SGD 1 Pty Ltd

Riverside Subdivision, Tea Gardens

Biodiversity Offsets Package

March 2016

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1. Introduction

GHD has been commissioned by the SGD 1 Pty Ltd (the Proponent - Sheargold) to complete a biodiversity offsets package using the NSW Biodiversity Banking and Offsets Scheme (BioBanking) for the proposed Riverside residential development at Tea Gardens, New South Wales (the Project). A Concept Plan was submitted for the Project in January 2013 in accordance with Part 3A (Major Projects) of the *Environmental Planning and Assessment Act 1979* (EP&A Act) with approval granted on 27 June 2013. Biodiversity impact and offsets were assessed in accordance with the 'Interim policy on assessing and offsetting biodiversity impacts of Part 3A developments' (OEH, 2011). The policy provided a framework for determining biodiversity impacts and offsets using a modified form of the BioBanking methodology and its application. The Riverside project has been assessed in accordance with this policy.

This biodiversity offset package report has been prepared to meet the Conditions of Consent for the project in relation to the delivery of biodiversity offsets for the Project. The intent of this offsets package is to deliver the biodiversity offsets through conservation of habitat for the affected threatened biota in suitable onsite and offsite offset sites using the NSW BioBanking Scheme. As such, the offset sites will be secured by obtaining a BioBanking agreement over the sites and 'retiring' biodiversity credits as outlined in this offsets package. It is proposed to complete the necessary credit retirements in a staged manner. The first stage will be to place all conservation lands onsite under a BioBanking agreement, to allow the initial stages of the project to commence, and then source remaining credits from offsite biobank sites to enable the remainder of the project to be completed.

1.1 Background

Environmental Resources Management Australia Pty Ltd (ERM) was engaged by Crighton Properties to prepare an environmental assessment (EA) of a Concept Plan under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) for a residential and tourist development at the Riverside site (ERM, 2011). The documentation for the Concept Plan application included a BioBanking Assessment (GHD 2013) which included an assessment of the projects impacts, the quantum of biodiversity offsets that may be required to compensate for impacts arising from the development and a suitable a biodiversity offset strategy.

The Concept Application included:

- Residential development, including approximately 880 dwellings and associated infrastructure.
- A tourism development which included approximately 65 tourist lodge sites.
- Water sensitive urban design (WSUD) measures, including basin, detention ponds and outlet to the Myall River.
- A residentially zoned open space network which provided for public recreation, stormwater management, a wildlife corridor, and community facilities.
- Site access, upgrading of external intersections and an internal road network.
- Associated landscaping and infrastructure works.

The Concept Plan was approved on 27 June 2013. The approval included a number of conditions relating to biodiversity, including the preparation of a biodiversity offsets package which is the subject of this report. The offsets package was to be prepared in accordance with Section 9 of the BioBanking Assessment (GHD, 2013).

Since Concept Plan Approval was granted, the project has subsequently been acquired by the Sheargold. The Sheargold have reviewed the Conditions of Consent attached to the project and re-engaged GHD to complete the biodiversity offsets package. As part of this review, the Sheargold in consultation with GHD, identified some outstanding biodiversity impact issues to be addressed, notably matters raised by the Commonwealth Department of the Environment (DotE) in relation to impacts to the Koala (Tea Gardens/Hawks Nest endangered population listed under the NSW *Threatened Species Conservation Act 1995*). The DotE indicated they would prefer to see impacts to the Koala population reduced such that a 'net positive credit balance' could be achieved onsite for this species. GHD worked in conjunction with the Sheargold to reduce the approved development footprint, particularly in locations of higher quality Koala habitat, and settle on a final development footprint which is the subject of this offsets package. This reduction was done using the results of the BioBanking impact assessment (GHD 2013) which were completed using Version 2 of the credit calculator. GHD calculated the credit impact rate per hectare associated with each vegetation type and then used these figures to target the most suitable locations for reducing the development footprint (i.e. those areas with the highest credit impact rate per hectare relate to vegetation in the best condition and so these areas were targeted). The development footprint was reduced from 101.8 ha to 85.4 ha and the onsite conservation lands were increased from 107.3 to 113.3 ha. This reduction achieved a 'net positive credit balance' for the Koala and also reduced the biodiversity credits required to be secured on offsite conservation lands.

1.1.1 Assessment of offset requirement

Biodiversity offsets are required to compensate for residual impacts on Threatened Ecological Communities (TECs), threatened species and their habitats and clearing of native vegetation. A biodiversity offset comprises one or more appropriate actions that are put in place to counterbalance specific impacts on native biota and their habitats. Appropriate actions are considered to be long-term management activities that aim to improve biodiversity conservation. This can include legal protection of land (i.e. an offset site) to ensure security of management actions and to remove threats (DECC, 2008).

The BioBanking methodology has been used to estimate the quantum of biodiversity credits that would be required to compensate for impacts of the Project (based on the results of the GHD (2013) assessment using Version 2 of the credit calculator).

This offsets package also includes a BioBanking assessment of the remainder of the study area outside of the development footprint that would be retained as conservation lands and set aside as a biobank site as part of the biodiversity offsets for the Project. This assessment was completed using the BioBanking methodology presented in the OEH (2014) 'BioBanking Assessment Methodology and Credit Calculator Operational Manual' with credit calculations completed using Version 4. Version 2 of the credit calculator is no longer available. Consultation with OEH indicated It was considered suitable to determine the estimated credit impact value based on interpreting the Version 2 results (GHD, 2013) as the Sheargold had made decisions regarding the reduction of the development based on the results of this assessment. These decisions had significant financial implications for the project, including reduced development potential and also a reduction in the number of biodiversity credits that would be required to be purchased from offsite biobank/s. As the Sheargold had acquired the project based on analysis of the results from the Version 2 assessment it is considered reasonable for this approach to continue when finalising this offsets package. The approach is in accordance with the principles attached to the Interim Guidelines (OEH 2011).

1.2 Purpose of this report

The overall objectives of this offsets package are to:

- Describe the project sites biodiversity values and the approach and rationale for the final development/conservation footprint which is the subject of this offsets package.
- Describe the ecological impacts of the Project in accordance with the results from the BioBanking assessment (GHD, 2013) as a guide to the scale and type of biodiversity credits that will be required.
- Calculate the number and type of biodiversity credits that would be generated from the proposed onsite biobank using Version 4 of the credit calculator.
- Describe a suitable biodiversity offset for the project. This offset package outlines the number, type and location to source the biodiversity credits.
- Provide a two staged approach to securing the biodiversity offsets, these being
  - The dedication of onsite conservation lands as a biobank site and the subsequent retirement of the necessary biodiversity credits.
  - The purchase and retirement of biodiversity credits from offsite biobank/s.
- Describe the security of tenure and rehabilitation and management of the onsite conservation lands under a BioBanking Agreement.
- Summarise the monitoring and reporting obligations for the biobank site/s in accordance with a BioBanking agreement

1.3 Relationship with existing reports

This Offsets Package and the earlier BioBanking assessment (GHD, 2013) have been prepared with consideration of information contained in the following reports:

- Cumberland Ecology (2010) *BioBanking Assessment Report.*
- Cumberland Ecology (2011a) *Riverside Tea Gardens Ecological Assessment Report.*
- Cumberland Ecology (2011b) *Biodiversity Assessment Report.*
- Conacher Environmental (2011) *Ecological Site Management Strategy.*
- Conacher Environmental (2011) *Bushfire Threat Assessment.*
- Conacher Environmental (2011) *Koala Management Strategy.*
- Environmental Resources Management (ERM) (2011) *Riverside at Tea Gardens Concept Plan Application Environmental Assessment Report.*
- GHD Pty Ltd (2013) *Riverside at Tea Gardens BioBanking Assessment.*
- Environmental Resources Management (ERM) (2012) *Riverside at Tea Gardens Concept Plan Application 0043707 – Final Environmental Assessment.*

Ecological values and impacts referred to in this report are referenced from the ecological assessments (as above) for the Project study area. These reports contain information relevant to the BioBanking assessment and offset strategy, including vegetation type and condition, conservation significance, impact assessment and suggested mitigation measures.

1.4 Subdivision planning approach

The project team followed the '*avoid, mitigate and offset'* principles when designing a suitable development/conservation footprint at Riverside, Tea Gardens. The approach adopted to avoid and mitigate impacts on native biodiversity is described below.

1.4.1 Measures taken to avoid impacts

The final development has been sited and designed to avoid, where possible, the most valuable vegetation and habitat on the site. The design of the subdivision has subsequently been through several layout changes as a greater understanding of biodiversity constraints was attained, these included:

- Reducing the extent of the development within the northern portion of the site to provide for a wider wildlife corridor in this area of the site. The proposed corridor will be a minimum 200 m wide.
- Removing development previously proposed in the south-eastern potion of the site, creating a much larger conservation area in the east. This also creates a much wider and continuous corridor along the Myall River with a minimum width of 410 m.
- Removing the proposed tourism development in the north-eastern corner of the site and adding these lands to the onsite biobank while increasing the extent of the corridor adjacent to the Myall River as well as the east/west corridor linking back through to Toonang Drive and beyond.
- Removing proposed development from the north-western portion of the site along Toonang Drive and adding these lands to the onsite biobank.

Removing these areas from the development and adding them to the onsite biobank has enabled the project to achieve a 'net positive credit balance' for the Koala (Tea Gardens/Hawks Nest listed endangered population).

1.4.2 Mitigation measures

The design also includes a range of mitigation measures, to further reduce impacts on native biodiversity, including:

- Protecting all conservation lands onsite within a biobank to ensure these lands are protected in perpetuity and actively managed to improve their biodiversity values.
- Location of Asset Protection Zones (APZ) between the built form and areas of native vegetation to the west of the site. The APZs will provide a management buffer between these land uses.
- Maintaining native vegetation within the APZ's as far as possible within fuel load requirements. This generally means maintaining these areas with a discontinuous canopy, a maximum of 25% of the lower storey with the remaining areas 'slashed'.
- Utilising a 'ring road' network, integrated with the APZs, to help provide a management buffer between the development and conservation areas.
- Incorporating drainage line systems throughout the site that will be rehabilitated with native species. Tree retention will also be a priority for these areas within the constraints imposed by cut and fill requirements for hydrological and storm water management.
- Commitment to prepare a Vegetation Management Plan (VMP) addressing weed management, rehabilitation and replanting of native vegetation throughout the drainage line network.
- Commitment to prepare a detailed landscaping plan using indigenous native species.

- Commitment to prepare a habitat tree management plan for the development area that identifies important habitat trees to be retained, recruitment trees to provide long-term replacement hollows, possible tree replanting areas and management measures to protect habitat resources from future potential issues relating to human safety and senescent trees etc. This plan will apply to such areas as:
  - The drainage line network
  - Proposed 'pocket parks'
  - The streetscape
  - Public recreation areas
- Implementing appropriate stormwater and erosion control activities.

1.5 Site context

The study area for this assessment is shown on Figure 1.

The study area is in the Great Lakes Local Government Area (LGA). It is situated to the north of existing development within Tea Gardens and is bound to the west by Myall Road, to the north by Toonang Drive and the Shearwater Residential Estate, and to the east by the Myall River. The study area has approximately 2 km frontage to the Myall River and adjoins the Myall Lakes National Park to the east and north-east (Cumberland Ecology, 2011).

The locations of the development footprint and potential biobank areas for the Project are shown on Figure 2 (a and b). The development footprint has been split into 'development' and 'open space' management zones for the purpose of BioBanking credit calculations. The development management zone comprises the hard stand area associated with the development. It is assumed that all vegetation and habitat resources within this area would be removed for the Project. The open space management zone comprises the mapped area of native vegetation within the open space areas such as parks and drainage corridors that do not require cut or fill, based on concept designs. It is assumed that vegetation and habitat resources within this area would be partially removed for the Project. As mentioned above, APZ's will also be managed to retain vegetation such as habitat trees where possible. However, for the purpose of the BioBanking calculations associated with the development, it was assumed these areas would be cleared as there is no certainty as to the amount or structure of native vegetation that would be retained at this stage. This approach has ensured that the impact assessments presented in this report are conservative.

Part of the Riverside Estate has previously been developed and comprises a range of residential, retail/commercial, recreation and tourist development (ERM, 2011). These areas have been excluded from the credit calculations.

The onsite biobank site has been determined to be all areas outside the development footprint, which includes retained open space, parklands, basins and APZ's, that will be conserved in perpetuity and actively managed for their biodiversity values. The credit calculations presented in this report reflect this management approach with future activities associated with the biobank site being limited to bush walking using a designated path network only.

LEGEND

Study Area

Paper Size A4

0 40 80 160 240 320

Metres

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

N

GHD

SGD 1 Pty Ltd
Riverside Subdivision
Biodiversity Offsets Package

Job Number 22-17733
Revision 0
Date 27 Oct 2015

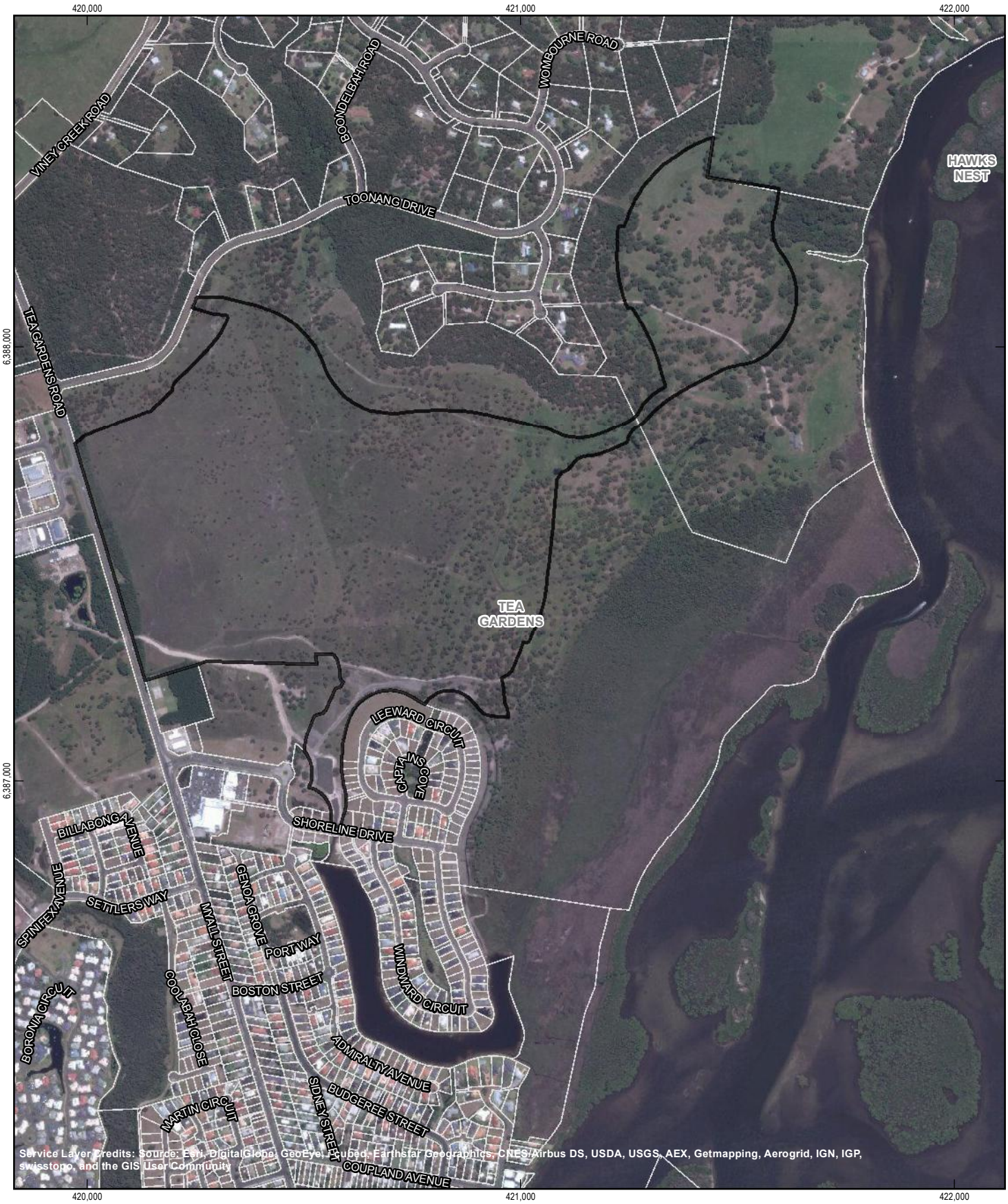
Study area location

Figure 1

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com **W** www.ghd.com.au

G:\22\17733\GIS\Maps\Deliverables\BiodiversityOffsetPackage\2217733_BOP001_StudyArea_0.mxd

Data source: LPI:DTDB, 2012; Cumberland Ecoloy: Biobank Plots; ESRI: Aerial Imagery, 2014. Created by: fmackay, tmorton



LEGEND

- Development site boundary
- Cadastre

Paper Size A4

0 40 80 160 240 320

Metres

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

N

SGD 1 Pty Ltd
Riverside Subdivision
Biodiversity Offsets Package

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Date 27 Oct 2015

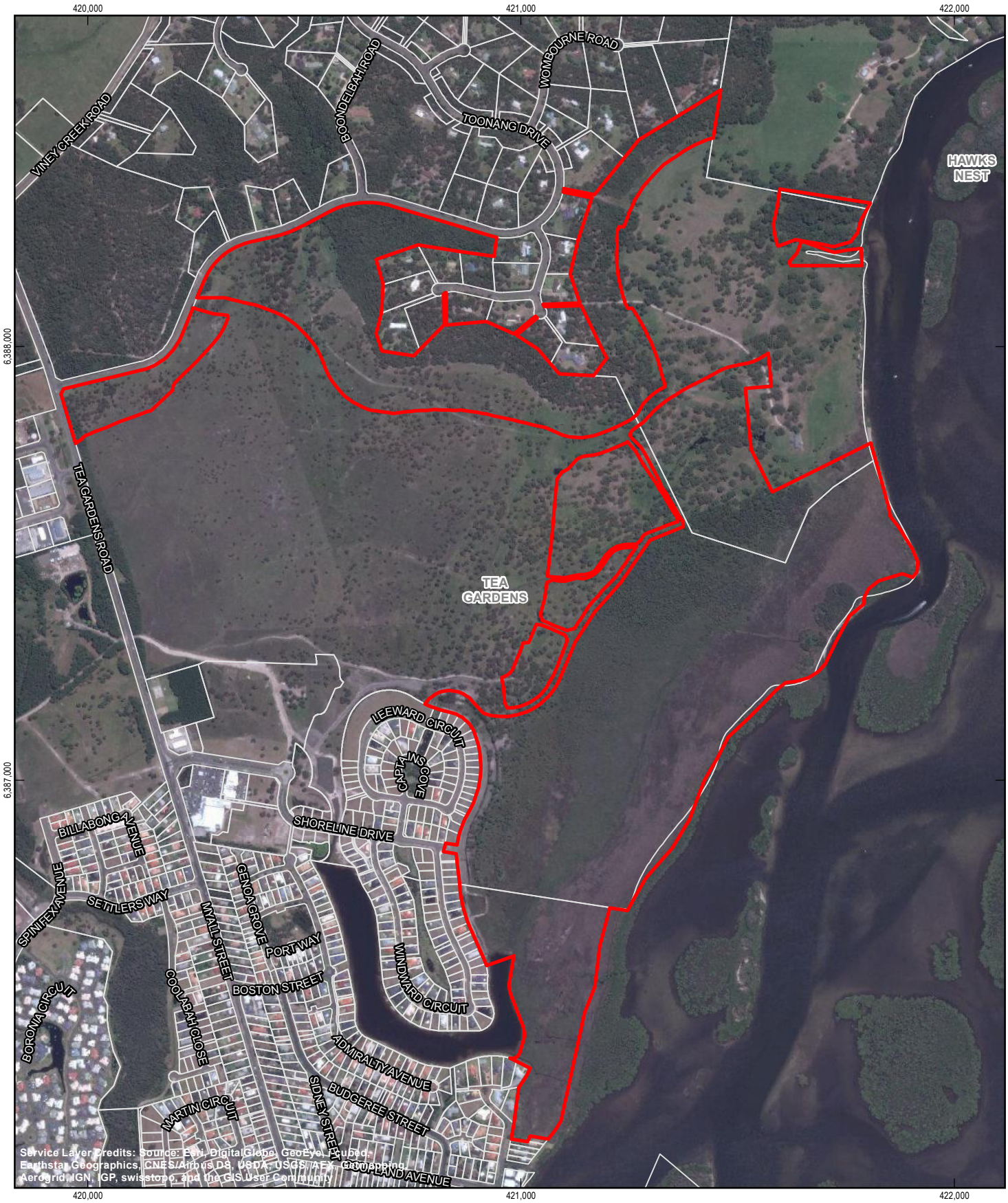
Development site boundary

Figure 2a

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com **W** www.ghd.com.au

G:\22\17733\GIS\Maps\Deliverables\BiodiversityOffsetPackage\2217733_BOP002_DevelopmentSiteBoundary_0.mxd

Data source: LPI: DCDB & DTDB, 2012; ESRI: Aerial Imagery, 2014. Created by: fmackay, tmorton



LEGEND

- Biobank site boundary
- Cadastre

Paper Size A4

0 40 80 160 240 320

Metres

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

N

GHD

SGD 1 Pty Ltd
Riverside Subdivision
Biodiversity Offsets Package

Job Number	22-17733
Revision	0
Date	27 Oct 2015

Biobank site boundary

Figure 2b

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com **W** www.ghd.com.au

G:\22\17733\GIS\Maps\Deliverables\BiodiversityOffsetPackage\2217733_BOP003_BiobankSiteBoundary_0.mxd

Data source: LPI: DCDB & DTDB, 2012; ESRI: Aerial Imagery, 2014. Created by: fmackay, tmorton

1.6 BioBanking

The NSW Biodiversity Banking and Offsets Scheme (BioBanking) has been established by the NSW Office of Environment and Heritage (OEH) to help address the loss of biodiversity and threatened species. BioBanking is a component of Part 7A of the *NSW Threatened Species Conservation Act 1995* (TSC Act) and is administered by OEH. To complete the legal framework, the *Threatened Species Conservation (Biodiversity Banking) Regulation 2008* establishes specific aspects of the scheme that are important for its smooth operation. 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.

To establish credits for 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.

Developers can also apply for a BioBanking Statement that specifies the number and class of credits that must be acquired to counterbalance or offset the impacts on biodiversity values that are likely to occur as a result of development. The scheme provides an alternative path to the threatened species assessment of significance process required under the EP&A Act.

The BioBanking Assessment Methodology (the methodology) 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.

Overall, it is intended the scheme will assist to conserve areas with high biodiversity values by providing incentives for conservation and disincentives for loss.

The BioBanking methodology (OEH, 2014) aims to encourage and secure investment in conservation and to provide financial incentives for the protection of biodiversity values by:

- Providing a measurable, consistent, transparent, and robust framework for the assessment and management of biodiversity offsets.
- Creating new opportunities for conservation on private land.
- Providing permanent security and management for biodiversity offsets.
- Providing a secure mechanism for investment in biodiversity conservation.

Biodiversity offsets are required to compensate for residual impacts on EECs, threatened species and their habitats and clearing of native vegetation. The BioBanking methodology has been used to estimate the quantum of offsets that would be required to compensate for impacts of the Project. It is the preferred mechanism for determining biodiversity offsets of major projects assessed under the EPA Act (OEH, 2011a). The BioBanking methodology does not strictly apply to Part 3A Projects; in 2011 the OEH released the *Interim policy on assessing and offsetting biodiversity impacts of Part 3A developments*. The policy provides a framework for determining biodiversity offsets using a modified form of the BioBanking methodology and its application. The Riverside project is being assessed in accordance with this policy.

The BioBanking methodology has been used to estimate the number of biodiversity credits that may be required to offset impacts of the final development portions of the Project and the biodiversity credits that would be generated by the conservation of the remainder of the study area as a biobank.

1.7 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 has been designated for development within the Riverside site, Tea Gardens.
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).
Riverside biobank (the biobank)	The land outside the development footprint that will be conserved under a BioBanking agreement, as described in Section 3.1.1 of this report and as shown on Figure 2b.
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.
Study area	Includes both the development area and proposed biobank site as shown in Figure 1.

2. Methodology

2.1 Previous assessments

Cumberland Ecology (2011a) prepared a notional BioBanking assessment which informed modifications to the original development footprint and provided an estimate of the biodiversity credits that would be generated from two separate biobank sites. This notional assessment was based on a broad scale vegetation map and a limited number of BioBanking plot/transects.

2.2 Site layout modification and assessment

GHD was subsequently engaged to complete a range of exercises using the BioBanking methodology to assist in determining a final development layout. A summary of these activities is outlined below.

2.2.1 Stage 1 assessment – September 2011

GHD completed a BioBanking assessment for the original development footprint from 2008 and the amended development footprint being presented by Crighton Properties in 2011 to obtain a credit calculation and comparison between the two development options.

The following activities were then undertaken:

- Collection of additional plot/transect data throughout the study area in accordance with the BioBanking methodology.
- Review of the vegetation types mapping prepared by Cumberland Ecology (2011) and adjusted accordingly to plot/transect data and further survey and mapping of vegetation type boundaries.
- Completion of a landscape assessment and update of vegetation type maps in GIS for both the original and amended development footprints.
- Calculations of BioBanking credits for the original and amended developments and associated biobanks.
- Preparation of a biodiversity offset comparison between development and biobank credit profiles.

2.2.2 Stage 2 assessment – November 2011

GHD consulted with OEH before commencing the stage 2 assessments. This consultation indicated that both OEH and DPI would require estimates of BioBanking results for the PAC boundary (this refers to the Planning Assessment Commissions proposed boundary after deliberation of a previous Concept Plan application was refused) before consideration of additional development outside of this boundary, as was being proposed with the 2011 development footprint, could be made. GHD therefore completed the following:

- The PAC development footprint was mapped using GIS.
- BioBanking credit calculations for the PAC development and associated biobank were completed.
- A biodiversity offset comparison between the PAC development and biobank credit profiles was prepared.

- Reviewed the results of the PAC boundary and adjusted the proposed development footprint accordingly. This activity considered areas of development that were proposed in locations where credit impact rates were high and where credit generation rates within proposed conservation rates were low and adjusted the footprint accordingly. Put simply, some areas outside the PAC development footprint had ecological values more suited to development and some areas within the PAC development footprint were more suited to conservation.
- BioBanking credit calculations for the modified development and associated biobank were completed.
- A biodiversity offset comparison between the modified development and biobank credit profiles was prepared.
- The credit profiles of the various study area layout options were compared.
- The results were presented to Crighton Properties, OEH and DPI and the development footprint was further modified according to inputs from all parties.

2.2.3 Stage 3 assessment – December 2011 – January 2012

The stage 3 assessment included refinements to the proposed development footprint and associated BioBanking results. Activities included:

- Final adjustment of the proposed development footprint in GIS.
- Undertaking BioBanking credit calculations and biodiversity offsets comparison for the proposed development and associated biobank.
- Comparison of the credit profiles of the various study area layout options being presented by Crighton Properties after considering the PAC boundary and results of the BioBanking assessment.

These results were presented in the final draft *Riverside at Tea Gardens BioBanking Assessment* Report (GHD, 2012).

2.2.4 Stage 4 assessment – September 2012 – February 2013

The stage 4 assessment included consideration of Agency comments on the final draft BioBanking Assessment (GHD, 2012) submitted in Stage 3. In early 2012, the Project was referred to the Commonwealth Department of Environment, Sustainability, Water, Populations and Communities (DSEWPAC) (now Department of the Environment (DotE)) and DotE was included in all subsequent consultation and review of reports.

The development footprint and associated BioBanking assessment were refined further as a result of this ongoing consultation and review process. Activities included:

- Transfer of all available data from the GHD (2012) assessment to Version 2 of the credit calculator.
- Adjustment of species polygons for the Koala and Wallum Froglet in consultation with OEH and DotE to better represent the condition of vegetation and habitat in the study area.
- Mapping and assessment of separate management zones to reflect the different magnitude of impacts associated with hard stand and open space portions of the development.
- BioBanking credit calculations and biodiversity offset comparisons for the various study area layout options, incorporating the modifications listed above.

- Submission of staged results reports to Crighton Properties and the Agencies presenting the results of modifications to the development footprint and methodology for the BioBanking assessment.
- Further refinement of both the development footprint and methodology for the BioBanking assessment based on consultation with Crighton Properties and the Agencies.
- Justification of the final development site layout based on an appropriate balance between development and conservation outcomes.
- Preparation of a final BioBanking assessment report, including comparison of the final development footprint with the PAC development footprint.

The final development/conservation footprint was presented in *Riverside at Tea Gardens BioBanking Assessment* (GHD 2013). This report was submitted to the Department of Planning and Environment (DPE) as part of the Concept Plan application documentation and subsequently approved 27 June 2013. The approval included a number of conditions relating to biodiversity, including the preparation of final biodiversity offsets package.

This report has been prepared in response and is considered the final biodiversity offsets package.

2.2.5 Stage 5 assessment – March 2014 to October 2015

GHD continued to engage with DotE regarding impacts to MNES following DPE approval of the project. DotE indicated a preference for a further reduction in impacts to the Koala population such that a 'net positive credit balance' could be achieved onsite for this species. GHD worked in conjunction with the Sheargold to reduce the development further, particularly in locations of higher quality Koala habitat, to achieve this outcome and settle on a final development footprint which is the subject of this offsets package.

The following activities were then undertaken to complete the offsets package:

- Collection of additional plot/transect data throughout the study area in accordance with the BioBanking methodology.
- Review of the vegetation types mapping from the 2013 assessment and adjustment according to the new Plant Community Types (PCT's) database for the Hunter Central Rivers. This process also included adjusting the mapping of vegetation type boundaries where applicable.
- Completion of a landscape assessment and update of vegetation type maps in GIS for both the original and amended development footprints.
- Completion of BioBanking credit calculations for the final development and associated onsite biobank. The credit calculations for the development were based on the previous results (completed using Version 2 of the BioBanking credit calculator) as detailed in Section 4.2. The onsite biobank credit calculations have been completed using Version 4 of the credit calculator with the results detailed in Section 4.3.
- Prepared a biodiversity offset comparison between development and biobank credit profiles.
- Outlined a suitable process to secure outstanding biodiversity credits including nominating potential biobank sites.
- Described the proposed rehabilitation, management and reporting that would be required for the onsite biobank

2.3 BioBanking assessment

2.3.1 Approach

Biodiversity credits were estimated with reference to the methodology presented in the *BioBanking Assessment Methodology and Credit Calculator Operational Manual (*OEH, 2014). 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.

The BioBanking assessment methodology has been used to estimate the quantum of biodiversity offsets required for the Project as follows:

- Review of Cumberland Ecology (2011) vegetation mapping and preliminary BioBanking Assessment as described above.
- Preliminary site survey of the study area using the BioBanking plot/transect methodology to refine the mapping of vegetation condition across the site and to collect site value data for each vegetation type.
- Application of the BioBanking methodology to each of the various development footprint options to determine impacts of the development and associated offsetting requirements in terms of biodiversity credits.
- Application of the BioBanking methodology to the remaining portions of the study area outside of the various development footprint options that would be set aside as a biobank and managed for conservation.
- Comparison of the credit profiles of the development sites and biobank sites to assess whether the on-site biobank is appropriate to offset biodiversity impacts of the Project.
- Comparison of the various development/biobank options to determine which would result in the optimum balance between development and conservation outcomes (i.e. a balance between development credits required and biobank credits generated).
- Estimation of the size and type of additional biobank site(s) that would be required to generate appropriate biodiversity credits to offset residual impacts of the Project.

The main inputs to the BioBanking assessment are described below.

2.3.2 Desktop assessment

Literature and database review

The following resources were reviewed to describe the existing environment of the site and to, as far as possible, obtain the necessary site data to perform BioBanking credit calculations:

- The Project environmental assessment (ERM, 2011) and associated concept design files.
- DECC (2008a) *NSW (Mitchell) Landscapes Version 3 (2008).*
- DECC (2008b) *Descriptions for NSW (Mitchell) Landscapes.*
- OEH (2011a) *Vegetation Types Database.*
- OEH (2010b) *Threatened Species Profile Database.*
- OEH (2012c) *NSW Interim Vegetation Extent remote sensing imagery.*
- Aerial photographs and satellite imagery of the study area.

Geographical Information System (GIS) analysis

Geographical Information System (GIS) was used in the current assessment as follows:

- Plotting of the site, development and biobank site boundaries on a high resolution aerial photo base.
- Mapping of vegetation types and species polygons within the study area.
- Assessment of native vegetation cover, extent and connectivity at the landscape scale.
- Calculation of the area of intersection between the various development, biobank, vegetation and species polygon layers.

2.3.3 Site surveys

Site surveys of the study area were conducted with reference to the BioBanking methodology to supplement the Project ecological assessment. Survey effort that has directly contributed to this BioBanking assessment is summarised in Table 2-1 and described below.

Table 2-1 GHD survey effort

Company responsible for survey	Date	Survey effort	Survey methods
GHD	10th,,11th and 13th October 2011	2 ecologists for 3 days 19 plot / transects	Broad-scale vegetation survey and mapping; 20 m x 50 m BioBanking plot / transects; opportunistic fauna observations.
GHD	10 and 17 April 2015	2 ecologists for 2 days 16 plot / transects	Broad-scale vegetation survey and mapping; 20 m x 50 m BioBanking plot / transects
Cumberland Ecology	2010 (date unknown)	47 plot /transects	Broad-scale vegetation survey and mapping; 20 m x 50 m BioBanking plot / transects

Plot /transect surveys were conducted on site in accordance with the DECC (2009) and OEH (2014) methodology. The Site Value was determined by assessing ten 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.

Although no systematic targeted surveys for threatened species were conducted as part of this assessment, previous targeted surveys have been completed by Conacher Environmental and Cumberland Ecology and have assisted in informing this assessment. Opportunistic observations of fauna and threatened plants were recorded and the locations of threatened species were captured with a handheld GPS if observed, during the GHD surveys.

2.3.4 Vegetation assessment

Cumberland Ecology (2011a) vegetation mapping was reviewed through additional site survey. Vegetation types and extent were re-evaluated, described and matched to NSW Plant Community Types and broad condition classes (OEH, 2015). 'Best match' NSW Vegetation Types were selected via a comparative analysis between site data and vegetation descriptions provided in LHCCREMS (2009). Field investigations were carried out involving the sampling of BioBanking plot/transects. Aerial photography analysis was used to broadly map vegetation condition prior to survey. The site was stratified with reference to the desktop vegetation condition mapping, Cumberland Ecology (2011a) vegetation mapping and the proposed split between development and biobank areas. Additional plots were completed in vegetation types mapped by Cumberland Ecology (2011a) that appeared to comprise more than one vegetation type (e.g. Swamp Mahogany Open Woodland in the western parts of the site).

Vegetation condition was re-interpreted on the basis of the revised vegetation mapping and typing. Vegetation descriptions published by LHCCREMS (2009) were used as the basis for defining cover for canopy, mid and ground cover strata. For instance, Swamp Mahogany Open Woodland was split into Swamp Mahogany Open Woodland and *Melaleuca sieberi* - Tall Saw-sedge closed shrubland in drainage lines on the Central Coast, Sydney Basin based on canopy cover. *Melaleuca sieberi* - Tall Saw-sedge closed shrubland was separated from surrounding woodland because occasional eucalypts in this vegetation type were considered canopy emergents.

Elevation contours broadly correlate with soil conditions and the sites hydrological regimes including ponding and depth to groundwater. This relationship provided insight into the type and extent of native vegetation cover. Vegetation mapping was adjusted in accordance with these observed relationships.

2.3.5 BioBanking assessment and credit calculation

Vegetation cover

The BioBanking methodology uses 100 hectare and 1,000 hectare assessment circles centred on the site to estimate the extent and connectivity of native vegetation and habitat surrounding the site. OEH (2012c) GIS data for vegetation cover was mapped across the study area. Vegetation cover and connectivity was calculated using GIS measurement within the assessment circles based on the current situation and after the development of the site. The percentage change in native vegetation cover was estimated by subtracting the area of woody vegetation within the development area from the total area within the assessment circles. Patch size and connectivity were assessed using GIS and air photo interpretation of native vegetation cover within the assessment circles and adjoining areas of native vegetation.

Connectivity

Impacts on connectivity are calculated by entering the 'primary link' for the development, which is the vegetated link that will experience the greatest change in connectivity as a result of the development.

The primary link for the development is in a north south direction extending from vegetation flanking the Myall River to vegetation north of Viney Creek Road in to the north east of the development site (as shown in Figure 4). The width of this primary link is >30-100 m and is characterised by:

- A tree canopy with <25% of the lower benchmark condition.
- A groundcover with <50% of the lower benchmark condition.

Site stratification

The study area was stratified into development and biobank areas and then each of these was stratified into vegetation zones and management zones. One vegetation zone was created for each native vegetation type and broad condition state present within respective development, open space or biobank management zones across the study area. The area of each zone was calculated using GIS.

The conservation status of each vegetation zone within the study area was determined through GHD field survey of the site.

Credit calculations

Changes in site biodiversity values through the development of a site is the basis for calculation of biodiversity credits required to offset impacts. Complete clearing of vegetation for a development reduces the site values to zero. There are certain circumstances where portions of a development are managed such that some site value is retained. These circumstances include drainage lines, asset protection zones where only partial vegetation removal may be required. However, for the purposes of this assessment all areas of the development were treated as though complete clearing would occur. This was considered the most conservative approach as there is not yet certainty as to the amount or structure of native vegetation that would be retained at this stage.

Changes in site biodiversity values through management of a biobank site are the basis for calculation of biodiversity credits that would be available to offset impacts of a development. The credit calculations include a default gain in site value based on the standard management of a biobank site. There are certain circumstances where a biobank is managed such that there would be a greater increase in site value, for example intensive bush regeneration and tree planting. For the purposes of this assessment it is assumed that the entire biobank sites will be subject to standard management and so the default decrease in site value was entered into the credit calculator.

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), except the threatened species or populations that require species credits.
- 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 in the Threatened Species Profile Database (OEH, 2010b).

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. These BioBanking assessment reports are appended to this offsets package.

The credit calculator reports the suite of threatened fauna species that are predicted to be associated with ecosystem credits generated for the development. That is, the threatened fauna species that are predicted to use habitat within the vegetation types at the site. Each of these species has a ‘Tg score’ that feeds into the ecosystem credit calculations. The fauna species with the lowest Tg score determines the overall credit requirement for the site. The lower the Tg score the greater the number of credits that are required to offset impacts on that species and all other species associated with the ecosystem credits. In certain cases, the fauna species with the lowest Tg score can be reliably excluded from occurring at the site and the credit calculations adjusted accordingly. No Tg score adjustments have been made for this assessment.

2.3.6 Assumptions and amendments to the methodology

The assumptions made for the purposes of the BioBanking assessment associated with this offsets package and credit calculations are as follows:

- Since field surveys for an ecological impact assessment to accompany the previous Part 3A Concept Application had already been performed (refer Cumberland Ecology, 2011a), it was assumed that no additional targeted threatened species surveys would be required for this assessment.
- Since assessments of significance of impacts on biodiversity to accompany a Part 3A Concept Application have already been prepared (refer Cumberland Ecology, 2011a), it is assumed that no additional assessment of red flag areas was required.
- The 100 hectare assessment circle was placed to 'capture' the greatest change in foliage projective cover within the development. GIS was then used to calculate percentage cover of vegetation and change in percentage cover of vegetation with the development.
- In some cases, less than the required minimum number of plot/transects were completed. In these instances, corresponding vegetation zones in either the development site or the Biobank Site were used to make up the shortfall.
- Two of the vegetation types were not sampled directly with plot/transects. For one of these vegetation zones, Mangrove Forest in the estuaries of the Sydney Basin and South East Corner (HU 563), plot/transect data was entered as benchmark values. For the second vegetation zone, Swamp Mahogany Swamp Forest- Low (HU633), plot/transect data for Swamp Mahogany Swamp Forest Moderate/Good/Moderate (HU 6330) was used and the canopy score was reduced to zero.
- In the development site, one of the vegetation zones, Spotted Gum- Red Ironbark –Grey Gum shrub-grass open forest in the Lower Hunter (HU 806), covered 0.09 hectares. This is less that the minimum 0.25 hectares required per vegetation zone. In this instance, this vegetation zone was combined with the adjoining vegetation zone, Blackbutt –Smooth Barked Apple shrubby open forest -Low (HU 509).
- For one of the vegetation zones located in the Biobank site, Swamp Mahogany Swamp Forest- Low (HU633), there were no plots located within the zone. Therefore, one of the plots for Swamp Mahogany Swamp Forest Moderate/Good/Moderate (HU 633) was used and the canopy score was reduced to zero.
- One set of assessment circles was used for this assessment. The 100 hectare circle was placed to capture the greatest possible change in vegetation cover as a result of the development or biobank.
- No additional increase in site value score with management was applied to any management zones in any biobank calculations.
- Species polygons were determined in consultation with OEH and DPI and comprised:
  - A Wallum Froglet species polygon, including all suitable wet vegetation types in the study area.
  - A Koala species polygon, including all suitable dry vegetation types in moderate or good condition in the study area. This polygon was refined after a site visit with government agencies on 4 July 2012 to exclude areas of unsuitable wetland vegetation.
- No Tg score adjustments were made for the biobank credit calculations.

The assumptions above have been developed in consultation with the OEH BioBanking unit and have received in principal support from the OEH Regional officer.

2.4 Staff qualifications

The BioBanking assessment included in this offsets package, including all BioBanking credit calculations, was prepared by Ben Harrington and Arien Quin. The assessment was peer reviewed by Daniel Williams and Jayne Tipping. Staff qualifications are presented in Table 2-2.

Table 2-2 GHD ecology personnel and qualifications

Name	Position / project role	Qualifications	Relevant experience
Daniel Williams	Principal Environmental Consultant / draft Offsets Package, peer review of credit calculations, consultation and planning	B. App. Sc. BioBanking Assessor Accreditation*	15+ years
Ben Harrington	Senior Ecologist / stage 3 and 4 BioBanking assessments and preparation of the BioBanking Assessment (GHD 2013)	BSc, MSc (Physical Geography) BioBanking Assessor Accreditation*	10+ years
Arien Quin	Ecologist / desktop assessment, lead site surveys and, final onsite biobank credit calculations	BSc, (B.A/BSc) BioBanking Assessor Accreditation*	8+ years
Kaycee Simuong	Graduate ecologist / site surveys	BSc (Biological Science)	2+ years
Mark Aitkens	Senior Ecologist / desktop assessment, site surveys, stage 1 and 2 BioBanking assessments	BSc (Env Biology) BioBanking Assessor Accreditation*	13+ years
Chris Mason	Ecologist / site surveys	BSc	1+ years
* Refer to OEH (2012c) list of accredited assessors.			

3. Existing environment

3.1 Site context

The study area is located in the 'Hunter/Central Rivers' CMA region; the 'Karuah Manning' CMA sub-region; and falls within the Myall - Forster Barrier System Mitchell Landscapes (DECC, 2008). It is characterised by various native vegetation types with differing condition status ranging from cleared land, too low to moderate/good condition native vegetation. The eastern portion of the site contains intact native vegetation in moderate to good condition. There is a mixture of estuarine, wetland and forest vegetation types that appears to vary with local drainage. Vegetation in the western portion of the site appears to have been influenced by past land uses more than environmental factors. Trees in the western parts of the site are remnant from prior natural vegetation cover and are characteristic of the tree canopy structure that occurred prior to clearing (i.e. emergent tall trees above a predominantly thick canopy mostly comprising *Melaleuca* spp.).

3.2 Vegetation

Cumberland Ecology (2011a) vegetation mapping was ground truthed by GHD through additional site survey. Vegetation types and extent were re-evaluated, described and matched to NSW Plant Community Types and broad condition classes (OEH, 2015). Vegetation types within the development and biobank areas are mapped on Figure 4 (a and b).

Condition aside, vegetation types vary from east to west in accordance with soil character and hydrological conditions (e.g. elevation contours). The eastern parts of the study area have proportionally greater sand content at the surface than soils in the western parts of the study area, which are more clayey in structure.

Vegetation in the east is characterised by vegetation types typically found on coastal sand masses such as dry shrubby forests with canopy species such as Blackbutt, Scribbly Gum, Red Bloodwood and Smooth-barked Apple (e.g. Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast). These dry shrubby vegetation types generally form on soils with greater than 1-2 m depth to groundwater and are regarded as obligate (i.e. reliant on groundwater resources) to facultative (i.e. partially reliant on groundwater resources) groundwater dependant (Bell and Driscoll, 2006).

Vegetation characterised by swamp sclerophyll species such as Swamp Mahogany and Broad-leaved Paperbark are obligate groundwater dependant and typically occur on sandy soils with decreasing depth to groundwater (e.g. <1 m depth to groundwater; Bell and Driscoll, 2006). Further decreases in depth to groundwater favour the formation of paperbark thickets and coastal wetlands with increased salinity influence from the Myall River enabling the formation of rushlands, salt marsh, Swamp Oak forests and mangrove woodlands.

The vegetation in the western parts of the site, where the soils are influenced by increasing levels of silt and clay, are responsive to a variety of factors, including impeded drainage (i.e. flat poorly draining lands or natural closed depressions) and depth to groundwater. These soil and hydrological conditions give rise to complex arrangements of vegetation in terms of type and structure.

For instance, the review of the Cumberland Ecology (2011) vegetation map identified two different vegetation types within the area broadly mapped as Swamp Mahogany swamp woodland. Vegetation types identified in this area include:

- *Melaleuca sieberi* - Tall Saw-sedge closed shrubland in drainage lines on the Central Coast, Sydney Basin (now referred to as Smooth-barked Apple – White Stringybark – Red Mahogany – *Melaleuca sieberi* shrubby open forest on lowlands of the lower North Coast under the new PCT database).
- Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin

The western portion of the site also included complex ecotone characteristics between these vegetation types (e.g. ecotone width, vegetation structure and floristic composition). These observations are consistent with the gradual change in determinant environmental resources (i.e. water availability and soil conditions) from north to south (i.e. elevated moist soils in the north grading to wet to inundated soils in a closed depression to the south).

3.3 Habitat resources

Areas of moderate and good condition vegetation within the study area are equivalent to undisturbed vegetation for the majority of BioBanking site attribute variables (over-, mid- and understorey vegetation cover, weed cover, quantities of woody debris and over storey regeneration).

Drainage channels are largely undefined due to the relatively uniform gradient across the study area with the exception of steeper lands located at the northern edge of the study area. Water generally moves via overland flow down gradient into porous sandy soils in the central and eastern parts, into a natural closed depression at the western edge of the study area or via excavated drainage channels that drain the study area from west to east. Semi-permanent to permanent water accumulations are restricted to the excavated drainage channels, the closed depression at the western margin of the study area and throughout the swamp sclerophyll forests located between the development footprint options and the Myall River.

Habitat resources such as loose surface rock, rock outcrops and fallen logs are absent from the cleared and partly cleared parts of the study area as are caves, mine shafts, bridges and other cavernous structures. Only within the naturally vegetated parts of the study area, comprising moderate to high vegetation condition, are their noticeable accumulations of fallen logs. The study area contains relatively few hollow-bearing trees with most being restricted to lands that would be conserved in the eastern biobank.

3.4 Habitat connectivity

The study area forms part of the Nerong – Pindimar regional corridor, which provides a link between Nerong Waterholes and Kirks Knoll (Scotts, 2003 in Cumberland Ecology, 2011). The regional corridor extends from the west to north-east and covers part of the central and northern portion of the study area (Cumberland Ecology, 2011).

At the local scale fauna movements are restricted by the Myall River which forms a hostile barrier too small to medium sized ground mammals, most arboreal mammals, frogs and small reptiles. However, this restriction does not necessarily apply to most bird species, bats and larger mammals and reptiles where movements between the study area and Myall Lakes National Park are possible.

The majority of local movements for most fauna species are restricted to vegetation on the eastern margin of the study area and vegetation to the west and northwest. Movements through the partially cleared and cleared lands in the study area would be required and may act as a partial barrier for smaller species prone to predation. Larger species have the potential to move through the study area, however, this movement is impeded due to existing fencing (cyclone and barbed wire).

Table 3-1 Vegetation types within the study area

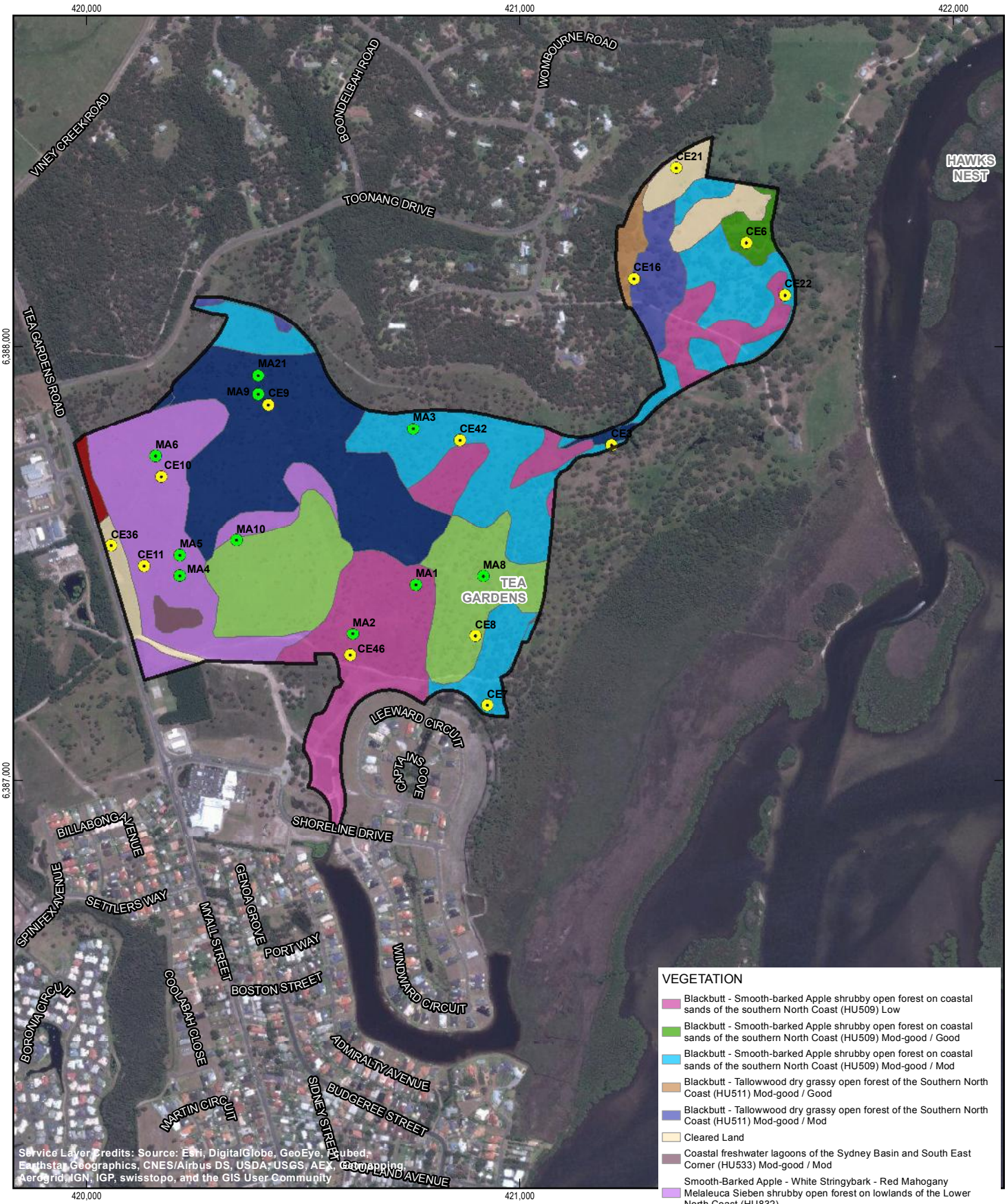
Vegetation type (OEH, 2011b)	Veg. ID (OEH, 2011b)	Conservation significance	Description
Saltmarsh in estuaries of the Sydney Basin and South East Corner	HU606	EEC TSC Act	Characteristic species include *Sporobolus virginicus*, *Sarcocornia quinqueflora* and *Samolus repens* grading into freshwater wetlands and swamp sclerophyll forests with the ecotone comprising *Juncus kraussii* and *Baumea juncea*.
Coastal freshwater lagoons of the Sydney Basin and South East Corner	HU533	EEC TSC Act	Open swamp forests with an overstorey characterised by the shrub *Melaleuca ericifolia*. The ground layer is wet and dominated by sedges and rushes, including *Juncus kraussii* and *Baumea juncea*. Other common ground layer species include the herb *Samolus repens*. This community occurs within the study area on margins of brackish water bodies and watercourses on floodplains of the lower North coast and Central Coast.
Smooth-barked Apple – White Stringybark – Red Mahogany – *Melaleuca sieberi* shrubby open forest on lowlands of the lower North Coast	HU832	EEC TSC Act	Woodlands characterised by a canopy, including Smooth-barked Apple and Red mahogany and mid storey of tall shrubs and small trees typically dominated by paperbarks (*Melaleuca sieberi* and *Melaleuca nodosa*) and often including *Leptospermum juniperinum* and *Allocasuarina littoralis*. The understorey is typically shrubby and characterised by *Pultenaea paleacea*, *Leptospermum juniperinum*, *Melaleuca thymifolia*, *Banksia oblongifolia*, *Epacris pulchella* and *Acacia longifolia*. The ground layer is characterised by numerous sedges and other grass like species commonly including *Lepyrodia scariosa*, *Empodisma minus*, *Ptilothrix deusta*, *Chorizandra cymbaria*, *Gahnia clarkei* and *Schoenus brevifolius*. Various grass species are also common in the ground layer, although less dominant, including *Entolasia stricta*, *Hemarthria uncinata*, *Themeda australis* and *Panicum simile*. In addition, various forbs may also be present in the ground layer such as *Gonocarpus tetragynus*, *Gonocarpus micranthus* and *Goodenia bellidifolia*.

Vegetation type (OEH, 2011b)	Veg. ID (OEH, 2011b)	Conservation significance	Description
Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin	HU663	EEC TSC Act	Open swamp forests with an overstorey dominated by Broad-leaved Paperbark and Swamp Mahogany and a mid storey of tall shrubs, including *Melaleuca sieberi*, *Glochidion ferdinandi* and *Acacia longifolia*. The ground layer is typically wet and dominated by sedges and other graminoids, including *Gahnia clarkei* and *Baumea juncea*. Ground ferns, in particular *Blechnum indicum*, are also common components of the ground layer. Forbs, including aquatic or semi aquatic species such as *Villarsia exaltata*, may be common, with other forbs, including *Goodenia paniculata*, *Goodenia heterophylla* and *Gonocarpus micranthus*. This community exists in three different condition classes across the site.
Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast	HU509		A variable vegetation type characterised by numerous canopy species in differing proportions. Vegetation comprising various combinations of Blackbutt, Smooth-barked Apple, Red Bloodwood and Scribbly Gum occur on the sandier soils in the central and eastern parts of the study area. The understorey is typically shrubby and commonly includes *Ricinocarpos pinifolius*, *Acacia ulicifolia*, *A. suaveolens*, *Persoonia levis*, *Leucopogon lanceolatus*, *Bossiaea rhombifolia* and *Hibbertia linearis* as well as the climbers *Hardenbergia violace* and *Billardiera scandens*. The ground layer is often dominated by *Pteridium esculentum* and grasses, including *Themeda australis* and *Imperata cylindrica*, with various grass like species, including *Dianella caerulea* and *Lomandra longifolia* also common as well as scattered forbs, including *Gonocarpus teucrioides* and *Pomax umbellata*. Open forests characterised by an overstorey dominated by Smooth-barked and White Stringybark often in association with Swamp Mahogany where soils are seasonally waterlogged occur in the north western portion of the study area. A mid layer of tall shrubs and small trees is typically present and dominated by paperbarks, including *Melaleuca sieberi, M. linariifolia* and *M. nodosa* and commonly also includes *Allocasuarina littoralis* and *Leptospermum polygalifolium*. The shrubby understorey typically consists of a relatively diverse range of smaller shrubs, including *Pultenaea villosa*, *Pultenaea retusa*, *Dodonaea triquetra*, *Persoonia levis*, *Daviesia ulicifolia* and *Epacris pulchella* and scrambling climbers,

Vegetation type (OEH, 2011b)	Veg. ID (OEH, 2011b)	Conservation significance	Description
			including *Billardiera scandens, Kennedia rubicunda* and *Hardenbergia violacea*. The understorey is typically dominated by grasses, in particular *Themeda australis* and *Entolasia stricta* along with others such *Panicum simile* and *Paspalum orbiculare*, and grass like plants, including *Lomandra longifolia*, *Schoenus apogon*, *Dianella caerulea* and *Baumea teretifolia*. Numerous forbs are typically also present in the ground layer and commonly include *Gonocarpus tetragynus*, *Hydrocotyle peduncularis* and *Goodenia paniculata* along with ferns, including *Lindsaea linearis*. This community exists in three different condition classes across the site.
Blackbutt - Tallowwood dry grassy open forest of the southern North Coast	HU511		Cumberland Ecology (2011) described this community as follows: "the tree stratum is dominated by *Eucalyptus microcorys* (Tallowwood), *Eucalyptus globoidea* (White Stringybark), *Eucalyptus resinifera* subsp*. resinifera* (Red Mahogany) and *Acacia irrorata* subsp*. irrorata* (Green Wattle). Other tree species occurring in this community include *Angophora costata* (Smooth-barked Apple) and *Corymbia gummifera* (Red Bloodwood). The tree stratum ranges in height from 12-18m. Common species in the shrub stratum include *Melaleuca linariifolia* (Snow in Summer), *Callistemon salignus* (Willow Bottlebrush), *Leptospermum polygalifolium* (Lemon Scented Tea-tree), *Melaleuca nodosa* (Ball Honeymyrtle), *Melaleuca sieberi* and the exotic *Lantana camara* (Lantana). The shrub stratum ranges in height from 1-5m. Common groundcover species include *Brunoniella pumilio* (Dwarf Blue Trumpet), *Pratia purpurascens* (Whiteroot), *Gahnia clarkei* (Tall Saw-sedge), *Lomandra longifolia* (Spinyheaded Mat-rush), *Entolasia stricta* (Wiry Panic), *Imperata cylindrica* var*. major* (Blady Grass), *Microlaena stipoides* var*. stipoides* (Weeping Meadow Grass) and *Oplismenusimbecillis*. The understorey of this community is predominantly comprised of regrowth Melaleuca species as a result of previous land use. This community is not significant impacted by weed invasion. Some weed invasion is evident in the areas surrounding the drainage line flowing through this community."

Vegetation type (OEH, 2011b)	Veg. ID (OEH, 2011b)	Conservation significance	Description
			This community exists in two different condition classes across the site.
Spotted Gum – Red Ironbark – Grey Gum shrub – grass open forest of the Lower Hunter	HU806		Cumberland Ecology (2011) described this community as follows: dominant species in the tree stratum are *Corymbia maculate* (Spotted Gum) and *Eucalyptus paniculata* subsp*. paniculata* (Grey Ironbark). There are also frequent occurrences of *Eucalyptus propinqua* var. *propinqua* (Small Fruited Grey Gum), *Eucalyptus fergusonii*, *Eucalyptus globoidea* (White Stringybark) and *Eucalyptus resinifera* subsp. *resinifera* (Red Mahogany). The tree stratum ranges in height from 15- 25m. Common species in the shrub stratum include *Pultenaea villosa*, *Melaleuca nodosa* (Ball Honeymyrtle), *Leptospermum polygalifolium* (Lemon Scented Tea-tree) and *Breynia oblongifolia* (Coffee Bush). The shrub stratum ranges in height from 0.2-3.5m. Common species in the groundcover stratum include *Dichondra repens* (Kidney Weed), *Pratia purpurascens* (Whiteroot), *Themeda australis* (Kangaroo Grass), *Entolasia stricta* (Wiry Panic), *Brunoniella pumilio* (Dwarf Blue Trumpet), *Lagenifera stipitata* (Blue Bottle-daisy), *Lomandra longifolia* (Spiny- headed Mat-rush), *Dianella caerulea* var. *producta* (Blue Flax lily) and the exotic *Conyza bonariensis* (Flaxleaf Fleabane) and *Axonopus fissifolius* (Narrow-leaved Carpet Grass). The groundcover stratum ranges in height from 0-2m. The vines *Glycine clandestina* (Twining Glycine), *Glycine microphylla* and *Glycine tabacina* were also recorded in this community. This community has been impacted by underscrubbing activities, most likely as result bushfire protection activities for the houses situated upslope. Native species continue to persist in this community, with only localised occurrences of exotic species. Both the canopy and shrub stratum are comprised of native species. Exotic species occupy approximately 5-10% of the groundcover stratum.”
Mangrove forest in estuaries of the Sydney Basin and South East Corner	HU563		Low open forests to low closed forests dominated by *Avicennia marina*, often in association with *Aegiceras corniculatum*. The understorey typically includes a sparse cover of small shrubs including *Suaeda australis* and *Sarcocornia quinqueflora* and graminoids including *Juncus kraussii* and *Triglochin striata*. The ground layer is typically also sparsely vegetated and is

Vegetation type (OEH, 2011b)	Veg. ID (OEH, 2011b)	Conservation significance	Description
			characterised by *Sporobolus virginicus*.
Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner	HU635	EEC TSC Act	Open swamp forests with an overstorey characterised by *Casuarina glauca*, and with the main understorey shrub being *Melaleuca ericifolia*. The climber *Parsonsia straminea* is also a common component of the mid and overstorey. The ground layer is wet and dominated by sedges and rushes, including *Juncus kraussii*, *Baumea juncea* and *Phragmites australis*. Other common ground layer species include the grass *Sporobolus virginicus* and the herb *Samolus repens*.
Paperbark swamp forest of the coastal lowlands of the North Coast and Sydney Basin	HU591	EEC TSC Act	Open swamp forests characterised by a canopy strongly dominated by *Melaleuca quinquenervia* and commonly including *Casuarina glauca* and *Eucalyptus robusta*. An open shrub layer may be present and typically includes *Glochidion ferdinandi* and *Acacia longifolia*, along with the climber *Parsonsia straminea*. The ground layer is typically wet and dominated by sedges and other graminoids, including *Gahnia clarkei* and *Baumea juncea*. Ground ferns, in particular *Blechnum indicum*, are also common components of the ground layer.



LEGEND

- Biobank Plot (GHD 2011)
- Biobank Plot (Cumberland Ecology)
- Development site boundary

VEGETATION

- Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast (HU509) Low
- Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast (HU509) Mod-good / Good
- Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast (HU509) Mod-good / Mod
- Blackbutt - Tallowwood dry grassy open forest of the Southern North Coast (HU511) Mod-good / Good
- Blackbutt - Tallowwood dry grassy open forest of the Southern North Coast (HU511) Mod-good / Mod
- Cleared Land
- Coastal freshwater lagoons of the Sydney Basin and South East Corner (HU533) Mod-good / Mod
- Smooth-Barked Apple - White Stringybark - Red Mahogany Melaleuca Sieben shrubby open forest on lowlands of the Lower North Coast (HU832)
- Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin (HU631) Mod-good / Good
- Swamp Mahogany swamp forest on coastal lowlands of the North Coast and Northern Sydney Basin (HU633) Mod-good / Good
- Swamp Mahogany swamp forest on coastal lowlands of the North Coast and Northern Sydney Basin (HU633) Mod-good / Mod
- Swamp Mahogany swamp forest on coastal lowlands of the North Coast and Northern Sydney Basin (HU633) Mod-good / Poor

Paper Size A4

0 40 80 160 240 320

Metres

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

N

SGD 1 Pty Ltd
Riverside Subdivision
Biodiversity Offsets Package

Development site
Vegetation zones

Job Number	22-17733
Revision	0
Date	27 Oct 2015

Figure 3a

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com **W** www.ghd.com.au

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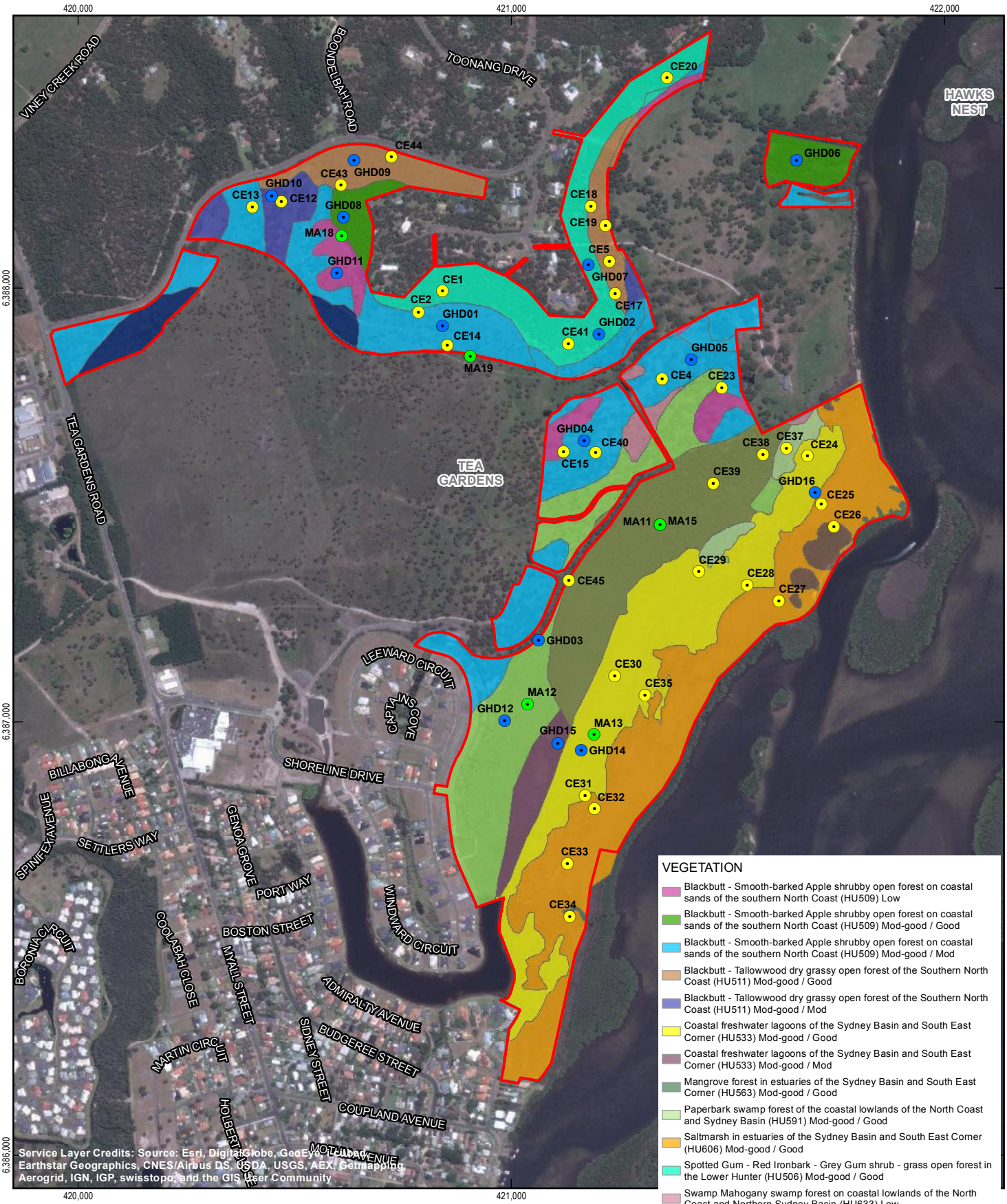
Data source: LPI: DTDB, 2012; Cumberland Ecoloy: Biobank Plots; ESRI: Aerial Imagery, 2014. Created by: fmackay, tmorton



VEGETATION

- Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast (HU509) Low
- Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast (HU509) Mod-good / Good
- Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast (HU509) Mod-good / Mod
- Blackbutt - Tallowwood dry grassy open forest of the Southern North Coast (HU511) Mod-good / Good
- Blackbutt - Tallowwood dry grassy open forest of the Southern North Coast (HU511) Mod-good / Mod
- Coastal freshwater lagoons of the Sydney Basin and South East Corner (HU533) Mod-good / Good
- Coastal freshwater lagoons of the Sydney Basin and South East Corner (HU533) Mod-good / Mod
- Mangrove forest in estuaries of the Sydney Basin and South East Corner (HU563) Mod-good / Good
- Paperbark swamp forest of the coastal lowlands of the North Coast and Sydney Basin (HU591) Mod-good / Good
- Saltmarsh in estuaries of the Sydney Basin and South East Corner (HU606) Mod-good / Good
- Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest in the Lower Hunter (HU506) Mod-good / Good
- Swamp Mahogany swamp forest on coastal lowlands of the North Coast and Northern Sydney Basin (HU633) Low
- Swamp Mahogany swamp forest on coastal lowlands of the North Coast and Northern Sydney Basin (HU633) Mod-good / Good
- Swamp Mahogany swamp forest on coastal lowlands of the North Coast and Northern Sydney Basin (HU633) Mod-good / Mod
- Swamp Mahogany swamp forest on coastal lowlands of the North Coast and Northern Sydney Basin (HU633) Mod-good / Poor
- Swamp Oak swamp forest fringing estuaries , Sydney Basin and South East Corner (HU635) Mod-good / Good

LEGEND

- Biobank Plot (GHD 2015)
- Biobank Plot (GHD 2011)
- Biobank Plot (Cumberland Ecology)
- Biobank site boundary

Paper Size A4

0 40 80 160 240 320

Metres

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

N

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Biobank site Vegetation zones

Job Number 22-17733
Revision 0
Date 27 Oct 2015

Figure 3b

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G:\22\17733\GIS\Maps\Deliverables\BiodiversityOffsetPackage\2217733_BOP005_BiobankSite_Vegetation_0.mxd

Data source: LPI:DTDB, 2012; Cumberland Ecoloy: Biobank Plots; ESRI: Aerial Imagery, 2014. Created by: fmackay, tmorton

3.5 Conservation significance

Threatened flora species

No threatened flora species have been identified within the study area during present or prior field surveys. Suitable habitat for cryptic species exists, such as the Leafless Tongue Orchid (*Cryptostylis hunteriana*), which requires targeted seasonal surveys to determine whether any further assessment is required. Targeted surveys completed by Conacher Environmental in the appropriate season indicated this species is not present on the site. The species has also not been detected by Cumberland Ecology or GHD during surveys.

Endangered ecological communities

As shown in Table 4, a number of the vegetation communities within the study area correspond to EECs (Cumberland 2011) listed under the TSC Act:

- Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions.
- Freshwater wetlands on coastal floodplains of the NSW North Coast; Sydney Basin and South East Corner bioregions.
- Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions.
- Swamp Sclerophyll Forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions.

The distribution of the above listed EEC's is the subject of the assessment by Cumberland Ecology (2011b). The Cumberland assessment considers the distribution of these EEC's in accordance with the Scientific Committees Determination, including the influence of the soil profile.

With regard to the BioBanking assessment included in this offsets package, the default EEC status of vegetation types within the study area was included i.e. vegetation types which are described as EECs in the NSW Vegetation Types database (OEH, 2011a) were entered as EECs. The EEC status of vegetation types does not affect the number or type of ecosystem credits and so does not have a direct bearing on the quantum of offsets estimated in this report.

No EECs listed under the EPBC Act were identified in the study area or are otherwise of relevance to this assessment. The Coastal Saltmarsh community is listed as vulnerable under the EPBC Act however this community is restricted to the onsite biobank only and will not be impacted by the project.

Threatened fauna species

The following threatened fauna have been recorded in the study area (Cumberland Ecology, 2011a, b):

- Wallum Froglet (*Crinia tinnula*).
- Varied Sitella (*Daphoenositta chrysoptera*).
- Little Lorikeet (*Glossopsitta pusilla*).
- Black Bittern (*Ixobrychus flavicollis*).
- Osprey (*Pandion haliaetus*).
- Barking Owl (*Ninnox connivens*).
- Squirrel Glider (*Petaurus norfolcensis*).

- Koala (*Phascolarctos cinereus*).
- Grey-headed Flying-fox (*Pteropus poliocephalus*).
- Common Blossom-bat (*Syconycteris australis*).
- Little Bentwing-bat (*Miniopterus australis*).
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*).
- Eastern Freetail-bat (*Mormopterus norfolkensis*).
- Greater Broad-nosed Bat (*Scoteanax rueppellii*).

All these species are listed as Vulnerable under the TSC Act. The Koala also forms part of an endangered population in the Hawks Nest and Tea Gardens area. The Koala and Grey-headed Flying-fox is also listed as Vulnerable under the EPBC Act.

The Wallum Froglet and the Koala population have been assessed in order to generate species credits as described in Section 4.

4. BioBanking credit calculations

4.1 Approach

BioBanking has been used to estimate the impact of development on biodiversity and the quantum of offsets that would be required to compensate for such impacts arising from the Project. This process has been applied to multiple development scenarios to inform the balance between development and conservation footprints across the study area and has informed the final development/conservation footprint which is the subject of this offsets package.

Development has been largely restricted to lands in low to moderate condition with vegetation in better condition largely present within the proposed biobank site. The proposed development would result in changes in the landscape through changes to the total vegetation cover and associated vegetation condition.

The development impacts were assessed in Version 2 of the credit calculator during preparation of the original BioBanking Assessment (GHD 2013). This assessment was based on a larger development footprint of 101.77 hectares. As outlined in Section 2, the project team has subsequently reduced the development footprint to 85.4 hectares to reduce impacts on native vegetation and threatened species, most notably the Koala. Since the 2013 assessment, a new version of the credit calculator (Version 4) has been released that has different variables with respect to credit impact rates than Version 2. As such, it was decided the most reasonable method of determining the credit impact score for the final development footprint was to extrapolate results from the original assessment (calculated using Version 2), as outlined in Section 4.2 below.

For the biobank site, additional field data (plot/transects) was collected according to the BioBanking methodology and entered into Version 4 of the calculator to calculate the number of credits that will be generated if a BioBanking agreement was obtained for the proposed 'onsite' biobank. The completion of the updated biobank site credit calculations was a requirement of the Concept Plan approval as outlined in Section 6.6 of the BioBanking Assessment (GHD 2013) and the approved Statement of Commitments.

A copy of the original credit report for the development, approved as part of the Concept Plan application, and the new credit report for the onsite biobank are included as Appendix A and Appendix B.

The BioBanking assessment associated with the original development footprint was completed by Ben Harrington (Assessor Accreditation No. 0073) with the new assessment of the onsite biobank completed by Arien Quin (Assessor Accreditation No. 120) and Daniel Williams (Assessor Accreditation No. 0082). The onsite biobank assessment is based on detailed plot/transect data collected according to the BBAM. Surveys were completed by GHD and Cumberland Ecology with plot locations shown in Figure 4 (a and b).

4.2 BioBanking credit estimate for the development footprint

GHD completed BioBanking credit calculations for the original development footprint using Version 2 of the credit calculator in the original BioBanking Assessment (GHD 2013). As noted above, this assessment was for a larger development footprint (101.77 ha). A copy of this credit report is included as Appendix A.

Considering this assessment was included in the approved Concept Plan application it was determined, in consultation with OEH, that the most suitable method of determining the appropriate credit impact for the reduced development would be to extrapolate data from this assessment. The applicant has undertaken detailed analysis of these results since the Concept Approval to define a development footprint on the site which would reduce biodiversity impacts and lead to an outcome where there would be a 'positive credit balance' for the Koala. This has led to a reduction in the development footprint to 85.4 ha.

4.2.1 Field and mapping activities

GHD completed the following activities to update the information included in the original BioBanking Assessment (GHD, 2013) in relation to the development impacts as outlined in Section 6.6 of that assessment:

- Additional field surveys to refine vegetation type boundaries
- Updated the vegetation types being impacted by the development in accordance with the new PTC's assigned to the Hunter Central Rivers CMA.
- Updated GIS mapping to reflect the new PCT's and adjusted boundaries.

4.2.2 Credit impact estimate activities

Using the results from the original biobanking assessment (GHD, 2013), the following activities were undertaken to estimate a suitable credit impact for the reduced development footprint:

- Analysis of the credit impact rates and calculation of the average credit generation rate per hectare for each vegetation type
- Determination of the highest and lowest credit generation rates per hectare based on the range of different conditions of the vegetation within the development footprint.
- Calculation of the predicted credit score based on using the highest credit impact rate, the average credit impact rate and the lowest credit impact rate. The results are shown in Table 4-2 and Table 4-3, below.

An analysis of the results showed that the areas removed from the development footprint were areas of vegetation in the highest condition (i.e. the difference between using the average and the highest rates was only approximately 5 credits). This was obviously a good biodiversity outcome for the site. The outcome was driven by the need to reduce the impact on the Koala so there was a positive net balance in species credits onsite (which has been achieved) but also demonstrates the project team targeted vegetation that was in good condition.

Table 4-1 Ecosystem credit impact rates for original assessment (Version 2)

Vegetation types	Impact area	Total credits	Av credit impact rate	High credit impact rate	Low credit impact rate
Coastal freshwater lagoons of the Sydney Basin and South East Corner	0.58	24	41.38	N/A	N/A
Melaleuca sieberi - Tall Saw-sedge closed shrubland in drainage lines on the Central Coast, Sydney Basin	33.45	1,247	37.28	52.6	16.4

Vegetation types	Impact area	Total credits	Av credit impact rate	High credit impact rate	Low credit impact rate
Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin	17.36	379	21.83	50	12.5
Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast	45.66	1,049	22.97	32	12
Blackbutt - Tallowwood dry grassy open forest of the southern North Coast	4.72	183	38.77	46.6	35.8
Totals	**101.77**	**2,882**			

Note: *Melaleuca sieberi* - Tall Saw-sedge closed shrubland in drainage lines on the Central Coast, Sydney Basin (HU566) has been remapped as Smooth-barked Apple - White Stringybark - Red Mahogany - *Melaleuca sieberi* shrubby open forest on lowlands of the lower North Coast (HU 832) using the updated PCT's for the Hunter Central Rivers CMA.

Table 4-2 Credit impact results for final development footprint

Vegetation types	Impact area	Av credit impact rate	High credit impact rate	Low credit impact rate
Coastal freshwater lagoons of the Sydney Basin and South East Corner	0.58	24	24	24
Smooth-barked Apple - White Stringybark - Red Mahogany - *Melaleuca sieberi* shrubby open forest on lowlands of the lower North Coast	13.84	516	728	227
Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin	31.25	682	1563	391
Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast	34.37	790	1100	412
Blackbutt - Tallowwood dry grassy open forest of the southern North Coast	4.05	157	189	145
Totals	**84.1**	**2,169**	**3,604**	**1,199**

The results confirm the approach taken by the project team in removing areas of vegetation in better condition from the development area. If the reduced development had impacted on vegetation in higher condition the total credit impact would have been 3,604. If the total development was focussed on vegetation in low condition the total impact would have been 1,199 credits. The difference in the credit estimates for vegetation in high condition is 1,435 whereas the difference in the low credit estimate is 970. This demonstrates that the project team has removed more vegetation of high condition from the development area since the 2013 Concept Plan application.

Using the results of the average credit impact rate from Table 4-2 shows the project team has been able to reduce the ecosystem credit impact from 2,882 down to 2,204. This is considered a fair result by the project team to reflect their efforts in reducing biodiversity impacts since the Concept Application approval.

It was agreed in consultation with OEH, that the average credit impact rate should be applied when determining the credit impact assessment for the development footprint with justification for this approach included in Section 4.1.

Table 4-3 Species credit analysis

Species	Original impact	Total credit impact	Credit impact per ha	Final impact	Total credits
Koala	57.65 ha	695	12	40.2 ha	482
Wallum froglet	51.41 ha	685	13.3	45.7 ha	609

With regard to species credits, the reduction in the development footprint means the project will now require 499 Koala credits and 612 Wallum Froglet credits

4.3 BioBanking credit calculations for the onsite biobank

As outlined in commitments described in Section 6.6 of the original BioBanking Assessment (GHD 2013), GHD has completed a biobanking assessment of the proposed onsite biobank using Version 4 of the credit calculator. The methodology and results are outlined below.

4.3.1 Biobank location

The biobank site is located in the 'Hunter Central Rivers CMA region; the 'Karuah Manning CMA sub-region; and 'Myall Foster Barrier System' Mitchell Landscape (DECC, 2008a; 2008b).

4.3.2 Biobank landscape value

The landscape assessment for the biobank is shown on Figure 6 and summarised in Table 4-4. The approach to the landscape assessment is described below.

The BBAM uses 100 hectare and 1,000 hectare assessment circles to estimate the extent and connectivity of native vegetation and habitat surrounding the site. Vegetation cover and connectivity 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 assessment circles were 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 total area of native vegetation within the assessment circles. There is approximately 70.8 hectares of vegetation within the 100 hectare circle. This would remain unchanged after the establishment of the

biobank site (see Table 4-4). There would also be no change in vegetation distribution within the 1,000 hectare assessment circle.

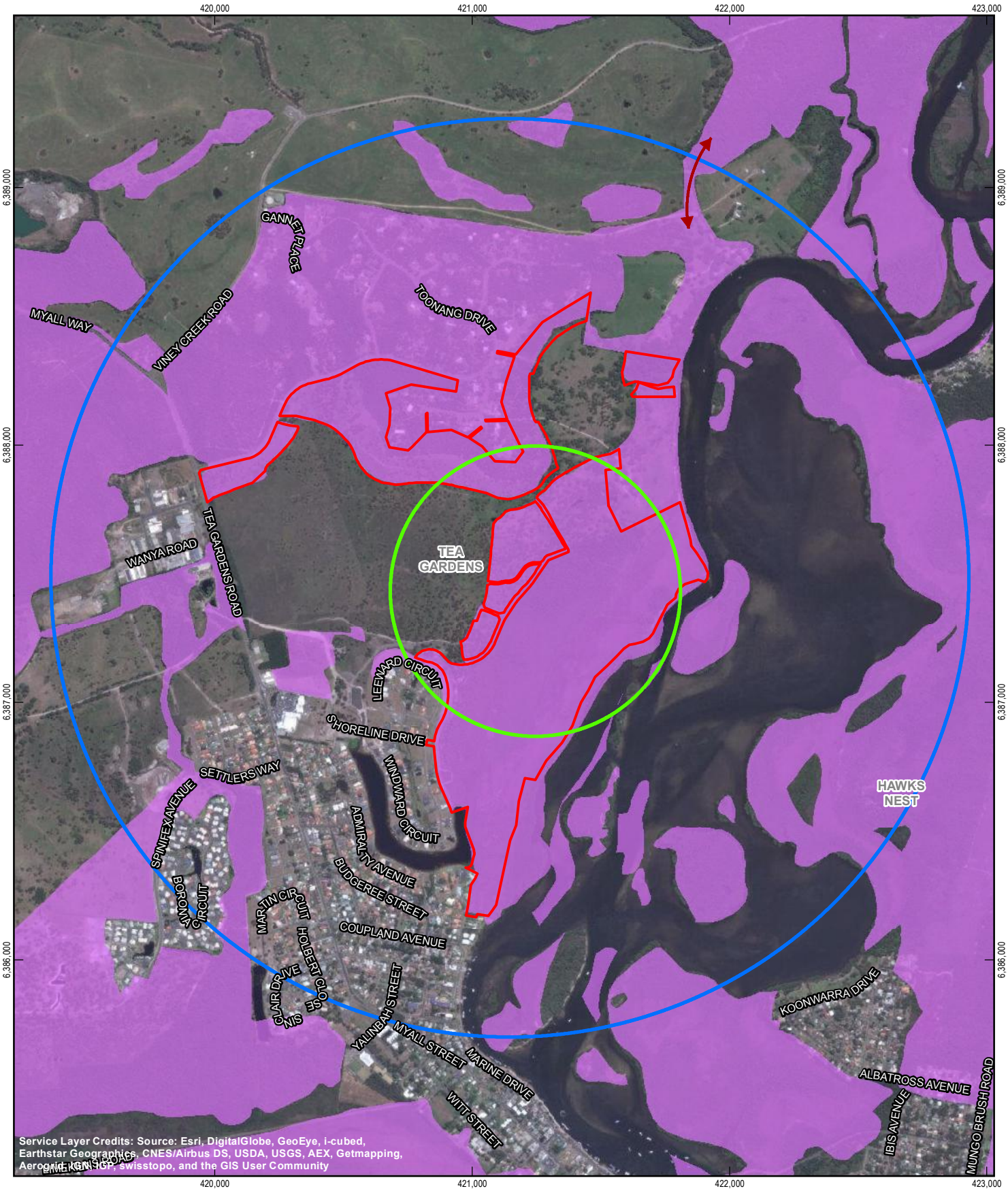
Patch size and connectivity were assessed using GIS and air photo interpretation of native vegetation cover within the assessment circles and adjoining areas of native vegetation. Impacts on connectivity are calculated by entering the 'primary link' for the biobank. The primary link for Riverside biobank site, before the biobank is established is > 30 m to 100 m. Management of the biobank would not affect the width of this primary link.

Based on site surveys the over-storey vegetation was at benchmark while mid storey and groundcover vegetation, within the primary link are at greater than 50% of lower benchmark condition. Vegetation condition would not be expected to improve as a result of management actions within the site as the primary link is outside the biobank site.

Table 4-4 Landscape assessment values summary

Landscape attribute	Before biobank	After biobank
% Native vegetation cover in 1000 ha assessment circle	46 – 50% (456.3 ha)	46 – 50% (456.3 ha)
% Native vegetation cover in 100 ha assessment circle	66 – 70% (70.8 ha)	66 – 70% (70.8 ha)
Connectivity value width	> 30 m to 100 m	> 30 m to 100 m
Connectivity value over-storey condition	PFC at BM	PFC at BM
Connectivity value mid-storey or groundcover condition	PFC > 50% lower BM	PFC > 50% lower BM

*PFC = percentage foliage cover; BM = benchmark values for the attribute (OEH, 2014d).



LEGEND

- Biobank site boundary
- Native Vegetation
- Primary Link (30 - 100m before and after biobank)
- 100 ha landscape assessment circle
- 1000 ha landscape assessment circle

Paper Size A4

0 70 140 280 420 560

Metres

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

N

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Job Number 22-17733
Revision 0
Date 27 Oct 2015

Landscape assessment

Figure 4

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G:\22\17733\GIS\Maps\Deliverables\BiodiversityOffsetPackage\2217733_BOP006_LandscapeAssessment_0.mxd

Data source: CANRI: Northern Crafti Vegetation 2008; LPI: DTDB, 2012; ESRI: Aerial Imagery, 2014. Created by: fmackay, tmorton

4.3.3 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 and threatened species sub zones within the Riverside biobank site are summarised below in Table 4-5.

All of the Moderate/good condition vegetation zones within the Riverside biobank are connected. These vegetated areas are connected to an extensive area of native vegetation extending to the north and east of the site. The area of contiguous treed vegetation connected to the Riverside biobank was calculated with GIS and is greater than the maximum value for adjacent remnant area in the BBAM of 500 hectares, so for all Moderate/good condition vegetation zones the adjacent remnant area was entered as 501 hectares. Patch size, including low condition vegetation is also equal to the maximum area within the BBAM of 501 hectares.

Site value data was collected using the BioBanking plot/transect methodology and was entered for each plot/transect field in each vegetation zone.

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 greater than expected increase in site value is obtained. This may include intense, targeted management activities such as supplementary planting.

Management zones are shown in Table 4-5.

No further specific, targeted management actions would be performed in any other zones. Accordingly, the default increase in site value was entered for all other management zones.

Table 4-5 Vegetation zones

Vegetation zone ID	Management zone	Vegetation type	Veg type ID	Condition	Patch size	Area	Plot / transects Required
1	1	Blackbutt – Smooth Barked Apple shrubby open forest on coastal sands of the Southern North Coast	HU509	Low	501 ha	3.26	1
2	2	Blackbutt – Smooth Barked Apple shrubby open forest on coastal sands of the Southern North Coast	HU509	Moderate/good - high	501 ha	3.41	2
3	3	Blackbutt – Smooth Barked Apple shrubby open forest on coastal sands of the Southern North Coast	HU509	Moderate/good - medium	501 ha	21.78	4
4	4	Blackbutt - Tallowwood dry grassy open forest of the southern NSW North Coast Bioregion	HU511	Moderate/good - high	501 ha	5.33	3
5	5	Blackbutt - Tallowwood dry grassy open forest of the southern NSW North Coast Bioregion	HU511	Moderate/good - medium	501 ha	2.63	2
6	6	Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	HU533	Moderate/good - high	501 ha	16.23	3
7	7	Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	HU533	Moderate/good - medium	501 ha	2.33	2
8	8	Mangrove forest in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	HU563	Moderate/good - high	501 ha	0.31	1
9	9	Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	HU806	Moderate/good - high	501 ha	8.83	3

Vegetation zone ID	Management zone	Vegetation type	Veg type ID	Condition	Patch size	Area	Plot / transects Required
10	10	Swamp Mahogany swamp forest of the coastal lowlands of the North Coast and Sydney Basin	HU633	Moderate/good - high	501 ha	12.16	3
11	11	Swamp Mahogany swamp forest of the coastal lowlands of the North Coast and Sydney Basin	HU633	Moderate/good - medium	501 ha	12.47	3
12	12	Swamp Mahogany swamp forest of the coastal lowlands of the North Coast and Sydney Basin	HU633	Moderate/good - poor	501 ha	2.50	2
13	13	Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion	HU635	Moderate/good - high	501 ha	1.20	1
14	14	Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	HU606	Moderate/good - high	501 ha	20.09	3
15	15	Paperbark swamp forest of the coastal lowlands of the North Coast and Sydney Basin	HU591	Moderate/good - high	501 ha	1.33	1
					Total	**113.86**	**20**

4.3.4 Threatened species assessment

Predicted ecosystem species

The BioBanking credit calculator identifies the suite of threatened fauna species that are predicted to be associated with ecosystem credits generated for the biobank. The suite of threatened species associated with ecosystem credits for the biobank is shown in Table 4-6.

Table 4-6 Predicted threatened species (ecosystem species)

Common name	Scientific name	Tg value[1]	Habitat on site[2]
Australian Painted Snipe	*Rostratula australis*	1.3	Yes
Barking Owl	*Ninox connivens*	0.30	Yes
Black-chinned Honeyeater (eastern subspecies)	*Melithreptus gularis gularis*	1.3	Yes
Black-tailed Godwit	*Limosa limosa*	2.6	Yes
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	2.0	Yes
Bush Stone-curlew	*Burhinus grallarius*	2.6	Yes
Common Blossom-bat	*Syconycteris australis*	1.2	Yes
Diamond Firetail	*Stagonopleura guttata*	1.3	Yes
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	2.2	Yes
Eastern Freetail-bat	*Mormopterus norfolkensis*	2.2	Yes
Eastern Grass Owl	*Tyto longimembris*	1.3	Yes
Freckled Duck	*Stictonetta naevosa*	1.3	Yes
Gang-gang Cockatoo	*Callocephalon fimbriatum*	2.0	Yes
Glossy Black-cockatoo	*Calyptorhynchus lathami*	1.8	Yes
Great Knot	*Calidris tenuirostris*	2.6	Yes
Greater Broad-nosed Bat	*Scoteanax rueppellii*	2.2	Yes
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	1.3	Yes
Hooded Robin (south-eastern form)	*Melanodryas cucullata* subsp. *cucullata*	1.7	Yes
Little Eagle	*Hieraaetus morphnoides*	1.4	Yes
Little Lorikeet	*Glossopsitta pusilla*	1.8	Yes
Long-nosed Potoroo	*Potorous tridactylus*	1.3	Yes
Magpie Goose	*Anseranas semipalmata*	1.3	Yes
Masked Owl	*Tyto novaehollandiae*	3	Yes
Powerful Owl	*Ninox strenua*	3	Yes
Rose-crowned Fruit-dove	*Ptilinopus regina*	1.3	Yes
Sanderling	*Calidris alba*	2.6	Yes
Scarlet Robin	*Petroica boodang*	1.3	Yes
Sooty Owl	*Tyto tenebricosa*	3.0	Yes

Common name	Scientific name	Tg value[1]	Habitat on site[2]
Speckled Warbler	*Chthonicola sagittata*	2.6	Yes
Spotted Harrier	*Circus assimilis*	1.4	Yes
Spotted-tailed Quoll	*Dasyurus maculatus*	2.6	Yes
Square-tailed Kite	*Lophoictinia isura*	1.4	Yes
Squirrel Glider	*Petaurus norfolcensis*	2.2	Yes
Superb Fruit-dove	*Ptilinopus superbus*	1.3	Yes
Swift Parrot	*Lathamus discolor*	1.3	Yes
Turquoise Parrot	*Neophema pulchella*	1.8	Yes
Varied Sittella	*Daphoenositta chrysoptera*	1.3	Yes
White-fronted Chat	*Epthianura albifrons*	0.8	Yes
Yellow-bellied Glider	*Petaurus australis*	2.3	Yes
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	2.2	Yes

Notes: 1. The Tg value 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.

4.3.5 Species credits

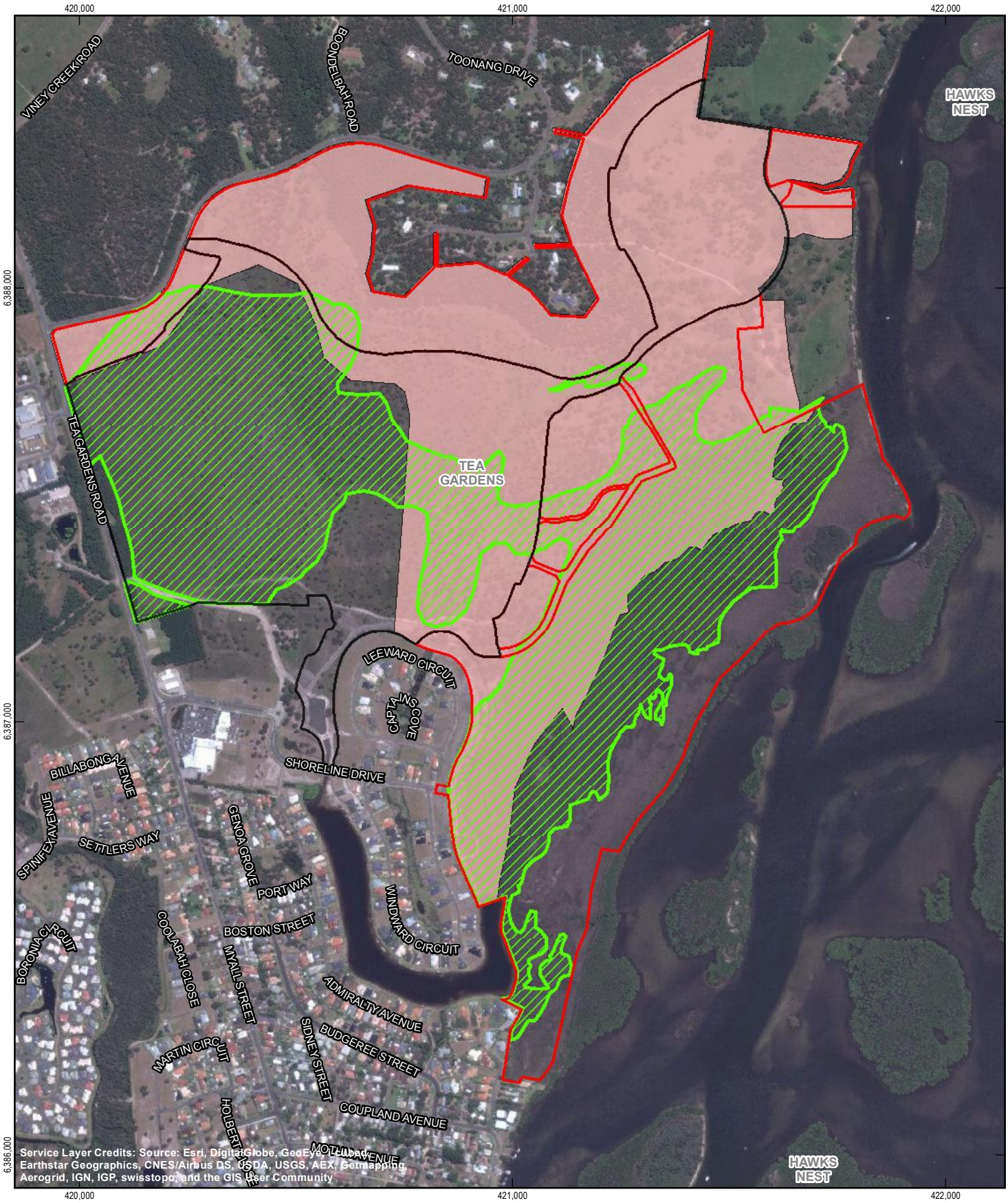
Overview

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.

Both the Koala (listed population) and Wallum Froglet have been recorded in previous surveys on the site. As noted above, GHD consulted with OEH during the preparation of the original BioBanking Assessment and agreed on a suitable species polygon for both these species as shown on Figure 7. The area of suitable habitat within the biobank site was entered into the credit calculator and species credits generated accordingly.

No targeted or seasonal surveys were conducted for any other species credit species. Therefore in order to complete the credit calculations default data for all threatened species was entered at the 'Threatened species survey results' stage, comprising: 'Managed at site?' = 'No'; 'ID Method' = 'Survey'; and 'Survey data' = '16/09/2014'

Additional species credits may be generated at the site at a later date after completion of targeted surveys. The generation of species credits would be included in a modification to the BioBanking agreement for the Riverside biobank site.



LEGEND

- Development site boundary
- Biobank site boundary
- Wallum froglet species
- Koala species

Paper Size A4

0 40 80 160 240 320

Metres

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

N

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Job Number	22-17733
Revision	0
Date	27 Oct 2015

Biobank species polygons

Figure 5

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Data source: LPI:DTDB, 2012; Cumberland Ecoloy: Biobank Plots; ESRI: Aerial Imagery, 2014. Created by: fmackay, tmorton

5. Biodiversity credits – Riverside biobank

This Section of the report summarises the results of credit calculations completed for the Riverside biobank site (onsite biobank).

The data from the field survey, GIS mapping and BioBanking assessment were entered into Version 4 of the credit calculator to determine the number and type of biodiversity credits that would be included in the biobanking agreement for the Riverside biobank. The BioBanking Credit Report is included in Table 5-1 and summarised below.

5.1 Ecosystem credits

A total of 921 ecosystem credits would be generated if a biobanking agreement was obtained over the Riverside biobank site. A summary of the number and type of ecosystem credits generated is provided in Table 5-1.

Table 5-1 Ecosystem credits generated at the Riverside biobank

Veg code	Vegetation type	Area (ha)	Ecosystem credits generated
HU509	Blackbutt – Smooth Barked Apple shrubby open forest on coastal sands of the Southern North Coast	28.45	254
HU511	Blackbutt - Tallowwood dry grassy open forest of the southern NSW North Coast Bioregion	7.96	59
HU532	Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	18.56	155
HU563	Mangrove forest in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	0.31	1
HU591	Paperbark swamp forest of the coastal lowlands of the North Coast and Sydney Basin	1.33	8
HU606	Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	20.09	195
HU806	Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	8.83	55
HU633	Swamp Mahogany swamp forest of the coastal lowlands of the North Coast and Sydney Basin	27.13	187
HU635	Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion	1.2	10
	Total	**113.86**	**924**

5.2 Species credits

A summary of the number and type of species credits that would be generated at the biobank site for the Koala and Wallum Froglet is provided in Table 5-2, below.

Table 5-2 Species credits

Common name	Scientific name	Area of habitat	Credits generated
Koala (listed population)	*Phascolarctos cinereus*	73.2	520
Wallum Froglet	*Crinia tinnula*	48.1	342

5.3 Assumptions and limitations

The following assumptions have been made for the biobank site in calculating the biodiversity credits included in the BioBanking Credit Report and summarised above:

- This assessment has been undertaken to determine the number of biodiversity credits generated from the Riverside biobank site if placed under a BioBanking agreement.
- Previous surveys have identified the presence of both the Koala (listed population) and Wallum Froglet on site. As such, impacts associated with these species were included in the original impact calculations for the development (GHD 2013) and will require offsetting. The final credit calculations for the biobank site in Version 4 have included these species only as they are the only two species required for the development.
- Targeted, seasonal surveys for threatened flora and fauna species other than the Koala and Wallum Froglet were not conducted as part of the current assessment. Surveys at appropriate times of year and/or specifically targeting threatened biota may be completed at a later date and may yield additional species credits. These would be included in a modification to the BioBanking agreement.
- Default data for each threatened species other than the Koala and Wallum Froglet was entered at the 'Threatened species survey results' stage, comprising either: 'Managed at site?' = 'No'; 'ID Method' = 'Survey'; or 'Managed at site?' = 'Yes' 'Survey date' = '(relevant date for each species entered from any of the past surveys inserted)'. Additional species credits may be generated at the site at a later date after completion of further targeted surveys. The generation of additional species credits would be included in a modification to the BioBanking agreement for the Riverside biobank.

6. BioBanking credit comparison

6.1 Ecosystem credits

The BioBanking ecosystem credit comparison between the development footprint options and the associated onsite biobank sites is presented in Table 6-1. The BioBanking methodology states that impacts of a development on biodiversity values must be offset by the retirement of biodiversity credits at the biobank site determined in accordance with the offset rules. These rules may be altered or may not apply when the Project is being assessed under Part 3A of the EP&A Act in accordance with the *Interim Policy for the Assessment of Major Projects* (OEH, 2011) using the variation criteria stated in Attachment B of the policy.

The offset rules state that ecosystem credits that are retired from a biobank site are determined to be compatible with those required by impacts at the development site if a number of conditions are met, including that "the number of ecosystem credits obtained and retired from the biobank site is equal to or greater than the number of credits required at the development site" (DECC, 2009).

There is an overall deficit of ecosystem credits and a deficit of credits for the majority of ecosystem credit types as shown in Table 6-1. Therefore additional biodiversity credit contributions from an offsite biobank would be required to adequately offset the final development footprint.

The BioBanking methodology includes criteria for the protection of Red Flag areas and rules for the trading of biodiversity credits that must be strictly applied to BioBanking statements. If these criteria are met, then a development is deemed to have met an 'improve or maintain' standard and a BioBanking statement can be obtained. BioBanking assessments for major projects do not include red flag provisions and include variations to the trading criteria in accordance with the OEH (2011a) policy. Depending on the type and degree of variation, a major project may achieve a 'Tier 1 - Improve or Maintain', 'Tier 2 – No Net Loss' standard or 'Tier 3 - Mitigated Net Loss Standard'. DPE considers the standard of biodiversity assessment achieved in the decision making process when determining major projects (OEH, 2011a).

The OEH (2011a) policy states that if Red Flag areas are only partially protected in a Project BioBanking assessment, then the Project will achieve at best a 'Tier 2 – No Net Loss' standard. If the BioBanking assessment also includes a variation applied to offset type then the Project would achieve a 'Tier 3 - mitigated net loss standard'. There are Red Flag areas that will not be protected within the development area and so the Project would achieve at best a 'Tier 2 – No Net Loss' standard.

Based on the onsite biobank included in this assessment, not all biodiversity credits within the development area would be fully offset with matching biodiversity credits and so this BioBanking assessment would achieve a Tier 3 - mitigated net loss standard. However the proponent will be required to secure additional credits from other off site biobank/s to adequately offset the developments impacts on threatened biota. The breakdown of credit trades required is included in Table 6-2. The additional credits would be sourced from suitable biobank sites based on the BioBanking trading rules for the project and would be located, to the best of the proponent's ability, in order to address the biodiversity credit shortfall. If a full complement of matching ecosystem credits could be located in offsite biobank/s then it would be possible to achieve a 'Tier 2 – No Net Loss' standard. It may also be appropriate to include extra ecosystem credits in the final offsets package to further compensate for impacts on over cleared vegetation types (see below).

The proposed onsite biobank would generate a credit surplus for six of the vegetation types in the study area. The OEH (2011a) variation criteria would permit trading of these ecosystem credits with other vegetation types for which there is a deficit as part of the overall offsets package.

Table 6-1 Biodiversity credit summary for final development footprint and onsite biobank

Biodiversity credit	Development area (ha)	Credits required	Biobank area (ha)	Credits generated	Credit Balance
Coastal freshwater lagoons of the Sydney Basin and South East Corner (HU533)	0.58	24	18.56	155	131
Smooth-barked Apple - White Stringybark - Red Mahogany - *Melaleuca sieberi* shrubby open forest on lowlands of the lower North Coast (HU832)	13.84	516	0	0	-516
Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin (HU633)	31.25	682	27.13	187	-495
Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast (HU509)	34.37	790	28.45	254	-536
Blackbutt - Tallowwood dry grassy open forest of the southern North Coast (HU511)	4.05	157	7.96	59	-98
Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion (HU606)	0	0	20.09	195	195
Spotted Gum - Red Ironbark – Grey Gum shrub – grassy open forest of the Lower Hunter (HU806)	0	0	8.83	55	55
Mangrove forest in estuaries of the Sydney Basin and South East Corner (HU563)	0	0	0.31	1	1
Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner (HU635)	0	0	1.2	10	10
Paperbark swamp forest of the coastal lowlands of the North Coast and Sydney Basin (HU591)	0	0	1.33	8	8
Totals	**84.1**	**2,169**	**113.86**	**924**	**-1,245**
Koala population	40.2	482	73.2	520	38
Wallum Froglet	45.7	609	48.1	342	-267

Table 6-2 Ecosystem credits required to deliver the projects total offsets

Vegetation types	PCT	Credit deficit	Vegetation formation required
Coastal freshwater lagoons of the Sydney Basin and South East Corner	HU533	0	N/A
Smooth-barked Apple - White Stringybark - Red Mahogany - *Melaleuca sieberi* shrubby open forest on lowlands of the lower North Coast	HU832	516	Dry Sclerophyll Forest (shrubby)
Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin	HU633	150 (1)	Forested Wetland
Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast	HU509	481 (2)	Dry Sclerophyll Forest (shrubby)
Blackbutt - Tallowwood dry grassy open forest of the southern North Coast	HU511	98	Wet Sclerophyll Forest (grassy)
	Total	**1,245**	

Note:

(1) Total credits outstanding for HU633 determined after subtracting all surplus credits from vegetation types within the biobank considered to be within the Forested Wetland or Wetland formation.

(2) Total credits outstanding for HU509 determined after subtracting surplus credits from HU806 from the biobank site as this vegetation type was in the same formation (i.e. Dry Sclerophyll Forest).

All credits would need to be sourced from within the same IBRA subregion (Karuah Mannning) or any adjoining subregion.

6.1.2 Species credits

The geographic and habitat questions in Step 2 of the credit calculator were answered based on information obtained in the desktop assessment and field surveys. The credit calculator combines this information with the vegetation and landscape data to generate lists of the threatened species predicted to occur at the site and those requiring targeted survey. Since an ecological impact assessment to accompany a Part 3A Concept Application has already been performed it is assumed that no additional targeted threatened species surveys would be required for this assessment.

The results from targeted surveys for threatened species are entered into the credit calculator in Step 5e ‘Enter Threatened Species Survey Results’. For each species, the credit calculator requires a ‘Yes’ or ‘No’ answer for the question, ‘Is the species impacted by the development?’ Answers must be justified by recording the Identification Method as either ‘Survey’, ‘Assumed Presence’ or ‘Expert Report’.

Those species determined to be present in the study area and requiring calculation of species credits include:

- The Hawks Nest and Teagardens Koala Endangered Population (Koala population)
- Wallum Froglet.

Species polygons for the Koala population and Wallum Froglet were mapped based on habitat assessments conducted during GHD site surveys and in consultation with OEH and DPE.

The BioBanking species credit comparison between the development footprint and the biobank sites is presented in Table 6-1. The reduction in the development footprint since the Concept Plan approval has led to a 'net positive credit balance' onsite of 38 credits for the Koala. There is a shortfall of 267 credits for the Wallum Froglet. These credits will need to be sourced from a suitable offsite biobank site.

The Project ecological assessments were considered to provide reliable evidence that no other species would be affected by the development. Therefore in all other cases the data was entered as 'No' and 'Survey'.

The development areas contain a red flag area for greater than the allowed magnitude of impacts on the Koala population (refer Appendices A and B). Since the Project is subject to a Part 3A Concept Application and a BioBanking Statement is not being obtained, then no further assessment of red flag areas is required.

7. Biodiversity offset site management framework

The biodiversity offset (biobank) sites will be formally titled and conserved under BioBanking agreements. To deliver the biodiversity outcomes required by a BioBanking Agreement, the following biodiversity management framework would be implemented at the biobank sites:

- ***Conservation*** – A 'conservation covenant' would be placed over the biobank sites in perpetuity. This covenant extinguishes all potential future land uses other than exploration/mining rights.
- ***Vegetation rehabilitation*** – Existing vegetation would have a 'targeted' weed control program applied to improve 'condition' throughout the biobank sites. Revegetation activities would increase the extent of native vegetation, through time, of the biobank sites. It is recommended these works be completed within the first five to ten years of management of the biobank sites.
- ***Maintenance and monitoring*** – An annual maintenance and monitoring regime would be applied to the biobank sites in perpetuity to ensure improvements in ecological values are maintained.

7.1.1 Conservation covenant (BioBanking Agreement)

Entering into a BioBanking Agreement places a conservation covenant over the land, regardless of zoning. The covenant is the strongest available on private lands and extinguishes all land uses other than conservation. There are circumstances where additional approval from the NSW Minister for the Environment may overturn the covenant for mining rights and, potentially, significant infrastructure but the BioBanking methodology includes mechanisms to ensure any impacts from these activities are, again, suitably offset as an addition to any offsetting activities required by a given project in its own right. Details of this policy can be provided by the BioBanking Unit.

BioBanking agreements include detailed contractual and financial obligations on the landowner and the purchaser and, in the absence of draft BioBanking agreements (including the draft detailed management actions plan and contractual obligations on both parties.

7.1.2 Management actions

A Management Actions Plan (prepared in accordance with the BioBanking Methodology), detailing rehabilitation activities and an associated management program, would be prepared and included in the final BioBanking agreements. The Management Actions Plan (MAP) forms the basis of the funds required to be placed in the BioBanking Trust when purchasing the credits. The BioBanking Trust then funds the biobank site owner to implement the MAP.

Biobank sites may have two types of management actions applied:

- Standard Management Actions.
- Site Specific Management Actions.

Standard management actions are those actions required on biobank sites to improve vegetation condition when entering into a BioBanking agreement. The standard management actions for all biobank sites are:

- Management of grazing for conservation.
- Weed control.

- Management of fire for conservation.
- Management of human disturbance.
- Retention of regrowth and remnant native vegetation.
- Replanting or supplementary planting where natural regeneration would not be sufficient.
- Retention of dead timber.
- Erosion control.
- Retention of rocks.

Based on the habitat resources within the site and the suite of threatened species which are predicted to occur, the credit calculator nominates management actions that would be required to alleviate site-specific threats. Undertaking these actions is over and above the minimal requirements for a biobank site and includes measures such as:

- Cat and/or Fox control.
- Control of feral and/or overabundant native herbivores (e.g. rabbit, goats, deer etc.).
- Maintain or reintroduce flow regimes (aquatic flora).

The MAP will identify site specific vegetation rehabilitation and management actions appropriate for the biobank site which would be completed during the preparation of the BioBanking Agreement.

Table 7-1 Summary of rehabilitation and management for proposed offset site

Management measure	Activities required	Timing
Management of grazing	Install stock fencing in accordance with the MAP	Within the first year of establishing the biobank site
	Maintenance and repair	Annually
Weed control	Control of noxious and large woody weeds (target 80% control)	Within first 3 years of establishing biobank site
	Completion of primary and secondary bush regeneration programs targeting other weeds	Within first 10 years of establishing biobank site
Management of human disturbance	Install controlled access point/s and fencing in accordance with the MAP	Within the first 6 months of establishing the biobank site
Retention of vegetation and retention of dead timber	Installation of protective fencing in accordance with MAP	Within first 6 months of establishing biobank site
Revegetation	Installation of native species, as described in the MAP, in areas currently devoid of existing vegetation	All plants to be installed within first 3 years of establishing biobank site. Minimum 80% survival rate or additional plantings required.
Erosion control	Installation of erosion control measures in accordance with the MAP	Within first 3 months of establishing biobank site.
Feral animal control	Trapping and targeted removal of pest species	Immediately upon establishment of biobank site and monitored regularly

Management measure	Activities required	Timing
Maintain or reintroduce flow regimes (aquatic flora)	Removal of any 'barriers' to flow regimes	Within first year of establishing biobank site.
Monitoring and Reporting	Reports will be prepared and issued in accordance with MAP by OEH.	Annually in perpetuity

7.1.3 Monitoring of biobank sites

The biobank owner is then required to submit standards reports, outlining the works completed, their success and monitoring results. OEH review the reports and, if works have been completely satisfactorily, provide the next payment for the following years work. The OEH also include site visits as part of their auditing process.

Biobanking plot/transects were sampled within the biobank site and would form the baseline for monitoring of the condition of the biobank site. The BioBanking Agreement for this site would include detailed monitoring requirements which would use these plots as their focus. Further, once the Agreement has been signed by the landholder it becomes their responsibility to undertake all monitoring and the results of such would be assessed when the OEH BioBanking Trust provides management funds at the beginning of each year.

7.1.4 Compliance assurance

The BioBanking Scheme includes a range of provisions to ensure delivery of the conservation outcomes. The OEH have the authority to:

- Enforce the provisions of the conservation covenant placed over the land.
- Adjust rehabilitation and management actions program depending on how the site responds.
- Include contingency for things such as 'natural disasters which may impact on the success or otherwise of the program.
- Take legal actions against biobank site owners for non-compliance including, as a last resort, acquisition of the land.

7.1.5 Koala habitat management

The impacts on Koala habitat have been included in the credit calculations and the development will need to retire the appropriate number of species credits to adequately offset this impact. This will see 499 credits retired from the onsite biobank site, no further Koala species credits are required from an offsite biobank. The onsite biobank provides suitable Koala population habitat and includes existing records. Conservation of the onsite biobank via a BioBanking agreement and the rehabilitation and management of this area would be in accordance with a BioBanking MAP. This approach will ensure the sites values for the Koala are maintained, and likely improved, in perpetuity.

8. Biodiversity offset approach

8.1 Approach

This section presents the proposed approach to securing the necessary biodiversity offsets for the Project. Activities required include:

- An estimate of the quantum of biodiversity offsets required for the Project as calculated using the BioBanking methodology.
- A BioBanking assessment of the proposed onsite biobank.
- Calculating the residual offsetting requirements for the Project, comprising the number and type of biodiversity credits that would need to be secured offsite in addition to the onsite biobank to fully offset impacts of the Project.
- A summary of potential offset sites that have been identified to deliver the residual offsetting requirements for the Project.
- The process for delivery of biodiversity offsets, including the next steps following approval of this BioBanking Assessment and offset strategy.
- A summary of the mechanism that will be used to secure the offset sites.
- The proposed staged development consent process and relationship with the delivery of biodiversity offsets.
- Recommended actions and approval timeframes.
- A summary of the tasks involved to complete the process of securing the biodiversity offsets for the Project.

8.2 Quantum of biodiversity offsets

The BioBanking methodology was used to determine an appropriate number and type of biodiversity credits to offset development impacts.

Based on the biodiversity credit estimates provided above, the final development footprint is estimated to require the following:

- The retirement of approximately 924 ecosystem credits associated with the conservation and management of approximately 113.86 ha within the onsite biobank.
- The purchase and retirement of approximately 1,245 additional ecosystems credits associated with an offsite biobank.
- The retirement of approximately 482 Koala population species credits and approximately 342 Wallum Froglet species credits from the onsite biobank.
- The purchase and retirement of approximately 267 Wallum Froglet species credits associated with offsite biobank(s).

The above credit estimates are based on a combination of available and extrapolated data and final development/conservation footprint as described in Sections 2 and 4 of this Report.

8.3 Residual offsetting requirements

Based on the BioBanking assessment conducted to date approximately 1,245 ecosystem credits and 267 Wallum Froglet credits would need to be secured from offsite biobank/s to fully offset impacts of the Project.

The BioBanking methodology when applied using the OEH (2011a) interim guidelines dictates the required location and vegetation types that must be conserved off site to achieve the maintain or improve outcome. The results of the BioBanking assessment indicate the following biodiversity credits that are in deficit and these would be the focus of the offset site/s credits to be secured:

- Smooth-barked Apple - White Stringybark - Red Mahogany - *Melaleuca sieberi* shrubby open forest on lowlands of the lower North Coast
- Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin
- Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast
- Blackbutt - Tallowwood dry grassy open forest of the southern North Coast
- Wallum Froglet species credits.

The OEH (2011a) interim guidelines recognise the inherent difficulties in finding offset sites which include every vegetation type impacted by such a development. The guidelines allow the applicant to focus on the minimum number of credits required from habitats of similar ecological values. For those vegetation types where a shortfall remains, the OEH can request additional credits be 'retired' to compensate for any such shortfall. As a minimum it is likely that the offset sites from which credits are secured would contain vegetation within the same formation as that being impacted by the project and will include suitable habitat for the Wallum Froglet to alleviate the current species credit deficit and satisfy OEH and DPE requirements. Ecosystem credits required to satisfy the shortfall would be sourced from within the same IBRA subregion as the project or any surrounding IBRA subregions as dictated by the BioBanking Methodology. Should no such credits be available in this region the applicant would need to apply to the OEH to gain approval to source ecosystem credits from another IBRA subregion. The species required for the Wallum Froglet can be sourced from any suitable biobank site within NSW. The proposed credit trades are shown in Table 6-2.

8.4 Potential offset sites

The Agencies assessing the Project require certainty that the offset package could be delivered through a suitable offset site being available. The Project team has already investigated a number of potential offset sites, including:

- An established biobank site near Karuah in the Great Lakes LGA. The site is dominated by Spotted Gum-Ironbark and Tallowwood-Brushbox-Blue Gum vegetation types.
- An established biobank site near Karuah in the Port Stephens LGA. This site has a large variety of vegetation types ranging from Mangroves and saltmarsh through to Swamp Sclerophyll and Spotted Gum-Ironbark Forests.
- An established biobank site near Crescent Head, in the Macleay River catchment. The site is dominated by Paperbark, Swamp Mahogany Forest types and Blackbutt Needlebark Stringybark. The site also includes species credits for the Wallum Froglet.

- A site currently being established as a biobank site near Port Stephens in the Port Stephens LGA. This site has a large variety of vegetation types ranging from wetlands through to Swamp Sclerophyll Dry Sclerophyll Forests.
- Two sites currently being established at Limeburners Creek, immediately south of Allworth. These sites comprise a total area of approximately 140 ha and include a range of vegetation types, including forested wetlands, wet and dry sclerophyll forests.
- Durness Station, a 180 ha site some 700-metres to the north of the study area, containing coastal floodplain vegetation similar to the study area as well as habitat for the Endangered Koala Population of Hawks Nest and Tea Gardens, as well as suitable habitat for Wallum Froglets, threatened forest owls and migratory shore-birds (Bell, M. Great Lakes Council, pers. comm.)

Initial assessments indicate all of these sites could contribute to the biodiversity credit shortfall for the Project and make an effective contribution to the offset package. The applicant would begin negotiating potential credit purchases with relevant landowners while construction is occurring on stages 1 - 7. Credits would need to be purchased and retired before Stage 8 could commence (see Section 8.7, below).

8.5 Preferred approach to securing offsets

The preferred approach to securing the additional offsets is via the purchase of biodiversity credits from established biobank sites as outlined above. However, if suitable credits aren't available within the timeframes required, the following mechanisms would be considered in consultation with OEH:

- Purchasing a suitable property, establishing a biobank agreement over the site and retiring the necessary credits.
- Purchasing a suitable offset property and placing a Conservation Agreement on title and/or transfer to the National Parks estate.

8.6 Process for delivery of biodiversity offsets

The following additional activities will be undertaken after granting of a concept plan approval to finalise the BioBanking assessment of the Project:

- Completion of a detailed BioBanking Agreement assessment of the onsite biobank. This will include:
  - Preparation of BioBanking Assessment Report, including GIS mapping and final credit calculations in accordance with OEH requirements.
  - Preparation of Management Action Plan and Total Fund Deposit
  - Completion of a biobank agreement application form as well as any other associated documentation required to establish the onsite biobank. These activities would commence after approval is granted for the offsets package
- Completion of the credit transfer and retirement process for all the credits from the biobank required to offset the developments impacts and deposit of the Total Fund Deposit amount into the BioBanking trust fund.
- Commencement of negotiations with other biobank site owners to secure the remaining credits required to offset the entire projects impacts.
- Completion of credit purchases, transfers and retirement from offsite biobank sites before Stage 8 commences or within seven (7) years (whichever comes first) (see below).

8.7 Staged development consent

The Riverside project would seek approval for the biodiversity offsets to be delivered in a staged approach. It is anticipated that securing the onsite biobank and retiring all credits available would allow approval for construction of stages 1, 2, 3, 4, 5, 6 and 7 (in accordance with the Riverside Staging Plan, July 2015 – included as Appendix C), or approx. 35 hectares, of development to commence. The estimated credit value of the onsite biobank would be more than sufficient to offset this initial impact.

Based on the BioBanking assessment conducted to date the onsite biobank would contribute enough biodiversity credits to compensate for impacts associated with approximately 35 hectares of the development footprint. This estimate is based on ecosystem credits only. The onsite biobank would contribute around 924 ecosystem credits, which is around 43% the total credit requirement to offset the entire development impacts. Considering a significant portion of the area being developed in the first 8 stages is classified as 'low' condition, 924 credits would probably allow for over 35 ha of development in this location.

The remaining development would be approved for construction once the deficit biodiversity credits are secured and 'retired'.

This approach is recommended as it would:

- Ensure that onsite conservation lands and obligations are secured before the commencement of the project.
- Allows the initial stages of the development to commence quickly providing the project with immediate cash-flow which would assist funding the purchase of additional biodiversity credits from offsite biobank/s.
- Allows the initial stages of the project to commence while negotiations with prospective biobank site owners to purchase credits are completed.

Note: It is assumed that Great Lakes Council (GLC) would have the responsibility of ensuing Construction Certificate could not be approved after approximately 35 hectares of development as GLC would not approve subsequent development until the offsite biobank or credits are secured.

8.8 Recommended actions and approval timeframes

There are two separate programs required to secure the necessary offsets for the Riverside project, these being:

- Establish the onsite biobank site and retire all credits required by the project (this will enable stages 1 - 7 to commence.
- Secure and retire the additional credits required from offsite biobank site/s (this will enable the remainder of the develop to proceed)

8.8.1 Establish the onsite biobank

Entering into a BioBanking agreement places a conservation covenant over the land, regardless of zoning. The covenant is the strongest available on private lands and extinguishes all land uses other than conservation. The offsets package allows for works to commence immediately upon approval of this package. The applicant commits to the timeframe for activities indicated in Table 8-1 to ensure the onsite biobank is established and that the credits required for stages 1 – 7 are generated and retired in a timely manner.

Table 8-1 Program for obtaining a BioBanking agreement for the proposed offset site

Task description	Timing	Anticipated due date
Complete any remaining site surveys and BioBanking assessment	Within 3 months from approval of the Offsets Package	1 December 201
Complete draft Management Actions Plan and costing template	Within 6 months from approval of the Offsets Package	1 March 2016
BioBanking agreement signed	Within 12 months from approval of the Offset Package	1 September 2016
Implementation of Management Actions Plan	Commence immediately after BioBanking agreement signed	1 September 2016

Note: Assumes offsets package will be approved by 1 September 2015

8.8.2 Secure deficit credits

As described above, the remaining credits will be sourced from suitable biobank sites. These credits will be required before stages 8 - 16 of the subdivision can commence. This offsets package commits to the purchase and retiring of these credits within seven (7) years from approval of this offsets package. This timeframe has considered the likely timeframe for completion of stages 1 – 7 based on current estimates of sales.

9. Conclusions

9.1 BioBanking credit calculations

Impacts of a development on biodiversity values must be offset by the retirement of biodiversity credits at the biobank site(s) determined in accordance with the DECC (2009) offset rules and the OEH (2011) offsets policy.

The offset rules state that ecosystem credits that are retired from a biobank site are determined to be compatible with those required by impacts at the development site if conditions presented in the DECC (2009) methodology are met. Of these, the most critical is that 'the number of ecosystem credits obtained and retired from the biobank site is equal to or greater than the number of credits required at the development site'.

Based on the credit calculations completed to date the development would require a minimum 2,169 ecosystem credits, 482 Koala species credits and 609 Wallum Froglet species credits (see detailed breakdown in Table 9-1) to adequately offset the projects impacts.

The onsite biobank site would generate approximately 924 ecosystem credits, 520 Koala species credits and 342 Wallum Froglet species credits. These credits would be generated once the onsite biobank site is established and immediately retired to offset stages 1 – 7 of the project.

This would leave a credit deficit of 1,245 ecosystem credits and 267 Wallum Froglet credits. The project would be required to source these credits in accordance with the rules associated with the BioBanking Methodology and as per the breakdown in Table 9-1, below. There would be a credit surplus of 40 credits for the Koala.

Table 9-1 Biodiversity credits required to complete the projects total offsets

Vegetation types	PCT	Credit deficit	Vegetation formation required
Coastal freshwater lagoons of the Sydney Basin and South East Corner	HU533	0	N/A
Smooth-barked Apple - White Stringybark - Red Mahogany - *Melaleuca sieberi* shrubby open forest on lowlands of the lower North Coast	HU832	516	Dry Sclerophyll Forest (shrubby)
Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin	HU633	150 (1)	Forested Wetland
Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast	HU509	481 (2)	Dry Sclerophyll Forest (shrubby)
Blackbutt - Tallowwood dry grassy open forest of the southern North Coast	HU511	98	Wet Sclerophyll Forest (grassy)
	Total	**1,245**	
Wallum Froglet		271 (3)	Any suitable habitat within a biobank site

Notes:

(1) Total credits outstanding for HU633 determined after subtracting all surplus credits from vegetation types within the biobank considered to be within the Forested Wetland or Wetland formation.

(2) Total credits outstanding for HU509 determined after subtracting surplus credits from HU806 from the biobank site as this vegetation type was in the same formation (i.e. Dry Sclerophyll Forest (shrubby)).

(3) Wallum Froglet species credits can be sourced from any biobank site in NSW

All ecosystem credits would need to be sourced from within the same IBRA subregion (Karuah Mannning) or any adjoining subregion.

The final development/conservation footprint would lead to the following biodiversity outcomes:

- Conservation of the most valuable habitat in the study area both in terms of the condition of vegetation and context (the onsite biobank maximises the conservation of east-west and north-south fauna movement corridors and estuarine and floodplain habitats adjoining the Karuah River).
- The onsite biobank would include all but one of the vegetation types being impacted within the development footprint. This ensures that ecological resources removed by the development would be conserved on site in some capacity.
- The onsite biobank would generate a credit surplus for six of the vegetation types in the study area.
- The most substantial offset deficit is with respect to Smooth-barked Apple - White Stringybark - Red Mahogany - *Melaleuca sieberi* shrubby open forest on lowlands of the lower North Coast. The majority of the affected vegetation is in low or moderate condition and has been degraded by tree removal and grazing. Securing an offsite biobank with other vegetation types in better condition may be considered a good outcome to compensate for this loss despite the compromise in 'like for like' matching of offsets with the vegetation to be removed. Such variation to the biodiversity credit trading rules is permitted under the OEH (2011a) interim policy.
- The final development footprint achieves a 'net positive credit balance' for the Koala.
- The final development/conservation footprint provides:
  - an 'east-west corridor' of a minimum 200 m wide ensuring suitable connection of the conservation lands in the east of the development to areas of high conservation values to the north and west.
  - a continuous, minimum 410 m wide corridor along the Myall River in the east of the study area.
- The development will provide resources to invest in the rehabilitation and management of the proposed onsite biobank via the Total Fund Deposit, thereby improving its condition and biodiversity values. The biobank will also be conserved in perpetuity under a BioBanking agreement and managed for its biodiversity values accordingly.

The onsite biobank would contribute a suitable 'like for like' contribution to the biodiversity offsets for the Project since it will achieve conservation outcomes within an area greater in size than the development and within the same overall patch of native vegetation and habitat. Local populations of native species, including threatened biota that will be affected by the Project will directly benefit from the regeneration of degraded lands throughout the onsite biobank. Further, the most valuable wetland and estuarine habitats within the study area would be conserved via the conservation of a strip over 400 metres wide adjoining the Myall River.

The onsite biobank would contribute to the quantum of biodiversity offsets required for the Project and have attributes that makes it highly suitable as an offset site, including:

- Landscape context – the site is continuous with a patch of native vegetation and habitat resources of many thousands of hectares that is connected to Myall Lakes National Park.
- The onsite biobank includes the majority of vegetation in good condition.
- Potential for improvement – the site contains degraded vegetation that would regenerate well as the biobank has excellent natural resilience, localised weed infestations would be treated and habitat for threatened fauna that would benefit from the management of exotic predators.
- Conservation significance – the site:
  - Includes intact native vegetation comprising over cleared vegetation types.
  - Contains local populations of threatened fauna, including suitable habitat for the Koala.
  - Contains important habitat associated with wetlands and saltmarsh, drainage lines, foraging resources and hollow-bearing trees that are likely to also support a number of other threatened species.

The BioBanking methodology has been varied with reference to the OEH (2011a) interim policy for assessment of biodiversity offsets for Part 3A Projects. This framework specifies the assessment process and decision-making criteria for using BioBanking to assist a Part 3A Project to achieve an '*improve or maintain'*, '*no net loss'* or '*mitigated net loss'* outcome. The project will achieve a '*no net loss'* or '*mitigated net loss'* outcome depending on the type of credits secured from offsite biobank/s.

The Riverside project seeks final approval for the biodiversity offsets to be delivered in a staged approach. It is anticipated that securing the onsite conservation lands would allow approval of stages 1 – 7 (in accordance with the Riverside Staging Plan, July 2015) of development to commence. This estimate has considered the portion of the development areas identified as being in 'low' condition.

9.2 Alignment with DECC offsetting principles

The OEH and DPI consider the merits of biodiversity offsets strategies against the DECC (2008) Principles for the use of biodiversity offsets in NSW. Table 9-2 summarises the alignment of the BioBanking assessment approach to the offsets package with the DECC (2008) offsetting principles.

Table 9-2 Comparison of the offsets package with the DECC (2008) offsetting principals

DECC (2008) Principles for the use of biodiversity offsets in NSW	Attributes of BioBanking Assessment and offset strategy
Impacts must be avoided first by using prevention and mitigation measures.	The approach to avoidance and mitigation of impacts is presented in ERM (2012) and GHD (2013) and Section 2 of this offsets package. There are unavoidable impacts on native vegetation as a result of the need for a viable development footprint and conservation areas.
All regulatory requirements must be met.	An Environmental Assessment (ERM, 2012) incorporating an ecological impact assessment (Cumberland Ecology, 2011) and an BioBanking Assessment (GHD 2013) was prepared for the Project in accordance with regulatory requirements and appropriate guidelines and approved on 27 June 2013.

DECC (2008) Principles for the use of biodiversity offsets in NSW	Attributes of BioBanking Assessment and offset strategy
Offsets must never reward ongoing poor performance.	The proposed offset sites have not been deliberately degraded or mismanaged. The onsite biobank is un-developed open space containing predominantly intact native vegetation. There has been some vegetation clearing and minor environmental degradation of the site through routine agricultural and recreational activities.
Offsets will complement other government programs.	The BioBanking assessment has been prepared using the BioBanking methodology and accordingly complements OEH and the NSW Governments' approach to biodiversity conservation. It complements other government programs and biodiversity conservation initiatives, in general, by contributing to regional habitat connectivity, managing weed and pest species and conservation of over cleared vegetation types and threatened species habitat.
Offsets must be underpinned by sound ecological principles.	The preparation of the BioBanking assessments associated with this offsets package, including identification of the onsite biobank, was underpinned by the DECC (2009) BioBanking methodology and OEH (2011a) offsets policy.
Offsets should aim to result in a net improvement in biodiversity over time.	The proposed Offset Package would result in a net improvement in biodiversity values over time because it has been developed using the BioBanking methodology and associated management actions for biobank sites. Specifically improvements would result through assisted natural regeneration, revegetation and management of weed and pest species.
Offsets must be enduring - they must offset the impact of the development for the period that the impact occurs.	The BioBanking assessment provides the framework for conservation of the offset sites under BioBanking agreements, which will ensure conservation in perpetuity.
Offsets should be agreed prior to the impact occurring.	The BioBanking assessment has been prepared in consultation with OEH and DPE and prior to vegetation clearing for construction of the Project.
Offsets must be quantifiable - the impacts and benefits must be reliably estimated.	Impacts and benefits were quantified using the BioBanking methodology.
Offsets must be targeted.	The onsite biobank site was targeted to achieve like for like conservation of vegetation types to be removed where possible; conservation of relevant threatened species habitat; conservation of remnant vegetation in the regional locality of the development site; and viable patches of habitat with good connectivity to other habitat in the locality. Securing the offsite biodiversity credits would be in accordance with the BioBanking trading rules associated with this project which would also lead to offsets being targeted.

DECC (2008) Principles for the use of biodiversity offsets in NSW	Attributes of BioBanking Assessment and offset strategy
Offsets must be located appropriately.	The onsite biobank is in the same IBRA bioregion and IBRA sub region as the development area. The onsite biobank site has a very similar suite of vegetation types as the development site, including matching vegetation types. It would support a very similar suite of native flora and fauna, including threatened biota. It is part of a relatively large, viable patch of habitat with good connectivity to other habitat in the locality, including frontage to the Myall River and associated wetland, saltmarsh and estuarine habitats. Securing the outstanding biodiversity credits from offsite biobank/s would be in accordance with the rules associated with the BioBanking Methodology and as described in Section 6.
Offsets must be supplementary.	Conservation of the eastern portion of the onsite biobank site is currently achieved by land use zoning but biodiversity values are not actively managed for improvement. Such management would occur in perpetuity under the BioBanking agreement. Conservation of the western portion of the biobank site is not currently achieved by land use zoning, a Covenant or by any other restriction on title. Management of the onsite biobank is not funded by any other scheme. The management actions that would be planned and funded under a BioBanking agreement for the site would be supplementary to the current situation.
Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or a contract.	Conservation and management of the on-site and offsite offset sites would be enforced through BioBanking agreements.

10. References

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Office of Environment (OEH) (2011c) *List of BioBanking assessors* http://www.environment.nsw.gov.au/BioBanking/Assessorlist.htm

11. Disclaimer

11.1 Scope and limitations

This report: has been prepared by GHD for SGD 1 Pty Ltd and may only be used and relied on by SGD 1 Pty Ltd for the purpose agreed between GHD and the SGD 1 Pty Ltd as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than SGD 1 Pty Ltd 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 (refer section(s) 1.4. of 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 SGD 1 Pty Ltd 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.

11.2 Assumptions

This assessment has been completed in accordance with the assumptions described in Section 2.3.6 and 5.3 of this report.

Appendices

Appendix A – Original development BioBanking credit reports – Version 2

BioBanking Credit Calculator

BioBanking credit report

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

Date of report: 6/02/2013 Time: 3:40:08PM Tool version: 2.0

Biobank details

Proposal ID:	0073/2012/0256B
Proposal name:	Tea Gardens Biobank
Proposal address:	Myall Way Tea Gardens NSW 2324
Proponent name:	Crighton Properties
Proponent address:	tbc tbc NSW
Proponent phone:	(02) 4352 4352
Assessor name:	Ben Harrington
Assessor address:	Level 15 133 Castlereagh St SYDNEY NSW 2000
Assessor phone:	9239 7189
Assessor accreditation:	0073

Additional information required for approval:

- ☐ Use of local benchmark
- ☐ Expert report
- ☐ Change threatened species response to gain (Tg value)

Ecosystem credits summary

Vegetation type	Area (ha)	Credits required	Red flag
Coastal freshwater lagoons of the Sydney Basin and South East Corner	16.21	158	No
Coastal freshwater lagoons of the Sydney Basin and South East Corner	2.33	24	No
Melaleuca sieberi - Tall Saw-sedge closed shrubland in drainage lines on the Central Coast, Sydney Basin	0.13	1	No
Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin	12.09	87	No
Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin	11.22	96	No
Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin	0.90	9	No
Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast	3.67	27	No
Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast	14.34	137	No
Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast	7.48	62	No
Blackbutt - Tallowwood dry grassy open forest of the southern North Coast	5.78	35	No
Blackbutt - Tallowwood dry grassy open forest of the southern North Coast	1.56	16	No
Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin	9.18	56	No
Mangrove forest in estuaries of the Sydney Basin and South East Corner	0.23	1	No
Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner	1.18	6	No
Paperbark swamp forest of the coastal lowlands of the North Coast and Sydney Basin	1.33	11	No
Saltmarsh in estuaries of the Sydney Basin and South East Corner	19.72	121	No
Total	107.35	847	

Credit profiles

1. Blackbutt - Tallowwood dry grassy open forest of the southern North Coast, (HU511)

Number of ecosystem credits required	51
CMA sub-region	Karuah Manning
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

2. Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin, (HU631)

Number of ecosystem credits required	56
CMA sub-region	Karuah Manning
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

3. Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast, (HU509)

Number of ecosystem credits required	62
CMA sub-region	Karuah Manning
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	

4. Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast, (HU509)

Number of ecosystem credits required	164
CMA sub-region	Karuah Manning
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

5. Coastal freshwater lagoons of the Sydney Basin and South East Corner, (HU533)

Number of ecosystem credits required	182
CMA sub-region	Karuah Manning
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

6. Melaleuca sieberi - Tall Saw-sedge closed shrubland in drainage lines on the Central Coast, Sydney Basin, (HU566)

Number of ecosystem credits required	1
CMA sub-region	Karuah Manning
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

7. Paperbark swamp forest of the coastal lowlands of the North Coast and Sydney Basin, (HU591)

Number of ecosystem credits required	11
CMA sub-region	Karuah Manning
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

8. Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin, (HU633)

Number of ecosystem credits required	9
CMA sub-region	Karuah Manning
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	

9. Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin, (HU633)

Number of ecosystem credits required	183
CMA sub-region	Karuah Manning
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

10. Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner, (HU635)

Number of ecosystem credits required	6
CMA sub-region	Karuah Manning
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

11. Mangrove forest in estuaries of the Sydney Basin and South East Corner, (HU563)

Number of ecosystem credits required	1
CMA sub-region	Karuah Manning
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

12. Saltmarsh in estuaries of the Sydney Basin and South East Corner, (HU606)

Number of ecosystem credits required	121
CMA sub-region	Karuah Manning
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Species credits

Common name	Scientific name	Extent of impact	Number of species credits required
Wallum Froglet	Crinia tinnula	44.21	265
Koala population, Hawks Nest and Tea Gardens	Phascolarctos cinereus - endangered population Hawks Nest and Tea Gardens	63.03	378

Additional management actions

Additional management actions are required for:

Vegetation type or threatened species	Management action details
Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast	Cat and/or Fox control
Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast	Exclude miscellaneous feral species
Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast	Feral and/or native herbivore control/ exclusion (eg rabbit, goats, deer etc)
Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast	Maintain or reintroduce flow regimes (aquatic flora)
Blackbutt - Tallowwood dry grassy open forest of the southern North Coast	Cat and/or Fox control
Blackbutt - Tallowwood dry grassy open forest of the southern North Coast	Exclude miscellaneous feral species
Blackbutt - Tallowwood dry grassy open forest of the southern North Coast	Feral and/or native herbivore control/ exclusion (eg rabbit, goats, deer etc)
Blackbutt - Tallowwood dry grassy open forest of the southern North Coast	Maintain or reintroduce flow regimes (aquatic flora)
Coastal freshwater lagoons of the Sydney Basin and South East Corner	Cat and/or Fox control
Coastal freshwater lagoons of the Sydney Basin and South East Corner	Control feral pigs
Coastal freshwater lagoons of the Sydney Basin and South East Corner	Feral and/or native herbivore control/ exclusion (eg rabbit, goats, deer etc)
Coastal freshwater lagoons of the Sydney Basin and South East Corner	Maintain or reintroduce flow regimes (aquatic flora)
Mangrove forest in estuaries of the Sydney Basin and South East Corner	Cat and/or Fox control
Mangrove forest in estuaries of the Sydney Basin and South East Corner	Feral and/or native herbivore control/ exclusion (eg rabbit, goats, deer etc)
Mangrove forest in estuaries of the Sydney Basin and South East Corner	Maintain or reintroduce flow regimes (aquatic flora)
Melaleuca sieberi - Tall Saw-sedge closed shrubland in drainage lines on the Central Coast, Sydney Basin	Cat and/or Fox control

Melaleuca sieberi - Tall Saw-sedge closed shrubland in drainage lines on the Central Coast, Sydney Basin	Exclude miscellaneous feral species
Melaleuca sieberi - Tall Saw-sedge closed shrubland in drainage lines on the Central Coast, Sydney Basin	Feral and/or native herbivore control/ exclusion (eg rabbit, goats, deer etc)
Melaleuca sieberi - Tall Saw-sedge closed shrubland in drainage lines on the Central Coast, Sydney Basin	Maintain or reintroduce flow regimes (aquatic flora)
Paperbark swamp forest of the coastal lowlands of the North Coast and Sydney Basin	Cat and/or Fox control
Paperbark swamp forest of the coastal lowlands of the North Coast and Sydney Basin	Exclude miscellaneous feral species
Paperbark swamp forest of the coastal lowlands of the North Coast and Sydney Basin	Feral and/or native herbivore control/ exclusion (eg rabbit, goats, deer etc)
Paperbark swamp forest of the coastal lowlands of the North Coast and Sydney Basin	Maintain or reintroduce flow regimes (aquatic flora)
Saltmarsh in estuaries of the Sydney Basin and South East Corner	Cat and/or Fox control
Saltmarsh in estuaries of the Sydney Basin and South East Corner	Feral and/or native herbivore control/ exclusion (eg rabbit, goats, deer etc)
Saltmarsh in estuaries of the Sydney Basin and South East Corner	Maintain or reintroduce flow regimes (aquatic flora)
Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin	Cat and/or Fox control
Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin	Exclude miscellaneous feral species
Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin	Feral and/or native herbivore control/ exclusion (eg rabbit, goats, deer etc)
Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin	Maintain or reintroduce flow regimes (aquatic flora)
Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin	Cat and/or Fox control
Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin	Exclude miscellaneous feral species
Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin	Feral and/or native herbivore control/ exclusion (eg rabbit, goats, deer etc)
Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin	Maintain or reintroduce flow regimes (aquatic flora)
Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner	Cat and/or Fox control
Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner	Exclude miscellaneous feral species
Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner	Feral and/or native herbivore control/ exclusion (eg rabbit, goats, deer etc)
Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner	Maintain or reintroduce flow regimes (aquatic flora)

Appendix B – Onsite biobank Credit Report – Version 4

BioBanking credit report

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

Date of report: 27/10/2015 Time: 2:55:33PM Calculator version: v4.0

Biobank details

Proposal ID: 0120/2015/1818B

Proposal name: Riverside Tea Gardens Biobank

Proposal address: Myall Road Tea Gardens NSW 2324

Proponent name: SGD 1 Pty Ltd

Proponent address:

Proponent phone: 0299397566

Assessor name: Arien Quin

Assessor address: Level 3, 24 Honeysuckle Drive NEWCASTLE NSW 2300

Assessor phone: 0405 443 341

Assessor accreditation: 0120

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 - Smooth-barked Apple shrubby open forest on coastal sands of the southern NSW North Coast Bioregion	28.45	254.00
Blackbutt - Tallowwood dry grassy open forest of the southern NSW North Coast Bioregion	7.96	59.00
Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	18.56	155.00
Mangrove forest in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	0.31	1.00
Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	1.33	8.00
Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	20.09	195.00
Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	8.83	55.00
Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion	27.13	187.00
Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion	1.20	10.00
Total	113.86	924

Credit profiles

1. Blackbutt - Tallowwood dry grassy open forest of the southern NSW North Coast Bioregion, (HU511)

Number of ecosystem credits created	59
IBRA sub-region	Karuah Manning

2. Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter, (HU806)

Number of ecosystem credits created	55
IBRA sub-region	Karuah Manning

3. Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern NSW North Coast Bioregion, (HU509)

Number of ecosystem credits created	231
IBRA sub-region	Karuah Manning

4. Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern NSW North Coast Bioregion, (HU509)

Number of ecosystem credits created	23
IBRA sub-region	Karuah Manning

5. Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion, (HU533)

Number of ecosystem credits created	155
IBRA sub-region	Karuah Manning

6. Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion, (HU591)

Number of ecosystem credits created	8
IBRA sub-region	Karuah Manning

7. Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion, (HU633)

Number of ecosystem credits created	187
IBRA sub-region	Karuah Manning

8. Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion, (HU635)

Number of ecosystem credits created	10
IBRA sub-region	Karuah Manning

9. Mangrove forest in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion, (HU563)

Number of ecosystem credits created	1
IBRA sub-region	Karuah Manning

10. Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion, (HU606)

Number of ecosystem credits created	195
IBRA sub-region	Karuah Manning

Species credits summary

Common name	Scientific name	Extent of impact Ha or individuals	Number of species credits created
Koala population, Hawks Nest and Tea Gardens	Phascolarctos cinereus - endangered population Hawks Nest and Tea Gardens	73.20	520
Wallum Froglet	Crinia tinnula	48.10	342

Additional management actions

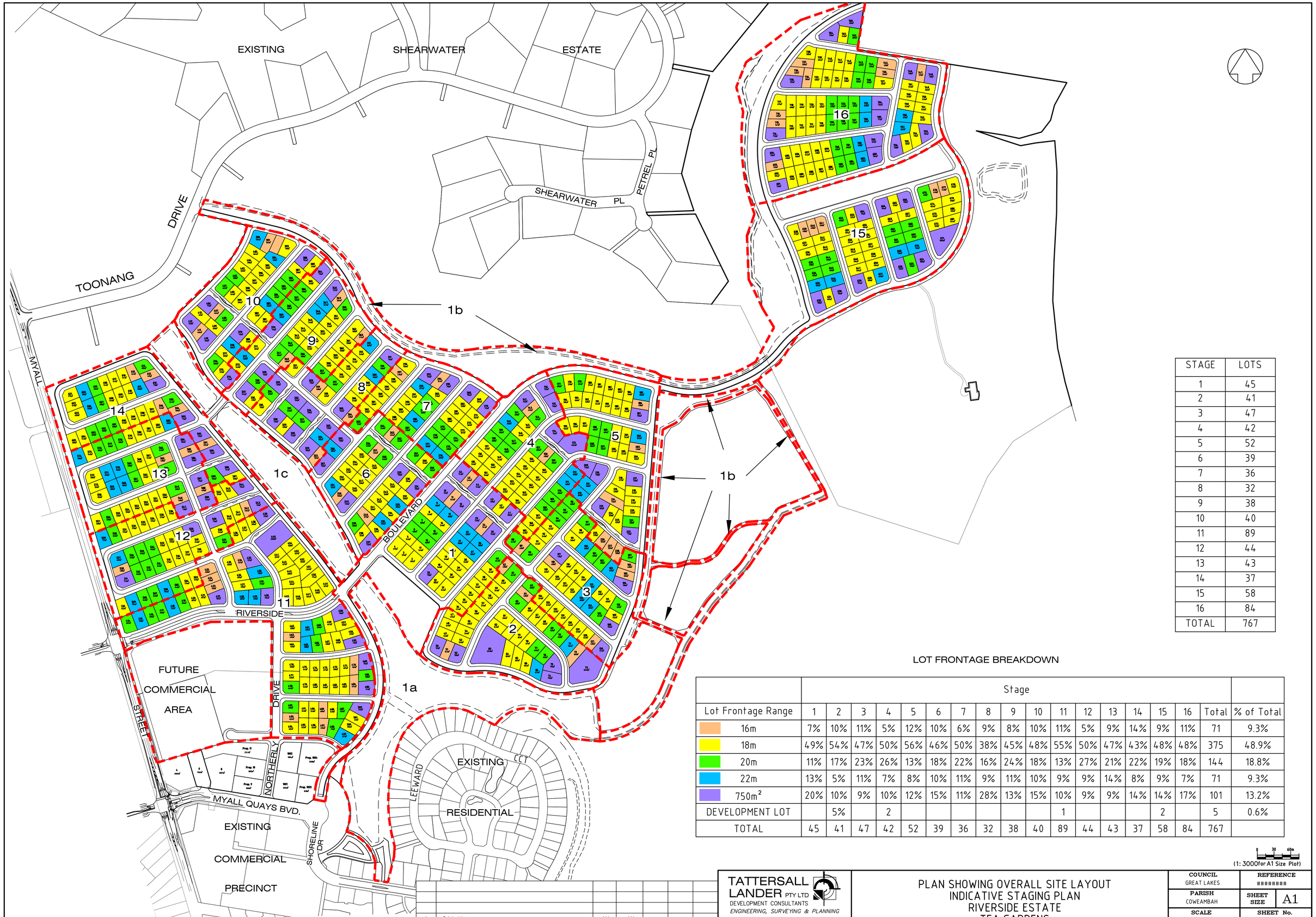
Additional management actions are required for:

Vegetation type or threatened species	Management action details
Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern NSW North Coast Bioregion	Exclude commercial apiaries
Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern NSW North Coast Bioregion	Exclude miscellaneous feral species
Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern NSW North Coast Bioregion	Feral and/or over-abundant native herbivore control
Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern NSW North Coast Bioregion	Fox control
Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern NSW North Coast Bioregion	Slashing
Blackbutt - Tallowwood dry grassy open forest of the southern NSW North Coast Bioregion	Exclude commercial apiaries
Blackbutt - Tallowwood dry grassy open forest of the southern NSW North Coast Bioregion	Exclude miscellaneous feral species
Blackbutt - Tallowwood dry grassy open forest of the southern NSW North Coast Bioregion	Feral and/or over-abundant native herbivore control
Blackbutt - Tallowwood dry grassy open forest of the southern NSW North Coast Bioregion	Fox control
Blackbutt - Tallowwood dry grassy open forest of the southern NSW North Coast Bioregion	Slashing
Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	Control exotic pest fish species (within dams)
Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	Control of feral pigs
Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	Exclude miscellaneous feral species
Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	Feral and/or over-abundant native herbivore control
Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	Fox control
Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	Maintain or re-introduce natural flow regimes

Koala population, Hawks Nest and Tea Gardens	Exclude miscellaneous feral species
Koala population, Hawks Nest and Tea Gardens	Slashing
Mangrove forest in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Control exotic pest fish species (within dams)
Mangrove forest in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Control of feral pigs
Mangrove forest in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Exclude miscellaneous feral species
Mangrove forest in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Feral and/or over-abundant native herbivore control
Mangrove forest in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Fox control
Mangrove forest in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Maintain or re-introduce natural flow regimes
Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	Control of feral pigs
Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	Exclude commercial apiaries
Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	Exclude miscellaneous feral species
Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	Feral and/or over-abundant native herbivore control
Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	Fox control
Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	Maintain or re-introduce natural flow regimes
Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	Slashing
Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Control exotic pest fish species (within dams)
Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Control of feral pigs
Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Exclude miscellaneous feral species
Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Feral and/or over-abundant native herbivore control
Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Fox control
Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Maintain or re-introduce natural flow regimes
Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	Exclude commercial apiaries
Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	Exclude miscellaneous feral species

Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	Feral and/or over-abundant native herbivore control
Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	Fox control
Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	Slashing
Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion	Exclude commercial apiaries
Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion	Exclude miscellaneous feral species
Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion	Feral and/or over-abundant native herbivore control
Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion	Fox control
Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion	Slashing
Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion	Exclude commercial apiaries
Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion	Exclude miscellaneous feral species
Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion	Feral and/or over-abundant native herbivore control
Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion	Fox control
Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion	Slashing
Wallum Froglet	Control exotic pest fish species (within dams)
Wallum Froglet	Maintain or re-introduce natural flow regimes
Wallum Froglet	Slashing

Appendix C – Riverside staging plan



STAGE	LOTS
1	45
2	41
3	47
4	42
5	52
6	39
7	36
8	32
9	38
10	40
11	89
12	44
13	43
14	37
15	58
16	84
TOTAL	767

LOT FRONTAGE BREAKDOWN

	Stage																	
Lot Frontage Range	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total	% of Total
16m	7%	10%	11%	5%	12%	10%	6%	9%	8%	10%	11%	5%	9%	14%	9%	11%	71	9.3%
18m	49%	54%	47%	50%	56%	46%	50%	38%	45%	48%	55%	50%	47%	43%	48%	48%	375	48.9%
20m	11%	17%	23%	26%	13%	18%	22%	16%	24%	18%	13%	27%	21%	22%	19%	18%	144	18.8%
22m	13%	5%	11%	7%	8%	10%	11%	9%	11%	10%	9%	9%	14%	8%	9%	7%	71	9.3%
750m^2	20%	10%	9%	10%	12%	15%	11%	28%	13%	15%	10%	9%	9%	14%	14%	17%	101	13.2%
DEVELOPMENT LOT		5%		2							1				2		5	0.6%
TOTAL	45	41	47	42	52	39	36	32	38	40	89	44	43	37	58	84	767	

0 30 60m
(1: 3000for A1 Size Plot)

REV	DETAILS OF AMENDMENT	DESIGNED	DRAWN	CHECKED	APPROVED	DATE
A	Original Issue	AV	AV			

* Denote the original signature and date when revision was issued.

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PLAN SHOWING OVERALL SITE LAYOUT INDICATIVE STAGING PLAN RIVERSIDE ESTATE TEA GARDENS

COUNCIL: GREAT LAKES	REFERENCE: ########
PARISH: COWEAMBAH	SHEET SIZE: A1
SCALE: 1:3000 on A1	SHEET No.: 1
DATE : Plotted 17:34 30/07/15	

CLIENT: SHEARGOLD GROUP | JOB No.: 213366 | COMPUTER FILE : S:\projects\Riverside\dwg\Riverside Layout Plan.dwg

Xref: Shearwater Boundaries xref [Shearwater Boundaries xref.dwg] Xref: port4scon [port4scon.dwg] Xref: Riverside [Riverside.dwg] Xref: Commercial Site [Commercial Site.dwg] Xref: Future Industrial [Future Industrial.dwg] Xref: Myall Quays Bdys [Myall Quays Bdys.dwg] Xref: Shearwater Bdys [Shearwater Bdys.dwg] Xref: Myall River Downs Bdys [Myall River Downs Bdys.dwg]

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		Name	Signature	Name	Signature	Date
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