Roads and Maritime Services

Pacific Highway Upgrade, Nambucca Heads to Urunga
Norton and Griffin Offset Management Plan

December 2016

Executive summary

Roads and Maritime Services (Roads and Maritime) are upgrading a section of the Pacific Highway between Nambucca Heads and Urunga (NH2U) as part of the Pacific Highway upgrade program funded by the Federal and NSW Governments (the Project).

The Project has resulted in impacts on habitat for the following threatened fauna species, listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 (*EPBC Act): the Koala (*Phascolarctos cinereus*), Grey-headed Flying-fox (*Pteropus poliocephalus*), Spotted-tailed Quoll (*Dasyurus maculatus*), Regent Honeyeater (*Anthochaera phrygia*), and Swift Parrot (*Lathamus discolor*). These five threatened fauna species are hereafter referred to collectively as 'the affected threatened fauna'. The Project was referred to the Commonwealth in accordance with the requirements of the EPBC Act.

The referral for the Project included an EPBC Act biodiversity offset strategy for affected threatened fauna (GHD, 2013a, 2013b). The offset strategy comprised the conservation and management of habitat for the affected threatened fauna in the Norton and Griffin offset sites. Offset assessment guide calculations were performed based on the quantum of removal of habitat included in the referral for the Project (GHD, 2013b, 2013c) and the conservation of habitat in these two offset sites. The outcome of the Offset assessment guide calculations for the Project was that conservation and management of the Norton and Griffin offset sites could meet all of the Project's EPBC Act threatened fauna offsetting requirements as direct offsets.

The Minister's approval was received on 21 November 2013 subject to a number of conditions being met. The EPBC Act Approval for the Project (EPBC 2013/6963) requires biodiversity offsets for affected threatened fauna calculated with reference to the *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (DSEWPaC, 2012).

GHD have prepared this 'Norton and Griffin Offset Management Plan' report (NGOMP) to assist Roads and Maritime deliver the biodiversity offsets required for the affected threatened fauna. A Draft NGOMP was submitted to the Department in December 2014. Since then portions of the Norton offset site have been reallocated to provide biodiversity offsets for impacts of other stages of the Pacific Highway upgrade. Separate parcels of land within the Norton offset site have been set aside to offset the impacts of the NH2U and these other projects. Additional offset areas have been identified at the Boambee State Forest (SF) offset site and xxxxx offset site and included in this Final NGOMP to compensate for the reduced NH2U offset area at the Norton site.

The NGOMP outlines the approach to the delivery of biodiversity offsets for threatened fauna impacted by the Project by conservation and management of the offset sites, comprising:

- Background information about the affected threatened fauna to inform appropriate management actions.
- A detailed description of the quality of the offset with reference to the ecology and habitat requirements of the affected threatened fauna and based on targeted field surveys of the sites.
- Description of the titling and management framework that will be adopted at the offset sites and how maintenance and enhancement of habitat will contribute to the conservation of the affected threatened fauna.
- Details of a monitoring program for determining the effectiveness of management actions.

- Updated Offset assessment guide calculations that demonstrate the quality of the biodiversity that would be delivered.

The conservation and management of the offset sites will meet the Project's direct offset requirements (as determined by the Department in accordance with the Offsets assessment guide) and enhance the conservation of the affected threatened fauna.

This NGOMP report is subject to, and must be read in conjunction with, the limitations set out in Section 1.5 and the assumptions and qualifications contained throughout the report.

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1. Introduction

1.1 Background

Roads and Maritime Services (Roads and Maritime) are upgrading a section of the Pacific Highway between Nambucca Heads and Urunga (NH2U) as part of the Pacific Highway upgrade program funded by the Federal and NSW Governments (the Project).

The Project has resulted in impacts on habitat for the following threatened fauna species, listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 (*EPBC Act): the Koala (*Phascolarctos cinereus*), Grey-headed Flying-fox (*Pteropus poliocephalus*), Spotted-tailed Quoll (*Dasyurus maculatus*), Regent Honeyeater (*Anthochaera phrygia*), Swift Parrot (*Lathamus discolor*). These five threatened fauna species are hereafter referred to collectively as 'the affected threatened fauna'. The Project was referred to the Commonwealth in accordance with the requirements of the EPBC Act.

The referral for the Project included an EPBC Act biodiversity offset strategy for threatened fauna (GHD, 2013a, 2013b). The offset strategy comprised the conservation and management of habitat for the affected threatened fauna in the Norton and Griffin offset sites. Offset assessment guide calculations were performed based on the quantum of removal of habitat included in the referral for the Project (GHD, 2013b, 2013c) and the conservation of habitat in these two offset sites. The outcome of the Offset assessment guide calculations for the Project was that conservation and management of the Norton and Griffin offset sites could meet all of the Project's EPBC Act threatened fauna offsetting requirements as direct offsets.

The Minister's approval was received on 21 November 2013 subject to a number of conditions being met. The EPBC Approval for the Project (EPBC 2013/6963) requires biodiversity offsets for impacts on the affected threatened fauna calculated with reference to the *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (DSEWPaC, 2012).

GHD have prepared this 'Norton and Griffin Offset Management Plan' report (NGOMP) to assist Roads and Maritime deliver the biodiversity offsets required for the affected threatened fauna. The NGOMP has been prepared specifically to comply with Condition 21:

"Within 12 months from the date of this approval, the person taking the action must provide to the Minister for approval, a plan for the management of the Norton Offset Site and Griffin Offset Site. The Norton and Griffin Offset Management Plan (NGOMP) must be targeted to the ecological requirements of the Koala, Grey-headed Flying-fox, Spotted-tail Quoll, Regent honey eater and Swift Parrot. "

The Project and the offset sites are shown on Figure 1.

A Draft NGOMP was submitted to the Department in December 2014 in accordance with Condition 21. Since then portions of the Norton offset site have been reallocated to provide biodiversity offsets for impacts of the Oxley Highway to Kempsey Pacific Highway upgrade (OH2K) project and the Warrell Creek to Nambucca Heads (WC2NH) project. Separate parcels of land within the Norton offset site have been set aside to offset the impacts of the NH2U project (270 hectares), OH2K project (37.1 hectares) and the WC2NH project (185 hectares) (see Figure 2). Additional offset areas have been identified at the Boambee State Forest (SF) offset site and xxxxx offset site and included in this Final NGOMP to compensate for the reduced NH2U offset area at the Norton site.

This Final NGOMP report comprises a plan of management for the Norton, Griffin, Boambee SF and xxxxx offset sites, targeted to the ecological requirements of the affected threatened fauna.

1.2 Purpose of report

This NGOMP outlines the approach to the delivery of biodiversity offsets for threatened fauna impacted by the Project by conservation and management of the offset sites, comprising:

- Background information about the Koala, Grey-headed Flying-fox, Spotted-tail Quoll, Regent Honeyeater and Swift Parrot (in relation to ecology, biology and conservation status) to inform appropriate management actions.
- A detailed description of the quality of the offset with reference to the affected threatened fauna, comprising:
  - map(s) and shapefiles that clearly define the location and boundaries of the offset sites.
  - the results of targeted field surveys within the offset sites to assess habitat suitability and presence / absence of individuals in relation to the affected threatened fauna.
  - an assessment of the baseline population of affected threatened fauna detected within the offset area during field surveys.
  - maps and data illustrating the extent and quality of habitat for the affected threatened fauna.
- Description of the titling and management framework that will be adopted at the offset sites.
- A description of performance objectives and management actions that will enable maintenance and enhancement of habitat within the offset area, as well as contribute to the better protection of individuals and/or populations of affected threatened fauna onsite, including:
  - Identification of management actions that will improve the quality of habitat or viability of fauna populations.
  - Demonstration that any management actions to be undertaken will not adversely impact the affected threatened fauna.
  - A description of funding arrangements or agreements, including work programs and responsible entities.
- Details of a monitoring program for determining the effectiveness of management actions.
- Concluding statements demonstrating that conservation and management of the offset sites will meet the Project's direct offset requirements (as determined by the Department in accordance with the Offsets assessment guide) and enhance the conservation of the affected threatened fauna.

1.3 Terms and definitions

Biodiversity values	The composition, structure and function of ecosystems, including native species, populations and ecological communities, and their habitats.
DotE	The Commonwealth Department of the Environment, now known as the Department of Environment and Energy.
DSEWPaC	The former Department of Sustainability Environment Water Populations and Communities, the Commonwealth Department of the Environment at the time of approval of the Project.

EPBC Act	The *Environment Protection and Biodiversity Conservation Act 1999*.
FCNSW	Forestry Corporation of New South Wales.
Flora reserve	An area that is set aside for the preservation of native flora under the Forestry Act 2012.
Food tree	A tree species that is recognised as being of significant value as a foraging resource for a given fauna species.
Forestry Act	The New South Wales *Forestry Act 2012*.
Habitat critical to the survival of the Koala	Koala habitat that is considered to be important for the species' long-term survival and recovery. Specifically an area that scores five or more, using the habitat assessment tool in the DotE (2013) *Draft EPBC Act referral guidelines for the vulnerable Koala.*
NGOMP	Norton and Griffin Offset Management Plan, this report.
NH2U	The Proposed upgrade of a section of the Pacific Highway between Nambucca Heads and Urunga that is the subject of EPBC Act approval EPBC 2013/6963 and this NGOMP. Also known as 'the Project'
NPW Act	The *National Parks and Wildlife Act 1974*
NPWS	The NSW National Parks and Wildlife Service
PMST	Protected Matters Search Tool, a database administered by the Department that contains known and predicted records of matters of national environmental significance listed under the EPBC Act.
Roads and Maritime	Roads and Maritime Services NSW
The affected threatened fauna	The five threatened fauna species that are the subject of this NGOMP: the Koala (*Phascolarctos cinereus*), Grey-headed Flying-fox (*Pteropus poliocephalus*), Spotted-tailed Quoll (*Dasyurus maculatus*), Regent Honeyeater (*Anthochaera phrygia*) and Swift Parrot (*Lathamus discolor*).
The Boambee State Forest (SF) offset site	The 121 hectare parcel of land within the Boambee SF that will be set aside and managed as a Flora Reserve as a biodiversity offset for the Project and other Roads and Maritime projects.
The Department	The Commonwealth Department of the Environment and Energy
The Griffin offset site	The 167 hectare parcel of land owned by Roads and Maritime that will be transferred to National Parks & Wildlife Services (NPWS) to maintain and manage in perpetuity to function as a biodiversity offset for the Project.

The locality	The area within a 10 kilometre radius of a site.
MAP	A Management Actions Plan prepared in accordance with the BioBanking methodology. Specifies the management actions that must be applied at a biobank site.
The NH2U Boambee SF offset area	A 59.8 hectare area contained within the broader Boambee SF offset site that will be specifically set aside as an offset for impacts of the NH2U Project on the affected threatened fauna.
The NH2U Norton offset area	A 270 hectare area contained within the broader Norton offset site that will be specifically set aside as an offset for impacts of the NH2U Project on the affected threatened fauna.
The NH2U xxxxx offset area	A 87.2 hectare area contained within the broader xxxxx offset site that will be specifically set aside as an offset for impacts of the NH2UH Project on the affected threatened fauna.
The Norton offset site	The 496 hectare parcel of land at South Kempsey that will be set aside and managed under a BioBanking agreement as a biodiversity offset for the Project and other Roads and Maritime projects.
The Offset assessment guide	The spreadsheet offset calculator that accompanies the Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy (DSEWPaC 2012).
The offset sites	The sites that will be set aside to offset the impacts of the Project and other Roads and Maritime projects, comprising the Norton offset, Griffin offset site, Boambee SF offset site and xxxxx offset site.
The policy	The Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy (DSEWPaC 2012).
The Project	The Proposed upgrade of a section of the Pacific Highway between Nambucca Heads and Urunga that is the subject of EPBC Act approval EPBC 2013/6963 and this NGOMP. Also known as 'NH2U'
The region	The NSW north coast, which is equivalent to the Northern Rivers Catchment Management Authority region.
The xxxxx offset site	The 98.3 hectare parcel of land at Upper Corindi that will be set aside and managed under three BioBanking agreements as a biodiversity offset for the Project and other Roads and Maritime projects.
WC2NH	The Proposed upgrade of a section of the Pacific Highway between Warrell Creek and Nambucca Heads that is the subject of EPBC Act approval EPBC 2013/7101.

1.4 Methods

1.4.1 Desktop assessment

A desktop assessment was undertaken to help describe the ecology of the affected threatened fauna, the existing environment of the offset sites and to describe the presence and characteristics of local and regional populations of the affected threatened fauna.

The following resources were reviewed:

- The OEH Threatened Species, Populations and Communities Database (OEH, 2014a) and the Department's Species Profiles and Threats Database for general information about the ecology and biology of the affected threatened fauna (DotE, 2014a).
- The NSW Office of Environment and Heritage (OEH) Atlas of NSW Wildlife (OEH, 2014b) for records of the affected threatened fauna in the locality of the offset sites and the Departments Protected Matters Search Tool (PMST) for known or predicted records of the affected threatened fauna in the locality (DotE, 2014b).
- Recovery plans for each of the affected threatened fauna and scientific journal articles that have informed these plans, for specific information about the ecology and biology of the species, threats, conservation objectives and recovery actions.
- The *Kempsey to Eungai: Compensatory Habitat package* (Lewis and James, 2010) which includes an ecological assessment of the Norton offset site.
- The *Griffin Candidature Site: Compensatory Habitat Package* (Lewis and Richards, 2011) which includes an ecological assessment of the Griffin offset site.
- Other resources describing the existing environment of the offset sites, including regional vegetation, soil landscapes and geology mapping.

1.4.2 Consultation

Development of the offset package

Consultation was undertaken with Roads and Maritime and other relevant stakeholders in developing this NGOMP, with particular focus on the titling and management framework that will be adopted at each site.

The main stakeholders involved were:

- Roads and Maritime Property Services to confirm the future owners of each property, arrangements for the changes in tenure and titling and provision of funds for management.
- The Forestry Corporation of NSW (FCNSW) who will be responsible for managing the Boambee SF offset site as a Flora Reserve.
- The NSW National Parks and Wildlife Service (NPWS) who will be responsible for managing the Griffin offset site.
- xxxxx, who along with his immediate family, owns the properties that comprise the xxxxx offset site.

Finalisation of the offset package

This NGOMP report has been finalised in accordance with Condition 21 of the approval (EPBC 2013/6963) and with reference to comments received from the Department based on their review of the final draft NGOMP.

A table summarising Roads and Maritime's response to the Department's comments is presented in Appendix F. The main issues raised in the Department's review and addressed in this final offset package report comprise:

- A more detailed description of project impact areas in terms of the extent and quality of habitat for the affected threatened biota and other data used to complete offset assessment guide calculations.
- Confirmation that a BioBanking agreement will be the conservation covenant that is applied at the Norton offset site and inclusion of the management actions plan for the biobank as Appendix E.
- Additional justification for attribute scores entered in offset assessment guide calculations, including habitat quality, averted risk of loss and confidence scores.
- Additional detail about field survey methodology and which of the affected threatened biota were targeted by each survey technique.
- Additional detail regarding management actions proposed at offset sites, including timing, measureable performance indicators, triggers and corrective actions.
- Details of the various parties responsible for implementing the offset package.
- Various editorial changes, corrections to formatting, clarification of references etc.

Other inputs to this final NGOMP due to factors beyond the Department's review include:

- Removal of areas of land at the Norton offset site from the suite of offsets set aside for the Project so that these areas could be set aside as offsets for the WC2NH and OH2K projects (see the 'WC2NH Norton offset area' and 'OH2K Norton offset area' shown on Figure 2).
- Inclusion of the 'NH2U Boambee SF offset area' and the 'NH2U xxxxx offset area' and associated Koala and Grey-headed Flying-fox habitat in the suite of offsets set aside for the Project to compensate for the removal of areas of land at the Norton offset site.
- Changes to the boundary of the Norton offset site and the location of the WC2NH Norton offset area because of recent land acquisitions and construction of the 'Pacific Highway Upgrade, Kundabung to Kempsey' project adjacent to the site.
- Inclusion of additional field survey results for the Norton offset site from the BioBanking assessment that was conducted at the site in April 2016, including plant species richness results from 39 BioBanking plot/transects and fine scale vegetation mapping.

1.4.3 Field surveys

Norton offset site

The Norton offset site was initially surveyed and assessed as part of the offset strategy for the broader Pacific Highway upgrade program. The Norton offset site was surveyed by a specialist zoologist and a specialist botanist as documented in Lewis and James (2010). The flora survey of the Norton offset site and an adjoining 100 hectare site was undertaken over five days in May 2010 with a total survey effort of around 50 person-hours (Lewis and James, 2010).

Each property was systematically traversed on foot to obtain data on the following:

- Type and extent of vegetation communities.
- Species composition/inventory.
- Condition of vegetation with reference to BioBanking condition thresholds and benchmark values.
- The presence and extent of noxious weeds.
- The presence or likelihood of occurrence of threatened species and ecological communities.

Targeted field surveys were undertaken by GHD and Omvi ecologists within the Norton offset site in September 2014 to assess habitat suitability and the status of local populations of the affected threatened species. The purpose of these supplementary surveys was to more accurately map the extent and quality of habitat for the affected threatened species to inform offset calculations and the development of management actions presented in the final draft NGOMP. The site was stratified into fauna habitat types following an assessment of floristic composition, structure, topography, hydrological features, soil characteristics and disturbance history.

An additional suite of targeted surveys was conducted by GHD and Idyll Spaces ecologists in April 2016 to help complete the BioBanking assessment for the Norton offset site. The 2016 surveys included full floristic survey of 39 BioBanking plot/transects and fine scale vegetation mapping.

Field survey methods over both rounds of targeted surveys completed by GHD (and associates) comprised:

- Ground-truthing of the existing vegetation mapping.
- Habitat assessments, focussing on identifying the extent and quality of specific habitat resources of relevance to the affected threatened species, including:
  - Food tree species for the Koala as specified in the Comprehensive Koala Plan of Management for the Eastern portion of Kempsey Shire LGA, Vol. 1 (KSC, 2011).
  - Vegetation type and structure, presence and quality of woody debris, caves rock outcrops and other potential den sites for the Spotted-tailed Quoll.
  - Critical foraging habitat for the Grey-headed Flying-fox as defined in Eby and Law (2008) and the recovery plan for the species (DECC, 2009).
- BioBanking plot/transect surveys to collect data on vegetation structure, species richness, regeneration and presence of habitat resources such as fallen logs and hollow bearing trees (note that some of these plot/transects are located outside of the NH2U Norton offset area that is the subject of this offset package. The results have been included in the general assessment of vegetation condition and habitat quality at the site).
- Sampling of ‘Canopy plots’ nested in BioBanking plot/transects, comprising counts of every tree in the 50 m x 20 m plot along with its height, species, canopy cover and any evidence of fauna activity. Each tree species was then cross referenced to lists of food tree species for the Koala and Grey-headed Flying-fox to calculate the cover of food tree species.
- Koala ‘Spot Assessment Technique’ (SAT) searches for scats and evidence of Koala activity with reference to Phillips and Callaghan (2011), comprising:
  - Location and flagging of a centre tree that was located in a plot/transect and that was a Koala primary food tree species;

  - Identification and marking of the 29 trees closest to the centre tree; and
  - Searches for Koala scats within 100cm of the trunk of each of the 30 trees.
- Nocturnal surveys targeting the Koala, Spotted-tailed Quoll and Grey-headed Flying-fox over three sets of four person-hour survey rounds on three separate nights, including walked spotlighting transects, quiet listening periods, call playback and streamside searches.
- Diurnal bird surveys targeting the Swift Parrot and Regent Honeyeater over six sets of two person-hour survey rounds, three at dawn and three at dusk.
- Four motion sensing camera-traps targeting the Koala and Spotted-tailed Quoll, placed for five days and five nights, split between the main habitat types and targeting potential fauna movement corridors such as fire trails and drainage lines.

The site was stratified into fauna habitat types following an assessment of floristic composition, structure, topography, hydrological features, soil characteristics and disturbance history.

Throughout all stages of the GHD surveys and the previous surveys, specific attention was given to detecting scats and other characteristic signs of fauna as well as areas of suitable habitat for affected threatened biota, including the presence of food trees for the Koala, Regent Honeyeater, Swift Parrot and Grey-headed Flying-fox, den or latrine sites for the Spotted-tailed Quoll and roost sites for the Grey-headed Flying Fox.

Field survey results are provided in Appendix A. These data comprise the baseline data for monitoring populations of the affected threatened fauna, the quality of habitat and the effectiveness of management actions.

Griffin offset site

The Griffin offset site was initially surveyed and assessed as part of the offset strategy for the broader Pacific Highway upgrade program. The Griffin offset site was surveyed by a specialist zoologist and two specialist botanists as documented in Lewis and Richards (2011). The initial survey of the Griffin offset site was undertaken over two days (8 and 9 August 2011) for a total survey effort of around 27 person-hours (Lewis and Richards, 2011).

The Griffin offset site was systematically traversed on foot to obtain data on the following (Lewis and James, 2010; Lewis and Richards, 2011):

- Type and extent of vegetation communities.
- Species composition/inventory.
- Condition of vegetation with reference to BioBanking condition thresholds and benchmark values.
- The presence and extent of noxious weeds.
- The presence or likelihood of occurrence of threatened species and ecological communities.

Additional targeted field surveys were undertaken within the Griffin offset site by GHD and OMVI ecologists in September 2014 to assess habitat suitability and the status of local populations of the affected threatened fauna. The purpose of these supplementary surveys was to more accurately map the extent and quality of habitat for the affected threatened fauna to inform offset calculations and the development of management actions. The site was stratified into fauna habitat types following an assessment of floristic composition, structure, topography, hydrological features, soil characteristics and disturbance history.

Field survey methods comprised:

- Ground-truthing of the existing vegetation mapping
- Habitat assessments, focussing on the extent and quality of specific habitat resources of relevance to the affected threatened fauna, including:
  - Food tree species for the Koala as specified in the Comprehensive Koala Plan of Management for Eastern portion of Kempsey Shire LGA, Vol. 1 (KSC, 2011).
  - Vegetation type and structure, presence and quality of woody debris, caves rock outcrops and other potential den sites for the Spotted-tailed Quoll.
  - Critical foraging habitat for the Grey-headed Flying-fox as defined in Eby and Law (2008) and the recovery plan for the species (DECC, 2009).
  - Winter-flowering Eucalyptus and other recognised food tree species for the Swift Parrot.
  - Winter-flowering Eucalyptus, mistletoes and other recognised food tree species for the Regent Honeyeater.
- BioBanking plot/transect surveys to collect data on vegetation structure, species richness, regeneration and presence of habitat resources such as fallen logs and hollow bearing trees (see DECC, 2009).
- Sampling of 'Canopy plots' nested in BioBanking plot/transects, comprising counts of every tree in the 50 m x 20 m plot along with its height, species, canopy cover and any evidence of fauna activity. Each tree species was then cross referenced to lists of food tree species for the affected threatened fauna to calculate the cover of food tree species.
- Koala 'Spot Assessment Technique' (SAT) searches for scats and evidence of Koala activity (see Phillips and Callaghan, 2011).
- Nocturnal surveys over two sets of four person-hour survey rounds on two separate nights, including walked spotlighting transects, quiet listening periods and streamside searches.
- Diurnal bird surveys targeting the Swift Parrot and Regent Honeyeater over four sets of two person-hour survey rounds, two at dawn and two at dusk.
- Four motion sensing camera traps targeting the Koala and Spotted-tailed Quoll placed for five days and five nights, split between the main habitat types and targeting potential fauna movement corridors such as fire trails and drainage lines.

Throughout all stages of the GHD surveys and the previous surveys, specific attention was given to detecting scats and other characteristic signs of fauna as well as areas of suitable habitat for affected threatened fauna, including the presence of food trees for the Koala, den or latrine sites for the Spotted-tailed Quoll and roost sites for the Grey-headed Flying Fox. Locations of any specific habitat resources were mapped (e.g. nest sites, feed/scar trees) and where applicable, were surveyed at relevant times (for example, flowering Swamp Mahogany and Spotted Gum were specifically targeted during morning and afternoon surveys for blossom-feeding migrants such as the Swift Parrot) (Lewis and James, 2010; Lewis and Richards, 2011).

Field survey results are provided in Appendix B.These data comprise the baseline data for monitoring populations of the affected threatened fauna, the quality of habitat and the effectiveness of management actions.

Boambee SF offset site

The Boambee SF offset site was initially surveyed and assessed to help develop the Threatened Flora Offset Management Plan for the Project (GHD, 2016b). The Boambee SF offset site was surveyed by a GHD ecologist and up to two specialist botanists. The threatened

flora survey of the Boambee SF offset site was undertaken over a total of 8 days in April and May 2015 with a total survey effort of around 140 person-hours.

Survey methods included in the threatened flora survey that have contributed to this NGOMP included:

- Ground-truthing of existing regional vegetation mapping (OEH, 2012).
- Sampling of five biometric plot/transects to describe the species composition, structure and condition of vegetation within the site.
- Habitat assessment and general description of the existing environment of the offset site and condition of native vegetation.
- Mapping and assessment of weed infestations, cleared or modified native vegetation and any other areas that will require management at the offset site.
- Mapping of management features and attributes such as the location of proposed or existing fences and gates, signs, trails etc.

Additional targeted field surveys were undertaken within the Boambee SF in November 2015, mainly targeting the affected threatened fauna species. Surveys were undertaken by a specialist botanist and two GHD ecologists over five days and four nights. The purpose of these supplementary surveys was to confirm the presence of local populations of the Koala and Grey-headed Flying Fox and to quantify the extent and quality of habitat for the affected threatened fauna species to inform offset calculations and the development of management actions.

The survey effort was stratified across fauna habitat types based on an assessment of floristic composition, structure, topography, hydrological features, soil characteristics and disturbance history.

Field survey methods comprised:

- Habitat assessments, focussing on the extent and quality of specific habitat resources of relevance to the affected threatened fauna, including:
  - Food tree species for the Koala as specified in the Coffs Harbour City Koala plan of management (Lunney et. al., 1999).
  - Vegetation type and structure, presence and quality of woody debris, caves rock outcrops and other potential den sites for the Spotted-tailed Quoll.
  - Critical foraging habitat for the Grey-headed Flying-fox as defined in Eby and Law (2008) and the recovery plan for the species (DECC, 2009).
- Sampling of a further seven BioBanking plot/transects, canopy plots and Koala SAT searches (as described above), stratified between vegetation types in the WC2NH offset area portion of the site (note that these plot/transects are located outside of the NH2U Norton offset area that is the subject of this offset package. The results have been included in the general assessment of vegetation condition and habitat quality at the site).
- Nocturnal surveys targeting the Koala, Spotted-tailed Quoll and Grey-headed Flying-fox over four sets of four person-hour survey rounds on four separate nights, including walked spotlighting transects and quiet listening periods for fauna calls.
- Five motion sensing camera-traps targeting the Koala and Spotted-tailed Quoll, placed for five days and four nights split between the main habitat types and targeting potential fauna movement corridors or habitat features.

Throughout all stages of the GHD surveys specific attention was given to detecting scats and other characteristic signs of fauna as well as areas of suitable habitat for the affected threatened fauna.

Field survey results are presented in Appendix C. These data comprise the baseline data for monitoring populations of the affected threatened fauna, the quality of habitat and the effectiveness of management actions.

xxxxx offset site

The xxxxx offset site was initially surveyed by a GHD ecologist, a specialist botanist and a recognised Giant Barred Frog specialist. The survey of the xxxxx offset site was undertaken over two days in April 2016 with a total survey effort of around 30 person-hours. The main purpose of the survey was to identify occupied Giant Barred Frog habitat as required by the conditions of approval for the WC2NH project and to quantify the extent and quality of habitat to inform offset calculations and the development of management actions for this species.

Survey methods included in the Giant Barred Frog survey that have contributed to this NGOMP included:

- Ground-truthing of existing regional vegetation mapping (OEH, 2012).
- Sampling of five biometric plot/transects to describe the species composition, structure and condition of vegetation within the site.
- Habitat assessment and general description of the existing environment of the offset site and condition of native vegetation.
- Mapping and assessment of weed infestations, cleared or modified native vegetation and any other areas that will require management at the offset site.
- Mapping of management features and attributes such as the location of proposed or existing fences and gates, signs, trails etc.

A subsequent detailed survey of the entire xxxxx offset site was undertaken by two specialist zoologists and a specialist botanist over five days in October 2016. The purpose of this supplementary survey was to:

- More accurately map the extent and quality of habitat for the affected threatened species to inform offset calculations and the development of management actions in this NGOMP; and
- To help complete BioBanking assessments for the three biobank sites that will be established at the xxxxx offset site.

Field survey methods comprised:

- Ground-truthing of the existing vegetation mapping and fine-scale mapping of vegetation zones according to the BBAM (i.e. NSW vegetation types and broad condition classes).
- Habitat assessments, focussing on identifying the extent and quality of specific habitat resources of relevance to the affected threatened species, including:
  - Food tree species for the Koala as specified in the Food tree species for the Koala as specified in the Coffs Harbour City Koala plan of management (Lunney et. al., 1999).
  - Vegetation type and structure, presence and quality of woody debris, caves rock outcrops and other potential den sites for the Spotted-tailed Quoll.
  - Critical foraging habitat for the Grey-headed Flying-fox as defined in Eby and Law (2008) and the recovery plan for the species (DECC, 2009).
- BioBanking plot/transect surveys to collect data on vegetation structure, species richness, regeneration and presence of habitat resources such as fallen logs and hollow bearing trees (note that some of these plot/transects are located outside of the NH2U xxxxx

offset area that is the subject of this offset package. The results have been included in the general assessment of vegetation condition and habitat quality at the site).

- Sampling of 'Canopy plots' nested in BioBanking plot/transects.
- Koala 'Spot Assessment Technique' (SAT) searches for scats and evidence of Koala activity.
- Nocturnal surveys targeting the Koala, Spotted-tailed Quoll, Grey-headed Flying-fox and Giant Barred Frog over four sets of four person-hour survey rounds on four separate nights, including walked spotlighting transects, quiet listening periods, call playback and streamside searches.
- Three motion sensing camera-traps targeting the Koala and Spotted-tailed Quoll, placed for five days and four nights, split between the main habitat types and targeting potential fauna movement corridors such as trails and drainage lines.

The site was stratified into fauna habitat types following an assessment of floristic composition, structure, topography, hydrological features, soil characteristics and disturbance history.

Throughout all stages of the surveys, specific attention was given to detecting scats and other characteristic signs of fauna as well as areas of suitable habitat for affected threatened biota, including the presence of food trees for the Koala, den or latrine sites for the Spotted-tailed Quoll and roost sites for the Grey-headed Flying Fox.

1.5 Scope and limitations

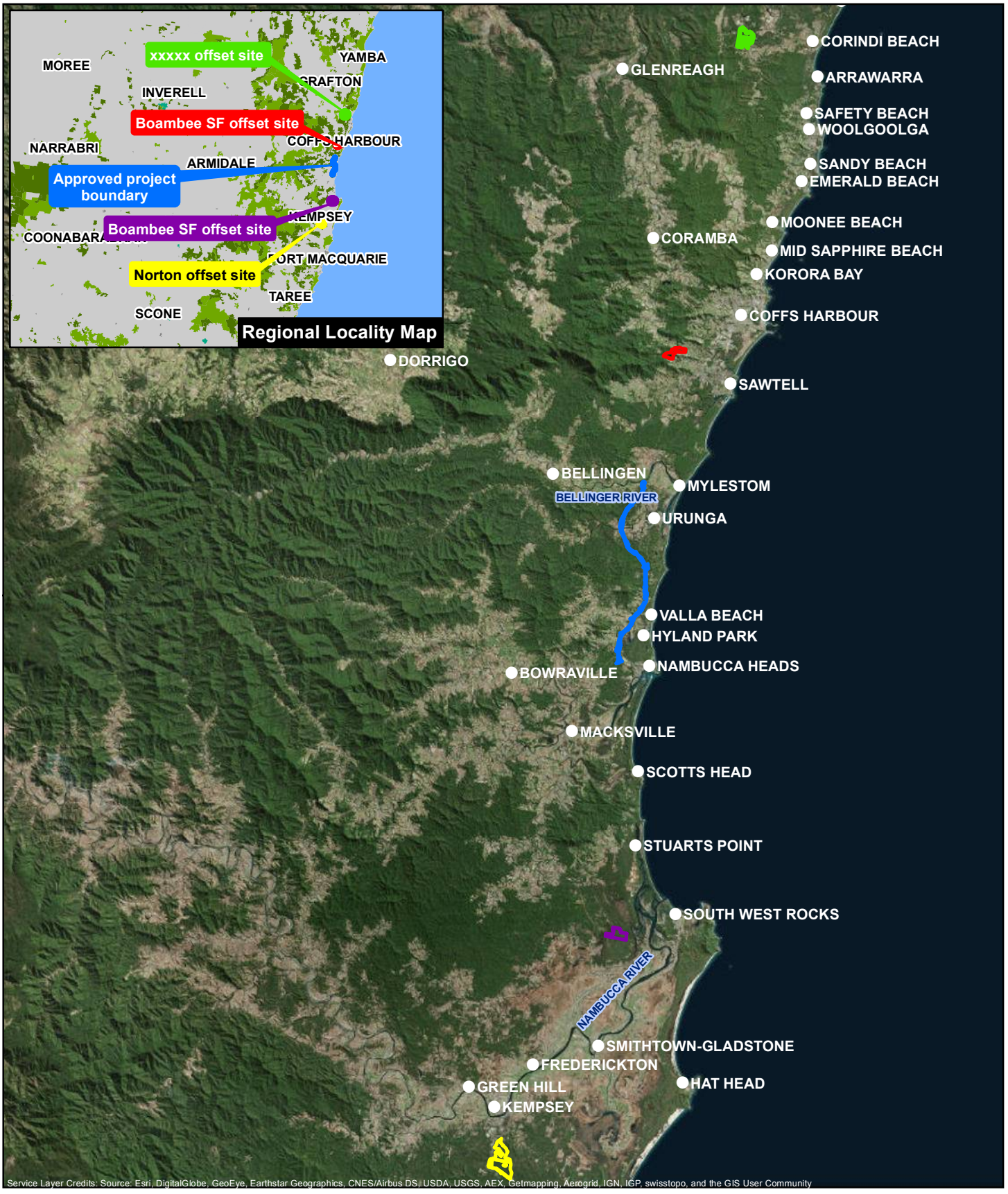
This report has been prepared by GHD for Roads and Maritime Services and may only be used and relied on by Roads and Maritime Services for the purpose agreed between GHD and the Roads and Maritime Services as set out in Section 1.2 of this report. GHD otherwise disclaims responsibility to any person other than Roads and Maritime Services arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report in Sections 2 to 4 and GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Roads and Maritime Services and others who provided information to GHD, which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which may have been included in the information provided by Roads and Maritime Services.



LEGEND

- The project
- Boambee SF offset site
- Griffin offset site
- Norton offset site
- xxxxx offset site

Paper Size A4

0 5 10 20

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Roads and Maritime Services
NH2U, Pacific Highway Upgrade
Norton and Griffin Offset Management Plan

Job Number	21-23829
Revision	A
Date	27 Oct 2016

The project and offset sites

Figure 1

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Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: General topo - NSW LPI DTDB 2012, Geoscience Australia: 250k Data - Jan 2011; Aerial Imagery - ESRI 2016.jrichardson

2. Ecology of the affected threatened fauna

2.1 Overview

The following section provides information about the Koala, Grey-headed Flying-fox, Spotted-tail Quoll, Regent Honeyeater and Swift Parrot, in relation to the ecology, biology and conservation status of these threatened fauna species, to inform the development of appropriate management actions.

The information about the ecology of the affected threatened fauna presented below has been used to compile this NGOMP as follows:

- To describe the existing environment of the offset sites, including the extent and quality of habitat resources and status of local populations (see Sections 3, 4, 5 and 6).
- To identify management actions appropriate to the life cycle, habitat requirements and threats to the persistence of these species (see Sections 7, 8, 9 and 10).
- To determine the quality of the biodiversity offset that will be delivered by conservation of the offset sites (see Section 11).

2.2 Koala

The combined populations of the Koala in Queensland, New South Wales and the Australian Capital Territory were determined to be a species for the purposes of the EPBC Act under the provisions of section 517 of the Act and are listed as a vulnerable species. In NSW, the Koala is also listed as a vulnerable species under the *Threatened Species Conservation Act 1995* (TSC Act) and two populations are listed as endangered; one in the Hawks Nest and Tea Gardens LGAs; and one in Pittwater LGA. This section refers to the population of the Koala that comprises a vulnerable species under the EPBC Act, with particular focus on the regional population that occurs in coastal portions of the Kempsey Shire and Coffs Harbour LGA.

The Koala is a tree-dwelling, medium-sized, herbivorous marsupial in the Family Phascolarctidae. Koalas live in breeding aggregations, generally comprising a dominant male, a small number of mature females and juveniles of various ages. The home range of Koalas varies depending on the quality of the habitat and the number of available food trees with average ranges of 10–15 ha recorded in the Pilliga region; 13–15 ha in north eastern NSW; and 0.2– 500 ha, with an average of 80–90 ha near Port Stephens (ref). The home range of the dominant male generally overlaps extensively with the home ranges of several females and adult Koalas generally remain within their individual home range areas throughout their life (DECC, 2008).

Koalas reach sexual maturity at approximately two years though juvenile males are generally excluded from mating by the dominant male. The breeding season for the Koala peaks between September and February and animals are most active during this period. While female Koalas can theoretically breed every year, this rarely occurs due to the metabolic pressures of lactation and the low nutritional value of their food resources (DECC, 2008).

The gestation period for the Koala is 35 days then, following birth, the young remains in the pouch for approximately six months and from about six to 12 months' age remains dependant on its mother and is carried on her back. Young can remain in the mother's home range for a

further two to three years before animals of both sexes disperse to establish their own home range areas. Dispersal distances generally range from 1–11 km although movements in excess of 50 km have been recorded (DECC, 2008).

The diet of the Koala primarily consists of Eucalyptus leaves which are low in nutrients and energy and high in indigestible components and toxic compounds. Koalas are able to cope with this diet because they have a slow metabolic rate, low nutrient requirements and a complex digestive tract. Koalas may also favour younger, more nutritious leaves and save energy by remaining inactive for much of the day (DECC, 2008).

The Koala occurs in a range of eucalypt forest and woodland communities, including coastal forests, the woodlands of the tablelands and western slopes, and the riparian communities of the western plains. The quality of forest and woodland communities as habitat for Koalas is influenced by factors such as: species and size of trees present; vegetation structure; soil nutrient status; climate and rainfall. It is widely considered that the most important factor influencing Koala occurrence is the suite of tree species available with regional populations depending on specific primary and/or secondary food tree species. If primary food tree species are not present or occur in low density, Koalas will rely on secondary food tree species, but the carrying capacity of the habitat is likely to be lower (DECC, 2008).

Throughout NSW, Koalas have been observed to feed on 66 eucalypt and seven non-eucalypt species (Phillips, 2000). The *Comprehensive Koala Plan of Management for Eastern portion of Kempsey Shire LGA, Vol. 1* lists primary and secondary food tree species for the region surrounding the Norton and Griffin offset sites (KSC, 2011). The Coffs Harbour City Koala plan of management lists primary and secondary food tree species for the region surrounding the Boambee SF and xxxxx offset sites (Lunney et. al., 1999). Primary food trees exhibit a level of use that is significantly higher than that of other Eucalyptus species and independent of tree density. Koalas may use trees other than food trees, including non-eucalypts, for incidental browsing or for purposes such as daytime resting or shelter in hot or rainy weather (DECC, 2008).

Small, fragmented or highly disturbed habitats are less likely to be able to support Koalas in the long term due to edge effects, limited resource availability and increased mortality. Koalas utilise scattered trees in largely cleared environments however travelling across open ground leaves them more vulnerable to threats such as predation or vehicle collision (DECC, 2008).

Since European settlement the size of the Koala population and the species' distribution have significantly declined in response to habitat loss and fragmentation and hunting (DotE, 2013). Contemporary habitat loss and fragmentation continue to threaten the Koala and compounds the species' susceptibility to direct mortality and injury from vehicle strikes, dog attacks, debilitating disease and the effects of climate change (DE, 2013). Drought and incidences of extreme heat are also known to cause very significant mortality, and post-drought recovery may be substantially impaired by the range of other threatening factors (DSEWPaC, 2012b).

Dog attack is recognised as a significant threat to the viability of many Koala populations and the management of dogs is therefore an important impact mitigation measure (KSC, 2011). Management measures that reduce the risk of dogs coming into contact with Koalas include preventing domestic dogs roaming, through education and awareness for dog owners and control of feral dogs (KSC, 2011).

Chlamydia infection is frequently noted as a health problem amongst Koalas that come into human care and is believed to be present in all wild Koala populations in NSW. Chlamydia symptoms may be instigated or exacerbated by stress related to factors such as habitat clearing

or disturbance. Female fecundity levels may be severely reduced by Chlamydia infection resulting in low to nil population increase (KSC, 2011).

The NSW Government has prepared a Koala recovery plan which aims to reverse the decline of the Koala in New South Wales, to ensure adequate protection, management and restoration of Koala habitat, and to maintain healthy breeding populations of Koalas throughout their current range (DECC, 2008). The following specific objectives of the Koala recovery plan are applicable to this NGOMP and have been reflected in the specific management actions proposed for the offset sites:

- Specific objective 1a: Identify and conserve habitat important for Koala conservation.
- Specific objective 1e: Implement strategies which minimise the impacts of dogs on Koala populations.
- Specific objective 1f: Develop and implement strategies to reduce the impact of fires on Koala populations.
- Specific objective 2a: Revegetate and rehabilitate selected sites (DECC, 2008).

2.3 Grey-headed Flying-fox

The Grey-headed Flying-fox is listed as a vulnerable species under the EPBC Act and the TSC Act.

The Grey-headed Flying-fox is a large, nomadic fruit and blossom-feeding bat. It occupies forests and woodlands in the coastal lowlands, tablelands and slopes of southeast Australia from Bundaberg, Queensland to Geelong, Victoria. It is usually found at altitudes <200 metres. Few localities within this range support a continuous presence and patterns of occurrence and relative abundance within its distribution varies widely between seasons and between years. The Grey-headed Flying-fox is a highly mobile, nomadic species that relies on food sources with largely irregular patterns of productivity. When assessed at a local scale, the species is generally present intermittently and irregularly however broad trends in the distribution of plants with similar flowering and fruiting times coincide with annual cycles of movement and habitat use that are apparent at regional scales (DECCW, 2009).

Reproduction in Australian flying-foxes is seasonal and synchronised. Grey-headed Flying-fox mating behaviour commences in January and conception occurs in April or May. Females give birth to single pups in October or November and lactate until around March. Individuals reach reproductive maturity in the second year of life however, there is evidence that few females younger than three years successfully raise young to independence and so this low reproductive potential inhibits the capacity of Grey-headed Flying-foxes to recover from population declines (DECCW, 2009).

Grey-headed Flying-foxes feed on blossom and fruit in canopy vegetation and forage over extensive areas. They disperse pollen and seeds of diet plants during their foraging bouts and in this way they contribute to the reproductive and evolutionary processes of forest communities (DECCW, 2009). Forty species of plants in the recognised nectar diet of Grey-headed flying foxes occur in the Northeast NSW region, comprising 34 species in the Myrtaceae (two *Angophora*, five *Corymbia*, 25 *Eucalyptus* and one each of *Lophostemon, Melaleuca* and *Syncarpia*); three species in the Proteaceae (two *Banksia* and one *Grevillea*) and one species in the Fabaceae (*Castanospermum australe*) (Eby and Law, 2008). These blossom-bearing species are primarily found in sclerophyll forests and woodlands. There are a further 46 species of trees and lianas in the fruit diet of Grey- headed flying foxes in the Northeast NSW region,

comprising members of 26 families and 30 genera, with five genera represented by more than one species. These fruit-bearing species are primarily found in rainforest and the floristic diversity decreases to the south of the region (Eby and Law, 2008). The majority of animals feed on nectar and pollen from eucalypts (genera *Eucalyptus, Corymbia* and *Angophora*), melaleucas and banksias. Grey-headed Flying-foxes forage over extensive areas: one-way trips of approximately 50 km have been recorded between camps and foraging areas although commuting distances are more often < 20 km (DECCW, 2009).

The survival of Grey-headed Flying-foxes depends on a connected sequence of productive foraging habitats, the migration corridors or stopover habitats that link them, and suitable roosting habitat within nightly commuting distance of foraging areas. On this basis, the recovery plan for the Grey-headed Flying-fox explicitly identifies foraging habitat which is critical to the survival of the species as habitat that meets one or more of the following criteria:

- It is productive during winter and spring, when food bottlenecks have been identified.
- It is known to support populations of > 30 000 individuals within an area of 50 km radius (the maximum foraging distance of an adult).
- It is productive during the final weeks of gestation, and during the weeks of birth, lactation and conception (September to May).
- It is productive during the final stages of fruit development and ripening in commercial crops affected by Grey-headed Flying-foxes (months vary between regions).
- It is known to support a continuously occupied camp (DECCW, 2009).

The species is colonial and roosts in large aggregations in the exposed branches of canopy trees (camps). When the camps are undisturbed their locations are generally stable through time and several camps have been known for over 100 years. Camp size fluctuates, and many camps may be empty for extended periods. Camps provide resting habitat, sites of social interactions and refuge for animals during significant phases of their annual cycle, such as birth, lactation and conception (DECCW, 2009). A total of seventy-four camps used by Grey-headed flying foxes have been documented in the north coast region of NSW with the majority occurring at altitudes below 200 m along the coastal lowlands and ranges (Eby and Law, 2008).

The recovery plan for the Grey-headed Flying-fox explicitly identifies roosting habitat which is critical to the survival of the species as habitat that meets one or more of the following criteria:

- It is used as a camp either continuously or seasonally in > 50% of years.
- It has been used as a camp at least once in 10 years (beginning in 1995) and is known to have contained > 10 000 individuals, unless such habitat has been used only as a temporary refuge, and the use has been of limited duration.
- It has been used as a camp at least once in 10 years (beginning in 1995) and is known to have contained > 2 500 individuals, including reproductive females during the final stages of pregnancy, during lactation, or during the period of conception (i.e. September to May) (DECCW, 2009).

Loss of foraging habitat is consistently identified as the primary threat to Grey-headed Flying-foxes. Reductions in nectar flow and fruit productivity occur as a result of forest clearance and degradation, reductions in floristic diversity, simplification of age structure from forestry practices, eucalypt dieback, drought, fire, climate change and the vulnerability of flowering and fruiting schedules to fluctuations in such factors as temperature and rainfall. Clearing of winter forage is a particular concern for the species as few diet plants flower in winter, and those that

flower reliably occur on coastal lowlands in northern New South Wales and southern Queensland and are associated with population centres and development pressure (DECCW, 2009). Other threats include loss of roosting habitat, deliberate destruction or harassment associated with commercial horticulture, electrocution on power lines or entanglement in barbed wire, disease and potentially competition from the Black flying-fox (*Pteropus alecto*) (DECCW, 2009).

A Grey-headed Flying-fox recovery plan has been prepared, the overall objectives of which are to: reduce the impact of threatening processes on Grey-headed Flying-foxes and arrest decline throughout the species' range; conserve the functional roles of Grey-headed Flying-foxes in seed dispersal and pollination; and improve the standard of information available to guide recovery of the Grey-headed Flying-fox, in order to increase community knowledge of the species and reduce the impact of negative public attitudes on the species (DECCW, 2009). The following specific actions of the recovery plan are applicable to this NGOMP and have been reflected in the specific management actions proposed for the offset sites:

- Action 1: Identify and protect foraging habitat critical to the survival of Grey-headed Flying-foxes across their range.
- Action 2: Enhance winter and spring foraging habitat for Grey-headed Flying-foxes.
- Action 7: Monitor population trends for the Grey-headed Flying-fox (DECCW, 2009).

2.4 Spotted-tailed Quoll

The southeast mainland population of the Spotted-tailed Quoll was determined to be a species for the purposes of the EPBC Act under the provisions of section 517 of the EPBC Act and is listed as an endangered species. In NSW, the Spotted-tailed Quoll is listed as a vulnerable species under the TSC Act. This section refers to the mainland population of the subspecies *Dasyurus maculatus maculatus* that comprises an endangered species under the EPBC Act.

The Spotted-tailed Quoll is a medium-sized, marsupial carnivore in the Family Dasyurideae. The Spotted-tailed Quoll typically occurs at low densities, as adults are solitary and occupy large home ranges. Female home ranges are generally non-overlapping and 88–1515 ha in area. Male home ranges are 359–5512 ha in area, overlap and encompass multiple female home ranges. The species is capable of covering large distances, with animals recorded moving at least 8 km in a day and 19 km in a week. Spotted-tailed Quolls hunt on the ground or in trees and feed on a wide variety of prey and carrion, including mammals, birds, reptiles and invertebrates although medium-sized mammals constitute the bulk of the diet. Prey varies between the sexes and age-classes as well as seasonally, annually, geographically and in accordance with prey availability (Long and Nelson, 2009).

The average lifespan of the species is relatively short (three to five years) with sexual maturity at 11-12 months of age. The majority of females breed annually with an average litter size of five young. There is some evidence of high mortality during the period from birth until weaning, although high annual recruitment of sub-adults into study populations has also been recorded (Long and Nelson, 2009).

The Spotted-tailed Quoll is known from a wide range of habitat types, including rainforest, wet and dry sclerophyll forest, coastal heathland, scrub and dunes, woodland, heathy woodland, swamp forest, mangroves, on beaches and sometimes in grassland or pastoral areas adjacent to forested areas. The majority of records are associated with forest vegetation in areas with relatively high (> 600 mm/yr) and predictable seasonal rainfall (Long and Nelson, 2009).

Spotted-tailed Quolls shelter in den sites such as caves or rock crevices, hollow trees or logs, dense vegetation, under buildings, burrows of rabbits or wombats or freshly dug burrows where suitable substrate is available. Individuals use up to 20 separate den sites and move between them every few days (Long and Nelson, 2009).

Habitat that is critical to the survival of the Spotted-tailed Quoll includes large patches of forest with adequate denning resources and relatively high densities of medium-sized mammalian prey, however, the threshold densities of these critical components required to maintain populations are unknown and so critical habitat has not been formally defined or mapped (Long and Nelson, 2009).

The Spotted-tailed Quoll has declined in distribution and abundance throughout its range, and many populations are now fragmented and isolated (Long and Nelson, 2009). In New South Wales, the Spotted-tailed Quoll remains widely distributed within large areas of contiguous forested land, from the Queensland border to the Victorian border, although the species is thought to have declined by at least 25–50% since European settlement (Lunney et al., 2000). Aspects of the ecology of Spotted-tailed Quolls render them especially susceptible to threatening processes: they occupy large home ranges at low population densities; they have a relatively short lifespan and a low overall reproductive output; they have a limited ability to recolonise fragmented patches of habitat; many prey species rely on hollows for shelter and breeding and are limited by timber harvesting or other practices that reduce these resources; and they may be limited by the availability of den sites. Consequently, Spotted-tailed Quoll populations are limited to large, relatively intact patches of forest and are significantly prone to threatening processes that reduce, degrade and fragment such habitat. Other threats include competition with and possibly predation by exotic carnivores, poison baiting programs to control these introduced carnivores, human persecution in areas where quolls may prey on domestic animals and vehicle collisions (Long and Nelson, 2009).

A Spotted-tailed Quoll recovery plan has been prepared the overall objectives of which are to: increase knowledge of the distribution, ecology, status of populations, and impact of threatening processes on Spotted-tailed Quoll populations and to reduce the impact of threatening processes throughout the species' range and subsequently halt the current decline in its distribution and abundance (Long and Nelson, 2009). The following specific actions of the recovery plan are applicable to this NGOMP and have been reflected in the specific management actions proposed for the offset sites:

- 3.1 Target landholders in areas where Spotted-tailed Quolls are known to occur to protect and manage their land in a manner that is compatible with maintenance of Spotted-tailed Quoll habitat, through voluntary conservation agreements.
- 3.2 Maintain and restore habitat corridors on unprotected freehold land.
- 5.5 Investigate alternative livestock protection methods that have fewer impacts on non-target species.
- 5.6 Review existing information on alternative poison delivery or biological control systems to identify systems with high target species specificity (Long and Nelson, 2009).

2.5 Regent Honeyeater

The Regent Honeyeater (*Anthochaera phrygia*, syn. *Xanthomyza phrygia*) is a medium-sized honeyeater in the Family Meliphagidae inhabiting drier open-forests and woodlands in south-

eastern Australia. The Regent Honeyeater is listed as a critically endangered species under the EPBC Act and the TSC Act.

The Regent Honeyeater mainly occurs in dry open-forest and woodland in areas of low to moderate relief on the western slopes of the Great Dividing Range, occupying broad valleys extending into the ranges. The Regent Honeyeater is a highly mobile species that undertakes sporadic regional movements to exploit intermittently available foraging resources (Menkhorst et. al., 1999). Patterns of seasonal movement are poorly understood, other than regular visitation of known, key-breeding areas such as the Capertee Valley and Hunter Valley in central east NSW and Bundarra-Barraba region, northern NSW (Commonwealth of Australia, 2016). The Clarence Valley in near-coastal NSW is also used as breeding areas on occasion (Garnett et. al., 2011). The species is described variously as nomadic, erratic or irruptive. Movements are thought to be governed mainly by the flowering of a select number of *Eucalyptus* and mistletoe species (DotE, 2014a). There are scattered records along the coast in the Northern Rivers and Mid-North Coast Regions (DotE, 2014a).

Most records of the Regent Honeyeater are from box-ironbark eucalypt associations with an apparent preference for wetter, more fertile sites such as along creek flats, broad river valleys and lower slopes. Along streams in NSW, riparian forests of River She-oak (*Casuarina cunninghamiana*) and associated mistletoes are also important for feeding and breeding. Wet lowland coastal forest dominated by Swamp Mahogany (*Eucalyptus robusta*) or Spotted Gum (*Corymbia maculata*) in coastal NSW are potentially used as refuge areas when conditions on the inland slopes are unfavourable, such as during drought (Menkhorst et. al., 1999).

Regent Honeyeaters breed from May to March, with a peak in breeding activity from September to November. Breeding can occur in the season following hatching and may involve fidelity to previous breeding sites. Seasonal patterns in breeding appear to correspond to regional patterns in the flowering of key eucalypt and mistletoe species. The female lays two or occasionally three eggs which are incubated by the female only for a period of 12–15 days. Both parents tend the nestlings. Young generally fledge 13–17 days after hatching, but may take up to 21 days during cold weather. Fledglings are fed by both adults and become independent approximately three to four weeks after leaving the nest. Breeding success varies annually. Pairs may re-nest after a successful or failed breeding attempt (DotE, 2014a).

The Regent Honeyeater is considered at risk of extinction in the wild because of its specialised habitat requirements and low population level, apparent reliance on a small number of favoured sites, significant reductions in the extent and quality of habitat throughout its range and a reduction in range in recent decades (Menkhorst et. al., 1999). The decline of the Regent Honeyeater is due mainly to the loss, fragmentation and degradation of the species' habitat. Threats to the species' persistence include: the clearance and fragmentation of better quality habitat for agricultural purposes; increased dieback and tree decline in agricultural and pastoral areas; inhibited native regenerating due to grazing by livestock and rabbits; forestry practices that promote dense regrowth of immature trees via the removal of large spreading trees from box-ironbark woodlands; and the removal of ironbark trees for timber (DotE, 2014a).

The *National Recovery Plan for the Regent Honeyeater* (Anthochaera phrygia)(Commonwealth of Australia, 2016) outlines the following conservation objectives relevant to the recovery effort of the Regent Honeyeater:

- To reverse the long-term population trend of decline and increase the numbers of regent honeyeaters to a level where there is a viable, wild breeding population, even in poor breeding years; and to

- Enhance the condition of habitat across the regent honeyeaters range to maximise survival and reproductive success, and provide refugia during periods of extreme environmental fluctuation.

The following strategies and specific actions of the recovery plan are applicable to this NGOMP and have been reflected in the specific management actions proposed for the offset sites:

- To improve the extent and quality of regent honeyeater habitat, through the specific actions:
  - 1c. Protect intact (high quality) areas of regent honeyeater breeding and foraging habitat (e.g., through land covenants and state/national parks).
  - 1e Habitat patches or corridors are enhanced in order to facilitate landscape scale movements. Key habitat patches and corridors are identified and expanded and/or rehabilitated.
- To maintain and increase community awareness, understanding and involvement in the recovery program, through the specific action:
  - 4c Continue to inform, support and encourage landholders and other community members to be involved in the conservation of the regent honeyeater) (Commonwealth of Australia, 2016).

2.6 Swift Parrot

The Swift Parrot (*Lathamus discolor*) is a medium-sized nectar-feeding bird in the Family Psittacidae. The Swift Parrot is listed as a critically endangered species under the EPBC Act and as an endangered species under the TSC Act.

Swift Parrots generally occur in small parties of up to 30 birds around sources of abundant food. The Swift Parrot occurs as a single, migratory population which breeds in Tasmania, moves to mainland Australia in autumn for the non-breeding season and winters in Victoria and New South Wales, before returning to Tasmania in spring. They are generally gregarious when breeding with many pairs nesting in close proximity as part of loose colonies (DotE, 2014b). The breeding range of the Swift Parrot is largely restricted to the east and south-east coast of Tasmania where it occupies an area of less than 500 km^2. Whilst on the mainland the Swift Parrot disperses widely, foraging on flowers and lerps in *Eucalyptus* spp. mainly in Victoria and New South Wales. In New South Wales, Swift Parrots forage in forests and woodlands throughout the coastal and western slopes regions each year (Saunders and Tsaroz, 2011). During periods of drought in central Victoria, Swift Parrots may concentrate in coastal drought refuge habitats in New South Wales, as observed in 2002 and 2009 (Tzaros et al., 2009).

During the winter migration period, the majority of the population frequents eucalypt woodlands and forests in Victoria and New South Wales. Research within winter habitats has identified key foraging habitat types and characteristics. Within the Northern Rivers region of NSW the key habitat types are forests dominated by Swamp Mahogany, Forest Red Gum (*Eucalyptus tereticornis*), Blackbutt (*Eucalyptus pilularis*) and Spotted Gum. The use of these habitats is dependent on prevailing climatic conditions and corresponding food availability. Within these habitats, Swift Parrots have been found to preferentially forage in large, mature trees that provide more reliable foraging resources than younger trees. The production of lerp and nectar food resources in these habitats and the availability of nesting hollows in the Tasmanian portion of the species' range are considered the main limiting factors to the species' survival (Saunders and Tsaroz, 2011).

Movement pathways used by Swift Parrots throughout their range are not well understood. Large scale movement trends have been demonstrated across mainland Australia however it is not known if long distance movements across Bass Strait or on the mainland are undertaken in groups, nocturnally or diurnally, at specific heights or what triggers such movements (Saunders and Tsaroz, 2011).

The main threats to the survival of the Swift Parrot population include the loss and alteration of foraging and nesting habitat through forestry activities and habitat removal for development. Other identified threats include climate change impacts, competition for foraging and nesting resources from aggressive and/or overabundant bird species, mortality from collisions with human-made objects, Psittacine beak and feather disease, and illegal bird capture and trade (Saunders and Tsaroz, 2011).

A Swift Parrot recovery plan has been prepared the overall objectives of which are: to prevent further decline of the Swift Parrot population; and to achieve a demonstrable sustained improvement in the quality and quantity of Swift Parrot habitat to increase carrying capacity (Saunders and Tsaroz, 2011). The following specific actions of the recovery plan are applicable to this NGOMP and have been reflected in the specific management actions proposed for the offset sites:

- Action 1 - Identify the extent and quality of habitat.
- Action 2 - Manage and protect Swift Parrot habitat at the landscape scale.
- Action 4 - Monitor population and habitat (Saunders and Tsaroz, 2011).

3. Existing Environment of Norton Offset Site

3.1 Location and landuse

The Norton offset site is a parcel of privately owned land that was purchased by Roads and Maritime for the purpose of securing biodiversity offsets for various stages of the Pacific Highway upgrade project. It has been the subject of detailed ecological surveys to establish its suitability as a biodiversity offset as part of a preliminary assessment of candidate properties (Lewis and James, 2010), to complete a BioBanking agreement application (GHD, 2016) and to inform the preparation of this offset package and management plan.

The Norton offset site comprises part Lot 501 DP 1200647, Lot 53 DP 1162355, Lot 301 DP 1161894, Lot 302 DP 1161894, Lot 56 DP1165099, Lot 11 DP1194544 and Lot 21 1199597 adjacent to the Pacific Highway, at South Kempsey, NSW as shown on Figure 2. The site boundary and associated cadastre have recently been modified to accommodate the Pacific Highway upgrade and a proposed quarry expansion. This recent and proposed development is shown on Figure 2. A portion of Lot 56 DP1165099 is excluded from the biobank site, as this area will be maintained as a house site and home paddocks. Lot 56 DP1165099 is currently the subject of an application to the Land and Property Management Authority (LPMA) to update the cadastral boundary to accommodate the Kundabung to Kempsey section of the Pacific Highway upgrade in the southwestern corner of the Lot. The portion of Lot 56 DP1165099 that will be removed for the Pacific Highway upgrade has been excluded from the biobank site.

The Norton offset site is around 496 hectares in area and contains remnant and regenerating forest on gently undulating terrain. It is 54 kilometres south of the approved Project boundary in an equivalent position on near-coastal low hills (Figure 1). The Koala and Grey-headed Flying Fox have been recorded at the site (Lewis and James, 2010) and there are extensive areas of suitable habitat for these two species as well as the Spotted-tailed Quoll, Regent Honeyeater and Swift Parrot. The Norton offset site is a large and highly suitable offset site that is under risk of development and has considerable capacity for improvement and that will meet the majority of the Project's biodiversity offset requirements.

The Norton offset site is currently unoccupied. Previous land uses include timber harvesting, low intensity grazing and stockpiling of timber, rubbish and fill. There is a limited network of dirt access tracks across the site and some internal fences, generally in poor condition. An electricity easement runs north-south through the southwestern portion of the site and another runs along the southern boundary. Essential Energy have confirmed that the voltage in these electricity easements through the Norton biobank is 11kV (three phase). The width of the easement that is maintained for this voltage is 20 metres. These 20 metre-wide easements have been excluded from the offset site (Figure 2).

There is an unbuilt Crown Road (i.e. a 'paper road') through the centre of the site which Roads and Maritime are in the process of extinguishing.

Roads and Maritime currently owns the Norton offset site. A BioBanking agreement under the NSW *Threatened Species Conservation Act 1995* (TSC Act) will be entered into over the majority of the property to conserve the proposed conservation area in perpetuity. The BioBanking agreement will be registered on the property title and is binding on successors in title.

A site specific Management Action Plan (MAP) has been prepared to accompany the BioBanking agreement. The MAP presents the management actions that must be applied at the

site under the BioBanking agreement. The plan includes the conditions the land owner must observe in accordance with the BioBanking agreement and strategies to assist landholders to maintain and improve biodiversity values. The MAP is designed to complement existing environmental legislation, which continues to apply to the land. The approved MAP will be implemented by the landowner and/or Roads and Maritime along with the management requirements specified in this offset package.

Management actions required to maintain and enhance the habitat for the affected threatened fauna were identified during the survey and are outlined in Section 7 of this report.

The 496 hectare Norton offset site will also provide biodiversity offsets for impacts of the Oxley Highway to Kempsey Pacific Highway upgrade (OH2K) project (GHD, 2013) and the Warell Creek to Nambucaa Heads (WC2NH) project (GHD, 2016a). The policy allows a single offset site to provide biodiversity offsets for more than one project provided that the offsets are for different threatened species or MNES (DSEWPaC, 2012). However, consultation with the DotE has confirmed that a specific parcel of land at an offset site can only be used to offset the impacts of a single project. Therefore, separate parcels of land within the Norton offset site have been set aside to offset the impacts of the NH2U project (270 hectares), OH2K project (37.1 hectares) and the WC2NH project (185 hectares) (see Figure 2). There is a further 4 hectares of mainly exotic vegetation which has not been included in any of these EPBC Act offset packages but which will be regenerated and managed as part of the Norton biobank site. The land that has been included as a biodiversity offset for the NH2U project is the 'NH2U Norton offset area' as shown on Figure 2.

3.2 Landscape context

The Norton offset site is around 496 hectares in area and contains wet and dry sclerophyll forest, gassy woodland and a small area of exotic vegetation on gently undulating, near-coastal hills. The southern portion of the site comprises a gentle slope, on fine grained sedimentary substrate and recent alluvium that drains northwards to Stumpy Creek. On the north side of Stumpy Creek there is a relatively steep, rocky ridge on fine grained volcanic substrate that rises to a height of 100 m elevation just to the west of the site. The northern portion of the offset site comprises moderate to steep slopes that drain northwards to Boat Harbour creek. There appears to be a transitional area of metamorphic geology between the sedimentary and volcanic portions of the site. This variable geology, combined with the site's disturbance history, is probably contributing to the complex and variable vegetation on site (see Section 3.3 below).

Stumpy Creek is a near-permanent, channel confined, third order stream that runs generally from west to east through the site. It follows a circuitous route through the southern portion of the site and along with its tributaries dominates the geomorphology of this area. Stumpy Creek is generally in good condition with intact riparian and in stream vegetation, intact channel and bank structure, continuous flow, very little weed infestation and no evidence of poor water quality.

Boat Harbour creek is a permanent, channel confined, third order stream that runs generally from southeast to northwest through the site. It is fed by multiple intermittent tributaries in narrow gullies running off the ridge through the centre of the site. Boat Harbour Creek is generally in moderate condition with partially cleared and regenerating riparian vegetation, healthy in stream vegetation, intact channel and bank structure, continuous flow, moderate weed infestation and some evidence of high turbidity.

Adjacent land uses include:

- The Pacific Highway, including the recently upgraded Kempsey Bypass section to the northwest and Kundabung to Kempsey section to the southwest.
- Farawell's Quarry, including a proposed expansion, a service centre and cleared land proposed for warehousing and light industrial land to the west.
- The north coast railway and sparsely cleared bush blocks and hobby farms to the north and northeast.
- The north coast railway and then the Maria National Park and vegetated private and Crown land to the east.
- Partially cleared grazing land, hobby farms and bush blocks to the southeast and south and beyond that the Maria River State Forest.

The Norton offset site includes a mapped regional fauna habitat corridor (Scotts et. al, 2003) that runs east-west connecting State forests to the west and south of the site with Maria National Park to the east.

The Norton offset site is part of a near continuous patch of native vegetation and habitat of many thousands of hectares. The recent and proposed development and the Pacific Highway to the west and north coast railway to the east will comprise barriers to fauna movement and other ecological processes. Kalateenee State Forest lies to the west of the Pacific Highway and beyond that there is an extensive network of native vegetation in national parks and State forests that stretches to the Great Dividing Range. The Norton offset site is partially connected to this extensive area of habitat via the riparian corridors of Boat Harbour and Stumpy Creek and associated culverts and underpasses. There are partial barriers to the south and southeast associated with partially cleared and/or fenced private land. The Maria River State Forest lies to the south of this land and is continuous with the Maria National Park and other native vegetation that stretches to the coast. The North Coast Railway is unfenced through the stretch adjacent to the site and would not comprise a complete barrier to fauna movement. East of the railway there is native vegetation in the Maria National Park and on private and Crown land that is part of the vegetated corridor to the coast.

The Norton offset site comprises appropriately situated habitat for each of the affected threatened fauna, notably including the Spotted-tailed Quoll, which is generally restricted to large patches of less-disturbed habitat (Long and Nelson, 2009). The Norton offset site comprises a valuable habitat link in terms of the riparian corridors it encompasses, its position between the coastal floodplain and ranges and as a conserved vegetated corridor around an area of relatively intense development.

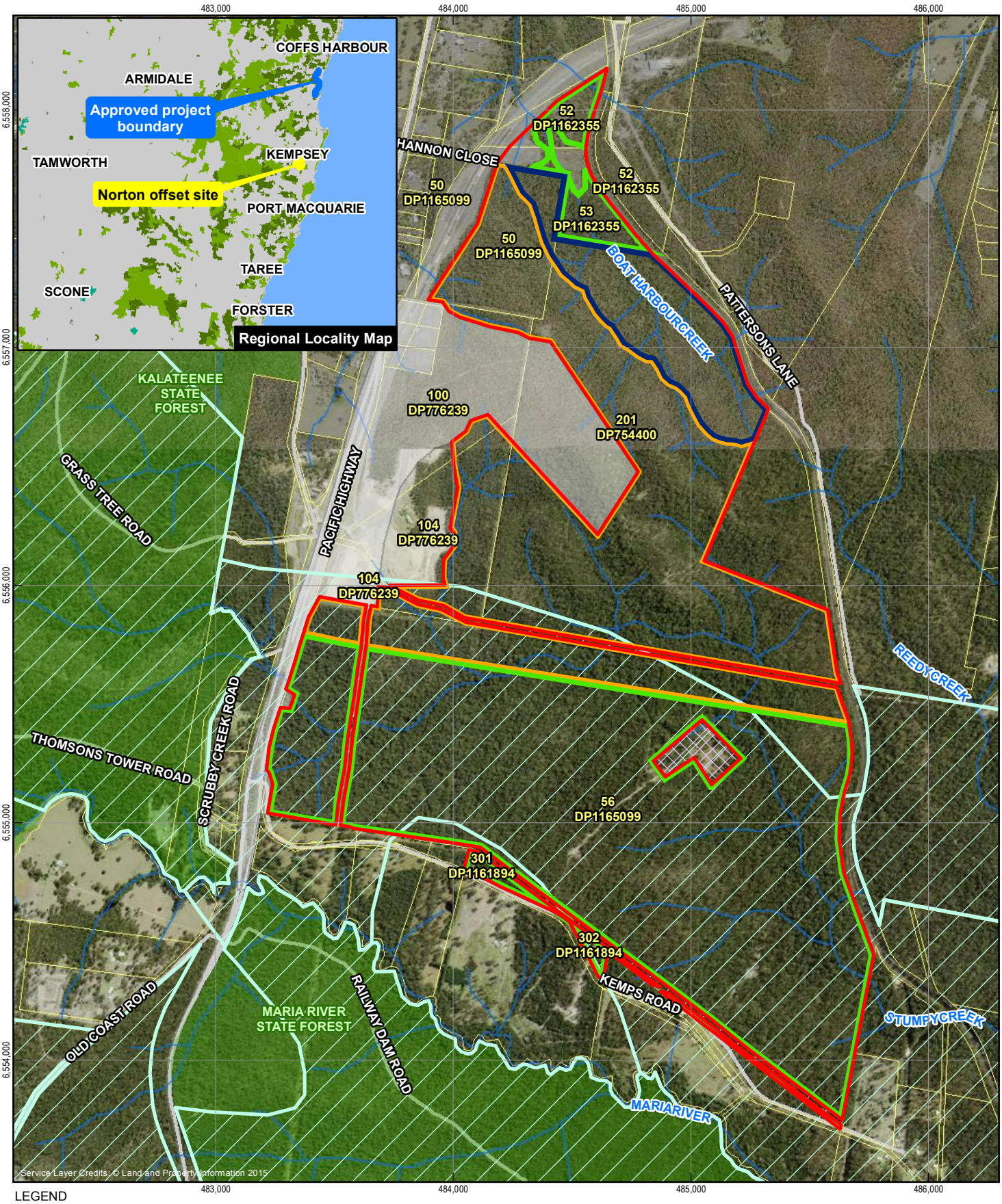
3.3 Vegetation

Vegetation communities were mapped within the Norton offset site by Lewis and James (2010) and then ground truthed and converted to NSW vegetation types and broad condition classes as part of the present study and the BioBanking assessment. Vegetation types within the Norton offset site are shown on Figure 3 and summarised in Table 1. A detailed description of the distribution, plant species composition and condition of vegetation at the site is provided in Appendix E.

Table 1 Vegetation in the Norton offset site

Vegetation Zone	NSW Veg. ID	Condition	Habitat type	Area in Norton offset site (ha)	Area in NH2U Norton Offset Area	Plot/transects
Blackbutt – Tallowwood dry grassy open forest (NR119, Moderate/good)	NR119	Moderate/good	Dry sclerophyll forest	44.5	38.7	34, 44, 45, 46
Red Mahogany open forest (NR222 , Moderate/good)	NR222	Moderate/good	Dry sclerophyll forest	30.2	14.7	41, 42, 1, 47
Scribbly Gum – Red Bloodwood heathy open forest (NR228, Moderate/good)	NR228	Moderate/good	Dry sclerophyll forest	164.4	145.6	6, 35, 16, 5, 19, 51
Spotted Gum - Grey Ironbark - Pink Bloodwood open forest (NR246, Moderate/good)	NR246	Moderate/good	Dry sclerophyll forest	135.4	11.4	20, 23, 26, 24, 40, 3
Spotted Gum – Grey Ironbark open forest (NR247, Moderate/good)	NR247	Moderate/good	Dry sclerophyll forest	19.5		21, 38, 39
		Total	**Dry sclerophyll forest**	**394.1**	**210.4**	
Blackbutt - Pink Bloodwood shrubby open forest (NR117, Moderate/good)	NR117	Moderate/good	Wet sclerophyll forest	53.4	31.6	29, 4, 37, 43, 50
Blackbutt – Turpentine – Tallowwood shrubby open forest (NR122, Moderate/good)	NR122	Moderate/good	Wet sclerophyll forest	33.4	21.0	18, 25, 31, 36
Flooded Gum – Tallowwood – Brush Box moist open forest (NR160, Moderate/good)	NR160	Moderate/good	Wet sclerophyll forest	7.4	3.3	30, 32, 33
		Total	**Wet sclerophyll forest**	**94.2**	**55.8**	
Forest Red Gum - Swamp Box (NR161, Moderate/good)	NR161	Moderate/good	Grassy woodland	3.8	3.8	48, 49
Spotted Gum - Grey Ironbark - Pink Bloodwood open forest (NR246, Low)	NR246	Low	Dry sclerophyll forest in low condition	4.0	0.0	27,28
		Total		**496.0**	**270.0**	

Notes: Wet sclerophyll forest, dry sclerophyll forest and grassy woodland at the Norton offset site comprise occupied Koala and Grey-headed Flying Fox habitat and likely Spotted-tailed Quoll, Regent Honeyeater and Swift Parrot habitat.



LEGEND

- Norton offset site
- NH2U Norton offset area
- WC2NH Norton offset area
- OH2K Norton offset area
- Recent or proposed development
- House site and home paddocks
- Regional biodiversity corridor
- State forest
- Cadastre
- Waterways
- Roads

Paper Size A4

0 150 300 600

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Roads and Maritime Services
NH2U, Pacific Highway Upgrade
Norton and Griffin Offset Management Plan

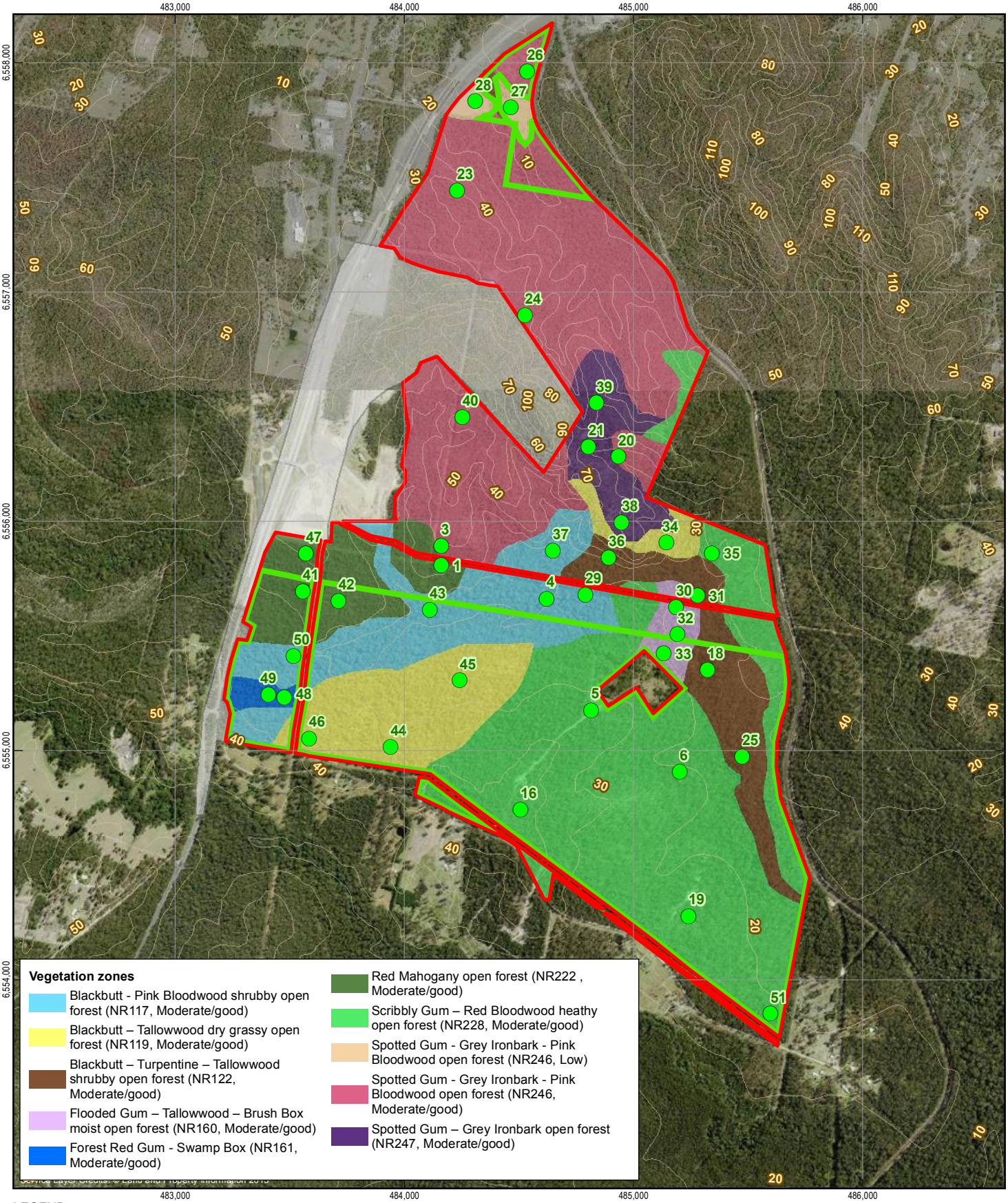
Job Number 21-23829
Revision A
Date 27 Oct 2016

Norton offset site location

Figure 2

N:\AU\Sydney\Projects\21\23829\GIS\Maps\Deliverables\NGOMP\21_23829_Z003_NortonOffsetSite.mxd Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: General topo - NSW LPI DTDB 2012, Geoscience Australia: 250k Data - Jan 2011; Aerial Imagery - Sixmaps 2016.jrichardson



LEGEND

- Norton offset site
- NH2U Norton offset area
- Recent or proposed development
- Contours
- BioBanking plot/transect

Paper Size A4

0 200 400 800

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Roads and Maritime Services
NH2U, Pacific Highway Upgrade
Norton and Griffin Offset Management Plan

Job Number	21-23829
Revision	A
Date	27 Oct 2016

Norton offset site vegetation

Figure 3

N:\AU\Sydney\Projects\21\23829\GIS\Maps\Deliverables\NGOMP\21_23829_Z001_NortonVegetation.mxd Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: General topo - NSW LPI DTDB 2012, Geoscience Australia: 250k Data - Jan 2011; Aerial Imagery - Sixmaps 2016.jrichardson

3.4 Habitat quality

This section describes the extent and quality of habitat for the affected threatened fauna in the Norton offset site based on the desktop assessment and field survey results. Habitat types, canopy plot survey locations and recorded observations of threatened fauna are shown on Figure 4. Canopy plots were sampled at the locations shown on Figure 4 and comprised counts of every tree in a 50 m x 20 m plot along with its height, species and canopy cover. Each tree species was then cross referenced to lists of food tree species for the affected threatened fauna to calculate the cover of food tree species. The results of canopy plot surveys to quantify habitat resources for the affected threatened fauna are presented in Table 2. A list of food tree species at the Norton offset site and/or the other offset sites is included in Table 3. A detailed description of habitat quality for each species is provided below.

3.4.1 Koala

The Koala was recorded at the Norton offset site during the GHD survey and by Lewis and James (2010). The Norton offset site contains around 492 hectares of habitat of varying quality for the resident population of the Koala associated with wet and dry sclerophyll forest and grassy woodland. The NH2U Norton offset area contains 270 hectares of occupied Koala habitat.

The *Comprehensive Koala Plan of Management for Eastern portion of Kempsey Shire LGA, Vol. 1* (KSC, 2011) identifies a riparian corridor through the Norton offset site as Secondary Class A habitat. Secondary Class A habitat comprises preferred Koala habitat that contains vegetation communities and/or associations wherein primary food tree species are subdominant components of the over storey tree species, growing in association with secondary food tree species (Phillips and Hopkins, 2008). The plan maps around 150 ha of moist sclerophyll forest habitat that comprises Secondary Class A habitat at the site and around 340 ha of dry sclerophyll forest that comprises Secondary Class B habitat (KSC, 2011).

The canopy plot results confirmed that the Norton offset site contains primary and secondary food trees for the Koala as defined in the *Comprehensive Koala Plan of Management for Eastern portion of Kempsey Shire LGA, Vol. 1* (KSC, 2011) and supplementary food tree species as defined in the North Coast management area of the *Approved Recovery Plan for the Koala* (*Phascolarctos cinereus*) (DECC, 2008). The canopy plot data presented in Table 2, confirms that there is good cover of food trees (average 19 % cover across the site), including primary food trees (average 5 % cover) and secondary food tree (average 5 % cover across the site). There is one primary food tree species at the Norton offset site: Tallowwood (*Eucalyptus microcorys*), which is a sub-dominant canopy species in the majority of both wet and dry sclerophyll forest types at the site. There was up to 18% foliage cover of Tallowwood in the plots sampled. The secondary food tree species Small-fruited Grey Gum (*Eucalyptus propinqua*) is a sub-dominant canopy species in dry sclerophyll forest types and White Stringybark (*Eucalyptus globoidea*) is a dominant canopy species in both wet and dry sclerophyll forest types at the site. There was up to 17% foliage cover of secondary food tree species in the plots sampled. A supplementary food tree species, Red Mahogany (*Eucalyptus. resinifera*) is also present at moderate densities throughout the Norton offset site and up to 53% cover in some vegetation types. Average over storey cover across the site was 36%, indicating a forest structure throughout and was generally within or above benchmark values for individual vegetation types (i.e. equivalent to intact examples of the vegetation type).

Habitat critical to the survival of the Koala is defined as habitat that is considered to be important for the species' long-term survival and recovery and specifically an area that scores five or more using the habitat assessment tool for the Koala in Table 4 of the DotE (2014a) guidelines. The habitat assessment tool scores for the Norton offset site are as follows:

- Koala occurrence +2 (high), evidence of one or more Koalas within the last 2 years (observed in the current surveys).
- Vegetation composition, +2 (high), forest or woodland with 2 or more known Koala food tree species in the canopy (Tallowwood, Small-fruited Grey Gum, White Stringybark and Red Mahogany).
- Habitat connectivity +2 (high), the area is part of a contiguous landscape ≥ 500 ha (the site contains around 500 ha of habitat and is connected to many thousands of hectares of habitat in the Maria State Forest to the south).
- Key existing threats +1 (medium), evidence of infrequent or irregular Koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for Koala occurrence (no direct evidence noted, however some mortality is likely given the proximity to the Pacific Highway, vehicle traffic on site associated with permitted land uses and presence of wild and domestic dogs).
- Recovery value +2 (high), the habitat is likely to be important for achieving the interim recovery objectives for the relevant context (the site is a large connected area of Koala habitat that contains a known population of Koalas).

The Norton offset site has a total habitat score of nine. Therefore the Norton offset site is habitat critical to the survival of the Koala. Notably, the entire site, including all wet and dry sclerophyll forest types qualifies.

The *Koala referral guidelines, offsets and existing projects* fact sheet (DotE, 2014b) states that the habitat assessment tool for the Koala (DotE, 2014a, Table 4) can be used to determine 'habitat quality' in accordance with the EPBC Act offset policy instead of the three generic habitat quality components (habitat condition, site context and species stocking rate).

Therefore based on the above assessment of habitat condition the current habitat quality of the NH2U Norton offset area was scored as 9/10 in the offset assessment guide calculations (see Section 11.5). This score reflects the presence of occupied habitat with moderate-high cover of primary food tree species as a part of an extensive patch of habitat but with some impact from weed infestation, timber harvesting, edge effects and probably also predatory pest fauna. The habitat assessment tool can also be used to calculate the starting quality of a proposed offset site and to estimate the future quality, with and without the proposed offset or management intervention (DotE, 2014b). The change in habitat quality scores with and without offset site management are described in Section 11.5.

Table 2 Canopy plot results for the Norton offset site

Canopy Plot ID	Habitat type	Veg. Type ID	No. of trees	Avg. tree height (m)	Over storey cover	Over storey condition	Koala food tree cover[1]	Koala primary food tree cover[2]	Koala secondary food tree cover[3]	Koala supplementary food tree cover[4]	GHFF diet plant cover[5]	GHFF key diet plant cover[6]	RH and SP food tree cover[7]	Koala activity level	Fauna observations
1	Dry Sclerophyll Forest	NR222	38	17.80	64%	Above benchmark	43%	5%	9%	29%	57%	0%	0%	3.33%	29 Koala scats beneath *E. propinqua*
2	Dry Sclerophyll Forest	NR263	31	22.03	11%	Within benchmark	8%	0%	6%	2%	7%	3%	11%		Possum/glider scratches beneath 3 x *E. propinqua*
3	Dry Sclerophyll Forest	NR247	22	15.09	18%	Within benchmark	10%	8%	1%	1%	9%	4%	38%	6.66%	22 Koala scats beneath 2 x *E. propinqua*
4	Wet Sclerophyll Forest	NR119	15	21.5	21%	Within benchmark	9%	4%	5%	0%	12%	12%	7%		Echidna digging at base of *E. pilularis*
5	Dry Sclerophyll Forest poor	NR263	11	25.64	66%	Within benchmark	56%	3%	0%	53%	60%	7%	0%		
16	Dry Sclerophyll Forest	NR228	32	17.41	35%	Within benchmark	3%	0%	3%	1%	25%	25%	23%		
18	Wet Sclerophyll Forest	NR122	21	25.86	48%	Above benchmark	19%	7%	3%	10%	37%	26%	0%		
19	Dry Sclerophyll Forest	NR227	13	20.54	24%	Below benchmark	2%	0%	2%	0%	9%	9%	7%		
20	Wet Sclerophyll Forest	NR122	40	18.75	62%	Within benchmark	35%	18%	5%	13%	33%	12%	0%	3.33%	Scuffed bark on 4 x *E. microrys* and 1 x *E. reisinifera*; 21 Koala scats beneath *E. propinqua*
21	Dry Sclerophyll Forest	NR247	30	19.07	36%	Within benchmark	24%	7%	17%	0%	23%	4%	1.2%	10%	Scratches on 5 x *E. propinqua*; Resident Koala

Canopy Plot ID	Habitat type	Veg. Type ID	No. of trees	Avg. tree height (m)	Over storey cover	Over storey condition	Koala food tree cover[1]	Koala primary food tree cover[2]	Koala secondary food tree cover[3]	Koala supplementary food tree cover[4]	GHFF diet plant cover [5]	GHFF key diet plant cover [6]	RH and SP food tree cover [7]	Koala activity level	Fauna observations
															and 9 scats on *E. propinqua*; 2 koala scats on 2 x *E. propinqua*
22	Wet Sclerophyll Forest	NR122	21	13	29%	Below benchmark	6%	3%	4%	0%	14%	3%	0%		3 Brushtail Possum scats and scratches on 2 x *E. propinqua*
23	Dry Sclerophyll Forest	NR263	27	16.33	30%	Within benchmark	14%	8%	6%	0%	11%	9%	2%	3.33%	24 Koala scats beneath *E. microcorys*
24	Dry Sclerophyll Forest	NR246	32	15.91	30%	Within benchmark	21%	3%	12%	6%	21%	7%	0%		
		Site average	**26**	**19**	**36%**		**19%**	**5%**	**5%**	**9%**	**29%**	**13%**	**7%**	**2%**	

1 – Total cover of Koala food trees as defined in categories 2-4.

2 - Primary food trees for the Koala as defined in the *Comprehensive Koala Plan of Management for Eastern portion of Kempsey Shire LGA, Vol. 1* (KSC, 2011).

3 - Secondary food trees for the Koala as defined in the KSC (2011).

4 - Supplementary food tree species are as defined in the North Coast management area listed in Appendix 2 of the *Approved Recovery Plan for the Koala* (Phascolarctos cinereus (DECC, 2008).

5 – Diet plants in the blossom or fruit diet of the Grey-headed Flying-fox (GHFF) as defined in Eby, P. and Law, B. (2008).

6 – Key diet plants in the blossom or fruit diet of the Grey-headed Flying-fox (GHFF) as defined in Eby, P. and Law, B. (2008).

7 - Winter-flowering species known to provide foraging habitat for the Swift Parrot (Saunders and Heinsohn, 2008; Saunders and Tzaros 2011) and foraging habitat for the Regent Honeyeater identified in Menkhorst et. al. (1999).

Table 3 Food trees for the affected threatened fauna recorded at the offset sites

Scientific Name	Common name	Koala food tree[1]	Grey-headed Flying-fox diet plant[2]	Swift Parrot and Regent Honeyeater foraging habitat habitat
Allocasuarina torulosa	Forest Oak	Secondary		
Angophora costata	Sydney Red Gum		Diet plant	
Angophora floribunda	Rough-barked Apple		Diet plant	
Angophora woodsiana			Diet plant	
Archontophoenix cunninghamiana	Bangalow Palm		Diet plant	
Corymbia gummifera	Red Bloodwood		Key diet plant	Winter-flowering[3]
Corymbia intermedia	Pink Bloodwood		Key diet plant	
Corymbia maculata	Spotted Gum		Key diet plant	Winter-flowering[3]
Dendrocnide excelsa	Giant Stinging Tree		Diet plant	
Dendrocnide photinophylla	Shiny-leaved Stinging Tree		Diet plant	
Diploglottis australis	Native Tamarind		Diet plant	
Eucalyptus acmenoides	White Mahogany		Diet plant	
Eucalyptus globoidea	White Stringybark	Secondary		
Eucalyptus grandis	Flooded Gum	Secondary	Diet plant	
Eucalyptus microcorys	Tallowwood	Primary		
Eucalyptus paniculata	Grey Ironbark		Diet plant	Habitat[4]
Eucalyptus pilularis	Blackbutt	Secondary	Key diet plant	Winter-flowering[3]
Eucalyptus propinqua	Small-fruited Grey Gum	Primary		Habitat[4]
Eucalyptus resinifera	Red Mahogany	Secondary / supplementary	Diet plant	
Eucalyptus robusta	Swamp Mahogany	Primary		Winter-flowering[3]
Eucalyptus saligna	Sydney Blue Gum		Key diet plant	
Eucalyptus siderophloia	Grey Ironbark		Key diet plant	Habitat[4]
Eucalyptus tereticornis	Forest Red Gum	Primary		Winter-flowering, Habitat[4]
Ficus coronata	Creek Sandpaper Fig		Diet plant	
Ficus fraseri	Sandpaper Fig		Diet plant	

Scientific Name	Common name	Koala food tree[1]	Grey-headed Flying-fox diet plant[2]	Swift Parrot and Regent Honeyeater foraging habitat habitat
Ficus rubiginosa	Port Jackson Fig		Diet plant	
Lophostemon confertus	Brush Box		Diet plant	
Syncarpia glomulifera	Turpentine		Key diet plant	

1 - Food trees for the Koala as defined in the Comprehensive Koala Plan of Management for Eastern portion of Kempsey Shire LGA, Vol. 1 (KSC, 2011), Coffs Harbour City Koala plan of management (Lunney et. al., 1999) and/or Appendix 2 of the Approved Recovery Plan for the Koala (DECC, 2008).

2 – Diet plants in the blossom or fruit diet of the Grey-headed Flying-fox as defined in Eby, P. and Law, B. (2008).

3 - Winter-flowering species known to provide foraging habitat for the Swift Parrot (Saunders and Heinsohn, 2008; Saunders and Tzaros 2011) and foraging habitat for the Regent Honeyeater identified in Menkhorst et. al. (1999).

4 – canopy species in vegetation communities identified as providing coastal foraging habitat for the Regent Honeyeater identified in Menkhorst et. al. (1999).

3.4.2 Grey-headed Flying-fox

The Grey-headed Flying-fox was recorded at the Norton offset site by Lewis and James (2010). The Norton offset site contains around 492 hectares of nectar or fruit-bearing foraging habitat for the known regional population of the Grey-headed Flying-fox associated with wet and dry sclerophyll forest. The NH2U Norton offset area contains 270 hectares of occupied Grey-headed Flying-fox habitat.

The canopy plot data presented in Table 2 confirms that there is good cover of plant species in the blossom diet of the Grey-headed Flying-fox (average 29 % cover in forest vegetation sampled across the site), including important diet plant species (average 13 % cover) (Eby and Law, 2008). The most abundant important diet plant species are Blackbutt, Pink Bloodwood and Red Bloodwood. The diet plants Turpentine, Small-fruited Grey Gum and Flooded Gum (*Eucalyptus grandis)* are also abundant at the site. Collectively these species could provide nectar throughout the entire year (Eby and Law, 2008). The Griffin offset site contains large, mature individuals of these species and regenerating patches and is likely to comprise an abundant and secure source of foraging resources into the future.

The following species in the fruit diet of the Grey-headed Flying-fox (Eby and Law, 2008) were present in small numbers in the plots and occur intermittently across the Norton offset site: Rusty Fig (*Ficus rubiginosa*), Sandpaper Fig (*F. coronata),* Sweet Pittosporum (*Pittosporum undulatum*) and Blueberry Ash (*Eleaocarpus reticulatus*).

The Norton offset site comprises foraging habitat critical to the survival of Grey-headed Flying-foxes because it addresses at least the following two identification criteria defined in the recovery plan for the species (DECC, 2009):

- It is productive during winter and spring, when food bottlenecks have been identified as confirmed by the presence of winter-flowering trees in the blossom diet of the species (Eby and Law, 2008), including good cover of Spotted Gum, Blackbutt and Turpentine.
- It is productive during the final weeks of gestation, and during the weeks of birth, lactation and conception (September to May) as confirmed by the presence of spring to autumn-flowering trees in the blossom diet of the species (Eby and Law, 2008), including good cover of Pink Bloodwood, Red Bloodwood and Red Mahogany.

The site is also likely to support at least one continuously occupied roost camp: there are three known camps within the vicinity of the Norton offset site (see Section 3.5.2), including two which comprise roosting habitat critical to the survival of the species (Eby, 2012) as defined in the recovery plan (DECC, 2009).

Based on the above assessment of habitat condition, and consideration of the site context and species stocking rate attributes the current habitat quality of the Norton offset site was scored as 7/10 in the offset assessment guide calculations (see Section 11.5). This score reflects the presence of occupied habitat, with moderate cover of diet plants and within commuting distance of roost camps but with some impacts from clearing, weed infestation and edge effects.

3.4.3 Spotted-tail Quoll

The Spotted-tailed Quoll is known from a wide range of habitat types, the threshold densities of critical components required to maintain populations are unknown and critical habitat has not been formally defined or mapped (Long and Nelson, 2009). Therefore identification of habitat for the species must be based on a subjective assessment and/or previous records of the species. The Spotted Tailed Quoll has not been recorded at the Norton offset site. The Norton offset site contains around 492 hectares of suitable habitat for the Spotted-tailed Quoll associated with wet and dry sclerophyll forest, substantiated by confirmed local records (OEH, 2014b). The NH2U Norton offset area contains 270 hectares of likely Spotted-tailed Quoll habitat.

This habitat has been identified based on the presence of the following characteristics identified in the recovery plan for the species (Long and Nelson, 2009):

- Forest vegetation in an area with high and predictable seasonal rainfall.
- A large, relatively intact patch of vegetation as confirmed by the plot/transect data which were at benchmark values for most attributes in the majority of plots sampled, as well as the species richness and general condition assessments provided by Lewis and James (2010).
- Moderate densities of medium-sized mammalian prey, including small wallabies, gliders and possums recorded in the present survey and by Lewis and James (2010) as well as moderate densities of hollow-bearing trees to support arboreal prey.
- Potential den sites associated with dense understorey vegetation, hollow-bearing logs and large quantities of woody debris.
- Its position in a vegetated habitat corridor that is continuous with vegetation containing known records of the species (Lewis and James, 2010; OEH, 2014b).

Based on the above assessment of habitat condition, and consideration of the site context and species stocking rate attributes the current habitat quality of the NH2U Norton offset area was scored as 7/10 in the offset assessment guide calculations (see Section 11.5). This score reflects

the presence of likely habitat with resources such as den sites, that is part of an extensive patch of habitat but with some impact from weed infestation, timber harvesting, edge effects and probably also predatory pest fauna.

3.4.4 Regent Honeyeater

The Norton offset site contains around 492 hectares of potential foraging habitat for the Regent Honeyeater associated with wet and dry sclerophyll forest. The NH2U Norton offset area contains 261.9 hectares of potential Regent Honeyeater habitat. The regional population of the Regent Honeyeater may use this habitat on an occasional or intermittent basis.

The canopy plot data presented in Table 2 confirms that there is good cover of tree species that indicate foraging habitat for the Regent Honeyeater as identified in the recovery plan (Menkhorst et. al. 1999). At the Norton offset site this included Spotted Gum and Red Bloodwood with an overall average of 7 % cover of these canopy species in forest vegetation sampled across the site. Some vegetation types had up to 23 % cover of these canopy species. Much of the vegetation in the site is mature regrowth with good quantities of mistletoe that would also provide a source of nectar for the Regent Honeyeater. The site also contains moderate numbers of large, mature trees which are likely to produce more abundant and reliable nectar.

Wet and dry sclerophyll forest at the site comprises 'habitat critical to the survival of the Regent Honeyeater' because it is foraging habitat in an area where the species is likely to occur as defined by the distribution map provided in Figure 2 of the recovery plan (Commonwealth of Australia, 2016).

The value of this habitat is further confirmed by the observed presence of other blossom-feeding nomadic species on site, including the Grey-headed Flying Fox (Lewis and James, 2010), Noisy Friarbird (*Philemon corniculatus*) and the Little Lorikeet (*Glossopsitta pusilla*).

Based on the above assessment of habitat condition, and consideration of the site context and species stocking rate attributes the current habitat quality of the NH2U Norton offset area was scored as 6/10 in the offset assessment guide calculations (see Section 11.5). This score reflects the presence of foraging habitat for the regional population of the species with moderate cover of food tree species but with some impact from weed infestation, timber harvesting and edge effects.

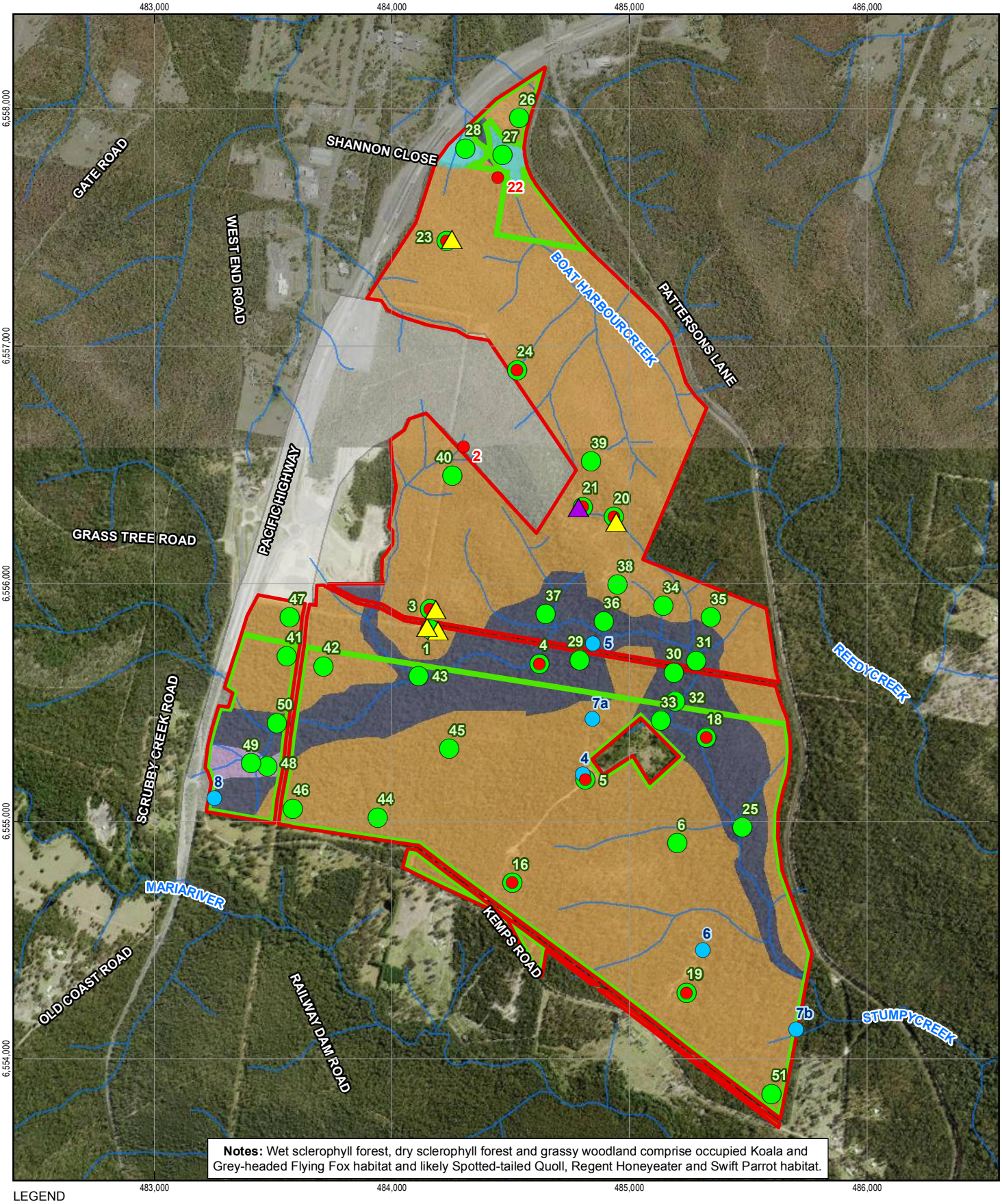
3.4.5 Swift Parrot

The Norton offset site contains around 492 hectares of potential seasonal foraging habitat for the Swift Parrot associated with wet and dry sclerophyll forest. The NH2U Norton offset area contains 261.9 hectares of potential Swift Parrot habitat. The single, migratory population of the Swift Parrot may use this habitat on an occasional basis as part of its occupation of winter foraging habitat.

The canopy plot data presented in Table 2 confirms that there is good cover of winter-flowering trees species known to provide foraging habitat for the Swift Parrot (Saunders and Heinsohn, 2008; Saunders and Tzaros 2011). At the Norton offset site this comprised Spotted Gum, Red Bloodwood and Blackbutt with an overall average of 7 % cover of these canopy species in forest vegetation sampled across the site. Some vegetation types had up to 23 % cover of these canopy species. The site also contains moderate numbers of large, mature trees which are likely to produce more abundant and reliable nectar.

The value of this habitat is further confirmed by the observed presence of other blossom-feeding nomadic species. Notably the Little Lorikeet and the Noisy Friarbird have a significant positive association with Swift Parrots in coastal habitats (Saunders and Heinsohn, 2008). Significant negative associations with Swift Parrot occurrence were found for the Rainbow Lorikeet (*Trichoglossus haematodus*) in coastal habitats and the Noisy Miner (*Manorina melanocephala*) throughout the species' range (Saunders and Heinsohn, 2008). Neither species was abundant at the site. The Norton offset site is, in general, a relatively large, continuous patch of habitat and is less likely to be dominated by these aggressive bird species than fragmented landscapes.

Based on the above assessment of habitat condition, and consideration of the site context and species stocking rate attributes the current habitat quality of the NH2U Norton offset area was scored as 6/10 in the offset assessment guide calculations (see Section 11.5). This score reflects the presence of foraging habitat for the regional population of the species with moderate cover of food tree species but with some impact from weed infestation, timber harvesting and edge effects.



LEGEND

- Norton offset site
- NH2U Norton offset area
- Recent or proposed development
- Waterways
- BioBanking plot/transect
- Camera trap
- Canopy plot and Koala SAT
- Koala scat
- Observed Koala

Habitat types

- Dry sclerophyll forest
- Dry sclerophyll forest in low condition
- Grassy woodland
- Wet sclerophyll forest

Paper Size A4

0 150 300 600

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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NH2U, Pacific Highway Upgrade
Norton and Griffin Offset Management Plan

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Norton offset site habitat for affected threatened fauna Figure 4

N:\AU\Sydney\Projects\21\23829\GIS\Maps\Deliverables\NGOMP\21_23829_Z011_NortonHabitatForAffected.mxd Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: General topo - NSW LPI DTDB 2012, Geoscience Australia: 250k Data - Jan 2011; Aerial Imagery - Sixmaps 2016.jrichardson Service Layer Credits: © Land and Property Information 2015

3.5 Populations of affected threatened fauna

The purpose of this section is to describe the local and regional populations of each of the affected threatened fauna that may use habitat within the Norton offset site. This assessment is based on:

- Presence / absence of individuals as revealed by the field surveys.
- Previous records of the species in the locality (see Table 4) and characteristics of the local and regional population as revealed by the desktop assessment.
- Likely use of the habitat resources within the site, as described in Section 3.4 above.

Table 4 Records of the affected threatened fauna in the locality of the Norton offset site (OEH, 2014b)

Species	Wildlife Atlas records within 10 km	Closest Record	Date of Closest Record
Koala	242	Within site	2014
Grey-headed Flying Fox	57	Within site	2010
Spotted-tailed Quoll	14	2.4 km east in connected bushland; 3 km south in Maria River SF	2004; 1992
Swift Parrot	0	-	-
Regent Honeyeater	0	-	-

3.5.1 Koala

A single female Koala was recorded on site in the September 2014 surveys. This individual was resting in a standing dead tree in an area of Spotted Gum - Grey Ironbark - Pink Bloodwood open forest in the north of the site. A total of 108 Koala scats were recorded in five separate canopy plots (see Table 2 and Figure 4), including one plot in the vicinity of the Koala observed. These scats were observed beneath Small Fruited Grey Gums (seven trees), Tallowwood (one tree) and one dead tree. All of these records were in dry sclerophyll forest in the northern portion of the site. Scuffed bark and deep scratches which were probably indicative of Koala activity were also recorded on multiple trees across the site, mainly on Small-fruited Grey Gum, Tallowwood and Red Mahogany. The use of these tree species is consistent with the food trees identified in the Kempsey Koala plan of management (KSC, 2011) though Koalas appeared to be favouring Small-fruited Grey Gum at the time of the survey and this is listed as a secondary species in the plan.

Koala scats were recorded beneath several trees, including Tallowwood and Small-fruited Grey Gum, during the previous surveys (Lewis and James, 2010). Koala scats were recorded at five locations in the southern part of the site and comprised three observations of aged scats (~6 months) in wet sclerophyll forest along Stumpy Creek and two of similar age located further to the south in dry sclerophyll forest (Lewis and James, 2010).

There are a total of 242 records of Koalas in the locality of the Norton offset site (OEH, 2014b). The Kempsey Koala plan of management (KSC, 2011) maps primary and secondary habitat within the site based on direct observations by the authors as well as habitat assessments conducted during the preparation of that plan.

Overall these results suggest that the Norton offset site contains a resident population of Koalas at a moderate density. Given the resident population, the extent and quality of Koala habitat in the site and its overall size, condition and landscape position, the Norton offset site will make a valuable contribution to the viability of the local and regional population of the Koala. It is likely that the viability of the resident population of the Koala will improve with conservation of the offset site. In particular, the resident population is likely to benefit from continued regeneration or maturation of native vegetation containing food trees and control of dogs.

3.5.2 Grey-headed Flying-fox

Grey-headed Flying Foxes have been recorded in the Norton offset site with individuals observed foraging on Pink Bloodwood and Blackbutt (Lewis and James, 2010). There are a total of 57 records of Grey-headed Flying Foxes in the locality of the Norton offset site (OEH, 2014b). There are three known camps within the vicinity of the Norton offset site (Eby, 2012):

- The 'Crescent Head road' camp, around 1.4 km to the north, which contains critical foraging habitat, has supported >10,000 individuals at least once, supports >2,500 individuals during the reproductive season and comprises roosting habitat critical to the survival of the species as defined in the recovery plan (DECC, 2009).
- The 'Crescent Head' camp, around 10 km to the east, which contains critical foraging habitat, has supported >10,000 individuals at least once, supports >2,500 individuals during the reproductive season and comprises roosting habitat critical to the survival of the species as defined in the recovery plan (DECC, 2009).
- The 'East Kempsey' camp, around 1.5 km to the north west, which has not been confirmed to contain critical foraging habitat, has not supported >10,000 individuals at least once or >2,500 individuals during the reproductive season and does not comprise roosting habitat critical to the survival of the species as defined in the recovery plan (DECC, 2009).

No Grey-headed Flying Foxes were recorded during the present survey, presumably because individuals within the local population were using seasonal foraging resources in other vegetation types and/or in other parts of their range. This is despite high canopy cover of diet plants and significant diet plants for the Grey-headed Flying fox in the area (see Table 2), including Blackbutt and Turpentine which have flowering schedules that coincide with the field survey (Eby and Law, 2008). Patterns of habitat use by Grey-headed Flying Foxes are seasonal and sporadic in response to food sources with largely irregular patterns of productivity (DECCW, 2009). When assessed at a local scale, the species is generally present intermittently and irregularly and so this one off absence from the site does not exclude its likely value to the regional population of the species.

Overall these results suggest that the Norton offset site is likely to provide critical foraging resources for a regional population of >10,000 Grey-headed Flying-foxes and help support two camps that are critical to the survival of the species. Given the nearby camps, the extent and cover of diet species at the site and its overall size, condition and landscape position, the Norton offset site will make a valuable contribution to the viability of the regional population of the Grey-headed

Flying-fox. It is likely that the viability of the nearby camps will improve with conservation of the offset site. In particular, the regional population is likely to benefit from continued regeneration or maturation of native vegetation containing abundant food trees.

3.5.3 Spotted-tail Quoll

The Spotted-tailed Quoll has not been recorded at the Norton offset site. There are a total of 14 records of Spotted-tailed Quolls in the locality of the Norton offset site, including two records in connected native vegetation within three kilometres of the site (OEH, 2014b). This species is recorded intermittently and irregularly within its very large home ranges and so the lack of confirmed records at the site does not exclude its potential value to the species.

Habitat resources such as dense groundcover, fallen logs and abundant tree hollows for prey species within an area recognised as a regional habitat corridor suggest the site may be inhabited by a local population of the Spotted-tailed Quoll known from Wildlife Atlas records described above and in connected vegetation within the Maria National Park (Lewis and James, 2010).

Given the extent and quality of habitat in the site and its overall size, condition and landscape position, the Norton offset site is likely to contribute to the viability of the local and regional population of the Spotted-tailed Quoll. Populations of the Spotted-tailed Quoll are likely to benefit from continued regeneration and maturation of native vegetation containing habitat resources and control of dogs.

3.5.4 Regent Honeyeater

The Regent Honeyeater has not been recorded at the Norton offset site. The species is predicted to occur in the region by the PMST (DotE, 2014b) however there are no confirmed records within the locality of the offset site (OEH 2014b). There are scattered records along the coast in the Northern Rivers and Mid-North Coast Regions with regional movements thought to be governed mainly by the flowering of a select number of *Eucalyptus* species (DotE, 2014a). As described above, the Norton offset site contains key indicator tree species for foraging habitat identified in the recovery plan for the Regent Honeyeater (Menkhorst et. al., 1999). The Norton offset site comprises potential foraging habitat for a regional population of the Regent Honeyeater that may occasionally be present on the north coast of NSW. The regional population of the Regent Honeyeater may use this habitat on an intermittent basis. This is an equivalent situation to the footprint, study area and locality for the Project (GHD, 2013b) and so the Norton offset site will provide an appropriate biodiversity offset for impacts in this context.

The viability of the regional population of the Regent Honeyeater is likely to improve with conservation of the Norton offset site through the conservation and continued regeneration of native vegetation containing abundant food trees.

3.5.5 Swift Parrot

The Swift Parrot has not been recorded in the Norton offset site. The species is predicted to occur in the region by the PMST (DotE, 2014b) however there are no confirmed records within the locality of the offset site (OEH 2014b). As described above, the Norton offset site contains good cover of winter-flowering trees species known to provide foraging habitat for the Swift Parrot (Saunders and Heinsohn, 2008; Saunders and Tzaros 2011). The single, migratory population of the Swift Parrot may use this habitat on an occasional basis as part of its occupation of winter

foraging habitat. This is an equivalent situation to the footprint, study area and locality for the Project (GHD, 2013b) and so the Norton offset site will provide an appropriate biodiversity offset for impacts in this context.

The viability of the national population of the Swift Parrot is likely to improve with conservation of the Norton offset site through the conservation and continued regeneration of native vegetation containing abundant food trees.

4. Existing Environment of Griffin Offset Site

4.1 Location and land use

The Griffin offset site includes Lots 130, 211 and 213 DP752409 and is located around 2.5 km to the east of the Pacific Highway at Barraganyatti (see Figure 5). It is around 167 hectares in area and contains sclerophyll forest, wet heathland and wetlands. The site is 29 kilometres south of the Project footprint in an equivalent position on near-coastal low hills. The Grey-headed Flying Fox has been recorded at the site (Lewis and Richards, 2011) and there are extensive areas of suitable habitat for each of the affected threatened fauna. The Griffin offset site is a highly suitable offset site, containing near-intact habitat with high biodiversity values as part of an extensive patch of conserved land that will supplement the Project's biodiversity offset requirements.

The Griffin offset site is currently unoccupied. Previous land uses include limited timber harvesting and bee keeping. There is a gravel access track adjacent to the western boundary of the site and a second gravel access track that runs east-west across the centre of the site. Adjacent land uses are all connected to conservation. The Griffin offset site is bounded to the north, east and west by the NPWS managed Clybucca Historic Site and Yarahappini Wetlands National Park. Adjacent land uses beyond these reserves and to the south comprise sparsely cleared bush blocks and agricultural bound by the Pacific Highway to the west and the Macleay River to the east.

Roads and Maritime currently owns the Griffin offset site and are progressing discussions with NPWS to undertake the long-term management and conservation of the property. Roads and Maritime will transfer ownership of the property to NPWS to be included in the Clybucca Historic Site (see Section 8.1). The Clybucca Historic Site has been included on the register of the national parks estate because it contains a large shell midden and other archaeological sites with significant cultural value (Kendall, P. per. comm.). The Griffin offset site will be managed as native vegetation for biodiversity conservation. These management actions will improve the quality of habitat for the affected threatened fauna by increasing the extent, health and productivity of native vegetation containing habitat resources.

Paper Size A4

0 50 100 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Griffin offset site
- Lots
- Regional biodiversity corridor
- Reserves
- Roads and tracks
- Waterways

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NH2U, Pacific Highway Upgrade
Norton and Griffin Offset Management Plan

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Revision	A
Date	27 Oct 2016

Griffin offset site location

Figure 5

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Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: General topo - NSW LPI DTDB 2012, Geoscience Australia: 250k Data - Jan 2011; Aerial Imagery - Sixmaps 2016. jrichardson

4.2 Landscape context

The Griffin offset site includes around 167 hectares of forest, heath and wetlands on a flat coastal floodplain. The majority of the site is at 0 to 5 metres elevation. There are slight rises composed of aeolian dune sands that support drier woodland, scrub and open forest. Lower lying areas feature sandy, organic matter rich soil with varying levels of inundation, probably composed of a mix of dune sand and alluvial deposits. Vegetation structure varies with inundation depth and frequency (see Section 4.3 below). There is a small ridge (5 to <10m elevation) along the western boundary of the site that is above the coastal floodplain and features drier forest vegetation.

There are no named streams or wetlands within the site. The closest named stream is Clybucca Creek, around 500 metres to the east. The majority of the site would be subject to periodic inundation from Clybucca Creek and the Macleay River and would have permanent shallow water tables given its low elevation.

The Griffin offset site is part of a continuous patch of native vegetation and habitat of many thousands of hectares. The Griffin offset site is surrounded to the north, west and east by the NPWS managed Clybucca Historic Site and Yarahappini Wetlands National Park. These reserves extend to the Macleay River estuary and the coast as part of an unbroken vegetated corridor linking coastal, estuarine and floodplain environments. There is around two to three kilometres of vegetation to the west of the site before the Pacific Highway, which would comprise a barrier to fauna movement and other ecological processes in this direction. Tamban State Forest lies to the west of the Pacific Highway and beyond that there is an extensive network of native vegetation in national parks and State forests that stretches to the Great Dividing Range. The Griffin offset site is partially connected to this extensive area of habitat on coastal foothills and ranges via riparian corridors, culverts and underpasses.

The Griffin offset site falls within a mapped regional fauna habitat corridor (Scotts et. al., 2003) that runs northwest-southeast connecting forest on the Great Diving Range to the west with coastal wetlands and estuarine habitats to the east.

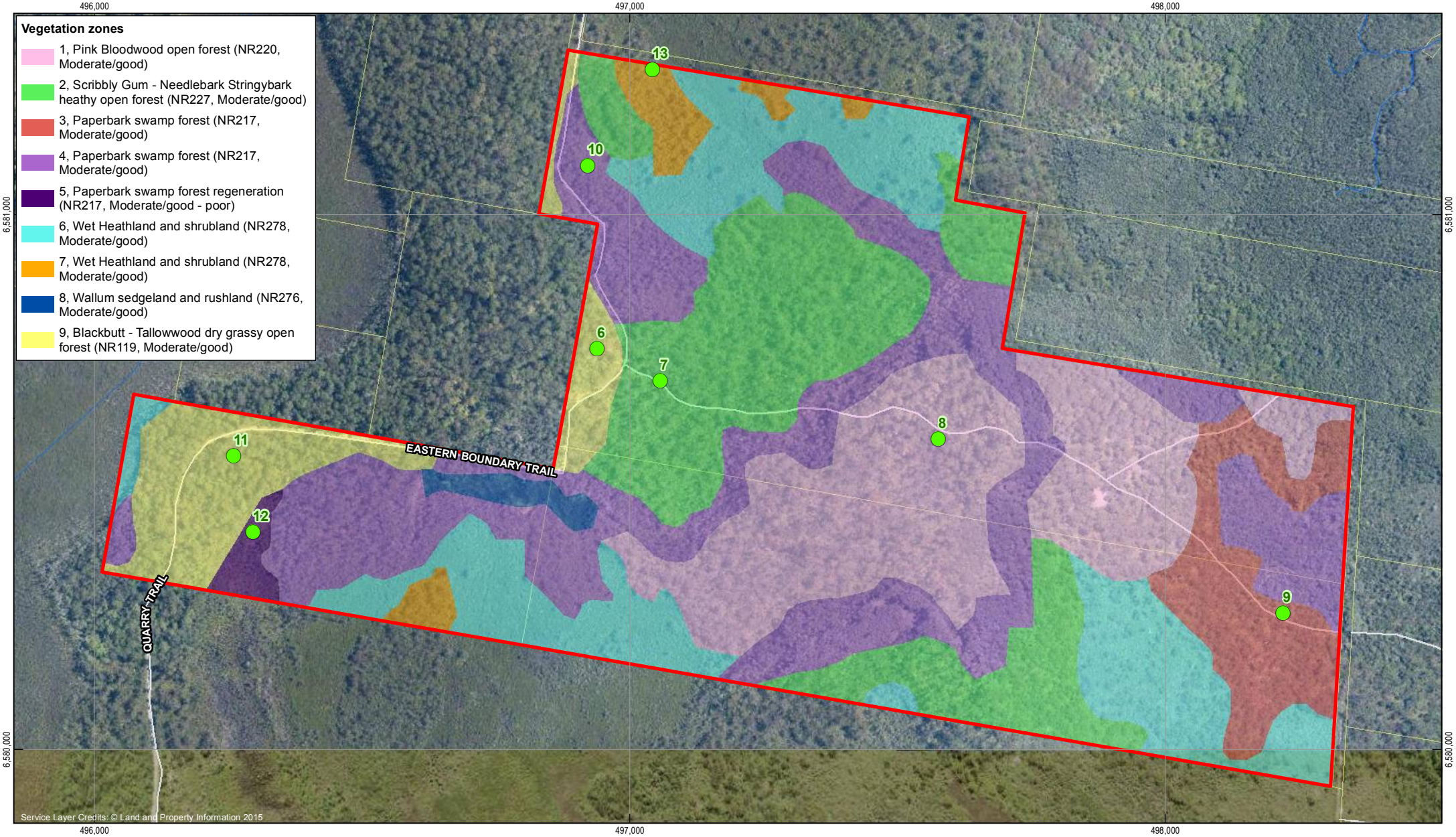
The Grififin site comprises appropriately situated habitat for each of the affected threatened fauna, including the Spotted-tailed Quoll which is less likely to occur in disturbed or fragmented landscapes (Long and Nelson, 2009). In this landscape context, the Griffin offset site comprises part of a valuable habitat link between the coastal floodplain and ranges.

4.3 Vegetation

Vegetation communities were mapped within the Griffin offset site by Lewis and Richards (2011) and then ground truthed and converted to NSW vegetation types as part of the present study. Vegetation types within the Griffin offset site are shown on Figure 6 and summarised in Table 4. A detailed description of the distribution, plant species composition and condition of vegetation at the site is provided in Lewis and Richards (2011).

Table 5 Vegetation in the Griffin offset site

Vegetation community (Lewis and Richards, 2011)	NSW Vegetation Type	NSW Veg. ID	Condition	Habitat type	Area (ha)	Plot/ transects
1 - Blackbutt - Scribbly Gum - Pink Bloodwood Very Tall Shrubby Dry Sclerophyll Forest	Pink Bloodwood open forest	NR220	Moderate/good	Dry sclerophyll forest	32.7	8
2 - Scribbly Gum - Pink Bloodwood Tall Heathy Dry Sclerophyll Forest	Scribbly Gum - Needlebark Stringybark heathy open forest	NR227	Moderate/good	Dry sclerophyll forest	32.2	7
9 - Blackbutt - Bloodwood - Tallowwood Dry Sclerophyll Forest Dry Sclerophyll Forest	Blackbutt - Tallowwood dry grassy open forest	NR119	Moderate/good	Dry sclerophyll forest	13.1	6, 11
			Total	**Dry sclerophyll forest**	**78**	
3 - Scribbly Gum - Broad-leaved Paperbark Swamp Sclerophyll forest and 4 - Broad-leaved Paperbark – Swamp Mahogany Swamp sclerophyll Forest	Paperbark swamp forest	NR217	Moderate/good	Swamp sclerophyll forest	52.7	9, 10
5 - Swamp Sclerophyll Forest Regeneration	Paperbark swamp forest regeneration	NR217	Moderate/good - poor	Swamp sclerophyll forest	1.4	12
			Total	**Swamp sclerophyll forest**	**54.1**	
6 - Banksia ericifolia Tall Wet Heathland and 7 - Banksia ericifolia Tall Wet Heathland - Shrubland with Scribbly gum	Wet Heathland and shrubland	NR278	Moderate/good	Wet heathland	33.3	13
8 - Sedgeland - Reedland Freshwater Wetland	Wallum sedgeland and rushland	NR276	Moderate/good	Wetland	1.6	
				Total	**167**	



Paper Size A4

0 50 100 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Griffin offset site
- Lots
- Roads and tracks
- Waterways
- BioBanking plot/transect

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Norton and Griffin Offset Management Plan

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Griffin offset site vegetation

Figure 6

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Data Source: General topo - NSW LPI DTDB 2012, Geoscience Australia: 250k Data - Jan 2011; Aerial Imagery - Sixmaps 2016. jrichardson

4.4 Habitat quality

This section describes the extent and quality of habitat for the affected threatened fauna in the Griffin offset site based on the desktop assessment and field survey results. Habitat types and canopy plot survey locations are shown on Figure 7. Canopy plots were sampled at the locations shown on Figure 7 and comprised counts of every tree in a 50 m x 20 m plot along with its height, species and canopy cover. Each tree species was then cross referenced to lists of food tree species for the affected threatened fauna to calculate the cover of food tree species. The results of canopy plot surveys to quantify habitat resources for the affected threatened fauna are presented in Table 6. A list of food tree species at the Griffin offset site and/or the other offset sites is included in Table 3. A detailed description of habitat quality for each species is provided below.

4.4.1 Koala

The Koala has not been recorded at the Griffin offset site. The Griffin offset site contains around 132 hectares of habitat of varying quality for a potential local population of the Koala associated with dry sclerophyll forest and swamp sclerophyll forest.

The canopy plot results confirmed that the Griffin offset site contains extensive areas of primary and secondary food trees for the Koala as defined in the Kempsey Koala plan of management (KSC, 2011) and supplementary food tree species as defined in the North Coast management area of the recovery plan (DECC, (2008). The canopy plot data presented in Table 6 confirms that there is moderate cover of food trees (average 9 % cover across the site) all of which are primary food trees. There are three primary food tree species at the site: Forest Red Gum (*Eucalyptus tereticornis*), Tallowwood and Swamp Mahogany (*Eucalyptus robusta*). Swamp Mahogany is a canopy dominant species in swamp sclerophyll forest at the site and Tallowwood is a sub-dominant canopy species in dry sclerophyll forest and coastal woodland vegetation types at the site. There was up to 25% foliage cover of primary food trees in the plots sampled. There are no secondary tree species present. At least one supplementary food tree species, Red Mahogany, occurs as an occasional sub-dominant canopy species in dry sclerophyll forest and coastal woodland vegetation.

The Draft Kempsey Koala Plan of Management identifies 71 ha of Secondary Class A habitat at the Griffin offset site (KSC, 2011). Based on the results of the current surveys and Lewis and Richards (2011) there is a further 10 hectares of this habitat type given the abundance of Tallowwood. A further 50.5 ha comprises Secondary Class B habitat (Lewis and Richards, 2011).

Habitat critical to the survival of the Koala is defined as an area that scores five or more using the habitat assessment tool the habitat assessment tool for the Koala in Table 4 of the DotE (2014a) guidelines. The habitat assessment tool scores for the Boambee SF site are as follows:

The habitat assessment tool scores for the Griffin offset site are as follows:

- Koala occurrence 1 (medium) Evidence of one or more koalas within 5 km of the edge of the site within the last 5 years (see Table 7).
- Vegetation composition +2 (high) Forest or woodland with 2 or more known Koala food tree species in the canopy (Tallowwood, Swamp Mahogany and Red Mahogany).
- Habitat connectivity +2 (high) Area is part of a contiguous landscape ≥ 500 ha (the site is connected to many thousands of hectares of habitat in the Yarahapinni National Park to the north and the Clybucca Historic site to the east and west).

- Key existing threats +1 (medium) Evidence of infrequent or irregular Koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for Koala occurrence (direct evidence is not applicable, because there is not a known population on or near the site. Potential recruitment would happen from the west. In this area some mortality is likely given the proximity to the Pacific Highway and presence of wild dogs.
- Recovery value +1 (medium) Uncertainty exists as to whether the habitat is important for achieving the interim recovery objectives for the relevant context (the site is a large connected area of Koala habitat however the capacity for recruitment of a local Koala population is unknown).

The Griffin offset site has a total habitat score of seven. Therefore, the Griffin offset site is habitat critical to the survival of the Koala. This score recognises that Koala populations are mobile and dynamic and that unoccupied habitat still has value to regional populations as areas for refuge or population expansion.

The habitat assessment tool for the Koala (DotE, 2014a, Table 4) can be used to determine 'habitat quality' in accordance with the EPBC Act offset policy (DotE, 2014b).

Therefore based on the above assessment of habitat condition the current habitat quality of the Griffin offset site was scored as 7/10 in the offset assessment guide calculations (see Section 11.5). This score reflects the presence of likely habitat with moderate-high cover of primary food tree species as a part of an extensive patch of habitat but with some impact from weed infestation, edge effects and probably also predatory pest fauna. The habitat assessment tool can also be used to calculate the starting quality of a proposed offset site and to estimate the future quality, with and without the proposed offset or management intervention (DotE, 2014b). The change in habitat quality scores with and without offset site management are described in Section 11.5.

Table 6 Canopy plot results for the Griffin offset site

Canopy Plot ID	Habitat type	Veg. Type ID	No. of trees	Average tree height (m)	Over storey cover	Over storey condition	Koala food tree cover[1]	Koala primary food tree cover[2]	Koala secondary food tree cover[3]	Koala supplementary food tree cover[4]	GHFF diet plant cover[5]	GHFF key diet plant cover[6]	Regent Honey-eater and Swift Parrot food tree cover[7]
6	Dry sclerophyll forest	NR119	18	18.61	58%	Within	23%	23%	0%	0%	21%	21%	21%
7	Dry sclerophyll forest	NR220	18	16.55	43%	Within	0%	0%	0%	0%	35%	32%	32%
8	Dry sclerophyll forest	NR220	15	17.33	33%	Within	0%	0%	0%	0%	32%	22%	22%
9	Swamp sclerophyll forest	NR217	21	21.24	40%	Within	2%	2%	0%	0%	17%	17%	2%
10	Swamp sclerophyll forest	NR217	31	15.06	64%	Within	25%	25%	0%	0%	31%	26%	25%
11	Dry sclerophyll forest	NR119	29	20.07	75%	Within	4%	5%	0%	0%	67%	67%	53%
		Site average	**22**	**18**	**52%**		**9%**	**9%**	**0%**	**0%**	**34%**	**31%**	**26%**

1 – Total cover of Koala food trees as defined in categories 2-4.

2 - Primary food trees for the Koala as defined in the *Comprehensive Koala Plan of Management for Eastern portion of Kempsey Shire LGA, Vol. 1* (KSC, 2011).

3 - Secondary food trees for the Koala as defined in the KSC (2011).

4 - Supplementary food tree species are as defined in the North Coast management area listed in Appendix 2 of the Approved Recovery Plan for the Koala (Phascolarctos cinereus (DECC, 2008).

5 – Diet plants in the blossom or fruit diet of the Grey-headed Flying-fox (GHFF) as defined in Eby, P. and Law, B. (2008).

6 – Key diet plants in the blossom or fruit diet of the Grey-headed Flying-fox (GHFF) as defined in Eby, P. and Law, B. (2008).

7 - Winter-flowering species known to provide foraging habitat for the Swift Parrot (Saunders and Heinsohn, 2008; Saunders and Tzaros 2011) and foraging habitat for the Regent Honeyeater identified in Menkhorst et. al. (1999).

4.4.2 Grey-headed Flying-fox

The Grey-headed Flying-fox was recorded at the Griffin offset site by Lewis and Richards (2011). The Griffin offset site contains around 134 hectares of nectar or fruit-bearing foraging habitat for the known regional population of the Grey-headed Flying Fox associated with swamp forest, wet heathland and dry sclerophyll forest. There is a further 33 hectares of habitat in wallum sedgeland that is a source of drinking water and which contains at least some nectar bearing plants.

The canopy plot data presented in Table 6 confirms that there is good cover of plant species in the blossom diet of the Grey-headed Flying-fox (average 34 % cover across the site), including important diet plant species (average 31 % cover across the site) (Eby and Law, 2008). The most abundant important diet plant species are Swamp Mahogany, Blackbutt, Pink Bloodwood and Broad-leaved Paperbark (*Melaleuca quinquinervia)*. Collectively these species could provide nectar throughout the entire year (Eby and Law, 2008). Each of these species are dominant canopy species in forest types at the site. The Griffin offset site contains large, mature individuals of these species and regenerating patches and is likely to comprise an abundant and secure source of foraging resources into the future.

The following species in the fruit diet of the Grey-headed Flying-fox (Eby and Law, 2008) were present in small numbers in the plots and occur intermittently across the Griffin offset site: Bangalow Palm (*Archontophoenix cunninghamiana*), Rusty Fig (*Ficus rubiginosa*), Sweet Pittosporum (*Pittosporum undulatum*) and Blueberry Ash (*Eleaocarpus reticulatus*).

The Griffin offset site comprises foraging habitat critical to the survival of the Grey-headed Flying-fox because it addresses at least the following two identification criteria defined in the recovery plan for the species (DECC, 2009):

- It is productive during winter and spring, when food bottlenecks have been identified as confirmed by the presence of winter-flowering trees in the blossom diet of the species (Eby and Law, 2008), including good cover of Swamp Mahogany, Blackbutt and Coastal Banksia.
- It is productive during the final weeks of gestation, and during the weeks of birth, lactation and conception (September to May) as confirmed by the presence of spring to autumn-flowering trees in the blossom diet of the species (Eby and Law, 2008), including good cover of Pink Bloodwood, Old Man Banksia and Broad-leaved Paperbark.

The site is also likely to support at least one continuously occupied roost camp: there are two known camps within the vicinity of the Griffin offset site both of which comprise roosting habitat critical to the survival of the species (Eby, 2012) as defined in the recovery plan (DECC, 2009).

Based on the above assessment of habitat condition, and consideration of the site context and species stocking rate attributes the current habitat quality of the Griffin offset site was scored as 7/10 in the offset assessment guide calculations (see Section 11.5). This score reflects the presence of occupied habitat, with moderate cover of diet plants and within commuting distance of roost camps but with some impacts from clearing, weed infestation and edge effects.

4.4.3 Spotted-tail Quoll

The Spotted-tailed Quoll is known from a wide range of habitat types, the threshold densities of critical components required to maintain populations are unknown and critical habitat has not been

formally defined or mapped (Long and Nelson, 2009). Therefore identification of habitat for the species must be based on a subjective assessment and/or previous records of the species. The Spotted Tailed Quoll has not been recorded at the Griffin offset site. The Griffin offset site contains a total of around 167 hectares of habitat for the Spotted Tailed Quoll comprising:

- Around 166.1 hectares of swamp sclerophyll forest, dry sclerophyll forest and wet heath that comprise suitable habitat, substantiated by confirmed local records (OEH, 2014b).
- A further 1.6 hectares of habitat in wallum sedgeland that is a source of drinking water and which would harbour prey species such as frogs and reptiles.

This habitat has been identified based on the presence of the following characteristics identified in the recovery plan for the species (Long and Nelson, 2009):

- Forest vegetation in an area with high and predictable seasonal rainfall.
- A large, intact patch of vegetation as confirmed by the plot/transect data which were at benchmark values for most attributes in all plots sampled, as well as the species richness and general condition assessments provided by Lewis and Richards (2011).
- Moderate densities of medium-sized mammalian prey, including wallabies, gliders and possums recorded in the present survey and by Lewis and Richards (2011) as well as high densities of hollow-bearing trees to support arboreal prey.
- Potential den sites associated with dense understorey vegetation, hollow-bearing logs and large quantities of woody debris.
- Its position in a vegetated habitat corridor that is continuous with vegetation containing known records of the species (Kendall, P., NPWS, pers. comm.; Lewis and Richards, 2011; OEH, 2014b).

Based on the above assessment of habitat condition, and consideration of the site context and species stocking rate attributes the current habitat quality of the Griffin offset site was scored as 7/10 in the offset assessment guide calculations (see Section 11.5). This score reflects the presence of likely habitat with resources such as den sites, that is part of an extensive patch of habitat but with some impact from weed infestation, edge effects and probably also predatory pest fauna.

4.4.4 Regent Honeyeater

The Griffin offset site contains around 132 hectares of potential foraging habitat for the Regent Honeyeater associated with swamp sclerophyll forest and dry sclerophyll forest habitat types. The regional population of the Regent Honeyeater may use this habitat on an occasional or intermittent basis.

The canopy plot data presented in Table 6 confirms that there is good cover of tree species that comprise potential foraging habitat for the Regent Honeyeater as identified in the recovery plan (Menkhorst et. al. 1999). At the Griffin offset site, this includes Swamp Mahogany and Red Bloodwood with an overall average of 26 % cover of these canopy species in vegetation sampled across the site. The site also contains good numbers of large, mature trees which are likely to produce more abundant and reliable nectar. The value of this habitat is further confirmed by the observed presence of other blossom-feeding nomadic species on site, including the Grey-headed Flying Fox (Lewis and Richards, 2011), Noisy Friarbird and the Little Lorikeet.

Swamp sclerophyll forest and dry sclerophyll forest at the site comprises 'habitat critical to the survival of the Regent Honeyeater' because it is foraging habitat in an area where the species is likely to occur as defined by the distribution map provided in Figure 2 of the recovery plan (Commonwealth of Australia, 2016).

Based on the above assessment of habitat condition, and consideration of the site context and species stocking rate attributes the current habitat quality of the Griffin offset site was scored as 6/10 in the offset assessment guide calculations (see Section 11.5). This score reflects the presence of foraging habitat for the regional population of the species with moderate cover of food tree species but with some impact from weed infestation, timber harvesting and edge effects.

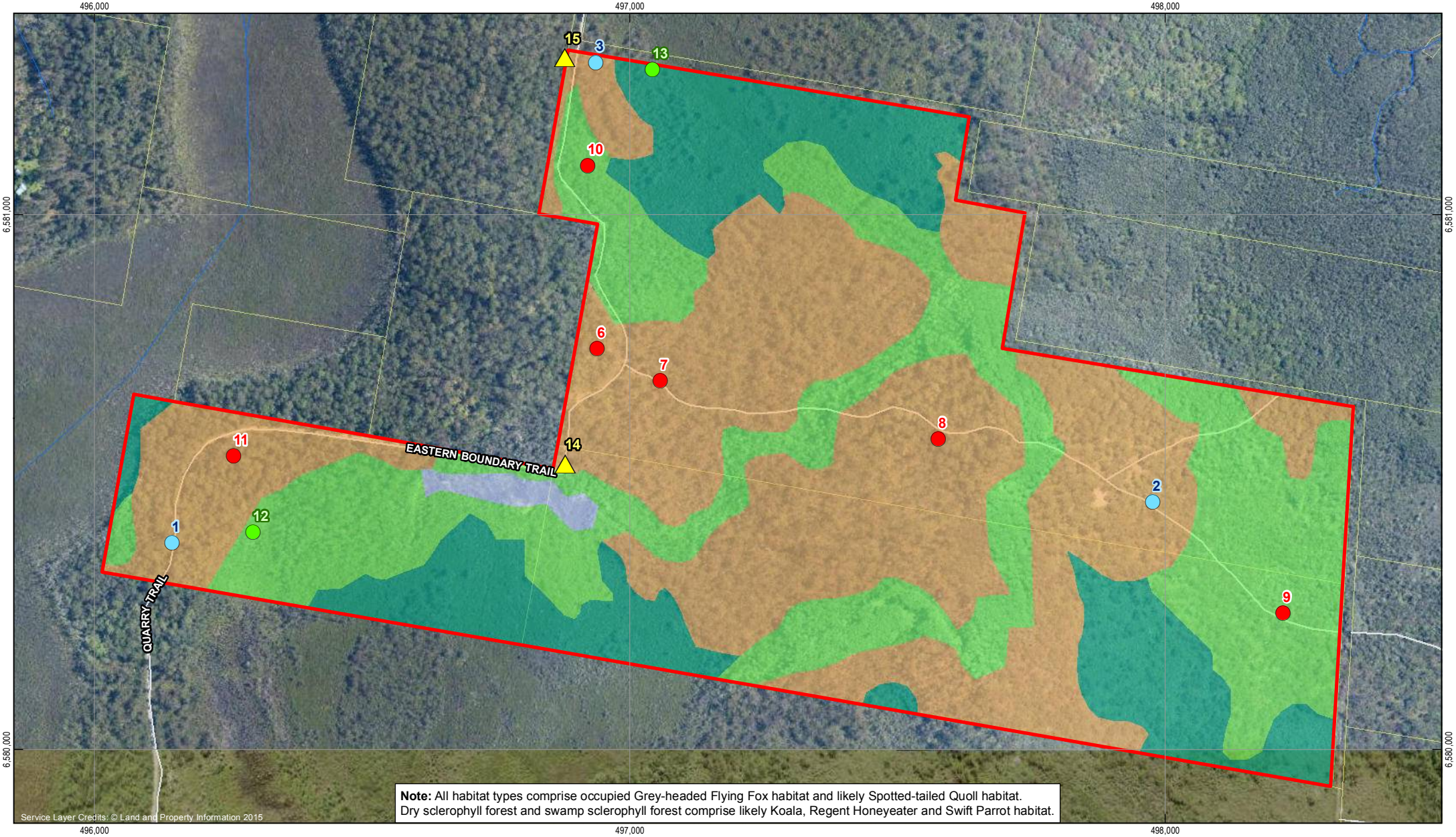
4.4.5 Swift Parrot

The Griffin offset site contains around 132 hectares of habitat for the Swift Parrot, substantiated by confirmed local records (OEH, 2014b).

The single, migratory population of the Swift Parrot may use this habitat on an occasional basis as part of its occupation of winter foraging habitat. The Griffin offset site contains four winter-flowering trees species known to provide foraging habitat for the Swift Parrot (Saunders and Heinsohn, 2008; Saunders and Tzaros 2011): Red Bloodwood, Blackbutt, Forest Red Gum and Swamp Mahogany. The canopy plot data presented in Table 2 confirms that there is good cover of these winter-flowering trees species with an overall average of 26 % cover in forest vegetation sampled across the site and up to 53 % cover in Swamp Mahogany or Blackbutt-dominated forest.

The value of this habitat is further confirmed by the observed presence of other blossom-feeding nomadic species. Notably the Little Lorikeet and the Noisy Friarbird have a significant positive association with Swift Parrots in coastal habitats (Saunders and Heinsohn, 2008). Significant negative associations with Swift Parrot occurrence were found for the Rainbow Lorikeet in coastal habitats and the Noisy Miner. Neither species was abundant at the site. The Griffin offset site is, in general, a relatively large, continuous patch of habitat and is less likely to be dominated by these aggressive bird species than fragmented landscapes.

Based on the above assessment of habitat condition, and consideration of the site context and species stocking rate attributes the current habitat quality of the Griffin offset site was scored as 6/10 in the offset assessment guide calculations (see Section 11.5). This score reflects the presence of foraging habitat for the regional population of the species with moderate cover of food tree species but with some impact from weed infestation, timber harvesting and edge effects.



Note: All habitat types comprise occupied Grey-headed Flying Fox habitat and likely Spotted-tailed Quoll habitat.
Dry sclerophyll forest and swamp sclerophyll forest comprise likely Koala, Regent Honeyeater and Swift Parrot habitat.

Paper Size A4

0 50 100 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Griffin offset site
- Lots
- Roads and tracks
- Waterways
- Dry sclerophyll forest
- Swamp sclerophyll forest
- Wet heathland
- Wetland
- Koala SAT
- Camera trap
- BioBanking plot/transect
- Plot/transect, canopy plot and Koala SAT

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Revision A
Date 27 Oct 2016

Griffin offset site habitat for affected threatened fauna

Figure 7

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Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: General topo - NSW LPI DTDB 2012, Geoscience Australia: 250k Data - Jan 2011; Aerial Imagery - Sixmaps 2016. jrichardson

4.5 Populations of affected threatened fauna

The purpose of this section is to describe the local and regional populations of each of the affected threatened fauna that may use habitat within the Griffin offset site. This assessment is based on:

- Presence / absence of individuals as revealed by the field surveys.
- Previous records of the species in the locality (see Table 7) and characteristics of the local and regional population as revealed by the desktop assessment.
- Likely use of the habitat resources within the site, as described in Section 4.4 above.

Table 7 Records of the affected threatened fauna in the locality of the Griffin offset site (OEH, 2014b)

Species	Wildlife Atlas records within 10 km	Closest Records	Date of Closest Records
Koala	18	Multiple records 3.7 km west in Tamban State Forest; 8.3km east on Lighthouse Road in Hat Head National Park	2011, 2008
Grey-headed Flying Fox	89	On site; 1.3 km north on Middle Island in the Yarrahapinni Wetlands.	2011; 2010,
Spotted-tailed Quoll	2	8.6 km east in Hat Head National Park	2006
Swift Parrot	23	5.1 km north-east in South West Rocks Tourist Park and surrounds (all records within 10 km are in the vicinity of this location).	2002
Regent Honeyeater	0	-	-

4.5.1 Koala

The Koala has not been recorded at the Griffin offset site and is not known from adjoining nature reserves despite extensive areas of suitable habitat (Kendall, P. NPWS, pers. comm.). This species is often recorded irregularly within home ranges and is dispersive over large distances at stages of its life cycle (DECC, 2008) so the lack of confirmed records at the site does not exclude its potential occurrence or value to the species.

There are a total of 18 records of Koalas in the locality of the Griffin offset site (OEH, 2014b). The closest observations of the species are around four kilometres to the west of the site in Tamban State Forest (OEH, 2014b).

The Griffin offset comprises habitat critical to the survival of the Koala according to the DSEWPaC (2013) guidelines given the presence of Koala food tree species in the canopy, habitat connectivity and recovery value. This recognises that Koala populations are mobile and dynamic and that unoccupied habitat still has value to regional populations as areas for refuge or population expansion. Conservation of the Griffin offset site is likely to contribute to the viability of the regional population of the Koala through continued regeneration and maturation of native vegetation containing food trees and control of dogs.

4.5.2 Grey-headed Flying-fox

Grey-headed Flying Foxes have been recorded in coastal woodland in the Griffin offset site; an individual was observed foraging on flowering Blackbutt (Lewis and Richards, 2011). There are a total of 89 records of Grey-headed Flying Foxes in the locality of the Griffin offset site (OEH, 2014b). There are two known camps within the vicinity of the Griffin offset site (Eby, 2012):

- The 'Arakoon' camp, around 7.9 kilometres to the east, which contains critical foraging habitat, has been continuously occupied, has supported >10,000 individuals at least once, supports >2,500 individuals during the reproductive season and comprises roosting habitat critical to the survival of the species as defined in the recovery plan (DECC, 2009).
- The 'Clybucca' camp, around 3 kilometres to the south, which contains critical foraging habitat, supports >2,500 individuals during the reproductive season and comprises roosting habitat critical to the survival of the species as defined in the recovery plan (DECC, 2009).

No Grey-headed Flying Foxes were recorded during the present survey, presumably because individuals within the regional population were using seasonal foraging resources in other vegetation types and/or in other parts of their range at the time of survey. This is despite high canopy cover of diet plants and significant diet plants for the Grey-headed Flying fox area (see Table 6), including Blackbutt and Turpentine which have flowering schedules that coincide with the field survey (Eby and Law, 2008). Patterns of habitat use by Grey-headed Flying Foxes are seasonal and sporadic in response to food sources with largely irregular patterns of productivity (DECCW, 2009). When assessed at a local scale, the species is generally present intermittently and irregularly and so this one off absence from the site does not exclude its likely value to the regional population of the species.

Overall these results suggest that the Griffin offset site is likely to provide critical foraging resources for a regional population of >10,000 Grey-headed Flying-foxes and help support two camps that are critical to the survival of the species. Given the nearby camps, the extent and cover of diet species at the site and its overall size, condition and landscape position, the Griffin offset site will make a valuable contribution to the viability of the regional population of the Grey-headed Flying-fox. It is likely that the viability of the nearby camps will improve with conservation of the offset site. In particular, the regional population is likely to benefit from continued regeneration or maturation of native vegetation containing abundant food trees.

4.5.3 Spotted-tail Quoll

The Spotted-tailed Quoll has not been recorded at the Griffin offset site. This species is recorded intermittently and irregularly within its very large home ranges and so the lack of confirmed records at the site does not exclude its potential occurrence and value to the species.

There are two records of Spotted-tailed Quolls in the locality of the Griffin offset site (OEH, 2014b). The closest confirmed observations of the species are at a duck farm around two kilometres to the west of the site (Kendall, P., NPWS, pers. comm.). The closest Wildlife Atlas record is in Hat Head National Park, 8.6 kilometres to the east (OEH, 2014b). Habitat resources such as dense groundcover, fallen logs and abundant tree hollows for prey species within an area recognised as a regional habitat corridor suggest the site may be inhabited by a local population of the Spotted-tailed Quoll.

Given the extent and quality habitat in the site and its overall size, condition and landscape position, the Griffin offset site is likely to contribute to the viability of the local and regional population of the Spotted-tailed Quoll. Populations of the Spotted-tailed Quoll are likely to benefit from continued regeneration and maturation of native vegetation containing habitat resources and control of dogs.

4.5.4 Regent Honeyeater

The Regent Honeyeater has not been recorded in the Griffin offset site. The species is predicted to occur in the region by the PMST (DotE, 2014b) however there are no confirmed records within the locality of the offset site (OEH 2014b). There are scattered records along the coast in the Northern Rivers and Mid-North Coast Regions with regional movements thought to be governed mainly by the flowering of a select number of *Eucalyptus* (DotE, 2014a). As described above, the Griffin offset site contains key indicator tree species for foraging habitat identified in the recovery plan for the Regent Honeyeater (Menkhorst et. al., 1999). The Griffin offset site comprises potential foraging habitat for a regional population of the Regent Honeyeater that may occasionally be present on the north coast of NSW. The regional population of the Regent Honeyeater may use this habitat on an intermittent basis. This is an equivalent situation to the footprint, study area and locality for the Project (GHD, 2013b) and so the Griffin offset site will provide an appropriate biodiversity offset for impacts in this context.

The viability of the regional population of the Regent Honeyeater is likely to improve with conservation of the Griffin offset site through the conservation and continued regeneration of native vegetation containing abundant food trees.

4.5.5 Swift Parrot

The Swift Parrot has not been recorded in the Griffin offset site. There are 23 confirmed records within the locality of the offset site, all within the South West Rocks Tourist Park and surrounds around 5.1 kilometres to the north-east (OEH 2014b). As described above, the Griffin offset site contains good cover of winter-flowering trees species known to provide foraging habitat for the Swift Parrot, including 54 hectares of the species' preferred Swamp Mahogany-dominated forest (Saunders and Heinsohn, 2008; Saunders and Tzaros 2011). The single, migratory population of the Swift Parrot may use this habitat on an occasional basis as part of its occupation of winter foraging habitat. This is an equivalent situation to the footprint, study area and locality for the Project (GHD, 2013b) and so the Griffin offset site will provide an appropriate biodiversity offset for impacts in this context.

The viability of the national population of the Swift Parrot is likely to improve with conservation of the Griffin offset site through the conservation and continued regeneration of native vegetation containing abundant food trees.

5. Existing environment of the Boambee SF offset site

5.1 Location and land use

The offset site is located in the Boambee SF at Boambee on the North Coast of NSW. The Boambee SF offset site is owned and managed by Forestry Corporation NSW (FCNSW) as part of the State forest estate. Roads and Maritime will fund the titling and management of the Boambee SF offset site as a biodiversity offset for the Project. The site has been the subject of detailed ecological assessment for this NGOMP report as well as for the *Pacific Highway Upgrade, Nambucca Heads to Urunga Threatened Flora Offset Management Plan* (TFOMP)(GHD, 2016a) and WC2NH offset package (GHD, 2016b). The Boambee SF offset site is located around 14 kilometres north of the Project site in an equivalent position on near coastal hills.

The Boambee SF offset site is in Coffs Harbour LGA. It is located around 6.5 kilometres west of the Pacific Ocean, 2.5 kilometres west of the Pacific Highway and 7 kilometres south west of the city of Coffs Harbour. The site location relative to the Project footprint and the region is shown on Figure 1.

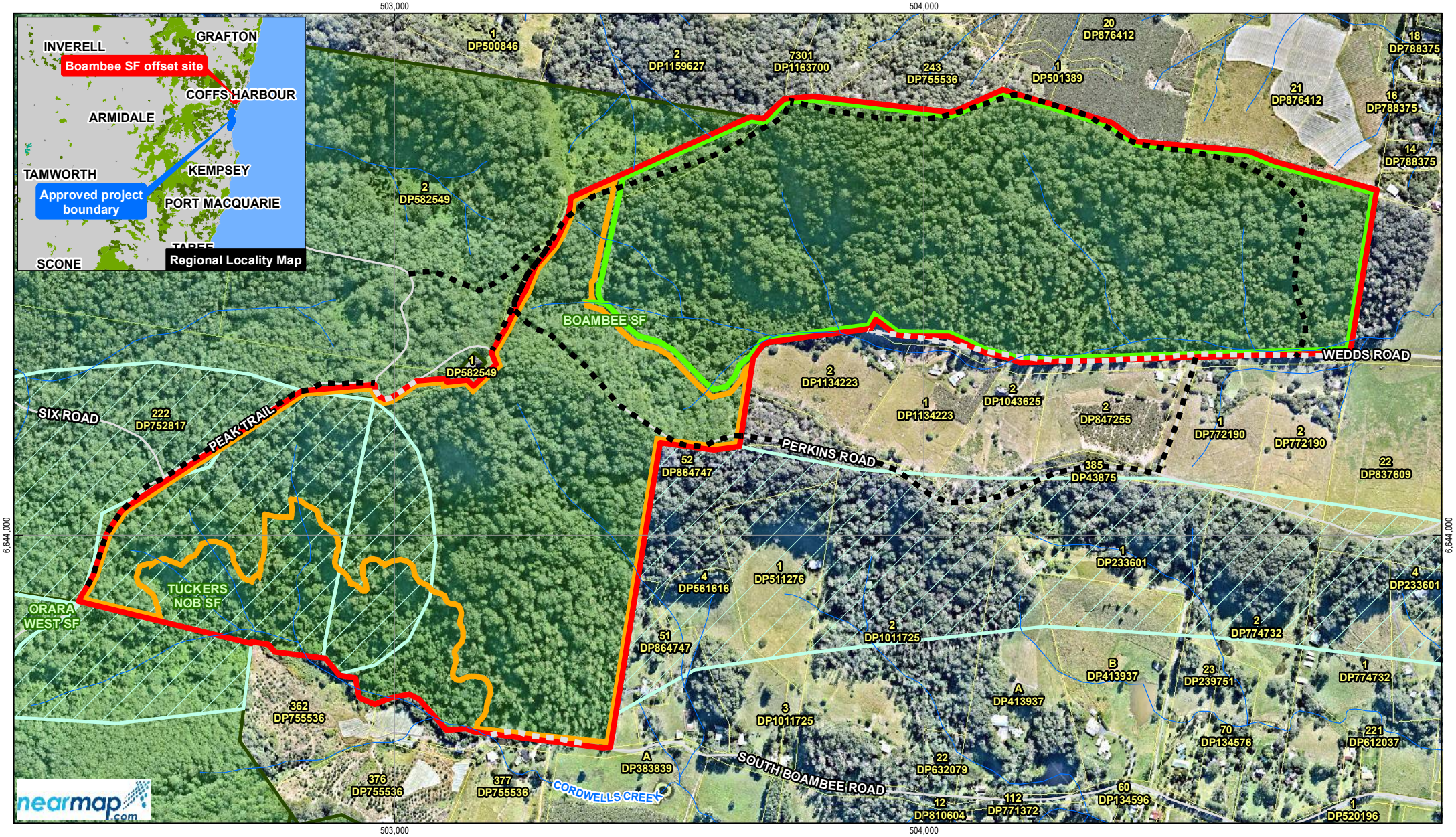
The Boambee SF offset site is accessed from the east via the suburb of Boambee and Wedds Road or South Boambee Road, or from the north via the village of Upper Orara and Fridays Creek Road. There is vehicle access around the northern boundary of the site via Fridays Creek Road and Peak Trail and partial access within the site via Perkins Road and the Foot Track. The site boundary and layout is shown on Figure 8.

The previous land use at the offset site was periodic timber harvesting as part of a State forest. Evidence of timber harvesting, track construction and partial clearing was noted during field surveys. Based on the presence of over mature and hollow-bearing trees, it appears that the site has never been clear-felled however given the comparative scarcity of larger trees it has probably been harvested relatively intensively in the past.

Land uses surrounding the site include:

- Partially cleared rural residential land to the east, south-east and south.
- Banana plantations to the north of the eastern portion of the offset site and to the northeast.
- State forest to the north of the western portion of the offset site and to the north-west, west and south-west (see Figure 8).

The 121 hectare Boambee SF offset site will also provide biodiversity offsets for impacts of the WC2NH project (GHD,2016b). The policy allows a single offset site to provide biodiversity offsets for more than one project provided that the offsets are for different threatened species or MNES (DSEWPaC, 2012). However, consultation with the DotE has confirmed that a specific parcel of land at an offset site can only be used to offset the impacts of a single project. Therefore, separate parcels of land within the Boambee SF offset site have been set aside to offset the impacts of the NH2U project (59.8 hectares) and the WC2NH project (49.5 hectares) (see Figure 8). There is a further 11.7 hectares of subtropical rainforest and exotic vegetation which has not been included in any of these EPBC Act offset packages but which will be included in the Flora Reserve. The land that has been included as a biodiversity offset for the NH2U project is the ‘NH2U Boambee SF offset area’ as shown on Figure 8.



Paper Size A4

0 75 150 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Boambee SF offset site
- NH2U Boambee SF offset area
- WC2NH Boambee SF offset area
- Regional biodiversity corridor
- State forest
- Cadastre
- Waterways
- Four wheel drive track
- Unsealed road
- Public roads

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Norton and Griffin Offset Management Plan

Job Number 21-23829
Revision A
Date 27 Oct 2016

Boambee SF offset site location

Figure 8

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Level 15, 133 Castlereagh Street Sydney NSW 2000 T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com.au W www.ghd.com.au

Data Source: NSW Department of Lands: Cadastre - Jan 2011; Geoscience Australia: 250k Data - Jan 2011, Aerial imagery - ESRI 2016 and Nearmap 2016 (image extracted 17/18/2016, image taken 05/05/2016).jrichardson

5.2 Landscape context

The Boambee SF offset site is around 121 hectares in area and contains wet and dry sclerophyll forest and rainforest on steep, near-coastal hills on the east face of the Great Dividing Range. The site comprises steep to very steep, south or east draining slopes that are incised by multiple steep sided gullies. The underlying geology is Permian metasediments.

The eastern and south-eastern portions of the offset site, at lower elevations, fall within the 'Brooms Head – Kempsey Coastal Ramp' Mitchell landscape (DECC 2008a). This landscape comprises hills and low ranges of the coastal fall on Permian Phyllite and schistose sandstone. General elevation is 50 to 450m with local relief of up to 300m. Soils consist of thin, stony gradational loam and sandy loam on the slopes grading to yellow-brown texture-contrast soils on lower slopes and in valleys (DECC 2008b).

The western and northern portions of the offset site, at higher elevations, are part of the Nymboida Great Escarpment Mitchell landscape (DECC 2008a). This landscape comprises ranges, peaks and steep escarpments on Permian/Carboniferous volcanics within extensive areas of moderately deformed Silurian-Devonian sedimentary rocks. General elevation is 400 to 1400m with local relief up to 500m. Soils vary from shallow gritty sandy loam through red and yellow earthy gradational profiles to deep siliceous sands and loams on valley floors (DECC 2008b).

There are extensive areas of rock outcrop and scree slopes at the site. Vegetation at the site varies in response to aspect and topographic position (see Section 5.3 and Figure 6 below).

The southern portion of the site is drained by a number of unnamed first and second order streams. These streams are bedrock confined, intermittent 'chain of pools' type drainage lines with sand or gravel substrate. They are generally in good condition with intact riparian and in stream vegetation, intact channel and bank structure, slight to moderate weed infestation and no visible evidence of poor water quality.

The second order stream that runs parallel to Wedds Road in the northeast of the site has been dammed and excavated in places to form deep pools or straight channels. These earthworks appear to have been completed many decades ago and the riparian corridor features mature regrowth vegetation and has considerable habitat value. However the hydrology and geomorphology of the drainage line has been substantially modified and in its present form is unlikely to comprise suitable breeding habitat for the Giant Barred Frog and other stream breeding frogs.

The offset site lies within a mapped regional fauna habitat corridor (Scotts et. al., 2003) that runs east-west connecting State forests to the west and south of the site with coastal vegetation to the east.

The Boambee SF offset site is part of a near continuous patch of native vegetation and habitat of many thousands of hectares. Partially cleared rural residential land in the locality of Boambee and the Pacific Highway to the east would comprise barriers to fauna movement and other ecological processes. Boambee SF and Tuckers Nob SF extend to the west of the offset site and beyond that there is an extensive network of native vegetation in national parks and State forests that stretches along the Great Dividing Range. The offset site is connected to this extensive area of habitat via continuous vegetation in Boambee SF. This vegetation is partially interrupted by small dirt or gravel tracks, including along the entire northern boundary of the site. These tracks would not comprise a significant gap in habitat and would not be a barrier to dispersal or other ecological processes in the life history of the affected threatened fauna. There are partial barriers to the north, south and southeast associated with partially cleared and/or fenced private land, including banana plantations. Near continuous vegetation is present around or between these gaps in habitat.

There is evidence of edge effects around the perimeter of the Boambee SF offset site where it adjoins disturbed, cleared land as well as along tracks. There is localised, moderate to severe weed infestation associated with these disturbed edges.

The offset site comprises appropriately situated habitat for the long term maintenance of populations of the affected threatened fauna. In this landscape context, the offset site comprises a valuable habitat link in terms of the extensive area of occupied habitat it encompasses, its position between the coast and ranges and as a conserved vegetated corridor around an area of rural residential development.

5.3 Vegetation

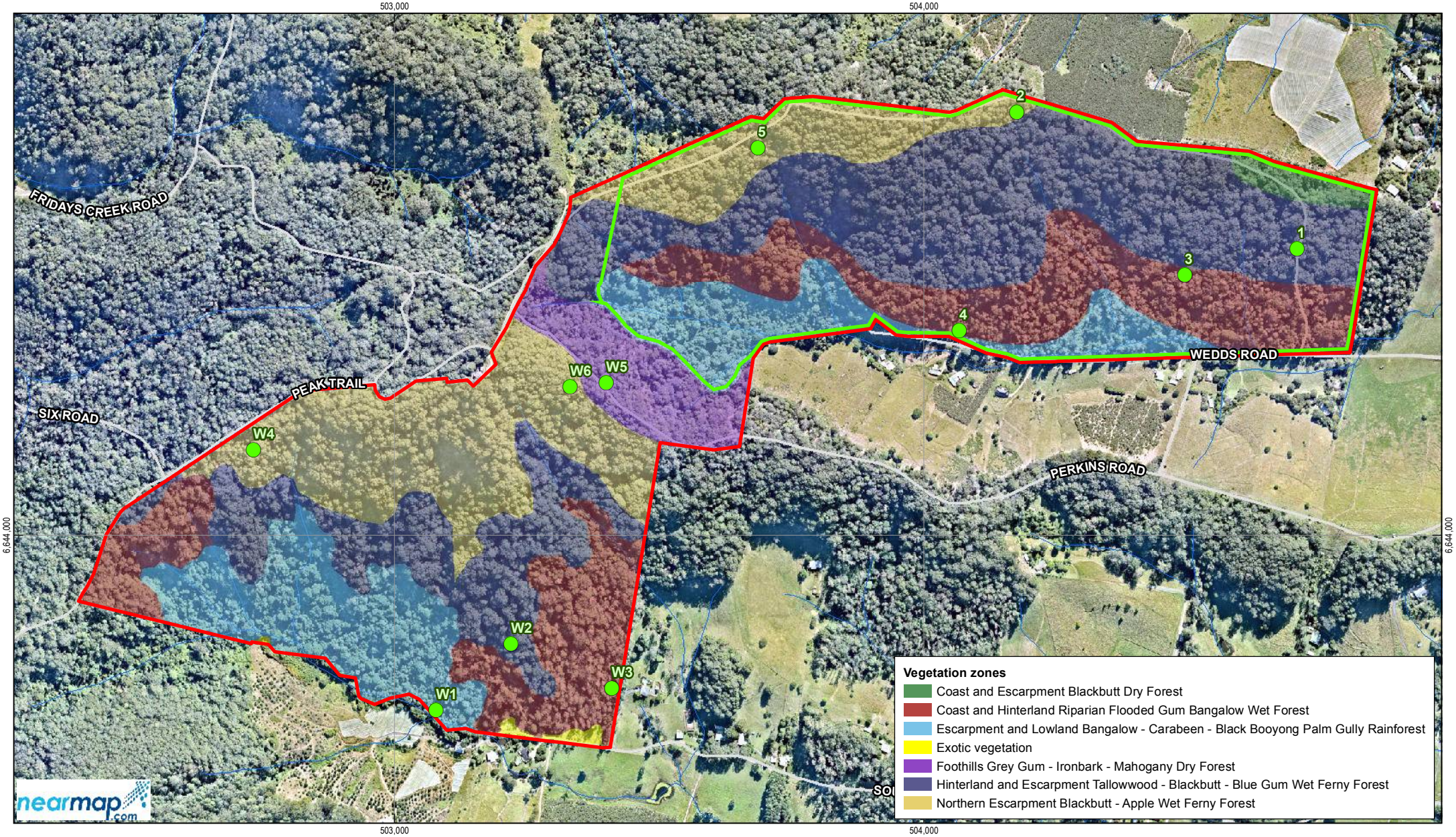
Vegetation types have been mapped within the offset site by OEH (2012) and this mapping was ground truthed and converted to NSW vegetation types as part of the present study. Vegetation types within the offset site are shown on Figure 9 and summarised in Table 8.

Plant species recorded in the plot/transects that were sampled in these vegetation types are listed in Appendix C.

Table 8 Vegetation in the Boambee SF offset site

Coffs Harbour LGA Vegetation Community (OEH 2012)	Habitat type	Area in Boambee offset site (ha)	Area in NH2U Boambee SF offset area (ha)	Plot/transects	Coffs Harbour LGA Map Unit Code (OEH 2012)	Plant Community Type Code (OEH, 2014a)	Condition
Hinterland and Escarpment Tallowwood - Blackbutt - Blue Gum Wet Ferny Forest	Wet sclerophyll forest	40.8	26.7	W2, 1	CH_WSF10	NR120	Moderate/good
Northern Escarpment Blackbutt - Apple Wet Ferny Forest	Wet sclerophyll forest	24.7	7.3	W4, 2, 5	CH_WSF09	NR120	Moderate/good
Coast and Hinterland Riparian Flooded Gum Bangalow Wet Forest	Wet sclerophyll forest	26.4	14.8	W3, 3, 4	CH_WSF01	NR159	Moderate/good
Total	**Wet sclerophyll forest[1]**	**91.9**	**48.8**				
Coast and Escarpment Blackbutt Dry Forest	Dry sclerophyll forest	1.5	1.5	-	CH_DOF01	NR117	Moderate/good
Foothills Grey Gum - Ironbark - Mahogany Dry Forest	Dry sclerophyll forest	6.2	0.0	W5	CH_DOF05	NR263	Moderate/good
Total	**Dry sclerophyll forest[1]**	**7.7**	**1.5**				
Escarpment and Lowland Bangalow - Carabeen - Black Booyong Palm Gully Rainforest	Rainforest[2]	21	9.5	W1, 4	CH_RF11	NR111	Moderate/good
Exotic vegetation	Exotic scrub	0.4	0.0		CH_EX04	n/a	Low
Total		**121**	**59.8**				

Notes: 1) comprises occupied Koala and Grey-headed Flying Fox habitat and likely Spotted-tailed Quoll habitat 2) comprises occupied Grey-headed Flying Fox habitat and likely Spotted-tailed Quoll habitat.



Paper Size A4

0 75 150 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Boambee SF offset site
- NH2U Boambee SF offset area
- BioBanking plot/transect
- Roads
- Waterways

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Norton and Griffin Offset Management Plan

Job Number 21-24927
Revision A
Date 27 Oct 2016

Boambee SF offset site vegetation

Figure 9

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Level 15, 133 Castlereagh Street Sydney NSW 2000 T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com.au W www.ghd.com.au

Data Source: NSW Department of Lands: Cadastre - Jan 2011; Geoscience Australia: 250k Data - Jan 2011, Aerial imagery - ESRI 2016 and Nearmap 2016 (image extracted 17/18/2016, image taken 05/05/2016).jrichardson

5.4 Habitat quality

This section describes the extent and quality of habitat for the affected threatened fauna in the Boambee SF offset site based on the desktop assessment and field survey results.

Fauna habitat types and canopy plot survey locations are shown on Figure 10. Canopy plots were sampled at the locations shown on Figure 10 and comprised counts of every tree in a 50 m x 20 m plot along with its height, species and canopy cover. Each tree species was then cross referenced to lists of food tree species for the affected threatened fauna to calculate the cover of food tree species. A list of food tree species at the Boambee SF offset site and/or the other offset sites is included in Table 3. The results of canopy plot surveys to quantify habitat resources for the affected threatened fauna species are presented in Table 9.

A detailed description of habitat quality for each of the affected threatened fauna is provided below.

The Boambee SF offset site contains known populations of the threatened plants Clear Milkvine also known as Slender Marsdenia (*Marsdenia longiloba*) and the Cryptic Forest Twiner also known as Woolls' Tylophora (*Tylophora woollsii*). The site has been the subject of targeted threatened plant surveys for the TFOMP (GHD, 2016a) and WC2NH offset package (GHD, 2016b). The presence of these threatened plants has been considered in the development of appropriate management actions at the offset site.

5.4.1 Koala

The Koala was recorded at three locations at the Boambee SF offset site in the current surveys, through observations of scats at two separate locations and hearing the calls of an adult male. An adult male was also heard calling in a patch of connected vegetation to the south of the site (see Figure 10). The NH2U Boambee SF offset area contains around 50.3 hectares of habitat for the known local population of the Koala associated with wet and dry sclerophyll forest.

The canopy plot results confirmed that the Boambee SF site contains extensive areas of primary and secondary food trees for the Koala as defined in the Coffs Harbour City Koala plan of management (Lunney et. al., 1999) and/or in the North Coast management area of the recovery plan (DECC, 2008). In the Coffs Harbour region, Tallowwood (*Eucalyptus microcorys*) is the tree species most preferred by Koalas. Swamp Mahogany (*E. robusta*), Small-fruited Grey Gum (*E. propinqua*), Broad-leaved Paperbark (*Melaleuca quinquenervia*), Flooded Gum (*E. grandis*), Blackbutt (*E. pilularis*) and Forest Oak (*Allocasuarina torulosa*) are also used and are considered secondary food tree species in this region (Lunney et. al., 1999).

The canopy plot data presented in Table 9 confirms that there is high cover of food trees (average 464 m^2 cover present as emergent, canopy or mid storey in each 1000m^2 plot sampled across the site) and primary food trees (average 318 m^2 cover across the site). There is one primary food tree species at the site: Tallowwood. Tallowwood is a dominant or sub-dominant canopy species in all wet and dry sclerophyll forest vegetation types at the site. There was up to 600 m^2 of foliage cover of primary food trees in the plots sampled. At least one secondary food tree species also occurs as a dominant or sub-dominant canopy species in all wet and dry sclerophyll forest vegetation types at the site. These include either Flooded Gum, Blackbutt or Forest Oak as identified in the Coffs Harbour City Koala plan of management (Lunney et. al., 1999) or Red Mahogany (*Eucalyptus resinifera*) as identified in the North Coast management area of the recovery plan (DECC, 2008).

Average over storey cover across the site was 40.1%, indicating a forest structure throughout and was consistently within benchmark values for individual vegetation types (i.e. equivalent to intact examples of the vegetation type).

The Coffs Harbour City Koala Plan of Management does not identify Koala habitat within State forests however there are mapped patches of Primary and Secondary habitat type on private land immediately adjoining the Boambee SF offset site (Lunney et. al., 1999). The plan specifically identifies a strip of land that runs south through Boambee SF to the far southeast of the region as one of the areas that contains the majority of the primary habitat in the region and the highest level of Koala records and activity (Lunney et. al., 1999).

The Boambee SF offset site is mapped as a 'locally significant link' in the Coffs Harbour City Koala Plan of Management, connecting State forest at higher elevations in the west of the region with coastal vegetation around Sawtell to the southeast (Lunney et. al., 1999).

The Koala SAT plot results indicated that two out of 10 plots featured 'Medium (normal) use' for the 'East Coast (low) activity category' (Phillips and Callaghan, 2011). The remaining 8 SAT plots (zero scats) and the cumulative Koala SAT plot results across the site (scats beneath <1% of trees sampled) suggest low activity levels. Low activity levels recorded in what might otherwise be medium or high carrying capacity Koala habitat may be a result of contemporary population dynamics, landscape configuration and/or historical disturbances, including logging, mining, fire, agricultural activities and/or urban development (Phillips and Callaghan, 2011). Such considerations should not necessarily detract from the potential importance of such habitat for longer-term conservation, particularly if preferred food trees are present and populations of the Koala are known to occur in the general area (Phillips and Callaghan, 2011) as is the case at the Boambee SF offset site.

Habitat critical to the survival of the Koala is defined as an area that scores five or more using the habitat assessment tool for the Koala in Table 4 of the DotE (2014) guidelines. The habitat assessment tool scores for the Boambee SF site are as follows:

- Koala occurrence +2 (high) Evidence of one or more koalas within the last 2 years (recorded on site in the GHD surveys).
- Vegetation composition +2 (high) Has forest, woodland or shrubland with emerging trees with 2 or more known koala food tree species (Tallowwood, Flooded Gum and Blackbutt).
- Habitat connectivity +2 (high) Area is part of a contiguous landscape ≥ 1000 ha (the site is connected to many thousands of hectares of habitat in State forests to the west).
- Key existing threats +1 (medium) Evidence of infrequent or irregular Koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for Koala occurrence (collection of direct evidence is outside the scope of this assessment. Some mortality is likely given the presence of roads within and adjoining the site, agricultural land adjoining the site and likely presence of wild dogs).
- Recovery value +2 (high) Habitat is likely to be important for achieving the interim recovery objectives for the relevant context (the site and adjoining land is recognised as an area of primary habitat and a key corridor in the regional plan of management (Lunney et. al., 1999)).

The Boambee SF site has a total habitat score of nine. Therefore, the Boambee SF site is habitat critical to the survival of the Koala.

The habitat assessment tool for the Koala (DotE, 2014a, Table 4) can be used to determine 'habitat quality' in accordance with the EPBC Act offset policy (DotE, 2014b).

Therefore based on the above assessment of habitat condition the current habitat quality of the Boambee offset site was scored as 9/10 in the offset assessment guide calculations (see Section 11.5). This score reflects the presence of likely habitat with high cover of primary food

tree species as a part of an extensive patch of habitat but with some impact from weed infestation, edge effects and probably also predatory pest fauna. The habitat assessment tool can also be used to calculate the starting quality of a proposed offset site and to estimate the future quality, with and without the proposed offset or management intervention (DotE, 2014b). The change in habitat quality scores with and without offset site management are described in Section 11.5.

The baseline site quality of occupied Koala habitat in the NH2U Boambee SF offset area was further assessed using BioBanking plot/transects and compared with benchmark data from matching NSW vegetation types (see Appendix C). The plot/transect data confirmed that the vegetation associated with occupied habitat is in good condition with benchmark values for the majority of attributes in the majority of plot/transects that were sampled. Notably for this species, over storey cover and regeneration were at benchmark values. Past timber harvesting at the site has had a negative impact on localised areas such as old timber harvesting tracks and log dumps. These areas are in various stages of regeneration but generally appeared to be developing well into native vegetation communities.

Table 9 Canopy plot results for the Boambee SF offset site

Canopy Plot ID	Habitat type	Veg. Type ID	No. of trees	Average tree height (m)	Over storey cover	Over storey condition	Tree cover (m^2)[1]	Koala food tree cover (m^2, % of total cover)[2]	Koala primary food tree cover (m^2, % of total cover)[3]	Koala secondary food tree cover (m^2, % of total cover)[4]	GHFF diet plant cover (m^2, % of total cover)[5]	GHFF key diet plant cover(m^2, % of total cover)[6]	Koala activity level[7]	Fauna observations
W2	Wet Sclerophyll Forest	NR120	31	23	46	Within benchmark	890	810 (54%)	290 (19%)	520 (35%)	600 (40%)	470 (31%)	3.33%	One Koala scat beneath *E. microcrys*
W3	Wet Sclerophyll Forest	NR159	31	22	48.5	Within benchmark	740	220 (15%)		220 (15%)	705 (47%)	60 (4%)		
W4	Wet Sclerophyll Forest	NR120	37	22	39.5	Within benchmark	1105	925 (62%)	601 (40%)	324 (22%)	504 (34%)	270 (18%)		
W5	Dry Sclerophyll Forest	NR263	27	13	29	Within benchmark	266	41 (3%)		41 (3%)	103 (7%)	71 (5%)		
W6	Wet Sclerophyll Forest	NR120	37	18	39.5	Within benchmark	593	488 (33%)	366 (24%)	122 (8%)	219 (15%)	140 (9%)		
		Site average	**30.8**	**18.8**	**40.1**		**847.1**	**464.4**	**318.5**	**225.5**	**415.1**	**231.4**	**0.66%**	

1 – Total cover of trees present in either the emergent, canopy or mid storey strata in the plot. Since separate strata overlap the total may be greater than the area of the plot (1000m^2).

2 – Total cover of Koala food trees as defined in categories 2-4.

3 - Primary food trees for the Koala as defined in the Coffs Harbour City Koala plan of management (Lunney et. al., 1999) and/or in the North Coast management area of the recovery plan (DECC, 2008).

4 - Secondary food trees for the Koala as defined in the Coffs Harbour City Koala plan of management (Lunney et. al., 1999).

5 – Diet plants in the blossom or fruit diet of the Grey-headed Flying-fox (GHFF) as defined in Eby, P. and Law, B. (2008).

6 – Key diet plants in the blossom or fruit diet of the Grey-headed Flying-fox (GHFF) as defined in Eby, P. and Law, B. (2008).

7 – Percentage of the 30 trees sampled in a Koala SAT plot that had at least one Koala scat (see Phillips and Callaghan, 2011).

5.4.2 Grey-headed Flying-fox

The NH2U Boambee SF offset area contains around 59.8 hectares of nectar or fruit-bearing foraging habitat for the known regional population of the Grey-headed Flying Fox associated with wet and dry sclerophyll forest. There is around 61.2 hectares of additional connected habitat at the Boambee SF offset site that will be set aside to offset the impacts of other projects.

The canopy plot data presented in Table 9 confirms that there is good cover of plant species in the blossom diet of the Grey-headed Flying-fox (average 415 m^2 cover present as emergent, canopy or mid storey in each 1000m^2 plot sampled across the site), including key diet plant species (average 318 m^2 cover across the site) (Eby and Law, 2008). The most abundant key diet plant species are Blackbutt, Turpentine (*Syncarpia glomulifera* subsp. *glomulifera*) and Sydney Blue Gum (*E. saligna*). Collectively these species could provide nectar throughout the entire year (Eby and Law, 2008). Each of these species is a dominant canopy species in the forest types at the site. The Boambee SF offset site contains large, mature individuals of these species and regenerating patches and is likely to comprise an abundant and secure source of foraging resources into the future.

The following species in the fruit diet of the Grey-headed Flying-fox (Eby and Law, 2008) are present at moderate cover in the plots and across the Boambee SF site: Bangalow Palm (*Archontophoenix cunninghamiana*), Rusty Fig (*Ficus rubiginosa*), Sweet Pittosporum (*Pittosporum undulatum*) and Blueberry Ash (*Eleaocarpus reticulatus*). These species are mainly present in the mid storey. In some areas they form dense stands that would yield abundant fruit. Fruit resources would be likely to peak in Spring and Summer but would be available at varying quantities throughout the year (Eby and Law, 2008).

The following additional species in the fruit diet of the Grey-headed Flying-fox (Eby and Law, 2008) were present in small numbers in the plots and occur intermittently across the Boambee SF site: Southern Melodinus (*Melodinus australis*), Cockspur Thorn (*Maclura coccinensis*), Five-leaf Water Vine (*Cissus hypoglauca*) and Native Passionfruit species (*Passiflora* species).

The Boambee SF site comprises foraging habitat critical to the survival of the Grey-headed Flying-fox because it meets at least the following two identification criteria defined in the recovery plan for the species (DECC, 2009):

- It is productive during winter and spring, when food bottlenecks have been identified as confirmed by the presence of winter-flowering trees in the blossom diet of the species (Eby and Law, 2008) such as Grey Ironbark (*E. siderophloia*).
- It is productive during the final weeks of gestation, and during the weeks of birth, lactation and conception (September to May) as confirmed by the presence of spring to autumn-flowering trees in the blossom diet of the species (Eby and Law, 2008), including extensive areas of forest dominated by Blackbutt and Sydney Blue Gum.

The site is also likely to support at least one continuously occupied roost camp: there are two known camps within the near vicinity of the Boambee SF offset site (CHCC, 2007; OEH and DSEWPac 2013) both of which comprise roosting habitat critical to the survival of the species (CHCC, 2007) as defined in the recovery plan (DECC, 2009).

The baseline site condition component of the quality score of occupied Grey-headed Flying-fox habitat in the NH2U Boambee SF offset area was further assessed using BioBanking plot/transects and compared with benchmark data from matching NSW vegetation types (see Appendix C). As described above for other species, the plot/transect data confirmed that the vegetation associated with occupied habitat is in good condition. Notably for this species over storey cover, mid storey cover and regeneration were at benchmark values.

Based on the above assessment of habitat condition, and consideration of the site context and species stocking rate attributes the current habitat quality of the NH2U Boambee SF offset area was scored as 8/10 in the offset assessment guide calculations (see Section 11.5). This score reflects the presence of occupied habitat with high cover of key diet tree species and within commuting distance of a significant roost camp but with some impact from weed infestation, timber harvesting and edge effects.

5.4.3 Spotted-tail Quoll

The Spotted-tailed Quoll is known from a wide range of habitat types, the threshold densities of critical components required to maintain populations are unknown and critical habitat has not been formally defined or mapped (Long and Nelson, 2009). Therefore, identification of habitat for the species must be based on a subjective assessment and/or previous records of the species.

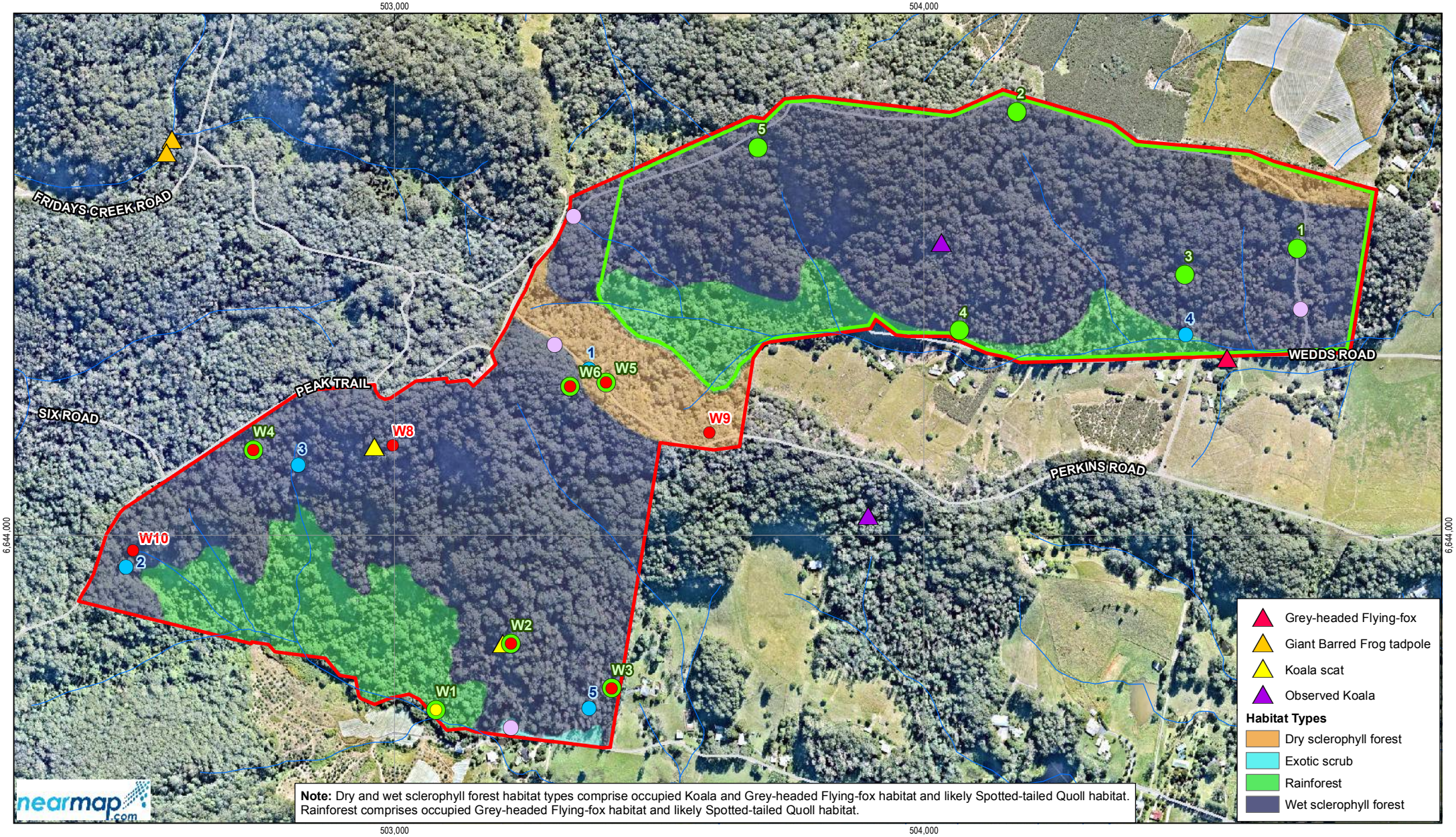
The Spotted Tailed Quoll has been recorded at the Boambee SF offset site in 2005 (OEH, 2015b). The NH2U Boambee SF offset area contains around 59.8 hectares of habitat for the Spotted Tailed Quoll in wet and dry sclerophyll forest. There is around 61.2 hectares of additional connected habitat at the Boambee SF offset site that will be set aside to offset the impacts of other projects.

This habitat has been identified based on the presence of the following characteristics identified in the recovery plan for the species (Long and Nelson, 2009):

- Forest vegetation in an area with high and predictable seasonal rainfall.
- A large, intact patch of vegetation in good condition as confirmed by the plot/transect data which were at benchmark values for most attributes in all plots sampled.
- Moderate densities of medium-sized mammalian prey, including wallabies, gliders, rats and possums recorded in the present survey as well as moderate densities of hollow-bearing trees to support arboreal prey.
- Potential den sites associated with dense understorey vegetation, rock outcrops and caves, hollow-bearing logs and large quantities of woody debris.
- Its position in a vegetated habitat corridor that is continuous with vegetation containing known records of the species (OEH, 2015b).

The baseline site condition component of the quality score of Spotted-tailed Quoll habitat in the NH2U Boambee SF offset area was assessed using BioBanking plot/transects and compared with benchmark data from matching NSW vegetation types (see Appendix C). As described above for other species, the plot/transect data confirmed that the vegetation associated with occupied habitat is in good condition. Notably for this species, vegetation cover in most strata and the amount of fallen logs were at benchmark values in all plot/transects. There were no hollow-bearing trees in some of the plot/transects sampled however when averaged across the site each vegetation type present would meet benchmark condition for this habitat criterion.

Based on the above assessment of habitat condition, and consideration of the site context and species stocking rate attributes the current habitat quality of the NH2U Boambee SF offset area was scored as 7/10 in the offset assessment guide calculations (see Section 11.5). This score reflects the presence of likely habitat with resources such as den sites, that is part of an extensive patch of habitat but with some impact from weed infestation, timber harvesting, edge effects and probably also predatory pest fauna.



Paper Size A4

0 75 150 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Boambee SF offset site
- NH2U Boambee SF offset area
- Roads
- Waterways
- Camera trap
- BioBanking plot/transect
- Plot/transect and canopy plot
- Plot/transect, canopy plot and Koala SAT
- Call playback

Roads and Maritime Services
NH2U, Pacific Highway Upgrade
Norton and Griffin Offset Management Plan

Job Number 21-24927
Revision A
Date 27 Oct 2016

Boambee SF offset site habitat for affected threatened fauna

Figure 10

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Level 15, 133 Castlereagh Street Sydney NSW 2000 T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com.au W www.ghd.com.au

Data Source: NSW Department of Lands: Cadastre - Jan 2011; Geoscience Australia: 250k Data - Jan 2011, Aerial imagery - ESRI 2016 and Nearmap 2016 (image extracted 17/18/2016, image taken 05/05/2016).jrichardson

5.5 Populations of affected threatened biota

The purpose of this section is to describe the local and regional populations of each of the affected threatened fauna that may use habitat within the Boambee SF offset site. This assessment is based on:

- Presence / absence of individuals at the Boambee SF offset site as revealed by the field surveys.
- Previous records of the species in the locality (see Table 10) and characteristics of the local and regional population as revealed by the desktop assessment.
- Likely use of the habitat resources within the site, as described in Section 5.4 above.

Table 10 Records of the affected threatened fauna in the locality of the Boambee SF offset site

Species	Wildlife Atlas records within 10 km (OEH, 2014b)	Closest Record	Date of Closest Record
Koala	901	One observation and two scats within the offset site and a second observation in habitat connected to the site during current surveys. Previous records within site in the southeastern corner and on the northwestern boundary (OEH, 2014b)	2015 2001 2003
Grey-headed Flying Fox	69	Around five individuals were observed foraging immediately to the south of the site during the present surveys. Previous records 2.51 km south over open grassland and 2.51 km north in connected habitat	2015 2000 2011
Spotted-tailed Quoll	20	Previous records within site on northern boundary (OEH, 2014b)	2005

5.5.1 Koala

The Koala was recorded at three locations at the Boambee SF offset site in the current surveys, through observations of scats at two separate locations and hearing the calls of an adult male. An adult male was also heard calling in a patch of connected vegetation to the south of the site (see Figure 10). A relatively small number of scats were located during Koala SAT searches at eight locations across the site. This does not necessarily indicate low population densities. Scat searching conditions were very difficult at this site because of the steep terrain, thick leaf litter, recent heavy rainfall and rain during much of the current survey period. Further, this species is often recorded irregularly within home ranges and is dispersive over large distances at different stages of its life cycle (DECC, 2008). Koalas may be more abundant at the site at other times of year. There are at least two previous records of the species at the site (OEH, 2015b).

There are a total of 900 records of Koalas in the locality of the Boambee SF offset site (OEH, 2015b). There are several observations of the species in patches of connected habitat in the vicinity of the site (OEH, 2015b).

The Boambee SF offset comprises habitat critical to the survival of the Koala according to the DSEWPaC (2013) guidelines given the presence of a known population, Koala food tree species in the canopy, habitat connectivity and recovery value. Conservation of the Boambee SF offset site is likely to contribute to the viability of the regional population of the Koala through

continued regeneration and maturation of native vegetation containing food trees, maintenance of vegetated fauna movement corridors and control of dogs.

5.5.2 Grey-headed Flying-fox

Around five Grey-headed Flying Foxes were observed foraging in exotic vegetation immediately to the south of the site during the present surveys. Additional flying foxes were observed flying over the Boambee SF offset site in the present surveys but could not be confidently distinguished as the Grey-headed Flying-fox from the other two flying fox species present in the region. There are a total of 69 records of over 30, 000 individual Grey-headed Flying Foxes in the locality of the Boambee SF offset site (OEH, 2015b). There are several known camps within the locality of the Boambee SF offset site (OEH and DSEWPac 2013) of which the two most significant are:

- The 'Coffs Creek' camp, around 6.9 kilometres to the north east, which contains critical foraging habitat, has been continuously occupied, has supported >10,000 individuals and over 30,000 at least once, supports >2,500 individuals during the reproductive season (CHCC, 2007) and as such comprises roosting habitat critical to the survival of the species as defined in the recovery plan (DECC, 2009).
- The 'Boambee, Englands Road' camp, around 2.15 kilometres to the north east, which contains critical foraging habitat and is used is used as a camp seasonally in > 50% of years (CHCC, 2007) and as such comprises roosting habitat critical to the survival of the species as defined in the recovery plan (DECC, 2009).

The Coffs Creek Flying-fox Camp is recognised as a significant maternity camp in the Coffs Harbour region and the only permanent maternity camp between Grafton (Susan Island) and Bellingen (Bellingen Island) (CHCC, 2007).

The Boambee, Englands Road camp appears to be used annually but on a temporary, seasonal basis during winters when swamp forests containing the key diet plants Broad-leaved Paperbark (*Melaleuca quinquinervia*) and Swamp Mahogany (*Eucalyptus robusta*) in the local area are in blossom and during years when food resources are not available in other areas (CHCC, 2007).

No Grey-headed Flying Foxes were recorded foraging at the site during the present survey, presumably because individuals within the regional population were using seasonal foraging resources in other vegetation types and/or in other parts of their range at the time of survey. This is despite high canopy cover of diet plants and significant diet plants for the Grey-headed Flying fox area (see Table 9). Patterns of habitat use by Grey-headed Flying Foxes are seasonal and sporadic in response to food sources with largely irregular patterns of productivity (DECCW, 2009). When assessed at a local scale, the species is generally present intermittently and irregularly and so this one off absence from the site does not exclude its likely value to the regional population of the species.

Overall these results suggest that the Boambee SF site is likely to provide critical foraging resources for a regional population of >10,000 Grey-headed Flying-foxes and help support at least two camps that are critical to the survival of the species. Given the nearby camps, the extent and cover of diet species at the site and its overall size, condition and landscape position, the Boambee SF offset site will likely make a valuable contribution to the viability of the regional population of the Grey-headed Flying-fox. It is likely that the viability of the nearby camps will improve with conservation of the offset site. In particular, the regional population is likely to benefit from continued regeneration or maturation of native vegetation containing abundant food trees.

5.5.3 Spotted-tail Quoll

The Spotted-tailed Quoll has been recorded at the Boambee SF offset site in 2005 (OEH, 2015b). It was not recorded during the current surveys. This species is recorded intermittently and irregularly within its very large home ranges and so the lack of recent, confirmed records at the site does not exclude its potential occurrence and value to the species.

There are 20 records of Spotted-tailed Quolls in the locality of the Boambee SF offset site (OEH, 2014b). Habitat resources such as dense groundcover, fallen logs, rock outcrops, caves and tree hollows for prey species within an area recognised as a regional habitat corridor suggest the site may be inhabited by a local population of the Spotted-tailed Quoll.

Given the extent and quality of habitat at the site and its overall size, condition and landscape position, the Boambee SF offset site is likely to contribute to the viability of the local and regional population of the Spotted-tailed Quoll. Populations of the Spotted-tailed Quoll are likely to benefit from continued regeneration and maturation of native vegetation containing habitat resources and control of dogs.

6. Existing environment of the xxxxx offset site

6.1 Location and landuse

The xxxxx site is a parcel of privately owned land at Upper Corindi. The site has been purposefully identified to provide offsets for the Pacific Highway upgrade. The landowners intend to establish BioBanking agreements over the property and then to sell biodiversity credits to Roads and Maritime for the purpose of securing biodiversity offsets for various stages of the Pacific Highway upgrade project. Roads and Maritime are assisting the landowners through this process, including funding ecological surveys to establish the site's suitability as a biodiversity offset and to inform the preparation of this offset package and management plan.

The xxxxx offset site includes part xxxxx and is located at xxxxx, Upper Corindi (see Figure 11). The proposed biobank site boundary within these lots and the NH2U xxxxx offset area that is the subject of this management plan are shown on Figure 11.

The xxxxx offset site is around 98.3 hectares in area and contains remnant and regenerating forest on gently undulating terrain. It is 49 kilometres north of the Project footprint in an equivalent position on near-coastal low hills (see Figure 1). The xxxxx offset site is a large and highly suitable offset site that is under risk of degradation by agricultural activities or development and has considerable capacity for improvement. The xxxxx offset site will help meet the Project's biodiversity offset requirements for the Koala, Grey-headed Flying-fox and Spotted-tailed Quoll.

The xxxxx site is an occupied rural residential property. The previous land use at the offset site was cattle and sheep grazing. Evidence of grazing as well as previous timber harvesting, track construction and partial clearing was noted during field surveys. Based on the presence of over mature and hollow-bearing trees, it appears that the site has never been clear-felled, however given the comparative scarcity of larger trees the site has probably been selectively harvested at some point in the past.

BioBanking agreements will be entered into over the majority of the property to conserve the proposed offset area in perpetuity. The BioBanking agreements will be registered on the property title and are binding on successors in title.

Site specific Management Action Plans (MAPs) will be prepared to accompany the BioBanking agreements. The MAPs will specify the management actions that must be applied at the site. The MAP includes the conditions the land owner must observe in accordance with the BioBanking agreement and strategies to assist landholders to maintain and improve biodiversity values. The MAP is designed to complement existing environmental legislation, which continues to apply to the land. The approved MAP and the management actions specified in this offset package will be implemented by Roads and Maritime and/or the landowner.

Management actions required to maintain and enhance the habitat for offsets were identified during the survey and are outlined in Section 10. These management actions will improve the quality of habitat for the affected threatened fauna by increasing the extent, health and productivity of native vegetation containing habitat resources.

The 98.3 hectare xxxxx offset site will also provide biodiversity offsets for impacts of the Warell Creek to Nambucca Heads (WC2NH) project (GHD, 2016 a). Therefore, separate parcels of land within the Norton offset site have been set aside to offset the impacts of the NH2U project (87.2 hectares) and the WC2NH project (five hectares) (see Figure 11). There is a further 6.1 hectares of native vegetation which has not been included in any of these EPBC Act offset packages but which will be managed as part of the three xxxxx biobanks and will be used to

help meet Roads and Maritime's requirements for biodiversity offsets under NSW legislation. The land that has been included as an EPBC Act biodiversity offset for the NH2U project is the 'NH2U xxxxx offset area' as shown on Figure 11.

6.2 Landscape context

The xxxxx site is around 98.3 hectares in area and contains wet and dry sclerophyll forest on gently undulating, near-coastal hills and valley floors.

xxxxx Creek flows from north to south through the centre of the site and is fed by numerous first and second order tributaries. xxxxx Creek is a near-permanent, channel confined, third order stream. The reaches of xxxxx Creek through the offset site are generally in good condition with intact riparian and in stream vegetation, intact channel and bank structure, continuous flow, very little weed infestation and no evidence of poor water quality.

Some downstream reaches of xxxxx Creek pass through cleared agricultural land. These reaches do not have any native riparian vegetation though there is moderate cover of native wetland plants along with exotic pasture grasses and environmental weeds. The channel and banks are generally intact though in places there is evidence of trampling by cattle. High turbidity was noted and there is probably also poorer water quality as a result of nutrient enrichment from livestock waste. These reaches are all downstream of the offset site and do not affect the quality of habitat in the NH2U xxxxx offset area.

The xxxxx offset includes a mapped regional fauna habitat corridor (Scotts et. al, 2003) that runs north-south connecting State forests to the west and south of the site with National Parks in coastal vegetation to the northeast (see Figure 11).

The xxxxx offset site adjoins partially cleared agricultural land that is managed by the same family that will manage the biobank sites. It is bordered to the east and west by near-intact native vegetation on large lot rural residential properties. There is partially cleared grazing land to the south and southeast. There is extensively cleared land with more intensive agricultural activities such as banana and blueberry plantations to the north and northeast.

The xxxxx site is part of a near continuous patch of native vegetation and habitat of many thousands of hectares. Agricultural land to the north and northeast would comprise partial barriers to fauna movement and other ecological processes. Sherwood State Forest and Sherwood Nature Reserve lie to the west of the xxxxx site and beyond that there is an extensive network of native vegetation in national parks and State forests that stretches to the Great Dividing Range. The xxxxx site is connected to this extensive area of habitat via native vegetation in private land and State forests. There are partial barriers to the south and southeast associated with partially cleared and/or fenced private land. Conglomerate State Forest lies to the south of this land and is continuous with many thousands of hectares of State forest on near coastal hills.

The xxxxx site comprises appropriately situated habitat for the affected threatened fauna. In this landscape context, the xxxxx site comprises an area of habitat in a relatively undisturbed catchment that is surrounded by an extensive patch of native vegetation.

6.3 Vegetation

Vegetation types have been mapped within the offset site by OEH (2012) and this mapping was ground truthed and converted to NSW vegetation types as part of the present study. Vegetation types within the xxxxx offset site are shown on Figure 12 and are summarised in Table 11.

Table 11 Vegetation in the xxxxx offset site

Vegetation Zone	NSW Veg type ID	Condition	Habitat type	Area in xxxxx offset site (ha)	Area in NH2U xxxxx offset area (ha)	Plot/transects
Flooded Gum - Brush Box moist forest (NR159, moderate/good-high)	NR159	Moderate/good-high	Wet Sclerophyll Forest	26.6	22.1	9,19,28,1,4,12, 14,15,24
Flooded Gum - Brush Box moist forest (NR159, moderate/good-poor)	NR159	Moderate/good-poor	Wet Sclerophyll Forest	4.1	0.0	29,2
Flooded Gum - Brush Box moist forest (NR159, low)	NR159	Low	Wet Sclerophyll Forest in low condition	1.5	0.0	3
Tallowwood - Small-fruited Grey Gum dry grassy open forest (NR263, moderate/good)	NR263	Moderate/good	Wet Sclerophyll Forest	40.9	39.9	8,16,27,5,10,11,6,13,30
Blackbutt - Tallowwood moist ferny open forest (NR120, moderate/good)	NR120	Moderate/good	Wet Sclerophyll Forest	0.6	0.6	18
Blackbutt - Turpentine - Tallowwood shrubby open forest (NR122, moderate/good)	NR122	Moderate/good	Wet Sclerophyll Forest	16.2	16.2	7,21,23
Blackbutt - bloodwood dry heathy open forest (NR115, moderate/good)	NR115	Moderate/good	Dry Sclerophyll Forest	8.4	8.4	17,22,20,25,26
			Total	**98.3**	**87.2**	**30**

Figure 11 xxxxx offset site location (figure removed to protect privacy).

Figure 12 xxxxx offset site vegetation (figure removed to protect privacy).

6.4 Habitat quality

This section describes the extent and quality of habitat for affected threatened fauna at the xxxxx offset site based on the desktop assessment and field survey results. Habitat types and recorded observations of threatened fauna species are shown on Figure 13.

The NH2U xxxxx offset area contains 87.2 hectares of habitat for the affected threatened fauna associated with wet and dry sclerophyll forest. The NH2U xxxxx offset area was purposefully defined around food trees and other habitat resources for the affected threatened fauna that were revealed by targeted surveys at the site.

Fauna habitat types and canopy plot survey locations are shown on Figure 13. Canopy plots were sampled at the locations shown on Figure 13 and comprised counts of every tree in a 50 m x 20 m plot along with its height, species and canopy cover. Each tree species was then cross referenced to lists of food tree species for the affected threatened fauna to calculate the cover of food tree species. The results of canopy plot surveys to quantify habitat resources for the affected threatened fauna species are presented in Table 12. A list of food tree species at the xxxxx offset site and/or the other offset sites is included in Table 3.

A detailed description of habitat quality for each species is provided below.

The Giant Barred Frog was recorded at the xxxxx offset site in March, April and October 2016 as part of the current surveys, through observations of up to 15 adults per night (see Figure 13). There are previous records of five adult Giant Barred Frogs at the site, from December 2013 (xxxxx, pers. comm.). The Giant Barred Frog is not a subject species in this NGOMP and there is no core, occupied habitat for the Giant Barred Frog within the NH2U xxxxx offset area. However, the presence of the Giant Barred Frog and its habitat in the broader xxxxx offset site has been considered in the development of management actions.

6.4.1 Koala

The Koala has not been recorded at the xxxxx offset site. The xxxxx offset site contains around 98 hectares of habitat for a potential local population of the Koala associated with wet and dry sclerophyll forest. There is 87.2 hectares of Koala habitat in the NH2U xxxxx offset area.

The canopy plot results confirmed that the xxxxx offset site contains extensive areas of primary and secondary food trees for the Koala as defined in the Coffs Harbour City Koala plan of management (Lunney et. al., 1999) and/or in the North Coast management area of the recovery plan (DECC, 2008). In the Coffs Harbour region, Tallowwood (*Eucalyptus microcorys*) is the tree species most preferred by Koalas. Swamp Mahogany (*E. robusta*), Small-fruited Grey Gum (*E. propinqua*), Broad-leaved Paperbark (*Melaleuca quinquenervia*), Flooded Gum (*E. grandis*), Blackbutt (*E. pilularis*) and Forest Oak (*Allocasuarina torulosa*) are also used and are considered secondary food tree species in this region (Lunney et. al., 1999).

The canopy plot data presented in Table 12 confirms that there is high cover of food trees (average 322 m^2 cover present as emergent, canopy or mid storey in each 1000m^2 plot sampled across the site) and primary food trees (average 208 m^2 cover across the site). There are two primary food tree species at the site: Tallowwood and Small-fruited Grey Gum. Tallowwood is a dominant or sub-dominant canopy species in all wet and dry sclerophyll forest vegetation types at the site. There was up to 423 m^2 of foliage cover of primary food trees in the plots sampled which comprised up to 92% of the canopy cover in the plot. At least one secondary food tree species also occurs as a dominant or sub-dominant canopy species in all wet and dry sclerophyll forest vegetation types at the site. These include either Flooded Gum, Blackbutt or Forest Oak as identified in the Coffs Harbour City Koala plan of management (Lunney et. al., 1999) or Red Mahogany (*Eucalyptus resinifera*) as identified in the North Coast management area of the recovery plan (DECC, 2008).

Average over storey cover across the site was 28.7%, indicating a forest structure throughout and was consistently within benchmark values or very slightly below benchmark values for individual vegetation types (i.e. equivalent to intact examples of the vegetation type) (see Appendix D). Areas with below benchmark over storey cover were associated with mature wet sclerophyll forest that featured a comparatively open over storey of *Eucalyptus* species over a dense mid storey of Turpentine, Forest Oak or rainforest plants (see plot/transects 15 and 24 in Appendix D).

The Coffs Harbour City Koala Plan of Management does not identify Koala habitat within State forests and so the majority of potential Koala habitat in native vegetation surrounding the site has not been mapped in the recovery plan (Lunney et. al., 1999). There are mapped patches of Tertiary habitat type on private land surrounding the offset site and secondary habitat farther east on the coastal floodplain (Lunney et. al., 1999).

No Koala scats were recorded in SAT plots suggesting low activity levels. Low activity levels recorded in what might otherwise be medium or high carrying capacity Koala habitat may be a result of contemporary population dynamics, landscape configuration and/or historical disturbances, including logging, mining, fire, agricultural activities and/or urban development (Phillips and Callaghan, 2011). Koalas have not been recorded at the site or in the local area since extensive wildfires in 1994 (xxxxx pers. comm.). Such considerations should not necessarily detract from the potential importance of such habitat for longer-term conservation, particularly if preferred food trees are present and populations of the Koala are known to occur in the general area (Phillips and Callaghan, 2011) as is the case at the xxxxx offset site.

Habitat critical to the survival of the Koala is defined as an area that scores five or more using the habitat assessment tool for the Koala in Table 4 of the DotE (2014) guidelines. The habitat assessment tool scores for the xxxxx offset site are as follows:

- Koala occurrence +1 (medium) Evidence of one or more koalas within 5 km of the edge of the site within the last 5 years (see Table 13).
- Vegetation composition +2 (high) Has forest, woodland or shrubland with emerging trees with 2 or more known koala food tree species (Tallowwood, Flooded Gum, Small-fruited Grey Gum, Forest She-oak and Blackbutt).
- Habitat connectivity +2 (high) Area is part of a contiguous landscape ≥ 1000 ha (the site is connected to many thousands of hectares of habitat in rural-residential land and State forests).
- Key existing threats +1 (medium) Evidence of infrequent or irregular koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence. (collection of direct evidence is outside the scope of this assessment. Some mortality is likely given the presence of roads within and adjoining the site, agricultural land adjoining the site and likely presence of wild dogs).
- Recovery value +1 (medium) Uncertain whether the habitat is important for achieving the interim recovery objectives for the relevant context as outline in Table 1 (the site is a large, connected area of koala habitat and a corridor that would allow movement of Koalas between large areas of habitat. However, there is not a Koala population currently known from the site or surrounding area and so there is some uncertainty about how valuable the site would be in this context).

The xxxxx offset site has a total habitat score of seven. Therefore, the xxxxx offset site is habitat critical to the survival of the Koala.

The habitat assessment tool for the Koala (DotE, 2014a, Table 4) can be used to determine 'habitat quality' in accordance with the EPBC Act offset policy (DotE, 2014b).

Therefore based on the above assessment of habitat condition the current habitat quality of the NH2U xxxxx offset area was scored as 7/10 in the offset assessment guide calculations (see Section 11.5). This score reflects the presence of potential habitat with high cover of primary food tree species as a part of an extensive patch of habitat for a known regional population of the Koala, with some impact from weed infestation, timber harvesting, edge effects and probably also predatory pest fauna. The habitat assessment tool can also be used to calculate the starting quality of a proposed offset site and to estimate the future quality, with and without the proposed offset or management intervention (DotE, 2014b). The change in habitat quality scores with and without offset site management are described in Section 11.5.

The baseline condition of occupied Koala habitat in the NH2U xxxxx offset area was assessed using BioBanking plot/transects and compared with benchmark data from matching NSW vegetation types (see Appendix D). The plot/transect data confirmed that the vegetation associated with Koala habitat is in good condition with benchmark values for the majority of attributes in the majority of plot/transects that were sampled. Notably for this species, over storey cover and regeneration were at benchmark values. Past timber harvesting and grazing at the site has had a negative impact on localised areas. These areas are in various stages of regeneration but generally appeared to be developing well into native vegetation communities.

Table 12 Canopy plot results for the xxxxx offset site

Canopy Plot ID	Habitat type	Veg. Type ID	No. of trees	Average tree height (m)	Over storey cover	Over storey condition	Tree cover (m^2)[1]	Koala food tree cover (m^2, % of total cover)[2]	Koala primary food tree cover (m^2, % of total cover)[3]	Koala secondary food tree cover (m^2, % of total cover)[4]	GHFF diet plant cover (m^2, % of total cover)[5]	GHFF key diet plant cover(m^2, % of total cover)[6]
8	Wet Sclerophyll Forest	NR263	29	16	28.5%	Within benchmark	580	441 (96%)	423 (92%)	18 (4%)	(0%)	(0%)
14	Wet Sclerophyll Forest	NR159	26	20	18.5%	Slightly below benchmark	434	339 (74%)	324 (71%)	15 (3%)	45 (10%)	(0%)
18	Wet Sclerophyll Forest	NR120	38	24	19.5%	Slightly below benchmark	459	262 (57%)	6 (1%)	256 (56%)	313 (68%)	273 (59%)
20	Dry Sclerophyll Forest	NR115	35.0	16	33.5%	Within benchmark	312.0	189 (41%)	(0%)	189 (41%)	312 (68%)	224 (49%)
23	Wet Sclerophyll Forest	NR122	37	25	44.5%	Within benchmark	464	381 (83%)	78 (17%)	303 (66%)	386 (84%)	253 (55%)
		Site average	**33**	**21**	**28.9%**		**450**	**322.4 (70%)**	**207.75 (45%)**	**156.2 (34%)**	**264 (58%)**	**250 (54%)**

1 – Total cover of trees present in either the emergent, canopy or mid storey strata in the plot. Since separate strata overlap the total may be greater than the area of the plot (1000m^2).

2 – Total cover of Koala food trees as defined in categories 2-4.

3 - Primary food trees for the Koala as defined in the Coffs Harbour City Koala plan of management (Lunney et. al., 1999) and/or in the North Coast management area of the recovery plan (DECC, 2008).

4 - Secondary food trees for the Koala as defined in the Coffs Harbour City Koala plan of management (Lunney et. al., 1999).

5 – Diet plants in the blossom or fruit diet of the Grey-headed Flying-fox (GHFF) as defined in Eby, P. and Law, B. (2008).

6 – Key diet plants in the blossom or fruit diet of the Grey-headed Flying-fox (GHFF) as defined in Eby, P. and Law, B. (2008).

7 – Percentage of the 30 trees sampled in a Koala SAT plot that had at least one Koala scat (see Phillips and Callaghan, 2011).

6.4.2 Grey-headed Flying-fox

The NH2U xxxxx offset area contains 87.2 hectares of nectar or fruit-bearing foraging habitat for the known regional population of the Grey-headed Flying Fox associated with wet and dry sclerophyll forest. There is five hectares of additional connected habitat at the xxxxx offset site that will be set aside to offset the impacts of the WC2NH project and around six hectares that has not been formally included in an EPBC Act offset package but will probably be set aside to contribute biodiversity offsets that are required under NSW legislation.

The canopy plot data presented in Table 9 confirms that there is good cover of plant species in the blossom diet of the Grey-headed Flying-fox (average 264 m^2 cover present as emergent, canopy or mid storey in each 1000m^2 plot sampled across the site), including key diet plant species listed in Eby and Law (2008) (average 250 m^2 cover across the site). The most abundant key diet plant species are Blackbutt and Turpentine. In Blackbutt and Turpentine-dominated vegetation types there was up to 253m^2 of canopy cover of key diet plants, comprising 55% of the total tree cover. Red Bloodwood (*Corymbia gummifera*), Pink Bloodwood (*C. intermedia*) and Grey Ironbark (*Eucalyptus siderophloia*) are also present at lower concentrations. Collectively these species could provide nectar throughout the entire year (Eby and Law, 2008). The xxxxx offset site contains large, mature individuals of these species and regenerating patches and is likely to comprise an abundant and secure source of foraging resources into the future.

The following species in the fruit diet of the Grey-headed Flying-fox (Eby and Law, 2008) are present at high cover in the plots and across the xxxxx offset site: Bangalow Palm (*Archontophoenix cunninghamiana*), Five-leaf Water Vine (*Cissus hypoglauca*) and Blueberry Ash (*Eleaocarpus reticulatus*). These species are mainly present in the mid storey. In some areas they form dense stands that would yield abundant fruit. Fruit resources would be likely to peak in Spring and Summer but would be available at varying quantities throughout the year (Eby and Law, 2008).

The following additional species in the fruit diet of the Grey-headed Flying-fox (Eby and Law, 2008) were present in small numbers in the plots and occur intermittently across the xxxxx site: Rusty Fig (*Ficus rubiginosa*), Lilly Pilly (*Acmena smithii*), White Cedar (*Melia azederachis*) and Sweet Morinda (*Morinda jasminoides*).

The xxxxx offset site comprises foraging habitat critical to the survival of the Grey-headed Flying-fox because it meets at least the following three identification criteria defined in the recovery plan for the species (DECC, 2009):

- It is productive during winter and spring, when food bottlenecks have been identified as confirmed by the presence of winter-flowering trees in the blossom diet of the species (Eby and Law, 2008) such as Grey Ironbark.
- It is productive during the final weeks of gestation, and during the weeks of birth, lactation and conception (September to May) as confirmed by the presence of spring to autumn-flowering trees in the blossom diet of the species (Eby and Law, 2008), including extensive areas of forest dominated by Blackbutt.
- The site is also likely to support at least one continuously occupied roost camp: the 'Coffs Creek' camp which comprises roosting habitat critical to the survival of the species (CHCC, 2007) as defined in the recovery plan (DECC, 2009).

The baseline condition of occupied Grey-headed Flying-fox habitat in the xxxxx offset site was assessed using BioBanking plot/transects and compared with benchmark data from matching NSW vegetation types (see Appendix D). As described above for other species, the plot/transect data confirmed that the vegetation associated with occupied habitat is in good

condition. Notably for this species over storey cover, mid storey cover and regeneration were at benchmark values.

Based on the above assessment of habitat condition, and consideration of the site context and species stocking rate attributes the current habitat quality of the NH2U xxxxx offset area was scored as 7/10 in the offset assessment guide calculations (see Section 11.5). This score reflects the presence of occupied habitat, with moderate to high cover of diet plants and within commuting distance of roost camps but with some impacts from clearing, weed infestation and edge effects.

6.4.3 Spotted-tail Quoll

The Spotted-tailed Quoll is known from a wide range of habitat types, the threshold densities of critical components required to maintain populations are unknown and critical habitat has not been formally defined or mapped (Long and Nelson, 2009). Therefore, identification of habitat for the species must be based on a subjective assessment and/or previous records of the species.

There are two records of the Spotted Tailed Quoll in the locality of the xxxxx offset site (OEH, 2016)(see Table 13). The NH2U xxxxx offset area contains 87.2 hectares of habitat for the Spotted Tailed Quoll in wet and dry sclerophyll forest.

This habitat has been identified based on the presence of the following characteristics identified in the recovery plan for the species (Long and Nelson, 2009):

- Forest vegetation in an area with high and predictable seasonal rainfall.
- A large, intact patch of vegetation in good condition as confirmed by the plot/transect data which were at benchmark values for most attributes in all plots sampled.
- Moderate densities of medium-sized mammalian prey, including wallabies, gliders, rats and possums recorded in the present survey as well as moderate densities of hollow-bearing trees to support arboreal prey.
- Potential den sites associated with dense understorey vegetation, hollow-bearing logs and large quantities of woody debris.
- Its position in a vegetated habitat corridor that is continuous with vegetation containing known records of the species (OEH, 2016).

The baseline condition of Spotted-tailed Quoll habitat in the NH2U xxxxx offset area was assessed using BioBanking plot/transects and compared with benchmark data from matching NSW vegetation types (see Appendix D). As described above for other species, the plot/transect data confirmed that the vegetation associated with occupied habitat is in good condition. Notably for this species, vegetation cover in most strata and the amount of fallen logs were at benchmark values in all plot/transects. There were no hollow-bearing trees in some of the plot/transects sampled however when averaged across the site each vegetation type present would meet benchmark condition for this habitat criterion.

Based on the above assessment of habitat quality, the site condition component of the current habitat quality of the NH2U xxxxx offset area was scored as 8/10 in the offset assessment guide calculations (see Section 11.5). This score reflects the presence of habitat in good condition and with good quantities of habitat resources such as woody debris and rock outcrops but with some impact from weed infestation, timber harvesting, edge effects and probably also predatory pest fauna.

Figure 13 xxxxx offset site habitat for affected threatened fauna (figure removed to protect privacy).

6.5 Populations of affected threatened biota

The purpose of this section is to describe the local and regional populations of each of the affected threatened fauna that may use habitat within the xxxxx offset site. This assessment is based on:

- Presence / absence of individuals as revealed by the field surveys.
- Previous records of the species in the locality (see Table 13) and characteristics of the local and regional population as revealed by the desktop assessment.
- Likely use of the habitat resources within the site, as described in Section 6.4 above.

Table 13 Records of the affected threatened fauna in the locality of the xxxxx offset site (OEH, 2016)

Species	Wildlife Atlas records within 10 km	Closest Records	Date of Closest Records
Koala	1	4.4 km south of the site, on Murphys Road in the Conglomerate State Forest	2014
Grey-headed Flying-fox	49	Recorded on site.	October 2016 on site.
Spotted-tailed Quoll	2	7km north of the site, adjacent to the Pacific Highway near Dirty Creek	2007

Although not directly relevant to this NGOMP it is important to note that there is a breeding population of the Giant Barred Frog at the xxxxx offset site. The Giant Barred Frog was recorded at the xxxxx offset site in March, April and October 2016, through observations of up to 15 adults (see Figure 13). There are previous records of five adult Giant Barred Frogs at the site, from December 2013 (xxxxx, pers. comm.). The WC2NH xxxxx offset area at the site has been set aside to conserve an area of Giant Barred Frog habitat to offset impacts of the WC2NH project on the species. The presence of the Giant Barred Frog at the xxxxx site has been considered in the development of the management actions included in Section 10.

6.5.1 Koala

The Koala has not been recorded at the xxxxx offset site and there is only one record in the locality in the last 10 years despite many thousands of hectares of suitable habitat (OEH, 2016). The closest record of the species is around four kilometres to the south of the site in Conglomerate SF (OEH, 2016). As stated above, Koalas have not been recorded at the site or in the local area since extensive wildfires in 1994 (xxxxx. pers. comm.). The Koala is often recorded irregularly within home ranges and is dispersive over large distances at stages of its life cycle (DECC, 2008) so the lack of confirmed records at the site does not exclude its potential occurrence or value to the species.

The xxxxx offset site comprises habitat critical to the survival of the Koala according to the DotE (2014) guidelines given the presence of Koala food tree species in the canopy, habitat connectivity and recovery value. This recognises that Koala populations are mobile and dynamic and that unoccupied habitat still has value to regional populations as areas for refuge or population

expansion. Conservation of the xxxxx offset site is likely to contribute to the viability of the regional population of the Koala through continued regeneration and maturation of native vegetation containing food trees and control of dogs.

6.5.2 Grey-headed Flying-fox

Grey-headed Flying Foxes were recorded flying over the site on three occasions during the current surveys (see Figure 13 Figure 10). There are a total of 49 records of Grey-headed Flying Foxes in the locality of the xxxxx offset site (OEH, 2016). There are two known camps within the vicinity of the xxxxx offset site based on DECCW (2009) mapping:

- The 'Bark Hut Road' camp around 7 kilometres to the south in the Conglomerate SF.
- The 'Woolgoolga Lake' camp, around 11 kilometres to the southeast near Coffs Coast Regional Park.

There is no evidence currently available about the number of flying foxes that occupy these camps or their permanence and so it is not clear whether they would comprise roosting habitat critical to the survival of the species as defined in the recovery plan (DECC, 2009).

The 'Coffs Creek' camp is located around 29 kilometres to the south of the site and contains critical foraging habitat, has been continuously occupied, has supported >10,000 individuals and over 30,000 at least once, supports >2,500 individuals during the reproductive season (CHCC, 2007) and as such comprises roosting habitat critical to the survival of the species as defined in the recovery plan. Grey-headed Flying-foxes commute daily to foraging areas, usually within 15 km of the day roost site but are capable of nightly flights of up to 50 km from their roost to different feeding areas as food resources change (DECC, 2009).

Overall these results suggest that the xxxxx offset site is likely to provide critical foraging resources for a regional population of >10,000 Grey-headed Flying-foxes and help support at least one roost camp that is critical to the survival of the species. Given the nearby camps, the extent and cover of diet species at the site and its overall size, condition and landscape position, the xxxxx offset site will make a valuable contribution to the viability of the regional population of the Grey-headed Flying-fox. It is likely that the viability of the nearby camps will improve with conservation of the offset site. In particular, the regional population is likely to benefit from continued regeneration or maturation of native vegetation containing abundant food trees.

6.5.3 Spotted-tail Quoll

The Spotted-tailed Quoll has not been recorded at the xxxxx offset site. This species is recorded intermittently and irregularly within its very large home ranges and so the lack of confirmed records at the site does not exclude its potential occurrence and value to the species.

There are two records of Spotted-tailed Quolls in the locality of the xxxxx offset site (OEH, 2016). The closest Wildlife Atlas record is around 7 kilometres to the north (OEH, 2016). Habitat resources such as dense groundcover, fallen logs and abundant tree hollows for prey species within an area recognised as a regional habitat corridor suggest the site may be inhabited by a local population of the Spotted-tailed Quoll.

Given the extent and quality habitat in the site and its overall size, condition and landscape position, the xxxxx offset site is likely to contribute to the viability of the local and regional population of the Spotted-tailed Quoll. Populations of the Spotted-tailed Quoll are likely to benefit

from continued regeneration and maturation of native vegetation containing habitat resources and control of dogs and foxes.

Based on the above assessment of habitat condition, and consideration of the site context and species stocking rate attributes the current habitat quality of the NH2U xxxxx offset area was scored as 7/10 in the offset assessment guide calculations (see Section 11.5). This score reflects the presence of likely habitat with resources such as den sites, that is part of an extensive patch of habitat but with some impact from weed infestation, grazing, timber harvesting, edge effects and probably also predatory pest fauna.

7. Management of the Norton offset site

7.1 Conservation mechanism and funding arrangements

The Norton offset site will be conserved under a BioBanking agreement under the NSW *Threatened Species Conservation Act 1995* (the TSC Act). The NSW Government established BioBanking under Part 7A of the TSC Act. The Threatened Species Conservation (Biodiversity Banking) Regulation 2008 and the BioBanking Assessment Methodology complete the legal framework that provides for the creation of biodiversity credits that can be sold on the open market.

Credits are created when a landowner enters into a BioBanking agreement to maintain or improve their land's biodiversity values by undertaking management actions. The land is then known as a biobank site. The agreement is attached to the land title and includes provisions that require current and future landowners to:

- Carry out management actions to improve biodiversity values on the site.
- Not undertake activities that will reduce the biodiversity values of the site.

When a landowner sells their credits, a specified minimum amount from the sale proceeds (a portion or all of the Total Fund Deposit) is paid into the BioBanking Trust Fund. Annual payments are then made to the landowner from the fund. This endowment runs with the land in perpetuity to benefit current and future owners.

As the landowner of the Norton offset site, Roads and Maritime will initiate a BioBanking agreement with the Office of Environment and Heritage (OEH), retire 100% of the credits generated on the property and deposit all of the Total Fund Deposit required into the BioBanking Trust Fund prior to on-selling the property to a third party with the BioBanking agreement in place.

Roads and Maritime will purchase and retire all of the biodiversity credits associated with the NH2U Norton offset area. This will secure the conservation covenant over the area of land, ensure that the credits cannot be used to offset the impacts of another development and provides for the management of the site in perpetuity.

OEH assume responsibility for monitoring, compliance and enforcement of all BioBanking agreements as outlined in the BioBanking Compliance Assurance Strategy (DECC, 2008). OEH monitor compliance through annual reports submitted by owners of biobank sites, inspections and compliance audits. OEH has a range of enforcement responses at its disposal, applied on a risk basis. These include:

- Requests for remedial action, warning letters and inspections.
- Withholding annual payments from the BioBanking Trust Fund if management actions have not been carried out.
- Directing the owner of a biobank site to carry out work at their own cost to rectify a breach of a BioBanking agreement.
- Allowing OEH to enter the land to carry out necessary work where the owner has failed to comply with a Ministerial direction.
- Allowing OEH to seek an award of damages against the owner of a biobank site for breaching a BioBanking agreement.
- Applying to the Land and Environment court to have the land transferred to a more responsible land manager where a person has contravened a BioBanking agreement.

A BioBanking agreement is the strongest covenant available on private lands in NSW and extinguishes all land uses other than conservation unless the BioBanking agreement is varied or terminated by the NSW Minister for the Environment to permit alternative uses. Certain mining rights may be granted over a biobank site, and certain development can be carried out by public authorities on a biobank site, but any impacts from these activities must be offset again as an addition to any offsetting activities required by a given project in its own right. Therefore, the risk of loss of the offset sites with the BioBanking agreement in place has been assessed as 3 per cent for the purposes of the offset assessment guide calculations.

The precise terms of the BioBanking agreement will be developed by the OEH in consultation with Roads and Maritime, but will include the following broad conditions:

- Exclusion of activities that will result in impacts on habitat for the affected threatened fauna, including timber harvesting, vegetation clearing, grazing, apiary, exclusion of cats or dogs from the conservation area, or uncontrolled public access.
- Management of the property in accordance with the management actions plan which will include reference to site specific management activities consistent with Section 7.2 of this offset package (see draft management actions plan included as Appendix E).
- Ongoing monitoring in accordance with Section 7.3 of this offset package.

7.2 Management plan

7.2.1 Management strategies

The following broad management strategies and related actions at the Norton offset site will improve the value and extent of habitat for the affected threatened fauna:

- Property maintenance, through:
  - Establishment and maintenance of appropriate fences, gates and signs.
  - Removal of rubbish.
  - Maintenance of tracks.
  - Maintenance of easements.
- Conservation and improvement of habitat, through:
  - Bush regeneration and facilitated improvement in the condition of native vegetation.
  - Natural regeneration and supplementary planting where appropriate in cleared or degraded land.
  - Weed control.
  - Exclusion of domestic stock grazing and management of human disturbance.
  - Retention of dead timber, rocks and other habitat resources.
  - Fire management.
- Pest fauna control.

An overview of these management strategies and how they relate to the site and to populations of the affected threatened fauna is provided below. The following sections provide specific detail of the management actions that will be performed, including a plan for their delivery, a works program and the minimum standards and objectives that will be achieved. Property management actions are illustrated on Figure 14.

The management strategies and actions will be implemented across the entire Norton biobank under an overarching Management Actions Plan (MAP) (GHD, 2016 included as Appendix E) prepared in accordance with this NGOMP, the WC2NH offset package (GHD, 2016 b) and any

other relevant plans. The implementation of management strategies and actions in accordance with the MAP for the biobank will be funded by the purchase and retirement of biodiversity credits by Roads and Maritime with costs allocated to the offset area for individual projects.

Property maintenance

The Norton offset site is currently unoccupied and comprises remnant and regenerating native vegetation with small areas of cleared or degraded land. The site will be maintained as native vegetation in a biobank site. Infrastructure such as fences, gates, signs and access tracks will be maintained to support these land uses as shown on Figure 14. This infrastructure is important to clearly define the biobank site, exclude harmful activities and facilitate efficient management.

The proposed house site and home paddocks area currently contains exotic or low condition native vegetation and cleared land. This location has been selected to provide for private ownership and management of the site with minimal impacts on biodiversity values. Initial treatment of existing weed infestations, removal of the unoccupied house and associated rubbish, construction of boundary fences and gates, maintenance of tracks and management of weeds around the boundary of the home paddocks have been included as actions in this offset package.

Construction and maintenance of a new dwelling, maintenance of any other infrastructure and management of vegetation and livestock within the 'house site and home paddocks' area shown on Figure 14 are not included as actions in this offset package. The landowner will maintain this area so as to avoid any indirect impacts on the remainder of the Norton offset site and in accordance with the BioBanking agreement and associated plan of management for the site.

The Norton offset site contains small areas of dumped building refuse and other rubbish at the locations shown on Figure 14. This rubbish will be removed to avoid the risk of contamination or physical injury to animals and to make the property more attractive to potential owners. There are also substantial areas of woody debris, including timber harvesting residues and dumped bridge timbers, particularly in the south of the site. Woody debris provides fauna shelter and foraging substrate, can reduce the risk of erosion or weed infestation and will break down naturally in the longer term. Woody debris will be left in place at the site.

Where woody debris is mixed with inorganic rubbish or crosses proposed access tracks or fence lines it will be separated and/or moved to the nearest practical area of retained or regenerating vegetation to function as a habitat resource. The relocation of any woody debris will be undertaken in a manner that minimises disturbance to vegetation and surface soil, and such debris will be placed to emulate naturally occurring habitat as far as possible (i.e. not stacked).

There is an existing network of access tracks across the site (see Figure 14). These tracks are likely to be adequate for weed management, fire management, monitoring and other activities. These tracks will be maintained as single lane, dirt 'bush tracks'.

The entire western boundary of the Norton offset site adjoins the Pacific Highway road corridor and other recent or proposed development. These developments include existing and/or required floppy-top fauna fencing or stock-proof fencing as well as appropriate sediment control devices on the outside of the fence. This offset package includes provision for monitoring of these fences and communication with neighbours about their maintenance. A new stock-proof fence will be constructed around the house site and home paddocks.

The entire northern, southern and eastern boundaries of the site adjoin near-intact native vegetation with small areas of land that has been cleared for domestic stock. There are domestic stock on properties to the south and southwest of the Norton offset site. Each of these

properties feature small (<20 hectares) areas set aside for grazing and relatively low numbers of stock. Each of these properties featured intact boundary fences at the time of the field survey. Given the impacts associated with fence construction, the risk of injury to Koalas and other fauna from fences and the relatively minor risk from stock outside the site, no boundary fence construction is proposed.

Short sections of fence or other vehicle barriers will be maintained on either side of gates to prevent unauthorised vehicle access. Discontinuous fences are unlikely to pose a threat to resident fauna.

There are sections of poorly maintained and/or obsolete fencing within the site that will be removed to improve habitat connectivity and reduce the risk of injury to Koalas and other fauna (see Figure 14).

Conservation and improvement of habitat

The Norton offset site will be managed as a biobank site under the BioBanking agreement. This biobank site includes 270 hectares of habitat for the affected threatened fauna in the NH2U Norton offset area that has been included in the Offset assessment guide calculations for the Project. Conservation and management of this vegetation will improve the quality of habitat for the affected threatened fauna and especially the quality of foraging resources by increasing the extent, health and productivity of vegetation containing food tree species.

The majority of the Norton offset site contains near-intact vegetation or mature regeneration. There are around four hectares of low condition vegetation in the north of the site associated with a disused orchard and pig sties. This area will be subject to supplementary planting to assist with natural regeneration (GHD, 2016) but is outside of the area of habitat for the affected threatened fauna that is the subject of the NGOMP.

There are other small areas of disturbed land associated with previous timber harvesting activities, particularly in the south of the site. Each of these areas featured natural regeneration, including the majority of canopy species, a mix of mid storey and groundcover species and overall high native species richness. This natural regeneration is likely to continue and so no supplementary planting or seed broadcasting is proposed.

Natural regeneration will be complemented by exclusion of domestic grazing, management of human disturbance and retention of dead timber, rocks and other habitat resources.

Weed control will be an important part of vegetation conservation at the site and will comprise three main activities:

- Treatment of localised woody weed infestations, including Lantana (*Lantana camara*), Privet (*Ligustrum* species), Wild Tobacco (*Solanum mauritianum*) and Camphor Laurel (*Cinnamonum camphora*) in the areas shown on Figure 14. This activity will be required in the first two years of the implementation of this plan to manage the localised, severe infestations currently present at the site. Additional control rounds will be performed as required to achieve performance targets.
- Treatment of exotic grasses such as Giant Parramatta Grass (*Sporobolus fertilis*), *Phalarus* species and Whiskey Grass (*Andropogon virginicus*) and herbaceous weeds such as Fireweed (*Senecio madagascariensis*) and dandelions in the areas shown on Figure 14. This activity will also be required along access tracks and any other areas where vegetation adjoins disturbed land.
- Broad scale weed monitoring and bush regeneration activities throughout the entire site. Bush regeneration will comprise treatment of localised, minor infestations of weeds such as Lantana, exotic grasses and herbs throughout forested areas and Groundsel Bush (*Baccharis halmifolia*) along drainage lines.

Fire management

The biobank site owner will actively manage fire at the Norton offset site to help maintain the structure and function of ecological communities. Ecological fire management will be coordinated with hazard reduction activities in accordance with the fire management plan included in Section 3 of the MAP for the Norton biobank (GHD, 2016) that is included as Appendix E of this offset package.

The site has been split into management zones according to vegetation types and the locations of tracks (see Appendix E). The landowner will meet the ecological fire requirements of vegetation at the site by maintaining a fire interval within each management zone of greater than 7 years and less than 25 years and avoiding successive fires of intensity sufficient to scorch or consume dominant tree crowns. In accordance with Section 3 of the MAP the landowner will:

- Carry out ecological burns for each management zone according to the method and frequency described in the 'Fire requirements for vegetation types and threatened species' table;
- Carry out the actions listed in the 'Ecological burning actions table' and the 'Other fire management activities' table.
- Undertake monitoring and inspections in accordance with the 'Fire management monitoring' table.

Ecological burns and bushfire hazard reduction works will be undertaken in accordance with a Bush Fire Hazard Reduction Certificate issued under the Rural Fires Act or a notification received under that Act, or in accordance with a Bush Fire Risk Management Plan that may apply to the land.

Pest fauna control

Dog attacks are recognised as a significant threat to Koalas that is managed by preventing domestic dogs from roaming and control of feral dogs (KSC, 2011). Dog, fox and feral cat attack and/or competition comprise a threat to the Spotted-tailed Quoll (Long and Nelson, 2009). Direct evidence of both feral dogs and roaming domestic dogs was observed during the field survey of the Norton offset site. It is expected that foxes and cats are also likely to occur.

Under the *Companion Animals Act 1998* dogs must be under the control of a competent person when in public places and must not roam or attack other animals, though in practice, enforcement of these aspects of the Act can be difficult (KSC, 2011). Education of dog owners is essential to achieving effective dog control and minimising the risk to Koalas. The community will be made aware of the nature of the threat to Koalas, the requirements of the law and the penalties for breaches (KSC, 2011). At the Norton offset site this will be achieved through a condition prohibiting the landowner from having cats or dogs in the conservation area and through site signage and targeted communication with neighbours.

Feral dogs, cats and foxes will be managed through a trapping and shooting program. Pest fauna populations will be monitored in consultation with the Local Land Services control officer and include techniques such as setting of camera traps, setting up of sand pits with bait stations and free feed and coordination with ongoing regional control programs as appropriate. Poison baiting is not the preferred control method at the Norton offset site because of the risk of harm to the Spotted-tailed Quoll (Long and Nelson, 2009).

Any baiting should preferably be conducted using Canid Pest Ejectors (CPEs). CPEs are a spring triggered device that fires a dose of 1080 into the mouth of dogs/foxes that pull hard and upwards at a bait lure. Once set, a CPE is only activated by a direct pull on the lure head that activates the spring loaded plunger to propel the contents of the capsule directly into the mouth

of the wild dog or fox. The firm upward pulling action required to trigger the poison delivery, is easily achieved by foxes and wild dogs, but much less so by most non-target species (Hunt, 2010).

As the ejector can only be activated by an animal with an upward pull force of >1.6kg, many small non-target animals are excluded from activating ejectors. Researchers in Victoria identified that “only red foxes, wild dogs and feral cats had been recovered in field trials when cyanide was used as the active agent, suggesting a high level of target specificity” (Busana et. al., 1998; Marks et. al., 2003).

An assessment of risk in known Spotted-tailed Quoll habitat did not record any CPE activations despite quolls being present within 1m of an ejector on five occasions at different locations (Hunt, 2010). Additional research in northern NSW has shown no adverse impact on quoll populations from 1080 baiting programs even though some baits may be taken by quolls (Kortner, 2007, Claridge and Mills, 2007).

Annual pest fauna control programs will be developed in response to monitoring and in consultation with the Local Land Services wild dog officer and will be consistent with regional plans and programs. Coordination with group control programs that include pest fauna control on the site and adjoining properties is likely to increase the effectiveness of pest fauna control (Thorman, M., local land services, pers. comm.).

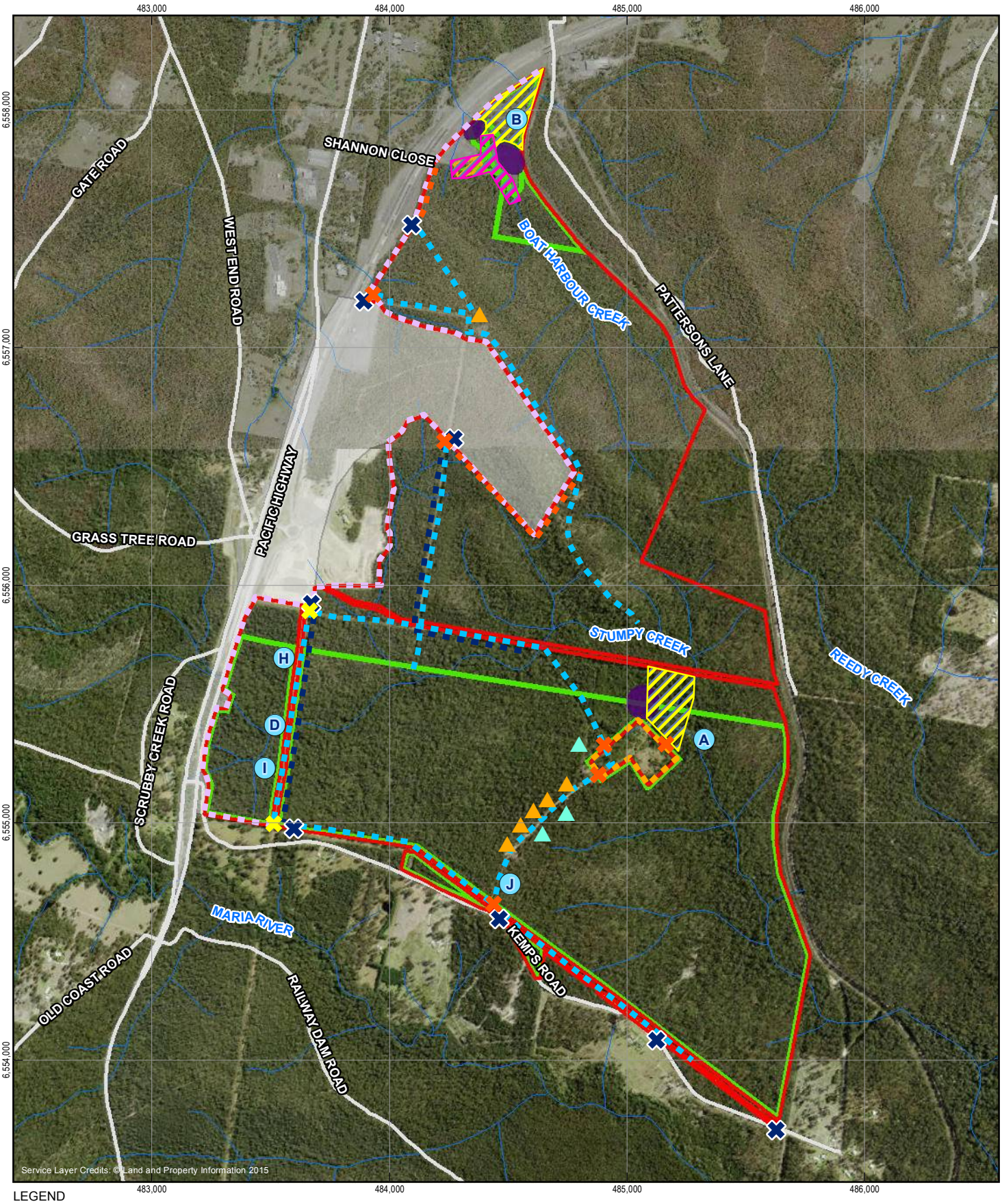
Feral pigs and exotic herbivores such as feral cattle, deer or rabbits will be controlled as required based on the results of the biodiversity monitoring and consultation with the Local Land Services control office. No specific evidence of any of these species, or environmental degradation as a result of their presence, was noted during field surveys. Active management of these pest fauna will commence if they are recorded at the site. Control methods are likely to include: active trapping; shooting from the ground; and/or strategic baiting. As above the type and method of baiting will need to consider the presence of native fauna and their feeding habits, especially the Spotted-tailed Quoll.

7.2.2 Relationship with other documents

The Norton property will be managed in accordance with the following documents prepared in conjunction with the OEH:

- An in perpetuity BioBanking agreement (conservation covenant) registered in the title of the property and tailored to suit the site.
- The Norton Biobank site MAP included as Appendix E which has been prepared with reference to this offset package, and which sets out the management strategies that must be applied at the site to manage the property in accordance with the BioBanking agreement.

It is recommended that weed and pest fauna control is conducted with reference to the *NPWS North Coast Regional Pest Management Strategy* (OEH, 2012).



LEGEND

- Norton offset site
- NH2U Norton offset area
- Heavy Lantana infestation
- Low - moderate Lantana infestation
- Exotic grasses
- Old farm pigsty
- Recent or proposed development
- Photo points
- General rubbish removal
- Logs/sleepers pile
- Existing gate
- New gate
- Signage
- New fence
- Maintain track
- New track
- Existing strands to be removed
- Existing fence to be maintained

Paper Size A4

0 150 300 600

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Roads and Maritime Services
NH2U, Pacific Highway Upgrade
Norton and Griffin Offset Management Plan

Job Number	21-23829
Revision	A
Date	27 Oct 2016

Norton offset site property action plan

Figure 14

N:\AU\Sydney\Projects\21\23829\GIS\Maps\Deliverables\NGOMP\21_23829_Z007_NortonPropertyActionPlan.mxd Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: General topo - NSW LPI DTDB 2012, Geoscience Australia: 250k Data - Jan 2011; Aerial Imagery - Sixmaps 2016.jrichardson

7.2.3 Management action plan

Table 14 presents the specific actions required to implement the strategies described above, including specifications, standards, objectives and timeframes for delivery. The landowner will be responsible for implementing these actions in accordance with the MAP and this biodiversity offset package. OEH will be responsible for monitoring performance against the MAP. Property management actions are illustrated on Figure 14. The funding amounts for each action were developed by GHD during the BioBanking assessment. The funding is calculated over an initial 20 year period, with an additional sum set aside for in-perpetuity payments to landowners from the Biodiversity Trust Fund. Once the BioBanking agreement is finalised and annual payments commence, landowners will be required to continue to manage the land in line with their BioBanking agreement and Management Action Plan and other relevant legislative requirements.

Table 14 Norton offset site management actions plan

Activity no.	Activity	Quantity	Activity details	Performance target	Corrective action	Timeframe
1	New fencing around house site and home paddocks	Fence line shown on Figure 14.	Electric or plain wire fences must contain a minimum of 6 wires to be considered sufficient to control stock. Steel post spacing not to exceed 5 meters. The fence must be considered permanent, and all materials used are new or 'as new'. A plain wire fence is recommended (with minimum steel post spacing + maxi posts) to avoid injury to native fauna. Fence to have no top barb (to avoid injury to gliders, kangaroos or owls, etc.), and will consider measures to avoid kangaroo entanglement.	Fences to be fully functional. Exclusion of stock from the biobank site.	Maintenance and/or replacement of fence lines.	Installation by June 30 2017. Maintenance ongoing as required.
2	New gates and signs	Gates and signs at locations shown on Figure 14.	Installation of gates and signs at the locations shown on Figure 12. Gates must be stock proof, lockable, considered permanent, and all materials used new or 'as new'. 10 metre wide fences in accordance with activity 1, or alternative vehicle barriers, are to be installed on either side of gates where no perimeter fence is present. Signs will clearly identify that the property is subject to a conservation covenant.	Permanent gates and signs on all entry points to the site. Exclusion of unauthorised access to the site and harmful activities.	Maintenance and/or replacement of signs.	Gates installed by 30 June 2017. Signs will be erected on finalisation of BioBanking agreement (expected by June 2017).

Activity no.	Activity	Quantity	Activity details	Performance target	Corrective action	Timeframe
3	Fence, gate and sign monitoring, repair and maintenance	Fence lines, gates and signs at locations shown on Figure 14.	Annual (as a minimum) dedicated monitoring and routine inspection of the new fences specified in activity 1 and the perimeter fences, gates and signs shown on Figure 14 to prevent public or stock access. Repair and maintenance as required to correct issues identified during monitoring. Electric or plain wire fences must contain a minimum of 6 wires to be considered sufficient to control stock. Steel post spacing not to exceed 5 meters. Signs to be clear and legible. Gates to be fully functional.	Exclusion of stock access and damaging activities. Signs to be clear and legible. Fences and gates to be fully functional. Exclusion of unauthorised access to the site and harmful activities.	Maintenance and/or replacement of fence lines. To be done in partnership with neighbours.	Annual dedicated monitoring and routine inspection during other activities. Maintenance ongoing as required.

Activity no.	Activity	Quantity	Activity details	Performance target	Corrective action	Timeframe
4	Rubbish removal	Rubbish in around 6.5 ha. Estimated as five 20 tonne dumper loads. Any additional dumped rubbish revealed by monitoring.	Rubbish at the locations shown on Figure 14 to be characterised by an appropriately qualified specialist and a safe and sustainable plan for its removal prepared. The removal plan is to include due consideration of any hazardous materials (e.g. asbestos sheeting). All non-organic rubbish at the locations shown on Figure 12 is to be removed and disposed of at an appropriately credited landfill or in accordance with the specific requirements for the material. Woody debris is to be left in place except where it is mixed with inorganic rubbish or crosses proposed access tracks or fence lines. In these instances, the woody debris will be separated and/or moved to the nearest practical area of retained or regenerating vegetation. The relocation of any woody debris will be undertaken in a manner that minimises disturbance to vegetation and surface soil, and such debris will be placed as naturally as possible (i.e. not stacked). Remove illegally dumped materials using staff and/or specialised contractors.	Safe and sustainable removal of all rubbish at the locations shown on Figure 14, any unexpected finds and any illegally dumped materials.	Characterisation and removal of rubbish as required.	Removal of rubbish at the locations shown on Figure 12 to be completed by end 2017. Ongoing as required.
5	Fence strand removal	Old fence lines as shown on Figure 14.	Fence strands at the locations shown on Figure 12 to be removed and appropriately disposed of at licensed landfill	Removal of fence strands.		Completion by 30 June 2017.
6	Track maintenance	Tracks shown on Figure 14. Estimated one day of slasher and crew when required	All tracks shown on Figure 12 to be maintained as single-lane, dirt tracks along with appropriate surface water and sediment controls where required. The single creek crossing will be maintained as a shallow 'ford' to maintain fish passage. Locally sourced, clean, rock material will be used as substrate if required to avoid impacts on channel or bank stability.	Maintenance of access for management and fire control activities. Entire perimeter and strategic internal trails open and ready prior to each fire season.	Quarterly monitoring and supplementary maintenance as required.	At least annually, prior to each fire season. Additional maintenance as required to achieve performance targets.

Activity no.	Activity	Quantity	Activity details	Performance target	Corrective action	Timeframe
7	Treatment of Lantana infestations and woody weeds	At locations shown on Figure 14. Additional scattered individuals throughout the site.	Treatment of moderate and severe Lantana infestations and woody weeds in accordance with best practice, including: • Splatter gun with high concentration of glyphosate for dense infestations of Lantana. • Spot spraying of isolated infestations. • Cut and paint/fill of planted citrus trees in the north of the site. • Hand pulling/crowning of scattered individual weeds • Spot spraying of seedlings. Weed waste is to be left on site. Plants with a heavy fruit or seed load are to be piled, covered with black plastic and composted.	Control of noxious and environmental weeds in the areas indicated on Figure 12. Weed management activities are to be undertaken by suitably qualified operators. Operators are to provide report of works undertaken, which includes mapping of area treated, primary species treated and photo monitoring points. Weed control works will aim to achieve the following outcomes: • Lantana reduced to less than 20% of original distribution by the end of year 2. • Lantana reduced to less than 10% of original distribution by the end of year 5. • Lantana maintained at less than 10% of original distribution from year 6.	Additional control rounds as required to achieve performance targets.	Lantana infestations: • 6 sessions per year during years 1* to 3. • 4 sessions per year during years 4 – 10. Scattered woody weeds: • 2 sessions per year in years 1 and 2. Planted citrus trees: • 2 sessions in year 1. Follow up treatment and monitoring as required under activity 9 ‘broad scale weed monitoring and bush regeneration’.

Activity no.	Activity	Quantity	Activity details	Performance target	Corrective action	Timeframe
8	Treatment of exotic grasses and herbaceous weeds	At locations shown on Figure 14.	Control of exotic grasses and herbs. Active spraying will be used to 'open up' patches. Over time it is anticipated that natural regeneration will shade out the introduced grasses. Methods may include: • spot spraying using 'back packs' throughout all zones. • hand pulling/crowning of weeds. Weed waste is to be left on site.	Control of noxious and environmental weeds in the areas indicated on Figure 14. Weed management activities are to be undertaken by suitably qualified operators. Operators are to provide report of works undertaken, which includes mapping of area treated, primary species treated and photo monitoring points. Exotic grasses and herbaceous pasture weeds maintained at less than 10% of original distribution in all native vegetation zones by the end of year 10. Note: access tracks will not be actively managed to control introduced grasses, rather activities will focus on restricting introduced grasses from recruiting in remnant vegetation.	Additional control rounds as required to achieve performance targets.	• 6 sessions per year in years 1* to 3 • 4 sessions per year in years 4 – 10. Follow up treatment and monitoring as required under activity 9 'broad scale weed monitoring and bush regeneration'.

Activity no.	Activity	Quantity	Activity details	Performance target	Corrective action	Timeframe
9	Broad scale weed monitoring and bush regeneration	Entire site.	Monitoring of native vegetation throughout the biobank site and treatment of weeds as follows: • Splatter gun with high concentration of glyphosate for dense infestations of Lantana. • Spot spraying of isolated infestations. • Cut and paint/fill. • Spot spraying of seedlings. Weed waste is to be left on site. Plants with a heavy fruit or seed load are to be piled, covered with black plastic and composted.	Control of noxious and environment weeds. Bush Regeneration activities to be undertaken by suitably qualified operators. Operators to provide report of works undertaken, which includes mapping of area treated, primary species treated and photo monitoring points. Weed control work within these management zones will aim to achieve the following outcomes: • Mature woody weeds maintained at less than 10% of original distribution in all zones from year 10 and in perpetuity. • Other herbaceous and pasture weeds maintained at less than 10% of original distribution in all zones from year 10 and in perpetuity. Note: access tracks will not be actively managed to control introduced grasses, rather activities will focus on restricting introduced grasses from recruiting in remnant vegetation.	Additional control rounds as required to achieve performance targets.	Years 1* to 10, coordinated with other weed control activities. Year 11 on, follow-up weed control, 6 sessions per year in perpetuity.

Activity no.	Activity	Quantity	Activity details	Performance target	Corrective action	Timeframe
10	Pest fauna control	Entire site	Annual dedicated monitoring of pest fauna populations in consultation with the Local land services control officer and including techniques such as setting of camera traps, setting up of sand pits with bait stations and free feed and coordination with ongoing local/regional control programs as appropriate. Annual rounds of pest fauna control, principally targeting wild dogs, foxes and cats, using soft-jaw trapping and shooting undertaken by appropriately licensed and qualified staff. Control programs to be developed in consultation with the Local Land Services wild dog officer and to be consistent with regional plans and programs. Control programs to be targeted to other pest fauna (e.g. goats, pigs, rabbits) as appropriate if populations or impacts are detected during monitoring.	Pest control to be undertaken by appropriately licensed and qualified practitioners. Pest fauna numbers to be kept below baseline levels. Practitioners to provide a report of monitoring locations, presence/absence and control activities undertaken. The matters to be contained in the report are outlined in Section 6.3.4 of the offset package. Where activities are co-ordinated by landholders, landholders shall complete the landholder report in the Management Funding Contract, and include copies of any tax receipts associated with control activities.	Pest control and monitoring to be reviewed annually. Adjustments implemented and documented.	Annual monitoring; Annual pest fauna control rounds, or as required in response to monitoring or landholder observations, ongoing.

Activity no.	Activity	Quantity	Activity details	Performance target	Corrective action	Timeframe
11	Management of fire for conservation	Entire Norton offset site	The landowner must implement, and at all relevant times, comply with the fire management plan included in Section 3 of the MAP for the Norton biobank (GHD, 2016). The landowner must carry out ecological burns for each management zone according to the method and frequency described in the 'Fire requirements for vegetation types and threatened species' table in Section 3 of the MAP for the Norton biobank (GHD, 2016). The landowner must also carry out the actions listed in the 'Ecological burning actions table' and the 'Other fire management activities' table in Section 3 of the MAP for the Norton biobank (GHD, 2016). Monitoring and inspections must be carried out in accordance with the 'Fire management monitoring' table in Section 3 of the MAP for the Norton biobank (GHD, 2016).	Meet the ecological fire requirements of vegetation at the site by maintaining a fire interval of greater than 7 years and less than 25 years. Avoid successive fires of intensity sufficient to scorch or consume dominant tree crown.	In the event that wildfires did not occur for more than 25 years on the property, a prescribed ecological burn will be conducted. Fire management activities will be documented. Prescribed burn schedules The schedule will be adjusted in the event of a wildfire or activities undertaken under the *Rural Fires Act (RFA) 1997* to ensure the minimum frequencies between ecological burns.	Inter fire interval for individual cells greater than 7 years, less than 25 years. It is anticipated the first ecological burn will occur in Year 7 (ie 2023). Burns will be conducted in April/May and/or August/September.
12	Exclusion of grazing and harmful activities	Entire Norton offset site, enforced by BioBanking agreement.	Exclude activities that will result in impacts on habitat for the affected threatened species, including grazing, vehicle based camping, domestic animal access, hunting, apiary or uncontrolled public access.	Exclusion of all grazing and other harmful activities.	Immediate halting of grazing or any other harmful activities if detected in the biobank site. Clear delineation of the biobank site via signs, fences and gates.	Ongoing, in perpetuity.

Note: * - it is assumed that 'year one' begins in the first quarter of 2017 for the purposes of weed control and implementation of the MAP. In practice management would commence upon finalisation of BioBanking agreement (expected by June 2017).

7.2.4 Management actions program

Table 15 Norton offset site management actions program

Activity no.	Activity	Works timing (periods for actions to be completed by Landholder)												Timeframe
		July-Dec 2016	Jan-Jun 2017	July-Dec 2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027 –	
1	New fencing around house site and home paddocks														Completion by June 30 2017.
2	New gates and signs														Completion by June 30 2017 when protected under a secure conservation mechanism.
3	Fence, gate and sign repair and maintenance														Ongoing as required.
4	Rubbish removal														Completion of removal of mapped locations by end 2017. Ongoing as required.
5	Fence strand removal														Completion by June 30 2017.
6	Track maintenance														Ongoing as required.
7	Treatment of woody weeds – Lantana infestations														6 sessions per year during years 1* to 3. 4 sessions per year during years 4 – 10.
	Scattered woody weeds														2 sessions per year in years 1 and 2.
	Planted citrus trees														2 sessions in year 1.

Activity no.	Activity	Works timing (periods for actions to be completed by Landholder)												Timeframe
		July-Dec 2016	Jan-Jun 2017	July-Dec 2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027 –	
8	Treatment of exotic grasses and herbaceous weeds														6 sessions per year in years 1 to 3 4 sessions per year in years 4 – 10.
9	Broad scale weed monitoring and bush regeneration														Coordinated with other weed control activities
	Follow-up weed control and bush regeneration														6 sessions per year in perpetuity.
10	Pest fauna control														Annual monitoring; annual pest fauna control rounds, or as required ongoing
11	Management of fire for conservation														Inter fire interval for individual cells greater than 7 years, less than 25 years. It is anticipated the first ecological burn will occur in year 7 (ie 2023). Burns will be conducted in April/May and/or August/ September.

Note: * - it is assumed that 'year one' begins in the first quarter of 2017 for the purposes of weed control and implementation of the MAP. In practice management would commence upon finalisation of BioBanking agreement (expected by June 2017).

7.3 Monitoring program

7.3.1 Overview

The following monitoring programs and reports will apply to the Norton offset site:

- Management actions performance monitoring, from the approval of the BioBanking agreement. Annual reports will be prepared by the landowner and submitted to OEH.
- A vegetation and habitat survey along with a targeted threatened species survey at year five to further confirm the presence and condition of occupied habitat for the affected threatened fauna.
- Pest fauna control monitoring, comprising annual monitoring of pest fauna populations and documenting of control activities from the approval of this offset package. Reports are to be completed by suitably qualified practitioners in accordance with Section 5.3.3 and maintained by the landholder.
- OEH monitoring and auditing to be completed on an ongoing basis from approval of the BioBanking agreement.

These monitoring programs and reports are summarised in Table 16 and described below.

Table 16 Norton offset site monitoring program

Monitoring program	Report	Dates for monitoring to be undertaken																						Timeframe
		2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037 on	
Management actions performance	Annual report prepared by biobank site owner and submitted to OEH																							Monitoring undertaken and reports completed annually in perpetuity.
Vegetation and habitat monitoring	Annual report prepared by biobank site owner and submitted to OEH																							Monitoring undertaken and reports completed annually in perpetuity.
Year 5 targeted threatened species survey	'Threatened species monitoring and management performance' report																							Monitoring undertaken and report completed by end 2021
Pest fauna control	Annual 'Pest fauna monitoring and control' summary reports prepared by pest control contractor as appropriate.																							Annual summary reports, until at least 2036.
OEH monitoring and auditing																								Ongoing review of annual monitoring reports, inspections, auditing and additional stewardship as required.

7.3.2 Management actions performance

The landowner will monitor and record the completion of management actions through each year through collection of receipts, performance reports from contractors, diaries etc. The landowner will complete an Annual Report in accordance with works program milestones and submit to the OEH in perpetuity. The report will be prepared in accordance with OEH's standard template and include a summary of the following topics:

- Fence maintenance.
- Feral animal presence.
- Feral animal control.
- Weed presence (including extent and severity of infestations and presence of any new infestations).
- Weed control.
- Description and proof of current reporting years' activities, including one-off or irregular events (fence replacement, fire management etc).

The OEH will confirm that activities have been completed in accordance with the MAP and/or recommend additional actions to achieve performance objectives.

7.3.3 Vegetation and habitat

The landowner will monitor the condition of vegetation and habitat as part of their management of the biobank site. The results of the vegetation and habitat monitoring program will be included in the landowner's annual report to OEH in perpetuity.

The annual monitoring of vegetation and habitat condition will comprise:

- Monitoring of photo points to record the condition of habitat and the effectiveness of management actions. Permanent photo point locations have been way pointed using a GPS and marked with star pickets to facilitate locating during subsequent monitoring events and consistent photo capture (see Table 17). A photo will be taken and notes taken on general vegetation condition, extent of weed infestation, ground cover, any management issues such as erosion or dieback, disturbance by pest fauna and any observed change since the last monitoring round.
- General observations of vegetation condition, degree of weed infestation, any management issues such as erosion or dieback and any observed change since the last monitoring round across the entire site.
- Description of any observed management problems or threats and proposed remedial action as required.
- Preparation of annual monitoring reports, including photo point data and comparisons with previous survey rounds, photos, assessment of vegetation condition and regeneration, assessment of the quality and extent of habitat resources, description of any observed management problems or threats and proposed remedial action as required.

Photo points will be maintained at six locations in the NH2U Norton offset area and at representative points in each vegetation zone in the broader biobank site to document the condition of habitat and the effectiveness of management actions. Photo point locations have been waypointed using a GPS and marked with star pickets to facilitate locating during subsequent monitoring events and consistent photo capture (see Table 17).

7.3.4 Targeted threatened species survey

The affected threatened fauna are each cryptic and/or prone to population fluctuations and/or mobile and transitory in their use of habitat as stated in Section 2. The management action plan for the offset site does not include trigger levels based on threatened species abundance because that would impose monitoring and management requirements on biobank site owners that are not practical or achievable. Vegetation condition and habitat quality will be monitored as a surrogate for the status of threatened species populations. The link between management actions and improvements in habitat quality and protection of populations is demonstrated in Section 9.3.

A targeted threatened species survey of the NH2U Norton offset area will be conducted five years after the offset site is formally established to further confirm the presence and condition of occupied habitat for the affected threatened fauna, the link between the proposed management actions and habitat quality and the security of threatened species. Five years is the 'Offset calculator – Time horizon – Time until ecological benefit' value that was entered in the Offset assessment guide calculations and so this is the critical period after which it is necessary to confirm that the biodiversity offset has been delivered as planned.

The targeted threatened species survey will comprise the following techniques:

- Ground-truthing of the existing vegetation and habitat mapping and confirmation of the extent and condition of map units.
- Collection of BioBanking plot/transect data at the six permanent locations where baseline data was collected in the GHD field surveys (see Table 17).
- Monitoring of photo points at the six permanent plot/transect locations to document the condition of habitat and the effectiveness of management actions in accordance with the methodology outlined above.
- Habitat assessments, focussing on the extent and quality of specific habitat resources of relevance to the affected threatened fauna, including:
  - Food tree species for the Koala.
  - Vegetation type and structure, presence and quality of woody debris, caves rock outcrops and other potential den sites for the Spotted-tailed Quoll.
  - Critical foraging habitat for the Grey-headed Flying-fox, Regent Honeyeater and Swift Parrot.
- Sampling of six 'Canopy plots' nested in BioBanking plot/transects, comprising counts of every tree in the 50 m x 20 m plot along with its height, species, canopy cover and any evidence of fauna activity. Each tree species will then be cross-referenced to lists of food tree species for the Koala and Grey-headed Flying-fox to calculate the cover of food tree species.
- Six Koala 'Spot Assessment Technique' (SAT) searches for scats and evidence of Koala activity with reference to Phillips and Callaghan (2011).
- Nocturnal surveys targeting the Koala, Spotted-tailed Quoll and Grey-headed Flying-fox over two sets of four person-hour survey rounds on two separate nights, including walked spotlighting transects, quiet listening periods and call playback.
- At least four motion sensing camera traps targeting the Koala and Spotted-tailed Quoll and placed for as long as is possible, split between the main habitat types and targeting potential fauna movement corridors such as fire trails and drainage lines.

- Preparation of a 'Threatened species monitoring and management performance' report, including survey results, plot/transect data and comparisons with the baseline survey round and benchmark values, photos, assessment of vegetation condition and regeneration, assessment of the quality and extent of habitat resources, description of any observed management problems or threats and proposed remedial action as required.

7.3.5 Pest fauna control

The landowner will arrange annual dedicated monitoring of pest fauna populations. The monitoring program will be developed in consultation with the Local Land Services control officer and will be consistent with regional plans and programs.

Practitioners will be required to prepare an annual pest fauna control report comprising:

- Dates and locations of monitoring activities.
- Numbers and species of animals recorded during monitoring.
- A brief description of group control programs that encompass the site or other relevant programs coordinated by Local Land Services and related to the year's pest control activities.
- Dates and locations of pest fauna control activities.
- Numbers and species of animals captured or killed during pest fauna control activities.
- Incidental observations of native animals.
- A summary of general observations of pest fauna abundance and activity throughout year.

Control programs will be targeted to other pest fauna (e.g. goats, pigs, rabbits) as appropriate if populations or impacts are detected during monitoring.

Table 17 Vegetation and habitat monitoring locations in the NH2U Norton offset area

Photo point	Plot/ transect ID	NSW Vegetation Type	NSW Veg. ID	Condition	Habitat type	Notes	Eastings	Northings
A	18	Blackbutt – Turpentine - Tallowwood shrubby open forest	NR122	Moderate/good	Wet sclerophyll forest	Natural regeneration of native vegetation and habitat resources for the affected threatened fauna.	485324	62555351
B	26	Spotted Gum – Grey Ironbark - Pink Bloodwood open forest	NR246	Moderate/good	Dry sclerophyll forest	Natural regeneration of native vegetation and habitat resources for the affected threatened fauna.	484536	6557961
D	50	Blackbutt - Pink Bloodwood shrubby open forest	NR117	Moderate/good	Wet sclerophyll forest	Natural regeneration of native vegetation and habitat resources for the affected threatened fauna.	483517	6555412
H	41	Red Mahogany open forest	NR222	Moderate/good	Dry sclerophyll forest	Natural regeneration of native vegetation and habitat resources for the affected threatened fauna.	483557	6555694
I	48	Forest Red Gum – Swamp Box	NR161	Moderate/good	Grassy Woodland	Natural regeneration of native vegetation and habitat resources for the affected threatened fauna.	483476	6555230

Photo point	Plot/ transect ID	NSW Vegetation Type	NSW Veg. ID	Condition	Habitat type	Notes	Eastings	Northings
J	16	Scribbly Gum – Red Bloodwood heathy open forest	NR228	Moderate/good	Dry sclerophyll forest	Natural regeneration of native vegetation and habitat resources for the affected threatened fauna.	484506	6554741

7.4 Responsibilities

Condition f) viii. for the Project states that this offset package must provide details of the various parties responsible for the management, monitoring and implementation of the management activities at offset sites, including their experience and qualifications and employment or engagement status. As management actions are proposed on the offset sites in-perpetuity it is not possible to provide details on every individual party, including future landowners, contractors or consultants, that will be engaged to undertake these activities. It is more appropriate to express this information in terms of the roles responsible for implementing management actions and the minimum experience and qualifications for the parties that will fulfil these roles. Table 18 outlines the management roles and the standard of qualifications and experience required for the parties who will be implementing the management actions at the Norton offset site.

Table 18 Parties responsible for implementing this offset package at the Norton offset site

Role / management actions	Responsible party	Qualifications / experience
Site manager / supervising the implementation of this offset package and the MAP.	Roads and Maritime offset site manager (initially). Biobank site owner (upon purchase of the site and then in perpetuity).	Complies with OEH's 'fit and proper' person requirements. Signatory to the BioBanking agreement.
EPBC Act offset package auditor / ensuring compliance with this offset package.	Roads and Maritime offset site manager.	Tertiary qualifications in environmental science or ecology / demonstrated senior professional experience in an environmental management role.
Biobank site auditor / ensuring compliance with the BioBanking agreement and MAP.	NSW Office of Environment and Heritage (OEH)	Tertiary qualifications in environmental science or ecology / professional experience in BioBanking unit.
Ecologist / Targeted threatened species survey in year five.	Consultant ecologist engaged by Roads and Maritime	Tertiary qualifications in environmental science or ecology / demonstrated professional experience in ecological survey and assessment.
Site maintenance contractor / installation and maintenance of fences, signs and tracks. Fence strand and rubbish removal as required.	Appropriately qualified and experienced contractors engaged by Roads and Maritime offset site manager (initially) and biobank site owner (upon purchase of the site and then in perpetuity).	Trade qualifications appropriate to the individual task / demonstrated professional experience in the individual task.
Bush regeneration contractor / Treatment of mapped weed infestations, ongoing broad scale weed monitoring and bush regeneration.	Appropriately qualified and experienced bush regeneration contractors engaged by Roads and Maritime offset site manager (initially) and biobank site	Certificate III Conservation & Land Management (or interstate equivalent) / minimum one year full-time equivalent experience as a bush regenerator.

Role / management actions	Responsible party	Qualifications / experience
	owner (upon purchase of the site and then in perpetuity).	
Pest fauna controller / pest fauna monitoring, control and reporting.	Appropriately qualified and experienced contractor engaged by Roads and Maritime offset site manager (initially) and biobank site owner (upon purchase of the site and then in perpetuity). Control programs to be developed in consultation with the Local Land Services wild dog officer and to be consistent with regional plans and programs	Endorsement of Local Land Services wild dog officer / demonstrated professional experience.

8. Management of Griffin Offset Site

8.1 Conservation mechanism and funding arrangements

The Griffin offset site will be transferred to National Parks & Wildlife Services (NPWS) to maintain and manage in perpetuity. Roads and Maritime currently owns the Griffin offset site and are progressing discussions with NPWS to undertake the long-term management and conservation of the property. Roads and Maritime will transfer ownership of the property to NPWS to be included in the Clybucca Historic Site. The Griffin offset site will be managed as native vegetation for biodiversity conservation.

Roads and Maritime will obtain a BioBanking agreement on the site prior to transferring it to NPWS. Roads and Maritime will initiate a BioBanking agreement with OEH, retire 100% of the credits generated on the property, deposit all of the Total Fund Deposit required into the BioBanking Trust Fund and then transfer the property to NPWS with the BioBanking agreement in place. The BioBanking agreement will lapse once the site is formally included in the NPWS Estate as part of the Clybucca Historic Site, however annual funds will continue to be paid from the BioBanking Trust Fund in perpetuity. This approach will ensure appropriate funding is paid to NPWS on an annual basis to ensure the management of the site in perpetuity.

8.2 Management plan

8.2.1 Management strategies

The following broad management strategies and related actions at the Griffin offset site will improve the value and extent of habitat for the affected threatened fauna:

- Property maintenance, through:
  - Establishment and maintenance of appropriate fences, gates and signs.
  - Removal of unnecessary fencing.
  - Removal of rubbish.
  - Maintenance of tracks.
- Conservation and improvement of habitat, through:
  - Maintenance of native vegetation.
  - Regeneration of cleared or degraded land.
  - Weed control.
  - Exclusion of domestic grazing and management of human disturbance.
  - Retention of dead timber, rocks and other habitat resources.
  - Fire management.
- Pest fauna control.

An overview of these management strategies and how they relate to the site and to populations of the affected threatened fauna is provided below. The following sections provide specific detail of the management actions that will be performed including a plan for their delivery, a works program and the minimum standards and objectives that will be achieved. Property management actions are illustrated on Figure 15.

Property maintenance

The Griffin offset site is currently unoccupied and comprises remnant and regenerating native vegetation with small areas of cleared or degraded land. The entire site will be maintained as native vegetation. Infrastructure such as gates, signs and access tracks will be maintained to support these land uses as shown on Figure 15. This infrastructure is important to clearly define the conservation area, exclude harmful activities and facilitate efficient management.

The Griffin offset site is to be managed in accordance with existing management objectives of Yarrahapinni Wetlands National Park and Clybucca Historic site. Fencing which has the potential to inhibit wildlife movement will be removed and access along fence lines will be allowed to regenerate.

Public access is permitted to the Clybucca Historic site and the Yarahapinni Wetlands National Park however access from public roads is indirect and not clearly sign posted and so visitation rates are likely to be very low. Potential public access is unlikely to reduce the value of the site as a biodiversity offset provided that harmful activities or threats such as camping, fires, domestic animals, walking or driving off marked trails etc. are excluded. These activities are routinely prohibited in the national parks estate, including the Clybucca Historic site and the Yarahapinni Wetlands National Park (DECC, 2009, NPWS, 2013).

There are signs near the boundaries of the current Clybucca Historic site and the Griffin offset site that serve their intended purpose (i.e. communicating that it is a conservation area and that certain activities are restricted). There are gates at the boundaries of the Yarahapinni Wetlands National Park and at the north and south boundaries of the Griffin offset site. These gates were open at the time of the field survey because public access is not restricted to these reserves. These gates should be maintained so that public access can be restricted during pest fauna control or fire management activities or if public access is considered to be a threat to the biodiversity or cultural values of the site in the future.

The Griffin offset site contains small areas of building refuse and other rubbish at the locations shown on Figure 15. This rubbish will be removed to avoid the risk of contamination or physical injury to animals.

There is an existing network of access tracks across the site (see Figure 15). These tracks are likely to be adequate for weed management, fire management, monitoring and other activities. These tracks will be maintained in their current state as single lane, gravel tracks.

The entire perimeter of the Griffin offset site adjoins intact native vegetation. Given the impacts associated with fence construction, the risk of injury to Koalas and other fauna from fences and the surrounding land uses, no perimeter fence construction is proposed. Vehicle barriers on either side of the gates will be maintained to prevent unauthorised vehicle access when the gates are locked however fencing is to be removed where not required to restrict vehicle movement. Discontinuous fences are unlikely to pose a threat to resident fauna.

There are sections of poorly maintained and/or obsolete fencing within the site that will be removed to improve habitat connectivity and reduce the risk of injury to Koalas and other fauna.

The Griffin offset site contains small areas of dumped drums and other rubbish at the location shown on Figure 15. This rubbish will be removed to avoid the risk of contamination or physical injury to animals and to maintain the cultural and biodiversity values of the site. The rubbish should be characterised by an appropriately qualified specialist to identify potentially hazardous material

and/or whether some of the material observed has cultural heritage value and should be left in place. Where woody debris is mixed with inorganic rubbish or crosses proposed access tracks or fence lines it will be moved to the nearest practical area of retained or regenerating vegetation to function as a habitat resource. Woody debris moved in this way will be moved so as to minimise disturbance of vegetation and surface soil and placed as naturally as possible (i.e. not stacked).

Conservation and improvement of habitat

The entire Griffin offset site will be managed as native vegetation. Conservation and management of this vegetation will improve the quality of habitat for the affected threatened fauna and especially the quality of foraging resources by maintaining the extent, health and productivity of vegetation containing food tree species.

The majority of the site contains near-intact vegetation or mature regeneration. There are small areas of cleared land associated with previous timber harvesting or bee keeping activities. Each of these areas featured natural regeneration, including the majority of canopy species, a mix of mid storey and groundcover species and overall high native species richness. This natural regeneration is likely to continue and so no supplementary planting or seed broadcasting is proposed.

Natural regeneration will be complemented by exclusion of domestic grazing, management of human disturbance and retention of dead timber, rocks and other habitat resources.

Weed control will be an important part of vegetation conservation at the site and will comprise three main activities:

- Treatment of localised woody weed infestations, including Lantana (*Lantana camara*) and Wild Tobacco (*Solanum mauritianum*) in the areas shown on Figure 15. This activity will be required in the first two years of the implementation of this plan.
- Treatment of exotic grasses such as Whiskey Grass (*Andropogon virginicus*) and herbaceous weeds such as Fireweed (*Senecio madagascariensis)* and dandelions in the areas shown on Figure 15. This activity will be required along access tracks and any other areas where vegetation adjoins disturbed land.
- Broad scale weed monitoring and bush regeneration activities throughout the entire site. This will include treatment of localised, minor infestations of weeds such as Lantana, exotic grasses and herbs throughout forest, woodland and heath and Groundsel Bush (*Baccharis halmifolia)* in wetlands. This activity will be required throughout all native vegetation. More intensive weed management activities may be required from time to time if severe infestations are detected.

Pest fauna control

Dog attacks are recognised as a significant threat to Koalas that is managed by preventing domestic dogs from roaming and control of feral dogs (KSC, 2011). Dog, fox and feral cat attack and/or competition comprise a threat to the Spotted-tailed Quoll (Long and Nelson, 2009). Direct evidence of feral dogs was observed during the field survey of the Griffin offset site and foxes and cats are also likely to occur.

There is a relatively minor risk of domestic animals roaming at the Griffin offset site given surrounding land uses. Domestic animals are prohibited from reserves in the National Park estate

and will be prohibited from the site. This is made clear on existing signage near the boundary of the property.

Feral dogs, cats and foxes will be managed through a trapping and shooting program and in accordance with the *NPWS North Coast Regional Pest Management Strategy: 2012-2016* (OEH, 2012). Pest fauna populations will be monitored in consultation with the Local Land Services control officer using techniques such as setting of camera traps, setting up of sand pits with bait stations and free feed and coordination with ongoing control programs as appropriate. Pest fauna control programs will be developed in response to monitoring and in consultation with the Local Land Services wild dog officer and will be consistent with the regional strategy (OEH, 2012). Poison baiting is the least preferred control option at the Griffin offset site because of the risk of harm to the Spotted-tailed Quoll (Long and Nelson, 2009). NPWS undertakes pest fauna control in the adjoining reserves which includes a combination of sand pit monitoring, soft jaw traps and shooting and/or baiting depending on the availability of resources (Kendall, P. NPWS, pers. comm.). Any baiting undertaken will be conducted according to best practice standards (refer to NPWS Best Practice Guidelines – fox control). If quolls are monitored near baiting sites, baiting will be ceased. Coordination with group control programs that include pest fauna control on the site and adjoining properties is likely to increase the effectiveness of pest fauna control (Thorman, M., Local Land Services, pers. comm.) Roads and Maritime will provide funding to undertake this activity in line with BioBanking funding arrangements.

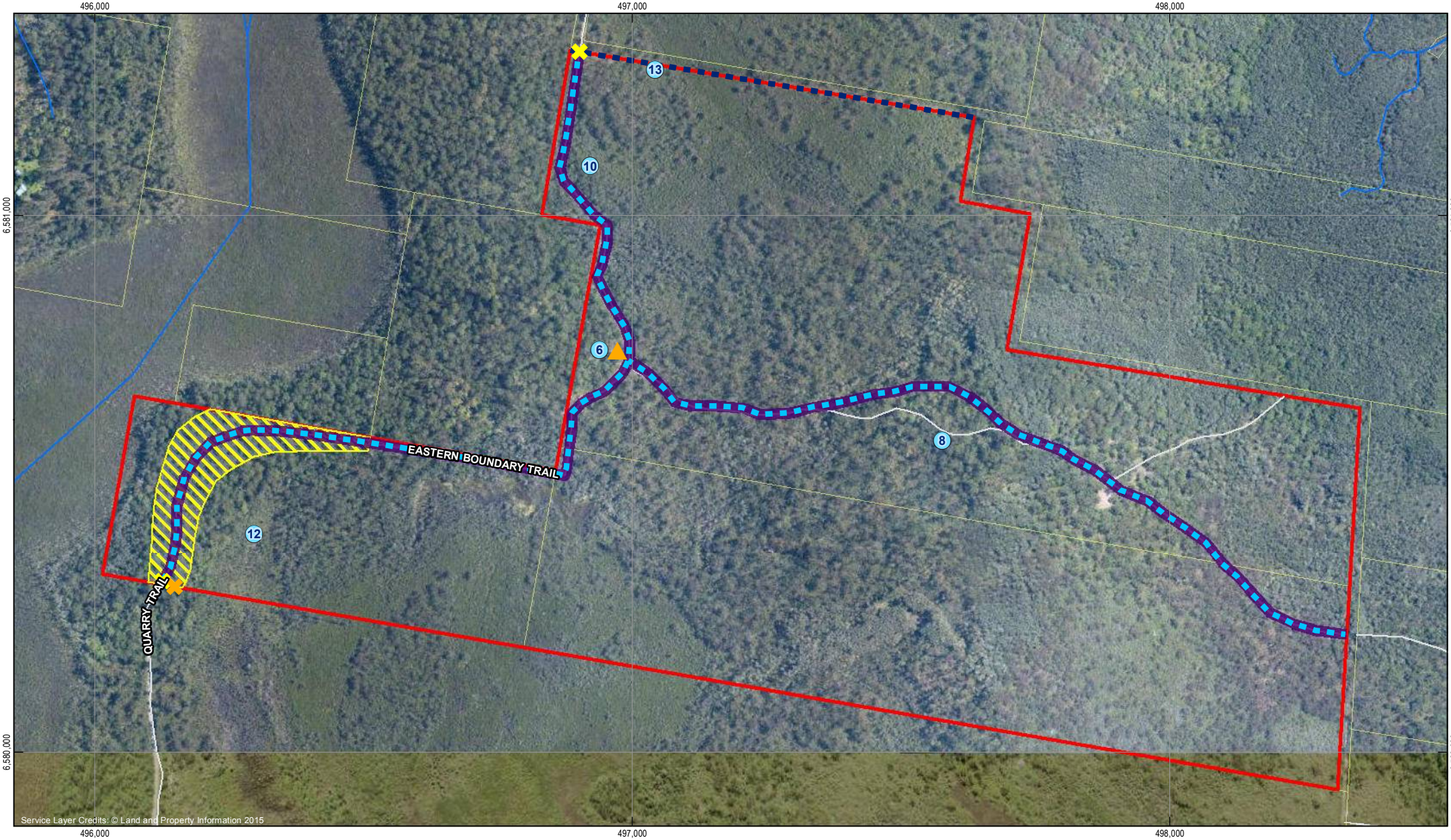
8.2.2 Relationship with other documents

The Griffin offset Site will be transferred to the NPWS to oversee its maintenance and management for conservation in perpetuity as part of the Clybucca Aboriginal Area (formerly known as Clybucca Historic site). The site will then be subject to NPWS's management and monitoring framework. NPWS will manage the site with reference to this NGOMP and under the *Clybucca Historic Site Plan of Management* (NPWS, 2007).

As described above, a BioBanking agreement will be obtained over the site initially to allow calculation of funds to be paid into the BioBanking Trust Fund. An MAP will be prepared in accordance with the BioBanking assessment methodology. The management strategies and actions will be implemented in accordance with the MAP, this offset package and any other relevant plans. The implementation of management strategies and actions in accordance with the MAP for the sites will be funded by Roads and Maritime through the purchase of biodiversity credits.

The Griffin offset site will also be managed with reference to the following documents:

- This NGOMP.
- The MAP for the Griffin biobank.
- *Yarrahapinni Wetlands National Park Plan of Management* (NPWS, 2013).
- *Yarrahappini Wetlands National Park, Clybucca Historic Site & Aboriginal Area Fire Management Strategy (Type 2)* (DECC, 2009).
- *NPWS North Coast Regional Pest Management Strategy: 2012-2016* (OEH, 2012).



Paper Size A4

0 50 100 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Griffin offset site
- Moderate Lantana infestation
- Exotic grasses and herbaceous weeds
- Photo points
- Maintain track
- Existing strands to be removed
- Roads
- Waterways
- Remove rubbish
- Existing gate
- Existing sign
- New gate
- New sign

Roads and Maritime Services
NH2U, Pacific Highway Upgrade
Norton and Griffin Offset Management Plan

Job Number 21-23829
Revision A
Date 27 Oct 2016

Griffin offset site property action plan

Figure 15

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Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: General topo - NSW LPI DTDB 2012, Geoscience Australia: 250k Data - Jan 2011; Aerial Imagery - Sixmaps 2016. jrichardson

8.2.3 Management actions plan

Table 19 presents the specific actions required to implement the strategies described above including specifications, standards, objectives and timeframes for delivery. Property management actions are illustrated on Figure 15. NPWS have provided in-principle agreement for the following management funding, to be provided by Roads and Maritime under a BioBanking agreement:

- Site establishment' funding to be split over two years. This is intended for relatively intensive activities that will be completed in the first two years after establishment of the site such as: trail upgrade, including heavy plant usage; the removal of boundary/internal fences; and treatment of more severe weed infestations. The split over two years is to account for variance in seasonal conditions associated with the works.
- An annual management funding allocation as per the BioBanking agreement. This is intended for trail maintenance, weed and pest animal control, planning and general site maintenance and management.

Funding has been costed according to the Macleay Area Expenditure Record Template developed in line with the agency-wide asset maintenance programme. NPWS will continue to manage the land as part of the national parks estate in line with the *Clybucca Historic Site Plan of Management* (NPWS, 2007) and other relevant legislative requirements.

Table 19 Griffin offset site management actions plan

Activity no.	Activity	Quantity	Activity details	Minimum standard / objective	Timeframe
1	Gate and sign repair and maintenance	2 gates, 2 signs	Monitoring, repair and maintenance of the gates and signs shown on Figure 9 to prevent unauthorised public access. Signs to be clear and legible. Signs must be permanent and clearly identify the name of the site, that it is part of the national park estate, that unauthorised public access is prohibited, that domestic animal access is prohibited and that activities like weed spraying, baiting or shooting may occur on site. Gates to be fully functional.	Maintenance of gates and signs. Exclusion of unauthorised public access and damaging activities. Signs to be clear and legible. Fences and gates to be fully functional.	Ongoing as required.

Activity no.	Activity	Quantity	Activity details	Minimum standard / objective	Timeframe
2	Rubbish removal	Around 0.5 ha at locations shown on Figure 15. Any additional dumped rubbish revealed by monitoring.	Rubbish at the location shown on Figure 15 to be characterised by an appropriately qualified specialist and a safe and sustainable plan for its removal prepared. The removal plan is to include due consideration of any hazardous materials (e.g. asbestos sheeting). All non-organic rubbish at the location shown on Figure 9 is to be removed and disposed of at an appropriately credited landfill or in accordance with the specific requirements for the material. Woody debris is to be left in place. Where woody debris is mixed with inorganic rubbish or crosses proposed access tracks or fence lines it should be moved to the nearest practical area of retained or regenerating vegetation. Woody debris should be moved so as to minimise disturbance of vegetation and surface soil and not stacked.	Safe and sustainable removal of all rubbish at the location shown on Figure 15, any unexpected finds and any illegally dumped materials. Characterisation and removal of rubbish as required.	Completion by end 2017. Ongoing as required.
3	Fence strand removal	760 m of fence	Fence strands at the locations shown on Figure 9 to be removed.	Removal of fence strands.	Completion by end 2017.
4	Track upgrade and maintenance	Around 3.5 km	All tracks shown on Figure 15 to be maintained if deemed necessary for management purposes such as fire management. Roads not required are to be closed. Roads are to be maintained to NPWS Fire management standards as single-lane, gravel or dirt tracks along with appropriate surface water and sediment controls where required.	Maintenance of access for management and fire control activities.	Ongoing, as required.
5	Treatment of woody weeds	Around 4.3 ha	Treatment of woody weeds is to be undertaken in accordance with the regional and park management strategies	Eradication of noxious weeds and control of environmental weeds in the areas indicated on Figure 9. Weed control works will aim to achieve the following outcomes: • Lantana reduced to less than 10% of original distribution by the end of year 2. • Lantana maintained at less than 10% of original distribution from year 3.	Two control rounds, in spring or autumn, completed by end 2018.

Activity no.	Activity	Quantity	Activity details	Minimum standard / objective	Timeframe
6	Broad scale weed monitoring and bush regeneration	Treatment of exotic grasses and herbaceous weeds in around 6.5 ha of trail margins. Bush regeneration in around 160 ha of near-intact vegetation.	Monitoring of native vegetation throughout the Conservation Area. Treatment of grasses and herbaceous weeds is to be undertaken in accordance with the regional and park management pest management strategies.	Eradicate of noxious weeds and control of environmental weeds in the site specifically comprising: • No dense infestations of any weed species present. • No mature or seeding woody weed species present. • Removed weed cover is being replaced by regenerating native plants species derived from the surrounding local vegetation communities, including recruitment of a range of understorey, mid-storey and canopy species.	Once yearly (spring), on-going.
7	Pest fauna control	Entire site	Dedicated monitoring of pest fauna populations in consultation with the Local land services control officer and including techniques such as setting of camera traps, setting up of sand pits with bait stations and free feed and coordination with ongoing control programs as appropriate. Pest fauna control at least every two years, principally targeting wild dogs and foxes, using soft-jaw trapping undertaken by appropriately licensed and qualified staff where possible. Any baiting undertaken will be conducted according to best practice standards (refer to NPWS Best Practice Guidelines – fox control). If quolls are monitored near baiting sites, baiting will be ceased. Control programs to be developed in consultation with the Local Land Services wild dog officer and to be consistent with regional plans and programs. Control programs to be targeted to other pest fauna (e.g. goats, pigs, rabbits) as appropriate if populations or impacts are detected during monitoring.	NPWS must make a reasonable effort to control pest fauna in the Conservation Area. Pest fauna numbers to be kept below baseline levels. Monitoring and the level of local activity (presence of neighbourhood baiting programs etc.) will help inform the level of effort necessary. NPWS must monitor the site at least once every two years.	Monitoring, followed by a pest fauna control round, at least once every two years or as required.

Activity no.	Activity	Quantity	Activity details	Minimum standard / objective	Timeframe
8	General conservation, maintenance and monitoring. Fire management.	Entire site	Exclude activities that would result in impacts on habitat for the affected threatened fauna, including, vehicle based camping, domestic animal access, apiary or uncontrolled public access. Facilitate and monitor natural regeneration and development of habitat resources in accordance with the monitoring program (see Section 8.3). Identify and monitor threats and impacts to biodiversity values (e.g. wildfire, erosion, harmful activities on adjoining properties) and undertake appropriate corrective actions. Manage fire in accordance with the *Yarrahappini Wetlands National Park, Clybucca Historic Site & Aboriginal Area Fire Management Strategy* (Type 2) (DECC, 2009).	NPWS must comply with their management plan and provide monitoring results for: • Vegetation and habitat condition • Weed control • Pest fauna control • Any identified threats and impacts to biodiversity values that are not covered in this plan and appropriate corrective actions • Any specific management actions for the reporting year (e.g. year one and two activities described above, ecological burns, bushfire hazard reduction etc).	Yearly monitoring report as per BioBanking requirements.

Note: * - it is assumed that ‘year one’ begins in the first quarter of 2017 for the purposes of weed control and implementation of the MAP. In practice management would commence upon finalisation of BioBanking agreement (expected by June 2017).

8.2.4 Management actions program

Activity no.	Activity	Quantity	Works timing (periods for actions to be completed by NPWS)												Timeframe
			2016				2017				Ongoing				
			Jan-Mar	Apr-Jun	July-Sep	Oct-Dec	Jan-Mar	Apr-Jun	July-Sep	Oct-Dec	Jan-Mar	Apr-Jun	July-Sep	Oct-Dec	
1	Gate and sign repair and maintenance	2 gates, 2 signs													Ongoing as required.
2	Rubbish removal	Around 0.5 ha													Completion by end 2017.
3	Fence strand removal	760 m of fence													Completion by end 2017.
4	Track maintenance	Around 3.5 km													Ongoing as required.
5	Treatment of woody weeds	Around 4.3 ha													Two control rounds, in spring or autumn, completion by end 2018.
6	Broad scale weed monitoring and bush regeneration	Entire site													Once yearly in spring, on-going.
7	Pest fauna control	Entire site													Monitoring and pest fauna control rounds every two years or as required.
8	General conservation, maintenance and monitoring	Entire site													Yearly monitoring reports as per BioBanking requirements.

Note: * - it is assumed that 'year one' begins in the first quarter of 2017 for the purposes of weed control and implementation of the MAP. In practice management would commence upon finalisation of BioBanking agreement (expected by June 2017).

8.3 Monitoring program

8.3.1 Overview

The NPWS will monitor biodiversity values at the Griffin offset site as part of their management of the Clybuccca Historic site. Monitoring will include an annual assessment of the general extent and quality of habitat for the affected threatened fauna and the effectiveness of management actions equivalent to the requirements for a biobank site. The following monitoring programs and reports will apply to the Griffin offset site:

- Vegetation and habitat monitoring, comprising a monitoring program to be completed by the NPWS annually, and including preparation of annual overviews of the condition of vegetation and habitat.
- Pest fauna control monitoring, comprising bi-annual survey of pest fauna populations and documenting of control activities

These monitoring programs and reports are described below.

8.3.2 Vegetation and habitat

A vegetation and habitat monitoring program will be completed by NPWS annually, as required by the BioBanking agreement. A vegetation and habitat condition report will be prepared and included as an attachment to the annual monitoring and reporting required under the management plan for the Clybucca Historic site (see NPWS, 2007).

The annual monitoring of vegetation and habitat condition by the NPWS will comprise:

- Monitoring of the five photo points shown on Figure 15 and summarised in Table 21 to record the condition of habitat and the effectiveness of management actions. Photo point locations have been way pointed using a GPS and marked with star pickets to facilitate locating during subsequent monitoring events and consistent photo capture. A photo should be taken at the bearing specified for each photo point and notes should be taken on general vegetation condition, extent of weed infestation, ground cover, any management issues such as erosion or dieback and any observed change since the last monitoring round.
- Observations of native animals, both targeted (e.g. spotlighting) and incidentally.
- A summary of general observations of vegetation condition, degree of weed infestation, any management issues such as erosion or dieback and any observed change since the last monitoring round across the entire site.
- Description of any observed management problems or threats and proposed remedial action as required.

8.3.3 Targeted threatened species survey

A targeted threatened species survey of the Griffin offset site will be conducted five years after the offset site is formally established to further confirm the presence and condition of occupied habitat for the affected threatened fauna, the link between the proposed management actions and habitat quality and the security of threatened species. Five years is the 'Offset calculator – Time horizon – Time until ecological benefit' value that was entered in the Offset assessment guide calculations

and so this is the critical period after which it is necessary to confirm that the biodiversity offset has been delivered as planned.

The targeted threatened species survey will comprise the following techniques:

- Ground-truthing of the existing vegetation and habitat mapping and confirmation of the extent and condition of map units.
- Collection of BioBanking plot/transect data at five permanent locations where baseline data was collected in the GHD field surveys. Survey locations are listed in Table 21.
- Monitoring of photo points at the five permanent plot/transect locations to document the condition of habitat and the effectiveness of management actions in accordance with the methodology outlined above.
- Incidental observations of native animals.
- A summary of general observations of vegetation condition, degree of weed infestation any management issues such as erosion or dieback and any observed change since the last monitoring round across the entire site.
- Habitat assessments, focussing on the extent and quality of specific habitat resources of relevance to the affected threatened fauna, including:
  - Food tree species for the Koala.
  - Vegetation type and structure, presence and quality of woody debris, caves rock outcrops and other potential den sites for the Spotted-tailed Quoll.
  - Critical foraging habitat for the Grey-headed Flying-fox.
  - Riparian breeding habitat for the Giant Barred Frog.
- Sampling of six 'Canopy plots' nested in BioBanking plot/transects, comprising counts of every tree in the 50 m x 20 m plot along with its height, species, canopy cover and any evidence of fauna activity. Each tree species will then be cross-referenced to lists of food tree species for the Koala and Grey-headed Flying-fox to calculate the cover of food tree species.
- Six Koala 'Spot Assessment Technique' (SAT) searches for scats and evidence of Koala activity with reference to Phillips and Callaghan (2011).
- Nocturnal surveys targeting the Koala, Spotted-tailed Quoll and Grey-headed Flying-fox over two sets of four person-hour survey rounds on two separate nights, including walked spotlighting transects, quiet listening periods and call playback.
- At least four motion sensing camera traps targeting the Koala and Spotted-tailed Quoll and placed for as long as is possible, split between the main habitat types and targeting potential fauna movement corridors such as fire trails and drainage lines.
- Preparation of a 'Threatened species monitoring and management performance' report, including survey results, plot/transect data and comparisons with the baseline survey round and benchmark values, photos, assessment of vegetation condition and regeneration, assessment of the quality and extent of habitat resources, description of any observed management problems or threats and proposed remedial action as required.

8.3.4 Pest fauna control

NPWS will conduct dedicated monitoring of pest fauna populations and prepare summary reports every two years. The monitoring program will be developed in consultation with the Local Land Services control officer and include techniques such as setting of camera traps, setting up of sand pits with bait stations and free feed, predator scat analysis and coordination with ongoing control programs as appropriate. Each monitoring round will be followed by a round of pest fauna control, principally targeting wild dogs and foxes, using soft-jaw trapping and/or shooting undertaken by appropriately licensed and qualified staff where possible. Any baiting undertaken will be conducted according to best practice standards (refer to NPWS Best Practice Guidelines – fox control). If quolls are monitored near baiting sites, baiting will be ceased. Control programs will be developed in consultation with the Local Land Services wild dog officer and will be consistent with regional plans and programs.

A brief pest fauna control report will be prepared and included as an attachment to reporting requirements of the management plan for the Clybucca Historic site (see NPWS, 2007) comprising:

- Dates and locations of monitoring activities.
- Numbers and species of animals recorded during monitoring.
- Dates and locations of pest fauna control activities.
- A brief description of group control programs encompassing the site or other relevant programs coordinated by Local Land Services and related to the pest control activities on site.
- Numbers and species of animals captured or killed during pest fauna control activities.
- Incidental observations of native animals.
- A summary of general observations of pest fauna abundance and activity throughout the preceding 24 months.

Control programs will be targeted to other pest fauna (e.g. goats, pigs, rabbits) as appropriate if populations or impacts are detected during monitoring.

Table 20 Griffin offset site monitoring program

Monitoring program	Report	Dates for monitoring to be undertaken																						Timeframe
		2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038 on	
Vegetation and habitat monitoring	Annual 'Vegetation and habitat monitoring' reports																							Monitoring undertaken and reports completed annually as an attachment to the annual reporting under the management plan for the Clybucca Historic site in perpetuity.
Year 5 targeted threatened species survey																								Monitoring undertaken and one off report. Completed by end 2022.
Pest fauna control	Biennial 'Pest fauna monitoring and control' summary reports prepared by pest control contractor as appropriate.																							Biennial monitoring and pest fauna control undertaken and summary reports completed.
NPWS monitoring and auditing																								Ongoing review of annual monitoring reports, inspections, auditing and additional stewardship as required.

Table 21 Vegetation and habitat monitoring locations in the Griffin offset site

Photo point	Plot/ transect ID	NSW Vegetation Type	NSW Veg. ID	Condition	Habitat type	Notes	Eastings	Northings
6	6	Blackbutt – Turpentine - Tallowwood dry grassy open forest	NR119	Moderate/good.	Dry sclerophyll forest	Natural regeneration of native vegetation and habitat resources for the affected threatened fauna.	496939	6580750
8	8	Pink Bloodwood open forest	NR220	Moderate/good.	Dry sclerophyll forest	Natural regeneration of native vegetation and habitat resources for the affected threatened fauna.	497575	6580582
10	10	Paperbark Swamp forest	NR217	Moderate/good.	Swamp sclerophyll forest	Natural regeneration of native vegetation and habitat resources for the affected threatened fauna.	496260	6580507
12	12	Paperbark Swamp Forest regeneration	NR217	Moderate/good-poor.	Swamp sclerophyll forest	Natural regeneration of native vegetation and habitat resources for the affected threatened fauna.	496301	6580418
13	13	Wet Heathland and shrubland	NR278	Moderate/good.	Wet heathland	Natural regeneration of native vegetation and habitat resources for the Grey-headed Flying-fox and Spotted-tailed Quoll.	497042	6581271

8.4 Responsibilities

Table 22 outlines the management roles and the standard of qualifications and experience required for the parties who will be implementing the management actions at the Griffin offset site.

Table 22 Parties responsible for implementing this offset package at the Griffin offset site

Role / management actions	Responsible party	Qualifications / experience
Site manager / supervising the implementation of this offset management plan.	National Parks and Wildlife Service (NPWS) Historic Site manager.	Tertiary qualifications in environmental science, forestry or ecology / demonstrated senior professional experience in site management role.
EPBC Act offset package auditor / ensuring compliance with this offset package and the Clybucca Historic Site plan of management.	NPWS Historic Site manager.	Tertiary qualifications in environmental science, forestry or ecology / demonstrated senior professional experience in site management role.
Ecologist / Annual vegetation and habitat monitoring until 2036	NPWS ecologist.	Tertiary qualifications in environmental science or ecology / demonstrated professional experience in ecological survey and assessment.
Ecologist / targeted threatened species survey in year five.	NPWS ecologist or consultant ecologist engaged by NPWS.	Tertiary qualifications in environmental science or ecology / demonstrated professional experience in ecological survey and assessment.
Site maintenance contractor / installation and maintenance of fences, signs and tracks. Fence strand and rubbish removal as required.	Appropriately qualified and experienced contractors engaged by NPWS.	Trade qualifications appropriate to the individual task / demonstrated professional experience in the individual task.
Bush regenerator / Treatment of mapped weed infestations, ongoing broad scale weed monitoring and bush regeneration.	Appropriately qualified and experienced NPWS personnel or bush regeneration contractors engaged by NPWS.	Certificate III Conservation & Land Management (or interstate equivalent) / minimum one year full-time equivalent experience as a bush regenerator.
Pest fauna controller / pest fauna monitoring, control and reporting.	Appropriately qualified and experienced contractor engaged by NPWS. Control programs to be developed in consultation with the Local Land Services wild dog officer and to be consistent with regional plans and programs	Endorsement of Local Land Services wild dog officer / demonstrated professional experience.

9. Management of the Boambee SF offset site

9.1 Management plan

9.2 Conservation mechanism and funding arrangements

A secure conservation mechanism is necessary to ensure that offset sites are protected in perpetuity and to support the 'averted risk' of the offset assessment guide. The Boambee SF offset site will remain in the State forest estate and will be secured as a Flora Reserve and managed for conservation by FCNSW. The portion of the State forest within the Boambee SF offset site will be set aside as a Flora Reserve under the Forestry Act 2012 (Forestry Act). The land that is dedicated as a Flora Reserve will not be limited so as to exclude any land lying below the surface of the land pursuant to Section 16 (2) of the Forestry Act (i.e. mining will be prohibited within or below the Flora Reserve). Subject to the Forestry Act, a Flora Reserve cannot be revoked wholly or in part otherwise than by Act of Parliament. The NSW OEH recognises that Flora Reserves offer a similar level of security and protection to biodiversity as National Parks and Nature Reserves (OEH, 2011).

Conservation as a Flora Reserve meets the Commonwealth standards for inclusion within the National Reserve System which state that a reserve must be:

- Statutorily defined and resourced.
- Reserved in perpetuity.
- And that any change in management status must have Ministerial or statutory approval (NRMMC, 2010).
- A fundamental requirement of any area's eligibility for inclusion within the National Reserve System is that it must meet the IUCN definition of a 'protected area' A clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values' (NRMMC, 2010). Conservation as a Flora Reserve through Section 16 of the Forestry Act meets the definition of 'Legal means': Land is brought under control of an Act of Parliament, specialising in land conservation practices, and requires a Parliamentary process to extinguish the protected area or excise portions from it (NRMMC 2010).

The Forestry Act requires the preparation of working plans for each Flora Reserve that specifies the operations to be carried out in or in relation to the Flora Reserve with the objective of the plan the preservation of native flora. The working plan will exclude activities such as timber harvesting, grazing and apiary that are inconsistent with the preservation of native flora and specify management measures such as weed management, fire management, track maintenance and erosion control.

Roads and Maritime will make an appropriate financial contribution to FCNSW to compensate for the loss of access to the timber resource and other economic potential within the Flora Reserve and to ensure that funds are available to manage the Flora Reserve for conservation.

Roads and Maritime and FCNSW are in the process of applying this approach to the 'Cairncross offset site' within Cairncross SF which has been set aside as an offset for impacts on threatened flora arising from the Oxley Highway to Kempsey stage of the Pacific Highway upgrade.

9.2.1 Management strategies

The following broad management strategies and related actions at the Boambee SF offset site will improve the value and extent of habitat for the affected threatened fauna:

- Exclusion of timber harvesting.
- Property maintenance, through:
  - Establishment and maintenance of appropriate fences, gates and signs.
  - Removal of rubbish.
  - Maintenance of tracks.
- Conservation and improvement of habitat, through:
  - Facilitated improvement in the condition of native vegetation.
  - Natural regeneration of cleared or degraded land.
  - Weed control.
  - Exclusion of domestic grazing and management of human disturbance.
  - Retention of dead timber, rocks and other habitat resources.
- Fire management.
- Pest fauna control.

An overview of these management strategies and how they relate to the site and to populations of the affected threatened fauna is provided below. The following sections provide specific detail of the management actions that will be performed, including a plan for their delivery, a works program and the minimum standards and objectives that will be achieved. Property management actions are illustrated on Figure 16.

The management strategies and actions will be implemented across the entire Boambee SF offset site under a coordinated working plan for the Flora Reserve prepared by FCNSW in accordance with this offset package, the GHD (in 2016 b) Pacific Highway Upgrade, Nambucca Heads to Urunga Threatened Flora Offset Management Plan and any other relevant plans. The implementation of management strategies and actions in accordance with the working plan will be funded by Roads and Maritime with costs allocated to the offset area for individual projects.

Exclusion of timber harvesting and other harmful activities

The majority of the Boambee SF offset site is currently within Forest Management Zone 4 (FMZ 4) 'General Management' and is available for timber harvesting and other activities that are likely to harm the affected threatened fauna and/or reduce the quality of habitat. The offset site will be changed to FMZ 1 'Special Protection' and protected as a Flora Reserve. Activities that are not permitted in a Flora Reserve include timber harvesting, removal of forest products and materials and grazing by domestic stock (State Forests NSW 2000). This Titling mechanism is a similar level of security to conservation in the National Parks Estate and is highly unlikely to be ever overturned to permit timber harvesting or other damaging activities. This scenario supports the 'risk of loss' calculations that are included in the Offset assessment guide calculations.

Exclusion of grazing, timber harvesting and unauthorised access will avoid direct impacts such as removal or degradation of habitat and vehicle strike of threatened fauna. Exclusion of harmful activities will also help avert secondary impacts such as erosion and sedimentation and introduction or spread of disease. Timber harvesting would involve broad scale disturbance of soil and vegetation and movement of vehicles and equipment throughout patches of habitat and will comprise a significant vector for transmission of disease. Under the proposed management of the site there will be minimal disturbance of soil or vegetation, vehicles will be restricted to

tracks and there will be only occasional foot traffic through patches of habitat. This will substantially reduce the risk of erosion, sedimentation or transmission of disease.

The proposed Flora Reserve includes 50.3 hectares of habitat for the Koala and 59.8 hectares of habitat for the Grey-headed Flying-fox and Spotted-tailed Quoll in the NH2U Boambee SF offset area that have been included in Offset assessment guide calculations in this offset package. Conservation and management of the Flora Reserve will improve the quality of habitat for the affected threatened fauna.

Property maintenance

The NH2U Boambee State forest offset area is currently a State forest, managed for timber production and comprises remnant and regenerating native vegetation with small areas of cleared or degraded land. The entire site will be maintained as native vegetation. Infrastructure such as signs and access tracks will be maintained to support these land uses as shown on Figure 16. This infrastructure is important to clearly define the conservation area, exclude harmful activities and facilitate efficient management.

Public access is permitted to the Boambee SF. Access from public roads is indirect and not clearly sign posted and so visitation rates are likely to be relatively low. Potential public access is unlikely to reduce the value of the site as a biodiversity offset provided that harmful activities or threats such as camping, fires, domestic animals, walking or driving off marked trails etc. are excluded. These activities are routinely prohibited in Flora Reserves (State Forests NSW 2000). There are no gates at the boundaries of the Boambee SF offset site because public access is not restricted to the State forest. Appropriate signage will help to exclude these potentially harmful activities.

The Boambee SF offset site contained small areas of dumped building refuse and other rubbish at the location shown on Figure 16. The site management budget will include funds to ensure that rubbish will be removed to avoid the risk of contamination or physical injury to plants or animals. Where woody debris is mixed with inorganic rubbish or crosses proposed access tracks or fence lines it will be moved to the nearest practical area of retained or regenerating vegetation to function as a habitat resource. Woody debris moved in this way will be moved so as to minimise disturbance of vegetation and surface soil and placed as naturally as possible (i.e. not stacked).

There is an existing network of access tracks across the site (see Figure 16). These tracks are likely to be adequate for weed management, fire management, monitoring and other activities. These tracks will be maintained in their current state as single lane, dirt or gravel tracks. Track maintenance will occur within the entire Boambee SF offset site and from the site boundary to the nearest junction with a public road.

The majority of the perimeter of the Boambee SF offset site adjoins intact native vegetation. Given the impacts associated with fence construction, the risk of injury to native fauna from fences and the surrounding land uses, no additional perimeter fence construction is proposed. The eastern and north-eastern boundaries of the NH2U Boambee SF offset area adjoin private agricultural land with livestock (see Figure 16). Annual inspection and maintenance of these fences is proposed to ensure exclusion of any neighbouring livestock. This activity will be undertaken in partnership with neighbours.

Conservation and improvement of habitat

Conservation and management of the Boambee SF offset site will improve the quality of habitat for the affected threatened flora and reduce the impact of threats.

The majority of the site contains near-intact vegetation or mature regeneration. There are small areas of cleared land associated with previous timber harvesting or cleared trail margins. Each of these areas featured natural regeneration, including the majority of canopy species, a mix of mid storey and groundcover species and overall high native species richness. This natural regeneration is likely to continue and so no supplementary planting or seed broadcasting is proposed. Natural regeneration will be facilitated through the exclusion of timber harvesting and grazing and the management of human disturbance.

Habitat resources such as dead timber, rocks, hollow-bearing trees and mature, structurally complex vegetation will be retained and will continue to develop over time.

Weed control will be an important part of conserving threatened plant habitat at the site and will comprise three main activities:

- Treatment of localised, severe noxious weed infestations, especially Lantana in the areas shown on Figure 16. This activity will be required in the first two years of the implementation of this plan in order to manage the current severe infestations currently present at the site. Additional control rounds will be performed as required to achieve performance targets.
- Broad-scale weed monitoring and bush regeneration activities throughout the entire site. This will include treatment of localised, minor infestations of weeds throughout the site This activity will be required throughout all native vegetation for a minimum of 20 years. More intensive weed management activities may be required from time to time if severe infestations are detected.
- Weed control will be conducted with reference to the locations of weed infestations shown on the property action plan (see Figure 16). Weed control will also consider the locations of threatened plants shown on Figure 4 and/or the results of the monitoring program outlined in Section 7.3. No weed spraying will be undertaken in the vicinity of identified stems of *Marsdenia longiloba* and *Tylophora woollsii* or other threatened plants or in the vicinity of aquatic habitat. Alternative weed control methods such as hand weeding or targeted herbicide application (cut and paint, stem scrape etc.) will be performed in these sensitive areas.

Fire management

Bushfire hazard reduction works may be undertaken in accordance with a Bush Fire Hazard Reduction Certificate issued under the Rural Fires Act 1997 or a notification received under that Act, or in accordance with a Bush Fire Risk Management Plan that may apply to the land. Fire management at the site will aim to maintain the ecological integrity and complexity of native ecosystems in the offset site and especially threatened plant habitat through appropriate fire regimes and ensure that assets and persons are protected from bushfire.

There will be two components of purposeful fire management at offset sites: suppression of wildfire and exclusion of fire from occupied habitat; and fuel reduction in adjoining vegetation to reduce the likelihood and intensity of accidental fire. This fire management regime will help maintain the vegetation structure and microclimate in occupied habitat (i.e. fire sensitive wet sclerophyll forest and rainforest) and reduce the risk of harm to individual plants and populations.

Pest fauna control

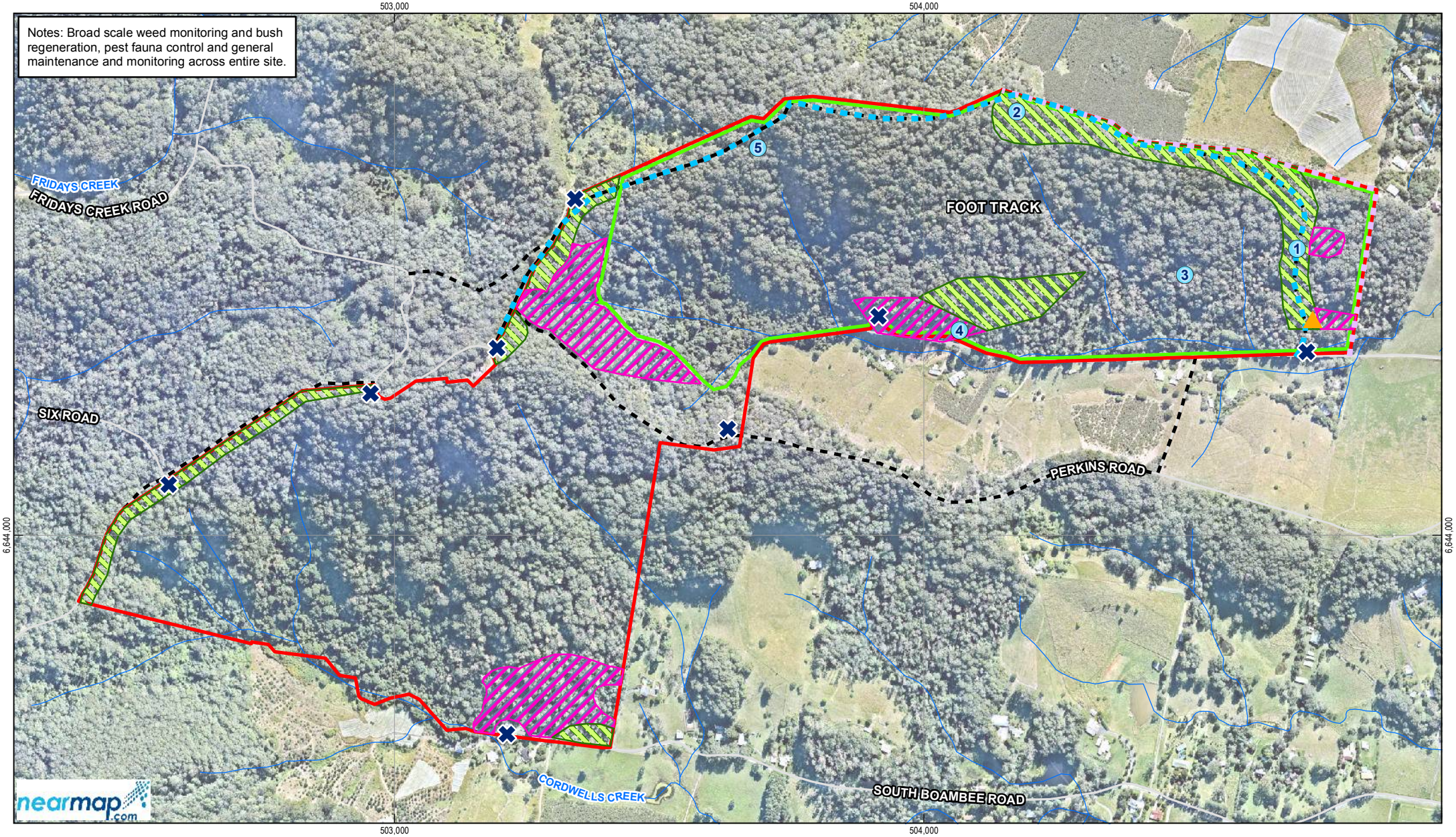
Pest fauna will be managed through a trapping and shooting program and in accordance with the NPWS North Coast Regional Pest Management Strategy: 2012-2016 (OEH, 2012). Pest fauna populations will be monitored in consultation with the Local Land Services control officer

using techniques such as setting of camera traps, setting up of sand pits with bait stations and free feed and coordination with ongoing control programs as appropriate. Pest fauna control programs will be developed in response to monitoring and in consultation with the Local Land Services and will be consistent with the regional strategy (OEH, 2012). Coordination with group control programs that include pest fauna control on the site and adjoining properties is likely to increase the effectiveness of pest fauna control (Thorman, M., local land services, pers. comm.)

Dog attacks are recognised as a significant threat to Koalas that is managed by preventing domestic dogs from roaming and control of feral dogs (KSC, 2011). Dog, fox and feral cat attack and/or competition comprise a threat to the Spotted-tailed Quoll (Long and Nelson, 2009). Direct evidence of feral dogs was observed during the field survey of the Boambee SF site and foxes and cats are also likely to occur.

Feral dogs, cats and foxes will be monitored and managed through a trapping and shooting program in consultation with the Local Land Services control officer using techniques such as setting of camera traps, setting up of sand pits with bait stations and free feed and coordination with ongoing control programs as appropriate. Pest fauna control programs will be developed in response to monitoring and in consultation with the Local Land Services wild dog officer and will be consistent with the regional strategy (OEH, 2012). Poison baiting is the least preferred control option at the Boambee SF offset site because of the risk of harm to the Spotted-tailed Quoll (Long and Nelson, 2009). Any baiting undertaken will be conducted according to best practice standards (refer to NPWS Best Practice Guidelines – fox control). If quolls are monitored near baiting sites, baiting will be ceased. Coordination with group control programs that include pest fauna control on the site and adjoining properties is likely to increase the effectiveness of pest fauna control (Thorman, M., local land services, pers. comm.). Roads and Maritime will provide funding to undertake this activity for at least 20 years.

Feral pigs and exotic herbivores such as feral cattle, deer or rabbits will be controlled as required based on the results of the biodiversity monitoring and consultation with the Local Land Services control office. No specific evidence of any of these species, or environmental degradation as a result of their presence, was noted during field surveys. Active management of these pest fauna will commence if they are recorded at the site. Control methods are likely to include: active trapping; shooting from the ground; and/or strategic baiting. As above, the type and method of baiting will need to consider the presence of native fauna and their feeding habits, especially the Spotted-tailed Quoll.



Paper Size A4

0 75 150 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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LEGEND

- Boambee SF offset site
- NH2U Boambee SF offset area
- Moderate weed infestation
- Severe Lantana infestation
- Waterways
- Four wheel drive track
- Unsealed road
- Public road
- Existing fence to be maintained
- Maintain track
- New sign
- Remove rubbish
- Photo points

Roads and Maritime Services
NH2U, Pacific Highway Upgrade
Norton and Griffin Offset Management Plan

Job Number 21-23829
Revision A
Date 27 Oct 2016

Boambee SF offset site property action plan

Figure 16

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Level 15, 133 Castlereagh Street Sydney NSW 2000 T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com.au W www.ghd.com.au

Data Source: NSW Department of Lands: Cadastre - Jan 2011; Geoscience Australia: 250k Data - Jan 2011, Aerial imagery - ESRI 2016 and Nearmap 2016 (image extracted 17/18/2016, image taken 05/05/2016).jrichardson

9.2.2 Management actions plan

Table 24 presents the specific actions required to implement the strategies described above, including specifications, standards, objectives and timeframes for delivery. Property management actions are illustrated on Figure 16. FCNSW have provided in-principle agreement for management funding, to be provided by Roads and Maritime. FCNSW will manage the NH2U Boambee SF offset area as part of a Flora Reserve within the State forest estate in line with the FMZ manual (State Forests NSW 2000) this offset package and other relevant legislative requirements.

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Table 23 Boambee SF offset site management actions plan

	Activity	Quantity	Activity details	Performance target	Corrective actions	Timeframe
1	Sign installation and maintenance	Signs as shown on Figure 16.	Installation, monitoring, repair and maintenance of the signs shown on Figure 16 to prevent unauthorised public access. Signs to be clear and legible. Signs must be permanent and clearly identify the name of the site, that it is a Flora reserve, that unauthorised public access is prohibited, that rubbish dumping and domestic animal access is prohibited and that activities like weed spraying, baiting or shooting may occur on site.	Signs to be legible. Exclusion of unauthorised public access and damaging activities.	Maintenance and/or replacement of signs.	Installation by mid 2017. Maintenance ongoing as required.
2	Maintenance of fences	Fence lines shown on Figure 17.	Annual (as a minimum) dedicated monitoring and routine inspection of perimeter fences, gates and signs to prevent public or stock access. Repair and maintenance as required to correct issues identified during monitoring. To be done in partnership with neighbours.	Fences to be fully functional. Exclusion of livestock.	Maintenance and/or replacement of fence lines. To be done in partnership with neighbours.	Annual dedicated monitoring and routine inspection during other activities. Maintenance ongoing as required.

	Activity	Quantity	Activity details	Performance target	Corrective actions	Timeframe
3	Rubbish removal	At the locations shown on Figure 16. Entire site as required	Rubbish at the location shown on Figure 16 to be characterised by an appropriately qualified specialist and a safe and sustainable plan for its removal prepared. The removal plan is to include due consideration of any hazardous materials (e.g. asbestos sheeting). Identify dumping hotspots. Install signs. Use cameras to identify and prosecute offenders. Remove illegally dumped materials using staff and/or specialised contractors during Clean-up Australia Day if appropriate.	Safe and sustainable removal of all rubbish at the location shown on Figure 16, any unexpected finds and any illegally dumped materials.	Characterisation and removal of rubbish as required.	Completion of removal of rubbish shown on Figure 5 by June 30 2017. Bi-annual monitoring, annual clean-up Australia day. As required for identified hazardous materials.
4	Track upgrade and maintenance	Tracks shown on Figure 17	All tracks shown on Figure 16 to be maintained if deemed necessary for management purposes such as fire management. Roads not required are to be closed. Roads are to be maintained to FCNSW Fire management standards as single-lane, gravel or dirt tracks along with appropriate surface water and sediment controls where required.	Maintenance of access for management and fire control activities.	Quarterly monitoring. Entire perimeter and strategic internal trails open and ready prior to each fire season.	At least annually, prior to each fire season. Additional maintenance as required to achieve performance targets.
5	Treatment of noxious weeds	Moderate and severe infestations shown on Figure 17	Treatment of noxious weeds is to be undertaken in accordance with the regional and forest management strategies. No weed spraying undertaken in the vicinity (5 m radius) of identified stems of *Marsdenia longiloba* and *Tylophora woollsii.*	Eradication of noxious weeds and control of environmental weeds in the areas indicated on Figure 16.	Additional control rounds as required to achieve performance targets.	Two control rounds, in spring or autumn, completed by end 2018. Additional control rounds as required to achieve performance targets.

	Activity	Quantity	Activity details	Performance target	Corrective actions	Timeframe
6	Broad scale weed monitoring and bush regeneration	Entire site	Monitoring of native vegetation throughout the offset site. Treatment of noxious and environmental weeds is to be undertaken in accordance with the regional and park management pest management strategies. No weed spraying undertaken in the vicinity of identified stems of *Marsdenia longiloba* and *Tylophora woollsii*. Weed management activities are to be undertaken by suitably qualified operators. Operators are to provide report of works undertaken, which includes mapping of area treated, primary species treated and photo monitoring points.	FCNSW is expected to make a reasonable effort to eradicate noxious weeds and control environmental weeds in the site Control of noxious and environment weeds in the biobank sites specifically comprising: • No dense infestations of any weed species present. • No mature or seeding woody weed species present. • No weeds to be touching or overshadowing threatened plants. • Removed weed cover is being replaced by regenerating native plants species derived from the surrounding vegetation types, including recruitment of a range of understorey, mid-storey and canopy species.	Additional control rounds as required to achieve performance targets.	Once yearly (spring), for a minimum of 20 years.

	Activity	Quantity	Activity details	Performance target	Corrective actions	Timeframe
7	Pest fauna control	Entire site	Ongoing evaluation of pest herbivore populations (e.g. goats, pigs, rabbits) in consultation with the Local land services control officer and including techniques such as setting of camera traps, setting up of sand pits with bait stations and free feed and coordination with ongoing control programs as appropriate. Pest fauna control at least every two years undertaken by appropriately licensed and qualified staff where possible. Control programs to be developed in consultation with the Local Land Services officer and to be consistent with regional plans and programs. Ongoing evaluation of pest carnivore populations in consultation with the Local land services control officer and including techniques such as setting of camera traps, setting up of sand pits with bait stations and free feed and coordination with ongoing control programs as appropriate. Pest fauna control at least every two years, principally targeting wild dogs and foxes, using soft-jaw trapping undertaken by appropriately licensed and qualified staff where possible. Any baiting undertaken will be conducted according to best practice standards (refer to NPWS Best Practice Guidelines – fox control). If quolls are monitored near baiting sites, baiting will be ceased. Control programs to be developed in consultation with the Local Land Services wild dog officer and to be consistent with regional plans and programs.	FCNSW must make a reasonable effort to control pest fauna in the Flora Reserve. Pest fauna numbers to be kept below baseline levels. Monitoring and the level of local activity (presence of neighbourhood baiting programs etc.) will help inform the level of effort necessary. FCNSW must monitor the site at least once every two years. Group control programs to be coordinated with adjoining properties	Pest control and monitoring to be reviewed annually. Adjustments implemented and documented.	Monitoring, followed by a pest fauna control round, at least once every two years or as required, for a minimum of 20 years.

	Activity	Quantity	Activity details	Performance target	Corrective actions	Timeframe
8	Wildfire suppression	1-2 per annum (on average)	Suppress wildfires as necessary quickly and efficiently.	Fires kept small and/or cool. Fire not allowed to spread into occupied threatened plant habitat or from State forest to other tenure, where possible.	Review fuel management strategy if frequency or intensity of wildfires increases.	Ongoing as required.
9	Fuel management	Entire site. Coordinated with management programs in surrounding State forests	Identification of fuel management strategies including formal lodgement of Asset Protection Zones and Strategic Fire Advantage Zones (APZ/SFAZ) with the regional Bush Fire Management Committee	Formal lodgement of FCNSW strategies into the regional Bush Fire Risk Management Plan.	Fuel management activities to be reviewed annually. Adjustments implemented and documented.	Ongoing as specified in the regional Bush Fire Risk Management Plan
10	General conservation, maintenance and monitoring.	Entire site	Facilitate and monitor natural regeneration and development of habitat resources in accordance with the monitoring program (see Section 9.3). Identify and monitor threats and impacts to biodiversity values (e.g. wildfire, erosion, harmful activities on adjoining properties) and undertake appropriate corrective actions.	FCNSW must comply with their management plan and provide monitoring results for: - vegetation and habitat condition - weed control - pest fauna control - any identified threats and impacts to biodiversity values that are not covered in this plan and appropriate corrective actions - any specific management actions for the reporting year.	Management activities and monitoring results to be reviewed annually. Adjustments implemented and documented.	Yearly monitoring report for a minimum of 20 years.

	Activity	Quantity	Activity details	Performance target	Corrective actions	Timeframe
11	Exclusion of timber harvesting and harmful activities	Entire site. Coordinated with harvest planning and management programs in surrounding State forest.	Exclude activities that will result in impacts on habitat for the affected threatened flora, including timber harvesting, vehicle based camping, domestic animal access, apiary or uncontrolled public access. Clear delineation of the Flora Reserve via signs and mapping. Consideration in harvest planning and management programs in surrounding State forest. Monitoring by FCNSW staff during all operations in the broader Boambee SF.	Exclusion of all timber harvesting, grazing and other harmful activities.	Immediate halting of timber harvesting, grazing or any other harmful activities if detected in the Flora Reserve.	Ongoing, in perpetuity.

9.2.3 Management actions program

Table 24 Boambee SF offset site management actions program

Activity	Works timing (periods for actions to be completed by FCNSW)												Timeframe
	2017				2018				Ongoing				
	Jan-Mar	Apr-Jun	July-Sep	Oct-Dec	Jan-Mar	Apr-Jun	July-Sep	Oct-Dec	Jan-Mar	Apr-Jun	July-Sep	Oct-Dec	
Gate and sign installation													Ongoing as required.
Rubbish removal													Completion of removal of rubbish shown on Figure 5 by June 30 2017. Ongoing as required.
Track maintenance													Ongoing as required.
Treatment of noxious weeds													Two control rounds, in spring or autumn, completion by end 2018
Broad scale weed monitoring and bush regeneration													Once yearly in spring, for a minimum of 20 years.
Pest fauna control													Monitoring and pest fauna control rounds two-yearly or as required for a minimum of 20 years.
General conservation, maintenance and monitoring													Yearly monitoring reports for a minimum of 20 years.

9.3 Monitoring program

9.3.1 Overview

The FCNSW will monitor biodiversity values at the Boambee SF offset site as part of their management of the State forest. Monitoring will include an annual assessment of the general extent and quality of habitat for the affected threatened flora and the effectiveness of management actions for a minimum of 20 years. The following monitoring programs and reports will apply to the Offset site:

- Vegetation and habitat monitoring, comprising a monitoring program to be completed by the FCNSW annually, for a minimum of 20 years and including preparation of annual overviews of the condition of vegetation and habitat.
- A targeted threatened species survey at year five to further confirm the presence and condition of occupied habitat for the affected threatened fauna.
- Pest fauna control monitoring, involving documenting of control activities for a minimum of 20 years.

These monitoring programs and reports are described below.

Table 25 Boambee SF offset site monitoring program

Monitoring program	Report	Dates for monitoring to be undertaken																					Timeframe
		2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038 on	
Vegetation and habitat monitoring	'Vegetation and habitat monitoring' reports prepared by a qualified ecologist																							Annual monitoring and summary reports, until 2037
Year 5 targeted threatened species survey	'Threatened species monitoring and management performance' report																							One off report. Completed by end 2022
Pest fauna control	Biennial 'Pest fauna monitoring and control' summary reports prepared by pest control contractor as appropriate.																							Biennial monitoring and summary reports, until at least 2036.
FCNSW monitoring and auditing	As per the Flora Reserve working plan																							Ongoing review of Flora reserve monitoring reports, inspections, auditing and additional stewardship as required.

9.3.2 Vegetation and habitat

FCNSW will monitor biodiversity values at the NH2U Boambee SF offset area as part of their management of the Flora Reserve. A vegetation and habitat monitoring program will be completed by FCNSW annually, for a minimum of 20 years. A vegetation and habitat condition report will be prepared annually.

The annual monitoring of vegetation and habitat condition by the FCNSW will comprise:

- Monitoring of the five photo points to record the condition of habitat and the effectiveness of management actions. Photo point locations have been way pointed using a GPS and marked with star pickets to facilitate locating during subsequent monitoring events and consistent photo capture (see Table 26). A photo will be taken and notes taken on general vegetation condition, extent of weed infestation, ground cover, any management issues such as erosion or dieback, disturbance by pest fauna and any observed change since the last monitoring round.
- General observations of vegetation condition, degree of weed infestation, any management issues such as erosion or dieback and any observed change since the last monitoring round across the entire site.
- Description of any observed management problems or threats and proposed remedial action as required.
- Preparation of 'Vegetation and habitat monitoring' reports, including photo point data and comparisons with previous survey rounds and benchmark values, photos, assessment of vegetation condition and regeneration, assessment of the quality and extent of habitat resources, description of any observed management problems or threats and proposed remedial action as required.

9.3.3 Targeted threatened species survey

A targeted threatened species survey of the NH2U Boambee SF offset area will be conducted five years after the offset site is formally established to further confirm the presence and condition of occupied habitat for the affected threatened fauna, the link between the proposed management actions and habitat quality and the security of threatened species. Five years is the 'Offset calculator – Time horizon – Time until ecological benefit' value that was entered in the Offset assessment guide calculations and so this is the critical period after which it is necessary to confirm that the biodiversity offset has been delivered as planned.

The targeted threatened species survey will comprise the following techniques:

- The year five 'vegetation and habitat monitoring' survey described above.
- Collection of BioBanking plot/transect data at five permanent locations where baseline data was collected in the GHD field surveys. Survey locations are listed in Table 26.
- Habitat assessments, focussing on the extent and quality of specific habitat resources of relevance to the affected threatened fauna, including:
  - Food tree species for the Koala.
  - Vegetation type and structure, presence and quality of woody debris, caves rock outcrops and other potential den sites for the Spotted-tailed Quoll.
  - Critical foraging habitat for the Grey-headed Flying-fox.
- Sampling of five 'Canopy plots' nested in five BioBanking plot/transects, comprising counts of every tree in the 50 m x 20 m plot along with its height, species, canopy cover and any evidence of fauna activity. Each tree species will then be cross referenced to lists

of food tree species for the Koala and Grey-headed Flying-fox to calculate the cover of food tree species.

- Koala SAT searches for scats and evidence of Koala activity with reference to Phillips and Callaghan (2011).
- Nocturnal surveys targeting the Koala, Spotted-tailed Quoll and Grey-headed Flying-fox over two sets of four person-hour survey rounds on two separate nights, including walked spotlighting transects, quiet listening periods and call playback.
- At least four motion sensing camera traps targeting the Koala and Spotted-tailed Quoll and placed for as long as is possible, split between the main habitat types and targeting potential fauna movement corridors such as fire trails and drainage lines.
- Preparation of a 'Threatened species monitoring and management performance' report, including survey results, plot/transect data and comparisons with the baseline survey round and benchmark values, photos, assessment of vegetation condition and regeneration, assessment of the quality and extent of habitat resources, description of any observed management problems or threats and proposed remedial action as required.

9.3.4 Pest fauna control

FCNSW will conduct dedicated monitoring of pest fauna populations and prepare summary reports every two years. The monitoring program will be developed in consultation with the Local Land Services control officer and include techniques such as setting of camera traps, setting up of sand pits with bait stations and free feed and coordination with ongoing control programs as appropriate. Each monitoring round will be followed by a round of pest fauna control undertaken by appropriately licensed and qualified staff where possible. Any baiting undertaken will be conducted according to best practice standards. Control programs will be developed in consultation with the Local Land Services officer and will be consistent with regional plans and programs.

The monitoring program will be developed in consultation with the Local Land Services control officer and include techniques such as setting of camera traps, setting up of sand pits with bait stations and free feed, predator scat analysis and coordination with ongoing control programs as appropriate. Each monitoring round will be followed by a round of pest fauna control using soft-jaw trapping and/or shooting undertaken by appropriately licensed and qualified staff where possible. Any baiting undertaken will be conducted according to best practice standards (refer to NPWS Best Practice Guidelines – fox control). If quolls are identified near baiting sites, baiting will be ceased. Control programs will be developed in consultation with the Local Land Services wild dog officer and will be consistent with regional plans and programs.

A brief pest fauna control report will be prepared following each monitoring round comprising:

- Dates and locations of monitoring activities.
- Numbers and species of animals recorded during monitoring.
- Dates and locations of pest fauna control activities.
- A brief description of group control programs encompassing the site or other relevant programs coordinated by Local Land Services and related to the pest control activities on site.
- Numbers and species of animals captured or killed during pest fauna control activities.
- Incidental observations of native animals.

- A summary of general observations of pest fauna abundance and activity throughout the preceding 24 months.

Table 26 Vegetation and habitat monitoring locations in the NH2U Boambee SF offset area

Photo point	Plot/ transect ID	NSW Vegetation Type	NSW Veg. ID	Condition	Habitat type	Notes	Eastings	Northings
1	1	Hinterland and Escarpment Tallowwood - Blackbutt - Blue Gum Wet Ferny Forest	NR120	Moderate/good	Wet sclerophyll forest	Moderate weed infestation.	504705	6644542
3	3	Coast and Hinterland Riparian Flooded Gum Bangalow Wet Forest	NR159	Moderate/good	Wet sclerophyll forest	Localised, slight Lantana infestation.	504493	6644492
2	2	Northern Escarpment Blackbutt - Apple Wet Ferny Forest	NR120	Moderate/good	Wet sclerophyll forest	Abundant Koala food trees.	504176	6644800
4	4	Foothills Grey Gum - Ironbark - Mahogany Dry Forest	NR263	Moderate/good - poor	Wet sclerophyll forest	Severe weed infestation.	504067	6644387
5	5	Northern Escarpment Blackbutt - Apple Wet Ferny Forest	NR120	Moderate/good	Wet sclerophyll forest	Localised, slight weed infestation.	503687	6644732

9.4 Responsibilities

Table 27 outlines the management roles and the standard of qualifications and experience required for the parties who will be implementing the management actions at the Boambee SF offset site in accordance with Condition f) viii. for the Project.

Table 27 Parties responsible for implementing this offset package at the Boambee SF offset site

Role / management actions	Responsible party	Qualifications / experience
Site manager / supervising the implementation of this offset package and the MAP.	Forestry Corporation NSW (FCNSW) Flora reserve manager.	Tertiary qualifications in environmental science, forestry or ecology / demonstrated senior professional experience in site management role.
EPBC Act offset package auditor / ensuring compliance with this offset package and the Flora reserve plan of management.	FCNSW Flora reserve manager.	Tertiary qualifications in environmental science, forestry or ecology / demonstrated senior professional experience in site management role.
Ecologist / Annual vegetation and habitat monitoring until 2036	FCNSW ecologist.	Tertiary qualifications in environmental science or ecology / demonstrated professional experience in ecological survey and assessment.
Botanist / threatened flora population monitoring	FCNSW botanist or consultant botanist engaged by FCNSW.	Tertiary qualifications in botany or ecology / demonstrated professional experience in botanical survey and assessment including experience with the affected threatened plants.
Ecologist / targeted threatened species survey in year five.	FCNSW ecologist or consultant ecologist engaged by FCNSW.	Tertiary qualifications in environmental science or ecology / demonstrated professional experience in ecological survey and assessment.
Site maintenance contractor / installation and maintenance of fences, signs and tracks. Fence strand and rubbish removal as required.	Appropriately qualified and experienced contractors engaged by FCNSW.	Trade qualifications appropriate to the individual task / demonstrated professional experience in the individual task.
Bush regenerator / Treatment of mapped weed infestations, ongoing broad scale weed monitoring and bush regeneration. Targeted treatment of weeds in the vicinity of populations of the affected threatened flora in consultation with the botanist.	Appropriately qualified and experienced FCNSW personnel or bush regeneration contractors engaged by FCNSW.	Certificate III Conservation & Land Management (or interstate equivalent) / minimum one year full-time equivalent experience as a bush regenerator.

Role / management actions	Responsible party	Qualifications / experience
Pest fauna controller / pest fauna monitoring, control and reporting.	Appropriately qualified and experienced contractor engaged by FCNSW. Control programs to be developed in consultation with the Local Land Services wild dog officer and to be consistent with regional plans and programs	Endorsement of Local Land Services wild dog officer / demonstrated professional experience.

10. Management of the xxxxx offset site

10.1 Conservation mechanism and funding arrangements

The xxxxx offset site will be conserved under three BioBanking agreements under the TSC Act. Further information about BioBanking is provided in Section 7.1.

A BioBanking agreement is the strongest covenant available on private land in NSW and extinguishes all land uses other than conservation unless the BioBanking agreement is varied or terminated by the NSW Minister for the Environment to permit alternative uses. Certain mining rights may be granted over a biobank site, and certain development can be carried out by public authorities on a biobank site, but any impacts from these activities must be offset again as an addition to any offsetting activities required by a given project in its own right. Therefore, the risk of loss of the offset sites with the BioBanking agreement in place has been assessed as 3 per cent for the purposes of the offset assessment guide calculations.

The biobanks that will be established at the xxxxx offset site will include additional land outside the 'NH2U xxxxx offset area' shown on Figure 11. Roads and Maritime will purchase and retire the biodiversity credits associated with the 'NH2U xxxxx offset area' to ensure that this land is secured for conservation and the offset area will not be used to compensate for the impacts of another development.

10.2 Management plan

10.2.1 Management strategies

The following broad management strategies and related actions at the xxxxx offset site will improve the value and extent of habitat for the affected threatened fauna:

- Exclusion of domestic grazing and management of human disturbance.
- Property maintenance, through:
  - Establishment and maintenance of appropriate fences, gates and signs.
  - Removal of rubbish.
  - Maintenance of tracks.
  - Maintenance of easements.
- Conservation and improvement of habitat, through:
  - Bush regeneration and facilitated improvement in the condition of native vegetation.
  - Natural regeneration of cleared or degraded land.
  - Weed control.
  - Retention of dead timber, rocks and other habitat resources.
- Fire management.
- Pest fauna control.

An overview of these management strategies and how they relate to the site and to the population of the affected threatened fauna is provided below. The following sections provide specific detail of the management actions that will be performed including a plan for their delivery, a works program and the minimum standards and objectives that will be achieved. Property management actions are illustrated on Figure 17.

The management strategies and actions will be implemented across the xxxxx biobanks under overarching MAPs prepared in accordance with the BioBanking assessment methodology, this NGOMP and any other relevant plans. The implementation of management strategies and actions in accordance with the MAPs for the biobanks will be funded by Roads and Maritime through the purchase of biodiversity credits.

Exclusion of grazing and other harmful activities

The xxxxx offset site is currently a rural residential landholding and is available for grazing, timber harvesting and other activities that are likely to harm the local population of the affected threatened fauna and/or reduce the quality of habitat. Permitted activities include clearing of vegetation for more intensive agricultural activities such as blueberry cultivation that would be economic and have been considered by the landowner (xxxxx. pers. comm.). These activities will not be permitted in the xxxxx biobank sites. The BioBanking agreements are highly unlikely to be ever overturned to permit grazing, clearing of vegetation for blueberry cultivation or other damaging activities. This scenario supports the 'risk of loss' calculations that are included in the Offset assessment guide calculations.

Exclusion of grazing, timber harvesting and unauthorised access will avoid direct impacts such as removal or degradation of habitat and vehicle strike of threatened fauna. Exclusion of harmful activities will also help avert secondary impacts such as erosion and sedimentation and introduction or spread of disease. Grazing results in disturbance of soil and vegetation and movement of vehicles and livestock throughout patches of habitat and would comprise a significant vector for transmission of disease. Under the proposed management of the site there will be minimal disturbance of soil or vegetation, stock will be excluded from the biobank, vehicles will be restricted to tracks and there will be occasional foot traffic through patches of habitat. This will substantially reduce the risk of erosion, sedimentation or transmission of disease.

The NH2U xxxxx offset area within the proposed biobanks includes 87.2 hectares of habitat for the affected threatened fauna that has been included in Offset assessment guide calculations in this NGOMP. Conservation and management of the biobanks will improve the quality of habitat for the affected threatened fauna.

Property maintenance

The xxxxx offset site is currently a rural residential landholding and comprises remnant and regenerating native vegetation with small areas of cleared or degraded land. The biobanks will be maintained as native vegetation. Infrastructure such as signs and access tracks will be maintained to support these land uses as shown on Figure 17. This infrastructure is important to clearly define the conservation area, exclude harmful activities and facilitate efficient management.

There is an existing network of access tracks across cleared agricultural land in the broader xxxxx property (see Figure 17). These tracks are likely to be adequate for weed management, fire management, monitoring and other activities. These tracks will be maintained in their current state as single lane, dirt or gravel tracks. Track maintenance will occur within the entire xxxxx site and from the site boundary to the nearest junction with a public road.

The majority of the perimeter of the xxxxx offset site adjoins intact native vegetation. Given the impacts associated with fence construction, the risk of injury to native fauna from fences and the surrounding land uses, no perimeter fence construction is proposed where the biobank adjoins native vegetation. Fences will be constructed and maintained where the biobank site adjoins agricultural land with livestock (see Figure 17). Annual inspection and maintenance of these

fences is proposed to ensure exclusion of any neighbouring livestock. This activity will be undertaken in partnership with neighbours.

Conservation and improvement of habitat

Conservation and management of the NH2U xxxxx offset area will improve the quality of habitat for the affected threatened fauna and reduce the impact of threats.

The majority of the xxxxx offset site, and all of the NH2U xxxxx offset area, contains near-intact vegetation or mature regeneration. There are small areas of poorer condition vegetation associated with previous clearing for agriculture (see Figure 12). Natural regeneration in these areas will be facilitated through the exclusion of grazing and the management of human disturbance.

Habitat resources such as mature food trees, structurally complex vegetation, hollow bearing trees and woody debris will be retained and will continue to develop over time.

Weed control will be an important part of conserving habitat at the site and will comprise two main activities:

- Treatment of localised, severe noxious weed infestations, especially Lantana in the areas shown on Figure 17. This activity will be required in the first ten years of the implementation of this plan in order to manage the current severe infestations currently present at the site. Additional control rounds will be performed as required to achieve performance targets.
- Broad-scale weed monitoring and bush regeneration activities throughout the entire site. This will include treatment of localised, minor infestations of weeds throughout the site This activity will be required throughout all native vegetation and will be funded in-perpetuity. More intensive weed management activities may be required from time to time if severe infestations are detected.

Weed control will be conducted with reference to the locations of weed infestations shown on the property action plan (see Figure 17). Additional detail will be included in the MAPs for the biobank site. No weed spraying will be undertaken in the vicinity of aquatic habitat. Alternative weed control methods such as hand weeding or targeted herbicide application (cut and paint, stem scrape etc.) will be performed in these sensitive areas.

Fire management

The biobank site owners will actively manage fire at the xxxxx offset site to help maintain the structure and function of ecological communities. Ecological fire management will be coordinated with hazard reduction activities in accordance with the fire management plan included in Section 3 of the MAPs for the biobanks when they are prepared. These MAPs will have a similar structure and requirements as the Norton offset site MAP included as Appendix E of this offset package.

MAPs will be prepared for the three biobank sites that comprise the xxxxx offset site. The biobank sites will be split into fire management zones according to vegetation types and the locations of tracks and other firebreaks. The landowner will meet the ecological fire requirements of vegetation at the site by maintaining a fire interval appropriate to the vegetation within each management zone and avoiding successive fires of intensity sufficient to scorch or consume dominant tree crown. In accordance with the MAPs the landowner will:

- Carry out ecological burns for each management zone according to the method and frequency described in the ‘Fire requirements for vegetation types and threatened species’ table;

- Carry out the actions listed in the ‘Ecological burning actions table’ and the ‘Other fire management activities’ table.
- Undertake monitoring and inspections in accordance with the ‘Fire management monitoring’ table.
- Ecological burns and bushfire hazard reduction works will be undertaken in accordance with a Bush Fire Hazard Reduction Certificate issued under the Rural Fires Act or a notification received under that Act, or in accordance with a Bush Fire Risk Management Plan that may apply to the land.

Pest fauna control

Pest fauna populations will be managed through a trapping, shooting and baiting program and in accordance with the NPWS North Coast Regional Pest Management Strategy: 2012-2016 (OEH, 2012). Pest fauna control programs will be developed in response to monitoring and in consultation with the Local Land Services and will be consistent with the regional strategy (OEH, 2012). Coordination with group control programs that include pest fauna control on the site and adjoining properties is likely to increase the effectiveness of pest fauna control (Thorman, M., local land services, pers. comm.).

Dog, fox and feral cat attack and/or competition comprise a threat to the Koala, Spotted-tailed Quoll and many other native fauna species. Control of these exotic predators will be part of the management of the xxxxx offset site in order to benefit these threatened species and their habitats.

Feral pigs and other large exotic herbivores such as feral cattle, deer or goats will be controlled as required based on the results of the biodiversity monitoring and consultation with the Local Land Services control office. No specific evidence of any of these species, or environmental degradation as a result of their presence, was noted during field surveys. Active management of these pest fauna will commence if they are recorded at the site. Control methods are likely to include: active trapping; shooting from the ground; and/or strategic baiting. The type and method of baiting will need to consider the presence of native fauna and their feeding habits, especially the Spotted-tailed Quoll.

10.2.2 Relationship with other documents

The xxxxx property will be managed in accordance with the following documents prepared in conjunction with the OEH:

- Three in perpetuity BioBanking agreements (one for each of the lots that make up the offset site because each has a separate owner) registered on the title of the property and tailored to suit the site.
- Three MAPs which will be prepared with reference to this NGOMP, and which will set out the management strategies that must be applied at the site to manage the property in accordance with the BioBanking agreements.

It is recommended that weed and pest fauna control is conducted with reference to the NPWS North Coast Regional Pest Management Strategy (OEH, 2012).

Figure 17 xxxxx offset site property action plan (figure removed to protect privacy).

10.2.3 Management actions plan

Table 28 presents the specific actions required to implement the strategies described above, including specifications, standards, objectives and timeframes for delivery. The landowner will be responsible for implementing these actions in accordance with the MAP and this biodiversity offset package. OEH will be responsible for monitoring performance against the MAP. Property management actions are illustrated on Figure 17. Roads and Maritime are developing standard funding rates for management activities as part of the framework for delivering the Pacific Highway Biodiversity Offsets Covenant Program. Rates will be based on known vegetation types, topography and ground conditions and provide for costs based on the scale of the works proposed. Payments will be spread over a twenty-year period. After the works program is completed, and all payments made, landowners will be required to continue to manage the land in line with their BioBanking agreement and MAP and other relevant legislative requirements.

Table 28 xxxxx offset site management actions plan

Activity number	Activity	Quantity	Activity details	Performance target	Corrective actions	Timeframe
1	Gate and sign installation and maintenance	Signs and gates as shown on Figure 17.	Installation of gates and signs at the locations shown on Figure 17. Gates must be stock proof, lockable, considered permanent, and all materials used new or 'as new'. 10 metre wide fences in accordance with activity 1, or alternative vehicle barriers, are to be installed on either side of gates where no perimeter fence is present. Signs will clearly identify that the property is subject to a conservation covenant.	Permanent gates and signs on all entry points to the site. Exclude unauthorised access to the site and harmful activities. Signs to be clear and legible. Fences and gates to be fully functional.	Maintenance and/or replacement of signs.	Installation by end 2017. Maintenance ongoing as required.
2	Maintenance of fences	Fence lines shown on Figure 17.	Annual fence line inspection and maintenance to ensure exclusion of any neighbouring livestock. To be done in partnership with neighbours.	Fences to be fully functional. Exclusion of livestock.	Maintenance and/or replacement of fence lines. To be done in partnership with neighbours.	Maintenance ongoing as required.

Activity number	Activity	Quantity	Activity details	Performance target	Corrective actions	Timeframe
3	Track upgrade and maintenance	Tracks shown on Figure 17.	All tracks shown on Figure 14 to be maintained if deemed necessary for management purposes such as fire management. Roads not required are to be closed. Roads are to be maintained as single-lane, gravel or dirt tracks along with appropriate surface water and sediment controls where required.	Maintenance of access for management and fire control activities.	Quarterly monitoring. Entire perimeter and strategic internal trails open and ready prior to each fire season.	At least annually, prior to each fire season. Additional maintenance as required to achieve performance targets.
4	Treatment of Lantana infestations and woody weeds	Moderate and severe infestations shown on Figure 17. Additional scattered individuals throughout the site.	Treatment of woody weeds in accordance with best practice, including: • Manual removal in areas of Giant Barred Frog habitat and/or within 50 metres of drainage lines. • Spot spraying of isolated infestations. • Cut and paint/fill. • Drilling or frilling of Camphor Laurel and other large woody weeds. • Spot spraying of seedlings. Weed waste is to be left on site. Plants with a heavy fruit or seed load are to be piled, covered with black plastic and composted.	Control of noxious weeds and control of environmental weeds in the areas indicated on Figure 14. Weed control works will aim to achieve the following outcomes: • Lantana reduced to less than 20% of original distribution by the end of year 2. • Lantana reduced to less than 10% of original distribution by the end of year 5. • Lantana maintained at less than 10% of original distribution from year 6. • No mature Camphor Laurel or other large woody weeds from year 2.	Additional control rounds as required to achieve performance targets.	Lantana infestations: • 6 sessions per year during years 1* to 3. • 4 sessions per year during years 4 – 10. Scattered mature Camphor Laurel and other woody weeds: • 2 sessions per year in years 1 and 2. Additional control rounds as required to achieve performance targets. Follow up treatment and monitoring as required under activity 5 ‘broad scale weed monitoring and bush regeneration’.

Activity number	Activity	Quantity	Activity details	Performance target	Corrective actions	Timeframe
5	Broad scale weed monitoring and bush regeneration	Entire site	Monitoring of native vegetation throughout the offset site and treatment of noxious and environmental weeds in accordance with best practice. No weed spraying undertaken in areas of Giant Barred Frog habitat and/or within 50 metres of drainage lines. Bush Regeneration activities to be undertaken by suitably qualified operators. Operators to provide report of works undertaken, which includes mapping of area treated, primary species treated and photo monitoring points.	Control of noxious and environment weeds in the biobank sites specifically comprising: • No dense infestations of any weed species present. • No mature or seeding woody weed species present. • Removed weed cover is being replaced by regenerating native plants species derived from the surrounding vegetation types, including recruitment of a range of understorey, mid-storey and canopy species.	Additional control rounds as required to achieve performance targets.	Years 1* to 10, coordinated with other weed control activities. Year 11 on, follow-up weed control, 6 sessions per year in perpetuity.

Activity number	Activity	Quantity	Activity details	Performance target	Corrective actions	Timeframe
6	Pest fauna control	Entire site	Annual dedicated monitoring of pest fauna populations in consultation with the Local land services control officer and including techniques such as setting of camera traps, setting up of sand pits with bait stations and free feed and coordination with ongoing local/regional control programs as appropriate. Annual rounds of pest fauna control, principally targeting wild dogs, foxes and cats, using soft-jaw trapping and shooting undertaken by appropriately licensed and qualified staff. Control programs to be developed in consultation with the Local Land Services wild dog officer and to be consistent with regional plans and programs. Control programs to be targeted to pigs and other feral herbivores as appropriate if populations or impacts are detected during monitoring.	Pest control to be undertaken by appropriately licensed and qualified practitioners. Pest fauna numbers to be kept below baseline levels. Practitioners to provide a report of monitoring locations, presence/absence and control activities undertaken. The matters to be contained in the report are outlined in Section 8.3.5 of the offset package. Where activities are co-ordinated by landholders, landholders shall complete the landholder report in the Management Funding Contract, and include copies of any tax receipts associated with control activities.	Pest control and monitoring to be reviewed annually. Adjustments implemented and documented.	Annual monitoring; Annual pest fauna control rounds, or as required in response to monitoring or landholder observations, ongoing.

Activity number	Activity	Quantity	Activity details	Performance target	Corrective actions	Timeframe
7	Management of fire for conservation	Entire xxxxx offset site	The landowner must implement, and at all relevant times, comply with the fire management plan included in Section 3 of the MAP for the biobank. The landowner must carry out ecological burns for each management zone according to the method and frequency described in the 'Fire requirements for vegetation types and threatened species' table in Section 3 of the MAP for the biobank. The landowner must also carry out the actions listed in the 'Ecological burning actions table' and the 'Other fire management activities' table in Section 3 of the MAP for the biobank Monitoring and inspections must be carried out in accordance with the 'Fire management monitoring' table in Section 3 of the MAP for the biobank.	Meet the ecological fire requirements of vegetation at the site by maintaining a fire interval of greater than 7 years and less than 25 years. Avoid successive fires of intensity sufficient to scorch or consume dominant tree crown.	In the event that wildfires did not occur for more than 25 years on the property, a prescribed ecological burn will be conducted. Fire management activities will be documented. Prescribed burn schedules The schedule will be adjusted in the event of a wildfire or activities undertaken under the *Rural Fires Act (RFA) 1997* to ensure the minimum frequencies between ecological burns.	Inter fire interval for individual cells greater than 7 years, less than 25 years. It is anticipated the first ecological burn will occur in Year 7 (ie 2023). Burns will be conducted in April/May and/or August/ September.
8	Exclusion of grazing and harmful activities	Entire xxxxx offset site, enforced by BioBanking agreement.	Exclude activities that will result in impacts on habitat for the affected threatened species, including grazing, vehicle based camping, domestic animal access, hunting, apiary or uncontrolled public access.	Exclusion of all grazing and other harmful activities.	Immediate halting of grazing or any other harmful activities if detected in the biobank site. Clear delineation of the biobank site via signs, fences and gates.	Ongoing, in perpetuity.

Note: * - 'year one' begins in the first quarter of 2017 for the purposes of weed control and implementation of the MAP.

10.2.4 Management actions program

The xxxxx offset site was identified relatively late in the planning and delivery process for this NGOMP to address the shortfall created by the reallocation of a portion of the Norton property to the WC2NH project (see the 'WC2NH Norton offset area' on Figure 2). The xxxxx offset site will be effectively secured as a biodiversity offset for the project upon approval of this offset package in early 2017. The landowners will exclude grazing and other harmful activities from the offset site immediately. However, because of the additional time taken to complete a BioBanking assessment and obtain BioBanking agreements over the site it will not be formally secured under a conservation covenant and funded management actions will not commence until the second half of 2017.

Table 29 xxxxx offset site management actions program

Activity no.	Activity	Works timing (periods for actions to be completed by Landholder													Timeframe
		Jan-Jun 2017	July-Dec 2017	Jan-Jun 2018	July-Dec 2018	2019	2020	2021	2022	2023	2024	2025	2026	2027 –	
1	New gates and signs														Completion by December 30 2017.
2	Fence, gate and sign repair and maintenance														Completion by end 2017 when protected under a secure conservation mechanism.
3	Track upgrade and maintenance														Ongoing as required.
4	Treatment of woody weeds – Lantana infestations														6 sessions per year during years 1 to 3. 4 sessions per year during years 4 – 10.
	Scattered mature Camphor Laurel and other woody weeds														2 sessions per year in years 1 and 2.
5	Broad scale weed monitoring and bush regeneration														Coordinated with other weed control activities years 1-10. 6 sessions per year in perpetuity.

Activity no.	Activity	Works timing (periods for actions to be completed by Landholder													Timeframe
		Jan-Jun 2017	July-Dec 2017	Jan-Jun 2018	July-Dec 2018	2019	2020	2021	2022	2023	2024	2025	2026	2027 –	
6	Pest fauna control														Annual monitoring; annual pest fauna control rounds, or as required ongoing
7	Management of fire for conservation														Inter fire interval for individual cells greater than 7 years, less than 25 years. It is anticipated the first ecological burn will occur in Year 7 (ie 2023). Burns will be conducted in April/May and/or August/ September.

Note: * - 'year one' begins in the first quarter of 2017 for the purposes of weed control and implementation of the MAP.

10.3 Monitoring program

10.3.1 Overview

The following monitoring programs and reports will apply to the xxxxx offset site:

- Management actions performance monitoring, from the approval of the BioBanking agreement. Annual reports will be prepared by the landowners and submitted to OEH.
- A targeted threatened species, vegetation and habitat survey at year five to further confirm the presence and condition of habitat for the affected threatened fauna and the effectiveness of management actions.
- Pest fauna control monitoring, comprising annual monitoring of pest fauna populations and documenting of control activities from the approval of this offset package until at least 2036. Reports are to be completed by suitably qualified practitioners and maintained by the landholder.
- OEH monitoring and auditing to be completed on an ongoing basis from approval of the BioBanking agreement.

These monitoring programs and reports are summarised in Table 30 and described below. Fixed monitoring locations are listed in Table 31.

Table 30 xxxxx offset site monitoring program

Monitoring program	Report	Dates for monitoring reports to be submitted by Landholder																						Timeframe
		2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038 on	
Management actions performance	Annual report prepared by biobank site owner and submitted to OEH																							Monitoring undertaken and reports completed annually in perpetuity.
Vegetation and habitat monitoring	Annual report prepared by biobank site owner and submitted to OEH																							Monitoring undertaken and reports completed annually in perpetuity.
Year 5 targeted threatened species survey	'Threatened species monitoring and management performance' report																							Monitoring undertaken at year five and a one off report completed by end 2021.
Pest fauna control	Annual 'Pest fauna monitoring and control' summary reports prepared by pest control contractor as appropriate.																							Annual summary reports, until at least 2036.
OEH monitoring and auditing																								Ongoing review of annual monitoring reports, inspections, auditing and additional stewardship as required.

10.3.2 Management actions performance

The landowner will monitor and record the completion of management actions through each year through collection of receipts, performance reports from contractors, diaries etc. The landowner will complete an Annual Report in accordance with works program milestones and submit to the OEH in perpetuity. The report will be prepared in accordance with OEH's standard template and include a summary of the following topics:

- Fence maintenance.
- Feral animal presence.
- Feral animal control.
- Weed presence (including extent and severity of infestations and presence of any new infestations).
- Weed control.
- Description and proof of current reporting years' activities, including one-off or irregular events (fence replacement, fire management etc).

The OEH will confirm that activities have been completed in accordance with the MAP and/or recommend additional actions to achieve performance objectives (See Table 28).

10.3.3 Vegetation and habitat

The landowner will monitor the condition of vegetation and habitat as part of their management of the biobank site. The results of the vegetation and habitat monitoring program will be included in the landowner's annual report to OEH in perpetuity.

The annual monitoring of vegetation and habitat condition will comprise:

- Monitoring of photo points to record the condition of habitat and the effectiveness of management actions. Permanent photo point locations have been way pointed using a GPS and marked with star pickets to facilitate locating during subsequent monitoring events and consistent photo capture (see Table 31). A photo will be taken and notes taken on general vegetation condition, extent of weed infestation, ground cover, any management issues such as erosion or dieback, disturbance by pest fauna and any observed change since the last monitoring round.
- General observations of vegetation condition, degree of weed infestation, any management issues such as erosion or dieback and any observed change since the last monitoring round across the entire site.
- Description of any observed management problems or threats and proposed remedial action as required.
- Preparation of annual monitoring reports, including photo point data and comparisons with previous survey rounds, photos, assessment of vegetation condition and regeneration, assessment of the quality and extent of habitat resources, description of any observed management problems or threats and proposed remedial action as required.

Photo points will be maintained at six locations in the NH2U xxxxx offset area that are linked to this NGOMP and at representative points in each vegetation zone in the broader biobank site to document the condition of habitat and the effectiveness of management actions. Photo point locations have been waypointed using a GPS and marked with star pickets to facilitate locating during subsequent monitoring events and consistent photo capture (see Table 31).

10.3.4 Targeted threatened species survey

The affected threatened fauna are each cryptic and/or prone to population fluctuations and/or mobile and transitory in their use of habitat as stated in Section 2. The management action plan for the offset site does not include trigger levels based on threatened species abundance because that would impose monitoring and management requirements on biobank site owners that are not practical or achievable. Vegetation condition and habitat quality will be monitored as a surrogate for the status of threatened species populations. The link between management actions and improvements in habitat quality and protection of populations is demonstrated in Section 9.3.

A targeted threatened species survey of the NH2U xxxxx offset area will be conducted five years after the offset site is formally established to further confirm the presence and condition of occupied habitat for the affected threatened fauna, the link between the proposed management actions and habitat quality and the security of threatened species. Five years is the 'Offset calculator – Time horizon – Time until ecological benefit' value that was entered in the Offset assessment guide calculations and so this is the critical period after which it is necessary to confirm that the biodiversity offset has been delivered as planned.

The targeted threatened species survey will comprise the following techniques:

- Ground-truthing of the existing vegetation and habitat mapping and confirmation of the extent and condition of map units.
- Collection of BioBanking plot/transect data at the six permanent locations where baseline data was collected in the GHD field surveys (see Table 31).
- Monitoring of photo points at the six permanent plot/transect locations to document the condition of habitat and the effectiveness of management actions in accordance with the methodology outlined above.
- Habitat assessments, focussing on the extent and quality of specific habitat resources of relevance to the affected threatened fauna, including:
  - Food tree species for the Koala.
  - Vegetation type and structure, presence and quality of woody debris, caves rock outcrops and other potential den sites for the Spotted-tailed Quoll.
  - Critical foraging habitat for the Grey-headed Flying-fox.
- Sampling of six 'Canopy plots' nested in BioBanking plot/transects, comprising counts of every tree in the 50 m x 20 m plot along with its height, species, canopy cover and any evidence of fauna activity. Each tree species will then be cross-referenced to lists of food tree species for the Koala and Grey-headed Flying-fox to calculate the cover of food tree species.
- Six Koala 'Spot Assessment Technique' (SAT) searches for scats and evidence of Koala activity with reference to Phillips and Callaghan (2011).
- Nocturnal surveys targeting the Koala, Spotted-tailed Quoll and Grey-headed Flying-fox over two sets of four person-hour survey rounds on two separate nights, including walked spotlighting transects, quiet listening periods and call playback.
- At least four motion sensing camera traps targeting the Koala and Spotted-tailed Quoll and placed for as long as is possible, split between the main habitat types and targeting potential fauna movement corridors such as fire trails and drainage lines.
- Preparation of a 'Threatened species monitoring and management performance' report, including survey results, plot/transect data and comparisons with the baseline survey

round and benchmark values, photos, assessment of vegetation condition and regeneration, assessment of the quality and extent of habitat resources, description of any observed management problems or threats and proposed remedial action as required.

10.3.5 Pest fauna control

The landowner will arrange annual dedicated monitoring of pest fauna populations. The monitoring program will be developed in consultation with the Local Land Services control officer and will be consistent with regional plans and programs.

Practitioners will be required to prepare an annual pest fauna control report comprising:

- Dates and locations of monitoring activities.
- Numbers and species of animals recorded during monitoring.
- A brief description of group control programs that encompass the site or other relevant programs coordinated by Local Land Services and related to the year's pest control activities.
- Dates and locations of pest fauna control activities.
- Numbers and species of animals captured or killed during pest fauna control activities.
- Incidental observations of native animals.
- A summary of general observations of pest fauna abundance and activity throughout year.

Table 31 Vegetation and habitat monitoring locations in the NH2U xxxxx offset area

Photo point	Plot/ transect ID	NSW Vegetation Type	NSW Veg. ID	Condition	Habitat type	Notes	Eastings	Northings
C	8	Foothills Grey Gum - Ironbark - Mahogany Dry Forest	NR263	Moderate/good	Wet sclerophyll forest	Habitat for Spotted-tailed Quoll, Koala and Grey-headed Flying-fox with moderate Lantana infestation. High abundance and cover of Koala food tree species.	xxxxxx	xxxxxxx
E	5	Foothills Grey Gum - Ironbark - Mahogany Dry Forest	NR263	Moderate/good	Wet sclerophyll forest	Habitat for Spotted-tailed Quoll, Koala and Grey-headed Flying-fox with moderate Lantana infestation.	xxxxxx	xxxxxxx
H	14	Flooded Gum - Brush Box moist forest	NR159	Moderate/good	Wet sclerophyll forest	Habitat for Spotted-tailed Quoll, Koala and Grey-headed Flying-fox with moderate Lantana infestation. Relatively high abundance and cover of Koala primary food tree species but low cover of Grey-headed Flying-fox diet plants.	xxxxxx	xxxxxxx
I	18	Blackutt Tallowwood moist ferny open forest	NR120	Moderate/good	Wet Sclerophyll Forest	Habitat for Spotted-tailed Quoll, Koala and Grey-headed Flying-fox with moderate Lantana infestation. Relatively high abundance and cover of Grey-headed Flying-fox diet plants.	xxxxxx	xxxxxxx

Photo point	Plot/ transect ID	NSW Vegetation Type	NSW Veg. ID	Condition	Habitat type	Notes	Eastings	Northings
J	20	Blackbutt - bloodwood dry heathy open forest	NR115	Moderate/good	Dry sclerophyll forest	Habitat for Spotted-tailed Quoll, Koala and Grey-headed Flying-fox. Moderate abundance and cover of Koala food tree species but relatively high cover of Grey-headed Flying-fox diet plants.	xxxxxx	xxxxxxx
L	23	Blackbutt - Turpentine - Tallowwood shrubby open forest	NR122	Moderate/good	Wet sclerophyll forest	Habitat for Spotted-tailed Quoll, Koala and Grey-headed Flying-fox. High abundance and cover of Koala food tree species and Grey-headed Flying-fox diet plants.	xxxxxx	xxxxxxx

10.4 Responsibilities

Table 32 outlines the management roles and the standard of qualifications and experience required for the parties who will be implementing the management actions at the xxxxx offset site in accordance with Condition f) viii. for the Project. There will be three biobank site owners each of whom is responsible for managing one of the three biobank sites that will collectively comprise the xxxxx offset site. As the properties are all owned by members of the same family we expect them to be managed in a holistic and co-ordinated way.

Table 32 Parties responsible for implementing this offset package at the xxxxx offset site

Role / management actions	Responsible party	Qualifications / experience
Site manager / supervising the implementation of this offset package and the MAP.	Biobank site owner	Complies with OEH's 'fit and proper' person requirements. Signatory to the BioBanking agreement.
EPBC Act offset package auditor / ensuring compliance with this offset package.	Roads and Maritime offset site manager.	Tertiary qualifications in environmental science or ecology / demonstrated senior professional experience in an environmental management role.
Biobank site auditor / ensuring compliance with the BioBanking agreement and MAP.	NSW Office of Environment and Heritage (OEH)	Tertiary qualifications in environmental science or ecology / professional experience in BioBanking unit.
Ecologist / Targeted threatened species survey in year five.	Consultant ecologist engaged by Roads and Maritime	Tertiary qualifications in environmental science or ecology / demonstrated professional experience in ecological survey and assessment.
Site maintenance contractor / installation and maintenance of fences, signs and tracks. Fence strand and rubbish removal as required.	Appropriately qualified and experienced contractors engaged by the biobank site owner.	Trade qualifications appropriate to the individual task / demonstrated professional experience in the individual task.
Bush regeneration contractor / Treatment of mapped weed infestations, ongoing broad scale weed monitoring and bush regeneration.	Appropriately qualified and experienced bush regeneration contractors engaged by the biobank site owner.	Certificate III Conservation & Land Management (or interstate equivalent) / minimum one year full-time equivalent experience as a bush regenerator.
Pest fauna controller / pest fauna monitoring, control and reporting.	Appropriately qualified and experienced contractor engaged by the biobank site owner.	Endorsement of Local Land Services wild dog officer / demonstrated professional experience.

11. Quality of offset

11.1 Overview

This section provides detail about the quality of the biodiversity offset that is being presented to compensate for the Project's impacts on the affected threatened species. The DSEWPaC (2012a) policy requires a formal assessment of impacts and offset contributions using the 'Offsets assessment guide'. The Offsets assessment guide utilises a balance sheet approach to measure impacts and offsets. According to the offsets policy (DSEWPaC 2012), controlled actions requiring offsets must achieve a minimum 90 per cent 'direct offset'. Direct offsets are defined as 'those actions that provide a measurable conservation gain for an impacted protected matter'. A conservation gain for the protected matter may be achieved by measures such as:

- Improving existing habitat.
- Creating new habitat.
- Reducing threats.
- Averting the loss of a protected matter or its habitat that is under threat.

A preliminary Offset guide assessment was performed based on known impacts and likely conservation and management of the Norton and Griffin offset sites (GHD, 2013a; 2013b). The outcome of the Offset guide assessment for the Project was that conservation and management of Norton and Griffin offset sites could meet over 100% of the offset requirement for each of the affected threatened fauna as direct offsets. The Department endorsed the preliminary Offset guide calculations through their approval of the Project and the offset strategy (GHD, 2013a; 2013b).

DSEWPaC would advise which (if any) MNES require biodiversity offsets in their determination of the Proposal. RMS, if required, would then finalise the EPBC Act biodiversity offset proposal with additional site specific information such as proposed management, current risk of development and the security of titling proposed. These additional data would be entered in the Offset assessment guide and the final calculations and details regarding data and assumptions underlying the results would be compiled and collectively comprise the EPBC Act offset package for the Proposal.

A draft NGOMP was submitted to the Department in December 2014 in accordance with Condition 21 of the Project approval. Since then portions of the Norton offset site have been reallocated to provide biodiversity offsets for impacts of other projects and additional offset areas have been identified at the Boambee SF offset site and xxxxx offset site to compensate for the reduced NH2U Norton offset area.

The biodiversity offset package for the affected threatened fauna will comprise:

- Conservation of around 539.5 hectares of known or likely habitat for the Koala to offset the removal of 171 hectares of habitat with a site quality score of seven.
- Conservation of around 584 hectares of known or likely habitat for the Grey-headed Flying-fox to offset the removal of 184 hectares of habitat with a site quality score of eight.
- Conservation of around 584 hectares of likely habitat for the Spotted-tailed Quoll to offset the removal of 167 hectares of habitat with a site quality score of eight.
- Conservation of around 402 hectares of likely habitat for the Regent Honeyeater to offset the removal of 73.5 hectares of habitat with a site quality score of six.
- Conservation of around 402 hectares of likely habitat for the Swift Parrot to offset the removal of 73.5 hectares of habitat with a site quality score of six.

These direct offsets will be delivered through conservation of appropriate areas of habitat at the Griffin offset site and in the NH2U Norton, Boambee SF and xxxxx offset areas. Offset assessment guide calculations that demonstrate how these direct offsets will comply with the EPBC Act offset policy are included in Section 11.5.

The entire Griffin offset site will be set aside as an offset for the Project. Portions of the Norton, Boambee SF and xxxxx offset sites have also been set aside to provide biodiversity offsets for impacts of the OH2K project and/or the WC2NH project. Separate parcels of land within the offset sites have been allocated to each project based on the area of habitat required to offset impacts on individual threatened biota (see Figure 2, Figure 8 and Figure 11). Table 42 provides a summary of the offset areas at the four offset sites that have been allocated to the NH2U, WC2NH and OH2K projects based on the completed offset assessment guide calculations for each project.

The desktop assessments, field surveys, habitat assessments and management action plans presented above provide further support for these offset calculations. The following section states how a conservation gain for the affected threatened fauna will be achieved through the measures proposed and how this direct offset will be delivered in accordance with the policy.

11.2 Summary of impacts

11.2.1 Koala

The approved Project footprint includes around 171 hectares of Koala habitat spread along 22 kilometres. The majority of this comprises Blackbutt open forest (65%) within Newry and Little Newry State Forest. Approximately 39.76 hectares of habitat to be removed features high cover of Koala food tree species in White Mahogany/Grey Gum/Ironbark Moist Forest and Swamp Mahogany/Paperbark Forest (see Table 34). The largest stands of Koala habitat to be removed occur along the northern section of the Project footprint. This is only a very minor proportion of similar habitat available in the locality (GHD, 2013b).

All of the Koala habitat in the Project footprint meet the criteria for secondary koala habitat as defined in the recovery plan (DECC, 2008). No primary koala habitat as defined in the recovery plan is present within the Project footprint. Secondary koala habitat (class A) is capable of supporting medium to high density Koala populations, while class B is capable of supporting medium to low density populations. Low levels of Koala activity were reported from the field surveys in Secondary habitat class B (GHD, 2013b).

The habitat assessment tool for the Koala (DotE, 2014a, Table 4) scores for the Project footprint are summarised in Table 33 along with a summary of the evidence considered in the habitat appraisal.

Table 33 Koala habitat assessment for the Project footprint

Attribute	Score	Habitat appraisal
Koala occurrence	+1	Evidence of one or more koalas within five km of the impact area within the last 2 years (SKM, 2012).
Vegetation composition	+2	Habitat in the Project footprint has a forest structure with two or more known koala food tree species (see Table 33).
Habitat connectivity	+2	Area is part of a contiguous landscape ≥ 500 ha (the site is connected to many thousands of hectares of habitat in State forests and other remnant native vegetation).
Key existing threats	0	Evidence of frequent or regular Koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for Koala occurrence. Much of the Project footprint follows the old alignment of the Pacific Highway which featured heavy traffic volumes and regular Koala mortality from vehicle strike. An investigation of the impacts of roads on Koalas noted 65 Koala road mortalities along a stretch of the Pacific Highway near Bonville from 2000 to 2010 (AMBS, 2012), which is an

Attribute	Score	Habitat appraisal
		average of 6.5 deaths per year. The example habitat appraisal included in the Koala referral guidelines states that four Koala deaths in a year would result in a score of 0 for the key existing threats attribute (DotE, 2014a, Example 1). The study area for this assessment was around 10 kilometres to the north of the Project footprint and is likely to have sampled equivalent traffic volumes. There are also threats associated with agricultural land adjoining the site, timber harvesting in State forests and the likely presence of wild dogs)
Recovery value	+2	Habitat is likely to be important for achieving the interim recovery objectives for the relevant context (the majority of the site and adjoining land is recognised as an area of primary or secondary habitat in the recovery plan (DECC, 2008)).
Total	**7**	

The Project footprint has a total habitat score of seven and comprises habitat critical to the survival of the Koala. The habitat assessment tool for the Koala (DotE, 2014a, Table 4) can be used to determine 'habitat quality' in accordance with the EPBC Act offset policy (DotE, 2014b). Therefore, the quality of Koala habitat in the impact area was scored as 7/10 for the purposes of Offset assessment guide calculations.

Table 34 Koala habitat within the Project footprint

Vegetation types (SKM, 2010)	Primary food trees present (Table 1 (% cover)	Secondary food trees present (Table 1) (% cover)	Habitat category, Callaghan unpublished in DECC (2008)	Area (ha)	Source
White Mahogany/Grey Gum/Ironbark Moist Forest (MU3)	Tallowwood (*Eucalyptus microcorys*) (5%)	Small-fruited Grey Gum (*E. propinqua*) (30%); Red Mahogany (*E. resinifera*) (20%)	Secondary habitat (class A)	30.70	SKM (2013) Table 2; Figure B-1
Swamp Mahogany/Paperbark Moist Forest (MU6)	Swamp Mahogany (*E. robusta*) (30-50%)	Red Mahogany (*E. resinifera*) <5%	Secondary habitat (class A)	9.06	SKM (2013) Table 2; Figure B-1
Blackbutt Open Forest (MU1)	Tallowwood (*E. microcorys*) (<20%)	Small-fruited Grey Gum (*E. propinqua*) (<5%)	Secondary habitat (class B)	109.05	SKM (2013) Table 2; Figure B-1
Mixed Floodplain Forest (MU2)	Forest Red Gum (*E. tereticornis*) (<1%)	Red Mahogany (*E. resinifera*) (20-40%)	Secondary habitat (class B)	9.88	SKM (2013) Table 2; Figure B-1
Flooded Gum Moist Forest (MU4)		Red Mahogany *(E. resinifera*) 30%	Secondary habitat (class B)	12.72	SKM (2013) Table 2; Figure B-1
Total Koala habitat				**171.41**	

11.2.2 Grey-headed Flying-fox

The approved Project footprint includes 184 hectares of Grey-headed Flying-fox habitat of which 171.5 hectares qualifies as critical foraging habitat as defined in the Recovery Plan for the species (DECCW, 2009). The 171.5 hectares of critical foraging habitat is made up of six vegetation types. Highly productive plants in the blossom diet of the Grey-headed Flying-fox (Eby, 2012) are present in five of these vegetation types. Blossom bearing species include *Corymbia intermedia, Eucalyptus pilularis, Eucalyptus robusta, Eucalyptus siderophloia* and *Melaleuca quinquinervia*. A diverse range of fruit-producing diet species defines the habitat value of the sixth type, Lowland rainforest, with *Eucalyptus grandis* and *Lophostemon confertus* emergents (GHD, 2013b).

The remaining Grey-headed Flying-fox habitat within the Project footprint comprises 11 hectares of Swamp Forest – Swamp Oak and 1.5 hectares of Freshwater Wetlands that would not provide foraging resources for the Grey-headed Flying-fox but would have value as a potential roost site and as a source of water respectively. No breeding colonies are located within the study area. Grey-headed Flying-fox records are scattered through the locality and the species is likely to forage in flowering eucalypts and fruit trees throughout this area.

The newly established Grey-headed Flying-fox camp at Macksville is located about 11 km south of the Project footprint. It has been occupied since late spring 2011, with a possible short break in occupation in May 2012. As noted above, the population is considered to be an 'important population' as defined under the EPBC Act as it is likely to be a key source population for breeding and dispersal. However, it is too early in its history to predict its long-term status or pattern of occupation (Eby, 2012). The Project is unlikely to impact breeding behaviour or habitat of Grey-headed Flying-foxes at this camp (Eby, 2012). The Macksville roost camp is located in a Swamp Oak forest adjacent to a Freshwater Wetland (Eby, 2012).

The Project footprint contains occupied Grey-headed Flying-fox habitat within nightly commuting distance of a roost camp, with primary food tree species identified in management plans, as part of a large patch of vegetation that is in good condition. This habitat features some impacts from timber harvesting, weed infestation and edge effects (GHD, 2013b).

Based on the above description of the Project footprint, the quality of Grey-headed Flying-fox habitat in the impact area was scored as 8/10 for the purposes of Offset assessment guide calculations.

Table 35 Grey-headed Flying-fox habitat within the Project footprint

Habitat Type	Vegetation types (SKM, 2010)	Area (hectares)	Source
Critical foraging habitat (DECCW, 2009)	Mixed Floodplain Forest, Moist Open Forest - Flooded Gum, Moist Open Forest - White Mahogany / Grey Gum / Ironbark, Open Forest – Blackbutt, Swamp Forest - Swamp Mahogany / Paperbark and Lowland Rainforest	171.59	Eby (2012); DECCW (2009); SKM (2013) section 2.2.2; SKM (2010) Figures 3-7 to 3-10
Other habitat	Freshwater Wetlands and Swamp Forest - Swamp Oak	12.72	Eby (2012); DECCW (2009); SKM (2013) section 2.2.2; SKM (2010) Figures 3-7 to 3-10

Habitat Type	Vegetation types (SKM, 2010)	Area (hectares)	Source
Grey-headed Flying-fox habitat		**184.31**	

11.2.3 Spotted-tailed Quoll

The approved Project footprint includes 167 hectares of Spotted-tailed Quoll habitat of varying suitability and condition. Native woodland and forest vegetation in this area comprised potential foraging, denning and movement habitat. These vegetation types are also likely to contain a variety of prey species, including macropods, birds, reptiles, arboreal mammals and small terrestrial mammals. Female quolls are likely to be more sensitive to the Project's impacts than males due to their smaller home range, higher energy requirements for breeding, and habitat centred on areas containing high prey densities. In terms of the mean home range for an individual female, which is an area of approximately 500 hectares (Belcher, 2008), it is estimated that up to 19.09 hectares or 3.8% of habitat contained within an individual home range may have been removed for the Project (GHD, 2013b).

The Spotted-tailed Quoll has not been recorded within the Project footprint during previous fauna surveys (SKM, 2010). However, records for the species occur throughout the study locality occupying a network of habitat patches alongside the Project aligned within large tracts of native vegetation such as Newry and Nambucca State Forest, Bongil Bongil National Park, Janningga Nature Reserve and Jagun National Reserve and extending west into the Great Diving Range. There are records along most of the major rivers and associated riparian habitat, including the Kalang River (GHD, 2013b).

Spotted-tailed quolls are also known to occupy and use selectively logged vegetation where a patchwork of suitable habitat comprising unlogged vegetation is retained through the logging process (Belcher, 2008). Within this context, it is considered that the Spotted-tailed Quoll would periodically use edge affected environments as supplementary habitat where adjacent to higher value habitat.

Based on the above description of the Project footprint the quality of Spotted-tailed Quoll habitat in the impact area was scored as 8/10 for the purposes of Offset assessment guide calculations.

11.2.4 Regent Honeyeater

The approved Project footprint includes 73.5 hectares of potential foraging habitat for the Regent Honeyeater comprising dry sclerophyll forests and swamp sclerophyll forests containing Swamp Mahogany. This loss represents approximately 0.20 % of the 35,898 hectares of native vegetation contained within the locality or 0.82% of the estimated 8559 hectares of dry sclerophyll and swamp sclerophyll forests located within Nambucca and Newry State Forests (GHD, 2013b).

The Regent Honeyeater is a wide ranging and highly mobile, semi-nomadic species with a patchy and sporadic distribution across coastal NSW. There are no records within the locality for the Regent Honeyeater (OEH, 2013) and it was not recorded in the study area during targeted surveys undertaken for the Project (SKM, 2010).

The presence of the Regent Honeyeater in the study area would depend predominantly on the flowering of Swamp Mahogany, Red Bloodwood and Forest Red Gum to provide seasonal food resources. These tree species are present in low abundance and the study area provides only marginal habitat for the Regent Honeyeater. The largest patches of potential foraging habitat

are present as SEPP 14 wetland areas in Nambucca and Newry State Forests. These areas were avoided as part of the route options study.

The Regent Honeyeater has never been recorded breeding in the locality of the Project. The Project would not have any direct impacts on breeding habitat for this species.

While this species is a regular visitor to the mid north coast region, the area between Warrell Creek and Urunga is not considered a critical area for the Regent Honeyeater (D. Geering, NPWS, *pers. comm.*). The limited extent of habitat within the study area and the lack of local records appears to support this assessment and the area between Nambucca and Urunga does not appear to support regionally significant habitat for this species (SKM, 2010).

Based on the above description of the Project footprint the quality of Regent Honeyeater habitat in the impact area was scored as 6/10 for the purposes of Offset assessment guide calculations.

11.2.5 Swift Parrot

The approved Project footprint includes 73.5 hectares of potential winter foraging habitat. This loss represents approximately 0.20 % of the 35,898 hectares of native vegetation contained within the locality.

The Swift Parrot has not been detected within the study area of the Project despite targeted surveys in areas of potentially suitable habitat during favourable conditions (SKM, 2010). There are also no records of this species within the study locality (OEH 2013). The largest patches of potential foraging habitat are present as SEPP 14 wetland areas in Nambucca and Newry State Forests. The study area in general, would constitute non-breeding habitat for a proportion of the population of this species (SKM 2010).

The Swift Parrot in the study area (if present) would depend predominantly on the flowering of Swamp Mahogany and Forest Red Gum to provide seasonal food resources. These tree species are present in low abundance and the study area provides only marginal habitat for the Swift Parrot. The largest patches of potential foraging habitat are present as SEPP 14 wetland areas in Nambucca and Newry State Forests. These areas have been avoided as part of the route options study and will not be impacted by the Project (GHD, 2013b).

Based on the above description of the Project footprint the quality of Swift Parrot habitat in the impact area was scored as 6/10 for the purposes of Offset assessment guide calculations.

11.3 Contribution of conservation and titling arrangements to the offset

The proposed conservation and titling arrangements for the offset sites will achieve a conservation gain for the affected threatened fauna through the following measures specified in the policy:

- Reducing threats.
- Averting the loss of a protected matter or its habitat that is under threat (DSEWPaC 2012).

11.3.1 Norton Offset Site

The Norton site is currently unoccupied. Previous land uses include timber harvesting, low intensity grazing and stockpiling of timber, rubbish and fill. Adjacent land uses include a quarry, a service centre, and cleared land proposed for warehousing and light industrial land. Continuation of recent land uses and currently permissible activities such as grazing would result in deterioration in the quality of habitat at the site and the viability of fauna populations.

Based on direct observations of recent and planned development in the near vicinity of the site there will also be a genuine risk of more intense land uses such as a quarry expansion, intensive agriculture, private forestry or industrial development over the 20 year 'risk related time horizon' nominated in the offset calculations. The proximity of the Pacific Highway to the site increases the likelihood of future development. A 20% risk of loss without the offset site conservation mechanism in place has been entered in the Offset assessment guide calculations.

Long-term management and conservation of the property under an in-perpetuity conservation covenant will substantially reduce the risk to the affected threatened species and their habitat. The Norton site will be protected under a BioBanking agreement (see Section 7.1) that is highly unlikely to be overturned to permit damaging activities. A 3% residual risk of loss with the offset site conservation mechanism in place has been entered in the Offset assessment guide calculations. Protection of the NH2U Norton offset area will see 270 hectares of habitat for the affected threatened species conserved which will otherwise be under threat of development in the next 20 years.

11.3.2 Griffin offset site

The Griffin offset site is currently unoccupied. Previous land uses include limited timber harvesting and bee keeping. Immediately adjacent land uses are all associated with conservation and beyond these reserves there are sparsely cleared bush blocks and agricultural land. Roads and Maritime will place a BioBanking agreement on the site prior to transferring ownership of the property to NPWS to be included in the Clybucca Historic Site (see Section 8.1).

Based on direct observations of recent and planned development in the near vicinity of the site there is a moderate risk of damaging land uses such as intensive agriculture, private forestry, residential or tourist development. A 10% risk of loss without the offset site conservation mechanism in place has been entered in the Offset assessment guide calculations.

In addition to the BioBanking agreement, the Griffin offset site will be reserved as a historic site under Section 30A (b) of the *NSW National Parks and Wildlife Act 1974* (NPW Act). The purpose of reserving land as a historic site is to identify, protect and conserve areas associated with a person, event or historical theme, or containing a building, place, feature or landscape of cultural significance.

A historic site must be managed in accordance with principles listed under the NPW Act including:

- the conservation of places, objects, features and landscapes of cultural value;
- the conservation of natural values;
- provision for sustainable visitor or tourist use and enjoyment that is compatible with the conservation of the historic site's natural and cultural values; and
- provision for appropriate research and monitoring.

A historic site imposes a secure conservation covenant that is supported by NSW and Commonwealth legislation and NPWS monitoring and enforcement and is highly unlikely to ever be overturned. As part of the National Parks estate the Griffin offset site will be protected under NPWS stewardship, monitoring and enforcement. A 3% residual risk of loss with the offset site conservation mechanism in place has been entered in the Offset assessment guide calculations.

11.3.3 Boambee SF Offset Site

The NH2U Boambee SF offset area is part of the Boambee SF and is under the management of FCNSW. Forest Management Zoning (FMZ) is a land classification system that sets out in a map format the way that FCNSW intends to manage forests across the State forests estate. The FMZ system clearly sets aside those areas that area set aside for conservation and those areas that are available for other activities, including timber harvesting (State Forests NSW 2000).

The majority of the NH2U Boambee SF offset area is currently within FMZ 4 'General Management' and is available for timber harvesting and other activities (State Forests NSW 2000) that are likely to harm the affected threatened fauna and/or reduce the quality of habitat. The Boambee SF offset site contains high quality Blackbutt regrowth with considerable timber value (Williams J., FCNSW pers. comm.) and would be likely to be harvested within the 20 year 'risk related time horizon' nominated in the offset calculations.

Timber harvesting is likely to have a significant impact on populations of the affected threatened fauna species and result in the long-term loss of habitat for the Koala, the Grey-headed Flying-fox and the Spotted-tailed Quoll. This conclusion is supported by:

- Food tree species for the Koala and the Grey-headed Flying Fox will be directly targeted by timber harvesting and the amount of foraging resources available will be significantly reduced. Timber harvesting may also harm or displace individual animals;
- The recovery plan for the Spotted-tailed Quoll, which notes that the species has a limited ability to recolonise fragmented patches of habitat; many prey species rely on hollows for shelter and breeding and are limited by timber harvesting or other practices that reduce these resources. Quoll populations are limited to large, relatively intact patches of forest and are significantly prone to threatening processes that reduce, degrade and fragment such habitat (Long and Nelson, 2009). Timber harvesting will directly harm or displace individual quolls and prey species and create an open, immature forest structure that will not be suitable habitat.

The habitat affected by timber harvesting will not be permanently removed, however the key habitat resources that are important to populations of the affected threatened species would not regenerate within the 'Risk related time horizon' included in the calculations (20 years).

This scenario supports the 80% 'risk of loss' value that is included in the Offset assessment guide calculations for the Koala, the Grey-headed Flying-fox and the Spotted-tailed Quoll.

The offset site will be changed to FMZ 1 'Special Protection' and protected as a Flora Reserve. Timber harvesting and other potentially damaging activities will be excluded. The land that is dedicated as a Flora Reserve will not be limited to exclude any land lying below the surface of the land pursuant to Section 16 (2) of the Forestry Act (i.e. mining will be prohibited within or below the Flora Reserve). This conservation mechanism is highly unlikely to be overturned to permit damaging activities; subject to the Forestry Act, a Flora Reserve cannot be revoked wholly or in part otherwise than by an Act of Parliament. This has been the case where several Flora Reserves previously declared in State forest are now within National Parks due to the surrounding forest being included in the National Park Estate.

There are currently 72 Flora Reserves declared on State forest in NSW. Areas within these zones are designed to meet the requirements of JANIS dedicated (formal) reserves in the National Forest Policy Statement and as such are equivalent to IUCN- Protected rea categories I, II, III or IV. The NSW OEH recognises that as a conservation mechanism, Flora Reserves offer a similar level of security and protection to biodiversity as National Parks and Nature Reserves (OEH, 2011).

The Flora Reserve that will encompass the Boambee SF offset site will be delimited by hard boundaries such as roads, drainage lines, fences and the State forest boundary will be readily identified and avoided in the planning and harvesting processes. FCNSW files have no records of a Flora Reserve being breached by any harvesting operations or management activities.

Gazettal of a Flora Reserve containing the NH2U Boambee SF offset area will see 59.8 hectares of occupied habitat for the affected threatened species conserved which will otherwise be under threat of timber harvesting. A 3% residual risk of loss with the offset site conservation mechanism in place has been entered in the Offset assessment guide calculations.

11.3.4 xxxxx Offset Site

The xxxxx offset site is currently an occupied rural residential property that is subject to cattle and sheep grazing. Evidence of grazing as well as previous timber harvesting, track construction and partial clearing was noted during field surveys. Adjacent land uses include grazing and macadamia and blueberry plantations. Continuation of recent land uses and currently permissible activities such as grazing would result in deterioration in the quality of habitat at the site and the viability of populations of the affected threatened fauna. Based on direct observations of recent and planned development in the near vicinity of the site there will also be a genuine risk of more intense land uses. Permitted activities include clearing of vegetation for more intensive agricultural activities such as blueberry cultivation that would be economic and have been considered by the landowner (xxxxx. pers. comm.). A 20% risk of loss without the offset site conservation mechanism in place has been entered in the Offset assessment guide calculations.

The NH2U xxxxx offset area will be protected and managed in perpetuity under an in-perpetuity conservation covenant (a BioBanking agreement). A BioBanking agreement is a secure conservation covenant that is supported by NSW legislation and OEH monitoring and enforcement and is highly unlikely to ever be overturned to permit grazing, clearing of vegetation for blueberry cultivation or other damaging activities. A 3% residual risk of loss with the offset site conservation mechanism in place has been entered in the Offset assessment guide calculations. Protection of the NH2U xxxx offset area will see 87.2 hectares of habitat for the Koala, the Grey-headed Flying-fox and the Spotted-tailed Quoll within an overall offset site of 98.3 hectares conserved which would otherwise be under threat of development in the next 20 years.

11.4 Contribution of management actions to the offset

The offset sites will be managed in perpetuity for biodiversity conservation and to protect the affected threatened fauna and their habitats. Specific management actions have been proposed that will improve the extent or quality of habitat for the affected threatened fauna and/or reduce threats. The field surveys and desktop assessments described above have confirmed that the offset sites contain habitat in moderate to good condition with some impacts from historical clearing, current land uses, weed infestation and edge effects. Current and potential threats to threatened fauna at the offset sites include pest fauna, disease and degradation of habitat. These degrading factors and threats are likely to continue and in the case of edge effects and weed infestation would intensify without active management in the short term. The proposed management actions will help avoid a decrease in the current habitat quality at the offset sites and achieve a future increase in habitat quality. The specific relationships between proposed management actions, the type of conservation gain according to the policy (DSEWPaC 2012) and the likely effect on populations and/or habitat for the affected threatened fauna are presented in Table 36. Table 36 also describes how current site quality and the predicted change were determined in this NGOMP and how the effectiveness of management actions will

be monitored. This summary of the likely benefits of management actions supports the habitat quality calculations that were included in the preliminary Offset guide assessment (GHD, 2013a; 2013c).

Table 36 Contribution of proposed management actions to the conservation of the affected threatened fauna

Management action	Type of conservation gain (DSEWPaC 2012)	Effect on populations and/or habitat for the affected threatened fauna	How surveyed / quantified in this NGOMP	How monitored
Retention of regrowth and remnant native vegetation.	Improving existing habitat. Creating new habitat.	Maintenance and improvement of shelter and foraging habitat. Regeneration and maturation of food tree species.	Plot/transects and canopy plots (see Table 2, Table 6 and Appendix A) confirmed the presence and quality of habitat resources for the affected threatened fauna.	Annual habitat monitoring and reporting, including photo points and sampling of selected plot/transects and canopy plots.
Property maintenance (rubbish and fence strand removal, monitoring of erosion and sedimentation etc).	Improving existing habitat. Reducing threats.	Increased quality of shelter and foraging habitat. Removal of barriers to fauna moment and associated reduced risk and energy costs of movement between patches of habitat. Reduced risk of rubbish dumping, erosion etc having an impact on the quality of habitat.	General observations confirmed the presence of threats and of degraded habitat with scope for improvement.	Annual management actions and habitat monitoring and reporting.
Weed control.	Improving existing habitat.	Maintenance and improvement in quality of foraging resources by increasing the extent, health and productivity of native vegetation containing food tree species.	Plot/transects (see Table 2, Table 6 and Appendix A) and mapping of major weed infestations (see Figure 8 and Figure 9) confirmed the presence of degraded habitat with scope for improvement.	Annual weed monitoring and reporting.
Exclusion of domestic grazing and management of human disturbance.	Improving existing habitat. Reducing threats. Averting the loss of a protected matter or its habitat that is under threat.	Maintenance and improvement in quality of foraging resources by increasing the health and productivity of native vegetation containing food tree species. Reduced risk, energy cost and/or stress of interactions with humans, pets or livestock.	General observations confirmed the presence of threats and of degraded habitat with scope for improvement.	Annual management actions and habitat monitoring and reporting.
Control of pest fauna.	Improving existing habitat. Reducing threats.	Reduced risk, energy cost and/or stress of interactions with feral dogs. Maintenance and improvement in quality of foraging resources by reducing impacts of feral herbivores on surface soil and on native vegetation containing food tree species.	Spotlighting and camera traps confirmed the presence of feral dog populations at both offset sites. Feral cats, foxes and herbivores are also likely to occur.	Management actions monitoring and reporting.

Management action	Type of conservation gain (DSEWPaC 2012)	Effect on populations and/or habitat for the affected threatened fauna	How surveyed / quantified in this NGOMP	How monitored
Management of fire for conservation	Improving existing habitat. Reducing threats.	Maintenance of natural fire regimes. Maintenance of natural vegetation structure, stimulation of regrowth, creation of habitat resources such as hollow-bearing trees and woody debris. Reduced risk of destructive wildfire or inappropriate fire regimes.	Mapping of vegetation and observation of evidence of fire history. Recommendation of fire regimes appropriate to vegetation types.	Management actions, monitoring and reporting.
Regeneration of cleared land and low condition vegetation (noting that these areas have not been counted as habitat for the affected threatened biota in their current condition).	Creating new habitat.	Increased extent of shelter and foraging habitat. Improved connectivity of habitat. Regeneration and maturation of food tree species. Reduced risk and energy costs of movement between patches of habitat. Improved quality and viability of retained habitat through reduced edge effects.	Vegetation mapping and sampling of plot/transects (see Appendix A to Appendix D) confirmed the presence of degraded habitat with scope for improvement.	Annual habitat monitoring and reporting, including photo points and sampling of selected plot/transects.

11.5 Offset assessment guide calculations

Direct offsets will be delivered through conservation of appropriate areas of habitat in the NH2U Norton, Griffin, Boambee SF and xxxxx offset areas as discussed in Section 11.3. Offset assessment guide calculations that demonstrate how these direct offsets will comply with the EPBC Act offset policy have been performed and are summarised in Table 37 to Table 41 along with a summary of the justification for each of the attribute values entered. Separate sets of calculations were performed for the NH2U Norton, Griffin, Boambee SF and xxxxx offset areas based on the specific habitat types, conditions, proposed management actions and titling arrangements at each site.

Table 37 Attribute values entered in the Offset assessment guide calculations for the Koala

Offset assessment guide attribute	Norton offset area	Justification	Griffin offset site	Justification	Boambee SF offset area	Justification	xxxxx offset area	Justification
Impact Calculator - Quantum of impact - Area	171 hectares	The limitation on the area of removal of Koala habitat under the EPBC Approval for the Project as documented in the approved offset strategy (GHD, 2013a; 2013c).	171 hectares	As for the Norton offset area.	171 hectares	As for the Norton offset area.	171 hectares	As for Norton offset area
Impact Calculator - Quantum of impact – Quality	7/10	The quality of the habitat in the impact area as described in Section 11.2.1.	7/10	As for Norton offset area	7/10	As for the Norton offset area.	7/10	As for Norton offset area
Offset calculator – Time horizon – Risk related time horizon	20 years	The Norton offset area will be protected and managed in perpetuity under a BioBanking agreement. 20 years is the maximum timeframe for averting loss in the guide.	20 years	The Griffin offset site will be protected and managed in perpetuity as a Historic Site. 20 years is the maximum timeframe for averting loss in the guide.	20 years	The Boambee SF offset area will be protected and managed in perpetuity as a Flora Reserve. 20 years is the maximum timeframe for averting loss in the guide.	20 years	The xxxxx offset area will be protected and managed in perpetuity under BioBanking agreements. 20 years is the maximum timeframe for averting loss in the guide.

Offset assessment guide attribute	Norton offset area	Justification	Griffin offset site	Justification	Boambee SF offset area	Justification	xxxxx offset area	Justification
Offset calculator – Time horizon – Time until ecological benefit	5 years	The Norton offset area contains habitat in moderate to good condition that will be managed for conservation, including through exclusion of damaging human activities, treatment of weed infestations, bush regeneration and treatment of pest fauna. Ecological benefits will be achieved in the short term, nominally five years. Conversely, a tangible reduction in the quality of habitat through increased weed infestation and edge effects, human impacts or uncontrolled wildfire is likely within five years.	5 years	The Griffin offset site contains habitat in good condition that will be managed for conservation, including through exclusion of damaging human activities, treatment of weed infestations, bush regeneration and treatment of pest fauna. Ecological benefits will be achieved in the short term, nominally five years. Conversely, a tangible reduction in the quality of habitat through increased weed infestation and edge effects, human impacts or uncontrolled wildfire is likely within five years.	5 years	The Boambee SF offset area contains habitat in good condition that will be managed for conservation, including through treatment of weed infestations, bush regeneration, treatment of pest fauna and especially exclusion of timber harvesting. Ecological benefits will be achieved in the short term, nominally five years. Conversely, a tangible reduction in the quality of habitat through timber harvesting, increased weed infestation and edge effects, human impacts or uncontrolled wildfire is likely within five years.	5 years	The xxxxx offset area contains habitat in moderate to good condition that will be managed for conservation, including through exclusion of damaging human activities, treatment of weed infestations, bush regeneration and treatment of pest fauna. Ecological benefits will be achieved in the short term, nominally five years. Conversely, a tangible reduction in the quality of habitat through increased weed infestation and edge effects, human impacts or uncontrolled wildfire is likely within five years.
Offset calculator - Future area and quality without offset – Risk of loss without offset	20%	The Norton offset site is currently vacant land owned by Roads and Maritime. Based on direct observations of recent and planned development in the near vicinity of the site there is a notable risk of damaging land uses such as a quarry expansion, intensive agriculture, private forestry or industrial development.	10%	The Griffin offset site is currently vacant land owned by Roads and Maritime. Based on direct observations of recent and planned development in the near vicinity of the site there is a moderate risk of damaging land uses such as intensive agriculture, private forestry, residential or tourist development.	80 %	The majority of the Boambee SF offset area is currently within FMZ 4 ‘General Management’ and is available for timber harvesting and other activities that are likely to harm Koala populations and/or remove habitat. The offset area contains high quality regrowth with considerable timber value (Williams J., FCNSW pers. comm.) and will be likely to be harvested in the short to medium term.	20%	The xxxxx offset site is currently rural residential land and is available for grazing and other activities that are likely to harm fauna populations and/or reduce the quality of habitat. Permitted activities include clearing of vegetation for more intensive agricultural activities such as blueberry cultivation that would be economic and have been considered by the landowner (xxxxx. pers. comm.).

Offset assessment guide attribute	Norton offset area	Justification	Griffin offset site	Justification	Boambee SF offset area	Justification	xxxxx offset area	Justification
Offset calculator - Future area and quality with offset – Risk of loss with offset	3%	The Norton offset area will be protected and managed in perpetuity under a conservation covenant (a BioBanking agreement). A BioBanking agreement is a secure conservation covenant that is supported by NSW legislation and OEH monitoring and enforcement and is highly unlikely to ever be overturned.	3%	The Griffin offset site will be protected and managed as part of the National Parks estate within the Clybucca Historic site. An historic site imposes a secure conservation covenant that is supported by NSW and Commonwealth legislation and NPWS monitoring and enforcement and is highly unlikely to ever be overturned.	3%	The NH2U Boambee SF offset area will be protected and managed in perpetuity as a Flora Reserve. The Flora Reserve that will encompass the Boambee SF offset site will be delimited by hard boundaries such as roads, drainage lines, fences and the State forest boundary and as such will be readily identified and avoided in the planning and harvesting processes. FCNSW files include no records of a Flora Reserve being breached by any harvesting operations or management activities. The NSW OEH recognises that as a conservation mechanism, Flora Reserves offer a similar level of security and protection to biodiversity as National Parks and Nature Reserves (OEH, 2011).	3 %	The NH2U xxxxx offset area will be protected and managed in perpetuity under a BioBanking agreement. A BioBanking agreement is highly unlikely to ever be overturned to permit grazing, clearing of vegetation for blueberry cultivation or other damaging activities.
Confidence in result – averted loss of offset	95%	A BioBanking agreement is a secure conservation covenant that is supported by: NSW legislation; implementation of the site specific MAP to exclude harmful activities; and OEH monitoring and enforcement (see Section 11.3.1).	95%	As part of the National Parks estate the Griffin offset site will be protected under the EPBC Act and NSW legislation, implementation of the site management plan to exclude harmful activities; and NPWS stewardship, monitoring and enforcement (see Section 11.3.2).	95 %	A Flora Reserve is a secure conservation covenant supported by NSW legislation as well as implementation of the Forestry Management Zoning system and a reserve specific works plan to exclude harmful activities (see Section 11.3.3).	95%	A BioBanking agreement is a secure conservation covenant that is supported by: NSW legislation; implementation of the site specific MAP to exclude harmful activities; and OEH monitoring and enforcement (see Section 11.3.4).

Offset assessment guide attribute	Norton offset area	Justification	Griffin offset site	Justification	Boambee SF offset area	Justification	xxxxx offset area	Justification
Offset calculator – Start area and quality – Area	270 hectares	Comprises the 'Dry Sclerophyll Forest', 'Wet Sclerophyll Forest' and 'Grassy Woodland' habitat within the NH2U offset area mapped on Figure 4. The area of habitat was confirmed through detailed field surveys, including targeted surveys for Koalas, quantification of the amount and quality of food resources available and mapping of vegetation type and condition (see Section 3.4.1). Occupied habitat was confirmed through direct observations of Koalas and their scats (see Section 3.5.1).	132 hectares	Comprises the 'Dry Sclerophyll Forest' and 'Swamp Sclerophyll Forest' habitat mapped on Figure 7. The area of habitat was confirmed through detailed field surveys, including quantification of the amount and quality of food resources available and mapping of vegetation type and condition (see Section 4.4.1).	50.3 hectares	The area of habitat comprises the 'Dry Sclerophyll Forest' and 'Wet Sclerophyll Forest' habitat within the NH2U offset area mapped on Figure 8. The area of habitat was confirmed through detailed field surveys, including targeted surveys for Koalas, quantification of the amount and quality of food resources available and mapping of vegetation type and condition (see Section 5.4.1). Occupied habitat was confirmed through direct observations of Koalas and their scats (see Section 5.5.1).	87.2 hectares	Comprises the 'Dry Sclerophyll Forest' and 'Wet Sclerophyll Forest' habitat within the NH2U offset area mapped on Figure 13. The area of habitat was confirmed through detailed field surveys, including targeted surveys for Koalas, quantification of the amount and quality of food resources available and mapping of vegetation type and condition (see Section 6.4.1).

Offset assessment guide attribute	Norton offset area	Justification	Griffin offset site	Justification	Boambee SF offset area	Justification	xxxxx offset area	Justification
Offset calculator – Start area and quality – Start quality	9/10	The habitat assessment tool for the Koala (DotE, 2014a, Table 4) was used to determine habitat quality in accordance with the *Koala referral guidelines, offsets and existing project fact sheet* (DotE, 2014b) (see Section 3.4.1). The offset area contains occupied habitat with moderate cover of food tree species identified in management plans, as part of a large patch of vegetation that is in good condition with some impacts from clearing, rubbish dumping, weed infestation, edge effects and the presence of dogs. The habitat quality score is further supported by: observations of the species at the site; the presence of moderate-high cover of food tree species in the canopy plots (see Table 2); and the good condition of vegetation and habitat as confirmed by BioBanking plot/transect data included in Appendix A.	7/10	As for the Norton site, the habitat assessment tool for the Koala was used to determine habitat quality (see Section 4.4.1). The offset area contains likely habitat with high cover of primary food tree species identified in management plans, as part of a large patch of vegetation that is in good condition with some impacts from timber harvesting, weed infestation, edge effects and the probable presence of dogs. The habitat quality score is supported by: the presence of high cover of food tree species in the canopy plots (see Table 6); and the good condition of vegetation and habitat as confirmed by BioBanking plot/transect data included in Appendix B.	9/10	As for the Norton site, the habitat assessment tool for the Koala was used to determine habitat quality (see Section 5.4.1). The offset area contains occupied habitat with high cover of primary food tree species identified in management plans, as part of a large patch of vegetation that is in good condition with some impacts from timber harvesting, weed infestation, edge effects and the probable presence of dogs. The habitat quality score is supported by: observations of the species at the site; the presence of high cover of food tree species in the canopy plots (see Table 9); and the good condition of vegetation and habitat as confirmed by BioBanking plot/transect data included in Appendix C.	7/10	As for the Norton site, the habitat assessment tool for the Koala was used to determine habitat quality (see Section 6.4.1). The offset area contains likely habitat with high cover of primary food tree species identified in management plans, as part of a large patch of vegetation that is in good condition with some impacts from timber harvesting, weed infestation, edge effects and the probable presence of dogs. The habitat quality score is supported by: the presence of high cover of food tree species in the canopy plots (see Table 12); and the good condition of vegetation and habitat as confirmed by BioBanking plot/transect data included in Appendix D.

Offset assessment guide attribute	Norton offset area	Justification	Griffin offset site	Justification	Boambee SF offset area	Justification	xxxxx offset area	Justification
Offset calculator - Future area and quality without offset – Future quality without offset (1-10)	9/10	Habitat in the Norton offset area will continue to deteriorate through impacts from weed infestation, edge effects, inappropriate fire regimes, predation by dogs etc. if not set aside for conservation. The habitat assessment tool for the Koala (DotE, 2014a, Table 4) was used to determine the change in habitat quality. The impacts on habitat quality described above would not be sufficient to reduce the score for any of the attributes described in the habitat assessment tool.	7/10	Habitat in the Griffin offset site will continue to deteriorate through impacts from weed infestation, edge effects, inappropriate fire regimes, predation by dogs etc. if not set aside for conservation. The habitat assessment tool for the Koala was used to determine the change in habitat quality. The impacts on habitat quality described above would not be sufficient to reduce the score for any of the attributes described in the habitat assessment tool.	9/10	Habitat in the Boambee SF offset area will continue to deteriorate through impacts from weed infestation, edge effects, pest fauna, inappropriate fire regimes, the probable presence of dogs etc. if not set aside for conservation. These incremental impacts are distinct from the removal of habitat associated with a timber harvesting event at NH2U offset area, which is assessed under 'risk of loss of offset'. The habitat assessment tool for the Koala was used to determine the change in habitat quality. The impacts on habitat quality described above would not be sufficient to reduce the score for any of the attributes described in the habitat assessment tool.	7/10	Habitat in the xxxxx offset area will continue to deteriorate through impacts from weed infestation, edge effects, inappropriate fire regimes, predation by dogs etc. if not set aside for conservation. The habitat assessment tool for the Koala was used to determine the change in habitat quality. The impacts on habitat quality described above would not be sufficient to reduce the score for any of the attributes described in the habitat assessment tool.

Offset assessment guide attribute	Norton offset area	Justification	Griffin offset site	Justification	Boambee SF offset area	Justification	xxxxx offset area	Justification
Offset calculator - Future area and quality with offset – Future quality with offset (1-10)	10/10	Habitat at the Norton offset area will be managed as described in Section 7. A tangible improvement in the quality of habitat will be achieved as described in Table 36 especially through the increased health and productivity of food tree species and reduced risk of predation by dogs. The habitat assessment tool for the Koala (DotE, 2014a, Table 4) was used to determine the increase in habitat quality in accordance with the Koala referral guidelines, offsets and existing projects fact sheet (DotE, 2014b). The 'Key existing threats' attribute will be increased to a score of '+2 (low) - Little or no evidence of koala mortality from vehicle strike or dog attack' through restriction of access to the site and treatment of pest fauna resulting in a total score of 10.	8/10	Habitat at the Griffin offset site will be managed as described in Section 8. A tangible improvement in the quality of habitat will be achieved as described in Table 36 especially through the increased health and productivity of food tree species and reduced risk of predation by dogs. The habitat assessment tool for the Koala was used to determine the increase in habitat quality. The 'Key existing threats' attribute will be increased to a score of '+2 (low) - Little or no evidence of koala mortality from vehicle strike or dog attack' through restriction of access to the site and treatment of pest fauna resulting in a total score of 8.	10/10	Habitat at the Boambee SF offset area will be managed as described in Section 9. A tangible improvement in the quality of habitat will be achieved as described in Table 36, especially through the increased health and productivity of food tree species and reduced risk of predation by dogs. The habitat assessment tool for the Koala was used to determine the increase in habitat quality. The 'Key existing threats' attribute will be increased to a score of '+2 (low) - Little or no evidence of koala mortality from vehicle strike or dog attack' through exclusion of timber harvesting and treatment of pest fauna resulting in a total score of 8.	8/10	Habitat at the xxxxx offset site will be managed as described in Section 10. A tangible improvement in the quality of habitat will be achieved as described in Table 36 especially through the increased health and productivity of food tree species and reduced risk of predation by dogs. The habitat assessment tool for the Koala was used to determine the increase in habitat quality. The 'Key existing threats' attribute will be increased to a score of '+2 (low) - Little or no evidence of koala mortality from vehicle strike or dog attack' through restriction of access to the site and treatment of pest fauna resulting in a total score of 8.

Offset assessment guide attribute	Norton offset area	Justification	Griffin offset site	Justification	Boambee SF offset area	Justification	xxxxx offset area	Justification
Confidence in result – change in quality	75 %	A modest increase in site quality is predicted and it has been determined with reference to the habitat assessment tool for the Koala (DotE, 2014a, Table 4). The link between the predicted improvement in the quality of habitat and viability of fauna populations through management actions is described in Table 36 The site will be managed under a plan that includes performance criteria and corrective actions to help ensure that targets are achieved. There is a low residual likelihood of the prescribed management actions not succeeding. 75% is a reasonable level of confidence in the effectiveness of the proposed environmental management actions.	75%	As for the Norton offset area.	75%	As for the Norton offset area.	75%	As for the Norton offset area.
Percentage of impact offset	**48.4%**		**13.01%**		**30.16%**		**13.37%**	

Based on the offset assessment guide calculations summarised above the 539.5 hectares of Koala habitat in the NH2U Norton, Griffin, Boambee SF and xxxxx offset areas could offset 104.94% of the Project's impacts on the Koala.

Table 38 Attribute values entered in the Offset assessment guide calculations for the Grey-headed Flying-fox

Offset assessment guide attribute	Norton offset area	Justification	Griffin offset site	Justification	Boambee SF offset area	Justification	xxxxx offset area	Justification
Impact Calculator - Quantum of impact - Area	184 hectares	The limitation on the area of removal of Grey-headed Flying-fox habitat under the EPBC Approval for the Project as documented in the approved offset strategy (GHD, 2013a; 2013c).	184 hectares	As for the Norton offset area.	184 hectares	As for the Norton offset area.	184 hectares	As for Norton offset area
Impact Calculator - Quantum of impact – Quality	8/10	The quality of the habitat in the impact area as described in Section 11.2.2.	8/10	As for the Norton offset area.	8/10	As for the Norton offset area.	8/10	As for Norton offset area
Offset calculator – Time horizon – Risk related time horizon	20 years	The Norton offset area will be protected and managed in perpetuity under a BioBanking agreement. 20 years is the maximum timeframe for averting loss in the guide.	20 years	The Griffin offset site will be protected and managed in perpetuity as a Historic Site. 20 years is the maximum timeframe for averting loss in the guide.	20 years	The Boambee SF offset area will be protected and managed in perpetuity as a Flora Reserve. 20 years is the maximum timeframe for averting loss in the guide.	20 years	The xxxxx offset area will be protected and managed in perpetuity as a biobank site. 20 years is the maximum timeframe for averting loss in the guide.

Offset assessment guide attribute	Norton offset area	Justification	Griffin offset site	Justification	Boambee SF offset area	Justification	xxxxx offset area	Justification
Offset calculator – Time horizon – Time until ecological benefit	5 years	The Norton offset area contains habitat in moderate to good condition that will be managed for conservation, including through exclusion of damaging human activities, treatment of weed infestations, bush regeneration and treatment of pest fauna. Ecological benefits will be achieved in the short term, nominally five years. Conversely, a tangible reduction in the quality of habitat through increased weed infestation and edge effects, human impacts or uncontrolled wildfire is likely within five years.	5 years	The Griffin offset site contains habitat in good condition that will be managed for conservation, including through exclusion of damaging human activities, treatment of weed infestations, bush regeneration and treatment of pest fauna. Ecological benefits will be achieved in the short term, nominally five years. Conversely, a tangible reduction in the quality of habitat through increased weed infestation and edge effects, human impacts or uncontrolled wildfire is likely within five years.	5 years	The Boambee SF offset area contains habitat in good condition that will be managed for conservation, including through treatment of weed infestations, bush regeneration, treatment of pest fauna and especially exclusion of timber harvesting. Ecological benefits will be achieved in the short term, nominally five years. Conversely, a tangible reduction in the quality of habitat through timber harvesting, increased weed infestation and edge effects, human impacts or uncontrolled wildfire is likely within five years.	5 years	The xxxxx offset area contains habitat in moderate to good condition that will be managed for conservation, including through exclusion of damaging human activities, treatment of weed infestations, bush regeneration and treatment of pest fauna. Ecological benefits will be achieved in the short term, nominally five years. Conversely, a tangible reduction in the quality of habitat through increased weed infestation and edge effects, human impacts or uncontrolled wildfire is likely within five years.
Offset calculator - Future area and quality without offset – Risk of loss without offset	20%	The Norton offset site is currently vacant land owned by Roads and Maritime. Based on direct observations of recent and planned development in the near vicinity of the site there is a notable risk of damaging land uses such as a quarry expansion, intensive agriculture, private forestry or industrial development.	10%	The Griffin offset site is currently vacant land owned by Roads and Maritime. Based on direct observations of recent and planned development in the near vicinity of the site there is a moderate risk of damaging land uses such as intensive agriculture, private forestry, residential or tourist development.	80 %	The majority of the Boambee SF offset area is currently within FMZ 4 ‘General Management’ and is available for timber harvesting and other activities that are likely to harm Grey-headed Flying-fox populations and/or remove habitat. The offset area contains high quality regrowth with considerable timber value (Williams J., FCNSW pers. comm.) and will be likely to be harvested in the short to medium term.	20%	The xxxxx offset site is currently rural residential land and is available for grazing and other activities that are likely to harm fauna populations and/or reduce the quality of habitat. Permitted activities include clearing of vegetation for more intensive agricultural activities such as blueberry cultivation that would be economic and have been considered by the landowner (xxxxx. pers. comm.).

Offset assessment guide attribute	Norton offset area	Justification	Griffin offset site	Justification	Boambee SF offset area	Justification	xxxxx offset area	Justification
Offset calculator - Future area and quality with offset – Risk of loss with offset	3%	The Norton offset area will be protected and managed in perpetuity under a conservation covenant (a BioBanking agreement). A BioBanking agreement is a secure conservation covenant that is supported by NSW legislation and OEH monitoring and enforcement and is highly unlikely to ever be overturned.	3%	The Griffin offset site will be protected and managed as part of the National Parks estate within the Clybucca Historic site. A historic site imposes a secure conservation covenant that is supported by NSW and Commonwealth legislation and NPWS monitoring and enforcement and is highly unlikely to ever be overturned.	3%	The NH2U Boambee SF offset area will be protected and managed in perpetuity as a Flora Reserve. The Flora Reserve that will encompass the Boambee SF offset site will be delimited by hard boundaries such as roads, drainage lines, fences and the State forest boundary and as such will be readily identified and avoided in the planning and harvesting processes. FCNSW files include no records of a Flora Reserve being breached by any harvesting operations or management activities. The NSW OEH recognises that as a conservation mechanism, Flora Reserves offer a similar level of security and protection to biodiversity as National Parks and Nature Reserves (OEH, 2011).	3 %	The NH2U xxxxx offset area will be protected and managed in perpetuity under a BioBanking agreement. A BioBanking agreement is highly unlikely to ever be overturned to permit grazing, clearing of vegetation for blueberry cultivation or other damaging activities.
Confidence in result – averted loss of offset	95%	A BioBanking agreement is a secure conservation covenant that is supported by: NSW legislation; implementation of the site specific MAP to exclude harmful activities; and OEH monitoring and enforcement (see Section 11.3.1).	95%	As part of the National Parks estate the Griffin offset site will be protected under the EPBC Act and NSW legislation, implementation of the site management plan to exclude harmful activities; and NPWS stewardship, monitoring and enforcement (see Section 11.3.2).	95 %	A Flora Reserve is a secure conservation covenants supported by NSW legislation as well as implementation of the Forestry Management Zoning system and a reserve specific works plan to exclude harmful activities (see Section 11.3.3).	95%	A BioBanking agreement is a secure conservation covenant that is supported by: NSW legislation; implementation of the site specific MAP to exclude harmful activities; and OEH monitoring and enforcement (see Section 11.3.4).

Offset assessment guide attribute	Norton offset area	Justification	Griffin offset site	Justification	Boambee SF offset area	Justification	xxxxx offset area	Justification
Offset calculator – Start area and quality – Area	270 hectares	Comprises the 'Dry Sclerophyll Forest', 'Wet Sclerophyll Forest' and 'Grassy Woodland' habitat within the NH2U offset area mapped on Figure 4. The area of habitat at the Norton offset area was confirmed through detailed field surveys, including targeted surveys for nocturnal fauna, quantification of the amount and quality of food resources available and mapping of vegetation type and condition (see Section 3.4.2). Occupied habitat was confirmed through direct observations of the species in previous surveys (Lewis and James, 2010).	167 hectares	Comprises the 'Dry Sclerophyll Forest' and 'Swamp Sclerophyll Forest' habitat mapped on Figure 7. The area of habitat was confirmed through detailed field surveys, including quantification of the amount and quality of food resources available and mapping of vegetation type and condition (see Section 4.4.2). Occupied habitat was confirmed through direct observations of the species in previous surveys (Lewis and Richards, 2011).	59.8 hectares	The area of habitat comprises the 'Dry Sclerophyll Forest', 'Wet Sclerophyll Forest' and 'Rainforest' habitat within the NH2U offset area mapped on Figure 8. The area of habitat at the Boambee SF offset area was confirmed through detailed field surveys, including targeted surveys, quantification of the amount and quality of food resources available and mapping of vegetation type and condition (see Section 5.4.2). Occupied habitat was confirmed through direct observations of Grey-headed Flying-foxes in vegetation immediately adjoining the site during the present surveys (see Section 5.5.2).	87.2 hectares	Comprises the 'Dry Sclerophyll Forest' and 'Wet Sclerophyll Forest' habitat within the NH2U offset area mapped on Figure 13. The area of habitat was confirmed through detailed field surveys, including targeted surveys, quantification of the amount and quality of food resources available and mapping of vegetation type and condition (see Section 6.4.2). Occupied habitat was confirmed through direct observations of Grey-headed Flying-foxes at the site during the present surveys (see Section 6.5.2).

Offset assessment guide attribute	Norton offset area	Justification	Griffin offset site	Justification	Boambee SF offset area	Justification	xxxxx offset area	Justification
Offset calculator – Start area and quality – Start quality	7/10	The offset area contains occupied habitat within nightly commuting distance of critical roosting habitat, with moderate cover of food tree species identified in management plans, and is part of a large patch of vegetation that is in good condition with some impacts from clearing, rubbish dumping, weed infestation and edge effects. The habitat quality score was confirmed: through the presence of moderate to high cover of food tree species in the canopy plots (see Table 2); and the good condition of vegetation and habitat as confirmed by BioBanking plot/transect data included in Appendix A.	7/10	The offset area contains occupied habitat within nightly commuting distance of critical roosting habitat, with moderate cover of primary food tree species identified in management plans and is part of a large patch of vegetation that is in good condition with some impacts from weed infestation and edge effects. The habitat quality score was confirmed: through the presence of high cover of food tree species in the canopy plots (see Table 6); and the good condition of vegetation and habitat as confirmed by BioBanking plot/transect data included in Appendix B.	8/10	The offset area contains occupied habitat within nightly commuting distance of a regionally significant, permanently occupied roost camp, with high cover of primary food tree species identified in management plans and is part of a large patch of vegetation that is in good condition with some impacts from timber harvesting, weed infestation and edge effects. The habitat quality score was confirmed: through the presence of high cover of food tree species in the canopy plots (see Table 9); and the good condition of vegetation and habitat as confirmed by BioBanking plot/transect data included in Appendix C.	7/10	The offset area contains occupied habitat within nightly commuting distance of critical roosting habitat, with high cover of primary food tree species identified in management plans and is part of a large patch of vegetation that is in good condition with some impacts from timber harvesting, weed infestation, edge effects and grazing. The habitat quality score was confirmed: through the presence of high cover of food tree species in the canopy plots (see Table 12); and the good condition of vegetation and habitat as confirmed by BioBanking plot/transect data included in Appendix D.

Offset assessment guide attribute	Norton offset area	Justification	Griffin offset site	Justification	Boambee SF offset area	Justification	xxxxx offset area	Justification
Offset calculator - Future area and quality without offset – Future quality without offset (1-10)	6/10	Habitat in the Norton offset area will continue to deteriorate through impacts from weed infestation, edge effects, inappropriate fire regimes, permissible grazing etc. if not set aside for conservation.	6/10	Habitat in the Griffin offset site will continue to deteriorate through impacts from weed infestation, edge effects, inappropriate fire regimes etc. if not set aside for conservation.	8/10	Habitat in the Boambee SF offset area will continue to deteriorate through impacts from weed infestation, edge effects, inappropriate fire regimes, the probable presence of dogs etc. if not set aside for conservation. This is not likely to be sufficient to drop habitat quality by an entire point. These incremental impacts are distinct from the removal of habitat associated with a timber harvesting event at the NH2U offset area, which is assessed under 'risk of loss of offset'.	6/10	Habitat in the xxxxx offset site will continue to deteriorate through impacts from weed infestation, edge effects, inappropriate fire regimes, permissible grazing etc. if not set aside for conservation.
Offset calculator - Future area and quality with offset – Future quality with offset (1-10)	8/10	Habitat at the Norton offset area will be managed as described in Section 7. A tangible improvement in the quality of habitat will be achieved as described in Table 36 especially through the increased health and productivity of food tree species.	8/10	Habitat at the Griffin offset site will be managed as described in Section 8. A tangible improvement in the quality of habitat will be achieved as described in Table 36 especially through the increased health and productivity of food tree species.	9/10	Habitat at the Boambee SF offset area will be managed as described in Section 9. A tangible improvement in the quality of habitat will be achieved as described in Table 36, especially through the increased health and productivity of food tree species.	8/10	Habitat at the xxxxx offset site will be managed as described in Section 10. A tangible improvement in the quality of habitat will be achieved as described in Table 36 especially through the increased health and productivity of food tree species.

Offset assessment guide attribute	Norton offset area	Justification	Griffin offset site	Justification	Boambee SF offset area	Justification	xxxxx offset area	Justification
Confidence in result – change in quality	75 %	A modest increase in site quality is predicted. The link between the predicted improvement in the quality of habitat and viability of fauna populations through management actions is described in Table 36 The site will be managed under a plan that includes performance criteria and corrective actions to help ensure that targets are achieved. There is a low residual likelihood of the prescribed management actions not succeeding. 75% is a reasonable level of confidence in the effectiveness of the proposed environmental management actions.	75%	As for the Norton offset area.	75%	As for the Norton offset area.	75%	As for the Norton offset area.
Percentage of impact offset	**44.56%**		**20.96%**		**26.3%**		**14.39%**	

Based on the offset assessment guide calculations summarised above the 584 hectares of Grey-headed Flying-fox habitat in the NH2U Norton, Griffin, Boambee SF and xxxxx offset areas could offset 106.21% of the Project's impacts on the Grey-headed Flying-fox.

Table 39 Attribute values entered in the Offset assessment guide calculations for the Spotted-tailed Quoll

Offset assessment guide attribute	Norton offset area	Justification	Griffin offset site	Justification	Boambee SF offset area	Justification	xxxxx offset area	Justification
Impact Calculator - Quantum of impact - Area	167 hectares	The limitation on the area of removal of Spotted-tailed Quoll habitat under the EPBC Approval for the Project as documented in the approved offset strategy (GHD, 2013a; 2013c).	167 hectares	As for the Norton offset area.	167 hectares	As for the Norton offset area.	167 hectares	As for Norton offset area
Impact Calculator - Quantum of impact – Quality	8/10	The quality of the habitat in the impact area as described in Section 11.2.2.	8/10	As for the Norton offset area.	8/10	As for the Norton offset area.	8/10	As for Norton offset area
Offset calculator – Time horizon – Risk related time horizon	20 years	The Norton offset area will be protected and managed in perpetuity under a BioBanking agreement. 20 years is the maximum timeframe for averting loss in the guide.	20 years	The Griffin offset site will be protected and managed in perpetuity as a Historic Site. 20 years is the maximum timeframe for averting loss in the guide.	20 years	The Boambee SF offset area will be protected and managed in perpetuity as a Flora Reserve. 20 years is the maximum timeframe for averting loss in the guide.	20 years	The xxxxx offset area will be protected and managed in perpetuity as a biobank site. 20 years is the maximum timeframe for averting loss in the guide.

Offset assessment guide attribute	Norton offset area	Justification	Griffin offset site	Justification	Boambee SF offset area	Justification	xxxxx offset area	Justification
Offset calculator – Time horizon – Time until ecological benefit	5 years	The Norton offset area contains habitat in moderate to good condition that will be managed for conservation, including through exclusion of damaging human activities, treatment of weed infestations, bush regeneration and treatment of pest fauna. Ecological benefits will be achieved in the short term, nominally five years. Conversely, a tangible reduction in the quality of habitat through increased weed infestation and edge effects, human impacts or uncontrolled wildfire is likely within five years.	5 years	The Griffin offset site contains habitat in good condition that will be managed for conservation, including through exclusion of damaging human activities, treatment of weed infestations, bush regeneration and treatment of pest fauna. Ecological benefits will be achieved in the short term, nominally five years. Conversely, a tangible reduction in the quality of habitat through increased weed infestation and edge effects, human impacts or uncontrolled wildfire is likely within five years.	5 years	The Boambee SF offset area contains habitat in good condition that will be managed for conservation, including through treatment of weed infestations, bush regeneration, treatment of pest fauna and especially exclusion of timber harvesting. Ecological benefits will be achieved in the short term, nominally five years. Conversely, a tangible reduction in the quality of habitat through timber harvesting, increased weed infestation and edge effects, human impacts or uncontrolled wildfire is likely within five years.	5 years	The xxxxx offset area contains habitat in moderate to good condition that will be managed for conservation, including through exclusion of damaging human activities, treatment of weed infestations, bush regeneration and treatment of pest fauna. Ecological benefits will be achieved in the short term, nominally five years. Conversely, a tangible reduction in the quality of habitat through increased weed infestation and edge effects, human impacts or uncontrolled wildfire is likely within five years.
Offset calculator - Future area and quality without offset – Risk of loss without offset	20%	The Norton offset site is currently vacant land owned by Roads and Maritime. Based on direct observations of recent and planned development in the near vicinity of the site there is a notable risk of damaging land uses such as a quarry expansion, intensive agriculture, private forestry or industrial development.	10%	The Griffin offset site is currently vacant land owned by Roads and Maritime. Based on direct observations of recent and planned development in the near vicinity of the site there is a moderate risk of damaging land uses such as intensive agriculture, private forestry, residential or tourist development.	80 %	The majority of the Boambee SF offset area is currently within FMZ 4 ‘General Management’ and is available for timber harvesting and other activities that are likely to harm Spotted-tailed Quoll populations and/or remove habitat. The offset area contains high quality regrowth with considerable timber value (Williams J., FCNSW pers. comm.) and will be likely to be harvested in the short to medium term.	20%	The xxxxx offset site is currently rural residential land and is available for grazing and other activities that are likely to harm fauna populations and/or reduce the quality of habitat. Permitted activities include clearing of vegetation for more intensive agricultural activities such as blueberry cultivation that would be economic and have been considered by the landowner (xxxxx. pers. comm.).

Offset assessment guide attribute	Norton offset area	Justification	Griffin offset site	Justification	Boambee SF offset area	Justification	xxxxx offset area	Justification
Offset calculator - Future area and quality with offset – Risk of loss with offset	3%	The Norton offset area will be protected and managed in perpetuity under a conservation covenant (a BioBanking agreement). A BioBanking agreement is a secure conservation covenant that is supported by NSW legislation and OEH monitoring and enforcement and is highly unlikely to ever be overturned.	3%	The Griffin offset site will be protected and managed as part of the National Parks estate within the Clybucca Historic site. A historic site imposes a secure conservation covenant that is supported by NSW and Commonwealth legislation and NPWS monitoring and enforcement and is highly unlikely to ever be overturned.	3%	The NH2U Boambee SF offset area will be protected and managed in perpetuity as a Flora Reserve. The Flora Reserve that will encompass the Boambee SF offset site will be delimited by hard boundaries such as roads, drainage lines, fences and the State forest boundary and as such will be readily identified and avoided in the planning and harvesting processes. FCNSW files include no records of a Flora Reserve being breached by any harvesting operations or management activities. The NSW OEH recognises that as a conservation mechanism, Flora Reserves offer a similar level of security and protection to biodiversity as National Parks and Nature Reserves (OEH, 2011).	3 %	The NH2U xxxxx offset area will be protected and managed in perpetuity under a BioBanking agreement. A BioBanking agreement is highly unlikely to ever be overturned to permit grazing, clearing of vegetation for blueberry cultivation or other damaging activities.
Confidence in result – averted loss of offset	95%	A BioBanking agreement is a secure conservation covenant that is supported by: NSW legislation; implementation of the site specific MAP to exclude harmful activities; and OEH monitoring and enforcement (see Section 11.3.1).	95%	As part of the National Parks estate the Griffin offset site will be protected under the EPBC Act and NSW legislation, implementation of the site management plan to exclude harmful activities; and NPWS stewardship, monitoring and enforcement (see Section 11.3.2).	95 %	A Flora Reserve is a secure conservation covenants supported by NSW legislation as well as implementation of the Forestry Management Zoning system and a reserve specific works plan to exclude harmful activities (see Section 11.3.3).	95%	A BioBanking agreement is a secure conservation covenant that is supported by: NSW legislation; implementation of the site specific MAP to exclude harmful activities; and OEH monitoring and enforcement (see Section 11.3.4).

Offset assessment guide attribute	Norton offset area	Justification	Griffin offset site	Justification	Boambee SF offset area	Justification	xxxxx offset area	Justification
Offset calculator – Start area and quality – Area	270 hectares	Comprises the 'Dry Sclerophyll Forest', 'Wet Sclerophyll Forest' and 'Grassy Woodland' habitat within the NH2U offset area mapped on Figure 4. The area of habitat at the Norton offset area was confirmed through detailed field surveys, including targeted surveys for nocturnal fauna, quantification of the amount and quality of food resources available and mapping of vegetation type and condition (see Section 3.4.3).	167 hectares	Comprises the 'Dry Sclerophyll Forest' and 'Swamp Sclerophyll Forest' habitat mapped on Figure 7. The area of habitat was confirmed through detailed field surveys, including quantification of the amount and quality of food resources available and mapping of vegetation type and condition (see Section 4.4.3).	59.8 hectares	The area of habitat comprises the 'Dry Sclerophyll Forest', 'Wet Sclerophyll Forest' and 'Rainforest' habitat within the NH2U offset area mapped on Figure 8. The area of habitat at the Boambee SF offset area was confirmed through detailed field surveys, including targeted surveys, quantification of the amount and quality of food resources available and mapping of vegetation type and condition (see Section 5.4.3).	87.2 hectares	Comprises the 'Dry Sclerophyll Forest' and 'Wet Sclerophyll Forest' habitat within the NH2U offset area mapped on Figure 13. The area of habitat was confirmed through detailed field surveys, including targeted surveys, quantification of the amount and quality of food resources available and mapping of vegetation type and condition (see Section 6.4.3).

Offset assessment guide attribute	Norton offset area	Justification	Griffin offset site	Justification	Boambee SF offset area	Justification	xxxxx offset area	Justification
Offset calculator – Start area and quality – Start quality	7/10	The offset area contains likely habitat in moderate to good condition, with resources such as dense understorey vegetation, hollow-bearing trees and woody debris, as part of a large patch of vegetation that is in good condition. There are some impacts from clearing, rubbish dumping, weed infestation, edge effects, the presence of dogs and the likely presence of foxes and cats. The habitat quality score is further supported by the good condition of vegetation and habitat as confirmed by the BioBanking plot/transect data included in Appendix A.	7/10	The offset area contains likely habitat in moderate to good condition, with resources such as dense understorey vegetation, hollow-bearing trees and woody debris, as part of a large patch of vegetation that is in good condition. There are some impacts from rubbish dumping, weed infestation, edge effects the presence of dogs and the likely presence of foxes and cats. The habitat quality score is further supported by the good condition of vegetation and habitat as confirmed by the BioBanking plot/transect data included in Appendix B.	8/10	The offset area contains occupied habitat in moderate to good condition, with resources such as dense understorey vegetation, hollow-bearing trees and woody debris, as part of a large patch of vegetation that is in good condition. There are some impacts from timber harvesting, weed infestation and edge effects. The habitat quality score is further supported by the good condition of vegetation and habitat as confirmed by BioBanking plot/transect data included in Appendix C.	7/10	The offset area contains likely habitat in moderate to good condition, with resources such as dense understorey vegetation, hollow-bearing trees and woody debris, as part of a large patch of vegetation that is in good condition. There are some impacts from timber harvesting, weed infestation, edge effects and grazing. The habitat quality score is further supported by the good condition of vegetation and habitat as confirmed by BioBanking plot/transect data included in Appendix D.
Offset calculator - Future area and quality without offset – Future quality without offset (1-10)	6/10	Habitat in the Norton offset area will continue to deteriorate through impacts from weed infestation, edge effects, inappropriate fire regimes, permissible grazing, predation and competition by pest fauna etc. if not set aside for conservation.	6/10	Habitat in the Griffin offset site will continue to deteriorate through impacts from weed infestation, edge effects, inappropriate fire regimes, predation and competition by pest fauna etc. if not set aside for conservation.	7/10	Habitat in the Boambee SF offset area will continue to deteriorate through impacts from weed infestation, edge effects, inappropriate fire regimes, predation and competition by dogs, foxes and cats. etc. if not set aside for conservation. These incremental impacts are distinct from the removal of habitat associated with a timber harvesting event at the NH2U offset area, which is assessed under 'risk of loss of offset'.	6/10	Habitat in the xxxxx offset site will continue to deteriorate through impacts from weed infestation, edge effects, inappropriate fire regimes, predation and competition by pest fauna, permissible grazing etc. if not set aside for conservation.

Offset assessment guide attribute	Norton offset area	Justification	Griffin offset site	Justification	Boambee SF offset area	Justification	xxxxx offset area	Justification
Offset calculator - Future area and quality with offset – Future quality with offset (1-10)	8/10	Habitat at the Norton offset area will be managed as described in Section 7. A tangible improvement in the quality of habitat will be achieved as described in Table 36 especially through the increased health and productivity of vegetation and prey species populations and reduced risk of predation or competition by dogs, foxes and cats.	8/10	Habitat at the Griffin offset site will be managed as described in Section 8. A tangible improvement in the quality of habitat will be achieved as described in Table 36 especially through the increased health and productivity of vegetation and prey species populations and reduced risk of predation or competition by dogs, foxes and cats.	9/10	Habitat at the Boambee SF offset area will be managed as described in Section 9. A tangible improvement in the quality of habitat will be achieved as described in Table 36, especially through the increased health and productivity of vegetation and prey species populations and reduced risk of predation or competition by dogs, foxes and cats.	8/10	Habitat at the xxxxx offset site will be managed as described in Section 10. A tangible improvement in the quality of habitat will be achieved as described in Table 36 especially through the increased health and productivity of vegetation and prey species populations and reduced risk of predation or competition by dogs, foxes and cats.
Confidence in result – change in quality	75 %	A modest increase in site quality is predicted. The link between the predicted improvement in the quality of habitat and viability of fauna populations through management actions is described in Table 36 The site will be managed under a plan that includes performance criteria and corrective actions to help ensure that targets are achieved. There is a low residual likelihood of the prescribed management actions not succeeding. 75% is a reasonable level of confidence in the effectiveness of the proposed environmental management actions.	75%	As for the Norton offset area.	75%	As for the Norton offset area.	75%	As for the Norton offset area.

Offset assessment guide attribute	Norton offset area	Justification	Griffin offset site	Justification	Boambee SF offset area	Justification	xxxxx offset area	Justification
Percentage of impact offset	**43.42%**		**21.14%**		**21.9%**		**16.02%**	

Based on the offset assessment guide calculations summarised above the 584 hectares of Spotted-tailed Quoll habitat in the NH2U Norton, Griffin, Boambee SF and xxxxx offset areas could offset 102.48% of the Project's impacts on the Spotted-tailed Quoll.

Table 40 Attribute values entered in the Offset assessment guide calculations for the Regent Honeyeater

Offset assessment guide attribute	Norton offset area	Justification	Griffin offset site	Justification
Impact Calculator - Quantum of impact - Area	73.5 hectares	The limitation on the area of removal of Regent Honeyeater habitat under the EPBC Approval for the Project as documented in the approved offset strategy (GHD, 2013a; 2013c).	73.5 hectares	As for the Norton offset area.
Impact Calculator - Quantum of impact – Quality	6/10	The quality of the habitat in the impact area as described in Section 11.2.4.	6/10	As for the Norton offset area.
Offset calculator – Time horizon –Risk related time horizon	20 years	The Norton offset area will be protected and managed in perpetuity under a BioBanking agreement. 20 years is the maximum timeframe for averting loss in the guide.	20 years	The Griffin offset site will be protected and managed in perpetuity as a Historic Site. 20 years is the maximum timeframe for averting loss in the guide.
Offset calculator – Time horizon – Time until ecological benefit	5 years	The Norton offset area contains habitat in moderate to good condition that will be managed for conservation, including through exclusion of damaging human activities, treatment of weed infestations, bush regeneration and treatment of pest fauna. Ecological benefits will be achieved in the short term, nominally five years. Conversely, a reduction in the quality of habitat through increased weed infestation and edge effects, human impacts or uncontrolled wildfire is likely within five years.	5 years	The Griffin offset site contains habitat in good condition that will be managed for conservation, including through exclusion of damaging human activities, treatment of weed infestations, bush regeneration and treatment of pest fauna. Ecological benefits will be achieved in the short term, nominally five years. Conversely, a reduction in the quality of habitat through increased weed infestation and edge effects, human impacts or uncontrolled wildfire is likely within five years.

Offset assessment guide attribute	Norton offset area	Justification	Griffin offset site	Justification
Offset calculator -Future area and quality without offset – Risk of loss without offset	20%	The Norton offset site is currently vacant land owned by Roads and Maritime. Based on direct observations of recent and planned development in the near vicinity of the site there is a notable risk of damaging land uses such as a quarry expansion, intensive agriculture, private forestry or industrial development.	10%	The Griffin offset site is currently vacant land owned by Roads and Maritime. Based on direct observations of recent and planned development in the near vicinity of the site there is a moderate risk of damaging land uses such as intensive agriculture, private forestry, residential or tourist development.
Offset calculator -Future area and quality with offset – Risk of loss with offset	3%	The Norton offset area will be protected and managed in perpetuity under a conservation covenant (a BioBanking agreement). A BioBanking agreement is a secure conservation covenant that is supported by NSW legislation and OEH monitoring and enforcement and is highly unlikely to ever be overturned.	3%	The Griffin offset site will be protected and managed as part of the National Parks estate within the Clybucca Historic site. A historic site imposes a secure conservation covenant that is supported by NSW and Commonwealth legislation and NPWS monitoring and enforcement and is highly unlikely to ever be overturned.
Confidence in result – averted loss of offset	95%	A BioBanking agreement is a secure conservation covenant that is supported by: NSW legislation; implementation of the site specific MAP to exclude harmful activities; and OEH monitoring and enforcement (see Section 11.3.1).	95%	As part of the National Parks estate the Griffin offset site will be protected under the EPBC Act and NSW legislation, implementation of the site management plan to exclude harmful activities; and NPWS stewardship, monitoring and enforcement (see Section 11.3.2).
Offset calculator – Start area and quality – Area	270 hectares	Comprises the 'Dry Sclerophyll Forest', 'Wet Sclerophyll Forest' and 'Grassy Woodland' habitat within the NH2U offset area mapped on Figure 4. The area of habitat at the Norton offset area was confirmed through detailed field surveys, including quantification of the amount and quality of food resources available and mapping of vegetation type and condition (see Section 3.4.4). The offset area contains potential foraging habitat for a nomadic regional population of the Regent Honeyeater that may occur on a transitory basis (see Section 3.5.4).	132 hectares	Comprises the 'Dry Sclerophyll Forest' and 'Swamp Sclerophyll Forest' habitat mapped on Figure 7. The area of habitat was confirmed through detailed field surveys, including quantification of the amount and quality of food resources available and mapping of vegetation type and condition (see Section 4.4.4). The offset area contains potential foraging habitat for a nomadic regional population of the Regent Honeyeater that may occur on a transitory basis (see Section 4.5.4).
Offset calculator – Start area and quality – Start quality	6/10	The offset area contains potential foraging habitat for the regional population of the species. The habitat quality score was confirmed: through the presence of moderate to high cover of food tree species in the canopy plots (see Table 2); and the good condition of vegetation and habitat as confirmed by BioBanking plot/transect data included in Appendix A.	6/10	The offset area contains potential foraging habitat for the regional population of the species. The habitat quality score was confirmed: through the presence of moderate to high cover of food tree species in the canopy plots (see Table 6); and the good condition of vegetation and habitat as confirmed by BioBanking plot/transect data included in Appendix B.

Offset assessment guide attribute	Norton offset area	Justification	Griffin offset site	Justification
Offset calculator -Future area and quality without offset – Future quality without offset (1-10)	6/10	Habitat in the Norton offset area will continue to deteriorate through impacts from weed infestation, edge effects, inappropriate fire regimes, permissible grazing etc. if not set aside for conservation. This incremental decrease in the quality of habitat resources would probably not be sufficient to reduce site quality by a full point.	6/10	Habitat in the Griffin offset site will continue to deteriorate through impacts from weed infestation, edge effects, inappropriate fire regimes etc. if not set aside for conservation. This incremental decrease in the quality of habitat resources would probably not be sufficient to reduce site quality by a full point.
Offset calculator -Future area and quality with offset – Future quality with offset (1-10)	7/10	Habitat at the Norton offset area will be managed as described in Section 7. A tangible improvement in the quality of habitat will be achieved as described in Table 36 especially through the increased health and productivity of food tree species.	7/10	Habitat at the Griffin offset site will be managed as described in Section 8. A tangible improvement in the quality of habitat will be achieved as described in Table 36 especially through the increased health and productivity of food tree species.
Confidence in result – change in quality	75 %	A modest increase in site quality is predicted. The link between the predicted improvement in the quality of habitat and viability of fauna populations through management actions is described in Table 36. The site will be managed under a plan that includes performance criteria and corrective actions to help ensure that targets are achieved. There is a low residual likelihood of the prescribed management actions not succeeding. 75% is a reasonable level of confidence in the effectiveness of the proposed environmental management actions.	75%	As for the Norton offset area.
Percentage of impact offset	**89.14%**		**30.01%**	

Based on the offset assessment guide calculations summarised above, the 402 hectares of Regent Honeyeater habitat in the NH2U Norton and Griffin offset areas could offset 119.15% of the Project's impacts on the Regent Honeyeater.

Table 41 Attribute values entered in the Offset assessment guide calculations for the Swift Parrot

Offset assessment guide attribute	Norton offset area	Justification	Griffin offset site	Justification
Impact Calculator - Quantum of impact - Area	73.5 hectares	The limitation on the area of removal of Swift Parrot habitat under the EPBC Approval for the Project as documented in the approved offset strategy (GHD, 2013a; 2013c).	73.5 hectares	As for the Norton offset area.
Impact Calculator - Quantum of impact – Quality	6/10	The quality of the habitat in the impact area as described in Section 11.2.5.	6/10	As for the Norton offset area.
Offset calculator – Time horizon –Risk related time horizon	20 years	The Norton offset area will be protected and managed in perpetuity under a BioBanking agreement. 20 years is the maximum timeframe for averting loss in the guide.	20 years	The Griffin offset site will be protected and managed in perpetuity as a Historic Site. 20 years is the maximum timeframe for averting loss in the guide.
Offset calculator – Time horizon – Time until ecological benefit	5 years	The Norton offset area contains habitat in moderate to good condition that will be managed for conservation, including through exclusion of damaging human activities, treatment of weed infestations, bush regeneration and treatment of pest fauna. Ecological benefits will be achieved in the short term, nominally five years. Conversely, a reduction in the quality of habitat through increased weed infestation and edge effects, human impacts or uncontrolled wildfire is likely within five years.	5 years	The Griffin offset site contains habitat in good condition that will be managed for conservation, including through exclusion of damaging human activities, treatment of weed infestations, bush regeneration and treatment of pest fauna. Ecological benefits will be achieved in the short term, nominally five years. Conversely, a reduction in the quality of habitat through increased weed infestation and edge effects, human impacts or uncontrolled wildfire is likely within five years.
Offset calculator -Future area and quality without offset – Risk of loss without offset	20%	The Norton offset site is currently vacant land owned by Roads and Maritime. Based on direct observations of recent and planned development in the near vicinity of the site there is a notable risk of damaging land uses such as a quarry expansion, intensive agriculture, private forestry or industrial development.	10%	The Griffin offset site is currently vacant land owned by Roads and Maritime. Based on direct observations of recent and planned development in the near vicinity of the site there is a moderate risk of damaging land uses such as intensive agriculture, private forestry, residential or tourist development.
Offset calculator -Future area and quality with offset – Risk of loss with offset	3%	The Norton offset area will be protected and managed in perpetuity under a conservation covenant (a BioBanking agreement). A BioBanking agreement is a secure conservation covenant that is supported by NSW legislation and OEH monitoring and enforcement and is highly unlikely to ever be overturned.	3%	The Griffin offset site will be protected and managed as part of the National Parks estate within the Clybucca Historic site. A historic site imposes a secure conservation covenant that is supported by NSW and Commonwealth legislation and NPWS monitoring and enforcement and is highly unlikely to ever be overturned.

Offset assessment guide attribute	Norton offset area	Justification	Griffin offset site	Justification
Confidence in result – averted loss of offset	95%	A BioBanking agreement is a secure conservation covenant that is supported by: NSW legislation; implementation of the site specific MAP to exclude harmful activities; and OEH monitoring and enforcement (see Section 11.3.1).	95%	As part of the National Parks estate the Griffin offset site will be protected under the EPBC Act and NSW legislation, implementation of the site management plan to exclude harmful activities; and NPWS stewardship, monitoring and enforcement (see Section 11.3.2).
Offset calculator – Start area and quality – Area	270 hectares	Comprises the 'Dry Sclerophyll Forest', 'Wet Sclerophyll Forest' and 'Grassy Woodland' habitat within the NH2U offset area mapped on Figure 4. The area of habitat at the Norton offset area was confirmed through detailed field surveys, including quantification of the amount and quality of food resources available and mapping of vegetation type and condition (see Section 3.4.5). The offset area contains potential foraging habitat for the migratory population of the Swift Parrot that may occur on a transitory basis (see Section 3.5.5).	132 hectares	Comprises the 'Dry Sclerophyll Forest' and 'Swamp Sclerophyll Forest' habitat mapped on Figure 7. The area of habitat was confirmed through detailed field surveys, including quantification of the amount and quality of food resources available and mapping of vegetation type and condition (see Section 4.4.5). The offset area contains potential foraging habitat for the migratory population of the Swift Parrot that may occur on a transitory basis. There are records of the species in similar coastal forest with winter-flowering food species in the locality(see Section 4.5.5).
Offset calculator – Start area and quality – Start quality	6/10	The offset area contains potential foraging habitat for the regional population of the species. The habitat quality score was confirmed: through the presence of moderate to high cover of food tree species in the canopy plots (see Table 2); and the good condition of vegetation and habitat as confirmed by BioBanking plot/transect data included in Appendix A.	6/10	The offset area contains potential foraging habitat for the regional population of the species. The habitat quality score was confirmed: through the presence of moderate to high cover of food tree species in the canopy plots (see Table 6); and the good condition of vegetation and habitat as confirmed by BioBanking plot/transect data included in Appendix B.
Offset calculator -Future area and quality without offset – Future quality without offset (1-10)	6/10	Habitat in the Norton offset area will continue to deteriorate through impacts from weed infestation, edge effects, inappropriate fire regimes, permissible grazing etc. if not set aside for conservation. This incremental decrease in the quality of habitat resources would probably not be sufficient to reduce site quality by a full point.	6/10	Habitat in the Griffin offset site will continue to deteriorate through impacts from weed infestation, edge effects, inappropriate fire regimes etc. if not set aside for conservation. This incremental decrease in the quality of habitat resources would probably not be sufficient to reduce site quality by a full point.
Offset calculator -Future area and quality with offset – Future quality with offset (1-10)	7/10	Habitat at the Norton offset area will be managed as described in Section 7. A tangible improvement in the quality of habitat will be achieved as described in Table 36 especially through the increased health and productivity of food tree species.	7/10	Habitat at the Griffin offset site will be managed as described in Section 8. A tangible improvement in the quality of habitat will be achieved as described in Table 36 especially through the increased health and productivity of food tree species.

Offset assessment guide attribute	Norton offset area	Justification	Griffin offset site	Justification
Confidence in result – change in quality	75 %	A modest increase in site quality is predicted. The link between the predicted improvement in the quality of habitat and viability of fauna populations through management actions is described in Table 36. The site will be managed under a plan that includes performance criteria and corrective actions to help ensure that targets are achieved. There is a low residual likelihood of the prescribed management actions not succeeding. 75% is a reasonable level of confidence in the effectiveness of the proposed environmental management actions.	75%	As for the Norton offset area.
Percentage of impact offset	**89.14%**		**30.01%**	

Based on the offset assessment guide calculations summarised above, the 402 hectares of Swift Parrot habitat in the NH2U Norton and Griffin offset areas could offset 119.15% of the Project's impacts on the Swift Parrot.

Table 42 Pacific Highway Upgrade offset areas

Project			Norton		Griffin		Boambee SF		xxxxx		Total	
	Impact (ha)	Site Quality	Area (ha)	% offset	Area (ha)	% offset	Area (ha)	% offset	Area (ha)	% offset	Area (ha)	% offset
WC2NH												
Grey-headed Flying Fox	106.6	7	185	60.41			53	42.06			238	102.47
Koala (known)	106.6	7	185	60.23			49.1	43.58			234.1	103.81
Spotted-tailed Quoll	111.3	7	185	72.79			53	46.69			238	119.48
Giant Barred Frog (known)	0.7	8							5	121.47	5	121.47
Marsdenia longiloba (known)	17.8	6					20	108.8			20	108.8
WC2NH total			**185**				**53**		**5**		**243**	
NH2U												
Grey-headed flying fox	184	8	270	44.56	167	20.96	59.8	26.3	87.2	14.39	584	106.21
Koala (known and potential)	171	7	270	48.4	132	13.01	50.3	30.16	87.2	13.37	539.5	104.94
Spotted-tail quoll	167	8	270	43.42	167	21.14	59.8	21.9	87.2	16.02	584	102.48
Regent honeyeater	73.5	6	270	89.14	132	30.01					402	119.15
Swift parrot	73.5	6	270	89.14	132	30.01					402	119.15
Marsdenia longiloba	36	6					46.5	124.24			46.5	124.24
Tylophora woollsii	36	6					46.5	102.28			46.5	102.28
NH2U total			**270**		**167**		**59.8**		**87.2**		**584**	
OH2K												
Giant Barred Frog (known)	7.7	7	37.1	107							37.1	107
OH2K total			**37.1**								**37.1**	
Total all projects			**496**		**167**		**121**		**98.3**		**882.3**	

12. Conclusions

The Project has resulted in impacts on habitat for the affected threatened fauna species, listed under the *Environment Protection and Biodiversity Conservation Act 1999 (*EPBC Act) (the Koala, Grey-headed Flying-fox, Spotted-tailed Quoll, Regent Honeyeater and Swift Parrot). The referral for the Project included an EPBC Act biodiversity offset strategy for these affected threatened fauna comprising the conservation and management of habitat at the nominated offset sites. GHD have prepared this 'Norton and Griffin Offset Management Plan' report (NGOMP) to assist Roads and Maritime deliver the biodiversity offsets required for the affected threatened fauna.

This NGOMP outlines the approach to the delivery of biodiversity offsets for threatened fauna impacted by the Project by conservation and management of the Griffin offset site and the NH2U Norton, Boambee SF and xxxxx offset areas, comprising:

- Background information about the affected threatened fauna to inform appropriate management actions.
- A detailed description of the quality of the offset with reference to the ecology and habitat requirements of the affected threatened fauna and based on targeted field surveys of the offset sites.
- Description of the titling and management framework that will be adopted at the offset sites and how maintenance and enhancement of habitat will contribute to the conservation of the affected threatened fauna.
- Details of a monitoring program for determining the effectiveness of management actions.

The biodiversity offset package for the affected threatened fauna will comprise:

- Conservation of around 539.5 hectares of known or likely habitat for the Koala to offset the removal of 171 hectares of habitat with a site quality score of seven.
- Conservation of around 584 hectares of known or likely habitat for the Grey-headed Flying-fox to offset the removal of 184 hectares of habitat with a site quality score of eight.
- Conservation of around 584 hectares of likely habitat for the Spotted-tailed Quoll to offset the removal of 167 hectares of habitat with a site quality score of eight.
- Conservation of around 402 hectares of likely habitat for the Regent Honeyeater to offset the removal of 73.5 hectares of habitat with a site quality score of six.
- Conservation of around 402 hectares of likely habitat for the Swift Parrot to offset the removal of 73.5 hectares of habitat with a site quality score of six.

These direct offsets will be delivered through conservation of appropriate areas of habitat in the Griffin offset site and the NH2U Norton, Boambee SF and xxxxx offset areas. Roads and Maritime will ensure that in-perpetuity conservation covenants will be established over the offset sites to ensure the long term protection and management of biodiversity values. A detailed management actions plan and monitoring program has been prepared for each site to ensure that the extent and quality of habitat for the affected threatened fauna is improved and then maintained in perpetuity.

Offset assessment guide calculations that demonstrate how these direct offsets will comply with the EPBC Act offset policy and fully offset the Project's impacts have been completed. The desktop assessments, field surveys, habitat assessments and management action plans presented above provide further support for these offset calculations.

The conservation and management of the Offset sites will meet the Project's direct offset requirements (as determined by the Department in accordance with the Offsets assessment guide) and enhance the conservation of the affected threatened fauna.

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Appendices

Appendix A – Norton offset site baseline survey results

NH2U Norton offset area biometric plot/transect data

Fauna habitat type	Veg Type ID	Plot ID	Native plant species richness	Native over-storey cover	Native mid-storey cover	Native ground cover (grasses)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Over storey regen.	Total length of fallen logs	Easting	Northing	Zone
Dry sclero-phyll forest	NR222	Bench-mark	44	15-50	10-40	5-50	5-40	5-70	0	0.1	1.0	> = 20			
		41	29	11	20	72	6	4	0	0	0.6	16	483557	6555694	56
		42	27	12	9	24	4	64	0	0	0.6	5	483712	6555651	56
	NR228	Bench-mark	35	15-50	5-70	5-70	5-60	5-80	0	1.5	1	> = 10			
		6	30	18	44.5	24	10	16	0	1	1	17	485202	6554907	56
		16	33	21.7	34.5	80	16	18	0	3	1	94	484506	6554741	56
		5	34	22.2	0	44	6	2	0	2	1	300	484815	6555175	56
		19	35	7.8	19.1	90	8	22	0	0	1	142	485241	6554276	56
		51	36	18	20.5	66	8	28	0	0	1	18	485598	6553851	56
	NR246	Bench-mark	37	20-50	10-60	10-60	5-60	10-50	0	1	1	10			
		26	32	30.5	14.5	42	0	44	38	0	0.6	126	484536	6557961	56
Wet sclero-phyll forest	NR119	Bench-mark	44	15-50	10-40	5-50	5-40	5-70	0	0.1	1	> = 20			56
		44	35	12.5	10.5	68	0	18	0	0	0.83	34	483940	6555015	56
		45	29	13	14.5	86	6	32	0	0	0.83	13	483134	6555782	56
		46	22	20.5	8.5	52	6	30	0	0	0.83	0	483570	6555859	56
	NR122	Bench-mark	49	20-90	15-90	0-50	10-70	5-90	0	10	1	> = 10			56
		18	44	30.5	55.5	64	28	40	0	1	0.5	76	485324	62555351	56
		25	42	38.5	30.5	24	22	20	0	0	0.5	82	485475	6554973	56

Fauna habitat type	Veg Type ID	Plot ID	Native plant species richness	Native over-storey cover	Native mid-storey cover	Native ground cover (grasses)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Over storey regen.	Total length of fallen logs	Easting	Northing	Zone
	NR160	Bench-mark	49	20-50	15-90	0-50	10-70	5-90	0	10	1.0	0.1			
		33	24	18.5	22.5	70	16	36	6	0	0.0	15	485132	6555423	56
	NR117	Bench-mark	49	20-90	15-90	0-50	10-70	5-90	0	0.1	1	10			
		43	42	15.5	21	54	18	36	0	1	0.6	40	484112	6555612	56
		50	35	14	18	60	38	8	0	0	0.6	9	483517	6555412	56
	NR161	Bench mark	27	10-35	5-30	10-60	0-10	5-25	0	1	1.0	5			
		48	36	9	18.5	54	6	28	2	0	1.0	0	483476	6555230	56
		49	28	6	20.5	50	16	54	0	0	1.0	18	483407	6555243	56

NH2U Norton offset area biometric plot/transect data

Fauna habitat type	Veg Type ID	Plot ID	Native plant species richness	Native over-storey cover	Native mid-storey cover	Native ground cover (grasses)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Over storey regen.	Total length of fallen logs	Easting	Northing	Zone
Dry sclero-phyll forest	NR222	Bench-mark	44	15-50	10-40	5-50	5-40	5-70	0	0.1	1.0	> = 20			
		1	34	19.5	17.5	84	4	56	0	0	0.6	32	484146	6555808	56
		47	22	13.5	12.5	54	0	48	0	1	0.6	5	483570	6555859	56
	NR247	Bench-mark	37	15-40	10-50	5-60	5-60	5-40	0	1	1.0	> = 10			
		21	40	27.2	29	88	8	22	0	2	1	65	484803	6556324	56
		38	30	15	4.5	24	0	70	0	0	1.0	20	484949	6555995	56
		39	30	18.5	13.5	48	4	18	0	0	1.0	5	484838	6556515	56
	NR228	Bench-mark	35	15-50	5-70	5-70	5-60	5-80	0	1.5	1	> = 10			
		35	30	13	12	84	8	40	0	0	1	94	484506	6554741	56
	NR246	Bench-mark	37	20-50	10-60	10-60	5-60	10-50	0	1	1	10			
		20	37	43.5	46	46	22	34	0	1	0.6	46	484935	6556281	56
		23	32	30.2	28.1	62	8	44	0	1	0.6	32.5	484229	6557443	56
		24	30	19.5	23.2	82	30	24	0	0	0.6	95	484526	6556898	56
		40	23	11	10.5	78	0	40	0	0	0.6	36	484254	6556454	56
		3	24	18.5	51	74	20	28	0	0	0.6	5	484161	6555892	56
		27	18	0	11	8	2	20	86	0	0.1	0	484466	6557804	56
		28	9	0	3	30	2	4	68	0	0.1	0	484310	6557831	56
Wet sclero-phyll forest	NR119	Bench-mark	44	15-50	10-40	5-50	5-40	5-70	0	0.1	1	> = 20			56

Fauna habitat type	Veg Type ID	Plot ID	Native plant species richness	Native over-storey cover	Native mid-storey cover	Native ground cover (grasses)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Over storey regen.	Total length of fallen logs	Easting	Northing	Zone
		34	39	15	14.5	58	14	38	0	0	0.83	54	485144	6555906	56
	NR122	Bench-mark	49	20-90	15-90	0-50	10-70	5-90	0	10	1	> = 10			56
		31	45	23	35	68	10	70	0	0	0.5	25	485281	6555675	56
		36	41	11	14.5	56	20	42	0	0	0.5	21	484893	6555840	56
	NR160	Bench-mark	49	20-50	15-90	0-50	10-70	5-90	0	10	1.0	0.1			
		30	36	34	32	74	38	78	0	0	0.0	12	485187	6555625	56
		32	22	24.5	20	36	36	52	0	0	0.0	18	485193	6555505	56
	NR117	Bench-mark	49	20-90	15-90	0-50	10-70	5-90	0	0.1	1	10			
		29	33	36	51	14	18	60	0	0	0.6	4	484791	6555678	56
		4	31	17.5	48.5	44	42	22	0	2	0.6	46	484621	6555662	56
		37	36	16	25.5	56	10	38	0	1	0.6	28	484621	6555662	56

NH2U Norton offset area flora species list

Flora species within NR222, NR161 (plots 41, 42, 48 and 49)

Family	Scientific Name	Common Name	Exotic	Plot 41 Cover	Plot 41 Abundance	Plot 42 Cover	Plot 42 Abundance	Plot 48 Cover	Plot 48 Abundance	Plot 49 Cover	Plot 49 Abundance
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower		1	8			1	1	1	50
Apiaceae	*Centella asiatica*	Indian Pennywort						1	1000	1	100
Apiaceae	*Hydrocotyle sibthorpioides*							1	1000	1	100
Apocynaceae	*Parsonsia straminea*	Common Silkpod		1	1			1	1	2	7
Asteraceae	*Vernonia cinerea*							1	200	1	50
Casuarinaceae	*Allocasuarina littoralis*	Black She-Oak				5	15	1	2	10	6
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak		10	21						
Convolvulaceae	*Dichondra repens*	Kidney Weed						1	1000	1	200
Convolvulaceae	*Polymeria calycina*							1	100		
Cyperaceae	*Carex appressa*	Tall Sedge						2	25		
Cyperaceae	*Carex maculata*							15	1000		
Cyperaceae	*Fimbristylis dichotoma*	Common Fringe-sedge						1	1		
Cyperaceae	*Gahnia sieberiana*	Red-fruit Saw-sedge								1	15
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge		2	100	1	20	1	1		
Cyperaceae	*Ptilothrix deusta*			1	3	3	200				
Cyperaceae	*Baumea rubiginosa*							1	50		
Cyperaceae	*Chorizandra cymbaria*									3	100
Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower		1	2	1	2				

Family	Scientific Name	Common Name	Exotic	Plot 41 Cover	Plot 41 Abundance	Plot 42 Cover	Plot 42 Abundance	Plot 48 Cover	Plot 48 Abundance	Plot 49 Cover	Plot 49 Abundance
Dilleniaceae	*Hibbertia obtusifolia*	Hoary Guinea Flower				1	1				
Fabaceae (Faboideae)	*Gompholobium pinnatum*	Pinnate Wedge Pea				1	4				
Fabaceae (Faboideae)	*Pultenaea myrtoides*			1	1	1	30				
Fabaceae (Faboideae)	*Dillwynia retorta*					1	2				
Fabaceae (Mimosoideae)	*Acacia binervata*	Two-veined Hickory				1	3				
Fabaceae (Mimosoideae)	*Acacia floribunda*	White Sally						1	7	2	3
Goodeniaceae	*Dampiera sylvestris*			1	2						
Goodeniaceae	*Goodenia ovata*	Hop Goodenia		1	10						
Goodeniaceae	*Velleia spathulata*					1	200			1	100
Haloragaceae	*Gonocarpus tetragynus*	Poverty Raspwort		1	4	1	200	1	1	1	20
Lauraceae	*Cassytha* sp.			1	7						
Lauraceae	*Cinnamomum camphora*	Camphor Laurel	*							1	1
Lobeliaceae	*Pratia purpurascens*	Whiteroot		1	1			1	1	1	3
Lomandraceae	*Lomandra filiformis*	Wattle Matt-rush				1	50				
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush						2	40	10	50
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry						1	1		
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush		3	17			15	14	2	3
Myrtaceae	*Corymbia gummifera*	Red Bloodwood		1	1	3	2				
Myrtaceae	*Eucalyptus cameronii*	Diehard Stringybark		5	3	5	2				

Family	Scientific Name	Common Name	Exotic	Plot 41 Cover	Plot 41 Abundance	Plot 42 Cover	Plot 42 Abundance	Plot 48 Cover	Plot 48 Abundance	Plot 49 Cover	Plot 49 Abundance
Myrtaceae	*Eucalyptus carnea*	Thick-leaved Mahogany				5	2				
Myrtaceae	*Eucalyptus resinifera*	Red Mahogany		5	2						
Myrtaceae	*Eucalyptus seeana*	Narrow-leaved Red Gum		5	4	3	4				
Myrtaceae	*Leptospermum polygalifolium*	Tantoon		1	1	1	4			1	8
Myrtaceae	*Melaleuca linariifolia*	Flax-leaved Paperbark		1	1			14	4	25	9
Myrtaceae	*Melaleuca nodosa*					2	22				
Myrtaceae	*Melaleuca sieberi*			1	1						
Myrtaceae	*Sannantha angusta*			2	12	1	1	1	22	7	20
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum						20	12	15	6
Orchidaceae	*Dipodium* sp.			1	2						
Oxalidaceae	*Oxalis* sp.			1	4			1	8	1	1
Phormiaceae	*Dianella caerulea*	Blue Flax-lily		1	50	1	1	1	3		
Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush						1	1		
Phyllanthaceae	*Glochidion ferdinandi*	Cheese Tree						1	1	1	1
Pittosporaceae	*Billardiera scandens*	Hairy Apple Berry		1	7						
Poaceae	*Andropogon virginicus*	Whisky Grass	*					1	1		
Poaceae	*Aristida* sp.	A Wiregrass				1	100				
Poaceae	*Aristida vagans*	Threeawn Speargrass		1	1	1	20				
Poaceae	*Axonopus fissifolius*	Narrow-leafed Carpet Grass	*					1	5		
Poaceae	*Cymbopogon refractus*	Barbed Wire Grass				1	1	1	1		

Family	Scientific Name	Common Name	Exotic	Plot 41 Cover	Plot 41 Abundance	Plot 42 Cover	Plot 42 Abundance	Plot 48 Cover	Plot 48 Abundance	Plot 49 Cover	Plot 49 Abundance
Poaceae	*Digitaria diffusa*	Open Summer-grass				1	1				
Poaceae	*Entolasia marginata*	Bordered Panic						1	1	1	100
Poaceae	*Entolasia stricta*	Wiry Panic		80	1000	70	1000	5	1000	30	1000
Poaceae	*Eragrostis* sp.	A Lovegrass	*			1	10				
Poaceae	*Imperata cylindrica*	Blady Grass		1	1						
Poaceae	*Ischaemum australe*							1	50	2	100
Poaceae	*Microlaena stipoides*	Weeping Grass						1	100	1	100
Poaceae	*Oplismenus aemulus*							1	2		
Poaceae	*Oplismenus imbecillis*									1	100
Poaceae	*Ottochloa gracillima*							5	1000		
Poaceae	*Paspalum mandiocanum*	Broadleaf Paspalum	*							1	3
Poaceae	*Paspalum orbiculare*	Ditch Millet						1	2		
Poaceae	*Paspalum urvillei*	Vasey Grass	*					1	1		
Poaceae	*Themeda australis*	Kangaroo Grass				1	50	1	1	1	1
Proteaceae	*Lomatia silaifolia*	Crinkle Bush								1	1
Sphagnaceae	*Sphagnum* sp.									1	1
Verbenaceae	*Lantana camara*	Lantana	*					1	3	1	2
Violaceae	*Hybanthus stellarioides*							1	3		
Xanthorrhoeaceae	*Xanthorrhoea* sp.			1	1	5	200				

Notes: Cover – visual estimate of foliage projective cover within the plot, recorded from 1–5% and then to the nearest 5%.

Abundance - relative number of individuals or shoots of a species within the plot. Based on the following intervals: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, 1000. Counts above 20 are estimates only

Flora species within NR160 and NR119 (plots 33, 44, 45 and 46)

Family	Scientific Name	Common Name	Exotic	Plot 33 Cover	Plot 33 Abundance	Plot 44 Cover	Plot 44 Abundance	Plot 45 Cover	Plot 45 Abundance	Plot 46 Cover	Plot 46 Abundance
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower				1	200	1	200	1	5
Apiaceae	*Centella asiatica*	Indian Pennywort		1	1						
Araliaceae	*Polyscias sambucifolia*	Elderberry Panax				1	1	1	3		
Asteraceae	*Vernonia cinerea*			1	1	1	50			1	3
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak								1	8
Commelinaceae	*Commelina cyanea*	Native Wandering Jew		1	100						
Convolvulaceae	*Dichondra repens*	Kidney Weed		1	1						
Convolvulaceae	*Polymeria calycina*							1	3		
Cyperaceae	*Carex maculata*			1	2						
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge				5	200	2	100		
Cyperaceae	*Ptilothrix deusta*							1	1		
Dennstaedtiaceae	*Pteridium esculentum*	Bracken				1	3	1	7	2	50
Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower				1	3	1	200		
Dilleniaceae	*Hibbertia scandens*	Climbing Guinea Flower								1	2
Dilleniaceae	*Hibbertia vestita*					1	50				
Fabaceae (Faboideae)	*Desmodium varians*	Slender Tick-trefoil				1	2				
Fabaceae (Faboideae)	*Glycine clandestina*	Twining glycine				1	7			1	1

Family	Scientific Name	Common Name	Exotic	Plot 33 Cover	Plot 33 Abundance	Plot 44 Cover	Plot 44 Abundance	Plot 45 Cover	Plot 45 Abundance	Plot 46 Cover	Plot 46 Abundance
Fabaceae (Faboideae)	*Glycine cyrtoloba*			1	50						
Fabaceae (Faboideae)	*Gompholobium pinnatum*	Pinnate Wedge Pea				1	4				
Fabaceae (Faboideae)	*Hardenbergia violacea*	False Sarsaparilla						1	1	1	1
Fabaceae (Mimosoideae)	*Acacia binervata*	Two-veined Hickory				2	20	5	15	1	10
Fabaceae (Mimosoideae)	*Acacia concurrens*	Curracabah				1	1			1	6
Fabaceae (Mimosoideae)	*Acacia floribunda*	White Sally		20	30						
Fabaceae (Mimosoideae)	*Acacia irrorata*	Green Wattle		1	1						
Geraniaceae	*Geranium solanderi*	Native Geranium		1	2						
Goodeniaceae	*Dampiera sylvestris*					1	50	1	20		
Goodeniaceae	*Goodenia ovata*	Hop Goodenia				1	1				
Haloragaceae	*Gonocarpus tetragynus*	Poverty Raspwort				1	1				
Iridaceae	*Patersonia sericea*	Silky Purple-Flag				1	1				
Juncaceae	*Juncus cognatus*		*	1	4						
Lauraceae	*Cassytha* sp.					1	1	1	2	1	3
Lauraceae	*Cinnamomum camphora*	Camphor Laurel	*							1	3
Lauraceae	*Cryptocarya microneura*	Murrogun		1	1						
Lobeliaceae	*Pratia purpurascens*	Whiteroot		1	100	1	1			1	2
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush				1	20			1	2
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry								1	8

Family	Scientific Name	Common Name	Exotic	Plot 33 Cover	Plot 33 Abundance	Plot 44 Cover	Plot 44 Abundance	Plot 45 Cover	Plot 45 Abundance	Plot 46 Cover	Plot 46 Abundance
Myrsinaceae	*Myrsine howittiana*	Brush Muttonwood		1	1						
Myrtaceae	*Acmena smithii*	Lilly Pilly		1	1						
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush		5	3	1	1	1	3	1	1
Myrtaceae	*Corymbia gummifera*	Red Bloodwood				1	2	1	1	5	3
Myrtaceae	*Eucalyptus cameronii*	Diehard Stringybark				5	2	4	1		
Myrtaceae	*Eucalyptus carnea*	Thick-leaved Mahogany								2	1
Myrtaceae	*Eucalyptus grandis*	Flooded Gum		35	11						
Myrtaceae	*Eucalyptus microcorys*	Tallowwood				10	2	4	1	1	1
Myrtaceae	*Eucalyptus pilularis*	Blackbutt				20	3	15	2	25	3
Myrtaceae	*Eucalyptus propinqua*	Small-fruited Grey Gum								2	1
Myrtaceae	*Leptospermum polygalifolium*	Tantoon				1	1				
Myrtaceae	*Melaleuca linariifolia*	Flax-leaved Paperbark		10	8						
Myrtaceae	*Melaleuca sieberi*					1	1	5	35		
Myrtaceae	*Melaleuca styphelioides*	Prickly-leaved Tea Tree		1	4						
Myrtaceae	*Sannantha angusta*			2	25	1	1	1	2		
Myrtaceae	*Syncarpia glomulifera*	Turpentine				5	14	10	19		
Oleaceae	*Notelaea ovata*							1	3		
Orchidaceae	*Pterostylis* sp.	Greenhood				1	2	1	20		
Phormiaceae	*Dianella caerulea*	Blue Flax-lily						1	2	1	5

Family	Scientific Name	Common Name	Exotic	Plot 33 Cover	Plot 33 Abundance	Plot 44 Cover	Plot 44 Abundance	Plot 45 Cover	Plot 45 Abundance	Plot 46 Cover	Plot 46 Abundance
Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush		1	1					1	1
Pittosporaceae	*Billardiera scandens*	Hairy Apple Berry		1	2	1	2	1	3	1	7
Poaceae	*Aristida vagans*	Threeawn Speargrass								1	1
Poaceae	*Cymbopogon refractus*	Barbed Wire Grass								1	2
Poaceae	*Digitaria diffusa*	Open Summer-grass								1	5
Poaceae	*Digitaria parviflora*	Small-flowered Finger Grass						1	1		
Poaceae	*Echinopogon* sp.	A Hedgehog Grass		1	1						
Poaceae	*Entolasia marginata*	Bordered Panic		2	100						
Poaceae	*Entolasia stricta*	Wiry Panic				30	1000	50	1000	5	100
Poaceae	*Eragrostis* sp.	A Lovegrass	*			1	1				
Poaceae	*Imperata cylindrica*	Blady Grass				20	1000	5	100	30	500
Poaceae	*Ischaemum australe*							1	2		
Poaceae	*Oplismenus aemulus*			1	100						
Poaceae	*Ottochloa gracillima*			50	1000					1	50
Poaceae	*Panicum simile*	Two-colour Panic								1	1
Poaceae	*Paspalum mandiocanum*	Broadleaf Paspalum	*	1	50						
Poaceae	*Setaria sphacelata*	South African Pigeon Grass	*	1	70						
Poaceae	*Themeda australis*	Kangaroo Grass				2	100			1	1
Proteaceae	*Lomatia silaifolia*	Crinkle Bush						1	13		
Proteaceae	*Persoonia stradbrokensis*					1	3	1	3	1	1

Family	Scientific Name	Common Name	Exotic	Plot 33 Cover	Plot 33 Abundance	Plot 44 Cover	Plot 44 Abundance	Plot 45 Cover	Plot 45 Abundance	Plot 46 Cover	Plot 46 Abundance
Sterculiaceae	*Commersonia fraseri*	Brush Kurrajong								1	1
Verbenaceae	*Lantana camara*	Lantana	*	1	2						
Violaceae	*Hybanthus stellarioides*					1	1			1	5

Notes: Cover – visual estimate of foliage projective cover within the plot, recorded from 1–5% and then to the nearest 5%.

Abundance - relative number of individuals or shoots of a species within the plot. Based on the following intervals: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, 1000. Counts above 20 are estimates only

Flora species within NR117 and NR246 (plots 43, 50 and 26)

Family	Scientific Name	Common Name	Exotic	Plot 26 Cover	Plot 26 Abundance	Plot 43 Cover	Plot 43 Abundance	Plot 50 Cover	Plot 50 Abundance
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower		1	2	1	3	1	100
Adiantaceae	*Adiantum aethiopicum*	Common Maidenhair				1	1	1	10
Adiantaceae	*Cheilanthes* sp.	Cloak Fern, Mulga Fern, Rock Fern						1	1
Apocynaceae	*Parsonsia straminea*	Common Silkpod						1	2
Apocynaceae	*Tabernaemontana pandacaqui*	Banana Bush				1	1		
Araceae	*Gymnostachys anceps*	Settler's Twine				1	1	1	2
Araliaceae	*Polyscias sambucifolia*	Elderberry Panax						1	1
Bignoniaceae	*Pandorea pandorana*	Wonga Wonga Vine				1	1	1	4
Casuarinaceae	*Allocasuarina littoralis*	Black She-Oak						1	2
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak		1	1	1	2		
Convolvulaceae	*Dichondra repens*	Kidney Weed				1	1		

Family	Scientific Name	Common Name	Exotic	Plot 26 Cover	Plot 26 Abundance	Plot 43 Cover	Plot 43 Abundance	Plot 50 Cover	Plot 50 Abundance
Convolvulaceae	*Polymeria calycina*					1	6	1	1
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge		3	100	1	3		
Dennstaedtiaceae	*Hypolepis muelleri*	Harsh Ground Fern				1	2		
Dennstaedtiaceae	*Pteridium esculentum*	Bracken				1	3	1	1
Dicksoniaceae	*Calochlaena dubia*	Rainbow Fern						2	100
Dilleniaceae	*Hibbertia scandens*	Climbing Guinea Flower				1	4	1	3
Dioscoreaceae	*Dioscorea transversa*	Native Yam				1	1	1	4
Fabaceae (Faboideae)	*Desmodium gunnii*	Slender Tick-trefoil		1	1				
Fabaceae (Faboideae)	*Desmodium varians*	Slender Tick-trefoil		1	20			1	2
Fabaceae (Faboideae)	*Glycine clandestina*	Twining glycine		1	50			1	3
Fabaceae (Faboideae)	*Glycine cyrtoloba*			1	5				
Fabaceae (Faboideae)	*Glycine* sp.					1	6		
Fabaceae (Mimosoideae)	*Acacia concurrens*	Curracabah		2	10				
Fabaceae (Mimosoideae)	*Acacia floribunda*	White Sally		1	4	1	4		
Fabaceae (Mimosoideae)	*Acacia irrorata*	Green Wattle				1	1		
Iridaceae	*Patersonia sericea*	Silky Purple-Flag						1	2
Lauraceae	*Cinnamomum camphora*	Camphor Laurel	*	1	1				
Lobeliaceae	*Pratia purpurascens*	Whiteroot				1	4	1	20
Lomandraceae	*Lomandra filiformis*	Wattle Matt-rush		1	20				
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush		5	200	1	8	5	100
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry		1	30	1	4	1	7
Myrtaceae	*Acmena smithii*	Lilly Pilly				1	2	1	3

Family	Scientific Name	Common Name	Exotic	Plot 26 Cover	Plot 26 Abundance	Plot 43 Cover	Plot 43 Abundance	Plot 50 Cover	Plot 50 Abundance
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush				1	7	1	6
Myrtaceae	*Corymbia intermedia*	Pink Bloodwood		2	1	2	4	2	1
Myrtaceae	*Eucalyptus cameronii*	Diehard Stringybark		5	3				
Myrtaceae	*Eucalyptus globoidea*	White Stringybark		10	2				
Myrtaceae	*Eucalyptus microcorys*	Tallowwood				1	2		
Myrtaceae	*Eucalyptus pilularis*	Blackbutt		2	1	30	3	30	3
Myrtaceae	*Eucalyptus propinqua*	Small-fruited Grey Gum		20	4				
Myrtaceae	*Eucalyptus seeana*	Narrow-leaved Red Gum				1	1		
Myrtaceae	*Leptospermum polygalifolium*	Tantoon						1	1
Myrtaceae	*Lophostemon confertus*	Brush Box				1	5		
Myrtaceae	*Melaleuca linariifolia*	Flax-leaved Paperbark				2	1		
Myrtaceae	*Sannantha angusta*			1	3	10	50	7	42
Myrtaceae	*Syncarpia glomulifera*	Turpentine				30	70	30	31
Oleaceae	*Notelaea ovata*			1	3				
Orchidaceae	*Pterostylis* sp.	Greenhood				1	2	1	1
Phormiaceae	*Dianella caerulea*	Blue Flax-lily		1	10	1	15		
Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush		1	5	1	1	1	1
Phyllanthaceae	*Glochidion ferdinandi*	Cheese Tree		1	2				
Pittosporaceae	*Billardiera scandens*	Hairy Apple Berry		1	1	1	5		
Poaceae	*Aristida vagans*	Threeawn Speargrass		1	5				
Poaceae	*Cymbopogon refractus*	Barbed Wire Grass		1	6				
Poaceae	*Digitaria parviflora*	Small-flowered Finger Grass				1	3		
Poaceae	*Entolasia marginata*	Bordered Panic				2	100	3	200
Poaceae	*Entolasia stricta*	Wiry Panic		30	1000	10	500	5	100
Poaceae	*Eragrostis leptostachya*	Paddock Lovegrass		1	5				

Family	Scientific Name	Common Name	Exotic	Plot 26 Cover	Plot 26 Abundance	Plot 43 Cover	Plot 43 Abundance	Plot 50 Cover	Plot 50 Abundance
Poaceae	*Imperata cylindrica*	Blady Grass		20	1000	1	25	2	200
Poaceae	*Oplismenus imbecillis*							1	100
Poaceae	*Ottochloa gracillima*					20	200		
Poaceae	*Paspalum mandiocanum*	Broadleaf Paspalum	*	1	50				
Poaceae	*Setaria sphacelata*	South African Pigeon Grass	*	1	3				
Poaceae	*Themeda australis*	Kangaroo Grass		1	1				
Proteaceae	*Persoonia stradbrokensis*			1	1	1	1		
Rubiaceae	*Morinda jasminoides*	Sweet Morinda						1	1
Sapindaceae	*Dodonaea triquetra*	Large-leaf Hop-bush				1	5		
Sterculiaceae	*Commersonia fraseri*	Brush Kurrajong				1	1		
Thymelaeaceae	*Pimelea linifolia*	Slender Rice Flower		1	2				
Verbenaceae	*Lantana camara*	Lantana	*	1	6			1	2
Violaceae	*Hybanthus stellarioides*					1	10	1	1
Xanthorrhoeaceae	*Xanthorrhoea macronema*							1	6
Orchidaceae	*Orchidaceae* sp.							1	100

Notes: Cover – visual estimate of foliage projective cover within the plot, recorded from 1–5% and then to the nearest 5%.

Abundance - relative number of individuals or shoots of a species within the plot. Based on the following intervals: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, 1000. Counts above 20 are estimates only

Flora species within NR228 (plots 5, 6, 16, 19 and 51)

Family	Scientific Name	Common Name	Exotic	Plot 5 Cover	Plot 5 Abundance	Plot 6 Cover	Plot 6 Abundance	Plot 16 Cover	Plot 16 Abundance	Plot 19 Cover	Plot 19 Abundance	Plot 51 Cover	Plot 51 Abundance
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower		1	30	1	5	1	2	1	4	1	20
Apocynaceae	*Parsonsia straminea*	Common Silkpod		1	4								
Araliaceae	*Polyscias sambucifolia*	Elderberry Panax		1	1	1	1	1	1				
Asteraceae	*Ozothamnus diosmifolius*	White Dogwood		1	2								
Asteraceae	*Vernonia cinerea*			1	1								
Casuarinaceae	*Allocasuarina littoralis*	Black She-Oak						20	70	20	50	3	35
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak		10	20								
Convolvulaceae	*Polymeria calycina*									1	2	1	3
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge		1	30	2	400	1	5	1	50	1	10
Cyperaceae	*Ptilothrix deusta*									2	100		
Dennstaedtiaceae	*Pteridium esculentum*	Bracken		1	2	1	20	2	50	1	1	30	1000
Dicksoniaceae	*Calochlaena dubia*	Rainbow Fern						1	10				
Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower		1	10			2	100	1	50	1	2
Dilleniaceae	*Hibbertia diffusa*	Wedge Guinea Flower				1	8						
Dilleniaceae	*Hibbertia scandens*	Climbing Guinea Flower										1	1
Dilleniaceae	*Hibbertia vestita*					1	20	1	50	1	1	1	6

Family	Scientific Name	Common Name	Exotic	Plot 5 Cover	Plot 5 Abundance	Plot 6 Cover	Plot 6 Abundance	Plot 16 Cover	Plot 16 Abundance	Plot 19 Cover	Plot 19 Abundance	Plot 51 Cover	Plot 51 Abundance
Ericaceae	*Monotoca scoparia*							1	5				
Fabaceae (Faboideae)	*Daviesia genistifolia*	Broom Bitter Pea								1	1		
Fabaceae (Faboideae)	*Desmodium varians*	Slender Tick-trefoil				1	1						
Fabaceae (Faboideae)	*Glycine clandestina*	Twining glycine								1	1		
Fabaceae (Faboideae)	*Glycine* sp.					1	1	1	1				
Fabaceae (Faboideae)	*Gompholobium pinnatum*	Pinnate Wedge Pea						1	2	1	8		
Fabaceae (Faboideae)	*Hardenbergia violacea*	False Sarsaparilla		1	3					1	1		
Fabaceae (Faboideae)	*Pultenaea myrtoides*			1	1			1	3			1	1
Fabaceae (Faboideae)	*Pultenaea retusa*			1	3	1	2			1	8	1	1
Fabaceae (Mimosoideae)	*Acacia binervata*	Two-veined Hickory				5	20	1	7	1	4	2	21
Fabaceae (Mimosoideae)	*Acacia concurrens*	Curracabah		5	8								
Fabaceae (Mimosoideae)	*Acacia floribunda*	White Sally		2	5	1	2	1	1				
Goodeniaceae	*Dampiera sylvestris*											1	100
Goodeniaceae	*Goodenia ovata*	Hop Goodenia								1	1		
Iridaceae	*Patersonia sericea*	Silky Purple-Flag						1	10	1	2		
Lauraceae	*Cassytha* sp.			1	4					1	7		
Lauraceae	*Cinnamomum camphora*	Camphor Laurel	*	1	1			1	2				

Family	Scientific Name	Common Name	Exotic	Plot 5 Cover	Plot 5 Abundance	Plot 6 Cover	Plot 6 Abundance	Plot 16 Cover	Plot 16 Abundance	Plot 19 Cover	Plot 19 Abundance	Plot 51 Cover	Plot 51 Abundance
Lindsaeaceae	*Lindsaea microphylla*	Lacy Wedge Fern		1	5								
Lobeliaceae	*Pratia purpurascens*	Whiteroot		1	10			1	3			1	5
Lomandraceae	*Lomandra filiformis*	Wattle Matt-rush		1	2							1	1
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush		1	1	1	1	1	2			1	6
Lomandraceae	*Lomandra multiflora subsp. multiflora*	Many-flowered Mat-rush		1	2	1	1			1	6		
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush				1	2			1	2		
Myrtaceae	*Corymbia gummifera*	Red Bloodwood		10	13	1	3	4	6	8	11	2	4
Myrtaceae	*Eucalyptus cameronii*	Diehard Stringybark		10	7	5	2			3	8	2	2
Myrtaceae	*Eucalyptus microcorys*	Tallowwood				3	2	2	1	1	1	1	1
Myrtaceae	*Eucalyptus pilularis*	Blackbutt		15	2	3	1	4	2			7	1
Myrtaceae	*Eucalyptus signata*	Scribbly Gum				20	4	10	9	10	5	25	3
Myrtaceae	*Leptospermum polygalifolium*	Tantoon				1	10	1	14	1	1	1	8
Myrtaceae	*Leptospermum trinervium*	Slender Tea-tree				1	3						
Myrtaceae	*Melaleuca sieberi*									1	2		
Myrtaceae	*Sannantha angusta*			1	1			1	2			1	1
Myrtaceae	*Syncarpia glomulifera*	Turpentine				20	50	2	5	2	9	2	9
Oleaceae	*Notelaea ovata*							1	1	1	3	1	2
Orchidaceae	*Cryptostylis* sp.					1	9						

Family	Scientific Name	Common Name	Exotic	Plot 5 Cover	Plot 5 Abundance	Plot 6 Cover	Plot 6 Abundance	Plot 16 Cover	Plot 16 Abundance	Plot 19 Cover	Plot 19 Abundance	Plot 51 Cover	Plot 51 Abundance
Orchidaceae	*Dipodium* sp.											1	1
Orchidaceae	*Pterostylis* sp.	Greenhood						1	1			1	1
Phormiaceae	*Dianella caerulea*	Blue Flax-lily		1	20			1	3	1	30	1	50
Phormiaceae	*Dianella revoluta*	Blueberry Lily				1	2						
Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush										1	4
Pittosporaceae	*Billardiera scandens*	Hairy Apple Berry		1	6	1	5	1	3			1	3
Poaceae	*Andropogon virginicus*	Whisky Grass	*	1	1								
Poaceae	*Cymbopogon refractus*	Barbed Wire Grass		1	1								
Poaceae	*Digitaria diffusa*	Open Summer-grass				1	1			1	1		
Poaceae	*Entolasia marginata*	Bordered Panic		1	2								
Poaceae	*Entolasia stricta*	Wiry Panic		20	1000	1	400	50	1000	80	1000	2	100
Poaceae	*Eragrostis* sp.	A Lovegrass	*							1	5		
Poaceae	*Imperata cylindrica*	Blady Grass		2	100	1	10	5	100	1	50	30	1000
Poaceae	*Themeda australis*	Kangaroo Grass		1	2			1	1	1	1	1	2
Proteaceae	*Lomatia silaifolia*	Crinkle Bush				1	4					1	2
Proteaceae	*Persoonia stradbrokensis*					1	3	1	80	1	3	1	5
Rubiaceae	*Pomax umbellata*	Pomax										1	1
Schizaeaceae	*Schizaea bifida*	Forked Comb Fern						1	6				
Thymelaeaceae	*Pimelea linifolia*	Slender Rice Flower		1	2					1	1		

Family	Scientific Name	Common Name	Exotic	Plot 5 Cover	Plot 5 Abundance	Plot 6 Cover	Plot 6 Abundance	Plot 16 Cover	Plot 16 Abundance	Plot 19 Cover	Plot 19 Abundance	Plot 51 Cover	Plot 51 Abundance
Violaceae	*Hybanthus stellarioides*			1	2								
Xanthorrhoeaceae	*Xanthorrhoea* sp.			1	1			1	2	2	25	1	3

Notes: Cover – visual estimate of foliage projective cover within the plot, recorded from 1–5% and then to the nearest 5%.

Abundance - relative number of individuals or shoots of a species within the plot. Based on the following intervals: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, 1000. Counts above 20 are estimates only

Norton offset site fauna observations

Common Name	Scientific Name	Exotic	NSW Status	EPBC Status	Observation Type
Amphibia					
Bibron's Toadlet	*Pseudophryne bibronii*				W
Bleating Tree Frog	*Litoria dentata*				W
Brown-striped Frog	*Limnodynastes peronii*				W
Common Eastern Froglet	*Crinia signifera*				W
Dusky Toadlet	*Uperoleia fusca*				W
Eastern Dwarf Tree Frog	*Litoria fallax*				W
Giant Barred Frog	*Mixophyes iteratus*		E	E	W
Haswell's Froglet	*Paracrinia haswelli*				W
Lesueur's Frog	*Litoria lesueuri*				O
Peron's Tree Frog	*Litoria peronii*				O
Red-backed Toadlet	*Pseudophryne coriacea*				W
Revealed Frog	*Litoria revelata*				W
Tyler's Tree Frog	*Litoria tyleri*				W
Aves					
Australian Magpie	*Cracticus tibicen*				O
Australian Owlet-nightjar	*Aegotheles cristatus*				W
Australian Raven	*Corvus coronoides*				OW
Australian Wood Duck	*Chenonetta jubata*				O
Bar-shouldered Dove	*Geopelia humeralis*				W
Bassian Thrush	*Zoothera lunulata*				W
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*				W
Brown Gerygone	*Gerygone mouki*				O
Brown Thornbill	*Acanthiza pusilla*				O
Brush Bronzewing	*Phaps elegans*				OW
Eastern Rosella	*Platycercus eximius*				O
Eastern Spinebill	*Acanthorhynchus tenuirostris*				O
Eastern Whipbird	*Psophodes olivaceus*				W
Eastern Yellow Robin	*Eopsaltria australis*				O
Fan-tailed Cuckoo	*Cacomantis flabelliformis*				W
Fuscous Honeyeater	*Lichenostomus fuscus*				O
Glossy Black-Cockatoo	*Calyptorhynchus lathami*		V		W

Common Name	Scientific Name	Exotic	NSW Status	EPBC Status	Observation Type
Golden Whistler	*Pachycephala pectoralis*				O
Grey Butcherbird	*Cracticus torquatus*				W
Grey Fantail	*Rhipidura albiscapa*				O
Grey Shrike-thrush	*Colluricincla harmonica*				W
Horsfield's Bronze-Cuckoo	*Chalcites basalis*				W
Indian Peafowl	*Pavo cristatus*	*			OW
Laughing Kookaburra	*Dacelo novaeguineae*				O
Leaden Flycatcher	*Myiagra rubecula*				OW
Lewin's Honeyeater	*Meliphaga lewinii*				O
Little Lorikeet	*Glossopsitta pusilla*		V		O
Little Raven	*Corvus mellori*				OW
Logrunner	*Orthonyx temminckii*				OW
Masked Lapwing	*Vanellus miles*				W
Mistletoebird	*Dicaeum hirundinaceum*				O
Musk Lorikeet	*Glossopsitta concinna*				W
New Holland Honeyeater	*Phylidonyris novaehollandiae*				W
Noisy Friarbird	*Philemon corniculatus*				O
Noisy Miner	*Manorina melanocephala*				OW
Olive-backed Oriole	*Oriolus sagittatus*				OW
Pacific Baza	*Aviceda subcristata*				W
Painted Button-quail	*Turnix varius*				O
Pallid Cuckoo	*Cacomantis pallidus*				W
Pied Butcherbird	*Cracticus nigrogularis*				OW
Pied Currawong	*Strepera graculina*				W
Rainbow Bee-eater	*Merops ornatus*			J	W
Rainbow Lorikeet	*Trichoglossus haematodus*				O
Red Wattlebird	*Anthochaera carunculata*				W
Red-browed Finch	*Neochmia temporalis*				O
Restless Flycatcher	*Myiagra inquieta*				W
Rose Robin	*Petroica rosea*				W
Rufous Whistler	*Pachycephala rufiventris*				W
Satin Bowerbird	*Ptilonorhynchus violaceus*				O

Common Name	Scientific Name	Exotic	NSW Status	EPBC Status	Observation Type
Shining Bronze-Cuckoo	*Chalcites lucidus*				O
Silvereye	*Zosterops lateralis*				OW
Spotted Pardalote	*Pardalotus punctatus*				W
Striated Thornbill	*Acanthiza lineata*		P		O
Superb Fairy-wren	*Malurus cyaneus*				W
Torresian Crow	*Corvus orru*				W
Varied Sittella	*Daphoenositta chrysoptera*		V		O
Variegated Fairy-wren	*Malurus lamberti*				O
Wedge-tailed Eagle	*Aquila audax*				O
Whistling Kite	*Haliastur sphenurus*				O
White-bellied Cuckoo-shrike	*Coracina papuensis*				O
White-browed Scrubwren	*Sericornis frontalis*				O
White-cheeked Honeyeater	*Phylidonyris niger*				O
White-naped Honeyeater	*Melithreptus lunatus*				O
White-throated Gerygone	*Gerygone olivacea*				W
White-throated Treecreeper	*Cormobates leucophaea*				W
Willie Wagtail	*Rhipidura leucophrys*				O
Yellow Thornbill	*Acanthiza nana*				OW
Yellow-faced Honeyeater	*Lichenostomus chrysops*				O
Yellow-tailed Black-cockatoo	*Calyptorhynchus funereus*				O
Yellow-throated Scrubwren	*Sericornis citreogularis*				O
Mammalia					
Common Brushtail Possum	*Trichosurus vulpecula*				O
Common Ringtail Possum	*Pseudocheirus peregrinus*				E
Dog	*Canis lupus familiaris*	*			F, Q
Eastern Grey Kangaroo	*Macropus giganteus*				O
European cattle	*Bos taurus*	*			O
Fox	*Vulpes vulpes*	*			F
Koala	*Phascolarctos cinereus*		V	V	O, P
Long-nosed Bandicoot	*Perameles nasuta*				W, Q
Red-necked Wallaby	*Macropus rufogriseus*				O
Sugar Glider	*Petaurus breviceps*				W

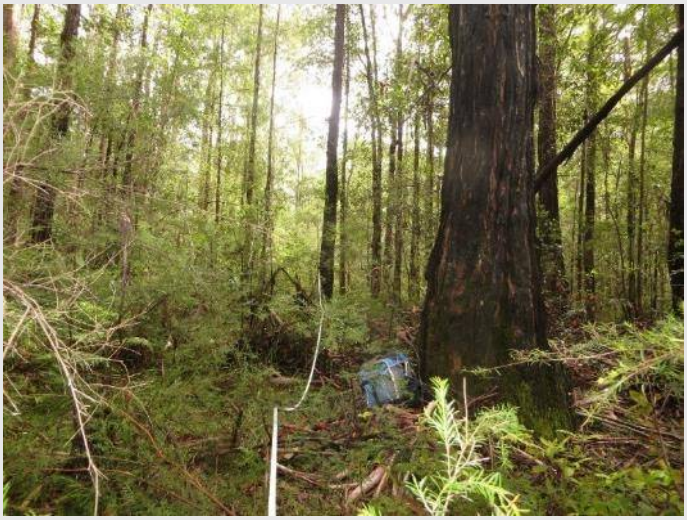
Common Name	Scientific Name	Exotic	NSW Status	EPBC Status	Observation Type
Swamp Wallaby	*Wallabia bicolor*				O, Q
White-striped Freetail-bat	*Tadarida australis*				W
Reptilia					
Copper-tailed Skink	*Ctenotus taeniolatus*				O
Eastern Water Dragon	*Intellagama lesueurii*				O
Lace Monitor	*Varanus varius*				O

Notes: E – endangered, M – migratory, V – vulnerable. B – burrow; F – tracks, H – skin, K – dead, O – observed, P – scat, W – heard, Q – camera trap image.

NH2U Norton Offset Area photo monitoring points

NH2U Norton Offset Area Photo point A		
Easting	485324	
Northing	62555351	
Bearing	180	
Monitoring round / date of photo	Baseline / 06.04.2016	
Vegetation type	Blackbutt – Turpentine - Tallowwood shrubby open forest	
NSW Veg Type ID	NR122	
Survey effort	Plot/ transect 18	
Conservation significance	Native vegetation. Not listed as a TEC. Habitat for the affected threatened fauna, including abundant Koala primary food trees and Grey-headed Flying-fox key diet plants.	
Condition	Moderate/good. Native vegetation with near intact over storey cover at benchmark values. Native midstorey and groundcover attributes excluding native grasses was also at benchmark. Species richness was below benchmark. Half the canopy species were observed regenerating. There was one hollow-bearing tree recorded in this photo point. Woody debris was high and well above benchmark values. The cover of exotic species was sparse to absent.	
Extent of weed infestation	0% cover along the transect sampled.	
Evidence of other management issues (e.g. erosion, dieback, pest fauna)	None observed. Healthy, near-intact native vegetation.	
Observed changes since last monitoring round	N/a – baseline monitoring round.	

NH2U Norton Offset Area Photo point B		
Easting	484536	
Northing	6557961	
Bearing	180	
Monitoring round / date of photo	Baseline / 06.04.2016	
Vegetation type	Spotted Gum – Grey Ironbark - Pink Bloodwood open forest	
NSW Veg Type ID	NR246	
Survey effort	Plot/ transect 26	
Conservation significance	Native vegetation. Not listed as a TEC. Habitat for the affected threatened fauna.	
Condition	Moderate/good. Native vegetation with near intact over storey cover at benchmark value in addition to native midstorey, native grasses and other. Species richness and native shrub groundcover was below benchmark values. Most of the canopy species were observed regenerating. There were no hollow-bearing trees recorded in the vegetation zones. The cover of exotic species was moderate.	
Extent of weed infestation	38% cover along the transect sampled mostly consisting of Broadleaf Paspalum (*Paspalum mandiocanum*).	
Evidence of other management issues (e.g. erosion, dieback, pest fauna)	None observed. Healthy, near-intact native vegetation.	
Observed changes since last monitoring round	N/a – baseline monitoring round.	

NH2U Norton Offset Area Photo point D		
Easting	483517	
Northing	6555412	
Bearing	300	
Monitoring round / date of photo	Baseline / 06.04.2016	
Vegetation type	Blackbutt - Pink Bloodwood shrubby open forest	
NSW Veg Type ID	NR117	
Survey effort	Plot/ transect 50	
Conservation significance	Native vegetation. Not listed as a TEC. Habitat for the affected threatened fauna, including abundant Grey-headed Flying-fox key diet plants.	
Condition	Moderate/good. Native vegetation with near-intact over storey cover and species richness that was below benchmark value. Ground cover attributes with the exception of native grasses were at benchmark values excepting native ground cover (grasses) which was marginally above benchmark, Native midstorey cover and woody was at or close to benchmark values in this vegetation zone. Most of the canopy species were observed regenerating. There were few hollow-bearing trees recorded in the vegetation zones, with none observed within the photo point. Exotic species were absent.	
Extent of weed infestation	Zero cover along the transect sampled. Lantana *(Lantana camara*), were noted within the vegetation zone but not within the photo point.	
Evidence of other management issues (e.g. erosion, dieback, pest fauna)	None observed. Healthy, near-intact native vegetation.	
Observed changes since last monitoring round	N/a – baseline monitoring round.	

NH2U Norton Offset Area Photo point H		
Easting	483557	
Northing	6555694	
Bearing	180	
Monitoring round / date of photo	Baseline / 06.04.2016	
Vegetation type	Red Mahogany open forest	
NSW Veg Type ID	NR222	
Survey effort	Plot/ transect 41	
Conservation significance	Native vegetation. Not listed as a TEC. Habitat for the affected threatened fauna.	
Condition	Moderate/good. Native vegetation with near-intact over storey and species richness that was below benchmark values. Native midstorey native ground cover shrubs and other were at benchmark. However native ground cover grasses was well above benchmark values. Woody debris was below benchmark value. Most dominant canopy species present were found to be regenerating. No hollow-bearing trees were recorded were recorded. No exotic plant cover was recorded though occasional exotic plants were found within the broader vegetation zone.	
Extent of weed infestation	Zero cover along the transect sampled.	
Evidence of other management issues (e.g. erosion, dieback, pest fauna)	None observed. Healthy, near-intact native vegetation.	
Observed changes since last monitoring round	N/a – baseline monitoring round.	

NH2U Norton Offset Area Photo point I		
Easting	483476	
Northing	6555230	
Bearing	180	
Monitoring round / date of photo	Baseline / 06.04.2016	
Vegetation type	Forest Red Gum – Swamp Box	
NSW Veg Type ID	NR161	
Survey effort	Plot/ transect 48	
Conservation significance	Native vegetation. Not listed as a TEC. Habitat for the affected threatened fauna, including abundant Koala primary food trees and Grey-headed Flying-fox key diet plants.	
Condition	Moderate/good. Native vegetation with near-intact over storey that was below benchmark values. Species richness was above benchmark values as was native ground cover other. Native midstorey and reaming ground cover attributes all occurred within benchmark. All of the over-storey species present in this vegetation zone were observed regenerating. No hollow-bearing trees were found, but occur in low densities within the broader vegetation zone. Some exotic species were recorded in the ground layer or mid-storey. Occasional exotic plants were observed throughout the broader vegetation zone.	
Extent of weed infestation	Up to 2% cover along the transect sampled. Low frequency and cover of Narrow-leafed Carpet Grass (*Axonopus fissifolius*) and Lantana (*Lantana camara*) with mild infestations of Whisky Grass (*Andropogon virginicus*) and Vasey Grass (*Paspalum urvillei*) observed around the edges of disturbed areas elsewhere in the vegetation zone	
Evidence of other management issues (eg erosion, dieback, pest fauna)	None observed. Healthy, near-intact native vegetation.	
Observed changes since last monitoring round	N/a – baseline monitoring round.	

NH2U Norton Offset Area Photo point J		
Easting	484506	
Northing	6554741	
Bearing	90	
Monitoring round / date of photo	Baseline / 06.04.2016	
Vegetation type	Scribbly Gum – Red Bloodwood heathy open forest	
NSW Veg Type ID	NR228	
Survey effort	Plot/ transect 16	
Conservation significance	Native vegetation. Not listed as a TEC. Habitat for the affected threatened fauna, including abundant Grey-headed Flying-fox key diet plants.	
Condition	Moderate/good. Native vegetation with near-intact over storey cover slightly within benchmark value. Native midstorey, native ground cover shrubs and groundcover other were also at benchmark. Species richness was just below benchmark with native grasses and woody debris well above benchmark scores. Species richness was well below benchmark in this vegetation zone as was woody debris. All canopy species were observed regenerating and a moderate density of few hollow-bearing trees were observed within the photo point. Exotic species were absent.	
Extent of weed infestation	Zero cover along the transect sampled. Camphor Laurel (*Cinnamomum camphora*) was noted within the vegetation zone, however none was observed within the photo point.	
Evidence of other management issues (e.g. erosion, dieback, pest fauna)	None observed. Healthy, near-intact native vegetation.	
Observed changes since last monitoring round	N/a – baseline monitoring round.	

Appendix B – Griffin offset site baseline survey results

Griffin offset site biometric plot/transect data

Fauna habitat type	Veg Type ID	Plot ID	Native plant species richness	Native over-storey cover	Native mid-storey cover	Native ground cover (grasses)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Over storey regen.	Total length of fallen logs	Easting	Northing	Zone
Dry sclerophyll forest		Bench-mark	40	20-50	8-40	10-50	0-10	10-60	0	> = 1;	1	> = 20			
	NR119	6		48	35.5	40	8	54	0	3	1	44	496939	6580749	56
	NR119	11		59	23	24	2	76	0	3	1	115	496260	6580649	56
Swamp sclerophyll forest		Bench-mark	6	10-70	0-80	0-50	0-60	5-60	0	> = 0.1	1	> = 5			
	NR217	9		36.5	15.2	40	2	88	0	5	1	97	498220	6580255	56
	NR217	10		11.1	44	30	2	98	0	3	1	103	496260	6580507	56
Coastal woodland		Bench-mark	37	10-50	0-60	5-60	5-60	5-60	0	> = 1.5	1	> = 7			
	NR220	7		29.5	8.2	0	12	80	0	5	1	164	497057	6580689	56
	NR220	8		35.5	22.9	2	12	86	0	3	1	112	497575	6580582	56
Swamp sclerophyll forest – poor condition		Bench-mark	32	38-58	24.5-39.5	0-5	0-5	26.6-34.6	0	> = 0	1	> = 50			
	NR217	12		5	10	5	0	80	0	0	1	0	496301	6580418	56
Wet heath		Bench-mark	40	27.5-32.5	35-45	1-10	8.5-12.5	14.5-18.5	0	> = 0	1	> = 0			
	NR278	13		0	90	2	40	55	0	0	0	0	497042	6581271	56

Griffin offset site fauna observations

Common Name	Scientific Name	Exotic	NSW Status	EPBC Status	Observation Type
Amphibians					
Bleating Tree Frog	*Litoria dentata*				W
Broad-palmed Frog	*Litoria latopalmata*				O
Brown-striped Frog	*Limnodynastes peronii*				W
Common Eastern Froglet	*Crinia signifera*				O
Dainty Green Tree Frog	*Litoria gracilenta*				O
Dusky Toadlet	*Uperoleia fusca*				W
Eastern Banjo Frog	*Limnodynastes dumerilii*				W
Eastern Dwarf Tree Frog	*Litoria fallax*				W
Eastern Sign-bearing Froglet	*Crinia parinsignifera*				O
Haswell's Froglet	*Paracrinia haswelli*				W
Rocket Frog	*Litoria nasuta*				O
Tyler's Tree Frog	*Litoria tyleri*				W
Aves					
Australian Owlet-Nightjar	*Aegotheles cristatus*				W
Bar-shouldered Dove	*Geopelia humeralis*				O
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*				O
Brown Gerygone	*Gerygone mouki*				W
Brown Thornbill	*Acanthiza pusilla*				O
Eastern Spinebill	*Acanthorhynchus tenuirostris*				O
Eastern Whipbird	*Psophodes olivaceus*				O
Eastern Yellow Robin	*Eopsaltria australis*				O
Fan-tailed Cuckoo	*Cacomantis flabelliformis*				O
Fuscous Honeyeater	*Lichenostomus fuscus*				W
Golden Whistler	*Pachycephala pectoralis*				O
Grey Fantail	*Rhipidura albiscapa*				O
Grey Shrike-thrush	*Colluricincla harmonica*				W
Horsfield's Bronze-Cuckoo	*Chalcites basalis*				O
Laughing Kookaburra	*Dacelo novaeguineae*				O
Leaden Flycatcher	*Myiagra rubecula*				OW
Lewin's Honeyeater	*Meliphaga lewinii*				O
Little Lorikeet	*Glossopsitta pusilla*		V		OW
Little Wattlebird	*Anthochaera chrysoptera*				W
Masked Lapwing	*Vanellus miles*				W
Mistletoebird	*Dicaeum hirundinaceum*				O
New Holland Honeyeater	*Phylidonyris novaehollandiae*				O
Noisy Friarbird	*Philemon corniculatus*				O

Common Name	Scientific Name	Exotic	NSW Status	EPBC Status	Observation Type
Olive-backed Oriole	*Oriolus sagittatus*				O
Pied Butcherbird	*Cracticus nigrogularis*				W
Powerful Owl	*Ninox strenua*		V		O
Purple Swamphen	*Porphyrio porphyrio*				W
Rainbow Bee-eater	*Merops ornatus*			J	O
Rainbow Lorikeet	*Trichoglossus haematodus*				O
Red-browed Finch	*Neochmia temporalis*				O
Rufous Whistler	*Pachycephala rufiventris*				O
Satin Bowerbird	*Ptilonorhynchus violaceus*				O
Shining Bronze-Cuckoo	*Chalcites lucidus*				O
Silvereye	*Zosterops lateralis*				O
Spotted Pardalote	*Pardalotus punctatus*				O
Striated Thornbill	*Acanthiza lineata*				O
Superb Fairy-wren	*Malurus cyaneus*				O
Swamp Harrier	*Circus approximans*				O
Torresian Crow	*Corvus orru*				O
Varied Sittella	*Daphoenositta chrysoptera*		V		O
Variegated Fairy-wren	*Malurus lamberti*				O
Weebill	*Smicrornis brevirostris*				O
White-bellied Cuckoo-shrike	*Coracina papuensis*				O
White-browed Scrubwren	*Sericornis frontalis*				O
White-cheeked Honeyeater	*Phylidonyris niger*				O
White-naped Honeyeater	*Melithreptus lunatus*				OW
White-throated Gerygone	*Gerygone olivacea*				O
White-throated treecreeper	*Cormobates leucophaea*				O
Yellow Thornbill	*Acanthiza nana*				O
Yellow-faced Honeyeater	*Lichenostomus chrysops*				O
Mammalia					
Brown Hare	*Lepus capensis*	*			O
Bush Rat	*Rattus fuscipes*				O
Common Brushtail Possum	*Trichosurus vulpecula*				O
Common Ringtail Possum	*Pseudocheirus peregrinus*				W
Dog	*Canis lupus familiaris*	*			O
Eastern Grey Kangaroo	*Macropus giganteus*				O
Feathertail Glider	*Acrobates pygmaeus*				O
Long-nosed Bandicoot	*Perameles nasuta*				O
Red-necked Wallaby	*Macropus rufogriseus*				O

Common Name	Scientific Name	Exotic	NSW Status	EPBC Status	Observation Type
Sugar Glider	*Petaurus breviceps*				W
Swamp Wallaby	*Wallabia bicolor*				O
Reptilia					
Dark-flecked Garden Sunskink	*Lampropholis delicata*				O
Lace Monitor	*Varanus varius*				O
Land Mullet	*Bellatorias major*				O
Red-bellied Black Snake	*Pseudechis porphyriacus*				O

Notes: E – endangered, M – migratory, V – vulnerable, O – observed, P – scat, W – heard.

Griffin offset site baseline photo monitoring point results

Griffin Offset Site Photo Point 6		
Easting	496939	
Northing	6580750	
Bearing	360	
Monitoring round / date of photo	Baseline / 10.09.2014	
Vegetation type	Blackbutt – Turpentine - Tallowwood dry grassy open forest	
NSW Veg Type ID	NR119	
Survey effort	Plot/ transect 6	
Conservation significance	Native vegetation. Not listed as a TEC. Habitat for the affected threatened fauna.	
Condition	Moderate/good. Native vegetation with near intact over storey cover at benchmark values. Native midstorey and all groundcover attributes was also at benchmark. All canopy species were observed regenerating. There was three hollow-bearing tree recorded in this photo point. Woody debris was high and well above benchmark values. Species richness is likely to be at benchmark values. The cover of exotic species was absent.	
Extent of weed infestation	0% cover along the transect sampled.	
Evidence of other management issues (eg erosion, dieback, pest fauna)	None observed. Healthy, near-intact native vegetation.	
Observed changes since last monitoring round	N/a – baseline monitoring round.	

Griffin Offset Site Photo Point 8		
Easting	497575	
Northing	6580582	
Bearing	135	
Monitoring round / date of photo	Baseline / 10.10.2014	
Vegetation type	Pink Bloodwood open forest	
NSW Veg Type ID	NR220	
Survey effort	Plot/ transect 8	
Conservation significance	Native vegetation. Not listed as a TEC. Habitat for the affected threatened fauna.	
Condition	Moderate/good. Native vegetation with near intact over storey cover within or close to benchmark values in addition to native midstorey, native grasses and native shrubs. Native other groundcover occurs above benchmark values. Most of the canopy species were observed regenerating. There was three hollow-bearing trees recorded in the photo point which is above benchmark condition. Large amounts of woody debris well above benchmark was recorded. Species richness is likely to be at benchmark values. The cover of exotic species was absent.	
Extent of weed infestation	0% cover along the transect sampled.	
Evidence of other management issues (eg erosion, dieback, pest fauna)	None observed. Healthy, near-intact native vegetation.	
Observed changes since last monitoring round	N/a – baseline monitoring round.	

Griffin Offset Site Photo Point 10		
Easting	496260	
Northing	6580507	
Bearing	135	
Monitoring round / date of photo	Baseline / 10.09.2014	
Vegetation type	Paperbark Swamp forest	
NSW Veg Type ID	NR217	
Survey effort	Plot/ transect 10	
Conservation significance	Native vegetation. Not listed as a TEC. Habitat for the affected threatened fauna.	
Condition	Moderate/good. Native vegetation with near intact over storey cover within or close to benchmark value in addition to native midstorey, native grasses and native shrubs. Native other groundcover occurs above benchmark values. All canopy species were observed regenerating. Three hollow-bearing trees were recorded in photo point which is above benchmark. Large amounts of woody debris well above benchmark was recorded. Species richness is likely to be at benchmark values. Exotic species were absent.	
Extent of weed infestation	0% cover along the transect sampled.	
Evidence of other management issues (eg erosion, dieback, pest fauna)	None observed. Healthy, near-intact native vegetation.	
Observed changes since last monitoring round	N/a – baseline monitoring round.	

Griffin Offset Site Photo Point 12		
Easting	496301	
Northing	6580418	
Bearing	220	
Monitoring round / date of photo	Baseline / 10.09.2014	
Vegetation type	Paperbark Swamp Forest regeneration	
NSW Veg Type ID	NR217	
Survey effort	Plot/ transect 12	
Conservation significance	Native vegetation. Not listed as a TEC. Habitat for the affected threatened fauna.	
Condition	Moderate/good-poor. Sparse over storey cover and native midstorey cover that was below benchmark value. Ground cover attributes with the exception of native other were at benchmark. Native other groundcover was well above benchmark values. All of the canopy species were observed regenerating. There were no hollow-bearing trees recorded within the photo point. No woody debris was recorded. Species richness is likely to be at benchmark values. Exotic species were absent.	
Extent of weed infestation	Zero cover along the transect sampled.	
Evidence of other management issues (eg erosion, dieback, pest fauna)	None observed. Healthy, near-intact native vegetation.	
Observed changes since last monitoring round	N/a – baseline monitoring round.	

Griffin Offset Site Photo Point 13		
Easting	497042	
Northing	6581271	
Bearing	180	
Monitoring round / date of photo	Baseline / 11.09.2014	
Vegetation type	Wet heathland and shrubland	
NSW Veg Type ID	NR278	
Survey effort	Plot/ transect 13	
Conservation significance	Native vegetation. Not listed as a TEC. Habitat for the Grey-headed Flying-fox and Spotted-tailed Quoll.	
Condition	Moderate/good. Native vegetation with no over storey cover. Native midstorey and all groundcover attributes excluding native ground grass cover was well above benchmark values. Woody debris was absent. No canopy species present were found to be regenerating. No hollow-bearing trees or exotic plant cover was recorded Species richness is likely to be at benchmark values.	
Extent of weed infestation	Zero cover along the transect sampled.	
Evidence of other management issues (eg erosion, dieback, pest fauna)	None observed. Healthy, near-intact native vegetation.	
Observed changes since last monitoring round	N/a – baseline monitoring round.	

Appendix C – Boambee SF Offset Site Baseline survey results

Boambee SF offset site plot/transect data

NH2U Boambee SF offset area BioBanking plot/transect data

Fauna habitat type	Coffs Harbour LGA Vegetation Community (OEH 2012)	Veg Type ID	Plot ID	Native plant species richness	Native over-storey cover	Native mid-storey cover	Native ground cover (grasses)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Over storey regen.	Total length of fallen logs	Easting	Northing	Zone
Wet sclerophyll forest		NR120	Benchmark	49	20-90	15-90	0-50	10-70	5-90	0	1	1	> = 10			
	Hinterland and Escarpment Tallowwood - Blackbutt - Blue Gum Wet Ferny Forest		1	44	56	34	2	16	40	10	0	1	51	504705	6644542	56
	Northern Escarpment Blackbutt - Apple Wet Ferny Forest		2	40	51.5	10.2	4	4	74	10	0	1	222	504176	6644800	56
			5	44	38.5	30	4	24	36	8	0	1	120	503686	6644732	56
		NR159	Benchmark	49	20-90	15-90	0-50	10-70	5-90	0	1	1	> = 10			
	Coast and Hinterland Riparian Flooded Gum Bangalow Wet Forest		3	37	28.5	59.5	10	6	48	4	0	0	65	504493	6644492	56
			4	42	34	55	4	16	14	23	0	0	129	504067	6644387	56

NH2U Boambee SF offset area BioBanking plot/transect data

Coffs Harbour LGA Vegetation Community (OEH 2012)	Veg Type ID	Plot ID	Native plant species richness	Native over-storey cover	Native mid-storey cover	Native ground cover (grasses)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Over storey regen.	Total length of fallen logs	Easting	Northing
Hinterland and Escarpment Tallowwood - Blackbutt - Blue Gum Wet Ferny Forest	NR120	Bench-mark	49	20-90	15-90	0-50	10-70	5-90	0	1	1	> = 10		
		W2	41	46	32.5	2	0	36	16	0	1	245	503220	6643795
Northern Escarpment Blackbutt - Apple Wet Ferny Forest	NR120	Bench mark	49	20-90	15-90	0-50	10-70	5-90	0	1	1	> = 10		
		W4	48	39.5	22	0	16	48	2	0	1	385	502734	6644161
		W6	51	39.5	20	6	14	44	4	0	1	95	503332	6644281
		W8	n/a	41.5	28	16	6	34	0	2	1	40	502997	6644170
Coast and Hinterland Riparian Flooded Gum Bangalow Wet Forest	NR159	Bench-mark	49	20-90	15-90	0-50	10-70	5-90	0	1	1	> = 10		
		W3	37	48.5	12	4	10	32	24	0	1	35	503411	6643711
		W10	n/a	24.5	64	0	10	32	0	2	1	85	502506	6643972
Foothills Grey Gum - Ironbark - Mahogany Dry Forest	NR263	Bench-mark	44	15-50	10-40	5-50	5-40	5-70	0	1	1	> = 20		
		W5	34	29	13.5	38	2	18	26	2	1	165	503400	6644288
		W9	n/a	41	21	68	0	4	4	2	1	65	503595	6644194

NH2U Boambee SF offset area plant species recorded in plots

Family	Scientific Name	Common Name	Exotic	1	2	3	4	5
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower		2	2		2	2
Adiantaceae	*Adiantum formosum*	Giant Maidenhair		1	3			
Adiantaceae	*Adiantum hispidulum*							1
Adiantaceae	*Adiantum hispidulum*	Rough Maidenhair		1	1			
Anacardiaceae	*Euroschinus falcatus* var. *falcatus*	Ribbonwood		1				
Apiaceae	*Hydrocotyle pedicellosa*						2	
Apocynaceae	*Marsdenia longiloba*	Slender Marsdenia		2				
Apocynaceae	*Marsdenia rostrata*	Milk Vine		1				
Apocynaceae	*Parsonsia straminea*	Common Silkpod						1
Apocynaceae	*Tabernaemontana pandacaqui*	Banana Bush					1	
Araceae	*Alocasia brisbanensis*	Cunjevoi				2		
Araliaceae	*Cephalaralia cephalobotrys*	Climbing Panax				1	2	
Arecaceae	*Archontophoenix cunninghamiana*	Bangalow Palm				3	6	
Arecaceae	*Calamus muelleri*	Southern Lawyer Cane				2	2	
Aspleniaceae	*Asplenium australasicum*	Bird's Nest Fern						1
Asteliaceae	*Cordyline petiolaris*	Broad-leaved Palm Lily					2	
Asteliaceae	*Cordyline* sp.		*	2				
Asteliaceae	*Cordyline stricta*	Narrow-leaved Palm Lily		2	1	1		
Asteraceae	*Ageratina adenophora*	Crofton Weed	*		2		1	2
Asteraceae	*Sigesbeckia orientalis* subsp. *orientalis*	Indian Weed			1			
Bignoniaceae	*Pandorea pandorana*	Wonga Wonga Vine						1
Blechnaceae	*Blechnum cartilagineum*	Gristle Fern		7		2	1	3
Blechnaceae	*Doodia aspera*	Prickly Rasp Fern		1	3		2	3
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak		2				3
Celastraceae	*Celastrus subspicata*	Large-leaved Staff Vine			1			

Family	Scientific Name	Common Name	Exotic	1	2	3	4	5
Commelinaceae	*Aneilema acuminatum*					2		
Cyatheaceae	*Cyathea australis*	Rough Treefern		1			1	2
Cyatheaceae	*Cyathea cooperi*	Straw Treefern				1		
Cyatheaceae	*Cyathea leichhardtiana*	Prickly Treefern				2		
Cyperaceae	*Carex* sp.						2	
Cyperaceae	*Cyperus filipes*						2	
Cyperaceae	*Gahnia melanocarpa*	Black Fruit Saw-sedge		1				
Davalliaceae	*Arthropteris tenella*							1
Davalliaceae	*Davallia solida* var. *pyxidata*	Hare's Foot Fern						1
Dennstaedtiaceae	*Hypolepis rugosula*	Ruddy Ground Fern				2		3
Dicksoniaceae	*Calochlaena dubia*	Rainbow Fern			4			
Dilleniaceae	*Hibbertia dentata*	Twining Guinea Flower						1
Dioscoreaceae	*Dioscorea transversa*	Native Yam		2	2	1		2
Dryopteridaceae	*Arachniodes aristata*	Prickly Shield Fern					2	
Dryopteridaceae	*Lastreopsis decomposita*	Trim Shield Fern		3	2			
Elaeocarpaceae	*Sloanea australis*	Maiden's Blush					2	
Escalloniaceae	*Quintinia verdonii*	Grey Possumwood				1		
Euphorbiaceae	*Homalanthus populifolius*						1	
Euphorbiaceae	*Mallotus philippensis*	Red Kamala			1			
Eupomatiaceae	*Eupomatia bennettii*	Small Bolwarra						2
Eupomatiaceae	*Eupomatia laurina*	Bolwarra		2	2			
Fabaceae (Caesalpinioideae)	*Senna pendula* var. *glabrata*		*		1		1	
Fabaceae (Faboideae)	*Derris involuta*				2			
Fabaceae (Faboideae)	*Glycine* sp.					1		
Fabaceae (Faboideae)	*Glycine* sp. *Coffs Harbour*	A glycine						1
Flagellariaceae	*Flagellaria indica*	Whip Vine				1		
Lamiaceae	*Clerodendrum floribundum* var. *floribundum*			1				

Family	Scientific Name	Common Name	Exotic	1	2	3	4	5
Lamiaceae	*Plectranthus parviflorus*							2
Lauraceae	*Cinnamomum camphora*	Camphor Laurel	*	1				
Lauraceae	*Cryptocarya glaucescens*	Jackwood				2		
Lauraceae	*Cryptocarya microneura*	Murrogun		2		1	1	
Lauraceae	*Cryptocarya rigida*	Forest Maple		2				3
Lauraceae	*Endiandra muelleri* subsp. *muelleri*					2	2	
Lauraceae	*Endiandra sieberi*	Hard Corkwood		2				
Lauraceae	*Endiandra virens*	White Apple		4	2			
Lauraceae	*Neolitsea dealbata*	Hairy-leaved Bolly Gum				1		
Lobeliaceae	*Lobelia trigonocaulis*	Forest Lobelia			1		2	
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush		1				2
Lomandraceae	*Lomandra spicata*					2		
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry			1			
Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling Lily		1				
Meliaceae	*Dysoxylum mollissimum* subsp. *molle*	Red Bean				2	2	
Meliaceae	*Synoum glandulosum* subsp. *glandulosum*	Scentless Rosewood		2			1	2
Menispermaceae	*Stephania japonica*	Snake vine		2	2			2
Monimiaceae	*Daphnandra apatela*					2		
Monimiaceae	*Wilkiea huegeliana*	Veiny Wilkiea		2		2	2	
Moraceae	*Ficus coronata*	Creek Sandpaper Fig				2	2	1
Myrtaceae	*Acmena smithii*	Lilly Pilly				1	2	
Myrtaceae	*Angophora costata*	Sydney Red Gum			3			2
Myrtaceae	*Archirhodomyrtus beckleri*	Rose Myrtle			1			2
Myrtaceae	*Corymbia intermedia*	Pink Bloodwood					2	
Myrtaceae	*Eucalyptus grandis*	Flooded Gum				4	4	
Myrtaceae	*Eucalyptus microcarpa*	Western Grey Box					3	
Myrtaceae	*Eucalyptus microcorys*	Tallowwood						2

Family	Scientific Name	Common Name	Exotic	1	2	3	4	5
Myrtaceae	*Eucalyptus pilularis*	Blackbutt		6	3			5
Myrtaceae	*Lophostemon confertus*	Brush Box		3	4	2	2	1
Myrtaceae	*Pilidiostigma glabrum*			1				
Myrtaceae	*Rhodamnia rubescens*	Scrub Turpentine						1
Myrtaceae	*Syncarpia glomulifera*	Turpentine		3	1			2
Nyctaginaceae	*Boerhavia coccinea*	Tarvine					2	
Ochnaceae	*Ochna serrulata*	Mickey Mouse Plant	*	1			1	
Passifloraceae	*Passiflora aurantia* var. *aurantia*	Blunt-leaved Passionfruit		1				
Passifloraceae	*Passiflora edulis*	Common Passionfruit	*	2				
Passifloraceae	*Passiflora subpeltata*	White Passionflower	*	2	3	1	2	1
Phormiaceae	*Dianella caerulea*	Blue Flax-lily		2	1			
Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush		2	1			
Phyllanthaceae	*Glochidion ferdinandi*	Cheese Tree		1			2	
Phyllanthaceae	*Phyllanthus gunnii*			2	2			2
Phyllanthaceae	*Poranthera microphylla*	Small Poranthera						2
Piperaceae	*Piper hederaceum* var. *hederaceum*	Giant Pepper Vine			1	2	2	
Pittosporaceae	*Pittosporum multiflorum*	Orange Thorn		1				
Pittosporaceae	*Pittosporum revolutum*	Rough Fruit Pittosporum		1	1			
Poaceae	*Entolasia marginata*	Bordered Panic				2		
Poaceae	*Imperata cylindrica*	Blady Grass			2			
Poaceae	*Oplismenus imbecillis*				2			2
Poaceae	*Ottochloa gracillima*				2		2	
Poaceae	*Paspalum mandiocanum*	Broadleaf Paspalum	*		1		2	
Poaceae	*Poa sieberiana*	Snowgrass						1
Poaceae	*Setaria palmifolia*	Palm Grass	*			2		
Polypodiaceae	*Platycerium bifurcatum*	Elkhorn Fern			1		1	
Polypodiaceae	*Pyrrosia rupestris*	Rock Felt Fern			1		2	1

Family	Scientific Name	Common Name	Exotic	1	2	3	4	5
Ripogonaceae	*Ripogonum elseyanum*	Hairy Supplejack				2	3	
Ripogonaceae	*Ripogonum fawcettianum*	Small Supplejack		3				2
Rosaceae	*Rubus moluccanus*	Molucca Bramble					1	
Rosaceae	*Rubus nebulosus*	Green-leaved Bramble				2		
Rosaceae	*Rubus parvifolius*	Native Raspberry			1			
Rubiaceae	*Morinda jasminoides*	Sweet Morinda				1	2	
Rutaceae	*Acronychia oblongifolia*	White Aspen		2				
Rutaceae	*Melicope elleryana*	Pink-flowered Doughwood					1	
Sapindaceae	*Diploglottis australis*	Native Tamarind				2		
Sapindaceae	*Guioa semiglauca*	Guioa		3			2	
Sapindaceae	*Jagera pseudorhus* var. *pseudorhus*	Foambark Tree		2		2		
Sapotaceae	*Niemeyera whitei*	Rusty Plum, Plum Boxwood				1		
Smilacaceae	*Smilax australis*	Lawyer Vine			2			2
Solanaceae	*Cestrum nocturnum*	Lady-of-the-night	*			3		
Solanaceae	*Solanum mauritianum*	Wild Tobacco Bush	*			2	1	
Thelypteridaceae	*Christella dentata*	Binung				1		
Thelypteridaceae	*Cyclosorus interruptus*						2	
Ulmaceae	*Trema tomentosa* var. *aspera*	Native Peach					1	
Uvulariaceae	*Tripladenia cunninghamii*			2	2			2
Verbenaceae	*Lantana camara*	Lantana	*	2	2	5	2	1
Violaceae	*Hybanthus* sp.							1
Violaceae	*Hybanthus stellarioides*			1				
Violaceae	*Viola hederacea*	Ivy-leaved Violet		1	2			3
Vitaceae	*Cayratia clematidea*	Native Grape						1
Vitaceae	*Cissus hypoglauca*	Giant Water Vine			1	3	2	2
Vitaceae	*Tetrastigma nitens*				1			
Xanthorrhoeaceae	*Xanthorrhoea malacophylla*				2			2

Family	Scientific Name	Common Name	Exotic	1	2	3	4	5
Zamiaceae	*Lepidozamia peroffskyana*							4
Zingiberaceae	*Alpinia caerulea*	Native Ginger		2	1	1	2	2

Key: Cover abundance rankings within each survey area: 1 Foliage sparsely or very sparsely present, cover less than 5%; 2 1-5% Plentiful, foliage cover 1-5 %; 3 5-25% foliage cover; 4 26-50% foliage cover; 5 51-75% foliage cover; 6 76-100% foliage cover; x opportunistic record, relative abundance not recorded.

Boambee SF offset site fauna observations

Common Name	Scientific Name	Exotic	NSW Status	EPBC Status	Observation Type
Amphibia					
Bleating Tree Frog	*Litoria dentata*				W
Broad-palmed Frog	*Litoria latopalmata*				W
Brown-striped Frog	*Limnodynastes peronii*				O
Eastern Dwarf Tree Frog	*Litoria fallax*				O,W
Giant Barred Frog	*Mixophyes iteratus*		E	E	O
Great Barred Frog	*Mixophyes fasciolatus*				O
Green Tree Frog	*Litoria caerulea*				W
Leaf-green Tree Frog	*Litoria phyllochroa*				O,W
Pearson's Green Tree Frog	*Litoria pearsoniana*				W
Peron's Tree Frog	*Litoria peronii*				W
Red-backed Toadlet	*Pseudophryne coriacea*				O,W
Red-eyed Tree Frog	*Litoria chloris*				W
Revealed Frog	*Litoria revelata*				O,W
Stoney Creek Frog	*Litoria wilcoxii*				O
Tusked Frog	*Adelotus brevis*				S
Tyler's Tree Frog	*Litoria tyleri*				W
Aves					
Australasian Figbird	*Sphecotheres vieilloti*				W
Australian Brush-turkey	*Alectura lathami*				Q
Australian Owlet-nightjar	*Aegotheles cristatus*				W
Black-faced Monarch	*Monarcha melanopsis*				O
Blue-faced Honeyeater	*Entomyzon cyanotis*				O
Brown Cuckoo-dove	*Macropygia amboinensis*				O
Brown Gerygone	*Gerygone mouki*				W
Brush Cuckoo	*Cacomantis variolosus*				W
Channel-billed Cuckoo	*Scythrops novaehollandiae*				W
Cicadabird	*Coracina tenuirostris*				W
Dollarbird	*Eurystomus orientalis*				O
Eastern Koel	*Eudynamys orientalis*				W
Eastern Whipbird	*Psophodes olivaceus*				W, Q
Fan-tailed Cuckoo	*Cacomantis flabelliformis*				W
Golden Whistler	*Pachycephala pectoralis*				W
Green Catbird	*Ailuroedus crassirostris*				W
Grey Shrike-thrush	*Colluricincla harmonica*				W
Horsfield's Bronze-Cuckoo	*Chalcites basalis*				W
Laughing Kookaburra	*Dacelo novaeguineae*				W
Lewin's Honeyeater	*Meliphaga lewinii*				O
Noisy Pitta	*Pitta versicolor*				W
Olive-backed Oriole	*Oriolus sagittatus*				W

Common Name	Scientific Name	Exotic	NSW Status	EPBC Status	Observation Type
Painted Button-quail	*Turnix varius*				O
Paradise Riflebird	*Ptiloris paradiseus*				W
Pheasant Coucal	*Centropus phasianinus*				W
Pied Currawong	*Strepera graculina*				O
Regent Bowerbird	*Sericulus chrysocephalus*				O
Satin Bowerbird	*Ptilonorhynchus violaceus*				W
Scarlet Honeyeater	*Myzomela sanguinolenta*				W
Shining Bronze-cuckoo	*Chalcites lucidus*				W
Southern Boobook	*Ninox novaeseelandiae*				W
Spangled Drongo	*Dicrurus bracteatus*				O
Spotted Pardalote	*Pardalotus punctatus*				W
Striated Pardalote	*Pardalotus striatus*				W
Superb Fairy-wren	*Malurus cyaneus*				O
Superb Lyrebird	*Menura novaehollandiae*				O, Q
Tawny Frogmouth	*Podargus strigoides*				O
Topknot Pigeon	*Lopholaimus antarcticus*				O
White-bellied Cuckoo-shrike	*Coracina papuensis*				W
White-throated Nightjar	*Eurostopodus mystacalis*				W
Wompoo Fruit-Dove	*Ptilinopus magnificus*		V		W
Yellow-faced Honeyeater	*Lichenostomus chrysops*				W
Yellow-throated Scrubwren	*Sericornis citreogularis*				W
Mammalia					
Bush rat	*Rattus fuscipes*				Q
Dog	*Canis lupus familiaris*	*			O
Grey-headed Flying-fox	*Pteropus poliocephalus*		V	V	W
Koala	*Phascolarctos cinereus*		V	V	P
Mountain Brushtail Possum	*Trichosurus cunninghami*				O
Water-rat	*Hydromys chrysogaster*				O
Reptilia					
Eastern Small-eyed Snake	*Cryptophis nigrescens*				W
Eastern Water Dragon	*Intellagama lesueurii*				S
Yellow-faced Whip Snake	*Demansia psammophis*				O

Key: E – endangered species; M – migratory, V – vulnerable species; B – burrow; F – tracks, H – skin, K – dead, O – observed, P – scat, W – heard, Q – camera trap image.

NH2U Boambee SF offset area baseline photo monitoring point results

NH2U Boambee SF Offset Area Photo Point 1		
Easting	504705	
Northing	6644542	
Bearing	90°	
Monitoring round / date of photo	Baseline / 28.04.2015	
Vegetation type	Hinterland and Escarpment Tallowwood - Blackbutt - Blue Gum Wet Ferny Forest	
NSW Veg Type ID	NR120	
Survey effort	Plot/transect 1	
Conservation significance	Native vegetation. Not listed as a TEC. Habitat for the affected threatened fauna including abundant Koala food trees and Grey-headed Flying-fox key diet plants. Occupied threatened plant habitat. *Marsdenia longiloba* stems within plot.	
Condition	Moderate/good. Remnant or regrowth native vegetation with high species richness and an intact over storey within benchmark values. Mid storey and groundcover attributes were within benchmark values. Large amounts of woody debris were present. No hollow-bearing trees were observed.	
Extent of weed infestation	Localised, moderate Lantana infestation. 10% cover along the transect sampled, comprising: occasional patches of Lantana; and Broad-leafed Paspalum (*Paspalum mandiocaunum)* along the edges of the access track.	
Evidence of other management issues (e.g. erosion, dieback, pest fauna)	None observed in majority of plot. Healthy, near-intact native vegetation.	
Observed changes since last monitoring round	N/a – baseline monitoring round.	

NH2U Boambee SF Offset Area Photo Point 2		
Easting	504176	
Northing	6644800	
Bearing	90°	
Monitoring round / date of photo	Baseline / 28.04.2015	
Vegetation type	Northern Escarpment Blackbutt - Apple Wet Ferny Forest	
NSW Veg Type ID	NR120	
Survey effort	Plot/transect 2	
Conservation significance	Native vegetation. Not listed as a TEC. Habitat for the affected threatened fauna, including abundant Grey-headed Flying-fox key diet plants. Occupied threatened plant habitat. *Tylophora woollsii* within the plot.	
Condition	Moderate/good. Remnant or regrowth native vegetation with moderate over storey cover. Native mid storey was below benchmark values as was native species richness. Native groundcover (shrubs) was below benchmark values. No hollows were observed. Large amounts of fallen timber was recorded with the total length of fallen logs well above benchmark values. The majority of canopy species were observed regenerating.	
Extent of weed infestation	Localised, moderate Lantana and Passion Flower (*Passiflora* species) infestation. 10% exotic plant cover along the transect sampled. Weed management should specifically target Passion Flower vines in the vicinity of *Tylophora woollsii* stems.	
Evidence of other management issues (e.g. erosion, dieback, pest fauna)	None observed. Healthy, near-intact native vegetation.	
Observed changes since last monitoring round	N/a – baseline monitoring round.	

NH2U Boambee SF Offset Area Photo Point 3		
Easting	504493	
Northing	6644492	
Bearing	270°	
Monitoring round / date of photo	Baseline / 28.04.2015	
Vegetation type	Coast and Hinterland Riparian Flooded Gum Bangalow Wet Forest	
NSW Veg Type ID	NR159	
Survey effort	Plot/transect 3	
Conservation significance	Native vegetation. Not listed as a TEC. Habitat for the affected threatened fauna, including abundant Grey-headed Flying-fox key diet plants. Occupied threatened plant habitat. *Marsdenia longiloba* recorded in vicinity of the plot.	
Condition	Moderate/good. Remnant or regrowth native vegetation with moderate over storey cover. Species richness was below benchmark values as was native ground cover (shrubs). All other native groundcover attributes were within benchmark values. Exotic cover was sparse and low. There was a moderate density of woody debris with the total length of fallen logs above benchmark value.	
Extent of weed infestation	Localised, slight Lantana infestation. 4% cover along the transect sampled.	
Evidence of other management issues (e.g. erosion, dieback, pest fauna)	None observed. Healthy, near-intact native vegetation.	
Observed changes since last monitoring round	N/a – baseline monitoring round.	

NH2U Boambee SF Offset Area Photo Point 4		
Easting	504067	
Northing	6644387	
Bearing	90°	
Monitoring round / date of photo	Baseline / 28.04.2015	
Vegetation type	Coast and Hinterland Riparian Flooded Gum Bangalow Wet Forest	
NSW Veg Type ID	NR159	
Survey effort	Plot/transect 4	
Conservation significance	Native vegetation. Not listed as a TEC. Poorer quality habitat for the affected threatened fauna.	
Condition	Moderate/good – poor.	
Extent of weed infestation	Severe infestation with Lantana, Crofton Weed (*Ageratina adenophora*) and Broadleaf Paspalum (*Paspalum mandiocanum*).	
Evidence of other management issues (e.g. erosion, dieback, pest fauna)	None observed.	
Observed changes since last monitoring round	N/a – baseline monitoring round.	

NH2U Boambee SF Offset Area Photo Point 5		
Easting	503687	
Northing	6644732	
Bearing	270 degrees	
Monitoring round / date of photo	Baseline / 29.04.2015	
Vegetation type	Northern Escarpment Blackbutt - Apple Wet Ferny Forest	
NSW Veg Type ID	NR120	
Survey effort	Plot/transect 5	
Conservation significance	Native vegetation. Not listed as a TEC. Habitat for the affected threatened fauna, including abundant Grey-headed Flying-fox key diet plants. Occupied threatened plant habitat. *Marsdenia longiloba* recorded in the vicinity of the plot.	
Condition	Moderate/good. Remnant or regrowth native vegetation with a moderate over storey cover. Species richness was just below benchmark values. Native mid storey and all ground over attributes were within benchmark values. Exotic plant over was low (predominantly Lantana) fallen logs were higher than benchmark. No hollow-bearing trees were observed.	
Extent of weed infestation	Localised, low Lantana and Crofton Weed (*Ageratina adenophora*) infestation. 8% cover along the transect sampled	
Evidence of other management issues (e.g. erosion, dieback, pest fauna)	None observed. Healthy, near-intact native vegetation.	
Observed changes since last monitoring round	N/a – baseline monitoring round.	

Appendix D – xxxxx offset site baseline survey results

xxxxx offset site biometric plot/transect data

NH2U offset area biometric plot/transect data

Vegetation Zone	Veg Type ID	Condition	Plot ID	Native species richness	Native over-storey cover	Native mid-storey cover	Native ground cover (grasses)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Over storey regeneration	Total length of fallen logs	Easting	Northing	Zone
	NR159	Benchmark		49	20-90	15-90	0-50	10-70	5-90	0	> = 0.1	1	> = 10			
1		Mod/good-high	9	38	17	9.5	24	4	20	51.5	1	0.3	22	xxxxx	xxxxx	56
			19	39	21.5	36	12	8	56	1	2	0.3	167	xxxxx	xxxxx	56
			28	54	25	57.5	4	16	20	2	3	0.3	0	xxxxx	xxxxx	56
			14	50	18.5	36	26	22	20	13	0	0.3	55	xxxxx	xxxxx	56
			15	30	14	40.5	0	2	22	1	0	0.3	42	xxxxx	xxxxx	56
			24	43	9	69.5	2	10	52	2	0	0.3	17	xxxxx	xxxxx	56
			12	43	31.5	32.5	0	16	36	0	0	0.3	35	xxxxx	xxxxx	56
	NR263	Benchmark		44	15-50	10-40	5-50	5-40	5-70	0	> = 0.1	1	> = 20			
4		Mod/good	8	34	28.5	4	76	10	12	9	0	0.9	3	xxxxx	xxxxx	56
			16	49	41	45.5	10	20	36	1.5	0	0.9	46	xxxxx	xxxxx	56
			27	34	41.5	15.5	78	6	34	7.5	0	0.9	0	xxxxx	xxxxx	56
			5	35	17.5	18	60	10	2	6.5	2	0.9	4	xxxxx	xxxxx	56
			10	36	17.5	14	24	8	14	33	1	0.9	8	xxxxx	xxxxx	56

Vegetation Zone	Veg Type ID	Condition	Plot ID	Native species richness	Native over-storey cover	Native mid-storey cover	Native ground cover (grasses)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Over storey regeneration	Total length of fallen logs	Easting	Northing	Zone
			11	48	11.5	21.5	0	14	16	2	0	0.9	12			56
			6	50	36.5	20.5	28	12	20	1	2	0.9	33	xxxxx	xxxxx	56
			13	41	15	11	20	12	10	4	0	0.9	27	xxxxx	xxxxx	56
			30	35	42	37	46	4	12	2	2	0.9	37	xxxxx	xxxxx	56
	NR120	Benchmark		44	20-90	15-90	0-50	10-70	5-90	0	> = 0.1	1	> = 10			
6		Mod/good	18	51	19.5	20	8	6	42	3	1	0.7	33	xxxxx	xxxxx	56
	NR122	Benchmark		49	20-90	15-90	0-50	10-70	5-90	0	> = 0.1	1	> = 10			
		Mod/good	7	49	34	67	4	12	18	0	0	1	107	xxxxx	xxxxx	56
			21	37	36.5	33	58	12	30	0	2	1	42	xxxxx	xxxxx	56
			23	47	44.5	19	4	12	18	3	1	1	36	xxxxx	xxxxx	56
	NR115	Benchmark		35	15-50	5-70	5-70	5-60	5-80	0	> = 1.5	1	> = 10			
8		Mod/good	17	32	23	2.5	4	12	44	0	3	0.7	18	xxxxx	xxxxx	56
			22	31	35.5	10.5	24	6	16	0	0	0.7	49	xxxxx	xxxxx	56
			20	38	33.5	9	32	8	30	0	0	0.7	4	xxxxx	xxxxx	56
			25	37	35	12.5	46	14	36	0	0	0.7	60	xxxxx	xxxxx	56
			26	42	42	13	78	4	48	0	3	0.7	7	xxxxx	xxxxx	56

Biometric plot/transect data for the remainder of the xxxxx offset site

Vegetation Zone	Veg Type ID	Condition	Plot ID	Native species richness	Native over-storey cover	Native mid-storey cover	Native ground cover (grasses)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Over storey regeneration	Total length of fallen logs	Easting	Northing	Zone
	NR159	Benchmark		49	20-90	15-90	0-50	10-70	5-90	0	> = 0.1	1	> = 10			
2		Mod/good-poor	29	36	0	88	2	20	0	0	0	0	13			56
	NR159	Benchmark		49	20-90	15-90	0-50	10-70	5-90	0	> = 0.1	1	> = 10			
1		Mod/good-high	1	46	21.5	65.5	10	22	24	12	0	0.3	45			56
			4	52	33	69	4	22	38	0	0	0.3	49			56
	NR159	Benchmark		49	20-90	15-90	0-50	10-70	5-90	0	> = 0.1	1	> = 10			
2		Mod/good-poor	2	46	0	43	56	4	30	19.5	0	0	5			56
	NR159	Benchmark		49	20-90	15-90	0-50	10-70	5-90	0	> = 0.1	1	> = 10			
3		Low	3	32	0	2.5	0	0	56	52	0	0	7			56

xxxxx offset site flora species list

NH2U xxxxx offset area species recorded in NR159 (plots 9,14,15,19,28)

Family	Scientific Name	Common Name	Exotic	Plot 9 Cover	Plot 9 Abundance	Plot 14 Cover	Plot 14 Abundance	Plot 15 Cover	Plot 15 Abundance	Plot 19 Cover	Plot 19 Abundance	Plot 28 Cover	Plot 28 Abundance
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower		1	100					1	100		
Adiantaceae	*Adiantum formosum*	Giant Maidenhair	0	1	10								
Adiantaceae	*Adiantum hispidulum*	Rough Maidenhair						1	3				
Anacardiaceae	*Euroschinus falcatus* var. *falcatus*	Ribbonwood		1	2	1	1					1	1
Apocynaceae	*Marsdenia hemiptera*			1	2								
Apocynaceae	*Melodinus australis*	Southern Melodinus										1	1
Apocynaceae	*Parsonsia straminea*	Common Silkpod				1	1						
Apocynaceae	*Tabernaemontana pandacaqui*	Banana Bush		1	3	1	8			1	7	1	2
Araceae	*Gymnostachys anceps*	Settler's Twine										1	3
Arecaceae	*Archontophoenix cunninghamiana*	Bangalow Palm				1	2	10	100	1	3	1	3
Arecaceae	*Linospadix monostachyos*	Walking-stick Palm						1	4				
Asteliaceae	*Cordyline stricta*	Narrow-leaved Palm Lily						1	30	1	20	1	2
Blechnaceae	*Blechnum cartilagineum*	Gristle Fern				1	2	1	5	7	500	4	100
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak								2	5		
Convolvulaceae	*Dichondra repens*	Kidney Weed		1	10								
Cunoniaceae	*Ceratopetalum apetalum*	Coachwood						2	15				
Cunoniaceae	*Schizomeria ovata*	Crabapple										5	1

Family	Scientific Name	Common Name	Exotic	Plot 9 Cover	Plot 9 Abundance	Plot 14 Cover	Plot 14 Abundance	Plot 15 Cover	Plot 15 Abundance	Plot 19 Cover	Plot 19 Abundance	Plot 28 Cover	Plot 28 Abundance
Cyperaceae	*Carex appressa*	Tall Sedge								1	2		
Cyperaceae	*Carex* sp.							1	6	1	30		
Cyperaceae	*Gahnia aspera*	Rough Saw-sedge		1	1	2	30						
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge										1	15
Dennstaedtiaceae	*Hypolepis muelleri*	Harsh Ground Fern				1	20	1	2	1	50		
Dennstaedtiaceae	*Pteridium esculentum*	Bracken		1	10	1	10						
Dicksoniaceae	*Calochlaena dubia*	Rainbow Fern				1	2			50	1000		
Dilleniaceae	*Hibbertia scandens*	Climbing Guinea Flower										1	2
Dioscoreaceae	*Dioscorea transversa*	Native Yam				1	1			1	3	1	2
Ebenaceae	*Diospyros pentamera*	Myrtle Ebony										1	1
Elaeocarpaceae	*Elaeocarpus reticulatus*	Blueberry Ash				1	5					1	1
Ericaceae	*Trochocarpa laurina*	Tree Heath				1	1			1	4	1	1
Euphorbiaceae	*Acalypha nemorum*	0		1	2								
Euphorbiaceae	*Claoxylon australe*	Brittlewood				1	4	1	5				
Euphorbiaceae	*Croton verreauxii*	Green Native Cascarilla						1	2	1	1		
Euphorbiaceae	*Mallotus philippensis*	Red Kamala		1	1							1	4
Eupomatiaceae	*Eupomatia laurina*	Bolwarra		1	1			1	4	1	2	1	2
Fabaceae (Mimosoideae)	*Acacia implexa*	Hickory Wattle				1	3						
Fabaceae (Mimosoideae)	*Acacia irrorata*	Green Wattle		1	1	1	6						

Family	Scientific Name	Common Name	Exotic	Plot 9 Cover	Plot 9 Abundance	Plot 14 Cover	Plot 14 Abundance	Plot 15 Cover	Plot 15 Abundance	Plot 19 Cover	Plot 19 Abundance	Plot 28 Cover	Plot 28 Abundance
Flagellariaceae	*Flagellaria indica*	Whip Vine				1	1					1	1
Lamiaceae	*Clerodendrum floribundum* var. *floribundum*			1	1	1	2					1	1
Lamiaceae	*Gmelina leichhardtii*	White Beech						1	1			1	3
Lauraceae	*Cryptocarya erythroxylon*	Pigeonberry Ash										1	1
Lauraceae	*Cryptocarya glaucescens*	Jackwood		1	1								
Lauraceae	*Cryptocarya microneura*	Murrogun				5	100	1	2	1	10	5	100
Lauraceae	*Cryptocarya obovata*	Pepperberry										10	1
Lauraceae	*Cryptocarya rigida*	Forest Maple								1	5		
Lauraceae	*Endiandra discolor*	Rose Walnut								1	1	5	3
Lauraceae	*Endiandra muelleri*	Green-leaved Rose Walnut				1	1	5	10	1	1	2	6
Lauraceae	*Litsea australis*	Brown Bolly Gum										10	20
Lauraceae	*Neolitsea dealbata*	Hairy-leaved Bolly Gum				1	2					1	2
Lobeliaceae	*Lobelia trigonocaulis*	Forest Lobelia				1	50						
Lomandraceae	*Lomandra hystrix*							1	20			1	6
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush								1	2		
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry										1	2
Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling Lily		1	1	1	3			1	10		
Malvaceae	*Hibiscus heterophyllus* subsp. *heterophyllus*	Native Rosella		2	6					1	2		
Meliaceae	*Melia azedarach*	White Cedar		1	6								
Meliaceae	*Synoum glandulosum* subsp. *glandulosum*	Scentless Rosewood				1	4	1	2	1	1	1	2

Family	Scientific Name	Common Name	Exotic	Plot 9 Cover	Plot 9 Abundance	Plot 14 Cover	Plot 14 Abundance	Plot 15 Cover	Plot 15 Abundance	Plot 19 Cover	Plot 19 Abundance	Plot 28 Cover	Plot 28 Abundance
Menispermaceae	*Echinostephia aculeata*			1	10	1	1						
Menispermaceae	*Sarcopetalum harveyanum*	Pearl Vine		1	1								
Menispermaceae	*Stephania japonica*	Snake vine				1	4						
Monimiaceae	*Palmeria scandens*	Anchor Vine						1	4				
Monimiaceae	*Wilkiea huegeliana*	Veiny Wilkiea		1	1	1	6	1	1	1	6	1	3
Moraceae	*Ficus coronata*	Creek Sandpaper Fig				1	2	1	6				
Moraceae	*Trophis scandens*	Burny Vine										1	2
Myrsinaceae	*Embelia australiana*			1	2	1	2					1	4
Myrsinaceae	*Myrsine variabilis*					1	1			1	1		
Myrtaceae	*Acmena smithii*	Lilly Pilly				1	3					1	2
Myrtaceae	*Backhousia myrtifolia*	Grey Myrtle										2	6
Myrtaceae	*Corymbia intermedia*	Pink Bloodwood		1	1					3	1	20	2
Myrtaceae	*Eucalyptus grandis*	Flooded Gum								7	2	15	2
Myrtaceae	*Eucalyptus microcorys*	Tallowwood		25	7	30	10						
Myrtaceae	*Eucalyptus propinqua*	Small-fruited Grey Gum		1	1								
Myrtaceae	*Lophostemon confertus*	Brush Box		1	1			10	2	7	4		
Myrtaceae	*Rhodamnia rubescens*	Scrub Turpentine										1	1
Myrtaceae	*Syncarpia glomulifera*	Turpentine								5	6		
Myrtaceae	*Syzygium crebrinerve*	Rose Satinash						1	2			1	1
Myrtaceae	*Tristaniopsis laurina*	Kanooka										1	7
Orchidaceae	*Unidentified orchid* sp.									1	20		
Oxalidaceae	*Oxalis* sp.			1	10	1	3						
Phormiaceae	*Dianella* sp.											1	1

Family	Scientific Name	Common Name	Exotic	Plot 9 Cover	Plot 9 Abundance	Plot 14 Cover	Plot 14 Abundance	Plot 15 Cover	Plot 15 Abundance	Plot 19 Cover	Plot 19 Abundance	Plot 28 Cover	Plot 28 Abundance
Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush				1	4						
Phyllanthaceae	*Glochidion ferdinandi*	Cheese Tree		1	3	1	8	2	1	1	1	1	1
Poaceae	*Entolasia stricta*	Wiry Panic		1	1	1	100			1	100		
Poaceae	*Imperata cylindrica*	Blady Grass		1	1	1	10						
Poaceae	*Oplismenus aemulus*			1	100								
Poaceae	*Oplismenus imbecillis*			1	10	5	500					1	100
Proteaceae	*Persoonia stradbrokensis*					1	5						
Ranunculaceae	*Clematis* sp.			1	100	1	6						
Rhamnaceae	*Alphitonia excelsa*	Red Ash				1	1						
Ripogonaceae	*Ripogonum fawcettianum*	Small Supplejack						1	10	1	100	1	1
Rubiaceae	*Cyclophyllum longipetalum*	Coast Canthium				1	30						
Rubiaceae	*Morinda jasminoides*	Sweet Morinda				1	5	1	2	1	100	1	5
Rubiaceae	*Psychotria loniceroides*	Hairy Psychotria		1	2	1	3			1	2	1	3
Rutaceae	*Acronychia oblongifolia*	White Aspen				3	50	1	1	1	3		
Sapindaceae	*Alectryon subcinereus*	Wild Quince		1	6	1	50						
Sapindaceae	*Elattostachys xylocarpa*	White Tamarind										1	2
Sapindaceae	*Guioa semiglauca*	Guioa		1	20	1	20	1	1			1	1
Sapindaceae	*Jagera pseudorhus var. pseudorhus*	Foambark Tree		1	1							1	2
Sapindaceae	*Mischocarpus pyriformis*	Yellow Pear-fruit										1	1
Sapindaceae	*Sarcopteryx stipata*	Steelwood						1	1			1	1
Smilacaceae	*Smilax australis*	Lawyer Vine				1	2			1	1	1	2
Smilacaceae	*Smilax glyciphylla*	Sweet Sarsparilla										1	1

Family	Scientific Name	Common Name	Exotic	Plot 9 Cover	Plot 9 Abundance	Plot 14 Cover	Plot 14 Abundance	Plot 15 Cover	Plot 15 Abundance	Plot 19 Cover	Plot 19 Abundance	Plot 28 Cover	Plot 28 Abundance
Sterculiaceae	*Seringia arborescens*									1	1		
Vitaceae	*Cayratia clematidea*	Native Grape		1	1								
Vitaceae	*Cissus antarctica*	Water Vine		1	1	1	4	1	3			5	2
Vitaceae	*Cissus hypoglauca*	Giant Water Vine				1	1			1	2		
Vitaceae	*Clematicissus opaca*	Pepper Vine				1	1						
Winteraceae	*Tasmannia insipida*	Brush Pepperbush						1	20			1	4
Zingiberaceae	*Alpinia caerulea*	Native Ginger						1	15	1	1		

Notes: Cover – visual estimate of foliage projective cover within the plot, recorded from 1–5% and then to the nearest 5%.

Abundance - relative number of individuals or shoots of a species within the plot. Based on the following intervals: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, 1000. Counts above 20 are estimates only

NH2U xxxxx offset area species recorded in NR159 and NR263 (plots 8,16,27,5,10)

Family	Scientific Name	Common Name	Exotic	Plot 5 Cover	Plot 5 Abundance	Plot 8 Cover	Plot 8 Abundance	Plot 10 Cover	Plot 10 Abundance	Plot 16 Cover	Plot 16 Abundance	Plot 27 Cover	Plot 27 Abundance
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower						1	100	1	100	1	100
Adiantaceae	*Adiantum hispidulum*	Rough Maidenhair						1	50				
Apiaceae	*Centella asiatica*	Indian Pennywort				1	2						
Apocynaceae	*Parsonsia rotata*	Veinless Silkpod										1	1
Apocynaceae	*Parsonsia straminea*	Common Silkpod		1	2			1	1				
Apocynaceae	*Tabernaemontana pandacaqui*	Banana Bush								1	2	1	2
Araceae	*Gymnostachys anceps*	Settler's Twine						1	4	1	4		
Araliaceae	*Astrotricha latifolia*									1	10		

Family	Scientific Name	Common Name	Exotic	Plot 5 Cover	Plot 5 Abundance	Plot 8 Cover	Plot 8 Abundance	Plot 10 Cover	Plot 10 Abundance	Plot 16 Cover	Plot 16 Abundance	Plot 27 Cover	Plot 27 Abundance
Asteraceae	*Ozothamnus diosmifolius*	White Dogwood				1	4					1	1
Asteraceae	*Vernonia cinerea*			1	5	1	20			1	10		
Blechnaceae	*Doodia aspera*	Prickly Rasp Fern						3	100	1	50		
Casuarinaceae	*Allocasuarina littoralis*	Black She-Oak										1	3
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak				1	1	1	2	1	7		
Convolvulaceae	*Dichondra repens*	Kidney Weed								1	1		
Cyperaceae	*Gahnia aspera*	Rough Saw-sedge		1	3								
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge		1	100	1	50	1	10				
Dilleniaceae	*Hibbertia scandens*	Climbing Guinea Flower						1	1			1	1
Dioscoreaceae	*Dioscorea transversa*	Native Yam								1	6	1	1
Ebenaceae	*Diospyros australis*	Black Plum		1	1								
Ericaceae	*Leucopogon juniperinus*	Prickly Beard-heath		1	20	1	3						
Ericaceae	*Trochocarpa laurina*	Tree Heath		1	1					2	5		
Euphorbiaceae	*Acalypha nemorum*									1	2		
Eupomatiaceae	*Eupomatia laurina*	Bolwarra								1	1		
Fabaceae (Faboideae)	*Desmodium gunnii*	Slender Tick-trefoil		1	20			1	20			1	3
Fabaceae (Faboideae)	*Desmodium varians*	Slender Tick-trefoil								1	1		
Fabaceae (Faboideae)	*Glycine clandestina*	Twining glycine				1	4			1	1	1	3
Fabaceae (Faboideae)	*Glycine microphylla*	Small-leaf Glycine		1	100								

Family	Scientific Name	Common Name	Exotic	Plot 5 Cover	Plot 5 Abundance	Plot 8 Cover	Plot 8 Abundance	Plot 10 Cover	Plot 10 Abundance	Plot 16 Cover	Plot 16 Abundance	Plot 27 Cover	Plot 27 Abundance
Fabaceae (Mimosoideae)	*Acacia falciformis*	Broad-leaved Hickory						1	3				
Fabaceae (Mimosoideae)	*Acacia fimbriata*	Fringed Wattle		1	3	1	15					1	12
Fabaceae (Mimosoideae)	*Acacia irrorata*	Green Wattle		2	11					1	2		
Lamiaceae	*Clerodendrum floribundum* var. *floribundum*							1	1				
Lamiaceae	*Plectranthus parviflorus*	(blank)								1	1		
Lauraceae	*Cassytha filiformis*											2	20
Lauraceae	*Cryptocarya microneura*	Murrogun				1	2	1	1	1	30	1	1
Lobeliaceae	*Pratia purpurascens*	Whiteroot		1	5	1	100	1	50	1	100	1	50
Lomandraceae	*Lomandra filiformis*	Wattle Matt-rush				1	100			1	20	1	20
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush		1	3	1	20	1	10	1	10	1	5
Lomandraceae	*Lomandra* sp.	Mat-rush		1	1								
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry		1	8							1	1
Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling Lily				1	2	1	3	1	4	1	2
Meliaceae	*Melia azedarach*	White Cedar								1	1		
Meliaceae	*Synoum glandulosum subsp. glandulosum*	Scentless Rosewood						1	1				
Menispermaceae	*Echinostephia aculeata*									1	1		
Menispermaceae	*Sarcopetalum harveyanum*	Pearl Vine										1	1
Menispermaceae	*Stephania japonica*	Snake vine						1	2			1	2
Myrsinaceae	*Embelia australiana*							1	1				
Myrsinaceae	*Myrsine howittiana*	Brush Muttonwood								3	30		

Family	Scientific Name	Common Name	Exotic	Plot 5 Cover	Plot 5 Abundance	Plot 8 Cover	Plot 8 Abundance	Plot 10 Cover	Plot 10 Abundance	Plot 16 Cover	Plot 16 Abundance	Plot 27 Cover	Plot 27 Abundance
Myrtaceae	*Angophora costata*	Sydney Red Gum								1	1		
Myrtaceae	*Corymbia intermedia*	Pink Bloodwood						1	1			1	1
Myrtaceae	*Eucalyptus carnea*	Thick-leaved Mahogany		2	3	3	1	10	10	10	5	5	4
Myrtaceae	*Eucalyptus microcorys*	Tallowwood				7	2			2	1	35	17
Myrtaceae	*Eucalyptus propinqua*	Small-fruited Grey Gum		20	11	15	7	20	8	5	1		
Myrtaceae	*Eucalyptus rummeryi*	Steel Box		10	3			4	3				
Myrtaceae	*Eucalyptus siderophloia*	Grey Ironbark								5	4		
Myrtaceae	*Leptospermum petersonii*	Lemon-scented Teatree								1	7		
Myrtaceae	*Lophostemon confertus*	Brush Box						1	1	1	1	1	1
Myrtaceae	*Syncarpia glomulifera*	Turpentine		1	1			1	1	2	6		
Oleaceae	*Notelaea longifolia*	Large Mock-olive		1	1	1	3						
Orchidaceae	*Dipodium* sp.					1	2						
Oxalidaceae	*Oxalis exilis*			1	5								
Oxalidaceae	*Oxalis* sp.					1	10			1	2	1	2
Phormiaceae	*Dianella caerulea*	Blue Flax-lily		1	4								
Phormiaceae	*Dianella* sp.					1	50	1	5			1	1
Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush		1	3	1	5	1	2			1	5
Phyllanthaceae	*Glochidion ferdinandi*	Cheese Tree		1	4	1	2	1	1	1	6		
Phyllanthaceae	*Phyllanthus gunnii*									1	2		
Pittosporaceae	*Hymenosporum flavum*	Native Frangipani										1	2
Poaceae	*Aristida vagans*	Threeawn Speargrass		1	5								

Family	Scientific Name	Common Name	Exotic	Plot 5 Cover	Plot 5 Abundance	Plot 8 Cover	Plot 8 Abundance	Plot 10 Cover	Plot 10 Abundance	Plot 16 Cover	Plot 16 Abundance	Plot 27 Cover	Plot 27 Abundance
Poaceae	*Cymbopogon refractus*	Barbed Wire Grass		1	20	1	50	1	20	1	10		
Poaceae	*Dichelachne micrantha*	Shorthair Plumegrass				1	10						
Poaceae	*Digitaria parviflora*	Small-flowered Finger Grass		1	20								
Poaceae	*Entolasia stricta*	Wiry Panic		50	1000	40	1000	1	50	1	50	3	100
Poaceae	*Imperata cylindrica*	Blady Grass				1	100					1	50
Poaceae	*Microlaena stipoides*	Weeping Grass				1	10						
Poaceae	*Oplismenus aemulus*											1	100
Poaceae	*Oplismenus imbecillis*					1	5			1	100	1	20
Poaceae	*Ottochloa gracillima*			1	100								
Poaceae	*Poa labillardierei var. labillardierei*	Tussock		1	200	1	10			1	25		
Poaceae	*Poa queenslandica*	Queensland Grass				1	2	1	50				
Poaceae	*Sporobolus laxus*			1	1								
Poaceae	*Themeda australis*	Kangaroo Grass								1	20		
Proteaceae	*Persoonia cornifolia*			1	1								
Ranunculaceae	*Clematis* sp.					1	10	1	20	1	10	1	30
Rhamnaceae	*Alphitonia excelsa*	Red Ash								1	1		
Rubiaceae	*Galium propinquum*	Maori Bedstraw								1	2		
Rubiaceae	*Morinda jasminoides*	Sweet Morinda						1	10	1	25	1	1
Rubiaceae	*Psychotria loniceroides*	Hairy Psychotria								1	3		
Rutaceae	*Acronychia oblongifolia*	White Aspen								1	5		
Sapindaceae	*Jagera pseudorhus* var. *pseudorhus*	Foambark Tree				1	1						
Smilacaceae	*Smilax australis*	Lawyer Vine								1	10	1	3
Uvulariaceae	*Tripladenia cunninghamii*									1	1		

Family	Scientific Name	Common Name	Exotic	Plot 5 Cover	Plot 5 Abundance	Plot 8 Cover	Plot 8 Abundance	Plot 10 Cover	Plot 10 Abundance	Plot 16 Cover	Plot 16 Abundance	Plot 27 Cover	Plot 27 Abundance
Violaceae	*Hybanthus* sp.							1	50				
Violaceae	*Hybanthus stellarioides*			1	100								
Vitaceae	*Cayratia clematidea*	Native Grape						1	1				
Vitaceae	*Cissus antarctica*	Water Vine				1	2	1	1				
Vitaceae	*Cissus hypoglauca*	Giant Water Vine				1	2	1	1				
Vitaceae	*Clematicissus opaca*	Pepper Vine		1	1								
Zamiaceae	*Macrozamia fawcettii*			1	1					1	3		

Notes: Cover – visual estimate of foliage projective cover within the plot, recorded from 1–5% and then to the nearest 5%.

Abundance - relative number of individuals or shoots of a species within the plot. Based on the following intervals: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, 1000. Counts above 20 are estimates only

NH2U xxxxx offset area species recorded in NR263 (plots 11,6,13,30)

Family	Scientific Name	Common Name	Exotic	Plot 6 Cover	Plot 6 Abundance	Plot 11 Cover	Plot 11 Abundance	Plot 13 Cover	Plot 13 Abundance	Plot 30 Cover	Plot 30 Abundance
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower								1	20
Adiantaceae	*Adiantum aethiopicum*	Common Maidenhair		1	100						
Adiantaceae	*Adiantum formosum*	Giant Maidenhair				1	50				
Adiantaceae	*Pellaea paradoxa*							1	1		
Apocynaceae	*Alstonia constricta*	Quinine Bush						1	2		
Apocynaceae	*Alyxia ruscifolia*	Prickly Alyxia				1	1				
Apocynaceae	*Melodinus australis*	Southern Melodinus				1	1				
Apocynaceae	*Parsonsia straminea*	Common Silkpod		1	2					1	3
Apocynaceae	*Tabernaemontana pandacaqui*	Banana Bush		1	1	1	6	1	20	1	2
Araceae	*Gymnostachys anceps*	Settler's Twine		1	2						

Family	Scientific Name	Common Name	Exotic	Plot 6 Cover	Plot 6 Abundance	Plot 11 Cover	Plot 11 Abundance	Plot 13 Cover	Plot 13 Abundance	Plot 30 Cover	Plot 30 Abundance
Araliaceae	*Astrotricha latifolia*			1	20	1	1			1	3
Araliaceae	*Polyscias sambucifolia*	Elderberry Panax		1	1						
Arecaceae	*Archontophoenix cunninghamiana*	Bangalow Palm				1	6			1	1
Asteraceae	*Vernonia cinerea*			1	100						
Blechnaceae	*Blechnum cartilagineum*	Gristle Fern				1	1			1	3
Blechnaceae	*Doodia aspera*	Prickly Rasp Fern		3	500	2	100	1	4		
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak		1	7						9
Commelinaceae	*Commelina cyanea*	Native Wandering Jew				1	1				
Cyperaceae	*Gahnia aspera*	Rough Saw-sedge				1	10	1	20		
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge		1	10			1	40	1	5
Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower		1	1						
Dioscoreaceae	*Dioscorea transversa*	Native Yam				1	1	1	2		
Ebenaceae	*Diospyros australis*	Black Plum				1	1	1	3		
Ericaceae	*Leucopogon juniperinus*	Prickly Beard-heath		1	3						
Ericaceae	*Leucopogon lanceolatus*			1	1						
Ericaceae	*Trochocarpa laurina*	Tree Heath		1	3			1	2	1	1
Euphorbiaceae	*Claoxylon australe*	Brittlewood				1	1	1	3		
Euphorbiaceae	*Mallotus philippensis*	Red Kamala				2	10				
Eupomatiaceae	*Eupomatia laurina*	Bolwarra				1	3				
Fabaceae (Faboideae)	*Desmodium gunnii*	Slender Tick-trefoil		1	5						
Fabaceae (Faboideae)	*Glycine clandestina*	Twining glycine		1	1						
Fabaceae (Mimosoideae)	*Acacia fimbriata*	Fringed Wattle		1	3						

Family	Scientific Name	Common Name	Exotic	Plot 6 Cover	Plot 6 Abundance	Plot 11 Cover	Plot 11 Abundance	Plot 13 Cover	Plot 13 Abundance	Plot 30 Cover	Plot 30 Abundance
Fabaceae (Mimosoideae)	*Acacia irrorata*	Green Wattle		2	6	1	1	1	2		5
Flacourtiaceae	*Scolopia braunii*	Flintwood				1	1				
Haloragaceae	*Gonocarpus tetragynus*	Poverty Raspwort		1	2						
Lamiaceae	*Clerodendrum floribundum var. floribundum*					1	1				
Lauraceae	*Cassytha filiformis*			1	1						
Lauraceae	*Cryptocarya microneura*	Murrogun				1	10	1	2	1	2
Lauraceae	*Cryptocarya rigida*	Forest Maple				1	1				
Lauraceae	*Endiandra muelleri*	Green-leaved Rose Walnut				1	1				
Lauraceae	*Neolitsea dealbata*	Hairy-leaved Bolly Gum				1	4				
Lobeliaceae	*Pratia purpurascens*	Whiteroot		1	50					1	1
Lomandraceae	*Lomandra filiformis*	Wattle Matt-rush		1	50					1	100
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush		1	5			1	1	1	5
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry								1	2
Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling Lily								1	3
Malvaceae	*Hibiscus diversifolius*	Swamp Hibiscus				1	2	1	6		
Meliaceae	*Synoum glandulosum subsp. glandulosum*	Scentless Rosewood				1	6				
Menispermaceae	*Stephania japonica*	Snake vine		1	1	1	1				
Monimiaceae	*Wilkiea huegeliana*	Veiny Wilkiea		1	1	1	1				
Myrsinaceae	*Embelia australiana*					2	1	1	4		
Myrsinaceae	*Myrsine howittiana*	Brush Muttonwood						1	2		
Myrsinaceae	*Myrsine variabilis*							1	1		
Myrtaceae	*Angophora costata*	Sydney Red Gum		2	1						1
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush						1	2		
Myrtaceae	*Corymbia intermedia*	Pink Bloodwood		1	1						

Family	Scientific Name	Common Name	Exotic	Plot 6 Cover	Plot 6 Abundance	Plot 11 Cover	Plot 11 Abundance	Plot 13 Cover	Plot 13 Abundance	Plot 30 Cover	Plot 30 Abundance
Myrtaceae	*Eucalyptus acmenoides*	White Mahogany									2
Myrtaceae	*Eucalyptus carnea*	Thick-leaved Mahogany		10	6						
Myrtaceae	*Eucalyptus microcorys*	Tallowwood		1	1	8	3				2
Myrtaceae	*Eucalyptus propinqua*	Small-fruited Grey Gum		25	4	15	5	15	5		7
Myrtaceae	*Eucalyptus resinifera*	Red Mahogany									3
Myrtaceae	*Eucalyptus rummeryi*	Steel Box				7	3				
Myrtaceae	*Eucalyptus siderophloia*	Grey Ironbark						15	4		
Myrtaceae	*Leptospermum petersonii*	Lemon-scented Teatree						1	4		
Myrtaceae	*Lophostemon confertus*	Brush Box						2	1		
Myrtaceae	*Rhodamnia argentea*	Silver Myrtle						1	1		
Myrtaceae	*Syncarpia glomulifera*	Turpentine		1	1			1	2		3
Oleaceae	*Notelaea longifolia*	Large Mock-olive				1	1	1	1	1	1
Oxalidaceae	*Oxalis* sp.			1	5					1	2
Phormiaceae	*Dianella* sp.			1	10	1	20	1	1	1	2
Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush		1	10			1	12		
Phyllanthaceae	*Bridelia exaltata*	Brush Ironbark				1	10				
Phyllanthaceae	*Glochidion ferdinandi*	Cheese Tree								1	4
Phyllanthaceae	*Phyllanthus gunnii*			1	10						
Pittosporaceae	*Hymenosporum flavum*	Native Frangipani						1	1		
Pittosporaceae	*Pittosporum multiflorum*	Orange Thorn				1	1	1	50		
Pittosporaceae	*Pittosporum revolutum*	Rough Fruit Pittosporum				1	1				
Poaceae	*Entolasia stricta*	Wiry Panic		3	100			1	50	5	1000
Poaceae	*Imperata cylindrica*	Blady Grass		1	500						
Poaceae	*Oplismenus imbecillis*			1	50	1	2	1	100		
Poaceae	*Ottochloa gracillima*					1	10				

Family	Scientific Name	Common Name	Exotic	Plot 6 Cover	Plot 6 Abundance	Plot 11 Cover	Plot 11 Abundance	Plot 13 Cover	Plot 13 Abundance	Plot 30 Cover	Plot 30 Abundance
Poaceae	*Poa labillardierei* var. *labillardierei*	Tussock		1	10						
Poaceae	*Themeda australis*	Kangaroo Grass		1	10						
Proteaceae	*Persoonia stradbrokensis*			1	2						
Putranjivaceae	*Drypetes deplanchei*	Yellow Tulipwood				1	1				
Ranunculaceae	*Clematis* sp.			1	2			1	2		
Rhamnaceae	*Alphitonia excelsa*	Red Ash				1	3			1	1
Rosaceae	*Rubus parvifolius*	Native Raspberry		1	10						
Rubiaceae	*Cyclophyllum longipetalum*	Coast Canthium		1	100						
Rubiaceae	*Cyclophyllum* sp.	#N/A						5	200		
Rubiaceae	*Morinda jasminoides*	Sweet Morinda				1	2			1	2
Rubiaceae	*Pomax umbellata*	Pomax		1	1						
Rubiaceae	*Psychotria loniceroides*	Hairy Psychotria				1	6	1	50	1	2
Santalaceae	*Santalum obtusifolium*	Sandalwood								1	1
Sapindaceae	*Alectryon subcinereus*	Wild Quince				1	3	1	4		
Sapindaceae	*Elattostachys xylocarpa*	White Tamarind				1	6	1	1		
Sapindaceae	*Guioa semiglauca*	Guioa								1	2
Sapindaceae	*Jagera pseudorhus* var. *pseudorhus*	Foambark Tree						1	3		
Sapindaceae	*Mischocarpus pyriformis*	Yellow Pear-fruit						1	1		
Smilacaceae	*Smilax australis*	Lawyer Vine		1	15	1	10			1	3
Sterculiaceae	*Brachychiton acerifolius*	Illawarra Flame Tree		1	1						
Uvulariaceae	*Tripladenia cunninghamii*					1	1				
Violaceae	*Viola hederacea*	Ivy-leaved Violet								1	2
Vitaceae	*Cissus antarctica*	Water Vine		1	1	2	1	1	2	1	2
Vitaceae	*Cissus hypoglauca*	Giant Water Vine				1	1				
Vitaceae	*Cissus* sp.			1	1						

Family	Scientific Name	Common Name	Exotic	Plot 6 Cover	Plot 6 Abundance	Plot 11 Cover	Plot 11 Abundance	Plot 13 Cover	Plot 13 Abundance	Plot 30 Cover	Plot 30 Abundance
Vitaceae	*Clematicissus opaca*	Pepper Vine						1	6		
Vitaceae	*Tetrastigma nitens*							1	1		
Zamiaceae	*Macrozamia fawcettii*			1	20						
Zingiberaceae	*Alpinia caerulea*	Native Ginger				1	2				

Notes: Cover – visual estimate of foliage projective cover within the plot, recorded from 1–5% and then to the nearest 5%.

Abundance - relative number of individuals or shoots of a species within the plot. Based on the following intervals: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, 1000. Counts above 20 are estimates only

NH2U xxxxx offset area species recorded in NR120 (plots 8,7,21,23)

Family	Scientific Name	Common Name	Exotic	Plot 7 Cover	Plot 7 Abundance	Plot 18 Cover	Plot 18 Abundance	Plot 21 Cover	Plot 21 Abundance	Plot 23 Cover	Plot 23 Abundance
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower		1	10	1	10	1	500	1	200
Adiantaceae	*Adiantum aethiopicum*	Common Maidenhair				1	2				
Anacardiaceae	*Euroschinus falcatus* var. *falcatus*	Ribbonwood								1	3
Apocynaceae	*Parsonsia rotata*	Veinless Silkpod						1	4		
Apocynaceae	*Parsonsia straminea*	Common Silkpod		1	3			1	1		
Apocynaceae	*Tabernaemontana pandacaqui*	Banana Bush				1	3			1	1
Araceae	*Gymnostachys anceps*	Settler's Twine						1	1	1	1
Araliaceae	*Astrotricha latifolia*									1	1
Araliaceae	*Polyscias sambucifolia*	Elderberry Panax		1	1						
Arecaceae	*Archontophoenix cunninghamiana*	Bangalow Palm		1	5	1	3	1	1	1	4
Asteliaceae	*Cordyline stricta*	Narrow-leaved Palm Lily				1	10				
Bignoniaceae		Wonga Wonga Vine		1	2	1	1	1	2		
Blechnaceae	*Blechnum cartilagineum*	Gristle Fern		1	20	4	500	1	1		

Family	Scientific Name	Common Name	Exotic	Plot 7 Cover	Plot 7 Abundance	Plot 18 Cover	Plot 18 Abundance	Plot 21 Cover	Plot 21 Abundance	Plot 23 Cover	Plot 23 Abundance
Casuarinaceae	*Allocasuarina littoralis*	Black She-Oak						2	12		
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak		1	20	2	7			1	1
Cunoniaceae	*Ceratopetalum gummiferum*	Christmas Bush		2	15			10	50		
Cyperaceae	*Gahnia aspera*	Rough Saw-sedge		1	10						
Cyperaceae	*Gahnia sieberiana*	Red-fruit Saw-sedge						1	1		
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge						1	1	1	10
Dennstaedtiaceae	*Pteridium esculentum*	Bracken		1	1			1	2		
Dicksoniaceae	*Calochlaena dubia*	Rainbow Fern		2	50	5	300			2	50
Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower		1	3					1	1
Dilleniaceae	*Hibbertia scandens*	Climbing Guinea Flower		1	3	1	1	1	1	1	3
Dioscoreaceae	*Dioscorea transversa*	Native Yam		1	1	1	50			1	4
Elaeocarpaceae	*Elaeocarpus reticulatus*	Blueberry Ash		1	20	1	1	1	1		
Ericaceae	*Leucopogon lanceolatus* var. *gracilis*			1	1						
Ericaceae	*Trochocarpa laurina*	Tree Heath		2	20	2	7	1	4		
Euphorbiaceae	*Claoxylon australe*	Brittlewood				1	1				
Eupomatiaceae	*Eupomatia laurina*	Bolwarra		1	1	1	2				
Fabaceae (Faboideae)	*Desmodium gunnii*	Slender Tick-trefoil								1	4
Fabaceae (Mimosoideae)	*Acacia binervata*	Two-veined Hickory		1	3						
Fabaceae (Mimosoideae)	*Acacia irrorata*	Green Wattle						1	1	1	6
Goodeniaceae	*Goodenia rotundifolia*							1	1		
Iridaceae	*Patersonia glabrata*	Leafy Purple-flag		1	10			1	5	1	2
Lamiaceae	*Clerodendrum floribundum* var. *floribundum*									1	1

Family	Scientific Name	Common Name	Exotic	Plot 7 Cover	Plot 7 Abundance	Plot 18 Cover	Plot 18 Abundance	Plot 21 Cover	Plot 21 Abundance	Plot 23 Cover	Plot 23 Abundance
Lauraceae	*Cryptocarya microneura*	Murrogun				1	5	1	4	1	10
Lauraceae	*Endiandra muelleri*	Green-leaved Rose Walnut		1	2					1	1
Lindsaeaceae	*Lindsaea microphylla*	Lacy Wedge Fern						1	1		
Lobeliaceae	*Pratia purpurascens*	Whiteroot				1	1000				
Lomandraceae	*Lomandra filiformis*	Wattle Matt-rush				1	100	1	10	1	20
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush				1	1	1	1	1	2
Lomandraceae	*Lomandra* sp.	Mat-rush		1	5						
Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling Lily		1	4	1	1			1	2
Meliaceae	*Synoum glandulosum* subsp. *glandulosum*	Scentless Rosewood		1	5			15	2	1	1
Menispermaceae	*Stephania japonica*	Snake vine		1	1	1	1			1	2
Monimiaceae	*Wilkiea huegeliana*	Veiny Wilkiea				1	4				
Myrsinaceae	*Embelia australiana*					1	1				
Myrsinaceae	*Myrsine variabilis*									1	50
Myrtaceae	*Acmena smithii*	Lilly Pilly		1	4	1	1	1	1		
Myrtaceae	*Angophora costata*	Sydney Red Gum		1	2			1	1	4	1
Myrtaceae	*Archirhodomyrtus beckleri*	Rose Myrtle		1	2					1	2
Myrtaceae	*Corymbia gummifera*	Red Bloodwood						5	5		
Myrtaceae	*Corymbia intermedia*	Pink Bloodwood		2	2	1	1				
Myrtaceae	*Eucalyptus acmenoides*	White Mahogany		1	1	2	1				
Myrtaceae	*Eucalyptus carnea*	Thick-leaved Mahogany				10	8				
Myrtaceae	*Eucalyptus microcorys*	Tallowwood		5	4	1	1	3	1	9	2
Myrtaceae	*Eucalyptus pilularis*	Blackbutt		25	5	30	4	3	1	20	5
Myrtaceae	*Eucalyptus propinqua*	Small-fruited Grey Gum								1	1
Myrtaceae	*Eucalyptus resinifera*	Red Mahogany								7	2

Family	Scientific Name	Common Name	Exotic	Plot 7 Cover	Plot 7 Abundance	Plot 18 Cover	Plot 18 Abundance	Plot 21 Cover	Plot 21 Abundance	Plot 23 Cover	Plot 23 Abundance
Myrtaceae	*Leptospermum petersonii*	Lemon-scented Teatree						1	6		
Myrtaceae	*Leptospermum polygalifolium*	Tantoon				1	1				
Myrtaceae	*Lophostemon confertus*	Brush Box		1	1					1	1
Myrtaceae	*Pilidiostigma glabrum*			1	1						
Myrtaceae	*Syncarpia glomulifera*	Turpentine		5	10	1	4			1	7
Oleaceae	*Notelaea longifolia*	Large Mock-olive								1	1
Orchidaceae		Unidentified orchid sp.				1	10				
Oxalidaceae	*Oxalis* sp.					1	1				
Phormiaceae	*Dianella* sp.			1	10	1	3	1	2	1	10
Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush		1	1	1	2			1	3
Phyllanthaceae	*Glochidion ferdinandi*	Cheese Tree				1	2				
Phyllanthaceae	*Phyllanthus gunnii*			1	1	1	1				
Poaceae	*Entolasia stricta*	Wiry Panic		1	10	1	10	1	50	1	1
Poaceae	*Imperata cylindrica*	Blady Grass								1	20
Poaceae	*Microlaena stipoides*	Weeping Grass				1	10				
Poaceae	*Oplismenus imbecillis*			1	10					1	2
Poaceae	*Poa labillardierei* var. *labillardierei*	Tussock								1	2
Proteaceae	*Persoonia stradbrokensis*							1	6		
Ranunculaceae	*Clematis* sp.					1	1			1	3
Rhamnaceae	*Alphitonia excelsa*	Red Ash				1	2				
Ripogonaceae	*Ripogonum fawcettianum*	Small Supplejack				1	1				
Rosaceae	*Rubus moluccanus*	Molucca Bramble				1	2				
Rubiaceae	*Cyclophyllum longipetalum*	Coast Canthium		1	6						
Rubiaceae	*Morinda jasminoides*	Sweet Morinda		1	2	1	10				
Rubiaceae	*Psychotria loniceroides*	Hairy Psychotria								1	30

Family	Scientific Name	Common Name	Exotic	Plot 7 Cover	Plot 7 Abundance	Plot 18 Cover	Plot 18 Abundance	Plot 21 Cover	Plot 21 Abundance	Plot 23 Cover	Plot 23 Abundance
Sapindaceae	*Guioa semiglauca*	Guioa								1	1
Smilacaceae	*Smilax australis*	Lawyer Vine		1	1	1	20	1	1	1	5
Smilacaceae	*Smilax glyciphylla*	Sweet Sarsparilla		1	1	1	2	1	1		
Thymelaeaceae	*Pimelea linifolia*	Slender Rice Flower								1	1
Violaceae	*Viola hederacea*	Ivy-leaved Violet		1	4	1	1000			1	10
Vitaceae	*Cissus antarctica*	Water Vine		1	2	1	1	1	2	1	1
Vitaceae	*Cissus hypoglauca*	Giant Water Vine		1	1	1	1			1	3
Winteraceae	*Tasmannia insipida*	Brush Pepperbush		1	1						
Xanthorrhoeaceae	*Xanthorrhoea* sp.			1	10	1	1	1	3		
Zamiaceae	*Macrozamia fawcettii*							1	1		
Zingiberaceae	*Alpinia caerulea*	Native Ginger				1	1				

Notes: Cover – visual estimate of foliage projective cover within the plot, recorded from 1–5% and then to the nearest 5%.

Abundance - relative number of individuals or shoots of a species within the plot. Based on the following intervals: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, 1000. Counts above 20 are estimates only

NH2U xxxxx offset area species recorded in NR115 (plots 17,22,20,25, 26,29)

Family	Scientific Name	Common Name	Exotic	Plot 17 Cover	Plot 17 Abundance	Plot 20 Cover	Plot 20 Abundance	Plot 22 Cover	Plot 22 Abundance	Plot 25 Cover	Plot 56 Abundance	Plot 26 Cover	Plot 26 Abundance	Plot 29 Cover	Plot 29 Abundance
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower				1	3					1	20	1	5
Adiantaceae	*Adiantum hispidulum*	Rough Maidenhair												1	10
Apocynaceae	*Melodinus australis*	Southern Melodinus												1	2
Apocynaceae	*Parsonsia rotata*	Veinless Silkpod				1	1								
Apocynaceae	*Parsonsia straminea*	Common Silkpod												2	1
Araliaceae	*Polyscias sambucifolia*	Elderberry Panax								1	1				
Blechnaceae	*Doodia caudata*	Small Rasp Fern												1	10
Casuarinaceae	*Allocasuarina littoralis*	Black She-Oak		2	4	2	19	1	1		7	2	20		
Convolvulaceae	*Polymeria calycina*					1	1								
Cunoniaceae	*Ceratopetalum gummiferum*	Christmas Bush				1	2	1	10						
Cyperaceae	*Carex* sp.													2	100
Cyperaceae	*Gahnia sieberiana*	Red-fruit Saw-sedge				1	1					1	2		
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge		1	10	1	100			1	100	1	20		
Dennstaedtiaceae	*Pteridium esculentum*	Bracken		1	2	1	2	1	6	1	100	1	5		
Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower				1	1								
Dilleniaceae	*Hibbertia scandens*	Climbing Guinea Flower						1	4			1	1		

Family	Scientific Name	Common Name	Exotic	Plot 17 Cover	Plot 17 Abundance	Plot 20 Cover	Plot 20 Abundance	Plot 22 Cover	Plot 22 Abundance	Plot 25 Cover	Plot 56 Abundance	Plot 26 Cover	Plot 26 Abundance	Plot 29 Cover	Plot 29 Abundance
Dilleniaceae	*Hibbertia vestita*			1	3	1	20	1	10	1	50	1	10		
Elaeocarpaceae	*Elaeocarpus reticulatus*	Blueberry Ash										1	2		
Ericaceae	*Epacris microphylla*	Coral Heath		1	7	1	20			1	1				
Ericaceae	*Leucopogon lanceolatus*			1	3										
Ericaceae	*Leucopogon lanceolatus* var. *gracilis*					1	15	1	6						
Ericaceae	*Leucopogon lanceolatus* var. *lanceolatus*									1	5	1	5		
Ericaceae	*Monotoca scoparia*			1	3	1	1			1	1				
Ericaceae	*Trochocarpa laurina*	Tree Heath						1	1						
Euphorbiaceae	*Mallotus philippensis*	Red Kamala												3	10
Fabaceae (Faboideae)	*Daviesia umbellulata*			2	50			1	20			1	10		
Fabaceae (Faboideae)	*Glycine clandestina*	Twining glycine						1	2						
Fabaceae (Faboideae)	*Gompholobium pinnatum*	Pinnate Wedge Pea				1	1			1	1				
Fabaceae (Faboideae)	*Gompholobium* sp.			1	40										
Fabaceae (Faboideae)	*Hardenbergia violacea*	False Sarsaparilla		1	1			1	2						
Fabaceae (Faboideae)	*Hovea heterophylla*					1	1								
Fabaceae (Faboideae)	*Jacksonia scoparia*	Dogwood		1	5										
Fabaceae (Faboideae)	*Kennedia rubicunda*	Dusky Coral Pea						1	20						
Fabaceae (Faboideae)	*Pultenaea petiolaris*					1	2								

Family	Scientific Name	Common Name	Exotic	Plot 17 Cover	Plot 17 Abundance	Plot 20 Cover	Plot 20 Abundance	Plot 22 Cover	Plot 22 Abundance	Plot 25 Cover	Plot 56 Abundance	Plot 26 Cover	Plot 26 Abundance	Plot 29 Cover	Plot 29 Abundance
Fabaceae (Faboideae)	*Pultenaea retusa*					1	5	1	10						
Fabaceae (Faboideae)	*Pultenaea villosa*	Hairy Bush-pea		1	10	1	2	1	50	1	2	1	3		
Fabaceae (Mimosoideae)	*Acacia binervata*	Two-veined Hickory		1	1			1	8			1	8		
Fabaceae (Mimosoideae)	*Acacia complanata*	Flat-stemmed Wattle									7				
Fabaceae (Mimosoideae)	*Acacia falciformis*	Broad-leaved Hickory		1	1										
Fabaceae (Mimosoideae)	*Acacia irrorata*	Green Wattle												1	2
Fabaceae (Mimosoideae)	*Acacia myrtifolia*	Red-stemmed Wattle								1	1				
Goodeniaceae	*Goodenia ovata*	Hop Goodenia								1	2	1	1		
Goodeniaceae	*Goodenia rotundifolia*			1	10			1	2			1	5		
Haloragaceae	*Gonocarpus* sp.	Raspwort				1	2			1	1				
Iridaceae	*Patersonia glabrata*	Leafy Purple-flag		1	100	1	100			1	10	1	10		
Iridaceae	*Patersonia sericea*	Silky Purple-Flag				1	20			1	5				
Lamiaceae	*Clerodendrum floribundum* var. *floribundum*													1	1
Lauraceae	*Cassytha filiformis*			1	1	1	1			1	1				
Lauraceae	*Cryptocarya microneura*	Murrogun												20	2

Family	Scientific Name	Common Name	Exotic	Plot 17 Cover	Plot 17 Abundance	Plot 20 Cover	Plot 20 Abundance	Plot 22 Cover	Plot 22 Abundance	Plot 25 Cover	Plot 56 Abundance	Plot 26 Cover	Plot 26 Abundance	Plot 29 Cover	Plot 29 Abundance
Lauraceae	*Cryptocarya obovata*	Pepperberry												1	1
Lauraceae	*Endiandra discolor*	Rose Walnut												1	2
Lauraceae	*Endiandra muelleri*	Green-leaved Rose Walnut												1	2
Lauraceae	*Neolitsea dealbata*	Hairy-leaved Bolly Gum												1	3
Lindsaeaceae	*Lindsaea linearis*	Screw Fern						1	10						
Lindsaeaceae	*Lindsaea microphylla*	Lacy Wedge Fern						1	1	1	1	1	5		
Lobeliaceae	*Pratia purpurascens*	Whiteroot										1	1		
Lomandraceae	*Lomandra filiformis*	Wattle Matt-rush		1	100	1	500	1	50	1	500	5	50		
Lomandraceae	*Lomandra hystrix*													1	20
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush		1	1										
Lomandraceae	*Lomandra multiflora* subsp. *multiflora*	Many-flowered Mat-rush		1	10	1	10			1	2				
Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling Lily										1	1		
Meliaceae	*Toona ciliata*	Red Cedar												10	1
Moraceae	*Ficus coronata*	Creek Sandpaper Fig												1	6
Moraceae	*Trophis scandens*	Burny Vine												1	3
Myrsinaceae	*Embelia australiana*													1	1
Myrtaceae	*Acmena smithii*	Lilly Pilly										1	2	1	2
Myrtaceae	*Angophora costata*	Sydney Red Gum		1	1										

Family	Scientific Name	Common Name	Exotic	Plot 17 Cover	Plot 17 Abundance	Plot 20 Cover	Plot 20 Abundance	Plot 22 Cover	Plot 22 Abundance	Plot 25 Cover	Plot 56 Abundance	Plot 26 Cover	Plot 26 Abundance	Plot 29 Cover	Plot 29 Abundance
Myrtaceae	*Angophora woodsiana*					5	18	1	1		3	15	5		
Myrtaceae	*Corymbia gummifera*	Red Bloodwood		10	4					8	6	1	1		
Myrtaceae	*Eucalyptus acmenoides*	White Mahogany										1	1		
Myrtaceae	*Eucalyptus microcorys*	Tallowwood										10	2		
Myrtaceae	*Eucalyptus notabilis*	Mountain Mahogany		3	4										
Myrtaceae	*Eucalyptus pilularis*	Blackbutt		3	1	15	3	1	1	7	3	3	1		
Myrtaceae	*Eucalyptus planchoniana*	Bastard Tallowwood		7	5										
Myrtaceae	*Eucalyptus resinifera*	Red Mahogany										5	2		
Myrtaceae	*Leptospermum petersonii*	Lemon-scented Teatree						1	2						
Myrtaceae	*Leptospermum polygalifolium*	Tantoon		1	20							1	5		
Myrtaceae	*Leptospermum whitei*					1	10								
Myrtaceae	*Syncarpia glomulifera*	Turpentine						1	2	1	8				
Myrtaceae	*Syzygium australe*	Brush Cherry												7	2
Myrtaceae	*Syzygium crebrinerve*	Rose Satinash												10	1
Myrtaceae	*Tristaniopsis laurina*	Kanooka												15	1
Oleaceae	*Notelaea ovata*											1	5		
Phormiaceae	*Dianella* sp.					1	10	1	20	1	1	1	10		
Phyllanthaceae	*Glochidion ferdinandi*	Cheese Tree										1	1	20	3
Phyllanthaceae	*Phyllanthus hirtellus*	Thyme Spurge				1	10	1	10	1	4				

Family	Scientific Name	Common Name	Exotic	Plot 17 Cover	Plot 17 Abundance	Plot 20 Cover	Plot 20 Abundance	Plot 22 Cover	Plot 22 Abundance	Plot 25 Cover	Plot 56 Abundance	Plot 26 Cover	Plot 26 Abundance	Plot 29 Cover	Plot 29 Abundance
Pittosporaceae	*Billardiera scandens*	Hairy Apple Berry										1	1		
Poaceae	*Aristida* sp.	A Wiregrass								1	1				
Poaceae	*Austrostipa pubescens*					1	5	1	20	1	100	1	10		
Poaceae	*Entolasia stricta*	Wiry Panic		1	100	1	100	1	20	1	50	25	200		
Poaceae	*Imperata cylindrica*	Blady Grass						1	10	3	100				
Poaceae	*Oplismenus imbecillis*											1	5		
Poaceae	*Ottochloa gracillima*													1	10
Poaceae	*Themeda australis*	Kangaroo Grass		20	1000	1	1	1	30	1	3	3	100		
Polypodiaceae	*Platycerium superbum*	Staghorn												1	1
Proteaceae	*Banksia serrata*	Old-man Banksia									6				
Proteaceae	*Banksia spinulosa*	Hairpin Banksia		1	3										
Proteaceae	*Hakea* sp.									1	3				
Proteaceae	*Lomatia silaifolia*	Crinkle Bush				1	1			1	8				
Proteaceae	*Persoonia stradbrokensis*			1	10	1	14	1	2		11	1	5		
Ranunculaceae	*Clematis* sp.													1	3
Rosaceae	*Rubus nebulosus*	Green-leaved Bramble												1	1
Rubiaceae	*Morinda jasminoides*	Sweet Morinda												1	10
Rubiaceae	*Pomax umbellata*	Pomax		1	10	1	2								
Rutaceae	*Zieria minutiflora* subsp. *minutiflora*											1	3		

Family	Scientific Name	Common Name	Exotic	Plot 17 Cover	Plot 17 Abundance	Plot 20 Cover	Plot 20 Abundance	Plot 22 Cover	Plot 22 Abundance	Plot 25 Cover	Plot 56 Abundance	Plot 26 Cover	Plot 26 Abundance	Plot 29 Cover	Plot 29 Abundance
Sapindaceae	*Dodonaea triquetra*	Large-leaf Hop-bush										1	4		
Sapindaceae	*Sarcopteryx stipata*	Steelwood												1	6
Sapotaceae	*Planchonella australis*	Black Apple												20	5
Schizaeaceae	*Schizaea bifida*	Forked Comb Fern								1	1				
Smilacaceae	*Smilax australis*	Lawyer Vine										1	5	1	3
Smilacaceae	*Smilax glyciphylla*	Sweet Sarsparilla										1	1		
Thelypteridaceae	*Christella dentata*	Binung												1	4
Thymelaeaceae	*Pimelea linifolia*	Slender Rice Flower				1	1	1	20						
Ulmaceae	*Aphananthe philippinensis*	Rough-leaved Elm												2	1
Violaceae	*Hybanthus* sp.					1	1								
Vitaceae	*Cissus antarctica*	Water Vine												5	2
Vitaceae	*Cissus hypoglauca*	Giant Water Vine										1	1		
Winteraceae	*Tasmannia insipida*	Brush Pepperbush												1	2
Xanthorrhoeaceae	*Xanthorrhoea* sp.			1	10	1	30	1	15	1	2	2	15		

Notes: Cover – visual estimate of foliage projective cover within the plot, recorded from 1–5% and then to the nearest 5%.

Abundance - relative number of individuals or shoots of a species within the plot. Based on the following intervals: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, 1000. Counts above 20 are estimates only

NH2U xxxxx offset area species recorded in NR159 (plots 1,4,2,3)

Family	Scientific Name	Common Name	Exotic	Plot 1 Cover	Plot 1 Abundance	Plot 2 Cover	Plot 2 Abundance	Plot 3 Cover	Plot 3 Abundance	Plot 4 Cover	Plot 4 Abundance
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower		1	20	1	5			1	1
Adiantaceae	*Adiantum formosum*	Giant Maidenhair								1	20
Amaranthaceae	*Alternanthera denticulata*	Lesser Joyweed						1	100		
Anacardiaceae	*Euroschinus falcatus* var. *falcatus*	Ribbonwood		3	1	3	2				
Apiaceae	*Centella asiatica*	Indian Pennywort						1	10		
Apocynaceae	*Parsonsia straminea*	Common Silkpod		1	1					1	1
Apocynaceae	*Tabernaemontana pandacaqui*	Banana Bush		1	2	1	3			1	2
Araceae	*Gymnostachys anceps*	Settler's Twine		1	3					1	6
Arecaceae	*Archontophoenix cunninghamiana*	Bangalow Palm		1	35	1	10	1	1	1	7
Blechnaceae	*Blechnum cartilagineum*	Gristle Fern		1	20	3	200			1	50
Blechnaceae	*Doodia aspera*	Prickly Rasp Fern		1	10					1	100
Commelinaceae	*Aneilema acuminatum*									1	2
Convolvulaceae	*Dichondra repens*	Kidney Weed				2	200				
Cyperaceae	*Carex appressa*	Tall Sedge						1	20	1	50
Cyperaceae	*Cyperus sanguinolentus*							1	50		
Cyperaceae	*Eleocharis sphacelata*	Tall Spike Rush						7	1000		
Cyperaceae	*Fimbristylis dichotoma*	Common Fringe-sedge						1	10		
Cyperaceae	*Gahnia aspera*	Rough Saw-sedge		1	5	1	1				
Cyperaceae	*Schoenoplectus mucronatus*							1	30		
Dennstaedtiaceae	*Hypolepis muelleri*	Harsh Ground Fern		1	10	1	50	40	500		
Dennstaedtiaceae	*Pteridium esculentum*	Bracken				2	200	1	10		
Dilleniaceae	*Hibbertia dentata*	Twining Guinea Flower								1	1
Dilleniaceae	*Hibbertia scandens*	Climbing Guinea Flower				1	2	1	1	1	2

Family	Scientific Name	Common Name	Exotic	Plot 1 Cover	Plot 1 Abundance	Plot 2 Cover	Plot 2 Abundance	Plot 3 Cover	Plot 3 Abundance	Plot 4 Cover	Plot 4 Abundance
Dioscoreaceae	*Dioscorea transversa*	Native Yam		1	4					1	1
Ebenaceae	*Diospyros fasciculosa*	Grey Ebony		1	1						
Ericaceae	*Trochocarpa laurina*	Tree Heath		1	2						
Euphorbiaceae	*Claoxylon australe*	Brittlewood		1	2						
Eupomatiaceae	*Eupomatia bennettii*	Small Bolwarra								1	1
Eupomatiaceae	*Eupomatia laurina*	Bolwarra		1	20					2	7
Fabaceae (Mimosoideae)	*Acacia fimbriata*	Fringed Wattle				1	5				
Fabaceae (Mimosoideae)	*Acacia irrorata*	Green Wattle				5	2	10	6		
Flacourtiaceae	*Scolopia braunii*	Flintwood								1	3
Flagellariaceae	*Flagellaria indica*	Whip Vine		1	1						
Juncaceae	*Juncus mollis*							1	20		
Lamiaceae	*Clerodendrum floribundum* var. *floribundum*			1	1					1	1
Lamiaceae	*Gmelina leichhardtii*	White Beech				1	6	1	1		
Lauraceae	*Cryptocarya glaucescens*	Jackwood		1	4					1	1
Lauraceae	*Cryptocarya microneura*	Murrogun		1	500	1	100			1	200
Lauraceae	*Cryptocarya rigida*	Forest Maple		2	20	1	1			1	3
Lauraceae	*Endiandra discolor*	Rose Walnut				1	1				
Lauraceae	*Endiandra muelleri*	Green-leaved Rose Walnut		15	2					1	2
Lauraceae	*Endiandra sieberi*	Hard Corkwood		1	2						
Lauraceae	*Neolitsea dealbata*	Hairy-leaved Bolly Gum		5	17	1	20			1	5
Lobeliaceae	*Lobelia trigonocaulis*	Forest Lobelia				1	4				
Lomandraceae	*Lomandra hystrix*			1	5			1	1	1	6
Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling Lily				1	1				
Meliaceae	*Synoum glandulosum* subsp. *glandulosum*	Scentless Rosewood		1	1	1	10	1	1	1	4

Family	Scientific Name	Common Name	Exotic	Plot 1 Cover	Plot 1 Abundance	Plot 2 Cover	Plot 2 Abundance	Plot 3 Cover	Plot 3 Abundance	Plot 4 Cover	Plot 4 Abundance
Meliaceae	*Toona ciliata*	Red Cedar				10	1				
Menispermaceae	*Stephania japonica*	Snake vine				1	2				
Monimiaceae	*Wilkiea huegeliana*	Veiny Wilkiea				1	2			1	1
Moraceae	*Ficus coronata*	Creek Sandpaper Fig		1	8	1	20	1	1	1	2
Moraceae	*Maclura cochinchinensis*	Cockspur Thorn				1	6			1	3
Moraceae	*Trophis scandens*	Burny Vine								1	2
Myrsinaceae	*Embelia australiana*					1	1			1	1
Myrsinaceae	*Myrsine variabilis*					1	1				
Myrtaceae	*Acmena smithii*	Lilly Pilly		1	2						
Myrtaceae	*Backhousia myrtifolia*	Grey Myrtle						1	1	20	3
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush								5	2
Myrtaceae	*Corymbia intermedia*	Pink Bloodwood								7	1
Myrtaceae	*Eucalyptus microcorys*	Tallowwood		30	3			2	1	10	2
Myrtaceae	*Leptospermum petersonii*	Lemon-scented Teatree		1	1						
Myrtaceae	*Lophostemon confertus*	Brush Box								10	2
Myrtaceae	*Rhodomyrtus psidioides*	Native Guava				1	3				
Myrtaceae	*Syncarpia glomulifera*	Turpentine								10	4
Myrtaceae	*Syzygium australe*	Brush Cherry		1	1						
Myrtaceae	*Tristaniopsis laurina*	Kanooka		10	4					7	4
Oleaceae	*Notelaea longifolia*	Large Mock-olive								1	1
Orchidaceae	*Calanthe triplicata*	Christmas Orchid								1	1
Orchidaceae	*Pterostylis* sp.	Greenhood								1	100
Philydraceae	*Philydrum lanuginosum*	Frogsmouth						1	50		
Phormiaceae	*Dianella revoluta*	Blueberry Lily		1	5					1	2
Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush		1	2	1	5	1	1		
Phyllanthaceae	*Glochidion ferdinandi*	Cheese Tree				20	9	7	5		

Family	Scientific Name	Common Name	Exotic	Plot 1 Cover	Plot 1 Abundance	Plot 2 Cover	Plot 2 Abundance	Plot 3 Cover	Plot 3 Abundance	Plot 4 Cover	Plot 4 Abundance
Poaceae	*Imperata cylindrica*	Blady Grass				5	1000				
Poaceae	*Microlaena stipoides*	Weeping Grass				1	10				
Poaceae	*Oplismenus aemulus*							1	10		
Poaceae	*Oplismenus imbecillis*			1	100	1	200			1	100
Poaceae	*Ottochloa gracillima*			2	200	3	1000	1	10	1	2
Poaceae	*Panicum bisulcatum*	Black-seeded Panic						1	1		
Poaceae	*Sacciolepis indica*	Indian Cupscale Grass				1	4				
Polygonaceae	*Persicaria hydropiper*	Water Pepper						1	50		
Polygonaceae	*Persicaria strigosa*							1	100		
Proteaceae	*Triunia youngiana*	Native Honeysuckle		1	2						
Ranunculaceae	*Clematis glycinoides*	Headache Vine				1	1				
Rhamnaceae	*Alphitonia excelsa*	Red Ash								1	1
Ripogonaceae	*Ripogonum fawcettianum*	Small Supplejack								1	2
Rosaceae	*Rubus moluccanus*	Molucca Bramble								1	1
Rosaceae	*Rubus nebulosus*	Green-leaved Bramble						1	2		
Rosaceae	*Rubus parvifolius*	Native Raspberry				1	1				
Rubiaceae	*Morinda jasminoides*	Sweet Morinda		1	20	1	5			1	4
Rubiaceae	*Psychotria loniceroides*	Hairy Psychotria		1	2					1	6
Rutaceae	*Acronychia oblongifolia*	White Aspen		1	3	1	1			1	1
Rutaceae	*Flindersia australis*	Crow's Ash		1	1						
Sapindaceae	*Alectryon subcinereus*	Wild Quince		1	1					1	1
Sapindaceae	*Guioa semiglauca*	Guioa		1	3	2	200			1	5
Sapindaceae	*Jagera pseudorhus* var. *pseudorhus*	Foambark Tree		1	9						
Sapindaceae	*Mischocarpus pyriformis*	Yellow Pear-fruit		1	1						

Family	Scientific Name	Common Name	Exotic	Plot 1 Cover	Plot 1 Abundance	Plot 2 Cover	Plot 2 Abundance	Plot 3 Cover	Plot 3 Abundance	Plot 4 Cover	Plot 4 Abundance
Smilacaceae	*Smilax australis*	Lawyer Vine				1	6	1	1		
Sparganiaceae	*Sparganium subglobosum*	Floating Bur-reed						1	100		
Thelypteridaceae	*Christella dentata*	Binung				1	2				
Thymelaeaceae	*Pimelea* sp.					1	1				
Ulmaceae	*Trema tomentosa* var. *aspera*	Native Peach						1	1		
Uvulariaceae	*Tripladenia cunninghamii*									1	2
Vitaceae	*Cayratia clematidea*	Native Grape				1	1				
Vitaceae	*Cissus antarctica*	Water Vine		1	2	1	2	1	1	1	1
Vitaceae	*Cissus hypoglauca*	Giant Water Vine		1	2	3	1				

Notes: Cover – visual estimate of foliage projective cover within the plot, recorded from 1–5% and then to the nearest 5%.

Abundance - relative number of individuals or shoots of a species within the plot. Based on the following intervals: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, 1000. Counts above 20 are estimates only

xxxxx offset site fauna species list

Scientific Name	Common Name	Exotic	NSW Status	EPBC Status	Observation Type
Amphibia					
Mixophyes iteratus	Giant Barred Frog		E	E	OW
Adelotus brevis	Tusked Frog				W
Litoria dentata	Bleating Tree Frog				W
Litoria fallax	Eastern Dwarf Tree Frog				W
Litoria peronii	Peron's Tree Frog				W
Litoria tyleri	Tyler's Tree Frog				W
Mixophyes fasciolatus	Great Barred Frog				OW
Pseudophryne coriacea	Red-backed Toadlet				W
Uperoleia fusca	Dusky Toadlet				W
Aves					
Acanthiza lineata	Striated Thornbill				OW
Acanthiza pusilla	Brown Thornbill				W
Acanthorhynchus tenuirostris	Eastern Spinebill				W
Aegotheles cristatus	Australian Owlet-nightjar				W
Alectura lathami	Australian Brush-turkey				C
Alisterus scapularis	Australian King-parrot				W
Cacomantis variolosus	Brush Cuckoo				W
Calyptorhynchus funereus	Yellow-tailed Black-cockatoo				W
Centropus phasianinus	Pheasant Coucal				W
Ceyx azureus	Azure Kingfisher				O
Chalcites lucidus	Shining Bronze-Cuckoo				W
Chalcophaps indica	Emerald Dove				O
Colluricincla harmonica	Grey Shrike-thrush				W
Coracina novaehollandiae	Black-faced Cuckoo-shrike				O
Coracina papuensis	White-bellied Cuckoo-shrike				W
Coracina tenuirostris	Cicadabird				W
Corvus orru	Torresian Crow				W
Cracticus nigrogularis	Pied Butcherbird				O
Cracticus tibicen	Australian Magpie				W
Cracticus torquatus	Grey Butcherbird				O
Dacelo novaeguineae	Laughing Kookaburra				O
Dicaeum hirundinaceum	Mistletoebird				W
Eopsaltria australis	Eastern Yellow Robin				W
Eudynamys orientalis	Eastern Koel				W
Eurostopodus mystacalis	White-throated Nightjar				W
Eurystomus orientalis	Dollarbird				O
Geopelia humeralis	Bar-shouldered Dove				W

Scientific Name	Common Name	Exotic	NSW Status	EPBC Status	Observation Type
Geopelia striata	Peaceful Dove			0	W
Gerygone mouki	Brown Gerygone				W
Lalage leucomela	Varied Triller				O
Leucosarcia picata	Wonga Pigeon				W
Lichenostomus chrysops	Yellow-faced Honeyeater				W
Macropygia amboinensis	Brown Cuckoo-dove				O
Malurus lamberti	Variegated Fairy-wren				O
Malurus melanocephalus	Red-backed Fairy-wren				W
Meliphaga lewinii	Lewin's Honeyeater				W
Monarcha melanopsis	Black-faced Monarch				O
Myiagra rubecula	Leaden Flycatcher				W
Myzomela sanguinolenta	Scarlet Honeyeater				O
Ninox novaeseelandiae	Southern Boobook				W
Oriolus sagittatus	Olive-backed Oriole				W
Orthonyx temminckii	Logrunner				O
Pachycephala pectoralis	Golden Whistler				W
Pachycephala rufiventris	Rufous Whistler				O
Pardalotus striatus	Striated Pardalote				W
Philemon corniculatus	Noisy Friarbird				W
Podargus strigoides	Tawny Frogmouth				O
Psophodes olivaceus	Eastern Whipbird				W
Ptilinopus magnificus	Wompoo Fruit-dove		V		O
Rhipidura albiscapa	Grey Fantail				W
Rhipidura rufifrons	Rufous Fantail				O
Scythrops novaehollandiae	Channel-billed Cuckoo				W
Sericornis frontalis	White-browed Scrubwren				W
Sphecotheres vieilloti	Australasian Figbird				O
Symposiachrus trivirgatus	Spectacled Monarch				O
Todiramphus macleayii	Forest Kingfisher				O
Tregellasia capito	Pale-yellow Robin				O
Trichoglossus haematodus	Rainbow Lorikeet				W
Vanellus miles	Masked Lapwing				W
Zoothera lunulata	Bassian Thrush				C
Zosterops lateralis	Silvereye				W
(blank)	Antechinus sp.				C
Mammalia					
Macropus giganteus	Eastern Grey Kangaroo				O
Macropus rufogriseus	Red-necked Wallaby				O
Perameles nasuta	Long-nosed Bandicoot				OW
Petaurus breviceps	Sugar Glider				OW

Scientific Name	Common Name	Exotic	NSW Status	EPBC Status	Observation Type
Pteropus poliocephalus	Grey-headed Flying-fox		V	V	O
Rattus fuscipes	Bush Rat				C
Trichosurus vulpecula	Common Brushtail Possum				OC
	Antechinus sp.				
Bellatorias major	Land Mullet				W
Varanus varius	Lace Monitor				OC

Key: E – endangered species; M – migratory, V – vulnerable species; B – burrow; F – tracks, H – skin, K – dead, O – observed, P – scat, W – heard, Q – camera trap image.

NH2U xxxxx offset area photo monitoring points

Photo point C		
Easting	xxxxxx	
Northing	xxxxxxx	
Bearing	180	
Monitoring round / date of photo	Baseline / 11.10.2016	
Vegetation type	Foothills Grey Gum - Ironbark - Mahogany Dry Forest	
NSW Veg Type ID	NR263	
Survey effort	Plot / transect 8	
Conservation significance	Native vegetation. Not listed as a TEC. Habitat for Spotted-tailed Quoll, Koala and Grey-headed Flying-fox. High abundance and cover of Koala food tree species.	
Condition	Moderate/good. Native vegetation with an intact overstorey cover at benchmark values in addition to native shrub and groundcover other. Native grass cover was recorded higher than benchmark in contrast to native midstorey cover that was below benchmark condition. Fallen logs were recorded well below benchmark values. Species richness was below benchmark values	
Extent of weed infestation	Localised Lantana (*Lantana camara*) and Camphor Laurel (*Cinnamomum camphora*) infestation. 9% exotic plant cover along the transect sampled	
Evidence of other management issues (eg erosion, dieback, pest fauna)	None observed. Healthy, near-intact native vegetation.	
Observed changes since last monitoring round	N/a – baseline monitoring round.	

Photo point H		
Easting	xxxxxx	
Northing	xxxxxxx	
Bearing	170	
Monitoring round / date of photo	Baseline / 12.10.2016	
Vegetation type	Flooded Gum - Brush Box moist forest	
NSW Veg Type ID	NR159	
Survey effort	Plot/ transect 14	
Conservation significance	Native vegetation. Not listed as a TEC. Habitat for Spotted-tailed Quoll, Koala and Grey-headed Flying-fox. Relatively high abundance and cover of Koala primary food tree species but low cover of Grey-headed Flying-fox diet plants.	
Condition	Moderate/good-high. Native vegetation with near-intact over storey marginally lower than benchmark values. Native midstorey, shrub, grass and forb cover attributes were recorded at benchmark values for this plant community type. Native Species richness was at benchmark. Only one canopy species was observed regenerating. There were no hollow-bearing trees recorded along the plot/transect sampled, however woody debris was higher than benchmark values.	
Extent of weed infestation	Localised Lantana infestation. 13% cover along the transect sampled.	
Evidence of other management issues (eg erosion, dieback, pest fauna)	None observed. Healthy, near-intact native vegetation.	
Observed changes since last monitoring round	N/a – baseline monitoring round.	

Photo point J		
Easting	xxxxxx	
Northing	xxxxxxx	
Bearing	270	
Monitoring round / date of photo	Baseline / 12.10.2016	
Vegetation type	Blackbutt - bloodwood dry heathy open forest	
NSW Veg Type ID	NR115	
Survey effort	Plot/ transect 20	
Conservation significance	Native vegetation. Not listed as a TEC. Habitat for Spotted-tailed Quoll, Koala and Grey-headed Flying-fox. Moderate abundance and cover of Koala food tree species but relatively high cover of Grey-headed Flying-fox diet plants.	
Condition	Moderate/good. Native vegetation with near-intact over storey and mid storey at benchmark values. Groundcover attributes such as shrub, grass and forb cover were also within benchmark values for this plant community type. Native Species richness was at benchmark. Five canopy species were observed regenerating. There were no hollow-bearing trees and woody debris was recorded below benchmark values.	
Extent of weed infestation	Small infestation of Camphor Laurel. 0% cover along the transect sampled.	
Evidence of other management issues (eg erosion, dieback, pest fauna)	None observed. Healthy, near-intact native vegetation.	
Observed changes since last monitoring round	N/a – baseline monitoring round.	

Photo point L		
Easting	xxxxxx	
Northing	xxxxxxx	
Bearing	180	
Monitoring round / date of photo	Baseline / 10.10.2016	
Vegetation type	Blackbutt - Turpentine - Tallowwood shrubby open forest	
NSW Veg Type ID	NR122	
Survey effort	Plot/ transect 23	
Conservation significance	Native vegetation. Not listed as a TEC. Habitat for Spotted-tailed Quoll, Koala and Grey-headed Flying-fox. High abundance and cover of Koala food tree species and Grey-headed Flying-fox diet plants.	
Condition	Moderate/good. Native vegetation with near-intact over storey and mid storey at benchmark values. Groundcover attributes such as shrub, grass and forb cover were also within benchmark condition for this plant community type. Native Species richness was slightly below benchmark. All five canopy species recorded in this vegetation type were observed regenerating. There were no hollow-bearing trees and woody debris was recorded below benchmark values.	
Extent of weed infestation	Small infestation of Lantana. 3% cover along the transect sampled.	
Evidence of other management issues (eg erosion, dieback, pest fauna)	None observed. Healthy, near-intact native vegetation.	
Observed changes since last monitoring round	N/a – baseline monitoring round.	

Photo point E		
Easting	xxxxxx	
Northing	xxxxxxx	
Bearing	180	
Monitoring round / date of photo	Baseline / 11.10.2016	
Vegetation type	Foothills Grey Gum - Ironbark - Mahogany Dry Forest	
NSW Veg Type ID	NR263	
Survey effort	Plot / transect 5	
Conservation significance	Native vegetation. Not listed as a TEC. Habitat for Spotted-tailed Quoll, Koala and Grey-headed Flying-fox. Abundant Koala food trees.	
Condition	Moderate/good. Native vegetation with an overstorey cover at benchmark values. Native midstorey and native shrub cover was also recorded at benchmark condition. Cover attributes below benchmark values include species richness and native groundcover other. Native grass cover was above benchmark condition. Exotic plant cover was low and two hollow-bearing trees were recorded. Fallen logs were lower than benchmark condition.	
Extent of weed infestation	Localised, low Lantana infestation. 6.5% cover along the transect sampled	
Evidence of other management issues (eg erosion, dieback, pest fauna)	None observed. Healthy, near-intact native vegetation.	
Observed changes since last monitoring round	N/a – baseline monitoring round.	

Photo point I		
Easting	xxxxxx	
Northing	xxxxxxx	
Bearing	270	
Monitoring round / date of photo	Baseline / 12.10.2016	
Vegetation type	Blackbutt – Tallowwood moist ferny open forest	
NSW Veg Type ID	NR120	
Survey effort	Plot / transect 18	
Conservation significance	Native vegetation. Not listed as a TEC. Habitat for Spotted-tailed Quoll, Koala and Grey-headed Flying-fox. Abundant Koala food trees and Grey-headed Flying-fox key diet plants.	
Condition	Moderate/good. Native vegetation with an overstorey cover at benchmark values. Native midstorey and groundcover grasses and other was also recorded at benchmark condition. Cover attributes below benchmark values include native shrub cover. Native species richness was above benchmark condition. Exotic plant cover was low and one hollow-bearing tree was recorded. Fallen logs were lower than benchmark condition.	
Extent of weed infestation	Localised, low Lantana infestation. 3% cover along the transect sampled	
Evidence of other management issues (eg erosion, dieback, pest fauna)	None observed. Healthy, near-intact native vegetation.	
Observed changes since last monitoring round	N/a – baseline monitoring round.	

Appendix E – Norton biobank site BioBanking Assessment and Management Actions Plan

Roads and Maritime Services

Norton Biobank

BioBanking Assessment

August 2016

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1. Introduction

1.1 Overview

GHD Pty Ltd (GHD) has been engaged by Roads and Maritime Services (Roads and Maritime) to provide a BioBanking Assessment of the proposed 'Norton biobank' to support an application for a BioBanking agreement over the site (see Figure 1). The purpose of the assessment is to determine the biodiversity credit value of the ecosystems and habitats at the Norton biobank using the *BioBanking Assessment Methodology 2014* (BBAM) (OEH 2014a). The BioBanking Credit Report is included as Appendix A.

The BioBanking assessment has been prepared with reference to biodiversity offset strategies and biodiversity management plans that will apply to the site and that have been prepared to meet Roads and Maritime's requirements for biodiversity offsets under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) for the Pacific Highway upgrade program. The BioBanking agreement will provide a secure conservation covenant over the Norton biobank in accordance with the *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (DSEWPaC 2012) (the EPBC Act offset policy).

This report provides an overview of the Biodiversity Banking and Offsets Scheme (BioBanking), the existing environment of the biobank site, the application of the BBAM, the results of the site assessment, the calculation of biodiversity credits and proposed management actions for the site.

1.2 BioBanking

BioBanking was established by the New South Wales (NSW) Department of Environment, Climate Change and Water (DECCW) (now the Office of Environment and Heritage (OEH)) as a method to address the loss of biodiversity and threatened species. The scheme attempts to create a market framework for the conservation of biodiversity values and the offsetting of development impacts. The scheme is currently voluntary.

BioBanking is established under Part 7A of the *NSW Threatened Species Conservation Act 1995* (TSC Act), which was enabled by the *Threatened Species Conservation Amendment (Biodiversity Banking) Bill 2006*. The *Threatened Species Conservation (Biodiversity Banking) Regulation 2008* provides additional rules for specific aspects of the scheme that are important for its operation.

To generate credits at a biobank site a landholder must commit to enhancing and protecting biodiversity values over time. A BioBanking agreement is entered into and registered on the title of the land, binding both the current and future landholders to maintaining biodiversity through the completion of a range of management actions on the site. Each biobank site may generate a number of different ecosystem credits and any of these credits may be sold separately or as a group.

The BBAM sets out how biodiversity values will be assessed, establishes rules for calculating the number and class of credits, and determines the trading rules that will apply. The methodology includes a software package known as the BioBanking Credit Calculator (the credit calculator) which processes site survey and assessment data. The credit calculator specifies the type and extent of surveys required for a BioBanking assessment and then processes survey data to calculate the number and type of biodiversity credits that are either required at a development site or will be generated at a biobank site.

The BioBanking Trust Fund ensures that landowners have the money needed to carry out the management actions required each year and provides a financial incentive to landowners to carry out those actions. The scheme is administered by OEH and ensures accountability and compliance through legislation, regular reporting requirements and financial measures.

1.3 Scope of assessment

The scope of this BioBanking assessment report is to:

- Outline the methods used in the BioBanking assessment.
- Describe the existing environment of the proposed Norton biobank, including the results of site surveys.
- Present the data used to perform the BioBanking assessment and credit calculations for the site.
- Calculate the number and type of biodiversity credits that will be generated when a BioBanking agreement is obtained for the site using Version 4.1 of the credit calculator.
- Provide an overview of the management actions and monitoring program that would be required in perpetuity under a BioBanking agreement, such that a net improvement in biodiversity over time is achieved.

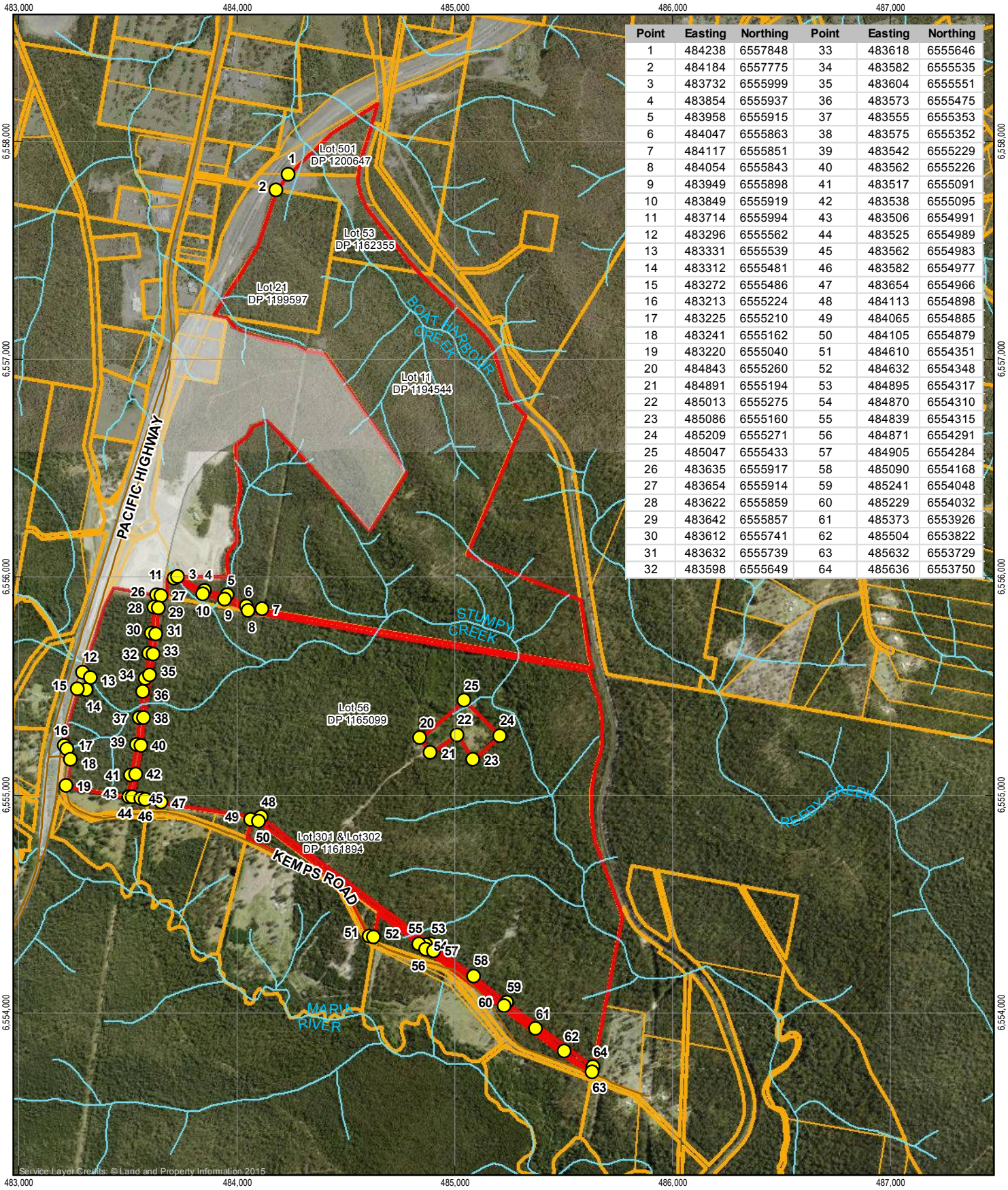
The BioBanking assessment and credit calculations were performed by Ben Harrington (Accredited BioBanking Assessor number 0073) based on site surveys, GIS analysis and draft credit calculations performed by GHD ecologists supported by a specialist botanist, Greg Elks.

This report should be read in conjunction with the Management Actions Plan (MAP) for the Norton biobank (GHD 2016).

1.4 Glossary of terms

Biobank site	Land that is designated by a BioBanking agreement to be a biobank site.
Biobanking agreement	An agreement entered into between the landowner and the Minister under Part 7A of the TSC Act for establishing a biobank site.
BioBanking Assessment Methodology (the methodology; BBAM)	The rules of the BioBanking Scheme established under the TSC Act that determine credits created, credits required and the circumstances that improve or maintain biodiversity values.
BioBanking Scheme (BioBanking; the scheme)	The biodiversity banking and offsets scheme established under Part 7A of the TSC Act.
Biobanking statement	Specifies the number and class of credits to be retired for a particular development. A BioBanking statement can only be issued in circumstances that improve or maintain biodiversity values.
Biobanking Trust Fund	The Trust Fund established under Part 7A of the TSC Act to hold funds from the sale of credits.

Biodiversity credit	Registered biodiversity credits are created for management actions that have been carried out or are proposed to be carried out, in accordance with the BioBanking agreement.
Biodiversity offset	Actions that are put in place to counterbalance (offset) an impact on biodiversity values.
Biodiversity values	The composition, structure and function of ecosystems including threatened species, populations and ecological communities, and their habitats.
Development site	Land that is designated by a BioBanking statement to be a development site.
Ecosystem credit	A credit that relates to a vegetation type and the threatened species that are reliably predicted by that vegetation type (as a habitat surrogate).
Norton biobank (the biobank)	The land that is the subject of this BioBanking assessment, as described in Section 3.1.1 of this report and as shown on Figure 1.
Management action	Means an action or proposed action in respect of which a biodiversity credit may be created.
Species credit	A credit that relates to an individual threatened species whose occurrence at a given site cannot be reliably predicted based on habitat surrogates. Threatened species that require species credits are identified in the Threatened Species Profile Database.



Point	Easting	Northing	Point	Easting	Northing
1	484238	6557848	33	483618	6555646
2	484184	6557775	34	483582	6555535
3	483732	6555999	35	483604	6555551
4	483854	6555937	36	483573	6555475
5	483958	6555915	37	483555	6555353
6	484047	6555863	38	483575	6555352
7	484117	6555851	39	483542	6555229
8	484054	6555843	40	483562	6555226
9	483949	6555898	41	483517	6555091
10	483849	6555919	42	483538	6555095
11	483714	6555994	43	483506	6554991
12	483296	6555562	44	483525	6554989
13	483331	6555539	45	483562	6554983
14	483312	6555481	46	483582	6554977
15	483272	6555486	47	483654	6554966
16	483213	6555224	48	484113	6554898
17	483225	6555210	49	484065	6554885
18	483241	6555162	50	484105	6554879
19	483220	6555040	51	484610	6554351
20	484843	6555260	52	484632	6554348
21	484891	6555194	53	484895	6554317
22	485013	6555275	54	484870	6554310
23	485086	6555160	55	484839	6554315
24	485209	6555271	56	484871	6554291
25	485047	6555433	57	484905	6554284
26	483635	6555917	58	485090	6554168
27	483654	6555914	59	485241	6554048
28	483622	6555859	60	485229	6554032
29	483642	6555857	61	485373	6553926
30	483612	6555741	62	485504	6553822
31	483632	6555739	63	485632	6553729
32	483598	6555649	64	485636	6553750

LEGEND

- Norton biobank site
- Cadastre
- Watercourses
- Recent or proposed development
- Boundary points

0 200 400 800
Metres

Geographic Coordinate System
Horizontal Datum: Geocentric Datum of Australia 1994

N

Roads and Maritime Services
Norton Biobank Site
BioBanking Assessment

Job Number 21-24927
Revision A
Date 20 Jul 2016

Biobank site boundary

Figure 1

G:\21\24927\GIS\Maps\Deliverables\Norton Biobank\21_24927_Z001_Site_Location.mxd
Level 15, 133 Castlereagh Street Sydney NSW 2000 T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com.au W www.ghd.com.au

Data Source: NSW Department of Lands: Cadastre - Jan 2011; LPMA Data 2013; Lewis and James (2010) Kempsey to Eungai: Compensatory Habitat package' Created by:mking3

2. Methods

2.1 Approach

GHD have prepared this BioBanking assessment based on field surveys and assessments completed by GHD ecologists supported by a specialist botanist, Greg Elks.

Biodiversity credits were calculated at the biobank site according to the methodology presented in the:

- *BioBanking Assessment Methodology 2014* (OEH 2014a)
- *Credit Calculator for Major Projects and BioBanking Operational Manual* (OEH 2016a).

The credit calculator is the software version of the methodology. Data is entered into the credit calculator based on information collected in the desktop assessment, site surveys and from using GIS mapping software. Data were entered in credit calculator version 4.0.

The methodology establishes two classes of biodiversity credits that may be created:

- Ecosystem credits – these are created or required for all impacts on biodiversity values, including threatened species that can be reliably predicted by habitat surrogates
- Species credits – these are created or required for impacts on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Threatened species that require species credits are identified by the credit calculator.

This BioBanking assessment has been prepared to support an application for a BioBanking agreement for the Norton biobank as follows:

- Geographic information system (GIS) assessment to map the biobank site and calculate the landscape value
- Field survey of the biobank site, including use of the BioBanking plot/transect methodology to calculate the site value
- Credit calculations using the credit calculator 4.0 to determine the ecosystems credits that will be generated when a BioBanking agreement is obtained for the site and it is formally set aside and managed for conservation.

The credit calculator produces a number of reports, including the threatened species predicted to occur, survey effort required at the site and the biodiversity credit profile which are appended to this BioBanking assessment.

The purpose of this BioBanking assessment is to assess the number of credits that may be created by conserving the vegetation on site in perpetuity under a BioBanking agreement.

2.2 Desktop assessment

2.2.1 Literature and database review

The following resources were reviewed to describe the existing environment of the biobank site and to obtain the necessary data to perform BioBanking credit calculations:

- *NSW (Mitchell) Landscapes Version 3 (2008)* (DECC 2008a).
- *Descriptions for NSW (Mitchell) Landscapes* (DECC 2008b).
- *Vegetation Types Database* (OEH 2014b).
- *NSW Vegetation Information System: Classifcation* (OEH 2016b).
- *Pacific Highway Upgrade, Nambucca Heads to Urunga Norton and Griffin Offset Management Plan* (GHD in prep).
- *Kempsey to Eungai: Compensatory Habitat package* (Lewis and James 2010)
- Aerial photographs and satellite imagery of the site.

2.2.2 Geographical Information System (GIS) analysis

GIS analysis is an integral part of the BBAM. GIS was used to plot the biobank site on a high resolution aerial photo base and to map vegetation types and biodiversity values across the site. GIS analysis was used to calculate the extent of native vegetation to be managed within the biobank site, which was entered into the credit calculator.

GIS analysis was used to accurately determine the Catchment Management Authority (CMA), CMA sub-region, Interim Biogeographic Regionalisation of Australia (IBRA) region and sub-region and Mitchell Landscape of the site.

Additional GIS analysis was used to plot the assessment circles surrounding the site in which landscape scores are calculated. Native vegetation cover, extent and connectivity were assessed vegetation zone mapping at the site and using aerial photography interpretation outside the site. Air photo interpretation was also used to identify and record distinct vegetation patches, determine the broad condition state of vegetation types and the location and extent of vegetated habitat corridors.

2.3 Site survey

2.3.1 Survey effort

This BioBanking assessment builds upon the results of field surveys conducted to inform the biodiversity offset strategy for the Pacific Highway upgrade program. The Norton offset site was surveyed by a specialist zoologist and a specialist botanist as documented in Lewis and James (2010). The flora survey of the Norton offset site and an adjoining 100 hectare site was undertaken over five days in May 2010 with a total survey effort of around 50 person-hours (Lewis and James 2010). Additional targeted field surveys were undertaken by GHD and Omvi ecologists within the Norton offset site in September 2014 to assess habitat suitability and the status of local populations of threatened fauna species. The purpose of these supplementary surveys was to more accurately map the extent and quality of habitat for threatened fauna species to inform EPBC Act offset calculations and the development of management actions (GHD in prep.).

Supplementary surveys were conducted in 2016 to collect the specific data required to complete the BioBanking assessment for the site. Staged field surveys of the biobank site were conducted by GHD ecologists and Greg Elks in accordance with the BBAM 2014. Survey effort

that has contributed to this BioBanking assessment is summarised in Table 1 and described below.

Table 1 Survey effort

Stage	Date	Survey Technique
Preliminary biodiversity offset assessment survey (Lewis and James 2010)	May 2010	Broad vegetation mapping, compilation of a flora species list, habitat assessment, opportunistic fauna observations.
Fauna offset assessment survey (GHD in prep.)	September 2014	Habitat assessments, partial BioBanking plot/transects (excluding species richness), food tree canopy plots, Koala 'Spot Assessment Technique' (SAT) searches, walked spotlighting surveys, call playback, nocturnal streamside searches, camera trapping.
Preliminary BioBanking survey	5th – 7th April 2016	Vegetation zone mapping, nine BioBanking plot/transects. Opportunistic fauna observations.
BioBanking survey	11th – 14th April 2016	Vegetation zone mapping, thirty BioBanking plot/transects.

2.3.2 BioBanking assessment

The initial vegetation mapping (Lewis and James 2010) was matched to NSW plant community types (PCTs) and ground-truthed in the field via systematic walked and driven transects across the entire site. Necessary adjustments were made by hand on aerial photographs of the site. The site was divided into vegetation zones for assessment with each zone comprising a distinct PCT and broad condition class. Vegetation types were split into 'Moderate/good' and 'Low' condition classes according to the BBAM, with Moderate/good vegetation featuring native overstorey cover or predominantly native groundcover (OEH 2014a). Vegetation zones at the site are shown on Figure 2.

Plot and transect surveys were conducted on site in accordance with the BBAM to obtain data for the calculation of ecosystem credits. The site value was determined by assessing 10 site condition attributes against benchmark values. Benchmarks are quantitative measures of the range of variability in condition in vegetation with relatively little evidence of alteration, disturbance or modification by humans since European settlement (OEH 2014a).

Plot/transects were distributed between vegetation zones according to the minimum number of plots required by the BBAM. Plot/transects are shown on Figure 2. Plant species were identified according to the nomenclature of the Royal Botanic Gardens and Domain Trust (RBGT) (2016). Cover, abundance, growth form and vegetation stratum data were collected for each species within the 20 metre x 20 metre species richness plot portion of each plot/transect.

Opportunistic and incidental observations of fauna species were recorded at all times during field surveys. Casual fauna observations were made in suitable areas of habitat throughout the course of the flora survey and while incidentally traversing the site. This included visual inspection of nests, creek lines, overhangs and woody debris, active searches for reptiles and frogs and opportunistic observation of scats, tracks, burrows or other traces. The locations of any threatened species identified within the site were captured with a handheld GPS.

2.4 BioBanking assessment

The BioBanking credit calculations were completed by Ben Harrington using the BBAM 2014 and credit calculator Version 4.0. Field survey results, BBAM assessments, GIS calculations and this assessment report have been peer reviewed by an accredited assessor (see Table 2).

The credit calculations have been submitted to OEH and the biodiversity credit report is included as Appendix A.

2.5 Staff qualifications

This report was prepared by Ben Harrington based on field surveys conducted by GHD and Idyll Spaces ecologists. The assessment was peer reviewed by Jayne Tipping and Dan Williams. Staff qualifications are presented in Table 2.

Table 2 Staff qualifications

Name	Position / Project Role	Qualifications	Years' experience
Ben Harrington	Senior Ecologist / desktop assessment, site surveys, credit calculations and reporting	BSc, MSc (Physical Geography) BioBanking Assessor Accreditation[1]	13+
Jayne Tipping	Principal Ecologist / Peer review	BSc, MEnv. Law	23+
Daniel Williams	Principal Environmental Scientist / Peer review, credit calculations, management actions, consultation and planning	B. App. Sc. BioBanking Assessor Accreditation[1]	13+
Jess Sharp	Graduate ecologist / site surveys, reporting	BEnvs	2+
Greg Elks (Idyll Spaces)	Senior Botanist / site surveys	BSc, MLitt	10+

1 Refer to OEH (2016c) list of accredited assessors.

3. Existing environment

3.1 Site context

3.1.1 Location and land uses

The proposed biobank is located at the 'Norton site', which comprise part Lot 501 DP 1200647, Lot 53 DP 1162355, Lot 301 DP 1161894, Lot 302 DP 1161894, Lot 56 DP1165099, Lot 11 DP1194544 and Lot 21 1199597 adjacent to the Pacific Highway, at South Kempsey, NSW as shown on Figure 1. A portion of Lot 56 DP1165099 is excluded from the biobank site, as this area will be maintained as a house site and home paddocks. Lot 56 DP1165099 is currently the subject of an application to the Land and Property Management Authority (LPMA) to update the cadastral boundary to accommodate the Kundabung to Kempsey section of the Pacific Highway upgrade in the southwestern corner of the Lot. The portion of Lot 56 DP1165099 that will be removed for the Pacific Highway upgrade has been excluded from the biobank site.

The site is located in the Kempsey Shire Council Local Government Area (LGA) and is zoned RU2 Rural Landscape in the *Kempsey Local Environment Plan 2012.*

The Norton site is a parcel of privately owned land that was purchased by Roads and Maritime for the purpose of securing biodiversity offsets for various stages of the Pacific Highway upgrade project. The site boundary and associated cadastre have recently been modified to accommodate the Pacific Highway upgrade and a proposed quarry expansion. A service centre has recently been constructed adjacent to the western boundary of the site. This recent and proposed development is shown on Figure 1 and has been treated as cleared land in the BioBanking landscape assessment (see Section 4.2).

The Norton site is around 495.9 hectares in area and contains remnant and regenerating forest on gently undulating terrain. The Norton site is currently unoccupied. Previous land uses include timber harvesting, low intensity grazing and stockpiling of timber, rubbish and fill. There is a limited network of dirt access tracks across the site and some internal fences, generally in poor condition. An electricity easement runs north-south through the southwestern portion of the site and another runs along the southern boundary. Essential Energy have confirmed that the voltage in these electricity easements through the Norton biobank is 11kV (three phase). The width of the easement that is maintained for this voltage is 20 metres. These 20 metre wide easements have been excluded from the biobank site (see Figure 1).

There is an unbuilt Crown Road (i.e. a 'paper road') through the centre of the site which Roads and Maritime are in the process of extinguishing.

Adjacent land uses include:

- The Pacific Highway, including the recently upgraded Kempsey Bypass section to the northwest and Kundabung to Kempsey section to the southwest.
- Farawell's Quarry, including a proposed expansion, a service centre and cleared land proposed for warehousing and light industrial land to the west.
- The north coast railway and sparsely cleared bush blocks and hobby farms to the north and northeast.
- The north coast railway and then the Maria National Park and vegetated private and Crown land to the east.
- Partially cleared grazing land, hobby farms and bush blocks to the southeast and south and beyond that the Maria River State Forest.

3.1.2 Landscape context

The site is in the 'NSW North Coast' Interim Biogeographic Regionalisation for Australia (IBRA), region and the 'Macleay Hastings' IBRA subregion (DSEWPac 2011).

The Norton site is around 495.9 hectares in area and contains wet and dry sclerophyll forest on gently undulating, near-coastal hills. The southern portion of the site comprises a gentle slope, on fine grained sedimentary substrate and recent alluvium that drains northwards to Stumpy Creek. On the north side of Stumpy Creek there is a relatively steep, rocky ridge on fine grained volcanic substrate that rises to a height of 100 m elevation just to the west of the site. The northern portion of the offset site comprises moderate to steep slopes that drain northwards to Boat Harbour creek. There appears to be a transitional area of metamorphic geology between the sedimentary and volcanic portions of the site. This variable geology, combined with the site's disturbance history, is probably contributing to the complex and variable vegetation on site (see Section 3.3 below).

Stumpy Creek is a near-permanent, channel confined, third order stream that runs generally from west to east through the site (Figure 2). It follows a circuitous route through the southern portion of the site and along with its tributaries dominates the geomorphology of this area. Stumpy Creek is generally in good condition with intact riparian and in stream vegetation, intact channel and bank structure, continuous flow, very little weed infestation and no evidence of poor water quality.

Boat Harbour creek is a permanent, channel confined, third order stream that runs generally from southeast to northwest through the site (Figure 2). It is fed by multiple intermittent tributaries in narrow gullies running off the ridge through the centre of the site. Boat Harbour Creek is generally in moderate condition with partially cleared and regenerating riparian vegetation, healthy in stream vegetation, intact channel and bank structure, continuous flow, moderate weed infestation and some evidence of high turbidity.

The southern portion of the Norton site falls within a mapped regional fauna habitat corridor (Scotts et. al, 2003) that runs east-west connecting State forests to the west and south of the site with Maria National Park to the east.

The Norton site is part of a near continuous patch of native vegetation and habitat of many thousands of hectares. The recent and proposed development and the Pacific Highway to the west and north coast railway to the east comprise barriers to fauna movement and other ecological processes. Kalateenee State Forest lies to the west of the Pacific Highway and beyond that there is an extensive network of native vegetation in national parks and State forests that stretches to the Great Dividing Range. The Norton site is partially connected to this extensive area of habitat via the riparian corridors of Boat Harbour and Stumpy Creek and associated culverts and underpasses. There are partial barriers to the south and southeast associated with partly cleared and/or fenced private land. The Maria River State Forest lies to the south of this land and is continuous with the Maria National Park and other native vegetation that stretches to the coast. East of the railway there is native vegetation in the Maria National Park and on private and Crown land that is part of the vegetated corridor to the coast.

The majority of the biobank site is mapped within the 'Brooms Head - Kempsey Coastal Ramp' Mitchell landscape (DECC, 2008a) as shown on Figure 3. This landscape comprises hills and low ranges of the coastal fall on lower Devonian greywacke, slate phyllite and quartzite and Permian Phyllite and schistose sandstone. The general elevation is 50 to 450m with local relief of up to 300m. Soils are thin, stony gradational loams and sandy loams on the slopes grading to yellow brown texture-contrast soils on lower slopes and in valleys. Vegetation comprises dry sclerophyll forest of Blackbutt (*Eucalyptus pilularis*), Sydney Blue Gum (*Eucalyptus saligna*) and Large-fruited Blackbutt (*Eucalyptus pyrocarpa*) (DECC, 2008b). Mid and upper slopes in the biobank site, comprising the majority of the area, are a good match for this Mitchell landscape.

There is a small area of the 'Macleay Coastal Alluvial Plain' Mitchell landscape in the southeast of the site (DECC, 2008a) associated with the riparian corridor of Stumpy Creek (Figure 3). This landscape comprises wide valleys, channels, floodplains, swamps, and terraces of the Manning and Macleay Rivers and other coastal streams on Quaternary alluvium. The general elevation is 0 to 50m, with local relief up to 15m. Soils are dark organic loams and silty clay on the floodplain, gradational brown loams and yellow-brown texture-contrast soil on terraces and organic silty mud in swamps (DECC, 2008b).

The majority of the site is consistent with the 'Brooms Head - Kempsey Coastal Ramp' and so this Mitchell landscape was entered in the BioBanking credit calculations (see Section 4.3).

3.2 Vegetation and habitat resources

3.2.1 Overview

Vegetation was classified according to vegetation structure, species composition, soil type and landscape position. NSW vegetation types were identified with reference to the descriptions and overview of diagnostic species presented in the NSW vegetation types database (OEH 2014b).

Vegetation zones, reflecting vegetation types and condition were identified according to the BBAM. These are shown on Figure 2, and are summarised in Table 3 and described below. There are a number of small, informal, dirt tracks and fence lines that have been included in surrounding vegetation zones because they do not comprise a gap in over storey vegetation and contain partial cover of native understorey vegetation.

Table 3 Vegetation zones within the Norton biobank

Veg Zone ID	NSW Vegetation Type	NSW Veg. ID	Condition	Area in Norton offset site (ha)
1	Blackbutt – Turpentine – Tallowwood shrubby open forest	NR122	Moderate/good	33.4
2	Red Mahogany open forest	NR222	Moderate/good	30.2
3	Forest Red Gum - Swamp Box	NR161	Moderate/good	3.8
4	Spotted Gum – Grey Ironbark open forest	NR247	Moderate/good	19.5
5	Spotted Gum - Grey Ironbark - Pink Bloodwood open forest	NR246	Low	4.0
6	Flooded Gum – Tallowwood – Brush Box moist open forest	NR160	Moderate/good	7.4
7	Blackbutt – Tallowwood dry grassy open forest	NR119	Moderate/good	44.5
8	Blackbutt - Pink Bloodwood shrubby open forest	NR117	Moderate/good	53.4
9	Spotted Gum - Grey Ironbark - Pink Bloodwood open forest	NR246	Moderate/good	135.4
10	Scribbly Gum – Red Bloodwood heathy open forest	NR228	Moderate/good	164.3
			Total	**495.9**

3.2.2 Vegetation zones

The structure, species composition and condition of the vegetation zones within the biobank are described below. Species lists are provided in Appendix B. Plot/transect data is also provided in Appendix B along with benchmark values for each vegetation type.

1 - Blackbutt – Turpentine – Tallowwood shrubby open forest (NR122, Moderate/good)	
Plant community type (OEH, 2015c)	Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central North Coast
NSW Vegetation Type ID	NR122
Survey effort	Plot/transects 18, 25, 31, 36
Condition (DECC, 2008)	Moderate/good. Remnant or regrowth native vegetation with near-intact over storey that was at or slightly below benchmark values in all but one of the plot/transects sampled. Native mid storey cover was at benchmark values in all of the four plot/transects. Shrub, grass and forb cover attributes and woody debris (i.e. length of fallen logs) were at or above benchmark values for this plant community type in the majority of plot/transects sampled, while overall species richness was slightly below benchmark values. The majority of canopy species were observed regenerating. There were no hollow-bearing trees and no exotic plant ground cover or mid storey noted along 20m x 50m Biobanking plot/transects. Occasional exotic plants were noted within the broader vegetation zone. This vegetation zone has high intrinsic value and moderate potential for achieving gains in biodiversity values through management within a biobank site. Improvements in biodiversity values could be obtained through continuing development of vegetation structure and habitat resources, removal of exotic plants, cessation of timber collection and management of pest fauna.
Conservation significance	Native vegetation. Not listed as a TEC.
Landscape position	Lower slopes and alluvial flats
Structure	Tall forest with a dense mid storey and a dense understorey of shrubs, herbs, ferns and grasses.
Over storey	Continuous, around 20 to 30 metres tall and around 11 - 38.5 per cent cover in the plot/transects sampled. Features a mixed canopy dominated by Blackbutt (*Eucalyptus pilularis)*, Tallowwood (*E. microcorys*) and Pink Bloodwood (*Corymbia intermedia*) with regeneration of all species except Blackbutt observed.
Mid storey	Mid-storey with a range of 14.5 – 55.5 per cent cover was recorded in the plot/transects sampled. Characteristic midstorey species include Turpentine (*Syncarpia glomulifera*), *Sannantha angusta*, Snake vine (*Stephania japonica*), Brush Box (*Lophostemon confertus*), White Sally (*Acacia floribunda*) and Tantoon (*Leptospermum polygalifolium*).
Groundcover	Moderately dense, species rich and structurally variable. Grass cover was well above the benchmark value while both shrubs and 'other' cover was at benchmark value for all plots/transects sampled. There are occasional patches of leaf litter and bare earth.
– grasses	A range of 24 – 68 per cent cover was estimated in the plot/transects sampled. Characteristic species include Wiry Panic (*Entolasia stricta*), Bordered Panic (*Entolasia marginata*) and *Oplismenus imbecillis*.

1 - Blackbutt – Turpentine – Tallowwood shrubby open forest (NR122, Moderate/good)	
– shrubs	A range of 10 – 28 per cent cover was estimated in the plot/transects sampled. Characteristic shrub species include *Sannantha angusta*, Coffee Bush (*Breynia oblongifolia*) and *Persoonia stradbrokensis*.
– 'other' (herbs, ferns and sedges)	A range of 20 – 70 per cent cover was estimated in the plot/transects sampled. Characteristic species include Rainbow Fern (*Calochlaena dubia*), Climbing Guinea Flower (*Hibbertia scandens*), Tall Sedge (*Carex appressa*), Spiny-headed Mat-rush (*Lomandra longifolia*), *Carex maculata*, Harsh Ground Fern (*Hypolepis muelleri*) and Pastel Flower (*Pseuderanthemum variabile*).
Exotic species	Camphor Laurel (*Cinnamomum camphora*) and Lantana (*Lantana camara*) were occasionally present in this vegetation zone, comprising isolated individual plants at very low frequency and cover. There was a thin band of environmental weeds such as Broad-leaved Paspalum (*Paspalum mandiocaunum)* and Pigeon Grass (*Setaria sphacelata)* along disturbed edges adjoining trails, easements and fence lines.
Vegetation zone 1 at Plot/transect 18	

2 - Red Mahogany open forest (NR222 , Moderate/good)	
Plant community type (OEH, 2015c)	Red Mahogany open forest of the coastal lowlands of the North Coast
NSW Vegetation Type ID	NR222
Survey effort	Plot/transects 41, 42, 1, 47
Condition (DECC, 2008)	Moderate/good. Remnant or regrowth native vegetation with near-intact over storey that was at or slightly below benchmark values. Native mid storey cover was at the benchmark values in all but one plot/transects. Native grass cover was significantly higher then the benchmark value while shrub cover, species richness and woody debris were lower. Other ground cover attributes and woody debris were well within the benchmark values for this plant community type in all but one of plot/transects sampled. The dominant canopy species of *Eucalyptus resinifera* was observed regenerating, in addition to a number of main associated over-storey species. There were few hollow-bearing trees recorded, including only one in the four plots sampled. No exotic species were recorded in the ground layer or mid-storey of any of the plots. This vegetation zone has high intrinsic value and moderate potential for achieving gains in biodiversity values through management within a biobank site. Improvements in biodiversity values could be obtained through continuing development of vegetation structure and habitat resources, removal of exotic plants, cessation of timber collection and management of pest fauna.
Conservation significance	Native vegetation. Not listed as a TEC.
Landscape position	Mid-lower slopes.
Structure	Tall open forest with high grass and sedge ground cover and in some instances, in the east of the mapped vegetation area, a distinct 'heathy' mid-storey is coming through. The western portion of the vegetation was more typical of the plant community type.
Over storey	Continuous, around 20 to 30 metres tall with a range of 11-19.5 per cent cover in the plot/transects sampled. Features a mixed canopy of Red Mahogany (*Eucalyptus resinifera),* Diehard Stringybark (*Eucalyptus cameronii*), Thick-leaved Mahogany (*Eucalyptus carnea*) and Red Bloodwood (*Corymbia gummifera*) with regenerating species found in two of the four plot/transects.
Mid storey	Mid-storey with a range of 9 – 20 per cent cover was estimated in the plot/transects sampled. Characteristic midstorey species include Black She-Oak (*Allocasuarina littoralis*), *Pultenaea myrtoides*, *Melaleuca nodosa*, Forest Oak (*Allocasuarina torulosa*) and Willow Bottlebrush (*Callistemon salignus*).
Groundcover	Moderately dense, species rich and structurally variable. High cover of grasses and 'other' with low cover of shrubs in the plot transects sampled. There are occasional patches of leaf litter and bare earth.

2 - Red Mahogany open forest (NR222 , Moderate/good)	
– grasses	A range of 24 – 84 per cent cover was estimated in the plot/transects sampled. Characteristic species include A Wiregrass (*Aristida* sp.), Wiry Panic (*Entolasia stricta*), Kangaroo Grass (*Themeda australis*), Threeawn Speargrass (*Aristida vagans*), A Lovegrass (*Eragrostis* sp.*)* and Blady Grass (*Imperata cylindrica*).
– shrubs	A range of 0 – 6 per cent cover was estimated in the plot/transects sampled. Characteristic shrub species included Rough Guinea Flower (*Hibbertia aspera*).
– 'other' (herbs, ferns and sedges)	A range of 4 – 64 per cent cover was estimated in the plot/transects sampled. Characteristic 'other' species include Poverty Raspwort (*Gonocarpus tetragynus*), *Velleia spathulata*, *Ptilothrix deusta*, *Xanthorrhoea* sp. and Spiny-headed Mat-rush (*Lomandra longifolia*).
Exotic species	No exotic plants were present throughout this vegetation zone, with 0 per cent cover in the four plot/transects sampled.
Open forest with a dense mid storey at Plot/transect 47	

3 - Forest Red Gum - Swamp Box (NR161, Moderate/good)	
Plant community type (OEH, 2015c)	Forest Red Gum - Swamp Box of the Clarence Valley lowlands of the North Coast
NSW Vegetation Type ID	NR161
Survey effort	Plot/transects 48, 49
Condition (DECC, 2008)	Moderate/good. Remnant or regrowth native vegetation with near-intact over storey that was slightly below benchmark values. Native mid storey cover was at the benchmark values in all plot/transects. Native grass cover was at the benchmark value while 'other' cover attributes (moss, ferns and sedges) and species richness were above. Native shrub cover and woody debris was found to be below the benchmark data in one plot, and above in the second for this plant community type in the plot/transects sampled. High leaf litter quantities were noted throughout the vegetation zone. The dominant canopy species *Eucalyptus tereticornis* was observed regenerating. There were no hollow-bearing trees found. While no exotic species were recorded along the 20m x 50m Biobanking plot/transects, occasional exotic shrubs and grasses were noted. This vegetation zone has high intrinsic value and moderate potential for achieving gains in biodiversity values through management within a biobank site. Improvements in biodiversity values could be obtained through continuing development of vegetation structure and habitat resources, removal of exotic plants, cessation of timber collection and management of pest fauna.
Conservation significance	Comprises a local occurrence of 'Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion' (Subtropical Coastal Floodplain Forest), which is listed as an endangered ecological community under the TSC Act.
Landscape position	Alluvial flats.
Structure	Tall open forest with moderate mid-storey and dense ground cover of grasses mosses, ferns, sedges and herbs.
Over storey	Continuous, around 15 to 25 metres tall with a range of 6-9 per cent cover in the plot/transects sampled. Features a canopy dominated by Forest Red Gum (*Eucalyptus tereticornis*), which was observed regenerating in one of the two plot/transects.
Mid storey	Mid-storey with a range of 18.5 – 20.5 per cent cover was estimated in the plot/transects sampled. Characteristic midstorey species include *Sannantha angusta*, Willow Bottlebrush (*Callistemon salignus*), Flax-leaved Paperbark (*Melaleuca linariifolia*), Tantoon (*Leptospermum polygalifolium*) and Black She-Oak (*Allocasuarina littoralis*).
Groundcover	Moderately dense, species rich and structurally variable. High cover of grass and 'other' groundcover attributes while shrub cover varied over the two plots/transects sampled. There are occasional patches of leaf litter and bare earth.

3 - Forest Red Gum - Swamp Box (NR161, Moderate/good)	
– grasses	A range of 50 – 54 per cent cover was estimated in the plot/transects sampled. Characteristic species include Wiry Panic (*Entolasia stricta*), *Ottochloa gracillima*, Bordered Panic (*Entolasia marginata*), *Ischaemum australe*, Weeping Grass (*Microlaena stipoides*) and *Oplismenus imbecillis*.
– shrubs	A range of 6 – 16 per cent cover was estimated in the plot/transects sampled. Characteristic shrub species included Coffee Bush (*Breynia oblongifolia*).
– 'other' (herbs, ferns and sedges)	A range of 28 – 54 per cent cover was estimated in the plot/transects sampled. Characteristic 'other' species include Sphagnum moss (*Sphagnum* sp.), Indian Pennywort (*Centella asiatica*), Kidney Weed (*Dichondra repens*), *Hydrocotyle sibthorpioides*, *Carex maculata*, *Vernonia cinerea* and Spiny-headed Mat-rush (*Lomandra longifolia*).
Exotic species	A variety of exotic plants are present throughout this vegetation zone, all at very low frequency and cover. There was no exotic cover in the plot/transects sampled. However, occasional individual Lantana (*Lantana camara*) and Camphor Laurel (*Cinnamomum camphora*) plants were observed in addition to mild infestations of Whisky Grass (*Andropogen virginicus*) and Giant Paspalum (*Paspalum urvillei*) throughout the vegetation zone.
Forest with a dense understorey of ferns and grasses at Plot/transect 49	

4 - Spotted Gum – Grey Ironbark open forest (NR247, Moderate/good)	
Plant community type (OEH, 2015c)	Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the North Coast
NSW Vegetation Type ID	NR247
Survey effort	Plot/transects 21, 38, 39
Condition (DECC, 2008)	Moderate/good. Remnant or regrowth native vegetation with near-intact over storey that was at benchmark values. Native mid storey cover and woody debris were at the benchmark values in all but one plot/transects. Native grass and 'other' cover were at the benchmark value. Shrub cover ranged from above, below and nil for the three plot/transects. The species richness of the plot/transects sampled found two of the three below benchmark value. High leaf litter quantities were noted throughout the vegetation zone. All of the over-storey species present in this vegetation zone were observed regenerating. Only two hollow-bearing trees were found in one of the plot/transects sampled. No exotic species were recorded in the ground layer or mid-storey in any plot/transects. Occasional exotic plants were observed throughout the vegetation zone. This vegetation zone has high intrinsic value and moderate potential for achieving gains in biodiversity values through management within a biobank site. Improvements in biodiversity values could be obtained through continuing development of vegetation structure and habitat resources, removal of exotic plants, cessation of timber collection and management of pest fauna.
Conservation significance	Native vegetation. Not listed as a TEC.
Landscape position	Mid and upper slopes
Structure	Tall forest with a moderate mid storey and a dense understorey of herbs, ferns and grasses.
Over storey	Continuous, around 20 to 25 metres tall and around 15-27.2 per cent cover in the plot/transects sampled. Features a mixed canopy of Spotted Gum (*Corymbia variegata*), Grey Ironbark (*Eucalyptus siderophloia*), Tallowwood (*Eucalyptus microcorys*), Thick-leaved Mahogany *(Eucalyptus carnea*), Pink Bloodwood (*Corymbia intermedia*) and Small-fruited Grey Gum *(Eucalyptus propinqua*). Regeneration of all these species was observed.
Mid storey	Mid-storey with a range of 4.5 – 29 per cent cover was estimated in the plot/transects sampled. Characteristic midstorey species include *Sannantha pluriflora*, Curracabah (*Acacia concurrens*), Black She-Oak (*Allocasuarina littoralis*), Brush Box (*Lophostemon confertus*) and Cheese Tree (*Glochidion ferdinandi*).
Groundcover	Moderately dense, species rich and structurally variable. There was a high cover of grass groundcover to moderate 'other' cover compared to minimal shrub cover in the plot transects sampled. There were occasional patches of leaf litter and bare earth.

4 - Spotted Gum – Grey Ironbark open forest (NR247, Moderate/good)	
– grasses	A range of 24 – 88 per cent cover was estimated in the plot/transects sampled. Characteristic species include Wiry Panic (*Entolasia stricta*), Bordered Panic (*Entolasia marginata*), Blady Grass (*Imperata cylindrica*), Small-flowered Finger Grass (*Digitaria parviflora*), Open Summer-grass (*Digitaria diffusa*) and Threeawn Speargrass (*Aristida vagans*).
– shrubs	A range of 0 – 8 per cent cover was estimated in the plot/transects sampled. Characteristic shrub species include *Sannantha angusta* and Coffee Bush (*Breynia oblongifolia*).
– 'other' (herbs, ferns and sedges)	A range of 18 – 70 per cent cover was estimated in the plot/transects sampled. Characteristic 'other' species include Spiny-headed Mat-rush (*Lomandra longifolia*), *Vernonia cinerea*, Wattle Matt-rush (*Lomandra filiformis*), Small-leaf Glycine (*Glycine microphylla*), Pastel Flower (*Pseuderanthemum variabile*) and Variable Sword-sedge (*Lepidosperma laterale*).
Exotic species	A variety of exotic plants were present throughout this vegetation zone, all at very low frequency and cover. There was no exotic cover noted in any of the 20 x 50m BioBanking plot/transects sampled. However, occasional individual Lantana (*Lantana camara*) plants and mild infestations of Whisky Grass (*Andropogen virginicus*) were observed throughout the vegetation zone.
Forest with moderate grassy understorey	

5 - Spotted Gum - Grey Ironbark - Pink Bloodwood open forest (NR246, Low)	
Plant community type (OEH, 2015c)	Spotted Gum - Grey Ironbark - Pink Bloodwood open forest of the Clarence Valley lowlands of the North Coast
NSW Vegetation Type ID	NR246
Survey effort	Plot/transects 27, 28
Condition (DECC, 2008)	Low Cleared land with minimal vegetation, primarily exotics, and no remnant over storey. Native mid storey cover was very low, with one plot/transect at the lower end of the benchmark value and one below. For all groundcover attributes, grass, shrubs and 'other' cover was minimal. Each attribute had one plot/transect at benchmark value and the other below while both species richness and woody debris were below benchmark. No remnant canopy species were present. Regeneration of one of the over storey species present in patches of Moderate/good condition Spotted Gum - Grey Ironbark - Pink Bloodwood open forest was observed. There were no hollow-bearing trees recorded due to a distinct lack of mature trees. Numerous exotic species were severe throughout the entire vegetation zone in both the ground cover and mid-storey levels. This vegetation zone has moderate intrinsic value and good potential for achieving gains in biodiversity values through management within a biobank site. Improvements in biodiversity values could be obtained through supplementary planting and development of vegetation structure and habitat resources, removal of exotic plants, cessation of timber collection and management of pest fauna.
Conservation significance	Low condition vegetation dominated by exotic plants.
Landscape position	Lower slopes and mounds of fill.
Structure	Cleared land with primarily exotic ground cover and mid storey cover.
Over storey	Not present. No over storey recorded in either of the two plot/transects sampled.
Mid storey	Sparse mid-storey with a range of 3 – 11 per cent cover was estimated in the plot/transects sampled. Characteristic midstorey species include *Sannantha angusta*, Curracabah (*Acacia concurrens*), *Acacia falcata*, Wattle (*Acacia* sp.), Two-veined Hickory (*Acacia binervata*), and *Persoonia stradbrokensis*.
Groundcover	Moderately dense, exotic dominated groundcover with a grass, 'other' and shrub attributes all near the lower range of benchmark value across all plot transects sampled. There are occasional patches of leaf litter and bare earth.

5 - Spotted Gum - Grey Ironbark - Pink Bloodwood open forest (NR246, Low)	
– grasses	A range of 8 – 30 per cent cover was estimated in the plot/transects sampled. Characteristic species include Common Couch (*Cynodon dactylon*) Indian Cupscale Grass (*Sacciolepis indica*) and Ditch Millet (*Paspalum orbiculare*).
– shrubs	2 per cent cover was estimated in the plot/transects sampled. Characteristic shrub species include Groundsel Bush (*Baccharis halimifolia*), *Pultenaea retusa* and Gorse Bitter Pea (*Daviesia ulicifolia*).
– 'other' (herbs, ferns and sedges)	A range of 4 – 20 per cent cover was estimated in the plot/transects sampled. Characteristic 'other' species include *Gonocarpus chinensis* subsp. *Verrucosus*, *Cyperus polystachyos*, *Mitrasacme alsinoides*, *Velleia spathulata*, Common Fringe-sedge (*Fimbristylis dichotoma*) and Fluke Bogrush (*Schoenus apogon*).
Exotic species	A variety of exotic plants were present throughout this vegetation zone, at very high frequency and cover. There was 68 – 86 per cent cover in the two plot/transects sampled. Moderate infestations of Lantana (*Lantana camara*) and Fireweed (*Senecio madagascariensis*) with severe cover of pasture grasses throughout entire vegetation zone.
Cleared land with dense exotic ground cover and mid-storey at Plot/transect 27	

6 - Flooded Gum – Tallowwood – Brush Box moist open forest (NR160, Moderate/good)	
Plant community type (OEH, 2015c)	Flooded Gum - Tallowwood - Brush Box moist open forest of the coastal ranges of the North Coast
NSW Vegetation Type ID	NR160
Survey effort	Plot/transects 30, 32, 33
Condition (DECC, 2008)	Moderate/good. Remnant or regrowth native vegetation with near-intact over storey that was at or slightly below benchmark values. Dense native mid storey cover was at benchmark standard in all plot/transects. All groundcover attributes, grass, 'other' and shrubs as well as woody debris were at or slightly higher than the benchmark value for this plant community type in all of plot/transects sampled. Species richness in plot/transects were all found to be lower than the benchmark value. No regeneration of overstorey species was recorded and there were no hollow-bearing trees in the three plots sampled. A low density of exotic groundcover was noted in one plot/transect. This vegetation zone has high intrinsic value and moderate potential for achieving gains in biodiversity values through management within a biobank site. Improvements in biodiversity values could be obtained through continuing development of vegetation structure and habitat resources, removal of exotic plants, cessation of timber collection and management of pest fauna.
Conservation significance	Native vegetation. Not listed as a TEC.
Landscape position	Alluvial flats
Structure	Tall forest with a dense mid storey and a dense understorey of shrubs, herbs, ferns and grasses.
Over storey	Continuous, around 25 to 35 metres tall and around 18.5 - 34 per cent cover in the plot/transects sampled. Features a mixed canopy of Flooded Gum (*Eucalyptus grandis*), Tallowwood (*Eucalyptus microcorys*) and Diehard Stringybark *(Eucalyptus cameronii*). No regeneration of these canopy species was noted.
Mid storey	Mid-storey with a range of 20 – 32 per cent cover was estimated in the plot/transects sampled. Characteristic midstorey species include Tantoon (*Leptospermum polygalifolium*), *Sannantha angusta*, White Sally (*Acacia floribunda*), Hairy Apple Berry (*Billardiera scandens*) and Flax-leaved Paperbark (*Melaleuca linariifolia*).
Groundcover	Moderately dense, species rich and structurally variable. All groundcover attributes were of similar densities and at benchmark value or slightly higher across all plot transects sampled. There are occasional patches of leaf litter and bare earth.

6 - Flooded Gum – Tallowwood – Brush Box moist open forest (NR160, Moderate/good)	
– grasses	A range of 36 – 74 per cent cover was estimated in the plot/transects sampled. Characteristic species include Bordered Panic (*Entolasia marginata*), *Oplismenus imbecillis*, *Ottochloa gracillima*, Wiry Panic (*Entolasia stricta*) and South African Pigeon Grass (*Setaria sphacelata*).
– shrubs	A range of 16 – 38 per cent cover was estimated in the plot/transects sampled. Characteristic shrub species include Coffee Bush (*Breynia oblongi*folia) and Scentless Rosewood (*Synoum glandulosum* subsp*. glandulosum*).
– 'other' (herbs, ferns and sedges)	A range of 36 – 78 per cent cover was estimated in the plot/transects sampled. Characteristic 'other' species include Harsh Ground Fern (*Hypolepis muelleri*), Native Wandering Jew (*Commelina cyanea*), Whiteroot (*Pratia purpurascens*) Bracken (*Pteridium esculentum*) and Pastel Flower (*Pseuderanthemum variabile*).
Exotic species	A low cover of exotic grasses and herbs was noted in the groundcover at one plot/transect sampled. There is a broad patch of Broad-leaved Paspalum (*Paspalum mandiocaunum*) and Pigeon Grass (*Setaria sphacelata*) surrounding the location of a disused dwelling and along disturbed edges adjoining trails.
Tall forest with a dense mid storey and understorey at Plot/transect 33	

7 - Blackbutt – Tallowwood dry grassy open forest (NR119, Moderate/good)	
Plant community type (OEH, 2015c)	Blackbutt - Tallowwood dry grassy open forest of the central parts North Coast
NSW Vegetation Type ID	NR119
Survey effort	Plot/transects 34, 44, 45, 47
Condition (DECC, 2008)	Moderate/good. Remnant or regrowth native vegetation with near-intact over storey that was at or slightly below benchmark values. Native mid storey cover was at the benchmark values in all but one plot/transects. Native grass cover was significantly higher than the benchmark value while an overall low count of shrub cover at benchmark value across all plot/transects but one. Other ground cover attributes were at benchmark value, while species richness was lower for this plant community type in all plot/transects sampled. Woody debris was below benchmark value in two plot/transects and at benchmark value for the remaining two plot/transects. High leaf litter quantities were noted throughout the vegetation zone. All dominant canopy species present were found to be regenerating across the plots sampled. No hollow-bearing trees were recorded were recorded in the plots sampled. No exotic plant cover was recorded in the plots sampled though occasional exotic plants were found within the broader vegetation zone. This vegetation zone has high intrinsic value and moderate potential for achieving gains in biodiversity values through management within a biobank site. Improvements in biodiversity values could be obtained through continuing development of vegetation structure and habitat resources, removal of exotic plants, cessation of timber collection and management of pest fauna.
Conservation significance	Native vegetation. Not listed as a TEC.
Landscape position	Slopes on gently undulating coastal hills
Structure	Tall open forest with a moderate mid storey and moderate grassy understorey.
Over storey	Continuous, around 20 to 30 metres tall and around 12.5 – 20.5 per cent cover in the plot/transects sampled. Features a mixed canopy of Blackbutt (*Eucalyptus pilularis),* Tallowwood (*Eucalyptus microcorys*), Diehard Stringybark *(Eucalyptus cameronii*), Pink Bloodwood (*Corymbia intermedia*), Red Bloodwood (*Corymbia gummifera*) and Red Mahogany (*Eucalyptus resinifera).* All dominant over storey species were observed regenerating.
Mid storey	Mid-storey with a range of 8.5 – 14.5 per cent cover was estimated in the plot/transects sampled. Characteristic midstorey species include Turpentine (*Syncarpia glomulifera*), *Sannantha angusta*, *Melaleuca sieberi*, Two-veined Hickory (*Acacia binervata*), Turpentine (*Syncarpia glomulifera*), Two-veined Hickory (*Acacia binervata*) and Forest Oak (*Allocasuarina torulosa*).

7 - Blackbutt – Tallowwood dry grassy open forest (NR119, Moderate/good)	
Groundcover	Moderately dense, species rich and structurally variable. High cover of grasses to a distinct lower cover of shrubs while 'other' attribute groundcover was moderate throughout the plot transects sampled. There are occasional patches of leaf litter and bare earth.
– grasses	A range of 52 – 86 per cent cover was estimated in the plot/transects sampled. Characteristic species include Wiry Panic (*Entolasia stricta*), Blady Grass (*Imperata cylindrica*), *Ottochloa gracillima*, Bordered Panic (*Entolasia marginata*) and Kangaroo Grass (*Themeda australis*).
– shrubs	A range of 0 – 14 per cent cover was estimated in the plot/transects sampled. Characteristic shrub species include Rough Guinea Flower (*Hibbertia aspera*), *Denhamia bilocularis*, *Bossiaea rhombifolia* and *Monotoca scoparia*.
– 'other' (herbs, ferns and sedges)	A range of 18 – 38 per cent cover was estimated in the plot/transects sampled. Characteristic 'other' species include Pastel Flower (*Pseuderanthemum variabile*), Rough Guinea Flower (*Hibbertia aspera*), Variable Sword-sedge (*Lepidosperma laterale*), Bracken (*Pteridium esculentum*) and Spiny-headed Mat-rush (*Lomandra longifolia*).
Exotic species	Low frequency and cover of Lantana (*Lantana camara*) and Camphor Laurel (*Cinnamomum camphora*) plants with mild infestations of Whisky Grass (*Andropogen virginicus*) observed around the edges of disturbed areas.
Open forest with grass dominated groundcover at Plot/transect 34	

8 - Blackbutt - Pink Bloodwood shrubby open forest (NR117, Moderate/good)	
Plant community type (OEH, 2015c)	Blackbutt - Pink Bloodwood shrubby open forest of the coastal lowlands of the North Coast
NSW Vegetation Type ID	NR117
Survey effort	Plot/transects 29, 4, 37, 43, 50
Condition (DECC, 2008)	Moderate/good. Remnant or regrowth native vegetation with near-intact over storey for which three of the five plot/transects were slightly below benchmark values. Native mid storey cover was at the benchmark values in all plot/transects. All groundcover attributes, grass, 'other' and shrubs were recorded as at benchmark value for this plant community type in all plot/transects sampled yet species richness was below. The majority of plot/transects had an amount of woody debris at benchmark value. The dominant canopy species were found to be regenerating in multiple plot/transects sampled. There were few hollow-bearing trees recorded, a total of four trees observed over the five plots sampled. High leaf litter quantities were noted throughout the vegetation zone. No exotic species were recorded as present in any of the plots ground layer or mid-storey. Occasional exotic plants were observed within the broader vegetation zone. This vegetation zone has high intrinsic value and moderate potential for achieving gains in biodiversity values through management within a biobank site. Improvements in biodiversity value could be obtained through continuing development of vegetation structure and habitat resources, removal of exotic plants, cessation of timber collection and management of pest fauna.
Conservation significance	Native vegetation. Not listed as a TEC.
Landscape position	Lower slopes and alluvial flats.
Structure	Tall forest with a dense mid storey and a dense understorey of shrubs, herbs, ferns and grasses.
Over storey	Continuous, around 25 to 30 metres tall and 14 – 36 per cent cover in the plot/transects sampled. Features a mixed canopy of Blackbutt (*Eucalyptus pilularis),* Tallowwood (*E. microcorys*), Red Mahogany (*Eucalyptus resinifera)*, Diehard Stringybark *(Eucalyptus cameronii*) and Pink Bloodwood (*Corymbia intermedia*) with regeneration of most canopy species apparent.
Mid storey	Mid-storey with a range of 18 – 48.5 per cent cover was estimated in the plot/transects sampled. Characteristic midstorey species include Tantoon (*Leptospermum polygalifolium*), *Sannantha angusta*, Turpentine (*Syncarpia glomulifera*), Wombat Berry (*Eustrephus latifolius*), Hairy Apple Berry (*Billardiera scandens*),

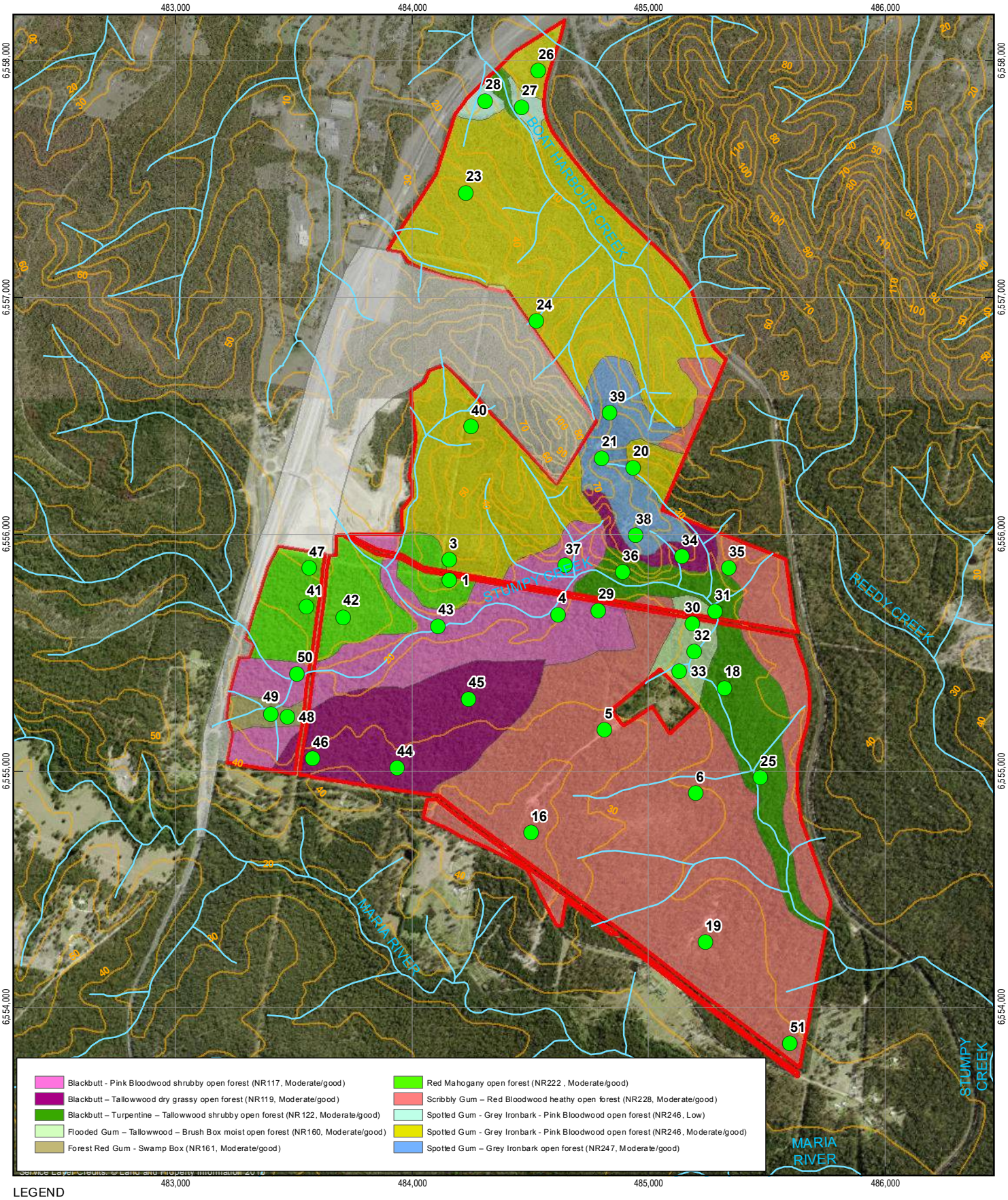
8 - Blackbutt - Pink Bloodwood shrubby open forest (NR117, Moderate/good)	
	White Sally (*Acacia floribunda*) and Green Wattle (*Acacia irrorata*).
Groundcover	Moderately dense, species rich and structurally variable. Grass, shrub and 'other' cover was all of similar, high values in the plot transects sampled. There are occasional patches of leaf litter and bare earth.
- grasses	A range of 14 – 60 per cent cover was estimated in the plot/transects sampled. Characteristic species include Wiry Panic (*Entolasia stricta*), Bordered Panic (*Entolasia marginata*), Blady Grass (I*mperata cylindrica*) and *Oplismenus imbecillis*.
- shrubs	A range of 10 – 42 per cent cover was estimated in the plot/transects sampled. Characteristic shrub species include Rough Guinea Flower (*Hibbertia aspera*) and Elderberry Panax (*Polyscias sambucifolia*).
- 'other' (herbs, ferns and sedges)	A range of 8 – 60 per cent cover was estimated in the plot/transects sampled. Characteristic 'other' species include Pastel Flower (*Pseuderanthemum variabile*), Spiny-headed Mat-rush (*Lomandra longifolia*), Rainbow Fern (*Calochlaena dubia*), Blueberry Lily (*Dianella revoluta*) and Slender Tick-trefoil (*Desmodium gunnii*).
Exotic species	Although there were no exotic species recorded in the groundcover or midstorey of the plot/transects sampled, a variety of exotic plants were present within this vegetation zone. These were mainly at very low frequency and cover, comprising ccasional Lantana (*Lantana camara*) and Camphor Laurel (*Cinnamomum camphora*) plants and mild infestations of Broadleaf Paspalum (*Paspalum mandiocanum*) and Pale Pigeon Grass (*Setaria pumila*).
Forest with a dense understorey at Plot/transect 29	

9 - Spotted Gum - Grey Ironbark - Pink Bloodwood open forest (NR246, Moderate/good)	
Plant community type (OEH, 2015c)	Spotted Gum - Grey Ironbark - Pink Bloodwood open forest of the Clarence Valley lowlands of the North Coast
NSW Vegetation Type ID	NR246
Survey effort	Plot/transects 20, 23, 26, 24, 40, 3
Condition (DECC, 2008)	Moderate/good. Remnant or regrowth native vegetation with near-intact over storey for which half the plot/transects sampled were at the benchmark value while half were slightly below. Native mid storey cover was at benchmark value in all plot/transects. Native grass cover and 'other' groundcover was at or above the benchmark value, while shrub cover was at or slightly lower for this plant community type. All but one of the plot/transects sampled were below benchmark value in species richness. The majority contained woody debris at benchmark value. The dominant canopy species were observed regenerating, in addition to a number of main associated over-storey species. There were few hollow-bearing trees recorded, including two in the six plots sampled. Exotic species were only recorded in the ground layer at one plot/transect. This vegetation zone has high intrinsic value and moderate potential for achieving gains in biodiversity values through management within a biobank site. Improvements in biodiversity values could be obtained through continuing development of vegetation structure and habitat resources, removal of exotic plants, cessation of timber collection and management of pest fauna.
Conservation significance	Native vegetation. Not listed as a TEC.
Landscape position	Mid and upper slopes on coastal hills.
Structure	Tall open forest with a dense mid storey and a dense understorey of herbs, ferns and grasses.
Over storey	Continuous, around 15 to 25 metres tall and around 11 – 43.5 per cent cover in the plot/transects sampled. Features a mixed canopy of Thick-leaved Mahogany *(Eucalyptus carnea*), Diehard Stringybark *(Eucalyptus cameronii*), Blackbutt *(Eucalyptus pilularis*), Small-fruited Grey Gum *(Eucalyptus propinqua*), Tallowwood (*Eucalyptus microcorys*), Narrow-leaved Red Gum *(Eucalyptus seeana*), Pink Bloodwood (*Corymbia intermedia*), Red Bloodwood (*Corymbia gummifera*) Spotted Gum (*Corymbia variegata*) and Grey Ironbark (*Eucalyptus siderophloia*) Regeneration was observed in all but two of the above species.
Mid storey	Mid-storey with a range of 10.5 – 51 per cent cover was estimated in the plot/transects sampled. Characteristic midstorey species include Black She-Oak (*Allocasuarina littoralis*), *Sannantha angusta*, Brush Box (*Lophostemon confertus*), Forest Oak (*Allocasuarina torulosa*), *Melaleuca sieberi*, and Curracabah (*Acacia concurrens*).

9 - Spotted Gum - Grey Ironbark - Pink Bloodwood open forest (NR246, Moderate/good)	
Groundcover	Moderately dense, species rich and structurally variable. Grass and 'other' cover was at benchmark value, with a slightly higher percentage of 'other' cover over grass. There was a lower cover of shrubs, and in two instances nil shrubs found in the six plot transects sampled. There are occasional patches of leaf litter and bare earth.
– grasses	A range of 42 – 82 per cent cover was estimated in the plot/transects sampled. Characteristic species include Wiry Panic (*Entolasia stricta*), Blady Grass (*Imperata cylindrica*), Bordered Panic (*Entolasia marginata*), Broadleaf Paspalum (*Paspalum mandiocanum*) and Open Summer-grass (*Digitaria diffusa*).
– shrubs	A range of 0 – 30 per cent cover was estimated in the plot/transects sampled. Characteristic shrub species include *Sannantha angusta*, Coffee Bush (*Breynia oblongifolia*), Elderberry Panax (*Polyscias sambucifolia*), Hop Goodenia (*Goodenia ovata*) and Rough Guinea Flower (*Hibbertia aspera*).
– 'other' (herbs, ferns and sedges)	A range of 24 – 44 per cent cover was estimated in the plot/transects sampled. Characteristic 'other' species include Spiny-headed Mat-rush (*Lomandra longifolia*) and Variable Sword-sedge (*Lepidosperma laterale*).
Exotic species	Lantana (*Lantana camara*), Camphor Laurel (*Cinnamomum camphora*) and Broadleaf Paspalum (*Paspalum mandiocanum*) were noted within the vegetation zone, including up to 38 per cent ground cover in plot/transects.
Forest with a dense understorey at Plot/transect 24	

10 - Scribbly Gum – Red Bloodwood heathy open forest (NR228, Moderate/good)	
Plant community type (OEH, 2015c)	Scribbly Gum - Red Bloodwood heathy open forest of the coastal lowlands of the North Coast
NSW Vegetation Type ID	NR228
Survey effort	Plot/transects 6, 35, 16, 5, 19, 51
Condition (DECC, 2008)	Moderate/good. Remnant or regrowth native vegetation with near-intact over storey that was at or slightly below benchmark values. Native mid storey cover was at the benchmark value in all but one of the plot/transects. Native grass and shrub cover was at or higher than the benchmark value. Other ground cover attributes and woody debris were at the benchmark values for this plant community type in all but one of plot/transects sampled. Species richness was below benchmark value in four of the six plot/transects. The dominant canopy species were observed regenerating, in addition to a number of main associated over-storey species. There were few hollow-bearing trees recorded, including only 6 in the six plots sampled. No exotic species were recorded in any of the plots ground layer or mid-storey but the occasional Camphor Laurel was noted in the vegetation zone. High leaf litter quantities were noted throughout the vegetation zone. This vegetation zone has high intrinsic value and moderate potential for achieving gains in biodiversity values through management within a biobank site. Improvements in biodiversity values could be obtained through continuing development of vegetation structure and habitat resources, removal of exotic plants, cessation of timber collection and management of pest fauna.
Conservation significance	Native vegetation. Not listed as a threatened ecological community (TEC).
Landscape position	Mid and lower slopes on rolling low hills.
Structure	Tall open forest with a moderate mid storey and a moderate understorey of herbs, ferns and grasses.
Over storey	Continuous, around 10 to 20 metres tall and around 7.8 – 22.2 per cent cover in the plot/transects sampled. Features a mixed canopy of Diehard Stringybark *(Eucalyptus cameronii*), Blackbutt *(Eucalyptus pilularis*), Scribbly Gum *(Eucalyptus signata*), Tallowwood (*Eucalyptus microcorys*), Red Bloodwood (*Corymbia gummifera*) and Grey Ironbark (*Eucalyptus siderophloia*) with regeneration evident in numerous plot/transects.
Mid storey	Mid-storey with a range of 0 – 44.5 per cent cover was estimated in the plot/transects sampled. Characteristic midstorey species include Sannantha angusta, Persoonia stradbrokensis, Black She-Oak (*Allocasuarina littoralis*), Turpentine (*Syncarpia glomulifera*), Forest Oak (*Allocasuarina torulosa*), Two-veined Hickory (*Acacia binervata*) and Tantoon (*Leptospermum polygalifolium*).

10 - Scribbly Gum – Red Bloodwood heathy open forest (NR228, Moderate/good)	
Groundcover	Moderately dense, species rich and structurally variable. Grass and 'other' cover was at benchmark value, with a higher percentage of grass cover over 'other'. There was a lower cover of shrubs in comparison found across the six plot transects sampled. There are occasional patches of leaf litter and bare earth.
– grasses	A range of 24 – 90 per cent cover was estimated in the plot/transects sampled. Characteristic species include Wiry Panic (*Entolasia stricta*) and Blady Grass (*Imperata cylindrica*).
– shrubs	A range of 6 – 16 per cent cover was estimated in the plot/transects sampled. Characteristic shrub species include Rough Guinea Flower (*Hibbertia aspera*), *Monotoca scoparia* and Coffee Bush (*Breynia oblongifolia*).
– 'other' (herbs, ferns and sedges)	A range of 2 – 40 per cent cover was estimated in the plot/transects sampled. Characteristic 'other' species include Bracken (*Pteridium esculentum*), Variable Sword-sedge (*Lepidosperma laterale*), *Ptilothrix deusta* and *Dampiera sylvestris*.
Exotic species	Occasional individual Camphor Laurel (*Cinnamomum camphora*) were observed within the vegetation zone. No exotic species were recorded in the groundcover or mid-storey of any of the six plot/transects sampled.
Forest with a dense understorey at Plot/transect 35	



LEGEND

Norton biobank site

Recent or proposed development

Contours

Plot/transect

Watercourses

0 200 400 800

Metres

Geographic Coordinate System
Horizontal Datum: Geocentric Datum of Australia 1994

N

Roads and Maritime Services
Norton Biobank Site
BioBanking Assessment

Job Number 21-24927
Revision A
Date 01 Aug 2016

Vegetation zones

Figure 2

G:\21\24927\GIS\Maps\Deliverables\Norton Biobank\21_24927_Z002_NortonVegetationZones_2.mxd

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Data Source: NSW Department of Lands: Cadastre - Jan 2011; LPMA Data 2013; Lewis and James (2010) Kempsey to Eungai: Compensatory Habitat package' Created by:mking3

3.2.1 Habitat resources

The Norton biobank contains gently undulating near coastal hills and valley floors that are vegetated with wet sclerophyll forest and dry sclerophyll woodland. It features colluvial, depositional and alluvial landscapes on fine-grained sedimentary, metamorphic and medium-grained volcanic substrate. Forest and woodland at the site contains habitat resources for a diverse range of native fauna, including threatened species. Section 4.4.1 lists threatened species that have been recorded at the site and those that are predicted to be associated with the vegetation types and habitat resources by the credit calculator. The following section describes specific habitat resources that may indicate the presence of additional threatened species.

There are no substantial cliff lines or rock outcrops nor associated caves, overhangs or fissures at the biobank site. The biobank site would not support cave-roosting microbats or other threatened fauna of rocky country.

There are two named, third order drainage lines at the site and a number of small, intermittent first and second order tributaries (see Figure 2). Both of the larger drainage lines are near permanent, channel-confined streams. The reaches of these drainage lines through the biobank site are generally in very good condition and feature intact in-stream and riparian vegetation, intact banks and other geomorphic features and good quantities of woody debris. No evidence of unnatural erosion or contamination was observed. Boat Harbour Creek contained occasional deep pools in its lower reaches at the times of each of the GHD field surveys. Stumpy Creek contained many deep pools along its length through the site, including reaches with 50+ metre lengths of deep surface water.

The smaller tributaries contained only shallow, isolated pools and would only flow for brief periods after very heavy rainfall events. These streams would not support threatened species of permanent or rocky streams.

There are no upland swamps at the biobank site.

The BioBanking assessment of habitat resources at the biobank site was completed with reference to the above observations and data collected in vegetation zones and is presented in Appendix B.

3.2.2 Noxious and environmental weeds

The distribution of noxious and environmental weeds at the site is very closely tied to disturbance, with the concentration of weeds greatest on partially cleared and grazed lower slopes. Relatively undisturbed vegetation on mid and upper slopes contains only very occasional weeds.

The biobank features localised moderate infestations of noxious weeds such as Lantana (*Lantana camara*), Privet (*Ligustrum* species), Wild Tobacco (*Solanum mauritianum*) and Camphor Laurel (*Cinnamonum camphora*). These weeds are mainly restricted to previously cleared land in the northwest of the site and are closely associated with the extent of vegetation zone 5: Spotted Gum - Grey Ironbark - Pink Bloodwood open forest (NR246) in Low condition.

There are slight infestations of these noxious weeds and environmental weeds such as African Love Grass (*Eragrostis curvula*), Broad-leaved Paspalum (*Paspalum mandiocaunum*), Whiskey Grass (*Andropogon virginicus*) and Cobblers Pegs (*Bidens pilosa*) throughout the site generally comprising isolated individual plants at very low frequency and cover. There is often a thin band of these weeds and exotic pasture grasses such as Pigeon Grass (*Setaria sphacelata*) along disturbed edges adjoining trails, easements and fence lines.

Management actions for weed control are described in the MAP (GHD 2016).

3.3 Conservation significance

3.3.1 Threatened flora species

No threatened flora species were observed during the field survey of the biobank.

There is potential for a number of threatened flora species to occur within the biobank, given the presence of suitable habitat and previous records within the locality. The survey effort to date has not included targeted seasonal threatened flora surveys. The BBAM allows for modifications to BioBanking agreements to allow generation of species credits based on supplementary survey results and so targeted, seasonal surveys for threatened plants may be conducted as part of a future modification.

3.3.2 Threatened fauna species recorded

A total of 12 threatened fauna species have been recorded at the site as listed in Table 4. Four of these species are species credit-type species.

No species credits were calculated as part of the current assessment. The purpose of this BioBanking assessment is only to obtain a secure conservation covenant over the site. Roads and Maritime Services would purchase and retire all biodiversity credits generated for a price equivalent to the total fund deposit for the site. Only ecosystem credits directly contribute to the total fund deposit and so species credits have not been calculated.

Table 4 threatened species recorded at the Norton biobank site

Common Name	Scientific Name	TSC Act Status	EPBC Act Status	Observation type	Credit type
Giant Barred-frog	*Mixophyes iteratus*	E	E	Heard (GHD in prep.)	Species
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	V	-	Seen (GHD in prep.); chewed cones.	Ecosystem
Green-thighed Frog	*Litoria brevipalmata*	V	-	Seen (Lewis and James 2010)	Species
Koala	*Phascolarctos cinereus*	V	V	Seen, scats (GHD in prep.)	Species
Little Lorikeet	*Glossopsitta pusilla*	V,	-	Seen (GHD in prep.)	Ecosystem
Varied Sittella	*Daphoenositta chrysoptera*	V	-	Seen	Ecosystem
Brush-tailed Phascogale	*Phascogale tapoatafa*	V	-	Seen (Lewis and James 2010)	Species
Yellow-bellied Glider	*Petaurus australis*	E	-	Feed scar (Lewis and James 2010)	Ecosystem
Grey-headed Flying-fox	*Pteropus poliocephalus*	V	V	Seen (Lewis and James 2010)	Ecosystem
Little Bentwing-bat	*Miniopterus australis*	V	-	Anabat recording (Lewis and James 2010)	Ecosystem
Eastern Bentwing-bat	*Miniopterus schreibersii oceanensis*	V	-	Anabat recording (Lewis and James 2010)	Ecosystem

Common Name	Scientific Name	TSC Act Status	EPBC Act Status	Observation type	Credit type
Powerful Owl	*Ninox strenua*	V	-	Heard (Lewis and James 2010)	Ecosystem

There is potential for a number of additional threatened fauna species to occur within the biobank, given the presence of suitable habitat and previous records within the locality.

3.3.3 Threatened ecological communities

Forest Red Gum - Swamp Box of the Clarence Valley lowlands of the North Coast (NR161) at the site (see Figure 2) comprises a local occurrence of Subtropical Coastal Floodplain Forest, which is listed as an endangered ecological community under the TSC Act.

There are no other threatened ecological communities at the biobank site.

4. BioBanking credit calculations

4.1 Overview

The BioBanking credit calculations were completed by Ben Harrington (assessor accreditation number 0073) using the BBAM 2014 and credit calculator Version 4.0. The credit calculations have been submitted to OEH and the biodiversity credit report is included as Appendix A.

A summary of the site location data for credit calculations is provided in Table 5. The other data and assumptions used to perform the BioBanking credit calculations are summarised below.

Table 5 Site location summary

Attribute	Site value
CMA region	Northern Rivers
IBRA region	NSW North Coast
IBRA subregion	Macleay Hastings
Mitchell Landscape	Kempsey Coastal Ramp
LGA	Kempsey
Lot / DP(s)	Lot 501 DP 1200647 Lot 53 DP 1162355 Lot 301 DP 1161894 Lot 302 DP 1161894 Lot 56 DP 1165099 Lot 11 DP 1194544 Lot 21 DP 1199597

4.2 Biobank landscape value

The landscape assessment for the biobank is shown on Figure 3 and the details are summarised in Table 6. The approach to the landscape assessment is described below.

The BBAM uses assessment circles to estimate the extent and connectivity of native vegetation and habitat surrounding the site. Vegetation cover was estimated based on the current situation and after the management of the site using GIS measurement of foliage projective cover within the assessment circles. The outer assessment circle is 2000 hectares in area and the inner assessment circles is 200 hectares in area (see Figure 3). The inner assessment circle was placed so as to capture the greatest change in vegetation cover as a result of the management of the biobank. The percentage change in native vegetation cover was estimated by adding the area of cleared land and exotic vegetation within the biobank site (i.e. the area that would regenerate into native vegetation cover) to the current area of native vegetation within the assessment circles.

The BBAM requires an assessment of whether the biobank is within or partly with in a ‘strategic location’. The Norton biobank does not fall within a strategic location as defined by the BBAM as it is not located within:

- an area of land identified by the assessor as being part of a state significant biodiversity link and in a plan approved by the Chief Executive of OEH, or
- an area of land identified by the assessor as being part of a regionally significant biodiversity link and in a plan approved by the Chief Executive of OEH, or

- the riparian buffer area of a 4th order stream or higher, an important wetland or an estuarine area.

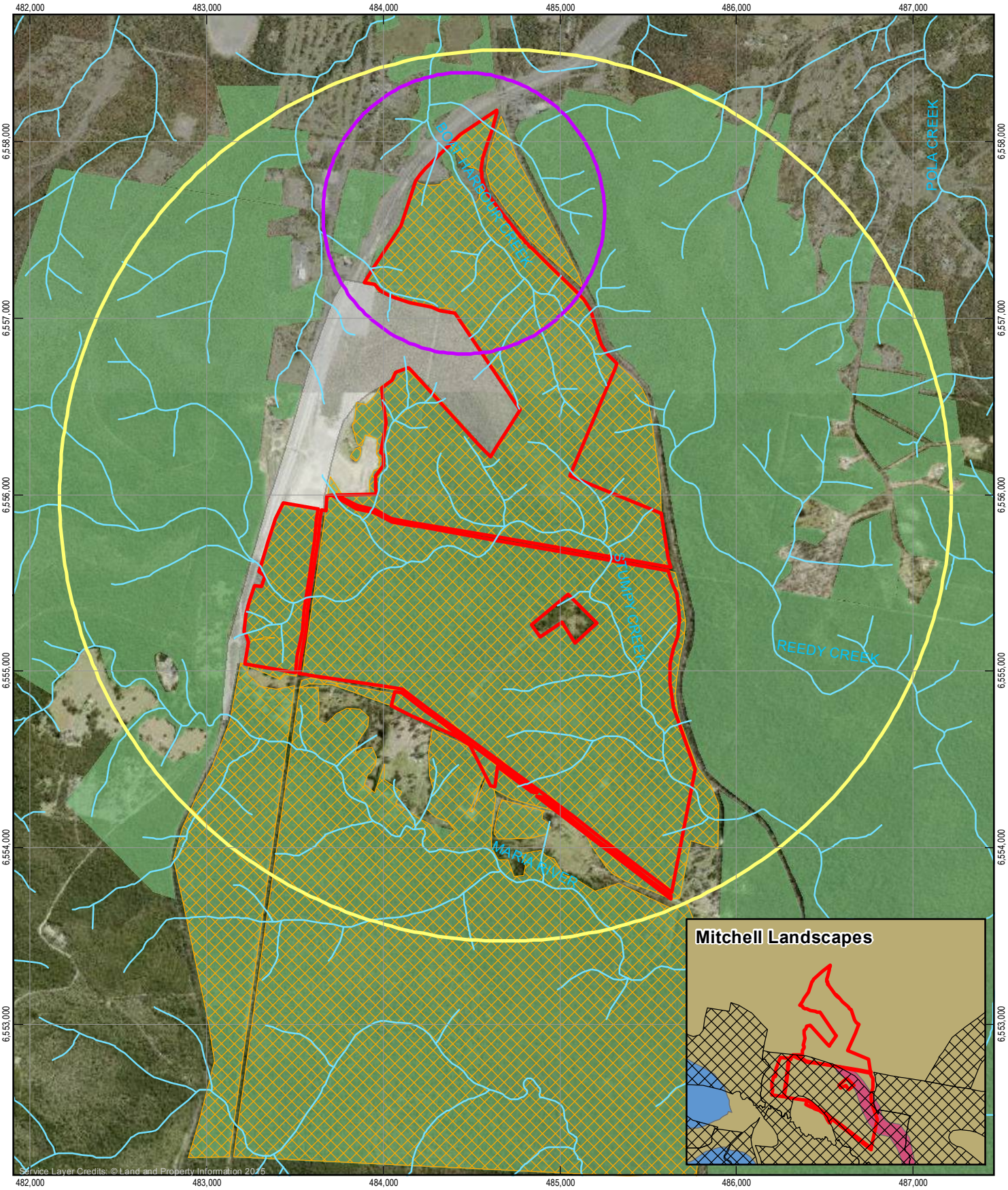
The biobank site is part of a regionally significant biodiversity link as shown on Figure 3 and will therefore affect a strategic location. The Norton biobank lies within a mapped regional fauna habitat corridor (Scotts et. al, 2003) that runs east-west connecting State forests to the west and south of the site with Maria National Park to the east.

Patch size was assessed using GIS and air photo interpretation of native vegetation cover within the assessment circles and adjoining areas of native vegetation. The percent native vegetation cleared in the Mitchell Landscape in which most of the biobank occurs (Brooms Head - Kempsey Coastal Ramp) is 26%. Native vegetation in the biobank site is continuous with a patch of native vegetation in the Maria River State Forest and other open space to the south (see Figure 3). This patch is greater than 1001 hectares in area. Therefore, according to the criteria for assessing patch size in Appendix 4 of the BBAM, the biobank falls within the 'extra large' patch size class (greater than 1000 hectares) (OEH 2014a).

Table 6 Landscape assessment values summary

Landscape Attribute	Before Biobank	After Biobank
% Native vegetation cover in outer (2000) ha assessment circle	81-85% (1652 ha)	81-85% (1656 ha)
% Native vegetation cover in inner (200 ha) assessment circle	66-70% (131 ha)	66-70% (135 ha)
Strategic location	Regional biodiversity corridor	
Patch size score	Extra large (>1000 ha)	Extra large (>1000 ha)

*PFC = percentage foliage cover; BM = benchmark values for the attribute (OEH 2016b).



LEGEND

- Norton biobank site
- Watercourses
- 200 ha assessment circle
- 2000 ha assessment circle
- Native vegetation
- Patch size >1001ha
- Recent or proposed development
- Regional biodiversity corridor

Mitchell Landscapes

- Brooms Head - Kempsey Coastal Ramp
- Manning - Macleay Coastal Alluvial Plain
- Wauchope Coastal Foothills

0 250 500 1,000
Metres

Geographic Coordinate System
Horizontal Datum: Geocentric Datum of Australia 1994

N

Roads and Maritime Services
Norton Biobank Site
BioBanking Assessment

Job Number	21-24927
Revision	A
Date	01 Aug 2016

Landscape assessment

Figure 3

G:\21\24927\GIS\Maps\Deliverables\Norton Biobank\21_24927_Z003_Landscape_Assessment.mxd Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: NSW Department of Lands: Cadastre - Jan 2011; LPMA Data 2013; Lewis and James (2010) Kempsey to Eungai: Compensatory Habitat package' Created by:mking3

4.3 Biobank site value

One vegetation zone was created for each native vegetation type and broad condition state at the site. The area of each zone was calculated using GIS. Vegetation zones within the Norton biobank are mapped on Figure 2 and summarised in Table 7.

All of the Moderate/good condition vegetation zones within the Norton biobank are connected. These vegetated areas are connected to an extensive area of native vegetation associated with the Maria River State Forest and other vegetated land to the south of the site (see Figure 3). As described above this patch of vegetation is many thousands of hectares in area and so the patch size for each vegetation zone at the biobank is 1001 hectares, which is the maximum in the BBAM and falls within the 'very large' patch size score for the Mitchell Landscape.

Table 7 Vegetation zones

Veg Zone ID	Vegetation Zone	PCT. ID	Condition	Area in Norton offset site (ha)	Patch size (ha)	Plot/transects required	Plot/transects sampled
1	Blackbutt – Turpentine – Tallowwood shrubby open forest (NR122, Moderate/good)	NR122	Moderate/good	33.4	1001	4	18, 25, 31, 36
2	Red Mahogany open forest (NR222, Moderate/good)	NR222	Moderate/good	30.2	1001	4	41, 42, 1, 47
3	Forest Red Gum - Swamp Box (NR161, Moderate/good)	NR161	Moderate/good	3.8	1001	2	48, 49
4	Spotted Gum – Grey Ironbark open forest (NR247, Moderate/good)	NR247	Moderate/good	19.5	1001	3	21, 38, 39
5	Spotted Gum - Grey Ironbark - Pink Bloodwood open forest (NR246, Low)	NR246	Low	4.0	0	2	27, 28
6	Blackbutt - Turpentine - Tallowwood shrubby open forest (NR122 moderate/good – other) (calculated for Flooded Gum – Tallowwood – Brush Box moist open forest)	NR122 (calculated for NR160)	Moderate/good	7.4	1001	3	30, 32, 33
7	Blackbutt – Tallowwood dry grassy open forest (NR119, Moderate/good)	NR119	Moderate/good	44.5	1001	4	34, 44, 45, 47
8	Blackbutt - Pink Bloodwood shrubby open forest (NR117, Moderate/good)	NR117	Moderate/good	53.4	1001	5	29, 4, 37, 43, 50
9	Spotted Gum - Grey Ironbark - Pink Bloodwood open forest (NR246, Moderate/good)	NR246	Moderate/good	135.4	1001	6	20, 23, 26, 24, 40, 3
10	Scribbly Gum – Red Bloodwood heathy open forest (NR228, Moderate/good)	NR228	Moderate/good	164.3	1001	6	6, 35, 16, 5, 19, 51

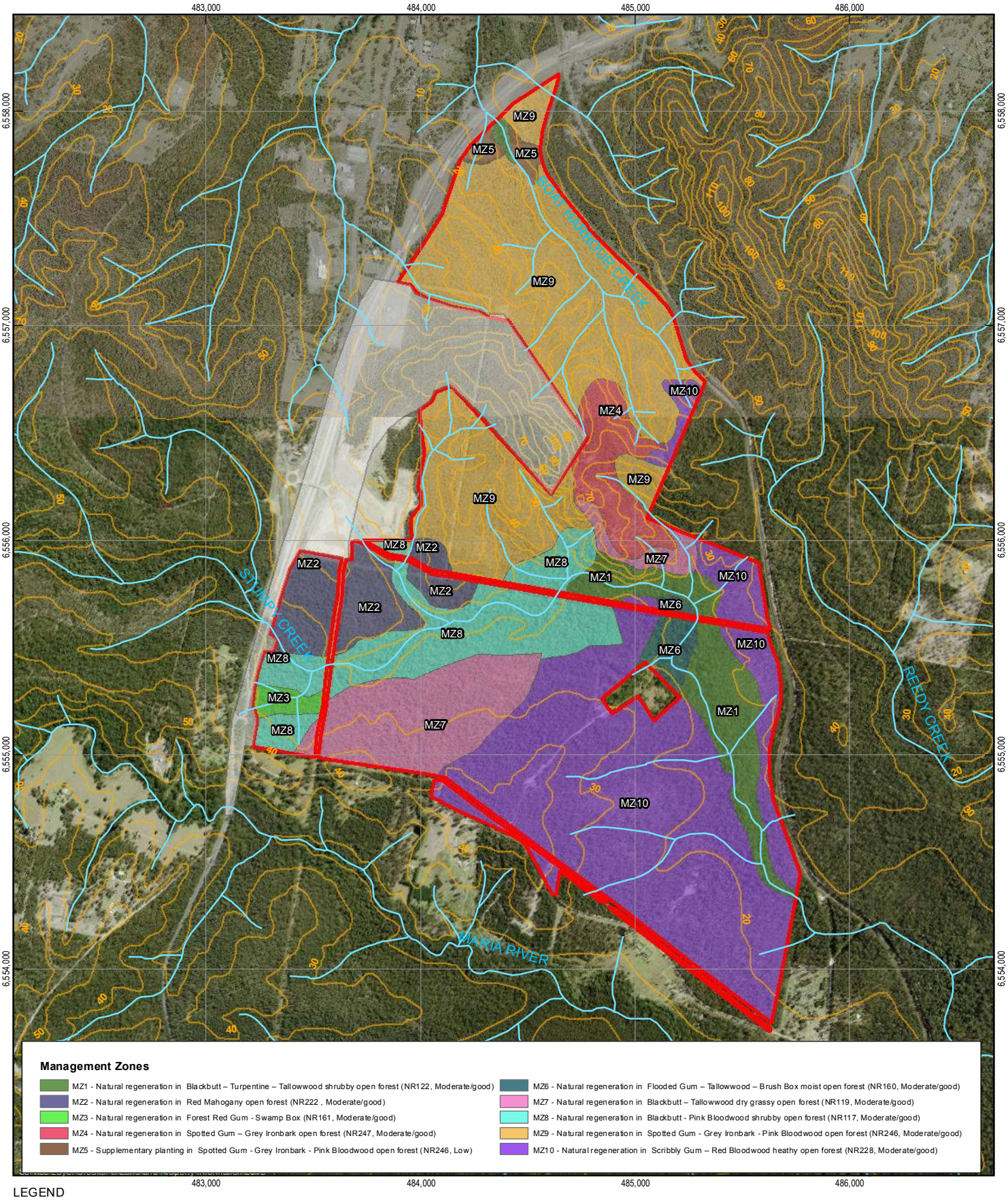
Site value data were collected using the BioBanking plot/transect methodology and entered for each plot/transect field in each vegetation zone. One management zone was created for each vegetation zone across the site (Table 8).

Change in site biodiversity values through the conservation and management of a biobank site is the basis for calculation of biodiversity credits that would be generated. Conservation of vegetation within a biobank increases the site value by a default amount based on expected improvements in the condition of vegetation and habitat resources. There are certain circumstances where portions of a biobank are managed such that a different increase in site value is obtained. This may include intense, targeted management activities such as tree planting. Management zone MZ5 ‘supplementary planting in Spotted Gum - Grey Ironbark - Pink Bloodwood open forest (NR246, Low)’ is dominated by exotic plant species and featured very little natural regeneration. Supplementary planting of canopy and mid storey species is proposed in this zone. An additional half point increase in over storey cover was entered in the credit calculations. The default increase in mid storey cover was equivalent to the maximum possible. The default increase in site value was entered for all other attributes.

No specific, targeted management actions would be performed in any other zones and the default increase in site value was entered. Figure 4 shows the location of management zones.

Table 8 Management zones

Zone ID	Veg Zone ID	Management Zone	Area in Norton offset site (ha)	Management / Attribute Scores	Photo point
MZ1	1	Natural regeneration in Blackbutt – Turpentine – Tallowwood shrubby open forest (NR122, Moderate/good)	33.4	Natural regeneration / default increase in all site value scores.	A
MZ2	2	Natural regeneration in Red Mahogany open forest (NR222, Moderate/good)	30.2	Natural regeneration / default increase in all site value scores.	H
MZ3	3	Natural regeneration in Forest Red Gum - Swamp Box (NR161, Moderate/good)	3.8	Natural regeneration / default increase in all site value scores.	I
MZ4	4	Natural regeneration in Spotted Gum – Grey Ironbark open forest (NR247, Moderate/good)	19.5	Natural regeneration / default increase in all site value scores.	G
MZ5	5	Supplementary planting in Spotted Gum - Grey Ironbark - Pink Bloodwood open forest (NR246, Low)	4.0	Supplementary planting. Additional half point increase in over storey cover / Default increase in all other site value scores.	C
MZ6	6	Natural regeneration in Blackbutt - Turpentine - Tallowwood shrubby open forest (NR122, Moderate/good – other) (calculated for Flooded Gum – Tallowwood – Brush Box moist open forest)	7.4	Natural regeneration / default increase in all site value scores.	E
MZ7	7	Natural regeneration in Blackbutt – Tallowwood dry grassy open forest (NR119, Moderate/good)	44.5	Natural regeneration / default increase in all site value scores.	F
MZ8	8	Natural regeneration in Blackbutt - Pink Bloodwood shrubby open forest (NR117, Moderate/good)	53.4	Natural regeneration / default increase in all site value scores.	D
MZ9	9	Natural regeneration in Spotted Gum - Grey Ironbark - Pink Bloodwood open forest (NR246, Moderate/good)	135.4	Natural regeneration / default increase in all site value scores.	B
MZ10	10	Natural regeneration in Scribbly Gum – Red Bloodwood heathy open forest (NR228, Moderate/good)	164.3	Natural regeneration / default increase in all site value scores.	J



LEGEND

- Norton biobank boundary
- Recent or proposed development
- Contours
- Watercourses

0 200 400 800
Metres

Geographic Coordinate System
Horizontal Datum: Geocentric Datum of Australia 1994

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Roads and Maritime Services
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Management zones

Figure 4

G:\21\24927\GIS\Maps\Deliverables\Norton Biobank\21_24927_Z005_ManagementZones.mxd
Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: NSW Department of Lands: Cadastre - Jan 2011; LPMA Data 2013; Lewis and James (2010) Kempsey to Eungai: Compensatory Habitat package' Created by:mking3

4.4 Threatened species assessment

4.4.1 Predicted threatened species

The BioBanking credit calculator reports the suite of threatened fauna species that are predicted to be associated with ecosystem credits generated for the biobank. The suite of predicted threatened species for the Norton biobank is listed in Table 9. There is suitable habitat for each of these threatened species at the biobank site and they may occur at the site from time to time or in the future.

Table 9 Predicted threatened species

Common name	Scientific name	TS offset multiplier[1]	On site[2]
Barking Owl	*Ninox connivens*	3.0	Yes
Barred Cuckoo-shrike	*Coracina lineata*	1.5	Yes
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus* subsp. *victoriae*	2.0	Yes
Bush Stone-curlew	*Burhinus grallarius*	2.6	Yes
Diamond Firetail	*Stagonopleura guttata*	1.3	Yes
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	2.2	Yes
Eastern Freetail-bat	*Mormopterus norfolkensis*	2.2	Yes
Flame Robin	*Petroica phoenicea*	1.3	Yes
Glossy Black-Cockatoo[3]	*Calyptorhynchus lathami*	1.8	Yes
Golden-tipped Bat	*Kerivoula papuensis*	1.3	Yes
Greater Broad-nosed Bat	*Scoteanax rueppellii*	2.2	Yes
Hoary Wattled Bat	*Chalinolobus nigrogriseus*	2.1	Yes
Hooded Robin (south-eastern form)	*Melanodryas cucullata* subsp. *cucullata*	1.7	Yes
Little Eagle	*Hieraaetus morphnoides*	1.4	Yes
Little Lorikeet[3]	*Glossopsitta pusilla*	1.8	Yes
Long-nosed Potoroo	*Potorous tridactylus*	1.3	Yes
Masked Owl	*Tyto novaehollandiae*	3.0	Yes
Powerful Owl[3]	*Ninox strenua*	3.0	Yes
Red-legged Pademelon	*Thylogale stigmatica*	2.6	Yes
Scarlet Robin	*Petroica boodang*	1.3	Yes
Sooty Owl	*Tyto tenebricosa*	3.0	Yes
Spotted-tailed Quoll	*Dasyurus maculatus*	2.6	Yes
Square-tailed Kite	*Lophoictinia isura*	1.4	Yes
Swift Parrot	*Lathamus discolor*	1.3	Yes
Varied Sittella[3]	*Daphoenositta chrysoptera*	1.3	Yes
Wompoo Fruit-dove	*Ptilinopus magnificus*	1.3	Yes
Yellow-bellied Glider[3]	*Petaurus australis*	2.3	Yes
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	2.2	Yes

Notes: 1. The TS offset multiplier is an index of the likely response of a threatened species to improvement in habitat condition at a biobank site.

2. The site contains habitat resources for the threatened species and the species may occur at the site from time to time or in the future.

3. The species was directly observed on site.

4.4.2 Species credits

The BBAM references geographic, vegetation and habitat data for the biobank site to generate a list of the species credit-type threatened species predicted to occur at the site and requiring targeted survey.

No species credits were calculated as part of the current assessment. The purpose of this BioBanking assessment is only to obtain a secure conservation covenant over the site to satisfy the biodiversity offsetting requirements for various stages of the Pacific Highway. Roads and Maritime would purchase and retire all biodiversity credits generated for a price equivalent to the total fund deposit for the site. Only ecosystem credits directly contribute to the total fund deposit and so species credits have not been calculated.

In order to complete the credit calculations, default data for each threatened species was entered at the 'Threatened species survey results' stage, comprising: 'Managed at site?' = 'No'; 'ID Method' = 'Survey'; and 'Survey data' = '14/4/16'.

Roads and Maritime, or a future owner of the biobank site, may choose to complete additional targeted surveys and to calculate species credits in the future. Future species credit calculations would require an addendum to this BioBanking assessment report and a modification to the BioBanking agreement. Any future species credit calculations must not include species that are already linked to biodiversity offset packages for the Pacific Highway upgrade project. Biodiversity offsets have already been secured for these species via the purchase and retirement of ecosystem credits that will secure a conservation covenant over an identified area of habitat. Specifically, species credits should not be generated for the Koala or the Giant Barred-frog.

5. Biodiversity credits

This Section of the report summarises the results of credit calculations completed for the biobank.

The data from the fieldwork and mapping were entered in the BioBanking credit calculator version 4.0 to determine the number of biodiversity credits that would be generated when the site is established as a biobank. The BioBanking Credit Report is included in Appendix A and summarised below.

5.1 Ecosystem credits

A total of 6,064 ecosystem credits would be generated at the Norton biobank site. A breakdown of the credits generated for each ecosystem credit (i.e. plant community type) is provided in Table 10. All of these credits are associated with the Macleay Hastings IBRA sub-region.

Table 10 Ecosystem credits generated at Norton biobank

PCT	NSW Veg.type ID	Ecosystem credits generated
Blackbutt – Turpentine – Tallowwood shrubby open forest	NR122	431
Red Mahogany open forest	NR222	454
Forest Red Gum - Swamp Box	NR161	37
Spotted Gum – Grey Ironbark open forest	NR247	224
Blackbutt - Turpentine - Tallowwood shrubby open forest (calculated for Flooded Gum – Tallowwood – Brush Box moist open forest)	NR122 (calculated for NR160[1])	85
Blackbutt – Tallowwood dry grassy open forest	NR119	575
Blackbutt - Pink Bloodwood shrubby open forest	NR117	737
Spotted Gum - Grey Ironbark - Pink Bloodwood open forest	NR246	1808
Scribbly Gum – Red Bloodwood heathy open forest	NR228	1713
	Total	**6,064**

Notes: 1 - The PCT 'Flooded Gum – Tallowwood – Brush Box moist open forest (NR160)' could not be entered in the credit calculator despite being a valid PCT in the VIS PCT database, presumably because of a programming error. The relevant vegetation zone was entered in the credit calculator as the closest matching PCT at the site: 'Vegetation zone 6: NR122 Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central NSW North Coast Bioregion Moderate/Good_Other' for the purposes of credit calculations.

5.2 Species credits

No species credits were calculated.

5.3 Assumptions and limitations

The assumptions and 'assessor's use of judgement' made for the purposes of this BioBanking assessment and credit calculations are as follows:

- The regional fauna habitat corridor that is mapped through the site (Scotts et. al, 2003) is assumed to comprise a 'regionally significant biodiversity link' for the purpose of assessing landscape value.
- The PCT 'Flooded Gum – Tallowwood – Brush Box moist open forest (NR160)' could not be entered in the credit calculator despite being a valid PCT in the VIS PCT database, presumably because of a programming error. The relevant vegetation zone was entered in the credit calculator as the closest matching PCT at the site: 'Vegetation zone 6 NR122 Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central NSW North Coast Bioregion Moderate/Good_Other' for the purposes of credit calculations.
- Systematic, targeted surveys for threatened flora and species credit-type fauna species were not conducted. The purpose of this BioBanking assessment is only to obtain a secure conservation covenant over the site. It is assumed that Roads and Maritime Services would purchase and retire all biodiversity credits generated for a price equivalent to the total fund deposit for the site. Only ecosystem credits directly contribute to the total fund deposit and so species credits have not been calculated.
- Default data for each threatened species was entered at the 'Threatened species survey results' stage, comprising: 'Managed at site?' = 'No'; 'ID Method' = 'Survey'; and 'Survey data' = '14/4/2016'.
- Any future amendment to the BioBanking agreement to generate species credits must not calculate any Koala or Giant Barred-frog species credits, because all of the occupied habitat for these species at the site has already been set aside as a biodiversity offset for the Pacific Highway upgrade.
- Supplementary planting is proposed in management zone MZ5 and so an additional half point increase in the site value score for overstorey cover was entered. The default increase was entered for all other site value scores.
- The default increase in site value scores was entered in all other management zones.

6. Management actions

6.1 Management actions

Improvement in biodiversity values through management actions at a biobank site is the basis for creation of species and ecosystem credits. The following sections provide an outline of the actions that would be required for ongoing management of the biobank and to achieve the proposed improvements in biodiversity values within each management zone (as per the scores entered in the credit calculator). A Management Action Plan (MAP) detailing rehabilitation activities for each management zone, cost estimates for proposed rehabilitation works over the life of the biobank and a management program has been prepared (GHD 2016) and is included in the BioBanking agreement application.

6.1.1 Standard management actions

Standard management actions are those actions required on biobank sites to improve vegetation condition when entering into a BioBanking agreement. A detailed description of these actions and their relevance to the biobank site are described in the MAP (GHD 2016). The standard management actions that apply to the Norton biobank site are:

- Weed control.
- Management of fire for conservation (subject to consultation with Roads and Maritime and the Rural Fire Service and confirmation of an appropriate approach).
- Management of human disturbance.
- Retention of regrowth and remnant native vegetation.
- Supplementary planting where natural regeneration will not be sufficient.

BioBanking agreements require all of the above management actions to be carried out. Completing these actions would increase the site value score and biodiversity value of the biobank site.

6.1.2 Site specific management actions

Based on field observations and the BioBanking Credit Report, the following management actions would be required to alleviate site-specific threats:

- Maintain fences and gates.
- Implement feral cat, wild dog and/or fox control, in line with existing control programs in the locality.
- Exclude and/or control feral herbivores (rabbits, goats, pigs, deer etc.) and over-abundant native herbivores.
- Exclude commercial apiaries.

The BioBanking Credit Report nominates ‘slashing’ as an additional management action that is required for all vegetation zones at the biobank site. Slashing of native vegetation would not be an appropriate management action at the biobank site because of the associated loss of fauna habitat resources and risk of injury or mortality of native fauna, harm to threatened plants, increased weed infestation etc. Slashing has not therefore been included in the MAP.

7. BioBanking agreement summary

The proposed BioBanking agreement for the Norton biobank site would ensure that around 495.9 hectares of native vegetation and habitat will be conserved as a biobank site and would generate 6,064 ecosystem credits. The number and type of ecosystem credits that will be generated is summarised in Table 10 and the credit report is provided in Appendix A.

This report makes no comment on:

- The regulations and requirements for trading of credits within the NSW BioBanking and Offsets Scheme or as biodiversity offsets for projects assessed outside of the scheme.
- The financial factors associated with trading (sale or purchase) of credits.

8. Disclaimer

This report: has been prepared by GHD for Roads and Maritime Services and *may only be used and relied on by Roads and Maritime Services for the purpose agreed between GHD and the Roads and Maritime Services as set out in Section 1.3 of this report.*

GHD otherwise disclaims responsibility to any person other than Roads and Maritime Services arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Roads and Maritime Services, *Idyll Spaces Environmental Consultants and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.*

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

9. References

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Appendices

Appendix A – BioBanking credit report

BioBanking credit report

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

Date of report: 21/07/2016 Time: 3:47:59PM Calculator version: v4.0

Biobank details

Proposal ID: 073/2016/3598B

Proposal name: Norton biobank

Proposal address: Kemps Road South Kempsey NSW 2440

Proponent name: Roads and Maritime Services

Proponent address: Level 2 76 Victoria Street Grafton NSW 2460

Proponent phone: 02 6640 1055

Assessor name: Ben Harrington

Assessor address: Level 15 133 Castlereagh Street Sydney NSW 2000

Assessor phone: 02 9239 7189

Assessor accreditation: 073

Additional information required for approval:

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

Ecosystem credits summary

Plant Community type	Area (ha)	Credits created
Blackbutt - Pink Bloodwood shrubby open forest of the coastal lowlands of the NSW North Coast Bioregion	53.40	737.00
Blackbutt - Tallowwood dry grassy open forest of the central parts NSW North Coast Bioregion	44.50	575.00
Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central NSW North Coast Bioregion	40.80	516.00
Forest Red Gum - Swamp Box of the Clarence Valley lowlands of the NSW North Coast Bioregion	3.80	37.00
Red Mahogany open forest of the coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion	30.20	454.00
Scribbly Gum - Red Bloodwood heathy open forest of the coastal lowlands of the NSW North Coast Bioregion	164.30	1,713.00
Spotted Gum - Grey Ironbark - Pink Bloodwood open forest of the Clarence Valley lowlands of the NSW North Coast Bioregion	139.40	1,808.00
Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion	19.50	224.00
Total	495.90	6,064

Credit profiles

1. Blackbutt - Tallowwood dry grassy open forest of the central parts NSW North Coast Bioregion, (NR119)

Number of ecosystem credits created	575
IBRA sub-region	Macleay Hastings - Northern Rivers

2. Red Mahogany open forest of the coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion, (NR222)

Number of ecosystem credits created	454
IBRA sub-region	Macleay Hastings - Northern Rivers

3. Blackbutt - Pink Bloodwood shrubby open forest of the coastal lowlands of the NSW North Coast Bioregion, (NR117)

Number of ecosystem credits created	737
IBRA sub-region	Macleay Hastings - Northern Rivers

4. Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central NSW North Coast Bioregion, (NR122)

Number of ecosystem credits created	516
IBRA sub-region	Macleay Hastings - Northern Rivers

5. Forest Red Gum - Swamp Box of the Clarence Valley lowlands of the NSW North Coast Bioregion, (NR161)

Number of ecosystem credits created	37
IBRA sub-region	Macleay Hastings - Northern Rivers

6. Spotted Gum - Grey Ironbark - Pink Bloodwood open forest of the Clarence Valley lowlands of the NSW North Coast Bioregion, (NR246)

Number of ecosystem credits created	1,764
IBRA sub-region	Macleay Hastings - Northern Rivers

7. Spotted Gum - Grey Ironbark - Pink Bloodwood open forest of the Clarence Valley lowlands of the NSW North Coast Bioregion, (NR246)

Number of ecosystem credits created	44
IBRA sub-region	Macleay Hastings - Northern Rivers

8. Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion, (NR247)

Number of ecosystem credits created	224
IBRA sub-region	Macleay Hastings - Northern Rivers

9. Scribbly Gum - Red Bloodwood heathy open forest of the coastal lowlands of the NSW North Coast Bioregion, (NR228)

Number of ecosystem credits created	1,713
IBRA sub-region	Macleay Hastings - Northern Rivers

Species credits summary

Additional management actions

Additional management actions are required for:

Vegetation type or threatened species	Management action details
Blackbutt - Pink Bloodwood shrubby open forest of the coastal lowlands of the NSW North Coast Bioregion	Exclude commercial apiaries
Blackbutt - Pink Bloodwood shrubby open forest of the coastal lowlands of the NSW North Coast Bioregion	Exclude miscellaneous feral species
Blackbutt - Pink Bloodwood shrubby open forest of the coastal lowlands of the NSW North Coast Bioregion	Feral and/or over-abundant native herbivore control
Blackbutt - Pink Bloodwood shrubby open forest of the coastal lowlands of the NSW North Coast Bioregion	Fox control
Blackbutt - Pink Bloodwood shrubby open forest of the coastal lowlands of the NSW North Coast Bioregion	Slashing
Blackbutt - Tallowwood dry grassy open forest of the central parts NSW North Coast Bioregion	Exclude commercial apiaries
Blackbutt - Tallowwood dry grassy open forest of the central parts NSW North Coast Bioregion	Exclude miscellaneous feral species
Blackbutt - Tallowwood dry grassy open forest of the central parts NSW North Coast Bioregion	Feral and/or over-abundant native herbivore control
Blackbutt - Tallowwood dry grassy open forest of the central parts NSW North Coast Bioregion	Fox control
Blackbutt - Tallowwood dry grassy open forest of the central parts NSW North Coast Bioregion	Slashing
Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central NSW North Coast Bioregion	Exclude miscellaneous feral species
Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central NSW North Coast Bioregion	Feral and/or over-abundant native herbivore control
Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central NSW North Coast Bioregion	Fox control
Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central NSW North Coast Bioregion	Slashing
Forest Red Gum - Swamp Box of the Clarence Valley lowlands of the NSW North Coast Bioregion	Exclude commercial apiaries
Forest Red Gum - Swamp Box of the Clarence Valley lowlands of the NSW North Coast Bioregion	Exclude miscellaneous feral species
Forest Red Gum - Swamp Box of the Clarence Valley lowlands of the NSW North Coast Bioregion	Feral and/or over-abundant native herbivore control
Forest Red Gum - Swamp Box of the Clarence Valley lowlands of the NSW North Coast Bioregion	Fox control
Forest Red Gum - Swamp Box of the Clarence Valley lowlands of the NSW North Coast Bioregion	Slashing

Red Mahogany open forest of the coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion	Exclude commercial apiaries
Red Mahogany open forest of the coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion	Exclude miscellaneous feral species
Red Mahogany open forest of the coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion	Feral and/or over-abundant native herbivore control
Red Mahogany open forest of the coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion	Fox control
Red Mahogany open forest of the coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion	Slashing
Scribbly Gum - Red Bloodwood heathy open forest of the coastal lowlands of the NSW North Coast Bioregion	Exclude commercial apiaries
Scribbly Gum - Red Bloodwood heathy open forest of the coastal lowlands of the NSW North Coast Bioregion	Exclude miscellaneous feral species
Scribbly Gum - Red Bloodwood heathy open forest of the coastal lowlands of the NSW North Coast Bioregion	Feral and/or over-abundant native herbivore control
Scribbly Gum - Red Bloodwood heathy open forest of the coastal lowlands of the NSW North Coast Bioregion	Fox control
Scribbly Gum - Red Bloodwood heathy open forest of the coastal lowlands of the NSW North Coast Bioregion	Slashing
Spotted Gum - Grey Ironbark - Pink Bloodwood open forest of the Clarence Valley lowlands of the NSW North Coast Bioregion	Exclude commercial apiaries
Spotted Gum - Grey Ironbark - Pink Bloodwood open forest of the Clarence Valley lowlands of the NSW North Coast Bioregion	Exclude miscellaneous feral species
Spotted Gum - Grey Ironbark - Pink Bloodwood open forest of the Clarence Valley lowlands of the NSW North Coast Bioregion	Feral and/or over-abundant native herbivore control
Spotted Gum - Grey Ironbark - Pink Bloodwood open forest of the Clarence Valley lowlands of the NSW North Coast Bioregion	Fox control
Spotted Gum - Grey Ironbark - Pink Bloodwood open forest of the Clarence Valley lowlands of the NSW North Coast Bioregion	Slashing
Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion	Exclude commercial apiaries
Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion	Exclude miscellaneous feral species
Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion	Feral and/or over-abundant native herbivore control
Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion	Fox control
Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion	Slashing

Appendix B – BioBanking data summary

Appendix Table 1 Norton biobank geographic / habitat assessment results

Impact?[1]	Common name	Scientific name	Feature
☐	Big Nellie Hakea	*Hakea archaeoides*	land east of Mount Banda Banda in Upper Manning CMA subregion
☑	*Dracophyllum macranthum*	*Dracophyllum macranthum*	Occurs on moderate to steep slopes mostly with a southerly aspect often associated with gaps in the forest canopy. It often occurs with dense patches of Coral Fern or on roadside bluffs or on conglomerate outcrops.
☑	Biconvex Paperbark	*Melaleuca biconvexa*	land south of Kempsey in Macleay Hastings CMA subregion
☐	Stuttering Frog	*Mixophyes balbus*	land east of Yarrowitch River in Walcha Plateau CMA subregion
☑	Giant Barred Frog	*Mixophyes iteratus*	land below 1000 m in altitude and within 40 m of rainforest or eucalypt forest with deep leaf litter
☐	Tree Guinea Flower	*Hibbertia hexandra*	land within Landsdowne State Forest or within a 5 km buffer of the SF in Comboyne Plateau CMA subregion
☑	Pale-headed Snake	*Hoplocephalus bitorquatus*	land within 40 m of watercourses, containing hollow-bearing trees, loose bark and/or fallen timber
☑	Milky Silkpod	*Parsonsia dorrigoensis*	subtropical or warm temperate rainforest or open eucalypt forest or ecotones between rainforest and eucalypt forest
☑	North Brother Wattle	*Acacia courtii*	shallow soils in dry open forest or rocky slopes
☐	Pale-vented Bush-hen	*Amaurornis moluccana*	land north of south west Rocks in Macleay Hastings CMA subregion
☐	Brush-tailed Phascogale	*Phascogale tapoatafa*	land east of Guy Fawkes River in Wongwibinda Plateau CMA subregion
☑	Common Planigale	*Planigale maculata*	rainforest, eucalypt forest, heathland, marshland, grassland or rocky areas
☑	Green-thighed Frog	*Litoria brevipalmata*	land within 100 m of semi-permanent or ephemeral ponds or depressions containing leaf litter
☐	Parma Wallaby	*Macropus parma*	land east of Oaky River in Armidale Plateau CMA subregion
☐	Eastern Osprey	*Pandion cristatus*	land within 40 m of fresh/brackish/saline waters of larger rivers or creeks; estuaries, coastal lagoons, lakes and/or inshore marine waters

Impact?[1]	Common name	Scientific name	Feature
☑	Spider orchid	*Dendrobium melaleucaphilum*	land containing Melaleuca styphelioides or rainforest trees/rocks
☑	Willawarrin Doubletail	*Diuris disposita*	grassy open forest
☑	Maundia triglochinoides	*Maundia triglochinoides*	swamps or shallow fresh water on clay
☐	Brush-tailed Rock-wallaby	*Petrogale penicillata*	land east of Avondale State Conservation Area in Wongwibinda Plateau CMA subregion
☐	Scented Acronychia	*Acronychia littoralis*	land within 5 km of coast in Richmond - Tweed (Qld - Scenic Rim) (Part A) CMA subregion
☐	Dwarf Heath Casuarina	*Allocasuarina defungens*	land within 15 km of coast in Yuraygir CMA subregion
☐	Nabiac Casuarina	*Allocasuarina simulans*	land south of Port Macquarie in Macleay Hastings CMA subregion

Notes: 1) the relevant habitat feature for the species is present at the site.

Appendix Table 2 Norton biobank plot/transect data

Vegetation Zone	Veg Type ID	Plot ID	Native plant species richness	Native over-storey cover	Native mid-storey cover	Native ground cover (grasses)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Over storey regeneration	Total length of fallen logs	Easting	Northing	Zone
1	NR122	Benchmark	49	20-90	15-90	0-50	10-70	5-90	0	0.1	1	10			
	M-G	18	44	30.5	55.5	64	28	40	0	1	0.5	76	485324	62555351	56
		25	42	38.5	30.5	24	22	20	0	0	0.5	82	485475	6554973	56
		31	45	23	35	68	10	70	0	0	0.5	25	485281	6555675	56
		36	41	11	14.5	56	20	42	0	0	0.5	21	484893	6555840	56
2	NR222	Benchmark	44	15-50	10-40	5-50	5-40	5-70	0	0.1	1.0	20			
	M-G	41	29	11	20	72	6	4	0	0	0.6	16	483557	6555694	56
		42	27	12	9	24	4	64	0	0	0.6	5	483712	6555651	56
		1	34	19.5	17.5	84	4	56	0	0	0.6	32	484146	6555808	56
		47	22	13.5	12.5	54	0	48	0	1	0.6	5	483570	6555859	56
3	NR161	Benchmark	27	10-35	5-30	10-60	0-10	5-25	0	1	1.0	5			
	M-G	48	36	9	18.5	54	6	28	2	0	1.0	0	483476	6555230	56
		49	28	6	20.5	50	16	54	0	0	1.0	18	483407	6555243	56
4	NR247	Benchmark	37	15-40	10-50	5-60	5-60	5-40	0	1	1.0	10			
	M-G	21	40	27.2	29	88	8	22	0	2	1	65	484803	6556324	56
		38	30	15	4.5	24	0	70	0	0	1.0	20	484949	6555995	56
		39	30	18.5	13.5	48	4	18	0	0	1.0	5	484838	6556515	56
5	NR246	Benchmark	37	20-50	10-60	10-60	5-60	10-50	0	1	1.0	10			
	Low	27	18	0	11	8	2	20	86	0	0.1	0	484466	6557804	56
		28	9	0	3	30	2	4	68	0	0.1	0	484310	6557831	56
6	NR160	Benchmark	49	20-50	15-90	0-50	10-70	5-90	0	0.1	1.0	10			
	M-G	30	36	34	32	74	38	78	0	0	0.0	12	485187	6555625	56
		32	22	24.5	20	36	36	52	0	0	0.0	18	485193	6555505	56

Vegetation Zone	Veg Type ID	Plot ID	Native plant species richness	Native over-storey cover	Native mid-storey cover	Native ground cover (grasses)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Over storey regeneration	Total length of fallen logs	Easting	Northing	Zone
		33	24	18.5	22.5	70	16	36	6	0	0.0	15	485132	6555423	56
7	NR119	Benchmark	44	15-50	10-40	5-50	5-40	5-70	0	0.1	1	20			
	M-G	34	39	15	14.5	58	14	38	0	0	0.83	54	485144	6555906	56
		44	35	12.5	10.5	68	0	18	0	0	0.83	34	483940	6555015	56
		45	29	13	14.5	86	6	32	0	0	0.83	13	483134	6555782	56
		47	22	20.5	8.5	52	6	30	0	0	0.83	0	483570	6555859	56
8	NR117	Benchmark	49	20-90	15-90	0-50	10-70	5-90	0	0.1	1	10			
	M-G	29	33	36	51	14	18	60	0	0	0.6	4	484791	6555678	56
		4	31	17.5	48.5	44	42	22	0	2	0.6	46	484621	6555662	56
		37	36	16	25.5	56	10	38	0	1	0.6	28	484621	6555662	56
		43	42	15.5	21	54	18	36	0	1	0.6	40	484112	6555612	56
		50	35	14	18	60	38	8	0	0	0.6	9	483517	6555412	56
9	NR246	Benchmark	37	20-50	10-60	10-60	5-60	10-50	0	1	1	10			
	M-G	20	37	43.5	46	46	22	34	0	1	0.6	46	484935	6556281	56
		23	32	30.2	28.1	62	8	44	0	1	0.6	32.5	484229	6557443	56
		26	32	30.5	14.5	42	0	44	38	0	0.6	126	484536	6557961	56
		24	30	19.5	23.2	82	30	24	0	0	0.6	95	484526	6556898	56
		40	23	11	10.5	78	0	40	0	0	0.6	36	484254	6556454	56
		3	24	18.5	51	74	20	28	0	0	0.6	5	484161	6555892	56
10	NR228	Benchmark	35	15-50	5-70	5-70	5-60	5-80	0	1.5	1	10			
	M-G	6	30	18	44.5	24	10	16	0	1	1	17	485202	6554907	56
		35	30	13	12	84	8	40	0	0	1	3	485343	6555859	56
		16	33	21.7	34.5	80	16	18	0	3	1	94	484506	6554741	56
		5	34	22.2	0	44	6	2	0	2	1	300	484815	6555175	56

Vegetation Zone	Veg Type ID	Plot ID	Native plant species richness	Native over-storey cover	Native mid-storey cover	Native ground cover (grasses)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Over storey regeneration	Total length of fallen logs	Easting	Northing	Zone
		19	35	7.8	19.1	90	8	22	0	0	1	142	485241	6554276	56
		51	36	18	20.5	66	8	28	0	0	1	18	485598	6553851	56

Appendix Table 3 Norton biobank plant species recorded in vegetation zone 1

Family	Scientific Name	Common Name	Exotic	Plot 18 Cover	Plot 18 Abundance	Plot 25 Cover	Plot 25 Abundance	Plot 31 Cover	Plot 31 Abundance	Plot 36 Cover	Plot 36 Abundance
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower		1	100	1	10	1	100	1	200
Adiantaceae	*Adiantum aethiopicum*	Common Maidenhair		1	100	1	20			1	30
Apocynaceae	*Tabernaemontana pandacaqui*	Banana Bush		1	1	1	3				
Araceae	*Gymnostachys anceps*	Settler's Twine		1	20			1	30		
Asteliaceae	*Cordyline stricta*	Narrow-leaved Palm Lily		1	1	1	7			1	1
Asteraceae	*Vernonia cinerea*			1	20						
Bignoniaceae	*Pandorea pandorana*	Wonga Wonga Vine								1	16
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak				1	1	1	2	1	4
Convolvulaceae	*Polymeria calycina*			1	2	1	50	1	20	1	8
Cunoniaceae	*Schizomeria ovata*	Crabapple				1	1				
Cyperaceae	*Carex appressa*	Tall Sedge		1	10						
Cyperaceae	*Carex maculata*			1	50						
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge								1	3
Dennstaedtiaceae	*Hypolepis muelleri*	Harsh Ground Fern		1	50						
Dennstaedtiaceae	*Pteridium esculentum*	Bracken				1	2	1	3	1	3
Dicksoniaceae	*Calochlaena dubia*	Rainbow Fern				2	50	1	5	1	5
Dilleniaceae	*Hibbertia scandens*	Climbing Guinea Flower		1	20	1	20	1	20	1	7
Dioscoreaceae	*Dioscorea transversa*	Native Yam		1	10	1	10	1	3		

Family	Scientific Name	Common Name	Exotic	Plot 18 Cover	Plot 18 Abundance	Plot 25 Cover	Plot 25 Abundance	Plot 31 Cover	Plot 31 Abundance	Plot 36 Cover	Plot 36 Abundance
Dryopteridaceae	*Lastreopsis acuminata*	Shiny Shield Fern								1	10
Eupomatiaceae	*Eupomatia laurina*	Bolwarra		1	1			1	1		
Fabaceae (Faboideae)	*Desmodium gunnii*	Slender Tick-trefoil		1	10	1	1	1	100	1	1
Fabaceae (Faboideae)	*Desmodium varians*	Slender Tick-trefoil						1	1	1	1
Fabaceae (Faboideae)	*Glycine* sp.					1	1	1	3	1	10
Fabaceae (Mimosoideae)	*Acacia binervata*	Two-veined Hickory						1	1		
Fabaceae (Mimosoideae)	*Acacia floribunda*	White Sally		1	3	1	4	1	2	1	8
Fabaceae (Mimosoideae)	*Acacia irrorata*	Green Wattle								1	3
Hydrocotyle	*Hydrocotyle peduncularis*			1	1						
Lamiaceae	*Clerodendrum floribundum* var. *floribundum*			1	1			1	1		
Lauraceae	*Cinnamomum camphora*	Camphor Laurel	*							1	1
Lauraceae	*Cryptocarya microneura*	Murrogun		1	5	1	1				
Lobeliaceae	*Pratia purpurascens*	Whiteroot		1	10	1	10	1	3	1	3
Lomandraceae	*Lomandra hystrix*					1	20				
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush		1	6	1	2	1	2	1	13
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry				1	1	1	1	1	15
Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling Lily		1	1	1	1				
Meliaceae	*Synoum glandulosum* subsp. *glandulosum*	Scentless Rosewood		1	2	1	4	1	2		

Family	Scientific Name	Common Name	Exotic	Plot 18 Cover	Plot 18 Abundance	Plot 25 Cover	Plot 25 Abundance	Plot 31 Cover	Plot 31 Abundance	Plot 36 Cover	Plot 36 Abundance
Menispermaceae	*Sarcopetalum harveyanum*	Pearl Vine		1	4						
Menispermaceae	*Stephania japonica*	Snake vine		1	20						
Moraceae	*Ficus coronata*	Creek Sandpaper Fig		1	1						
Myrsinaceae	*Myrsine howittiana*	Brush Muttonwood		1	1			1	1		
Myrsinaceae	*Myrsine variabilis*					1	1	1	3		
Myrtaceae	*Acmena smithii*	Lilly Pilly		1	1	1	5	1	1		
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush		1	2	1	1	1	4	1	4
Myrtaceae	*Corymbia gummifera*	Red Bloodwood						10	3		
Myrtaceae	*Corymbia intermedia*	Pink Bloodwood				5	1				
Myrtaceae	*Eucalyptus cameronii*	Diehard Stringybark								3	2
Myrtaceae	*Eucalyptus microcorys*	Tallowwood		5	1			1	1	5	3
Myrtaceae	*Eucalyptus pilularis*	Blackbutt		15	2	25	3	30	4	30	4
Myrtaceae	*Eucalyptus resinifera*	Red Mahogany		15	3	10	2				
Myrtaceae	*Eucalyptus siderophloia*	Grey Ironbark								1	1
Myrtaceae	*Leptospermum polygalifolium*	Tantoon						1	2	1	7
Myrtaceae	*Lophostemon confertus*	Brush Box		1	2	5	9	15	12	1	6
Myrtaceae	*Melaleuca linariifolia*	Flax-leaved Paperbark		2	5						
Myrtaceae	*Melaleuca styphelioides*	Prickly-leaved Tea Tree				1	1	1	1	1	1
Myrtaceae	*Sannantha angusta*			10	100	2	30	1	3	1	1

Family	Scientific Name	Common Name	Exotic	Plot 18 Cover	Plot 18 Abundance	Plot 25 Cover	Plot 25 Abundance	Plot 31 Cover	Plot 31 Abundance	Plot 36 Cover	Plot 36 Abundance
Myrtaceae	*Syncarpia glomulifera*	Turpentine		20	11	5	8	20	16	40	200
Orchidaceae	*Pterostylis* sp.	Greenhood						1	3		
Phormiaceae	*Dianella revoluta*	Blueberry Lily		1	50	1	50			1	12
Phormiaceae	*Dianella sp.*							1	4		
Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush		1	20			1	2	1	3
Phyllanthaceae	*Glochidion ferdinandi*	Cheese Tree								1	5
Pittosporaceae	*Billardiera scandens*	Hairy Apple Berry				1	2	1	1	1	5
Poaceae	*Digitaria diffusa*	Open Summer-grass				1	1	1	3		
Poaceae	*Entolasia marginata*	Bordered Panic		10	1000	3	1000	1	1		
Poaceae	*Entolasia stricta*	Wiry Panic		1	10	1	200	20	1000	2	200
Poaceae	*imperata cylindrica*	Blady Grass		1	100			1	50	1	50
Poaceae	*Oplismenus imbecillis*			7	1000	2	1000	3	100	1	100
Poaceae	*Ottochloa gracillima*							1	1		
Proteaceae	*Persoonia stradbrokensis*							1	5	1	2
Rubiaceae	*Morinda jasminoides*	Sweet Morinda		1	1						
Rutaceae	*Zieria* sp.					1	1				
Sapindaceae	*Dodonaea triquetra*	Large-leaf Hop-bush				1	1	1	2	1	5
Smilacaceae	*Smilax australis*	Lawyer Vine				1	3	1	1	1	1
Smilacaceae	*Smilax glyciphylla*	Sweet Sarsparilla		1	1						
Sterculiaceae	*Commersonia fraseri*	Brush Kurrajong				1	1				
Violaceae	*Hybanthus stellarioides*			1	1					1	2

Appendix Table 4 Norton biobank plant species recorded in vegetation zone 2

Family	Scientific Name	Common Name	Exotic	Plot 1 Cover	Plot 1 Abundance	Plot 41 Cover	Plot 41 Abundance	Plot 42 Cover	Plot 42 Abundance	Plot 47 Cover	Plot 47 Abundance
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower		1	20	1	8			1	4
Apocynaceae	*Parsonsia straminea*	Common Silkpod				1	1				
Casuarinaceae	*Allocasuarina littoralis*	Black She-Oak		1	30			5	15	25	80
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak				10	21				
Convolvulaceae	*Polymeria calycina*			1	2						
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge		1	50	2	100	1	20	1	25
Cyperaceae	*Ptilothrix deusta*			2	200	1	3	3	200	1	2
Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower		1	10	1	2	1	2	1	3
Dilleniaceae	*Hibbertia obtusifolia*	Hoary Guinea Flower						1	1		
Fabaceae (Faboideae)	*Glycine clandestina*	Twining glycine								1	1
Fabaceae (Faboideae)	*Gompholobium pinnatum*	Pinnate Wedge Pea						1	4		
Fabaceae (Faboideae)	*Hardenbergia violacea*	False Sarsaparilla		1	2						
Fabaceae (Faboideae)	*Jacksonia scoparia*	Dogwood		1	8						
Fabaceae (Faboideae)	*Pultenaea myrtoides*			1	1	1	1	1	30	1	1
Fabaceae (Faboideae)	*Dillwynia retorta*							1	2		
Fabaceae (Mimosoideae)	*Acacia binervata*	Two-veined Hickory						1	3		

Family	Scientific Name	Common Name	Exotic	Plot 1 Cover	Plot 1 Abundance	Plot 41 Cover	Plot 41 Abundance	Plot 42 Cover	Plot 42 Abundance	Plot 47 Cover	Plot 47 Abundance
Fabaceae (Mimosoideae)	*Acacia concurrens*	Curracabah		1	2						
Fabaceae (Mimosoideae)	*Acacia falcata*			1	2						
Goodeniaceae	*Dampiera sylvestris*					1	2			1	8
Goodeniaceae	*Goodenia ovata*	Hop Goodenia		1	20	1	10				
Goodeniaceae	*Velleia spathulata*							1	200		
Haloragaceae	*Gonocarpus tetragynus*	Poverty Raspwort		1	2	1	4	1	200		
Lauraceae	*Cassytha sp.*			1	4	1	7				
Lauraceae	*Cryptocarya microneura*	Murrogun								1	1
Lindsaeaceae	*Lindsaea microphylla*	Lacy Wedge Fern		1	4						
Lobeliaceae	*Pratia purpurascens*	Whiteroot		1	5	1	1				
Lomandraceae	*Lomandra filiformis*	Wattle Matt-rush						1	50		
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush		5	100					1	4
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush		1	2	3	17			1	7
Myrtaceae	*Corymbia gummifera*	Red Bloodwood		2	2	1	1	3	2	5	2
Myrtaceae	*Eucalyptus cameronii*	Diehard Stringybark				5	3	5	2	15	4
Myrtaceae	*Eucalyptus carnea*	Thick-leaved Mahogany		30	12			5	2		
Myrtaceae	*Eucalyptus pilularis*	Blackbutt								5	1
Myrtaceae	*Eucalyptus resinifera*	Red Mahogany				5	2			15	1
Myrtaceae	*Eucalyptus*	Narrow-leaved		3	3	5	4	3	4		

Family	Scientific Name	Common Name	Exotic	Plot 1 Cover	Plot 1 Abundance	Plot 41 Cover	Plot 41 Abundance	Plot 42 Cover	Plot 42 Abundance	Plot 47 Cover	Plot 47 Abundance
	seeana	Red Gum									
Myrtaceae	*Eucalyptus siderophloia*	Grey Ironbark		1	1						
Myrtaceae	*Leptospermum polygalifolium*	Tantoon				1	1	1	4		
Myrtaceae	*Melaleuca linariifolia*	Flax-leaved Paperbark				1	1				
Myrtaceae	*Melaleuca nodosa*			1	5			2	22	1	1
Myrtaceae	*Melaleuca sieberi*					1	1				
Myrtaceae	*Sannantha angusta*			1	1	2	12	1	1		
Myrtaceae	*Syncarpia glomulifera*	Turpentine		1	3						
Orchidaceae	*Dipodium* sp.					1	2				
Orchidaceae	*Themeda australis*	Kangaroo Grass		1	50						
Oxalidaceae	*Oxalis* sp.			1	1	1	4				
Phormiaceae	*Dianella caerulea*	Blue Flax-lily		1	50	1	50	1	1		
Pittosporaceae	*Billardiera scandens*	Hairy Apple Berry		1	3	1	7			1	3
Poaceae	*Aristida sp.*	A Wiregrass						1	100		
Poaceae	*Aristida vagans*	Threeawn Speargrass		1	6	1	1	1	20		
Poaceae	*Cymbopogon refractus*	Barbed Wire Grass						1	1		
Poaceae	*Digitaria diffusa*	Open Summer-grass						1	1		
Poaceae	*Digitaria parviflora*	Small-flowered Finger Grass		1	2						
Poaceae	*Echinopogon* sp.	A Hedgehog Grass		1	2						
Poaceae	*Entolasia stricta*	Wiry Panic		70	1000	80	1000	70	1000	70	100
Poaceae	*Eragrostis* sp.	A Lovegrass	*					1	10		

Family	Scientific Name	Common Name	Exotic	Plot 1 Cover	Plot 1 Abundance	Plot 41 Cover	Plot 41 Abundance	Plot 42 Cover	Plot 42 Abundance	Plot 47 Cover	Plot 47 Abundance
Poaceae	*imperata cylindrica*	Blady Grass		1	10	1	1			1	1
Poaceae	*Panicum simile*	Two-colour Panic								1	1
Poaceae	*Themeda australis*	Kangaroo Grass						1	50		
Poaceae	*Austrostipa pubescens*									1	9
Xanthorrhoeaceae	*Xanthorrhoea* sp.					1	1	5	200	15	100

Notes: Cover – visual estimate of foliage projective cover within the plot, recorded from 1–5% and then to the nearest 5%. Abundance - relative number of individuals or shoots of a species within the plot. Based on the following intervals: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, 1000. Counts above 20 are estimates only.

Appendix Table 5 Norton biobank plant species recorded in vegetation zones 3 and 4

Family	Scientific Name	Common Name	Exotic	Plot 21 Cover	Plot 21 Abundance	Plot 38 Cover	Plot 38 Abundance	Plot 39 Cover	Plot 39 Abundance	Plot 48 Cover	Plot 48 Abundance	Plot 49 Cover	Plot 49 Abundance
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower		1	50	1	50	1	40	1	1	1	50
Adiantaceae	*Cheilanthes sieberi*	Rock Fern		1	1								
Adiantaceae	*Cheilanthes* sp.	Cloak Fern, Mulga Fern, Rock Fern				1	15	1	4				
Apiaceae	*Centella asiatica*	Indian Pennywort		1	1					1	1000	1	100
Apiaceae	*Hydrocotyle sibthorpioides*									1	1000	1	100
Apocynaceae	*Marsdenia* sp.			1	1								
Apocynaceae	*Parsonsia straminea*	Common Silkpod								1	1	2	7
Asteraceae	*Ozothamnus diosmifolius*	White Dogwood				1	6						
Asteraceae	*Vernonia cinerea*			1	30	1	100	1	1	1	200	1	50
Casuarinaceae	*Allocasuarina littoralis*	Black She-Oak		25	20			3	10	1	2	10	6
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak				1	5	2	4				
Convolvulaceae	*Dichondra repens*	Kidney Weed								1	1000	1	200
Convolvulaceae	*Polymeria calycina*			1	30	1	3			1	100		
Cyperaceae	*Carex appressa*	Tall Sedge								2	25		
Cyperaceae	*Carex maculata*									15	1000		
Cyperaceae	*Cyperus* sp.			1	1								
Cyperaceae	*Fimbristylis dichotoma*	Common Fringe-sedge				1	2			1	1		

Family	Scientific Name	Common Name	Exotic	Plot 21 Cover	Plot 21 Abundance	Plot 38 Cover	Plot 38 Abundance	Plot 39 Cover	Plot 39 Abundance	Plot 48 Cover	Plot 48 Abundance	Plot 49 Cover	Plot 49 Abundance
Cyperaceae	*Gahnia sieberiana*	Red-fruit Saw-sedge										1	15
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge		2	50	2	50	1	50	1	1		
Cyperaceae	*Baumea rubiginosa*									1	50		
Cyperaceae	*Chorizandra cymbaria*											3	100
Fabaceae (Faboideae)	*Desmodium gunnii*	Slender Tick-trefoil						1	1				
Fabaceae (Faboideae)	*Desmodium varians*	Slender Tick-trefoil						1	3				
Fabaceae (Faboideae)	*Glycine microphylla*	Small-leaf Glycine		2	50								
Fabaceae (Faboideae)	*Glycine* sp.					1	3	1	7				
Fabaceae (Faboideae)	*Jacksonia scoparia*	Dogwood						1	1				
Fabaceae (Faboideae)	*Pultenaea retusa*					1	1						
Fabaceae (Mimosoideae)	*Acacia concurrens*	Curracabah		10	20	1	4	10	50				
Fabaceae (Mimosoideae)	*Acacia floribunda*	White Sally				1	2			1	7	2	3
Goodeniaceae	*Goodenia ovata*	Hop Goodenia				1	5	1	1				
Goodeniaceae	*Goodenia rotundifolia*			1	20								
Goodeniaceae	*Velleia spathulata*											1	100
Haloragaceae	*Gonocarpus* sp.	Raspwort		1	10								
Haloragaceae	*Gonocarpus tetragynus*	Poverty Raspwort				1	2			1	1	1	20
Lauraceae	*Cassytha* sp.			1	2								

Family	Scientific Name	Common Name	Exotic	Plot 21 Cover	Plot 21 Abundance	Plot 38 Cover	Plot 38 Abundance	Plot 39 Cover	Plot 39 Abundance	Plot 48 Cover	Plot 48 Abundance	Plot 49 Cover	Plot 49 Abundance
Lauraceae	*Cinnamomum camphora*	Camphor Laurel	*									1	1
Lobeliaceae	*Pratia purpurascens*	Whiteroot		1	20			1	1	1	1	1	3
Lomandraceae	*Lomandra filiformis*	Wattle Matt-rush				1	100						
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush		10	50	30	400	1	2	2	40	10	50
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry								1	1		
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush				1	2			15	14	2	3
Myrtaceae	*Corymbia variegata*			10	1	20	7	20	5				
Myrtaceae	*Eucalyptus cameronii*	Diehard Stringybark		5	1								
Myrtaceae	*Eucalyptus carnea*	Thick-leaved Mahogany				20	9	15	5				
Myrtaceae	*Eucalyptus microcorys*	Tallowwood		20	2								
Myrtaceae	*Eucalyptus propinqua*	Small-fruited Grey Gum		20	10								
Myrtaceae	*Eucalyptus siderophloia*	Grey Ironbark		10	1	2	2	5	3				
Myrtaceae	*Leptospermum polygalifolium*	Tantoon										1	8
Myrtaceae	*Lophostemon confertus*	Brush Box		10	20			1	1				
Myrtaceae	*Melaleuca linariifolia*	Flax-leaved Paperbark								14	4	25	9
Myrtaceae	*Sannantha angusta*							1	2	1	22	7	20
Myrtaceae	*Sannantha pluriflora*			10	30								

Family	Scientific Name	Common Name	Exotic	Plot 21 Cover	Plot 21 Abundance	Plot 38 Cover	Plot 38 Abundance	Plot 39 Cover	Plot 39 Abundance	Plot 48 Cover	Plot 48 Abundance	Plot 49 Cover	Plot 49 Abundance
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum								20	12	15	6
Oxalidaceae	*Oxalis sp.*			1	1	1	1			1	8	1	1
Phormiaceae	*Dianella caerulea*	Blue Flax-lily						1	2	1	3		
Phormiaceae	*Dianella longifolia*	Blueberry Lily		1	5								
Phormiaceae	*Dianella revoluta*	Blueberry Lily				1	1						
Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush		1	1					1	1		
Phyllanthaceae	*Glochidion ferdinandi*	Cheese Tree		1	5					1	1	1	1
Poaceae	*Andropogon virginicus*	Whisky Grass	*			1	5			1	1		
Poaceae	*Aristida vagans*	Threeawn Speargrass		2	50	1	20	1	3				
Poaceae	*Axonopus fissifolius*	Narrow-leafed Carpet Grass	*							1	5		
Poaceae	*Cymbopogon refractus*	Barbed Wire Grass		1	10	1	2	1	1	1	1		
Poaceae	*Dichelachne sp.*	A Plumegrass						1	1				
Poaceae	*Digitaria diffusa*	Open Summer-grass		2	30	1	2	1	2				
Poaceae	*Digitaria parviflora*	Small-flowered Finger Grass		3	50	1	4	1	3				
Poaceae	*Echinopogon* sp.	A Hedgehog Grass		1	20	1	1						
Poaceae	*Entolasia marginata*	Bordered Panic		15	100					1	1	1	100

Family	Scientific Name	Common Name	Exotic	Plot 21 Cover	Plot 21 Abundance	Plot 38 Cover	Plot 38 Abundance	Plot 39 Cover	Plot 39 Abundance	Plot 48 Cover	Plot 48 Abundance	Plot 49 Cover	Plot 49 Abundance
Poaceae	*Entolasia stricta*	Wiry Panic		30	500	30	1000	20	1000	5	1000	30	1000
Poaceae	*Eragrostis brownii*	Brown's Lovegrass		1	20								
Poaceae	*Eragrostis* sp.	A Lovegrass	*			1	10	1	1				
Poaceae	*imperata cylindrica*	Blady Grass		5	50			2	100				
Poaceae	*Ischaemum australe*									1	50	2	100
Poaceae	*Microlaena stipoides*	Weeping Grass								1	100	1	100
Poaceae	*Oplismenus aemulus*									1	2		
Poaceae	*Oplismenus imbecillis*											1	100
Poaceae	*Ottochloa gracillima*									5	1000		
Poaceae	*Panicum simile*	Two-colour Panic		1	20	1	12	1	3				
Poaceae	*Paspalum mandiocanum*	Broadleaf Paspalum	*									1	3
Poaceae	*Paspalum orbiculare*	Ditch Millet								1	2		
Poaceae	*Paspalum urvillei*	Vasey Grass	*							1	1		
Poaceae	*Sporobolus fertilis*	Giant Parramatta Grass	*			1	1						
Poaceae	*Themeda australis*	Kangaroo Grass		1	5			1	2	1	1	1	1
Proteaceae	*Lomatia silaifolia*	Crinkle Bush										1	1
Proteaceae	*Persoonia stradbrokensis*			1	1	1	5						
Rubiaceae	*Pomax*	Pomax						1	1				

Family	Scientific Name	Common Name	Exotic	Plot 21 Cover	Plot 21 Abundance	Plot 38 Cover	Plot 38 Abundance	Plot 39 Cover	Plot 39 Abundance	Plot 48 Cover	Plot 48 Abundance	Plot 49 Cover	Plot 49 Abundance
	umbellata												
Verbenaceae	*Lantana camara*	Lantana	*					1	1	1	3	1	2
Violaceae	*Hybanthus stellarioides*			1	2					1	3		

Notes: Cover – visual estimate of foliage projective cover within the plot, recorded from 1–5% and then to the nearest 5%. Abundance - relative number of individuals or shoots of a species within the plot. Based on the following intervals: 1, 2, 3, 4, 5, 6, 7, 8 9, 10, 20, 50, 100, 500, 1000. Counts above 20 are estimates only.

Appendix Table 6 Norton biobank plant species recorded in vegetation zones 5 and 6

Family	Scientific Name	Common Name	Exotic	Plot 27 Cover	Plot 27 Abundance	Plot 28 Cover	Plot 28 Abundance	Plot 30 Cover	Plot 30 Abundance	Plot 32 Cover	Plot 32 Abundance	Plot 33 Cover	Plot 33 Abundance
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower						1	50				
Apiaceae	*Centella asiatica*	Indian Pennywort						1	10			1	1
Apocynaceae	*Parsonsia straminea*	Common Silkpod								1	1		
Apocynaceae	*Tabernaemontana pandacaqui*	Banana Bush						1	2				
Araceae	*Gymnostachys anceps*	Settler's Twine						1	1				
Asteliaceae	*Cordyline stricta*	Narrow-leaved Palm Lily						1	2				
Asteraceae	*Ageratum houstonianum*		*	1	5								
Asteraceae	*Ambrosia artemisiifolia*	Annual Ragweed	*			2	1000						
Asteraceae	*Aster subulatus*	Wild Aster	*			1	100						
Asteraceae	*Baccharis halimifolia*	Groundsel Bush	*	1	2								
Asteraceae	*Bidens pilosa*	Cobbler's Pegs	*			1	1000						
Asteraceae	*Conyza* sp.	A Fleabane	*	1	8								
Asteraceae	*Hypochaeris radicata*	Catsear	*	2	100								
Asteraceae	*Senecio madagascariensis*	Fireweed	*	1	50								
Asteraceae	*Vernonia cinerea*											1	1
Commelinaceae	*Commelina cyanea*	Native Wandering Jew										1	100

Family	Scientific Name	Common Name	Exotic	Plot 27 Cover	Plot 27 Abundance	Plot 28 Cover	Plot 28 Abundance	Plot 30 Cover	Plot 30 Abundance	Plot 32 Cover	Plot 32 Abundance	Plot 33 Cover	Plot 33 Abundance
Convolvulaceae	*Dichondra repens*	Kidney Weed										1	1
Convolvulaceae	*Polymeria calycina*							1	10	1	2		
Cyperaceae	*Carex appressa*	Tall Sedge						1	2				
Cyperaceae	*Carex fascicularis*	Tassel Sedge								1	2		
Cyperaceae	*Carex maculata*							1	25	1	6	1	2
Cyperaceae	*Cyperus polystachyos*			1	500								
Cyperaceae	*Fimbristylis dichotoma*	Common Fringe-sedge		1	100								
Cyperaceae	*Gahnia sieberiana*	Red-fruit Saw-sedge								1	3		
Cyperaceae	*Gahnia* sp.							1	5				
Cyperaceae	*Schoenus apogon*	Fluke Bogrush		1	100								
Dennstaedtiaceae	*Hypolepis muelleri*	Harsh Ground Fern						5	100				
Dennstaedtiaceae	*Pteridium esculentum*	Bracken						3	50				
Dicksoniaceae	*Calochlaena dubia*	Rainbow Fern						1	5				
Dilleniaceae	*Hibbertia scandens*	Climbing Guinea Flower						1	1				
Dioscoreaceae	*Dioscorea transversa*	Native Yam						1	20				
Fabaceae (Faboideae)	*Crotalaria* sp.		*			1	200						
Fabaceae (Faboideae)	*Daviesia ulicifolia*	Gorse Bitter Pea				1	1						
Fabaceae (Faboideae)	*Desmodium varians*	Slender Tick-trefoil		1	1					1	1		

Family	Scientific Name	Common Name	Exotic	Plot 27 Cover	Plot 27 Abundance	Plot 28 Cover	Plot 28 Abundance	Plot 30 Cover	Plot 30 Abundance	Plot 32 Cover	Plot 32 Abundance	Plot 33 Cover	Plot 33 Abundance
Fabaceae (Faboideae)	*glycine cyrtoloba*											1	50
Fabaceae (Faboideae)	*Glycine* sp.					1	1	1	1				
Fabaceae (Faboideae)	*Hardenbergia violacea*	False Sarsaparilla				1	2						
Fabaceae (Faboideae)	*Kennedia rubicunda*	Dusky Coral Pea				1	1						
Fabaceae (Faboideae)	*Macroptilium atropurpureum*	Siratro	*			1	100						
Fabaceae (Faboideae)	*Pultenaea retusa*			1	2								
Fabaceae (Mimosoideae)	*Acacia binervata*	Two-veined Hickory		1	2					1	1		
Fabaceae (Mimosoideae)	*Acacia concurrens*	Curracabah		2	50	1	4						
Fabaceae (Mimosoideae)	*Acacia falcata*					1	20						
Fabaceae (Mimosoideae)	*Acacia floribunda*	White Sally						1	2	5	50	20	30
Fabaceae (Mimosoideae)	*Acacia irrorata*	Green Wattle										1	1
Fabaceae (Mimosoideae)	*Acacia* sp.	Wattle				1	3						
Geraniaceae	*Geranium solanderi*	Native Geranium										1	2
Goodeniaceae	*Velleia spathulata*			1	100								
Haloragaceae	*Gonocarpus chinensis* subsp. *verrucosus*			1	500								

Family	Scientific Name	Common Name	Exotic	Plot 27 Cover	Plot 27 Abundance	Plot 28 Cover	Plot 28 Abundance	Plot 30 Cover	Plot 30 Abundance	Plot 32 Cover	Plot 32 Abundance	Plot 33 Cover	Plot 33 Abundance
Haloragaceae	*Gonocarpus tetragynus*	Poverty Raspwort						1	1				
Juncaceae	*Juncus cognatus*		*	1	1							1	4
Juncaceae	*Juncus* sp.	A Rush								1	10		
Lauraceae	*Cinnamomum camphora*	Camphor Laurel	*							1	1		
Lauraceae	*Cryptocarya microneura*	Murrogun								1	2	1	1
Lobeliaceae	*Pratia purpurascens*	Whiteroot		1	20			1	10			1	100
Loganiaceae	*Mitrasacme alsinoides*			1	100								
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry								1	1		
Meliaceae	*Synoum glandulosum subsp. glandulosum*	Scentless Rosewood						1	1				
Myrsinaceae	*Myrsine howittiana*	Brush Muttonwood										1	1
Myrtaceae	*Acmena smithii*	Lilly Pilly						1	1			1	1
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush						1	2	3	4	5	3
Myrtaceae	*Corymbia intermedia*	Pink Bloodwood		1	5								
Myrtaceae	*Eucalyptus cameronii*	Diehard Stringybark						25	3	1	1		
Myrtaceae	*Eucalyptus grandis*	Flooded Gum						25	3	25	9	35	11
Myrtaceae	*Eucalyptus signata*	Scribbly Gum								2	2		
Myrtaceae	*Leptospermum polygalifolium*	Tantoon								5	50		
Myrtaceae	*Melaleuca linariifolia*	Flax-leaved						10	9	5	11	10	8

Family	Scientific Name	Common Name	Exotic	Plot 27 Cover	Plot 27 Abundance	Plot 28 Cover	Plot 28 Abundance	Plot 30 Cover	Plot 30 Abundance	Plot 32 Cover	Plot 32 Abundance	Plot 33 Cover	Plot 33 Abundance
		Paperbark											
Myrtaceae	*Melaleuca quinquenervia*	Broad-leaved Paperbark		1	1								
Myrtaceae	*Melaleuca styphelioides*	Prickly-leaved Tea Tree										1	4
Myrtaceae	*Sannantha angusta*			20	100			10	50	60	500	2	25
Myrtaceae	*Syncarpia glomulifera*	Turpentine						7	2				
Phormiaceae	*Dianella revoluta*	Blueberry Lily						1	20				
Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush										1	1
Phyllanthaceae	*Glochidion ferdinandi*	Cheese Tree						1	2				
Pittosporaceae	*Billardiera scandens*	Hairy Apple Berry						1	6	1	20	1	2
Poaceae	*Andropogon virginicus*	Whisky Grass	*	50	1000								
Poaceae	*Axonopus fissifolius*	Narrow-leafed Carpet Grass	*	30	1000	1	50						
Poaceae	*Cynodon dactylon*	Common Couch				10	1000						
Poaceae	*Echinopogon* sp.	A Hedgehog Grass										1	1
Poaceae	*Entolasia marginata*	Bordered Panic						5	1000	1	50	2	100
Poaceae	*Entolasia stricta*	Wiry Panic						1	100	1	100		
Poaceae	*Eragrostis leptostachya*	Paddock Lovegrass		1	50								
Poaceae	*Oplismenus*											1	100

Family	Scientific Name	Common Name	Exotic	Plot 27 Cover	Plot 27 Abundance	Plot 28 Cover	Plot 28 Abundance	Plot 30 Cover	Plot 30 Abundance	Plot 32 Cover	Plot 32 Abundance	Plot 33 Cover	Plot 33 Abundance
	aemulus												
Poaceae	*Oplismenus imbecillis*							5	1000				
Poaceae	*Ottochloa gracillima*							30	1000			50	1000
Poaceae	*Paspalum mandiocanum*	Broadleaf Paspalum	*	1	10	2	100					1	50
Poaceae	*Paspalum notatum*	Bahia Grass	*			1	10						
Poaceae	*Paspalum orbiculare*	Ditch Millet				1	2						
Poaceae	*Paspalum urvillei*	Vasey Grass	*	10	200	1	100						
Poaceae	*Sacciolepis indica*	Indian Cupscale Grass		1	100								
Poaceae	*Setaria sphacelata*	South African Pigeon Grass	*	1	10	1	200					1	70
Poaceae	*Sporobolus fertilis*	Giant Parramatta Grass	*			1	10						
Proteaceae	*Persoonia stradbrokensis*			1	2								
Rubiaceae	*Morinda jasminoides*	Sweet Morinda								1	2		
Rutaceae	*Acronychia oblongifolia*	White Aspen						1	1				
Rutaceae	*Citrus* sp.		*	1	4								
Verbenaceae	*Lantana camara*	Lantana	*									1	2
Verbenaceae	*Verbena bonariensis*	Purpletop	*	1	1	1	3						
Violaceae	*Viola hederacea*	Ivy-leaved Violet						1	10				
Xyridaceae	*Xyris juncea*	Dwarf Yellow-eye		1	50								

Notes: Cover – visual estimate of foliage projective cover within the plot, recorded from 1–5% and then to the nearest 5%. Abundance - relative number of individuals or shoots of a species within the plot. Based on the following intervals: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, 1000. Counts above 20 are estimates only.

Appendix Table 7 Norton biobank plant species recorded in vegetation zone 7

Family	Scientific Name	Common Name	Exotic	Plot 34 Cover	Plot 34 Abundance	Plot 44 Cover	Plot 44 Abundance	Plot 45 Cover	Plot 45 Abundance	Plot 47 Cover	Plot 47 Abundance
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower		1	10	1	200	1	200	1	4
Araliaceae	*Polyscias sambucifolia*	Elderberry Panax		1	2	1	1	1	3		
Asteraceae	*Vernonia cinerea*			1	2	1	50				
Bignoniaceae	*Pandorea pandorana*	Wonga Wonga Vine		1	2						
Casuarinaceae	*Allocasuarina littoralis*	Black She-Oak								25	80
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak		2	15						
Convolvulaceae	*Polymeria calycina*			1	5			1	3		
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge		1	1	5	200	2	100	1	25
Cyperaceae	*Ptilothrix deusta*							1	1	1	2
Dennstaedtiaceae	*Pteridium esculentum*	Bracken				1	3	1	7		
Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower		1	100	1	3	1	200	1	3
Dilleniaceae	*Hibbertia diffusa*	Wedge Guinea Flower		1	50						
Dilleniaceae	*Hibbertia vestita*					1	50				
Ericaceae	*Monotoca scoparia*			1	4						
Fabaceae (Faboideae)	*Bossiaea rhombifolia*			1	4						
Fabaceae (Faboideae)	*Desmodium varians*	Slender Tick-trefoil		1	2	1	2				
Fabaceae (Faboideae)	*Glycine clandestina*	Twining glycine		1	50	1	7			1	1
Fabaceae (Faboideae)	*Glycine* sp.			1	50						
Fabaceae (Faboideae)	*Gompholobium pinnatum*	Pinnate Wedge Pea				1	4				
Fabaceae (Faboideae)	*Hardenbergia violacea*	False Sarsaparilla						1	1		

Family	Scientific Name	Common Name	Exotic	Plot 34 Cover	Plot 34 Abundance	Plot 44 Cover	Plot 44 Abundance	Plot 45 Cover	Plot 45 Abundance	Plot 47 Cover	Plot 47 Abundance
Fabaceae (Faboideae)	*Pultenaea myrtoides*									1	1
Fabaceae (Faboideae)	*Pultenaea retusa*			1	3						
Fabaceae (Mimosoideae)	*Acacia binervata*	Two-veined Hickory				2	20	5	15		
Fabaceae (Mimosoideae)	*Acacia concurrens*	Curracabah		1	6	1	1				
Fabaceae (Mimosoideae)	*Acacia floribunda*	White Sally		1	1						
Fabaceae (Mimosoideae)	*Acacia irrorata*	Green Wattle		1	2						
Goodeniaceae	*Dampiera sylvestris*					1	50	1	20	1	8
Goodeniaceae	*Goodenia ovata*	Hop Goodenia				1	1				
Haloragaceae	*Gonocarpus tetragynus*	Poverty Raspwort		1	3	1	1				
Iridaceae	*Patersonia sericea*	Silky Purple-Flag				1	1				
Lauraceae	*Cassytha* sp.					1	1	1	2		
Lauraceae	*Cinnamomum camphora*	Camphor Laurel	*	1	1						
Lauraceae	*Cryptocarya microneura*	Murrogun								1	1
Lindsaeaceae	*Lindsaea microphylla*	Lacy Wedge Fern		1	2						
Lobeliaceae	*Pratia purpurascens*	Whiteroot				1	1				
Lomandraceae	*Lomandra filiformis*	Wattle Matt-rush		1	2						
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush		3	50	1	20			1	4
Lomandraceae	*Lomandra multiflora* subsp. *multiflora*	Many-flowered Mat-rush		1	1						
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry		1	2						
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush		1	1	1	1	1	3	1	7
Myrtaceae	*Corymbia gummifera*	Red Bloodwood				1	2	1	1	5	2

Family	Scientific Name	Common Name	Exotic	Plot 34 Cover	Plot 34 Abundance	Plot 44 Cover	Plot 44 Abundance	Plot 45 Cover	Plot 45 Abundance	Plot 47 Cover	Plot 47 Abundance
Myrtaceae	*Eucalyptus cameronii*	Diehard Stringybark		2	1	5	2	4	1	15	4
Myrtaceae	*Eucalyptus microcorys*	Tallowwood		5	1	10	2	4	1		
Myrtaceae	*Eucalyptus pilularis*	Blackbutt		20	2	20	3	15	2	5	1
Myrtaceae	*Eucalyptus resinifera*	Red Mahogany		5	1					15	1
Myrtaceae	*Leptospermum polygalifolium*	Tantoon				1	1				
Myrtaceae	*Lophostemon confertus*	Brush Box		1	5						
Myrtaceae	*Melaleuca nodosa*									1	1
Myrtaceae	*Melaleuca sieberi*					1	1	5	35		
Myrtaceae	*Sannantha angusta*					1	1	1	2		
Myrtaceae	*Syncarpia glomulifera*	Turpentine		2	9	5	14	10	19		
Oleaceae	*Notelaea ovata*							1	3		
Orchidaceae	*Pterostylis* sp.	Greenhood				1	2	1	20		
Phormiaceae	*Dianella caerulea*	Blue Flax-lily		1	10			1	2		
Pittosporaceae	*Billardiera scandens*	Hairy Apple Berry		1	1	1	2	1	3	1	3
Poaceae	*Cymbopogon refractus*	Barbed Wire Grass		1	10						
Poaceae	*Digitaria diffusa*	Open Summer-grass		1	1						
Poaceae	*Digitaria parviflora*	Small-flowered Finger Grass						1	1		
Poaceae	*Entolasia stricta*	Wiry Panic		5	200	30	1000	50	1000	70	100
Poaceae	*Eragrostis* sp.	A Lovegrass	*			1	1				
Poaceae	*imperata cylindrica*	Blady Grass		20	1000	20	1000	5	100	1	1
Poaceae	*Ischaemum australe*							1	2		
Poaceae	*Panicum simile*	Two-colour Panic								1	1
Poaceae	*Themeda australis*	Kangaroo Grass				2	100				
Poaceae	*Austrostipa*									1	9

Family	Scientific Name	Common Name	Exotic	Plot 34 Cover	Plot 34 Abundance	Plot 44 Cover	Plot 44 Abundance	Plot 45 Cover	Plot 45 Abundance	Plot 47 Cover	Plot 47 Abundance
	pubescens										
Proteaceae	*Lomatia silaifolia*	Crinkle Bush		1	4			1	13		
Proteaceae	*Persoonia stradbrokensis*			1	1	1	3	1	3		
Violaceae	*Hybanthus stellarioides*					1	1				
Xanthorrhoeaceae	*Xanthorrhoea* sp.									15	100

Notes: Cover – visual estimate of foliage projective cover within the plot, recorded from 1–5% and then to the nearest 5%. Abundance - relative number of individuals or shoots of a species within the plot. Based on the following intervals: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, 1000. Counts above 20 are estimates only.

Appendix Table 8 Norton biobank plant species recorded in vegetation zone 8

Family	Scientific Name	Common Name	Exotic	Plot 4 Cover	Plot 4 Abundance	Plot 29 Cover	Plot 29 Abundance	Plot 37 Cover	Plot 37 Abundance	Plot 43 Cover	Plot 43 Abundance	Plot 50 Cover	Plot 50 Abundance
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower		1	50	1	200	1	50	1	3	1	100
Adiantaceae	*Adiantum aethiopicum*	Common Maidenhair								1	1	1	10
Adiantaceae	*Cheilanthes* sp.	Cloak Fern										1	1
Apiaceae	*Centella asiatica*	Indian Pennywort				1	1						
Apocynaceae	*Parsonsia straminea*	Common Silkpod		1	1	1	1					1	2
Apocynaceae	*Tabernaemontana pandacaqui*	Banana Bush								1	1		
Araceae	*Gymnostachys anceps*	Settler's Twine		1	1					1	1	1	2
Araliaceae	*Polyscias sambucifolia*	Elderberry Panax		1	3							1	1
Asteraceae	*Vernonia cinerea*			1	1								
Bignoniaceae	*Pandorea pandorana*	Wonga Wonga Vine						1	1	1	1	1	4
Casuarinaceae	*Allocasuarina littoralis*	Black She-Oak				2	2					1	2
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak						1	20	1	2		
Convolvulaceae	*Dichondra repens*	Kidney Weed								1	1		
Convolvulaceae	*Polymeria calycina*					1	2			1	6	1	1
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge		1	50			2	100	1	3		
Dennstaedtiaceae	*Hypolepis muelleri*	Harsh Ground Fern								1	2		
Dennstaedtiaceae	*Pteridium esculentum*	Bracken		1	10	1	5	1	5	1	3	1	1
Dicksoniaceae	*Calochlaena dubia*	Rainbow Fern										2	100
Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower		1	11								
Dilleniaceae	*Hibbertia scandens*	Climbing Guinea Flower				1	2			1	4	1	3

Family	Scientific Name	Common Name	Exotic	Plot 4 Cover	Plot 4 Abundance	Plot 29 Cover	Plot 29 Abundance	Plot 37 Cover	Plot 37 Abundance	Plot 43 Cover	Plot 43 Abundance	Plot 50 Cover	Plot 50 Abundance
Dilleniaceae	*Hibbertia vestita*							1	30				
Dioscoreaceae	*Dioscorea transversa*	Native Yam								1	1	1	4
Fabaceae (Faboideae)	*Desmodium gunnii*	Slender Tick-trefoil				1	50						
Fabaceae (Faboideae)	*Desmodium varians*	Slender Tick-trefoil		1	1			1	3			1	2
Fabaceae (Faboideae)	*Glycine clandestina*	Twining glycine										1	3
Fabaceae (Faboideae)	*Glycine* sp.			1	6	1	2	1	10	1	6		
Fabaceae (Mimosoideae)	*Acacia binervata*	Two-veined Hickory		1	2	1	2						
Fabaceae (Mimosoideae)	*Acacia floribunda*	White Sally		1	2	5	4	1	13	1	4		
Fabaceae (Mimosoideae)	*Acacia irrorata*	Green Wattle		1	1	5	4	1	5	1	1		
Goodeniaceae	*Dampiera sylvestris*							1	11				
Goodeniaceae	*Goodenia rotundifolia*							1	8				
Haloragaceae	*Gonocarpus tetragynus*	Poverty Raspwort						1	1				
Iridaceae	*Patersonia sericea*	Silky Purple-Flag						1	5			1	2
Lauraceae	*Cassytha* sp.					1	10						
Lauraceae	*Cinnamomum camphora*	Camphor Laurel	*	1	3								
Lauraceae	*Cryptocarya microneura*	Murrogun				1	10						
Lindsaeaceae	*Lindsaea microphylla*	Lacy Wedge Fern						1	5				
Lobeliaceae	*Pratia purpurascens*	Whiteroot		1	1					1	4	1	20
Lomandraceae	*Lomandra filiformis*	Wattle Matt-rush						1	2				
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush		1	5	5	200	2	50	1	8	5	100
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry		1	25	1	3	1	3	1	4	1	7

Family	Scientific Name	Common Name	Exotic	Plot 4 Cover	Plot 4 Abundance	Plot 29 Cover	Plot 29 Abundance	Plot 37 Cover	Plot 37 Abundance	Plot 43 Cover	Plot 43 Abundance	Plot 50 Cover	Plot 50 Abundance
Meliaceae	*Synoum glandulosum* subsp. *glandulosum*	Scentless Rosewood				1	1						
Myrtaceae	*Acmena smithii*	Lilly Pilly								1	2	1	3
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush		1	3	1	5	1	20	1	7	1	6
Myrtaceae	*Corymbia intermedia*	Pink Bloodwood		1	2			1	1	2	4	2	1
Myrtaceae	*Eucalyptus cameronii*	Diehard Stringybark				15	3						
Myrtaceae	*Eucalyptus microcorys*	Tallowwood		10	2	1	1			1	2		
Myrtaceae	*Eucalyptus pilularis*	Blackbutt		30	2	15	2	30	3	30	3	30	3
Myrtaceae	*Eucalyptus resinifera*	Red Mahogany				1	1						
Myrtaceae	*Eucalyptus seeana*	Narrow-leaved Red Gum								1	1		
Myrtaceae	*Leptospermum polygalifolium*	Tantoon		1	10	10	100	2	20			1	1
Myrtaceae	*Leptospermum trinervium*	Slender Tea-tree						1	3				
Myrtaceae	*Lophostemon confertus*	Brush Box						1	4	1	5		
Myrtaceae	*Melaleuca linariifolia*	Flax-leaved Paperbark								2	1		
Myrtaceae	*Melaleuca styphelioides*	Prickly-leaved Tea Tree						1	3				
Myrtaceae	*Sannantha angusta*			1	20	10	100	15	100	10	50	7	42
Myrtaceae	*Syncarpia glomulifera*	Turpentine		20	70			20	100	30	70	30	31
Orchidaceae	*Pterostylis* sp.	Greenhood						1	1	1	2	1	1
Phormiaceae	*Dianella caerulea*	Blue Flax-lily		1	1					1	15		
Phormiaceae	*Dianella revoluta*	Blueberry Lily				1	100						
Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush								1	1	1	1
Pittosporaceae	*Billardiera scandens*	Hairy Apple Berry		1	5	1	4	1	6	1	5		
Poaceae	*Digitaria diffusa*	Open Summer-grass				1	1						

Family	Scientific Name	Common Name	Exotic	Plot 4 Cover	Plot 4 Abundance	Plot 29 Cover	Plot 29 Abundance	Plot 37 Cover	Plot 37 Abundance	Plot 43 Cover	Plot 43 Abundance	Plot 50 Cover	Plot 50 Abundance
Poaceae	*Digitaria parviflora*	Small-flowered Finger Grass								1	3		
Poaceae	*Entolasia marginata*	Bordered Panic				1	50			2	100	3	200
Poaceae	*Entolasia stricta*	Wiry Panic		2	100	5	500	10	1000	10	500	5	100
Poaceae	*imperata cylindrica*	Blady Grass		2	200	1	50	1	20	1	25	2	200
Poaceae	*Oplismenus aemulus*			1	2	1	100						
Poaceae	*Oplismenus imbecillis*							1	50			1	100
Poaceae	*Ottochloa gracillima*									20	200		
Poaceae	*Paspalidium distans*					1	10						
Poaceae	*Themeda australis*	Kangaroo Grass						1	1				
Proteaceae	*Persoonia stradbrokensis*			1	5			1	3	1	1		
Rubiaceae	*Morinda jasminoides*	Sweet Morinda										1	1
Rubiaceae	*Pomax umbellata*	Pomax		1	1			1	5				
Sapindaceae	*Dodonaea triquetra*	Large-leaf Hop-bush								1	5		
Sterculiaceae	*Commersonia fraseri*	Brush Kurrajong								1	1		
Verbenaceae	*Lantana camara*	Lantana	*									1	2
Violaceae	*Hybanthus stellarioides*					1	10			1	10	1	1
Xanthorrhoeaceae	*Xanthorrhoea macronema*											1	6
Xanthorrhoeaceae	*Xanthorrhoea* sp.							1	1				

Notes: Cover – visual estimate of foliage projective cover within the plot, recorded from 1–5% and then to the nearest 5%. Abundance - relative number of individuals or shoots of a species within the plot. Based on the following intervals: 1, 2, 3, 4, 5, 6, 7, 8, 9,10, 20, 50, 100, 500, 1000. Counts above 20 are estimates only.

Appendix Table 9 Norton biobank plant species recorded in vegetation zone 9

Family	Scientific Name	Common Name	Exotic	Plot 3 Cover	Plot 3 Abundance	Plot 20 Cover	Plot 20 Abundance	Plot 23 Cover	Plot 23 Abundance	Plot 24 Cover	Plot 24 Abundance	Plot 26 Cover	Plot 26 Abundance	Plot 40 Cover	Plot 40 Abundance
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower		1	20	1	20	1	20	1	100	1	2	1	4
Araliaceae	*Polyscias sambucifolia*	Elderberry Panax				1	4	1	6						
Asteraceae	*Vernonia cinerea*					1	3								
Bignoniaceae	*Pandorea pandorana*	Wonga Wonga Vine				1	1			1	2				
Casuarinaceae	*Allocasuarina littoralis*	Black She-Oak		20	70	1	3			4	18			20	400
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak				2	8	3	20			1	1		
Convolvulaceae	*Polymeria calycina*					1	10			1	100			1	50
Cyperaceae	*Carex maculata*					1	1								
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge		1	50	1	100	2	100	2	50	3	100	2	100
Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower		1	3	1	20	1	1	1	1			1	2
Dilleniaceae	*Hibbertia diffusa*	Wedge Guinea Flower						1	20						
Fabaceae (Faboideae)	*Desmodium gunnii*	Slender Tick-trefoil						1	3			1	1		
Fabaceae (Faboideae)	*Desmodium varians*	Slender Tick-trefoil						1	6			1	20		
Fabaceae (Faboideae)	*Glycine clandestina*	Twining glycine				1	5	1	6	1	1	1	50	1	2
Fabaceae (Faboideae)	*glycine cyrtoloba*											1	5		
Fabaceae (Faboideae)	*Hardenbergia violacea*	False Sarsaparilla				1	1								

Family	Scientific Name	Common Name	Exotic	Plot 3 Cover	Plot 3 Abundance	Plot 20 Cover	Plot 20 Abundance	Plot 23 Cover	Plot 23 Abundance	Plot 24 Cover	Plot 24 Abundance	Plot 26 Cover	Plot 26 Abundance	Plot 40 Cover	Plot 40 Abundance
Fabaceae (Faboideae)	*Jacksonia scoparia*	Dogwood						1	3						
Fabaceae (Faboideae)	*Pultenaea retusa*			1	1			1	2						
Fabaceae (Faboideae)	*Pultenaea villosa*	Hairy Bush-pea						1	1						
Fabaceae (Mimosoideae)	*Acacia concurrens*	Curracabah		1	1	1	6	3	13	1	15	2	10	1	11
Fabaceae (Mimosoideae)	*Acacia floribunda*	White Sally		1	3							1	4		
Goodeniaceae	*Goodenia ovata*	Hop Goodenia		1	2					1	3				
Goodeniaceae	*Goodenia rotundifolia*					1	2								
Haloragaceae	*Gonocarpus* sp.	Raspwort				1	1								
Haloragaceae	*Gonocarpus tetragynus*	Poverty Raspwort								1	1				
Lauraceae	*Cassytha* sp.									1	10				
Lauraceae	*Cinnamomum camphora*	Camphor Laurel	*					1	1			1	1		
Lindsaeaceae	*Lindsaea microphylla*	Lacy Wedge Fern				1	10								
Lobeliaceae	*Pratia purpurascens*	Whiteroot								1	1			1	1
Lomandraceae	*Lomandra filiformis*	Wattle Matt-rush				1	5			1	5	1	20	1	12
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush		1	3	2	100	5	100	30	400	5	200	1	1
Lomandraceae	*Lomandra multiflora subsp. multiflora*	Many-flowered Mat-rush		1	2	1	20			1	1				
Lomandracea	*Lomandra* sp.	Mat-rush						1	20						

Family	Scientific Name	Common Name	Exotic	Plot 3 Cover	Plot 3 Abundance	Plot 20 Cover	Plot 20 Abundance	Plot 23 Cover	Plot 23 Abundance	Plot 24 Cover	Plot 24 Abundance	Plot 26 Cover	Plot 26 Abundance	Plot 40 Cover	Plot 40 Abundance
e															
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry				1	6	1	5			1	30		
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush		1	1					1	6				
Myrtaceae	*Corymbia gummifera*	Red Bloodwood								10	4			2	3
Myrtaceae	*Corymbia intermedia*	Pink Bloodwood				3	2	1	3			2	1		
Myrtaceae	*Corymbia variegata*			10	3									3	1
Myrtaceae	*Eucalyptus cameronii*	Diehard Stringybark				4	2	2	1	5	3	5	3	1	1
Myrtaceae	*Eucalyptus carnea*	Thick-leaved Mahogany		1	2	4	2	10	4						
Myrtaceae	*Eucalyptus globoidea*	White Stringybark				2	1					10	2		
Myrtaceae	*Eucalyptus microcorys*	Tallowwood				10	2	10	1	1	1				
Myrtaceae	*Eucalyptus pilularis*	Blackbutt										2	1		
Myrtaceae	*Eucalyptus propinqua*	Small-fruited Grey Gum										20	4		
Myrtaceae	*Eucalyptus seeana*	Narrow-leaved Red Gum		5	4									6	4
Myrtaceae	*Eucalyptus siderophloia*	Grey Ironbark		3	5	7	2	5	3	10	2			3	2
Myrtaceae	*Leptospermum polygalifolium*	Tantoon				2	7								
Myrtaceae	*Lophostemon confertus*	Brush Box				5	20			3	8			1	7
Myrtaceae	*Melaleuca sieberi*			2	16										
Myrtaceae	*Melaleuca styphelioides*	Prickly-leaved Tea								1	2				

Family	Scientific Name	Common Name	Exotic	Plot 3 Cover	Plot 3 Abundance	Plot 20 Cover	Plot 20 Abundance	Plot 23 Cover	Plot 23 Abundance	Plot 24 Cover	Plot 24 Abundance	Plot 26 Cover	Plot 26 Abundance	Plot 40 Cover	Plot 40 Abundance
		Tree													
Myrtaceae	*Sannantha angusta*			1	7	1	8			2	23	1	3	1	5
Myrtaceae	*Syncarpia glomulifera*	Turpentine						2	8						
Oleaceae	*Notelaea ovata*											1	3	1	1
Oxalidaceae	*Oxalis* sp.					1	5			1	1				
Phormiaceae	*Dianella caerulea*	Blue Flax-lily		1	1	1	50			1	50	1	10	1	5
Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush								1	7	1	5		
Phyllanthaceae	*Glochidion ferdinandi*	Cheese Tree										1	2		
Pittosporaceae	*Billardiera scandens*	Hairy Apple Berry				1	2	1	3			1	1		
Poaceae	*Aristida vagans*	Threeawn Speargrass										1	5		
Poaceae	*Cymbopogon refractus*	Barbed Wire Grass				1	3					1	6		
Poaceae	*Digitaria diffusa*	Open Summer-grass						1	20					1	4
Poaceae	*Digitaria parviflora*	Small-flowered Finger Grass		1	5										
Poaceae	*Entolasia marginata*	Bordered Panic				1	100								
Poaceae	*Entolasia stricta*	Wiry Panic		50	1000	10	1000	10	1000	20	1000	30	1000	60	1000
Poaceae	*Eragrostis leptostachya*	Paddock Lovegrass						1	3			1	5		
Poaceae	*imperata cylindrica*	Blady Grass				1	100	1	100	1	20	20	1000		
Poaceae	*Ischaemum australe*			1	2										

Family	Scientific Name	Common Name	Exotic	Plot 3 Cover	Plot 3 Abundance	Plot 20 Cover	Plot 20 Abundance	Plot 23 Cover	Plot 23 Abundance	Plot 24 Cover	Plot 24 Abundance	Plot 26 Cover	Plot 26 Abundance	Plot 40 Cover	Plot 40 Abundance
Poaceae	*Microlaena stipoides*	Weeping Grass		1	5										
Poaceae	*Panicum simile*	Two-colour Panic		1	1	1	10	1	5					1	1
Poaceae	*Paspalum mandiocanum*	Broadleaf Paspalum	*									1	50		
Poaceae	*Setaria sphacelata*	South African Pigeon Grass	*									1	3		
Poaceae	*Themeda australis*	Kangaroo Grass		1	1							1	1		
Proteaceae	*Lomatia silaifolia*	Crinkle Bush						1	10						
Proteaceae	*Persoonia stradbrokensis*							1	1	1	1	1	1		
Rubiaceae	*Pomax umbellata*	Pomax						1	30						
Sapindaceae	*Dodonaea triquetra*	Large-leaf Hop-bush								1	8				
Thymelaeaceae	*Pimelea linifolia*	Slender Rice Flower										1	2		
Verbenaceae	*Lantana camara*	Lantana	*									1	6		
Violaceae	*Hybanthus stellarioides*													1	1
Xanthorrhoeaceae	*Xanthorrhoea macronema*							2	30						

Notes: Cover – visual estimate of foliage projective cover within the plot, recorded from 1–5% and then to the nearest 5%. Abundance - relative number of individuals or shoots of a species within the plot. Based on the following intervals: 1, 2, 3, 4, 5, 6, 7, 8, 9,10, 20, 50, 100, 500, 1000. Counts above 20 are estimates only.

Appendix Table 10 Norton biobank plant species recorded in vegetation zone 10

Family	Scientific Name	Common Name	Exotic	Plot 5 Cover	Plot 5 Abundance	Plot 6 Cover	Plot 6 Abundance	Plot 16 Cover	Plot 16 Abundance	Plot 19 Cover	Plot 19 Abundance	Plot 35 Cover	Plot 35 Abundance	Plot 51 Cover	Plot 51 Abundance
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower		1	30	1	5	1	2	1	4	1	30	1	20
Apocynaceae	*Parsonsia straminea*	Common Silkpod		1	4										
Araliaceae	*Polyscias sambucifolia*	Elderberry Panax		1	1	1	1	1	1						
Asteraceae	*Ozothamnus diosmifolius*	White Dogwood		1	2										
Asteraceae	*Vernonia cinerea*			1	1										
Casuarinaceae	*Allocasuarina littoralis*	Black She-Oak						20	70	20	50	15	25	3	35
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak		10	20										
Convolvulaceae	*Polymeria calycina*									1	2			1	3
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge		1	30	2	400	1	5	1	50	5	200	1	10
Cyperaceae	*Ptilothrix deusta*									2	100				
Dennstaedtiaceae	*Pteridium esculentum*	Bracken		1	2	1	20			1	1			30	1000
Dicksoniaceae	*Calochlaena dubia*	Rainbow Fern						1	10						
Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower		1	10			2	100	1	50	1	7	1	2
Dilleniaceae	*Hibbertia diffusa*	Wedge Guinea Flower				1	8								
Dilleniaceae	*Hibbertia scandens*	Climbing Guinea Flower												1	1
Dilleniaceae	*Hibbertia vestita*					1	20	1	50	1	1			1	6

Family	Scientific Name	Common Name	Exotic	Plot 5 Cover	Plot 5 Abundance	Plot 6 Cover	Plot 6 Abundance	Plot 16 Cover	Plot 16 Abundance	Plot 19 Cover	Plot 19 Abundance	Plot 35 Cover	Plot 35 Abundance	Plot 51 Cover	Plot 51 Abundance
Ericaceae	*Monotoca scoparia*							1	5						
Fabaceae (Faboideae)	*Daviesia genistifolia*	Broom Bitter Pea								1	1				
Fabaceae (Faboideae)	*Desmodium varians*	Slender Tick-trefoil				1	1					1	1		
Fabaceae (Faboideae)	*Glycine clandestina*	Twining glycine								1	1				
Fabaceae (Faboideae)	*Glycine* sp.					1	1	1	1						
Fabaceae (Faboideae)	*Gompholobium pinnatum*	Pinnate Wedge Pea						1	2	1	8	1	1		
Fabaceae (Faboideae)	*Hardenbergia violacea*	False Sarsaparilla		1	3					1	1				
Fabaceae (Faboideae)	*Pultenaea myrtoides*			1	1			1	3			1	1	1	1
Fabaceae (Faboideae)	*Pultenaea retusa*			1	3	1	2			1	8			1	1
Fabaceae (Mimosoideae)	*Acacia binervata*	Two-veined Hickory				5	20	1	7	1	4			2	21
Fabaceae (Mimosoideae)	*Acacia concurrens*	Curracabah		5	8							1	1		
Fabaceae (Mimosoideae)	*Acacia floribunda*	White Sally		2	5	1	2	1	1			1	2		
Fabaceae (Mimosoideae)	*Acacia irrorata*	Green Wattle										1	2		
Goodeniaceae	*Dampiera sylvestris*											1	1	1	100
Goodeniaceae	*Goodenia ovata*	Hop Goodenia								1	1				
Goodeniaceae	*Goodenia rotundifolia*											1	4		
Iridaceae	*Patersonia sericea*	Silky Purple-Flag						1	10	1	2				
Lauraceae	*Cassytha sp.*			1	4					1	7				

Family	Scientific Name	Common Name	Exotic	Plot 5 Cover	Plot 5 Abundance	Plot 6 Cover	Plot 6 Abundance	Plot 16 Cover	Plot 16 Abundance	Plot 19 Cover	Plot 19 Abundance	Plot 35 Cover	Plot 35 Abundance	Plot 51 Cover	Plot 51 Abundance
Lauraceae	*Cinnamomum camphora*	Camphor Laurel	*	1	1			1	2			1	1		
Lindsaeaceae	*Lindsaea microphylla*	Lacy Wedge Fern		1	5							1	50		
Lobeliaceae	*Pratia purpurascens*	Whiteroot		1	10			1	3			1	3	1	5
Lomandraceae	*Lomandra filiformis*	Wattle Matt-rush		1	2									1	1
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush		1	1	1	1	1	2			2	50	1	6
Lomandraceae	*Lomandra multiflora* subsp. *multiflora*	Many-flowered Mat-rush		1	2	1	1			1	6	1	5		
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush				1	2			1	2	1	5		
Myrtaceae	*Corymbia gummifera*	Red Bloodwood		10	13	1	3	4	6	8	11	2	2	2	4
Myrtaceae	*Eucalyptus cameronii*	Diehard Stringybark		10	7	5	2			3	8	25	4	2	2
Myrtaceae	*Eucalyptus microcorys*	Tallowwood				3	2	2	1	1	1			1	1
Myrtaceae	*Eucalyptus pilularis*	Blackbutt		15	2	3	1	4	2					7	1
Myrtaceae	*Eucalyptus siderophloia*	Grey Ironbark										2	1		
Myrtaceae	*Eucalyptus signata*	Scribbly Gum				20	4	10	9	10	5	15	3	25	3
Myrtaceae	*Leptospermum polygalifolium*	Tantoon				1	10	1	14	1	1			1	8
Myrtaceae	*Leptospermum trinervium*	Slender Tea-tree				1	3								
Myrtaceae	*Melaleuca sieberi*									1	2				
Myrtaceae	*Melaleuca styphelioides*	Prickly-leaved Tea										1	2		

Family	Scientific Name	Common Name	Exotic	Plot 5 Cover	Plot 5 Abundance	Plot 6 Cover	Plot 6 Abundance	Plot 16 Cover	Plot 16 Abundance	Plot 19 Cover	Plot 19 Abundance	Plot 35 Cover	Plot 35 Abundance	Plot 51 Cover	Plot 51 Abundance
		Tree													
Myrtaceae	*Sannantha angusta*			1	1			1	2			15	100	1	1
Myrtaceae	*Syncarpia glomulifera*	Turpentine				20	50	2	5	2	9			2	9
Oleaceae	*Notelaea ovata*							1	1	1	3	1	1	1	2
Orchidaceae	*Cryptostylis* sp.					1	9								
Orchidaceae	*Dipodium* sp.													1	1
Orchidaceae	*Pterostylis* sp.	Greenhood						1	1			1	1	1	1
Phormiaceae	*Dianella caerulea*	Blue Flax-lily		1	20			1	3	1	30	1	20	1	50
Phormiaceae	*Dianella revoluta*	Blueberry Lily				1	2								
Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush												1	4
Pittosporaceae	*Billardiera scandens*	Hairy Apple Berry		1	6	1	5	1	3			1	1	1	3
Pittosporaceae	*Pittosporum revolutum*	Rough Fruit Pittosporum										1	2		
Poaceae	*Andropogon virginicus*	Whisky Grass	*	1	1										
Poaceae	*Cymbopogon refractus*	Barbed Wire Grass		1	1										
Poaceae	*Digitaria diffusa*	Open Summer-grass				1	1			1	1				
Poaceae	*Entolasia marginata*	Bordered Panic		1	2										
Poaceae	*Entolasia stricta*	Wiry Panic		20	1000	1	400	50	1000	80	1000	30	1000	2	100
Poaceae	*Eragrostis* sp.	A Lovegrass	*							1	5				
Poaceae	*imperata cylindrica*	Blady Grass		2	100	1	10	5	100	1	50			30	1000
Poaceae	*Themeda*	Kangaroo		1	2			1	1	1	1			1	2

Family	Scientific Name	Common Name	Exotic	Plot 5 Cover	Plot 5 Abundance	Plot 6 Cover	Plot 6 Abundance	Plot 16 Cover	Plot 16 Abundance	Plot 19 Cover	Plot 19 Abundance	Plot 35 Cover	Plot 35 Abundance	Plot 51 Cover	Plot 51 Abundance
	australis	Grass													
Proteaceae	*Lomatia silaifolia*	Crinkle Bush				1	4							1	2
Proteaceae	*Persoonia stradbrokensis*					1	3	1	80	1	3	1	4	1	5
Rubiaceae	*Pomax umbellata*	Pomax												1	1
Schizaeaceae	*Schizaea bifida*	Forked Comb Fern						1	6						
Thymelaeaceae	*Pimelea linifolia*	Slender Rice Flower		1	2					1	1				
Violaceae	*Hybanthus stellarioides*			1	2										
Xanthorrhoeaceae	*Xanthorrhoea* sp.			1	1			1	2	2	25			1	3

Notes: Cover – visual estimate of foliage projective cover within the plot, recorded from 1–5% and then to the nearest 5%. Abundance - relative number of individuals or shoots of a species within the plot. Based on the following intervals: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, 1000. Counts above 20 are estimates only.

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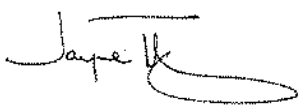
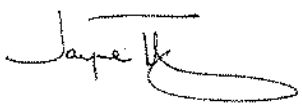
Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	B Harrington J Sharp	Jayne Tipping		Jayne Tipping		3/5/16
B	B Harrington J Sharp	Jayne Tipping		Jayne Tipping		1/8/16

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BioBanking
Biodiversity Banking and Offsets Scheme

Instructions for completing the template for management actions

This template for management actions should be filled in by the landowner and submitted to OEH with an application to establish a biobank site. These standard words and format must be used for the management actions (refer to the *Guide to establishing a biobank site* for guidance).

OEH will review the management actions and plans and make any necessary amendments after consultation with the landowner. These management actions will be incorporated into the biobanking agreement as Annexure C.

There are four sections to this template:

1. standard management actions – mandatory
2. additional management actions – only if indicated by the assessment
3. standard management plans (weeds and fire for conservation) – mandatory
4. additional management plans (feral and overabundant herbivores and vertebrate pests) – only if indicated by the assessment.

An additional short section is also included in this template that requires the details of photo points for monitoring purposes. This information will be incorporated into the agreement as Annexure D.

Green boxes like this one provide instructions and examples and will be deleted by OEH before the biobanking agreement is processed.

Yellow highlighted fields need to be customised by the landowner. Usually the landowner needs to provide the information required; sometimes the landowner will need to delete or retain provided options. It is important to ensure that, especially where fields are customised, that the management actions are certain, clear and specific so that it is clear what the requirements of the actions are.

The format and wording of standard and additional management actions must not be changed. Enter site specific information into the yellow highlighted fields as required.

Management actions are divided into passive and active actions. Passive actions have little or no cost and include refraining from doing something, such as not removing fallen logs or bush rock. Passive management actions must be commenced as soon as the biobanking agreement is signed.

If a management action is active, you have to undertake specific activities to improve the site's biodiversity. Active management actions only need to be commenced when 80% of the Total Fund Deposit is met (ie from 'first payment date').

In the table below, the timing column indicates:

- passive actions by the term 'Ongoing from commencement date'
- active actions by a reference to 'Ongoing from first payment date'.

Managing grazing for conservation can be passive or active depending on the biobank site. For example, managing grazing for conservation is a passive management action if the biobank site is already suitably fenced, and it is an active management action if the biobank site needs to be fenced. Both options appear in the timing column and are highlighted yellow. Delete whichever option is not applicable.

Section 1: Standard management actions

Standard management actions		
Item 1	**Management of grazing for conservation**	**Timing**
1.1	Stock must not be permitted to graze in any area of the biobank site.	Ongoing from commencement date.
	If no grazing is to be allowed, replace the above item with: 'Stock must not be permitted to graze in any area of the biobank site.' Then delete the words in item 1.2 and 1.3 (but keep the numbering) and replace with: 'This item is not applicable'. The wording in the adjacent Timing column can also be deleted.	
1.2	This item is not applicable.	
	Insert any requirements specific to the site to accommodate local conditions and allow for flexibility in a framework of reasonable certainty. Delete 'Specific requirements:' if it is not relevant. The landowner can prevent stock from grazing or require stock to graze in specific areas by erecting and maintaining stockproof fencing. Fencing may be permanent or temporary (including electric fences). Indicate the specific type and length of fence to be erected and by when. Soil disturbance may be required (and is permitted) to encourage regeneration of native vegetation in conjunction with management of grazing for conservation.	
1.3	This item is not applicable.	
1.4	If, at any time, the landowner observes stock in any area of the biobank site, other than an area on the biobank site where grazing is permitted, the landowner must take necessary measures to remove the stock from the area immediately.	Ongoing from commencement date.
Item 2	**Weed control**	**Timing**
2.1	The landowner must implement and, at all relevant times, comply	Ongoing from first

	with, the integrated weed management plan included in Section 3 ('**the weed management plan'**) (or such updated integrated weed management plan as has been approved by the Director General under item 2.2 below). To allow for adaptive management, minor alterations can be made to the implementation of the weed management plan. Any alterations must be recorded in writing in accordance with Section 3 of this Annexure.	payment date.
2.2	The weed management plan must be reviewed at intervals of no less than 4 years and no more than 6 years by an appropriately qualified person. The review is to consider the efficacy of the management actions in the plan and consider the effectiveness of the matters contained in the current plan that are outlined in the dot points below. Notification of the date of the review commencement must be provided to the Director General in writing within 14 days of the commencement of the review. The findings of the review must be submitted to the Director General within 3 months of commencing the review. Where the Director General determines from the review that an update of the plan is required, the Director General will notify the landowner in writing that an update of the plan is required. The landowner must update the plan and submit it to the Director General for approval within 3 months of receiving written notification from the Director General that an update of the plan is required. The revised plan must be prepared by an appropriately qualified person and must cover the matters outlined below and any additional matters specified by the Director General in writing: • a description of the target weed/s at the biobank site and their location/s, linked to each management zone where weeds are present • the method/s of weed control in each zone • the frequency of weed control activities at the site, taking into account management practices where weeds are providing habitat for native species • the timing of any planting of native plant species required in each management zone to provide alternative habitat for native species affected by weed control activities • methods for monitoring the success of weed control activities • a timetable/measures for inspections to identify new weed species or exotic plant species (including noxious weeds under the *Noxious Weeds Act 1993*) • additional weed control activities to destroy or remove any new weed species that are found on the site • measures for assessing and reporting monitoring results • a diary for recording actions taken in accordance with the weed management plan and minor alterations to this plan permitted for adaptive management. The details (management zone/s, date, alternative action) and reasons for the minor alterations must be recorded in the diary.	Ongoing from first payment date.

Item 3	Management of fire for conservation	Timing
3.1	The landowner must implement, and at all relevant times, comply with the fire management plan included in Section 3 (or such updated fire management plan as has been approved by the Director General under item 3.2 below) ('**the fire management plan")**. To allow for adaptive management and weather conditions, minor alterations can be made to the implementation of the fire management plan, and must be recorded in writing in accordance with Section 3 of this Annexure.	Ongoing from commencement date.
3.2	The fire management plan must be reviewed at intervals of no less than 4 years and no more than 6 years by an appropriately qualified person. The review is to consider the efficacy of the management actions in the plan and consider the effectiveness of the matters contained in the current plan that are outlined in the dot points below. Notification of the date of the review commencement must be provided to the Director General in writing within 14 days of the commencement of the review. The findings of the review must be submitted to the Director General within 3 months of commencing the review. Where the Director General determines from the review that an update of the fire management plan is required, the Director General will notify the landowner in writing that an update of the plan is required. The landowner must update the plan and submit it to the Director General for approval within 3 months of receiving written notification from the Director General that an update of the plan is required. The revised plan must be prepared by an appropriately qualified person and cover the matters outlined below and any additional matters specified by the Director General in writing:) the year the last fire went through, the type of fire and the extent of the fire and location, where known) frequency of natural fires in the area of the biobank site, where known) a description of locations and management zones where ecological burns will be conducted and areas that will not be burnt) the methods that will be used for ecological burns) the fire frequency intervals recommended for the vegetation types and threatened species present, including any required adjustment to the schedule in the event of a wildfire or activities undertaken under the *Rural Fires Act 1997* to ensure minimum frequency between ecological burns) the fire intensity for the recommended vegetation types) the time of year suitable for ecological burns) the diary for recording actions taken in accordance with the fire management plan and minor alterations to fire management plan permitted for adaptive management. The details (management zone/s, date, alternative action) and reasons for the minor alterations must be recorded in the diary.	Ongoing from first payment date.
3.3	Fires must not be lit on the biobank site other than for the purpose of ecological burning in accordance with the fire management plan or as permitted as a permissible human activity on the biobank site under item 4 of this Annexure or	Ongoing from commencement date.

	clause 3.6 of this agreement.	
Item 4	**Management of human disturbance**	**Timing**
4.1	Except as permitted under clause 3 of this agreement or item 4.2 (below), human activities that adversely affect biodiversity values on the biobank site, including repeated disturbance of native animals, must not be carried out, or caused or permitted to be carried out, on the biobank site.	Ongoing from commencement date.
4.2	Human activities that may have a negative impact on biodiversity values on the biobank site are permitted if they are listed as permissible activities under clause 3.6 of this agreement or if they are undertaken as part of the management actions or management plans.	Ongoing from commencement date.
4.3	All waste shown on the map entitled Property Action Plan dated 01/06/2016 must be removed from the biobank site in an appropriate manner. Miscellaneous rubbish scattered along the length of the access track from Kemps Road to the proposed house lot to be collected. The northern end of the property also includes an old farm pigsty that would be demolished with materials removed from the site. A funding allocation is included in the TFD accordingly. The site includes pile of sleepers (old bridging material) are located along the access track from Kemps Road to the proposed dwelling location. It is proposed to leave these in situ for their habitat value and/or move to other locations in the biobank site as woody debris. A funding allocation for moving woody debris has been included in the TFD. If there is no waste on the biobank site delete the words of this item (but retain the numbering) and replace with: 'This item is not applicable.'	Commencing from first payment date.
4.4	The landowner must not store, dispose of, or cause or permit to be disposed of, any waste on the biobank site. Note: The storage or disposal of waste on the biobank site may require an approval under the *Protection of the Environment Operations Act* 1997.	Ongoing from commencement date.
4.5	The landowner must take all reasonable steps to remove waste deposited by others on the biobank site, or which is otherwise present on the biobank site.	Ongoing from first payment date.
4.6	Fencing and/or signage must be installed and maintained to deter human disturbance including waste dumping. Signage must be the BioBanking signs available from the OEH. **Specific requirements:** The site is bordered by a railway line to the north and east, the Pacific Highway to the west with the southern boundary generally associated with Kemps Road. It has access points via the large service station and from the south from Kemps Road. **Existing Fencing** An existing fence in good condition runs along the entirety of the western border associated with the boundary of the Pacific	Ongoing from first payment date.

	Highway. A new fence has been installed associated with the boundary between the biobank site and the quarry. There is also an existing fence along the southern boundary of the site and associated with the boundary with the quarry and service centre. There is no threat from stock access associated with the northern and eastern boundaries due to the presence of the rail line and large tracts of vegetated lands to the east. **Existing Fence – removal of strands** Existing fencing is shown on the Property Action Plan (dated 01/06/2016) These fences will have wire and star posts removed with timber posts left in situ. Should additional internal fencing be located throughout the site, these would also have wire and star posts removed by the implementing contractor. **New Fence** A new fence would be installed around the perimeter of the proposed 'house lot and home paddocks' in the south of the site with two new gates to provide access to track running north into the biobank (as shown on the Property Action Plan dated 01/06/2016) This would be a simple plain wire and star post fence to delineate the biobank site boundary. The location of gates and the OEH biobank signage is also shown on the Property Action Plan.	
	Signage should be located at points of access and other practical locations interfacing with adjoining properties. For biobank sites that are located fully within a larger private landholding, there should be at least one BioBanking sign to be placed at the main access gate to the site. It is recommended that required signage be installed within 3 months of first payment date.	

Item 5	**Retention of regrowth and remnant native vegetation** Note: An approval under the *Native Vegetation Act 2003* may be required to carry out thinning or any other removal or damage to native vegetation under this item.	**Timing**
5.1	Native vegetation (whether remnant native vegetation or regrowth) on the biobank site must not be cut down, felled, thinned, logged, killed, destroyed, poisoned, ringbarked, uprooted, burnt or otherwise removed, except in accordance with item 5.2 below, or if it is required as part of the management actions or it is essential for the carrying out of permissible development under clause 3.5 of this agreement. Note: Native vegetation on the biobank site may be managed to improve biodiversity values by thinning to benchmark stem densities over no more than 80% of each management zone. Benchmark stem densities has the same meaning as defined in the Vegetation Benchmark Database as published by OEH and updated from time to time. An approval under the *Native Vegetation Act 2003* may be required to carry out thinning or any other removal or damage to native vegetation under this item.	Ongoing from commencement date.
5.2	Native vegetation on the biobank site must not be burnt except in accordance with the fire management plan prepared pursuant to item 3 above.	Ongoing from commencement date.
Item 6	**Replanting or supplementary planting where natural regeneration will not be sufficient**	**Timing**
6.1	The landowner must undertake planting or seeding of the native groundcover/shrub/tree species indicated in the planting schedule for the biobank site as set out in item 6.6 below (**'the planting schedule**') in the areas of planting and within the timeframe indicated in the planting schedule. If the landowner cannot complete the planting within the timeframe indicated in the planting schedule due to local weather conditions, the landowner must complete the planting as soon as possible after that date and must make a record of and retain the reasons why the planting was not completed by the required time. Appropriate site treatment (e.g. weed control) of each area of planting or seeding identified in the planting schedule must be undertaken prior to such planting. Specific requirements: It is proposed to include hand broadcasting of native canopy and *Acacia* species within MZ5 after treatment of introduced grasses to supplement natural regeneration in this location. Hand broadcasting of native seed is proposed in MZ5 which has been identified as Spotted Gum – Grey Ironbark – Pink Bloodwood open forest (NR228) in low condition. The weed control and bush regeneration is to be programmed independently of the broadcasting activities. Targeted weed control activities will occur in Spring and Summer whereas hand broadcasting would occur in Autumn in years 2 and 3. It is anticipated introduced grasses will be 'shaded out' through time as stock is excluded and native plants establish and increase competition for light and nutrients. In addition, these areas have	Commencing from first payment date.

	some existing natural resilience and it is anticipated natural regeneration of native species will supplement the broadcasting of native seed program. Should these activities not achieve the restoration outcomes anticipated within 7 years however, discussion should occur with OEH to discuss potential alternative strategies. A contingency for supplementary planting has been included in the TFD. The long term control of introduced grasses in these areas will be included in the overall weed control and maintenance programs.	
	Include details regarding site treatment that must be undertaken before planting each area under the 'Specific requirements'. Planting or seeding is only required where natural regeneration is not sufficient to bring back native vegetation. Where no replanting is required, delete the words in every point of this item (but retain the numbering) and replace with: 'This item is not applicable.'	
6.2	As stated in Clause 1.1 stock must not be permitted to graze in any area of the biobank site.	Ongoing from the completion of planting in each area of replanting.
	If required, different years or heights for specific types of plants can be listed under 'Specific requirements'.	
6.3	The landowner must survey each area of planting or seeding established under item 6.1 above and document them to determine whether the planted plants or seeds have established and survived, and retain the findings in accordance with the record keeping requirements. If, after the first survey or subsequent surveys, the establishment and survival rate of plants in an area of planting or seeding are below those usual for the species and region, the landowner must supplement the planting in the adversely affected areas within a reasonable timeframe (usually within 12 months, though this can be varied and recorded in a diary with reasons for variation, if the weather is unsatisfactory for the establishment and survival of plants or seeds).	Conduct the first survey 24 months after the completion of planting or seeding in each area of planting or seeding, and then every 12 months thereafter.
6.4	Areas of planting and seeding must be managed as required to assist the establishment and survival of native plant species. Management includes watering, slashing, scalping, spraying of weeds, plant replacement and strategic grazing by stock (in accordance with item 6.2 above) at strategic times of the year to control weeds to improve biodiversity values. The dates of planting must be recorded in accordance with the record keeping requirements set out in Annexure D.	As required, from the date that planting or seeding areas are established.
6.5	Seeds and plants used for planting and seeding must be obtained from locally collected provenances, unless there are reasons to do otherwise (e.g. to ensure genetic variability or for adaptation to climate change).	As required (from commencement date if relevant to prepare for future planting).

The planting schedule should be filled in including:

- **number of plants per area** – for tubestock, the number of plants should be rounded to the nearest 100 if there are more than 1,000 plants or to the nearest 10 if there are 1,000 plants or less; if direct seeding is used leave this field blank
- **planting method** – specify whether plants are to be tubestock, direct seeding or another method
- **timing** – describe as the number of months (or Year if relevant (ie Year 1, Year 2, etc)) for completion of planting from the first payment date.

6.6 Planting schedule at the biobank site

Species' common name	**Species' scientific name**	**Management zone/s of planting**	**Number of plants per area**	**Planting method**	**Timing** (months or Year)
Spotted Gum	*Corymbia variegata*	MZ5		Broadcasting seed	March-May, year 2 and March-May year 3.
Black She-Oak	*Allocasuarina littoralis*	MZ5		Broadcasting seed	March-May, year 2 and March-May year 3
Forest Oak	*Allocasuarina torulosa*	MZ5		Broadcasting seed	March-May, year 2 and March-May year 3
Small-fruited Grey Gum	*Eucalyptus propinqua*	MZ5		Broadcasting seed	March-May, year 2 and March-May year 3
Pink Bloodwood	*Corymbia intermedia*	MZ5		Broadcasting seed	March-May, year 2 and March-May year 3

Diehard Stringybark	*Eucalyptus cameronii*	MZ5		Broadcasting seed	March-May, year 2 and March-May year 3
Tallowwood	*Eucalyptus microcorys*	MZ5		Broadcasting seed	March-May, year 2 and March-May year 3
White Sally	*Acacia floribunda*	MZ5		Broadcasting seed	March-May, year 2 and March-May year 3
Curracabah	*Acacia concurrens*	MZ5		Broadcasting seed	March-May, year 2 and March-May year 3

Item 7	Retention of dead timber	Timing
7.1	Dead timber (whether standing or fallen and including branches and leaf litter) must not be removed from or moved within the biobank site except for the personal (non-commercial) use by the landowner for firewood for one dwelling only or for repair of fencing (not for construction of fencing). Dead timber used for fencing repair must be documented by the landowner in writing and records must be kept in accordance with the record keeping requirements. The landowner must record the approximate amount of dead timber collected from the biobank site for use in fencing, the location that that dead timber was collected from and the date it was collected (month, year). Specific requirements: There are piles of logs and 'off cuts' associated with previous logging activities located along the main track to the proposed housing lot off Kemps Road. These would be 'scattered' in the neighbouring areas of the biobank site to provide additional habitat resources for native fauna.	Ongoing from commencement date.
7.2	Timber from outside the biobank site may be introduced to and placed on the biobank site to improve biodiversity values. Once the timber has been brought onto the site, it is subject to the requirements of item 7.1 above. Timber brought from outside the biobank site must be documented by the landowner in writing and records must be kept in accordance with the record keeping requirements. The landowner must record the approximate amount of timber brought from outside the biobank site, the location where the timber was placed on the biobank site and the date on which it was placed (month, year). Specific requirements: x	When required but not required before the first payment date.
Item 8	**Erosion control**	**Timing**
8.1	All reasonable steps must be undertaken to prevent, control and remedy erosion on the biobank site. Soil management for preventing and controlling erosion is to be undertaken using best practice management, such as that developed by the Soil Conservation Service, applied as relevant for the biobank site. The landowner must manage existing erosion on the biobank site, identified on the map entitled Property Action Plan dated 01/06/2016 by conducting: • Stock exclusion • Revegetation activities – broadcasting native seed • Weed control • Monitoring	Commencing from first payment date.

	Of note is the eroding 'S' bend in Boat Harbour Creek in the northern portion of the site. Vegetation in this location is in low condition. It is recommended this site is monitored for the first 5~~3~~ years and if the location remains unstable after this time active erosion control measures be undertaken. Actions that may need to be considered include: • Small machine (Bobcat recommended) to reshape soil surface • Appropriate topsoil medium applied • Erosion control matting (e.g. 'jute matting') • Placement of logs or other debris • Revegetation (hand plantings and broadcasting native seed) • Plant maintenance Resources have been included in the TFD accordingly. Access tracks shown on the Property Action Plan dated 01/06/2016 will also be maintained and/or established in a manner which considers drainage and erosion control. Access track establishment and maintenance would be limited to periodic slashing and minor earthworks associated with crossing of minor drainage lines.	
	If there is no existing erosion, delete the last paragraph.	

Item 9	Retention of rocks	Timing
9.1	The landowner must not remove, or cause or permit to be removed, rocks from the biobank site or move, or cause or permit to be moved, rocks within the biobank site.	Ongoing from commencement date.
9.2	Rocks from outside the site may be placed on the biobank site to improve habitat for threatened species. Rocks, once placed on the biobank site, are subject to item 9.1 above. The landowner must make and retain records of the location of the rocks placed on the site and the date the rocks were brought onto the site in accordance with the record keeping requirements.	When required but not required before the first payment date.

Section 2: Additional management actions

Additional management actions should only be completed when they are required for creating ecosystem credits or species credits. This will be stated on the Biobanking Agreement Credit Report.

Complete the required fields for any additional management actions required for your site. Leave all other additional management actions and OEH will delete them before including this section in your draft biobanking agreement.

Additional management actions		
Item 10	**Control of feral and overabundant native herbivores**	**Timing**
10.1	The landowner must implement, and at all relevant times, comply with the management plan to control feral and overabundant native herbivores included in Section 4 (or such updated management plan as has been approved by the Director General under item 10.2 below) ('**the feral and overabundant native herbivores management plan**'). To allow for adaptive management, minor alterations can be made to the implementation of the feral and overabundant native herbivores management plan, which must be recorded in writing in accordance with Section 3 of this Annexure. Note: A licence under Section 121 of the *National Parks and Wildlife Act 1974* may be required to control overabundant native herbivores.	Ongoing from first payment date.
10.2	The feral and overabundant native herbivores management plan must be reviewed at intervals of no less than 4 years and no more than 6 years. The review is to consider the efficacy of the management actions in the plan and consider the effectiveness of the matters contained in the plan that are outlined in the dot points below. Notification of the date of the review commencement must be provided to the Director General in writing within 14 days of the commencement of the review. The findings of the review must be submitted to the Director General within 3 months of commencing the review. Where the Director General determines from the review that an update of the feral and overabundant native herbivores management plan is required, the Director General will notify the landowner in writing that an update of the plan is required and the landowner must update the plan and submit the amended plan to the Director General for approval within 3 months of receiving written notification from the Director General that an update of the plan is required. The revised plan must cover the matters outlined below and any additional matters specified by the Director General in writing:) a description of the feral or overabundant native herbivore/s) consideration of relevant current OEH and other pest management programs and methods) the method/s for feral and overabundant native herbivore control in each management zone, determined in accordance with best	Ongoing from first payment date.

	practice management - the frequency and timing of the control actions in each management zone - methods for monitoring the success of the pest control actions - a timetable and measures for inspections to identify new feral or overabundant native herbivores that may adversely affect biodiversity values on the biobank site - additional control actions to destroy or remove any new feral and overabundant native herbivore pest species that occur on site - measures for assessing and reporting monitoring results - a diary for recording actions taken in accordance with the feral and overabundant native herbivores management plan and minor alterations to this plan permitted for adaptive management. The details (management zone/s, date, alternative action) and reasons for the minor alterations must be recorded in the diary.	
Item 11	**Vertebrate pest management – Fox, Wild Dogs Feral Pig and Feral cats**	**Timing**
11.1	The landowner must implement, and at all relevant times, comply with the vertebrate pest management plan included in Section 4 (or such updated vertebrate pest management plan as has been approved by the Director General under item 11.2 below) ('**the vertebrate pest management plan**'). To allow for adaptive management, minor alterations can be made to the implementation of the vertebrate pest management plan, but these must be recorded in writing in accordance with Section 3 of this Annexure.	Ongoing from first payment date.
11.2	The vertebrate pest management plan must be reviewed at intervals of no less than 4 years and no more than 6 years by an appropriately qualified person. The review is to consider the efficacy of the management actions in the plan and consider the effectiveness of the matters contained in the current plan that are outlined in the dot points below. Notification of the review commencement must be provided to the Director General in writing within 14 days of the commencement. The findings of the review must be submitted to the Director General within 3 months of commencing the review. Where the Director General determines from the review that an update of the plan is required, the Director General will notify the landowner in writing that an update of the plan is required. The landowner must update the plan and submit it to the Director General for approval within 3 months of receiving written notification from the Director General that an update of the plan is required. The revised plan must cover the matters outlined below and any additional matters specified by the Director General in writing: - a description of the target fauna species e.g. pigs, foxes or other species such as feral dogs or goats - consideration of relevant current OEH and other pest management programs - the method/s of vertebrate pest control in each management zone determined in accordance with best management practice - the frequency and timing of vertebrate pest control actions in	Ongoing from first payment date.

	each management zone - methods for monitoring the success of vertebrate pest control actions - a timetable and measures for inspections to identify new vertebrate pest species that may negatively impact on threatened species on the biobank site - additional vertebrate pest control actions to destroy or remove any new vertebrate pest species that occur on-site - measures for assessing and reporting monitoring results - a diary for recording actions taken in accordance with the vertebrate pest management plan and minor alterations to this plan permitted for adaptive management. The details (management zone/s, date, alternative actions) and reasons for the minor alterations must be recorded in the diary.	
Item 12	**Nutrient control**	**Timing**
12.1	Fertilisers, pesticides and herbicides must not be applied on the biobank site, except where required to undertake the management actions. Use of fertilisers for establishing native vegetation through planting or seeding, use of herbicides for controlling weeds or use of pesticides for controlling vertebrate pests or feral herbivores can be undertaken in accordance with best practice management when required to undertake the management actions.	Ongoing from commencement date.
Item 13	**Control of exotic fish species**	**Timing**
13.1	This item is not applicable.	
Item 14	**Maintenance or reintroduction of natural flow regimes**	**Timing**
14.1	This item is not applicable.	
14.2	This item is not applicable.	
14.3	Artificial structures such as dams or levee banks that impede the natural flow regimes on the biobank site must not be constructed unless approved by the Director General in writing for the purpose of restoring natural flows.	Ongoing from commencement date.

Section 3: Standard management plans

Completing the compulsory weed management plan

A table is provided below for the integrated weed management plan. Add additional sections to the table if required.

The plan must include, but is not limited to:

- a description of the target weed/s at the biobank site and their location/s, linked to each management zone where weeds are present
- the method/s of weed control in each management zone
- the frequency of weed control activities at the site, taking into account management practices where weeds are providing habitat for native species
- the timing of any planting of native plant species required in each management zone to provide alternative habitat for native species affected by weed control activities
- methods for monitoring weed control activities
- reporting and assessing the results from monitoring
- a timetable/measures for inspections to identify new weed species or exotic plant species (including noxious weeds under the *Noxious Weeds Act 1993*)
- a diary for recording actions taken in accordance with the integrated weed management plan and minor alterations to this plan permitted for adaptive management. The details (management zone/s, date, alternative action) and reasons for the minor alterations must be recorded in the diary.

When the management plan is reviewed (see item 2.2), weed control activities may be amended, deleted or added to take into account the weed species on the site at that time.

Weed management plan

The weed types, description and location (management zone/s) of weed infestations existing at the commencement date are listed in the weed management plan. The methods of weed control (management actions), monitoring and inspections are also listed.

The landowner must perform the methods of weed control and other weed management activities and monitoring in the weed management plan by the methods described (and in accordance with item 2 of this Annexure) for all weeds. The methods of control will apply to the weeds listed in the table below as well as any other weeds that may be present on the site from time to time.

The template for reporting of monitoring activities and the diary template for weed control management must be filled in to record observations during the implementation of the weed management plan, including any minor variations.

Weed types

Weed	Common name of target weed	Scientific name of target weed	Description of infestation (eg intensity (% cover) & location within zone)	Management zone/s
A	Lantana	*Lantana camara*	Moderate 'patches' associated with Boat Harbour Creek and the northern portion of the site (MZ1, MZ5 and MZ9). Scattered individuals across all zones (<10% cover)	All zones
B	Camphor Laurel	*Cinnamomum camphora*	Scattered individuals throughout all zones	All zones
C	Introduced grasses (e.g. Whisky Grass, Paspalum, Kikuyu, Narrow-leaved Carpet Grass)		Moderate 'patches' located within MZ5 and MZ9 (including previous citrus planting area – see below). Minor infestations associated with existing access tracks. These areas are concentrated to the north of the proposed housing lot and in low condition vegetation in the north of the biobank.	All zones
D	Planted citrus trees		Individual planted citrus trees in MZ5 only.	MZ5
E	Small woody and Herbaceous weeds (e.g. Fleabane, Fireweed, Spear thistle, Cobblers Pegs, Paddy's Lucerne, Purpletop, etc.)		Scattered individuals throughout all zones	All zones

Methods of weed control

Management zone/s	Weed/s	Method of weed control	Frequency (months or Year)
All zones	A	Targeted weed control to be carried out by suitably qualified contractors and specialised equipment. As infestations are localised to relatively small areas, back pack spraying is the recommended method of control in most areas, as the ground can be easily traversed on foot.	- 6 sessions per year during years 1 to 3. - 4 sessions

		Methods will include: - using back packs, teams of two spray with glyphosate or selective herbicide at flowering/fruiting stage, when most effective (areas of moderate infestation). - cut and paint with undiluted glyphosate for treatment of scattered individuals - hand pulling/crowning of weeds - scattered individuals **Performance measures** Weed control works will aim to achieve the following outcomes: 1. Lantana reduced to less than 20% of original distribution by the end of year 2. 2. Lantana reduced to less than 10% of original distribution by the end of year 5. 3. Lantana maintained at less than 10% of original distribution from year 6	per year during years 4 - 10
All zones	B	The site contains scattered individuals only. **Methods may include:** - cut and paint crown/lignotuber with undiluted glyphosate or Garlon and diesel or Grazon® immediately for isolated plants or smaller areas of infestation. - hand pulling/crowning of weeds	- 2 sessions per year in years 1 and 2
All zones	C	Active spraying will be used to 'open up' patches. Over time it is anticipated that natural regeneration will shade out the introduced grasses. **Methods may include:** - spot spraying using 'back packs' throughout all zones. - hand pulling/crowning of weeds	- 6 sessions per year in years 1 to 3 - 4 sessions per year in years 4 - 10
MZ5	D	Planted citrus trees exist in rows in MZ5. Treatment will include: - 'cut and paste' with individual trees then left on the ground in situ.	- 2 sessions in year 1
All Zones	All	Ongoing (follow-up) weed control activities to be carried out by qualified contractors. **Methods may include:** - spot spraying using backpacks in large areas of	6 sessions per year in perpetuity

		infestation. - cut and paint crown/lignotuber with undiluted glyphosate - pulling/crowning of weeds **Performance Measures** Weed control work within these management zones will aim to achieve the following outcomes: 1. Mature woody weeds maintained at less than 10% of original distribution in all zones by the end of year 10. 2. Other herbaceous and pasture weeds maintained at less than 10% of original distribution in all zones by the end of year 10. Note: access tracks will not be actively managed to control introduced grasses, rather activities will focus on restricting introduced grasses from recruiting in remnant vegetation.	

Native planting required to provide habitat for native species affected by weed control activities

Management zone	**Description of planting required** (reference planting schedule at item 6.6)	**Timing**

Monitoring and inspections of existing and new weeds

Management zone/s	**Weed/s**	**Method of monitoring**	**Date/s required**
All Zones	All Weeds	A monitoring and evaluation program to address weed regrowth and control measures will be undertaken annually by the landholder through the set-up of fixed photo-points across all restoration zones. Photos should be taken by digital camera and recorded in the project file by date and discrete photo-point number at the locations shown on the Photo Points Plan (01/06/2016) and listed in Annexure D. Photo-point locations should be clearly marked on site and/or recorded using a GPS. The photo-point monitoring will be augmented by a completion of a weed management log (included below) describing actions and observations. The photographic records and observations log will completed by the landholder and provided to OEH. For each management zone, the following information will be reported: • A summary of weed control activities works undertaken for	Annually

		the previous 12 months in the zone and a review of their success or otherwise. • A description of the current condition of the zone. This may include presence/absence of canopy, shrub and/or ground-layer regeneration and any evidence of dieback etc. • Brief descriptions of the type and locations of any significant new or remaining weed infestations. Successful suppression of weeds should also be documented. Refer back to the performance targets in methods of weed control. • Recommendations, if required, of any adaptations to the weed control techniques previously applied.	
All Zones	All Weeds	Condition mapping (floristic and habitat field survey assessment) to determine vegetation quality and ecological condition. This will be provided to OEH.	Every six years by an independent botanical consultant.

Other weed management activities (where required)

Notes:

Qualified contractors includes bush regeneration contractors being used when completing weed control works in areas of native vegetation and/or 'high' natural resilience. Other contractors required may include earthworks operators, farm chemical certificate trained staff, fencing contractors etc.

One session of weed control refers to a team of 2 staff per day using various treatment techniques depending on weed type being treated.

Weed control in perpetuity refers to the ongoing treatment, through time, of any weed that may inhabit the site now and in the future.

Template for reporting of monitoring activities

Management zone/s	**Date**	**Observations and assessment of monitoring** This table must include the information for each zone (or groups of zones) which is described in the table titled 'monitoring and inspections of existing and new weeds'.

Diary template for weed control management			
Date	**Management zone/s**	**Description and type of activity undertaken** (e.g. weed control, observation)	**Minor variations** (details and reasons)

Completing the compulsory fire for conservation management plan

A table is provided below for the fire conservation management plan. Add additional sections to the table if required. The plan must include, but is not limited to:

- a map of the vegetation on the biobank site (with date) and any infrastructure and built assets on the biobank site (the map to be included in the biobanking agreement)
- the year the last fire went through, the type of fire and the extent of the fire and location, where known
- frequency of natural fires in the area of the biobank site, where known
- a description of locations and management zones where ecological burns will be conducted and areas that will not be burnt
- the methods that will be used for ecological burns
- the fire frequency intervals recommended for the vegetation types and threatened species present, including any required adjustment to the schedule in the event of a wildfire or activities undertaken under the *Rural Fires Act 1997* to ensure minimum frequency between ecological burns
- the fire intensity for the recommended vegetation types
- the time of year suitable for ecological burns
- methods for monitoring the outcomes of ecological burns
- reporting and assessing the results from monitoring
- the diary for recording actions taken in accordance with the fire management plan and minor alterations to this plan permitted for adaptive management. The details (management zone/s, date, alternative action) and reasons for the minor alterations must be recorded in the diary in accordance with the record keeping requirements.

Fire for conservation management plan

The plan includes information on all known previous fire events in the 'Fire history' table to demonstrate local fire conditions including intensity and frequency.

The ecological fire requirements for each vegetation type or threatened species on the biobank site are listed in the 'Fire requirements for vegetation types and threatened species' table. These are the fire frequency intervals recommended for the vegetation types and threatened species present on the biobank site. They include any requirement adjustments to the schedule in the event of a wildfire or activities undertaken under the *Rural Fires Act (RFA) 1997* to ensure the minimum frequencies between ecological burns.

The landowner must carry out ecological burns for each management zone according to the method and frequency described (as informed by the history and requirements sections and in accordance with Section 3 of this annexure). These actions are set out in the 'Ecological burning actions table'. Monitoring and inspections (set out in the 'Fire management monitoring' table) as described must also be implemented. The landowner must also carry out the actions listed in the 'Other fire management activities' table.

The table titled 'Template of monitoring activities' must be completed to record observations during the implementation of the plan and assessment of monitoring activities. The landowner must also complete the table titled 'Diary template for fire management activities' to record the management actions undertaken or observations made, including any minor variations.

Fire history for previous 20 years (or longer if known)		
Year of fire	**Hazard reduction, wildfire or ecological burn and extent of fire**	**Management zone/s**
	Unknown	

Fire requirements for vegetation types and threatened species				
Vegetation type and/or threatened species	**Fire frequency required**	**Time of year for burning**	**Fire intensity required**	**Adjustment required due to wildfires or RFA activities**
Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central North Coast (NR122)	Greater than 7 years, less than 25 years It is anticipated the first ecological burn will occur in Year 7~~6~~.	April/May and August/ September	Avoid successive fires of intensity sufficient to scorch or consume dominant tree crown	In the event that wildfires did not occur for more than 25 years on the property, a prescribed ecological burn would be conducted.
Red Mahogany open forest of the coastal lowlands of the North Coast (NR222)	Greater than 7 years, less than 25 years It is anticipated the first ecological burn will occur in Year 7~~6~~.	April/May and August/ September	Avoid successive fires of intensity sufficient to scorch or consume dominant tree crown	In the event that wildfires did not occur for more than 25 years on the property, a prescribed ecological burn would be conducted.
Forest Red Gum - Swamp Box of the Clarence Valley lowlands of the North Coast (NR161)	Greater than 7 years, less than 25 years It is anticipated the first ecological burn will occur in Year ~~6~~7.	April/May and August/ September	Avoid successive fires of intensity sufficient to scorch or consume dominant tree crown	In the event that wildfires did not occur for more than 25 years on the property, a prescribed ecological burn would be conducted.
Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the North Coast (NR274)	Greater than 7 years, less than 25 years It is anticipated the first ecological burn will occur in Year ~~6~~7.	April/May and August/ September	Avoid successive fires of intensity sufficient to scorch or consume dominant tree crown	In the event that wildfires did not occur for more than 25 years on the property, a prescribed ecological burn would be conducted.
Spotted Gum -	Greater than 7	April/May and	Avoid	In the event that wildfires

Grey Ironbark - Pink Bloodwood open forest of the Clarence Valley lowlands of the North Coast (NR246)	years, less than 25 years It is anticipated the first ecological burn will occur in Year 7~~6~~.	August/ September	successive fires of intensity sufficient to scorch or consume dominant tree crown	did not occur for more than 25 years on the property, a prescribed ecological burn would be conducted.
Flooded Gum - Tallowwood - Brush Box moist open forest of the coastal ranges of the North Coast (NR160)	Greater than 7 years, less than 25 years It is anticipated the first ecological burn will occur in Year 7~~6~~.	April/May and August/ September	Avoid successive fires of intensity sufficient to scorch or consume dominant tree crown	In the event that wildfires did not occur for more than 25 years on the property, a prescribed ecological burn would be conducted.
Blackbutt - Tallowwood dry grassy open forest of the central parts North Coast (NR119)	Greater than 7 years, less than 25 years It is anticipated the first ecological burn will occur in Year ~~6~~7.	April/May and August/ September	Avoid successive fires of intensity sufficient to scorch or consume dominant tree crown	In the event that wildfires did not occur for more than 25 years on the property, a prescribed ecological burn would be conducted.
Blackbutt - Pink Bloodwood shrubby open forest of the coastal lowlands of the North Coast (NR117)	Greater than 7 years, less than 25 years It is anticipated the first ecological burn will occur in Year 7~~6~~.	April/May and August/ September	Avoid successive fires of intensity sufficient to scorch or consume dominant tree crown	In the event that wildfires did not occur for more than 25 years on the property, a prescribed ecological burn would be conducted.
Scribbly Gum - Red Bloodwood heathy open forest of the coastal lowlands of the North Coast (NR228)	Greater than 7 years, less than 25 years It is anticipated the first ecological burn will occur in Year 7~~6~~.	April/May and August/ September	Avoid successive fires of intensity sufficient to scorch or consume dominant tree crown	In the event that wildfires did not occur for more than 25 years on the property, a prescribed ecological burn would be conducted.

Ecological burning actions

Management zone/s	**Actions**	**Supervision & extinguishing techniques**	**Time of year for burning**	**Frequency** (years)
All	The potential impact of the proposed burn on native vegetation, biodiversity, waterways or important cultural heritage sites will continue to be assessed. Rural Fire Service to be consulted prior to the burn to	Rural Fire Service to be present for protection and advice. Asset control lines ('hoe' lines or similar) to be installed where required	April to September	Approx. 15 years from the date of the previous ecological burn or a wildfire occurring

	determine appropriate regime. Publications such as NSW RFS publication *Standards for Low Intensity Bushfire Hazard Reduction Burning* The biobank has been divided into ~~four~~ five separate 'cells' to promote a mosaic ecological burn program across the site. It is proposed that two cells (as shown in Fire Management Plan dated 01/06/2016) will be burnt on rotation at 7 year intervals. A suggested rotation would be to burn cells 1 and 2 in year 7, cell 3 in year 14 and then cells 4 and 5 in year 21. This rotation would then continue. It should be noted this is a suggested rotation using approximate timeframes only. It is also recommended that burns occur in smaller patches within each cell using existing barriers and access trails to help control fire spread. Ignition points and control locations should coincide with access tracks (which will be maintained), ridge tops, the edge of 'patches' and existing drainage lines. Burning 'downhill' is also recommended. The biobank includes an existing network of degraded tracks. Some of these tracks will require earthworks to re-establish them to a standard suitable for fire management purposes. The proposed access track network, including those locations requiring earthworks, is shown on the Fire Management Plan dated 01/06/2016. Access tracks will then require periodic slashing to maintain. All earthworks associated with the re-establishment or management of the access tracks would be completed in a manner which minimises erosion control and sediment being deposited in areas of existing native vegetation and drainage lines. It is recommended burning should be completed in August/September or late April/May (i.e. cooler weather			on the property.

	with fuel not completely dry) to assist in reducing the potential for burns to enter neighbouring properties at high intensity. All neighbouring property owners would be notified in advance of any controlled burn. Controlled burns should avoid locations where seed has been broadcast (MZ5) for at least the first 7 years of establishment. Targeted surveys for threatened flora and fauna will be conducted across each proposed burn area (cell) prior to burning commencing. Surveys will be conducted during the appropriate season for detection of a given species. Frequency of burns will take into consideration the recommended fire frequencies of any threatened species located. This may mean adjusting the proposed burn regime should a threatened species be identified which requires a different burn pattern. The survey will be a one day site visit focusing on the 'Cell' proposed for burning and will utilise a random meander technique. Funds have been included in the TFD accordingly.			

Methods for monitoring the outcomes of ecological burns

Management zone/s	Method of monitoring	Date/s required
All Zones	Visual auditing and noting of observations in a diary record (template provided below). • A general description of the vegetation structures and species composition within the zone/s impacted by the ecological burn six months after the burn • An interpretation of the ecological outcomes of previous fires (either planned or unplanned) within the zone/s impacted by the ecological burn 6 months after the burn • A recommendation on the timing and location for future planned ecological burns within the zone (or other zones) • A written and photographic report for plots relating to plant species and cover abundance starting 12 months post fire. The plots to be used for this monitoring are 18, 26, 27, 50, 30, 34, 38, 41, 48 and 16. These coincide with the photo points A, B, C, D, E, F, G, H, I, and J)	Monitoring to occur 6 months after fire (summary of initial response) then a follow-up photographic and written report 12 months after the burn.
All Zones	Condition mapping (floristic and habitat field survey assessment)	

	to determine vegetation quality and ecological condition.	

Other fire management activities (where required)
Surrounding residents should be notified at least one month prior to an ecological burn occurring. All existing access tracks will be maintained for use for and during ecological burns. Should containment lines be required during controlled burns, they should be constructed, where possible, without complete removal of vegetation and exposing the soil surface.

Template for reporting of monitoring activities

Management zone/s	**Date**	**Observations and assessment of monitoring**

Diary template for fire management activities

Date	**Management zone/s**	**Description of activity undertaken or observation made**	**Minor variations** (details and reasons)

Section 4: Additional management plans

If required, complete this control of feral and overabundant native herbivores management plan

A table is provided below for the management plan to control feral and overabundant native herbivores. Add additional sections to the table if required. The plan must include, but is not limited to:

- a description of the feral or overabundant native herbivore/s
- consideration of relevant current OEH and other pest management programs and methods
- the method/s for feral and overabundant native herbivore control in each management zone, determined in accordance with best practice management
- the frequency and timing of the control actions in each management zone
- methods for monitoring the success of the pest control actions
- reporting and assessing the results from monitoring
- a timetable and measures for inspections to identify new feral or overabundant native herbivores that may adversely affect biodiversity values on the biobank site
- a diary for recording actions taken in accordance with the management plan to control feral and overabundant native herbivores and minor alterations to this plan permitted for adaptive management. The details (management zone/s, date, alternative action) and reasons for the minor alterations must be recorded in the diary.

When the management plan is reviewed (see item 10.2 in Section 1), control activities may be amended, deleted or added to take into account the feral and overabundant native herbivore on the site at the time.

Management plan to control feral and overabundant native herbivores

The management plan for feral and overabundant native herbivores includes information on the management requirements for the feral and overabundant native herbivores at the biobank site listed in the 'Feral and overabundant native herbivores' table. The possible methods of control for each species, used by OEH and other pest management programs, are listed and the suitability of each method is described in the 'Methods considered' table.

The landowner must carry out the methods for control for feral and overabundant native herbivores for each management zone according to the method and frequency as described in the 'Methods for control' table. The methods of control applied to the feral or overabundant native herbivores listed in the 'Feral or overabundant native herbivores' table as well as any other feral or overabundant herbivores that may be present on the site from time to time.

Monitoring and inspections of existing and new feral and overabundant herbivores at the biobank site as described in the 'Monitoring and inspections' table must be implemented.

The table titled 'Template for reporting of monitoring activities' must be completed to record observations during the implementation of the plan and assessment of the monitoring activities. The landowners must complete the table titled 'Diary template for feral and overabundant herbivore management' to record the management actions undertaken including any minor variations or observations made.

Feral and overabundant native herbivores

Feral type	Name of feral/overabundant native herbivore	Description of extent	Management zone/s
A	Rabbit	No evidence identified during surveys. Results of desktop analysis (NPWS Wildlife Atlas) indicate may be present on the site. Level of infestation appears very low and sporadic if present	All

Methods considered

Feral type	Name and description of program or method	Describe suitability
A	Monitored and controlled as necessary in accordance with the Rabbit control programs administered by the NPWS. The methods considered include: • Active shooting • Gassing of warrens • Baiting program • Trapping program	Baiting, gassing and active trapping considered most suitable. Active shooting may be appropriate though consideration of this technique is required considering proximity to nearby residencies, roads and other amenities.

Methods of control

Management zone/s	Feral type	Method of control	Frequency and timing
All	A	Baiting and/or active trapping are considered the most appropriate control methods due to the level of rabbit infestation appearing to be low. Warrens may also be treated via gassing if located on the site.	Gassing of any active warrens will occur within the first 3 years of the rehabilitation program if required. Baiting and/or trapping is the preferred method after this time in response to monitoring. Shooting may be appropriate though consideration of the proximity of residential dwellings would be required.

Monitoring and inspections

Management zone/s	Feral type/s	Method of monitoring	Date/s required
All	A	The monitoring is to comprise a nocturnal walk over of the site annually and a visual estimate of the level of grazing, browsing and/or burrowing impacts. The level of impact is to be recorded as negligible, minimal, moderate or high. The monitoring is to also include recording the date, number and location of any tracks, traces scats or sightings. This information is to be used in the feral herbivores pest management plan to inform the methods of control listed in that plan. Monitoring survey would include a random meander throughout the biobank site (suggest 2 hours) considering the Rapid Assessment Technique (Cooke et al, 2008).	Annually

Other management activities (where required)

Records will be kept of opportunistic pest animal sightings by the landholder in the "Diary template for vertebrate pest management" included below. These records will be submitted to OEH annually for review and discussion of suitable control methods to be employed.

Note: The above program has been included as a contingency only as no rabbits (or evidence of rabbits) were identified during field surveys. The amount included in the TFD reflects this contingency approach.

Template for reporting of monitoring activities

Management zone/s	Date	Current level of impact on vegetation This column must record impact as Negligible, Minimal, Moderate or High	Observations and assessment of monitoring

Diary template for feral and overabundant herbivore management			
Date of activity	**Management zone/s**	**Description and type of activity undertaken** This column must include details of the feral and overabundant herbivores targeted, control techniques applied and numbers controlled.	**Minor variations** (details and reasons)

If required, complete this vertebrate pest management plan

A table is provided below for the vertebrate pest management plan. Add additional sections to the table if required. The plan must include, but is not limited to:

- a description of the target fauna species e.g. pigs, foxes or other species such as feral dogs or goats
- consideration of relevant current OEH and other pest management programs
- the method/s of vertebrate pest control in each management zone determined in accordance with best management practice
- the frequency and timing of vertebrate pest control actions in each management zone
- methods for monitoring the success of vertebrate pest control actions
- reporting and assessing the results from monitoring
- a timetable and measures for inspections to identify new vertebrate pest species that may negatively impact on threatened species on the biobank site
- a diary for recording actions taken in accordance with the vertebrate pest management plan and minor alterations to this plan permitted for adaptive management. The details (management zone/s, date, alternative actions) and reasons for the minor alterations must be recorded in the diary in accordance with the requirements.

All pest species identified as requiring management on a biobank site must be included in the vertebrate pest management plan.

Separate management plans can be developed for each pest species.

When the management plan is reviewed (see item 11.2 in Section 1), control activities may be amended, deleted or added to take into account vertebrate pest species found on the site at that time.

Vertebrate pest management plan

The management plan for vertebrate pests includes information on the vertebrate pests and their extent existing at the time of the agreement as listed in the 'Vertebrate pests' table. The possible methods of control for each species, used by OEH and other pest management programs are listed and the suitability of each method to the biobank site is described in the 'Methods considered' table.

The landowner must carry out the methods for vertebrate pest control for each management zone according to the method and frequency described in the 'Methods of control' table. The methods of control will apply to the vertebrate pests listed in the 'Vertebrate pests' table as well as any other vertebrate pests that may be present on the site from time to time.

Monitoring and inspections of existing and new vertebrate pests on the biobank site, as described in the 'Monitoring and inspections' table, must be implemented.

The table titled 'Template for reporting of monitoring activities' must be completed to record observations during the implementation of the plan and assessment of monitoring activities. The landowner must also complete the 'Diary template for vertebrate pest management' to record the management actions undertaken, including any minor variations, and observations made.

Vertebrate pests

Pest	Name of vertebrate pest (e.g. pig, fox, goat, dog)	Description of extent	Management zone/s
A	Fox	Recorded during field surveys and known to occur on site.	Possibly present throughout the site, although specific locations unknown.
B	Wild dogs	Recorded during field surveys and known to occur on site.	Possibly present throughout the site, although specific locations unknown.
C	Pigs	Not sited during field assessments or known to occur on site. Should this species be identified treatment will be required as described below.	Possibly present in the northern portion of the site associated with Boat Harbour Creek.
D	Feral cat	Not sited during field assessments or known to occur on site. Results of desktop analysis indicate may be present on the site in a transient nature only. Opportunistic visitation only most likely.	Possibly present throughout the site, although specific locations unknown.

Methods considered

Pest type	Name and description of program or method	Describe suitability
A	Monitored and controlled in accordance with strategies outlined in Best-practice guidelines for fox control contained within the **Predation by the red fox - threat abatement plan (OEH, 2010).** The methods considered include: • Baiting. • Active shooting.	Baiting considered most suitable if sighted due to low potential activity. Shooting may be appropriate though consideration of the proximity of residential dwellings would be required.
B	Monitored and controlled in accordance with strategies outlined in; New South Wales **Wild Dog Management Strategy 2012 – 2015** (DPI, 2012). The methods considered include: • Baiting. • Active shooting.	Baiting considered most suitable if sighted due to low potential activity. Shooting may be considered appropriate though

		consideration of the proximity of residential dwellings would be required.
C	Monitored and controlled in accordance with strategies outlined on the DPI website, titled **Integrated Feral Pig Management.** The methods considered include: ⁾ Active trapping ⁾ Shooting from the ground ⁾ Strategic baiting	Strategic baiting using **1080** is considered most effective treatment if required. Shooting may be considered appropriate though consideration of the proximity of residential dwellings would be required.
D	To be monitored and controlled in accordance with NSW DPI Monitoring Techniques for Vertebrate Pests – Feral Cats (2007). Techniques considered include: ⁾ Ground shooting (in accordance with Standard Operating Procedure CAT001) ⁾ Live Trapping using Cage Traps (in accordance with Standard Operating Procedure CAT002) ⁾ Baiting (using Curiosity®)	Baiting not considered unsuitable at this stage as baiting program can impact on native carnivores such as the Spotted-tailed Quoll. Further research is being completed by the Australian Government which may remove this risk. It is recommended this research be monitored and if baiting approach can be modified to remove the threat to native carnivores it may be considered in the future for this site. Live trapping considered most effective

		treatment if required. Shooting may be considered appropriate though consideration of the proximity of residential dwellings would be required.

Methods of control

Management zone/s	Pest type	Method of control	Frequency and timing
All	A	Baiting will be used to control foxes. The ~~correct~~ type and method of baiting will need to consider the presence of native fauna and their feeding habits, especially the Spotted-tailed Quoll. Active shooting may be suitable but consideration of neighbouring properties is required.	As required.
All	B	Baiting will be used to control wild dogs. The type and method of baiting will need to consider the presence of native fauna and their feeding habits, especially the Spotted-tailed Quoll. Active shooting may be suitable but consideration of neighbouring properties is required.	As required.
All	C	Baiting will be used to control feral pigs should they be identified to be using the site. The type and method of baiting will need to consider the presence of native fauna and their feeding habits, especially the Spotted-tailed Quoll. Active trapping may also be suitable due to low numbers and localised infestation on the site. Active shooting may be suitable but consideration of neighbouring properties is required.	As required.
All	D	Active trapping using cage traps will be used to control feral cats should they be identified on site. Active shooting may also be suitable but consideration of neighbouring properties is required.	As required.

Monitoring and inspections of existing and new vertebrate pests

Management zone/s	Pest type/s	Method of monitoring	Date/s required
All	All	All sightings of feral animals by the landholder are to be recorded in monitoring log, and include the date, location, and the number of animals sighted and any damage noted. Monitoring of damage is essential and can include information on the size of the affected area and feral animal	Annually

		induced impacts. The monitoring is to comprise a nocturnal walk over of the site annually and a visual estimate of the level of grazing, browsing and/or burrowing impacts. The level of impact is to be recorded as negligible, minimal, moderate or high. The monitoring is to include recording the date, number and location of any tracks, traces scats or sightings of feral species. This information is to be used in the vertebrate pest management plan to inform the methods of control listed in that plan.	
All	All	Annual spotlight survey of vehicle accessible tracks and fire trails noting number of feral species identified. This survey can be conducted by the landholder.	Annually

Other management activities (where required)

Records will be kept of opportunistic pest animal sightings by the landholder in the "Diary template for vertebrate pest management" included below. These records will be submitted to OEH annually for review and discussion of suitable control methods to be employed.

Note: The above program has been included as a contingency only as no rabbits (or evidence of rabbits) were identified during field surveys. The amount included in the TFD reflects this contingency approach.

Template for reporting of monitoring activities

Management zone/s	**Date**	**Current level of impact on vegetation or threatened fauna species** This column must record impact as Negligible, Minimal, Moderate or High	**Observations and assessment of monitoring**

Diary template for vertebrate pest management

Date of activity	**Management zone/s**	**Description and type of activity undertaken** This column must include details of the vertebrate pests targeted, control techniques applied and numbers controlled.	**Minor variations** (details and reasons)

Photo points

This section of the management actions template is not part of *Annexure C: Management actions* but is required for *Annexure D* of the biobanking agreement which requires information relating to the placement of photo points for monitoring purposes. Fill in the table below so that this information can be included in the appropriate format in the final agreement. A map of the photo point locations is also required to be submitted.

Photo points should be positioned in areas that are likely to show change over time. Some plot locations can be used as photo points but many plot locations (especially in vegetated areas already in very good condition) may not show any change over time. Locate photo points where there will be changes because of management actions such as areas currently in low to moderate condition, targeted for revegetation and/or intensive weed control.

Photos are required to be taken every 12 months at the same location, direction, height and time of day.

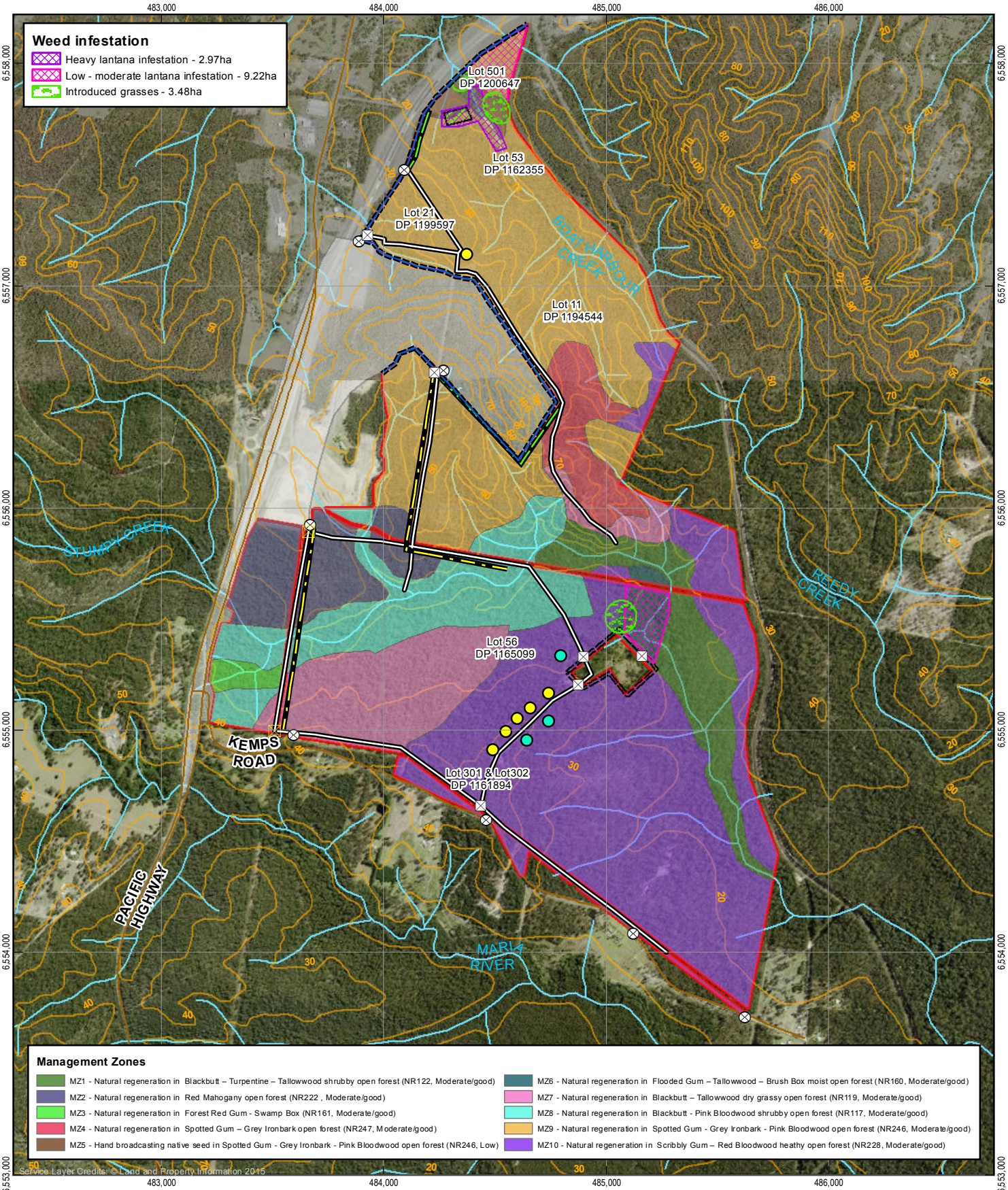
Annexure D: Monitoring, reporting and record keeping requirements

1 Monitoring requirements

1.1 The landowner must ensure that photographs are taken at photo-points at each of the locations and in the direction identified in the table below titled 'Locations of plots and photo points' within 12 months of the commencement date and then at least every 12 months thereafter.

1.2 The photo points are identified on the map entitled Photo Points map dated 01/06/2016 in Annexure A of this agreement. The purpose of the photographs is to show changes over time. Photographs should be taken at approximately the same direction, location, height and time of day (during daylight hours) in each reporting period (as defined in item 2.2 of this Annexure D) and retained for the life of this agreement. All photographs must be dated, stating the direction in which they were taken and identified with their locations.

Locations of photo points			
Projected coordinate system: GDA 94			
Photo point reference	Easting	Northing	Direction of photo (magnetic degrees)
A	485324	6555351	180
B	484536	6557961	180
C	484466	6557804	180
D	483517	6555412	300
E	485187	6555625	180
F	485144	6555906	90
G	484949	6555995	180
H	483557	6555694	180
I	483476	6555230	180
J	484507	6554741	90



Management Zones

- MZ1 - Natural regeneration in Blackbutt – Turpentine – Tallowwood shrubby open forest (NR122, Moderate/good)
- MZ2 - Natural regeneration in Red Mahogany open forest (NR222 , Moderate/good)
- MZ3 - Natural regeneration in Forest Red Gum - Swamp Box (NR161, Moderate/good)
- MZ4 - Natural regeneration in Spotted Gum – Grey Ironbark open forest (NR247, Moderate/good)
- MZ5 - Hand broadcasting native seed in Spotted Gum - Grey Ironbark - Pink Bloodwood open forest (NR246, Low)
- MZ6 - Natural regeneration in Flooded Gum – Tallowwood – Brush Box moist open forest (NR160, Moderate/good)
- MZ7 - Natural regeneration in Blackbutt – Tallowwood dry grassy open forest (NR119, Moderate/good)
- MZ8 - Natural regeneration in Blackbutt - Pink Bloodwood shrubby open forest (NR117, Moderate/good)
- MZ9 - Natural regeneration in Spotted Gum - Grey Ironbark - Pink Bloodwood open forest (NR246, Moderate/good)
- MZ10 - Natural regeneration in Scribbly Gum – Red Bloodwood heathy open forest (NR228, Moderate/good)

LEGEND

- Contours
- Watercourses
- Maintain track
- New track
- Existing strands to be removed
- Existing fence to be retained
- New fence
- Old farm pigsty
- General rubbish removal
- Logs/sleepers pile
- Existing gate
- New gate
- Signage
- Recent or proposed development
- Norton biobank site

0 200 400 800
Metres

Geographic Coordinate System
Horizontal Datum: Geocentric Datum of Australia 1994

N

Roads and Maritime Services
Norton Biobank Site
BioBanking Assessment

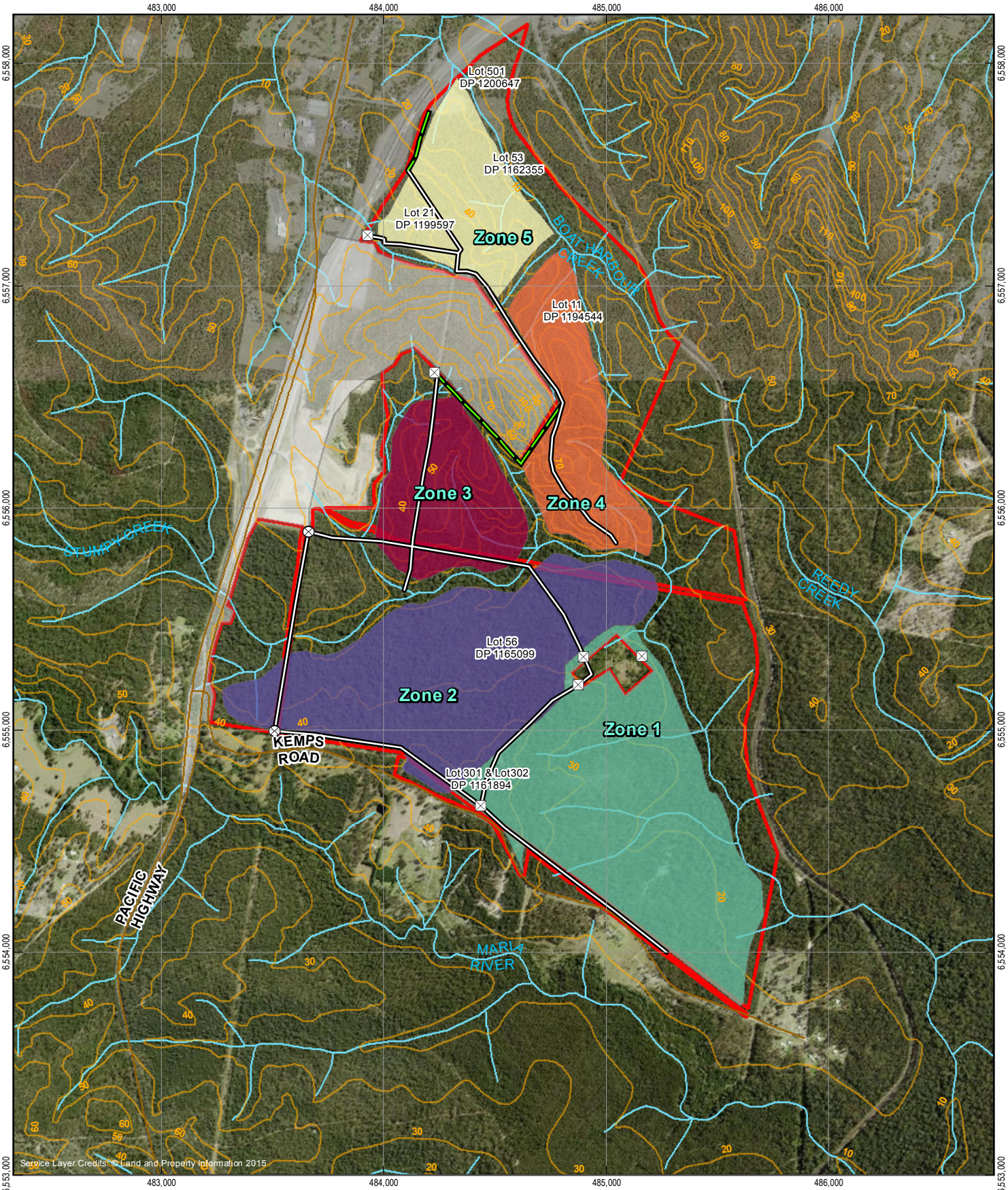
Job Number	21-24927
Revision	A
Date	11 Aug 2016

Biobank property action plan

Figure 5

N:\AU\Sydney\Projects\21\24927\GIS\Maps\Deliverables\Norton MAP\21_24927_Z001_Property_Action_Plan.mxd Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: NSW Department of Lands: Cadastre - Jan 2011; LPMA Data 2013; Lewis and James (2010) Kempsey to Eungai: Compensatory Habitat package' Created by:mking3



LEGEND

- Contours
- Watercourses
- Maintain track
- New track
- Existing gate
- New gate
- Recent or proposed development
- Norton biobank site
- Zone 1
- Zone 2
- Zone 3
- Zone 4
- Zone 5

0 205 410 820

Metres

Geographic Coordinate System
Horizontal Datum: Geocentric Datum of Australia 1994

N

Roads and Maritime Services
Norton Biobank Site
BioBanking Assessment

Job Number	21-24927
Revision	A
Date	18 Aug 2016

Biobank fire management plan

Figure 6

N:\AU\Sydney\Projects\21\24927\GIS\Maps\Deliverables\Norton MAP\21_24927_Z002_Fire_Management_Zones.mxd Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: NSW Department of Lands: Cadastre - Jan 2011; LPMA Data 2013; Lewis and James (2010) Kempsey to Eungai: Compensatory Habitat package' Created by:mking3

Appendix F – Response to the Department's Document Review / Comments

Document Review / Comments

Proponent:	Roads and Maritime Services
Project:	Pacific Highway Upgrade (Nambucca Heads to Urunga), NSW
Document:	Norton & Griffin Offset Management Plan
EPBC conditions:	EPBC 2013/6963: Condition 21.
Document full title	*Norton and Griffin Offset Management Plan, 21/23829, December 2014*
Date document received	December 2014
Drafting officer	Kahli Beissner
Reviewing officer	Peter Blackwell

Condition Number	Condition	Has the condition been met?	Comments (Gaps in information, improvements, adequacy of technical/ scientific information and assumption/justifications, etc.)	Response by Proponent to comments/issues
General Comments			Please specify if comprehensive targeted fauna surveys have been undertaken on both offset sites.	Targeted fauna surveys have been undertaken in all of the offset sites. The surveys undertaken are consistent with the approval condition requirements regarding a baseline population of the affected threatened fauna and a baseline description of the quality of habitat for each threatened species. The affected threatened fauna are each cryptic and/or prone to population fluctuations and/or mobile and transitory in their use of habitat as clearly stated and referenced throughout the NGOMP. The surveys undertaken are adequate to manage the site to achieve improvements in habitat quality and to deliver an effective biodiversity offset for the affected threatened fauna.
Condition 21	Within one year from the date of the approval, the person taking the action must provide to the Minister for approval, a plan for the management of the Norton Offset Site and Griffin Offset Site. The Norton and Griffin Offset Management Plan (NGOMP) must be targeted to the ecological requirements of the Koala, Grey-		Please include a section to discuss the project area, with focus on vegetation types, the extent and quality of threatened species habitat, methods and locations of surveys, results of targeted fauna surveys and detailed baseline conditions.	Noted and included in Section 11 along with updated Offset assessment guide calculations.

Condition Number	Condition	Has the condition been met?	Comments (Gaps in information, improvements, adequacy of technical/ scientific information and assumption/justifications, etc.)	Response by Proponent to comments/issues
	headed Flying-fox, Spotted-tail Quoll, Regent Honeyeater and Swift Parrot and build upon the ideas and concepts described in the referral. The plan must include but need not be limited to:			
			Please ensure that terminology committing to the actions and aims of the plan is used. For example, change “would” to ‘will’.	Noted and amended.
			Please provide updated Management Plan Templates in Appendix B if available. Please justify including them from the Norton offset site but not for the Griffin offset site.	Updated BioBanking assessment and MAP for the Norton offset site have been provided as Appendix E. Equivalent management plans have not been provided for the: • Griffin site, because as stated in section 8.2.2 the site will be transferred to NPWS and will then be subject to NPWS’s management and monitoring framework. NPWS will manage the site in accordance with this NGOMP and under the Clybucca Historic Site Plan of Management (NPWS, 2007) and other

Condition Number	Condition	Has the condition been met?	Comments (Gaps in information, improvements, adequacy of technical/ scientific information and assumption/justifications, etc.)	Response by Proponent to comments/issues
				relevant plans listed in section 8.2.2. • Boambee SF offset site, because the site will be transferred to FCNSW and managed as a Flora Reserve as stated in section 9.1. FCNSW will prepare a working plan for the Flora Reserve as stated in section 9.1 • xxxxx offset site,because the site has not yet been subject to a full BioBanking assessment and management actions plans have not yet been prepared. Each of the offset sites will be managed in accordance with this NGOMP.
		Measurable baseline conditions, triggers and targets are required as outlined in the offsets policy and the guide to the Offset Assessments guide as available at:		Measurable baseline conditions, triggers and targets have been added to sections 7, 8, 9 and 10.

Condition Number	Condition	Has the condition been met?	Comments (Gaps in information, improvements, adequacy of technical/ scientific information and assumption/justifications, etc.)	Response by Proponent to comments/issues
			http://www.environment.gov.au/epbc/publications/epbc-act-environmental-offsets-policy	
	Map(s) and shapefiles that clearly define the location and boundaries of the offset sites;	No	Maps and shapefiles that define the location and boundaries of the offset sites have been provided. ACTION Please clarify if the plot locations in Figures 4 and 7 are from the 2014 surveys.	The plot locations in Figures 4 and 7 are from the GHD 2014 surveys. Additional plots from 2016 surveys have since been added to figure 4.
			Please justify the number of the plots on the Griffin site (Map 7) and their locations (ie. no plots within the wet heathland, most plots on or near roads).	Plot 13 was sampled in the wet heath (see the plot/transect table in Appendix B). Also note plot 12. These two plots did not appear on the draft Figure because of a GIS error that has now been corrected. No plots are on roads. The start point of all plot/transects are at least 10m from tracks and extend 50 metres away from the track edge. All tracks at the site are single lane, dirt or gravel tracks without any table drains or other formed structures. The plots are located well beyond the extent of associated edge effects.

Condition Number	Condition	Has the condition been met?	Comments (Gaps in information, improvements, adequacy of technical/ scientific information and assumption/justifications, etc.)	Response by Proponent to comments/issues
			Please provide maps showing the locations of the nocturnal surveys, diurnal bird surveys and motion sensing camera traps. Maps of the survey locations and habitat types within the project area are required.	The locations of camera traps have been added to relevant figures. Nocturnal surveys and diurnal bird surveys are undertaken throughout broad areas and/or long transects and cannot be readily mapped on figures. Habitat types were mapped on Figures 4 and 7. Text boxes have been added to make it clearer which habitat types comprise habitat for each of the affected threatened fauna.
			Sections 3.1 and 3.2 state that the Norton offset site is 488 ha, however the assessment documentation has it as 499 ha. Section 5.2.1 describes 484 ha of native vegetation and 4.6ha of cleared land (totalling 488.6 ha). Please clarify which is correct and provide justification for the discrepancy.	The area of the Norton offset site has been subject to multiple changes with cadastral lot boundary changes as a result of developments. The 499 ha area presented in the assessment documentation was initially reduced due to a boundary adjustment to accommodate a quarry development. The discrepancy between the figure of 488 ha and 488.6 ha presented in the final draft NGOMP is because of a rounding error. The total area of the Norton site has since changed with recent land acquisitions, exclusion of land to accommodate a section of the

Condition Number	Condition	Has the condition been met?	Comments (Gaps in information, improvements, adequacy of technical/ scientific information and assumption/justifications, etc.)	Response by Proponent to comments/issues
				Pacific Highway upgrade and recognition of easements. The new area of the Norton offset site / biobank site is 495.9 ha. The NH2U Norton offset area is 270 ha.
			Section 4.2 mentions that the Griffin offset site is 167 ha, however the Assessment documentation says that it is 165 ha. Please clarify which is correct and justify the difference.	The figure of 165 ha included in the assessment documentation is as was presented in Lewis and James (2010) and Lewis and Richards (2011) and presumably is the result of a GIS error. The figure of 167ha presented in the NGOMP is based on the digital cadastral database provided by the NSW Land and Property Management Authority.
			Please provide maps showing the extent of habitat available for each listed species being considered in this plan.	Habitat types were mapped on figures 4 and 7. It is not practical to map habitat for each of the five affected threatened fauna species separately because that would require multiple overlapping polygons or additional sets of near-identical figures. Text boxes have been added to make it clearer which habitat types comprise habitat for each of the affected threatened fauna.

Condition Number	Condition	Has the condition been met?	Comments (Gaps in information, improvements, adequacy of technical/ scientific information and assumption/justifications, etc.)	Response by Proponent to comments/issues
	Details on the quality of the offset with reference to all EPBC species this plan is intended to protect;	No	Habitat quality for the koala, Grey-headed Flying Fox, Spotted-tail Quoll, Regent Honeyeater and the Swift Parrot on the Norton offset site is discussed in Section 3.4, and for the Griffin offset site in Section 4.4. The quality of the offset is outlined in Section 7 but requires further detail and justification, particularly in relation to scores entered into the Offsets Assessment Guide calculator. ACTION The assessment documentation refers to 15 ha of cleared habitat that will be regenerated. Please discuss where this is located and proposed how this will be done.	Noted and included in Section 11 along with updated Offset assessment guide calculations. The area of 15 hectares of cleared land that would be regenerated was based on mapping of vegetation in the former Norton site included in Lewis and James (2010). Since then the site boundary has been modified and around five hectares of cleared land has been set aside for a house site. No regeneration of cleared land is included in this offset proposal.
			Section 3.4.1 states that that Norton has 484 ha of koala habitat. Later in the section mentions that the property contains 197 ha of Secondary Class A habitat (147 ha moist sclerophyll forest, 50 ha dry sclerophyll forest) and 337 of Secondary Class B habitat. This totals 534 ha of koala habitat. Please justify and correct this discrepancy.	No - Section 3.4.1 describes the extent of koala habitat at the Norton offset site as: - 197 ha of Secondary Class A habitat comprising 147 moist sclerophyll forest mapped by KSC (2011) and 50 ha of dry sclerophyll that was reclassified by Lewis and James (2011), and -337 ha of Secondary Class B habitat mapped by KSC (2011) of which 50 ha was reclassified by Lewis and James (2011). So the total is 147 ha class A plus 337 ha class B as mapped by KSC (2011) OR 197 ha class A plus 287 ha class B as mapped by Lewis

Condition Number	Condition	Has the condition been met?	Comments (Gaps in information, improvements, adequacy of technical/ scientific information and assumption/justifications, etc.)	Response by Proponent to comments/issues
				and James (2011) both of which = 484 ha which along with 4.6 hectares of cleared land = the 488.6 ha area of the Norton site. The updated NGOMP includes revised mapping and calculations based on the new site boundary and the results of GHD surveys. The new area of the Norton offset site / biobank site is 495.9 ha. The Norton offset site contains around 492 hectares of habitat of varying quality for the resident population of the Koala associated with wet and dry sclerophyll forest and grassy woodland. The NH2U Norton offset area contains 270 hectares of occupied Koala habitat.The KSC (2011) mapping has been summarised in more general terms.
			Section 4.4.1 mentions that the Griffin offset site contains 81 ha of Secondary Class A habitat and 50.5 ha of Secondary Class B habitat. This equals 131.5 ha, however the start of this section refers to 132 ha. Please clarify which is correct.	It is fairly standard practice to round to the nearest whole number in introductory text (i.e. 131.5 ha was rounded up to 132 ha).
			Please explain what is meant by “A further 50.5 ha would comprise Secondary Class B habitat”. Is it Secondary Class B habitat or not?	Noted and reworded.
			Please list all koala food trees on both properties and their significance (ie. Primary Food Tree).	Noted and added as Table 3 (which also includes flying fox, swift parrot

Condition Number	Condition	Has the condition been met?	Comments (Gaps in information, improvements, adequacy of technical/ scientific information and assumption/justifications, etc.)	Response by Proponent to comments/issues
				and regent honeyeater food tree species).
			Please clarify if the “total habitat score of 9” (Section 3.4.1) is comparable to the habitat quality as entered into the Offset Assessment Guide calculator.	The total habitat score of 9 is as calculated in accordance with the Draft EPBC Act referral guidelines for the vulnerable Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) (DSEWPaC, 2013) as stated clearly in Section 3.4.1. It is not directly comparable to the habitat quality as entered into the Offset Assessment Guide calculator.
			Please provide a score (and justification) for habitat quality as defined by the Offset Policy and Offset Assessment Guide for each of the listed threatened species (Sections 3.4 and 4.4).	Noted and included in Section 11 along with updated Offset assessment guide calculations.
			Section 7 refers to the Offset Quality and the offsets calculator. Please comprehensively justify all elements entered into the offsets calculator as suggested in the guide to the Offset Assessment Guide and the offset policy.	Noted and included in Section 11 along with updated Offset assessment guide calculations.
	Information about the Koala, Grey-headed Flying-fox, Spotted-tail Quoll, Regent Honeyeater and Swift Parrot (in relation to ecology, biology and conservation status) to inform appropriate management actions;	No	Section 2 provides an appropriate overview of the ecology and biology of Koalas, Grey-headed Flying Foxes, Spotted-tail Quolls, Regent Honeyeaters and Swift Parrots. Recent conservation status and advice for the EPBC listed species needs to be considered. ACTION	Amended to reflect the listing of the Regent Honeyeater as a critically endangered species in March 2015. Efforts have also been made to reference updated referral guidelines, recovery plans, threat abatement plans etc. where relevant and if likely to affect the

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			Please ensure that current referral guidelines, recovery plans, threat abatement plans, conservation advice and listing advice are referenced. For example, the Regent Honeyeater is now listed as Critically Endangered.	outcome of the assessment. However since the main purpose of most references to these documents is to provide general information about ecology, biology and to inform appropriate management actions if the information is still factually correct then the original reference has been retained.
			Please discuss the conservation status of the Swift Parrot in Section 2.6.	Amended.
	The results of targeted field surveys within both offset sites (undertaken at any ecologically appropriate time of the year) to assess habitat suitability and presence/absence of individuals in relation to the Koala, Grey-headed Flying-fox, Spotted-tail Quoll, Regent Honeyeater and Swift Parrot;	No	Section 1.4.3 mentions that flora surveys were undertaken on the Norton offset site from 4 – 7 and 13 May 2011, and on the Griffin offset site on 8 and 8 August 2011. Habitat suitability of both offset sites was undertaken in September 2014. Appendix A provides data collected from the BioMetric plots and of fauna observations. More information is required on the methodologies undertaken for targeted fauna surveys. There is confirmed koala presence on the Norton offset site (Section 3.5.1). The Griffin offset site surveys did not identify koalas but recent records indicate that they are present in the area (Section 4.5.1). 3 known Grey-headed Flying Fox (GhFF) camps are located within the vicinity of the Norton offset area and individuals have been recorded on site (Section 3.5.2). The surveys on the Griffin offset site did not identify any GhFF but this is most likely due to the survey being undertaken at an ecologically inappropriate time (as admitted in Section 4.5.2). There are 2 roost camps located near this offset sites and	Noted. Additional detail added to Section 1.4.3.

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			previous records indicate the GhFF occur on the site (Section 4.5.2). The Spotted-tailed quoll was not identified during the Norton and Griffin offset site surveys, however recent records have identified them in the region (Sections 3.5.3 and 4.5.3). There are no confirmed records of the Regent Honeyeater and Swift Parrot in the locality of the Norton offset site and they were not identified during surveys (Sections 3.5.4 and 3.5.5). The Regent Honeyeater and Swift Parrot were not identified during the Griffin offset site surveys, yet there are records of the Swift Parrot occurring in the area (Sections 4.5.4 and 4.5.5).	
			ACTION Section 1.4.3 mentions that diurnal bird surveys were undertaken “over at least 3 sets...”. Please specify how many surveys were undertaken, if they were done at dawn or dusk, and the methodology that was used.	Section 1.4.3 updated accordingly.
			Please specify how targeted Spot-tailed Quoll targeted surveys were undertaken (Section 1.4.3).	Spotlighting and camera traps. Section 1.4.3 has been updated to make this clearer.
			Please clarify which species were targeted during the nocturnal surveys and diurnal bird surveys (Section 1.4.3).	Koala, Spotted-tailed Quoll and Grey-headed Flying-fox were targeted during nocturnal surveys. The Swift parrot and Regent Honeyeater were targeted during diurnal bird surveys. Section 1.4.3has been updated to make this clearer.

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			Please justify how the flora survey dates were undertaken at an ecologically appropriate time of year.	Flora surveys that required accurate samples of plant species richness were conducted in April 2016 at the Norton site, May and November 2015 at the Boambee SF offset site and October 2016 at the xxxxx site. Each of these surveys were conducted in Autumn or Spring which is when the majority of native plant species are flowering or fruiting and which is an ecologically appropriate time of year for plant species richness surveys. Flora surveys were undertaken in August 2011 at the Griffin site and then in September 2014. The aim of the surveys at the Griffin site (and the overarching aim of all surveys for this threatened fauna offset management plan) was to describe vegetation type and condition. Any seasonal limitations on the identifiability of individual plant species will have a negligible effect on this aim.
			Please clarify if the BioMetric plots provide information on weed cover as a percentage. Ie., does 'exotic plant cover' include weeds?	'Exotic plant cover' as measured according to the BBAM includes exotic species and non-indigenous natives which is generally accepted to mean 'weeds'.

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			Figure 4 shows that a Koala was observed during a survey at Norton. Appendix A shows the field survey results for the Norton site, where no Koalas were found to be present. Please clarify at what point the data for the GIS was collected and whether the information needs to be reconciled.	The GIS data was collected at the location of an opportunistic observation of a Koala. It was mistakenly not included in the species list which was mainly compiled from pro formas from dedicated fauna surveys such as diurnal bird surveys, nocturnal surveys etc.
			Please provide the raw data from the Koala SAT searches.	Results of Koala SAT searches are as presented in Tables 2, 5, 8 and 11. Data for Koala activity levels have been added.
	Clear performance objectives and management actions that will enable maintenance and enhancement of habitat within the offset area, as well as contribute to the better protection of individuals and/or populations of EPBC species onsite;		Section 5.1 states that the Norton offset site will be secured in perpetuity by registering a Trust Agreement (conservation agreement) on the land title. This property will be sold once the Trust Agreement has been registered. The Griffin offset site is owned by Roads and Maritime Services (RMS) and will potentially be transferred over to NPWS for ongoing management and protection (Section 6.1). The Norton offset site will be managed through: maintenance of tracks and easements, removal of rubbish, establishment and maintenance of fences/gates/signs, maintenance of native vegetation, natural regeneration of cleared or degraded land, invasive species control, fire management, exclusion of stock, management of human disturbance and retention of habitat resources including dead timber and rocks (Section 5.2.1). The Griffin offset site will have the same management actions implemented (Section 6.2.1). ACTION Section 2 proposes that selected sites within the offset areas will be revegetated to enhance habitat for the Koala, GhFF	Section 2 does not state that revegetation is proposed as a management action. The only references to revegetation in Section 2 are the following direct quotes which state management actions listed in recovery plans: Specific objective 2a: Revegetate and rehabilitate selected sites (DECC, 2008) 2. Maintain and enhance the value of Regent Honeyeater habitat at the key sites and throughout the former range, by active participation in land-use planning processes and by active vegetation rehabilitation at strategic sites (Menkhorst et al. 1999a).

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			and Regent Honeyeater. Please include details of this management action if it will be undertaken; otherwise please remove from Section 2.	The management actions proposed in the NGOMP involve rehabilitation of existing habitat rather than revegetation, however this is still consistent with the wording of the management actions which encompasses both approaches. It would not be appropriate to remove the word 'revegetation' from direct quotes of management actions listed in recovery plans.
			Please discuss when controlled burning will be undertaken (ie. a certain percentage of biomass or weeds).	It is not practical to prescribe burns based on set dates or factors such as biomass or weeds. Ecological burns will be conducted in order to maintain the prescribed fire frequency for each vegetation type. This is typically an inter fire interval for individual cells of greater than 7 years, less than 25 years. Wild fire and prescribed hazard reduction burns by the Rural Fire Service or other parties may also occur. These burns will be need to be noted and the planning for the next prescribed burn adjusted accordingly to ensure that the minimum inter-fire frequency for any given cell is maintained.
			Sections 5.2.1 and 6.2.1 outline some of the feral animals that pose a risk to koalas and spot-tailed quoll. Please include feral animals that are a threat to the GhFF, Swift	The Cane Toad does not occur on the mid north coast of NSW.

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			Parrot and the Regent Honeyeater. Is the cane toad present within the offset areas?	
			Please provide more details on how human disturbance will be managed (Sections 5.2.1 and 6.2.1).	
			Please consider eradicating all feral animal species, including pigs and rabbits as they reduce habitat quality.	"Pest fauna control … principally targeting wild dogs and foxes" section 5.3.5, 6.3.3 is proposed because dogs and foxes are recognised as the most serious and specific threats to the Koala and Spotted-tailed Quoll. Further, wild dogs were directly observed at both sites during surveys. Section 5.3.5, 6.3.3 go on to say "Control programs would be targeted to other pest fauna (e.g. goats, pigs, rabbits) as appropriate if populations or impacts are detected during monitoring."
			Measureable targets are required for all management actions. Measurable triggers and corrective actions that are specific and timely are required for all potential risks. Please consider including a risk analysis table.	Noted. 'Management actions plan' tables for each offset site have been updated with measureable targets for management actions where appropriate (e.g. measureable parameters such as weed cover). The performance targets that have been set are outcomes based, as is appropriate for an adaptive management framework. It is not always appropriate to set specific, quantifiable targets in this context e.g. if a fence is broken the time

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				taken to fix it will depend on the length of fence requiring repair, topography, magnitude of damage etc. Repairs and other corrective actions will be undertaken as soon as is practicable to ensure performance targets are met.
			Norton offset site Please provide information on the timing for implementing the conservation agreement.	BioBanking has been confirmed as the conservation agreement for the Norton site. A draft BioBanking assessment and agreement application has been prepared. The final timing for implementation will depend on the time taken for OEH to process the application.
			Please provide an update on the discussions with NPWS about accepting the Griffin offset site.	NPWS have accepted the Griffin offset site for inclusion in the Clybucca Historical site. The site will first be conserved under a BioBanking agreement to help allocate appropriate funds for management (see Section 8.1).
			Please consider erecting more signs around the offset site, particularly along the eastern border and near the proposed development, and along tracks. Please justify not erecting a fence to the north of the offset site where there are adjoining paddocks (Figure 8).	The paddocks to the north of the Norton site are now located within the offset site because of a recent RMS land acquisition and boundary adjustment. The northern and eastern boundaries of the Norton offset site adjoin the main north-south railway line. There is no public access. A sign is proposed at

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				the south-eastern corner of the site where it adjoins a public road.
			Please include information on how potential effects of the proposed development adjoining the Norton offset site (as seen in Figure 8) will be managed, with focus on an increased edge effect, higher potential of human disturbance and impact on EPBC listed species.	Edge effects etc will be managed through: the maintenance of signs and fences; weed control; and ongoing vegetation monitoring and bush regeneration.
			Section 5.2.1 mentions that minor weed infestations will be treated but does not outline what will happen with more extensive weed infestations.	Extensive weed infestations at the site are discussed in the immediately preceding two bullet points. Any new weed infestations will be treated before they become severe or extensive.
			TABLE 7- Management Actions (Norton) Activities 2 and 3 have the performance objective of "Minimise unauthorise access to the site and harmful activity". Please consider rewording to restrict access and eliminate harmful activity.	Noted and amended.
			Activities 1, 2 and 3 require performance indicators in relation to fence, gate and sign condition.	Noted and amended.
			If fences, signs or gates require repair, please provide a timeframe of when it will be fixed once an issue is identified.	The performance targets that have been set are outcomes based, as is appropriate for an adaptive management framework. It is not appropriate to set specific, quantifiable targets in this context e.g. if a fence is broken the time taken to fix it will depend on the length of fence requiring repair, topography, magnitude of damage (which could range from a few metres of broken strands to an

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				entire fence line being burnt out in a wildfire) etc. Repairs and other corrective actions will be undertaken as soon as is practicable to ensure performance targets are met.
			Please provide activity details, performance objectives and timeframes for if rubbish is identified throughout the offset site and not just in the areas previously identified.	Note and amended.
			Please include management actions for maintenance of easements, fire (ecological burns, wildfire), erosion control, restricting human activities such as clearing and camping, and retaining habitat features.	Note and amended.
			Please specify if a performance objective for the treatment of exotic grasses, woody and herbaceous weeds is to eradicate them within the offset site.	Performance target is set as: Mature woody weeds maintained at less than 10% of original distribution in all zones from year 10 and in perpetuity. Other herbaceous and pasture weeds maintained at less than 10% of original distribution in all zones from year 10 and in perpetuity. Given wind and birds as vectors for weeds 'eradication' is not a practical or achievable performance target.
			It is unclear if exotic grasses, woody weeds and herbaceous weeds will be controlled and eradicated throughout the offset area under Activity 9. Please justify 2 people being able to monitor and control weeds over 484 ha in one day. Will identified weed infestations be treated again if initially unsuccessful?	Additional detail has been added for these tasks. Additional weed control effort has been added.

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			Please specify the proposed actions for bush regeneration (in Activity 9).	
			Please discuss how other pest fauna will be controlled (ie., goats, pigs, rabbits, cane toads, etc).	See 'Management strategies, Pest fauna control' in the various management sections.
			This Table mentions that feral animal control will be focussed on foxes and dogs. Please ensure that feral cats are a target species as stated previously in the plan. Is a performance objective that all feral animals will be eradicated within the offset site or kept below baseline?	Noted and amended. The performance target will be to keep pest fauna below baseline levels. It is not possible to commit to eradication given the likelihood of recruitment from outside of the site.
			TABLE 8- Management actions timing Some of the timeframes proposed have elapsed. Will this table require updating to reflect accurate timeframes?	All timeframes have been updated (noting that the Department's review comments on the draft NGOMP were not received for 14 months and were received after many of the timeframes had elapsed.
			Please justify not proposing fence, sign and gate repair and maintenance (if required) during 2016.	Noted and amended.
			Justification is required for rubbish removal not being proposed as a continuing management action.	Noted and amended.
			Griffin Offset Site As public access is permitted in the offset area, please justify how "potential public access is unlikely to reduce the value of the site", particularly as illegal dumping has been identified on the site (Section 6.2.1).	The Griffin offset site is very isolated and cannot be accessed via public roads. Although public access is permitted visitation levels are likely to be very low and public access is unlikely to reduce the value of the site. There is no evidence of illegal dumping. The rubbish at the mapped locations is more likely

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				associated with previous land uses noting that the site was privately owned until purchased by RMS and has not been formally set aside and signposted as a conservation area.
			Please ensure that the prior suggestions for Table 7 and Table 8 are considered for Tables 11 & 12.	Noted and amended.
			Please specify if there is an existing fence along the southern border of the offset site.	There is no fence along the southern border of the site. The site is surrounded by intact native vegetation.
			The areas to be treated for exotic grasses and herbaceous weeds, and areas to be cleared of rubbish are not evident in Figure 9 even though being discussed in Section 6.2.1. Please update the map accordingly.	Noted and amended.
	An assessment of the baseline population for EPBC species which are detected within the offset area during field surveys;	No	The comments against Condition 21 summarise results of the fauna surveys. More information is required on how the surveys were sufficiently targeted, therefore providing an accurate baseline. ACTION Please include information on the baseline populations for the Koala, Grey-headed Flying Fox, the Spot-tailed Quoll, Swift Parrot and the Regent Honeyeater. Please demonstrate that adequate targeted surveys were undertaken.	Baseline populations are described in 3.5, 4.5, 5.5 and 6.5 of the report. The surveys undertaken are consistent with the approval condition requirements regarding a baseline population of the affected threatened fauna and a baseline description of the quality of habitat for each threatened species. The affected threatened fauna are each cryptic and/or prone to population fluctuations and/or mobile and transitory in their use of habitat as clearly stated and referenced throughout the NGOMP. The surveys undertaken are adequate to manage the site to achieve

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				improvements in habitat quality and an effective biodiversity offset for the affected threatened fauna. RMS does not intend to undertake any further baseline surveys of the offset sites, other than that required to enter into a BioBanking agreement with OEH over the Norton and xxxxx sites.
	Demonstration that any management actions to be undertaken will not adversely impact EPBC species (for example, this may apply to pest control);	No	ACTION Please demonstrate how each of the proposed management actions will not adversely impact EPBC species. For example, what measures will be put in place to ensure that ecological burns do not harm wildlife or that traps will not affect non-target species?	Additional detail has been added as appropriate (e.g. avoiding impacts of pesticide use on threatened plants or aquatic habitat, avoiding impacts of pest control on quolls etc.).
			Sections 5.2.1 and 6.2.1 propose no baiting in the offset areas to eliminate the risk to the Spot-tailed Quoll, however Sections 5.3.5 and 6.2.1 refer to using bait stations. The draft Conservation Area Plan of Management in Appendix B mentions controlling feral animals through baiting (Section 7). Please specify which is correct.	Section 5.2.1 amended to read “poison baiting is the least preferred control option at the Norton offset site” consistent with the Griffin offset site (Section 6.2.1). Consultation with OEH and local land services control offices suggests that the risk of harm to quolls from baiting can be reduced to acceptable levels. Sections 5.3.5 and 6.2.1 refer to using bait stations with appropriate monitoring and adaptive management measures to reduce the risk of harm to quolls.
	A description of funding arrangements or agreements	Yes	A Property Works Plan will be developed with the NCT at the time the Trust Agreement is registered on the Norton offset	

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	including work programs and responsible entities;		site. New property owners will have to manage the property in accordance with the Department approved Offset Management Plan for a minimum of 20 years. Funding will be provided to NCT to implement compliance monitoring with the Trust Agreement (Section 5.1) as outlined in Section 5.3.1. For the Griffin offset site, the NPWS will manage and monitor the offset site if it is accepted as an ongoing reserve (Sections 6.1 and 6.2.3).	
	Details of a comprehensive long-term monitoring program for determining the effectiveness of management actions;	No	For the Norton offset site, NCT will monitor the effectiveness of management actions (Section 5.3.1). If NPWS accepts the Griffin offset area, they will implement all monitoring (Section 6.3.1). ACTION Table 9 appears to show only the reporting aspects of the monitoring program. Please include in the table monitoring efforts such as vegetation surveys and targeted fauna surveys.	Noted and amended.
			Please include targeted fauna surveys over the monitoring period to provide information about the listed EPBC species on the Norton Offset site.	The proposed monitoring program is consistent with the approval condition requirement a monitoring program to assess the effectiveness of the management actions measured against the baseline condition. The NGOMP does not include a requirement for ongoing monitoring of threatened fauna because that would impose monitoring and management

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				requirements on FCNSW, NPWS and biobank site owners that are not practical or achievable. The affected threatened fauna are each cryptic and/or prone to population fluctuations and/or mobile and transitory in their use of habitat as clearly stated and referenced throughout the NGOMP. The link between management actions and improvements in habitat quality and protection of populations is demonstrated in Table 32. RMS have committed to a full ecological survey of the offset sites at Year 5 to further confirm the link between the proposed management actions and habitat quality and the security of threatened species populations. Ongoing monitoring of ecological condition will be undertaken by biobank site owners (supported and enforced by OEH), NPWS and FCNSW.
			Section 5.3.4 proposes monitoring vegetation and habitat every 5 years. Please consider revising this to provide more frequent monitoring for the first decade.	Vegetation/habitat quality will be monitored annually at photo points as part of the annual report required under the BioBanking methodology at the Norton and xxxxx offset sites and as part of FCNSW's and NPWSs' monitoring of the Boambee SF and Griffin offset sites. Monitoring linked to

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				weed and pest fauna control would occur annually or biannually. These various monitoring regimes would be sufficient to detect a decline in condition before a large change occurs that would be addressed in the following years' management actions. A full ecological survey at Year 5 will be used to confirm the improvement in habitat quality.
			This section mentions a baseline survey to be undertaken at the end of 2015 and for monitoring points to be established. Baseline conditions are as reported in this Offset Management Plan so please consider rewording. Were these 2015 surveys undertaken? If so, please provide the results in the Plan. Monitoring points will need to include locations previously surveyed during actual baseline surveys. Please provide a map indicating the locations for the detailed vegetation and habitat monitoring.	The surveys undertaken at the offset sites through 2014, 2015 and 2016 collectively comprise the baseline conditions. Results are provided in the appendices to the plan. The plan has been reworded to make this clearer. Maps and summary tables show the locations for the detailed vegetation and habitat monitoring.
			If the monitoring methodology and sites will be specified in the NCT's site specific plan of management (Appendix B), please provide the final version to the Department or include all the details within the Offset Management Plan.	The details have been included in the plan.
			Please consider ongoing monitoring of the same 13 BioBanking plots/transects at the Norton offset site as shown in Figure 4. The 5 sites proposed in Section 5.3.4 are not sufficient.	Six plot/transects will be monitored in the NH2U Norton offset area. A further five plot/transects will be monitored in the WC2NH Norton offset area. 11 photo points will be monitored annually across the Norton biobank site.

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			Please justify not proposing ongoing targeted fauna surveys.	As above, the NGOMP does not include a requirement for ongoing monitoring of threatened fauna because that would impose monitoring and management requirements on FCNSW, NPWS and biobank site owners that are not practical or achievable. The affected threatened fauna are each cryptic and/or prone to population fluctuations and/or mobile and transitory in their use of habitat as clearly stated and referenced throughout the NGOMP. The link between management actions and improvements in habitat quality and protection of populations is demonstrated in Table 32. RMS have committed to a full ecological survey of the offset sites at Year 5 to further confirm the link between the proposed management actions and habitat quality and the security of threatened species populations. Ongoing monitoring of ecological condition will be undertaken by biobank site owners (supported and enforced by OEH), NPWS and FCNSW.
			Please justify why feral cats, pigs and cane toads are not considered target species for feral animal control (Section 5.3.5).	Feral cats and pigs are considered target species: “Feral dogs, cats and foxes will be managed through a trapping and

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				shooting program…" s.5.2.1 and s6.2.1 "Control programs to be targeted to other pest fauna (e.g. goats, pigs, rabbits) as appropriate if populations or impacts are detected during monitoring." Table 7, Table 11. "Pest fauna control … principally targeting wild dogs and foxes" section 5.3.5, 6.3.3 is proposed because dogs and foxes are recognised as the most serious and specific threats to the Koala and Spotted-tailed Quoll. Further, wild dogs were directly observed at both sites during surveys. Section 5.3.5, 6.3.3 go on to say "Control programs would be targeted to other pest fauna (e.g. goats, pigs, rabbits) as appropriate if populations or impacts are detected during monitoring." Cane toads do not occur on the mid north coast of NSW however the proposed monitoring and adaptive management regime would include management of cane toads if they occur as a result of climate change at some point in the future.
			Please specify if the Griffin offset site will be monitored for EPBC listed fauna.	Threatened fauna monitoring will not be undertaken at the Griffin site on an ongoing basis. RMS have

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				committed to a full ecological survey of the offset sites at Year 5 to further confirm the link between the proposed management actions and habitat quality and the security of threatened species populations.
			Details are required on the photopoint monitoring methods. Will they be taken in north, east, south and west directions?	They will be taken in a single direction at the bearing specified for each photo point. See monitoring location tables in the OMP and baseline results in Appendix A, B , C and D.
			Please clarify if BioMetric/ BioBanking will be an ongoing monitoring method for determining habitat quality. Will at least the 8 plots surveyed for baseline conditions (Figure 7) be assessed? Please consider proposing additional plots further from roads.	BioMetric/ BioBanking is not proposed as an ongoing monitoring method for determining habitat quality. Less intensive management and monitoring is proposed at the Griffin offset site than at the other offset sites given the stewardship by NPWS and because the site is near-intact and minimal management intervention is required.
	Commitments to undertake contingency measures and corrective actions in the event that performance objectives are not met; and	No	ACTION Contingency measures, triggers and corrective actions are required for all potential risks, including if the performance objectives are not met.	Noted and management actions plans for each site have been updated accordingly.
			Please define specific targets for management actions, in particular for weed and pest animal management and bush regeneration.	Noted and management actions plans for each site have been updated accordingly.

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	Anticipated timeframes for achieving performance objectives	No	Table 8 provides approximate timeframes for some of the management measures that will be implemented on the Norton offset site. Some comments in relation to this have been provided against Condition 21(e). ACTION Please include measurable targets (specific performance objectives), along with realistic timeframes to achieve these.	Noted and management actions plans for each site have been updated accordingly.

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Document Status

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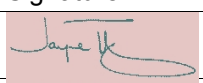
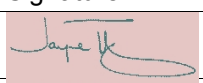
0	B Harrington	J Tipping		J Tipping		16/10/14
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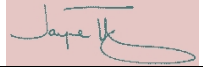
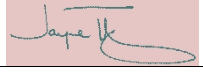
3	B Harrington	J Tipping		J Tipping		21/12/16

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