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Crichton Properties Pty Ltd

Riverside at Tea Gardens
BioBanking Assessment

February 2013



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Executive Summary

GHD was commissioned by Crighton Properties Pty Ltd (the Proponent) to conduct an assessment using the NSW Biodiversity Banking and Offsets Scheme (BioBanking) for the proposed Riverside residential development at Tea Gardens, New South Wales (the Project). Environmental Resources Management Australia Pty Ltd (ERM) has been 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). This assessment has been prepared by GHD to assist with planning the layout of the development, to assess the biodiversity impacts and to estimate the quantum of biodiversity offsets that may be required to compensate for impacts arising from the development.

Crighton Properties is seeking concept approval for a residential development, an open space network, a tourist/recreational precinct and associated water management, access, landscaping and infrastructure works (ERM, 2011).

The Project will result in impacts on native biota. An ecological impact assessment of a similar (though larger) development proposal on the same site had been previously prepared and had identified and quantified the impacts on native biodiversity along with proposed measures to avoid and mitigate these impacts (Cumberland Ecology, Feb 2011). The outcome of that assessment indicated that the Project would result in residual impacts of up to 94 ha of native vegetation, including habitat for threatened species (Cumberland Ecology, Feb 2011).

Since that report was prepared the project has been amended significantly to reduce the biodiversity impacts on the site. GHD assessed the biodiversity impacts and offsets required in detail using the BioBanking methodology. The final development footprint has been modified through a staged approach comparing the BioBanking assessment results of multiple site layout options, including consideration of a development footprint recommended by the Planning Assessment Commission (PAC). The assessments and results which support the final, preferred development footprint for the Project are the subject of this report.

The Project team have engaged with representatives of the Office of Environment and Heritage (OEH) since the original PAC determination to agree on a suitable development footprint and biodiversity offsets. These consultations have led to significant changes to the original development, the approach to biodiversity offsets and the long term management of biodiversity offsets. Similarly, the Project has also considered impacts to Matters of National Environmental Significance (MNES) in accordance with the Environmental Protection and Biodiversity Conservation (EPBC) Act 1999. A referral is currently being prepared for submission to the Department of Sustainability Environment Water Populations and Community (DSEWPac) in accordance with this Act. Consultation has already commenced with relevant officers from DSEWPac regarding the project and modifications to the development footprint have been made to accommodate requests from DSEWPac. This consultation has led to general support from both OEH and DSEWPac as shown in Appendix C.

Biodiversity offsets are required to compensate for residual impacts on EECs, threatened species and their habitats and clearing of native vegetation. The BioBanking methodology 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; the OEH (2011a) interim policy provides a framework for determining biodiversity offsets for Part 3A Projects using a modified form of the BioBanking methodology.

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. This process has been applied to multiple development scenarios for the Project to optimise the balance between development and conservation footprints within the study area. Two development scenarios are presented in this Report:

- ▶ The PAC footprint based on the results of site observations from relevant approval authorities
- ▶ The final development footprint, developed with specific reference to the supplementary GHD site survey data, detailed mapping and consultation with Agencies to minimise impacts on native biodiversity.

The remainder of the study area outside of each of the development footprint options would be retained as conservation lands and set aside as a biobank.

The outcome of this assessment is presented in Table 1. For the development footprint options considered the results of this assessment indicate there is a biodiversity credit deficit i.e. additional offset sites would be required.

Table 1 Comparison between the Development Footprint Options Credits Required and Biobank Credits Contribution

Name	Final development footprint	PAC development footprint	Original development footprint
Development area (ha)	101.77	73.66	114.64
Ecosystem credits required	2882	2151	3281
Biobank area (ha)	107.35	119.18	66.86
Ecosystem credits generated –	847	949	611
Ecosystem Credit Balance	-2035	-1202	-2670
Estimated off site biobank requirement (ha) 1	258	152	338
Estimated Size Range off site biobank requirement (ha)	192-260	114-154	252-342
Koala population species credits	-269	145	-734
Wallum Froglet species credits	-405	-224	-572



The above credit estimates are based on a combination of available and extrapolated data and indicative site layouts. The final development footprint has achieved a reduction in the credit deficit of 635 ecosystem credits compared to the original development footprint but would still need to secure biodiversity offsets off site to gain approval.

This BioBanking assessment has been able to demonstrate that economies in the number of biodiversity credits required can be obtained by concentrating development in areas supporting vegetation of poorer condition.

The final development footprint is considered the most appropriate layout for the study area based on the following criteria:

- ▶ Achieving economies in the number of biodiversity credits required by concentrating development in poorer condition vegetation as demonstrated by:
 - An overall ratio of 28.3 credits per hectare for the final development footprint, versus
 - An overall ratio of 29.2 credits per hectare for the PAC development footprint
 - A development footprint that is 38% larger than the PAC development footprint but which results in only a 34% increase in the number of ecosystem credits required
- ▶ It maintains a vegetated corridor through the east of the study area containing the most valuable estuarine and floodplain habitats and with a minimum width of 410 m
- ▶ It maintains the east-west vegetated corridor through the north of the study area with a minimum width of 200 m
- ▶ It includes approximately 10.2 ha of disturbed, cleared land with very little biodiversity value. This area meets the BioBanking definition of cleared land and does not require biodiversity offsets
- ▶ The onsite biobank contains the majority of vegetation types being impacted within the final development footprint. This ensures most of the types of ecological resources available are generally protected on site in some capacity
- ▶ The onsite biobank would generate a credit surplus for five of the vegetation types in the study area, including a credit surplus for three of the four over cleared vegetation types present in the study area.

The onsite biobank would contribute a suitable 'like for like' contribution to the BioBanking assessment since it will achieve conservation outcomes within an area approximately equal in size to the development area 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 land in the study area. Further, the most valuable wetland and estuarine habitats within the study area would be conserved via the conservation of a riparian corridor adjoining the Myall River.

The BioBanking calculations presented in this report would be used to support a BioBanking agreement for the onsite biobank. The development will provide resources to invest in the rehabilitation and management of the onsite biobank, thereby improving its condition and biodiversity values. These lands would be conserved in perpetuity under a BioBanking agreement or alternative conservation mechanism as agreed with OEH and DPI. Additional offset contributions



would be required which are most likely to consist of biodiversity credits from an additional off site biobank (or similar). Crighton Properties would purchase and retire biodiversity credits generated at the biobank site or oversee its protection via another agreed conservation mechanism.

The BioBanking assessment has shown that the final development site layout is the most appropriate balance between development and conservation outcomes for the study area. The PAC footprint does not necessarily conserve the highest conservation values on site and would also require significant biodiversity offsets. The final development footprint has been designed using detailed site assessment and data collected in accordance with the BioBanking methodology whereas the suggested PAC boundary was determined without the benefit of such information.

Whilst the need for offsite offsets is higher than the PAC footprint, it is substantially less than the original development footprint. Additionally, the proposed footprint has an increased development yield when compared to the PAC but the required offsite offsets are not proportional to the increase in yield, due to development being focused in areas of lower biodiversity values. This may be viewed as a more efficient use of the site given suitable offsets are available.

Crighton anticipates preparing an appropriate biodiversity offsets package as a Condition of Consent. The preparation of this package would include consultation with OEH and DPI to ensure it meets the project's requirements. It is recommended that the offsets package be prepared to allow a staged development commencement. This BioBanking assessment estimates the development of Stages 1-8 based on establishment of the on-site biobank. The subsequent stages can be developed after retirement of further biodiversity credits from a suitable biobank site.



1. Introduction

1.1 Overview

GHD was commissioned by Crighton Properties Pty Ltd (the Proponent) to conduct an assessment using the NSW Biodiversity Banking and Offsets Scheme (BioBanking) for the proposed Riverside residential development at Tea Gardens, New South Wales (the Project). Environmental Resources Management Australia Pty Ltd (ERM) has been 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). This BioBanking assessment has been prepared by GHD to assist with planning the layout of the development, to estimate the quantum of biodiversity offsets that may be required to compensate for impacts arising from the development and to provide a biodiversity offset strategy.

Crighton Properties is seeking concept approval for the following (ERM, 2011):

- ▶ Residential development, including approximately 880 dwellings in addition to 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 provides 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 location for the Concept Plan is referred to in this document as the 'study area' and is shown on Figure 1.

The Project will result in impacts on native biota. The ecological impact assessment for an earlier and larger proposal for the site had been previously prepared and had identified and quantified the impacts on native biodiversity along with proposed measures to avoid and mitigate these impacts (Cumberland Ecology, Feb 2011). The outcome of that assessment was that the Project would result in residual impacts within a 114 ha development footprint including removal of up to 94 ha of native vegetation of varying condition (Cumberland Ecology, Feb 2011).

Since that application was prepared and assessed by the PAC the project has been amended significantly to reduce the biodiversity impacts on the site. GHD has since assessed the biodiversity impacts and offsets required in detail using the BioBanking methodology and further refined the final development footprint for the Concept Plan. The assessments and results which support the final development footprint are the subject of this report.

Biodiversity offsets are required to compensate for residual impacts on EECs, 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 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 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. This process has been applied to multiple development scenarios for the Project to optimise the balance between development and conservation footprints within the study area. Two development scenarios are presented in this BioBanking assessment as shown on Figures 2a and 2b:

- ▶ A development footprint recommended by the Planning Assessment Commission (PAC) based on the results of site observations from relevant approval authorities
- ▶ The final development footprint, developed with specific reference to the supplementary GHD site survey data, detailed mapping and consultation with Agencies to minimise impacts on native biodiversity.

The remainder of the study area outside of each of the development footprint options would be retained as conservation lands and set aside as a biobank as a biodiversity offset for the Project.

The PAC development footprint and final development footprint have also been compared with the results of a previous BioBanking assessment conducted on the original development.

The BioBanking calculations presented in this report could also be used to support a BioBanking agreement or other approved conservation mechanism. The BioBanking Trust Fund (or alternative conservation mechanism) would fund the management of both the onsite and offsite conservation lands in perpetuity and ensure that the site is conserved and actively managed to achieve long term gains in biodiversity values.

1.2 Objectives

The overall objectives of this assessment are to:

- ▶ Describe the ecological impacts of the Project as a guide to the scale and type of biodiversity offsets that will be required
- ▶ Calculate the quantum of biodiversity offsets required for the development footprint scenarios using a modified methodology agreed with the OEH. To express the quantum of offsets in biodiversity credits required for:
 - The PAC development footprint
 - The final development footprint
- ▶ Estimate the biodiversity credits that would be generated if the remainder of the study area, outside of each of the two development footprint options, was conserved and set aside as a biobank



- ▶ Provide a justification for the final development footprint for the Project, in comparison with the PAC development footprint, based on an optimum balance between development and conservation lands
- ▶ Provide a biodiversity offset strategy (offset strategy) for the Project, including:
 - Description of the security and implementation of the offsets for the Project using BioBanking
 - Summary of the monitoring and reporting obligations for the biobank site/s using BioBanking.

1.3 Relationship with Existing Reports

This BioBanking assessment has been prepared giving consideration to information contained in the following:

- ▶ Environmental Resources Management (ERM) (2011) *Riverside at Tea Gardens Concept Plan Application Environmental Assessment Report*
- ▶ Cumberland Ecology (2010) *BioBanking Assessment Report*
- ▶ Cumberland Ecology (Feb 2011) *Riverside Tea Gardens Ecological Assessment Report*
- ▶ Cumberland Ecology (Dec 2011) *Biodiversity Assessment Report*
- ▶ Conacher Environmental (2011) *Ecological Site Management Strategy*
- ▶ Conacher Environmental (2011) *Bushfire Threat Assessment*
- ▶ Conacher Environmental (2011) *Koala Management Strategy*

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 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 subsequently went 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 portion 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
- ▶ Reducing the extent of the proposed tourism development in the north-eastern corner of the site adding further lands for conservation and increasing the extent of the corridor adjacent to the Myall River
- ▶ Removing the previously proposed basin from the far north-eastern corner of the site and increasing the area of conservation. This vegetation will be connected to a riparian corridor to the north as proposed in the Great Lakes City Council comprehensive Local Environment Plan (LEP) template.

1.4.2 Mitigation Measures

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

- ▶ Location of Asset Protection Zones (APZ) between the built form and areas of native vegetation to the west of the site. The APZ's will provide a management buffer between these land uses
- ▶ Minimising clearing within the APZ to maintain existing vegetation (as far as possible)
- ▶ Maintaining native vegetation within the APZ's 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 APZ's, 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 endemic species
- ▶ Commitment to reduce impacts on native vegetation and habitat resources within the tourist precinct and other 'sensitive development' areas, including through:
 - Retention of hollow-bearing trees
 - Development footprint to be no more than 30% of site coverage
 - All pavements to be permeable
- ▶ Commitment to prepare a habitat tree management plan for the subject site 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.

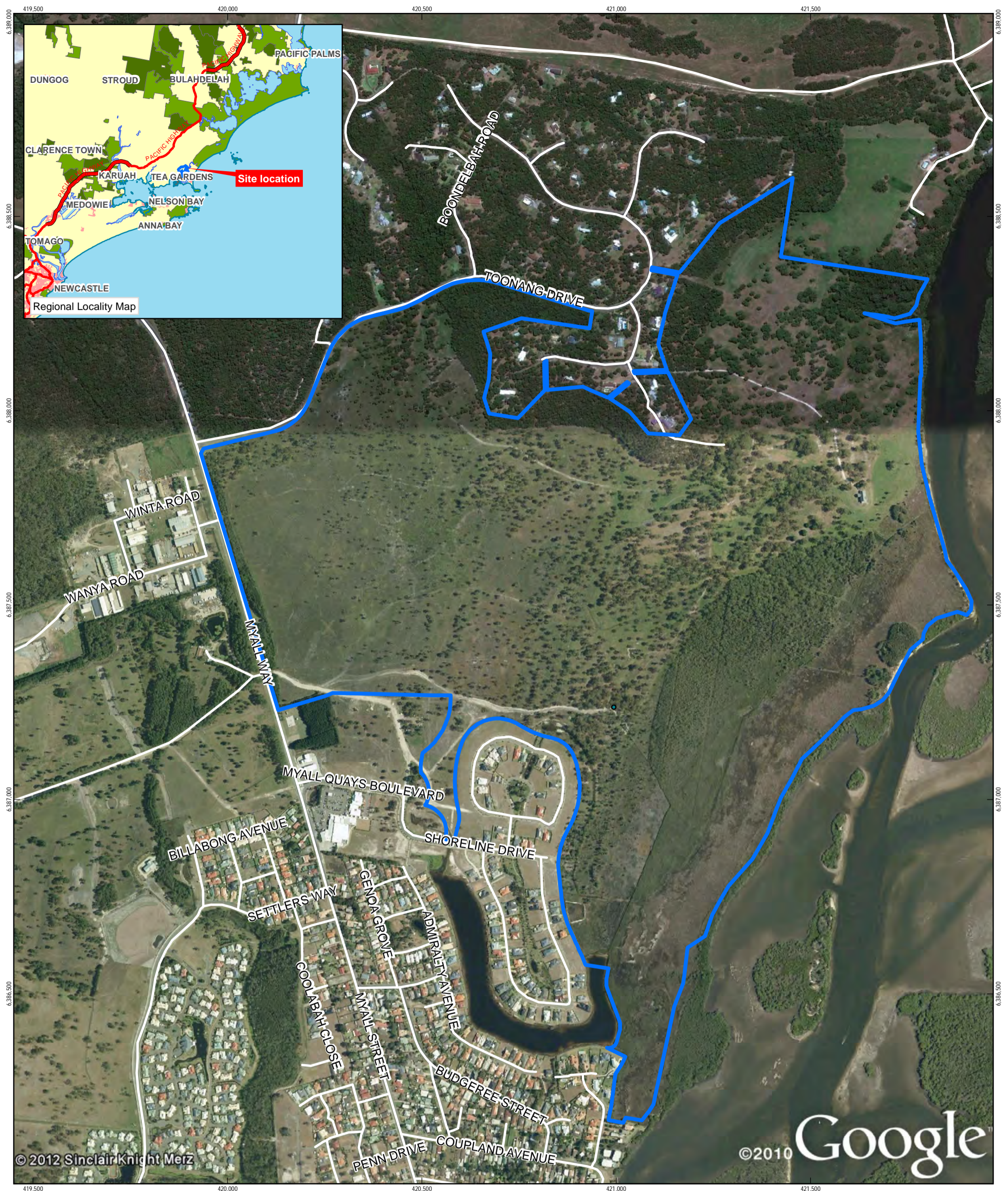
1.5 Site Context

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

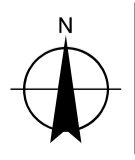
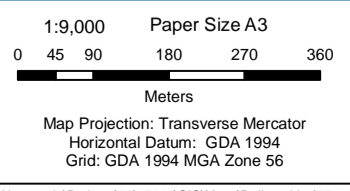
The study area is in the Great Lakes Local Government Area (LGA). It is situated to the north of existing development within Tea Gardens and is bound to the west by Myall Road, to the north by Toonang Drive and the Shearwater Residential Estate, and to the east by the Myall River. The study area has 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 two development footprint options and potential biobank areas for the Project are shown on Figure 2a and 2b. The development footprints have 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 of each of the two development footprint options, based on concept designs. 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 of each of the two development footprint options, 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. There are additional areas of 'sensitive development', such as within the tourist precinct, that would be developed with a set of requirements that are designed to maintain vegetation and habitat resources. Based on the initial concept design impacts within these areas would be reduced but not sufficiently to be included in the open space management zone for the purpose of BioBanking credit calculations. 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).



LEGEND
 Study Area



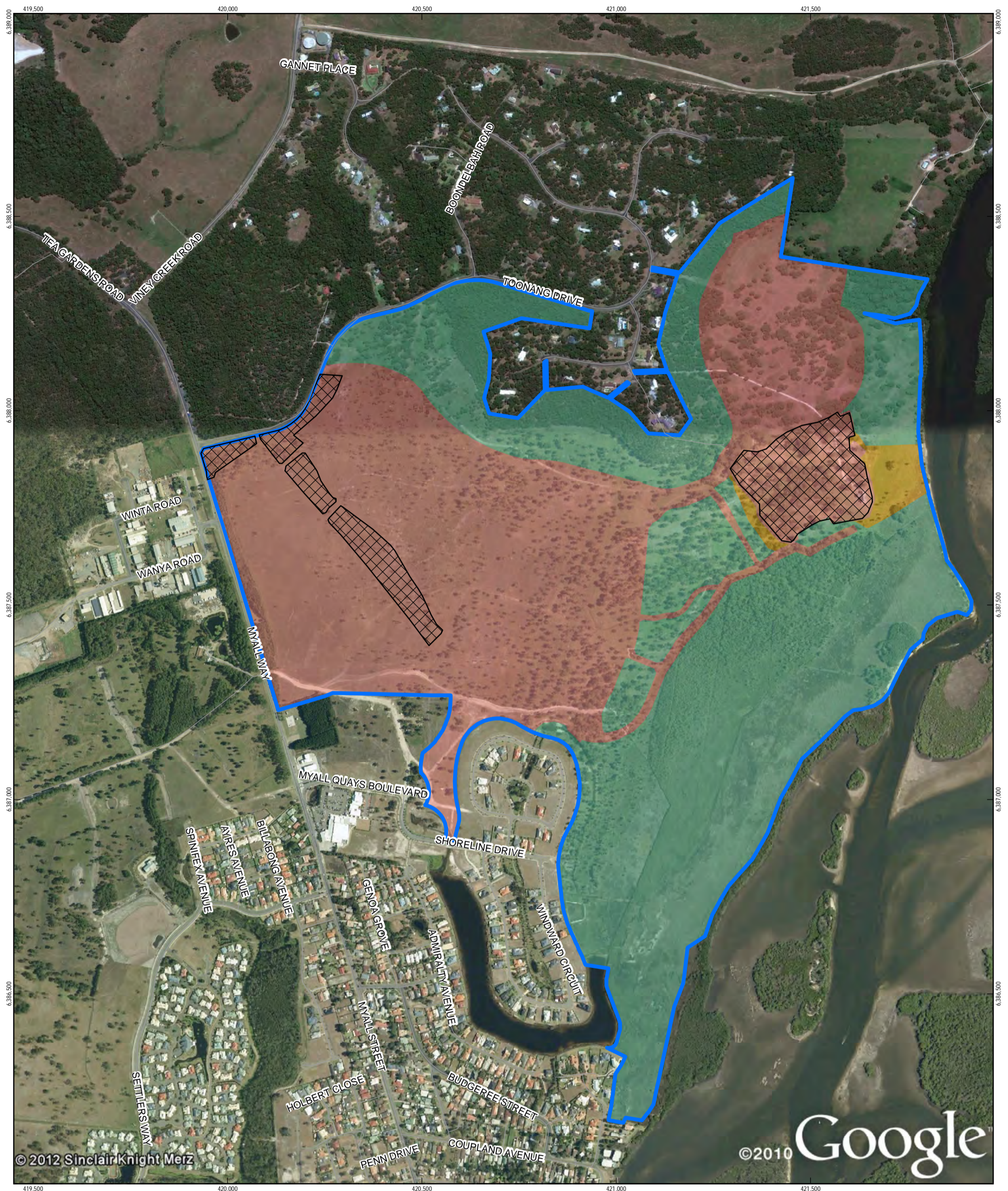
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 Riverside at Tea Gardens - BioBanking Assessment

Job Number	22-15960
Revision	0
Date	08 Feb 2013

Study Area Location

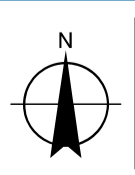
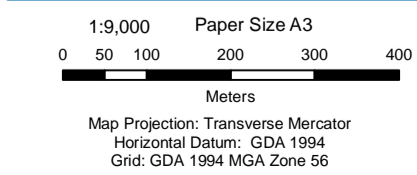
Figure 1



LEGEND

- Roads
- ▨ Sensitive Development*
- ▭ Study Area
- Biobank Site
- Development (complete vegetation removal)
- Open Space (partial vegetation removal)

* Detailed design would ensure that some vegetation and habitat resources would be retained however these areas were entered as development (complete vegetation removal) for BBAM calculations.

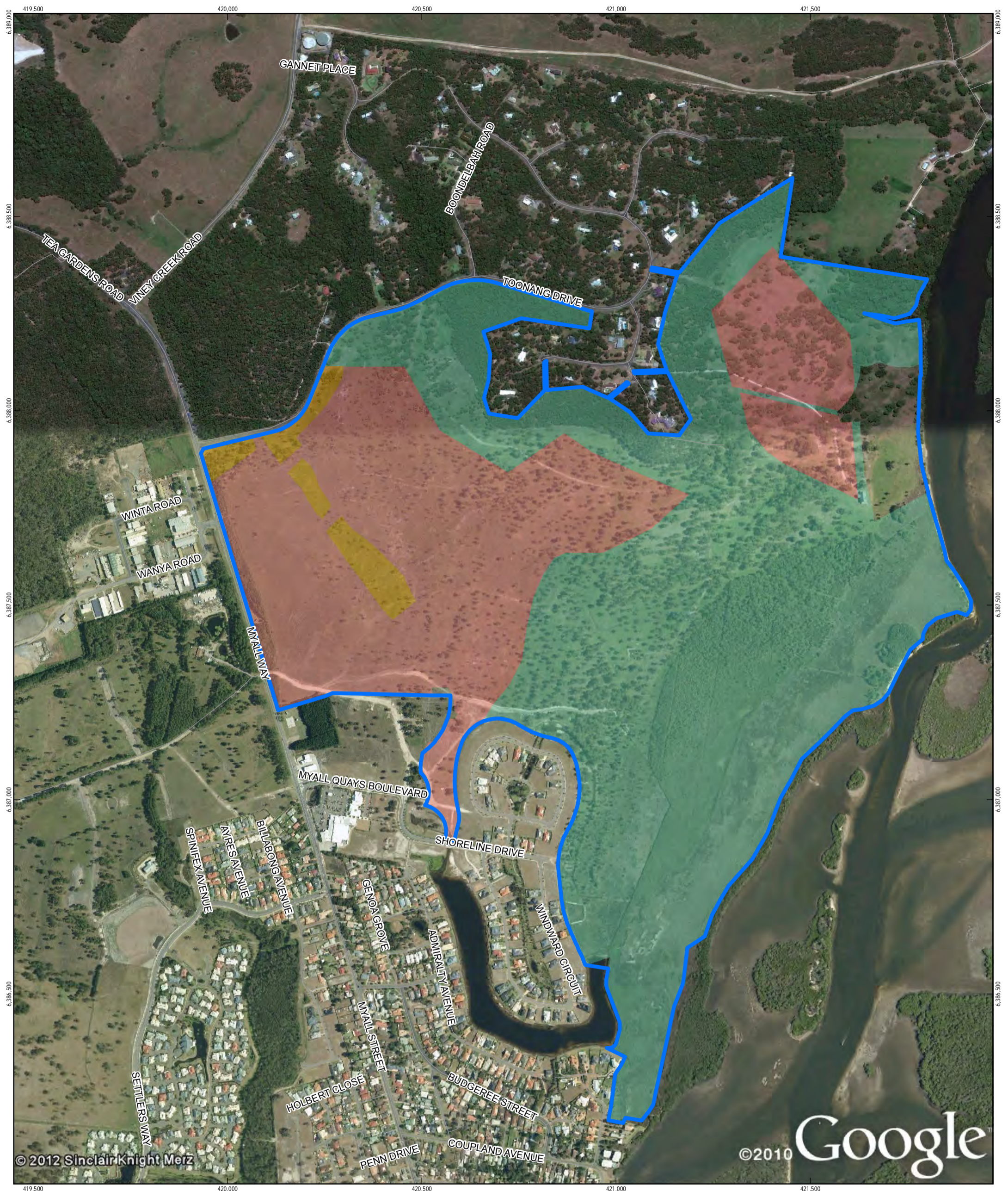


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Job Number	22-15960
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Final Development Site Layout

Figure 2a



LEGEND

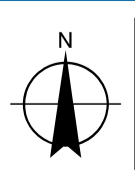
- Study Area
- PAC Boundary Biobank Site
- PAC Boundary Development (complete vegetation removal)
- PAC Boundary Open Space (partial vegetation removal)

1:9,000 Paper Size A3

0 45 90 180 270 360

Meters

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



Crighton Properties Pty. Ltd.
Riverside at Tea Gardens - BioBanking Assessment

Job Number	22-15960
Revision	B
Date	24 Sep 2012

PAC Development Site Layout

Figure 2b



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 DECC (2009) BioBanking methodology 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.



1.7 Glossary of Terms

1.7.1 Project Definitions

Study Area	The site for the Project; the parcel of land containing the various component areas of the Project.
Development footprint	<p>The area of direct disturbance for construction of the Project. Three development footprint options are considered in this assessment:</p> <ul style="list-style-type: none">▶ The original development footprint that was assessed by Cumberland Ecology (2011)▶ The Planning Assessment Commission (PAC) footprint, based on amendment to the original design intended to minimise impacts on native biodiversity▶ The final development footprint developed with specific reference to site survey data and detailed mapping to minimise impacts on native biodiversity.
Development management zone	The area of impact that was entered was entered into the BioBanking credit calculator to determine the biodiversity credits that would be required to offset impacts of the hard stand portions of the development footprint. Comprises the mapped area of native vegetation within the hard stand area of each of the two development footprint options, based on concept designs. It is assumed that all vegetation and habitat resources within this area would be removed for the Project. There are areas of 'sensitive development', such as within the tourist precinct, that would be developed with a set of requirements that are designed to maintain vegetation and habitat resources. Impacts within these areas would be reduced but not sufficiently to be included in the open space management zone for the purpose of BioBanking credit calculations.
Open space management zone	The area of impact that was entered was entered into the BioBanking credit calculator to determine the biodiversity credits that would be required to offset impacts of the open space portions of the development footprint. Comprises the mapped area of native vegetation within the open space areas of each of the two development footprint options, 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.



Biobank management zone

The remainder of the study area outside the development footprints that would be set aside for conservation to offset biodiversity impacts arising from the Project. All land within this area was entered into the BioBanking credit calculator to determine the biodiversity credits that would be generated if this area was set aside as a biobank. This area of land will be included in a BioBanking Agreement or other conservation mechanism supported by OEH and DPI.

1.7.2 BioBanking Definitions

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)	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 Credit Calculator (the calculator)	The software component of the BioBanking Assessment Methodology that calculates the credits created or credits required.
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	Means the BioBanking 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 offsets	Actions 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.
Compulsory development	Development that in the opinion of the Minister of Planning is “of State or regional environmental planning significance”. Section 127ZM (7) of the <i>TSC Amendment (Biodiversity BioBanking Act 2006, No 125)</i> specifies that these projects have priorities and the Minister of Planning is not required to concur to the issue of the BioBanking statement if the project is of importance to the State. When the project has a state or regional environmental planning significance it satisfies the condition to be declared as a part 3A project.



BioBanking Credit Calculator (the credit calculator)	The credit calculator is the software component of the methodology. It is a database that contains threatened species, habitat and vegetation data. The credit calculator determines the number of ecosystem credits and species credits required at a development site and the number of ecosystem credits and species credits created at a biobank site. It does this on the basis of the existing biodiversity data, equations, information collected at the site and GIS calculations according to the assessment process outlined in the methodology.
Development site	Land that is designated by a BioBanking Statement to be a development site.
The calculator	See BioBanking Credit Calculator.
The development footprint	The portion of the subject site that is proposed for development
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).
Management action	An action or proposed action in respect of which a biodiversity credit may be created.
Red flag areas	A red flag area is an area of particular conservation significance, of significant scale to be viable over the medium to long term. <i>Note: The red flag provisions do not apply to Major Project assessments.</i>
Species credit	A credit that relates to an individual threatened species that cannot be reliably predicted based on habitat surrogates. Threatened species that require species credits are identified in the Threatened Species Profile Database.



2. Methodology

2.1 Previous Assessments

Cumberland Ecology (Feb 2011) prepared a notional BioBanking assessment which informed modifications to the development footprint and 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 Assessment

GHD subsequently completed a range of exercises using the BioBanking methodology to assist in determining the 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 and the amended development footprint to obtain a more accurate credit calculation than the notional assessment previously completed by Cumberland Ecology for this footprint. The Cumberland Ecology assessment was mainly based on predicted data. The methodology adopted and the conclusions reached were supported by OEH.

Subsequently, GHD completed the following activities:

- ▶ Collected additional plot/transect data throughout the study area in accordance with the BioBanking methodology
- ▶ Reviewed the vegetation types mapping prepared by Cumberland Ecology and adjusted accordingly to plot/transect data and further survey and mapping of vegetation type boundaries
- ▶ Completed landscape assessment and updated vegetation type maps in GIS for both the original and amended development footprints
- ▶ Completed BioBanking credit calculations for the original and amended developments and associated biobanks
- ▶ Prepared 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 need estimates of BioBanking results for the PAC boundary before consideration of additional development outside this boundary could be made. GHD therefore completed the following:

- ▶ Mapped the PAC development footprint using GIS
- ▶ Completed BioBanking credit calculations for the PAC development and associated biobank
- ▶ Prepared a biodiversity offset comparison between PAC development and biobank credit profiles



- ▶ 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
- ▶ Completed BioBanking credit calculations for the modified development and associated biobank
- ▶ Prepared a biodiversity offset comparison between the modified development and biobank credit profiles
- ▶ Compared the credit profiles of the various study area layout options
- ▶ Presented the results to Crighton Properties, OEH and DPI and modified the development footprint further 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:

- ▶ Completing the final adjustment to the proposed development footprint in GIS
- ▶ Completed BioBanking credit calculations and biodiversity offsets comparison for the proposed development and associated biobank
- ▶ Compared the credit profiles of the various study area layout options.

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

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 submitted in Stage 3. In early 2012 the Project was referred to the Commonwealth Department of Environment, Sustainability, Water, Populations and Communities (DSEWPAC) and DSEWPAC 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 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 this final BioBanking assessment report, including comparison of the final development footprint with the PAC development footprint.

2.3 Stakeholder Consultation

GHD completed consultation with key stakeholders throughout all stages of the assessment. A summary of this consultation is outlined below:

- ▶ Meetings with Crighton Properties on 28 September, 2, 15, 22 and 28 of November 2011 and 26 April 2012
- ▶ Meeting with OEH 18 October
- ▶ Meetings with OEH and DPI 15 and 23 November 2011
- ▶ Phone Conference with OEH including site visit to agree on modifications to species polygons on 18 June 2012
- ▶ Meeting with Crighton Properties, DPI, OEH, DSEWPAC and Great Lakes Council, including a site visit, on 4 July 2012.

A Referral is being prepared to assist DSEWPAC to assess impacts of the project on Matters of national Environmental Significance (MNES) listed under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Consultation has commenced with the DSEWPAC assessing officers and they have provided in principal support for the BioBanking assessment as a suitable approach to optimise the development site layout, assess impacts and determine the quantum of biodiversity offsets required.

2.4 Vegetation Assessment

Cumberland Ecology (Feb 2011) vegetation mapping was reviewed by GHD through additional site survey. Vegetation types and extent were re-evaluated, described and matched to OEH (2011b) NSW Vegetation Types and broad condition classes. 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 over two days involving the collection of 19 BioBanking plot/transects. Aerial photography analysis was used to broadly map vegetation condition prior to survey. The site was stratified with reference to this the desktop vegetation condition mapping, Cumberland Ecology (2011) vegetation mapping and the proposed split between development and biobank. Additional plots were completed in vegetation types mapped by Cumberland Ecology (2011) 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 HCCREMS (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.

2.5 BioBanking Assessment

2.5.1 Approach

Biodiversity credits were estimated with reference to the methodology presented in the DECC (2009) *BioBanking Assessment Methodology and Credit Calculator Operational Manual*. 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 are 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.



2.5.2 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 across 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.

2.5.3 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 and described below.

Table 2 GHD Survey Effort

Date	Survey Effort	Survey Methods
10 th , 11 th and 13 th 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.

Plot /transect surveys were conducted on site in accordance with the DECC (2009) 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



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.

2.5.4 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 an east west direction extending from vegetation flanking the Myall River to vegetation north of Toonang Drive and west of Miles Street. The width of this primary link is over 500 m and is characterised by:

- ▶ A tree canopy with <25% of the lower benchmark condition; and
- ▶ A groundcover with <25% 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.

Because this is a preliminary BioBanking assessment some zones across the study area did not include the required number of plot/transects specified in the methodology. In these instances, available plot data was duplicated. This would make a minor difference to the credit calculations. Once a final development footprint and biobank site layout has been determined additional plot/transect data would be collected to finalise the assessment.

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 asset protection zones where only partial vegetation removal may be required. For the purposes of this assessment the development was stratified into two management zones:

- ▶ 'Development' including proposed housing, roads and other hard stand portions of the development footprint. It is assumed that the entire development zone will be cleared and so the default decrease in site value was entered into the credit calculator. Site scores were adjusted to reflect the complete removal of vegetation and habitat within the development management zone
- ▶ 'Open space' including proposed drainage corridors, parkland and other portions of the development footprint where some native vegetation would be retained. The site value score was reduced according to the DECC (2009) rules for impacts within the Inner Protection Area of an Asset Protection Zone

There are additional areas of 'sensitive development', such as within the tourist precinct, that would be developed with a set of requirements that are designed to maintain vegetation and habitat resources. Based on the initial concept design impacts within these areas would be reduced, but not sufficiently to be included in the open space management zone for the purpose of BioBanking credit calculations.

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 BioBanking assessment.

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.

2.5.5 Assumptions and Amendments to the Methodology

The assumptions made for the purposes of this BioBanking assessment 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, Feb 2011), 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, Feb 2011), it is assumed that no additional assessment of red flag areas is 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
- ▶ The condition of the vegetation for each vegetation zone was assigned based on a combination of plot/transects data (where available) and notional site attribute data
- ▶ At least one plot/transect was collected for most Cumberland Ecology (2011) defined vegetation types identified to describe condition. Two vegetation types were not sampled directly with plot/transects: Blackbutt - Tallowood dry grassy open forest of the southern North Coast and Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin. Plot/transect data for these vegetation types was entered as benchmark values
- ▶ In some cases, less than the required number of plot/transects were sampled and so available plot data was duplicated within each vegetation zone
- ▶ The same set of each vegetation zones were used for each comparative assessment to ensure consistent distribution of plot/transect data and to save assessment time, since this approach allowed plot/transect data to be imported into the credit calculator from assessments that had already been completed. Because of this approach the rules governing the minimum size of threatened species sub zones were varied; specifically, subzones with an area of less than 0.25 ha were entered instead of being included in adjoining subzones. On one occasion the area of a threatened species sub zone was actually zero (Melaleuca sieberi – Tall saw-sedge closed shrubland in moderate condition in the Original Development Footprint - west biobank as shown in Appendix A). The area of this sub zone was entered as '0.01 ha' which yielded zero biodiversity credits. Therefore this approach did not affect the credit estimates presented in this report.
- ▶ 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



- ▶ Treatment of open space areas within the development footprint as separate management zones with reduced development impacts. Open space was mapped with reference to the concept plans for the various site layouts as shown on Figures 2a and 2b. The site value score was reduced according to the DECC (2009) rules for impacts within the Inner Protection Area of an Asset Protection Zone
- ▶ No additional increase in site value score with management was applied to any management zones in any biobank calculations
- ▶ Species polygons were 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.
- ▶ The Stephens Banded Snake (*Hoplocephalus stephensii*) was the predicted threatened species with the lowest Tg score at the development site. The Stephens Banded Snake was entered as 'not present at the site' because the study area does not contain any suitable rainforest or wet sclerophyll forest habitats. The Powerful Owl (*Ninox strenua*) was the predicted threatened species with the next lowest Tg scores at the development site. Based on previous records in or near the study area and consultation with OEH, there is habitat for this species on site and so it has been included in the credit calculations
- ▶ 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 Steve Lewer from OEH and have received in principal support.

2.6 Staff Qualifications

This BioBanking Assessment, including all BioBanking credit calculations, was prepared by Ben Harrington. The assessment was peer reviewed by Daniel Williams. Staff qualifications are presented in Table 3.

Table 3 GHD Ecology Personnel and Qualifications

Name	Position / Project Role	Qualifications	Relevant Experience
Ben Harrington	Senior Ecologist / report compilation, stage 3 and 4 BioBanking assessments	BSc, MSc (Physical Geography) BioBanking Assessor Accreditation*	7+ years
Daniel Williams	Principal Environmental Consultant / Peer review, consultation and planning	B. App. Sc. BioBanking Assessor Accreditation*	13+ years



Name	Position / Project Role	Qualifications	Relevant Experience
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).

The study area is characterised by various native vegetation types with differing condition status ranging from cleared land, 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 (Feb 2011) vegetation mapping was ground-truthed during the GHD site survey and matched to OEH (2011b) NSW Vegetation Types and BioBanking condition classes. Vegetation types within the study area are mapped on Figure 3. .

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 surface when compared to soils of 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 comprising tree 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; and
- ▶ Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin

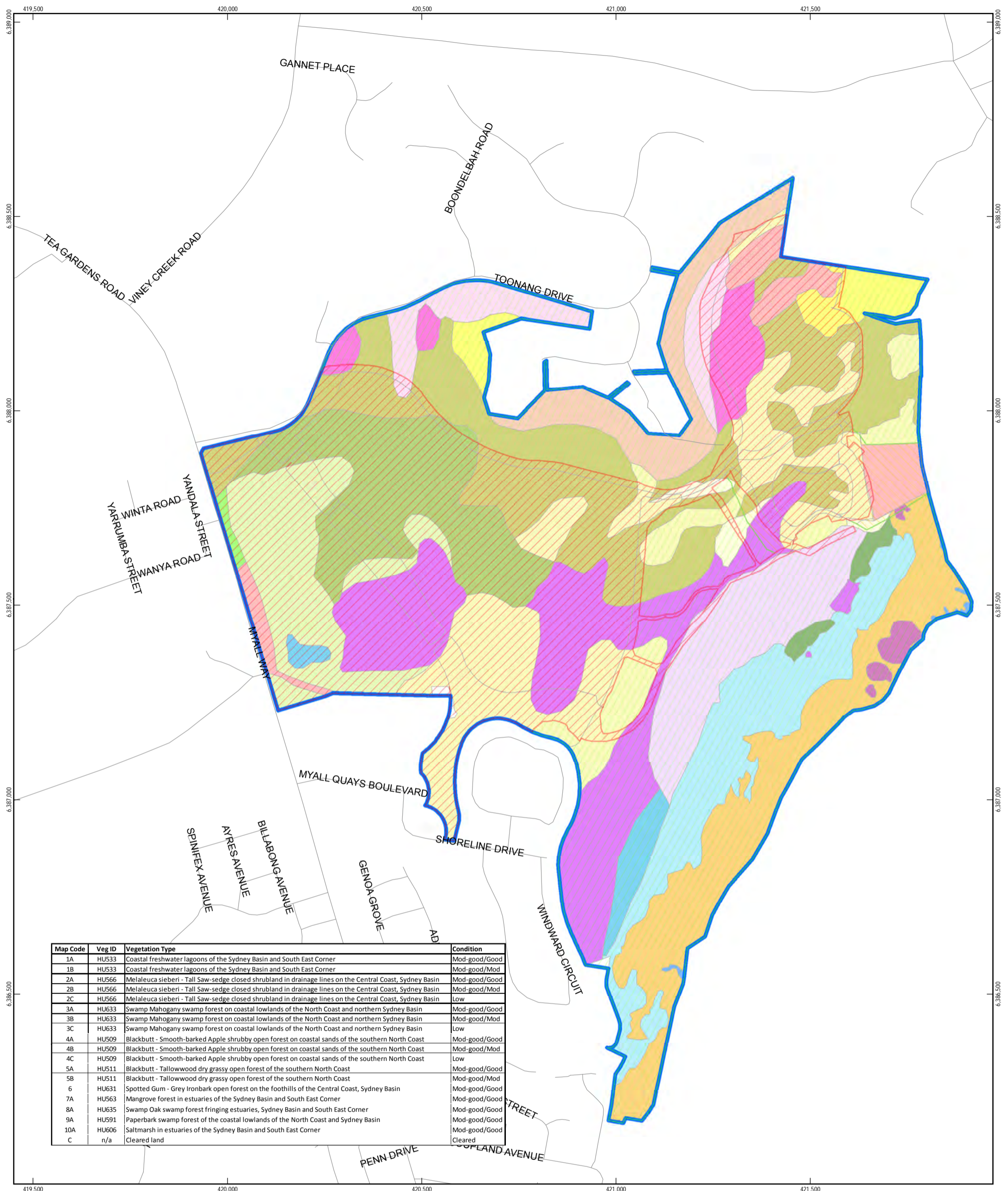
This area also included complex ecotone characteristics between these vegetation types (e.g. ecotone width, vegetation structure and floristic composition). These observations are consistent with the gradual change in determinant environmental resources (i.e. water availability and soil conditions) from 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 with some of these occurring near to excavated drainage channels.



Map Code	Veg ID	Vegetation Type	Condition
1A	HU533	Coastal freshwater lagoons of the Sydney Basin and South East Corner	Mod-good/Good
1B	HU533	Coastal freshwater lagoons of the Sydney Basin and South East Corner	Mod-good/Mod
2A	HU566	Melaleuca sieberi - Tall Saw-sedge closed shrubland in drainage lines on the Central Coast, Sydney Basin	Mod-good/Good
2B	HU566	Melaleuca sieberi - Tall Saw-sedge closed shrubland in drainage lines on the Central Coast, Sydney Basin	Mod-good/Mod
2C	HU566	Melaleuca sieberi - Tall Saw-sedge closed shrubland in drainage lines on the Central Coast, Sydney Basin	Low
3A	HU633	Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin	Mod-good/Good
3B	HU633	Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin	Mod-good/Mod
3C	HU633	Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin	Low
4A	HU509	Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast	Mod-good/Good
4B	HU509	Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast	Mod-good/Mod
4C	HU509	Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast	Low
5A	HU511	Blackbutt - Tallowood dry grassy open forest of the southern North Coast	Mod-good/Good
5B	HU511	Blackbutt - Tallowood dry grassy open forest of the southern North Coast	Mod-good/Mod
6	HU631	Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin	Mod-good/Good
7A	HU563	Mangrove forest in estuaries of the Sydney Basin and South East Corner	Mod-good/Good
8A	HU635	Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner	Mod-good/Good
9A	HU591	Paperbark swamp forest of the coastal lowlands of the North Coast and Sydney Basin	Mod-good/Good
10A	HU606	Saltmarsh in estuaries of the Sydney Basin and South East Corner	Mod-good/Good
C	n/a	Cleared land	Cleared

LEGEND

Study Area (Blue outline)

Vegetation Zones

- 1A (Light blue)
- 1B (Medium blue)
- 2A (Light green)
- 2B (Medium green)
- 2C (Light yellow-green)
- 3A (Light purple)
- 3B (Medium purple)
- 3C (Light yellow)
- 4A (Yellow)
- 4B (Light green)
- 4C (Light yellow)
- 5A (Light pink)
- 5B (Pink)
- 6 (Light orange)
- 7A (Light blue)
- 7B (Medium blue)
- 8A (Purple)
- 8B (Medium purple)
- 9A (Dark green)
- 10A (Orange)
- C (Red)

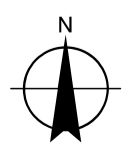
Management Zones

- Biobank Site (Green diagonal lines)
- Development (complete vegetation removal) (Red diagonal lines)
- Open Space (partial vegetation removal) (Yellow diagonal lines)

1:9,000 Paper Size A3

0 50 100 200 300 400 Meters

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

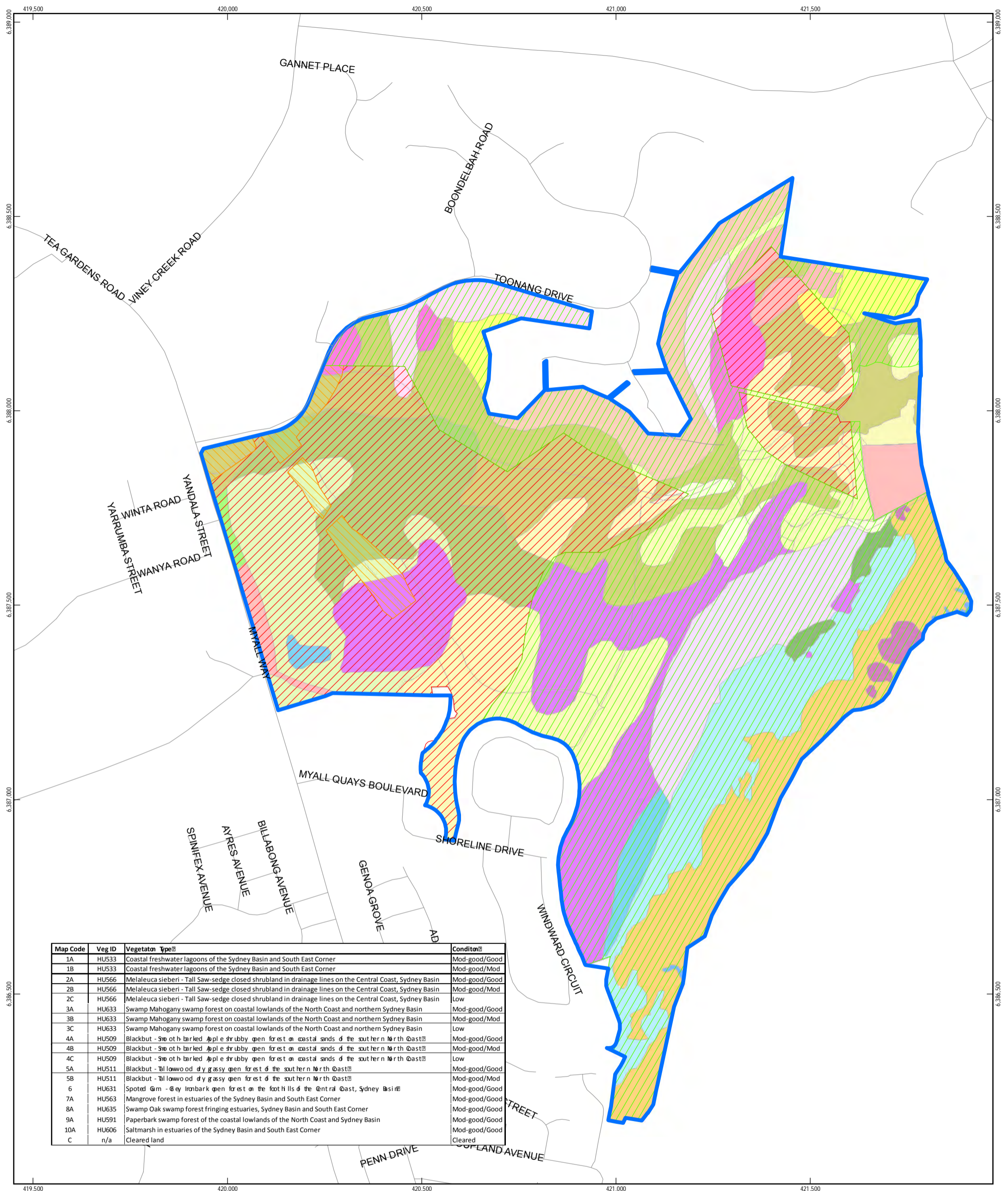


CLIENTS | PEOPLE | PERFORMANCE

Crighton Properties Pty. Ltd.
Riverside at Tea Gardens - BioBanking Assessment

Job Number 22-15960
Revision A
Date 05 Feb 2013

Final Development Vegetation Zones Figure 3a



Map Code	Veg ID	Vegetation Type	Condition
1A	HU533	Coastal freshwater lagoons of the Sydney Basin and South East Corner	Mod-good/Good
1B	HU533	Coastal freshwater lagoons of the Sydney Basin and South East Corner	Mod-good/Mod
2A	HU566	Melaleuca sieberi - Tall Saw-sedge closed shrubland in drainage lines on the Central Coast, Sydney Basin	Mod-good/Good
2B	HU566	Melaleuca sieberi - Tall Saw-sedge closed shrubland in drainage lines on the Central Coast, Sydney Basin	Mod-good/Mod
2C	HU566	Melaleuca sieberi - Tall Saw-sedge closed shrubland in drainage lines on the Central Coast, Sydney Basin	Low
3A	HU633	Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin	Mod-good/Good
3B	HU633	Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin	Mod-good/Mod
3C	HU633	Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin	Low
4A	HU509	Blackbut - Smooth barked Apple shrubby open forest on coastal sands of the southern North Coast	Mod-good/Good
4B	HU509	Blackbut - Smooth barked Apple shrubby open forest on coastal sands of the southern North Coast	Mod-good/Mod
4C	HU509	Blackbut - Smooth barked Apple shrubby open forest on coastal sands of the southern North Coast	Low
5A	HU511	Blackbut - Tall wood dry grassy open forest of the southern North Coast	Mod-good/Good
5B	HU511	Blackbut - Tall wood dry grassy open forest of the southern North Coast	Mod-good/Mod
6	HU631	Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin	Mod-good/Good
7A	HU563	Mangrove forest in estuaries of the Sydney Basin and South East Corner	Mod-good/Good
8A	HU635	Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner	Mod-good/Good
9A	HU591	Paperbark swamp forest of the coastal lowlands of the North Coast and Sydney Basin	Mod-good/Good
10A	HU606	Saltmarsh in estuaries of the Sydney Basin and South East Corner	Mod-good/Good
C	n/a	Cleared land	Cleared

LEGEND

Study Area (Blue outline)

Management Zones

- PAC Boundary Biobank Site (Green hatched)
- PAC Boundary Development (complete vegetation removal) (Red hatched)
- PAC Boundary Open Space (partial vegetation removal) (Orange hatched)

Vegetation Zones

- 1A (Light blue)
- 1B (Blue)
- 2A (Light green)
- 2B (Green)
- 2C (Light yellow-green)
- 3A (Light purple)
- 3B (Purple)
- 3C (Yellow)
- 4A (Yellow)
- 4B (Light green)
- 4C (Light yellow)
- 5A (Light pink)
- 5B (Pink)
- 6 (Light orange)
- 7A (Blue)
- 8A (Purple)
- 9A (Green)
- 10A (Orange)
- C (Red)

1:9,000 Paper Size A3

0 45 90 180 270 360 Meters

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

N

GHD

CLIENTS | PEOPLE | PERFORMANCE

Crighton Properties Pty. Ltd.
Riverside at Tea Gardens - BioBanking Assessment

Job Number | 22-15960
Revision | A
Date | 24 Sep 2012

PAC Development Vegetation Zones Figure 3b



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 (i.e. hostile barrier to small to medium sized ground mammals, most arboreal mammals, frogs and small reptiles). However, these restrictions do 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 4 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 <i>Sporobolus virginicus</i> , <i>Sarcocornia quinqueflora</i> and <i>Samolus repens</i> grading into freshwater wetlands and swamp sclerophyll forests with the ecotone comprising <i>Juncus kraussii</i> and <i>Baumea juncea</i> .
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 <i>Melaleuca ericifolia</i> . The ground layer is wet and dominated by sedges and rushes, including <i>Juncus kraussii</i> and <i>Baumea juncea</i> . Other common ground layer species include the herb <i>Samolus repens</i> . 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.
<i>Melaleuca sieberi</i> - Tall Saw-sedge closed shrubland in drainage lines on the Central Coast, Sydney Basin	HU566	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 (<i>Melaleuca sieberi</i> and <i>Melaleuca nodosa</i>) and often including <i>Leptospermum juniperinum</i> and <i>Allocasuarina littoralis</i> . The understorey is typically shrubby and characterised by species including <i>Pultenaea paleacea</i> , <i>Leptospermum juniperinum</i> , <i>Melaleuca thymifolia</i> , <i>Banksia oblongifolia</i> , <i>Epacris pulchella</i> and <i>Acacia longifolia</i> . The ground layer is characterised by numerous sedges and other grass like species commonly including <i>Lepyrodia scariosa</i> , <i>Empodisma minus</i> , <i>Ptilothrix deusta</i> , <i>Chorizandra cymbaria</i> , <i>Gahnia clarkei</i> and <i>Schoenus brevifolius</i> . Various



Vegetation Type (OEH, 2011b)	Veg. ID (OEH, 2011b)	Conservation Significance	Description
			grass species are also common in the ground layer, although less dominant, including <i>Entolasia stricta</i> , <i>Hemarthria uncinata</i> , <i>Themeda australis</i> and <i>Panicum simile</i> . In addition, various forbs may also be present in the ground layer such as <i>Gonocarpus tetragynus</i> , <i>Gonocarpus micranthus</i> and <i>Goodenia bellidifolia</i> .
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 <i>Melaleuca sieberi</i> , <i>Glochidion ferdinandi</i> and <i>Acacia longifolia</i> . The ground layer is typically wet and dominated by sedges and other graminoids, including <i>Gahnia clarkei</i> and <i>Baumea juncea</i> . Ground ferns, in particular <i>Blechnum indicum</i> , are also common components of the ground layer. Forbs, including aquatic or semi aquatic species such as <i>Villarsia exaltata</i> , may be common, with other forbs, including <i>Goodenia paniculata</i> , <i>Goodenia heterophylla</i> and <i>Gonocarpus micranthus</i> .
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 <i>Ricinocarpos pinifolius</i> , <i>Acacia ulicifolia</i> , <i>A. suaveolens</i> , <i>Persoonia levis</i> , <i>Leucopogon lanceolatus</i> , <i>Bossiaea rhombifolia</i> and <i>Hibbertia linearis</i> as well as the climbers <i>Hardenbergia violacea</i> and <i>Billardiera scandens</i> . The ground layer is often dominated by <i>Pteridium esculentum</i> and grasses, including <i>Themeda australis</i> and



Vegetation Type (OEH, 2011b)	Veg. ID (OEH, 2011b)	Conservation Significance	Description
			<p><i>Imperata cylindrica</i>, with various grass like species, including <i>Dianella caerulea</i> and <i>Lomandra longifolia</i> also common as well as scattered forbs, including <i>Gonocarpus teucroides</i> and <i>Pomax umbellata</i>.</p> <p>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 <i>Melaleuca sieberi</i>, <i>M. linariifolia</i> and <i>M. nodosa</i> and commonly also includes <i>Allocasuarina littoralis</i> and <i>Leptospermum polygalifolium</i>. The shrubby understorey typically consists of a relatively diverse range of smaller shrubs, including <i>Pultenaea villosa</i>, <i>Pultenaea retusa</i>, <i>Dodonaea triquetra</i>, <i>Persoonia levis</i>, <i>Daviesia ulicifolia</i> and <i>Epacris pulchella</i> and scrambling climbers, including <i>Billardiera scandens</i>, <i>Kennedia rubicunda</i> and <i>Hardenbergia violacea</i>. The understorey is typically dominated by grasses, in particular <i>Themeda australis</i> and <i>Entolasia stricta</i> along with others such <i>Panicum simile</i> and <i>Paspalum orbiculare</i>, and grass like plants, including <i>Lomandra longifolia</i>, <i>Schoenus apogon</i>, <i>Dianella caerulea</i> and <i>Baumea teretifolia</i>. Numerous forbs are typically also present in the ground layer and commonly include <i>Gonocarpus tetragynus</i>, <i>Hydrocotyle peduncularis</i> and <i>Goodenia paniculata</i> along with ferns, including <i>Lindsaea linearis</i>.</p>
Blackbutt - Tallowood dry grassy open forest of the southern North Coast	HU511		Cumberland Ecology (2011) described this community as follows: "the tree stratum is dominated by <i>Eucalyptus</i>



Vegetation Type (OEH, 2011b)	Veg. ID (OEH, 2011b)	Conservation Significance	Description
			<p><i>microcorys</i> (Tallowwood), <i>Eucalyptus globoidea</i> (White Stringybark), <i>Eucalyptus resinifera</i> subsp. <i>resinifera</i> (Red Mahogany) and <i>Acacia irrorata</i> subsp. <i>irrorata</i> (Green Wattle). Other tree species occurring in this community include <i>Angophora costata</i> (Smooth-barked Apple) and <i>Corymbia gummifera</i> (Red Bloodwood). The tree stratum ranges in height from 12-18m. Common species in the shrub stratum include <i>Melaleuca linariifolia</i> (Snow in Summer), <i>Callistemon salignus</i> (Willow Bottlebrush), <i>Leptospermum polygalifolium</i> (Lemon Scented Tea-tree), <i>Melaleuca nodosa</i> (Ball Honey Myrtle), <i>Melaleuca sieberi</i> and the exotic <i>Lantana camara</i> (Lantana). The shrub stratum ranges in height from 1-5m. Common groundcover species include <i>Brunoniella pumilio</i> (Dwarf Blue Trumpet), <i>Pratia purpurascens</i> (Whiteroot), <i>Gahnia clarkei</i> (Tall Saw-sedge), <i>Lomandra longifolia</i> (Spinyheaded Mat-rush), <i>Entolasia stricta</i> (Wiry Panic), <i>Imperata cylindrica</i> var. <i>major</i> (Blady Grass), <i>Microlaena stipoides</i> var. <i>stipoides</i> (Weeping Meadow Grass) and <i>Oplismenus imbecillis</i>.</p> <p>The understory of this community is predominantly comprised of regrowth <i>Melaleuca</i> species as a result of previous land use. This community is not significantly impacted by weed invasion. Some weed invasion is evident in the areas surrounding the drainage line flowing through this community.”</p>
Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin	HU631		Cumberland Ecology (2011) described this community as follows: dominant species in the tree stratum are <i>Corymbia maculate</i> (Spotted Gum) and <i>Eucalyptus paniculata</i> subsp. <i>paniculata</i> (Grey Ironbark). There are also frequent



Vegetation Type (OEH, 2011b)	Veg. ID (OEH, 2011b)	Conservation Significance	Description
			<p>occurrences of <i>Eucalyptus propinqua</i> var. <i>propinqua</i> (Small Fruited Grey Gum), <i>Eucalyptus fergusonii</i>, <i>Eucalyptus globoidea</i> (White Stringybark) and <i>Eucalyptus resinifera</i> subsp. <i>resinifera</i> (Red Mahogany). The tree stratum ranges in height from 15- 25m. Common species in the shrub stratum include <i>Pultenaea villosa</i>, <i>Melaleuca nodosa</i> (Ball Honey Myrtle), <i>Leptospermum polygalifolium</i> (Lemon Scented Tea-tree) and <i>Breynia oblongifolia</i> (Coffee Bush). The shrub stratum ranges in height from 0.2-3.5m. Common species in the groundcover stratum include <i>Dichondra repens</i> (Kidney Weed), <i>Pratia purpurascens</i> (Whiteroot), <i>Themeda australis</i> (Kangaroo Grass), <i>Entolasia stricta</i> (Wirry Panic), <i>Brunoniella pumilio</i> (Dwarf Blue Trumpet), <i>Lagenifera stipitata</i> (Blue Bottle-daisy), <i>Lomandra longifolia</i> (Spiny-headed Mat-rush), <i>Dianella caerulea</i> var. <i>producta</i> (Blue Flax lily) and the exotic <i>Conyza bonariensis</i> (Flaxleaf Fleabane) and <i>Axonopus fissifolius</i> (Narrow-leaved Carpet Grass).</p> <p>The groundcover stratum ranges in height from 0-2m. The vines <i>Glycine clandestina</i> (Twining Glycine), <i>Glycine microphylla</i> and <i>Glycine tabacina</i> 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."</p>



Vegetation Type (OEH, 2011b)	Veg. ID (OEH, 2011b)	Conservation Significance	Description
Mangrove forest in estuaries of the Sydney Basin and South East Corner	HU563		Low open forests to low closed forests dominated by <i>Avicennia marina</i> , often in association with <i>Aegiceras corniculatum</i> . The understorey typically includes a sparse cover of small shrubs including <i>Suaeda australis</i> and <i>Sarcocornia quinqueflora</i> and graminoids including <i>Juncus kraussii</i> and <i>Triglochin striata</i> . The ground layer is typically also sparsely vegetated and is characterised by <i>Sporobolus virginicus</i> .
Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner	HU635	EEC TSC Act	Open swamp forests with an overstorey characterised by <i>Casuarina glauca</i> , and with the main understorey shrub being <i>Melaleuca ericifolia</i> . The climber <i>Parsonsia straminea</i> is also a common component of the mid and overstorey. The ground layer is wet and dominated by sedges and rushes, including <i>Juncus kraussii</i> , <i>Baumea juncea</i> and <i>Phragmites australis</i> . Other common ground layer species include the grass <i>Sporobolus virginicus</i> and the herb <i>Samolus repens</i> .
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 <i>Melaleuca quinquenervia</i> and commonly including <i>Casuarina glauca</i> and <i>Eucalyptus robusta</i> . An open shrub layer may be present and typically includes <i>Glochidion ferdinandi</i> and <i>Acacia longifolia</i> , along with the climber <i>Parsonsia straminea</i> . The ground layer is typically wet and dominated by sedges and other graminoids, including <i>Gahnia clarkei</i> and <i>Baumea juncea</i> . Ground ferns, in particular <i>Blechnum indicum</i> , are also common components of the ground layer.



3.5 Conservation Significance

Threatened Flora Species

No additional 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 detailed seasonally appropriate targeted surveys to determine whether any further assessment is required (i.e. species credits). Targeted surveys completed by Conacher Environmental indicate this species is not present on the site. Details of this survey effort and timing would be included in the offsets package.

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 (Dec 2011). The Cumberland assessment considers the distribution of these EEC's in accordance with the Scientific Committees Determination, including the influence of the soil profile.

In regards this BioBanking assessment, 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.

Threatened Fauna Species

The following threatened fauna have been recorded in the study area (Cumberland Ecology, Feb and Dec 2011):

- ▶ Wallum Froglet (*Crinia tinnula*)
- ▶ Varied Sitella (*Daphoenositta chrysoptera*)
- ▶ Little Lorikeet (*Glossopsitta pusilla*)
- ▶ Black Bittern (*Ixobrychus flavicollis*)
- ▶ Osprey (*Pandion haliaetus*)
- ▶ Barking Owl (*Ninox 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 screibersii 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 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.

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 orientation of developments to biobank would result in changes in the landscape through changes to the primary link, total vegetation cover and associated vegetation condition.

Available and extrapolated data was entered into Version 2 of the credit calculator to estimate the number of credits that would need to be purchased and retired if the entire development area was included in an application for a BioBanking statement.

For the biobank site, data was collected according to the BioBanking methodology and entered into the calculator to calculate the number of credits that will be generated if a BioBanking agreement was obtained the site.

The complete BioBanking Credit Reports for the development and biobank options are included as Appendices A and B.

This BioBanking assessment was completed by Ben Harrington (Assessor Accreditation no. 0073) and Daniel Williams (Assessor Accreditation no. 0082). It is based on available and extrapolated data and provides a reliable estimate for the purposes of calculating the quantum of offsets required for the Project. However, as stated in Section 2.5, data has not been collected in accordance with the strict application of the methodology and so should be considered a notional assessment for the purposes of generation and sale of biodiversity credits. The final Offset Package for the development would need to be developed in consultation with OEH and may require additional assessment. The final BioBanking agreement would require a more detailed assessment, including additional site surveys.

4.2 BioBanking Credit Comparison

4.2.1 Ecosystem Credits

The BioBanking ecosystem credit comparison between the development footprint options and the associated biobank sites is presented in Table 5 and Table 6. 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 using the variation criteria stated in Attachment B of the OEH (2011a) 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 5 and Table 6. Therefore additional biodiversity credit contributions from an offsite biobank would be required for both development footprint options.

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 may include variations to these 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'. DPI 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'.

Red Flag areas 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 would consider options for other off site biobank for inclusion in the final offset package for the Project. Additional, suitable biobank sites 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 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 biobank would generate a credit surplus for five 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 5 Biodiversity Credit Summary for Final Development Footprint and Biobank

Biodiversity credit	Development area (ha)	Credits required	Biobank area	Credits generated	Credit Balance
Saltmarsh in estuaries of the Sydney Basin and South East Corner	0	0	19.72	121	121
Coastal freshwater lagoons of the Sydney Basin and South East Corner	0.58	24	18.54	182	158
Melaleuca sieberi - Tall Saw-sedge closed shrubland in drainage lines on the Central Coast, Sydney Basin	33.45	1247	0.13	1	-1246
Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin	17.36	379	24.21	192	-187
Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast	45.66	1049	25.49	226	-823
Blackbutt - Tallowwood dry grassy open forest of the southern North Coast	4.72	183	7.34	51	-132
Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin	0	0	9.18	56	56
Mangrove forest in estuaries of the Sydney Basin and South East Corner	0	0	0.23	1	1
Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner	0	0	1.18	6	6
Paperbark swamp forest of the coastal lowlands of the North Coast and Sydney Basin	0	0	1.33	11	11
Totals	101.77	2882	107.35	847	-2035
Koala population		695		426	-269
Wallum Froglet		685		280	-405



Table 6 Biodiversity Credit Summary for PAC Development Footprint and Biobank

Biodiversity credit	Development area (ha)	Credits required	Biobank area	Credits generated	Credit Balance
Saltmarsh in estuaries of the Sydney Basin and South East Corner	0	0	19.78	121	121
Coastal freshwater lagoons of the Sydney Basin and South East Corner	0.58	24	18.54	182	158
<i>Melaleuca sieberi</i> - Tall Saw-sedge closed shrubland in drainage lines on the Central Coast, Sydney Basin	33.04	1155	0.54	4	-1151
Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin	7.62	158	33.96	276	118
Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast	29.48	708	25.44	227	-481
Blackbutt - Tallowwood dry grassy open forest of the southern North Coast	2.94	106	8.81	63	-43
Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin	0	0	9.33	57	57
Mangrove forest in estuaries of the Sydney Basin and South East Corner	0	0	0.23	1	1
Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner	0	0	1.22	7	7
Paperbark swamp forest of the coastal lowlands of the North Coast and Sydney Basin	0	0	1.33	11	11
Totals	73.66	2151	119.18	949	-1202
Koala population	32.08	387	88.6	532	145
Wallum Froglet	41.22	550	54.38	326	-224



4.2.2 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:

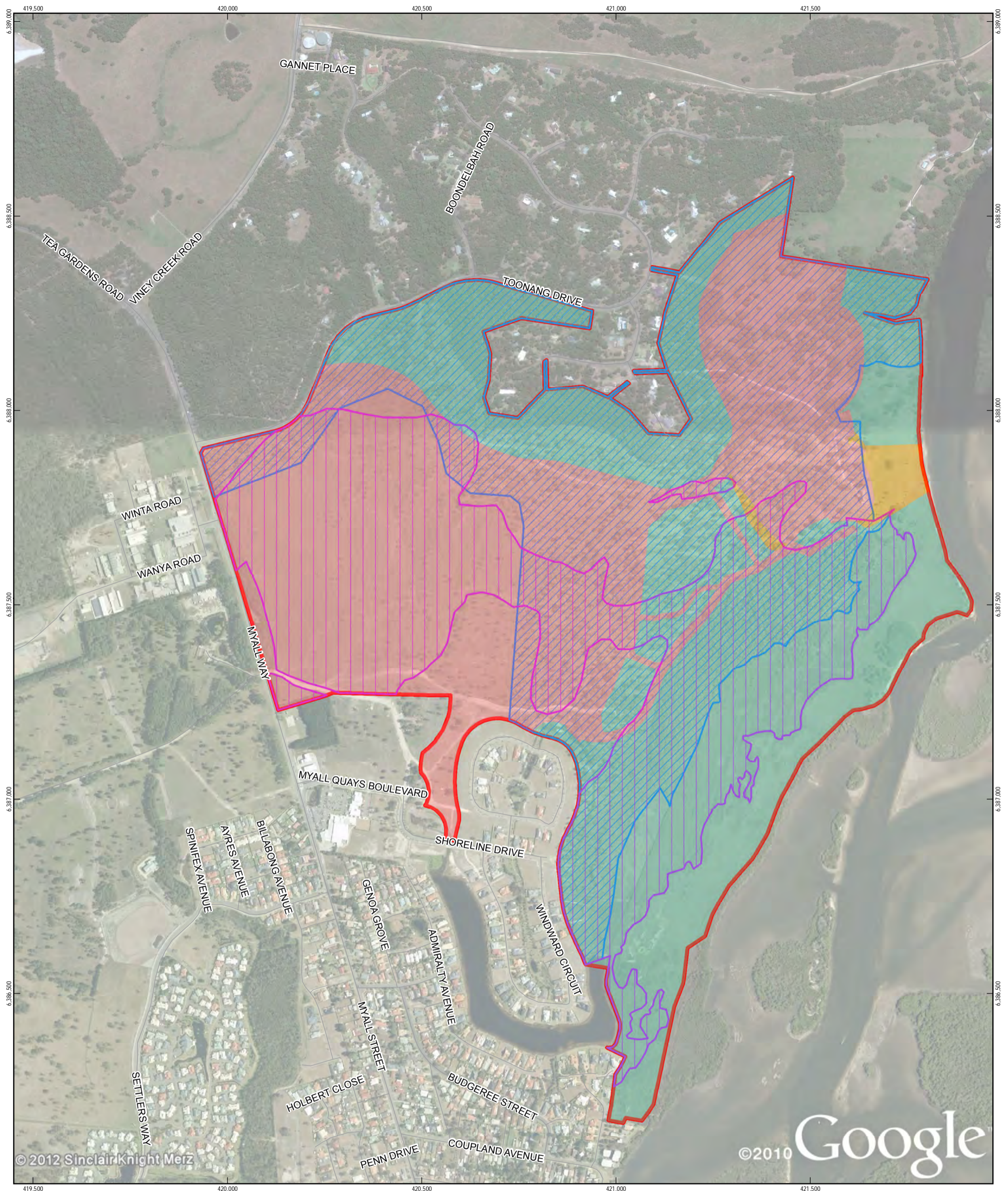
- ▶ The Hawks Nest and Teagardens Koala Endangered Population (Koala population)
- ▶ Wallum Froglet.

Species polygons for the Koala population and Wallum Froglet were mapped based on habitat assessments conducted during GHD site surveys and consultation with OEH and DPI. Species polygons within the final development and biobank are shown on Figure 4a and the PAC development and biobank on Figure 4b.

The BioBanking species credit comparison between the four development footprint options and the associated biobank sites is presented Table 5 and Table 6. The PAC and preferred development footprints would yield a surplus of Wallum Froglet species credits. All four development footprint options would result in a shortfall of Koala population species credits.

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.



LEGEND

Study Area	Management Zones
Wallum froglet species polygon	Biobank Site
Koala species polygon	Development (complete vegetation removal)
	Open Space (partial vegetation removal)

1:9,000 Paper Size A3

Meters

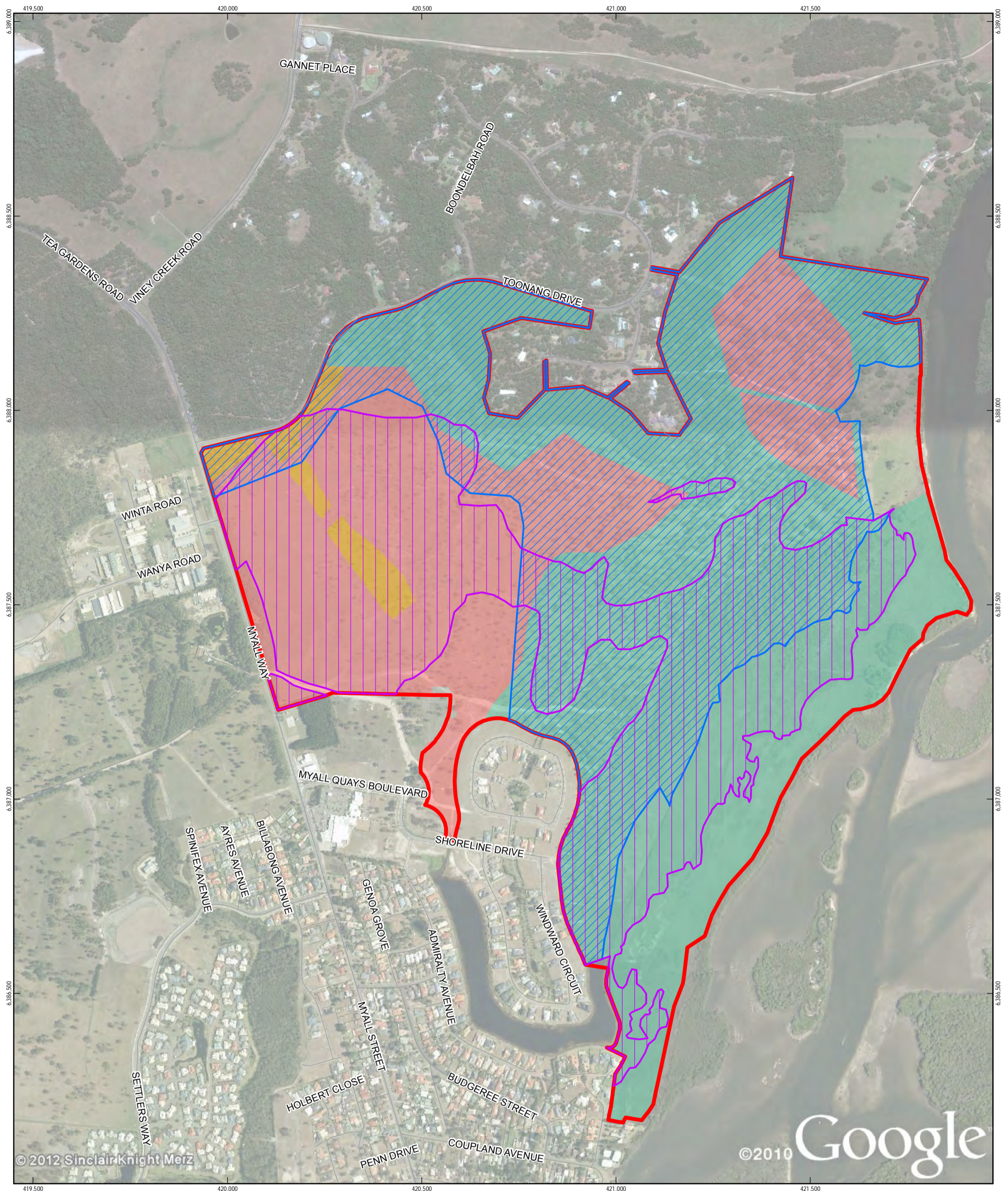
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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Crighton Properties Pty. Ltd.
Riverside at Tea Gardens - BioBanking Assessment

Job Number	22-15960
Revision	A
Date	06 Feb 2013

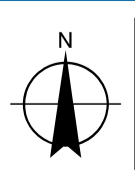
Final Development Species Polygons Figure 4a



LEGEND

Study Area	Management Zones
Wallum froglet species polygon	PAC Boundary Biobank Site
Koala species polygon	PAC Boundary Development (complete vegetation removal)
	PAC Boundary Open Space (partial vegetation removal)

1:9,000 Paper Size A3
 0 45 90 180 270 360
 Meters
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 56



Crighton Properties Pty. Ltd.
 Riverside at Tea Gardens - BioBanking Assessment

Job Number	22-15960
Revision	A
Date	24 Sep 2012

PAC Development Species Polygons Figure 4b



4.3 Biodiversity Offset Site Management Framework

The BioBanking assessment for the Project will identify biodiversity offset (biobank) sites that 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.

4.3.1 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.

4.3.2 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.

4.3.3 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.

4.3.4 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.



4.3.5 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. Both the onsite and offsite biobanks would need to provide suitable Koala population habitat. Should both the onsite and offsite biobanks be conserved via a BioBanking agreement then the rehabilitation and management of these areas would be in accordance with a BioBanking Management Actions Plan (MAP).

If the onsite biobank is conserved via a different mechanism then the area would be managed in accordance with the Koala Management Study (Conacher, 2011). This plan has been prepared considering the Recovery Plan for the Hawks Nest and Tea Gardens Endangered Koala Population (2003) and the Draft Recovery Plan for the Koala (2007). Similarly, if the offsite biobank is conserved via a different mechanism then similar management activities, as described in the Koala Management Study (Conacher, 2011), would need to be applied.



5. Justification and Benefits of Proposed Development/Conservation Footprint

5.1 Development/Conservation Footprint Options Assessment

BioBanking has been used to estimate the quantum of offsets that would be required to compensate for impacts of the Project. This process has been applied to multiple development scenarios to optimise the balance between development and conservation footprints across the study area. Two of these development footprints have been considered in this BioBanking Assessment report and are shown on Figures 2a and 2b:

- ▶ The Planning Assessment Commission (PAC) development
- ▶ The final development footprint based on ongoing assessment and consultation in order to optimise the balance between development lot yield and efforts to minimise impacts on native biodiversity.

The final development site layout was identified based on consideration of the biodiversity credit requirements for development impacts and the biodiversity credits generated by conservation of on-site biobanks. The outcome of this assessment for the final, PAC and original development site layouts is presented in Table 7. The preferred final development layout presents a considerable reduction in biodiversity impacts from the original site layout. The PAC development layout would reduce biodiversity impacts further, but would reduce lot yield to the extent that the viability of the Project would be compromised.

For all development footprint options considered, there is a biodiversity credit deficit i.e. additional off site biobank site(s) would be required. The final development footprint has achieved a reduction in the credit deficit of 635 ecosystem credits from the original development. It should also be noted that the proposed PAC development footprint will also require significant biodiversity offsets (75 % of the total biodiversity credits required for the development footprint), including an estimated area of 114-154 ha to be secured off site.

This BioBanking assessment has been able to increase the development lot yield while achieving economies in the number of biodiversity credits required by concentrating development in poorer condition vegetation poorer condition vegetation as shown by:

- ▶ An overall ratio of 28.3 credits per hectare for the final development footprint, versus
- ▶ An overall ratio of 29.2 credits per hectare for the PAC development footprint

The final development footprint is 38% larger than the PAC development footprint but would result in a 34% increase in the number of ecosystem credits required.



Table 7 Comparison between the Development Footprint Options Credits Required and Biobank Credits Contribution

Name	Final development footprint	PAC development footprint	Original development footprint
Development area (ha)	101.77	73.66	114.64
Ecosystem credits required	2882	2151	3281
Biobank area (ha)	107.35	119.18	66.86
Ecosystem credits generated –	847	949	611
Ecosystem Credit Balance	-2035	-1202	-2670
Estimated off site biobank requirement (ha) 1	258	152	338
Estimated Size Range off site biobank requirement (ha)	192-260	114-154	252-342
Koala population species credits	-269	145	-734
Wallum Froglet species credits	-405	-224	-572

Note: (1) It is difficult to estimate the size of offsite biobanks required as it depends on the ecological condition and other landscape factors. GHD has provided the above figures using a constant (though conservative) multiplier for comparison purposes only. The estimate quoted is expected to be an 'upper limit'. Off-site biobanks for species credits would need to be considered separately, but it is likely that the biobank (s) identified to provide ecosystem credits would also contribute appropriate species credits.



5.2 Proposed Development/Conservation Footprint

The final development site layout is considered the most appropriate balance between development and conservation outcomes for the site based on the following criteria:

- ▶ A reduction in the credit impact of 635 ecosystem credits when compared to the original development footprint due to additional avoidance measures adopted by the project since this time including:
 - Removing development proposed in the southern corner of the site and adding these lands to proposed conservation lands
 - Reducing the development scale in the north eastern corner of the site and providing additional lands for conservation
 - Increasing the east-west vegetated corridor to a minimum width of 200 m throughout
- ▶ Achieving economies in the number of biodiversity credits required by concentrating development in poorer condition vegetation
- ▶ The proposed biobank would conserve the most valuable habitat in the study area both in terms of the condition of vegetation and context (the final biobank maximises the conservation of east-west and north-south fauna movement corridors and estuarine and floodplain habitats adjoining the Karuah River)
- ▶ The proposed biobank includes all vegetation types being impacted within the development footprint. This ensures that all ecological resources removed by the development would be conserved on site in some capacity
- ▶ The proposed biobanks would generate a credit surplus for five of the vegetation types in the study area, including a credit surplus for three of the four over cleared vegetation types present in the study area
- ▶ The most substantial offset deficit is with respect to *Melaleuca sieberi* - Tall Saw-sedge closed shrubland. The majority of the affected vegetation is in moderate or low 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 (2011) *NSW OEH interim policy on assessing and offsetting biodiversity impacts of Part 3A, State significant development (SSD) and State significant infrastructure (SSI) projects*
- ▶ The development footprint considers the distribution of over cleared vegetation types on the site. Some areas put forward for development by the PAC boundary impacted on over cleared landscapes while conserving areas of vegetation of a lesser conservation status
- ▶ The proposed 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 proposed conservation lands on site, thereby improving their condition and biodiversity values. These lands



will also be conserved in perpetuity by a BioBanking agreement or equivalent conservation mechanism as agreed with OEH and DPI.

The development will provide resources to invest in the rehabilitation and management of proposed conservation lands on site, thereby improving their condition and biodiversity values. These lands will also be conserved in perpetuity by a BioBanking agreement or equivalent conservation mechanism as agreed with OEH and DPI.



6. Biodiversity Offset Strategy

6.1 Approach

This section presents the biodiversity offset strategy for the Project (offset strategy), comprising a summary of the approach to delivery biodiversity offsets to compensate for residual impacts arising from the Project. The offset strategy includes:

- ▶ An estimate of the quantum of biodiversity offsets for the Project as calculated using the BioBanking methodology
- ▶ An estimate of the residual offsetting requirements for the Project, comprising the area of additional offset site(s) would need to be conserved 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
- ▶ The potential planning mechanisms for securing offset sites, including the preferred option of a BioBanking agreement
- ▶ 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 with preparation of the offset package, which would present the specific biodiversity offsets for the Project.

6.2 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 847 ecosystem credits associated with the conservation and management of approximately 107 ha within the onsite biobank
- ▶ The purchase and retirement of approximately 2035 additional ecosystems credits associated with an offsite biobank anticipated to be between 192-260 ha in area
- ▶ The retirement of approximately 426 Koala population species credits and approximately 280 Wallum froglet species credits within the onsite biobank
- ▶ The purchase and retirement of approximately 269 additional Koala population species credits and 405 Wallum froglet species credits associated with offsite biobank(s).

The above credit estimates are based on a combination of available and extrapolated data and indicative site layouts as described in Sections 2 and 4 of this Report.

6.3 Residual Offsetting Requirements

Based on the BioBanking assessment conducted to date approximately 192-260 ha of additional offset site(s) would need to be conserved 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 that *Melaleuca sieberi* - Tall Saw-sedge closed shrubland in drainage lines on the Central Coast, Sydney Basin and Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast, Koala population and Wallum Froglet species credits are in deficit and would be the focus of the offset site secured.

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. These matters will be discussed with OEH/DPI during detailed assessments of potential offset sites. As a minimum it is likely that the offset sites secured would need to provide enough suitable habitat for the Koala population and Wallum Froglet to alleviate the current species credit deficit and satisfy OEH and DPI requirements. DSEWPAC would also require specific offset contributions for the Koala, because it is a Matter of National Environmental Significance.

The methodology used will endeavour to identify the general location of the offset site which this assessment indicates would need to be secured between the Hunter and Macleay River catchments.

6.4 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:

- ▶ 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 significant habitats for Wallum Froglets, threatened forest owls and migratory shore-birds (Bell, M. Great Lakes Council, pers. comm.)
- ▶ Madden land, a 19 ha site some 1200-metres to the south of the study area which also contains 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 significant habitats for Wallum Froglets, threatened forest owls and migratory shore-birds (Bell, M. Great Lakes Council, pers. comm.)
- ▶ A site adjacent to the Nerong State Forest, in the Myall River catchment north of the study area and dominated by Paperbark swamp forest and Spotted Gum Grey Ironbark forest vegetation types
- ▶ A site currently being established as a biobank site near Karuah in the Great Lakes LGA. The site is dominated by Spotted Gum-Ironbark and Tallowood-Brushbox-Blue Gum vegetation types.
- ▶ A site currently being established as a 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.



- ▶ A site identified by GHD site near Crescent Head, in the Macleay River catchment north of the study area and dominated by Paperbark and Swamp Mahogany Forest types.

Initial assessments indicate any of these sites could contribute the bulk of the biodiversity credit shortfall for the Project and make an effective contribution to the offset package. The Durness Station and Madden land sites would be the preferred options because they would contain Koala population species credits whereas. The two sites near Karuah could supply any shortfalls or assist in the 'mix' of credit being retired. The two Macleay River catchment sites would contain suitable ecosystem credits, Wallum Froglet species credits. They would also conserve Koala habitat, but would not provide species credits because they are too far from the Hawks Nest – Tea Gardens Koala population.

The site(s) chosen would be secured by a BioBanking agreement or other conservation mechanism as agreed by OEH and DPI.

The possibility of Crighton Properties purchasing an alternative property and entering into a BioBanking agreement or 'retiring' to conservation will also be investigated during preparation of the offsets package.

6.5 Potential Planning Mechanisms for Securing Offsets

Initial discussions with OEH and DPI indicate there are two conservation mechanisms that would be deemed suitable for the project to secure its offsets, these being:

- ▶ Purchasing and retiring the agreed credits from a suitable biobank (OEH and DPI preferred).
- ▶ Purchasing a suitable offset property and placing a Conservation Agreement on title.

It is anticipated the merits of both approaches and their suitability to the Riverside Project would be discussed between Crighton and the OEH/DPI during preparation of the biodiversity offsets package (see description below).

6.6 Process for delivery of Biodiversity Offset

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

- ▶ Present a final credit impact calculation for the final development footprint. Given the extent of assessment and consultation conducted to date this is likely to comprise the credit calculations presented in this BioBanking Assessment
- ▶ Complete a final credit calculation for the proposed onsite biobank in consultation with OEH/DPI. This will provide the credit balance required to be secured offsite.
- ▶ Investigate potential offset sites and suitable conservation mechanisms to secure the credit balance.
- ▶ Complete a BioBanking assessment of preferred off site conservation site(s).
- ▶ Prepare a biodiversity offsets package including the following:
 - The results of the final credit calculations for the development and onsite conservation lands.
 - The results of assessments of the preferred offset site.
 - The preferred conservation mechanism and timeframe for securing the required offsets.
 - The proposed staging of development aligned with credit retirement
 - Any expert reports or results of targeted surveys.



- ▶ Preparation of Management Action Plans and any other associated documentation required to establish both the onsite and offsite conservation lands. These activities would commence after approval is granted for the offsets package
- ▶ Complete a BioBanking agreement application for the onsite biobank
- ▶ Complete a BioBanking agreement application for the off-site conservation site(s) or suitable alternative conservation mechanism.

6.7 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 our onsite conservation lands would allow approval of stages 1, 2, 3, 4, 5, 6, 7 and 8 (in accordance with the Riverside Staging Plan, October 2012), or approx. 37 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 30 hectares of the development footprint. This estimate is based on ecosystem credits only. The onsite biobank would contribute around 847 ecosystem credits, which is around 29% 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, 847 credits would probably allow for over 37 ha of development in this location.

The remaining development would be approved for construction once the offsite conservation lands are secured.

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 off site biobank.
- ▶ Allows the initial stages of the project to commence while investigations into suitable off site conservation lands are underway while project construction is underway thereby not delaying the commencement of the project until all offsets required are secured.
- ▶ Assist in providing the necessary resources to secure the required off site conservation lands.

Note: It is assumed that GLC would have the responsibility of ensuing development could not proceed past Stage 8 as they would not approve subsequent DA's until the offsite biobank is secured.

6.8 Recommended Actions and Approval Timeframes

The following time frames for completing necessary assessments, consultation and documentation to secure the required offsets are recommended:

- ▶ Completion and submission of the biodiversity onsite offsets package within three (4) months of development approval of the first four stages.
- ▶ Completion of Management Actions Plans (or equivalent), other associated documentation for the onsite conservation lands and their retirement to conservation within six (6) months of



project plan approval and/or prior to approval of DA's associated with Stages 1, 2, 3, 4, 5, 6, 7 and 8 of the proposed development.

- ▶ Completion of Management Actions Plans (or equivalent), other associated documentation for the offsite conservation lands and their retirement to conservation within 18 months of project plan approval and/or prior to the registration of Stages 8 through 14 of the proposed development. Completion of this task will allow the remaining development to proceed.

6.9 Preparation of Offset Package

The BioBanking methodology does not strictly apply to Part 3A Projects; however the OEH (2011a) interim policy provides a framework to assist in determining biodiversity offsets for Part 3A Projects using a modified form of the BioBanking methodology. This framework specifies the assessment process and decision-making criteria for using BioBanking:

This interim policy:

- ▶ Acknowledges that proposals assessed under Part 3A do not have to meet the 'improve or maintain' standard, as defined by the BioBanking Methodology under Part 4 and 5 of the EP&A act.
- ▶ Nevertheless adopts the use of the BioBanking Assessment Methodology (BBAM) for the purpose of:
 - Quantifying and categorising the biodiversity values and impacts of Part 3A proposals
 - Establishing, for benchmarking purposes, the offsets that would be required if the Part 3A proposal had been expected to meet the improve or maintain standard
 - Providing a structured approach to determining how proposals may, in lieu of meeting the 'improve or maintain' standard, meet one of two alternative standards established under the policy.

The offset package for the Project would be prepared with reference to the OEH (2011a) policy and include detailed justification of the outcome and associated decision-making criteria.

The key components of the offset package would be as follows:

- ▶ Estimation of biodiversity credits required to offset impacts of the development (as presented in this BioBanking Assessment report)
- ▶ Estimation of the biodiversity credits generated by conservation and management of the on and off site biobank sites
- ▶ Comparison of development and biobank credit profiles to demonstrate that the biobank sites are appropriate to offset impacts of the development, including reference to the OEH (2011a) variation criteria as appropriate
- ▶ Commitment to prepare Final BioBanking Assessment Reports and either enter into a BioBanking agreement or another DPI/OEH approved Conservation Agreement for the offset sites
- ▶ Commitment from Crighton Properties to either purchase credits generated at the offset sites and to retire those credits or to enter into another approved Conservation Agreement.

The next steps in the submission of the offset package and finalisation of the Project would be as follows:

- ▶ Submit offset package to DPI/OEH for approval.



- ▶ The biobank site owners to complete and submit an application for BioBanking agreements, in consultation with OEH or complete and submit all or part of an agreement for these lands to be used for another approved Conservation Agreement
- ▶ OEH to review the applications for the BioBanking agreements, the Minister to enter into agreements for the biobank sites and biodiversity credits to be generated and listed on the register
- ▶ Crighton Properties to purchase credits and to retire those credits. An application to transfer credits and to retire credits must be made to OEH and approved
- ▶ Money from the sale of credits to be deposited into the BioBanking Trust Fund and the land owners to be paid from this for undertaking ongoing management of the biobank sites
- ▶ Money over and above the amount required for the trust fund (i.e. the 'profit') to be negotiated and agreed between land owners and Crighton Properties. It is anticipated that the cost of the site surveys, BioBanking credit calculations and other assessments that have been funded by Crighton Properties and provided in the offset package would be recognised in the agreed credit price.

After the approval of the offset package the OEH would require additional information to issue a BioBanking agreement and to generate biodiversity credits.

A Final BioBanking Assessment Report would be submitted as part of the documentation required in order to obtain a BioBanking agreement or other approved Conservation Agreement for onsite conservation areas.

Information required to support an application for a BioBanking agreement is as follows:

- ▶ BioBanking agreement application form
- ▶ Final BioBanking Assessment Report, including additional information required to support the application
- ▶ Copy of the BioBanking agreement credit reports
- ▶ Copy of the .xml file for the proposal from the credit calculator
- ▶ A digital map (identifying the development site, boundary, vegetation zones, species polygons and any management zones where an increase in gain in Site Value is requested)
- ▶ Copy of draft management actions plans (prepared in accordance with the BioBanking agreement template) for each of the biobank sites
- ▶ Credit Pricing Spread Sheets outlining the minimum fund deposit for the 'trust' and estimates of potential credit pricing
- ▶ Proof of ownership of the properties
- ▶ Any other information required by the BioBanking agreement application form.



7. Conclusions

7.1 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 preliminary credit calculations performed to date a suite of biodiversity credits has been identified in the onsite biobank that are appropriate to compensate for a proportion of the impacts of the Project. There would be a biodiversity credit deficit for each of the development footprint options assessed, that is there are not sufficient biodiversity credits able to be generated in an onsite biobank to offset the impacts of a viable Project development. This BioBanking Assessment has been prepared in order to optimise the balance between development and conservation outcomes in the study area. The final development site layout is considered the most appropriate balance between development and conservation based on the following criteria:

- ▶ A reduction in the credit impact of 635 ecosystem credits when compared to the original development footprint due to additional avoidance measures adopted by the project since this time including:
 - Removing development proposed in the southern corner of the site and adding these lands to proposed conservation lands
 - Reducing the development scale in the north eastern corner of the site and providing additional lands for conservation
 - Increasing the east-west vegetated corridor to a minimum width of 200 m throughout
- ▶ Achieving economies in the number of biodiversity credits required by concentrating development in poorer condition vegetation as shown by:
 - An overall ratio of 28.3 credits per hectare for the final development footprint, versus
 - An overall ratio of 29.2 credits per hectare for the PAC development footprint
- ▶ 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 vegetation types being impacted within the development footprint. This ensures that all ecological resources removed by the development would be conserved on site in some capacity
- ▶ The onsite biobank would generate a credit surplus for five of the vegetation types in the study area, including a credit surplus for three of the four over cleared vegetation types present in the study area



- ▶ The most substantial offset deficit is with respect to *Melaleuca sieberi* - Tall Saw-sedge closed shrubland. The majority of the affected vegetation is in moderate or low 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 considers the distribution of over cleared vegetation types on the site. Some areas put forward for development by the PAC boundary impacted on over cleared landscapes while conserving areas of vegetation of a lesser conservation status
- ▶ The final development footprint includes approximately 10.2 ha of disturbed, cleared land with very little biodiversity value. This area meets the BioBanking definition of cleared land and does not require biodiversity offsets
- ▶ 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 proposed conservation lands on site, thereby improving their condition and biodiversity values. These lands will also be conserved in perpetuity by a BioBanking agreement or equivalent conservation mechanism as agreed with OEH and DPI.

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 approximately equal in size to the development area 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 land in the study area. 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
- ▶ Potential for improvement – the site contains degraded vegetation that would regenerate, localised weed infestations that 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
 - 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. Additional ecosystem credits may be appropriate to compensate for the removal of EECs within the development area.

The BioBanking assessment would aim to conserve a large, continuous parcel of native vegetation on the site including over cleared vegetation types and habitats for threatened species.

Based on the credit estimates presented in this BioBanking assessment additional offset contributions would be required. These additional contributions are most likely to consist of biodiversity credits from additional offset sites. A number of potentially suitable offset sites have been identified.

The Riverside project would seek 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, 2, 3, 4, 5, 6, 7 and 8 (in accordance with the Riverside Staging Plan, October 2012) of development to commence. This estimate has considered the portion of the development areas identified as being in ‘low’ condition. The final development area able to be offset via the on-site biobank would be determined during preparation of the Offsets Package.

7.2 Alignment with 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 summarises the alignment of the BioBanking assessment approach to the offsets strategy with the DECC (2008) offsetting principles.

Table 8 Comparison of the BioBanking Assessment with the DECC (2008) Offsetting Principals

DECC (2008) Principles for the use of biodiversity offsets in NSW	Attributes of BioBanking Assessment and offset strategy
<i>Impacts must be avoided first by using prevention and mitigation measures.</i>	The approach to avoidance and mitigation of impacts is presented in ERM (2011). There are unavoidable impacts on native vegetation as a result of the balance between a viable development footprint and conservation areas.
<i>All regulatory requirements must be met.</i>	An Environmental Assessment (ERM, 2011) incorporating an ecological impact assessment (Cumberland Ecology, 2011) was prepared for the Project in accordance with regulatory requirements and appropriate guidelines.
<i>Offsets must never reward ongoing poor performance.</i>	The proposed offset sites have not been deliberately degraded or mismanaged. The onsite biobank is undeveloped 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.
<i>Offsets will complement other government programs.</i>	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



DECC (2008) Principles for the use of biodiversity offsets in NSW	Attributes of BioBanking Assessment and offset strategy
	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.
<i>Offsets must be underpinned by sound ecological principles.</i>	The preparation of the BioBanking assessment, including identification of the onsite biobank, was underpinned by the DECC (2009) BioBanking methodology and OEH (2011a) offsets policy. This principal would also be applied to the additional offset site(s).
<i>Offsets should aim to result in a net improvement in biodiversity over time.</i>	The proposed Offset Package would result in a net improvement in biodiversity values over time because it has been developed with 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.
<i>Offsets must be enduring - they must offset the impact of the development for the period that the impact occurs.</i>	The BioBanking assessment provides the framework for conservation of two offset sites under BioBanking agreements, which will ensure conservation in perpetuity.
<i>Offsets should be agreed prior to the impact occurring.</i>	The BioBanking assessment has been prepared and will be agreed with OEH and DPI and prior to vegetation clearing for construction of the Project.
<i>Offsets must be quantifiable - the impacts and benefits must be reliably estimated.</i>	Impacts and benefits were quantified using the BioBanking methodology.
<i>Offsets must be targeted.</i>	The onsite biobank sites was targeted to achieve like for like conservation of vegetation types to be removed; conservation of 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. This principal would also be applied to the additional offset site(s).
<i>Offsets must be located appropriately.</i>	The onsite biobank is in the same IBRA bioregion and CMA sub region as the development area. The biobank sites have very similar suites of vegetation types as the development site, including matching vegetation types. The biobank sites would support a very similar suite of native flora and fauna, including threatened biota. The biobank sites are 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. This principal would also be applied to the additional offset site(s).
<i>Offsets must be supplementary.</i>	Conservation of the eastern portion of the onsite biobank site is currently achieved by land use zoning. Conservation of the western biobank site is not currently achieved by land use zoning, a Covenant or by any other



DECC (2008) Principles for the use of biodiversity offsets in NSW	Attributes of BioBanking Assessment and offset strategy
	<p>restriction on title.</p> <p>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. This principal would also be applied to the additional offset site(s).</p>
<p><i>Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or a contract.</i></p>	<p>Conservation and management of the offset sites would be enforced through BioBanking agreements or other conservation mechanism approved by DPI and OEH.</p>



8. Disclaimer

This BioBanking assessment for the proposed Riverside development at Tea Gardens (“Report”):

- ▶ has been prepared by GHD Pty Ltd (“GHD”) for Crighton Properties Pty Ltd
- ▶ may only be used and relied on by Crighton Properties Pty Ltd
- ▶ must not be copied to, used by, or relied on by any person other than Crighton Properties Pty Ltd without the prior written consent of GHD
- ▶ may only be used for the purpose of gaining necessary project approvals (and must not be used for any other purpose).

GHD and its servants, employees and officers otherwise expressly disclaim responsibility to any person other than Crighton Properties Pty Ltd arising from or in connection with this Report.

To the maximum extent permitted by law, all implied warranties and conditions in relation to the services provided by GHD and the Report are excluded unless they are expressly stated to apply in this Report.

The services undertaken by GHD in connection with preparing this Report:

- ▶ were limited to those specifically detailed in section 2 of this Report.

GHD expressly disclaims responsibility for any error in, or omission from, this Report arising from or in connection with any of the Assumptions listed throughout section 2 being incorrect.

Subject to section 2 of the Report, the opinions, conclusions and any recommendations in this Report are based on conditions encountered and information reviewed at the time of preparation and may be relied on for a period of 6 months, after which time, GHD expressly disclaims responsibility for any error in, or omission from, this Report arising from or in connection with those opinions, conclusions and any recommendations.



9. References

- Bell and Driscoll (2006) *Vegetation of the Tomago and Tomaree Sandbeds, Port Stephens, New South Wales: Part 1 Vegetation Classification*. Report prepared for Hunter Water, Newcastle NSW.
- Conacher Environmental Group (2011) *Koala Management Strategy – Riverside Tea Gardens*
- Cumberland Ecology (2010) *BioBanking Assessment Report*.
- Cumberland Ecology (Feb 2011) *Riverside Tea Gardens Ecological Assessment Report*.
- Cumberland Ecology (Dec 2011) *Biodiversity Assessment*.
- Department of Environment and Conservation and Department of Primary Industries (DEC/DPI) (2005) *Draft Guidelines for Threatened Species Assessment*, Department of Environment and Climate Change (NSW).
- Department of Environment and Climate Change (DECC) (2007). *BioBanking Biodiversity Banking and Offsets Scheme, Scheme Overview*.
- Department of Environment and Climate Change (2008) *Approved Recovery Plan for the Koala*. Department of Environment and Climate Change, Sydney, NSW.
- Department of Environment and, Climate Change (DECC) (2008). *Principles for the use of biodiversity offsets in NSW*. < <http://www.environment.nsw.gov.au/biocertification/offsets.htm> >.
- Department of Environment, Climate Change and Water (DECC) (NSW).
- Department of Environment and Climate Change (DECC) (2009a) *BioBanking Assessment Methodology and Credit Calculator Operation Manual*. State of NSW and Department of Environment and Climate Change, Sydney.
- Department of Environment, Climate Change and Water NSW. (2009b). *Draft National Recovery Plan for the Grey-headed Flying-fox Pteropus poliocephalus*. Prepared by Dr Peggy Eby. Department of Environment, Climate Change and Water NSW, Sydney.
- Department of Environment and Conservation (DEC) (2005) *Guidelines for Threatened species assessment*.
- Department of Environment and Water (DEW) (2007). *Use of Environmental Offsets Under the Environment Protection and Biodiversity Conservation Act 1999 – Discussion Paper*.
- Department of Environment and Climate Change (DECC) (2008b) *Descriptions for NSW (Mitchell) Landscapes Version 2 (2002) Based on descriptions compiled by Dr. Peter Mitchell*. DECC, NSW.
- Department of Environment and Climate Change (DECC) (2008a) *NSW (Mitchell) Landscapes Version 3 (2002) Based on descriptions compiled by Dr. Peter Mitchell*. DECC, NSW.
- Environmental Resources Management (ERM) (2011) *Riverside at Tea Gardens Concept Plan Application Environmental Assessment Report*
- HCCREMS (Hunter & Central Coast Regional Environment Strategy) (2009) *Hunter, Central & Lower North Coast Vegetation Classification & Mapping Project Volume 2: Vegetation Community Profiles*, report prepared by HCCREMS/Hunter Councils Environment Division for Hunter–Central Rivers Catchment Management Authority, Tocal, NSW.



National Parks and Wildlife Service (2003) *Approved Recovery Plan for the Hawks Nest Tea Gardens Endangered Koala (*Phascolarctos cinereus*) Population*. NSW National Parks and Wildlife Service, Hurstville, NSW.

Office of Environment (OEH) (2011a) *Vegetation Types Database*.

<http://www.environment.nsw.gov.au/BioBanking/VegTypeDatabase.htm> (viewed on the 05/07/2010).

Office of Environment (OEH) (2011b) *Threatened Species Profile Database*.

<http://www.environment.nsw.gov.au/BioBanking/BioBankingtspd.htm> (viewed on the 05/07/2010).

Office of Environment (OEH) (2011c) *List of BioBanking assessors*

<http://www.environment.nsw.gov.au/BioBanking/Assessorlist.htm>



Appendix A
On Site Biobank BioBanking Credit
Reports

BioBanking Credit Calculator



Office of
Environment
& Heritage

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	>100 ha

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	<i>Crinia tinnula</i>	44.21	265
Koala population, Hawks Nest and Tea Gardens	<i>Phascolarctos cinereus</i> - 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)
<i>Melaleuca sieberi</i> - 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

Final Development BioBanking Credit Report

BioBanking credit report

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

Date of report: 6/02/2013

Time: 3:04:28PM

Tool version: 2.0

Development details

Proposal ID: 0073/2012/0255D
Proposal name: Riverside Tea Gardens
Proposal address: Myall Way Tea Gardens NSW 2324

Proponent name: Crighton Properties
Proponent address: Indicative indicative NSW 1111
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

Improving or maintaining biodiversity

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

Red flag	Reason
Koala population, Hawks Nest and Tea Gardens	An impact greater than that allowed;

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

Additional information required for approval:

Change to percent cleared for a vegetation type/s

Use of local benchmark

Change negligible loss

Expert report

Predicted threatened species not on site

■ Stephens' Banded Snake

Hoplocephalus stephensii

Change threatened species response to gain (Tg value)

Ecosystem credits summary

Vegetation type	Area (ha)	Credits required	Red flag
Melaleuca sieberi - Tall Saw-sedge closed shrubland in drainage lines on the Central Coast, Sydney Basin	0.52	25	No
Melaleuca sieberi - Tall Saw-sedge closed shrubland in drainage lines on the Central Coast, Sydney Basin	18.83	991	No
Melaleuca sieberi - Tall Saw-sedge closed shrubland in drainage lines on the Central Coast, Sydney Basin	14.10	231	No
Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin	0.35	8	No
Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin	15.54	325	No
Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin	0.53	8	No
Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast	1.27	35	No
Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast	21.37	684	No
Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast	0.19	3	No
Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast	22.58	324	No
Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast	0.25	3	No
Blackbutt - Tallowwood dry grassy open forest of the southern North Coast	1.31	61	No
Blackbutt - Tallowwood dry grassy open forest of the southern North Coast	3.41	122	No
Coastal freshwater lagoons of the Sydney Basin and South East Corner	0.58	24	No
Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin	0.24	3	No
Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin	0.70	35	No
Total	101.77	2,882	

Credit profiles

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

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

Offset options - vegetation types	Offset options - CMA sub-regions
<p>Blackbutt - Tallowood dry grassy open forest of the southern North Coast, (HU511)</p> <p>Small-fruited Grey Gum - Tallowood shrubby open forest on coastal foothills of the southern North Coast, (HU620)</p>	<p>Karuah Manning</p> <p>Clarence Lowlands</p> <p>Richmond - Tweed (Qld - Scenic Rim) (Part A)</p> <p>Macleay Hastings - Hunter/Central Rivers</p> <p>Macleay Hastings - Northern Rivers</p> <p>Coffs Coast & Escarpment</p>

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

Number of ecosystem credits required	327
CMA sub-region	Karuah Manning
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	

Offset options - vegetation types	Offset options - CMA sub-regions
<p>Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin and South East Corner, (HU502)</p> <p>Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast, (HU509)</p> <p>Blackbutt - Swamp Mahogany low woodland on coastal sands of the North Coast, (HU510)</p> <p>Coast Banksia - Coast Wattle dune scrub, Sydney Basin and South East Corner, (HU530)</p> <p>New England Blackbutt grassy open forest of the eastern New England Tablelands, (HU587)</p> <p>Parramatta Red Gum - Narrow-leaved Apple shrubby woodland on sand near Kurri Kurri in the Hunter Valley, Sydney Basin, (HU592)</p> <p>Parramatta Red Gum - Scribbly Gum heathy woodland on the Tomago sand beds of the southern North Coast, (HU593)</p> <p>Pink Bloodwood open forest on the coastal lowlands of the North Coast, (HU594)</p> <p>Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux of the Sydney Basin, (HU595)</p> <p>Rough-barked Apple - Coast Banksia shrubby woodland on Warkworth Sands of the central Hunter Valley, Sydney Basin, (HU600)</p>	<p>Wollemi (Part A)</p> <p>Wollemi (Part B)</p> <p>Karuah Manning</p> <p>Yengo - Hunter/Central Rivers</p> <p>Wyang</p> <p>Barrington</p> <p>Walcha Plateau - Hunter/Central Rivers</p> <p>Macleay Hastings - Hunter/Central Rivers</p> <p>Mummel Escarpment</p> <p>Comboyne Plateau - Hunter/Central Rivers</p> <p>Tomalla</p> <p>Ellerston</p> <p>Upper Hunter</p> <p>Kerrabee - Hunter/Central Rivers</p>

Rough-barked apples grassy open forest on valley flats of the North Coast and Sydney Basin, (HU605)	Hunter
Scribbly Gum - Red Bloodwood heathy woodland on the coastal plains of the Central Coast, Sydney Basin, (HU610)	Liverpool Range - Hunter/Central Rivers
Scribbly Gum heathy open forest of coastal lowlands of the North Coast, (HU611)	Pilliga - Hunter/Central Rivers
Scribbly Gum shrubby woodland on sand deposits in the Quorrobolong area of the Central Coast, Sydney Basin, (HU612)	Wollemi (Part C)
Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin, (HU618)	Hunter/Central Rivers - marine zone
Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin, (HU621)	
Smooth-barked Apple - Sydney Peppermint - Turpentine heathy open forest on plateau areas of the southern Central Coast, Sydney Basin, (HU622)	
Sydney Peppermint - Smooth-barked Apple shrubby open forest on coastal hills and plains of the southern North Coast and northern Sydney Basin, (HU641)	
Yellow Bloodwood - ironbark shrubby woodland of the dry hinterland of the Central Coast, Sydney Basin, (HU657)	

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

Number of ecosystem credits required	722
CMA sub-region	Karuah Manning
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Blackbutt - Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast, (HU509)	Karuah Manning
Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux of the Sydney Basin, (HU595)	Clarence Lowlands
Smooth-barked Apple - Sydney Peppermint - Turpentine heathy open forest on plateau areas of the southern Central Coast, Sydney Basin, (HU622)	Wyong
Sydney Peppermint - Smooth-barked Apple shrubby open forest on coastal hills and plains of the southern North Coast and northern Sydney Basin, (HU641)	Clarence Sandstones
Yellow Bloodwood - ironbark shrubby woodland of the dry hinterland of the Central Coast, Sydney Basin, (HU657)	Stanthorpe Plateau

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

Number of ecosystem credits required	24
CMA sub-region	Karuah Manning
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Coastal freshwater lagoons of the Sydney Basin and South East Corner, (HU533) Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin, (HU673)	Karuah Manning Clarence Lowlands Richmond - Tweed (Qld - Scenic Rim) (Part A) Murwillumbah (Qld - Southeast Hills and Ranges)

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

Number of ecosystem credits required	231
CMA sub-region	Karuah Manning
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	

Offset options - vegetation types	Offset options - CMA sub-regions
Coastal floodplain sedgelands, rushlands, and forblands of the North Coast, (HU532) Forest Red Gum - Rough-barked Apple open forest on poorly drained lowlands of the Central Coast, Sydney Basin, (HU546) Melaleuca nodosa closed shrubland on alluvium of the Central Coast, Sydney Basin, (HU565) Melaleuca sieberi - Tall Saw-sedge closed shrubland in drainage lines on the Central Coast, Sydney Basin, (HU566) Paperbark swamp forest of the coastal lowlands of the North Coast and Sydney Basin, (HU591) River Oak riparian woodland of the North Coast and northern Sydney Basin, (HU598) Rough-barked Apple - red gum grassy woodland of the MacDonald River Valley on the Central Coast, Sydney Basin, (HU602) Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin, (HU633) Swamp Oak forest of the central Hunter Valley, Sydney Basin, (HU634) Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner, (HU635) Woollybutt - Paperbark sedge forest on alluvial plains of the Central Coast, Sydney Basin, (HU656)	Wollemi (Part A) Wollemi (Part B) Karuah Manning Yengo - Hunter/Central Rivers Wyong Barrington Walcha Plateau - Hunter/Central Rivers Macleay Hastings - Hunter/Central Rivers Mummel Escarpment Comboyne Plateau - Hunter/Central Rivers Tomalla Ellerston Upper Hunter Kerrabee - Hunter/Central Rivers Hunter Liverpool Range - Hunter/Central Rivers

	Pilliga - Hunter/Central Rivers
	Wollemi (Part C)
	Hunter/Central Rivers - marine zone

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

Number of ecosystem credits required	1,016
CMA sub-region	Karuah Manning
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Melaleuca sieberi - Tall Saw-sedge closed shrubland in drainage lines on the Central Coast, Sydney Basin, (HU566)	Karuah Manning
Melaleuca nodosa closed shrubland on alluvium of the Central Coast, Sydney Basin, (HU565)	Clarence Lowlands
Paperbark swamp forest of the coastal lowlands of the North Coast and Sydney Basin, (HU591)	Richmond - Tweed (Qld - Scenic Rim) (Part A)
Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin, (HU633)	Macleay Hastings - Northern Rivers
	Coffs Coast & Escarpment

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

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

Offset options - vegetation types	Offset options - CMA sub-regions
Coastal floodplain sedgelands, rushlands, and forblands of the North Coast, (HU532)	Wollemi (Part A)
Forest Red Gum - Rough-barked Apple open forest on poorly drained lowlands of the Central Coast, Sydney Basin, (HU546)	Wollemi (Part B)
Melaleuca nodosa closed shrubland on alluvium of the Central Coast, Sydney Basin, (HU565)	Karuah Manning
Melaleuca sieberi - Tall Saw-sedge closed shrubland in drainage lines on the Central Coast, Sydney Basin, (HU566)	Yengo - Hunter/Central Rivers
Paperbark swamp forest of the coastal lowlands of the North Coast and Sydney Basin, (HU591)	Wyong
River Oak riparian woodland of the North Coast and northern Sydney Basin, (HU598)	Barrington
Rough-barked Apple - red gum grassy woodland of the MacDonald River Valley on the Central Coast, Sydney Basin, (HU602)	Walcha Plateau - Hunter/Central Rivers
Swamp Mahogany swamp forest on coastal lowlands of the North Coast	Macleay Hastings - Hunter/Central Rivers
	Mummel Escarpment
	Comboyne Plateau - Hunter/Central Rivers

and northern Sydney Basin, (HU633)	Tomalla
Swamp Oak forest of the central Hunter Valley, Sydney Basin, (HU634)	Ellerston
Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner, (HU635)	Upper Hunter
Woollybutt - Paperbark sedge forest on alluvial plains of the Central Coast, Sydney Basin, (HU656)	Kerrabee - Hunter/Central Rivers
	Hunter
	Liverpool Range - Hunter/Central Rivers
	Pilliga - Hunter/Central Rivers
	Wollemi (Part C)
	Hunter/Central Rivers - marine zone

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

Number of ecosystem credits required	368
CMA sub-region	Karuah Manning
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin, (HU633)	Karuah Manning Clarence Lowlands Macleay Hastings - Northern Rivers Coffs Coast & Escarpment

Species credits

Common name	Scientific name	Extent of impact	Number of species credits required
Wallum Froglet	<i>Crinia tinnula</i>	51.41	685
Koala population, Hawks Nest and Tea Gardens	<i>Phascolarctos cinereus</i> - endangered population Hawks Nest and Tea Gardens	57.65	695



Appendix C

Response from Agencies

Response from OEH Officer

Response from DSEWPaC Officer

Dan Williams

From: Steve Lewer <Steve.Lewer@environment.nsw.gov.au>
Sent: Wednesday, 12 September 2012 7:14 AM
To: Dan Williams
Cc: Richard Bath
Subject: RE: Tea Gardens final development footprint

CompleteRepository: 2215960
Description: Tea Gardens Development BioBanking Assessmnt
JobNo: 15960
OperatingCentre: 22
RepoEmail: 2215960@ghd.com
RepoType: Job

Dan

At this stage the footprint looks fine, but obviously as stated in previous emails we would likely support this dependant on the TG offset area and its values. We support the further reduction in impact. I note the marina has been removed but the area is still to be developed (passive rec) – I expect ourselves and DP&I would prefer this left as a riparian buffer – would be good to get reveged.

Please note this is a very quick look – but overall we would likely support. Cheers Steve

Steve Lewer
Regional Biodiversity Conservation Officer
Planning and Aboriginal Heritage Section
Conservation and Regulation - North East Branch
Office Of Environment and Heritage
PO Box 488G
NEWCASTLE (NSW) 2300

ph: (02) 4908 6814
mobile: 0459 082 162
fax: (02) 4904 6810
email: steve.lewer@environment.nsw.gov.au

From: Dan Williams [mailto:Daniel.Williams@ghd.com]
Sent: Friday, 7 September 2012 11:59 AM
To: Lewer Steve
Subject: RE: Tea Gardens final development footprint

Steve,

Please see attached. Can you please provide a quick comment on the final footprint? Important changes I was able to achieve include:

- Placing additional conservation lands on the east of the development
- Increased the width of the eastern conservation lands from the shoreline
- Removal of Marina area in the nth and adding a further 3+ ha here to conservation
- Reducing the development in the 2 ha remaining in this area to passive recreation type facilities only (BBQ's/tables etc) and, possibly, a recreational boat ramp.
- Rehabilitating the riparian zone in this area (other than where the potential boat ramp may occur)
- Tree retention throughout tourism area

I will be sending the same email to Melissa

Cheers mate

Regards

Daniel Williams
Principal Environmental Scientist

NSW Leader BioBanking

GHD

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From: Steve Lewer [mailto:Steve.Lewer@environment.nsw.gov.au]
Sent: Friday, 7 September 2012 11:09 AM
To: Dan Williams
Subject: Midal Cables

Dan – Midal Cables letters as discussed. Cheers Steve

Steve Lewer
Regional Biodiversity Conservation Officer
Planning and Aboriginal Heritage Section
Conservation and Regulation - North East Branch
Office Of Environment and Heritage
PO Box 488G
NEWCASTLE (NSW) 2300

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email: steve.lewer@environment.nsw.gov.au

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Dan Williams

From: Masters, Melissa <Melissa.Masters@environment.gov.au>
Sent: Wednesday, 19 September 2012 12:43 PM
To: Dan Williams
Cc: Taylor, Mahani
Subject: RE: Tea Gardens final development footprint [SEC=UNCLASSIFIED]

CompleteRepository: 2215960
Description: Tea Gardens Development BioBanking Assessmnt
JobNo: 15960
OperatingCentre: 22
RepoEmail: 2215960@ghd.com
RepoType: Job

EPBC 2012/6293 – Riverside at Teagardens, NSW

Hello Dan

Thank you for providing a revised footprint of the Riverside proposal for SEWPaC's comment.

SEWPaC considers that the revised development proposal is an improvement on the original footprint referred under the EPBC Act. The department acknowledges that the revision goes some way to addressing SEWPaC's concerns about protection of habitat for listed threatened species, such as the Koala, Grey-headed Flying-fox and Spotted-tailed Quoll, as well as the viability of the proposed east-west habitat corridor. However, please note that SEWPaC considers a residual impact on habitat for listed threatened species remains likely.

As previously discussed, owing to the number of changes to the development proposal, SEWPaC considers that it would be appropriate to withdraw the original referral (via a letter in accordance with section 170C of the EPBC Act) and re-refer a revised proposal, focussing on relevant up-to-date information about the action and how it may impact on matters of national environmental significance.

If you choose to withdraw EPBC Act referral 2012/6293 under section 170C of the EPBC Act, a withdrawal letter should be sent to the following (with Attention to Melissa Masters):

Mr James Tregurtha
Assistant Secretary
South-Eastern Australia Assessments
SEWPaC
GPO Box 787
Canberra ACT 2601

Please do not hesitate to contact me if you have any questions about the department's comments or the process under the EPBC Act.

Regards
Melissa

Melissa Masters
A/g Assistant Director
NSW Section | South-Eastern Australia Assessments
Environment Assessment and Compliance Division
Department of Sustainability, Environment, Water, Population & Communities (DSEWPaC)



From: Dan Williams [<mailto:Daniel.Williams@ghd.com>]
Sent: Wednesday, 12 September 2012 9:10 AM
To: Masters, Melissa
Subject: Tea Gardens final development footprint

Melissa,

Please see attached. Can you please provide a quick comment on the final footprint? Important changes I was able to achieve include:

- Placing additional conservation lands on the east of the development
- Increased the width of the eastern conservation lands from the shoreline
- Removal of Marina area in the nth and adding a further 3+ ha here to conservation
- Reducing the development in the 2 ha remaining in this area to passive recreation type facilities only (BBQ's/tables etc) and, possibly, a recreational boat ramp.
- Rehabilitating the riparian zone in this area (other than where the potential boat ramp may occur)
- Tree retention throughout tourism area

I have sent Steve the same email and information and he has shown support for the changes and final footprint. Give me a call to discuss if you have any questions otherwise look forward to a quick response and your general thoughts

Cheers

Regards

Daniel Williams
Principal Environmental Scientist

NSW Leader BioBanking

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0.	B Harrington	D Williams	<i>D Williams</i>	J Tipping	<i>J Tipping</i>	07/12/11
1.	B Harrington	D Williams	<i>D Williams</i>	J Tipping	<i>J Tipping</i>	22/12/11
2.	B Harrington	D Williams	<i>D Williams</i>	J Tipping	<i>J Tipping</i>	23/01/12
3	B Harrington	D Williams	<i>D Williams</i>	J Tipping	<i>J Tipping</i>	27/11/12
4	B Harrington	D Williams	<i>D Williams</i>	D Williams	<i>D Williams</i>	06/02/13