3. Environmental and Social Considerations

3.1 Flora and fauna

A flora and fauna assessment was undertaken to determine the ecological values and implications for development of the area. The aim of the investigation was to identify the species and habitats of conservation significance, based on current legislative and planning instruments, with the ultimate aim of assisting in decision making for sustainable development of the area.

Area E has been subject to extensive disturbance as a result of clearing for agriculture and as such the ecological values are confined to those areas too steep or otherwise unsuitable for agriculture. A number of assessments have previously been undertaken for areas that make up most of the site. These assessments have considered the ecological values of defined areas within the study area, with consideration to rezoning and development proposals. The ecological values have been described in these previous studies and give an indication of the values that need to be considered.

The site has been largely cleared of vegetation for agricultural purposes with the remaining vegetation confined to lowland wetland areas and drainage channels or where steep terrain prevents easy access. The agricultural land use has resulted in disturbance of the vegetation communities and allowed invasion of exotic species (particularly camphor laurel) over much of the site. The wetlands area has also been historically disturbed, as indicated in aerial photos by the presence of wind rows of vegetation and constructed drainage channels. Significant wetland areas associated with Trutes Bay within the Terranora Broadwater abut the site to the north. This area is of ecological and economic significance as it provides suitable habitat for migratory wader birds and oyster farming, both of which require protection from the degrading processes of adjacent land use and development.

3.1.1 Methodology

The following section identifies the various methods used to complete this examination of flora and fauna. Investigation included:

- review of Existing Information and Previous Studies;
- desktop reviews; and
- field studies.

3.1.1.1 Review of Existing Information and Previous Studies

There is a considerable amount of information relating to the flora and fauna values for the Area E study area. Review of the ecological information to date for the Area E was undertaken to identify the constraints for future land use in the area. The review is based on historical information including:

- previous reports including ecological assessments associated with rezoning applications;
- Tweed Shire Council Vegetation Management Strategy 2003 and mapping;
- Wader Bird monitoring reports for the Tweed River Estuary;
- State Government legislation and planning instruments;

- information on local ecological values;
- NSW Biodiversity Plan;
- Tweed Shire Planning Documents; and
- correspondence with relevant stakeholder including Tweed Shire Council Environment Officers and NSW National Parks and Wildlife service

The information was obtained by:

- review of existing information for previous planning studies, Tweed Shire Environmental Studies, State Planning Policies, Conservation Plans and relevant legislation;
- comments and recommendations from stakeholder agencies which outline the information required to identify the environmental constraints with development of the site. These comments have been considered in the preparation of this assessment; and
- obtaining additional information where gaps have been identified in the existing information set such as, areas of land not assessed by previous data sets, updated legislative significance of species previously identified in the area and by undertaking additional field investigations to confirm the relevance of historical data and add additional information where possible.

The existing flora and fauna information has been drawn from a number of reports including preliminary flora and fauna assessments, vegetation mapping compiled for the Tweed Vegetation Management Strategy 2003 and the Lower Tweed Estuary River Management Plan Technical Summary September 1991. Preliminary flora and fauna surveys have been undertaken for most of the Area E site. Since the commissioning and completion of these reports the legislative and natural environment may have changed. Hence, these reports are considered to give a good indication of the existing flora and fauna values of the site and development constraints, with regard to the protection of the natural environment. However, these documents require a review in light of more recent information. Flora and Fauna survey reports reviewed for this assessment include (refer also to Figure 3.1):

- February 1993 Preliminary Floral and Faunal Assessment on Lot 2 DP 778727, Lot C DP 954793, Lot 2 DP 169490, Lot 1 FP 165461 and Lots 39,40 and 43 DP 254416 and plan in transfer No. A846508 Parish of Terranora, county of Rous;
- February 1995, Mahers Lane landowners group Preliminary Biological Assessment;
- March 1995, Preliminary Biological Assessment of the Bolster Property; and
- November 2003, Preliminary Flora and Fauna Assessment, Area E Terranora NSW.

3.1.1.2 Database Searches

Database searches were undertaken to identify species recorded as inhabiting the area or potentially inhabiting the area. Database searches were undertaking including:

- Searches of NSW National Parks and Wildlife Service Atlas Database; and
- Searches of the Department of Environment and Heritage online database for significant species likely to be present in the study area as listed under the *Environmental Protection and Biodiversity Conservation Act 1999.*

3.1.1.3 Field Assessment

The information required for land use planning with respect to flora and fauna values needs to be sufficient to determine the impacts of development and adjacent effects from long term land use and reflect current understandings of ecological resource management. The historical information, although identifying most of the main issues, was based on limited field investigation over a long period of time. Gap studies were therefore undertaken and information collated into this report to achieve the objectives, including:

- Confirmation of the presence or absence of Mitchell's Rainforest Snail in remnant lowland rainforest and swamp forest in the area.
- Updated list of species and legislative significance of species under state and commonwealth legislation.
- Confirmation that ecological values of the areas identified in previous assessments has not significantly changed. This includes confirming the presence of rare and threatened flora and fauna on the site in areas previously identified and more importantly confirming the absence of rare and threatened species in areas with little or no conservation value.
- Consideration of current planning considerations to the updated information.

The methodology for undertaking the gap studies included undertaking a desktop review to assess significant species likely to be present in the area, field reconnaissance to confirm the findings of previous assessments and update changes in legislative significance of the species associated with the site. A field assessment was undertaken to update the information already obtained for the site, to confirm the relevance of this data and identify the ecological significance of the environmental values on the site. The field assessment was undertaken over a four day/ night period from Monday 6 October to Friday 10 October 2003 by two PB ecologists. The methodology for the field survey included:

- an assessment of the site vegetation classifications and mapping identified in previous assessments;
- identification of the presence of significant flora in areas of sensitivity (Threatened species were identified in the vicinity of the brushbox forest and swamp rainforest during a site visit in June 2003);
- confirmation of vegetation communities undertaken by transect walk through each habitat where the dominant structural species of the community was confirmed and targeted searches for rare and threatened species was undertaken;
- spotlight searches for a period of 2 hours per night including a transect in each of the habitat types on the site;
- targeted searches of lowland rainforest and swamp rainforest for the presence of Mitchell's Rainforest Snail;
- Anabat echo-location recordings each night;
- identification of wader bird habitat within the site;
- incidental sightings and searches of fauna within remnant habitat on the site; and
- Searches for signs (scratches, marks, nests, scats) of fauna inhabiting the site.

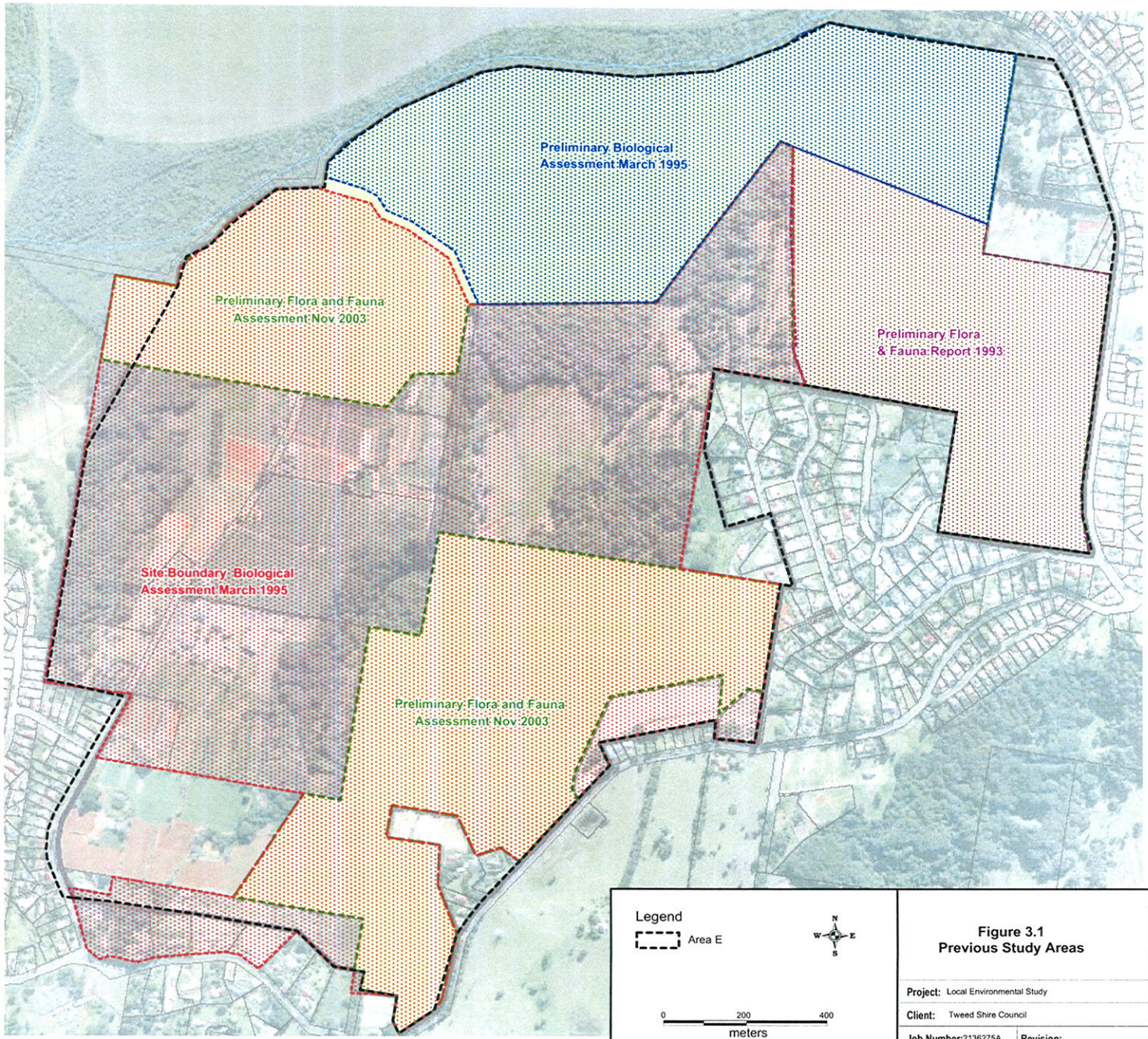

Figure 3.1
Previous Study Areas

Datum:	
Scale:	As Shown
Author:	MB
Checked:	
Project:	Local Environmental Study
File:	2136275A/drf/gis/workspaces/Eco Assess.wor
Client:	Tweed Shire Council
Job Number:	2136275A
Revision:	
Date:	15/07/03
Drawing Number:	

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3.1.2 Findings

3.1.2.1 Review of Previous Studies

Many of the ecological values for the Area E were identified from existing reports and assessments for the site and local area. A summary of the main findings of each of the historical assessments into flora and fauna values is provided below and a complied list of species from these studies is provided in Appendix C.

February 1993 Ecological Assessment Report

Remnant vegetation on this site is comprised of a small area of remnant vegetation and disturbed areas associated with rural land use. Vegetation communities were identified to encompass a small area of remnant vegetation and disturbed habitat. The remnant vegetation was identified as being significant, representing a rainforest community containing rare and threatened plants. Other vegetation on the site was considered as disturbed without conservation significance. The vegetation remnants identified in the area and plants of conservation significance include:

- Closed Forest (Rainforest) is a small remnant of highly disturbed vegetation. Mature canopy species with a closed canopy. Understorey seedlings evident.
- Significant flora species identified in this area and listed in Briggs and Leigh (1995) Rare or Threatened Australian Plants of Australia (ROTAP).
- Rare and threatened plants - Rhodamnia maideiana (ROTAP listing 2RC) Macadamia tetraphylla (ROTAP Listing 2VC) Southern quassia (ROTAP listing 3RC).

2 - species with a very restricted distribution in Australia and with a maximum geographic range of less than 100km.

3 - species with a range over 100km in Australia but occurring only in small populations which are mainly restricted to highly specific and localised habitats.

V - Vulnerable

R - Rare

C - a species known to be represented within a National Park or other proclaimed reserve

- when used in conjunction with the C coding indicates that the species has been recorded from a reserve(s) but that the population size is unknown.

The remaining vegetation within this area is considered highly disturbed and complex and is associated with historical land use including vegetation used for agricultural screening, remnant vegetation around dam storage and grassed paddocks.

A buffer planting of 10m around the remnant rainforest and a 20m buffer to the wetland habitat adjacent to the north of the property was recommended for development of the site.

No detailed fauna survey was conducted for this assessment. The method of assessment consisted of extrapolating the likely occurrences of species from incidental sightings and observations of habitat characteristics made at the time of the vegetation assessment.

The desktop review identified three significant species that may be present in the study area including the Golden Bell frog (Litoria aurea), Comb-crested Jacana (Irediparra gallinacea) and Black-headed flying fox (Pteropus alecto). These species were not identified or considered likely to have significant habitat on the site.

Species identified on the site included common species that is reflected by the disturbed nature of the site.

Habitat associated with the remnant rainforest, man made dam, vegetative screenings, grass lands and orchards were not considered to provide habitat for fauna species of ecological significance. Fauna of significance were thought to potentially visit these areas as part of a wider home range.

February 1995 Ecological Assessment Report

The ecological assessment for the site, which is commonly known as Mahers lane, covers a section including most of the study site for Area E. The site is historically highly disturbed as a result of agricultural land uses. Much of the good quality agricultural areas with good access have been cleared and vegetation comprising mostly of introduced camphor laurel exists along drainage lines or in areas where the land is too steep for cropping. Significant remnant vegetation was identified to the north of the site where the low relief areas are not suitable for agriculture due to water logging of soils. Mapped SEPP 14 Wetlands are within the site and immediately adjacent to the north west of the site.

The vegetation remnants identified in the area and issues of significance include:

- Closed forest (camphor laurel) represents most of the remnant vegetation in this area. It occurs in areas on steep slopes and drainage lines running north to south through the properties. It was noted that this area would have once contained an assemblage of species consistent with Subtropical Rainforest remnant vegetation. Some native species which were identified as common pioneering species still occur within this species complex however none of these were identified as being listed under the ROTAP scheme.
- Sub-tropical Rainforest which is relatively not impacted upon by camphor laurel was identified on drainage lines and in the north of the site. Mapping provided in the assessment did not clearly identify the location of the assemblage, however it is expected to be located in slightly elevated areas adjacent to the Bangalow palm and paperbark communities with in the swamplands in the north of the site. This community was not considered to have particular conservation significance as it was considered to be adequately conserved in other areas based on the dominant species represented by a blue quandong (Elaeocarpus grandis) suballiance. No ROTAP listed plants were identified in this area.
- The almost monotypic stand of Bangalow palms (Archonotophoenis cunninghamiana) and broad-leaved paper barks (Melaleuca quinquinervia) in the swampy areas in the north of the site were considered to be of regional conservation significance. No ROTAP listed plants were identified in this area.
- Swamp sclerophyll forest was identified in the north-western boundary of the site in the area identified by SEPP 14 wetlands. The vegetation in this area typically reflects an ecotone of species including marine mangroves (Avicena marina), wetland species swamp oak (Casuarina glauca) and broad-leaved paperbark and a few forest red gums (Eucalyptus tereticornis). The forest red gums are identified as SEPP 44 koala food trees;
- Significant species were anticipated to be present in the vicinity of drainage lines in areas not inspected during the assessment.
- Buffers were recommended for areas containing significant vegetation communities such as the Bangalow palm forest and around sensitive receptors such as the school on the site.

This report identified that the habitat value of the Mahers Lane vicinity study area has been reduced through disturbance of the area for agriculture such as grazing and cropping.

A total of 15 significant species were considered to potentially exist in the area including:

- Osprey (Pandion haliaetus) (Observed overflying the site during a site visit June 2003);
- Koala (Phascolarctos cinereus);
- Black flying fox (Pteropus alecto);
- Comb-crested Jacana (Irediparra gallinacea);
- Black necked stork (Xenorhynchus asiaticus);
- Bush hen (Gallinula olivacea);
- Superb fruit dove (P. superbus);
- Yellow-eyed cuckoo shrike (Coracina lineata);
- Mangrove honeyeater (Lichenostomus fasciogularis);
- White-eared monarch (Monarcha leucotis);
- Common Plannigale (Planigale maculata);
- Queensland Blossom bat (Syconyceteris australis);
- Queensland long eared bat (Nyctophilus bifax); and
- Little bent-wing bat (Miniopterus australis).

No significant fauna species were identified on the site however some scratches on a few remaining forest redgums on the site were thought to be indicative of some koala activity in the area. Koalas were not considered to use this area as core habitat but as a conduit to move between suitable habitat areas.

Species identified on the site were characteristically common species associated with disturbed areas of urban environments. Significant fauna species were considered unlikely to utilise the site as core habitat, however it is possible that some bird species would forage within the remaining habitat areas as part of a wider home range.

SEPP 14 wetlands were identified adjacent to the habitat areas in the north of the site.

March 1995 Ecological Assessment Report

This area includes the remainder of the Area E site in the north east of the study area. This area contains some residential land to the east and a large portion of disturbed wetland in the remaining area. The SEPP 14 wetland identified immediately adjacent to the north of the Area E site has particular relevance to the site with respect to altering drainage conditions within the disturbed wetland. The planning policy prohibits alteration of drainage that may impact SEPP 14 wetlands. Alterations to drainage patterns has occurred in this area as a result of the construction of a flood gate, prior to implementation of the planning scheme policy and has reportedly altered the ecology of the community to species specialised to marine areas. The site predominantly comprises of disturbed low land areas subject to tidal inundation and wetland.

The vegetation community remnants identified in the area and issues of significance include:

- Low Open Shrubland (mangrove regrowth forest) identified in the north western portion of the site as a result of tidal inundation. No ROTAP listed species were identified in this area.
- Chenopod shrub land (salt marsh community) to the north east is reported to be in poor condition and colonising as a result of tidal inundation.

- Tall closed grass land (common reed (Phragmites Australis)) was identified as being located over much of this area particularly in the eastern portion of the site.
- Closed forest (swamp rainforest) identified in the eastern portion of the site and reported to indicate the original forest likely to have existed in the area. This forest is subject to some weed invasion from camphor laurel and lantana, however contains significant species listed in ROTAP (Briggs and Leigh, 1998) including:
  - Fine leaved tuckeroo (Lepiderema pulachella) (2RC-) (also listed as vulnerable (V) under the *Threatened Species Conservation Act 1995*(TSCA));
  - Duroby (Syzygium moorei) (2VC) (V, TSCA); and
  - Coastal cordyline (Cordyline congesta) (2RC-).

  2 - species with a very restricted distribution in Australia and with a maximum geographic range of less than 100km.

  3 - species with a range over 100km in Australia but occurring only in small populations which are mainly restricted to highly specific and localised habitats.

  V - Vulnerable

  R - Rare

  C - a species known to be represented within a National Park or other proclaimed reserve

  - when used in conjunction with the C coding indicates that the species has been recorded from a reserve(s) but that the population size is unknown.
- Closed/ Open forest (Brush box forest (Lophostemon confertus) which is a highly disturbed remnant and subject to weed invasion however contains one significant ROTAP species the coastal cordyline.

No detailed fauna survey was conducted for the assessment in the area known as the Bolster Property. The method of assessment consisted of extrapolating the likely occurrences of species from incidental sightings and observations of habitat characteristics made at the time of the vegetation assessment.

Desktop review identified the potential significant species that may be present in the area. Records were obtained from a search of the NSW National Parks and Wildlife Service database and from review of existing ecological studies and reports for the area including Reviving the Tweed (1991) and Vintage Lakes development (Warren, 1995), Egg and I Survey (Warren, 1994) and Piggabeen Road Bypass EIS (1993).

Significant species historically recorded in the vicinity of the site and considered to potentially exist in the habitat on the site:

- Osprey (Pandion haliaetus) (Observed overflying the site during a site visit June 2003);
- Koala (Phascolarctos cinereus); and
- Black flying fox (Pteropus alecto).

Approximately 20 conservation significant species were identified as potentially being present in the habitat on the site as evidenced by records from other studies in the local area. In addition to these species, migratory waders associated with the aquatic areas of the Broadwater are also considered to have a significant association with the site. Trutes Bay has been identified as a major roost site for wader birds and considered to be the most important migratory bird roost site in the area. The regenerating mangrove communities were also identified as likely to provide significant habitat in the future.

Of the significant fauna species identified only the Osprey was identified overflying the site however was not considered to rely on the site as significant habitat but as part of a larger home range.

Habitat values identified on the site include:

- the phragmites reed community is considered to provide aquatic wetland habitat to water birds and aquatic fauna and was considered to be of low to medium conservation value;
- mangroves and salt marsh communities identified adjacent to the Terranora Broadwater was considered to potentially provide habitat for significant species and provide buffering for SEPP 14 Wetlands and of medium conservation value;
- swamp Rainforest identified in the eastern areas of the site potentially provides habitat for frugivorous and michrochiropteran (Insectivorous bats) protected species and is of medium conservation value; and
- brush box forest located on the drier ridges in the eastern areas of the site was assigned a medium to low conservation significance and identified as containing features such as developed understorey and hollow bearing trees that may be suitable as habitat for significant species.

Protection of the rainforest communities in the east of the site was considered to reduce impacts to significant fauna from development of the area.

Preliminary fauna Assessment Area E Terranora NSW November 2003

This assessment has been undertaken in parallel to the site assessment undertaken for the study area. This assessment does not cover the whole of Area E. The report identified five vegetation communities of which significant vegetation communities present include mangroves, Swamp She-Oak, Paperbark and some areas of Bangalow Farm Rainforest.

The report identified two threatened species, being the Rough-shelled Queensland nut (Macadamia tetraphylla) and Fine-leaved Tuckeroo (Lepiderema pulchella) and identified that an appropriate buffer around these species and regeneration of the rainforest remnants within which they occur is likely to be required. Retention and enhancement of wildlife corridors is also identified as potentially being required.

The report also identified that management measures to mitigate impacts on threatened fauna species should include retention of a proportion of suitable areas of vegetation and rehabilitation and embellishment of closed forest types.

In regard to the protection of Terranora Broadwater and SEPP 14 Wetlands, the report recommended that any development of the site will need to incorporate appropriate buffers and demonstrate that the hydrological regime of Terranora Broadwater and the wetlands will not be significantly affected.

State of the Rivers and Estuaries Policy

This study provides for encouraging the protection of wetlands. The NSW Wetland management policy indicates the requirement for protection of existing water quality discharged into wetlands. The relevance of existing policy in NSW to Area E relates to the wetland habitat that is present in the northern part of the site.

Rehabilitation of the existing wetland in the Area E would be consistent with policy requirements for NSW Wetlands Management. Government assistance with wetland rehabilitation is available through the Department of land and water conservation.

3.1.2.2 Database Searches

NSW National Parks and Wildlife Atlas Database search

A search of the NSW National Parks and Wildlife Atlas database identified 25 fauna species and 8 flora species of conservation significance that are listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act).

The fauna species of conservation significance are shown in Table 3.1. Of the species listed in the database search two were identified as inhabiting the site.

Table 3-1: NSW National Parks and Wildlife Atlas Database search results - fauna

Species	Common Name	Status
Amaurornis olivaceus	Bush-hen	V
Calidris tenuirostris	Great Knot	V
Charadrius mongolus	Lesser Sand Plover	V
Coracina lineata	Barred Cuckoo-shrike	V
Crinia tinnula	Wallum Froglet	V
Haematopus fuliginosus	Sooty Oystercatcher	V
Haematopus longirostris	Pied Oystercatcher	V
Ixobrychus flavicollis	Black Bittern	V
Lichenostomus fasciogularis	Mangrove Honeyeater	V
Limosa limosa	Black-tailed Godwit	V
Monarcha leucotis	White-eared Monarch	V
Mormopterus beccarii	Beccari's Freetail-bat	V
Ninox connivens	Barking Owl	V
Pandion haliaetus	Osprey	V
Phascolarctos cinereus	Koala	V
Podargus ocellatus	Marbled Frogmouth	V
Pteropus alecto	Black Flying-fox	V
Pteropus poliocephalus	Grey-headed Flying-fox	V
Ptilinopus magnificus	Wompoo Fruit-Dove	V
Ptilinopus regina	Rose-crowned Fruit-Dove	V
Puffinus carneipes	Flesh-footed Shearwater	V
Syconycteris australis	Common Blossom-bat	V
Todiramphus chloris	Collared Kingfisher	V
Tyto capensis	Grass Owl	V
Therites michellae	Mitchell's Rainforest Snail	E1
Xenus cinereus	Terek Sandpiper	V

V – vulnerable, E1 Endangered - Refers to:

- *fauna and flora species that are likely to become extinct in nature in NSW unless the circumstances and factors threatening its survival or evolutionary developments cease to operate; or*
- *its numbers have been reduced to such a critical level, or its habitats have been so drastically reduced, that it is in immediate danger of extinction; or*
- *it might already be extinct, but it is not presumed extinct (Schedule 1, part 1, TSC Act 1995).*

A search of the NSW National Parks and Wildlife Species Database identified eight flora species of conservation significance that could be present on the site (See Table 3.2).

Table 3-2: NSW National Parks and Wildlife Atlas Database search results - flora

Species	Common Name	Status
Ebenaceae	Diospyros mabacea	E1
Fabaceae (Caesalpinioideae)	Cassia brewsteri var. marksiana	E1
Flacourtiaceae	Xylosma terrae-reginae	E1
Rubiaceae	Randia moorei	E1
Arecaceae	Archontophoenix cunninghamiana	P13
Aspleniaceae	Asplenium australasicum forma australasicum	P13
Cyatheaceae	Cyathea cooperi	P13
Orchidaceae	Cymbidium madidum	P13

V – vulnerable, P13 - Protected Native Plants - Refers to flora listed in Schedule 13 of the NPW Act 1974, E1 Endangered - Refers to:

- *fauna and flora species that are likely to become extinct in nature in NSW unless the circumstances and factors threatening its survival or evolutionary developments cease to operate; or*
- *its numbers have been reduced to such a critical level, or its habitats have been so drastically reduced, that it is in immediate danger of extinction; or*
- *it might already be extinct, but it is not presumed extinct (Schedule 1, part 1, TSC Act 1995).*

Commonwealth Department of Environment and Heritage database search

The Department of Environment and Heritage database identifies locations that may be relevant in determining obligations under the EPBC Act 1999. The database holds mapped locations of World Heritage properties, RAMSAR wetlands, threatened migratory and many marine species, and protected areas.

A search of the Department of Environment and Heritage database was undertaken for the areas encompassing the site between longitude 1501 latitude -24 and longitude 1526 latitude -22.

This search revealed the potential presence of no threatened ecological communities, 21 threatened fauna species, 11 species protected by migratory provisions and 12 marine protected species under the EPBC Act 1999. The threatened species lists from the database search are provided in Table 3.3. It should be noted that the results of this database search are indicative only, and as a result of the methods of data entry, the extracted results are typically an over-estimation of the specific area requested (Environment Australia, 2001).

Of the species listed under the EPBC Act, two species of plants Rough-shelled Queensland Nut (Macadamia tetraphylla) and Duroby (Syzygium moorei) have been identified on habitat on the site. If development is likely to impact on habitat containing these species then a referral of the project to the Department of Environment and Heritage for assessment is recommended as the project may be deemed to have a significant impact on a matter of National significance.

The remaining listed species are unlikely to be significantly impacted as deemed under the EPBC Act, as they do not have suitable habitat on the site or the site represents a small part of a wider home range. Significant impacts to the wetland areas of Terranora Lake adjacent to the site as a result of the project may impact an important migratory bird staging area

which would likely require referral to the Department of Environment and Heritage. Development of the area outside the wetland areas would be unlikely to have a significant impact on these values.

Table 3-3: Department of Environment and Heritage Database Threatened Species listed for the site

Scientific Name	Common Name	Commonwealth Status
Fauna		
Cyclopsitta diophthalma coxeni	Coxen's Fig-Parrot	Endangered
Lathamus discolor	Swift Parrot	Endangered
Poephila cincta cincta	Black-throated Finch (southern)	Vulnerable
Rostratula australis	Australian Painted Snipe	Vulnerable
Turnix melanogaster	Black-breasted Button-quail	Vulnerable
Litoria olongburensis *	Wallum Sedge Frog	Vulnerable
Phyllodes imperialis (southern subsp. - ANIC 3333)	a moth	Endangered
Chalinolobus dwyeri	Large-eared Pied Bat, Large Pied Bat	Vulnerable
Dasyurus maculatus maculatus (s. lat.)	Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (south-east mainland and Tasmanian subspecies)	Vulnerable
Potorous tridactylus tridactylus	Long-nosed Potoroo (SE mainland)	Vulnerable
Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable
Flora		
Acronychia littoralis	Scented Acronychia	Endangered
Austromyrtus fragrantissima	Scale Myrtle, Sweet Myrtle	Endangered
Bosistoa transversa	Three-leaved Bosistoa	Vulnerable
Cryptocarya foetida	Stinking Cryptocarya	Vulnerable
Diospyros mabacea	Red-fruited Ebony	Endangered
Diploglottis campbellii	Small-leaved Tamarind	Endangered
Endiandra floydii	Floyd's Walnut	Endangered
Floydia praealta *	Ball Nut, Possum Nut, Big Nut	Vulnerable
Hicksbeachia pinnatifolia	Monkey Nut, Bopple Nut, Red Bopple, Red Bopple Nut, Red Nut, Beef Nut, Red Apple Nut	Vulnerable
Macadamia tetraphylla *	Rough-shelled Bush Nut, Macadamia Nut, Rough-shelled Macadamia, Rough-leaved Queensland Nut	Vulnerable
*Marsdenia longiloba**	Clear Milkvine	Vulnerable
Randia moorei	Spiny Gardenia	Endangered
Syzygium hodgkinsoniae	Smooth-bark Rose Apple, Red Lilly Pilly	Vulnerable
Syzygium moorei	Rose Apple, Coolamon, Robby, Durobby, Watermelon Tree, Coolamon Rose Apple	Vulnerable
Tinospora tinosporoides	Arrow-head Vine	Vulnerable

3.1.2.3 Field Studies

Flora

The field flora component of the assessment was undertaken to confirm the presence of ecological values previously identified in historical reports and confirm the presence of significant flora values on the site. Targeted searches for significant plant species were undertaken and confirmation of the vegetation communities and mapping was undertaken for the site. The results of the flora assessment include those species identified during previous assessments and discusses the significance of these values.

A total of 2 significant species were identified on the site during the site assessment in October 2003 including;

- Coastal Cordyline (Cordyline congesta)(2RC-, ROTAP).
- Rough shelled Queensland Nut (Macadamia tetraphylla)(Vulnerable, EPBC Act, TSC Act, 2VC ROTAP).

Additional significant Plants identified in historical studies include:

- Fine-leaved Tuckeroo (Lepiderema pulachella) (Vulnerable, TSCA).
- Duroby (Syzygium moorei)(Vulnerable, EPBC Act, TSCA).
- Rhodamnia maideiana (2RC, ROTAP).
- Southern quassia (3RC,ROTAP).

General meander transects through each of the vegetation habitat areas on the site confirmed the adequacy of previous mapping of vegetation communities which are described below and allowed confirmation of the presence of significant plants previously identified.

Rhodamnia maideniana and Southern quassia were reported to be present in a small remnant of habitat represented as lowland rainforest shown on Figure 3.2. These species were not located in this area in the 2003 assessment. This remnant vegetation has been significantly impacted by edge effects, including trampling and grazing pressures of stock, which is likely to have reduced the ability of these species to survive in this location. Although this is suitable habitat, it is unlikely that development impacts in the area would have a significant impact to habitat of ecological conservation significance due to the size and condition of the remnant and fragmentation from other areas of suitable habitat.

The lowland rainforest habitat in the far north east corner of the site is of significance due to the presence of a number of reported significant species (although in low numbers this area supports a relatively high diversity of significant plants), the intactness of the habitat and connectivity with other areas of ecological significance.

The following section discusses the vegetation communities on the site and their significance in terms of containing significant environmental values. Areas were selected according to habitat and are discussed in the following Section, as per the mapped areas shown in Figure 3.2.

Fauna

A total of 48 vertebrate species were identified during the field assessment and are listed in Appendix D. Of these, two species, the cane toad and brown hare are introduced, 37 are birds (including two species listed as vulnerable under the NSW *Threatened Species Conservation Act 1995*). Four amphibians, one reptile, and four mammals were also identified. One invertebrate, Fraser's Snail (Sphaerospira fraseri) was located during targeted searches for Mitchell's Rainforest Snail (Therites mitchellae) that may have potentially inhabited the site.

Three species identified on the site are listed as vulnerable under the Theatened Species Conservation Act 1995, namely;

- (Irediparra gallinacea) comb-crested jacana;
- (Ptilinopus regina)Rose-crowned Fruit-dove; and
- (Pteropus alecto) Black flying-fox.

The comb-crested jacana (Irediparra gallinacea) is an aquatic bird that utilises floating pond vegetation, such as lily pads, as foraging habitat for insects and small crustaceans and for protection from predators. One comb-crested jacana was identified utilising the series of ponded dam areas located in the eastern part of the study site. This bird is likely to have migrated and colonised this area from nearby populations that have been identified in Trutes Bay (Sandpiper, 2000). The presence of this bird indicates the importance of the freshwater resources for aquatic birds in the area. Development of the site would need to consider the significance of impacts to this species from development of adjacent areas.

The rose-crowned fruit-dove was identified within camphor laurel habitat in the far-eastern area of the site. These are frugivorous birds that commonly inhabit rainforest areas including utilising melaleuca and mangrove areas (Simpson and Day, 1999). It is likely that this species utilises a large home range incorporating the habitat on site as they are a known locally nomadic species occupying this type of habitat (Date et al, 1992). Removal of the entire vegetation on the site may have an impact on this species by reducing the available foraging habitat within its range and severing linkages to other important forage areas. Camphor laurels are an opportunistic resource for frugivorous birds supplying large quantities of fruit and good cover. A large number of pigeons were identified in this area during the site assessment.

The black flying fox (Pteropus alecto) were identified feeding in fruiting rainforest trees during the site assessment. These mammals feed on nectar and fruits within a home range as much as 50 km from their day roost camps (Strahn, 1995). No camps were identified on the site. It is likely that the site provides foraging resources for these species, particularly in the lowland rainforest areas where a number of large figs were identified. The camphor laurel and remaining habitat areas on the site is unlikely to represent significant habitat to this species.

Other species identified in the database searches are likely to periodically inhabit the site as part of a migratory home range. These are likely to include aquatic bird species that forage in the significant low lying aquatic and wetland areas on the site. These will likely include transient migratory wader and frugivorous bird species of which the site plays an important role.

3.1.3 Discussion

3.1.3.1 Vegetation Communities

The vegetation communities on the site have been previously classified according to broad scale vegetation mapping within the Tweed Vegetation Management Plan and previous studies. A full vegetation species listing based on previous studies and studies carried out during the preparation of this report is provided in Appendix C.

The revised vegetation community mapping is shown in Figure 3.2.The vegetation communities are divided into six broad communities consisting of:

- lowland rainforest communities;
- camphor laurel dominant closed to open forest;
- Melaleuca and Swamp She-oak Forest;
- Phragmities australis open sedgeland;
- mangrove low closed forest; and
- BrushBox open forest.

The remainder of the site consists of cleared grazing and small crop land.

Vegetation mapping for an assessment of the site was recently undertaken by James Warren and Associates (2003) which discussed the conservation status of each of the vegetation communities in terms of the Tweed Shire Vegetation Management Plan and the Comprehensive Regional Assessment (CRA Unit 1999). This mapping included vegetation assessment over most of the Area E site. This assessment has been considered in relation to the vegetation mapping provided and conservation significance of the site.

Lowland Rainforest Communities

This area comprises the vegetation communities in the low lying areas to the north of the site. These areas are periodically inundated by freshwater. The species composition is almost monotypic stands of bungalow palm (Archontophoenix cunninghamiana) however broadleaf paperbark (Melaleuca quinqenervia) and some mixed rainforest trees are interspersed through some areas. This community has little structural diversity due to limited light penetration under the canopy which has resulted in a depauperate mid and understorey.

Significant plant species including Rough shelled Queensland Nut (Macadamia tetraphylla), Cordiline congesta, Fine Leaved Tuckeroo (Lepiderema pulchella) have been identified in the northeast lowland rainforest community which is particularly significant.

This vegetation community is recognised as an area of high conservation value under the Tweed Vegetation Management Plan 2003 which necessitates protection of these areas as a priority. This vegetation community is considered to be endangered under the Comprehensive, Adequate and Representative (CAR) reserve system (James Warren and Associates, 2003) which supports the classification of the area by the Tweed Vegetation Management Plan (See Photographs 3.1. and 3.2).

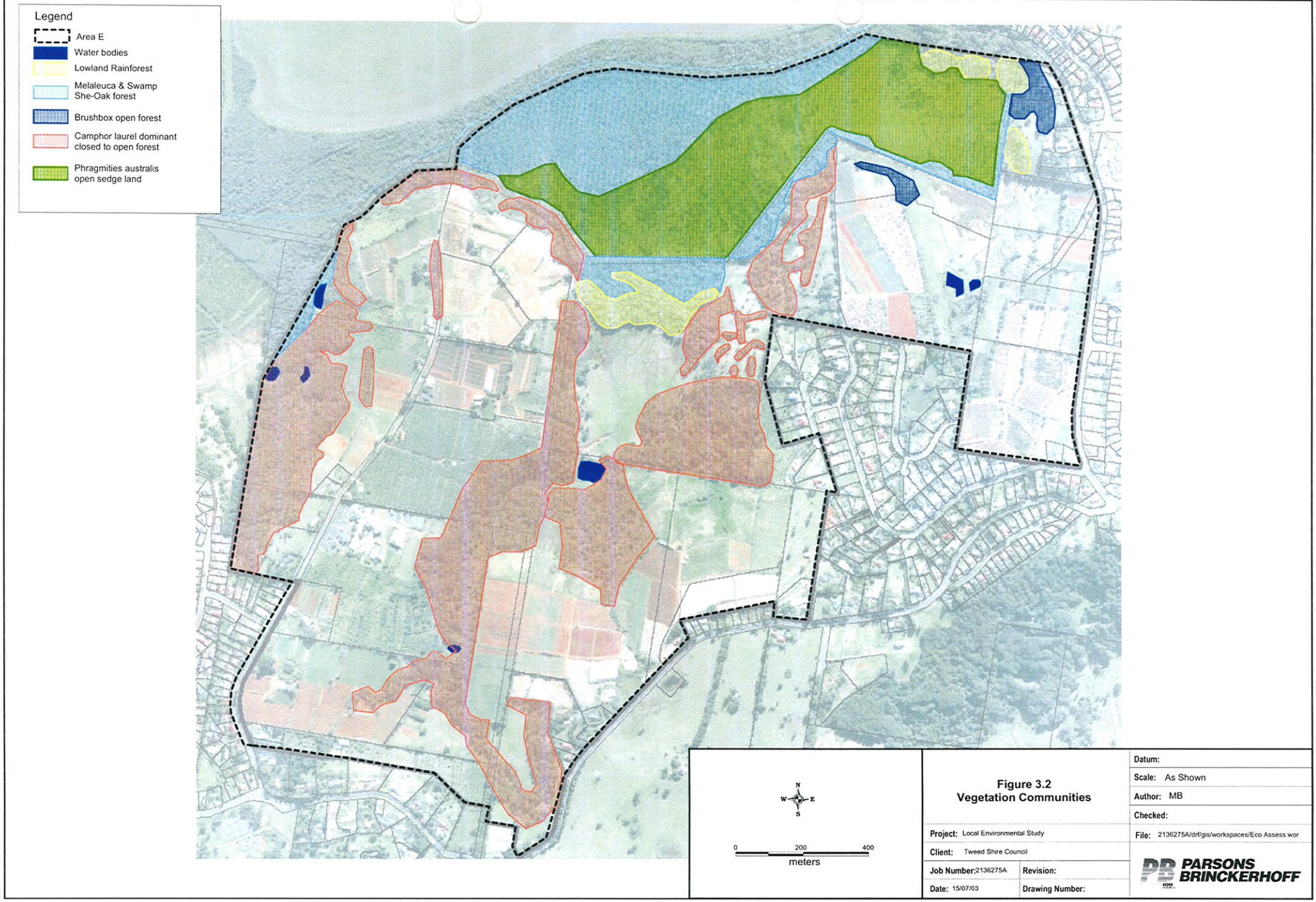

Figure 3.2
Vegetation Communities

Datum:	
Scale:	As Shown
Author:	MB
Checked:	
Project:	Local Environmental Study
File:	2136275A/drf/gis/workspaces/Eco Assess.wor
Client:	Tweed Shire Council
Job Number:	2136275A
Revision:	
Date:	15/07/03
Drawing Number:	

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Photograph 3-1: Lowland Rainforest showing Macadamia tetratphylla in right hand corner of photo

Photograph 3-2: Piccabeen Palm Forest

Camphor laurel dominant closed to open forest

This community is present on the disturbed areas of the site on higher slopes in the vicinity of drainage areas or those areas with topography limiting access for agricultural land use. Camphor laurel (Cinamomon camphora) dominate the canopy species and has become an almost monotypic stand in places.

These areas are highly weed infested with species such as ochna, lantana and privet, however rainforest species including macaranga, guioa and cheese tree are present in the assemblage.

Riparian areas dominated by camphor laurel have rainforest species in the understorey including the significant species Rough-Shelled Queensland Nut (Macadamia tetraphylla). A total of eleven Macadamia tetraphylla were identified in the understorey of the camphor laurel complex along the creek adjacent to the school.

The conservation status of this complex is indicated to be low according to the Tweed Vegetation Management Plan. The presence of Macadamia tetraphylla in the understorey of this community indicates that there is a localised area of high conservation along the creek line. This indicates that this area should be considered as a priority for management (See Photographs 3.3 and 3.4).

Melaleuca and Swamp Sheoak Forest

This vegetation community is present in the low lying swamp areas in the north of the site, in areas between the marine mangrove assemblages and lowland rainforest and cleared agricultural land. This community is present in an area designated SEPP 14 Wetlands.

The species composition consists of interspersed stands of Swamp oak (Allocasuarina glauca) and broad leaved paperbark (Melaleuca quinqenervia). Some Forest Red Gums (Eucalyptus tereticornis - See Photograph 3.5) are present in the western areas in a narrow ecotone between mangrove forest and upper slopes of the site. This area is heavily infested with weedy species including morning glory and groundsel.

This area is identified as having a conservation status of very high according to the Tweed Vegetation Management Plan 2003. This community has been identified under the Regional Forest Agreement as 'of priority for conservation on private lands', as much of the natural distribution of this community has been removed within the Tweed area (Tweed Vegetation Management Plan, 2003). The current classification and conservation significance of this assemblage appears appropriate.

Photograph 3-3: Camphor Laurel dominated habitat

Photograph 3-4: Macadamia tetraphylla along camphor laurel dominated creek line

Phragmities australis Open Sedgeland

This assemblage covers a large area of the wetland in the north east of the site between the mangrove forest and sheoak/ melaleuca assemblages. The species present consist almost entirely of Common Reed (Phragmities australis) which is typically associated with freshwater swamps. This vegetation community is located in an area designated under SEPP 14 Wetlands.

Part of this area has been identified as 'of very high conservation significance' with some area not determined (Tweed vegetation Management Plan 2003). This vegetation assemblage is considered to be endangered according to the Regional Forest Agreement (Warren and Associates 2003). The mapping for this area has been extended from that identified in the broad vegetation mapping in the Tweed Vegetation management Plan 2003.

Mangrove Low closed forest

Mangrove assemblages are confined to the tidal marine areas on the northern boundary of the site. Grey Mangrove (Avicena marina) makes up the dominant species in this area which is interspersed with less abundant mangrove species (River mangrove, black mangrove and milky mangrove). This community is located in an area designated under SEPP 14 Wetlands

The Tweed Vegetation Management Plan identifies this area has having a very high conservation significance. Warren (2003) also identified that this vegetation community is considered rare under the Regional Forest Agreement.

Brushbox Open Forest

This vegetation assemblage is present in areas on the far north-east of the site on the higher slopes adjacent to the lowland rainforest and melaleuca and swamp sheoak forest (see Photograph 3.6).

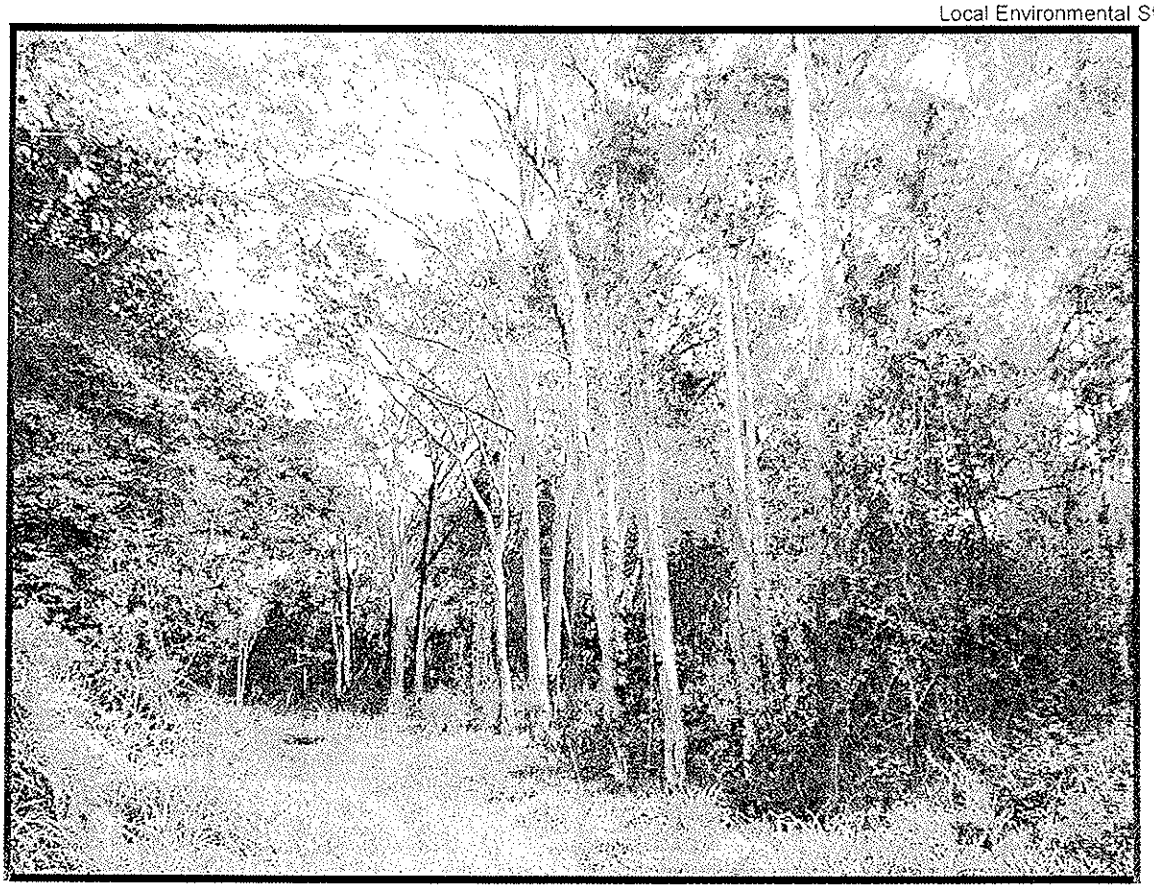
Brushbox (Lophostemon confertus) is relatively abundant in the canopy however this vegetation assemblage is highly disturbed and infested with lantana and other weeds and grasses. Adjacent development has encroached on this habitat causing significant edge effects.

This vegetation community is identified as having a high conservation significance under the Tweed Shire Vegetation Management Plan 2003. As this vegetation assemblage is highly disturbed it is unlikely to be particularly viable for preservation of significant vegetation in the future. This may indicate that this assemblage has a lower conservation status than that suggested by the Tweed Shire Vegetation Management Plan.

Cleared Areas

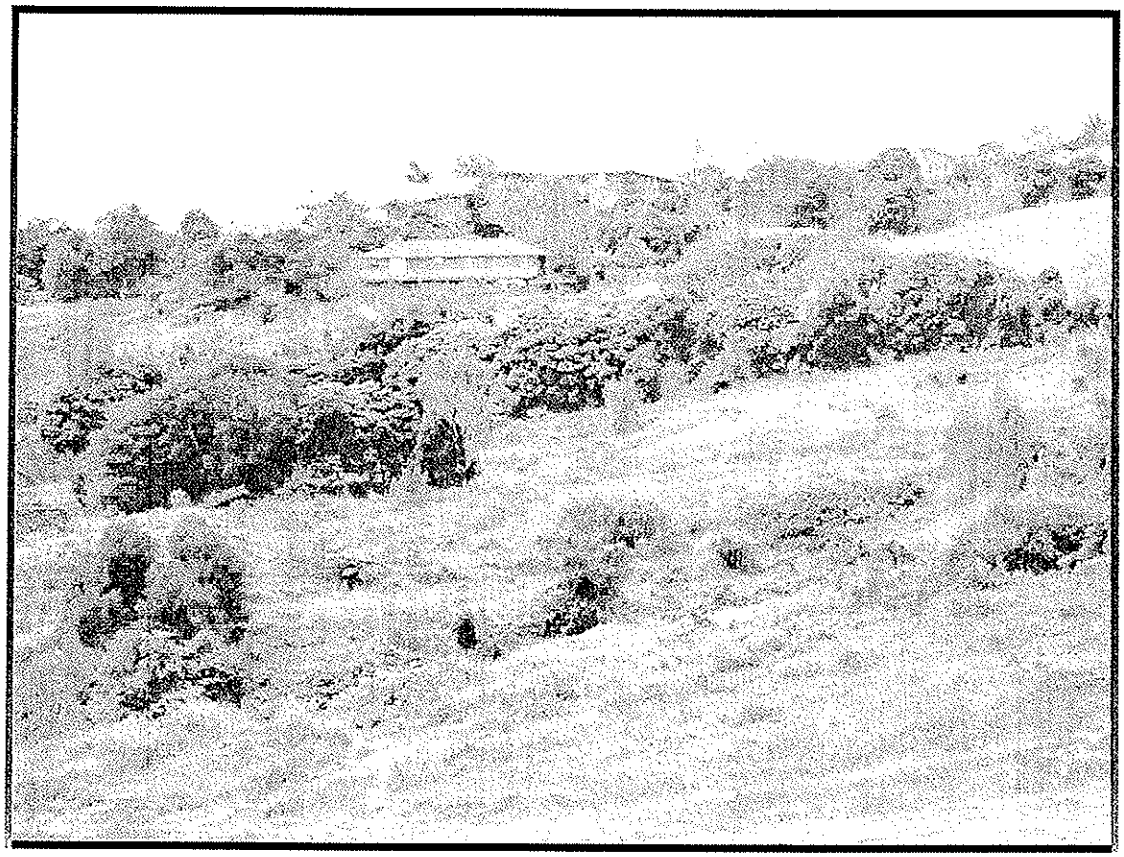
The remainder of the areas on the site are highly disturbed areas cleared of remnant vegetation to make way for cropping or agricultural land use such as for dams. Vegetation in these areas consists of pioneering exotic weed and grass species which are of low conservation significance. Dams on the site although providing significant habitat for fauna are of low conservation significance for vegetation (see Photograph 3.7 and 3.8).

The Tweed Vegetation Management Plan 2003 does not consider these areas for conservation status due to the significant disturbance. This report concurs with this finding.



Photograph 3-5: Eucalyptus Tereticornis

Photograph 3-6: Brushbox Open Forest



Photograph 3-7: Cleared Areas

Photograph 3-8: View north across open grazing land, note jacana habitat associated with habitat in the foreground.

3.1.3.2 Habitat Values

Habitat values on the site are considered in terms of potential habitat for threatened species and value in terms of supporting high diversity of fauna species.

The habitat in the vicinity of the SEPP 14 wetlands area is considered likely to play a significant role in facilitating fauna movement around the Terranora Broadwater and providing a habitat buffer for significant wader birds.

Trutes Bay is recognised as one of the areas with the highest diversity of wader birds and recognised as supporting the largest number of wader birds in the area (Sandpiper, 2000). Significant wader birds and species protected under the NSW Threatened Species Conservation Act were identified in association with the Trutes Bay wetland which, includes the freshwater areas associated with the site. This highlights the significance of this area for providing habitat for significant wader bird species. The identification of a significant population of comb-crested jacana in this area highlights the importance of minimising impact from adjacent development.

The wetland areas including the lowland rainforest forms the most significant habitat on the site. It is likely that these areas provide habitat for fauna of conservation significance. These species are likely to consist predominantly of aquatic birds including migratory waders that have been identified inhabiting Trutes Bay. Low lying areas on the site used for grazing does not represent optimal habitat for waders and aquatic birds which would opportunistically forage in these areas.

Avian species are the most abundant and diverse species on the site. Rainforest birds, predominantly pigeons, facilitate dispersal of the seeds of camphor laurels which provide significant food resource and nesting areas. As birds are highly mobile they are best adapted to migrate in and out of the area. Significant species such as the rose-crowned pigeon inhabit the relatively intact habitat areas associated with the wetlands and lowland rainforest habitat on the site. The camphor laurel dominant habitat although providing habitat for these species is subject to edge effects and infestations with weeds which are favourable to colonisation by aggressive pioneering species that thrive in disturbed habitats. This reduces the significance of these areas to protected fauna.

There is a relatively low abundance of hollow bearing trees which may account for the low numbers of arboreal fauna. Spotlight transects identified the presence of a northern brown bandicoot and fawn-footed melomy's on the site in the vicinity of the lowland rainforest in the far northeast corner of the site. This area has high structural diversity in the understorey and is relatively protected from impacts of nearby residents due to the topography.

High numbers of reptiles were not identified on the site however it is considered that the dense habitat to the north of the site would provide suitable habitat.

Mitchell's Rainforest snail was not located during targeted searches in the rainforest areas on the site. This habitat is suitable for this species however it has not been located during previous assessments. This snail has been recorded from Stotts Island which is in the local area, existing in 120 ha of low lying rainforest on the island. It is possible these species exist within the study area, despite not being directly located on site, however this indicates that it is unlikely a significant population is present in the available habitat areas.

3.1.3.3 Habitat Connectivity and Fauna corridors

The Tweed Remnant Bushland Map (Tweed Vegetation Management Plan, 2001) identifies the regional bushland corridors that would be used by locally nomadic and migratory species. The vegetation on the site linking directly to the riverine areas of Trutes Bay and the Terranora Broadwater is identified as part of one of the main regional corridors. The site provides significant linkage in the northern vegetated wetland and rainforest areas to other sites locally around the Broadwater. The remainder of the site, including the camphor laurel dominant habitat, is highly fragmented and subject to edge effects limiting the internal habitat through which relatively sedentary species can migrate. This area is likely to provide "stepping stone" linkage for highly mobile bird and bat species to areas of significant habitat.

3.1.3.4 Habitat Areas

The wetland and lowland rainforest areas provide the most significant habitat on the site in terms of supporting significant species and are of conservation significance in the local and wider regional area. These habitats provide linkage along the Broadwater and harbour significant flora and fauna species.

The wetlands are protected under SEPP 14 and as such an impact assessment of development in this area is likely to be required for development including any proposed roads or impacts due to significant changes in the hydrological regime such as increased flows or draining of the area. Consequently, it is recommended that a policy of avoidance and buffering of the wetlands areas is adopted.

These areas will require buffering (usually approximately 50m) from development to minimise impacts from edge effects. Development of the catchment will need to ensure that water quality mitigation measures are implemented to ensure water quality in the downstream environments is maintained. Measures for water quality mitigation are likely to include the provision of detention basins and constructed wetlands for water polishing and sediment and erosion control measures such as grass swales.

Camphor laurel habitat although not being of particular conservation significance does provide habitat for species, particularly bird species, and should be retained where possible. Retaining this habitat on steep slopes will help to prevent erosion.

The brush box community in the far north eastern portion of the site, as stated is highly disturbed and may not be viable in the long term. This vegetation may play a beneficial role in buffering the adjacent wetland area and stabilising the soil on steep slopes and as such should be retained where possible.

The remainder of the site is highly disturbed and of low ecological significance. Development in these areas seems appropriate if protection of adjacent high value areas can be implemented.

3.1.3.5 Significant species

Significant species have been identified associated with the lowland rainforest and the aquatic areas on the site.

Development will be required to avoid impacting the significant plants identified in the lowland rainforest in the northeast of the site and the population of Macadamia tetraphylla identified within the camphor laurel habitat. These areas will require buffering from adjacent development to ensure further degradation of the habitat due to development is minimised. Rehabilitation of the camphor laurel dominated habitat to allow the rainforest species in the understorey to re-establish is recommended as part of long term rehabilitation. This would facilitate the use of this area as a connective conduit for fauna.

Habitat for the comb-crested jacana identified on the site should be preserved within any development layout proposed for the area and appropriately buffered from adjacent residences.

It is unlikely that the rose-crowned pigeon or black flying fox would be significantly impacted from development of the site if the lowland rainforest and wetland areas are protected and buffered from adjacent impacts.

3.1.3.6 Wetland Rehabilitation

The NSW Wetland management policy indicates the requirement for protection of existing water quality discharged into wetlands. The relevance of existing policy in NSW to Area E relates to the wetland habitat that is present in the northern part of the site.

Rehabilitation of the existing wetland in the Area E would be consistent with policy requirements for NSW Wetlands Management. Government assistance with wetland rehabilitation is available through the Department of Land and Water Conservation.

The major wetland area identified within the study areas has undergone significant habitat modification through clearing which was undertaken prior to the introduction of SEPP14. Discussions with Tweed Shire Council's entomologist further identified that the area of wetlands was previously modified with the resulting effect being a change from a largely freshwater to a saline hydraulic regime which has created breeding habitat for salt marsh mosquitos. Salt marsh mosquitoes have an extensive range and in the right climatic conditions could range throughout the extent of the study area which would effect the potential for residential development of this land. Without rehabilitation to return the wetlands to a largely freshwater regime the salt marsh mosquitoes from the wetlands area would be an ongoing cause of nuisance to any residential development within the vicinity. There is also potential that further saline influence which would be triggered by the failure of existing floodgates could result in the area also becoming potential breeding habitat for biting midge which would further compound insect nuisance not only within Area E but also within surrounding residential areas (Clive Easton, pers. comm. 2003).

Biting insect problems associated with this area would be exacerbated by the introduction of increased population numbers that would result from residential development of the area and would require frequent intervention by Council to address the problem, as such becoming a long term issue to Council.

The potential solution to this issue is to undertake rehabilitation of the wetlands area to return it largely to a freshwater regime which would eliminate breeding habitat for salt marsh mosquitoes. This would also have the advantage of ensuring that this area of known PASS/ASS was kept inundated thus limiting potential for ASS discharge events. While the area would still provide breeding habitat for freshwater breeds of mosquitoes their effective range is substantially limited and with control of vegetation corridors which may provide routes for mosquito travel their range could be substantially contained to areas adjacent to the wetlands area.

Appropriate measures for the rehabilitation of the wetlands areas will need to be determined through further studies of the site and the funding for rehabilitation could be dealt with through the introduction of a Section 94 Plan that levied contributions towards these works. Alternate sources of funding may include wetland funding opportunities available from State and federal government Sources.

Likely requirements for rehabilitation would be:

- ensuring adequate freshwater input to the wetlands (both quantity and quality;
- ensuring that saline water incursion into the wetlands was limited;
- rehabilitation/re-establishment of freshwater vegetation species within the wetland;
- provision of appropriate buffers; and
- provision of water quality treatment prior from the adjoining catchment prior to water entering the wetlands.

3.1.4 State and Federal Legislative Considerations

3.1.4.1 Commonwealth Environmental Protection and Biodiversity Conservation Act 1999 considerations

The *Environmental Protection and Biodiversity Conservation (EPBC) Act 1999* at a Commonwealth level provides, amongst other things, protection to a number of matters of national environmental significance:

Under the EPBC Act a person must not take an action that has, will have or is likely to have a significant impact any of these matters of National Environmental Significance (NES) without approval from the Commonwealth Environment Minister. There are penalties for taking such an action without approval.

In regard to whether any development that may result from this LES may involve actions that will have or are likely to have a significant impact on any of these matters of natural environmental significance:

- The study area does not contain any World Heritage properties.
- The study area does not contain any wetlands which are listed as Ramsar wetlands of international importance.
- The site contains some nationally threatened plant and fauna species which are listed under the EPBC Act. However steps can be taken to ensure that these are protected including appropriate zoning and development controls.
- The adjacent Trutes Bay area is a significant habitat for wader birds which includes migratory species that are listed under the EPBC Act. Given the substantial wetlands, associated buffers and controls that are to be imposed on development likely to arise out of this study, is not likely to have a significant impact on migratory species that are listed under the EPBC Act.
- With the incorporation of appropriate measures for the management of stormwater the development likely to arise out of this study is not likely to have a significant impact on the Commonwealth marine environment.

It is therefore concluded that development likely to result from the potential alteration of land use (from this study) will not have a significant impact on any matters of NES.

3.1.4.2 NSW Legislative Considerations

State Environmental Protection Policy (SEPP) 14 Wetlands

A SEPP 14 wetland has been designated over the low lying northern portion of the site (SEPP 14 wetland number 23 - see Figure 3.3)

This requires consideration of development of the area to ensure that there is no degradation of these wetlands. Buffering wetlands from reduction in water quality runoff and habitat destruction (edge effects) from upstream impacts of development is considered necessary to ensure preservation of these areas. Provision of detention areas for pre-treatment of stormwater runoff would be considered appropriate for mitigation of adjacent land use water quality impacts

SEPP 14 Section 7, Clause 2 (a-g) sets out the requirements that need to be satisfied for the council and concurrence of the director to grant works in SEPP 14 wetlands.

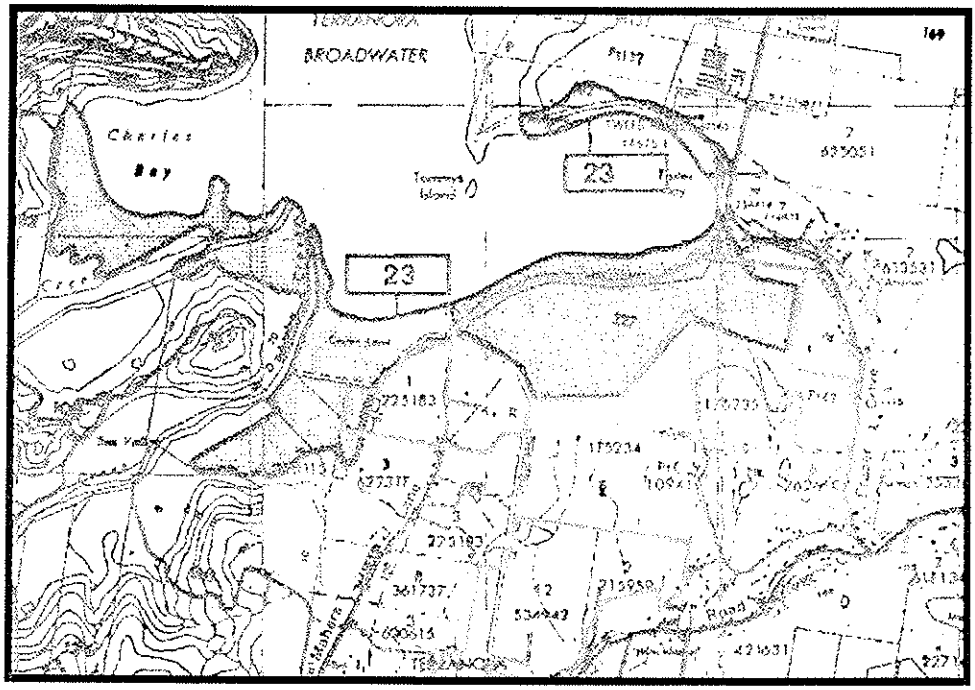


Figure 3-3: SEPP 14 Wetlands No 23

State Environmental Protection Policy (SEPP) 44 Koala Habitat

A small number of Forest Redgums (Eucalyptus tereticornis) (see Figure 3.5) have been identified in the ecotone between the mangrove forest and camphor laurel dominated habitat in the central north of the site.

SEPP 44 operates to protect koala habitat from being removed from the area. Forest redgums are recognised koala habitat food trees under SEPP 44. However as there is less than 15% of the total number of trees in the upper or lower strata, this area is not considered as "potential Koala habitat". In addition, there were no signs of koala inhabitation (scratches or scats) and the area does not have connectivity or link up with other areas of potential or core habitat suggesting the site as being unsuitable habitat for koalas.

Threatened Species Conservation Act 1995

An 8 part test is required to consider species listed under the NSW *Threatened Species Conservation Act 1995* where under 5A there is a significant effect on threatened species, populations or ecological communities, or their habitats.

For the purposes of this Act and, in particular, in the administration of sections 78A, 79C (1) and 112, the following factors must be taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

(a) *in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction;*

(b) *in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised;*

(c) *in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed;*

(d) *whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community;*

(e) *whether critical habitat will be affected;*

(f) *whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region;*

(g) *whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process; and*

(h) *whether any threatened species, population or ecological community is at the limit of its known distribution.*

At this stage there is not sufficient information to determine what form of development, if any, will occur within Area E and as such it is not possible to carry out an eight part test. Any subsequent development should however be assessed with respect to the eight part test where it is located in or close to areas identified as significant by this report.

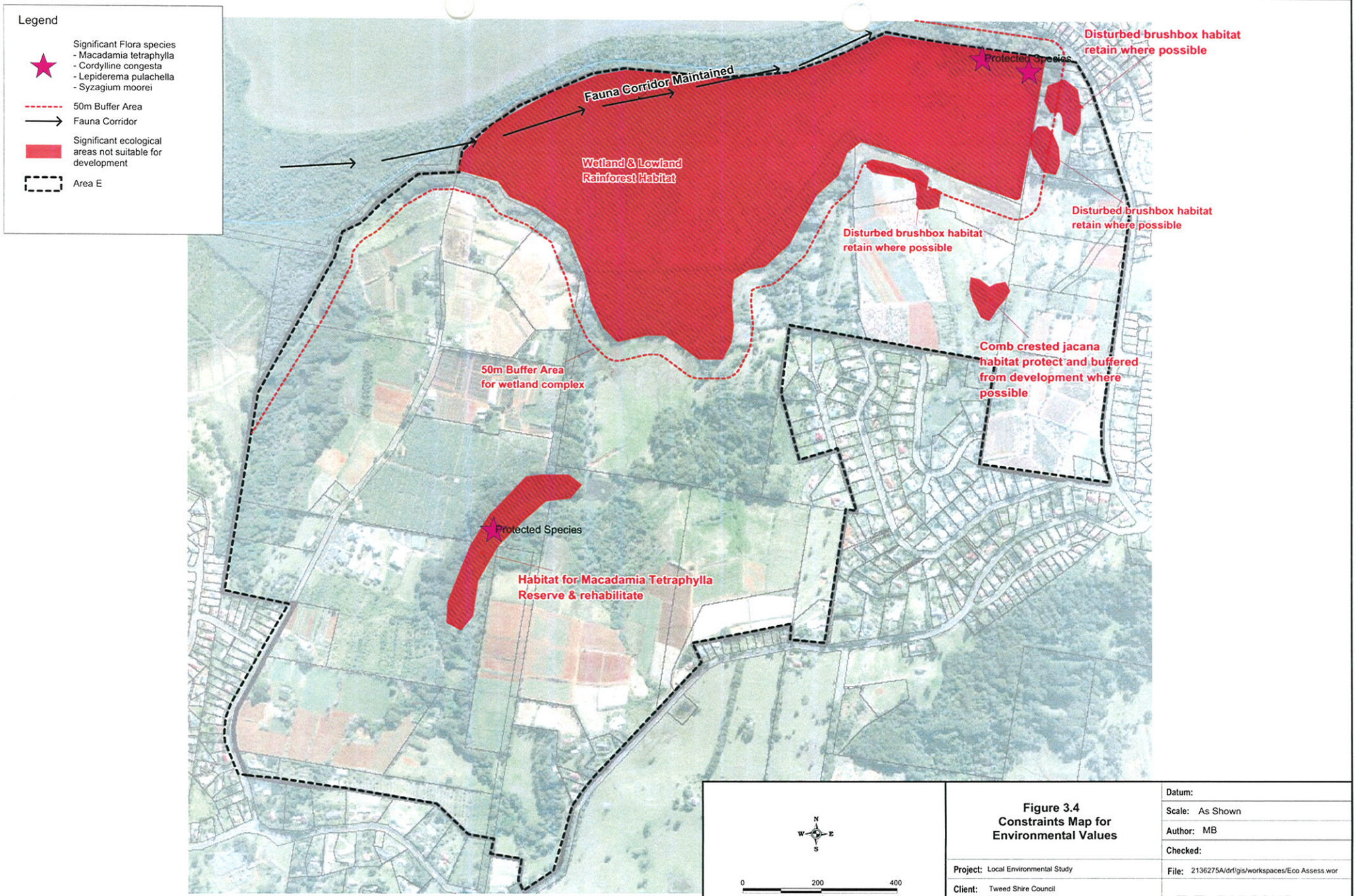


Figure 3.4
Constraints Map for Environmental Values

Datum:	
Scale:	As Shown
Author:	MB
Checked:	
Project:	Local Environmental Study
File:	2136275A/drf/gis/workspaces/Eco Assess.wor
Client:	Tweed Shire Council
Job Number:	2136275A
Revision:	
Date:	15/07/03
Drawing Number:	

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3.1.5 Summary and Conclusions

The findings of the previous environmental assessment reports for the area have been summarised within this report and the following findings and conclusions are made.

The Tweed Vegetation Management Strategy 2003 mapping identifying the communities on the site and their conservation status is generally confirmed with a few minor amendments as outlined in this report.

Significant flora species, which will require protection as part of redevelopment of the site, have been identified on the site including:

- Coastal Cordyline (Cordyline congesta) (2RC-, ROTAP);
- Rough shelled Queensland Nut (Macadamia tetraphylla) (Vulnerable, EPBC Act, TSC Act, 2VC ROTAP);
- Fine-leaved Tuckeroo (Lepiderema pulachella) (Vulnerable, TSCA); and
- Duroby (Syzygium moorei) (Vulnerable, EPBC Act, TSCA).

Three significant fauna species identified on the site which have habitat that will require protection as part of the development of the site include:

- (Irediparra gallinacea) comb-crested jacana;
- (Ptilinopus regina) Rose-crowned Fruit-dove; and
- (Pteropus alecto) Black flying-fox.

If this habitat is protected from impacts as a result of the development of Area E, other fauna species could also potentially continue to utilise the protected areas of the site.

The wetlands area and lowland rainforest in the northern portion of the site contain the most significant ecological values on-site which are of regional significance. These areas have been identified as high value areas that should be protected by the provision of a buffer and potential rehabilitation. In addition, both water flows and quality entering the wetland have the potential to be impacted upon by development of the catchment and as such any development must be required to take this factor into account in order to minimise any such impacts.

It is concluded that the rezoning of degraded areas is appropriate if the recommendations for mitigation of impacts outlined in this report are adopted.

3.1.6 Recommendations

The constraints to development are discussed in this section in terms of significance of the environmental values identified on the site. A constraints map for development of the site, with respect to conserving the environmental values, is shown in Figure 3.4.

Any subsequent development should however be assessed with respect to the eight part test where it is located in or close to areas identified as significant by this report.

3.2 Landform and soils

3.2.1 Landform and Slope

The elevations of the site range from 0-2 m where the site adjoins the Terranora Broadwater, rising in a southerly direction along the dominant ridgelines to approximately 138m (near where the site adjoins the Terranora Road/ McAuleys Road intersection) (See Figure 3.5).

The varied range in elevation in Area E results in a number of steep slopes and cuttings. These slopes range from 0° - 5° to slopes exceeding 25°. The Area E Slope Analysis (Figure 3.6) illustrates the general slopes within Area E.

Given that these slopes are indicated in degrees, a further analysis has been undertaken with the slopes converted into percentages then agglomerated into slope categories generally considered suitable for urban development. Guidelines for slope suitability for urban development vary from source to source:

- an absolute constraint to urban development are slopes greater than 33% (DEP, 1981, p.37); and
- development of sites for urban uses on land having steep slopes (those exceeding 20%) require consideration of several factors that may affect development of the land, including disturbance of the existing environment, soil erosion, provision of safe access, amongst others (BCC, 1993, p.2).

Based on the above, and given that maximum slope category for urban development is open to conjecture, land with up to 27% slopes will be included as being generally suitable for urban development (subject to other constraints identified in the LES). Those slopes greater than 27% have been recognised and mapped as an environmental constraint.

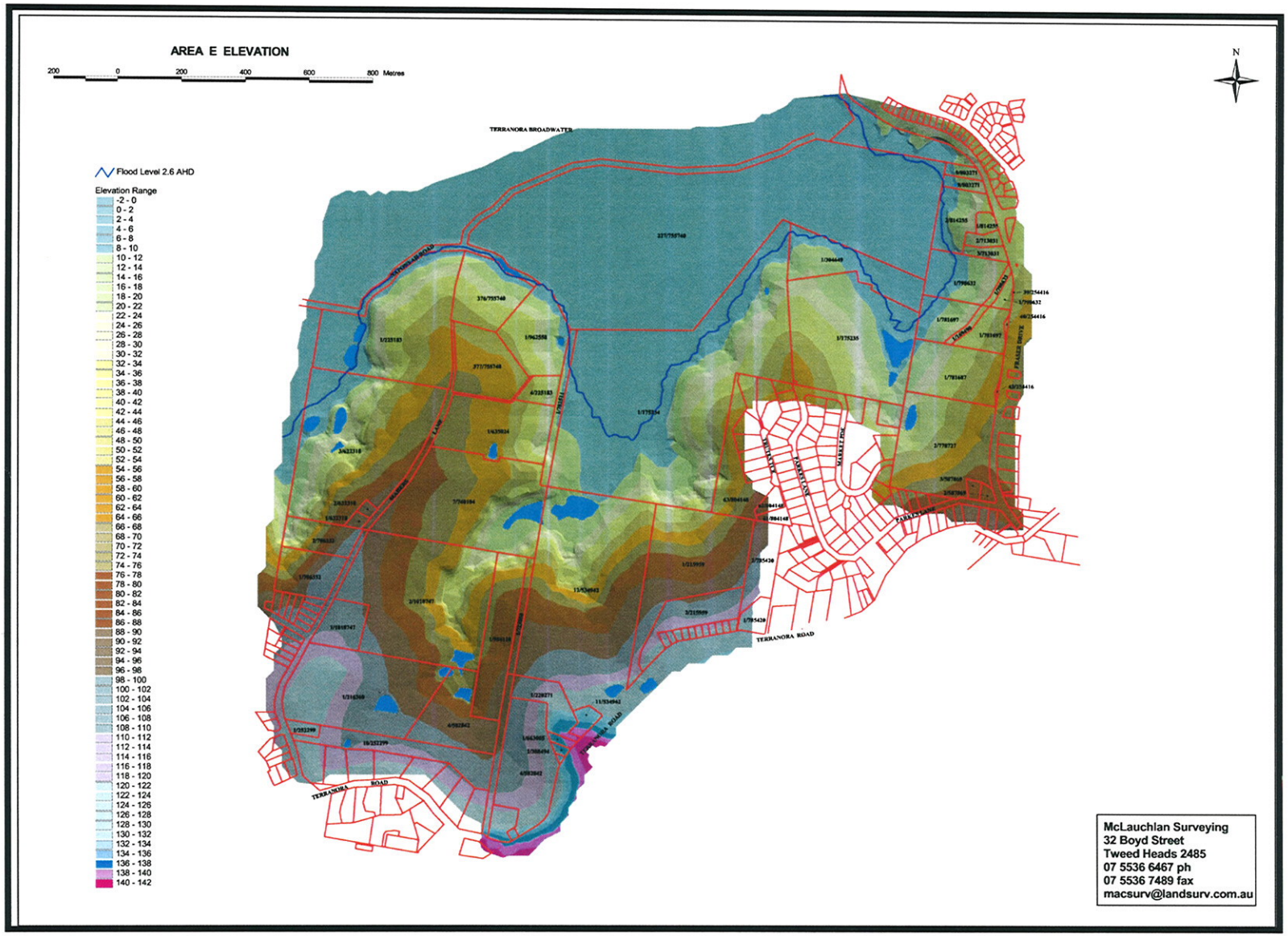

Figure 3-5: Elevation Map (provided by McLauchlan Surveying)