TERRESTRIAL AND AQUATIC ECOLOGY

REPORT

for the
Proposed raising of Bootawa Dam and associated infrastructure

BOOTAWA DAM

BOOTAWA
NSW

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EXECUTIVE SUMMARY

This report assesses whether the proposed raising of Bootawa Dam and associated infrastructure is likely to have a significant impact on threatened species of flora, fauna and ecological communities and to fulfil other requirements of the Environmental Planning and Assessment Act (EPA Act) 1979 and the Threatened Species Conservation Act (TSC Act) 1995. Consideration has also been afforded to the Commonwealth Environment Protection and Biodiversity Conservation Act 1999.

The Proposal

It is proposed Bootawa Dam be raised to increase its storage capacity from 2200 ML to 4500 ML. The proposal involves raising Bootawa Dam by 7m using an earthfill type embankment. The material for the raising will be gained from the site, sourced from two borrow areas located on the storage perimeter. The proposal will also include the construction of a new saddle dam over the site of the existing spillway channel and the construction of a new spillway, approximately 25m wide.

Description of study area

Bootawa Dam is an off-creek storage located on an unnamed tributary of the Manning River, 8km west of Taree. The dam was constructed in 1968 and is owned and operated by MidCoast Water and supplies the Greater Taree area and the surrounding region with potable water. Water is pumped to the dam from the Manning River via an intake located upstream of the township of Wingham. From Bootawa Dam water is pumped to reservoirs across the Manning and Great Lakes for distribution.

The study area covered an area of 44ha which included Bootawa Dam with a surface area of approximately 22ha and the surrounding catchment up to the ring road around the dam.

Vegetation

Within the study area the catchment was largely cleared. A large portion of this cleared area had been recently turned into a plantation. Despite the disturbance an area of open forest was present on the eastern shore of the dam. Other areas of moist native regrowth were present within a number of the minor gullies and drainage lines leading down into Bootawa Dam. A total of six vegetation communities were delineated. These communities were:

- Open Forest;
- Moist Regrowth Scrub;
- Plantation;

- Open Woodland;
- Cleared Grassland within scattered remnant trees;
- Aquatic/Wetland Vegetation.

None of these communities were considered to constitute an endangered ecological community under State or National legislation. The raising of Bootawa Dam will result in the inundation of approximately 20ha of land within the study area which is primarily composed of highly disturbed cleared grassland. Approximately 1ha of an area of 3.5ha of open forest and 0.7ha of an area of 5ha of moist regrowth scrub and a small area of Open Woodland will need to be removed.

Threatened Flora

Despite targeted searches no threatened flora species were recorded during the survey. Limited habitat was found to be present for 6 of the 8 species addressed in this report:

- *Asperula asthenes* (Trailing Woodruff)
- *Diuris flavescens* (Pale Yellow Doubletail)
- *Eucalyptus glauca* (Slaty Red Gum)
- *Melaleuca biconvexa* (Biconvex Wattle)
- *Asperula asthenes* (Trailing Woodruff)
- *Cynanchum elegans* (White-flowered Wax Plant)

The proposal may result in the removal of a relatively small amount of habitat for these flora species resulting in an incremental reduction of habitat in the local area. However no significant habitat will be affected that is likely to disrupt the life cycle these addressed flora species such that local extinction would occur.

Threatened Fauna

Three threatened fauna species were recorded within the study area during the survey:

- *Calyptorhynchus lathami* (Glossy Black Cockatoo)
- *Phascolarctos cinerea* (Koala)
- *Pteropus poliocephalus* (Grey-headed Flying-fox)

Due to the similarity of calls within the Genus *Vespadelus*, *Vespadelus troughtoni* (Eastern Cave Bat) was regarded as present within the study area as a precaution. *Ephippiorhynchus asiaticus* (Black-necked Stork) had also been previously recorded within the site.

A number of distinctively chewed cones from *Allocasuarina torulosa* (Forest Oak) trees, an indication of recent feeding by Glossy Black-Cockatoos were found on the ground in the area of open forest. No nesting habitat in the form of large suitable tree hollows was considered to be present. The proposed raising of Bootawa Dam will require the removal of a small number of specimens of *A. torulosa.* Considering that foraging habitat will still remain within the study area and the fact that larger areas of suitable habitat occur within the local area the proposal is unlikely to result in the extinction of any

local population of this mobile species.

An individual Koala and a skull belonging to a Koala were found within the area of open forest. Scratches and a small number of scats consistent with those of the Koala were found on the boles of specimens of known Koala Feed Trees. It is believed that Koalas periodically utilise the study area for foraging as part of a larger home range. It is likely that the Koala would only forage on two species of Eucalypt within the study area, *Eucalyptus tereticornis* (Forest Red Gum) and *Eucalyptus propinqua* (Small-fruited Grey Gum). The proposed raising of the dam will result in the removal of approximately 25 of the 59 Koala feed trees within the study area. Considering the presence of larger areas of similar connecting open forest habitat to the east and the fact that many known Koala feed trees will remain within the study area after the dam raising the proposal is unlikely to have an adverse effect on the life cycle of the species such that the local population of Koalas may be placed at risk of extinction.

A number of specimens of *P. poliocephalus* were observed whilst spotlighting within the open forest assemblage foraging on flowering Ironbark trees. The study area contains suitable foraging habitat for the Grey-headed Flying-fox in the form of seasonally flowering myrtaceous species. No suitable roosting camps were considered to be present. It is considered that the proposal is unlikely to cause extinction of the local population of this mobile species.

Due to the similarity of calls within the genus *Vespadelus*, *Vespadelus troughtoni* was regarded under the precautionary principle as present within the study area during the survey. As no significant hunting or roosting habitat will be affected the proposal is unlikely to disrupt the life cycle of this microchiropteran bat species such that local extinction would occur.

The Black-necked Stock was not recorded during fieldwork however the DECCW database contained two records of the Black-necked Stock within Bootawa Dam dating back to the year 2004. Bootawa Dam itself contains suitable foraging habitat for the Black-necked Stock. A small number of trees around the dam may offer marginal nesting habitat, however no breeding activity has been reported within the vicinity of the dam. The proposal is unlikely to result in a significant change foraging habitat for this wetland bird. Considering this species is an infrequent visitor to the dam the proposal is unlikely to cause extinction of any local population of this mobile species.

No other threatened species were recorded within the site. However it is considered that foraging/hunting/nesting resources of varying quality was available for 27 of the 32 remaining fauna species assessed:

- *Litoria aurea* Green and Golden Bell Frog
- *Rostratula benghalensis australis* Australian Painted Snipe
- *Botaurus poiciloptilus* Australasian Bittern

- *Ixobrychus flavicollis* Black Bittern
- *Ptilinopus magnificus* Wompoo Fruit-Dove
- *Ptilinopus regina* Rose-crowned Fruit-Dove
- *Ptilinopus superbus* Superb Fruit-Dove
- *Glossopsitta pusilla* Little Lorikeet
- *Lathamus discolor* Swift Parrot
- *Anthochaera phrygia* Regent Honeyeater
- *Daphoenositta chrysoptera* Varied Sittella
- *Hieraaetus morphnoides* Little Eagle
- *Lophoictinia isura* Square-tailed Kite
- *Ninox connivens* Barking Owl
- *Ninox strenua* Powerful Owl
- *Tyto novaehollandiae* Masked Owl
- *Dasyurus maculatus maculatus* Tiger Quoll
- *Phascogale tapoatafa* Brush-tailed Phascogale
- *Planigale maculata* Common Planigale
- *Potorous tridactylus tridactylus* Long-nosed Potoroo
- *Petaurus australis* Yellow-bellied Glider
- *Petaurus norfolcensis* Squirrel Glider
- *Mormopterus norfolkensis* Eastern Freetail Bat
- *Miniopterus schreibersii oceanensis* Eastern Bentwing-bat
- *Myotis adversus* Large-footed Myotis
- *Miniopterus australis* (Small Bentwing-bat
- *Chalinolobus dwyeri* Large-eared Pied Bat

The most likely of these species to utilise the study area would include the Varied Sittella, Powerful Owl, Squirrel Glider and Microchiropteran Bats. The proposal will result in a small incremental loss of potential habitat for these addressed threatened species. However considering the recommendations the proposal is unlikely to disrupt the life cycle of the addressed threatened species such that local extinction would occur.

Commonwealth Environment Protection and Biodiversity Conservation (EPBC) Act (1999).

Consideration has been given to the Commonwealth Environment Protection and Biodiversity Conservation (EPBC) Act (1999). As previously mentioned one nationally listed species *Pteropus poliocephalus* (Grey-headed Flying-fox) was recorded within the study area. However it was determined that the proposal is unlikely to have any significant impact on this species or other matters of National Environmental Significance.

Aquatic Assessment

Bootawa Dam was found to provide habitat to a number of aquatic species. Species present within the dam were typically those adapted to still water conditions at varying depths. The majority of aquatic plants were present on the edge of Bootawa Dam and included species such as *Typha orientalis* (Cumbungi). Few free floating macrophytes were observed. Fauna species noted included insects, molluscs, crustaceans, fish and turtles.

The proposed raising of the Bootawa Dam will result in the drowning of mostly cleared land. Native vegetation around the storage perimeter will be cut at the base and removed prior to inundation. Tree root balls will remain which will provide habitat for a number of invertebrates and fish. No important areas of aquatic habitat within the tributaries such as stream riffles or pools will be inundated. Similar aquatic habitat to that currently present within the dam will also be present after the dam raising. Therefore it is considered that the raising of Bootawa Dam is unlikely to result in any significant impact to aquatic habitat within the study area.

Fisheries Management Act

Despite various database searches no threatened or protected aquatic species or ecological communities were likely to occur within the study area. Therefore a Seven Part Test for aquatic species under the Fisheries Management Act was not required. However a number of threatening processes listed under the Fisheries Management Act could potentially apply to the proposal such as the Predation by *Gambusia holbrooki* (Plague minnow).

Recommendations

- To reduce the impact of the proposal on the Koala it is recommended that additional specimens of *E. tereticornis* and *E. propinqua* be planted where possible around the dam to compensate those species that will be removed. Before any tree removal, trees will need to be inspected by a suitably qualified person on the day to prevent any avoidable harm to any Koalas that may be present. Any new fencing particularly along the eastern boundary will be required to allow the safe passage of Koalas to areas of habitat within the study area.
- To reduce the impact of the proposal in relation to any arboreal marsupials, microchiropteran bats and certain birds the removal of hollow-bearing trees should be supervised by a suitably qualified and vaccinated ecologist. It is recommended that suitable compensatory nestboxes be installed within the remaining area of open forest and adjacent areas prior to clearing.
- A small number of noxious weeds such as *Lantana camara* (Lantana) and *Rubus fruticosus* (Blackberry) were present within the study area. Aquatic weeds also pose a threat to the dam itself. Periodic weed monitoring and control will be required to be undertaken within the study area.
- Site specific sediment control plans will be required to be prepared for the two burrow areas to help prevent sediment moving into Bootawa Dam.
- Borrow areas are to be revegetated using locally native flora species.

In conclusion the raising of Bootawa Dam will result in a small incremental loss of habitat for a number of addressed threatened species. However taking the recommendations into consideration it

is believed that the proposal is unlikely to disrupt the life cycle of any addressed threatened species, endangered population or endangered ecological community such that local extinction would occur.

CONTENTS

1.0 INTRODUCTION 1
1.1 GENERAL DESCRIPTION OF THE SITE 1
1.2 DESCRIPTION OF THE PROPOSAL 1

2.0 SCOPE OF THE STUDY 6
2.1 LEGISLATIVE REQUIREMENTS 6

3.0 METHODOLOGY 7
3.1 VEGETATION APPRAISAL METHODOLOGY 7
3.2 HABITAT APPRAISAL METHODOLOGY 7
3.2.1 GENERAL HABITAT FOR NATIVE SPECIES 7
3.2.2 HABITAT FOR SIGNIFICANT SPECIES 8
3.3 FAUNA APPRAISAL METHODOLOGY 8
3.3.1 SMALL TERRESTRIAL MAMMAL TRAPPING 8
3.3.2 MEDIUM TERRESTRIAL MAMMAL TRAPPING 8
3.3.3 ARBOREAL TERRESTRIAL MAMMAL TRAPPING 10
3.3.4 HARP TRAPPING 10
3.3.5 MICROCHIROPTERAN BAT CALL SURVEY 10
3.3.6 AMPHIBIAN SURVEY 10
3.3.7 REPTILE SURVEY 12
3.3.8 DIURNAL AVIFAUNA SURVEY 12
3.3.9 NOCTURNAL AVIFAUNA AND MAMMAL CALLPLAYBACK SURVEY 12
3.3.10 SPOTLIGHTING SURVEY 12
3.3.11 STAG WATCHING 13
3.4 DATE, TIMES, ACTIVITIES & WEATHER CONDITIONS 13
3.5 SIGNIFICANT SPECIES, POPULATIONS AND ECOLOGICAL COMMUNITIES 14

4.0 RESULTS 16
4.1 FLORA ASSEMBLAGES 16
4.1.1 ENDANGERED ECOLOGICAL COMMUNITIES 26
4.1.2 THREATENED AND RARE FLORA SPECIES 26
4.1.3 NOXIOUS WEEDS AND WEEDS OF STATE AND NATIONAL SIGNIFICANCE 27
4.2 HABITAT APPRAISAL 27
4.2.1 HABITAT DESCRIPTION AND DISTRIBUTION IN THE VICINITY 27
4.2.2 HABITAT CORRIDORS 28

4.2.3 SIGNIFICANT TREE SURVEY 28
4.2.4 HABITAT FOR SIGNIFICANT SPECIES 29
4.3 FAUNA APPRAISAL RESULTS 37
4.3.1 SMALL TERRESTRIAL MAMMAL TRAPPING 37
4.3.2 MEDIUM TERRESTRIAL MAMMAL TRAPPING 37
4.3.3 ARBOREAL MAMMAL TRAPPING 37
4.3.4 HARP TRAPPING 37
4.3.5 MICROCHIROPTERAN BAT CALL DETECTION 37
4.3.6 AMPHIBIAN SURVEY 38
4.3.7 REPTILE SURVEY 38
4.3.8 DIURNAL AVIFAUNA SURVEY 38
4.3.9 NOCTURNAL AVIFAUNA SURVEY 39
4.3.10 SPOTLIGHTING SURVEY 39
4.3.11 STAGWATCHING SURVEY 39
4.3.12 INCIDENTIAL OBSERVATIONS AND SECONDARY INDICATIONS 39
4.3.13 SURVEY LIMITATIONS 40

5.0 CONSIDERATIONS UNDER SECTION 5A OF THE EPA ACT 41

6.0 THE DRAFT GREATER TAREE CITY COUNCIL COMPREHENSIVE KOALA PLAN OF MANAGEMENT 45

7.0 AQUATIC SURVEY 50

8.0 FISHERIES MANAGEMENT ACT (FM ACT) 52

9.0 CONSIDERATIONS UNDER THE COMMONWEALTH ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999 53

10.0 BURROW AREAS 58

11.0 RECOMMENDATIONS 58

12.0 CONCLUSION 59

13.0 BIBLIOGRAPHY 61

APPENDIX A - CONSIDERATIONS UNDER SECTION 5A OF THE EPA ACT

APPENDIX B - FLORA SPECIES LIST

APPENDIX C – VEGETATION QUADRATS AND TRANSECTS

APPENDIX D – EXPECTED FAUNA SPECIES LIST

1.0 INTRODUCTION

It is proposed that Bootawa Dam, Bootawa NSW be raised to increase the water security of the Greater Taree and surrounding Great Lakes area and to achieve environmental flow requirements for the Manning River. This report is intended to indicate the likelihood of the action having a significant effect on threatened species of flora, fauna, populations and ecological communities and to fulfil other requirements of the Environmental Planning and Assessment Act (EPA Act) 1979 and the Threatened Species Conservation Act (TSC Act) 1995. Considerations have also been given to the Fisheries Management Act 1994 (FM Act), and Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

1.1 GENERAL DESCRIPTION OF THE SITE

Bootawa Dam is an off-creek storage located on an unnamed tributary of the Manning River, 8km west of Taree (Figure 1). The dam constructed in 1968, is owned and operated by MidCoast Water and supplies the Greater Taree area and the surrounding region with potable water. The dam's storage capacity is 2200 ML. Water is pumped to the dam from the Manning River via an intake located upstream of the township of Wingham. From Bootawa Dam water is pumped to reservoirs across the Manning and Great Lakes for distribution.

The study area covered an area of 44ha which included Bootawa Dam with a surface area of approximately 22ha and the surrounding catchment up to the ring road around the dam (Figure 2). Within the study area the catchment immediately surrounding the storage was largely cleared. Much of the cleared area had been transformed into a plantation having been recently planted out with eucalypt seedlings. An area of native open forest was present on the northern shore of the dam. Other areas of native vegetation primarily composed of moist regrowth scrub were present within a number of the minor gullies and drainage lines leading down to the water's edge.

1.2 DESCRIPTION OF THE PROPOSAL

It is proposed Bootawa Dam be raised 7m to increase its storage capacity from 2200 ML to 4500 ML. The proposal would involve:

- Raising Bootawa Dam by 7m using an earthfill type embankment. The new crest length would be approximately 590m. The material for the raising will be gained from the site, sourced from two borrow areas (Borrow Areas A and B) on located on the storage perimeter;
- Construction of a new saddle dam over the site of the existing spillway channel. The existing spillway channel will be filled;
- Construction of a new spillway, approximately 25m wide (at the base) with side slopes of 1H to 1V. The spillway will be located adjacent to the right abutment;

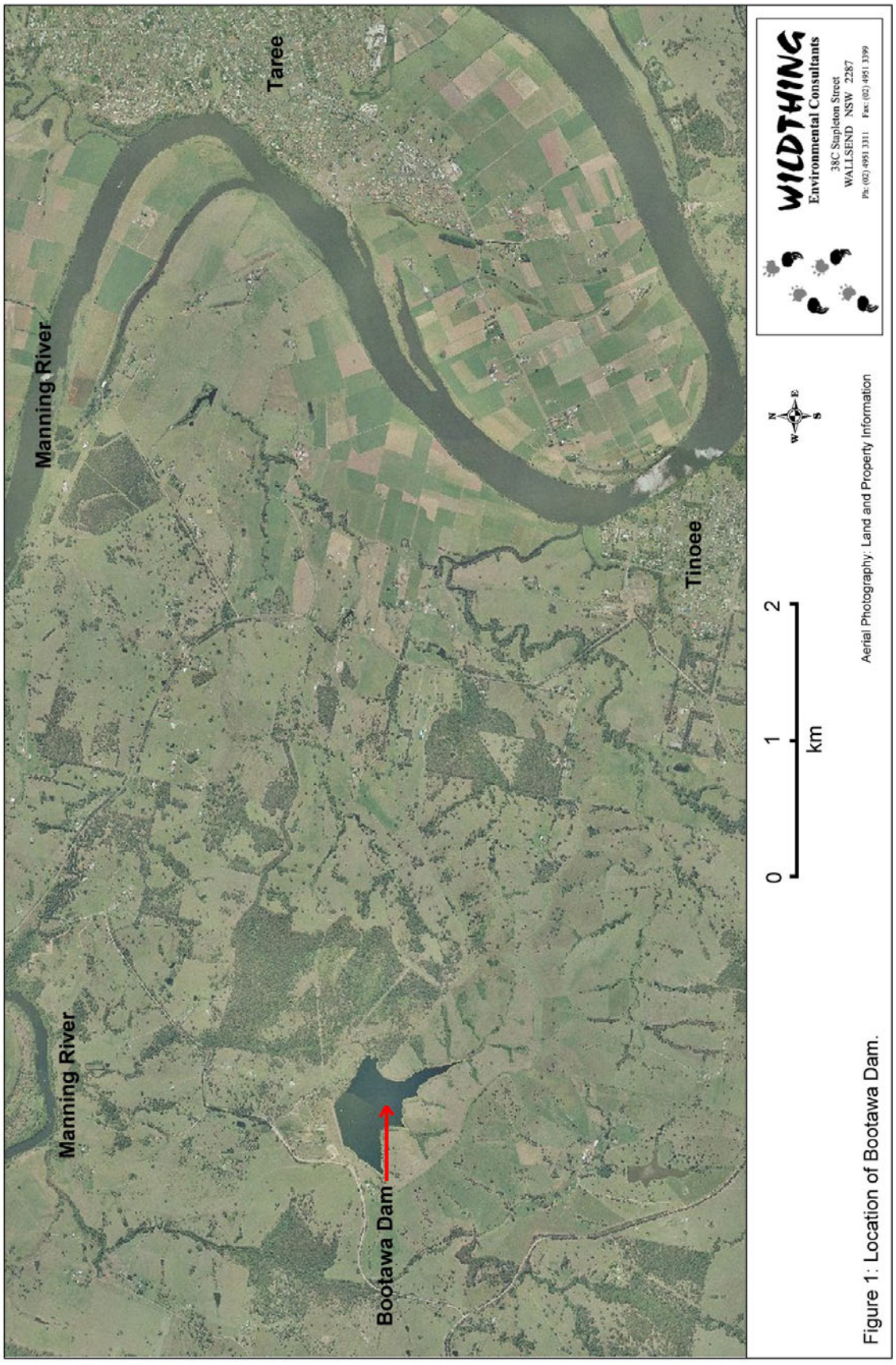
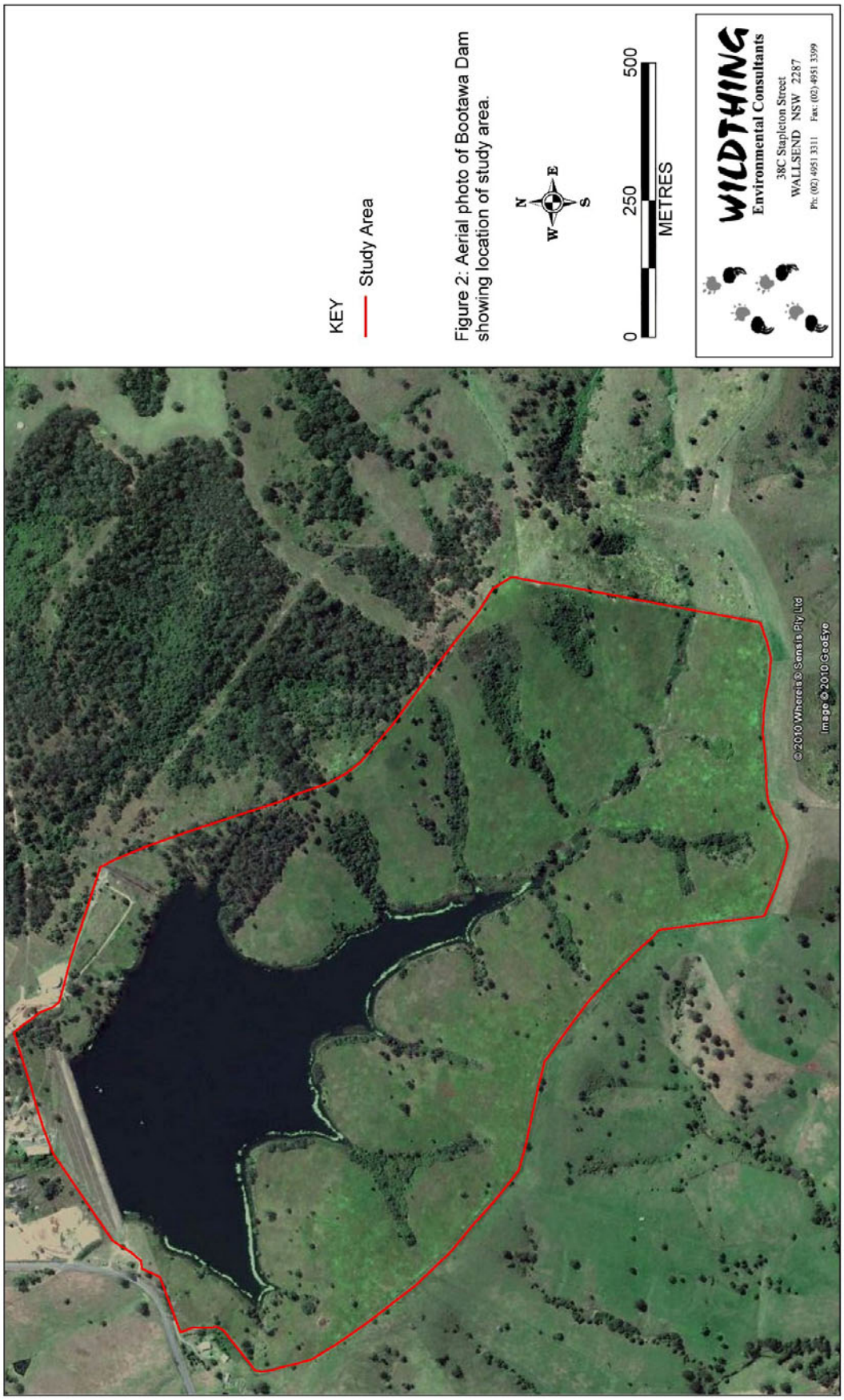


Figure 1: Location of Bootawa Dam.


KEY
Study Area
Figure 2: Aerial photo of Bootawa Dam showing location of study area.
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500
METRES
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©2010 Whereis® Sensis Pty Ltd
Image © 2010 GeoEye

- Construction of a new inlet channel approximately 150m in length within the floor of the dam storage. The inlet channel would be constructed via open cut excavation undertaken in the dry;
- Construction of a new intake tower and outlet works. The tower will be located on the right hand side of the storage and will be constructed in the dry. The outlet works would comprise a 1m diameter pipeline, approximately 250m long and would be tunnel led (directional drilled) through the right abutment to the new valve house located downstream of the dam embankment;
- Construction of a new bridge to assess the intake tower.

The plan of proposal is shown in Figure 3. The proposal aims to pump and store water from the Manning River during periods of high flow thereby avoiding the need to pump during periods of low flow and high turbidity. The project would guarantee environmental flows in the Manning River in accordance with NSW Office of Water requirements. Pumping rates from the Manning River are not expected to increase.

Vegetation around the storage perimeter will be cut at the base and removed prior to inundation. Tree root balls will remain. The removal of fill from the borrow areas will result in a high degree of disturbance to these areas. Strict erosion control measures and revegetation will be required to be implemented to prevent sediment moving into the dam.

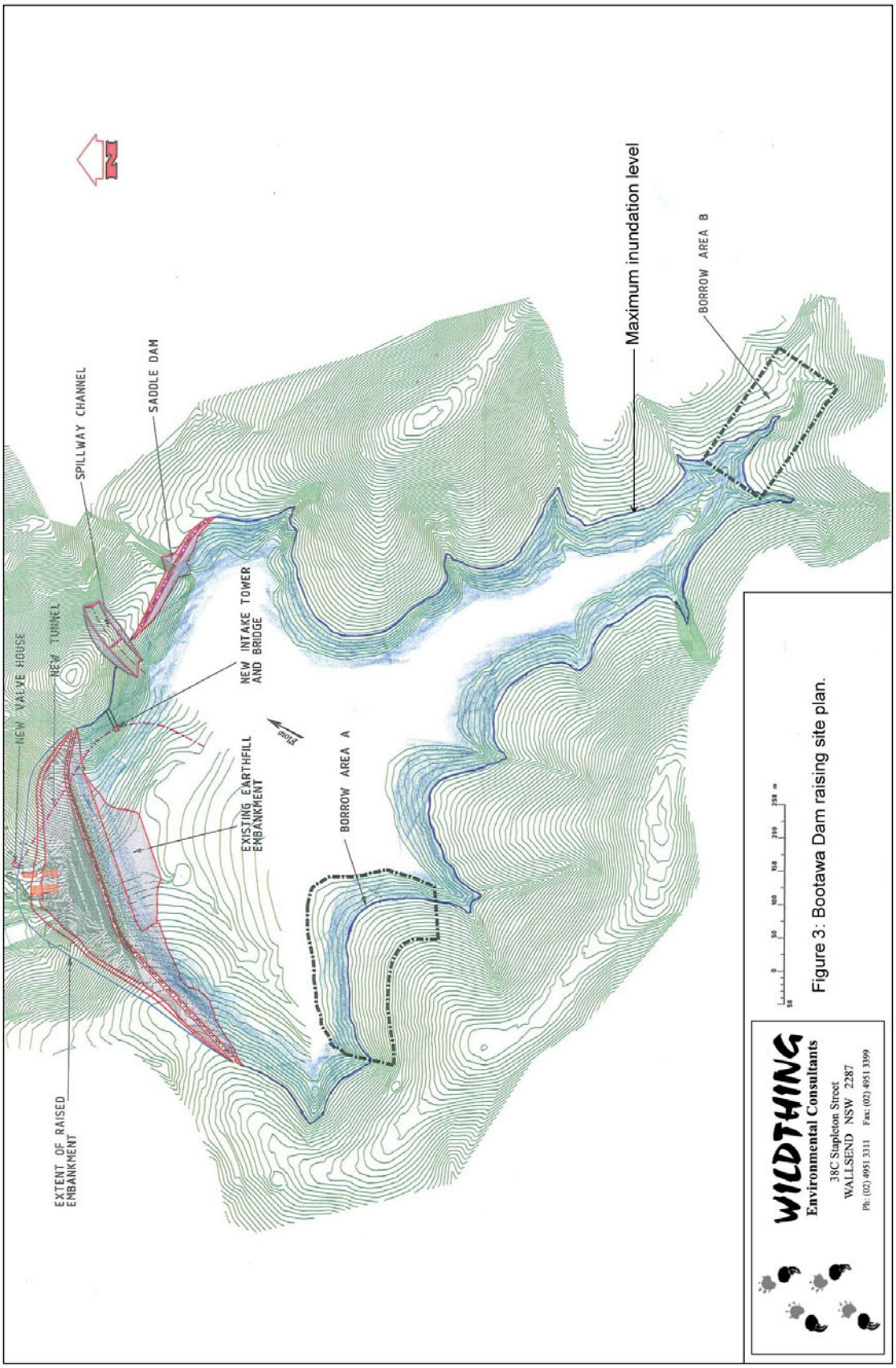


Figure 3: Bootawa Dam raising site plan.

2.0 SCOPE OF THE STUDY

This study was designed to address any likely flora and fauna issues of significance occurring upon the study area. This was achieved by appraisal of the vegetation assemblage and structural formation, and identification of representative plant species of the various structural layers. Potential habitat offered by the vegetation present was also assessed. The possibility of this site being significant for any Schedule 1 and 2 (endangered and vulnerable) flora, fauna and ecological communities was paramount in the assessment process. Appraisal has been confined to the study area and its immediate surroundings in the Section 5A assessment.

2.1 LEGISLATIVE REQUIREMENTS

This report has been structured upon the guidelines laid down in Section 5A of the Environmental Planning and Assessment Act (1979), and the Threatened Species Conservation Act (1995), which requires consideration of the impact of the proposed development upon any Schedule 1 and 2 (endangered or vulnerable) species and ecological communities expected or found on the site. Endangered and vulnerable species are collectively referred to as 'threatened' species in this report.

Also considered in this report was the Commonwealth Environment Protection and Biodiversity Conservation Act (1999) and Fisheries Management Act 1994 (FM Act). An assessment of SEPP 44 – 'Koala Habitat Protection' was not undertaken as it is not required under Part 5 of the EP&A Act.

Fieldwork undertaken by Wildthing Environmental Consultants was carried out under NPWS Scientific Investigation Licence S10475 and under Animal Care and Ethics Approval: Animal Research Authority Issue by the Director General of NSW Agriculture (File No. 08 – 361) for the Fauna Survey for Biodiversity and Impact Assessment.

3.0 METHODOLOGY

3.1 VEGETATION APPRAISAL METHODOLOGY

The initial determination of the basic vegetation community boundaries was undertaken through the review of an orthophoto covering the site. Following this, a detailed ground survey was conducted, in accord with the Department of Environment and Conservation's (NSW) Threatened Biodiversity Survey and Assessment Guidelines – Working Draft (Department of Environment and Conservation, 2004). This involved three vegetation transects of an average length of 100m and one vegetation plot 20×20m in area. During the transect-based surveys all species observed within 2m either side of the centre line were recorded as well as the physical attributes of the surrounding area. Within the survey plot the height of each primary structural layer and relative cover abundance of the species within was recorded, along with location, elevation, slope, aspect and general soil type.

In addition to the above, flora searches for threatened species were undertaken across the site in the manner described by Cropper (1993) as the 'Random Meander Technique'. This involved walking in a random manner throughout the entire study site, visiting the full range of potential habitats and checking every plant species seen. A list of all flora species identified on site has been provided in Appendix B and the results of transect and plot surveys can be seen in Appendix C.

3.2 HABITAT APPRAISAL METHODOLOGY

Habitat may be defined as the physical and biological environment required for the survival of a specific population of a species. In modern usage habitat has also come to be regarded as an association of landform and plant life, which provides sustenance and shelter for a particular fauna assemblage.

The methodology of the habitat appraisal used the vegetation community data combined, where relevant, with geomorphological features and the occurrence of particular plant species or forms (i.e. tree hollows) to provide a basis for a subjective habitat assessment aimed at placing the ecological status of the site within a local perspective.

3.2.1 GENERAL HABITAT FOR NATIVE SPECIES

From the vegetation appraisal and a general inspection of the site and surrounding areas, a subjective assessment of the general habitat value of this site was made. Considered in this assessment were:

- occurrence of that habitat type in the general vicinity;
- degree of disturbance and degradation;
- area occupied by that habitat on site;
- continuity with similar habitat adjacent to the site, or connection with similar habitat off site by way of corridors; and
- structural and floral diversity.

3.2.2 HABITAT FOR SIGNIFICANT SPECIES

This study area was evaluated as potential habitat for each of the threatened species reported on the Department of Environment, Climate Change and Water (DECCW) Database and the Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) on-line database from within 10km of the site. This evaluation was based on home-range, feeding, roosting, breeding, movement patterns and corridor requirements for fauna and hydrology, soil types, aspect and structural formation for flora species.

3.3 FAUNA APPRAISAL METHODOLOGY

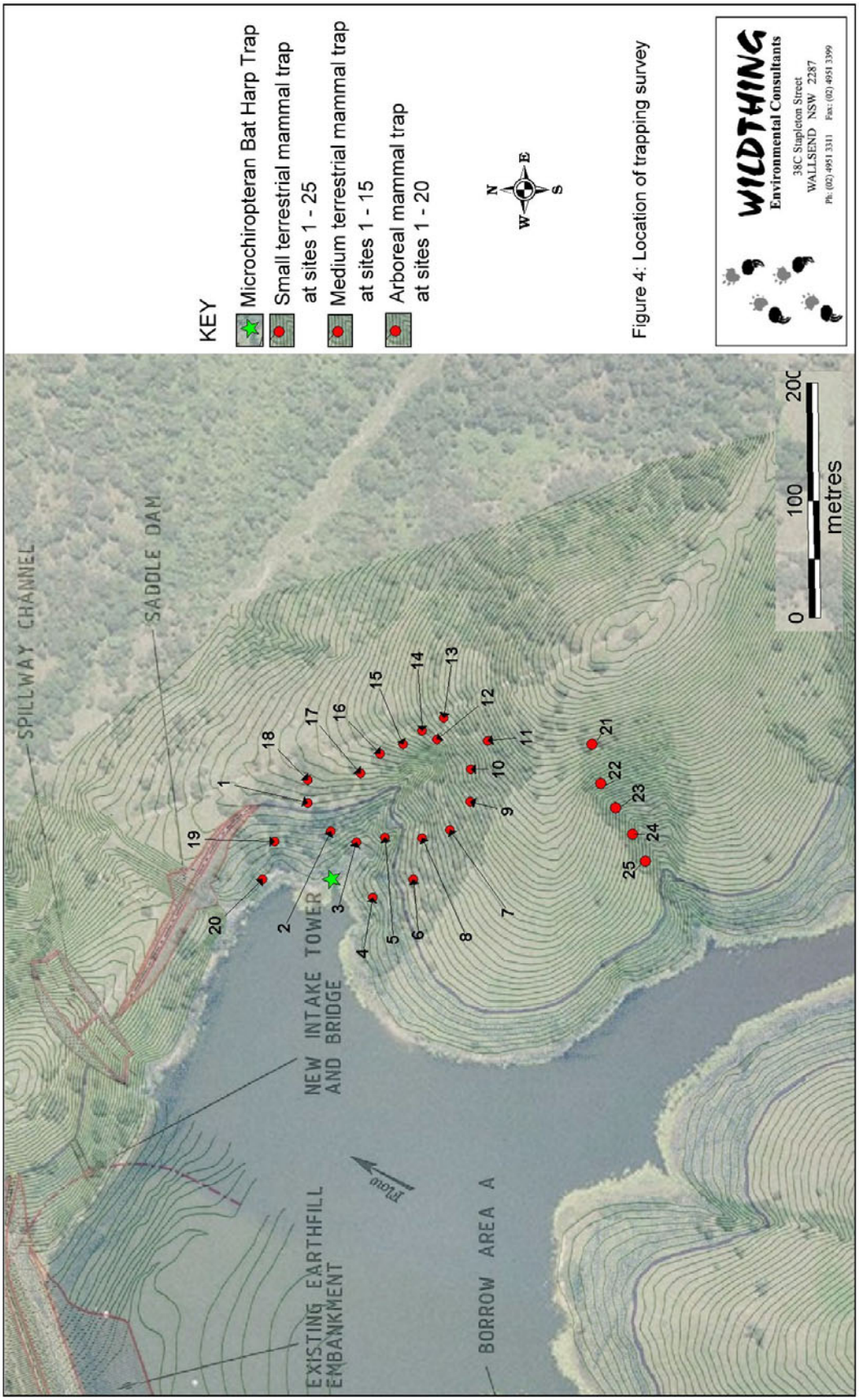
The fauna survey was initiated with an assessment of the potential use of the study area by any threatened species identified in the DECCW and DSEWPC database searches. Subsequently, the survey was carried out using the Department of Environment and Conservation's (NSW) Threatened Biodiversity Survey and Assessment Guidelines – Working Draft (Department of Environment and Conservation, 2004). Due to the disturbance to the study area the total number of traps specified in the assessment guidelines was not fully undertaken.

3.3.1 SMALL TERRESTRIAL MAMMAL TRAPPING

Terrestrial mammal trapping was undertaken using 25 Elliott Type A traps (8x10x33cm) within the study area. The traps were left in place for three consecutive nights giving a total of 75 small terrestrial trap nights. The traps were hidden in thick grass, under shrubs or and around trees and were camouflaged with vegetation where the ground cover was sparse. The baits used for the traps were a mixture of rolled oats and honey, Good-O's (dry dog food) and peanut butter. The traps were checked early each morning and, where necessary, reset and rebaited. The location of the small terrestrial traps is shown in Figure 4.

3.3.2 MEDIUM TERRESTRIAL MAMMAL TRAPPING

Medium terrestrial mammal trapping was undertaken using 15 cage traps (60×35×40cm) within the study area. The traps were left in place for three consecutive nights giving a total of 45 terrestrial trap nights. The traps were hidden in thick grass, under shrubs or near fallen logs and were camouflaged with vegetation where the ground cover was sparse. The bait used for the traps was sardines. The traps were checked early each morning and where necessary, reset and rebaited. The Medium Terrestrial Mammal traps were placed within the less disturbed western portion of the site with their location shown in Figure 4.


KEY
Microchiropteran Bat Harp Trap
Small terrestrial mammal trap at sites 1 - 25
Medium terrestrial mammal trap at sites 1 - 15
Arboreal mammal trap at sites 1 - 20
N
E
S
W
Figure 4: Location of trapping survey
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Ph: (02) 4951 3311 Fax: (02) 4951 3399
SPILLWAY CHANNEL
SADDLE DAM
NEW INTAKE TOWER AND BRIDGE
EXISTING EARTHFILL EMBANKMENT
BORROW AREA A
FLOW
0
100
200
metres

3.3.3 ARBOREAL TERRESTRIAL MAMMAL TRAPPING

Arboreal mammal trapping was undertaken using 20 Elliott Type B traps (15 × 15 × 46cm) within the study area to determine the presence of arboreal mammals, particularly *Phascogale tapoatafa* (Brush-tailed Phascogale) and *Petaurus norfolcensis* (Squirrel Glider). The traps were left in place for three consecutive nights giving a total of 60 terrestrial trap nights. The traps were placed around 3 - 4 metres above the ground on platforms mounted on tree trunks. Trees, which were targeted, contained hollows, were flowering or had scratches present on the boles. The baits used consisted of a rolled oats and honey mixture, peanut butter and an aniseed ring (sugar coated sweet). The traps were sprayed with honey mixed in water before being placed in the trees to attract fauna and mask the smell of humans. The tree trunks were also sprayed with this mixture each day. In all cases the traps were checked early each morning and, where necessary, reset and rebaited. The position of the arboreal traps within the study area can be seen in Figure 4.

3.3.4 HARP TRAPPING

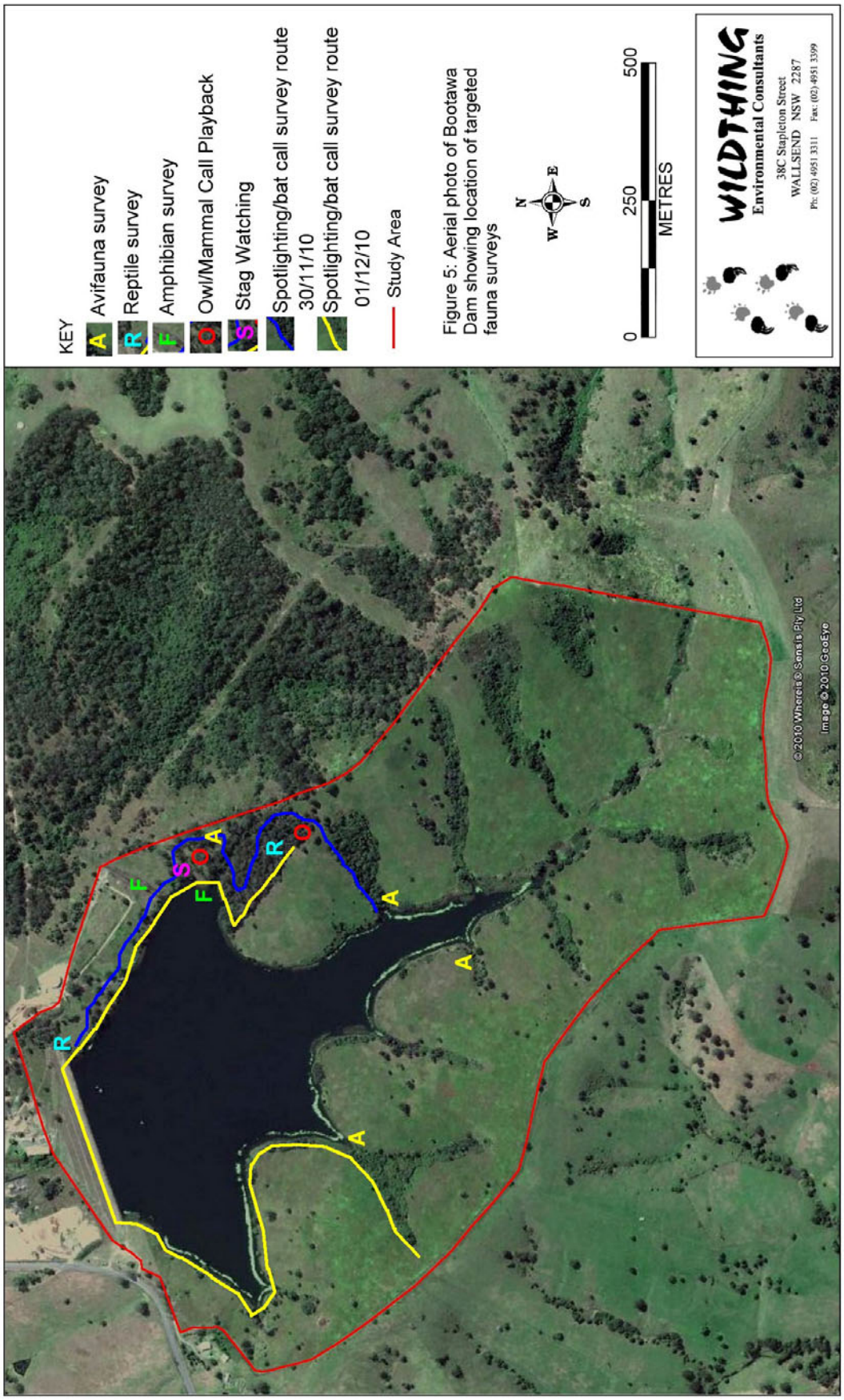
One monofilament harp traps was set for three consecutive nights within the site. The harp trapping was undertaken in order to sample the use of the site by sub-canopy microchiropteran bat species, such as *Mormopterus norfolkensis* (East Coast Freetail Bat) and *Miniopterus australis* (Little Bentwing-bat). The traps were positioned in a potential flyway and were checked early each morning. The location of the harp trap is shown in Figure 4.

3.3.5 MICROCHIROPTERAN BAT CALL SURVEY

Bat echo-location calls were taped using an Anabat detector in areas which were considered likely to be used by bats. These positions were selected to sample potential hunting sites for bats, including flyways, clearings and ecotones. Echolocation surveys used a combination of set point and hand held mobile surveys over the entire site. Surveys were conducted for 60 minutes over two nights giving a total of 2 hours of bat call survey. The transformed calls were analysed using an Anabat V Zero Crossing Analysis Interface feeding into a computer and identified by comparison with sample bat calls. The bat calls recorded by Wildthing Environmental Consultants were analysed in-house by Mungo Worth. The location of the bat call survey is shown in Figure 5.

3.3.6 AMPHIBIAN SURVEY

The amphibian survey included a combination of diurnal and nocturnal census methods. Diurnal searches were undertaken for two person hour periods. Systematic searches involved searches within appropriate habitat for basking or sheltering individuals. Any appropriate cover such as logs were turned over for resting individuals. Nocturnal surveys were undertaken for two one person hour periods. The surveys were undertaken in suitable habitat and involved listening for the characteristic call of male frogs. Playback of frog calls was undertaken in an attempt to elicit a response from threatened amphibian species in particular *Litoria aurea* (Green and Golden Bell Frog). The location


KEY
A Avifauna survey
R Reptile survey
F Amphibian survey
O Owl/Mammal Call Playback
S Stag Watching
Spotlighting/bat call survey route 30/11/10
Spotlighting/bat call survey route 01/12/10
Study Area
Figure 5: Aerial photo of Bootawa Dam showing location of targeted fauna surveys
N
E
S
W
0
250
500
METRES
WILDTHING
Environmental Consultants
38C Stapleton Street
WALLSEND NSW 2287
Ph: (02) 4951 3311 Fax: (02) 4951 3599
©2010 Whereis® Sensis Pty Ltd
Image © 2010 GeoEye

of the frog census conducted is shown in Figure 5. Frog searches were also augmented by recording any frog calls heard within the study area. Recorded calls were identified by auditory comparison with commercially available frog call recordings.

3.3.7 REPTILE SURVEY

Searches for reptiles involved a combination of diurnal and nocturnal searches. Diurnal searches for reptiles involved searching in likely habitat (i.e. leaf litter, dead logs and long grass) during the morning and afternoon survey period. Nocturnal searches were conducted for reptile species active at night such as geckos and some species of snakes and involved searching in likely habitats with the aid of a spotlight. The location of the reptile surveys is shown in Figure 5.

3.3.8 DIURNAL AVIFAUNA SURVEY

The diurnal avifauna survey involved transects targeting potential habitat within the study area for species such as *Daphoenositta chrysoptera* (Varied Sittella). Surveys were conducted at peak activity periods (i.e. dawn and dusk) for three periods for half an hour. A total of 3.0 hours of targeted diurnal bird surveys were undertaken. Incidental observations and secondary indications (i.e. distinctive feathers and nests) of avifauna were also recorded. The location of the diurnal avifauna surveys is shown in Figure 5.

3.3.9 NOCTURNAL AVIFAUNA AND MAMMAL CALLPLAYBACK SURVEY

During the nocturnal avifauna and mammal survey pre-recorded calls of *Ninox connivens* (Barking Owl), *Ninox strenua* (Powerful Owl), *Tyto novaehollandiae* (Masked Owl), *Tyto tenebricosa* (Sooty Owl), *Petaurus australis* (Yellow-bellied Glider), *Petaurus norfolcensis* (Squirrel Glider) and *Phascolarctos cinereus* (Koala) were broadcast through an amplification system designed to project the sound for at least 1km under still night conditions. An initial listening period of 10 minutes was undertaken, followed by 5 minutes of calls (repeated in four different directions). A period of two minutes of quiet listening was then employed after each 5-minute bracket of calls. At the conclusion of the call playback survey, spotlighting was carried out in the vicinity of the call playback site. The locations of the call playback are shown in Figure 5.

3.3.10 SPOTLIGHTING SURVEY

Spotlighting was undertaken on foot using 100watt hand-held spotlights. The spotlighting undertaken was completed by two persons and involved walking at a slow pace around the study area particularly the Open Forest area and stopping every 2 minutes, allowing the observer to hear movements of animals. A total of 6 person hours of spotlighting was conducted during the survey. The spotlight routes are shown in Figure 5.

3.3.11 STAG WATCHING

The Stag watching involved watching a dead hollow-bearing trees, 20 minutes prior to sunset and continuing until 20 minutes after sunset. The required listening period and stag watching were undertaken concurrently. The location of the stag watching survey is shown in Figure 5.

3.4 DATE, TIMES, ACTIVITIES & WEATHER CONDITIONS

A summary of the time spent on site during fieldwork and the prevailing weather conditions at the time is contained below in Table 1.

Table 1: Survey Dates, Times and Weather Conditions

DATE	TIME (24HR)	ACTIVITY	WEATHER
Monday 29/11/10	1000 - 1100	General Site inspection	
	1230 – 1630	Trap deployment Incidental observations	2/8 cloud, NE breeze, 24°C.
Tuesday 30/11/10	0600 – 0730	Checking traps. Incidental observations.	7/8 cloud, NE breeze, light shower, 19°C
	0730 – 0800	Avifauna survey	
	0800 - 0700	Diurnal Reptile Survey	
	1000 – 1500	Vegetation surveys	
	1900 - 1930	Avifauna survey	
	1945 – 2200 (two persons)	Spotlighting/Bat detection, Stagwatching, Owl & Mammal Call Playback, Frog Searches.	8/8 cloud, NE breeze, 19°C.
Wednesday 01/12/10	0600 – 0730	Checking traps. Incidental observations.	8/8 cloud, light shower, calm, 19°C.
	0730 – 0800	Avifauna survey	
	0900 - 1200	Koala tree location, Koala spot searches & habitat tree location.	
	1700 - 1830	Aquatic Surveys	light shower, calm, 23°C.
	1945 - 2200	Spotlighting/Bat detection, Owl & Mammal Call Playback, Frog Searches.	8/8 cloud, light shower, calm, 19°C.
Thursday 02/12/10	0600 – 0800	Checking Traps, Trap retrieval & Incidental observations.	8/8 calm, earlier shower, 18°C.
	0730 – 0800	Avifauna survey	
	0800 - 0830	Diurnal Reptile Survey	

3.5 SIGNIFICANT SPECIES, POPULATIONS AND ECOLOGICAL COMMUNITIES

The following threatened species listed in Table 2 have been recorded on the DECCW Database and DSEWPC (*) on-line database within 10km of the study area.

Table 2: Threatened Species, Endangered Populations and Ecological Communities Considered.

Scientific Name	Common Name	TSC Act 1995	EPBC Act 1999
Flora			
Diuris flavescens	Pale Yellow Doubletail	E4A	
**Cryptostylis hunteriana*	Leafless Tongue Orchid	V	V
Allocasuarina defungens	Dwarf Heath Casuarina	E	E
Eucalyptus glaucina	Slaty Red Gum	V	
Melaleuca biconvexa	Biconvex Paperbark	V	
Asperula asthenes	Trailing Woodruff	V	
Cynanchum elegans	White-flowered Wax Plant	E	E
Amphibians			
Litoria aurea	Green and Golden Bell Frog	E	V
**Mixophyes balbus*	Stuttering Frog	V	V
**Mixophyes iteratus*	Giant Barred Frog	E	E
Birds			
**Rostratula benghalensis australis*	Australian Painted Snipe	E	
Botaurus poiciloptilus	Australian Bittern	E	
Ixobrychus flavicollis	Black Bittern	V	
Ephippiohynchus asiaticus	Black-necked Stock	E	
Irediparra gallinacea	Comb-crested Jacana	V	
Ptilinopus magnificus	Wompoo Fruit-Dove	V	
Ptilinopus regina	Rose-crowned Fruit-Dove	V	
Ptilinopus superbus	Superb Fruit-Dove	V	
**Lathamus discolor*	Swift Parrot	E	E
Glossopsitta pusilla	Little Lorikeet	V	
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	
Anthochaera phrygia	Regent Honeyeater	E4A	E
Daphoenositta chrysoptera	Varied Sittella	V	
Pandion haliaetus	Osprey	V	
Hieraaetus morphnoides	Little Eagle	V	
Lophoictinia isura	Square-tailed Kite	V	
Ninox connivens	Barking Owl	V	
Ninox strenua	Powerful Owl	V	
Tyto novaehollandiae	Masked Owl	V	
Tyto tenebricosa	Sooty Owl	V	
Mammals			
Dasyurus maculatus maculatus	Tiger Quoll	V	V
Phascogale tapoatafa	Brush-tailed Phascogale	V	
Planigale maculata	Common Planigale	V	
Phascolarctos cinereus	Koala	V	
**Potorous tridactylus tridactylus* SE Mainland	Long-nosed Potoroo	V	V
Petaurus australis	Yellow-bellied Glider	V	
Petaurus norfolcensis	Squirrel Glider	V	
**Psuedomys novaehollandiae*	New Holland Mouse		V
Pseudomys oralis	Hastings River Mouse	E	E
Pteropus poliocephalus	Grey-headed Flying-fox	V	V
Mormopterus norfolkensis	Eastern Freetail-bat	V	
Miniopterus australis	Little Bentwing-bat	V	
Miniopterus schreibersii oceanensis	Large Bentwing-bat	V	
Myotis adversus	Large-footed Myotis	V	

Scientific Name	Common Name	TSC Act 1995	EPBC Act 1999
**Chalinolobus dwyeri*	Large Pied Bat	V	V
Vespadelus troughtoni	Eastern Cave Bat	V	
Endangered Populations			
Eucalyptus seeana population in the Greater Taree local government area			
Endangered Ecological Communities			
Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion			
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions			
River Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions.			
Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion			
Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions			
Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions.			

E=Endangered Species E4A=Critically Endangered V=Vulnerable Species

4.0 RESULTS

4.1 FLORA ASSEMBLAGES

As previously mentioned land within the study area was largely cleared. A large portion of this cleared area had been recently turned into a plantation. Despite the disturbance an area of open forest was present on the eastern shore of the dam. Other areas of native regrowth vegetation were present within a number of the minor gullies and drainage lines leading down to the waters edge. The study area was found to comprise six vegetation communities. These communities were:

- Open Forest;
- Moist Regrowth Scrub;
- Plantation;
- Open Woodland;
- Cleared Grassland within scattered remnant trees;
- Aquatic/Wetland Vegetation.

A description of the six vegetation communities is shown below. A map of the vegetation found within the site is shown in Figure 6. The results and locations of the quadrat and transect based surveys can be seen in Appendix C.

*Note on Vegetation Community Distribution Map. A map of vegetation of any area seeks to describe the distribution of the plant species in that area by defining a number of vegetation units (assemblages or communities), which are relatively internally homogenous. Whilst such mapping is a convenient tool, it greatly oversimplifies the real situation. Plants rarely occur in defined communities with distinct boundaries. Accordingly vegetation units used for the accompanying map should be viewed as indicative of their extent rather than being precise edges of communities.

Tall Open Forest

An area of approximately 3.5ha of Open Forest was present on the slopes of the eastern shore of Bootawa Dam (Figures 7 & 8). According to the Greater Taree Council Vegetation Extant Map (Greater Taree Council, 2006) this area was mapped as Small Fruited Grey Gum – Tall Open Forest. Although this community did contain specimens of *Eucalyptus propinqua* (Small-fruited Grey Gum) other canopy species such as *Eucalyptus paniculata* (Grey Ironbark), *Corymbia maculata* (Spotted Gum), *Eucalyptus tereticornis* (Forest Red Gum) and *Syncarpia glomulifera* (Turpentine) were also common. *Allocasuarina torulosa* (Forest Oak) was a common smaller tree species within the mid storey. Common shrub species included *Breynia oblongifolia* (Breynia) and *Phyllanthus gunnii* (Scrubby Spurge). The invasive weed *Lantana camara* (Lantana) formed areas of dense thickets within this assemblage. Native grass species such as *Themeda australis* (Kangaroo Grass) and *Imperata cylindrica* var. *major* (Blady Grass) were found to be common ground covers. Other native ground covers recorded included *Desmodium rhytidophyllum*, *Plectranthus parviflorus* and *Desmodium rhytidophyllum.* The northern portion of this community had undergone some past underscrubbing and had a relatively clear grassy understorey.

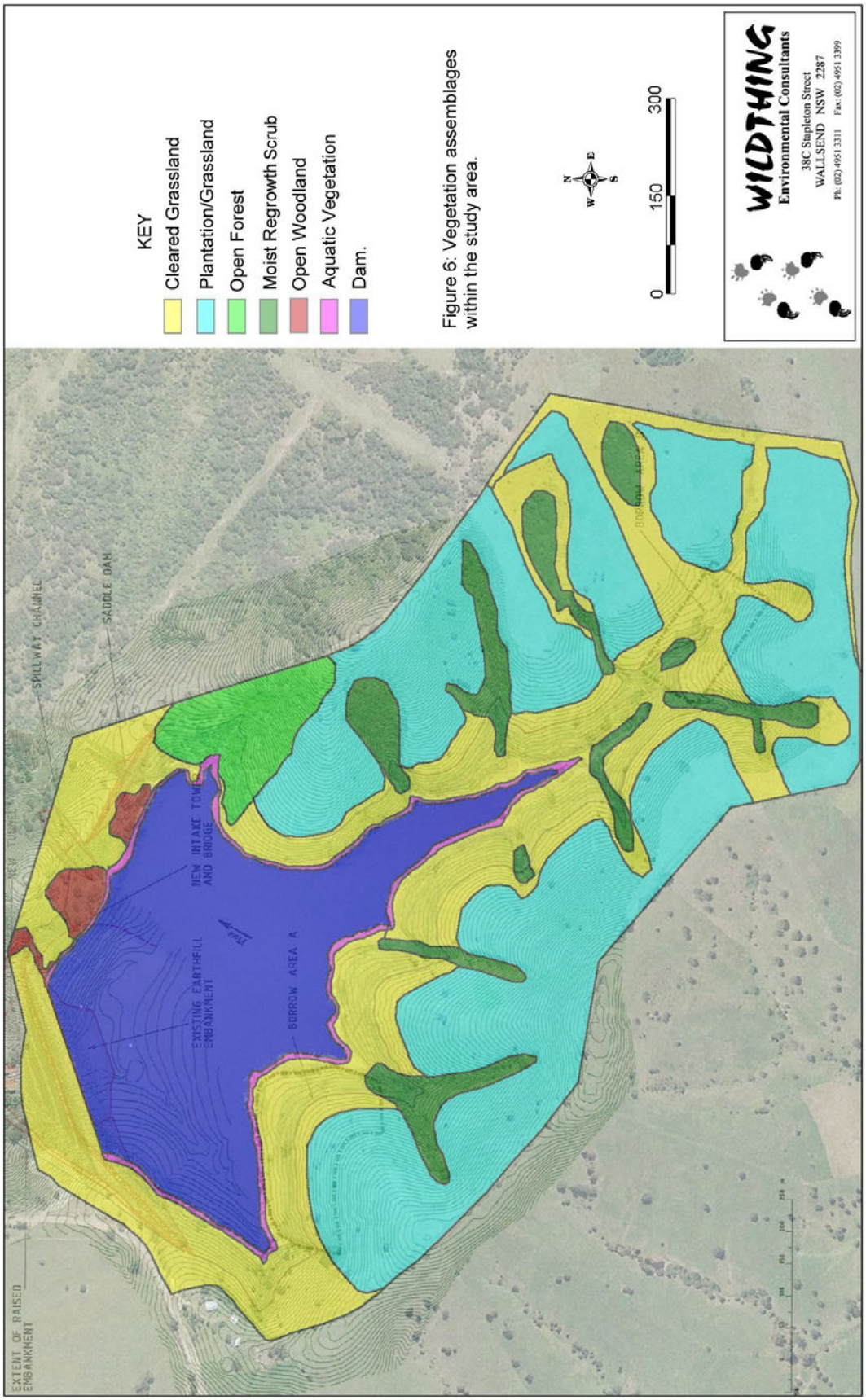

KEY
Cleared Grassland
Plantation/Grassland
Open Forest
Moist Regrowth Scrub
Open Woodland
Aquatic Vegetation
Dam.
Figure 6: Vegetation assemblages within the study area.
0
150
300
WILDTHING
Environmental Consultants
38C Stapleton Street
WALLSEND NSW 2287
Ph: (02) 4951 3311 Fax: (02) 4951 3399
SPILLWAY CHANNEL
SADDLE DAM
NEW INTAKE TOWER AND BRIDGE
EXISTING EARTHFILL EMBANKMENT
BORROW AREA A
EXTENT OF RAISED EMBANKMENT

Figure 7: Open Forest to the north-east of Bootawa Dam.

Figure 8: Area of Open Forest with the majority of understorey removed.

Moist Regrowth Scrub

Areas of moist regrowth scrub occupied a number of gullies which ran down into Bootawa Dam (Figures 9, 10 & 11). Within the study area Moist Regrowth Scrub occupied a combined total of approximately 5ha. The areas were generally densely vegetated and contained a number of flora species adapted to moister conditions. According to the Greater Taree Council Vegetation Extant Map these areas were mapped as regrowth Scrub (Greater Taree Council, 2006).

Trees within this assemblage were generally young and consisted of species such as *Syncarpia glomulifera* (Turpentine), *Lophostemon confertus* (Brush Box) and *Eucalyptus paniculata* (Grey Ironbark). Smaller tree species noted included *Melaleuca styphelioides* (Prickly-leaved Paperbark), *Callistemon salignus* (Willow Paperbark), *Glochidion ferdinandi* (Cheese Tree), *Commersonia fraseri* (Black-Fellow's Hemp), *Acacia melanoxylon* (Blackwood) and *Acacia binervata* (Two-veined Hickory). Common shrub species included *Phylanthus gunnii* (Scrubby Spurge), *Polyscias sambucifolia* (Elderberry Panax), *Acacia irrorata* and *Maytenus silvestris* (Narrow-leaved Orangebark). Common invasive weed species were *Lantana camara* (Lantana), *Rubus fruticosa* (Blackberry) and *Ageratina adenophora* (Crofton Weed). Common ground covers observed included *Pteridium esculentum* (Bracken Fern) and *Imperata cylindrica* var. *major* (Blady Grass).

Figure 9: Gully containing Moist Regrowth Scrub on the eastern side of Bootawa Dam.

Figure 10: Moist Regrowth Scrub in gullies north-east of Bootawa Dam.

Figure 11: Area of Moist Regrowth Scrub on north-east side of Bootawa Dam.

Open Woodland

Two small areas of clumped and scattered native trees were present to the north of Bootawa Dam (Figure 12). These areas generally consisted of young eucalypt species such as *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus paniculata* (Grey Ironbark) and *Eucalyptus acmenoides* (White Mahogany). A common small tree was *Acacia melanoxylon* (Black Wattle). The understorey generally consisted of native and introduced grasses such as *Themeda australis* (Kangaroo Grass) and *Imperata cylindrica* var. *major* (Blady Grass).

Figure 12: Areas of Dry Eucalypt Regrowth (far side of dam).

Mixed Eucalypt Plantation/Grassland

A recently planted mixed eucalypt plantation established on formerly cleared land around Bootawa Dam occupied a large portion of the study area (Figure 13). Planting was undertaken in February and March 2010 with species utilised being *Corymbia variegata* (Spotted Gum), *Eucalyptus pilularis* (Blackbutt), *Eucalyptus agglomerata* (Blue-leaved Stringybark) and *Eucalyptus punctata* (Grey Gum) (Mid Coast Water, 2010). Grasses both native and introduced were common between the rows. The most common native grasses were *Themeda australis* (Kangaroo Grass) and *Imperata cylindrica* var. *major* (Blady Grass). Common introduced grasses included *Chloris gayana* (Rhodes Grass).

Figure 13: Area of mixed eucalypt plantation on the eastern side of Bootawa Dam.

Cleared Grassland within scattered remnant trees

Mainly cleared grassland occupied the majority of the area situated between the boundary of the Plantation and the shore of Bootawa Dam (Figures 14 & 15). These areas were largely composed of grasses such as the native *Themeda australis* (Kangaroo Grass) and *Imperata cylindrica* var. *major,* and the introduced *Chloris gayana* (Rhodes Grass).

Aquatic/Wetland Vegetation;

Vegetation adapted to varying amounts of inundation was present around the periphery of Bootawa Dam (Figures 16, 17, 18 & 19). The water level was down approximately 1m at the time of the survey with an area of exposed drying mud present. Small clumped areas of species such as *Typha orientalis* (Cumbungi), *Eleocharis sphacelata* (Tall Spike-rush), *Schoenoplectus mucronatus, Philydrum lanuginosum* (Woolly Frogmouth) and *Juncus usitatus* (Common Rush) were common around the higher water mark of the dam. Exposed areas of drying mud below the high water mark were found to contain a number of small quick growing species such as *Cyperus eragrostis* (Umbrella Sedge), *Alternanthera dentata* (Lesser Joyweed), *Centipeda cunninghamii* (Sneezeweed) and *Gratiola pedunculata* (Stalked Brooklime). Few aquatic plants were observed within the water itself with small areas of *Potamogeton tricarinatus* (Floating Pondweed) one of the exceptions.

Figure 14: Cleared Grassland on the southern side of Bootawa Dam.

Figure 15: Cleared Grassland on the southern side and wall of Bootawa Dam.

Figure 16: Area of *Typha orientalis* (Cumbungi) on the eastern shore of Bootawa Dam.

Figure 17: Flora species growing on exposed areas of drying mud below the high water mark.

Figure 18: Area of *Eleocharis sphacelata* (Tall Spike-rush) in the far south-east of Bootawa Dam.

Figure 19: Exposed area of mud within the far south-east of Bootawa Dam.

4.1.1 ENDANGERED ECOLOGICAL COMMUNITIES

Five Endangered Ecological Communities are known to occur within the local area:

- River Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions.
- Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion
- Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions
- Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
- Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion

None of the above Endangered Ecological Communities were considered to be present within the study area. The areas of Moist Regrowth Scrub contained a small number of flora species found within Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions. However these areas are not likely to be regarded as this Endangered Ecological Community.

4.1.2 THREATENED AND RARE FLORA SPECIES

Seven threatened plant species were recorded within 10km of the site on the DECCW database (Table 3). Species marked with an asterisk (*) are also considered to have potential habitat within 10km according to DSEWPC on-line database.

Table 3: Threatened and Rare Flora species recorded within the locality.

FLORA SPECIES	TSC	EPBC	ROTAP
**Cryptostylis hunteriana* Leafless Tongue Orchid	E	V	
Diuris flavescens Pale Yellow Doubletail	E		
Allocasuarina defungens Dwarf Heath Casuarina	E	E	
Eucalyptus glauca Slaty Red Gum	V		3VCa
Melaleuca biconvexa Biconvex Paperbark	V		
Asperula asthenes Trailing Woodruff	V	V	3VC-.
Cynanchum elegans White-flowered Wax Plant	V		

None of the abovementioned flora species were found within the study area during fieldwork. It must be noted that the fieldwork was carried out outside the flowering season for *D. flavescens* which is from September to October and it would be unlikely to be observed during this period. With the exception of *C. hunteriana* and *A. defungens* suitable habitat was considered to be present within the study area for the remaining five threatened flora species. However habitat would be largely confined to the area of Open Forest.

A species-specific habitat assessment for the addressed threatened flora species has been provided in Section 4.2.4 of this report.

4.1.3 NOXIOUS WEEDS AND WEEDS OF STATE AND NATIONAL SIGNIFICANCE

A number noxious weed species were found to be present within the study area and are listed below in Table 4. The study area lies within the Greater Taree Council Noxious Plants Advisory Committee.

Table 4: Noxious Weed species found within the study area.

WEED SPECIES	WEED CLASS	ADDITIONAL SIGNIFICANCE
Lantana camara (Lantana)	Class 5	N & T
Rubus fruticosa (Blackberry)	Class 4	
Xanthium occidentale (Noogoora Burr)	Class 4	

N – Weed of National Significance (Listed in the Commonwealth Government's National Weeds Strategy 1997)
T – Listed as a Threatening Process under the NSW TSC Act 1995.

***Control Classes under the Noxious Weeds Act 1993.**

Class 1 & 2	This plant must be eradicated from the land and the land must be kept free of this plant.
Class 3	This plant must be fully and continuously suppressed and destroyed.
Class 4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the LCA. Must also, 'not be sold, propagated or knowingly distributed'.
Class 5	The requirements of the Noxious Weeds Act 1993 for a notifiable weed must be complied with.

Lantana was quite invasive within the area of open woodland. Blackberries were common within the lower gullies which ran down into Bootawa Dam and specimens of Noogoora Burr were observed around the upper shoreline of the dam. It is recommended that periodic weed control be undertaken within the study area to control these species.

4.2 HABITAT APPRAISAL

4.2.1 HABITAT DESCRIPTION AND DISTRIBUTION IN THE VICINITY

The vegetation and landforms present within the study area offer potential habitat for a variety of native species. The three main habitats were eucalypt forest/woodland, cleared grassland and aquatic.

Eucalypt Woodland/Forest occurring within the study area provides suitable habitat opportunities for a variety of species. Frugivorous, nectivorous, granivorous and insectivorous birds and microchiropteran bat species would all find potential foraging resources within this complex. A number of hollow-bearing trees would provide some potential nesting and roosting sites for a variety of avifauna and other hollow dependant species such as arboreal marsupials and tree-roosting bats. Hunting opportunities exist for birds of prey, given that the variable tree coverage and understorey vegetation has created a myriad of ecotones and habitat densities. Such habitat is suitable for terrestrial species including small and medium sized mammals, macropods, reptiles and potentially for some frog species adapted to such areas. Recognised species of Koala feed trees are also present, and these may provide a suitable resource for these animals.

The grassland habitat provides opportunity for a variety of avifauna, including predominantly terrestrial species preferring open spaces, seed eating birds and several birds of prey, which may hunt over this area in search of potential prey species. Macropods may also frequent such areas whilst grazing. Some species of bats may also forage over this cleared area for insects. However, the lack of vegetative cover often limits the value of such areas as this for many species, particularly reptiles and small mammals which are vulnerable to predation in open spaces.

Aquatic habitat was contained within Bootawa Dam and its periphery. The dam provides habitat for fish, water birds, frogs and other herpetofauna, and acts as a water source for other native animals such as macropods. Bootawa Dam also offers potential habitat for bats that prefer to hunt above or around water bodies.

In general, the habitats on site offer a wide range of habitat opportunities for a range of native species. The habitats proposed to be affected by the proposal range from less ecologically insignificant areas such as open grassland dominated by predominantly introduced species, to areas of Eucalypt Woodland/forest that would appear capable of offering suitable resources to both resident and transitory species.

4.2.2 HABITAT CORRIDORS

The value of the habitat within the study area particularly the area of open forest is strengthened by its connection to larger areas of similar habitat to the east. According to the National Parks and Wildlife Service Key Habitats and Corridors for Forest Fauna – Figure 7.20 (Scott, D. 2003) habitat within the study area does not form part of any regional, sub-regional or Key Habitat Corridor. The removal of habitat particularly a 1ha area of Open Forest on the eastern side of Bootawa Dam, is not likely to result in any movement restriction for native fauna in the local area.

4.2.3 SIGNIFICANT TREE SURVEY

A total of twenty trees were identified as a result of a significant tree survey within the study area. Approximately twelve habitat trees (hollow-bearing trees) will be required to be removed for the raising of Bootawa Dam. It is recommended that a suitably qualified and vaccinated ecologist be present during the removal of the habitat trees to reduce the impact on any fauna they may contain. It is also recommended that suitable nest boxes be installed into trees above the new water level to compensate for the loss of habitat.

The details of each habitat tree occurring within the study area including fauna attributes such as hollows were recorded. The results of the assessment are shown in Table 5 and the location of these trees are shown in Figure 20.

Table 5: Details of habitat trees present within study area.

TREE NO.	SPECIES	HABITAT TREE HOLLOWS COMMMENTS
1.	*Eucalyptus tereticornis* Forest Red Gum	1 x Class 2 3 x Class 3
2.	*E. tereticornis*	3 x Class 3
3.	*E. tereticornis*	3 x Class 2 3 x Class 3 Large tree with large scar at base.
4.	Dead Stag	3 x Class 3
5.	*Corymbia maculata* Spotted Gum	Half trunk broken off 1 x Class 1 spout.
6.	Dead Stag	Only trunk left. Was mostly burnt out 1 x Class 1 spout.
7.	Dead Stag	1 x Class 1 1 x Class 2 3 x Class 3
8.	Dead Stag	2 x Class 2 Tree hollow through middle.
9.	Dead Stag	2 x Class 2 2 x Class 3
10.	*Eucalyptus propinqua* Small-fruited Grey Gum	Opening at base 1 x Class 2
11.	*E. propinqua*	Long opening at base 1 x Class 2
12.	Dead Stag	Only trunk left. 1 x Class 2
13.	*E. tereticornis*	1 x Class 2 1 x Class 3
14.	Dead Stag	Small trunk of tree 1 x Class 3
15.	*Eucalyptus acmenoides* White Mahogany	Arboreal termite nest with hollow.
16.	*E. propinqua*	Half tree missing. 1 x Class 1 spout.
17.	Dead Stag	2 x Class 3 Crack through middle of tree.
18.	*E. acmenoides*	1 x Class 2 2 x Class 3
19.	Dead Stag	Arboreal Termite Nest 2 x Class 3
20.	Dead Stag	2 x Class 2 3 x Class 3

The classification system employed involved three classes:

- **Class 1 –** large sized hollow openings (i.e. >15cm) suitable for species such as Owls
- **Class 2 –** medium sized hollow-openings (i.e. 5-15cm) suitable for species such as Gliders and Possums
- **Class 3 –** small sized hollow openings (i.e. <5cm) suitable for species such as microchiropteran bats.

4.2.4 HABITAT FOR SIGNIFICANT SPECIES

An assessment of habitat attributes on site has been undertaken for the threatened species listed in Section 3.5. The results of the assessment are displayed in Table 6. Those species identified in this assessment as having potential habitat available on site have been considered further under Section 5A of the EPA Act in Section 5.0 of this report. The description of the ecology of each species is contained in Appendix A.

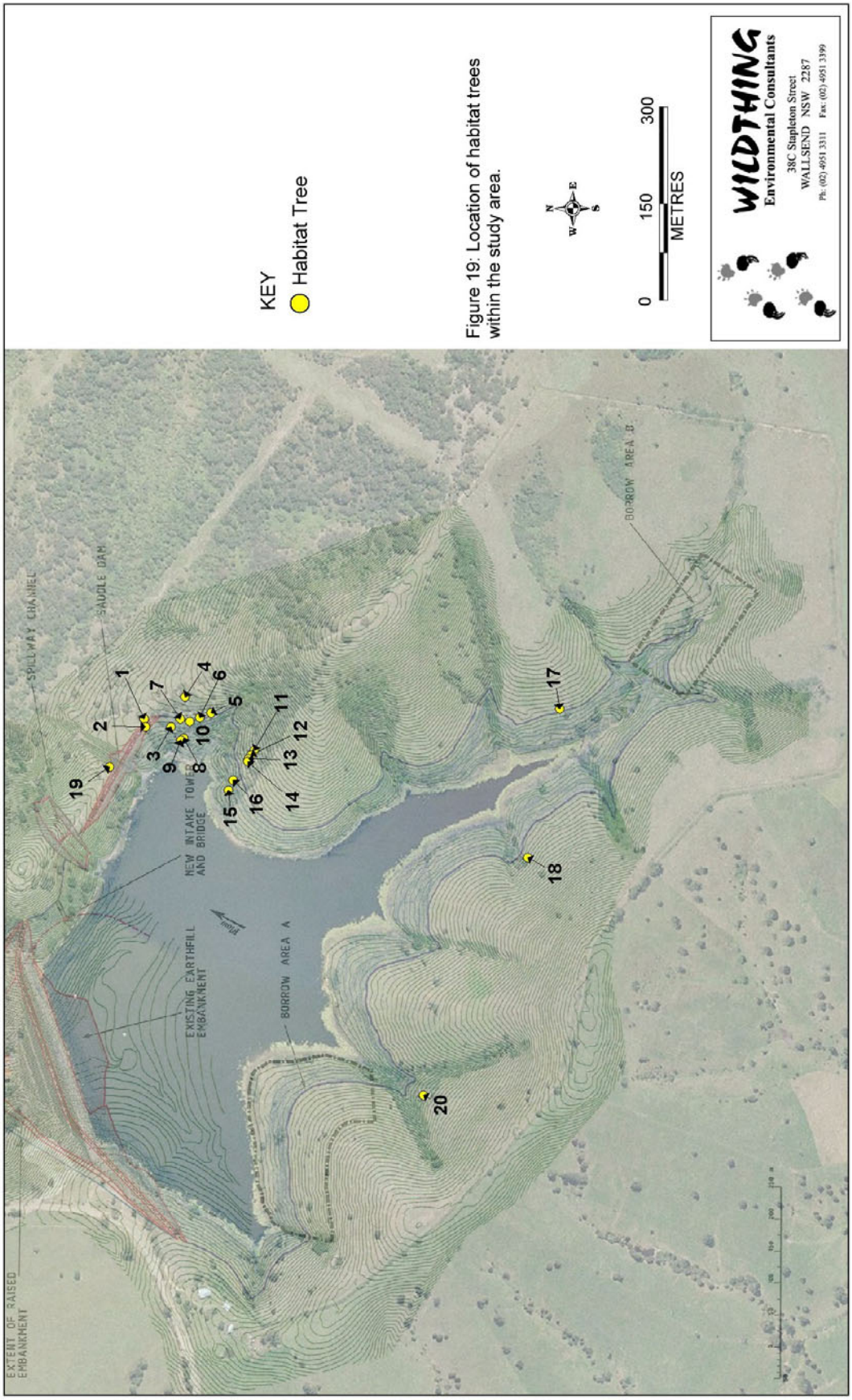


Figure 19: Location of habitat trees within the study area.

Table 6: Habitat Assessment for Significant Species

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE WITHIN THE STUDY AREA	7-PART TEST REQUIRED
Cryptostylis hunteriana Leafless Tongue Orchid	TSC Act-E EPBC Act-E	This species is a saprophyte, which grows in small, localised colonies on flat plains close to the coast. This species has also been recorded in mountainous areas growing in moist depressions as well as in swampy habitats.	**Unlikely** No suitable habitat was considered to be present for this orchid species.	**No**
Diuris flavescens Pale Yellow Doubletail	TSC Act-E4A	Grows in tall eucalypt forest with Kangaroo Grass and Blady Grass river flats on brown clay soil.	**Low** Suitable habitat was considered to be present within the area of open forest.	**Yes**
Allocasuarina defungens Dwarf Heath Casuarina	TSC Act-E EPBC Act-E ROTAP – 2E	A small erect shrub occurring on sand in the Nabiac area and farther north in the NSW North Coast Region.	**Unlikely** The study area lacks suitable habitat for this *Allocasuarina* species.	**No**
Melaleuca biconvexa Biconvex Paperbark	TSC Act - V	May occur in dense stands adjacent to watercourses, in association with other *Melaleuca* species or as an understorey species in wet forest.	**Low** Limited habitat was considered to be present within areas of moist regrowth scrub.	**Yes**
Asperula asthenes Trailing Woodruff	TSC Act - V	Damp Sites, often along riverbanks (DEC, 2006). The major portion of the distribution of this species occurs in the Great Lakes LGA.	**Low** Limited habitat was considered to be present within wetter gullies.	**Yes**
Cynanchum elegans White-flowered Wax Plant	TSC Act – E1 EPBC Act – E ROTAP 3ECi	This species occurs in scattered coastal localities from the QLD-NSW border south to Wollongong. Found in dry, littoral or subtropical rainforest, and occasionally in scrub and woodland from sea level to about 600m ASL.	**Low** Suitable habitat was considered to be present within the study area. The occurrence of this species is marginalised by the lack of local records.	**Yes**
Mixophyes balbus Stuttering Frog	TSC Act-V EPBC Act-V	Occurs in wet forest regions of south-eastern Queensland, Eastern NSW and Victoria. In late spring, eggs are deposited among leaf litter on the banks of streams and subsequently are washed into the water during heavy rain.	**Unlikely** No suitable habitat was considered to be present on site for this frog species.	**No**
Mixophyes iteratus Great Barred Frog	TSC Act-E EPBC Act-E	Occurs on forest slopes of the Great Dividing Range, generally between 20-800m A.S.L. It appears to prefer riparian vegetation or other moist vegetation communities, generally on rich organic	**Unlikely** No suitable habitat was considered to be present on site	**No**

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE WITHIN THE STUDY AREA	7-PART TEST REQUIRED
		soils. Deep leaf litter and/or thick cover is necessary for this species. Water quality must be of a high standard, and the species occurs in 1st to 3rd order streams (i.e. 'young' streams), and is absent from ponds and ephemeral pools. Graded banks with undercuts and steep edges are favourable haunts of this frog.	for this frog species.	
Rostratula benghalensis australis Australian Painted Snipe	TSC Act-V	Margins of swamps and streams, chiefly those covered with low and stunted vegetation.	**Moderate** Suitable habitat was considered to be present around the edge of Bootawa Dam.	**Yes**
Botaurus poiciloptilus Australasian Bittern	TSC Act-V	Favours permanent fresh-waters dominated by sedges, rushes, reeds or cutting grasses (eg. Phragmites, Scirpus, Eleocharis, Juncus, Typha, Baumea and Gahnia).	**Moderate** Suitable habitat was considered to be present around the edge of Bootawa Dam.	**Yes**
Ixobrychus flavicollis Black Bittern	TSC Act-V	Near water in mangroves and other trees, often forming only a narrow fringe of cover.	**Unlikely** No suitable habitat was likely to be present within the study area.	**No**
Ephippiorhynchus asiaticus Black-necked Stork	TSC Act-E	Inhabits swamps associated with river systems and large permanent pools but sometimes appears on the coast or in estuaries. It has also been recorded on farm dams and sewage treatment ponds.	**Moderate** Suitable habitat was present within Bootawa Dam.	**Yes**
Irediparra gallinacea Comb-crested Jacana	TSC Act-V	Inhabits mostly deep permanent freshwater wetlands, which are abundant with floating aquatic vegetation that forms dense mats or rafts on the surface of the water (eg. *Nymphaeaceae, Myriophyllum lacifolium, Marsilea* and *Riccia*).	**Unlikely** No habitat was considered to be present due to the lack of suitable floating aquatic vegetation.	**No**
Ptilinopus magnificus Wompoo Fruit-Dove	TSC Act-V	This frugivorous Rainforest specialist inhabits the canopy of Sub-tropical, Warm-temperate and Littoral Rainforests. Favoured feed trees include Figs, Laurels, Myrtles and native Tamarind. The females lay one egg on a flimsy platform of vine tendrils on a slender horizontal branch.	**Marginal** Limited habitat was considered to be present within the areas of moist regrowth scrub.	**Yes**
Ptilinopus regina Rose Crowned Fruit-dove	TSC Act-V	Inhabits rainforest, though it also frequents nearby drier forests as well as mangroves. It usually feeds on Figs or other fruit and berry-bearing trees.	**Marginal** Limited habitat was considered to be present within the areas of moist regrowth scrub.	**Yes**
Ptilinopus superbus Superb Fruit Dove	TSC Act-V	Lives mainly in Rainforest but will feed in adjacent Mangroves or Eucalypt forest, venturing into coastal habitats. The nest is a platform built in a small tree on a horizontal fork situated in Open Forest at the	**Marginal** Limited habitat was considered to be present within the areas of	**Yes**

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE WITHIN THE STUDY AREA	7-PART TEST REQUIRED
		edge of scrub.	moist regrowth scrub.	
Glossopsitta pusilla Little Lorikeet	TSC Act-V	Tall Open Forests, woodlands, orchards, parks and street trees.	**Moderate** Suitable habitat was present within the area of open forest.	**Yes**
Calyptorhynchus lathami Glossy Black-Cockatoo	TSC Act-V	Lowland coastal forests, dense mountain forests, semi-arid woodland and trees bordering watercourses, with (Allo)Casuarina trees for foraging.	**High** Foraging habitat was present within the area of open forest where a number of specimens of *Allocasuarina torulosa* (Forest Oak) were present. No preferred nesting habitat was considered to be present.	**Yes**
Anthochaera phrygia Regent Honeyeater	TSC Act-E4A EPBC Act-E	Temperate woodlands and open forest, including forest edges, preferring to forage on large-flowered Eucalypts.	**Low** Suitable foraging habitat was present in the form of flowering myrtaceous species.	**Yes**
Daphoenositta chrysoptera Varied Sittella	TSC Act-V	Open eucalypt woodland/forest, mallee, inland acacia, coastal tea-tree scrubs, golf courses, orchards and parks.	**Moderate** Suitable habitat was considered to be present within the area of open forest for this small bird species.	**Yes**
Pandion haliaetus Osprey	TSC Act-V	Open and swamp forest adjacent to the coast or estuaries, fishing mainly in brackish or salt water.	**Unlikely** No suitable habitat was present due to the relatively large distance to the coast and lack of brackish water.	**No**
Lophoictinia isura Square-tailed Kite	TSC Act-V	The Square-tailed Kite inhabits Open Forests and Woodlands, particularly those on fertile soils with abundant passerines. They may also range into nearby open habitats but not into extensive treeless regions.	**Moderate** Due to the generalist habitat requirements of this species habitat was considered to be present within the study area.	**Yes**
Hieraaetus morphnoides Little Eagle	TSC Act-V	The Little Eagle occupies habitats rich in prey within open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used (Marchant and Higgins 1993; Aumann 2001a). For nest sites it	**Moderate** Due to the generalist habitat requirements of this species habitat was considered to be	**Yes**

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE WITHIN THE STUDY AREA	7-PART TEST REQUIRED
		requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring.	present within the study area.	
Ninox connivens Barking Owl	TSC Act-V	This species is found in forest and woodland, encountered most commonly in savanna and paperbark woodlands. It sometimes roosts in rainforests, but it requires the more open country for hunting and hollow Eucalypts for breeding.	**Low-Moderate** Suitable hunting and limited roosting habitat was present. Due to the lack of large hollows no nesting habitat was present.	**Yes**
Ninox strenua Powerful Owl	TSC Act-V	Inhabits a wide range of vegetation types from wet Eucalypt forests with a Rainforest understorey to Dry Open Forests and Woodlands. The species has been recorded utilising disturbed habitats such as exotic pine plantations and large trees in parks and gardens. Powerful Owls nest in a slight depression in the wood-mould on the base of a cavity in a large old tree, sometimes in excess of 25 metres above the ground.	**Moderate** Suitable hunting and limited roosting habitat was present. Due to the lack of large hollows no nesting habitat was present.	**Yes**
Tyto novaehollandiae Masked Owl	TSC Act-V	A range of wooded habitats that contain mature trees with large hollows for roosting and nesting, and more open areas for hunting.	**Moderate** Suitable hunting and limited roosting habitat was present. Due to the lack of large hollows no nesting habitat was present.	**Yes**
Tyto tenebricosa Sooty Owl	TSC Act-V	Prefers dense dimly-lit forests, inhabiting pockets of rainforest and wet sclerophyll forest mainly in mountainous areas, often in south-east facing gullies.	**Unlikely** Due to the lack of suitable rainforest and tall wet sclerophyll forest the Sooty Owl would be considered unlikely to be present.	**No**
Dasyurus maculatus maculatus Tiger Quoll	TSC Act-V	Inhabits sclerophyll forests, rainforests and coastal woodlands. Nests are made in rock caves and hollow logs or trees, and basking sites are usually found nearby.	**Low** Only marginal habitat is considered to be present for the Tiger Quoll due to the disturbance within the study area.	**Yes**
Phascogale tapoatafa Brush-tailed Phascogale	TSC Act-V	Sparsely distributed outside the semi-arid zone in dry sclerophyll forest and monsoonal forest and woodland.	**Moderate** Suitable habitat was considered to be present within the area of open forest.	**Yes**
Planigale maculata Common Planigale	TSC Act-V	Occupies a variety of habitats ranging from rainforest, wet and dry sclerophyll forests to grasslands, marshlands and rocky areas.	**Low-Moderate** Suitable habitat was considered	**Yes**

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE WITHIN THE STUDY AREA	7-PART TEST REQUIRED
			to be present within the area of open forest.	
Phascolarctos cinereus Koala	TSC Act-V	Coastal woodland and open forest containing suitable food trees.	**High – Present within study area.** Preferred feed trees in the form of *Eucalyptus tereticornis* (Forest Red Gum) and *Eucalyptus propinqua* (Small-fruited Grey Gum) were present.	**Yes**
Potorous tridactylus tridactylus Long-nosed Potoroo	TSC Act-V	This species is known from a variety of habitats, including Rainforest, Open Forests and Woodlands with dense groundcover, and dense, wet coastal heathlands. Soft (often sandy) substrates are preferred by this species.	**Low** Marginal habitat was available within denser vegetation in the east of the study area.	**Yes**
Petaurus australis Yellow-Bellied Glider	TSC Act-V	This species occupies tall, mature wet eucalypt forest.	**Low** Some suitable habitat was considered to be present within the area of Open Forest.	**Yes**
Petaurus norfolcensis Squirrel Glider	TSC Act-V	Dry sclerophyll forests and woodlands with exudates for foraging and hollows for nesting.	**Moderate** Suitable foraging and nesting habitat was available within the area of open forest.	**Yes**
Psuedomys novaehollandiae New Holland Mouse	EPBC Act – E	Known to inhabit open heathlands, open woodlands with a heathland understorey and vegetated sand dunes.	**Unlikely** No suitable habitat was present within the study area.	**No**
Pseudomys oralis Hastings River Mouse	TSC Act-E EPBC Act-E	Lives in a variety of dry open forest and woodland types with dense low ground cover. Ideal ground cover ranges from 10 to 75cm and may consist of grass, sedge, rush or heath. Permanent shelter such as rocky outcrops, are important, as is access to seepage zones, creeks and gullies.	**Unlikely** No suitable habitat was present within the study area.	**No**
Pteropus poliocephalus Grey-headed Flying-Fox	TSC Act-V EPBC Act-V	Wet and Dry Sclerophyll Forests, Rainforest, Mangroves and Paperbark swamps and Banksia Woodlands.	**High – Observed within study area.** Foraging habitat was available with the presence of seasonally flowering myrtaceous species.	**Yes**

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE WITHIN THE STUDY AREA	7-PART TEST REQUIRED
Mormopterus norfolkensis East Coast Freetail-bat	TSC Act-V	This species appears to live in Sclerophyll Forests and Woodland. Roosts in tree hollows or under loose bark.	**Moderate** Suitable hunting and roosting habitat was present.	**Yes**
Miniopterus australis Little Bentwing-bat	TSC Act-V	Tropical Rainforest to warm-temperate Wet and Dry Sclerophyll Forest; caves or similar structures for roosting.	**Moderate** Suitable hunting habitat was present. The study area lacked preferred roosting habitat.	**Yes**
Miniopterus schreibersii oceanensis Large Bentwing-bat	TSC Act-V	Wet and Dry Tall Open Forest, Rainforest, Monsoon Forest, Open Woodland, Paperbark Forests and Open Grasslands; caves or similar structures for roosting. It occasionally uses tree hollows.	**Moderate** Suitable hunting habitat was present. The study area lacked preferred roosting habitat.	**Yes**
Myotis adversus Large Footed Myotis	TSC Act-V	Various habitats of the coast and adjacent ranges with suitable waterbodies for hunting; caves or similar structures for roosting. It occasionally uses tree hollows.	**Moderate** Suitable hunting habitat was present. The study area lacked preferred roosting habitat.	**Yes**
Chalinolobus dwyeri Large-eared Pied Bat	TSC Act-V	This species has been found occupying Dry Sclerophyll Forest and Woodland. Roosts in caves, abandoned mud-nests of Fairy Martins and mine tunnels.	**Low** Suitable hunting habitat was present. No suitable roosting habitat was considered to be present.	**Yes**
Vespadelus troughtoni (Eastern Cave Bat)	TSC Act-V	The Eastern Cave Bat roosts in caves and occurs in wet/dry sclerophyll forests to the semi arid zone. It has been found roosting in small groups in sandstone overhangs, in mine tunnels and occasionally buildings.	**Low-Moderate** Suitable hunting habitat was present. No suitable roosting habitat was considered to be present.	**Yes**

4.3 FAUNA APPRAISAL RESULTS

A full list of fauna species observed during the survey is contained in Appendix D.

4.3.1 SMALL TERRESTRIAL MAMMAL TRAPPING

During this component of the survey two species of mammal, *Antechinus stuartii* (Brown Antechinus) and *Rattus lustreolus* (Swamp Rat) and *Rattus rattus* (Black Rat) were captured. The results of the small terrestrial mammal survey are shown in Table 7.

Table 7: Small Terrestrial Mammal Trapping Results.

DATE	TRAP NO	SPECIES	SEX
Tuesday	T13	*Antechinus stuartii* (Brown Antechinus)	Female
30/12/10	T17	*A. stuartii*	Female
	T19	*A. stuartii*	Female
Wednesday	T13	*Rattus lutreolus* (Swamp Rat)	Male
01/12/10	T17	*R. lutreolus*	Male
	T18	*A. stuartii*	Female
Thursday	T13	*A. stuartii*	Female
02/12/10	T15	*A. stuartii*	Female
	T17	*R. lutreolus*	Male

4.3.2 MEDIUM TERRESTRIAL MAMMAL TRAPPING

During this component of the survey no captures were recorded.

4.3.3 ARBOREAL MAMMAL TRAPPING

During this component of the survey no captures were recorded.

4.3.4 HARP TRAPPING

During this component of the survey no captures were recorded.

4.3.5 MICROCHIROPTERAN BAT CALL DETECTION

Two species of microchiropteran bat, *Chalinolobus gouldii* (Gould's Wattled Bat) and *Chalinolobus morio* (Chocolate Wattled Bat) were positively identified during the bat call survey. The audible *Nyctinomus australis* (White-striped Freetail-bat) was also heard. Other calls were only identified to genus level, these being *Vespadelus* sp. Calls attributed to the genus *Vespadelus* were thought to be from either *V. pumilus* (Eastern Forest Bat), *V. vulturnus* or *V. troughtoni* (Eastern Cave Bat) which are known to occur in the local area.

None of the microchiropteran bat species positively identified are listed as threatened under either State or National legislation. However as *V. troughtoni* is listed under the TSC Act (1995) the precautionary principle has been applied and this species has been further assessed within Section 5 and Appendix A of this report.

4.3.6 AMPHIBIAN SURVEY

Six species of amphibian, *Crinia signifera* (Common Eastern Froglet), *Litoria nasuta* (Rocket Frog), *Limnodynastes peronii* (Striped Marsh Frog), *Litoria fallax* (Dwarf Tree Frog), *Litoria wilcoxi* (Stony Creek Frog) and *Litoria peronii* (Peron's Tree Frog) were recorded within the study area during targeted and incidental surveys.

None of these species are listed as threatened under State or National legislation.

4.3.7 REPTILE SURVEY

Four species of reptile, *Lampropholis delicata* (Grass Skink), *Eulamprus quoyii* (Eastern Water Skink), *Physignathus lesuerii* (Eastern Water Dragon) and *Chelodina longicollis* (Eastern Long-necked Turtle) were recorded within the study area during the survey. *Lampropholis delicata* was found to be common within the area of Open Forest, *E. quoyii* was observed in debris near the edge of Bootawa Dam and a number of specimens of *P. lesuerii* were found to be common amongst the rocks on the Bootawa Dam Wall. A dead specimen of *C. longicollis* was found near the waters edge of Bootawa Dam.

None of these reptile species are regarded as threatened according to State or National legislation.

4.3.8 DIURNAL AVIFAUNA SURVEY

An array of avifauna species were found to be present within the varius habitats across the study area.

Within the Open Forest areas avifauna species commonly encountered included *Rhipidura fuliginosa* (Grey Fantail), *Lichenostomus chrysops* (Yellow-faced Honeyeater), *Todiramphus sancta* (Sacred Kingfisher), *Philemon corniculatus* (Noisy Miner), *Philemon corniculatus* (Noisy Friarbird), *Meliphaga lewinii* (Lewin's Honeyeater) *Platycercus eximius* (Eastern Rosella) and *Acanthiza pusilla* (Brown Thornbill). A number of *Allocasuarina torulosa* (Forest Oak) seed cones consistent with those chewed by *Calyptorhynchus lathami* (Glossy Black Cockatoo) were found on the ground within the area of open forest. *Calyptorhynchus lathami* is vulnerable under the TSC Act (1995) and has been further assessed within Section 5 and Appendix A of this report.

Birds recorded within the open grassy areas included *Vanellus miles* (Masked Lapwing), *Anthus novaseelandiae* (Richards Pipit) and *Gymnorhina tibicen* (Magpie).

Waterbirds observed within and around the periphery of Bootawa Dam included *Cygnus atratus* (Black Swan), *Anas superciliosa* (Pacific Black Duck), *Chenonetta jubata* (Australian Wood Duck) and *Phalacrocorax varius* (Pied Cormorant). According to the DECCW database the threatened *Ephippiorhynchus asiaticus* (Black-necked Stork) has been observed within Bootawa Dam in the past. As a consequence *E. asiaticus* has also been further assessed within Section 6 and Appendix A of this report.

Birds of prey recorded included *Haliastur sphenurus* (Whistling Kite) and *Haliaeetus leucogaster* (White-breasted Sea-Eagle). The White-bellied Sea-eagle is recognised as a Migratory Bird species under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) and has been further addressed in Section 10 of this report.

All birds observed on site during this and the previous surveys are indicated in the Fauna Species List in Appendix D.

4.3.9 NOCTURNAL AVIFAUNA SURVEY

Ninox boobook (Southern Boobook) was commonly heard calling from within the area of open forest during nocturnal surveys. *Podargus strigoides* (Tawny Frogmouth) was also observed within this area. There were no responses as a result of the owl calls played during the survey.

4.3.10 SPOTLIGHTING SURVEY

Four species of native mammal, *Phascolarctos cinerea* (Koala), *Trichosurus vulpecula* (Brush-tailed Possum), *Macropus rufogriseus* (Red-necked Wallaby) and *Pteropus poliocephalus* (Grey-headed Flying-fox) were recorded during the spotlighting survey. One specimen of *P. cinerea* was observed on the boundary of the study area next to the open forest assemblage. *Trichosurus vulpecula* was also recorded within the area of open forest. A number of specimens of *P. poliocephalus* were observed foraging within flowering Ironbark species in the open forest assemblage. *Macropus rufogriseus* was encountered a number of times on the eastern side of Bootawa Dam.

The introduced species *Oryctolagus cuniculus* (European Rabbit) and *Lepus capensis* (European Hare) were commonly encountered within the cleared areas of the study area particularly in the northern portion around the wall of Bootawa Dam.

There were no responses as a result of the mammal calls played during the survey.

Both *P. cinerea* and *P. poliocephalus* are listed as vulnerable under the TSC Act (1995) and have been further assessed within Section 5 and Appendix A of this report. *Pteropus poliocephalus* has also been assessed under National legislation.

4.3.11 STAGWATCHING SURVEY

No species were observed during the stag watching survey.

4.3.12 INCIDENTIAL OBSERVATIONS AND SECONDARY INDICATIONS

A number of incidental observations and secondary indications of fauna were observed during the survey and included:

- A *Phascolarctos cinerea* (Koala) skull was found within the area of Open Forest to the north-east of Bootawa Dam. Scratches consistent with those of the Koala were found on the boles

of trees particularly *Eucalyptus propinqua* (Small-fruited Grey Gum) which is a known Koala Feed Tree in the local area. A number of scats also consistent with this species were found at the base of a number of these trees.

- A number of small conical diggings attributed to Bandicoot species *Perameles nasuta* (Long-nosed Bandicoot) or *Isoodon macrourus* (Northern Brown Bandicoot) were commonly found throughout within the area of open forest.
- Scats and footprints consistent with that of a macropod were found to be common throughout the site. The prints were most likely from *Macropus rufogriseus* (Red-necked Wallaby) which was commonly observed within the study area during fieldwork.

4.3.13 SURVEY LIMITATIONS

As with all reports of this type the main survey limitation for the survey is considered to be the very short period of time in which the fieldwork was carried out. Limitations to the likelihood of detecting certain subject species were also encountered during this survey. Such limitations were generally related to the seasonal occurrence of species, be it as a result of known flowering periods for flora or migratory movements by fauna. Showers experienced during the survey would also have greatly reduced the chances of recording some species particularly microchiropteran bat and reptile species.

These limitations have been overcome by applying the precautionary principle in all cases where the survey methodology may have given a false negative result. This precautionary principle was achieved by recognising that most threatened species are rare and therefore unlikely to be encountered during a survey even if they may utilise the site at other times. These species have been assessed on the basis of the presence of their habitat and the likely significance of that habitat to a viable local population.

5.0 CONSIDERATIONS UNDER SECTION 5A OF THE EPA ACT

Considerations of the effects of the proposal under the guidelines of Section 5A of the Environmental Planning and Assessment Act (1995) are given in Appendix A. The species dealt with were those species identified on site during the fieldwork and those considered to have potential habitat available within the study area as detailed in Section 4.2.4 of this report.

Endangered Populations

Eucalyptus seeana was not identified within the study area during fieldwork. Areas of suitable habitat were considered to be present around Bootawa Dam however the majority of the study area was highly disturbed with large areas covered in a relatively new plantation. The proposal may result in the removal of a relatively small amount of suitable habitat, however it is unlikely to have an adverse effect on the life cycle of *E. seeana* such that a viable local population is likely to be placed at risk of extinction.

Threatened Flora Species

Despite targeted searches no threatened flora species were recorded during the survey. Limited habitat was found to be present for 6 of the 8 species addressed in this report.

- *Asperula asthenes* (Trailing Woodruff)
- *Diuris flavescens* (Pale Yellow Doubletail)
- *Eucalyptus glauca* (Slaty Red Gum)
- *Melaleuca biconvexa* (Biconvex Wattle)
- *Asperula asthenes* (Trailing Woodruff)
- *Cynanchum elegans* (White-flowered Wax Plant)

Suitable habitat for *D. flavescens* was confined to the area of open forest. It must be noted that the fieldwork was carried out outside the flowering season for *D. flavescens* (September to October) and would be unlikely to be detected during this period. This orchid is currently known from only one population in the Wingham area and no records were present within the immediate vicinity of Bootawa Dam. The area of open forest contained suitable habitat for *E. glaucina*. Marginal habitat was also considered to be present for this Red Gum species over much of the study area. Limited habitat for *C. elegans* was thought to be present within the area of open forest and areas of moist regrowth scrub. Areas of moist regrowth scrub were also considered to contain limited habitat for *M. biconvexa* and *A. asthenes*. The proposal will result in the removal of a relatively small amount of habitat for these flora species resulting in an incremental reduction of habitat in the local area. However no significant habitat will be affected that is likely to disrupt the life cycle these addressed flora species such that local extinction would occur.

Threatened Fauna Species

Three threatened fauna species were recorded within the study area during the survey:

- *Calyptorhynchus lathami* (Glossy Black Cockatoo)

- *Phascolarctos cinerea* (Koala)
- *Pteropus poliocephalus* (Grey-headed Flying-fox)

Ephippiorhynchus asiaticus (Black-necked Stork) has also been previously recorded within the site (DECCW, 2010). As a precaution another species *Vespadelus troughtoni* (Eastern Cave Bat) was also regarded as present within the study area.

Calyptorhynchus lathami (Glossy Black Cockatoo)

A number of distinctively chewed cones from *Allocasuarina torulosa* (Forest Oak) trees, an indication of recent feeding by the Glossy Black-Cockatoos were found on the ground in the area of open forest. Foraging habitat in the form of Forest Oak was confined to the area of open forest on the eastern shore of Bootawa Dam. No nesting habitat in the form of large suitable tree hollows was considered to be present. The proposed raising of Bootawa Dam will require the removal of a small number of specimens of *A. torulosa* within the area of open forest resulting in a small incremental reduction of foraging habitat in the local area. No suitable nesting habitat is likely to be removed.

Phascolarctos cinerea (Koala)

An individual Koala was observed whilst spotlighting on the eastern boundary of the study area next to the open forest assemblage. A skull belonging to the Koala was also found within the area of open forest inside the study area. Scratches and a small number of scats consistent with those of the Koala were found on the boles of specimens of *Eucalyptus propinqua* (Small-fruited Grey Gum) and *Eucalyptus tereticornis* (Forest Red Gum). It is believed that Koalas periodically utilise the study area for foraging as part of a larger home range. It is likely that the Koala would only forage on two species of Eucalypt within the study area, *E. tereticornis* and *E. propinqua.* The recently established mixed eucalypt plantation contains very young specimens of *Eucalyptus punctata* (Grey Gum) another listed Koala Feed Tree Species under SEPP 44 (Mid Coast Water, 2010). It is unknown if the local population of Koalas would forage on these particular trees when they become older.

The proposed raising of the dam will result in the removal of approximately 25 of the 59 Koala feed trees (*E. propinqua* & *E. tereticornis*) recorded within the study area. A small number of these trees particularly those occurring on the western side of the dam are isolated and less likely to be utilised by Koalas. This action will result in a small incremental decrease in Koala habitat in the local area. Considering the presence of larger areas of similar connecting open forest habitat to the east of the site and the fact many known Koala feed trees will remain within the study area after the dam raising the proposal is unlikely to have an adverse effect on the life cycle of the species such that the local population of Koalas may be placed at risk of extinction. To reduce the impact of the proposal on the Koala it is recommended that additional specimens of *E. tereticornis* and *E. propinqua* be planted where possible around the dam. Before any tree removal, trees to be removed will be required to be

inspected by a suitably qualified person on the day to prevent any avoidable harm to any Koalas that may be present.

Pteropus poliocephalus (Grey-headed Flying-fox)

A number of specimens of *P. poliocephalus* were observed whilst spotlighting within the open forest assemblage foraging on flowering Ironbark trees. The study area contains suitable foraging habitat for the Grey-headed Flying-fox in the form of seasonally flowering myrtaceous species. No suitable roosting camps were considered to be present. The proposal will result in the removal of a small amount of foraging habitat, which may be seen as an incremental loss of habitat within the locality however it is considered that the proposal is unlikely to cause extinction of the local population of this mobile species.

Ephippiorhynchus asiaticus (Black-necked Stork)

The Black-necked Stock was not recorded within the study area during fieldwork. However the DECCW database contains two records of the Black-necked Stock within Bootawa Dam dating back to the year 2004. Bootawa Dam itself contains suitable foraging habitat for the Black-necked Stock with the presence of prey species such as eels. A small number of trees around the dam may offer marginal nesting habitat, however no breeding activity has been reported within the vicinity of the dam. The proposal is unlikely to have any impact on foraging habitat for this wetland bird. A small number of potential nesting trees may need to be removed.

Vespadelus troughtoni (Eastern Cave Bat)

Due to the similarity of calls within the genus Vespadelus, *Vespadelus troughtoni* was regarded under the precautionary principle as present within the study area during the survey. The majority of the study area provided hunting habitat for this species of microchiropteran bat. Roosting habitat in the form of caves or similar man made structures was absent. As no significant hunting or roosting habitat will be affected the proposal is unlikely to disrupt the life cycle of this microchiropteran bat species such that local extinction would occur.

No other threatened species were recorded within the site. However it is considered that foraging/hunting/nesting resources of varying quality was available for 26 of the 32 remaining fauna species assessed:

- *Litoria aurea* Green and Golden Bell Frog
- *Rostratula benghalensis australis* Australian Painted Snipe
- *Botaurus poiciloptilus* Australasian Bittern
- *Ixobrychus flavicollis* Black Bittern
- *Ptilinopus magnificus* Wompoo Fruit-Dove
- *Ptilinopus regina* Rose-crowned Fruit-Dove
- *Ptilinopus superbus* Superb Fruit-Dove
- *Glossopsitta pusilla* Little Lorikeet
- *Lathamus discolor* Swift Parrot

- *Anthochaera phrygia* Regent Honeyeater
- *Daphoenositta chrysoptera* Varied Sittella
- *Hieraaetus morphnoides* Little Eagle
- *Lophoictinia isura* Square-tailed Kite
- *Ninox connivens* Barking Owl
- *Ninox strenua* Powerful Owl
- *Tyto novaehollandiae* Masked Owl
- *Dasyurus maculatus maculatus* Tiger Quoll
- *Phascogale tapoatafa* Brush-tailed Phascogale
- *Planigale maculata* Common Planigale
- *Potorous tridactylus tridactylus* Long-nosed Potoroo
- *Petaurus australis* Yellow-bellied Glider
- *Petaurus norfolcensis* Squirrel Glider
- *Mormopterus norfolkensis* Eastern Freetail Bat
- *Miniopterus schreibersii oceanensis* Eastern Bentwing-bat
- *Myotis adversus* Large-footed Myotis
- *Miniopterus australis* (Small Bentwing-bat
- *Chalinolobus dwyeri* Large-eared Pied Bat

The most likely of these species to utilise the study area would include the Varied Sittella, Powerful Owl, Squirrel Glider and Microchiropteran Bats.

6.0 THE DRAFT GREATER TAREE CITY COUNCIL COMPREHENSIVE KOALA PLAN OF MANAGEMENT

The Draft Greater Taree City Council CKPoM has been prepared for the Greater Taree Local Government Area (LGA) in accordance with State Environmental Policy No. 44 – Koala Habitat Protection (SEPP 44) and aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas to ensure a permanent free-living population over their present range and to reverse the current trend of Koala population decline.

Review of the Greater Taree Koala Planning Map (Figure 21) shows the majority of the study area as mainly cleared land. The area of Open Forest on the eastern side of Bootawa Dam is mapped as Class 3 (other secondary habitat Class A). Another nearby small area of Moist Regrowth Scrub was mapped as Other Vegetation.

Only one Koala Feed Tree species, *Eucalyptus tereticornis* (Forest Red Gum), listed in Schedule 2 of SEPP 44 – Koala Habitat Protection was found to be present within the study area. This tree species is also listed as Primary Koala Feed Tree species in the Draft CKPoM. Additionally, another Primary Koala Feed Tree species, *Eucalyptus propinqua* (Small-fruited Grey Gum) was also recorded within the study area in greater numbers than *E. tereticornis*.

As previously mentioned the Koala was recorded within study area during fieldwork and has been assessed in Sections 5 and Appendix A of this report. The Koala sighting and the location of the Koala Feed Tree Species within the study area is shown in Figure 22. Information pertaining to the species of these located trees and evidence of Koala activity is shown in Table 8.

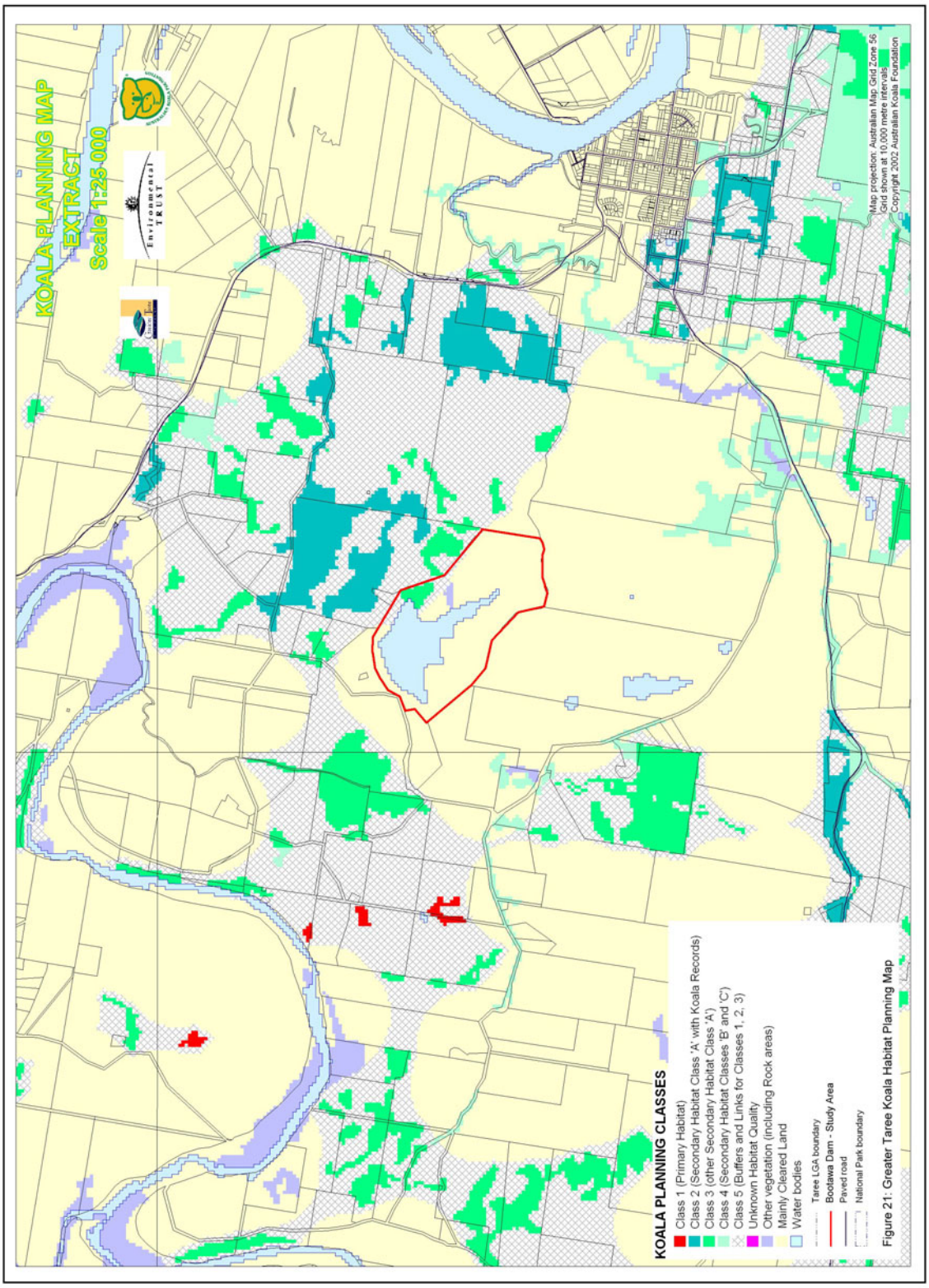


Figure 21: Greater Taree Koala Habitat Planning Map

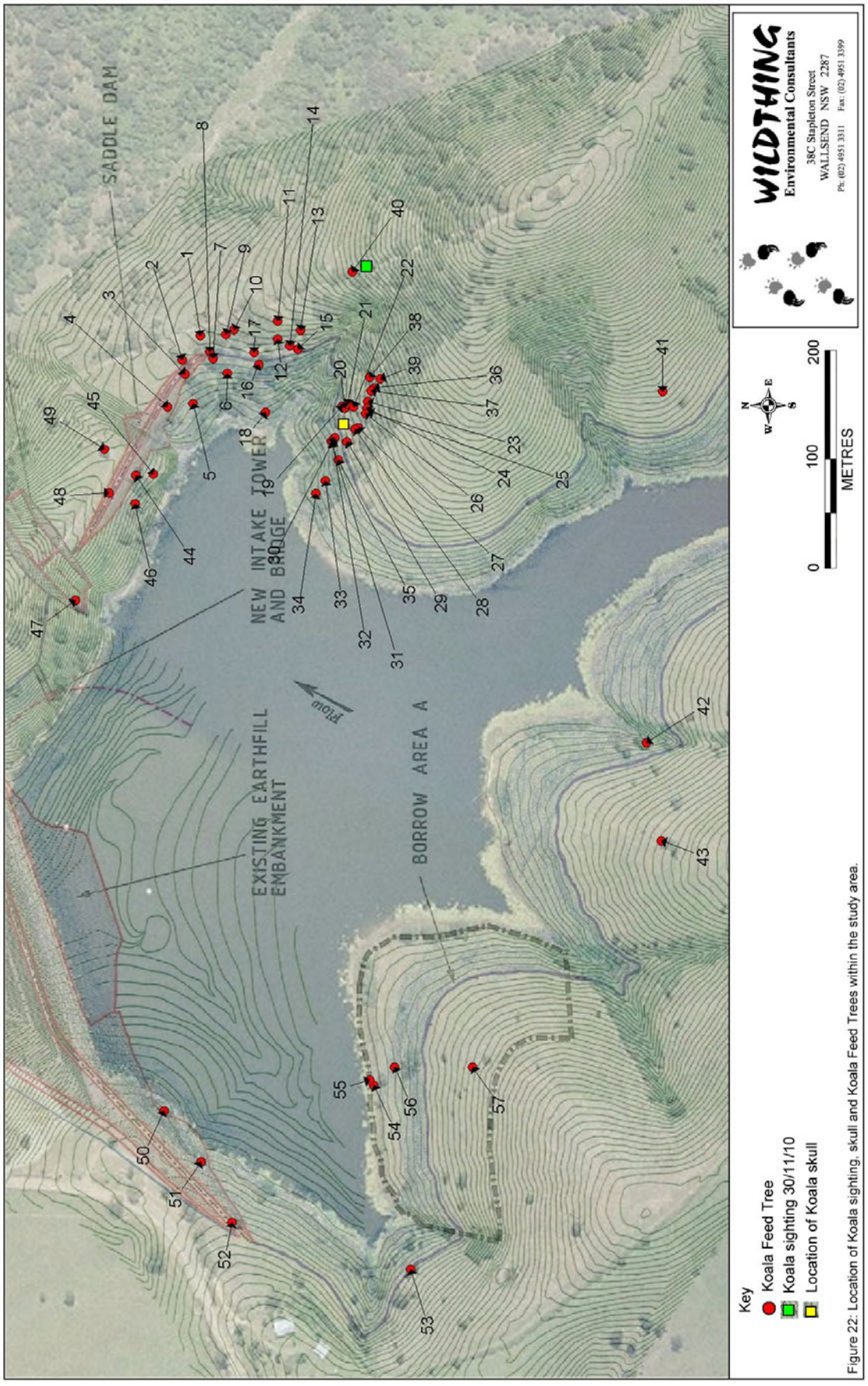


Figure 22: Location of Koala sighting, skull and Koala Feed Trees within the study area.

Table 8: Koala Feed Tree Species present within the study area.

TREE NO.	SPECIES	EVIDENCE OF KOALA ACTIVITY
1	*Eucalyptus tereticornis* Forest Red Gum	Some scratches not conclusively from a Koala.
2	*E. tereticornis*	Large tree. Larger scratches probably Koala.
3	*E. tereticornis*	Larger scratches probably Koala.
4	*E. tereticornis*	Little evidence of Koala activity.
5	*E. tereticornis*	Little evidence of Koala activity.
6	*E. tereticornis*	Very large tree.
7	*E. tereticornis*	Small number of larger scratches probably Koala.
8	*E. tereticornis*	Small number of scratches possibly a Koala.
9	*E. tereticornis*	Small number of scratches possibly a Koala.
10	*E. tereticornis*	Small number of scratches possibly a Koala.
11	*Eucalyptus propinqua* Small-fruited Grey Gum	Small number of scratches and scats consistent with those of a Koala.
12	*E. tereticornis*	Little evidence of Koala activity.
13	*E. propinqua*	Small number of larger scratches probably Koala.
14	*E. propinqua*	Large number of scratches and small number of scats consistent with those of a Koala.
15	*E. propinqua*	Small number of larger scratches probably Koala.
16	*E. propinqua*	Larger scratches probably Koala.
17	*E. propinqua*	Larger scratches probably Koala.
18	*E. tereticornis*	Little evidence of Koala activity.
19	*E. propinqua*	Larger scratches probably Koala.
20	*E. propinqua*	Larger scratches probably Koala.
21	*E. propinqua*	Scratches consistent with a Koala.
22	*E. propinqua*	Scratches consistent with a Koala.
23	*E. propinqua*	Large number of scratches consistent with a Koala.
24	*E. propinqua*	Scratches consistent with a Koala.
25	*E. propinqua*	Scratches consistent with a Koala.
26	*E. propinqua*	Large number of scratches and a small number of older scats at base of tree consistent with a Koala.
27	*E. tereticornis*	Large tree. Small number of scratches possibly a Koala.
28	*E. propinqua*	Large number of scratches consistent with a Koala. Also chewed Forest Oak seed cones on ground consistent with those eaten by a Glossy Black Cockatoo.
29	*E. tereticornis*	Small number of scratches possibly a Koala.
30	*E. propinqua*	Large number of scratches consistent with a Koala.
31	*E. propinqua*	Large number of scratches consistent with a Koala.
32	*E. propinqua*	Scratches consistent with a Koala.
33	*E. propinqua*	Scratches consistent with a Koala.
34	*E. propinqua*	Scratches consistent with a Koala.
35	*E. tereticornis*	Little evidence of Koala activity.
36	*E. propinqua*	Scratches consistent with a Koala.
37	*E. propinqua*	Number of scratches consistent with a Koala. Also chewed Forest Oak seed cones on ground consistent with those eaten by a Glossy Black Cockatoo.
38	*E. propinqua*	Scratches consistent with a Koala.
39	*E. propinqua*	Scratches consistent with a Koala.
40	*E. propinqua*	Little evidence of Koala activity.
41	*E. propinqua*	Large number of scratches and two older scats at base of tree consistent with a Koala.
42	*E. tereticornis*	Little evidence of Koala activity.
43	*E. propinqua*	Small number of larger scratches probably Koala.
44	*E. tereticornis*	Little evidence of Koala activity.
45	*E. tereticornis*	Little evidence of Koala activity.

TREE NO.	SPECIES	EVIDENCE OF KOALA ACTIVITY
46	*E. tereticornis*	Little evidence of Koala activity.
47	*E. tereticornis*	Number of scratches and scats at base of tree consistent with a Koala.
48	*E. tereticornis*	Little evidence of Koala activity.
49	*E. tereticornis*	Little evidence of Koala activity.
50	*E. tereticornis*	Little evidence of Koala activity.
51	*E. tereticornis*	Little evidence of Koala activity.
52	*E. tereticornis*	Little evidence of Koala activity.
53	*E. tereticornis*	Little evidence of Koala activity.
54	*E. tereticornis*	Little evidence of Koala activity.
55	*E. tereticornis*	Little evidence of Koala activity.
56	*E. tereticornis*	Little evidence of Koala activity.
57	*E. tereticornis*	Little evidence of Koala activity.
58	*E. tereticornis*	Little evidence of Koala activity.
59	*E. tereticornis*	Little evidence of Koala activity.

7.0 AQUATIC SURVEY

The objectives of the aquatic ecology component of this report are to:

- describe the existing aquatic values within the study area;
- describe potential adverse and beneficial impacts of the proposal on these aquatic values; and
- identify any potential impacts that may occur as a result of the proposed works and provide mitigation measures and recommendations to ameliorate any potential adverse impacts.

As previously mentioned Bootawa Dam is an off-creek artificial storage located on an unnamed tributary of the Manning River built in 1968. Water is pumped to the dam from the Manning River via an intake located upstream of the township of Wingham. Bootawa Dam is about 16 metres deep. The water level within Bootawa Dam can drop quite quickly, particularly in summer when homes use more water. A special aeration and mixing system is used to keep the water stratification and make sure there is enough oxygen in the dam. This system also stops unwanted algae growing. The bottom of the dam was primarily composed of unconsolidated fine sediment. Underwater habitat in the form of timber and other similar debris was found to be virtually absent. A number of small ephemeral drainage lines run into the dam. These drainage lines were generally highly disturbed and were situated on previously cleared ground. A number of these drainage lines contained dense areas of moist regrowth shrub.

Methodology

A rapid assessment in the form of a Stream Invertebrate Grade Number – Average Level (SIGNAL) test which is a bio-indicator to determine the health of a waterway by the absence or presence of certain indicator species was not performed within the dam as this type of survey is only suitable for flowing streams. However sampling was carried out involved dip/sweep netting to sample invertebrate and fish species. No electro-fishing or gill netting was undertaken.

Aquatic Flora

As previously mentioned vegetation adapted to varying amounts of inundation was present around the periphery of Bootawa Dam. The majority of the edge of the dam contained few aquatic plants. Small sections of the dam primarily along the high water mark however did contain reeds and rushes. These areas included species such as *Typha orientalis* (Cumbungi), *Eleocharis sphacelata* (Tall Spike-rush), *Schoenoplectus mucronatus, Philydrum lanuginosum* (Woolly Frogmouth) and *Juncus usitatus* (Common Rush). The water level was down approximately 1m at the time of the survey with an area of exposed drying mud present. Exposed areas of drying mud below the high water mark were found to contain a number of small quick growing species such as *Cyperus eragrostis* (Umbrella Sedge), *Alternanthera dentata* (Lesser Joyweed), *Centipeda cunninghamii* (Sneezeweed) and *Gratiola pedunculata* (Stalked Brooklime). Few aquatic plants were observed within the water itself with small areas of *Potamogeton tricarinatus* (Floating Pondweed) one of the exceptions.

Aquatic Fauna

Aquatic fauna species present within the dam are typically those adapted to still water conditions at varying depths. Species noted included insects, molluscs, crustaceans and fish.

Invertebrates

Although not as diverse as a flowing stream a number of aquatic insects were recorded. Common species included those belonging to the Genus Notonectadae (Backswimmers). Other species noted included the dragonfly species *Rhyothemis graphiptera* (Graphic Flutterer). Molluscs noted included Thiarid Snails and Freshwater Mussels. Common crustaceans noted were *Macrobrachium australiense* (Freshwater Prawn) and *Paratya australiensis* (Freshwater Shrimp).

Veretebrates

Few vertebrates were recorded within Bootawa Dam. Two species of fish *Anguilla reinhardtii* (Long-finned Eel) and *Gambusia holbrooki* (Plague Minnow) were observed close to the waters edge. Predation by the introduced *Gambusia holbrooki* (Plague minnow) is a key threatening process listed under the Threatened Species Conservation Act 1995. *Gambusia holbrooki* was found to be relatively common around the edge of the dam. Other fish that are likely to be present within Bootawa Dam include *Anguilla australis* (Short-finned Eel). *Notesthes robusta* (Bullrout) has also been reported to occur within the dam. One dead specimen of *Chelodina longicollis* (Eastern Long-necked Turtle) was also observed on the shore of the dam.

Impact of the proposal

The proposed raising of the dam to increase its storage capacity from 2200 ML to 4500 ML will mainly result in the drowning of mostly cleared land. Areas of vegetation such as open forest and moist regrowth scrub also occur within the inundation area. Vegetation around the storage perimeter will be cut at the base and removed prior to inundation. Tree root balls will remain which will provide habitat for a number of invertebrates and fish. No important areas of aquatic habitat within the tributaries such as stream riffles or pools will be inundated. The two burrow areas will result in a high degree of disturbance to the ground above Bootawa Dam. Strict erosion control measures will have to be carried out to prevent sediment from these areas moving into the aquatic environment. Similar aquatic habitat to that currently present within the dam will occur after the dam raising. It is considered that the raising of Bootawa Dam is unlikely to result in any significant impact to aquatic habitat within the study area.

8.0 FISHERIES MANAGEMENT ACT (FM ACT)

The objectives of the Fisheries Management Act (FM Act) are to conserve, develop and share the fishery resources of the state for the benefit of present and future generations. Part 7A of the Fisheries Management Act 1994 (FM Act) provides for the listing of threatened species, populations and endangered ecological communities. Searches on the DECCW Database and the BIONET and DEWHA on-line databases indicated that there would be no threatened or protected aquatic species or ecological communities living within or nearby the study area with potential to be affected by the proposal. Therefore a Seven Part Test for aquatic species under the Fisheries Management Act would not be required. However a small number of threatening processes listed under the Fisheries Management Act could potentially apply to the proposal. These threatening processes should be considered during planning and avoided or mitigated against if possible. The Key Threatening Processes that are considered to be pertinent to the site include:

Instream structures and other mechanisms that alter natural flow

Instream structures, including canals, culverts, levee banks and erosion control structures can modify the natural flows of waterways. The proposal involving the raising of Bootawa Dam is unlikely to cause any significant alteration to the flow of local ephemeral drainage lines entering or exiting Bootawa Dam. Additionally the increased storage aims to avoid pumping from the Manning River in periods of low flow and high turbidity. The project would guarantee environmental flows in the Manning River in accordance with NSW Office of Water requirements. Pumping rates from the Manning River are not expected to increase.

Predation by the plague minnow

Predation by *Gambusia holbrooki* (Plague minnow) is a key threatening process listed under the Threatened Species Conservation Act 1995. Due to the high numbers of this introduced fish species recorded within Bootawa Dam it is likely that it has some impact on native freshwater fish, macroinvertebrates, frog eggs and tadpoles that are present. However the risk of the Plague Minnow increasing in abundance is minimal as a result of the proposal.

9.0 CONSIDERATIONS UNDER THE COMMONWEALTH ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

Considerations have been made to the Commonwealth Environment Protection and Biodiversity Conservation (EPBC) Act 1999. Assessments have been made to determine whether or not the proposal or activity has, will have, or is likely to have a significant impact on a matter of National Environmental Significance. The matters of National Environmental Significance and the appropriate responses are listed below:

- *World Heritage properties;*

The proposed development is not considered to affect any World Heritage properties.

- *wetlands recognised under the Ramsar convention as having international significance;*

The proposal is considered unlikely to affect any Ramsar listed wetland.

- *listed threatened species and communities;*

Sixteen nationally threatened species were recorded on the DSEWPC on-line database as occurring or having potential habitat available within 10km of the site, these being:

Cryptostylis hunteriana	Leafless Tongue Orchid
Allocasuarina defungens	Dwarf Heath Casuarina
Melaleuca biconvexa	Biconvex Paperbark
Cynanchum elegans	White-flowered Wax Plant
Litoria aurea	Green and Golden Bell Frog
Mixophyes balbus	Stuttering Frog
Mixophyes iteratus	Giant Barred Frog
Rostratula benghalensis australis	Australian Painted Snipe
Anthochaera phrygia	Regent Honeyeater
Lathamus discolor	Swift Parrot
Potorous tridactylus tridactylus	Long-nosed Potoroo
Dasyurus maculatus maculatus	Tiger Quoll
Pteropus poliocephalus	Grey-headed Flying Fox
Chalinolobus dwyeri	Large-eared Pied Bat
Psuedomys novaehollandiae	New Holland Mouse
Pseudomys oralis	Hastings River Mouse

Under the EPBC Act Policy Statement 1.1 – Significant Impact Guidelines (DEWHA, 2009) an action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- lead to a long-term decrease in the size of an important population of a species;
- reduce the area of occupancy of an important population;
- fragment an existing important population into two or more populations;
- adversely affect habitat critical to the survival of a species;
- disrupt the breeding cycle of an important population;

- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;
- introduce disease that may cause the species to decline; or
- interfere substantially with the recovery of the species.

Pteropus poliocephalus was recorded foraging within the study area. The proposal will result in the removal of a relatively small amount of seasonal foraging habitat for this species. However given the highly disturbed nature of the site and the abundance of foraging habitat in the local area it is considered that the proposal is not likely to significantly impact upon or cause extinction to the local population of this highly mobile species.

No other nationally threatened species were recorded on site during the survey. With the exception of *C. hunteriana, A. defungens, M, balbus, M. iteratus, P. novaehollandiae* and *P. oralis* suitable habitat of varying quality was found to be present for the remaining species within the study area. All nationally listed species that were considered to have habitat on site have been addressed under the provisions of state legislation (ie: Section 5A of the NSW Environmental Planning and Assessment Act 1979). As stated within Section 5, the proposal will lead to a small incremental loss of habitat within the locality, however it is not considered to be locally significant.

- *migratory species protected under international agreements;*

The migratory species *Haliaeetus leucogaster* (White-bellied Sea-Eagle) is protected under international agreements and was recorded flying over the study area. The listed migratory species, *Xanthomyza phrygia* and *Lathamus discolor* have been assessed as threatened species within Section 5 and Appendix A of this report. Each of the remaining species has been assessed below in Table 9.

Table 9: Assessment of Migratory Species.

Scientific Name	Habitat	Possibility of occurrence & impact of action
Migratory Terrestrial Species		
Haliaeetus leucogaster White-bellied Sea-Eagle	Considered to be a migratory species, however any movements are likely to be nomadic rather than migratory, in response to food availability.	One specimen of White-bellied Sea Eagle was observed on two occasions flying over the study area. No nest belonging to this species was noted. Potential hunting and nesting habitat was considered to be present. The proposal is unlikely to have a significant impact on this species
Hirundapus caudacutus White-throated Needletail	Inhabits the airspace above forests, woodlands, farmlands, plains, lakes, coasts and towns.	This species was not recorded during the survey. Due to the general habitat requirements of the White-throated

Scientific Name	Habitat	Possibility of occurrence & impact of action
		Needletail it is considered unlikely that the proposal will adversely impact upon this species.
Monarcha melanopsis Black-faced Monarch	Utilises a range of habitats including rainforests, eucalypt woodlands, coastal scrubs (Pizzey & Knight, 2001).	This species was not recorded during the survey. Due to the general habitat requirements of this species it is considered unlikely that the proposal will adversely impact upon it.
Merops ornatus Rainbow Bee-eater	Inhabits areas such as open woodlands with sandy soils, sandridges, riverbanks, beaches, dunes, cliffs and rainforests.	This species was not recorded on site during the survey. No nesting habitat was found within the study area. Due to the general habitat requirements of this species it is considered unlikely that the proposal will have an adverse impact upon this species.
Myiagra cyanoleuca Satin Flycatcher	Heavily vegetated gullies in forests and taller woodlands. During migration this species also utilises coastal forests, woodlands, mangroves, remnant trees in paddocks and gardens (Pizzey & Knight, 2001).	This species was not recorded during the survey. Due to the general habitat requirements of this species it is considered unlikely that the proposal will adversely impact upon it.
Rhipidura rufifrons Rufous Fantail	Utilises a range of habitats including rainforests, wet sclerophyll forests, monsoon forests, scrubs, mangroves, watercourses, parks and gardens. During migration this species also utilises farms, street trees and buildings (Pizzey & Knight, 2001).	The Rufous Fantail was not recorded during the survey. More suitable habitat was found to be present within the thicker areas of vegetation on site. The removal of open forest will result in an incremental decrease in habitat for this species, however it would be considered unlikely to be adversely impacted upon.
Anthochaera phrygia Regent Honeyeater	Temperate woodlands and open forest, including forest edges, preferring to forage on large-flowered eucalypts.	Suitable foraging habitat was found to be present on site for the Regent Honeyeater. The proposal will result in an incremental decrease in habitat, however it is considered unlikely that the proposal will adversely impact upon this species.
Migratory Wetland Species:		
Gallinago hardwickii Latham's Snipe	Utilises a variety of habitat, such as soft wet ground or shallow water with tussock and other green and dead vegetation, and scrub or open wetland from sea-level to alpine bogs (Pizzey & Knight, 2001).	This species was not recorded on site during the survey. Suitable habitat was considered to be present on the periphery of Bootawa Dam. The proposal is unlikely to impact upon habitat for this species.
Rostratula benghalensis australis Painted Snipe	This species frequents the margins of swamps and streams, chiefly those covered with low and stunted vegetation.	This species was not recorded on site during the survey. Suitable habitat was considered to be present on the periphery of Bootawa Dam. The proposal is unlikely to impact upon habitat for this species.
Migratory Marine Species (overflies a marine area):		
Lathamus discolor Swift Parrot	Utilises open forest and woodland, as well as winter flowering eucalypt street trees and trees in parks and gardens. The preferred winter food species are *Eucalyptus sideroxylon* (Red Ironbark), *E. albens* (White Box), *E. ovata* (Swamp Gum), *E. robusta* (Swamp Mahogany)	This species was not recorded on site during the survey. The removal of the Open Forest habitat may result in an incremental decrease in potential foraging habitat for the Swift Parrot. However it is considered unlikely that the proposal will adversely impact

Scientific Name	Habitat	Possibility of occurrence & impact of action
	and *E. melliodora* (Yellow Gum).	upon this species. This species has been assessed in more detail in Section 5 and Appendix A of this report.
Apus pacificus Fork-tailed Swift	Inhabits the airspace over open country from semi deserts to coasts.	This species was not recorded during the survey. Due to the general habitat requirements of the Fork-tailed Swift it is considered unlikely that the proposal will adversely impact upon this species.
Ardea alba Great Egret	Inhabits shallows of rivers, larger dams, freshwater wetlands and irrigation areas.	This species was not recorded during the survey. Suitable habitat was considered to be present on the periphery of Bootawa Dam. The proposal is unlikely to impact upon habitat for this species.
Ardea ibis Cattle Egret	Inhabits stock paddocks, pastures, croplands, wetlands and drains.	This species was not recorded during the survey. Suitable habitat was considered to be present on the periphery of Bootawa Dam. The proposal is unlikely to impact upon habitat for this species.
Gallinago hardwickii Latham's Snipe	Inhabits a range of habitats including soft wet ground or shallow water with tussocks and other green and dead growth, wet paddocks, saltmarsh and mangrove fringes.	This species was not recorded on site during the survey. Suitable habitat was considered to be present on the periphery of Bootawa Dam. The proposal is unlikely to impact upon habitat for this species.
Haliaeetus leucogaster White-bellied Sea-Eagle	Considered to be a migratory species, however any movements are likely to be nomadic rather than migratory, in response to food availability	One specimen of White-bellied Sea Eagle was observed on two occasions flying over the study area. No nest belonging to this species was noted. Potential hunting and nesting habitat was considered to be present. The proposal is unlikely to have a significant impact on this species
Hirundapus caudacutus White-throated Needletail	Inhabits the airspace above forests, woodlands, farmlands, plains, lakes, coasts and towns.	This species was not recorded during the survey. Due to the general habitat requirements of the White-throated Needletail it is considered unlikely that the proposal will adversely impact upon this species.
Merops ornatus Rainbow Bee-eater	Inhabits areas such as open woodlands with sandy soils, sandridges, riverbanks, beaches, dunes, cliffs and rainforests.	This species was not recorded on site during the survey. No nesting habitat was found within the study area. Due to the general habitat requirements of this species it is considered unlikely that the proposal will have an adverse impact upon this species.
Rostratula benghalensis australis Painted Snipe	Frequents the margins of swamps and streams, chiefly those covered with low and stunted vegetation.	This species was not recorded on site during the survey. Suitable habitat was considered to be present on the periphery of Bootawa Dam. The proposal is unlikely to impact upon habitat for this species.
Monarcha melanopsis Black-faced Monarch	Utilises a range of habitats including rainforests, eucalypt woodlands and coastal scrubs (Pizzey & Knight, 2001).	This species was not recorded during the survey. Due to the general habitat requirements of this species it is considered unlikely that the proposal

Scientific Name	Habitat	Possibility of occurrence & impact of action
		will adversely impact upon it.

- *nuclear activities;*

The proposal does not involve any type of nuclear activity.

- *the Commonwealth marine environment;*

The proposal does not involve the modification of the Commonwealth marine environment.

10.0 BURROW AREAS

The material for the earthfill type embankment of Bootawa Dam will be sourced from two burrow areas within the site. These burrow areas (Borrow Areas A and B) are located on the storage perimeter (Figure 3). Borrow Area A is located on the western shore of Bootawa Dam with Borrow Area B situated on the south-eastern shore where an ephemeral drainage line enters the dam. Uncontrolled sediment runoff from the borrow areas could impact the water quality of Bootawa Dam. Site specific sediment control plans will be required to be prepared for these two areas. It is also recommended that these borrow areas occurring above the new high water level undergo revegetation using primarily locally native plant species. Tree species used should be those known to be utilised by Koalas occurring within the local area. Considering the recommendations the borrow areas are unlikely to have a significant impact upon habitat within or in proximity to Bootawa Dam.

11.0 RECOMMENDATIONS

The recommendations given in the report have been listed here along with a brief discussion of their implementation.

- To reduce the impact of the proposal on the Koala it is recommended that additional specimens of *E. tereticornis* and *E. propinqua* be planted where possible around the dam. Before any tree removal, trees to be removed will need to be inspected by a suitably qualified person on the day to prevent any avoidable harm to any Koalas that may be present. It is also recommended that any fencing including internal fencing be designed so as not to restrict the movement of Koalas.
- Approximately twelve habitat trees (hollow-bearing trees) will need to be removed for the raising of Bootawa Dam. It is recommended that a suitably qualified and vaccinated ecologist be present during the removal of the habitat trees to reduce the impact on any fauna they may contain. It is also recommended that suitable nest boxes be installed into trees above the new water level to compensate for the loss of habitat.
- All infestations of the invasive weeds particularly *Lantana camara* (Lantana), *Xanthium occidentale* (Noogoora Burr) and *Rubus fruticosa* (Blackberry) are to be controlled within the site. This will involve two stages.
    - Primary weed control to target the removal of weed species particularly noxious weed infestations/occurrences and
    - Follow-up weed control following on from primary weed control to treat all weed species for perpetuity.
- Site specific sediment control plans will be required to be prepared for the two burrow areas to help prevent sediment moving into Bootawa Dam.
- Borrow areas are to be revegetated using locally native flora species.

12.0 CONCLUSION

Flora, fauna and habitat studies have been undertaken at Bootawa Dam, Bootawa NSW to assess the impact of a proposed raising of Bootawa Dam and associated infrastructure.

It is proposed Bootawa Dam be raised to increase its storage capacity from 2200 ML to 4500 ML. The proposal involves raising Bootawa Dam by 7m using an earthfill type embankment. The proposal will also include the construction of a new saddle dam over the site of the existing spillway channel and the construction of a new spillway, approximately 25m wide.

The study area covered an area of 44ha which included Bootawa Dam with a surface area of approximately 22ha and the surrounding catchment up to the ring road around the dam. The study area was found to be largely cleared with a large portion of this land recently turned into a plantation. Despite the disturbance an area of open forest was present on the eastern shore of the dam. Other areas of moist regrowth scrub were present within a number of the minor gullies and drainage lines leading down into Bootawa Dam. A total of six vegetation communities were delineated. None of these communities were considered to constitute an endangered ecological community under State or National legislation.

Despite targeted searches no threatened flora species were recorded during the survey. Limited habitat was found to be present for 6 of the 8 species addressed in this report. Four threatened fauna species, *Ephippiorhynchus asiaticus* (Black-necked Stork), *Calyptorhynchus lathami* (Glossy Black Cockatoo), *Phascolarctos cinerea* (Koala) and *Pteropus poliocephalus* (Grey-headed Flying-fox) were found to have utilised the study area. A species of microchiropteran bat, *Vespadelus troughtoni* (Eastern Cave Bat) was also regarded as present within the study area as a precaution. No other threatened species were recorded within the site. However it is considered that foraging/hunting/nesting resources of varying quality was available for 27 of the 32 remaining fauna species assessed. The report found the proposal is unlikely to disrupt the life cycle of these fauna species such that local extinction would occur.

Considerations have been made to the Commonwealth Environment Protection and Biodiversity Conservation (EPBC) Act (1999). As previously mentioned one nationally listed species *Pteropus poliocephalus* (Grey-headed Flying-fox) was recorded within the study area. However it was determined that the proposal is unlikely to have any significant impact on this species or other matters of National Environmental Significance.

Bootawa Dam was found to provide habitat to a number of aquatic species. Species present within the dam were typically those adapted to still water conditions at varying depths. The proposed raising of the Bootawa Dam will result in the drowning of mostly cleared land. important areas of aquatic

habitat within the tributaries such as stream riffles or pools will be inundated. Similar aquatic habitat to that currently present within the dam will also be present after the dam raising. Therefore it is considered that the raising of Bootawa Dam is unlikely to result in any significant impact to aquatic habitat within the study area.

Despite various database searches no threatened or protected aquatic species or ecological communities were likely to occur within the study area. Therefore a Seven Part Test for aquatic species under the Fisheries Management Act was not required.

In conclusion the raising of Bootawa Dam will result in a small incremental loss of habitat for a number of addressed threatened species. However taking the recommendations given in this report into consideration it is believed that the proposal is unlikely to disrupt the life cycle of any addressed threatened species, endangered population or endangered ecological community such that local extinction would occur.

13.0 BIBLIOGRAPHY

Auld, B.A. and Medd, R.W. (1996). *Weeds: An Illustrated Botanical Guide to the Weeds of Australia*. Inkata Press, Sydney.

Barker, J., Grigg, G.C. and Tyler, M.J. (1995). *A Field Guide to Australian Frogs*. Surrey, Beatty & Sons, New South Wales.

Chippendale, G.M. (Ed) (1988). *Flora of Australia-Volume 19: Myrtaceae-Eucalyptus, Angophora*. Australian Government Publishing Service, Canberra.

Churchill, S. (2008). *Australian Bats*. (2nd edn.). Allen & Unwin Australia.

Cogger, H.G. (2000). *Reptiles and Amphibians of Australia* (6th edn.). Reed International, New South Wales.

Cropper, S. (1993). *Management of Endangered Plants*. CSIRO Publications, East Melbourne.

DECCW, (2010). *Flora and Fauna Database 1:100,000 map sheet covered '9334 'Wingham'* (data abstracted 04/11/10). Department of Environment, *Climate* Change and Water.

Department of Environment and Conservation NSW (2005). *Draft Recovery Plan for the Green and Golden Bell Frog (Litoria aurea)*. DEC NSW, Hurstville, NSW.

DSEWPC. (2010). *EPBC Act Protected Matters Report for a 10 Kilometre radius search from the centre of the Study Area.* Department of Sustainability, Environment, Water, Population and Communities (DSEWPC), Commonwealth of Australia. (Accessed 04 November 2010). www.environment.gov.au

Greater Taree City Council. (2002). *Greater Taree City Council Draft Comprehensive Koala Plan of Management – Part 1: The CKPoM*. Prepared September 2002.

Greater Taree City Council (2006). Greater Taree City Council Vegetation Map Extract. Greater Taree Council.

Greater Taree City Council. (2002). *Greater Taree City Council Draft Comprehensive Koala Plan of Management – Part 1: The CKPoM*. Prepared September 2002.

Harden, G (1991-2000). *Flora of New South Wales. Vols 1-4.* NSW University Press.

Jones, D. L. (2006). *A Complete Guide to Native Orchids of Australia including the Island Territories.* New Holland Publishers (Australia) Pty Ltd.

Keith, D.A. (2004). '*Ocean Shore to desert dunes: the native vegetation of New South Wales and the ACT*.' NSW Department of Environment and Conservation, Sydney.

Leonard, G. (2007). *Eucalypts: A Bushwalker's Guide.* New South Wales 2nd Ed. University Press, Sydney.

McAlpine, C.A., Callaghan, J. G, Lunney, D, Bowen, M.E, Rhodes, J.R, Mitchell, D, L, and Possingham, H.P. (2007). *Planning Guidelines for Koala Conservation and Recovery. A guide to best planning practice.* For Australian Research Council and Australian Koala Foundation.

Mid Coast Water (2010). *Bootawa Dam 2009 – 2010 Annual Report*. Mid Coast Water.

National Parks and Wildlife Service (2001). *NSW Scientific Committee's Final Determination to list the Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions as an Endangered Ecological Community.*

National Parks and Wildlife Service (2000). *Vegetation Survey, Classification and Mapping: Lower Hunter and Central Coast Region*. A project undertaken for the Lower Hunter and Central Coast Regional Environment Management Strategy, April 2000.

National Parks and Wildlife Service (2003). *NSW Threat Abatement Plan. Predation by Gambusia holbrooki - The Plague Minnow.* NPWS, Hurstville NSW.

Robinson, L. (2003). *Field Guide to the Native Plants of Sydney* (2nd edn.). Kangaroo Press Pty. Ltd., New South Wales.

Sainty, G. R,. & Jacobs, S. W,. (2003). *Waterplants of Australia*. 4th edition, Sainty & Associates, Sydney.

Scotts, D. (2003). *Key Habitats and Corridors for Forest Fauna: A Landscape Framework for Conservation in North-east New South Wales*. NSW NPWS Occasional Paper 32, NSW Na

Slater, P., Slater, P. and Slater, R. (1995*). The Slater Field Guide to Australian Birds.* Lansdowne Publishing, Sydney.

Swan, G, Shea, G. & Sadlier. (2004). *A Field Guide to the Snakes and Lizards of New South Wales.* (2nd edn). Reed New Holland, Australia.

Triggs, B. (1984). *Mammal Tracks and Signs-A Field Guide for South-eastern Australia*. Oxford University Press, Melbourne.

Tyler, M.J. (1992). *Encyclopedia of Australian Animals-Frogs*. Angus & Robertson, Sydney.

Van Dyck, S. & Strahan, R. (Ed) (2008). *The Mammals of Australia* (3rd edn). Reed New Holland, Australia.

APPENDIX A
CONSIDERATIONS UNDER SECTION 5A OF THE EPA ACT

CONSIDERATIONS UNDER SECTION 5A OF THE EPA ACT - SIGNIFICANT EFFECT ON THREATENED SPECIES, POPULATIONS OR ECOLOGICAL COMMUNITIES, OR THEIR HABITATS.

Consideration of this development under the guidelines of Section 5A of the Environmental Planning & Assessment Act (1979) as amended by the Environmental Planning and Assessment Amendment Act (1997) has been made. The heads of consideration of this Section are given in italics followed by the answers applicable to this site. Each species is dealt with separately.

Threatened species recorded within the study area:

1.	*Ephippiorhynchus asiaticus*	Black-necked Stork
2.	*Calyptorhynchus lathami*	Glossy Black Cockatoo
3.	*Phascolarctos cinereus*	Koala
4.	*Pteropus poliocephalus*	Grey-headed Flying-fox

Threatened species considered regarded as present within the study as a precaution.

5	*Vespadelus troughtoni*	Eastern Cave Bat

Flora species considered to have potential habitat within the site;

6.	*Diuris flavescens*	Pale Yellow Doubletail
7.	*Eucalyptus glauca*	Slaty Red Gum
8.	*Melaleuca biconvexa*	Biconvex Paperbark
9.	*Asperula asthenes*	Trailing Woodruff
10.	*Cynanchum elegans*	White-flowered Wax Plant

Fauna species considered to have potential habitat within the study area;

11.	Frogs	
	Litoria aurea	Green and Golden Bell Frog
12.	Waterbirds	
	Rostratula benghalensis australis	Australian Painted Snipe
	Botaurus poiciloptilus	Australasian Bittern
13.	Fruit Doves	
	Ptilinopus magnificus	Wompoo Fruit-Dove
	Ptilinopus regina	Rose-crowned Fruit-Dove
	Ptilinopus superbus	Superb Fruit-Dove
14.	Parrots	
	Lathamus discolor	Swift Parrot
	Glossopsitta pusilla	Little Lorikeet
15.	Woodland Birds	
	Anthochaera phrygia	Regent Honeyeater
	Daphoenositta chrysoptera	Varied Sittella
16.	Birds of Prey	
	Hieraaetus morphnoides	Little Eagle
	Lophoictinia isura	Square-tailed Kite
17.	Owls	
	Ninox connivens	Barking Owl
	Ninox strenua	Powerful Owl
	Tyto novaehollandiae	Masked Owl

18. Terrestrial Marsupials

Dasyurus maculatus maculatus	Tiger Quoll
Planigale maculata	Common Planigale
Potorous tridactylus tridactylus	Long-nosed Potoroo (SE mainland)

19. Arboreal Mammals

Petaurus australis	Yellow-bellied Glider
Petaurus norfolcensis	Squirrel Glider
Phascogale tapoatafa	Brush-tailed Phascogale

20. Microchiropteran Bats

Myotis adversus	Large-footed Myotis
Miniopterus australis	Little Bentwing-bat
Miniopterus schreibersii oceanensis	Large Bentwing-bat
Mormopterus norfolkensis	Eastern Freetail Bat
Chalinolobus dwyeri	Large-eared Pied Bat

Endangered Populations

21. *Eucalyptus seeana* population in the Greater Taree local government area

1 *Ephippiorhynchus asiaticus* Black-necked Stork

Description
The Black-necked Stork, formerly known as the Jabiru, is a large glossy black and white stork with very long red legs and a large straight black bill.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology
The Black-necked Stock inhabits shallow, permanent, freshwater terrestrial wetlands, and surrounding marginal vegetation, including swamps, floodplains, watercourses and billabongs, freshwater meadows, wet heathland, farm dams and shallow floodwaters, as well as extending into adjacent grasslands, paddocks and open savannah woodlands. They also forage within or around estuaries and along intertidal shorelines, such as saltmarshes, mudflats and sandflats, and mangrove vegetation. They mainly forage in shallow, still water, preferring open wetlands, and taking a variety of prey, including eels and other fish, frogs, turtles, snakes, and small invertebrates, such as crabs and small insects. Vertebrates form the main mass of the diet, with medium-sized eels contributing the greatest biomass and were also the only food seen to be delivered to nestlings.

In NSW, breeding activity has been recorded in most months, with activities from nest construction to fledging of young recorded from May to January. Most activity, however, takes place between June and December, and clutches present May to September. In NSW, Storks usually nest in a tall, live and isolated paddock trees, but also in other trees, including paperbarks, or even lower shrubs within wetlands. The nest is a large platform, 1-2 m in diameter, made in a live or dead tree, in or near a freshwater swamp.

Distribution
The Black-necked Stork ranges through India, south-eastern Asia, southern New Guinea and into northern and eastern Australia. Its core distribution in Australian is in the north. In eastern Australia the Black-necked Stork has been recorded as far south as Victoria and inland to the Macquarie Marshes and Griffith.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been 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 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.

The Black-necked Stock was not recorded within the study area during fieldwork. However the DECCW database contains two records of the Black-necked Stock within Bootawa Dam dating back to the year 2004. Bootawa Dam itself contains suitable foraging habitat for the Black-necked Stock with the presence of prey species such as eels. A small number of trees around the dam may offer marginal nesting habitat, however no breeding activity has been reported within the vicinity of the dam. The proposed raising of Bootawa Dam is unlikely to have any impact on foraging habitat for this wetland bird. A small number of potential nesting trees may need to be removed. However considering the fact that this species only rarely utilises Bootawa Dam and the fact that suitable foraging habitat will remain within this artificial water source the proposal is unlikely to result in the extinction of any local population of the Black-necked Stork.

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.

No 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.

No applicable.

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.

It is proposed Bootawa Dam be raised 7m to increase its storage capacity from 2200 ML to 4500 ML. This action is unlikely to result in any loss of foraging habitat for this bird species. A small number of potential nesting trees may need to be removed. It is considered that no area of habitat important to the long-term survival of the Black-necked Stork is likely to become modified, fragmented or isolated as a result of the proposal.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for the Black-necked Stock. However the Department of Environment, Climate Change and Water has prepared Priority Action Statements (PAS) to promote the recovery of this species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of strategies to help this bird species recover in NSW.

- Prepare and implement an education campaign to raise public awareness of the value in conserving wetlands in north-eastern NSW for waterbirds, including the Black-necked Stork;
- Promote the Black-necked Stork as an icon species for the conservation of floodplain wetlands and educate the community on important habitat requirements and threats to Black-necked Storks and their habitat;
- Control feral animals near nesting sites;

- Improve the protection of Black-necked Stork habitat by excluding stock, reducing grazing pressure and controlling weed species at important sites;
- Avoid placing powerlines over or near wetlands and/or nest sites;
- Reduce nutrient runoff into wetlands known to be used by Black-necked Storks;
- Avoid the use of herbicides and pesticides near or in wetlands.
- Identify areas of crown land that provide foraging and/or nesting sites for Black-necked Storks and seek to acquire these sites;
- Restore natural hydrological regimes to freshwater wetlands;
- Maintain existing hydrological regimes;
- Do not fill or drain wetlands;
- Retain and protect native vegetation in and around wetlands;
- Restore degraded wetlands;
- Identify sites for rehabilitation or construction in the Northern Rivers catchment, having due consideration for water regime, existing or potential habitat, predators, other threatening processes & monitoring activities;
- Collect baseline data on the abundance of this species and monitor long-term changes in population density;
- Collect baseline data on the population of Black-necked Storks in NSW and develop an appropriate population monitoring program;
- Prevent Black-necked Stork mortality due to powerlines by fitting them with deterrents (eg. coloured metal tags) in the vicinity of nests and flyways;
- Assess the potential impact of climate change on Black-necked Stork habitat;
- Support research into the ecology of Black-necked Storks in NSW. Encourage and support research on movements, habitat use and current threats to Black-necked Storks;
- Develop strategies to mitigate threats;
- Identify priority breeding wetlands and determine threatening processes at each site in order to target management actions.

It is considered that the proposal does not significantly conflict with the PAS for the Black-necked Stork.

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 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the study area have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of native vegetation within the study area may be viewed as being part of this Key Threatening Process, however is not considered to be significant in relation to this species.

Bibliography:

Garnett, S.T. and Crowley, G.M. (2000). The Action Plan for Australian Birds 2000. Report to Environment Australia and Birds Australia, October 2000.

Hunter Bird Observers Club (1999). Hunter Region of New South Wales: Annual Bird Report Number 6 (1998), HBOC Inc., August 1999.

NSW NPWS (NSW National Parks and Wildlife Service) (2000) *Threatened Species of the Lower North Coast of New South Wales.* NSW National Parks and Wildlife Service: Hurstville (Sydney), NSW.

2 *Calyptorhynchus lathami* Glossy-Black Cockatoo

Description

The Glossy Black-cockatoo is a dusky brown to black cockatoo with a massive, bulbous bill and a broad, red band through the tail.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not Listed.

Habitat Requirements and Ecology

The Glossy Black-Cockatoo inhabits Wet and Dry Sclerophyll Forests and Woodlands. It prefers highland habitats in the northern part of its range but may be found closer to the coast when and where conditions are suitable. In the south they are widespread in lowland coastal forests, dense mountain forests, semi-arid woodland and trees bordering watercourses.

Glossy Black-Cockatoos forage primarily on the seeds of (*Allo*)*Casuarina* species, but will also take wood borers from large *Acacia* stems. *Allocasuarina torulosa, A. verticillata* and *A. littoralis* are the predominant food trees in N.S.W. On Kangaroo Island, *Casuarina stricta* is the predominant food source. They have also been observed eating *Angophora, Acacia* and *Eucalyptus* seeds. It now appears to supplement its diet with the seeds of exotic pine trees. A sign that foraging individuals have recently fed at a site is a scattering of leaves, twigs and freshly chewed cones under the (*Allo*)*Casuarina* trees. While feeding they are tame and relatively easy to approach. Flocks of Glossy Black-Cockatoos have been seen but are not common. They are usually seen in pairs or threes (being a pair and their young), or as feeding groups consisting of 10-12 birds that are likely to be loose family aggregations. Such groups seem to occupy an area permanently and have a distinctive flight pattern of slow, shallow wing-beats. Nesting takes place from March to August in the hollows of large Eucalypts, 10-20m above the ground, where a single egg is laid.

Distribution

The Glossy Black-Cockatoo inhabits Sclerophyll Forests and Woodlands of eastern Victoria to central Queensland, extending to the western slopes in New South Wales. A subspecies, *C. l. halmaturinus* exists on Kangaroo Island, South Australia.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been 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 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.

The Glossy Black Cockatoo was not observed within the study area during the survey. However a number of distinctively chewed cones from *Allocasuarina torulosa* (Forest Oak) trees, which is an indication of recent feeding by Glossy Black-Cockatoos were found on the ground in the area of open forest. Foraging habitat in the form of Forest Oak was confined to the area of open forest on the eastern shore of Bootawa Dam. No nesting habitat in the form of large suitable tree hollows was considered to be present.

The proposed raising of Bootawa Dam will require the removal of a small number of specimens of *A. torulosa* within the area of open forest resulting in a small incremental reduction of foraging habitat in the local area. No suitable nesting habitat is likely to be removed. Considering that foraging habitat will still remain within the study area and the fact that larger areas of suitable habitat occur within the local area the proposal is unlikely to result in the extinction of any local population of this mobile species.

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.

No 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.

No applicable.

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

It is proposed Bootawa Dam be raised 7m to increase its storage capacity from 2200 ML to 4500 ML. This action will require the removal of a small number of specimens of Forest Oak within the area of open forest resulting in a small incremental reduction of foraging habitat in the local area. No suitable nesting habitat is likely to be removed.

(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

Considering the mobility of this species no area of habitat is likely to become fragmented or isolated.

(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 proposal will result in the removal of a small amount of foraging habitat leading to a small incremental reduction in the local area. However it is unlikely that an area of habitat important to the long-term survival of the Glossy Black Cockatoo is likely to be removed, modified, fragmented or isolated as a result of the proposal.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for the Glossy Black Cockatoo. However the Department of Environment, Climate Change and Water has prepared Priority Action Statements (PAS) to promote the recovery of this species and the abatement of key threatening processes in NSW. The Priority Action Statements identified a number of broad strategies to help these species recover in NSW.

A total of 7 strategies have been identified to help recover this threatened species. Each of these strategies has a number of priority actions within it.

Community and land-holder liaison/ awareness and/or education –

- Increase landholder and public awareness and interest in Glossy Black Cockatoo conservation and habitat management.
- Utilise the Glossy Black Cockatoo as a flagship threatened species for woodland and forest conservation education and awareness programs.

Habitat management: Ongoing EIA - Advice to consent and planning authorities

- Develop/encourage strategic planning approach for Glossy Black Cockatoo at the local and regional level.
- Periodically review IFOA prescriptions to ensure adequate protection of nesting and foraging habitat.
- Prepare and distribute EIA guidelines to decision makers.

Habitat management: Site Protection (eg Fencing/Signage)

- Provide incentives for landholders to fence and manage key sites.

Habitat Protection

- Assist landholders who wish to enter into voluntary conservation agreements at key sites.

Habitat Rehabilitation/Restoration and/or Regeneration

- Encourage the restoration of foraging habitat that has been cleared or degraded by previous impacts.

Monitoring

- Continue existing monitoring programs (e.g. Goonoo population) and encourage other community groups to develop a monitoring program of local populations.

Survey/Mapping and Habitat assessment

- Identify and map key breeding and foraging habitat.

The proposal is unlikely to significantly compromise these priority actions developed to assist the recovery of the Glossy Black Cockatoo.

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 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of native vegetation within the study area may be viewed as being part of this Key Threatening Process.
- **Loss of Hollow-bearing Trees***:* No suitable nesting trees are likely to be removed as a result of the proposal.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the study area.
- **Competition from feral honeybees *Apis mellifera:* T**he Feral Honeybee has the potential to occupy potential nesting hollows.
- **Predation by the Feral Cat *Felis catus*:** The Feral Cat was not recorded during the survey, however would have some impact on native fauna in the local area. The proposal is unlikely to lead to an increase in feral cats.
- **Predation by the European Red Fox *Vulpes vulpes*:** Scats and paw prints consistent with those of the Red Fox were observed within the study area during the survey period. The proposal is unlikely to increase numbers of the European Red Fox.

Bibliography:

NPWS Database (2000). Fauna Species Lists for Protected Areas in NSW at

'http://www.nationalparks.nsw.gov.au'

NPWS (1999). Threatened Species Information – Glossy Black-Cockatoo, at 'www.nationalparks.nsw.gov.au'

Pizzey, G. & Knight, F. (1997). Field Guide to the Birds of Australia, Angus and Robertson, Sydney.

Reader's Digest (1982). The Complete Book of Australian Birds, Reader's Digest Services Pty. Ltd., Sydney.

Slater, P., Slater, P. & Slater, R. (1995). The Slater Field Guide to Australian Birds, Lansdowne Publishing Pty. Ltd., Sydney

3 *Phascolarctos cinereus* Koala

Description
The *Phascolarctos cinereus*(Koala) is the sole member of the family Phascolarctidae. It is an arboreal marsupial with large furry ears and a vestigial tail. The fur colour of the koala varies from pale grey in the northern parts of its range to grey-brown in the south.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements
The Koala is limited to areas where there are acceptable food trees. Its diet is generally restricted to that of Eucalypt leaves and much less-often, non-Eucalypt foliage. The foliage of *Eucalyptus camaldulensis* (River Red Gum), *E. tereticornis* (Forest Red Gum), *E. punctata* (Grey Gum), *E. viminalis* (Manna Gum), and *E. robusta* (Swamp Mahogany) are some of the preferred Eucalypt species. Koalas use a wide variety of tree sizes, and do not preferentially use large or tall trees in NSW forests, although this has been listed as a habitat preference in areas where trees are generally small, stunted, or nutrient deprived.

Koalas sleep in the fork of a tree during the day and feed at night with the peak of activity just after sunset. It is generally a solitary animal with a social behaviour pattern that influences its breeding biology. Breeding biology of the Koala is characterised by the occurrence of discrete core breeding groups which are sedentary. A core group may comprise up to several dozen individuals that are usually well separated from other breeding groups. These core groups produce a continual supply of dispersing nomadic sub-adults. Individual Koalas within core breeding groups occupy semi-exclusive territories. There is interaction with and marginal overlap of territories between adjacent individual animals. The territories of breeding males generally occur within a matrix of adjacent territories of breeding females. In the overlap zones of adjacent territories of breeding Koalas, individual trees occur that are habitually used for interaction between the two animals concerned. These breeding core interaction trees (sometimes termed "home range trees") are readily identifiable by scratched "trails" up the bole and copious dung deposits at the base of the tree. Breeding occurs in summer and young females produce one young (rarely twins) each year.

Distribution
The Koala occurs along the east coast of Australia and extends into woodland, mulga and River Red Gum forests west of the Great Dividing Range. In drier forested areas, Koalas are generally observed as individuals in low densities. They are more abundant in coastal woodland and in open forest. They are rare or absent in wet forests in the south above 600 m which may be due more to distribution of Eucalypt species than climate.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been 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 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.

An individual Koala was observed whilst spotlighting on the eastern boundary of the study area next to the open forest assemblage. A skull belonging to a Koala was also found within the area of open forest inside the study area. Scratches consistent with those of the Koala were found on the boles of specimens of *Eucalyptus propinqua* (Small-fruited Grey Gum) and *Eucalyptus tereticornis* (Forest Red Gum). A number of Koala scats were also found at the base of a small number of these trees.

It is believed that Koalas regularly utilise the study area for foraging as part of a larger home range. It is likely that the Koala would only forage on two species of Eucalypt within the study area, *E. tereticornis* and *E. propinqua.* Of these two trees, only *Eucalyptus tereticornis* is recognised as a Koala Feed Tree species under SEPP 44. However *Eucalyptus propinqua,* is a known Koala Feed Tree species under the Draft Greater Taree City Council Comprehensive Koala Plan of Management (CKPoM). The mixed eucalypt plantation recently established on formerly cleared land around Bootawa Dam contains very young specimens of *Eucalyptus punctata* (Grey Gum) another listed Koala Feed Tree Species under SEPP 44 (Mid Coast Water, 2010). It is unknown if the local population of Koalas would forage on these particular trees when they become older.

The proposed raising of the dam will result in the removal of approximately 25 of the 59 Koala feed trees (*E. propinqua* & *E. tereticornis*) recorded within the study area. A small number of these trees particularly those occurring on the western side of the dam are isolated and less likely to be utilised by Koalas. This action will result in a small incremental decrease in Koala habitat in the local area. However considering the presence of larger areas of similar connecting open forest habitat to the east of the site and the fact many known Koala feed trees will remain within the study area as a result of the proposed raising of the dam the action is unlikely to have an adverse effect on the life cycle of the species such that the local population of Koalas may be placed at risk of extinction.

To reduce the impact of the proposal on the Koala it is recommended that additional specimens of *E. tereticornis* and *E. propinqua* be planted where possible around the dam to compensate those species that will be removed. Before any tree removal, trees will need to be inspected by a suitably qualified person on the day to prevent any avoidable harm to any Koalas that may be present. Any new fencing particularly along the eastern boundary will be required to allow the safe passage of Koalas to areas of habitat within the study area.

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.

Currently two populations of Koalas, the Hawks Nest/Tea Gardens and Pittwater Local Government Area populations are listed on the TSC Act. Neither of these populations is relevant to the study area.

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.

No applicable.

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 raising of Bootawa Dam will result in the inundation of approximately 20ha of land within the study area which is primarily composed of highly disturbed cleared grassland. However 25 of 59 Koala Feed Tree species recorded within the study area will also need to be removed. The majority of these trees occur within a 1ha area of open forest on the eastern side of Bootawa Dam. No areas of habitat occurring within the study area will become fragmented or isolated for Koalas provided no Koala exclusion fencing is used. This is particularly pertinent along the eastern boundary of the study area adjacent to the area of open forest. Considering the recommendations it is unlikely that the proposal will adversely affect the long-term survival of the Koala in the local area.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

A Recovery Plan has been completed for the Koala (DECC, 2008). A number of recovery actions have been developed for each of the specific objectives, each with a performance criterion or criteria, and in most cases these actions address the broad actions of the National Koala Conservation Strategy.
Objective 1: To conserve koalas in their existing habitat.
Objective 2: To rehabilitate and restore koala habitat and populations.
Objective 3: To develop a better understanding of the conservation biology of koalas.
Objective 4: To ensure that the community has access to factual information about the distribution, conservation and management of koalas at a national, state and local scale.
Objective 5: To manage captive, sick or injured koalas and orphaned wild koalas to ensure consistent and high standards of care.
Objective 6: To manage overbrowsing to prevent both koala starvation and ecosystem damage in discrete patches of habitat.
Objective 7: To coordinate, promote the implementation, and monitor the effectiveness of the NSW Koala Recovery Plan across NSW.

The proposal is unlikely to significantly compromise these actions developed to assist the recovery of the Koala.

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 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of native vegetation containing suitable feed tree species may be viewed as being part of this Key Threatening Process.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the study area.
- **Predation by the Feral Cat *Felis catus*:** The Feral Cat was not recorded during the survey, however would have some impact on native fauna in the local area. The proposal is unlikely to lead to an increase in feral cats.

- **Predation by the European Red Fox *Vulpes vulpes*:** Scats and paw prints consistent with that of the Red Fox were observed within the study area during the survey period. The proposal is unlikely to increase numbers of the European Red Fox.

Bibliography:

Australian Koala Foundation (1996). *The Koala Habitat Atlas - Project No 6: Port Stephens Local Government LGA*. Draft Report prepared for Port Stephen Council.

Berghout, M. J. (1993). Ecology of the Koala (*Phascolarctos cinereus*) on Tilligerry Peninsula, NSW: Tree species selection and foliage composition. Thesis submitted to the Department of Biological Sciences, University of Newcastle, November 1993.

Callaghan, J., Leathley, S. and Lunney, D. (1994). Port Stephens Koala Management Plan Draft for Public Discussion, 27th September 1994. Port Stephens Council, NSW.

Martin, R.W. and Handasyde, K.A. (1995). Koala (*Phascolarctos cinereus*). In: The Mammals of Australia, pp: 196-8. Strahan, R. (Ed). Reed Books, Sydney.

NPWS. (2003). Atlas of NSW Wildlife, at http://www.nationalparks.nsw.gov.au

Department of Environment and Climate Change NSW (2008). *Recovery plan for the koala (Phascolarctos cinereus)*. Department of Environment and Climate Change NSW

Greater Taree City Council. (2002). *Greater Taree City Council Draft Comprehensive Koala Plan of Management – Part 1: The CKPoM*. Prepared September 2002.

Reed, P.C., Lunney, D. and Walker, P. (1990). A 1986-1987 Survey of the Koala *Phascolarctos cinereus* (Goldfuss) in New South Wales and an Ecological Interpretation of its Distribution. In: Lee, A.K., Handasyde, K.A. and Sanson, G.D. (Eds). Biology of the Koala, Surrey Beatty and Sons Pty Ltd.

Triggs, B. (1996). Tracks, Scats and Other Traces: a Field Guide to Australian Mammals. Oxford University Press, Australia.

Wilks, D. (1989). The Feeding Ecology of the Koala, *Phascolarctos cinereus*, in the Tomago Sandbeds area, NSW. Honours Thesis, University of Newcastle, NSW.

4 *Pteropus poliocephalus* Grey-headed Flying-fox

Description
The Grey-headed Flying-fox is a large species of megachiropteran bat which possess a mantle of rusty brown fur that full encircles the neck. The fur on the back is dark grey and as the common name suggests, the head is covered with light grey fur. The grey belly fur is often flecked with white and ginger. The fur extends down the legs to the toes. which contrasts with other *Pteropus* species, which are furred only to the knees. This species weighs up to a kilogram and has a forearm length of up to 180mm.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Listed as Vulnerable.

Habitat Requirements and Ecology
Grey-headed Flying-foxes are known to occupy a variety of habitats, including wet and dry sclerophyll forests, rainforest, mangroves and paperbark swamps and *Banksia* woodlands. Here they forage on a range of fruits and blossoms. Their diet is so varied that they have been recorded eating the fruit or blossom of more than 80 species of plant. The predominant food source is Eucalypt blossom and fruits from trees such as *Ficus* spp. (Figs). It is likely to act as an important pollinator for many of the trees on which they utilise blossoms. They also inhabit cultivated areas where they feed on introduced trees including commercial food crops, and can become a 'pest' animal in these areas. Ironically, this has led to this species being the most intensively researched bat in Australia.

As with most species of Flying-fox, *P. poliocephalus* roost communally where they form large communal colonies called 'camps'. Camps are mostly in rainforest patches, mangroves, paperbark forests and modified vegetation in urban areas. These camps may contain thousands of individuals, and up to 200 000 individuals have been recorded at one camp. They may move up to 70km from the camp each night to forage. Young are raised in maternity camps after birthing in September to October. The young are able to fly at 3 months of age and puberty is reached at 18 months, although males do not achieve effective fertility until 30 months. Vocal communication is highly sophisticated, with over 20 different situation-specific calls being recorded. Recently, it has been identified as being a potential carrier of viral pathogens, such as Lyssa-virus.

Distribution
The Grey-headed Flying-fox is distributed predominantly along the sub-tropical east coast, from Rockhampton (Qld) through NSW to SE Victoria.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been 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 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.

A number of specimens of *P. poliocephalus* were observed whilst spotlighting within the open forest assemblage foraging on flowering Ironbark trees. These Grey-headed Flying-foxes are likely to originate from the large Flying Fox camp at Wingham Brush Nature Reserve to the north of the study area. The study area contains suitable foraging habitat for the Grey-headed Flying-fox in the form of seasonally flowering myrtaceous species. No suitable roosting camps were considered to be present. The proposal will result in the removal of a small amount of foraging habitat, which may be seen as an incremental loss of habitat within the locality, however it is considered that the proposal is unlikely to cause extinction of the local population of this mobile species.

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.

Not applicable.

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 raising of Bootawa Dam will result in the removal of approximately 1ha of open forest and 0.7ha of moist regrowth scrub within the study area. No areas are likely to become fragmented or isolated for this highly mobile species. As only a relatively small amount of foraging habitat will be removed it is unlikely that the proposal will adversely affect the long-term survival of the Grey-headed Flying-fox in the local area.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

A Recovery Plan has been completed for the Grey-headed Flying-fox. The plan recommends the retention of as many foraging species as possible. The proposal is not considered to compromise this recovery plan.

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 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of native vegetation is a key threat to the Grey-headed Flying Fox. The removal of vegetation for the raising of the dam is not considered to be significant in relation to the Grey-headed Flying-fox.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused to the study area. The proposal is unlikely to result in any change to the fire frequency within the study area.
- **Predation by the European Red Fox *Vulpes vulpes:*** The European Red Fox would rarely come into contact with this species of flying-fox. There is the potential of the predation of young that have fallen to the ground particularly within campsites. The European Red Fox would have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in fox numbers.
- **Predation by the Feral Cat *Felis catus*:** The Feral Cat would rarely come into contact with this species of flying-fox. There is the potential of the predation of young that have fallen to the ground particularly within campsites. The Feral Cat was not observed within the study area during the survey however, would have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in feral cat numbers.

Bibliography:

Augee, M.L. and Ford, D. (1999). *Radio-tracking studies of Grey-headed Flying-foxes Pteropus poliocephalus, from the Gordon colony, Sydney*. Proceedings of the Linnaean Society of NSW, Vol. 121, pp 61-70.

Churchill, S. (2008). *Australian Bats*. Allen & Unwin, Crows Nest, Australia.

Eby, P. (2000). The results of four synchronous assessments of relative distribution and abundance of Grey-headed Flying-fox *Pteropus poliocephalus* in Richards, G. and Hall, L. (Eds). *Proceedings of a Workshop to Assess the Status of the Grey-headed Flying-fox*, Australasian Bat Society, Canberra.

Hall, L.S. and Richards, G. (2000). *Flying Foxes: Fruit and Blossom Bats of Australia*, UNSW Press, Sydney.

NPWS Database (2000). *Fauna Species List for Protected Areas in NSW* at http://www.npws.gov.au/wildlife/species.htm

Tidemann, C.R. (1995). *Grey-headed Flying-fox (Pteropus poliocephalus) in Strahan, R. (ed*) *The Mammals of Australia*, pp 439-441 Australian Museum / Reed Books.

Webb, N. and Tidemann, C.R. (1995). *Hybridisation between Black (Pteropus alecto) and Grey-headed (P. poliocephalus) Flying-foxes in Australian Mammalogy*, Vol 18, pp 19-26.

5 *Vespadelus troughtoni* Eastern Cave Bat

Description
Vespadelus troughtoni (Eastern Cave Bat) is a small bat with light brown fur on its back and ginger tips mainly around the head. Fur on the belly is dark at the base with light fawn tips.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology
It is a cave-dweller, known from wet sclerophyll forest and tropical woodlands from the coast and Dividing Range to the drier forests of the semi-arid zone. It has been found roosting in small groups in sandstone overhangs, in mine tunnels and occasionally in buildings. In all situations, the roost sites are frequently in reasonably well-lit areas. Single-sex colonies varying in size from 6 to 50 individuals are more commonly recorded; however a large colony of 500 individuals of equal sex ratio has been recorded in a mine. Little is known of its diet and hunting behaviour. Similarly, information on reproductive activities is limited to the noted capture of lactating females in December in the Atherton Tablelands.

Distribution
Although it is widely distributed, relatively few records of this species exist, particularly in the southern part of its range where it appears to be localised. The main population stretches from Cape York south to the mid-north coast of NSW.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been 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 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.

Due to the similarity of calls within the genus Vespadelus, *Vespadelus troughtoni* was regarded under the precautionary principle as present within the study area during the survey. The majority of the study area provided hunting habitat for this species of microchiropteran bat. Roosting habitat in the form of caves or similar man made structures was absent. As no significant hunting or roosting habitat will be affected the proposal is unlikely to disrupt the life cycle of this microchiropteran bat species such that local extinction would occur.

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.

No 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.

No applicable.

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 proposal will only result in the modification of a very small amount of hunting habitat. No areas are likely to become fragmented or isolated for this mobile species. As no preferred roosting habitat and only a relatively small amount of hunting habitat would be modified it is unlikely that the proposal will adversely effect the long-term survival of this species in the local area.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for this microchiropteran bat species. However DECCW has prepared Priority Action Statements (PAS) to promote the recovery of this species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help these species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for these species.

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 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of vegetation for the proposal is unlikely to result in a significant loss of habitat for these species.
- **Predation by the European Red Fox *Vulpes vulpes:*** Scats and footprints consistent with the European Red Fox were observed within the site. This fox species would have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in fox numbers.
- **Predation by the Feral Cat *Felis catus*:** The Feral Cat was not observed within the site during the survey period although it would be considered likely to be having some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.

Bibliography:

Churchill, S. (1998). Australian Bats. Reed New Holland Publishers, Sydney, Australia.

NPWS. (2003). Atlas of NSW Wildlife, at 'www.nationalparks.nsw.gov.au'.

6 *Diuris flavescens* Pale Yellow Doubletail

Description
Diuris flavescens (Pale Yellow Doubletail) is a ground orchid belonging to the Doubletail, or Donkey Orchid, group. It has two leaves to 17 cm long, at the base of the plant. The plant produces a 20 cm flowering stem with up to six flowers. The mustard-yellow and brown flowers overlap vertically and are about 16 mm across. They have the typical yellow 'donkey ear' sepals bent back at the top, and narrow, darker sepals crossed below the flower forming the 'doubletail'. An upper sepal projects over the flower like a veranda and has two brown markings, while the lower tongue-like petal has a slight ridged fold down its centre.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Critically Endangered under schedule 2.

Habitat Requirements and Ecology
Grows in tall eucalypt forest with Kangaroo Grass and Bladey Grass river flats on brown clay soil. It flowers in spring from September to October.

Distribution
It is currently known from only 1 population, in the Wingham area. A total of less than 50 plants is known and none occur in a reserve.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been 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.

Diuris flavescens (Pale Yellow Doubletail) was not recorded within the study area during fieldwork. This survey was undertaken outside the known flowering period for *D. flavescens* (September – October) and would be not likely be recorded if present. Suitable habitat was considered to be present within the area of open forest to the east of the dam. However this orchid species is only known from one location near Wingham and has not been reported within the immediate vicinity of Bootawa Dam. The proposal will result in the removal of approximately 1ha of potential open forest habitat adjacent to Bootawa Dam however is unlikely to result in the extinction of any local population of this orchid species.

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.

Not applicable.

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.

Up to 1ha of potential habitat in the form of open forest may be removed as a result of the proposal. No known habitat will be fragmented or isolated. It is unlikely that habitat important to the long-term survival of *D. flavescens* will be removed, modified, fragmented or isolated as a result of the raising of Bootawa Dam.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for this threatened orchid species. However DECCW has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help this flora species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for this species.

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 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of vegetation from within the study area is not considered to be significant in relation to this orchid species.
- ***Lantana camara* -** Lantana was found to be present within the site. It is recommended that Lantana be managed within the study area.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** The European Rabbit was recorded within the study area. The proposal is unlikely to result in a significant increase in Rabbit numbers.
- **Invasion of native plant communities by exotic perennial grasses:** Introduced grasses such as *Andropogon virginicus* (Whisky Grass) were present within the study area. Introduced grasses have the potential to further invade the site. It is unlikely that the proposal will further exacerbate invasion by exotic grasses.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the site.

Bibliography:

Jones, D,.J. (2006). *A Complete Guide to Native Orchids of Australia including the Island Territories.* New Holland Publishers Australia Pty Ltd.

NSW Scientific Committee (1998) *Diuris flavescens* (a terrestrial orchid) - Endangered species determination - final. DEC (NSW), Sydney.

7 *Eucalyptus glaucina* Slaty Red Gum

Description
Eucalyptus glaucina (Slaty Red Gum) is a small to medium-sized woodland tree, often to 18 m and sometimes to 30 m high. The bark is smooth throughout, white or grey. Juvenile leaves are ovate, pale green or glaucous and slightly discolorous. Adult leaves are lanceolate to broadly lanceolate, acuminate and moderately thick. Fruits are hemispherical or ovoid, 7-10mm long, 7-10mm wide; disc broad, ascending; valves 3-5. The seeds are brown-black.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Vulnerable
ROTAP-coded 3VCa

Habitat Requirements and Ecology
It grows mostly on gentle slopes near drainage lines in alluvial and clayey soils, in open forest. It is closely aligned with *E. tereticornis* (Forest Red Gum), but distinguished by the glaucous buds.

Distribution
The Slaty Red Gum principally occurs in the Casino area in northern NSW and from Gloucester to Broke, in mid-northern NSW.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been 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 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.

Despite targeted searches *Eucalyptus glaucina* was not recorded within the study area. A number of specimens of the Red Gum species *Eucalyptus tereticornis* (Forest Red Gum) were present although none of the trees inspected had glaucous leaves or buds. Areas of suitable habitat were considered to be present around Bootawa Dam however the majority of the study area was highly disturbed with large areas covered in a relatively new plantation. The proposal may result in the removal of a relatively small amount of suitable habitat, however it is unlikely to have an adverse effect on the life cycle of *E. glauca* such that a viable local population is likely to be placed at risk of extinction.

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.

Not applicable.

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 raising of Bootawa Dam will result in the inundation of approximately 20ha of land within the study area including a small amount of habitat suitable for *E. glaucina*. No known habitat will be fragmented or isolated. It is unlikely that any habitat important to the long-term survival of *E. glaucina* will be removed, modified, fragmented or isolated as a result of the raising of Bootawa Dam.

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

Not applicable.

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

No Recovery or Threat Abatement Plan has been developed for this eucalypt species. However DECCW has prepared Priority Action Statements (PAS) to promote the recovery of this species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help this species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for this species.

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 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the study area and subject site for this species have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal.

Clearing of Native Vegetation: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of remnant vegetation on site for the proposal is likely to result in a small incremental reduction of habitat in the local area for this species and may be viewed as being part of this Key Threatening Process however is unlikely to be significant.
High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the site.
***Lantana camara* -** Infestations of Lantana were found to be present within the study area. There is the potential for further infestation of Lantana within the study area.
Invasion of native plant communities by exotic perennial grasses: This threatening process is already present with a number of introduced grasses such as *Andropogon virginicus* (Whisky Grass) and *Axonopus affinis* (Narrow-leaved Carpet Grass).
Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*: The European Rabbit was recorded within the study area during the survey. The proposal is unlikely to significantly increase Rabbit numbers.

Bibliography:
Brooker, M.I.H and Kleining, D.A. (1983). Field Guide to the Eucalypts of South-eastern Australia.

Inkata Press, Sydney.

Carolin, R.C. and Tindale, M.D. (1993). Flora of the Sydney Region (4th edn.). Reed, Sydney.

Department of Environment and Climate Change (DECC) NSW 2005, *Threatened Species Information Slaty Red Gum.*

Harden, G. (ed) (1991). *Flora of NSW - Vol 2.* New South Wales Uni Press, Sydney.

8 *Melaleuca Biconvexa* Biconvex Paperbark

Description
Melaleuca. biconvexa (Biconvex Paperbark) is a shrub to small tree with papery bark which flowers in summer.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.
ROTAP – 2V

Habitat Requirements and Ecology
It may occur in dense stands adjacent to watercourses, in association with other *Melaleuca* species or as an understorey species in wet forest. Present populations are threatened by land clearing, filling, excavation for construction of floodwater detention basins and alteration to water tables. This species is not ROTAP-listed.

Distribution
Melaleuca biconvexa occurs in disjunct populations in coastal NSW from Jervis Bay to Port Macquarie with the main concentration of records in the Gosford/Wyong Area.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been 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 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.

Despite targeted searches *Melaleuca biconvexa* (Biconvex Paperbark) was not recorded within the study area. Marginal habitat was considered to be present within the small areas of moist regrowth scrub. Few records of *M. biconvexa* occur in the local area. The proposal may result in the removal of a small amount of marginal habitat however it is unlikely to have an adverse effect on the life cycle of this paperbark species such that a viable local population is likely to be placed at risk of extinction.

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.

Not applicable.

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 raising of Bootawa Dam will result in the inundation of approximately 20ha of land within the study area including a small amount of marginal habitat suitable for *M. biconvexa*. No known habitat will be fragmented or isolated. It is unlikely that any habitat important to the long-term survival of *M. biconvexa* will be removed, modified, fragmented or isolated as a result of the raising of Bootawa Dam.

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

Not applicable.

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

No Recovery or Threat Abatement Plan has been developed for this paperbark species. However DECCW has prepared Priority Action Statements (PAS) to promote the recovery of this species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help this species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for this species.

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 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the study area and subject site for this species have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal.

Clearing of Native Vegetation: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of remnant vegetation on site for the proposal is likely to result in a small incremental reduction of habitat in the local area for this species and may be viewed as being part of this Key Threatening Process however is unlikely to be significant.
High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the site.
***Lantana camara* -** Infestations of Lantana were found to be present within the study area. There is the potential for further infestation of Lantana within the study area.
Invasion of native plant communities by exotic perennial grasses: This threatening process is already present with a number of introduced grasses such as *Andropogon virginicus* (Whisky Grass) and *Axonopus affinis* (Narrow-leaved Carpet Grass).
Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*: The European Rabbit was recorded within the study area during the survey. The proposal is unlikely to significantly increase Rabbit numbers.

Bibliography:

Carolin, R.C. and Tindale, M.D. (1993). Flora of the Sydney Region (4th edn.). Reed, Sydney.

Harden, G. (ed) (1991). *Flora of NSW - Vol 2.* New South Wales Uni Press, Sydney.

NSW Scientific Committee (1998). Final Determination to list *Melaleuca biconvexa* as a Vulnerable Species, at 'http://www.nationalparks.nsw.gov.au'.

Robinson, L. (2003). *Field Guide to the Native Plants of Sydney* (3rd edn.). Kangaroo Press Pty. Ltd., New South Wales.

9 *Asperula asthenes* Trailing Woodruff

Description
Asperula asthenes, of the family Rubiaceae, is a decumbent perennial herb with weak, trailing stems to 30cm long. The leaves and stipules occur irregularly in whorls of 4 and range from linear to oblanceolate to narrow elliptic (Harden, 1992). The leaves are generally 10-20mm long. The flowers are small, white and occur in terminal cymes, typical of the *Asperula* genus.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.
ROTAP-coded 3VC-.

Habitat Requirements and Ecology
Asperula asthenes inhabits damp sites, often along river banks. This species flowers in spring.

Distribution
Asperula asthenes ranges from approximately Taree to Bulahdelah. Populations are known to be protected on the Wallis Island Nature Reserve.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been 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.

Despite targeted searches *Asperula asthenes* (Trailing Woodruff) was not recorded within the study area. Limited habitat was considered to be present within the small areas of moist regrowth scrub. The proposal may result in the removal of a small amount of marginal habitat however it is unlikely to have an adverse effect on the life cycle of this species such that a viable local population is likely to be placed at risk of extinction.

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.

Not applicable.

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 raising of Bootawa Dam will result in the inundation of approximately 20ha of land within the study area including a small amount of marginal habitat suitable for *A. asthenes.* No known habitat will be fragmented or isolated. It is unlikely that any habitat important to the long-term survival of *A. asthenes* will be removed, modified, fragmented or isolated as a result of the raising of Bootawa Dam.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for this flora species. However DECCW has prepared Priority Action Statements (PAS) to promote the recovery of this species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help this species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for this species.

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 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the study area and subject site for this species have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal.

Clearing of Native Vegetation: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of remnant vegetation on site for the proposal is likely to result in a small incremental reduction of habitat in the local area for this species and may be viewed as being part of this Key Threatening Process however is unlikely to be significant.
High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the site.
***Lantana camara* -** Infestations of Lantana were found to be present within the study area. There is the potential for further infestation of Lantana within the study area.
Invasion of native plant communities by exotic perennial grasses: This threatening process is already present with a number of introduced grasses such as *Andropogon virginicus* (Whisky Grass) and *Axonopus affinis* (Narrow-leaved Carpet Grass).
Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*: The European Rabbit was recorded within the study area during the survey. The proposal is unlikely to significantly increase Rabbit numbers.

Bibliography:

Briggs, J.D. and Leigh, J.H. (1995). *Rare or Threatened Australian Plants*. CSIRO Publishing, Victoria.

Carolin, R.C. and Tindale, M.D. (1993). *Flora of the Sydney Region* (4th edn.). Reed, Sydney.

Harden, G. (ed) (1992). Flora of NSW - Vol 3. New South Wales Uni Press, Sydney.

10 *Cynanchum elegans* White-flowered Wax Plant

Description
Cynanchum elegans (White-flowered Wax Plant) a member of the Asclepiadaceae family is an evergreen vine which grows to 10m in length. The stems and branches are corky. The leaves are opposite.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Endangered under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Endangered.
ROTAP – 3ECi

Habitat Requirements and Ecology
This climber grows mainly in dry vine thickets on richer clay-shales and fertile volcanic soils. Has also been recorded in littoral rainforests, open forest and on sand. It flowers in summer (November – March) producing clusters of white, tubular and lobed flowers.

Distribution
Cynanchum elegans is endemic to New South Wales and occurs from Gloucester to the Illawarra.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been 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 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.

Despite targeted searches *Cynanchum elegans* (White-flowered Wax Plant) was not recorded within the study area. Suitable habitat was considered to be present within the small areas of moist regrowth scrub and open forest however few local records of this species are known. The proposal may result in the removal of a small amount of marginal habitat however it is unlikely to have an adverse affect on the life cycle of this species such that a viable local population is likely to be placed at risk of extinction.

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.

Not applicable.

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 raising of Bootawa Dam will result in the inundation of approximately 20ha of land within the study area including a small amount of marginal habitat suitable for *C. elegans.* No known habitat will be fragmented or isolated. It is unlikely that any habitat important to the long-term survival of *C. elegans* will be removed, modified, fragmented or isolated as a result of the raising of Bootawa Dam.

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

Not applicable.

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

No Recovery or Threat Abatement Plan has been developed for this flora species. However DECCW has prepared Priority Action Statements (PAS) to promote the recovery of this species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help this species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for this species.

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 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the study area and subject site for this species have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal.

Clearing of Native Vegetation: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of remnant vegetation on site for the proposal is likely to result in a small incremental reduction of habitat in the local area for this species and may be viewed as being part of this Key Threatening Process however is unlikely to be significant.
High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the site.
***Lantana camara* -** Infestations of Lantana were found to be present within the study area. There is the potential for further infestation of Lantana within the study area.
Invasion of native plant communities by exotic perennial grasses: This threatening process is already present with a number of introduced grasses such as *Andropogon virginicus* (Whisky Grass) and *Axonopus affinis* (Narrow-leaved Carpet Grass).
Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*: The European Rabbit was recorded within the study area during the survey. The proposal is unlikely to significantly increase Rabbit numbers.

Bibliography:

Briggs, J.D. and Leigh, J.H. (1995). Rare or Threatened Australian Plants. CSIRO Publishing, Victoria.

Carolin, R.C. and Tindale, M.D. (1993). Flora of the Sydney Region (4th edn.). Reed, Sydney.

Fairley, A. (2004). *Seldom Seen, Rare Plants of Greater Sydney*. New Holland Publishers (Australia) Pty Ltd.

Harden, G. (Ed) (1992). Flora of NSW - Vol 3. New South Wales Uni Press, Sydney.

Fauna species considered to have potential habitat within the study area

11. *Litoria aurea* Green and Golden Bell Frog

Description
The Green and Golden Bell Frog belonging to the Tree Frog Family Hylidae is a relatively large robust frog with a variable dorsal colouration of vivid pea green splotched with almost a metallic brass brown or gold. Adult size ranges from approximately 45mm to 100mm long (Department of Environment and Conservation NSW, 2005). Males are generally smaller than females.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Endangered under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Listed as Vulnerable.

Habitat Requirements and Ecology
This frog species inhabits swamps, lagoons, streams and ponds as well as dams, drains and storm water basins. The Green and Golden Bell Frog is a summer breeder and voraciously cannibalistic. The males call from August through to January using a distinctive four part call: "crawk-awk, crawk, crok, crok". The common name of *L. aurea* is derived from its body colouration described as being dull olive to bright emerald green above with blotches of brown or golden-bronze.

Distribution
Litoria aurea was formerly known to inhabit the eastern seaboard of New South Wales and Victoria from Byron Bay through to the Gippsland Lake Region as well as highland sites (New England District, south-western slopes of N.S.W. and Monaro District). Recent literature indicates that the northern and southern distribution limits have not changed, however, *L. aurea* is no longer found on sites above an altitude of 300m above sea level.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been 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 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.

Litoria aurea (Green and Golden Bell Frog) was not recorded within the study area despite targeted surveys under favourable conditions. Few recent local records exist for this frog species. Suitable habitat was considered to be present around Bootawa Dam particularly within the areas of emergent aquatic vegetation. The raising of Bootawa Dam is not likely to result in any net loss of suitable habitat for the Green and Golden Bell Frog. Considering the fact that few recent records of this species exist in the local area the proposal is unlikely to cause extinction of any local population of this frog species.

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.

Not applicable.

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 raising of Bootawa Dam is not likely to result in any net loss of suitable habitat for the Green and Golden Bell Frog. It is expected that similar habitat will be available at the new high water level. No areas of known habitat are likely to become fragmented or isolated as a result of the action. As the Green and Golden Bell Frog has not been recorded within the study area during the survey or within recent times in the local area it is considered that no areas of habitat important to the long-term survival of this frog species will be removed, modified, fragmented or isolated.

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

To date no Critical Habitat, as defined under Part 3 of the TSC Act has not been declared for the Green and Golden Bell Frog.

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

A Draft Recovery Plan has been developed for the Green and Golden Bell Frog. Objectives include:

- To avoid direct impacts and retain habitat;
- Minimise impacts where ever possible;
- Mitigate or ameliorate impacts; and as a last resort;
- Compensate or offset for any unavoidable impacts.

Given similar habitat will remain around Bootawa Dam it is considered that the proposal will not significantly conflict with this draft recovery plan.

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 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to this site and species have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of remnant vegetation within the study area may be viewed as being part of this Key Threatening Process however is unlikely to be significant in relation to this frog species.
- **Predation by *Gambusia holbrooki* (Plague Minnow):** This species of fish was observed within Bootawa Dam and would be likely to have some impact on frog populations in the local area. The proposal is not likely to further exacerbate the predation of this fish on frog eggs and tadpoles.
- **Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis:** It is possible that this fungus has an impact on frogs in the local area. However the proposal is unlikely to have any impact on this threatening process.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the study area.
- **Human-caused Climate Change**: Has the potential to have an adverse effect on these frog species. The proposal is unlikely to significantly contribute to Climate Change.
- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands:** The proposed raising of Bootawa Dam is unlikely to have any significant change to the natural flow of the local drainage line the dam is contained within.

Bibliography:

Barker, J., Grigg, G.C. & Tyler, M.J. (1995). A Field Guide to Australian Frogs. Surry Beatty & Sons, Norton, NSW.

Cogger, H.G. (1996). Reptiles and Amphibians of Australia. (5th edn) Reed Books, Victoria.

Department of Environment and Conservation NSW (2005). *Draft Recovery Plan for the Green and Golden Bell Frog (Litoria aurea)*. DEC NSW, Hurstville, NSW.

Ehmann, H. (Ed) (1997). Threatened Frogs of New South Wales: Habitats, Status and Conservation. Frog and Tadpole Study Group of NSW.

Mahony, M. (2010). *What has happened to the Green and Golden Bell Frog?* Article in "The Star", Newcastle and Lake Macquarie Community Newspaper, 13 March 2010.

NPWS Database (2000). Fauna Species Lists for Protected Areas in NSW, at http://www.nationalparks.nsw.gov.au

Robinson, M. (1996). A Field Guide to Frogs of Australia. Reed Books Australia, Melbourne.

Tyler, M.J. (1992). Encyclopedia of Australian Animals: Frogs. Angus & Robertson, NSW.

12. Waterbirds

Rostratula benghalensis australis **Australian Painted Snipe**

Description

The Australian Painted Snipe is a medium-sized freshwater wader with a long bill that drops slightly at the tip. It is strongly patterned and has fairly short legs.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Vulnerable.

Habitat Requirements and Ecology

It is usually found in pairs, frequenting the margins of swamps and streams, chiefly those covered with low and stunted vegetation. It probes in mud along the shore to gather snails, water insects and aquatic plants. When flushed, it flies close to the ground, making for the nearest cover, and is then exceedingly difficult to flush again. The Painted Snipe appears to be nomadic, with movements mainly north in winter and south in summer. It requires shallow fresh water for breeding, though the nest is not deserted if the water dries up. Nests are usually in groups, and consist of a shallow depression in the ground, lined with grass or leaves and frequently sheltered by a low bush or tuft of grass. Nests have been recorded at a density of 24 nests/ha but other smaller colonies have had distances of 15-50 m between nests.

Distribution

The better watered areas of Eastern Australian.

Botaurus poiciloptilus **Australasian Bittern**

Description

The Australasian Bittern is a large, stocky heron-like water bird with a long thin neck and long straight bill.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology

The Australasian Bittern lives alone or in loose groups and favours permanent fresh-waters with tall dense vegetation dominated by sedges, rushes, reeds or cutting grasses (eg. Phragmites, Scirpus, Eleocharis, Juncus, Typha, Baumea and Gahnia). Breeding is sometimes loosely colonial but in other cases pairs have been observed to maintain territories when several are present in a reedbed. The Australasian Bittern feeds on insects, small fish, eels, frogs and other aquatic life, sometimes in ricefields. It is partly nocturnal in habits, and, keeping as it does to the depths of reedy swamps, is seldom seen during the day unless flushed. The breeding season is from October to January and it is during this time that the distinct 'booming' calls can be heard.

Distribution

Within Australia, the Australasian Bittern occurs in the south-east and south-west, as well as in Tasmania and is also known as a vagrant in the north-west of Australia. This species is probably sedentary in permanent habitat with possible regular short distance movements during winter and is occasionally irruptive following heavy rains and floods, or drought elsewhere.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been 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 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.

Neither the Australian Painted Snipe nor Australasian Bittern were recorded within the study area during fieldwork. Suitable habitat was considered to be present around the edge of Bootawa Dam for both of these species of waterbird. The Australasian Bittern would prefer the smaller areas of emergent vegetation in the form of Typha and Eleocharis which were more common along the southern shore of Bootawa Dam. The raising of Bootawa Dam is not likely to result in any net loss of suitable habitat for these mobile waterbirds. Similar habitat is likely to shift to the new high water mark. The proposal is therefore considered unlikely to cause extinction of any local population of these two species of waterbird.

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.

Not applicable.

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 raising of Bootawa Dam is not likely to result in any net loss of suitable habitat for either the Australian Painted Snipe or Australasian Bittern as similar habitat will be available at the new high water level. No areas of known habitat are likely to become fragmented or isolated for these mobile species. No potential habitat will be removed, fragmented or isolated as a result of the proposal that is important to the long-term survival of the Australian Painted Snipe or Australasian Bittern.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for The Australian Painted Snipe or Australasian Bittern. However DECCW has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help these species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for these species.

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 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of remnant vegetation within the study area may be viewed as being part of this Key Threatening Process however is unlikely to be significant in relation to these waterbird species.
- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands:** The proposed raising of Bootawa Dam is unlikely to have any significant change to the natural flow of the local drainage line the dam is contained within.

Bibliography:

Garnett, S.T. and Crowley, G.M. (2000). The Action Plan for Australian Birds 2000. Report to Environment Australia and Birds Australia, October 2000.

Geering, A., Agnew, L & Harding, S. (2008). *Shorebirds of Australia*. CSIRO Publishing, Australia.

Marchant, S. and Higgins, P.J. (Eds.) (1993). Handbook of Australian, New Zealand & Antarctic Birds: Volume 2 Raptors to Lapwings, Oxford University Press, Melbourne.

NPWS. (2003). Atlas of NSW Wildlife, at 'www.nationalparks.nsw.gov.au'.

Pizzey, G. & Knight, F. (1997). Field Guide to the Birds of Australia, Angus and Robertson, Sydney

Reader's Digest (1982). The Complete Book of Australian Birds, Reader's Digest Services Pty. Ltd., Sydney.

Slater, P., Slater, P. and Slater, R. (1997). The Slater Field Guide to Australian Birds, Lansdowne Publishing, Sydney.

13. Fruit-Doves

Ptilinopus magnificus **Wompoo Fruit-Dove**

Description

The Wompoo Fruit-dove is a large rainforest pigeon, almost twice the size of other coloured fruit-doves. It is up to 56 cm long, with a pale grey head shading into rich green back and wings. There is a broken yellow band across each wing. The breast and belly are plum-purple and the underparts are yellow.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not Listed.

Habitat Requirements and Ecology

This Fruit-Dove is a frugivorous Rainforest specialist inhabiting the canopy of Sub-tropical, Warm-temperate and Littoral Rainforests. Occasionally it will stray to fruiting trees outside of Rainforest areas. Breeding occurs between July and December and is linked to the fruiting cycles of favoured feed trees including Figs, Laurels, Myrtles and native Tamarind. The females lay one egg on a flimsy platform of vine tendrils on a slender horizontal branch. This species prefers relatively undisturbed to completely intact Rainforest.

Distribution

The Wompoo Fruit-Dove is distributed from Cape York (Qld.) along the coast and ranges south to the Hunter River (N.S.W.). The southern part of the species range has decreased, having once extended to the Shoalhaven River.

Ptilinopus regina **Rose-crowned Fruit-Dove**

Description

The Rose-crowned Fruit-doves is a small, colourful rainforest pigeon to 24 cm in length. Males have a rose crown edged with yellow, and the head and breast are blue-grey, spotted white. The upper parts are grey-green, the tail-tip yellow and the abdomen are orange. Females are mostly grey-green.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not Listed.

Habitat Requirements and Ecology

The Rose-crowned Fruit-Dove generally lives in Rainforest, though it also frequents nearby drier forests as well as Mangroves. It usually feeds on Figs or other fruit and berry-bearing trees. The breeding season is from October to February, with a flimsy nest being constructed of twigs on a scanty platform in a low tree or bush. A seasonal movement of birds from the southern end of the range to the north occurs in winter, whilst others have been found to move seasonally in relation to the availability of fruit, with distance and direction travelled varying from one year to the next. The call is a loud, explosive, repeated 'hookcoo' which becomes faster and on declining notes as a rapid 'coocoocoocoocoo'.

Distribution

The Rose-crowned Fruit-Dove occurs in Eastern Australia, from Cape York south to the vicinity of Port Stephens. Occasionally it extends into Victoria.

Ptilinopus superbus **Superb Fruit-Dove**

Description

The Superb Fruit-dove is a small pigeon, approximately 24 cm in length. The male is brightly coloured, with golden-green upperparts, a brilliant orange-vermilion neck, and a rich purple crown. The tail is short and tipped with white. The throat and breast are grey with a lilac tinge, and a broad black band on the lower breast separates the grey breast from the creamy-white belly and green

flanks. The female is light green on the back, has a small purple spot on the crown, and no dark breast band.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not Listed.

Habitat Requirements and Ecology
The Superb Fruit-Dove lives mainly in Rainforest but will feed in adjacent Mangroves or Eucalypt forest, venturing into coastal habitats at various times of the year, particularly during winter. Many winter-migrating birds in N.S.W often perish by flying into windows in residential areas (A. Morris, NSW FOC, pers. comm.). It usually feeds on Figs or other fruit-bearing trees. Breeding season is from October to February. The nest is usually a platform about 10cm in diameter, composed of a few twigs; built in a small tree on a horizontal fork, usually about 3 metres from the ground, and situated in Open Forest at the edge of scrub. The species may have one of the shortest nesting periods of any Pigeon, being perhaps no more than seven days. The call is a distinctive cooing, rising in pitch and volume to a loud and clear 'whoop, whoop'. Also gives a low 'oom' in a steady sequence.

Distribution
The Superb Fruit-Dove is quite common north of Cardwell, Queensland; becoming uncommon nomads or non-breeding migrants further south to the Hunter River, with rare sightings recorded south to Tasmania.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been 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 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.

Neither the Wompoo, Rose-crowned or Superb Fruit-Doves were recorded within the study area during the survey despite targeted and incidental searches. Despite the disturbance the small areas of moist regrowth scrub which contained a small number of rainforest species were considered to contain marginal foraging habitat for these Fruit-dove species. The raising of Bootawa Dam will result in the removal of approximately 1ha of moist regrowth scrub, however considering the lack of preferred habitat and the fact that the majority of this community will remain above the new high water mark it is considered that the proposal is unlikely to cause extinction of any local population of these three Fruit-Dove species.

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.

Not applicable.

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.

Approximately 0.7ha of moist regrowth scrub containing marginal foraging habitat will need to be removed to allow for the raising of Bootawa Dam. No areas of known habitat are likely to become fragmented or isolated for these mobile species. Therefore no potential habitat will be removed, fragmented or isolated as a result of the proposal that is important to the long-term survival of these three Fruit-dove species.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for the assessed Fruit-dove species. However DECCW has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help this species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for these species.

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 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of remnant vegetation within the study area may be viewed as being part of this Key Threatening Process however is unlikely to be significant in relation to these Fruit-dove species.
- **High frequency fire resulting in the disruption of life cycle processors in plants and**

animals and loss of vegetation structure and composition: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the site.

Bibliography:

Higgins, P.J. and Davies, S.J.J.F. (1996). Handbook of Australian, New Zealand and Antarctic Birds. Volume 3: Snipe to Pigeons, Oxford University Press, Melbourne.

Hunter Bird Observers Club (1999). Hunter Region of New South Wales: Annual Bird Report Number 6 (1998). HBOC Inc., August 1999.

NPWS. (2003). Atlas of NSW Wildlife, at 'www.nationalparks.nsw.gov.au'.

Recher, H.F., Date, E.M. and Ford, H.A. (1995). The Biology and Management of Rainforest Pigeons in N.S.W. Species Management Report No. 16. NSW National Parks and Wildlife Service.

Pizzey, G. & Knight, F. (1997). Field Guide to the Birds of Australia, Angus and Robertson, Sydney

Reader's Digest (1982). The Complete Book of Australian Birds, Reader's Digest Services Pty. Ltd., Sydney.

Recher, H.F., Date, E.M. and Ford, H.A. (1995). The Biology and Management of Rainforest Pigeons in N.S.W. Species Management Report No. 16. NSW National Parks and Wildlife Service.

14 Lorikeets and Parrots

Glossopsitta pusilla **Little Lorikeet**

Description

The Little Lorikeet is a small green bird with a black bill and red patch covering forehead/throat, but not ear-coverts. The eyes are orange yellow.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not Listed.

Habitat Requirements and Ecology

This Lorikeet species occurs in forests, woodlands, large trees within open country, timbered watercourses, shelterbelts and street trees. The Little Lorikeet nests in a small hollow within a eucalypt.

Distribution

This species is endemic to Australia and the main distribution of the Turquoise Parrot is in the grassy woodlands of the western slopes and tablelands from the Darling Downs in Queensland to northern Victoria, particularly along watercourses.

Lathamus discolor **Swift Parrot**

Description

The Swift Parrot is most closely related to Rosellas, though its habits are most closely aligned with those of the Lorikeets, which it also resembles morphologically. The main distinction of the Swift Parrot is the long red tail that is not found in Lorikeets, which generally have dumpier green tails.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Endangered under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Endangered.

Habitat Requirements

The Swift Parrot prefers Dry Sclerophyll Forest in Tasmania and Open Forest to Woodland in the north on the mainland. It has also been recorded utilising street trees and in parks and gardens. Swift Parrots forage on the nectar of Eucalypts, often in mixed flocks with Lorikeets. The preferred winter food species are *Eucalyptus sideroxylon* (Red Ironbark), *E. albens* (White Box), *E. ovata* (Swamp Gum), *E. robusta* (Swamp Mahogany) and *E. melliodora* (Yellow Gum) and have also been observed eating the seeds and flowers of *Xanthorrhoea* spp. (Grass Trees). They also feed on insects and their larvae, fruits, berries, seeds and vegetable matter. While feeding, individuals may be approached and watched from under the feed tree. When there is an abundance of food, large congregations of hundreds of birds may gather in noisy and crowded roosts. Nesting occurs from September to January in a hollow branch of Eucalypts and they return to the mainland during March and April.

Distribution

The species is patchily distributed within the south-eastern corner of mainland Australia and Tasmania. During winter the Swift Parrot inhabits mainland Australia from Adelaide (S.A.) through Victoria, and up the east coast to south-east Queensland, as well as visiting the south and central western slopes and the Riverina in N.S.W. The Swift Parrot returns to eastern Tasmania in spring to breed.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been 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 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.

Neither the Little Lorikeet or Swift Parrot were detected within the study area during the survey. It must be noted that the survey was carried out when the Swift Parrot is breeding in Tasmania. Suitable foraging habitat was considered to be primarily confined to the area of open forest on the eastern shore of Bootawa Dam. A small number of hollow-bearing trees were also considered to contain suitable nesting habitat for the Little Lorikeet. The proposal will result in a small loss of foraging habitat for both parrot species and a reduction in the number of potential nesting hollows for the Little Lorikeet. However the removal of habitat for the raising of Bootawa Dam is unlikely to result in the extinction of any local population of these bird species.

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.

Not applicable.

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 raising of Bootawa Dam will result in the removal of approximately 1ha of suitable foraging habitat in the form of open forest for both the Swift Parrot and Little Lorikeet. Approximately twelve hollow-bearing trees will also need to be removed. No areas of known habitat are likely to become fragmented or isolated for these mobile species. It is considered that no habitat will be removed that is important to the long-term survival of either the Swift Parrot or Little Lorikeet.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No State Recovery or Threat Abatement Plan has been developed for the Swift Parrot or Little Lorikeet. However DECCW has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help these species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for these species.

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 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of remnant vegetation within the study area may be viewed as being part of this Key Threatening Process however is unlikely to be significant in relation to these bird species.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the site.
- **Loss of Hollow-bearing Trees**: The proposal will result in the loss of up to one suitable nesting tree. However this loss is unlikely to be significant in relation to this species. It is recommended that potential nesting trees be felled under supervision by a suitably qualified and vaccinated person to reduce the impact on the Little Lorikeet.
- **Competition from feral honeybees *Apis mellifera:*** This species was not observed occupying tree hollows within the study area.
- **Removal of dead wood and dead trees:** Dead wood and a small number of dead trees will need to be removed as a result of the proposal. It is recommended that if any potential nesting trees are required to be felled then they be marked and their felling supervised by a suitably qualified and vaccinated person to reduce the impact on the Little Lorikeet.

Bibliography:

Forshaw, Joseph M. (1991). Australian Parrots (2nd Ed.), Ure Smith Press, Willoughby, NSW.

Pizzey, G. & Knight, F. (1997). Field Guide to the Birds of Australia, Angus and Robertson, Sydney.

Reader's Digest (1982). The Complete Book of Australian Birds, Reader's Digest Services Pty. Ltd., Sydney.

15 Woodland Birds

Anthochaera phrygia **Regent Honeyeater**

Description

The Regent Honeyeater is a medium distinctive, medium-sized, black and yellow honeyeater with a sturdy, curved bill. Adults weigh 35 - 50 grams, are 20 - 24 cm long and have a wings-pan of 30 cm. Its head, neck, throat, upper breast and bill are black and the back and lower breast are pale lemon in colour with a black scalloped pattern. Its flight and tail feathers are edged with bright yellow. There is a characteristic patch of dark pink or cream-coloured facial-skin around the eye.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Endangered under schedule 2. (Has been preliminary listed as Critically Endangered).
Environmental Protection and Biodiversity Conservation Act 1999 – Endangered.

Habitat Requirements and Ecology

It occurs in temperate woodlands and open forest, including forest edges. Seasonal movements appear to be dictated by the flowering of various species of Eucalypts that are characteristic of the dry forests and woodlands of south-eastern Australia. The Regent Honeyeater prefers to forage on large-flowered Eucalypts (e.g. *Eucalyptus sideroxylon*, *E. melliodora*, *E. albens, E. leucoxylon*), particularly where these trees grow in more productive areas and yield plentiful and predictable nectar flows. They also forage on mistletoe and *Banksia* flowers, and arthropods. In parts of coastal N.S.W. they are also attracted to stands of *Eucalyptus robusta* (Swamp Mahogany). Nests are constructed of strips of Eucalypt bark, dried grass and other plant material. They are placed in an upright fork 4 to 25m above ground, and 2-3 eggs are laid. Nesting occurs mainly between November and January, but breeding has been recorded in all months between July and February.

Distribution

It is nomadic, although it does seem to return to nesting areas sporadically. Small flocks regularly, sometimes annually, visit the northern tablelands and the north western and central western slopes of N.S.W. in the spring and summer. Individuals also appear on the N.S.W. coast at most times of year but primarily in winter.

Daphoenositta chrysoptera **Varied Sittella**

Description

The Varied Sittella is a small songbird with a sharp, slightly upturned bill, short tail, barred undertail, and yellow eyes and feet.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not Listed.

Habitat Requirements and Ecology

The Varied Sittella inhabits Eucalypt forests, woodlands, mallee orchards and golf courses. This species is not found in treeless deserts, open grasslands and heavier rainforests. It prefers rough-barked species and mature smoothed-barked gums with dead branches. The Varied Sittella feeds from arthropods gleaned from crevices and decorticating bark of standing live and dead trees.

Distribution

The Varied Sittella is sedentary and inhabits most of mainland Australia apart from those areas mentioned in the habitat requirements.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been 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 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.

Despite targeted and incidental searches neither the Regent Honeyeater or Varied Sittella were recorded within the study area during the survey. Suitable foraging and nesting habitat was confined to the area of open forest for the Varied Sittella. The area of open forest also contained limited foraging habitat for the Regent Honeyeater. Habitat was marginalised for the Regent Honeyeater due the lack of preferred foraging species and the fact that this species is usually found west of the Great Dividing Range. The proposed raising of Bootawa Dam may result in the removal of a small amount of habitat for these two bird species however is not likely to have an adverse effect on the life cycle of these mobile species such that a viable local population is likely to be placed at risk of extinction.

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.

Not applicable.

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 raising of Bootawa Dam will result in the removal of approximately 1ha of open forest within the study area. No areas are likely to become fragmented or isolated these this highly mobile species. As only a relatively small amount of foraging habitat will be removed it is unlikely that the proposal will adversely affect the long-term survival of these two bird species in the local area.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

A Recovery Plan has been completed for the Regent Honeyeater. The plan recommends the retention of preferred foraging and Mistletoe. The proposal will result in the removal of a small number of foraging species, however is unlikely to significantly compromise the Recovery Plan.

No Recovery or Threat Abatement Plan has been developed for the Varied Sittella. However DECCW has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help these species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for this bird species.

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 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of remnant vegetation within the study area may be viewed as being part of this Key Threatening Process however is unlikely to be significant in relation to these bird species.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the site.

Bibliography:

Department of Environment, Climate Change and Water (2010). *Varied Sittella (Daphoenositta chrysoptera) – Vulnerable species listing. NSW Scientific Committee – final determination.*

Nature Conservation Council (1999). Threatened Species Network - Regent Honeyeater Species Profile Sheet. http://nccnsw.org.au/member/tsn/context/profiles/22196.html

NPWS. (1999). Threatened Species Information – Regent Honeyeater, NPWS, Hurstville.

Pizzey, G. & Knight, F. (1997). Field Guide to the Birds of Australia, Angus and Robertson, Sydney

Reader's Digest (1982). The Complete Book of Australian Birds, Reader's Digest Services Pty. Ltd., Sydney.

Slater, P., Slater, P. and Slater, R. (1997). The Slater Field Guide to Australian Birds, Lansdowne Publishing, Sydney.

16 BIRDS OF PREY

Hieraaetus morphnoides **Little Eagle**

Description

The Little Eagle is a medium-sized (45-55 cm) bird of prey that occurs in two colour forms: either pale brown with an obscure underwing pattern, or dark brown on the upperparts and pale underneath, with a rusty head and a distinctive underwing pattern of rufous leading edge, pale 'M' marking and black-barred wingtips. Both forms have a black-streaked head with a slight crest, a pale shoulder band on the upperwings, a rather short and square-tipped barred tail, and feathered legs.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology

The Little Eagle occupies habitats rich in prey within open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used (Marchant and Higgins 1993; Aumann 2001a). For nest sites it requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring. Young fledge in early summer.

Distribution

The Little Eagle is distributed throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment (Marchant and Higgins 1993). It occurs as a single population throughout NSW.

Lophoictinia isura **Squared-tailed Kite**

Description

The Square-tailed Kite is a reddish, medium-sized, long-winged raptor. Adults have a white face with thick black streaks on the crown and finer streaks elsewhere. The saddle, rump and central upper tail coverts are blackish with grey-brown barring. The underparts are predominantly grey-brown with black tips on the grey, square-tipped tail and wing edges. A key character in flight is the long fingered, upswept wings with a large white patch at the base of the barred 'fingers'.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology

The Square-tailed Kite inhabits Open Forests and Woodlands, particularly those on fertile soils with abundant passerines. They may also range into nearby open habitats but not into extensive treeless regions. The Square-tailed Kite hunts mostly Passerines and foliage insects, though it also known to prey on mammals and lizards. Prey taken has also included fledging birds, insects and rabbits. Breeding occurs from July to February with an average clutch size of 3 eggs. Nests are built as a platform or bowl of sticks lined with green *Eucalyptus* leaves in forks or large horizontal branches of Eucalypts, *Angophora* or *Melaleuca* trees and may be used in successive years.

Distribution

This raptor is endemic to Australia and is widespread throughout the mainland (absent from Tasmania). The species is migratory throughout its range and is a spring-summer breeding migrant to south-eastern, southern and south-western Australia.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been 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 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.

Neither the Square-tailed Kite nor Little Eagle were recorded in or within the vicinity of the study area during fieldwork. Potential hunting habitat as part of a much larger hunting home range was present over the study area for both birds of prey. Nesting habitat was also be considered to be present . The proposal is likely to result in a modification/loss of a very small amount of habitat that may be viewed as an incremental decline of habitat in the local area. However taking into consideration the amount of habitat that will remain it is unlikely to adversely affect these highly mobile species such that a viable local population of these species is likely to be placed at risk of extinction.

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.

Not applicable.

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 raising of Bootawa Dam will result in the inundation of approximately 20ha of land within the study area which is primarily composed of highly disturbed cleared grassland. Approximately 1ha of open forest and 0.7ha of moist regrowth scrub will also need to be removed. No known habitat will be fragmented or isolated for these highly mobile species. As only a relatively small amount of hunting habitat will be removed it is unlikely that the proposal will adversely affect the long-term survival of these two bird species in the local area.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for the above species although a Priority Action Statement (PAS) has been developed for each species. The objective of the PAS is to promote the recovery of threatened species, populations and ecological communities and manage key threatening processes. It is considered that the proposal does not conflict with the PAS for the above birds of prey.

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 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of vegetation for the proposal is unlikely to result in a significant loss of habitat for these species.

Bibliography:

Marchant, S. and Higgins, P.J. (1993). *Handbook of Australian, New Zealand & Antarctic Birds*. Oxford University Press, Melbourne.

NPWS (1999). Threatened Species Information – Square-tailed Kite, at 'www.nationalparks.nsw.gov.au'

Pizzey, G. & Knight, F. (1997). *Field Guide to the Birds of Australia*, Angus and Robertson, Sydney.

17. OWLS

Ninox connivens **Barking Owl**

Description

The Barking Owl is medium-sized owl (42 cm, 650 g) smaller than the similar Powerful Owl and larger than the Southern Boobook. It has bright yellow eyes and no facial-disc. Upperparts are brown or greyish-brown, and the white breast is vertically streaked with brown. The large talons are yellow.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology

The Barking Owl is found in forest and woodland, encountered most commonly in savanna and paperbark woodlands. It sometimes roosts in rainforests, but it requires the more open country for hunting and hollow Eucalypts for breeding. These owls are usually found in pairs which occupy permanent territories, generally greater than 100 ha. The main call of the species is a repetitive barking 'wook wook', hence the common name. It does occasionally produce a rather loud and disturbing scream that has earnt it a second common name of the 'screaming woman bird'. Mammals and birds are the main prey, though it also feeds on insects and other invertebrates. In Southern Australia it feeds particularly on rabbits. It also kills hares, rats, mice, occasional small bats and some marsupials, including possums. It kills birds up to the size of Magpies and Tawny Frogmouths.

Distribution

The Barking Owl is found throughout continental Australia except for the central arid regions. Although common in parts of northern Australia, the species has declined greatly in southern Australia and now occurs in a wide but sparse distribution in NSW. Core populations exist on the western slopes and plains (especially the Pilliga) and in some northeast coastal and escarpment forests.

Ninox strenua **Powerful Owl**

Description

The Powerful Owl is the largest owl in Australasia. It is a typical hawk-owl, with staring yellow eyes and no facial-disc. Adults reach 60 cm in length, have a wingspan of up to 140 cm and weigh up to 1.45 kilograms.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not Listed.

Habitat Requirements and Ecology

The Powerful Owl inhabits a wide range of vegetation types from wet Eucalypt forests with a Rainforest understorey to Dry Open Forests and Woodlands. The species has been recorded utilising disturbed habitats such as exotic pine plantations and large trees in parks and gardens. The Powerful Owl is the largest predator of nocturnal forest-dwelling animals in Australian forests. Major prey species in NSW forests are the Greater Glider, Common Ringtail Possum, Sugar Glider, Grey-headed Flying Fox, and several species of diurnal birds, including the Pied Currawong, Magpie and Lorikeets. It rests during the day amid thick foliage, often grasping food-remains. The male of the species employs a slow, far-carrying 'whoo-hoo' call, more deliberate than the female call, which is higher pitched with the second note slightly higher than the first. Powerful Owls nest in a slight depression in the wood-mould on the base of a cavity in a large old tree, sometimes in excess of 25 metres above the ground. These trees are usually found growing on a hillside in heavy forest and may be utilised intermittently for several years. The breeding season of the Powerful Owl is highly synchronised, being strictly winter breeders. Pairs appear to mate for life and occupy exclusive territories that can be greater than 800ha in size (Kavanagh, 2000).

Distribution
The Powerful Owl is found in the coastal areas and adjacent ranges of eastern Australia from South Australia to around Rockhampton in Queensland, generally within 200km from the coast. Within N.S.W., Powerful Owls are distributed throughout the length of the Great Dividing Range, which is their stronghold, and extend from the coast to the western slopes where they occur in much lower numbers

Tyto novaehollandiae **Masked Owl**
Description
A medium-sized owl to 40 - 50 cm long, with dark eyes set in a prominent flat, heart-shaped facial disc that is encircled by a dark border. The feet are large and powerful, with fully feathered legs down to the toes.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology
Within this range they inhabit a range of wooded habitats that contain both mature trees for roosting and nesting and more open areas for hunting. They are most commonly encountered within Open Forest with a sparse understorey as well as along the ecotones of these areas to more or less densely vegetated habitats. Their diet comprises mainly ground-dwelling prey, including several species of native and introduced Rodents, *Antechinus* spp. and Bandicoots. On occasions, other prey such as Possums, Gliders and other birds are taken. Masked Owls usually roost in large hollows inside large, old living trees, most often Eucalypts. Within dry forests they often choose hollow trees in gullies or drainage lines. Pairs appear to mate for life and occupy exclusive territories in order of 1000ha in size.

Distribution
Masked Owls in N.S.W. are distributed throughout the length of the Great Dividing Range and extend from the coast to the western slopes.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been 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 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.

Neither the Barking, Powerful or Masked Owl were observed within the study area during the survey. No evidence of their presence was found (ie whitewash, regurgitation pellets, prey remains) nor was a response heard during the call playback census. Suitable hunting habitat was largely confined to the 3.5ha area of open forest on the eastern side of Bootawa Dam and to a lesser extent areas of moist regrowth scrub. Roosting habitat for the Barking and Powerful Owls would be confined to denser areas of open forest and moist regrowth scrub. The proposal is likely to result in a loss of a very small amount of habitat for prey species such as rats and may be viewed as an incremental decline of habitat in the local area. However taking into consideration the amount of habitat that will remain within the study area it is unlikely to adversely affect these mobile owl species such that a viable local population of these species is likely to be placed at risk of extinction.

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.

Not applicable.

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 raising of Bootawa Dam will result in the inundation of approximately 20ha of land within the study area which is primarily composed of highly disturbed cleared grassland. Approximately 1ha of open forest and 0.7ha of moist regrowth scrub will also need to be removed. No known habitat will be fragmented or isolated for these highly mobile species. As only a relatively small amount of hunting and roosting habitat will be removed it is unlikely that the proposal will adversely affect the long-term survival of these owl species in the local area.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

Draft Recovery Plans have been completed for Large Forest Owls and the Barking Owl (NPWS, 2003a). The recovery plans recommend that developments containing bushland protect nest and roost sites, patches of habitat and prey bases. The proposal will result in the future removal of a small amount of hunting habitat. However as the majority of habitat will remain within the study area it is considered that the proposal is unlikely to significantly compromise these recovery plans.

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 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of vegetation for the proposal is unlikely to result in a significant loss of habitat for these species.
- **Predation by the European Red Fox *Vulpes vulpes:*** Scats consistent with the European Red Fox were observed within the site. This fox species would have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in fox numbers.
- **Predation by the Feral Cat *Felis catus*:** The Feral Cat was not observed within the site during the survey period although it would be considered likely to be having some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Loss of Hollow-bearing Trees***:* A number of hollow-bearing trees will need to be removed as a result of the proposal. However no hollows are considered to contain suitable nest habitat for these owl species.

Bibliography:

Davey, S.M. (1993). *Notes on the Habitat of Four Australian Owl Species, In Olsen, P.D. (Ed)* (1993). Australian Raptor Studies, Australasian Raptor Association, RAOU, Melbourne, pp 126-42.

Debus, S.J.S. and Rose, A.B. (1994). *The Masked Owl Tyto novaehollandiae in New South Wales*, In Australian Birds, 28 (Supplement): pp 40-64

Kavanagh, R.P. (1993). *Project 149: Ecology and Management of Large Forest Owls*, Unpublished Progress Report to World Wide Fund for Nature, Sydney.

Kavanagh, R.P. and Peake, P. (1993). *Distribution and Habitats of Nocturnal Forest Birds in South-eastern New South Wales, In Olsen, P.D. (Ed) (1993).* Australian Raptor Studies, Australasian Raptor Association, RAOU, Melbourne, pp 101-5.

Kavanagh, R.P. and Murray, M. (1996). *Home Range, Habitat and Behaviour of the Masked Owl Tyto novaehollandiae near Newcastle, New South Wales*. In: Emu, 96: pp 250-7.

Kavanagh, R.P. (2000). *Conservation and Management of Large Forest Owls in South-eastern New South Wales. Proceedings of Owls 2000*: Third International Conference on the Biology, Conservation and Cultural Significance of Owls.

Kavanagh, R.P. and Stanton, M. A. (2000). *Response to Habitat Fragmentation by the Powerful Owl, Sooty Owl, Masked Owl and other Nocturnal Fauna in South-eastern New South Wales. Proceedings of Owls 2000:* Third International Conference on the Biology, Conservation and Cultural Significance of Owls.

Marchant, S. and Higgins, P.J. (1993). *Handbook of Australian, New Zealand & Antarctic Birds*. Oxford University Press, Melbourne.

Pizzey, G. & Knight, F. (1997). *Field Guide to the Birds of Australia*, Angus and Robertson, Sydney.

Reader's Digest (1982). *The Complete Book of Australian Birds, Reader's Digest Services Pty. Ltd., Sydney.*

18. Terrestrial Carnivores

Description
The Tiger Quoll (*Dasyurus maculatus maculatus*) is the largest marsupial carnivore on the Australian mainland.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Listed as Endangered

Habitat Requirements
It is an agile climber but spends most of its time on the floor of sclerophyll forests, rainforests and coastal woodlands and heathlands. It has occasionally been seen utilising open country, grazing lands and rocky outcrops (NPWS, 1999). Nests are made in rock caves and hollow logs or trees, and basking sites are usually found nearby. A large area of relatively good quality vegetation is required for foraging. It is an opportunistic hunter of a variety of prey, including birds and their young, rats and other small terrestrial and arboreal mammals, gliders, small Macropods, reptiles and Arthropods.

Distribution
The Tiger Quoll is widespread in eastern Australia, with its distribution being spread between two subspecies. The nominate subspecies, *D. m. maculatus* occurs from southern Queensland to Tasmania whereas *D. m. gracilus* occurs in northern Queensland.

Planigale maculata **Common Planigale**
Description
Formerly a part of the Antechinus complex, the Planigales differ mainly in that they possess a backward-facing pouch, typical of a burrowing species. The Common Planigale is the largest of the Planigales, though still small in terms of the prey that it feeds on.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Endangered under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology
In NSW it is found along the coastal strip, occupying a variety of habitats ranging from rainforest, wet and dry sclerophyll forests to grasslands, marshlands and rocky areas. In these habitats it shelters under logs and rocks and any available burrows. It is a ferocious predator of small insects, often tackling prey of its own size. In NSW, the young may be born from late spring to summer and presumably the males die after reproduction, typical of small Dasyurids.

Distribution
The Common Planigale is found throughout eastern Australia.

Potorous tridactylus tridactylus **Long-nosed Potoroo (SE mainland)**
Description
The Long-nosed Potoroo (SE Mainland) is a medium sized marsupial of the order Diprotodontia. The Long-nosed Potoroo (SE Mainland) can be identified by a brown to grey upper body and paler underbody. They have a long nose that tapers with a small patch of skin extending from the snout to the nose. The length of the feet is shorter than their head length. They are smaller than the Long-footed *Potorous longipes* (Potoroo).

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Vulnerable.

Habitat Requirements
Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. In NSW it is generally restricted to coastal heaths and forests east of the Great Dividing Range, with an annual rainfall exceeding 760 mm. A sandy loam soil is also a common feature. The fruit-bodies of hypogeous (underground-fruiting) fungi are a large component of the diet of the Long-nosed Potoroo. They also eat roots, tubers, insects and their larvae and other soft-bodied animals in the soil. Mainly nocturnal, hiding by day in dense vegetation - however, during the winter months animals may forage during daylight hours. Individuals are mainly solitary, non-territorial and have home range sizes ranging between 2-5 ha. Breeding peaks typically occur in late winter to early summer and a single young is born per litter. Adults are capable of two reproductive bouts per annum.

Distribution
The Long-nosed Potoroo is found on the south-eastern coast of Australia, from Queensland to eastern Victoria and Tasmania, including some of the Bass Strait islands. There are geographically isolated populations in western Victoria.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been 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 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.

The Tiger Quoll, Common Planigale and Long-nosed Potoroo were not recorded within the study area despite targeted surveys, which involved trapping and spotlighting. Limited habitat was found to be present for these species within the areas of open forest and to a lesser extent smaller patches of Moist Regrowth Scrub. The Tiger Quoll and Long-nosed Potoroo are most commonly found in more isolated, pristine areas of habitat and would be less likely to be present within the study area. There was a paucity of local records of these species in the immediate local area on the DECCW database. The proposal will result in the incremental removal of marginal habitat for these three marsupials, however considering the disturbance to the study area and lack of nearby records the proposal is not likely to result in the extinction of any local population of either of these species.

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.

Not applicable.

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 raising of Bootawa Dam will result in the inundation of approximately 20ha of land within the study area which is primarily composed of highly disturbed cleared grassland. Approximately 1ha of open forest and 0.7ha of moist regrowth scrub will also need to be removed. No known habitat will be fragmented or isolated for either of these two marsupial species. As only a relatively small amount of hunting habitat will be removed it is unlikely that the proposal will adversely affect the long-term survival of these terrestrial species in the local area.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for the Tiger Quoll, Common Planigale or Long-nosed Potoroo. However DECCW has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help this species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for these species.

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 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Predation by the European Red Fox *Vulpes vulpes:*** Scats consistent with the European Red Fox were observed within the site. This fox species would have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in fox numbers.
- **Predation by the Feral Cat *Felis catus*:** The Feral Cat was not observed within the site during the survey period although it would be considered likely to be having some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Loss of Hollow-bearing Trees***:* A number of hollow-bearing trees will need to be removed as a result of the proposal.
- **Removal of dead wood and dead trees:** Dead wood and dead trees were present within the study area. This action is unlikely to be significant for these marsupial species.

Bibliography:

Edgar, R. and Belcher, C. (1995). Spotted-tailed Quoll (*Dasyurus maculatus*). In: The Mammals of Australia, pp: 67-68. Strahan, R. (Ed). Reed Books, Australia.

NPWS (1999). Threatened Species Information – Spotted-tailed Quoll, at 'www.nationalparks.nsw.gov.au'

NPWS. (2003). Atlas of NSW Wildlife, at 'www.nationalparks.nsw.gov.au'.

19. ARBOREAL MAMMALS

Petaurus australis **Yellow-bellied Glider**

Description

The Yellow-bellied Glider (*Petaurus australis*) is the largest of the Australian Petaurids and is the most vocal.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements

It occurs patchily in tall, mature Wet Eucalypt Forest, at a density 0.05-0.14 individuals per hectare in preferred habitat. Plant and insect exudates (sap, nectar, honeydew and manna) make up the bulk of its diet. Eucalypt sap is consumed throughout the year. Eucalypt blossom provides valuable food when available, while insects, spiders and pollen provide most of the protein in the diet. During the day, the Yellow-bellied Glider rests in a den in a hollow branch, usually in a living, smooth-barked Eucalypt. It emerges at night to forage, sometimes travelling more than 2km from the den. The home range is of the order of 35 hectares. Young are born mostly from August to September in the southern part of the range and from May to September in the northern parts (although some births have been recorded throughout the year). Pouch life is 90-100 days, after which the young is suckled in the den for 40-60 days.

Distribution

It ranges throughout eastern Australia from Portland, Victoria to central-coastal Queensland. A separate population of the subspecies (*P. a. reginae*) occurs on the western Rainforest slopes in northern Queensland.

Petaurus norfolcensis **Squirrel Glider**

Description

The Squirrel Glider (*Petaurus norfolcensis*) is a medium sized arboreal gliding marsupial with long grey fur and a pronounced black dorsal strip extending from between the eyes to the base of the tail. The belly fur is white and the tail is grey and fluffy. The gliding membrane (patagium) extends from the wrist to the ankle. The Squirrel Glider is similar to the Sugar Glider (*Petaurus breviceps*) however is larger with a longer pointed face, longer and narrower ears and a much bushier furred tail.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements

Throughout its range *P. norfolcensis* is found in dry forest and woodland associations dominated by winter flowering eucalypts or with an understorey of winter flowering Banksias or gum producing Acacias (Smith, 2002). Squirrel Gliders nest in tree hollows or "dens" with a range of entrance diameters of 4-15cm. Squirrel Glider colonies and individuals may change nest sites frequently within their home range. The Squirrel Glider eats a high proportion of invertebrates from the foliage of Eucalypts and *Acacias* supplemented by plant exudates in the form of Eucalypt and *Melaleuca* sap and *Acacia* gum.

Distribution

The Squirrel Glider is distributed throughout the dry sclerophyll forests and woodlands of eastern Australia from South Australia to Cairns.

Phascogale tapoatafa **Brush-tailed Phascogale**

Description

The Brush-tailed Phascogale is tree-dwelling marsupial carnivore with a characteristic, black, bushy 'bottlebrush' tail, with hairs up to 4 cm long. Its fur is grey above and pale cream below and it has conspicuous black eyes and large naked ears.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements

The Brush-tailed Phascogale is known from a variety of forest types from Rainforest to Woodland, but is most frequently recorded in the drier Sclerophyll Forests with little ground cover, on ridges up to 600m altitude. A nocturnal species, the Brush-tailed Phascogale is mainly arboreal but also forages on the ground, eating insects and occasionally small vertebrates. It requires small tree hollows and suitable foraging sites in the canopy, sub-canopy, and ground layer of vegetation. During the day it sleeps in a nest lined with leaves or shredded bark in a tree hollow, emerging at dusk to feed. Animals may return to the nest occasionally through the night and, when several share a nest, they tend to show a similar pattern of nocturnal activity.

Distribution

The Brush-tailed Phascogale has a patchy distribution around the coast of Australia. In NSW it is mainly found east of the Great Dividing Range although there are occassional records west ot the divide.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been 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 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.

Neither *Petaurus norfolcensis* (Squirrel Glider), *Petaurus australis* (Yellow-bellied Glider) nor *Phascogale tapoatafa* (Brush-tailed Phascogale) were recorded within the study area despite targeted trapping and spotlighting surveys. Habitat for these arboreal marsupials within the study area would be confined to the 3.5ha area of open forest on the eastern side of Bootawa Dam. A number of suitable nesting hollows were also present within this area. The raising of Bootawa Dam will result in the removal of approximately 1ha of open forest including approximately ten hollow-bearing trees resulting in a small incremental reduction in suitable foraging habitat and nesting habitat in the local area. However considering the relatively small size of the habitat removed the proposal is unlikely to result in the extinction of any local population of these arboreal marsupial species.

To reduce the impact of the proposal in relation to these three arboreal marsupials it is recommended that the removal of hollow-bearing trees be supervised by a suitably qualified and vaccinated ecologist. It is also recommended that suitable compensatory nestboxes be installed within the remaining area of open forest and adjacent areas prior to clearing to replaced lost nesting hollows.

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.

Not applicable.

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 raising of Bootawa Dam will result in the inundation of approximately 20ha of land within the study area including approximately 1ha of a 3.5ha area of suitable habitat for *P. norfolcensis, P. australis* and *P. tapoatafa* in the form of open forest. No known habitat will be fragmented or isolated for either of these three marsupial species. As only a relatively small amount potential habitat will be removed it is unlikely that the proposal will adversely affect the long-term survival of these species in the local area.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

A recovery plan has been released for the Yellow-bellied Glider. The plan recommends the retention of suitable habitat and nest trees. As only a small amount of marginal foraging habitat and no nest trees will be affected the proposal would not be considered to significantly compromise this recovery plan.

No Recovery or Threat Abatement Plan has been developed for the Squirrel Glider or Brush-tailed Phascogale. However the Department of Environment, Climate Change and Water has prepared Priority Action Statements (PAS) to promote the recovery of the Squirrel Glider and Brushtail Phascogale and the abatement of key threatening processes in NSW. The Priority Action Statements identified a number of broad strategies to help these species recover in NSW. These actions include:

- Ensure the largest hollow-bearing trees (including dead trees) are given highest priority for retention.
- Delineate boundaries of population to identify the extent to which populations are interconnected.

The proposal is unlikely to significantly compromise these priority actions developed to assist the recovery of the Squirrel Glider or Brush-tailed Phascogale.

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 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of vegetation for the proposal is unlikely to result in a significant loss of habitat for these species.
- **Predation by the European Red Fox *Vulpes vulpes:*** Scats consistent with the European Red Fox were observed within the site. This fox species would have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in fox numbers.
- **Predation by the Feral Cat *Felis catus*:** The Feral Cat was not observed within the site during the survey period although it would be considered likely to be having some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Loss of Hollow-bearing Trees***:* Up to ten hollow bearing trees will need to be removed within the area of open forest resulting in an incremental reduction of this habitat resource in the local area. Considering the recommendations, the loss of hollow bearing trees is not considered to be significant.
- **Removal of dead wood and dead trees:** Dead wood and dead trees were present within the study area. No significant areas of dead wood and dead trees will be removed as a result of the proposal.

Bibliography:

Fleay, D.(1947). Gliders of the Gum Trees. Melbourne Bread and Cheese Club.

Mackowski, C.M. (1988). Characteristics of Eucalypts incised for sap by the Yellow-bellied Glider *Petaurus australis* in North-eastern New South Wales. In: Australian Mammology, Vol 11: pp5-13.

NPWS. (2003). Atlas of NSW Wildlife, at http://www.nationalparks.nsw.gov.au

Quin, D.G. (1995). Population Ecology of the Squirrel Glider (*Petaurus norfolcensis*) and the Sugar Glider (*P. breviceps*) (Marsupialia : Petauridae) at Limeburners Creek, on the Central North Coast of New South Wales. In: Australian Wildlife Research 22: pp 471-505.

Quin, D.G. (1993). Sociology of the Squirrel Glider and the Sugar Glider. PhD Thesis, Department of Ecosystem Management, University of New England.

Quin, D.G. (1995). *Population Ecology of the Squirrel Glider (Petaurus norfolcensis) and the Sugar Glider (P. breviceps) (Marsupialia : Petauridae) at Limeburners Creek, on the Central North Coast of New South Wales.* In: Australian Wildlife Research 22: pp 471-505.

Russell, R. (1995). Yellow-bellied Glider (*Petaurus australis*). In: The Mammals of Australia, pp 226-228. Strahan, R. (Ed). Reed Books, Australia.

Smith, A. (1996). On The Brink - Squirrel Gliders, Pittwater Council and Housing Development. At

http://www.nccsw.org.au

Smith, A.P.,(2000). Sub-Regional Squirrel Glider Study, North Wyong Shire. Wyong Shire Council.

Smith, A.P.,(2002). *Squirrel Glider (Petaurus norfolcensis) Conservation Management Plan: Wyong Shire*. Wyong Shire Council, Wyong.

Smith, A. P. & Murray, M. (2003). *Habitat requirements of the Squirrel Glider (Petaurus norfolcensis) and associated possum and gliders on the New South Wales Central Coast*. Wildlife Research, 2003, **30**, 291-301.

Suckling, G.C. (1995). Squirrel Glider (*Petaurus norfolcensis*). In: The Mammals of Australia, pp: 234-5. Strahan, R. (Ed). Reed Books, Sydney.

SWC Consultancy (1996). Eleebana Local Squirrel Glider Study. Report to Lake Macquarie City Council.

Triggs, B. (1996). Tracks, Scats and Other Traces: a Field Guide to Australian Mammals. Oxford University Press, Australia.

20. Microchiropteran Bats

***Myotis adversus* (Southern Myotis)**

Description

Myotis adversus (Large-footed Myotis) is similar to most other bats with a grey-brown fur colour. The main distinguishing feature of this species is its unusually large feet.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology

Myotis macropus seldom occurs far from suitable water bodies which range from rainforest streams to large reservoirs and even brackish water. It hunts by raking the surface of the water for aquatic insects and small fish. Some aerial hunting also occurs for prey items include moths, beetles, crickets, cockroaches, flies and many water insects. It roosts in small colonies of between 15 and several hundred individuals with recorded roosts including caves, mines and disused railway tunnels as well as dense rainforest foliage in the tropical parts of its range. Some occurrences of roosting in tree hollows are also noted.

Distribution

The Large-footed Myotis has been recorded along much of the coastal strip of Australia occurring from the east of South Australia, around the Victorian, New South Wales, Queensland and Northern Territory coasts and into Western Australia as far as the Kimberleys (the northern population is likely to be a different subspecies - currently undergoing taxonomic revision). In N.S.W., the Large-footed Myotis is found in various habitats of the coast and adjacent ranges. Recently, it has also been found along the Murray River valley well into South Australia.

***Miniopterus australis* (Little Bentwing-bat)**

Description

Miniopterus australis (Little Bentwing-bat) has uniform chocolate fur on the back and slightly lighter fur on the belly. It has a short muzzle and domed head. The ears are short and rounded. The last phalanx on the third finger of the wing is about four times the length of the middle phalanx. This species is very similar to *Miniopterus schreibersii oceanensis* (Large Bentwing-bat) but has a smaller forearm (37 to 41mm).

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology

It is a sub-canopy hunter with a preference for well-timbered areas but it is also known to hunt in clearings adjacent to forests. Prey items include crane flies, ants, moths and wasps. Flight characteristics include rapid movement with considerable manoeuvrability. The species is a cave dweller that congregates in the summer months in maternity roost colonies and disperses during winter. Recorded roosts include caves, mines, stormwater drains, disused railway tunnels and houses.

Distribution

This species inhabits tropical rainforest to warm-temperate wet and dry sclerophyll forest occurring along the coastal plains and adjacent ranges from Cape York to north-eastern N.S.W. around the Hunter River. Its distribution within Australia becomes increasingly coastal towards the southern limit of its range in N.S.W.

***Miniopterus schreibersii oceanensis* (Large Bent-wing Bat)**

Description

The *Miniopterus schreibersii oceanensis* (Large Bent-wing Bat) has chocolate to reddish-brown fur on its back and slightly lighter coloured fur on its belly. It has a short snout and a high 'domed' head with short round ears. The wing membranes attach to the ankle, not to the base of the toe. The last bone of the third finger is much longer than the other finger-bones giving the "bent wing" appearance.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology

The Large Bentwing-bat hunts in forested areas, catching moths and other flying insects above the tree tops. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Cold caves are used for hibernation in southern Australia. Breeding or roosting colonies can number from 100 to 150,000 individuals.

Distribution

The Large Bent-wing Bats occur along the east and north-west coasts of Australia.

***Mormopterus norfolkensis* (Eastern Freetail-bat)**

Description

Mormopterus norfolkensis (Eastern Freetail-bat) has dark brown to reddish brown fur on the back and is slightly paler below. Like other freetail-bats it has a long (3 - 4 cm) bare tail protruding from the tail membrane. Like other freetail-bats they have hairless faces with wrinkled lips and triangular ears.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology

Mormopterus norfolkensis occurs in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. It roosts mainly in tree hollows but will also roost under bark or in man-made structures. Usually solitary but also recorded roosting communally, probably insectivorous.

Distribution

The Eastern Freetail-bat is found along the east coast from south Queensland to southern NSW.

***Chalinolobus dwyeri* (Long-eared Pied Bat)**

Description

Chalinolobus dwyeri (Long-eared Pied Bat) is a small to medium-sized bat with long, prominent ears and glossy black fur. The lower body has broad white fringes running under the wings and tail-membrane, meeting in a V-shape in the pubic area.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Vulnerable.

Habitat Requirements and Ecology

This species has been found occupying dry sclerophyll forest and woodland, both to the east and west of the Great Divide. Recordings of this species have also been made in subalpine woodland and at the

ecotone of rainforest and wet Eucalypt forest. The Large-eared Pied Bat roosts in caves, abandoned mud-nests of Fairy Martins and mine tunnels. Colonies recorded have ranged in size from 3 to 37 individuals, and are usually located in the twilight area not far from the cave entrance.

Distribution

Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. There are scattered records from the New England Tablelands and North West Slopes.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been 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 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.

Neither *Chalinolobus dwyeri, Myotis macropus, Miniopterus schreibersii oceanensis* nor *Miniopterus australis* were identified within the study area during fieldwork despite the undertaking of harp trapping and echolocation call recording. The study area provided hunting habitat for all of these threatened microchiropteran bat species. Preferred hunting habitat in the form of suitable areas of surface water for *M. adversus* was found on the surface of Bootawa Dam. Roosting habitat in the form of caves and similar man made structures was not present within the study area. A number of tree hollows present may provide some secondary roosting habitat for species such as *M. schreibersii oceanensis.* The raising of Bootawa Dam will result in a small reduction/modification of hunting habitat in the local area and the removal of a small amount of secondary roosting habitat, however, is unlikely to result in the extinction of any local population of these microchiropteran bat species.

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.

Not applicable.

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 raising of Bootawa Dam will result in the inundation of approximately 20ha of land within the study area which is primarily composed of highly disturbed cleared grassland. Approximately 1ha of open forest and 0.7ha of moist regrowth scrub will also need to be removed. No known habitat will be fragmented or isolated for these highly mobile species. As only a relatively small amount of hunting and roosting habitat will be removed/modified it is unlikely that the proposal will adversely affect the long-term survival of these microchiropteran bat species in the local area.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for these microchiropteran bat species. However DECCW has prepared Priority Action Statements (PAS) to promote the recovery of this species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help these species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for these species.

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 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of vegetation for the proposal is unlikely to result in a significant loss of habitat for these species.
- **Predation by the European Red Fox *Vulpes vulpes:*** Scats consistent with the European Red Fox were observed within the site. This fox species would have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in fox numbers.
- **Predation by the Feral Cat *Felis catus*:** The Feral Cat was not observed within the site during the survey period although it would be considered likely to be having some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Loss of Hollow-bearing Trees***:* Up to ten hollow bearing trees will need to be removed within the area of open forest resulting in an incremental reduction of this habitat resource in the local area. Considering the recommendations, the loss of hollow bearing trees is not considered to be significant.
- **Removal of dead wood and dead trees:** Dead wood and dead trees were present within the study area. No significant areas of dead wood and dead trees will be removed as a result of the

Bibliography:

Churchill, S. (2008). Australian Bats. Allen & Unwin, Crows Nest, Australia.

Parnaby, H. (1992). An Interim Guide to Identification of Insectivorous Bats of South-eastern Australia. Technical Reports of the Australian Museum, Sydney.

Richards, G.C. (2008). Large-footed Myotis (*Myotis adversus*). In: The Mammals of Australia, pp: 544-545. Strahan, R. (Ed). Reed New Holland, Australia.

Endangered Populations

21. *Eucalyptus seeana* population in the Greater Taree local government area

Description

Narrow-leaved Red Gum is a medium to tall woodland tree to 40 m. Bark is smooth and mottled. Leaves are long, narrow and lance-shaped, up to 18 cm long and 2 cm wide. Buds are elongated, horn-shaped, 8-15 mm long. Fruit is hemispherical, 5 - 8 mm wide.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as an Endangered Population.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology

Occurs as scattered individuals in woodlands and open forests on low, often swampy, sandy soils.

Distribution

The species has a distribution from the north coast of NSW to south east Queensland. The Endangered Population within the Greater Taree Local Government Area represents the southern-most occurrence of the species and is isolated from other populations of the species to the north. Within the Greater Taree Local Government Area the population is sporadic in distribution, consisting mainly of scattered trees but with some denser stands. A small part of the population occurs in a Council reserve.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been 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 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.

Eucalyptus seeana was not identified within the study area during fieldwork. Areas of suitable habitat were considered to be present around Bootawa Dam however the majority of the study area was highly disturbed with large areas covered in a relatively new plantation. The proposal may result in the removal of a relatively small amount of suitable habitat, however it is unlikely to have an adverse effect on the life cycle of *E. seeana* such that a viable local population is likely to be placed at risk of extinction.

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.

Not applicable.

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 raising of Bootawa Dam will result in the inundation of approximately 20ha of land within the study area which is primarily composed of highly disturbed cleared grassland. Approximately 1ha of open forest and 0.7ha of moist regrowth scrub will also need to be removed. No known habitat will be fragmented or isolated for this tree species. It is unlikely that any habitat important to the long-term survival of *E. seeana* will be removed, modified, fragmented or isolated as a result of the raising of Bootawa Dam.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for *Eucalyptus seeana*. However DECCW has prepared Priority Action Statements (PAS) to promote the recovery of this species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help these species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for these species.

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 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of vegetation for the proposal is unlikely to result in a significant loss of habitat for these species.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the site.
- ***Lantana camara* -** Infestations of Lantana were found to be present within the study area. There is the potential for further infestation of Lantana within the study area.
- **Invasion of native plant communities by exotic perennial grasses:** This threatening process is already present with a number of introduced grasses such as *Andropogon virginicus* (Whisky Grass) and *Axonopus affinis* (Narrow-leaved Carpet Grass).
- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** The European Rabbit was recorded within the study area during the survey. The proposal is unlikely to significantly increase Rabbit numbers.

Bibliography:

Brooker, M. and Kleinig, D.A. (1999) Field guide to eucalypts, Volume 1: South-eastern Australia. 2nd edn. Blooming Books, Hawthorn.

Harden, G.J. (ed.) (2002) *Flora of New South Wales* Volume 2 Revised Edition. UNSW, Sydney.

NSW Scientific Committee (2002) *Eucalyptus seeana* Maiden population, Greater Taree Local Government Area - Endangered population determination - final. DEC (NSW), Sydney.

APPENDIX B:
TOTAL FLORA LIST

Key

Introduced species are indicated by an asterisk ("*").

The following standard abbreviations are used to indicate subspecific taxa:

ssp. - subspecies
var.- variety
× **-** hybrid between the two indicated species

Threatened Species Conservation Act 1995 (TSC Act)

Schedule 1: Endangered – E
Schedule 2: Vulnerable - V

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

Endangered – E
Vulnerable - V

ROTAP (Rare or Threatened Australian Plants)

Distribution

1. – Known from only one collection
2. – Geographic range in Australia less than 100km
3. – Geographic range in Australia greater than 100km.
+ - Also occurs overseas.

Conservation Status

E. – Endangered. Species at risk of disappearing from the wild within 20 years. Includes populations of 100 or less individual plants.
V. – Vulnerable. Species not presently endangered, but at risk over 20-50 years.
R. – Rare in Australia, but not currently under threat. Includes species within a very restricted area or small populations over a wide range.
K. – Poorly known. Accurate knowledge is inadequate.
C. – Reserved. The species has at least one population within a national park or other reserve.

Size of Reserved Populations

a. – 1000 plants or more known within a conservation reserve.
i. – Less than 1000 plants known within a conservation reserve.
- - Reserved population size not accurately known.
t - Total known population reserved.

FLORA LIST FOR THE STUDY AREA

SCIENTIFIC NAME	COMMON NAME
CLASS FILICOPSIDA (Ferns)	
Adiantaceae	
Adiantum aethiopicum	Common Maidenhair Fern
Dennstaedtiaceae	
Hypolepis muelleri	Harsh Ground Fern
Pteridium esculentum	Bracken
Schizaeaceae	
Cheilanthes sieberi ssp. *sieberi*	Mulga Fern
Sinopteridaceae	
Pellaea falcata ssp. *falcata*	
Thelypteridaceae	
Christella dentata	
MAGNOLIOPSIDA: Magnoliidae	
LILOPSIDA: (Monocotyledons)	
Alismataceae	
**Damasonium minus*	Starfruit
Commelinaceae	
Commelina cyanea	
Cyperaceae	
Carex appressa	
Cyperus brevifolius	Mullumbimby Couch
Cyperus eragrostis	Umbrella Sedge
Eleocharis sphacelata	Tall Spike-rush
Fimbristylis dichotoma	
Lepidosperma laterale	Sword Sedge
Schoenoplectus mucronatus	
Schoenoplectus validus	
Juncaceae	
Juncus prismatocarpus	
Juncus usitatus	Common Rush
Orchidaceae	
Microtis parviflora	Slender Onion Orchid
Philesiaceae	
Eustrephus latifolius	Wombat Berry
Geitonoplesium cymosum	Scrambling Lily
Philydraceae	
Philydrum lanuginosum	Woolly Frogmouth
Phormiaceae	
Dianella caerulea var. *producta*	

SCIENTIFIC NAME	COMMON NAME
Poaceae	
**Andropogon virginicus*	Whisky Grass
**Axonopus affinis*	Narrow-leaved Carpet Grass
**Briza maxima*	Quaking Grass
**Briza minor*	
**Chloris gayana*	Rhodes Grass
Cynodon dactylon	Common Couch
Cymbopogon refractus	Barbed Wire Grass
Digitaria parviflora	Smallflower Fingergrass
Echinopogon caespitosus var. *caespitosus*	Hedgehog Grass
Entolasia marginata	Bordered Panic
Imperata cylindrica var. *major*	Blady Grass
Microlaena stipoides var. stipoides	Weeping Meadow Grass
Oplismenus aemulus	Basket Grass
Paspalum dilatatum	Paspalum
**Pennisetum clandestina*	Kikuyu
Poa labillardieri	Tussock Grass
**Stenotaphrum secundatum*	Buffalo Grass
Themeda australis	Kangaroo Grass
Potamogetonaceae	
Potamogeton tricarinatus	Floating Pondweed
Smilacaceae	
Smilax australis	Smilax
Typhaceae	
Typha orientalis	Cumbungi
Xanthorrhoeaceae	
Lomandra cylindrica	
Lomandra longifolia	Spiny Mat Rush
Lomandra multiflora ssp. *multiflora*	
MAGNOLIIDAE (Dicotyledons)	
Acanthaceae	
Brunoniella australis	Blue Trumpet
Amaranthaceae	
Alternanthera denticulata	Lesser Joyweed
Apiaceae	
Centella asiatica	
Apocynaceae	
Parsonsia straminea var. *straminea*	Common Silkpod
Araliaceae	
Polyscias sambucifolia	Elderberry Panax
Asteraceae	
**Ageratina adenophora*	Crofton Weed
Bidens pilosa	Cobblers Pegs
Centipeda cunninghamii	Sneezeweed

SCIENTIFIC NAME	COMMON NAME
**Cirsium vulgare*	Spear Thistle
**Conyza bonariensis*	Flax-leaved Fleabane
Euchiton involucratus	Cudweed
**Hypochaeris radicata*	Catsear
**Senecio madagascariensis*	Fireweed
**Sonchus oleraceus*	Common Sow Thistle
**Taraxacum officinale*	Dandelion
Vernonia cinerea var. *cinerea*	
Bignoniaceae	
**Jacaranda mimosifolia*	Jacaranda
Pandorea pandorana	Wonga-wonga Vine
Campanulaceae	
Wahlenbergia gracillis	Native Bluebell
Cassythaceae	
Cassytha pubescens	Devil's Twine
Casuarinaceae	
Allocasuarina torulosa	Forest Oak
Celastraceae	
Maytenus silvestris	
Chenopodiaceae	
Einadia nutans	Nodding Saltbush
Convolvulaceae	
Convolvulus erubescens	Australian Bindweed
Dichondra repens	Kidney Weed
Cucurbitaceae	
Zehneria cunninghamii	Slender Cucumber
Dilleniaceae	
Hibbertia scandens	Climbing Guinea Flower
Epacridaceae	
Leucopogon juniperinus	Lance Beard-heath
Euphorbiaceae	
Breynia oblongifolia	Coffee Bush
Euphorbia peplus	Petty Spurge
Glochidion ferdinandi var. *ferdinandi*	Cheese Tree
Phyllanthus gunnii	Scrubby Spurge
Poranthera microphylla	
Fabaceae (Faboideae)	
Daviesia ulicifolia	-
Desmodium rhytidophyllum	
Desmodium varians	
Glycine clandestina sp. complex	Love Creeper
Hardenbergia violacea	False Sarsaparilla
Jacksonia scoparia	Dogwood

SCIENTIFIC NAME	COMMON NAME
Kennedia rubicunda	Dusky Coral Pea
**Trifolium repens*	White Clover
Geraniaceae	
Geranium solanderi	Cranesbill
Goodeniaceae	
Goodenia heterophylla	Varible-leaved Goodenia
Haloragaceae	
Gonocarpus teucrioides	Germander Raspwort
Lamiaceae	
Mentha satureioides	Creeping Mint
Plectranthus parviflorus	
Lauraceae	
**Cinnamomum camphora*	Camphor Laurel
Lobeliaceae	
Pratia purpurascens	White Root
Malvaceae	
**Sida rhombifolia*	Paddys Lucerne
Meliaceae	
Melia azedarach var. *australasica*	White Cedar
Menispermaceae	
Stephania japonica var. *japonica*	Snake Vine
Mimosoideae	
Acacia binervata	Two-veined Hickory
Acacia falcata	
Acacia irrorata	
Acacia longifolia	Sydney Golden Wattle
Acacia melanoxylon	Blackwood
Acacia ulicifolia	Prickly Moses
Myrsinaceae	
Myrsine variabilis	Muttonwood
Myrtaceae	
Acmena smithii	Lilly Pilly
Callistemon salignus	Willow Bottlebrush
Corymbia intermedia	Pink Bloodwood
Corymbia maculata	Spotted Gum
Corymbia variegata	Spotted Gum
Eucalyptus acmenoides	White Mahogany
Eucalyptus paniculata ssp. *paniculata*	Grey Ironbark
Eucalyptus propinqua	Small-fruited Grey Gum
Eucalyptus tereticornis	Forest Red Gum
Eucalyptus umbra	White Mahogany
Lophostemon confertus	Brush Box
Melaleuca styphelioides	Prickly-leaved Paperbark

SCIENTIFIC NAME	COMMON NAME
Syncarpia glomulifera	Turpentine
Oleaceae	
Notelea longifolia	Mock Olive
Onagraceae	
Ludwigia peploides ssp. *montevidensis*	Water Primrose
Oxalidaceae	
Oxalis corniculata	Creeping Oxalis
Oxalis perennans	-
Phytolaccaceae	
**Phytolacca octandra*	Inkweed
Primulaceae	
Anagallis arvensis var. *arvensis*	Scarlet Pimpernel
Polygonaceae	
Rumex brownii	Swamp Dock
Plantaginaceae	
Plantago lanceolata	Plantain
Ranunculaceae	
Clematis aristida	Old Man's Beard
Ranunculus inundatus	River Buttercup
Ranunculus lappaceus	Common Buttercup
Rhamnaceae	
Alphitonia excelsa	Red Ash
Rosaceae	
**Rubus fruticosus* ssp. *aggregate*	Blackberry
Rubus parvifolius	Native Raspberry
Rubiaceae	
Opercularia sp.	Stink Weed
Pomax umbulata	Pomax
Salicaceae	
**Salix babylonica*	Weeping Willow
Santalaceae	
Exocarpus cupressiformis	Cherry Ballart
Scrophulariaceae	
Gratiola pedunculata	Stalked Brooklime
**Verbascum virgatum*	Twiggy Mullein
Solanaceae	
**Solanum mauritianum*	Wild Tobacco
**Solanum nigrum*	Blackberry Nightshade
Sterculiaceae	
Brachychiton populneus ssp. *populneus*	Kurrajong

SCIENTIFIC NAME	COMMON NAME
Commersonia fraseri	Black-fellow's Hemp
Thymelaeaceae	
Pimelea linifolia	Rice Flower
Verbenaceae	
Clerodendrum tomentosum	Hairy Clerodendrum
**Lantana camara*	Lantana
**Verbena bonariensis*	Purple Top
**Verbena rigida* var. *rigida*	Veined Verbena
Vitaceae	
Cissus hypoglauca	Native Grape
Violaceae	
Hybanthus stellarioides	
Viola hederacea	Native Violet

APPENDIX C

VEGETATION TRANSECT & QUADRAT DATA

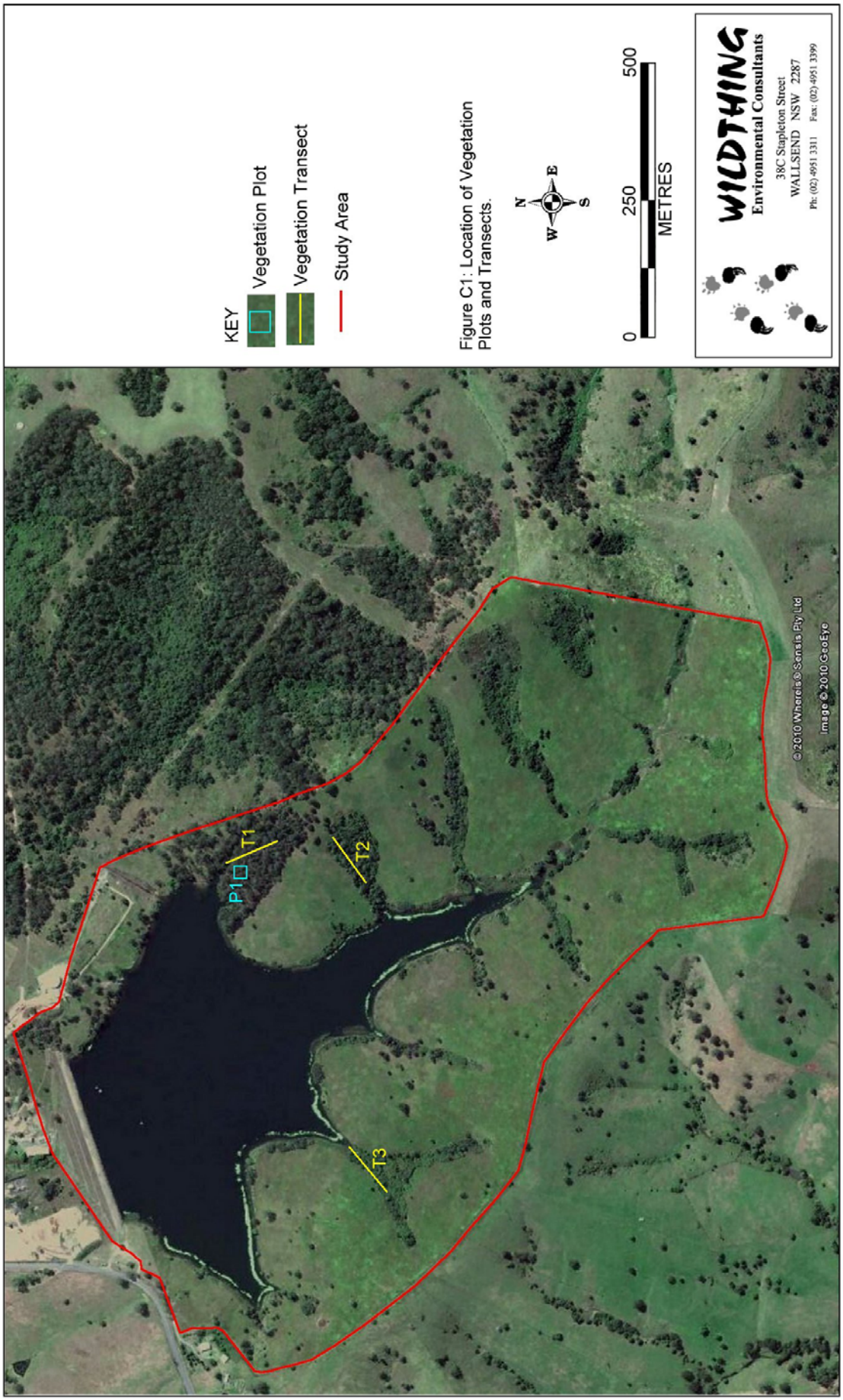
C1.0 TRANSECT METHODOLOGY

Three walking transects were undertaken within the bounds of the study area to provide detail on the floral assemblages occurring therein. The location of the transects is shown in Figure C1.

TRANSECT 1
*Community – Open Forest
*Length – 100m
*Aspect – South facing slope

*Species Recorded

Themeda australis	Kangaroo Grass
Desmodium rhytidophyllum	
Lantana camara	Lantana
Lepidosperma laterale	Sword Grass
Corymbia maculata	Spotted Gum
Hardenbergia violacea	False Sarsaparilla
Desmodium varians	
Dianella caerulea var. *producta*	
Eucalyptus umbra	White Mahogany
Poa labillardieri	Tussock Grass
Eustrephus latifolius	Wombat Berry
Acacia falcata	Falcata Wattle
Vernonia cinerea	
Pratia purpurascens	White Root
Allocasuarina torulosa	Forest Oak
Hibbertia scandens	Climbing Guinea Flower
Brunoniella australis	Blue Trumpet
Convolvulus erubescens	Australian Bindweed
Notelea longifolia	Mock Olive
Pimelea linifolia	Rice Flower
Lomandra longifolia	Spiny Mat Rush
Imperata cylindrica var. *major*	Blady Grass
Phyllanthus gunnii	Scrubby Spurge
Corymbia gummifera	Red Bloodwood
Dichondra repens	Kidney Weed
Rubus parvifolius	Native Raspberry
Clerodendrum tomentosum	Hairy Clerodendrum
Geitonoplesium cymosum	Scrambling Lily
Geranium solanderi	Native Geranium
Glycine clandestina	Glycine
Cheilanthes sieberi ssp. *sieberi*	Mulga Fern
Acacia ulicifolia	Prickly Moses
Breynia oblongifolia	Breynia
Eucalyptus paniculata	Grey Ironbark
Daviesia ulicifolia	
Verbena rigida var. *rigida*	Veined Verbena
Pandorea pandorana	Wonga Wonga Vine


KEY
Vegetation Plot
Vegetation Transect
Study Area
Figure C1: Location of Vegetation Plots and Transects.
N
E
S
W
0
250
500
METRES
WILDTHING
Environmental Consultants
38C Stapleton Street
WALLSEND NSW 2287
Ph: (02) 4951 3311 Fax: (02) 4951 3399
P1
T1
T2
T3
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TRANSECT 2

*Community – Moist Regrowth Scrub
*Length – 100m
*Aspect – Western aspect in gully

*Species Recorded

Imperata cylindrica var. *major*	Blady Grass
Commersonia fraseri	Black Fellow's Hemp
Pteridium esculentum	Bracken
Polyscias sambucifolia	Elderberry Panax
**Lantana camara*	Lantana
Melaleuca styphelioides	Prickly-leaved Paperbark
Hibbertia scandens	Climbing Guinea Flower
Phyllanthus gunnii	Scrubby Spurge
Poa labillardieri	Tussock Grass
**Ageratina adenophora*	Crofton Weed
Maytenus silvestris	
Acacia irrorata	
Acacia binervata	
Callistemon salignus	Willow Bottlebrush
Breynia oblongifolia	Breynia
Acacia melanoxylon	Blackwood
Jacksonia scoparia	Dogwood
Allocasuarina torulosa	Forest Oak
Lophostemon confertus	Brush Box
Syncarpia glomulifera	Turpentine
Lomandra longifolia	Spiny Mat Rush
Myrsine variabilis	Muttonwood
Exocarpus cupressiformis	Cherry Ballart
**Hypochaeris radicata*	Flatweed
Glochidion ferdinandi var. *ferdinandi*	Cheese Tree
**Rubus fruticosus* ssp. *aggregate*	Blackberry

TRANSECT 3

*Community – Moist Regrowth Scrub
*Length – 100m
*Aspect – Eastern aspect in gully.

*Species Recorded

Alphitonia excelsa	Red Ash
**Lantana camara*	Lantana
Pteridium esculentum	Bracken
Notelea longifolia	Mock Olive
Imperata cylindrica var. *major*	Blady Grass
Clematis aristida	Old Mans Beard
Maytenus silvestris	
Syncarpia glomulifera	Turpentine
Acacia irrorata	
Polyscias sambucifolia	Elderberry Panax
Breynia oblongifolia	Breynia
Lomandra longifolia	Spiny Mat Rush
Rubus parvifolius	Raspberry
Eustrephus latifolius	Wombat Berry
Exocarpus cupressiformis	Cherry Ballart
**Hypochaeris radicata*	Flatweed
Hibbertia scandens	Climbing Guinea Flower

2.0 PLOT METHODOLOGY

One plot-based vegetation survey was undertaken within the bounds of the site to provide additional detail on the flora assemblages present (Figure C1). The quadrats were 20 × 20m in area. All species observed within the plot were recorded, with the dominant species in each stratum being duly noted. A modified Braun-Blanquet 6-point scale (Braun-Blanquet 1927), with selected modifications sourced from Poore 1955 and Austin *et al*. 2000) was used to estimate cover-abundances of all plant species within each plot. The cover-abundance categories are shown in Table C1.

Table C1: Modified Braun-Blanquet Crown Cover-abundance Scale

Class	Cover - Abundance	Notes
1	Few individuals (less than 5% cover)	Herbs, sedges and grasses: < 5 individuals Shrubs and small trees: 5 or more individuals
2	Many individuals (less than 5% cover)	Herbs, sedges and grasses: 5 or more individuals Medium-large over hanging tree
3	5 – less than 20% cover	-
4	20 – less than 50% cover	-
5	50 – less than 75% cover	-
6	75 – 100% cover	-

- X - denotes species found immediately adjacent to but not inside the survey plot.
- * - introduced species

PLOT 1

*Community – Open Forest
*GPS location – 441266E, 6468186N
*Aspect – Southerly
*Soil Texture – Clay - loam
*Fire History – Little evidence of fire.

*Structural Components –

Canopy	(to 30m)	%coverage = 40%
Mid Storey	(to 15m)	%coverage = 15%
Shrub	(< 1m)	%coverage = 5%
Ground Cover	(< 1m)	%coverage = 60%

*Species Recorded –

Upper Stratum Dominants	*Eucalyptus paniculata*	Grey Ironbark	4
	Corymbia maculata	Spotted Gum	2
	Eucalyptus propinqua	Small-fruited Grey Gum	1
	Eucalyptus umbra	White Mahogany	1
Mid Layer Dominants	*Allocasuarina torulosa*	Forest Oak	3
Shrub Layer Dominants	*Phyllanthus gunnii*	Scrubby Spurge	2
	**Lantana camara*	Lantana	2
Ground Cover Dominants	*Themeda australis*	Kangaroo Grass	4
	Imperata cylindrica	Blady Grass	3
Additional Species Recorded	*Brunoniella australis*	Blue Trumpet	1
	Myrsine variabilis	Muttonwood	1
	Glycine clandestina	Glycine	1
	Geitonoplesium cymosum	Scrambling Lily	1
	Hybanthus stellarioides		1
	Rubus parvifolius	Native Raspberry	1
	Maytenus silvestris	Narrow-leaved Orangebark	1
	Dianella caerulea	Blue Flax-lily	1
	Dichondra repens	Kidney Weed	2
	Vernonia cinerea var. *cinerea*		1
	Cheilanthes sieberi	Mulga Fern	1
	Acacia falcata	Falcata Wattle	1
	Convolvulus erubescens	Australian Bindweed	1
	Plectranthus parviflorus		1
	Pratia purpurascens	White Root	2
	Hardenbergia violacea	False Sarsaparilla	1

APPENDIX D:
FAUNA LIST FOR THE STUDY AREA

FAUNA LIST

Family sequencing and taxonomy follow for each fauna class:

Birds - Pizzey and Knight (1997).

Herpetofauna - Cogger (2000), Ehmann (Ed) (1997) and Barker, Grigg and Tyler (1995).

Mammals - Van Dyck & Strahan (Ed) (2008) and Churchill (2008).

- Species observed or indicated by scats, tracks etc. on site during this investigation.

#(?) - Indicates a species identified without certainty or to a Genus level only.

* - Indicates an introduced species.

Threatened species addressed within this assessment appear in **bold** font.

The following symbols are used to indicate species recorded during previous surveys.

Scientific Name	Common Name	Legal Status
FISH		
Family Anguillidae		
Anguilla sp.		
Family Poeciliidae		
**Gambusia holbrooki*	Mosquito Fish	
AMPHIBIANS		
Family Myobatrachidae - 'Southern Frogs'		
Crinia signifera	Common Eastern Froglet	
Limnodynastes peronii	Striped Marsh Frog	
Family Hylidae - Tree Frogs		
Litoria fallax	Dwarf Tree Frog	
Litoria nasuta	Rocket Frog	
Litoria wilcoxi	Stony Creek Frog	
REPTILES		
Family Chelidae - Tortoises		
Chelodina longicollis	Eastern Snake-necked Tortoise	
Family Agamidae - Dragons		
Physignathus lesuerii	Eastern Water Dragon	
Family Varanidae - Monitors		
Varanus varius	Lace Monitor	
Family Scinidae - Skinks		
Eulamprus quoyii	Eastern Water Skink	
Lampropholis delicata	Grass Skink	
Family Anatidae - Ducks, Swans and Geese		
Anas superciliosa	Pacific Black Duck	
Chenonetta jubata	Australian Wood Duck	
Cygnus atratus	Black Swan	
Family Ardeidae - Herons, Egrets and Bitterns		
Egretta novaehollandiae	White-faced Heron	
Family Ciconiidae Storks		
Ephippiorhynchus asiaticus	Black-necked Stork (DECCW database)	TSC - V
Family Phalacrocoracidae		
Phalacrocorax varius	Pied Cormorant	
Phalacrocorax carbo	Great Cormorant	
Family Threskiornithidae - Ibises and Spoonbills		
Threskiornis molucca	Sacred Ibis	
Family Accipitridae - Osprey, Hawks, Eagles and Harriers		
Haliaeetus leucogaster	White-breasted Sea-Eagle	EPBC Act Migratory

Scientific Name	Common Name	Legal Status
Family Charadriidae - Plovers, Dotterels and Lapwings		
Vanellus miles	Masked Lapwing	
Family Columbidae - Pigeons, Doves		
Leucosarcia melanoleuca	Wonga Pigeon	
Macropygia amboinensis	Brown Cuckoo-Dove	
Family Cacatuidae - Cockatoos and Corellas		
Cacatua galerita	Sulphur-crested Cockatoo	
Cacatua roseicapilla	Galah	
Calyptorhyncus funereus	Yellow-tailed Black-Cockatoo	
Family Psittacidae - Parrots, Rosellas and Lorikeets		
Alisterus scapularis	King Parrot	
Platycercus eximius	Eastern Rosella	
Trichoglossus chlorolepidotus	Scaly-breasted Lorikeet	
Trichoglossus haematodus	Rainbow Lorikeet	
Family Cuculidae - Cuckoos		
Cuculus pallidus	Pallid Cuckoo	
Cacomantis flabelliformis	Fan-tailed Cuckoo	
Eudynamys scolopacea	Common Koel	
Scythrops novaehollandiae	Channel-billed Cuckoo	
Family Strigidae - Hawk-Owls		
Ninox boobook	Southern Boobook	
Family Podargidae - Frogmouths		
Podargus strigoides	Tawny Frogmouth	
Family Halcyonidae - Tree Kingfishers		
Dacelo novaeguineae	Laughing Kookaburra	
Todiramphus sancta	Sacred Kingfisher	
Family Coraciidae - Rollers		
Eurystomus orientalis	Dollarbird	
Family Maluridae - Fairy-Wrens and Emu-Wrens		
Malurus assimilis	Variegated Fairy-Wren	
Malurus cyaneus	Superb Fairy-Wren	
Family Pardalotidae - Pardalotes, Gerygones, Scrubwrens, Heathwrens and Thornbills		
Acanthiza nana	Yellow Thornbill	
Acanthiza pusilla	Brown Thornbill	
Gerygone mouki	Brown Gerygone	
Gerygone olivacea	White-throated Gerygone	
Pardalotus punctatus	Spotted Pardalote	
Pardalotus striatus	Striated Pardalote	
Sericornis frontalis	White-browed Scrubwren	
Family Meliphagidae - Honeyeaters		
Acanthorhynchus tenuirostris	Eastern Spinebill	
Lichenostomus chrysops	Yellow-faced Honeyeater	

Scientific Name	Common Name	Legal Status
Manorina melanocephala	Noisy Miner	
Meliphaga lewinii	Lewin's Honeyeater	
Philemon corniculatus	Noisy Friarbird	
Family Petroicidae - Robins and Jacky Winter		
Eopsaltria australis	Eastern Yellow Robin	
Microeca leucophaea	Jacky Winter	
Family Cinclosomatidae - Whipbird and Quail-thrushes		
Psophodes olivaceus	Eastern Whipbird	
Family Pachycephalidae - Whistlers, Shrike-tit and Shrike-thrushes		
Pachycephala pectoralis	Golden Whistler	
Family Dicruridae - Monarchs, Flycatchers, Fantails, Drongo and Magpie-Lark		
Myiagra inquieta	Restless Flycatcher	
Rhipidura fuliginosa	Grey Fantail	
Rhipidura leucophrys	Willie Wagtail	
Grallina cyanoleuca	Magpie-lark	
Family Campephagidae - Cuckoo-shrikes and Trillers		
Coracina novaehollandiae	Black-faced Cuckoo-shrike	
Family Artamidae - Wood-swallows, Butcherbirds, Magpie and Currawongs		
Cracticus nigrogularis	Pied Butcherbird	
Gymnorhina tibicen	Australian Magpie	
Strepera graculina	Pied Currawong	
Family Corvidae - Crows, Raven		
Corvus coronoides	Australian Raven	
Family Hirundinidae - Swallows and Martins		
Hirundo neoxena	Welcome Swallow	
Family Zosteropidae - White-eyes		
Zosterops lateralis	Silvereye	
MAMMALS		
Family Dasyuridae - Dasyurids		
Antechinus stuartii	Brown Antechinus	
Family Peramelidae - Bandicoots		
Isoodon macrourus	Northern Brown Bandicoot?	
Perameles nasuta	Long-nosed Bandicoot?	
Family Phascolarctidae - Koala		
Phascolarctos cinereus	Koala	TSC Act - V
Family Phalangeridae - Brushtail Possums		
Trichosurus vulpecula	Common Brushtail Possum	

Scientific Name	Common Name	Legal Status
Family Macropodidae - Kangaroos, Wallabies		
Macropus rufogriseus	Red-necked Wallaby	
Family Pteropodidae - Fruit Bats		
Pteropus poliocephalus	Grey-headed Flying-fox	
Family Molossidae - Freetail-bats		
Nyctinomus australis	White-striped Freetail-bat	
Family Vespertilionidae - Plain-nosed Bats		
Chalinolobus gouldi	Gould's Wattled bat	
Chalinolobus morio	Chocolate Wattled Bat	
Vespadelus pumilus ?	Eastern Forest Bat	
Vespadelus troughtoni?	Eastern Cave Bat	TSC Act - V
Vespaledus vulturnus ?	Little Forest Bat	
Family Muridae - Rodents		
Rattus lutreolus	Swamp Rat	
**Rattus rattus*	Black Rat	
Family Canidae		
**Vulpes vulpes*	Red Fox	
Family Leporidae		
**Lepus capensis*	European Hare	
**Oryctolagus cuniculus*	European Rabbit	