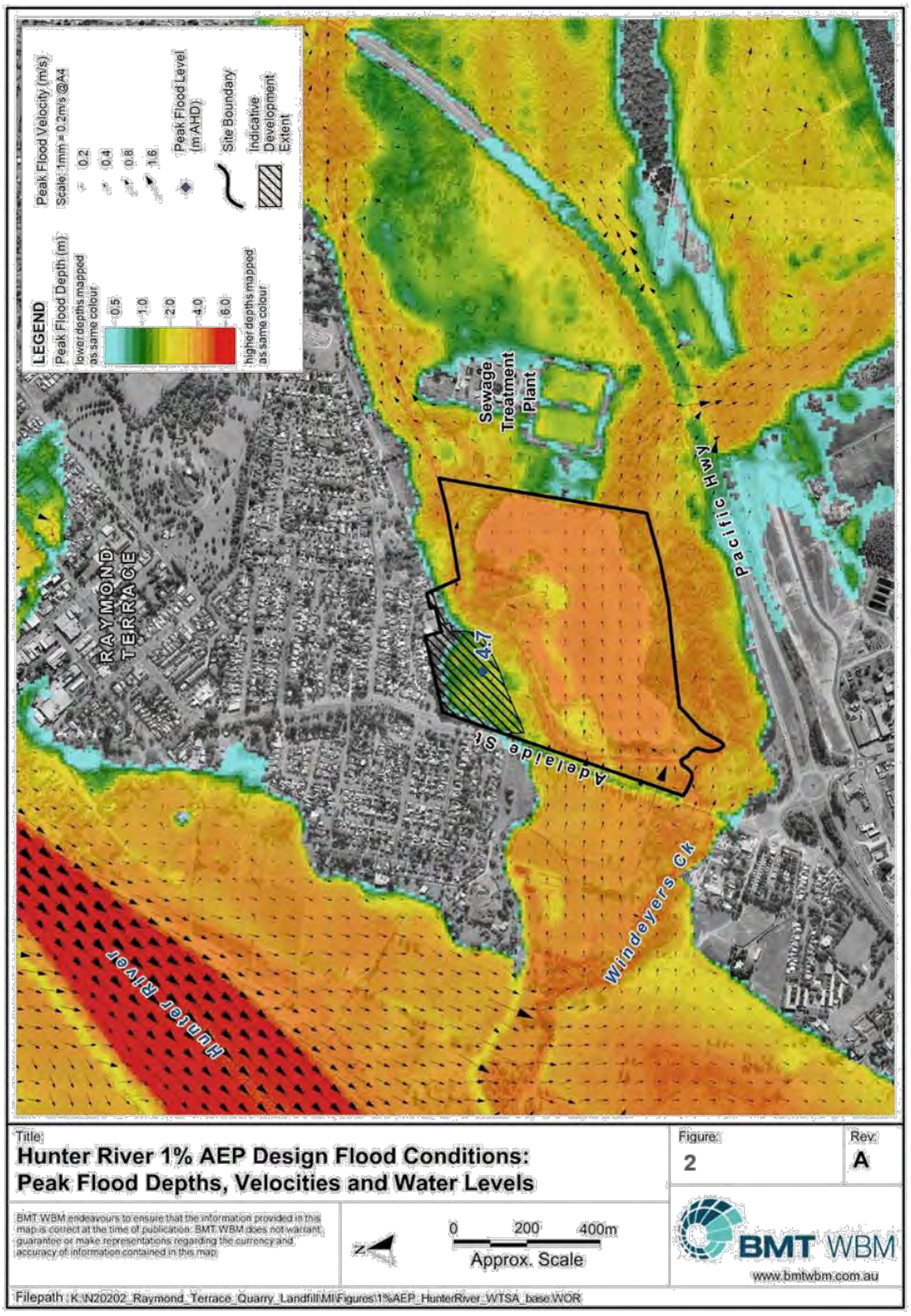

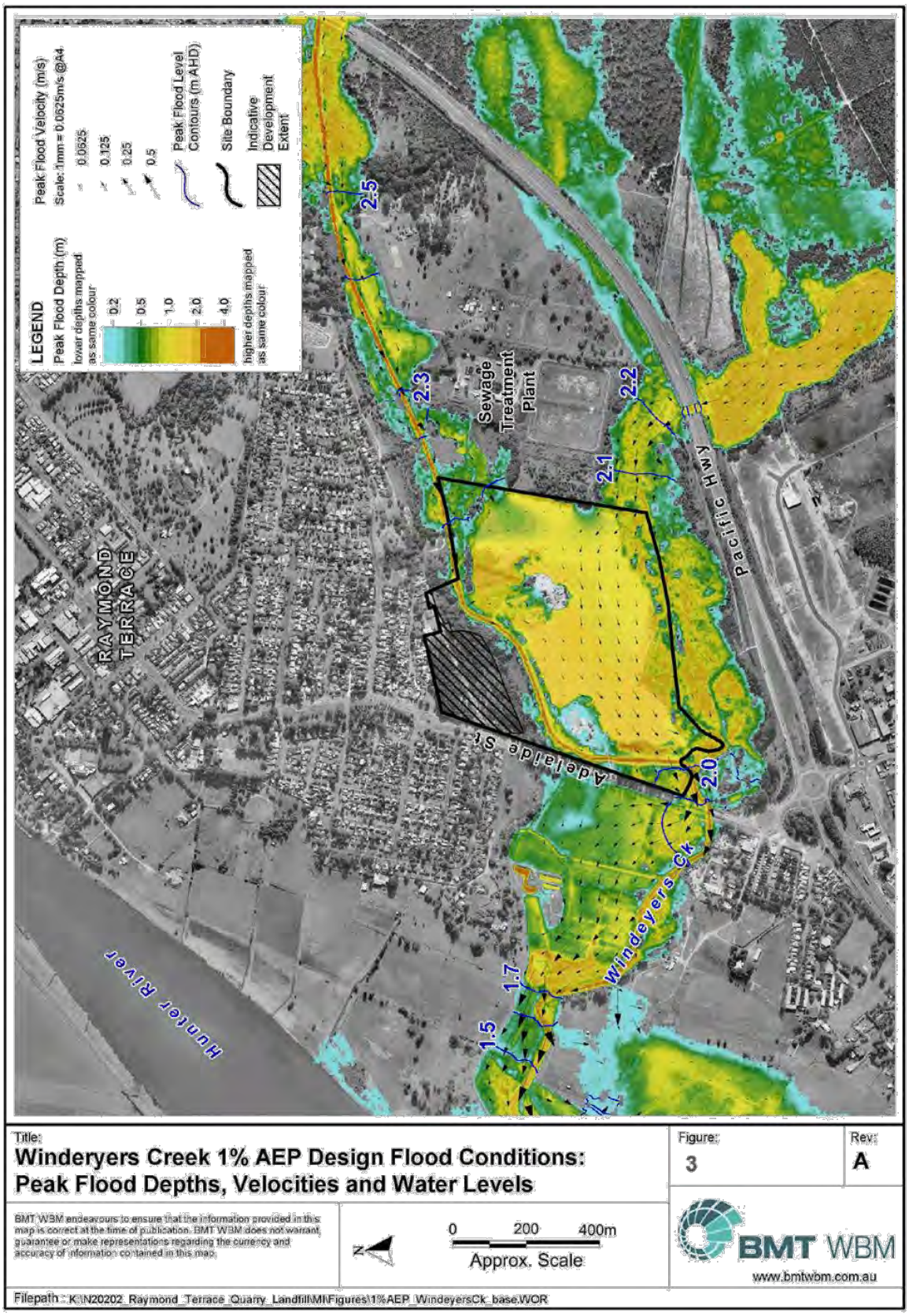
LEGEND
Peak Flood Depth (m)
lower depths mapped as same colour
0.2
0.5
1.0
2.0
4.0
higher depths mapped as same colour
Peak Flood Velocity (m/s)
Scale: 1mm = 0.0625m/s @A4
0.0625
0.125
0.25
0.5
Peak Flood Level Contours (m AHD)
Site Boundary
Indicative Development Extent
2.5
2.3
2.2
2.1
2.0
1.7
1.5
Sewage Treatment Plant
Pacific Hwy
RAYMOND TERRACE
Adelaide St
Windeyers Ck
Hunter River
Title:
Winderyers Creek 1% AEP Design Flood Conditions: Peak Flood Depths, Velocities and Water Levels
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BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.
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BMT WBM
www.bmtwbm.com.au
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Existing design flood conditions for each flooding mechanism are detailed below.

Hunter River Flooding

Design flood conditions were developed for the Lower Hunter and Williams River System in the Williamtown / Salt Ash Flood Study Review (BMT WBM, 2012). Following on from the flood study, the Williamstown / Salt Ash Floodplain Risk Management Study (BMT WBM, 2017) was completed. The study involved further updates and refinement to modelling and provides the most recent definition of design flood conditions at the site.

The 1% AEP design conditions for Hunter River flooding were derived from adopting the following boundary conditions:

- Hunter River flow at Raymond Terrace, just downstream of the confluence with the Williams River. The Williams River inflow components were scaled to produce a peak flood level for the 1% AEP of ~4.8m AHD – consistent with the Flood Frequency Analysis for Raymond Terrace.
- Water level time series at the downstream boundaries of Newcastle Harbour and Tilligerry Creek. The time series are representative of 50% AEP design conditions.
- Local catchment inflows into the Hunter River, including the Windeyers Creek catchment, derived from 10% AEP design rainfall conditions. A 48 hour duration design storm was adopted as it was found to be the critical event for the catchment.

A water level time series along the Hunter River was extracted from the Williamtown / Salt Ash model and was applied at the boundary of the local model developed for this study. The finer cell resolution adopted in this study (5m grid compared to 40m grid in the former study) provided the necessary detail to compare development impacts as a result of filling the site.

For the 1% AEP flooding condition, inundation across the floodplain is extensive. Both the levee protection system and Adelaide Street are significantly overtopped. The storage area is filled and floodwaters breach over sections of the Pacific Highway. Typical depths across the site are within the order of 3.0-4.0m (refer to Figure 2), with the peak water level at approximately 4.7m AHD. The broader low-lying floodplain of Windeyers Creek provides for an extensive storage area of Hunter River derived floodwater. The elevated road embankments of both Adelaide Street and the Pacific Highway provide some level of control, however, extensive overtopping of both roads are expected at the 1% AEP Hunter River flood magnitude.

The main flow path traverses through the centre of the site across the lake, as indicated by the velocity vectors shown on Figure 2.

Local Catchment Flooding of Windeyers Creek

In order to gain a full appreciation of catchment derived flooding conditions, the local Windeyers Creek model was run without influence from Hunter River tailwater conditions. Past studies including the Williamtown / Salt Ash Flood Study adopted a tailwater condition of~ 1.2m AHD which is representative of the 50% AEP (2yr ARI) Hunter River water level. During coincident flooding events of the Hunter River and Windeyers Creek, the levee system offers significant protection against backwater inundation from Hunter River water levels up to around 2.0m AHD. Accordingly, the simulated flood conditions shown in Figure 3 are largely derived from the local Windeyers Creek catchment.

The Adelaide St road embankment acts as a major control for Windeyers Creek flooding with flow confined to the existing bridge opening (i.e. no local overtopping of Adelaide St). The resulting flood levels at the proposed development site are influenced by the backwater from the Adelaide St bridge. Upstream of the development site, the elevated Pacific Highway embankment also provides for a significant hydraulic control, particularly on the southern tributary of Windeyers Creek.

The extent of overbank inundation within the site boundary is generally maintained within the disused quarry lake area between the two Windeyers Creek branches, to the west of the elevated sewage treatment plant. Typical depths across the site are within the order of 0.5-1.5m, with the peak water level at 2.1m AHD. Velocity of floodwaters are generally less than 0.3m/s, with higher velocities (up to 1m/s) contained within the realigned Windeyers Creek channel along the northern boundary of the site. Due to the poorly defined nature of the southern creek branch, the main flood path along the southern boundary of the site is less distinct. Modelled floodwaters spill out of the natural creek channel onto the disused quarry area. The preferential flow path across the lake is indicated on Figure 3.

There is notable attenuation of floodwaters over the wider catchment due to the flat topography and remnant sand dunes. The local hydraulic model was developed by applying inflow boundary conditions derived from the XP-RAFTS hydrological model at selected locations. Due to the flooding behaviour of the wider floodplain, the inflows derived from the XP-RAFTS model are expected to be slightly higher than what would realistically occur as some attenuation outside the model domain is not explicitly accounted for. The results found in this study are conservative and would represent the maximum peak flood level likely across the site. Previous model results from the Williamtown Salt Ash Flood Study (WBM Oceanics, 2004) indicated that 1% AEP flooding of Windeyers Creek resulted in peak flood levels at the site of 1.9m AHD. Therefore, it is appropriate to assume that peak flood conditions in the order of 1.9-2.1m AHD should be expected at the site for the 1% AEP event.

Development Potential

In considering the impact of flood conditions on potential development, the Hunter River conditions will drive the required flood planning level (FPL). The Williamtown / Salt Ash FRMS (BMT WBM, 2017) was in part prepared to inform Council of the likely changes in flood behaviour within the study area that may arise through future climate change conditions, particularly in relation to flood planning levels. Following completion of the study, Council has adopted the 1% AEP Hunter River design event including a 0.9m sea level rise allowance and 20% increase in flow (indicative 2100 planning horizon) to define flood planning levels. A similar 20% increase in design rainfall intensity is applied to the local Windeyer's Creek catchment.

The peak flood inundation extents and depths for the 1% AEP flood planning event for Hunter River and Windeyers Creek flooding are shown in Figure 4 and Figure 5 respectively.

A summary of the simulated peak water levels for existing and flood planning conditions (2100 planning horizon) is shown in Table 1. At the site, the peak flood level for the appropriate flood planning event is 5.2m AHD. An additional allowance for freeboard is required for certain types of development. For residential development, a freeboard of 0.5m is typically required. This would provide for a FPL of 5.7m AHD for habitable floor levels at the site.

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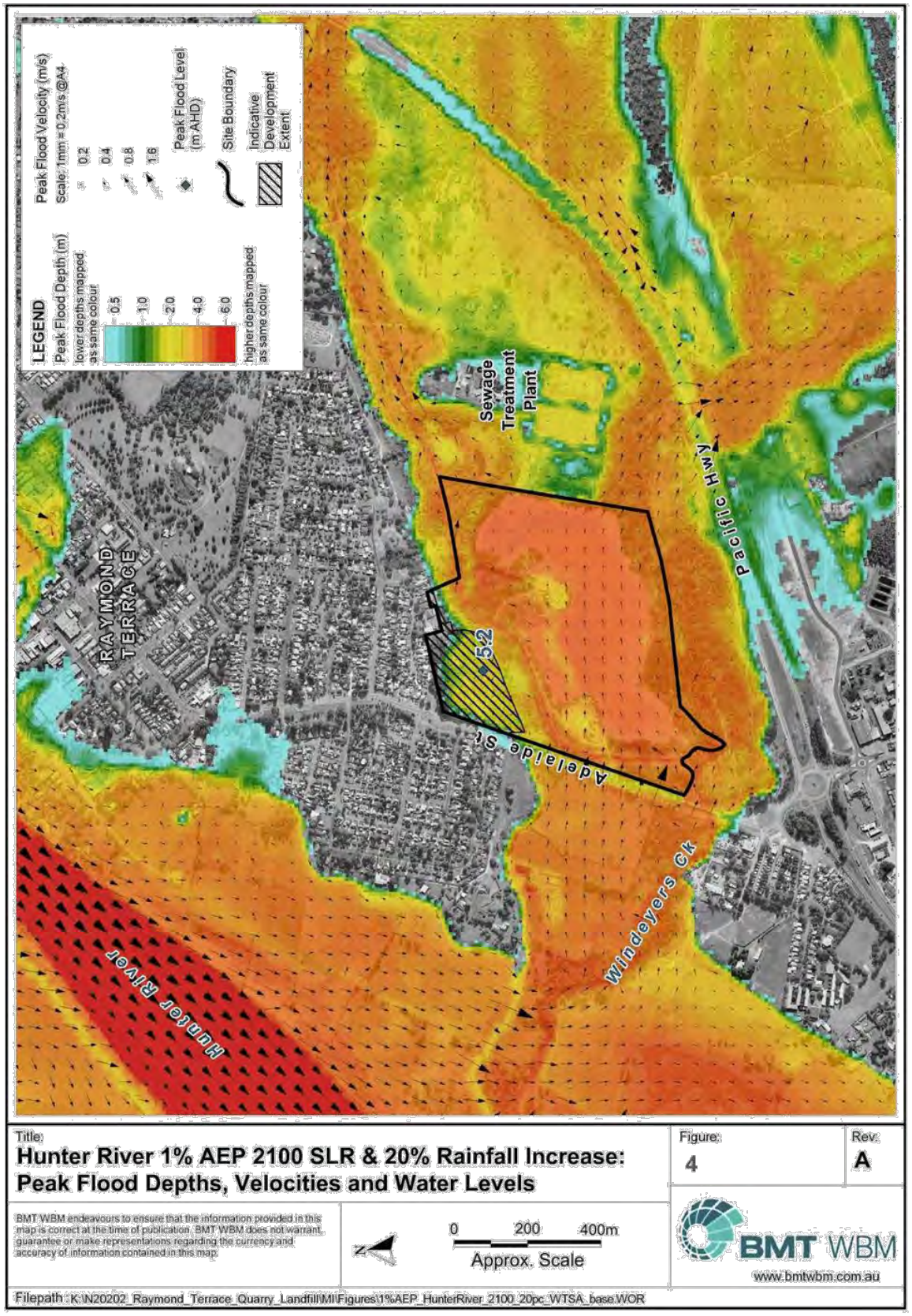


ITEM 11 - ATTACHMENT 1 PLANNING PROPOSAL - 251 ADELAIDE STREET RAYMOND TERRACE.

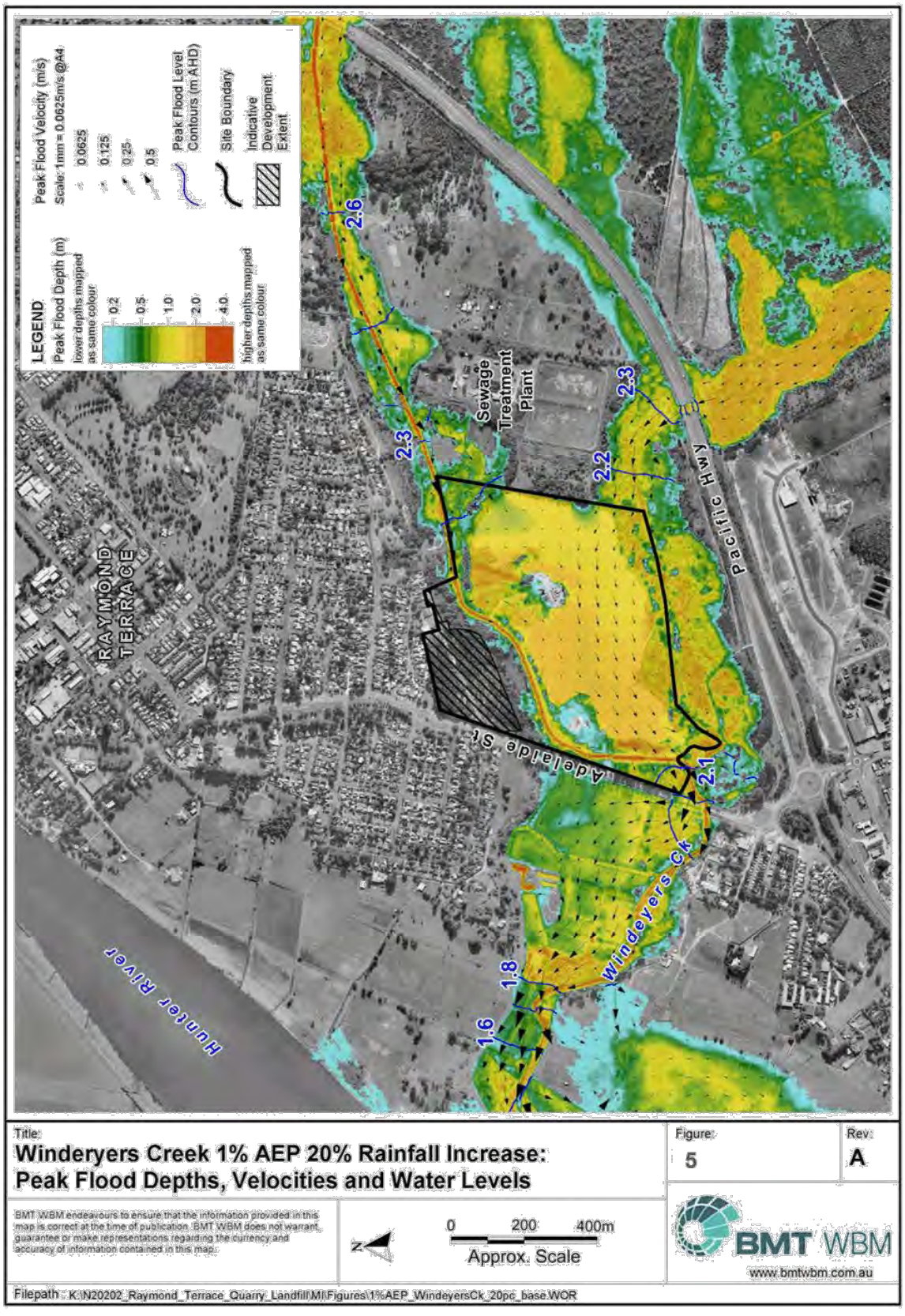


Table 1 Peak Flood Levels at 251 Adelaide St, Raymond Terrace

Flooding Mechanism	Peak flood level (m AHD)
Hunter River 1% AEP (BMT WBM, 2017)	4.7
Hunter River 1% AEP 2100 planning horizon w/ 0.9m SLR and 20% increase in flow (BMT WBM, 2017)	5.2
Windeyers Creek 1% AEP	2.1
Windeyers Creek 1% AEP 2100 planning horizon with 20% increase rainfall	2.2

As the majority of the site is elevated below 2.5m AHD, an extensive amount of fill would be required to provide flood immunity to the 1% AEP flood level and is indicative of the severity of flooding affecting the area and suggests that stringent controls would apply to any proposed development in this location. Preliminary investigation into flood constraints at the site indicated that filling of a large, central portion of the site was not viable due to potential for changes to existing flood conditions through:

- Redistribution of flow arising from works on the floodplain;
- Concentrated discharges and subsequent impact on downstream areas; and
- Increase in flood levels through impedance of overland flow paths and loss of temporary flood storage.

As a consequence of the preliminary investigation, this current study is focused on filling the north-western portion of the site only. The assessment will assume the parcel of land indicated as having development potential to above the peak 1% AEP flood level. This represents the exclusion of all existing flood storage within the fill footprint.

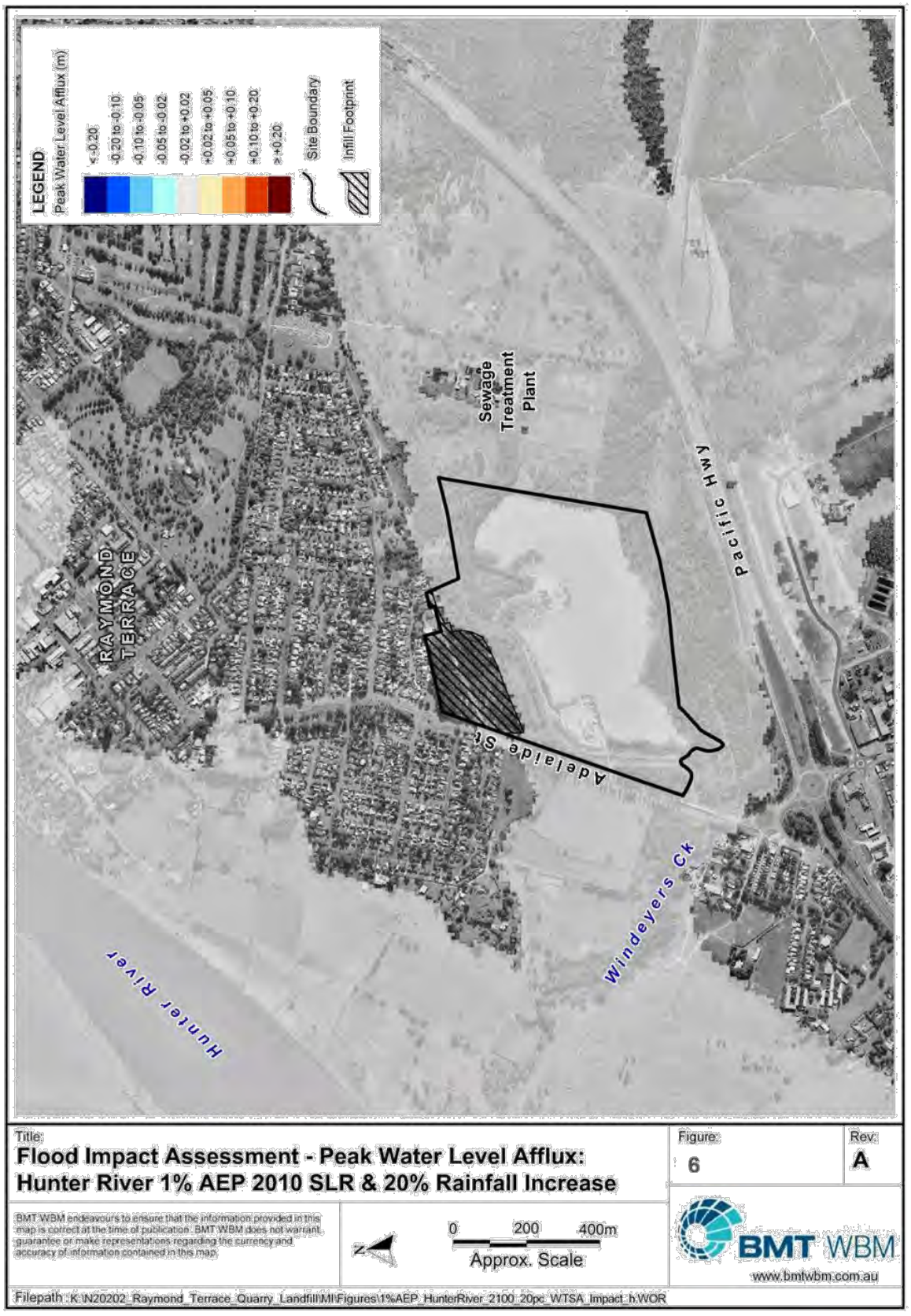
It should be noted that the proposed development extent is outside of the 1% AEP Windeyers Creek flood inundation extent (refer to Figure 5). Therefore, impacts will be assessed for Hunter River derived flooding only. This assessment is focused on identifying the opportunity for development based on the flooding constraints and potential flood impacts. The assessment has not considered other design constraints such as environmental constraints, construction practicalities, planning approvals etc.

Flood Impact Assessment

The proposed development layout is included in Appendix A for reference. Within the model the development footprint area, ground levels have been raised above the adopted FPL for habitable dwellings (i.e. 5.7m AHD).

The simulated change in peak flood level and peak flood velocity for the proposed fill footprint is shown in Figure 6 and Figure 7 respectively. In both instances, there are no significant impacts on existing flood water level and velocity distributions for the proposed fill footprint.

ITEM 11 - ATTACHMENT 1 PLANNING PROPOSAL - 251 ADELAIDE STREET RAYMOND TERRACE.



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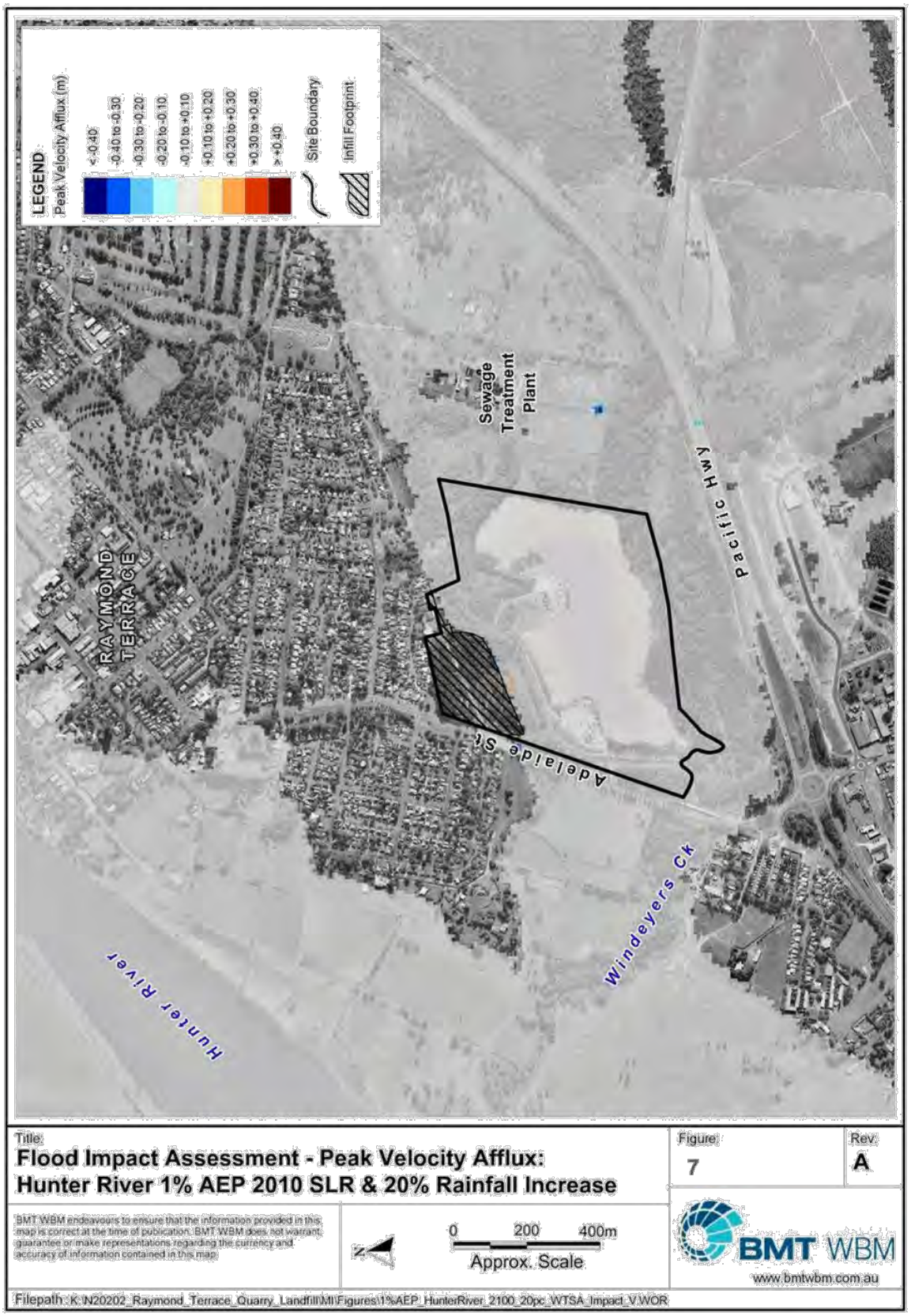

The proposed development area is located on the fringe of the 1% AEP Hunter River flood inundation extent, where velocities are minor (less than 0.1m/s) and depths are typically in the order of 1-2m. Residential development located to the north-west of the site on the opposite side of Adelaide Street (Wahroonga Street and Parkway Avenue area) is elevated well above the floodplain and offers protection to the proposed development area from Hunter River flooding. As such, the results of the flood impact assessment show that there will be negligible impact to existing 1% AEP design flood conditions at the site as a result of filling the north-western corner out of the floodplain. Increases in peak flood levels and velocities are less than 5mm and 0.05m/s. respectively.

The flood impact assessment has only considered the proposed fill footprint for the proposed dwellings (raised to the FPL). At this stage of the development design, there is no detail of the proposed access road that runs from Adelaide Street through to the development lots. The access road traverses the flood inundation area under both Hunter River and Windeyers Creek flood conditions (refer to Figure 4 and 5). The road elevations and cross drainage provisions will need to be designed to meet the objectives for access road flood immunity and minimising potential adverse impacts through elevated road profiles.

Other Considerations

In assessing the development potential site there are a number of other considerations with respect to flooding including:

- Risks to life considered for flood events up to the PMF;
- Flood warning; and
- Emergency response and flood access.

Whilst these aspects have not been considered in detail to date, the following comments are offered. The Hunter River flooding is noted as the dominant flooding mechanism and far exceeds the Windeyers Creek flooding in terms of severity. Accordingly, the design standards for any proposed development on the site is based on peak Hunter River flood levels. With regards the other design considerations noted above, it is important to note that flooding of the wider Hunter / Williams River system has a very long warning time (likely to be days), with flood waters rising slowly as a result of the large contributing catchment area. Accordingly, it is envisaged that existing formal flood warning and emergency procedures for the Hunter River would serve proposed development at the site for flood events in excess of the 1% AEP design standard.

I trust the above provides a suitable description of the opportunity and constraints for development at the subject site. Please feel free to contact the undersigned to discuss further as required.

Yours Faithfully
BMT WBM

Darren Lyons
Water & Environment Manager – Newcastle

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References:

BMT WBM (2012) Williamtown / Salt Ash Flood Study Review, prepared for Port Stephens Council

BMT WBM (2017) Williamtown-Salt Ash Floodplain Risk Management Study and Plan (in preparation), prepared for Port Stephens Council

Appendix A – Proposed Development Layout