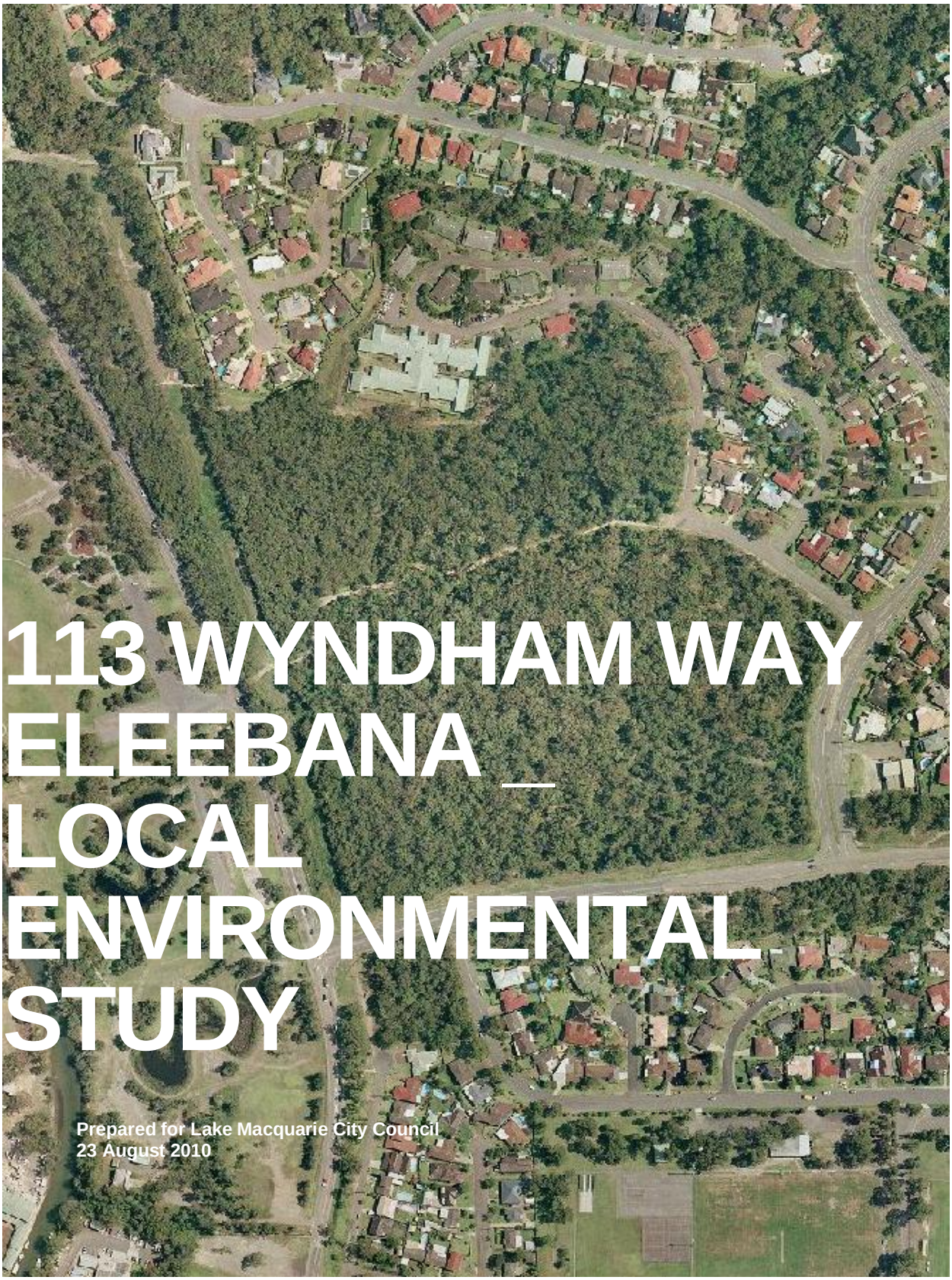
Architecture
Interior Design
Landscape Architecture
Planning
Urban Design

Australia
PR China
Hong Kong SAR
Singapore
Thailand



113 WYNDHAM WAY ELEEBANA _ LOCAL ENVIRONMENTAL STUDY

Prepared for Lake Macquarie City Council
23 August 2010

HASSELL

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Content

Appendices

1 ___ Introduction

Lake Macquarie City Council ("Council") appointed HASSELL as lead consultant to undertake and prepare a Local Environmental Study ("LES") for land at 113 Wyndham Way, Eleebana (part Lot 414 DP 866775). Council is the owner of the 7.64 hectare site, which is currently undeveloped and identified to support a range of environmentally sensitive flora and fauna species and their habitats. While the site is currently partially zoned to permit urban development, Council have commissioned this Local Environmental Study to test the development opportunities of the site to support residential and retail land uses.

This LES has been prepared in response to the Council resolution of 10 June 2008 to prepare a draft amendment to the *Lake Macquarie Local Environmental Plan 2004* ("LMLEP 2004") to allow a variety of urban land use and conservation zones on the site, to accommodate continued growth and to preserve areas of ecological significance.

The Department of Planning has directed Council to comply with section 57 and 61 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) in respect of the draft amendment and provided Council with specifications for the LES, upon which this Study is based.

1.1_Purpose of Study

The purpose of the LES is to undertake a detailed assessment of the study area and its surrounds in order to identify land with potential for urban development and land with ecological or environmental significance which is required to be conserved. Based on these findings, the Study will guide Council in their determination of appropriate future zoning of the land.

A key objective of the Study is to identify the sustainable development opportunity of the site to meet the needs of the growing community, while balancing the need to retain and protect ecologically valuable land and links between conservation areas.

1.2_Study Background

The Eleebana site has been subject of a number of environmental studies, and development opportunity investigations. Council has resolved to investigate the rezoning of land at the site to promote continued growth and conservation of environmentally sensitive land in Lake Macquarie.

Council's Property Department commenced an investigation into the development potential of the subject site in 2006, specifically looking into the feasibility of accommodating a small neighbourhood shopping centre and residential development at the site. Preliminary studies were undertaken, recommending the retention of the existing Endangered Ecological Community (*Melaleuca Scrub*) and the conservation of the main population of *Tetratheca juncea*. Of the 7.64 hectare site, approximately 5.7 hectares was identified to be developable - subject to further investigation (as previous studies and recommendations have considered the area of potential development to be substantially less).

In context of the above investigations, Asquith and Dewitt were commissioned by Council to undertake a planning investigation to determine the development potential of the site. The study (Asquith and Dewitt, 2006) identified that the site has potentially high ecological value and noted that if ecological values were proven and given priority it is possible the site has no development potential (it is noted that the study did not include comprehensive flora and fauna studies, and recommended further site survey work). Asquith and Dewitt further noted that if all (known) ecological constraints were applied, the developable area may be limited to just 2 to 3 hectares.

Various flora and fauna surveys have previously been undertaken on the site, including studies by EcoTone Ecological Consultants (2003) and EcoBiological (2007), and several squirrel glider studies. Previous studies have been referenced in the flora and fauna report prepared by WorleyParsons to inform this LES (attached at Appendix B).

The site has been identified by Council as a potential site for a neighbourhood centre. As part of a series of 'enquiry by design' workshops to inform the Lifestyle 2020 Strategy (refer to section 5.1 of this report), the site was identified as providing an opportunity for "a combination of commercial and retail activities, a high quality tourist facility as well as housing" and the site is identified within the Lifestyle 2020 Strategy as a "neighbourhood centre under investigation". The potential for development of the site for a neighbourhood centre is investigated as part of this LES.

Introduction

1.3_Scope of Work and Methodology

Lake Macquarie Council detailed the scope of work to be undertaken for the Local Environmental Study in their Brief, including the Department of Planning LES Specifications within Council's brief (refer Appendix N). In summary, the Local Environmental Study is to:

Review background material, in particular the statutory planning context in relation to the Environmental Planning and Assessment Act 1979 and regulations, relevant environmental planning instruments at the State, regional and local level, including Section 117 directions and other Statutory provisions as they apply.
_Identify the environmental characteristics and potential constraints;
_Review infrastructure capability;
_Identify social opportunities;
_Identify economic opportunities;
_Assess whether urban development is appropriate for the site (or part thereof); and
_If land is identified as being able to support urban purposes, assess what type of urban development is most appropriate considering site location, constraints and opportunities.

In addressing Council's requirements a specific methodology was developed. The methodology encompassed three main stages and is described below:
Stage 1: Project Initiation and Review;
Stage 2: Investigations; and
Stage 3: Environmental Study.

1.4_Acknowledgments

HASSELL acknowledges the valuable contributions of the project team in preparing the Local Environmental Study: Worley Parsons, Total Earth Care, Better Transport Futures and RCA Australia. Further HASSELL acknowledges the valuable support and service provided by Lake Macquarie Council staff.

2 ___ Regional Context

2.1_Regional Location

The study area is located within the Lake Macquarie Local Government Area (LGA) in the Lower Hunter Region. Newcastle is the largest urban centre in the region, and is located approximately 20 kilometres to the north-east of the study area.

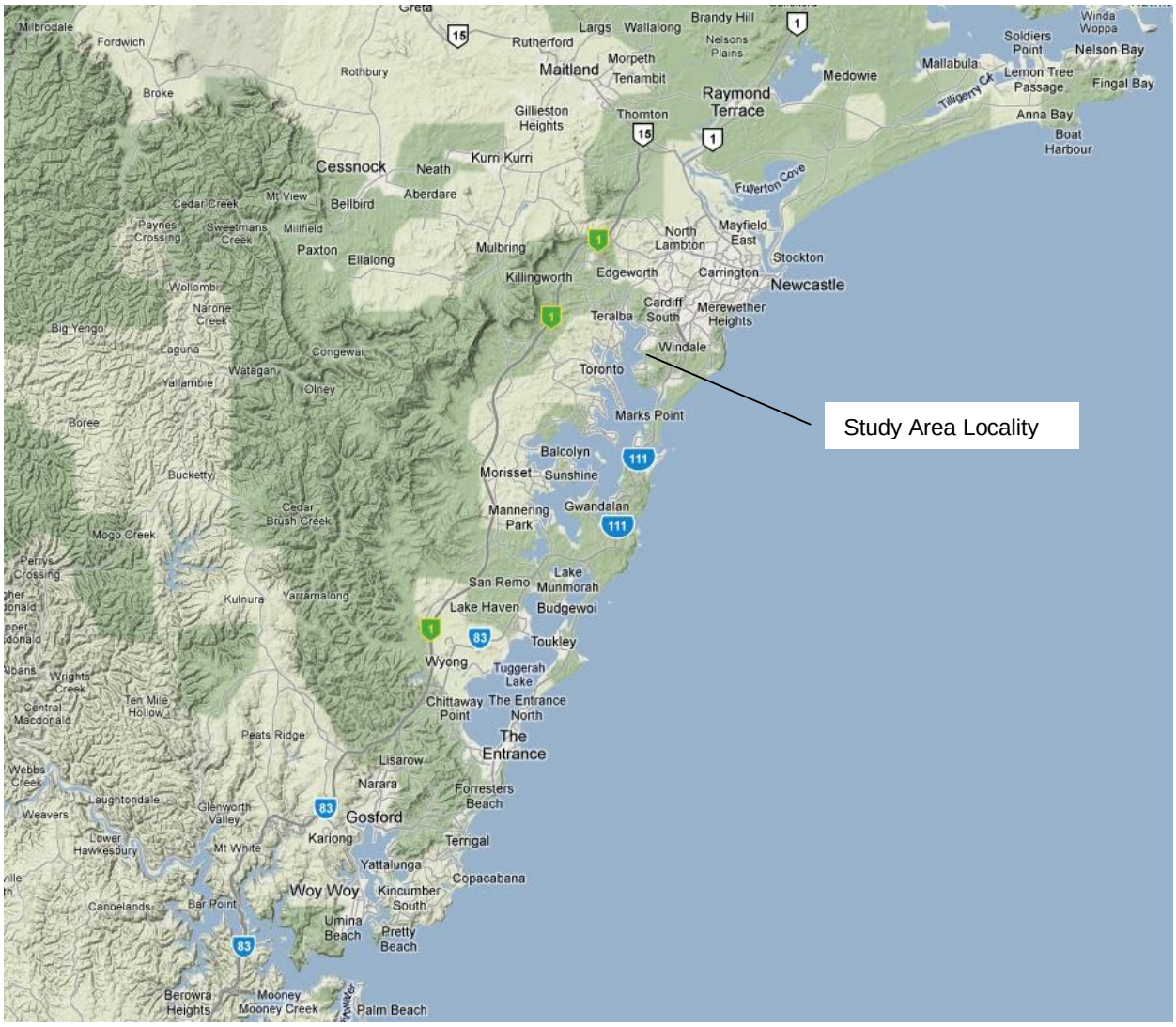

Figure 2.1_Regional Location of Study Area

Lake Macquarie, with an area of approximately 748.7 square kilometres, is the key natural attraction in the area being one of the largest coastal saltwater lakes in Australia, making the area a popular tourist destination.

The Lake Macquarie LGA includes semi-rural areas such as Morisset and Cooranbong in the southern mountainous areas through to the lakeside villages of Wangi Wangi and Toronto on the western side of the lake. On the eastern side of the lake, beach and lakeside communities such as Swansea and Belmont merge with the northern lake suburbs of Warners Bay, Cardiff and Charlestown.

Regional Context

2.2_Town Centres

Lake Macquarie is characterised by many villages and towns dotted around the city's lake, beaches and mountains. The study area is within the suburb of Eleebana, located to the east of Lake Macquarie.

The nearest shopping facilities are at Valentine (approximately 1.8 kilometres to the south west of the study area) which consist of a small number of local retailers including a chemist, newsagent, small grocery store, butcher, bottle shop, post office, Chinese restaurant and a take away food shop.

The neighbourhood centre of Croudace Bay Park to the north of the study area provides recreational facilities including playgrounds, shelters, BBQs, a boat ramp and car parking, with Eleebana Oval on the eastern side accommodating a football field and three tennis courts with associated car parking.

Larger town centres in proximity to the site include:
_ Warners Bay (approximately 3.5 kilometres north);
_ Mount Hutton (approximately 4 kilometres north east); and
_ Belmont (approximately 5 kilometres south east).

These centres provide a wider range of commercial and retail services.

Charlestown is a sub-regional centre located approximately 8 kilometres north east of the site. Located between Newcastle and Lake Macquarie on the Pacific Highway, Charlestown is the principal business and shopping area for the region.

Glendale is the other sub-regional centre in proximity to the site and provides Hunter's largest employment zone, and Glendale Stockland provides a subregional shopping centre. The Hunter Sports Centre offers world-class facilities for Olympic-standard training and competition in a range of sports.

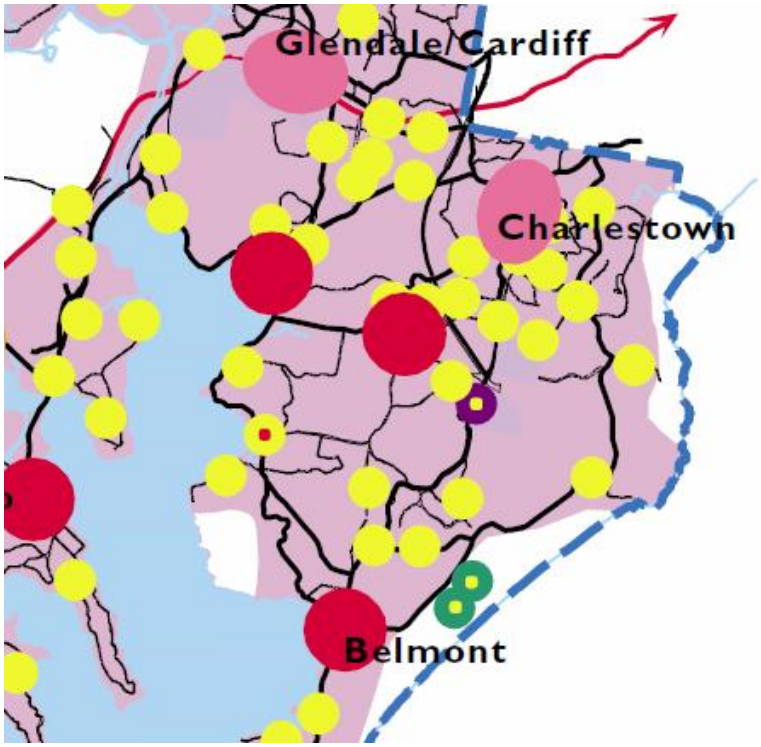

Figure 2.2_Centres Hierarchy in proximity to the site

Regional Context

2.3_Transport

The primary road access to the Lake Macquarie area is from the Sydney to Newcastle Freeway (Freeway 1). The Pacific Highway (State Highway 111) provides a key route along the east side of the lake from Sydney to Newcastle.

Rail services link the area to Newcastle, Sydney and the Central Coast. The railway line runs on the western side of the Lake with key train stations located at Wyee, Morisset, Fassifern, Cockle Creek and Cardiff.

The nearest airport is at Newcastle.

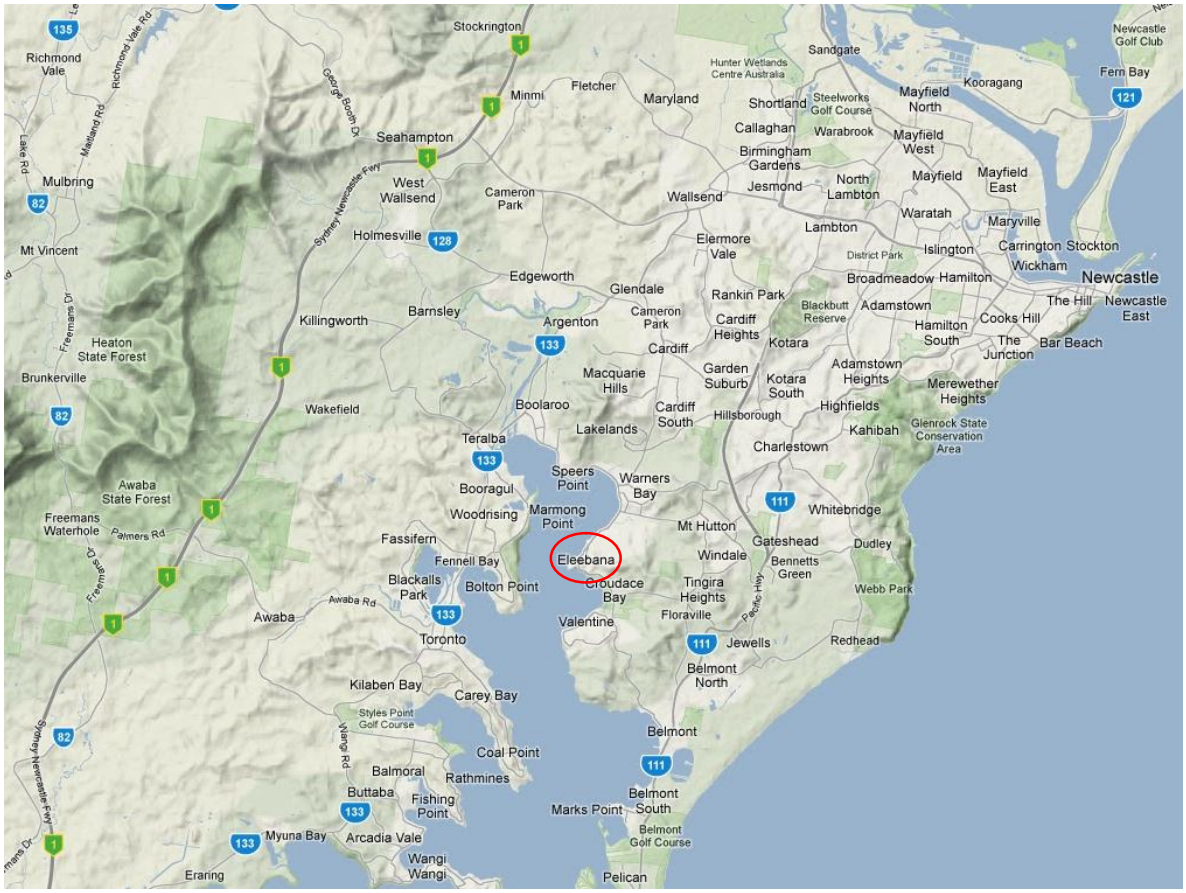

Figure 2.3_Road and Rail Access

2.4_Recreational Facilities

The lake provides an important recreational facility and is well used for fishing, sailing and other activities. An extensive cycle path network links the various lakeside communities.

Recreational facilities and activities on the north-east side of the Lake tend to be focussed around, and serviced by, the nearby town centres of Warners Bay and Belmont.

Warners Bay provides shopping, restaurants and cafés, and a waterfront walking path connecting Warners Bay with Speers Point. Other recreational facilities include an ice skating rink, indoor bowling centre and indoor swim and sporting centres.

Belmont has two major sailing clubs and a championship golf course, and offers restaurants, cafes and shopping. The Lake and the beaches of Blacksmiths and Redhead are easily accessible from Belmont.

The Green Point Nature Reserve to the south of the site covers an area of 220 hectares, including 3 kilometres of lake foreshore, and provides opportunities for cycling, walking and picnicking.

Regional Context

Figure 2.4_Recreational Facilities in the Area (Source: Lake Macquarie Visitor Guide Map)

3 ___ Description of the Site and Study Area

3.1_The Site

The subject site is located at 113 Wyndham Way, Eleebana, within the Lake Macquarie Local Government Area (LGA). The site has a legal description of Lot 414 DP 866775.

The site is located on the north-eastern side of Lake Macquarie, to the east of Halton Park. Macquarie Drive / Bareki Road to the west of the site forms part of the key road network that runs around the perimeter of the Lake. Macquarie Drive is separated from the site by a power transmission easement.

The site is further bounded by the road network with Tingira Drive to the south, and Wyndham Way / Stenhouse Drive / Gleeson Crescent to the east. A retirement village adjoins the site to the north.

Figure 3.1_Site Location

Description of the Site and Study Area

3.2_Study Area

113 Wyndham Way (Lot 414 DP 866775) ("the site") includes an identified Endangered Ecological Community (EEC) of Melaleuca scrub, which has previously been identified as occupying an area of 5.31ha in the western portion of the site (as shown in Figure 3.2). Council has determined that any future development of the site should occur outside of the EEC area, and therefore this LES is prepared for the remainder of the site, herein referred to as the "study area" and shown in Figure 3.2.

The study area is approximately 7.64ha in area, and occupies the eastern portion of the site.

Figure 3.2_Study Area (Source: Lake Macquarie City Council)

The study area contains no existing development, and is predominantly covered in dense vegetation. There is however some evidence of past disturbance, including tree-clearing and thinning, fire, earthworks and rubbish dumping, and weed invasion is evident in disturbed areas.

An informal walking track occurs on the site running from Stenhouse Drive in a westerly direction through the site to Macquarie Drive, roughly following the line of the watercourse.

A full description of the study area is provided through the detailed investigations undertaken as part of this LES and outlined in subsequent sections of this report, however an overview is provided here.

Description of the Site and Study Area

3.2.1_Study Area Photos

Fig 3.3_Study area, viewed from Tingira Road to the south (Source: HASSELL, 2010)

Fig 3.4_Study area, viewed from walking track through site (Source: HASSELL, 2010)

Description of the Site and Study Area

Fig 3.5_Study area, viewed from access way on Stenhouse Drive (Source: HASSELL, 2010)

Fig 3.6_Study area, viewed from Wyndham Way to the east (Source: HASSELL, 2010)

Description of the Site and Study Area

3.2.2_Topography

The site is generally flat and low-lying in the west and slopes up gently towards the eastern boundary, with a north-westerly aspect. The maximum elevation of the site is approximately 26 metres above sea level at Wyndham Way. The western portion of the site, where the Melaleuca Scrub has been mapped, ranges between 4 and 10 metres above sea level. The southern portion of the study area is steeper, with typical grades ranging from 3 to 5%.

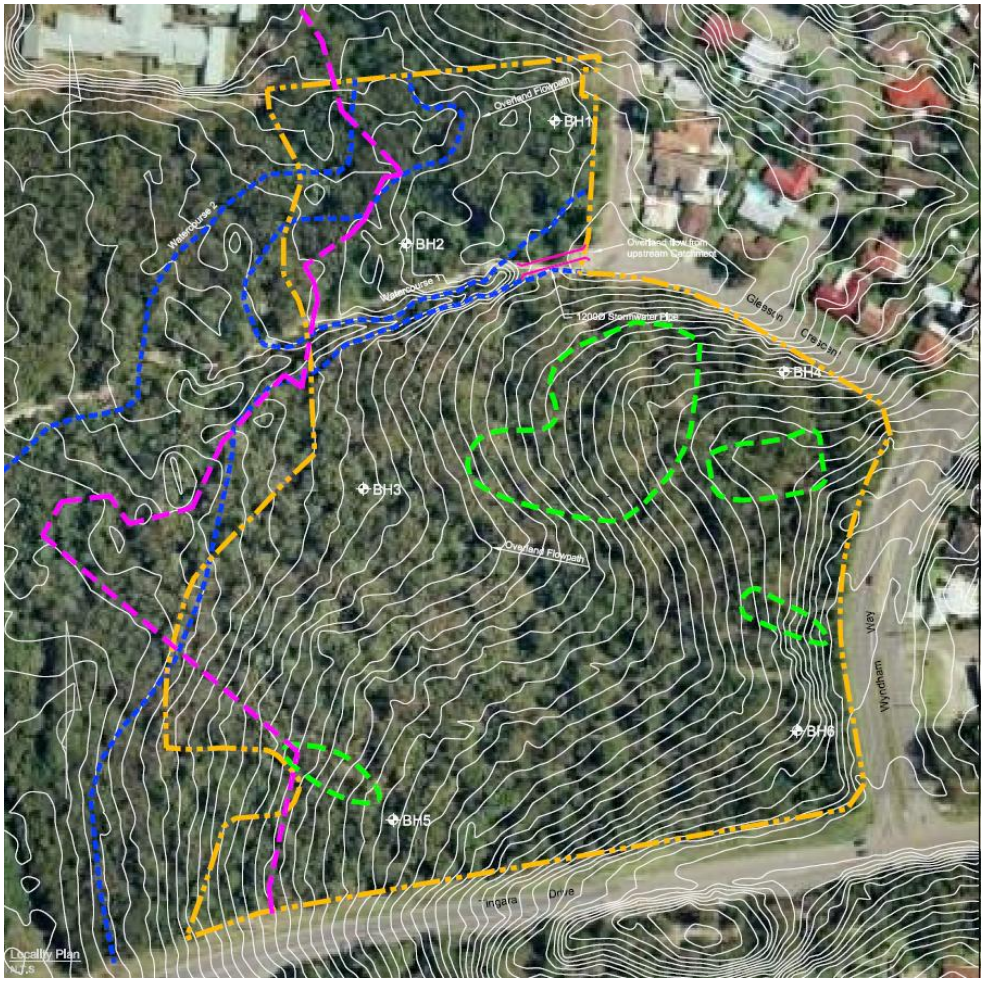

Fig 3.7_Site Topography (source RCA Australia)

3.2.3_Access

There are two formed vehicular access ways to the site, located at the corner of Stenhouse Drive and Gleeson Crescent (as shown in Figure 3.8), and at Gleeson Crescent just south of the adjacent retirement village (as shown in Figure 3.9).

Figure 3.8_Vehicle access, Stenhouse Drive (Source: Google Maps 2010)

Figure 3.9_Vehicle access, Gleeson Crescent (Source: Google Maps 2010)

Description of the Site and Study Area

3.2.4_Water Courses and Drainage

There are two indentified watercourses on the site. Both watercourses collect runoff from upstream urban and bushland areas. These watercourses join immediately to the west of the study area and drain to the west, into Lake Macquarie. A small ephemeral overland flow path is aligned in a north-westerly direction through the south-eastern portion of the site. An existing stormwater pipe currently discharges uncontrolled drainage onto the site.

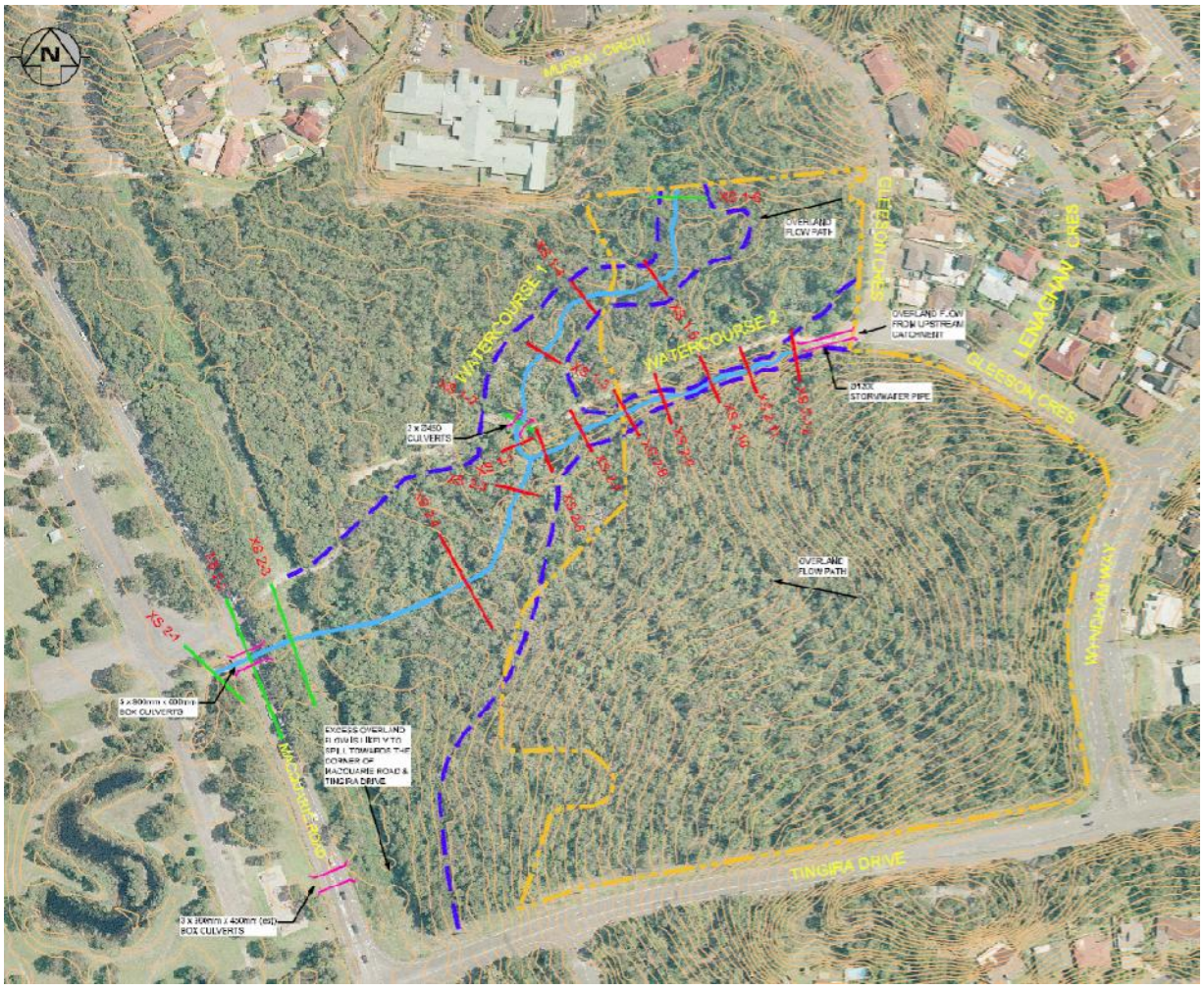

Figure 3.10_Identified watercourses on the site (Source: WorleyParsons, 2010)

Description of the Site and Study Area

Figure 3.11_Headwall and outlet of Watercourse 2 (Source: HASSELL, 2009)

Description of the Site and Study Area

3.2.5_Surrounding Development

Residential development interspersed with areas of natural vegetation predominates to the north, east and south of the site. Allotment sizes predominantly fall within the range of 650 square metres to 1000 square metres. East of the site, across Wyndham Way (corner of Tingira) is a Telstra site supporting utility infrastructure.

A seniors living development (retirement village) is located directly to the north of the site (St Francis Retirement Village).

To the west of the site is Halton Park and Lake Macquarie.

Figure 3.12_Development to the east of the site, Wyndham Way (Source: HASSELL, 2009)

Description of the Site and Study Area

Figure 3.13_Development to the east of the site, Wyndham Way (Source: HASSELL, 2009)

Figure 3.14_Development on Stenhouse Drive (viewed from Wyndham Way) (Source: HASSELL, 2009)

Description of the Site and Study Area

Figure 3.15_Development on Gleeson Crescent (viewed from site access way, corner of Stenhouse Drive and Gleeson Crescent) (Source: HASSELL, 2009)

Figure 3.16_Entrance to Retirement Village located to the north of the site (viewed from Gleeson Crescent) (Source: Google Maps, 2010)

Description of the Site and Study Area

Figure 3.17_ Retirement Village located to the north of the site (viewed from Murray Circuit) (Source: Google Maps, 2010)

Figure 3.18_Electricity easement to the west of the site (Source: HASSELL, 2009)

Description of the Site and Study Area

Figure 3.19_Halton Park located to the west of the site across Macquarie Drive (Source: HASSELL, 2009)

Figure 3.20_Tingira Road, south of the site, looking east (Source: HASSELL, 2009)

Description of the Site and Study Area

Figure 3.21_Tingira Road, south of the site, looking west (Source: HASSELL, 2009)

4 ___ Commonwealth, State and Regional Planning Considerations

This section of the report considers the Commonwealth, State and Regional planning framework of relevance to the site and the proposed development.

4.1_Commonwealth Legislation

4.1.1_Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is a Commonwealth level piece of legislation with the following objectives:

_ to provide for the protection of the environment, especially those aspects of the environment that are matters of national environmental significance;
_ to promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources;
_ to promote the conservation of biodiversity;
_ to provide for the protection and conservation of heritage;
_ to promote a co-operative approach to the protection and management of the environment involving governments, the community, land-holders and indigenous peoples;
_ to assist in the co-operative implementation of Australia's international environmental responsibilities;
_ to recognise the role of indigenous people in the conservation and ecologically sustainable use of
_ biodiversity; and
_ to promote the use of indigenous peoples' knowledge of biodiversity with the involvement of, and in co-operation with, the owners of the knowledge.

The EPBC Act requires that proposals for development or actions that are likely to have a significant impact on any matter of national environmental significance are referred to the Commonwealth Environment Minister for consideration and, if appropriate, approval sought. Matters of national environmental significance include where a significant impact may occur on a threatened, vulnerable or endangered species, ecological community or migratory species. The study area includes species listed under the EPBC Act including:

_ Black-eyed Susan (*Tetratheca juncea),* listed as 'vulnerable', known to occur on the subject site;
_ Grey-headed Flying-fox, listed as 'vulnerable', potential foraging habitat exists on the site;
_ Regent Honeyeater, listed as 'endangered', potential foraging habitat exists on the site; and
_ Swift Parrot, listed as 'endangered', potential foraging habitat exists on the site.

Extensive site analysis and flora and fauna surveys have been undertaken to inform this Study. Potential impacts on flora and fauna present on the site are considered in sections 7.1 and 7.2 of this report.

It is recommended that the Council refer the findings of this Study, and any intentions of a future rezoning to the Commonwealth Environment Minister for consideration.

4.2_State Legislation

4.2.1_Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) is the primary piece of legislation which controls planning matters in NSW. Part 3 of the EP&A Act covers the preparation of Environmental Planning Instruments such as a Local Environmental Plan (LEP), which this study will inform, and provides requirements for the form and content of an LEP as well as other matters such as required community consultation.

Section 5A of the EP&A Act requires that consideration must be given to whether an activity or development proposal is likely to pose a significant effect on threatened species, populations or ecological communities, or their habitats. If a significant effect is considered likely, a species impact statement (clause 78A(8)(b) and 112(1B) of the EP&A Act) must be prepared, in accordance with the *Threatened Species Conservation Act 1995*.

Potential impacts of development on flora and fauna present on the site are considered in sections 7.1 and 7.2 of this report.

_Ministerial Directions(Section 117)

The Minister for Planning, under section 117(2) of the *Environmental Planning and Assessment Act 1979*, issues directions that councils must follow when preparing new Local Environment Plans (LEPs). The Ministerial Directions of relevance to the study area are considered below.

Commonwealth, State and Regional Planning Considerations

Direction 1.3_Mining, Petroleum Production and Extractive Industries
The objective of this direction is to ensure that the future extraction of State or regionally significant reserves of coal, other minerals, petroleum and extractive materials are not compromised by inappropriate development. This direction applies when a council prepares a draft LEP that would have the effect of: prohibiting the mining of coal or other minerals, production of petroleum, or winning or obtaining of extractive materials; or restricting the potential development of resources of coal, other minerals, petroleum or extractive materials which are of State or regional significance by permitting a land use that is likely to be incompatible with such development.

Consultation with the NSW Department of Primary Industries (DPI) has been undertaken by Council under section 62 of the EP&A Act (refer to section 6.1.5 of this report). DPI have stated that they have no objection to the proposed rezoning of the site.

Direction 2.1_Environment Protection Zones
The objective of this direction is to protect and conserve environmentally sensitive areas, and it requires that a draft LEP includes provisions that facilitate the protection and conservation of environmentally sensitive areas.

A draft LEP may be inconsistent with the terms of this direction if the inconsistency is justified by an environmental study prepared in accordance with section 57 of the EP&A Act which gives consideration to the objectives of this direction (i.e. *to protect and conserve environmentally sensitive areas*). This LES considers the need to protect and conserve the identified environmental qualities of the site and surrounding area.

The site has been identified as having environmental values. The Local Environmental Study is supported by specialist investigations, including flora and fauna studies, to test the environmental sensitivities of this site. These studies have confirmed the site has areas of environmentally sensitive areas as demonstrated in the opportunities and constraints modelling. The Study recommends substantial areas of this site be retained for conservation.

Direction 2.2_Coastal Protection
The objective of this direction is to implement the principles in the NSW Coastal Policy, and is applicable to land within the coastal zone. Accordingly, a draft LEP shall include provisions that give effect to and are consistent with the:
_NSW Coastal Policy 1997;
_Coastal Design Guidelines 2003; and
_NSW Coastline Management Manual 1990.

The site is within the coastal zone, however it is considered that development will not give rise to any inconsistencies with the above policies.

Direction 2.3_Heritage Conservation
This direction states that a draft LEP shall contain provisions that facilitate the conservation of Aboriginal and European heritage items.

A heritage assessment of the study area has been undertaken which has identified that there are no known Aboriginal or European heritage items present (refer to section 7.8 of this report).

Direction 3.1_Residential Zones
The objectives of this direction are:
_ to encourage a variety and choice of housing types to provide for existing and future housing needs;
_ to make efficient use of existing infrastructure and services and ensure that new housing has appropriate access to infrastructure and services; and
_ to minimise the impact of residential development on the environment and resource lands.

This LES considers the appropriateness of residential development within the study area, with regards to State, regional and local housing policy as well as potential impacts associated with such development. This Study, after considering the environmental and planning constraints to this site, recommends part of the site is suitable for urban development which includes residential opportunities.

Commonwealth, State and Regional Planning Considerations

Direction 3.4_Integrating Land Use and Transport
The objective of this direction is to ensure that urban structures, building forms, land use locations, development designs, subdivision and street layouts achieve the following planning objectives:
_ improving access to housing, jobs and services by walking, cycling and public transport;
_ increasing the choice of available transport and reducing dependence on cars;
_ reducing travel demand including the number of trips generated by development and the distances travelled, especially by car;
_ supporting the efficient and viable operation of public transport services; and
_ providing for the efficient movement of freight.

A draft LEP shall locate zones for urban purposes and include provisions that give effect to and are consistent with aims, objectives and principles of:
_ *Improving Transport Choice – guidelines for planning and development* (DUAP 2001)
_ *The Right Place for Business and Services – Planning Policy* (DUAP 2001)

The LES takes into considerations the findings of Better Transport Futures, informing site capacity and access to established transport infrastructure. The site is well served by public transport, and any future of the site as neighbourhood shops would provide a local service, within walking distance of surrounding residences reducing reliance on travel to other local centres.

Direction 4.2_Mine Subsidence and Unstable Land
The objective of this direction is to prevent damage to life, property and the environment on land identified as unstable or potentially subject to mine subsidence. This direction states that the Mine Subsidence Board must be consulted where a draft LEP would permit development on land within a Mine Subsidence District.

As the site is within the Lake Macquarie Mine Subsidence District, the Mine Subsidence Board (MSB) has been consulted by Council under section 62 of the EP&A Act (refer to section 6.1.6 of this report), with MSB stating that they have no objection to the proposed rezoning of the site. WorleyParsons have also consulted with MSB and guidelines have been provided for surface development on the site (refer to section 7.6 of this report).

Direction 4.3_Flood Prone Land
This direction applies when council prepares a draft LEP that creates, removed or alters a zone or a provision that affects flood prone land.

The flood liability of the site has been assessed at the subject site. A stormwater and flooding assessment has been undertaken as part of the LES (refer to section 7.7 of this report). Any future development of the site would be isolated to land which is suitably for urban purposes and measures have been recommended to mitigate the effects of flooding risk on future urban development.

Direction 4.4_Planning for Bushfire Protection
This direction applies when a council prepares a draft LEP that affects or is in close proximity to land mapped as bushfire prone land, and requires consultation with the NSW Rural Fire Service (RFS), as well as the establishment of Asset Protection Zones.

The site is identified as bushfire prone land. The bushfire risk has been assessed at the subject site (refer to section 7.3 of this report) and measures have been recommended to mitigate the effects of this risk, consistent with the *Planning for Bushfire Protection Guidelines 2006*. The RFS have been consulted by Council under section 62 of the EP&A Act (refer to section 6.1.4 of this report).

Direction 5.1_Implementation of Regional Strategies
This direction states that draft LEPs shall be consistent with a regional strategy released by the Minister for Planning.

Consideration of the Lower Hunter Regional Strategy has been undertaken as part of this LES, and is outlined in section 4.4 of this report. Recommendations of this Study remain consistent with the objectives of the Strategy.

Commonwealth, State and Regional Planning Considerations

4.2.2_Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) provides lists of threatened and vulnerable species, populations and ecological communities, and "key threatening processes" such as clearing of native vegetation and loss of hollow-bearing trees. The study area includes threatened species covered by the TSC Act, and development of the site may constitute a key threatening process as it will require the removal of native vegetation. The potential impacts of development on flora and fauna has been taken into consideration within this LES (refer to sections 7.1 and 7.2 of this report).

4.2.3_National Parks and Wildlife Act 1974

Schedule 13 (Protected Native Plants) of the *National Parks and Wildlife Act 1974* (NPW Act) classifies certain plants as protected native plants. Under the Act all Orchidaceae (Orchids) native to NSW are protected, and this is directly relevant to the LES as the site contains native orchids.

The potential impacts of development on flora has been taken into consideration within this LES (refer to section 7.1 of this report).

4.2.4_Native Vegetation Act 2003

The *Native Vegetation Act 2003* (NV Act) regulates the clearing of native vegetation on NSW land. The provisions of the Act do not apply to urban areas, which includes land zoned residential, village, township, industrial or business, or having the substantial character of such a zone. Therefore whilst the current zoning of the site means the NV Act is applicable, if parts of the land are rezoned to an urban zoning (as proposed), the provisions of the NV Act will no longer apply.

Under the NV Act, consent for broad scale clearing of native vegetation is not to be granted unless it will "improve or maintain environmental outcomes".

The potential impacts of development on flora has been taken into consideration within this LES (refer to section 7.1 of this report).

4.2.5_Coastal Protection Act 1979

The site is within the Coastal Protection Zone surrounding Lake Macquarie, and is therefore subject to the *Coastal Protection Act 1979* (CP Act).

Under the Act, a public authority shall not grant or carry out development in the coastal zone if it will be inconsistent with the principles of ecologically sustainable development, or adversely affect (or be affected by) the behaviour of the Lake.

Ecologically sustainable development principles are considered in this report. The LES addresses relevant matters such as stormwater and flooding (refer to sections 7.7 and 8.3 of this report) and contamination (refer to section 7.5 of this report), and it is considered that site development will not impact upon the Lake.

Commonwealth, State and Regional Planning Considerations

4.3_State Environmental Planning Policies

The following State Environmental Planning Policies (SEPPs) are applicable to the preparation of any LEP amendment to support a rezoning of the site.

4.3.1_State Environmental Planning Policy No 19–Bushland in Urban Areas

State Environmental Planning Policy No 19-Bushland in Urban Areas (SEPP 19) seeks to protect and preserve bushland within urban areas, for its value to the community as part of natural heritage, its aesthetic value, and its value as a recreational, educational and scientific resource. Lake Macquarie is listed as an area to which the Policy applies.

The aims of the policy are:

_ to protect the remnants of plant communities which were once characteristic of land now within an urban area,
_ to retain bushland in parcels of a size and configuration which will enable the existing plant and animal communities to survive in the long term,
_ to protect rare and endangered flora and fauna species,
_ to protect habitats for native flora and fauna,
_ to protect wildlife corridors and vegetation links with other nearby bushland,
_ to protect bushland as a natural stabiliser of the soil surface,
_ to protect bushland for its scenic values, and to retain the unique visual identity of the landscape,
_ to protect significant geological features,
_ to protect existing landforms, such as natural drainage lines, watercourses and foreshores,
_ to protect archaeological relics,
_ to protect the recreational potential of bushland,
_ to protect the educational potential of bushland,
_ to maintain bushland in locations which are readily accessible to the community, and
_ to promote the management of bushland in a manner which protects and enhances the quality of the bushland and facilitates public enjoyment of the bushland compatible with its conservation

Clause 10 of the SEPP requires Council to have regard to the general and specific aims of the Policy when preparing a Draft LEP, and to give priority to retaining bushland, unless it is satisfied that significant environmental, economic or social benefits will arise which outweigh the value of the bushland. This LES considers that development is possible on the site provided the identified areas containing threatened and vulnerable species, and supporting habitat, are protected. Flora and fauna impacts are considered in sections 7.1 and 7.2 of this report.

4.3.2_State Environmental Planning Policy No 44–Koala Habitat Protection

The aims of *State Environmental Planning Policy No 44–Koala Habitat Protection* (SEPP 44) are to encourage the conservation and management of natural vegetation areas that provide habitat for koalas. Lake Macquarie LGA is listed as an area to which the Policy applies.

According to clause 15 of the SEPP, Council should make or amend a local environmental plan to include land identified as a core koala habitat within an environmental protection zone, or to identify land that is a core koala habitat and apply special provisions to control the development of that land. A Council can also be required to prepare an environmental study of the land to which a draft local environmental plan applies if it is proposed to zone (or rezone) land that is a potential koala habitat or a core koala habitat other than as environment protection (clause 16).

A flora and fauna assessment has been undertaken by WorleyParsons as part of this LES, which identifies that the study area does not contain potential koala habitat (refer to section 7.2 of this report). Accordingly, any proposed rezoning recommended in this LES will not require further assessment under SEPP 44.

4.3.3_State Environmental Planning Policy No 55–Remediation of Land

State Environmental Planning Policy No 55—Remediation of Land (SEPP 55) provides a State wide planning approach to the remediation of contaminated land.

Clause 6 of SEPP 55 requires that contamination and remediation are considered in the preparation of an environmental planning instrument. Council must consider whether the land is contaminated, and if so whether it is suitable for the intended use of the land, and ensure that any necessary remediation is undertaken before the land is used for the intended purpose.

Commonwealth, State and Regional Planning Considerations

A Phase 1 Environmental Investigation for the study area has been undertaken as part of the preparation of this LES, which has not identified any significant contamination (refer to section 7.5 of this report).

4.3.4_State Environmental Planning Policy No 71–Coastal Protection

The site is located within the coastal zone of Lake Macquarie, and as such is subject to *State Environmental Planning Policy No 71–Coastal Protection* (SEPP 71). The policy identifies State significant development in the coastal zone, requires certain development applications to carry out development in sensitive coastal locations to be referred to the Director General for comment, and identifies master plan requirements for certain development in the coastal zone.

The aims of SEPP 71 of relevance to the site include:

_ to protect and manage the natural, cultural, recreational and economic attributes of the New South Wales coast
_ to protect and improve existing public access to and along coastal foreshores to the extent that this is compatible with the natural attributes of the coastal foreshore
_ to ensure that new opportunities for public access to and along coastal foreshores are identified and realised to the extent that this is compatible with the natural attributes of the coastal foreshore
_ to protect and preserve Aboriginal cultural heritage, and Aboriginal places, values, customs, beliefs and traditional knowledge
_ to ensure that the visual amenity of the coast is protected
_ to protect and preserve native coastal vegetation
_ to manage the coastal zone in accordance with the principles of ecologically sustainable development
_ to ensure that the type, bulk, scale and size of development is appropriate for the location and protects and improves the natural scenic quality of the surrounding area

Council must take into account the matters for consideration set out in clause 8 of the SEPP when preparing a draft local environmental plan, including the following of relevance to the site:

_ the aims of this Policy
_ existing public access to and along the coastal foreshore for pedestrians or persons with a disability should be retained and, where possible, public access to and along the coastal foreshore for pedestrians or persons with a disability should be improved
_ opportunities to provide new public access to and along the coastal foreshore for pedestrians or persons with a disability
_ the suitability of development given its type, location and design and its relationship with the surrounding area
_ any detrimental impact that development may have on the amenity of the coastal foreshore, including any significant overshadowing of the coastal foreshore and any significant loss of views from a public place to the coastal foreshore
_ the scenic qualities of the New South Wales coast, and means to protect and improve these qualities
_ measures to conserve animals (within the meaning of the Threatened Species Conservation Act 1995) and plants (within the meaning of that Act), and their habitats
_ existing wildlife corridors and the impact of development on these corridors
_ the likely impact of coastal processes and coastal hazards on development and any likely impacts of development on coastal processes and coastal hazards
_ measures to reduce the potential for conflict between land-based and water-based coastal activities
_ measures to protect the cultural places, values, customs, beliefs and traditional knowledge of Aboriginals
_ likely impacts of development on the water quality of coastal water bodies
_ the conservation and preservation of items of heritage, archaeological or historic significance
_ the means to encourage compact towns and cities

The site is located approximately 450 metres from the lake foreshore and is separated by Halton Park and the EEC area to the west of the site which is to be retained. Development of the site is not expected to result in any direct impacts to coastal processes or to negatively impact upon amenity or visual values of the coast.

Assessments undertaken as part of this LES have considered the potential impacts of site development on environmental processes including stormwater runoff, flora and fauna, bushfire, as well as a visual analysis, and consideration of social and economic issues. Furthermore, the LES recommends mitigation measures to ensure there are no adverse impacts on the locality, including the coastal area. It is considered that a draft LEP based on the recommendations of this Study would be able to take into account the matters for consideration, meeting the key objectives of the SEPP.

Commonwealth, State and Regional Planning Considerations

4.3.5_State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004
State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004 (Seniors SEPP) aims to encourage the provision of housing (including residential care facilities) that will increase the supply and diversity of residences that meet the needs of seniors or people with a disability, make efficient use of existing infrastructure and services, and be of good design.

The Seniors SEPP applies to land zoned primarily for urban purposes, and therefore will be applicable to the site should it be rezoned for urban purposes. The Social Impact Assessment (SIA) undertaken as part of this LES (refer to section 9.1 of this report) considers the current and future demographic profile of the area, and associated housing requirements. In considering an urban zone for the land, a potential for seniors living accommodation on the site is introduced. Any future development application for a seniors living facility would need to consider the constraints of the site, and surrounding environmental conservation qualities.

This SEPP facilitates future seniors living development on the site, and is not considered to negatively impact upon the future potential urban rezoning of a portion of the site.

4.3.6_State Environmental Planning Policy (Affordable Rental Housing) 2009
State Environmental Planning Policy (Affordable Rental Housing) 2009 (Affordable Housing SEPP) establishes a consistent planning regime for the provision of affordable rental housing. The policy provides incentives for new affordable rental housing, facilitates the retention of existing affordable rentals, and expands the role of not-for-profit providers. It also aims to support local centres by providing housing for workers close to places of work, and facilitate development of housing for the homeless and other disadvantaged people.

The SEPP allows for development of some affordable rental housing without consent, and provides criteria and development standards. If the study area is rezoned to residential uses, development under this SEPP may be possible. Issues related to housing affordability are considered within the Social Impact Assessment (refer to section 9.1 of this report).

The SEPP facilitates the opportunity for affordable housing should the site be rezoned for urban purposes.

4.3.7_State Environmental Planning Policy (Infrastructure) 2007
State Environmental Planning Policy (Infrastructure) 2007 (Infrastructure SEPP) provides a consistent planning regime for infrastructure and the provision of services across NSW. The SEPP outlines certain infrastructure works that can be undertaken without development consent, as well as development controls, for works such as educational establishments, hospitals, road and rail facilities. This is unlikely to be applicable to the study area.

In addition, clause 104 and Schedule 3 of the Infrastructure SEPP provides criteria for when traffic generating developments must be referred to the Roads and Traffic Authority (RTA). As the site has access to a road that connects to a classified road, the size or capacity of development that would trigger referral to the RTA includes the following potentially relevant classifications:
_ Subdivision of land: 50 or more allotments
_ Shops: 500sqm

Referral to the RTA under the Infrastructure SEPP may be relevant at the master planning or development application stage for future subdivision or development of lands should Council proceed with an urban rezoning of lands.

Further liaison with the RTA is recommended following finalisation of a rezoning classification with likely yield of residential and/ or retail components. A traffic impact assessment has been undertaken as part of this LES and is outlined in section 8.1 of this report.

Commonwealth, State and Regional Planning Considerations

4.3.8_State Environmental Planning Policy (Major Development) 2005

State Environmental Planning Policy (Major Development) 2005 (Major Development SEPP) defines certain developments that are major projects to be assessed under Part 3A of the *Environmental Planning and Assessment Act 1979* and determined by the Minister for Planning. It also provides planning provisions for State significant sites.

Specifically, the SEPP applies to the subject site where future development may include:

> *(a) caravan parks and tourist and visitor accommodation:*
>
> *(i) in the case of development wholly or partly in a sensitive coastal location outside the metropolitan coastal zone—that provide accommodation (or additional accommodation) for 10 persons or more, or*
>
> *(ii) in the case of development wholly or partly in a sensitive coastal location in the metropolitan coastal zone—that provide accommodation (or additional accommodation) for 100 persons or more, or*
>
> *(iii) in the case of development outside a sensitive coastal location that is not connected to an approved sewerage treatment work or system—that provide accommodation (or additional accommodation) for 25 persons or more,*
>
> *(b) buildings or structures (other than minor alterations or minor additions to existing buildings or structures) that are greater than 13 metres in height, excluding any building that complies with all development standards relating to the height of such a building set by a local environmental plan that applies to the land on which the building is located,*
>
> *(c) subdivision of land into more than 5 lots but not more than 100 lots, if more than 5 of the lots will not be connected to an approved sewage treatment work or system,*
>
> *(d) subdivision for residential purposes of land that is not in the metropolitan coastal zone (unless it is wholly or partly in a sensitive coastal location) into more than 25 lots but not more than 100 lots,*
>
> *(e) subdivision for rural-residential purposes of land that is not in the metropolitan coastal zone (unless it is wholly or partly in a sensitive coastal location) into more than 5 lots but not more than 25 lots.*
>
> *(SEPP cl 13C)*

This SEPP may be applicable at development application stage, depending on the nature of development proposed. Therefore, the Minister for Planning may become the consent authority for any future development on the site.

4.3.9_State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004

Any future dwellings on the site would be subject to the water and energy efficiency requirements of *State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004* when applying for development consent.

This Policy is not considered to impact upon the findings of this Study.

4.4_Lower Hunter Regional Strategy 2006

In 2006 the Department of Planning released the Lower Hunter Regional Strategy (LHRS), which applies to the five local government areas of Lake Macquarie, Newcastle, Port Stephens, Maitland and Cessnock. The primary purpose of the LHRS is *"to ensure that adequate land is available and appropriately located to sustainably accommodate the projected housing and employment needs of the region's population over the next 25 years"* (LHRS:preface).

The LHRS is based upon a population growth scenario of an additional 160,000 persons in the Lower Hunter region, to reach a forecast regional population of 675,000 persons by 2031. An additional 115,000 dwellings are estimated to be required to accommodate the region's growing and changing population over the next 25 years.

The major regional centres of Charlestown and Glendale (emerging centre) identified in the LHRS have targets of an additional 4,400 jobs and 3,200 dwellings for Charlestown and an additional 6,200 jobs and 4,000 dwellings for Glendale.

Town centres identified in the LHRS and in proximity to the subject site include Warners Bay, Mt Hutton, and Belmont. These centres are described as *"providing a shopping and business centre for the district, including health and professional services mixed with medium and higher density residential".*

Commonwealth, State and Regional Planning Considerations

Figure 4.1_Extract of Lower Hunter Regional Strategy Map, showing centres in the region.

The policies and strategies outlined in the LHRS include the following of particular relevance to the LES:

_ 60% of new dwellings are to be in new release areas and 40% within existing urban areas. Within the Lake Macquarie LGA the dwelling capacity projects are 36,000 new dwellings, with 21,000 to be provided as infill development (14,000 within centres and corridors, and 7,000 as other urban infill).
_ Seek higher residential densities in and around major centres to maximise proximity to employment and services and the use of existing infrastructure, while maintaining amenity.
_ Concentrate employment and residential development in proximity to public transport to maximise transport access.
_ Plan for a range of housing types of appropriate densities, location and suitability that are capable of adapting and responding to the ageing of the population.
_ Ensure a mix of housing types in proximity to employment to provide the necessary supply of labour locally. This includes housing for lower as well as higher income groups to fill the diversity of employment opportunities provided.

This Local Environmental Study has critically analysed the opportunity for both dwellings and local neighbourhood shops to be accommodated at the subject site to meet the growing population demands in this location. Based on significant environmental constraints, the site has limited capacity to support substantial residential land subdivision. A portion of land has been identified as being suitable to support urban purposes which could include a range of low density residential or a neighbourhood shop function, however, the intensity of these would be subject to detailed environmental assessment at master planning and development design stages.

Commonwealth, State and Regional Planning Considerations

It is considered that the dedication of portion of the subject site for urban purposes, while retaining the environmental integrity of the site, remains consistent with the LHRS.

Achieving a small scale neighbourhood shopping facility on the site would remain consistent with the LHRS, depending upon the scale and type of shopping facility introduced. A small scale shop, serving the immediate residential population would not compromise the commercial integrity of the designated hierarchy of centres. A detailed economic impact analysis would need to accompany any future development application for retail uses at the site.

The LHRS recognises that a number of important green corridors run through the region and recognises the importance of large vegetated areas being linked via habitat corridors at a landscape scale. Key environmental challenges identified for the region include accommodating significant population growth whilst protecting and managing the biodiversity and conservation values of the key green corridors of the region, and maintaining or improving the biodiversity value of the region.

This is of particular relevance to the LES which seeks to balance the need to identify future potential residential lands to cater to projected population growth with the identified conservation values of the study area. This matter is fully assessed as part of this LES with identified green corridors and identified flora and fauna habitat corridors nominated for protection.

4.5_Lower Hunter Regional Conservation Plan

In 2009 the Department of Environment & Climate Change released the Lower Hunter Regional Conservation Plan (LHRCP) as a partner document to the Lower Hunter Regional Strategy. The LHRCP sets out a 25-year program to direct and drive biodiversity conservation efforts in the Lower Hunter region.

The LHRCP seeks to assess the extent of the biodiversity impacts of the Lower Hunter Regional Strategy and to recommend priority areas for investment in biodiversity conservation and environmental repair and restoration to offset these impacts.

The primary objectives of the LHRCP are:
_ describing the conservation values of the Lower Hunter Region;
_ analysing the current status of biodiversity within the region, and assessing the likely impacts of development on biodiversity;
_ assessing the biodiversity values of the region, at a landscape scale, and identifying strategic areas for biodiversity protection, enhancement or restoration;
_ contributing to a practical framework that can secure, improve or maintain biodiversity values as the Hunter grows over the next 25 years; and
_ guiding local level planning with respect to biodiversity, including the development of local biodiversity conservation strategies and the development of new Local Environmental Plans (LEP) that can merit biodiversity certification.

Areas of high conservation value are identified in the LHRCP, and the study area is recognised as lying within an area containing a regionally significant squirrel glider population and wildlife corridors of state significance, as shown in figure 4.2 below.

Those areas of high conservation value which have not been incorporated into new formal reserves have been identified as suitable for protection using a suite of other conservation mechanisms. These include BioBanking, voluntary conservation agreements under the NPW Act, environment protection zonings or appropriate conservation management plans. The suitability of an environment protection zoning for the study area is considered as part of this LES.

Commonwealth, State and Regional Planning Considerations

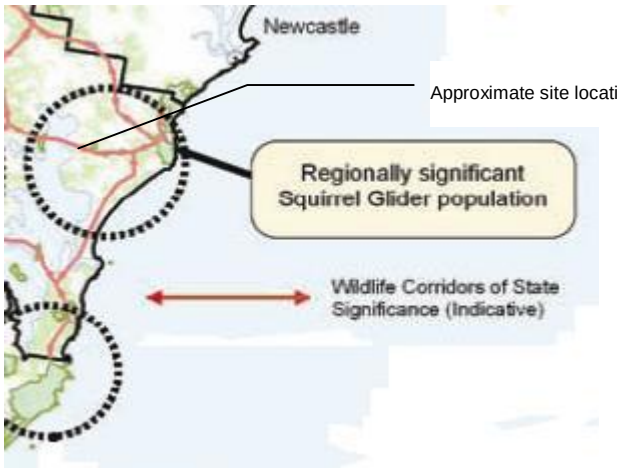

Figure 4.2_Extract from "Map 3: Other regional investment priorities for the Lower Hunter Region" (Source: Lower Hunter Regional Conservation Plan)

4.6_Hunter-Central Rivers Catchment Action Plan

The Hunter-Central Rivers Catchment Action Plan (CAP) is prepared by the Hunter-Central Rivers Catchment Management Authority. The Hunter CAP provides guiding principles for resource management in the Hunter-Central Rivers region.

Guiding principles within the Hunter CAP of relevance to the LES include:

Minimising habitat destruction and improving the condition of habitat

_ Protecting biodiversity should be achieved through regulatory and planning controls to prevent species and habitat decline, forming conservation areas for long-term protection (e.g. parks, reserves and aquatic reserves) and appropriate planning that considers future impacts (such as climate change and population increases) on biodiversity.
_ Broad scale clearing of native vegetation as defined by the Native Vegetation Act 2003 should end.
_ Regionally significant vegetation (RSV) should be protected and all representative vegetation communities be retained.
_ The habitat of threatened species, communities and populations should be protected and, where possible, improved. Key threatening processes should be taken into consideration in planning land use change.
_ Where practical, future development (e.g. residential, industrial) should be restricted to primarily cleared land. Where loss of vegetation is unavoidable, native vegetation offsets should be used.
_ Local environment plans should aim to manage native vegetation to be consistent with a regional approach to biodiversity management which co-ordinates policies from the Native Vegetation Act 2003 and other relevant legislation.
_ Planning for biodiversity should improve the health of ecosystems by increasing the connectivity and the size of habitat remnants.
_ Management plans for existing threatened species and communities should be completed if they do not already exist.

Managing pests and weeds

_ Restoring habitat so that it is healthy will enable native species to out-compete exotic species.
_ It is important to identify and monitor emerging weed and pest threats so that they can be managed before they establish themselves.
_ A coordinated approach to pest and weed management is needed to restore the health of ecosystems.

Bushfire management

_ Clearing of Asset Protection Zones (APZs) is primarily an exempted activity under the Native Vegetation Act 2003. APZs (where vegetation is largely cleared around infrastructure) are needed to protect property but it is important to minimise the loss of biodiversity when they are used.

Commonwealth, State and Regional Planning Considerations

The principles of the Hunter CAP are reflected within the LES, with consideration given to the conservation of biodiversity and the protection of the identified threatened and vulnerable species on the site. Proposed zoning (refer to section 10.2 of this report) incorporates protection of these areas.

Furthermore, management measures are recommended within the LES (refer to section 11 of this report) to improve the conservation values of the site, including the preparation of a Vegetation Management Plan which should include strategies to manage pests and weeds.

Bushfire management is also considered within this LES (refer to section 7.3 of this report).

5 ___ Local Planning Considerations

5.1_Lifestyle 2020 Strategy

The Lifestyle 2020 Strategy, adopted in 2002, is a major planning initiative for Lake Macquarie that provides the strategy necessary to manage the population and employment growth expected to occur in the Council area up to the year 2020, and provides the long term direction for the overall development of the City.

The strategy aims to:

_ Provide the community with a realistic expectation about the future development patterns of the City, while retaining flexibility for land use decision making in the longer term;
_ Reinforce and strengthen Centres so that a wide range of commercial and community services may be provided in a timely and accessible manner;
_ Provide local employment opportunities for residents and to promote economic development consistent with the City's natural, locational and community resources;
_ Guide the development of urban communities which are compact, distinct and diverse with a range of housing types and activities;
_ Achieve a strong sense of positive community identity, through the development of local communities which are safe and liveable and offer a diversity of use, economic opportunity and ready access to services;
_ Develop an attractive urban setting for the City which reflects its physical and natural environment, and visual character;
_ Manage the City's natural environment so that its ecological functions and biological diversity are conserved and enhanced, and contribute to the City's overall well being;
_ Manage the City's heritage and economic resources, in a way that protects the value of these resources and enhances the City's character; and
_ Integrate land use with the efficient provision of public and private movement systems.

The Lifestyle 2020 Strategy recognises that the pattern of existing urban development and character is strongly influenced by the Lake, and considers that the City will prosper and support its community through the adoption of a hierarchy of centres. Centres are intended to increasingly act as the focus for:

_ Commercial and retail activity;
_ Service delivery and employment opportunities;
_ Safe, convenient and accessible public transport;
_ Meeting places for social and community interaction and recreation; and
_ Medium density housing and mixed-use development incorporating housing.

The study area is highlighted with the Lifestyle 2020 Strategy as a neighbourhood centre under investigation, as shown in Figure 5.1.

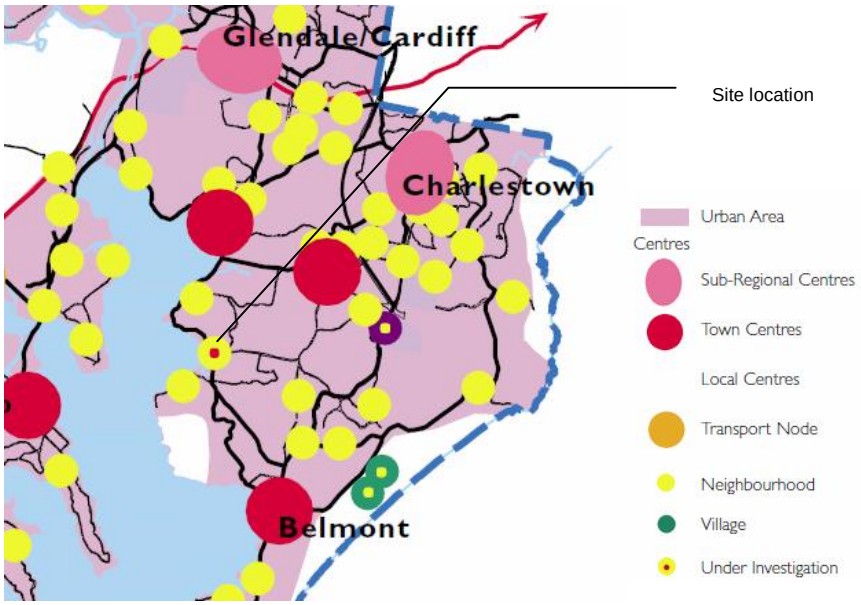

Figure 5.1_Centres Hierarchy in the site locality (Source: Lifestyle 2020 Strategy)

Local Planning Considerations

Under the Strategy, neighbourhood centres are considered as part of the "local centres" classification that:
_ Predominantly serve a local business and residential community;
_ Provide retail and business services and may also include social services or community facilities;
_ Provide opportunities for employment;
_ Are located on public transport routes between Sub-Regional and Town Centres or may benefit from their proximity to the rail network; and
_ Express the character of the local area.

There are currently no local centres within walking distance (400 metres) of the site and surrounding area, with the nearest neighbourhood centre being located approximately 1.8 kilometres away at Valentine. Shopping facilities at Valentine consist of a small number of local retailers including a chemist, newsagent, small grocery store, butcher, bottle shop, post office, Chinese restaurant and a take away food shop.

Larger town centres in proximity to the site include:
_ Warners Bay (approximately 3.5 kilometres north);
_ Mount Hutton (approximately 4 kilometres north east); and
_ Belmont (approximately 5 kilometres south east).

Consideration of the suitability of providing a neighbourhood centre within the study area is provided within this LES.

In relation to the desired form of urban development, the Strategy states that a substantial part of the City's urban area is intended to remain in the form of low rise, detached housing on individual lots of various sizes. Medium density housing (including retirement homes, townhouses, small lot housing, apartments, shop top housing and dual occupancy) is promoted within a five minute walk of centres and bus stops.

The Lifestyle 2020 Strategy includes a Green System Map which identifies land and water elements that are intended to enhance the long term biodiversity, scenic amenity and liveability of the City. It is intended to ensure that these elements are valued, retained and managed as part of an integrated system.

The Strategy identifies "high value habitat" areas which contain significant stands of vegetation or important remnants of vegetation communities. These areas are valued for the preservation of the vegetation in its own right and/or as habitat for wildlife as core areas of habitat, movement corridors for flora and fauna, or refuges for migratory fauna. It is intended that a majority of these lands be protected and enhanced to ensure the retention of the City's and Region's biodiversity. The Strategy also states that existing corridors should be protected and enhanced, and disjointed corridors restored to provide the necessary links between habitat areas.

As the study area has been identified as an area of high habitat value, the policy within the Lifestyle 2020 Strategy regarding desired retention of such high value habitat areas and corridors has been taken into account within this Study.

Local Planning Considerations

5.2_Lake Macquarie Local Environmental Plan 2004

The *Lake Macquarie Local Environmental Plan* 2004 (LMLEP) is the principal environmental planning instrument that sets the framework for the land use structure of Eleebana and the wider Lake Macquarie area.

The objective of the LMLEP is to achieve development of land in accordance with the principles of ecologically sustainable development by:
_ promoting balanced development of that land; and
_ implementing the Lifestyle 2020 Strategy adopted by the Council on 27 March 2000.

5.2.1_Zoning

The study area is currently zoned 2(1) Residential, 6(1) Open Space and 10 Investigation Zone under the LMLEP, as shown below.

_ 2(1) Residential Zone - The objective of this zone is to allow low density forms of housing. It is noted that the surrounding residential land, adjacent to or adjoining the subject site are zoned 2(1) Residential.
_ 6(1) Open Space Zone - Provides land intended for recreation use by the community, and to facilitate the preservation of the environmental qualities of the land.
_ 10 Investigation Zone - The key objective of this zone is to identify land for future investigation to allow for potential rezoning to support future development and/ or conservation.

The majority of the site is zoned 10 Investigation Zone and this is land intended for future development and/or conservation. Objectives within the LMLEP include to:
_ ensure that land in this zone is thoroughly assessed to identify and substantiate future uses;
_ provide for limited development of the land and allow that development only where it can be proven not to prejudice or have the potential to prejudice future protection or use of the land;
_ ensure that land is released in a strategic and efficient manner consistent with the Lifestyle 2020 Strategy; and
_ require comprehensive local environmental studies to substantiate the capability and suitability of land in this zone proposed for rezoning.

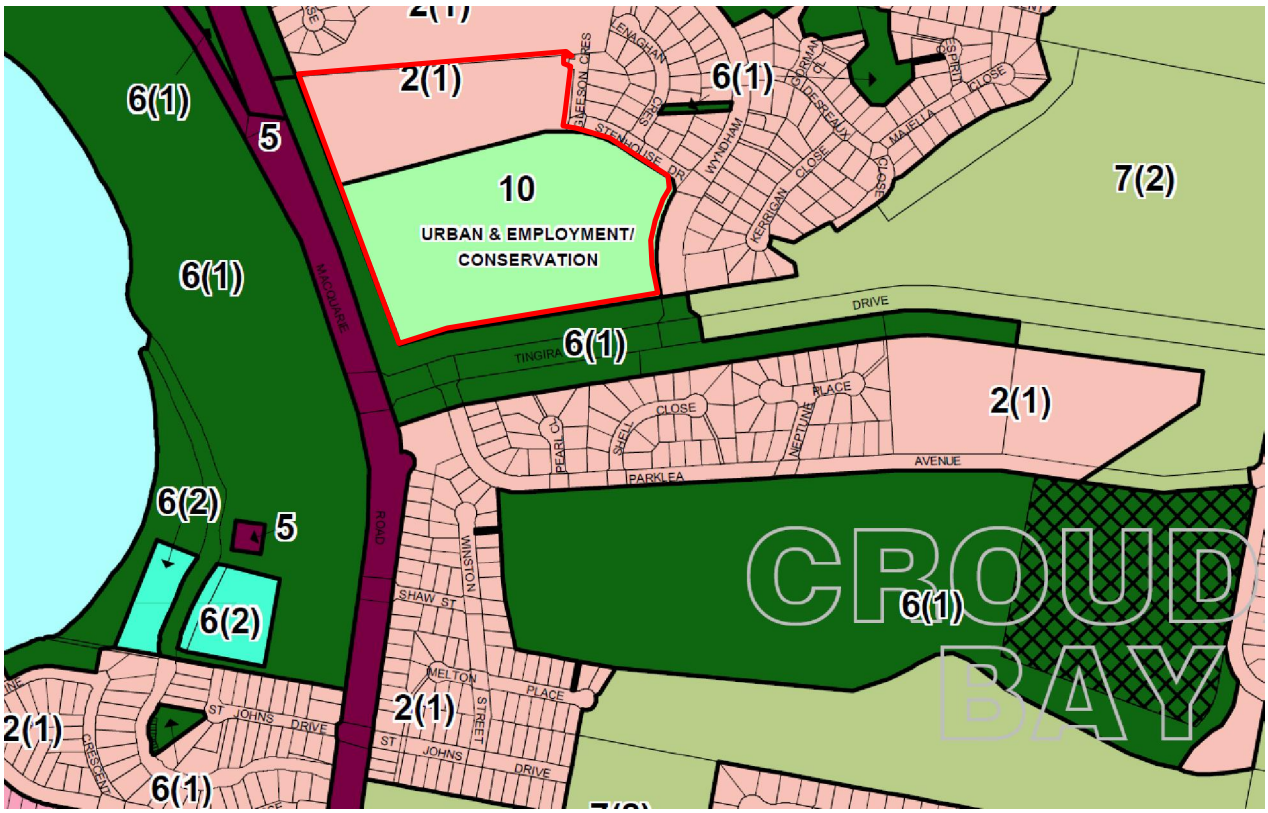

Figure 5.2_Extract of LEP Zoning Map, with site shown outlined in red (Source: Lake Macquarie City Council)

Local Planning Considerations

Zoning of surrounding land includes 2(1) Residential to the north, east and south of the site. The remainder of the area is zoned 6(1) Open Space and 7(2) Conservation (Secondary). Macquarie Drive is zoned as 5 Infrastructure.

5.2.2_General
The Local Environmental Plan contains a number of clauses that are identified relevant in the consideration of this Study. A summary of these clauses is provided below.

LEP Reference	Comment
Clause 17 - Provision of essential infrastructure Council must not consent to a development application unless it is satisfied that adequate arrangements have been made for the provision of any infrastructure that is essential for the proposed development.	Infrastructure availability has been investigated as part of this LES, it has been found that in general, suitable infrastructure is available for the site to support urban development.
Clause 24 - Subdivision Land in any zone may be subdivided only if the consent authority is satisfied: (a) that the resulting lots will conform to the requirements in Schedule 2 (Subdivision standards) applicable to subdivision in that zone, and (b) the resulting lots can be developed in accordance with this plan.	Any future subdivision of lands will need to meet these requirements. Allotments size recommendations have taken these requirements into consideration. Dwelling houses, dual occupancies and small lot housing are permitted with consent in the 2(1) Residential zone. Schedule 2 of the LMLEP sets subdivision standards for the 2(1) Residential zone with a standard lot size of 450sqm for a dwelling house and 250-450sqm for small lot housing. If a subdivision creates 10 lots or more, a minimum of 20% standard lots and 10% small lots must be provided.
Clause 29 - Building heights In considering an application for consent to the erection of a building the whole or part of which exceeds 8 metres, the consent authority must take into consideration whether that height is compatible with the heights of other buildings in the immediate vicinity or locality, with additional criteria identified.	This matter would be applicable to future master planning and detailed development design and assessment at this site. It is not envisaged that this height would be exceeded at the site given its environmental constraints.
Clause 32 - Flood prone land Requires suitable approval and design for development within flood prone lands.	Any future development proposals would need to meet these requirements.
Clause 33 - **Bush fire considerations** Requires suitable approval and design for development within bushfire prone lands.	Any future development proposals would need to meet these requirements.
Clause 34 - **Trees and native vegetation** Requires development consent for the removal of native vegetation.	Any future development proposals would need to meet these requirements.
Clause 41 - Development for the purpose of retirement villages Specifies that development for the purpose of a retirement village within the 2(1) Residential zone may only be granted if the land is of sufficient size to accommodate a minimum 70 unit retirement village.	Any future development proposals would need to meet these requirements.
Clause 42 - Consent to development subject to special requirements Identifies design guidelines for specified land holdings.	Clause may offer a mechanism for controlling the future development of identified areas of the site appropriate for urban purposes.
Clause 42A - Restricted development Specifies uses for identified land holdings.	This clause may offer a mechanism for controlling the future development of identified areas of the site appropriate for urban purposes.

Local Planning Considerations

5.3_Lake Macquarie Development Control Plan No. 1

The *Lake Macquarie Development Control Plan No. 1 – Principles of Development* (DCP No.1) provides guidance to the development of land under the LMLEP 2004. The objective of DCP No.1 is to implement the Lifestyle 2020 Strategy by facilitating ecologically sustainable development.

The DCP includes many specific provisions which will be applicable to any development of the site, and should be considered at the development stage. It should be noted that the environmental constraints of the study area which have been identified within this LES will require consideration against DCP No. 1, for example development will need to consider bush fire protection measures, protection of ecological values and corridors, tree preservation and management, and flood management. Any proposed housing on the site will also need to consider the detailed DCP provisions.

It is anticipated that future development within the site will be able to be undertaken in accordance with the provisions of DCP No. 1.

According to clause 2.1.3 *Scenic Values*, the study area is within Zone B which is assigned to areas highly valued in the City for the maintenance of the scenic quality and identity of the various localities. In Zone B a Visual Impact Statement must be prepared and lodged in accordance with the *Lake Macquarie Scenic Quality Guidelines* (2004) as part of any development application. A visual assessment of the site has been undertaken as part of this LES and is outlined in section 11 of this report.

5.4_Proposed Biodiversity Planning Principles for Local Environmental Plan Rezoning Proposals (2009)

This guideline, prepared by Lake Macquarie City Council, provides principles for rezoning proposals, to be used to help guide the information and reporting requirements for LEP amendments. The principles also provide consistent guidelines for the implementation of the biodiversity goal and strategic directions in the Lifestyle 2020 Strategy. Where the identified benchmarks cannot be achieved, a full justification and documentation of the consequences for biodiversity will be required.

5.4.1_General Principles

Lake Macquarie City Council's strategic approach to biodiversity planning will seek to achieve the Lifestyle 2020 Strategy aim and strategic directions and be guided by the following general principles:

1. Key biodiversity issues must be resolved at the rezoning stage, when future land uses and management frameworks are determined.
2. Consistent principles for biodiversity conservation will be applied to all rezoning proposals.
3. Adequate information on biodiversity values is required at the rezoning stage to inform decision making.
4. At rezoning stage, Council will seek to ensure that significant impacts on listed threatened species and endangered ecological communities are prevented, thereby avoiding the need for a species impact statement to be prepared at the development application stage.
5. Land identified as having conservation values requiring protection should be protected in a secure tenure (preferably in public ownership) with appropriate conservation management.
6. Conservation land requires ongoing management, and at the rezoning stage, arrangements for long term ownership and management for conservation should be finalised.
7. Council will accept dedication and ongoing management of land with conservation values, where this is at no cost, and the land is in a size, shape and condition that will minimise ongoing management costs.

For land zoned Investigation 10 (the majority of the study area), the objective is to retain important natural ecosystems and biodiversity, and maintain landscape connectivity. The following general principles apply:

- No removal of native vegetation or habitat which will result in complete loss of local populations of threatened species, or loss of endangered ecological communities.
- Maintain quality, condition and extent of high quality threatened species habitat, and area of endangered ecological communities on the site.
- Accept loss of non-significant vegetation communities that are widespread within LGA, provided that >70% native vegetation cover of these communities is retained in the whole LGA, as mapped on LMCC 2004 vegetation mapping.
- Maintain existing landscape scale connectivity of native vegetation in corridors with suitable characteristics e.g. width, habitat quality, and area.

Local Planning Considerations

_ Native vegetation in habitat corridors is to be retained by implementing adequate long term security e.g. zoning, dedication to LMCC, covenant, or acquisition.
_ Use of offsets (including protected areas or rehabilitation) may be considered where appropriate. Any offsets must be within the Lake Macquarie LGA, provide long term certainty of tenure, ensure funding for ongoing management, and rehabilitation or enhancement must be on land in public ownership.
_ Note: To ensure conservation of biodiversity within the City, it is desirable for not less than 70% of native vegetation communities to be retained, except within existing urban areas. Scientific evidence shows that substantial (and progressively increasing) reduction in native species occurs following the loss of about 30% or more of native vegetation area.

5.4.2_Specific Principles
The following specific principles will be applied in the consideration of proposals to rezone land, and are of relevance to the subject site.

Principle
Habitat corridors
_ Habitat corridors to protect vegetation and provide landscape scale connectivity, and to be an appropriate minimum width (minimum 150 metres).
_ Protection of riparian areas with a corridor >40 metres on each side of the creek centreline or from bank of major streams, or greater where there are endangered ecological communities.

Endangered ecological communities
_ All areas of endangered ecological community are to be protected, plus a buffer.
_ A minimum buffer of 20 metres of native vegetation shall be provided to endangered ecological communities.

Habitat trees
_ Retain 75% - 80% of habitat trees with small to medium hollows, and 95% of habitat trees with large hollows or spouts.

Management of conservation land
_ There is a need for active management of conservation land.
_ Adaptive management of natural areas is necessary, but requires ongoing monitoring and appropriate skills and resources.

Species requirement – Threatened flora
_ Maintain viable population on site.

Species requirement – Tetratheca juncea
_ Requirements are included in Lake Macquarie Tetratheca Conservation Management Plan already adopted by Council and specified in separate planning document – requires (1) stepping stone clumps to be retained, (2) increased conservation in sectors of the City where inadequately conserved, (3) morphological variants to be conserved, and (4) populations setting seed to be conserved. At least 75% of local sub-population to be retained on site.

Species requirement – Threatened fauna
_ Maintain >80% of high quality habitat areas, >50% of medium habitat areas, and maintain viable population on site.

Species requirement – Squirrel Glider
_ In existing fragmented areas, maintain habitat size and shape (minimum 4 ha patches) not more than 1.0 km apart, with suitable vegetated links having gaps <35 metres wide.
_ Protect known feed trees and den trees.

Species requirement – Forest Owls
_ Retain nest trees and roost trees, plus a buffer of native vegetation >100 m wide around these trees.

Local Planning Considerations

5.4.3_Native Vegetation and Corridors

Council's Native Vegetation and Corridors Map (LMCC 2009) shows that the study area provides important corridor connectivity to the remnant vegetation to the north-west, north and east. The site contains four corridor crossing points or linkages. The quality of these linkages has been considered in the squirrel glider study undertaken by Forest Fauna Surveys Pty Ltd (refer to section 11 of this report), and three out of four of the linkages are of medium to high quality.

6 ___ Consultation

In 2008, as part of the proposed amendment to the Lake Macquarie Local Environment Plan 2004, Lake Macquarie City Council undertook consultation with various State and Local Government Agencies in accordance with section 62 of the EP&A Act (now repealed).

In total, 11 submissions were received from public agencies (attached at Appendix A). All submissions received have been considered in the preparation of this study. The following section of the report provides a summary of the issues raised in the submissions and outlines how the issues have been addressed.

6.1_Submissions

Submissions were received from the following agencies:
_ Department of Planning;
_ Department of Environment and Climate Change;
_ Department of Water and Energy;
_ NSW Rural Fire Service;
_ Department of Primary Industries;
_ Mine Subsidence Board;
_ Ministry of Transport;
_ Roads and Traffic Authority;
_ Hunter Central Rivers Catchment Management Authority;
_ Hunter New England Area Health Service;
_ Hunter Water Corporation; and
_ Department of Education and Training.

6.1.1_Department of Planning

The Department of Planning were consulted but did not provide any specific comments regarding the proposed Draft LEP amendment.

6.1.2_Department of Environment and Climate Change

The Department of Environment and Climate Change (DECC) considers that remnant bushland on the site has high biodiversity value and is a viable component of other interconnecting bushland patches in the immediate area, including the nearby DECC managed Tingira Heights Nature Reserve. It is important that future development proposals for this area do not compromise these conservation values and that future planning for the site maintains existing connections to biodiversity values adjacent to the study area as these are necessary to maintain the long-term conservation values of the site.

DECC recommends that impacts on areas of native vegetation should be considered in the preparation of the Draft LEP, with special reference to threatened or regionally significant flora and fauna species, populations and ecological communities. Where impacts are proposed on areas of biodiversity value, the proponent should clearly demonstrate how they propose to offset any loss in biodiversity value to meet the 'improve and maintain' threshold.

The LES includes a full flora and fauna assessment (refer to sections 7.1 and 7.2 of this report), which has informed the proposed zoning and identification of the potential developable area. Wildlife corridors have been preserved on the site to maintain linkages to other remnant bushland in the surrounding area.

6.1.3_Department of Water and Energy

The Department of Water and Energy (DWE) require that the draft LEP identifies groundwater issues and potential degradation to the groundwater source as a result of any proposed changes in land use, and identifies any impacts on groundwater dependent ecosystems. The draft LEP should include the protection and rehabilitation of riparian lands, and riparian corridors should follow the DWE *Guidelines for Controlled Activities - Riparian Corridors*.

A stormwater and flooding assessment has been undertaken as part of the LES (refer to sections 7.7 and 8.3 of this report), and riparian corridors have been recommended in accordance with the DWE's *Guidelines for Controlled Activities – Riparian Corridors* (February 2008).

6.1.4_NSW Rural Fire Service

The NSW Rural Fire Service identified the site and adjoining land as bush fire prone. They have no objection to the rezoning, however they advise that the retention of vegetation within the site in the form of environmental conservation areas will retain the bush fire risk and that appropriate bush fire protection measures for future development will be necessary commensurate with hazard.

A bushfire assessment report has been undertaken as part of this LES (refer to section 7.3 of this report).

Consultation

6.1.5_Department of Primary Industries
The Department of Primary Industries was consulted and provided the following comments.

The Mineral Resources department advised that they have no objection to the rezoning and reclassification of the site. They advised that the land in the Eleebana and Valentine localities is part of a current Petroleum Exploration Licence and is in a Declared Mine Subsidence District and as such any proposed development upon these parcels of land require referral to the Mine Subsidence Board. The Mine Subsidence Board was separately consulted by Council (refer to section 6.1.6 of this report), and in addition have provided surface development guidelines (refer to section 7.6 of this report) as part of consultation undertaken for this LES.

The Aquatic Habitat Protection Department indicated concerns relating to the potential overdevelopment of the site and the potential for excessive stormwater to be generated and runoff to the lake. There is concern that existing drainage issues on the site will be transferred to the existing SQIDs in Halton Park, overloading and compromising their operation.

6.1.6_Mine Subsidence Board
The Mine Subsidence Board (MSB) had no objections to the proposed rezoning. They indicated that any applicant should seek the Board's approval for any subdivision or the erection of improvements at the appropriate time – this will be required for any future development applications on the site.

In addition, MSB have provided surface development guidelines (refer to section 7.6 of this report) as part of consultation undertaken for this LES.

6.1.7_Ministry of Transport (now known as NSW Transport and Infrastructure)
The Ministry of Transport have requested that a Transport Study is undertaken to address a broad range of transport issues including:
_ The provision of pedestrian and cycle connections;
_ The provision of related infrastructure such as bicycle racks and public seating;
_ The provision of roadside bus infrastructure;
_ Integration of the site with adjoining residential areas and Halton Park; and
_ The potential impact of the proposal on existing bus services and any likely additional costs to the Government where network changes and service improvements are recommended.

A traffic assessment has been undertaken as part of this LES (refer to section 8.1 of this report).

6.1.8_Roads and Traffic Authority
The Roads and Traffic Authority (RTA) requests that a detailed traffic study is prepared, in accordance with the RTA's *Guide to Traffic Generating Development,* and referred to the RTA for comment.

The RTA further advised that concurrence is required for any connection to Macquarie Drive, and that RTA consent is required for traffic control signals and facilities under section 87 of the Act.

A traffic assessment has been undertaken as part of this LES (refer to section 8.1 of this report), in accordance with the RTA's *Guide to Traffic Generating Development*.

6.1.9_Hunter Central Rivers Catchment Management Authority
The Hunter Central Rivers Catchment Management Authority (CMA) states that native vegetation management is a key issue for the site and expects the LES to address the application of the objectives of the Native Vegetation Act 2003 (NV Act). The CMA will object to any proposed rezoning if it is likely to result in the clearing of native vegetation and where the 'improve or maintain' principle has not been demonstrated. Using offsets to mitigate against the impact of any clearing can be used to demonstrate this principle.

The LES includes consideration of the flora present on the site and the application of the NV Act (refer to section 7.1 of this report), and has identified a developable area and proposed zoning which accounts for these values.

The CMA advocates the consideration of the Hunter-Central Rivers Catchment Action Plan (CAP), in particular the guiding principles section of the document and how the principles apply to this proposal. The CAP has been considered in section 4.6 of this report.

The CMA would support the rezoning of the site from 10 Investigation to a conservation zoning. This is reflected in the proposed zoning which includes an Environmental Management zone for those areas identified as containing important flora and fauna species

Consultation

6.1.10_Hunter New England Area Health Service

The Hunter New England Area Health Service recommended the following:

- A traffic assessment is conducted to determine availability and access to public transport
- Consideration of the following in the aim of maximising health and social outcomes:

_Design streets to minimise distance between residential lots, neighbourhood facilities and nearby suburbs.

_Provide safe and convenient footpaths and cycleways - particularly across Macquarie Drive - for residents to access nearby facilities and amenities.

_Consideration of Crime Prevention Through Environmental Design principles.

_Retain existing trees to enhance visual environment and provide shading.

- Consider the availability of affordable/healthy food within the proposed neighbourhood shopping centre.
- Ensure minimal impact on the water quality of the surrounding natural waterways and Lake Macquarie, particularly from stormwater runoff
- Address the issue of environmental noise from the proposed neighbourhood.
- The incorporation of best practice design principles should include energy, water saving strategies and grey water re-use with the appropriate approval and monitoring processes in place.

A traffic assessment (refer to section 8.1 of this report) and stormwater and flooding assessment (refer to sections 7.7 and 8.3 of this report) has been undertaken as part of the LES, which addresses some of the points raised by the Hunter New England Area Health Service. The other aspects of the submission relate to the detailed design of the ensuing development, and should be considered further at this stage.

6.1.11_Hunter Water Corporation

The Hunter Water Corporation was consulted and have no objections to the proposed rezoning of the site. They indicated that there is sufficient capacity in the water supply, sewerage, and wastewater systems to cater for development of the site, however this will be assessed in more detail once Hunter Water receives accurate load and timing information.

7 ___ Environmental Investigations

The following Section provides an overview of each environmental investigation. Each study is supported by graphical mapping of findings which are then overlayed to inform opportunities and constraints for the subject site. The findings of the culminated impacts and resultant potential developable parcel are discussed in detail in Section 8.

7.1_Flora

WorleyParsons were commissioned to undertaken a detailed flora assessment of the study area (attached at Appendix B).

The assessment included reviewing previous studies undertaken for the site, confirming the boundary of the Endangered Ecological Community (EEC), and undertaking targeted surveys of the following species:
_ Black-eyed Susan (*Tetratheca juncea)*
_ Leafless Tongue Orchid (*Cryptostylis hunteriana)*
_ Tessellated Spider Orchid – (*Caladenia tessellate)*
_ White-flowered Wax Plant – (*Cynanchum elegans)*
_ Small-flower Grevillea – (*Grevillea parviflora subsp parviflora)*

The key findings and recommendations made in the "Eleebana Flora and Fauna Study" (January 2010) are summarised in this section.

7.1.1_Existing Conditions

At present the site is fully vegetated and most of the site has a significant cover of tall, mature trees. Although there is currently no development on the site, evidence of past disturbance including tree-clearing and thinning, fire, earthworks and rubbish dumping are evident. Weed invasion is particularly evident in disturbed areas.

The subject site possesses the following major characteristics (Ecotone 2003):
_ Scattered large mature trees
_ Few large dead stags are present but smaller dead trees occur
_ Absence of large tree hollows suitable as nest / roost sites
_ Trees with moderate to small hollows are scattered across the site
_ Dense shrub layer in the moist forest and sparse shrub layer in the woodland / open forest
_ Dense ground cover in the moist and dry areas
_ No rocky outcrops
_ Fallen small to moderate sized timber is common across the entire site
_ Wet areas occur along the drainage channel
_ Some evidence of rubbish dumping on site
_ Weed invasion is low in the drier woodland / open forest parts and denser in the moist low lying habitats
_ A track traverses the site from Wyndham Way to Macquarie Drive

In their consultation response (refer to section 6 of this report), the Department of Environment and Climate Change (DECC) considered that the remnant bushland on the site has a "high biodiversity value, and is a viable component of other interconnecting bushland patches in the immediate area".

Flora Species

Comprehensive vegetation surveys have been undertaken at the subject site on a number of occasions (Ecotone 1993 and 2003; EcoBiological 2007). The EcoBiological 2007 survey recorded 201 flora species from 67 families including six ferns, 144 dicotyledon and 51 moncotyledons. Of these 20% (40 species) were exotic. A comprehensive list of flora species recorded at the subject site is provided in Appendix 2 to the Eleebana Flora and Fauna Study (attached at Appendix B).

The predominant exotic species occurring at the subject site include Pampas Grass (*Cortaderia selloana*), Bitou Bush (*Chrysanthemoides monilifera subsp. rotundata*) and Camphor Laurel (*Cinnamomum camphora*) in dryer slope areas and gully areas, and *Lantana camara* (Lantana) in the flatter wet areas (Ecotone 2003).

Vegetation Communities

Four vegetation communities have been identified on the subject site by EcoBiological (2007), as follows:
_ Coastal Foothills Spotted Gum – Ironbark Forest
_ Coastal plains Smooth-barked Apple Woodland
_ Coastal Sheltered Apple – Peppermint Forest
_ Paperbark Swamp Melaleuca Scrub

Endangered Ecological Communities (EEC)
A 5.31 ha area of *Melaleuca Scrub* (or Riparian *Melaleuca Swamp Woodland*), which is classified as the EEC *"Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregion"* under the *NSW Threatened Species Act (TSC) 1995*, occurs in the western section of the study area, directly adjacent to the subject site.

Assessment by WorleyParsons included confirmation of the EEC boundary, using the previously mapped boundary as a guide and using the identification of diagnostic species (especially the presence of a dense understorey or canopy of Melaleuca species). This work identified deviations from the previously mapped boundary in some locations. In particular, in the northern section of the subject site the EEC boundary extends further east than previously mapped, and in the southern area an obvious western extension of the boundary can be seen. The previously mapped EEC boundary and the revised EEC boundary are shown the figure below.

Figure 7.1_EEC Boundary showing previously mapped and revised mapping

Protected, Threatened and Vulnerable Species
The only threatened or vulnerable flora species that has been positively identified on the subject site is *Tetratheca juncea* (Black-eyed Susan). *T. juncea* is listed as vulnerable under the NSW TSC Act 1995 and the Commonwealth EPBC Act 1999. *T. juncea* was found to be relatively common throughout the study site during the November and December surveys undertaken by WorleyParsons. As the surveys were undertaken at the end of (and after) the general flowering period, it is considered that the distribution of *T. juncea* within the site is likely to be greater than that which is currently mapped, especially along the southern portion of the site where suitable habitat was available but only a small number of individuals were found during the surveys.

Figure 7.2_ Location of Tetratheca juncea within the study site (Source: WorleyParsons, 2010)

Within a 500 metre radius of the subject site, numerous individuals of the *T. juncea* species were also recorded. In particular two large areas of *T. juncea* occurred in remnant bushland to the north / north-east of the site. The first was in a small patch of remnant bushland on the southern side of Woodside Drive, and the second was on the steep slopes of a hill adjacent to houses on Wyndham Way. In addition, a third significant area of *T. juncea* was recorded on the northern side of Tingira Drive (west of the site), though this population is predominantly located just outside of the 500 metre radius. Suitable habitat for *T. juncea* was available in numerous locations within the 500 metre radius of the study site.

The subpopulation of *T. juncea* found on the site is by far the largest population found in the locality and occurs in an area of high quality habitat with a floral diversity unlike any other habitat surveyed within 500 metres of the site. The subpopulation is deemed as "significant" under the criteria listed in the 'Lake Macquarie Tetratheca juncea Conservation Management Plan' (Payne 2001a) for the following reasons:

_ The subpopulation contains over 100 plant clumps.
_ Some nearby sites where this species is found could be considered close enough to be regarded as part of the same inter-breeding subpopulation under the 'stepping-stone principle' (sites must be within 500 m of each other to be regarded as potentially interbreeding).

In addition, WorleyParsons have identified that the subject site may provide potential habitat for *Cryptostylis hunteriana* (Leafless Tongue orchid) and *Caladenia tessellata* (Tessellated Spider-orchid), though they were not detected during the flora surveys. *Caladenia tessellata* is listed as vulnerable under the NSW TSC Act 1995 and under the Commonwealth EPBC Act 1999. The Tessellated Spider Orchid is classed as endangered in NSW under the TSC Act 1995, and has a national conservation status of vulnerable under the EPBC Act 1999.

Several orchid species were found within the primary study site and surrounding 500 m radius, including *Dipodium punctatum* (Slender Hyacinth Orchid), *C. erecta* (Bonnet Orchid) and *C. subulata* (Large Tongue Orchid). Under Schedule 13 (Protected Native Plants) Part 2 (Whole Plants) of the NPW Act 1974 all Orchidaceae (Orchids) which are native to NSW are protected.

The presence of the Large Tongue Orchid and Bonnet Orchid is noteworthy as these orchids are often found in association with the threatened Leafless Tongue Orchid.

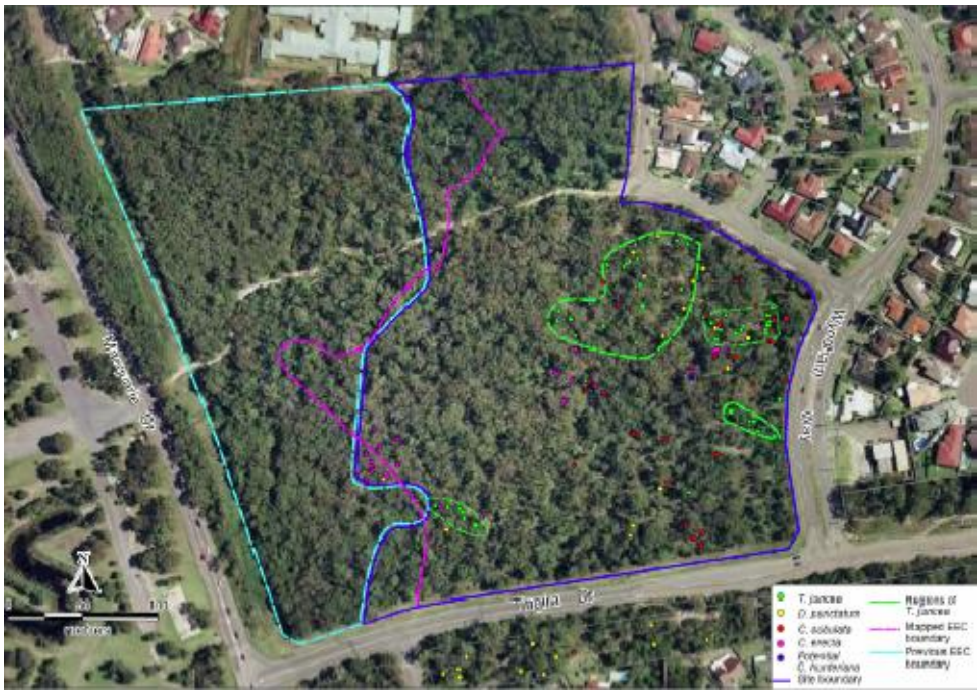

Figure 7.3_Location of orchids within the study site (also showing *T. juncea* and EEC boundary) (Source: WorleyParsons, 2010)

Vegetation Corridors

The site has links to a larger conservation corridor to the east (including the Tingira Heights Nature Reserve), as well as other vegetation corridors to the north and north-west. These corridors are recognised in Council's Native Vegetation and Corridors Map (LMCC 2009). Further information related to the role of these corridors for wildlife movement is provided in section 7.2 of this report.

7.1.2_Potential Impacts of Site Development

Development of the subject site, and associated vegetation clearance, may lead to:

_ Direct impacts on threatened and protected species including *Tetratheca juncea* and native orchids (directly and indirectly).
_ Reduction in the availability and quality of fauna habitat, including habitat for vulnerable fauna species such as the squirrel glider.
_ Interruption of wildlife corridors (including those recognised as being of regional significance under the Lower Hunter Regional Conservation Plan).
_ Increased pressure on ecological processes (e.g. water and sediment movement, nutrient cycling) and the potential disruption or loss of ecological functions (which consists of physical conditions such as soil type, and ecological processes). This in turn may result in a change or loss of a habitat and the species which depend on it.
_ Increase susceptibility to weed invasion (noting that currently the roads bounding the site provide a barrier between the subject site and existing residential development).
_ Trampling of native vegetation and soil disturbance through increased visitor traffic could potentially lead to fragmentation of vegetation and habitat within the site.
_ The necessity for erection of boundary fences and bushfire APZ's around any development will require the clearing of a substantial area of native vegetation, in addition to that required for the development itself. These cleared areas provide increased habitat for exotic species, allow greater access to the site and are associated with substantial disturbance (e.g. use of machinery) in their construction.
_ Development will potentially require the installation of additional infrastructure which may require excavation.

WorleyParsons have undertaken an initial assessment of significance (7-part test), focusing on the potential impacts on *Tetrathecha juncea*, which is required under section 5A of the EP&A Act to assess the potential impacts related to any development of the subject site (refer to Table 5.1 within the Eleebana Flora and Fauna Study). This assessment concludes that significant impacts on *T. juncea* are likely to result from any development on the subject site, and outlines the following potential impacts:

_ A large area of habitat for *T. juncea* to be either directly removed or indirectly modified.
_ The creation of further barriers to surrounding habitats, further fragmenting *T. juncea* subpopulations on the site.

Consideration of Referral under EPBC Act
As the fauna species listed above forage over large areas, a significant impact is considered unlikely. Therefore, the key consideration on whether referral to Department of Environment, Water, Heritage and the Arts (DEWHA) for assessment under the EPBC Act would be required for any proposed development on the land would depend on the extent of proposed removal or disturbance of *T. juncea* within the site.

7.1.3_Recommendations
A number of recommendations and management options have previously been made to protect the integrity of the vegetation and threatened species within the subject site (EcoBiological 2007, Ecotone 2003). Recommendations from these and the flora and fauna study undertaken by WorleyParsons (2010), as discussed below, will aid in the long term conservation and enhancement of the site's ecological values.

Vegetation Management Plan
An appropriate vegetation management plan should be adopted to monitor, maintain and improve the ecological value of the study site and adjacent EEC. This plan should address the requirements of the Lake Macquarie Tetratheca juncea Management Plan (Payne 2001). Key management issues for the site would include: weed control and management; erosion control; maintenance of drainage conditions; fire management; ecological thinning; signage; and access restriction.

Offsets
Any proposed vegetation clearance could be offset with positive management options. Offsets may include agreeing not to clear regrowth, planting, re-seeding or improving habitat by weed control.

Species Impact Statement
If development is proposed on the subject site, a Species Impact Statement for *Tetratheca juncea* will be required.

Clearing of vegetation
If development of the site is to occur, recommendations related to vegetation clearance include the following:
_ Hollow bearing trees should be retained where possible and any hollow bearing trees that are proposed for clearing should be checked for wildlife habitation by a qualified and licensed ecologist.
_ Any hollow bearing trees should be soft-felled (including several gentle nudges flowed by monitoring for life) to alert any occupying fauna and allow them to self-relocate.
_ A nest box installation and monitoring program within the EEC has been suggested, as the majority of hollows mapped on the subject site occur within the proposed development area. The number of nest boxes should equal the number of hollows removed. They should be attached to mature and remnant trees at a variety of heights and aspects.

Retention of EEC
Under Council's *Biodiversity Planning Policy and Guidelines for LEP Rezoning*, all areas of EEC are to be protected plus a minimum buffer of 20 metres of native vegetation shall be provided to them (LMCC 2009). The EEC adjacent to the study site should be kept intact and managed according to an appropriate vegetation management plan as described above.

Tetratheca juncea Population
Retention of the entire subpopulation of *Tetratheca juncea* at the subject site is recommended (WorleyParsons, 2010).

The Council's Addendum to the final Tetratheca juncea Conservation Management Plan (Payne 2000) suggests that conservation of larger populations of the species, in the order of 75 - 80% of plant clumps in these populations, should retain a viable population depending on edge effects (i.e. a maximum of 20 - 25% of a *T. juncea* subpopulation can be removed). According to this plan, EcoBiological (2007) recommended that the main *T. juncea* population be conserved with an additional 20 m buffer (about 87% of the total population). Ecotone (2003) considered the sacrifice of one or both of the smaller patches of *T. juncea* acceptable if the remaining areas were restored, conserved and actively managed on an ongoing basis.

Additional Surveys
There is a possibility that additional orchid species occur at the site in association with the orchid species identified, and that the small-flowered Grevillea is present in the fire-affected area. Any further vegetation survey work would likely reduce the potential developable area by inclusion of the southern section of the site which provides potential habitat for other orchid species including the Leafless Tongue Orchid. However, it may identify additional species which could allow a more flexible approach to developable site design and species retention.

7.2_Fauna

WorleyParsons were commissioned to undertaken a detailed fauna assessment of the site (attached at Appendix B). The key findings and recommendations made in the "Eleebana Flora and Fauna Study" (January 2010) are summarised in this section.

In addition, Council separately commissioned Forest Fauna Surveys Pty Ltd to undertake a squirrel glider study (attached at Appendix C). The outcomes of the report are also summarised in this section.

7.2.1_Existing Conditions
The study area provides a refuge for many terrestrial and arboreal mammals, birds, reptiles and amphibians. Dense ground cover and an abundance of hollow logs provide significant habitat for small terrestrial mammals, reptiles and amphibians (Ecotone 2003). However, the relatively low number of tree hollows is considered to reduce the refuge value of the site for arboreal mammals and bats (Ecotone 2003; EcoBiological 2007). A tree hollow survey conducted by EcoBiological (2007) over the entire site reported just 14 trees with 32 potential habitat hollows. Most of these were small to medium (97%) with only one large hollow present. The actual level of use of these hollows by birds and mammals has not been established (EcoBiological 2007).

Comprehensive fauna surveys have been undertaken at the subject site on a number of occasions (Ecotone 1993 and 2003; EcoBiological 2007).

In 2003, Ecotone recorded 60 fauna species including 15 mammals (including bats), 36 birds, four amphibians and five reptiles at the site. They also reported that with suitable foraging or nesting habitat available a number of additional species have the potential to occur within the site (Ecotone 2003). In 2007 a total of 53 species, including three amphibians, one reptile, nine mammals / bats and 40 birds were recorded by EcoBiological (2007).

In addition, Forest Fauna Surveys Pty Ltd (2006) listed 38 birds, one native terrestrial mammal, one introduced mammal, three arboreal mammals, seven bats, five reptiles and five frog species in the nearby Tingira Heights Nature Reserve and surrounding area. In all these surveys, there was no evidence of larger mammals such as macropods (kangaroos and wallabies). Habitat fragmentation within the locality, the impact of predation by native and introduced predators and fire are the likely causes of this absence (Forest Fauna Surveys Pty Ltd 2006).

A comprehensive list of fauna species recorded at the subject site is provided in Appendix 3 to the Eleebana Flora and Fauna Study (attached at Appendix B).

Protected, Threatened and Vulnerable Species
The following fauna species, which are listed as vulnerable under the TSC Act 1995, have been detected at the study site:
_ Little Bent-wing Bat (*Miniopterus australis*);
_ East-coast Free-tail Bat (*Mormopterus norfolkensis*); and
_ Squirrel Glider (*Petaurus norfolcensis*).

More information on the Squirrel Glider population is provided below.

The subject site is also considered to provide potential habitat for a number of other threatened species, including:
_ Greg-headed Flying-fox (*Pteropus poliocephalus*)
_ Regent Honeyeater (*Xanthomyza Phrygia*)
_ Swift Parrot (*Lathamus discolour*)
_ Powerful Owl (*Ninox strenua)*
_ Masked Owl (*Tyto novaehollandiae*)

In addition, suitable habitat for the Wallum Froglet, listed as vulnerable under the TSC Act 1995, may occur in the EEC adjacent to the subject site. Surveys were not considered necessary under the present study due to the assumed inclusion of the EEC under conservation zoning.

Squirrel Gliders

A Squirrel Glider study has been undertaken by Forest Fauna Surveys Pty Ltd to inform this LES, and is attached at Appendix C. Findings of the study are summarised below.

The site occurs within the home range of the Eleebana Squirrel Glider population, a population recognised as being of local, regional and state significance (Murray 1996). The subject site has been identified as forming the higher quality habitat of the Eleebana populations known home range.

A number of Squirrel Glider investigations have been undertaken on the subject site since1993. The most significant record was in the 1995 study, where nine Squirrel Glider captures plus 12 observations by spotlight were recorded. With the exception of a 1997 study which recorded one capture, other studies have recorded no results. The field survey undertaken for this study (December 2009) trapped one Squirrel Glider and observed an additional Squirrel Glider by spotlight observation, confirming their continued existence on the subject site.

A total of 45 habitat trees were identified on the subject site, most of them within the study area with very few in the EEC area. Habitat trees are identified as those suitable for tree hollow dependant fauna, including the Squirrel Glider.

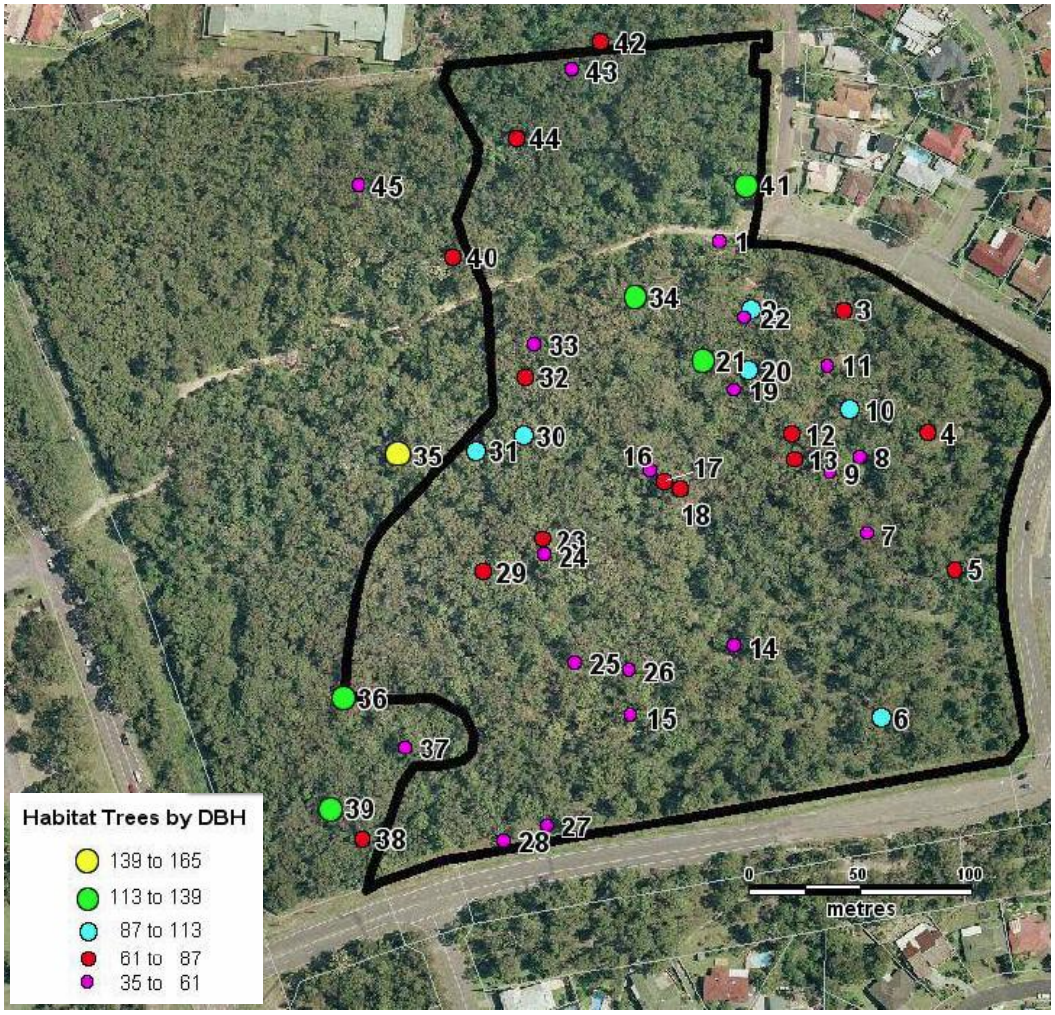

Figure 7.4_Location of Squirrel Glider habitat trees (Source: Forest Fauna Surveys Pty Ltd, 2010)

A corridor assessment within the Squirrel Glider study undertaken by Forest Fauna Surveys Pty Ltd (May 2010), identifies at least four identified crossing points for the Squirrel Glider and assesses that connectivity between adjoining bush remnants is good to the north-west, north and east. The corridors passing over Tingira Drive (#1) and Wyndham Way (#2) present obstacles to glider movements. While the gap in canopy cover in these locations are not deemed as isolating distances for glider movements, tree canopy heights are low. The crossing point to the north-east of the site (#3) contains the highest eucalypt trees and ensure easy gliding angles across Gleeson Crescent. The linkage through the EEC area (#4) does provide an alternative for glider movement however until the trees reach a greater height, this route is considered less optimal.

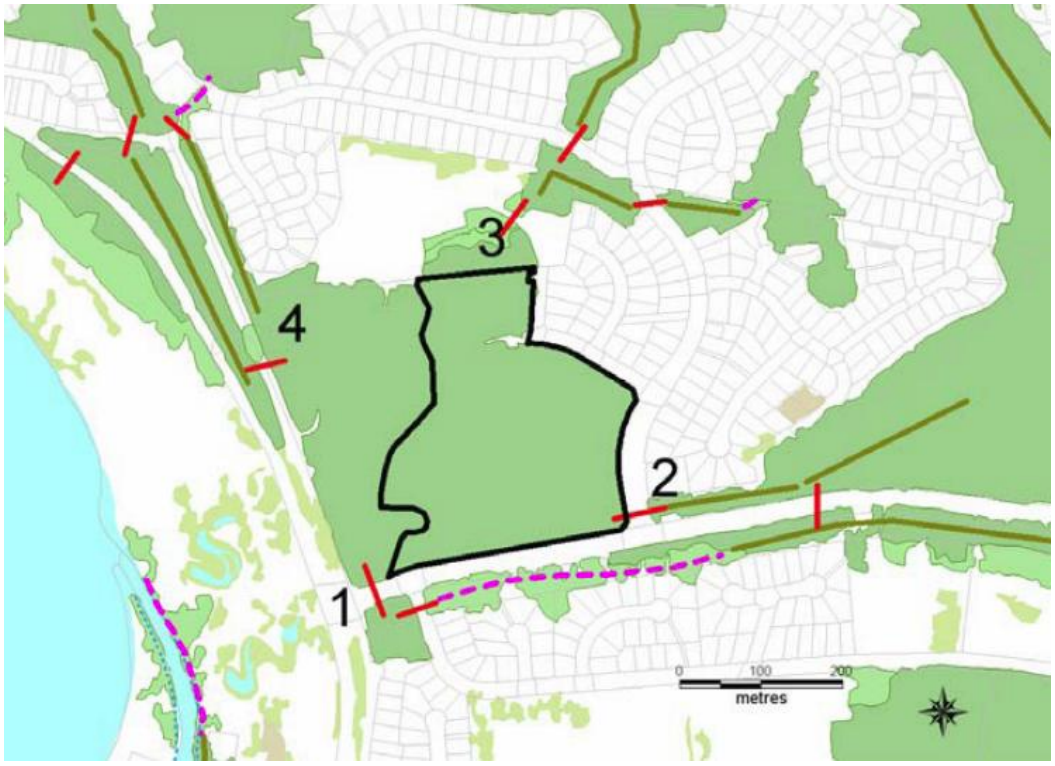

Figure 7.5_Habitat Corridors connected to the subject site (Source: Forest Fauna Surveys Pty Ltd, 2010)

All of the remnant vegetation within the subject site is identified as of high significance to the Squirrel Glider. In particular, the portion of corridor #3 in Lot 29 DP 850091 (currently zoned as 2(1) Residential)) is essential for population persistence of the Squirrel Glider and loss or reduction in quality could result in significant impact on the subject site population. This area is therefore recommended to be rezoned for conservation or environmental protection.

Koala Habitat

There are no listed koala food trees in the study area where development is proposed. Accordingly, it is unlikely that further assessment under SEPP 44 – Koala Habitat Protection will be required.

It is noted that the western part of the site (outside the study area) represents potential koala habitat with the occurrence of three Koala food tree species (Grey Gum *Eucalyptus punctata*, Swamp Mahogany *E. robusta* and Forest Red Gum *E. tereticornis*).

Wildlife Movement Corridors

Connectivity between remnant forest areas within and surrounding the site is often unbroken with the major exception of several roads which separate larger fragments. The busy major roads that surround much of the subject site (Tingira Drive, Macquarie Drive and Wyndham Way), in addition to the increasing residential development of the area, are considered as potential barriers for the movement of terrestrial and arboreal fauna species from the subject site to nearby areas of remnant vegetation. However, at present, a narrow corridor along the roadside verge of Macquarie Drive provides a narrow link to bushland areas to the north and east.

One area, considered connected to the subject site, is a 78 ha area of remnant bushland lying to the east. The Tingira Heights Nature Reserve (17.71 ha), which was gazetted in 1989, forms a part of this remnant (Forest Fauna Surveys 2006). Tingira Heights Nature Reserve is contiguous with larger bushland remnants in the Eleebana / Tingira Heights area including the Mt Hutton and Eleebana fragments, as described in Forest Fauna Surveys Pty Ltd (2006). It supports remnant open forest which provides habitat for a range of protected and threatened species including the Squirrel Glider (*P. norfolcensis*), the Masked Owl (*Tyto novaehollandiae*), the Grey-headed Flying-fox (*Pteropus poliocephalus*) and a number of microchiropteran (insectivorous) bats (Forest Fauna Surveys 2006). The potential of the subject site as a wildlife corridor for movement of these threatened species (along with many other faunal species) is considered high.

The study area is recognised in the Lower Hunter Regional Conservation Plan as lying within an area containing a regionally significant squirrel glider population and wildlife corridors of state significance.

7.2.2_Potential Impacts of Site Development

Development of the subject site, and associated vegetation clearance, may lead to:

_ Impacts on the viability of fauna populations that may become isolated as a result of habitat loss.
_ The introduction of domestic fauna (e.g. cats and dogs) may impact on native fauna that currently use the area, through predation or disturbance.
_ Noise, light and visual disturbance may affect wildlife.

Development will result in the loss of high quality Squirrel Glider habitat. The critical factor in ensuring the long term persistence of the Squirrel Glider population on the site is corridor connectivity. Provided the highest quality corridor is preserved (corridor #3), the loss of habitat (based on a loss of up to 3.5ha) is unlikely to result in the extinction of a local population of Squirrel Glider. However it is noted that the loss of habitat will contribute to the incremental reduction in habitat in the longer term.

7.2.3_Recommendations

The Forest Fauna Surveys report identifies potential development options for the site that will ensure protection of the Squirrel Glider habitat and corridor connectivity. The options provided include the following key components / recommendations:

_ Maintain corridor connectivity between the site and the larger adjoining Eleebana fragment – with crossing points 3 and 4 identified as the better quality corridor pathways;
_ Removal of some habitat trees equating to 71% and 73.3% retention (noting that this is below the parameter of 75-80% retention in the LMCC *Biodiversity Planning Policy and Guidelines for LEP Rezoning Proposals*);
_ No development in the small area of taller forest between the end of Stenhouse Drive and Gleeson Crescent to offset loss of important habitat in central portion of the study area.
_ Planting and habitat enhancement for Squirrel Gliders in unused portions of Croudace Bay Park (i.e. in proximity to the sediment detention basins). This would require maintenance of the narrow canopy gap across Macquarie Drive, and future road upgrades would need to maintain a canopy gap of less than 35m in width.
_ Provision of nesting boxes for Squirrel Gliders to compensate for the loss of hollow trees. Recommended for installation in the EEC as the area does not currently support tree hollows. It is noted that this measure requires ongoing maintenance and replacement.

7.3_Bushfire

Total Earth Care was commissioned to undertake a bushfire threat assessment of the subject site (attached at Appendix D). The following summarises the key findings of recommendations made in the Bushfire Threat Assessment (July 2009).

7.3.1_Existing Conditions

The entire area of Lot 414 is mapped as Bushfire Prone Land (Vegetation Category 1) as per the Lake Macquarie local government area 'Bushfire Prone Land Map'. Bushfire Prone Land (Vegetation Buffer) is mapped outside the Lot adjoining the Category 1 areas along the eastern boundary, with some smaller areas of Vegetation Category 1 across Tingira Drive to the south, and also another area to the north-east. The entire area of Melaleuca Scrub (EEC) that is proposed to be retained and the 10 metre buffer is mapped as bush fire prone land Vegetation Category 1.

Bushfire History

No fire history record is available for the site itself, and the NSW Rural Fire Service and NSW Fire Brigades did not have any specific records of fires occurring on the site recently. However, information obtained from the fire control authorities as part of the background research for this report indicated that fires have occurred in the Tingira Drive area in 1991, and several smaller fires from localised arson events are fairly common in the area.

7.3.2_Assessment of Bushfire Threat

The assessment of bushfire threat and recommended asset protection zones (APZ's), outlined in the table below, follows methodology set out in Appendix 2 of *Planning for Bushfire Protection* (NSW Rural Fire Service, 2006).

Table 7.1 – Bushfire Threat and Recommended Asset Protection Zones

Zone	Vegetation formation	Effective slope category	Distance of site boundary to vegetation	Recommended APZ[1] (IPA[2], OPA[3])	Bushfire Threat
North	Forest	Upslope	At boundary	20 (10, 10)	The vegetation along the north of the site is a small area, which does join up with larger areas of vegetation to the north-east. It is slightly smaller than 1 hectare in area, however it could support a fire to the site under northerly winds, and it is assumed that a vegetated link will retain connectivity of this area to the forested wetland on the subject site. The impact of fire approaching the site would be moderate from this zone.
East	Mainly managed land, small forest area	Level / upslope	30m across Wyndham Way to 30m wide vegetated corridor at south-east corner	Nil	A vegetated corridor will remain along southern boundary that will link to existing 30 m wide corridor to east across Wyndham Way. The largest area mapped as Tetratheca juncea habitat is located in the eastern portion of the site, but its small area and isolation will not contribute significantly to bush fire threat. The impact of fire approaching the site would be minor from this zone.

[1] Asset Protection Zone
[2] Inner Protection Area
[3] Outer Protection Area

Zone	Vegetation formation	Effective slope category	Distance of site boundary to vegetation	Recommended APZ[1] (IPA[2], OPA[3])	Bushfire Threat
West	Forest	>0º – 5º (downslope)	At boundary	25 (15, 10)	The Melaleuca Scrub vegetation will remain on site and is the greatest threat to the subject site. The gentle slope, relatively small area and intermittently inundated land mean the impact of fire approaching the site would be moderate from this zone.
South	Predominantly managed land, small forest areas	Level / upslope	Vegetation corridor retained on site and approx. 20m across Tingira Drive to vegetation corridor	20 (10,10)	The open space area will be retained along Tingira Drive and will combine with vegetation across the road to form a corridor of bush fire prone land. The degree of management of the understorey will influence the intensity of a fire. The impact of fire approaching the site is expected to be low as it would only occur if the vegetated corridor ignited from vegetation further to the west or east of the site.

The recommended asset protection zone for the northern and southern boundary of the site is 20m, including a 10m Inner Protection Area and a 10m outer protection area. A larger asset protection zone, comprising a 15m Inner Protection Area and a 10m outer protection area is recommended along the Melaleuca Scrub vegetation area. An 8 metre wide perimeter road reserve is recommended in these areas, and this can be located with the Outer Protection Zone as part of the required setbacks.

The outer 10 metres of the vegetated link along Tingira Drive and *Tetratheca juncea* zone could be used as the required 10 metre outer asset protection zone setbacks where appropriate. Ember attack could still be a threat on any properties constructed close to these boundaries, so Level 3 construction is recommended for this section of the site.

Outer Protection Areas
Fuel loadings within the Outer Protection Area (OPA) should be maintained in such a manner that the vegetation is not continuous. Fine fuel loadings within the OPA should be kept to a level where the fire intensity expected will not impact on adjacent developments (8 tonnes per hectare of fuel is commonly used). As stated above the OPA of 10 metres that is required around the *Tetratheca juncea* zone and the vegetated corridor on the southern boundary can potentially be located within the retained vegetation areas. This would only be the case if there is no significant impact to threatened species.

Inner Protection Areas
Fuel loadings within the Inner Protection Area (IPA) should ensure that (RFS 2001):
_ there is minimal fine fuel at ground level which could be set alight by a bushfire; and
_ any vegetation in the inner protection area does not provide a path for the transfer of fire to the development – that is, the fuels are discontinuous.

The presence of a few shrubs or trees in the inner protection area is acceptable provided that they:
_ do not touch or overhang the building;
_ do not form a continuous canopy;
_ are not species that retain dead material or deposit excessive quantities of ground fuel in a short period or in a danger period; and
_ are located far enough away from the house so that they will not ignite the house by direct flame contact or radiant heat emission.

7.3.3_Potential Impacts
Development within the bushfire protection zone is possible, providing the recommended asset protection zones and other bush fire protection measures are implemented.

7.3.4_Recommendations
Asset protection zones, along with general principles for other bush fire protection measures such as APZ management, services, access and egress, subdivision design and building location should be used to limit and manage the threat of bushfire attack to any future development of the site.

The following Performance Based Controls are derived from the information contained in Chapter 4 of PBP 2006. Planning for Bushfire Protection sets out the design issues, and the following are examples that should be considered for the Eleebana site.

_ Minimise perimeters of urban development that front the bushfire hazards, particularly in the western portion of the site;
_ Minimise bushland corridors that permit the passage of fire;
_ Provide accessible refuge areas, ideally situated within the eastern section of the site away from the main hazard;
_ Ensure the ongoing maintenance of APZs, clear and ready access to the public road system and ensure adequate water supply;
_ Develop in blocks to minimise internal fuel loads;
_ Limit the number of battle-axe style blocks to avoid access difficulties during bushfire.
_ Locate as many lots on level ground as possible;
_ Where buildings are to be built on slopes they should be constructed using a cut and fill method;
_ Consider a static water supply for dwellings located closest to the hazard; and
_ Use of concrete slabs rather than raised floors for building construction in areas of lower bushfire threat.

Council must ensure that bushfire hazard reduction is not prohibited within an asset protection zone, and as a condition of development consent Council should ensure that a mechanism is established to allow for the ongoing maintenance of the asset protection zones.

Access and Egress
Two access points as a minimum to the site must be maintained. The public road system should provide alternative access or egress for fire fighters and residents during a bushfire emergency if part of the road system is cut off by fire. At least one alternative access road needs to be provided for individual dwellings or groups of dwellings more than 200 metres from a public through-road. The routes of these roads should be selected to ensure that both roads are unlikely to be cut by a fire at the same time, so there is at least one evacuation route.

It is recommended that a perimeter road be incorporated into any future subdivision plan for those parts of the site that adjoin bushland. This should be located at the boundary of the proposed inner protection area along the forested wetland part of the site, and along the northern and southern boundary. The section of perimeter road along the western boundary should be linked back into the internal road system in at least one place, depending upon lot layouts.

7.4_Geotechnical Conditions

A Geotechnical Assessment was undertaken by RCA (attached at Appendix E), and outcomes are outlined below.

7.4.1_Existing Conditions

Regional Geology

The site straddles the mapped boundary between Quaternary alluvium and the sub-crop of the Boolaroo subgroup of the Permian aged Newcastle Coal Measures. Listed rock types for the Boolaroo subgroup include conglomerate, sandstone, tuff, shale and coal.

Records from underground coal workings in the vicinity of the site indicate north-westerly trending dykes run sub-parallel to the western and eastern site boundaries.

Soil Landscape

The lower western portion of the site lies within the mapped extent of the Wyong alluvial landscape. The remainder and majority of the site is located within the mapped extent of the Warners Bay residual soil landscape.

The Wyong alluvial landscape is characterised by broad poorly drained floodplains and alluvial flats and deep (>2m) soils, with localised peaty soils. Limitations for this landscape type include: flooding; water logging; acid sulfate potential; and impermeable soils of very low fertility.

The Warners Bay residual soil landscape is characterised by undulating to rolling low hills and rises, with broad crests, long gentle slopes and broad drainage lines, and moderately deep (1m to >1.5m) soils. Limitations for this landscape type include: high water erosion hazard; foundation hazard; steep slopes (localised); mass movement hazard (localised) moderate to high shrink-swell; plastic subsoil; and strongly acid soil of low fertility.

Acid Sulfate Soil Potential

There are no known occurrences of acid sulfate soils within the site area.

Surface Conditions

The site surface elevation falls from 26m AHD at the intersection of Wyndham Way and Tingira Drive down to 5m AHD in the south west corner of the site. Ground slopes over the majority of the site range from essentially flat ground to slopes of some 4° to 8° generally falling towards the west and northwest. There are some localised steep slopes 25° to 35° and undercut incised banks along Creek 1.

Preliminary Site Classification

The encountered subsurface profile indicates a typical profile consisting of a slope wash or residual clay, sandy clay and clayey sand soils which grade into bedrock. Given that the clays are generally of medium to high plasticity, they are expected to have a moderate to high reactivity to moisture changes. In accordance with AS2870-1996, a preliminarily site classification of Class H has been assigned to the site.

7.4.2_Potential Impacts

From a geotechnical viewpoint, there are no major constraints to future developments on the site provided the developments are undertaken in accordance with sound engineering principles.

The risk of slope instability affecting appropriately designed development on the site is assessed to be low.

Future developments have the potential to increase the risk of landslides on the site. It is therefore recommended that new development should be carried out in accordance with good hillside practice and the recommendations given in the RCA report.

7.4.3_Recommendations

A detailed geotechnical investigation will be required at the appropriate stage of development.

Recommendations related to excavations, filling, footing design, retaining walls and pavement design as part of future development are provided in the RCA report.

7.5_Contamination

A Phase 1 Environmental Assessment was undertaken by RCA, and outcomes are outlined below.

7.5.1_Existing Conditions

No significant contamination was identified during the investigation. No previous developments on the site were identified and thus it is considered unlikely that contamination of soils or ground water has occurred.

Several stockpiles of asphalt and concrete were observed close to the centre of the site. Small amounts of general refuse were observed on those site boundaries shared by public roads. Further investigation and sampling may be required to classify this material for offsite disposal to a licensed facility.

A groundwater bore search for existing bores was not undertaken as part of this investigation. There were not deemed to be any past site uses which would have impacted on groundwater and therefore an assessment of groundwater was not considered to be required.

7.5.2_Recommendations

None.

7.6_Extractive and Mineral Resources

7.6.1_Existing Conditions

The site is located within the proclaimed Lake Macquarie and Extension Mine Subsidence District. WorleyParsons have consulted with the Mine Subsidence Board (MSB) to determine if there are any areas of interest or concerns regarding development of the site.

The MSB has provided the following guidelines for any future surface development on the Eleebana site (letter is attached at Appendix F):

_ Single or two storey timber of steel framed improvements clad with weatherboards or other similar materials.
_ Single or two storey brick veneer improvements.
_ Full masonry and other types of improvements will be considered for this property under MSB's *Graduated Guidelines for Residential Construction*. The improvements will be subject to length restriction and may require engineering design.

The guidelines are subject to the improvements being erected on reinforced concrete footings and/or slabs to comply with AS 2870, and improvements are limited to a maximum length of 30 metres.

Future development applications on the site will require approval from the Mine Subsidence Board.

7.6.2_Recommendations

The Mine Subsidence Board should be consulted during future planning and design stages and during the approvals process for on-site structures.

Surface development on the site should meet the following guidelines (subject to the improvements being erected on reinforced concrete footings and/or slabs to comply with AS 2870, and improvements are limited to a maximum length of 30 metres):

_ Single or two storey timber of steel framed improvements clad with weatherboards or other similar materials.
_ Single or two storey brick veneer improvements.
_ Full masonry and other types of improvements will be considered for this property under MSB's *Graduated Guidelines for Residential Construction*. The improvements will be subject to length restriction and may require engineering design.

7.7_Hydrology, Flooding and Drainage

WorleyParsons have completed an assessment of hydrology, flooding and drainage on the site. The Stormwater and Flooding Report is attached at Appendix G, with key findings and recommendations outlined below.

7.7.1_Existing Conditions

Watercourses and Catchments

The subject site contains two watercourses and an overland flow path, with three identified sub-catchments contributing runoff to the subject site.

Watercourse 1 (WC1), aligned through the north-western corner of the subject site, comprises a shallow emphemeral channel that has a typically top width of 1 metre. Over bank regions comprise dense riparian vegetation with some weed species observed. WC1 joins Watercourse 2 (WC2) approximately 50 metres to the west of the western boundary of the subject site. Both WC1 and WC2 are unnamed creeks.

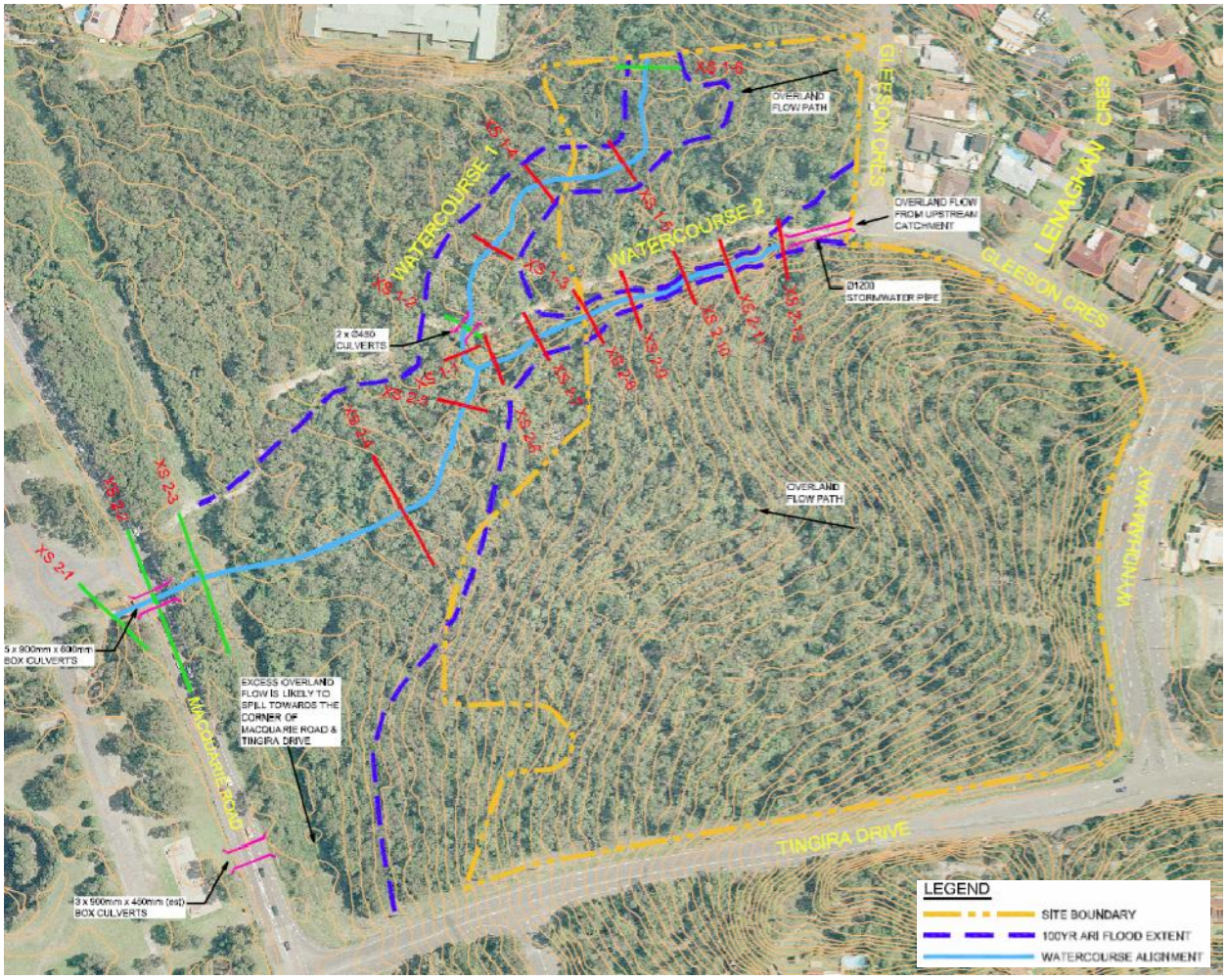

Figure 7.6_Watercourses on the site

WC2 is the largest watercourse in the study area. The upstream section of the watercourse comprises a tail-out drain that was excavated to the invert level of the 1200mm stormwater pipe that drains Catchment 2. The excavated channel is approximately 2 to 3 m deep and has a top width of approximately 10 m. There is evidence of bank erosion in some areas of the channel. The bank erosion is most likely attributed to the increased velocities associated with the channelisation of flow as well as the increase in flood frequency resulting from the urbanisation of the upstream catchment. It is likely that the channel will progressively widen if the banks are not reinforced.

Downstream of the study area, WC2 returns to what is likely to be its original channel configuration, comprising a shallower and narrower channel with densely vegetated overbank regions. The watercourse discharges under

Macquarie Road through a set of box culverts. Any flow in excess of the culvert capacity is likely to flow to the south-west towards the low point at the Tingira Drive and Macquarie Road intersection.

Potential Flooding
Hydraulic modelling indicates that flooding within WC1 would be contained to a 20 to 30m wide inundation extent. Modelling indicates that during a 100 year ARI flood event, the majority of the flow would be conveyed through the channel, with predicted channel velocities ranging between 1 and 2 m/s. Flooding in the overbank regions is predicted to be generally less than 500mm inundation depth with average velocities predicted to range from 0.4m/s to 0.7m/s.

Hydraulic modelling indicates that flooding within the upper reaches of WC2 is contained within the tail-out drain, which has been excavated to approximately 2 to 3 m below the natural surface. During a 100 year ARI flood, flow velocities within the channel are predicted to range between 2 to 4 m/s. These high velocities have the potential to cause significant bank erosion by eroding the toe of the channel banks, which could possibly lead to a collapse of the upper portion of the bank. This is particularly a concern on the southern bank, which rises steeply away from the channel in the upper 60m of the tail-out drain.

Downstream of the study area, the channel conveyance capacity is reduced and a significant portion of the flow is conveyed as overland flow. During a large flood, such as a 100 year event, it is likely that a significant portion of the flow would be conveyed to the south-west towards the low point adjacent to the Tingira Drive and Macquarie Road intersection.

Provisional flood hazard mapping has been generated for the design 100 year ARI flood within the subject site, and is shown in the figure below. Flood waters within the channel of both Watercourse 1 and 2 are considered to be high hazard, while flooding in the overbank regions of Watercourse 1 is considered to be low hazard.

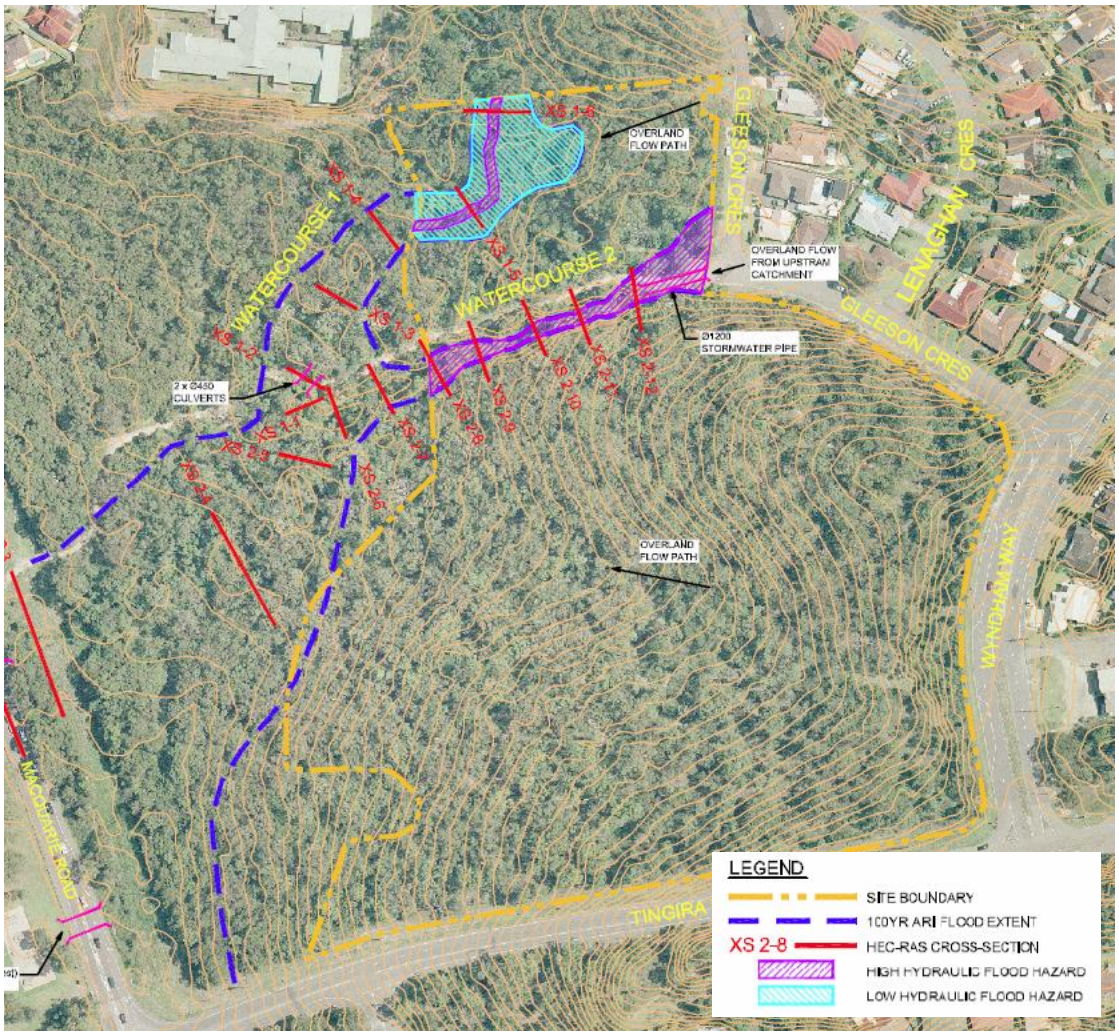

Figure 7.7_Provision flood hazard mapping

7.7.2_Recommendations

Due to moderate bank erosion observed in some areas of the Watercourse 2 channel, it is recommended that bank stabilisation works are undertaken to reduce the risk of bank collapse.

Public access should be restricted in areas that are categorised as high flood hazard.

Riparian Corridors

Recommended riparian corridors for the identified watercourses on the subject site have been identified, in accordance with the Department of Water & Energy's *"Guidelines for controlled Activities: Riparian Corridors"* (DWE, 2008).

A 40 metre wide riparian corridor is recommended for both Watercourse 1 and 2, consisting of:

_ A Core Riparian Zone (CRZ) of 10 metres either side of the channel (total CRZ width of 20 metres); and

_ A Vegetated Buffer (VB) of 10 metres width either side of the CRZ.

Rehabilitation and Protection Measures

The following rehabilitation and protection measures are recommended:

_ Watercourse 1

_Removal of weed species in accordance with the vegetation management plan that is outlined in the Eleebana Flora and Fauna Study (WorleyParsons, 2010).

_If development of the north-eastern corner of the site occurs, fencing should be established around the eastern edge of the Vegetation Buffer to discourage public access to the riparian zone.

_ Watercourse 2

_Installation of rock armouring along the toe of the channel of the tail-out drain (between cross sections XS 2-6 and XS 2-12) where there is evidence of bank erosion. The rock armouring should comprise appropriate sized rocks that are keyed into the channel bank. Riparian vegetation should be planted between the rocks. The rock armouring will reduce the chance of further erosion of the channel banks and provide protection for the establishment of riparian vegetation within the currently eroded areas.

_Removal of weed species in accordance with the vegetation management plan that is outlined in the Eleebana Flora and Fauna Study (WorleyParsons, 2010).

_In areas where development directly adjoins the Vegetation Buffer, fencing should be established to discourage public access into the riparian zone, and the tail-out drain, which is considered to be a high flood hazard.

7.8_Heritage Assessment

Total Earth Care have prepared an “Aboriginal and Historic Cultural Heritage Assessment” (Jan 2010) for the study area (attached at Appendix H), with findings summarised below.

7.8.1_Existing Situation

There are no Aboriginal cultural heritage sites in the study area based on the register of known sites and field survey involving Aboriginal stakeholder parties.

There are no historical heritage items in the study area based on register searches and field survey.

7.8.2_Likely Impacts

It is considered that there are no Aboriginal or historic heritage constraints to development in the study area and that no further heritage assessment is required.

7.8.3_Recommendation

In the event that any unanticipated items of Aboriginal cultural heritage are located in the study area at any time in future, any work in that area should cease and notification made to the Aboriginal stakeholders listed in this report. An archaeologist should inspect the find, being either a consultant or from the Department of Environment, Climate Change and Water office in Coffs Harbour.

The Aboriginal community groups involved in this study are established as being the principle determinants of the significance of Aboriginal cultural heritage there. No decisions about Aboriginal cultural heritage should be made in the area without consultation with these parties. Consultation should follow the guidelines provided by the Department of Environment, Climate Change and Water.

It is noted that Aboriginal stakeholder parties have expressed wishes to be involved in monitoring works in the development area to ensure that unanticipated Aboriginal cultural heritage material is not impacted. Such monitoring is not archaeologically justified nor required under any provisions of the *National Parks and Wildlife Act 1974* – however, the requests are highlighted for the benefit of LMCC should they choose to act upon them. A desire to see signage noting the association of the area with Aboriginal groups has also been expressed. This is also not the subject of independent recommendations in this report, but is again highlighted for consideration at later planning stages.

7.9_Amenity Assessment

An amenity assessment has been undertaken by HASSELL to consider the landscape and amenity, subdivision and the potential impacts which development of the site may introduce.

7.9.1_View Analysis

A detailed view analysis was undertaken, using Geographical Information Systems (GIS), to investigate the view opportunities on the site, and to explore and understand the view corridors established in the immediate surrounds.

The evident view opportunity identified in the local context is Lake Macquarie, with views provided from the Lake to the surrounding area and vice versa. The view analysis undertaken is therefore based on two primary methods:
_ Using observation points on the Lake to assess views towards the site and surrounding landform; and
_ Using observation lines at key contour levels on land to assess views across the site towards the Lake.

It is noted that the analysis models are based on terrain, and therefore do not take into account manmade or natural features above ground that may block the observer's view. They do however provide a good indication of view opportunities in the local area.

The viewshed analysis maps are provided in Appendix I.

Five observation points at the Lake were used to analyse views of the site and surrounding land. These are shown in Figure 10.2. The observation points provide very similar results, with the exception of views from observation point 5 (where some views are blocked by the location of this observation point around the corner towards Valentine).

The mapping illustrates that the lower topography areas near the foreshore are visible, including Halton Park and the site. It is however noted that substantial tall vegetation in the foreshore area (as shown in Figure 7.8) restricts views to and from the Lake. There are no view opportunities between the site and the Lake due to the presence of the EEC area in the western portion of the site, which is to be retained.

Figure 7.8_Vegetation in foreshore area, Halton Park

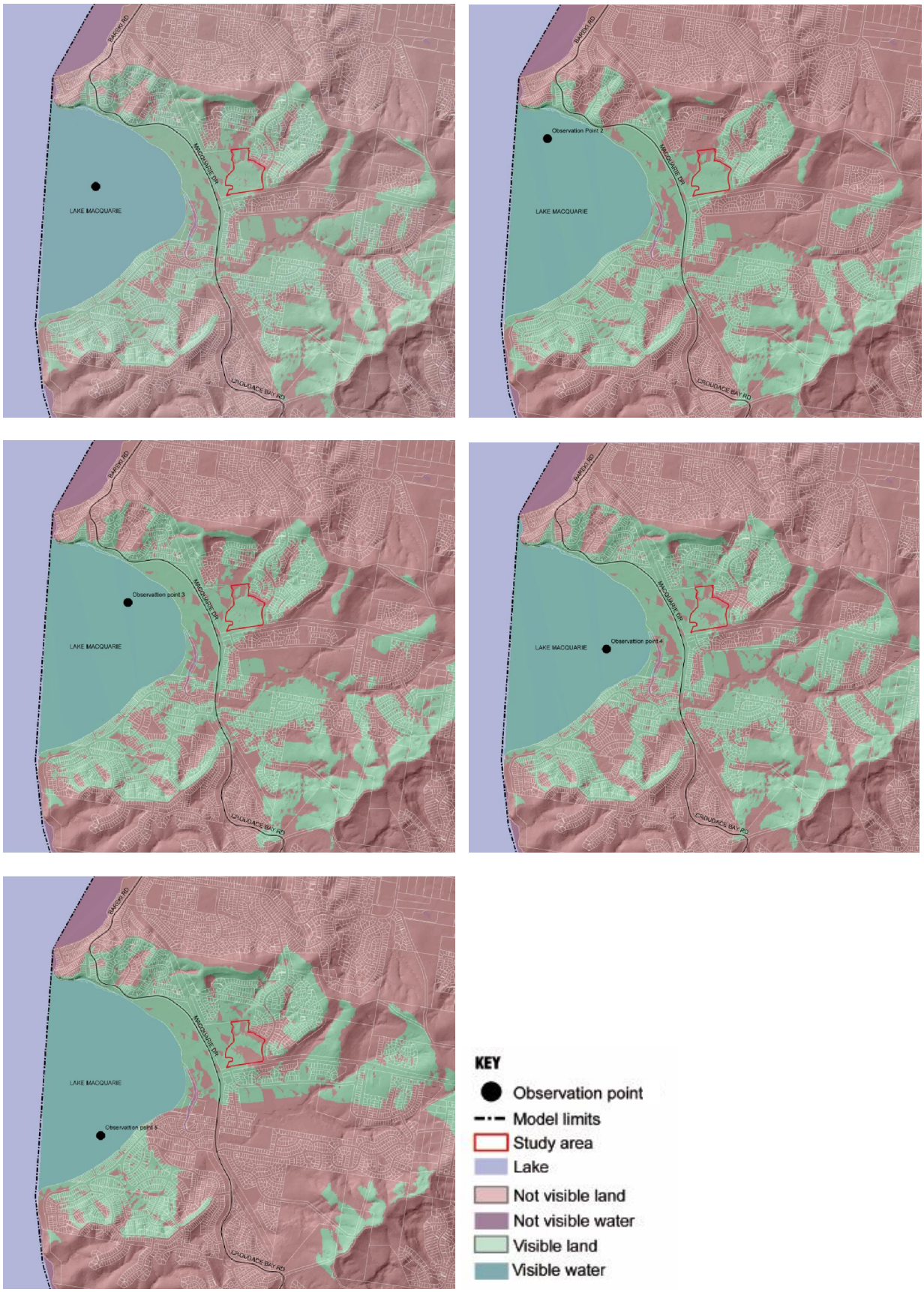

Figure 7.9_Views of the site and surrounding land from observation points at the Lake

Due to the steep topography to the east of the Lake, the key land areas which are visible from the Lake observation points are the elevated residential areas surrounding the Lake. In relation to the site, the areas to the north and east of the site have potential views across the site towards the Lake. Observations during the site visit reinforce this assessment, with clear view corridors identified above the established tree canopy of the site, as shown in Figure 7.10.

Figure 7.10_Views towards the Lake from elevated residential areas to the east of the site

It is noted that there is a substantial existing tree canopy on the site (up to approximately 20 metres in height) and it is proposed to retain key vegetation areas as part of any development of the site. The EEC vegetation area to the west of the study area will also be retained. Figures 10.3 and 10.4 show that the topography at the higher elevations allows views over and above the existing tree canopy on the site.

7.9.2_Landscape Amenity

Aesthetic qualities of the site's native vegetation fronting Tingira Drive and Macquarie Drive is found to be important to the amenity of the locality.

A green corridor has been established along either side of Tingira Drive. This is a regenerative vegetation setback, has generally been established through Council control, required as new land was subdivided for residential development in this location. The undeveloped nature of the subject site extends this green corridor. As Tingira Drive forms a strong link to Lake Macquarie and Halton Park, retaining this green corridor is important to retain a strong green/ landscaped link to the Lake. From an amenity point of view, this green corridor should be continued from Wyndham Way intersection along the southern end of the subject site to Macquarie Drive.

7.9.3_ Character Assessment and Density Analysis

HASSELL has developed an indicative street layout for the subject site that draws from the elements of urban character found within the locality and analysis of the environmental qualities of the site. The indicative street layout allows us to determine potential lot yields for the subject site. The following summarises the findings of our investigation.

Residential Character Adjacent to the Site

The character of the residential development immediately surrounding the site is consistent with that in other parts of Eleebana. It is based on a newer subdivision layout, following the more natural lines of the local topography with many streets ending in cul de sacs.

Streets are defined by regularly spaced dwellings on allotments of approximately 650 square metres to 1000 square metres, with consistent front boundary setbacks.

The street character, is informal, with no regular street tree planting. A modest residential setback, providing a 'green' setback, typically exists on both sides of the road reserve, but no paved footpath is provided. Vegetation is characterised by informal planting set back within private lots.

Dwellings are typically double storey with single or double garages incorporated in the design of the home, located at the front of the property. There is no trend with regard to front fences. A large proportion of properties do not have a fence.

Density Assessment
The density assessment of the site involved a review of existing development within close proximity to the Eleebana site, as well as environmental and infrastructure constraints. An indicative site layout (sketch only) and analysis was undertaken to determine the density of lots that could potentially be developed on site.

Residential density north of the site is lower than that in more environmentally sensitive parts of the Lake Macquarie area. A range of lot sizes varying between 800 and 1,000 square metres were applied across the site, although the majority of lot sizes are a minimum of 800 square metres.

The range selected reflects the specific characteristics of the subject site, in particular, the high biodiversity and environmental integrity of flora and fauna habitats found across the developable area. Larger lots (1,000 to 1,200 square metres) maybe more appropriate adjacent to environmentally
sensitive areas along the eastern and northern boundaries of the developable area to allow for a larger buffer between the developed and EEC areas.

Higher density allotments ranging from 600 square metres to 800 square metres could be investigated on parts of the site, depending upon location and treatment of asset protection zones and road locations buffering the EEC. However, this would be subject to additional investigations to ensure suitable levels of important flora and fauna habitats can be protected across the site.

Recommendation
_ It is recommended that any development on the site is lower in height than the vegetation on the site or within the EEC, so that it will not result in built form domination of the established green setting of the site. In addition, built form should not result in additional screening or obscuring of views towards the Lake from surrounding areas. In order to be consistent with surrounding built form, dwellings should generally be restricted to two storeys, and it is noted that this would remain below the tree canopy height.
_ The green corridor established along Tingira Drive is to be reinforced by retaining a building setback along the southern boundary of the site of at least 10 metres. This setback can be integrated into a subdivision plan as residential property back yards, or integrated walking paths/ active recreation areas etc.
_ Retaining the EEC will ensure the site's visual appearance from Macquarie Drive will remain 'green'.
_ Future development of this site should remain conservative, reflecting the importance of retaining the integrity of the EEC and overall biodiversity of the subject site.
_ Street layouts should follow the natural topography where practical, and be located within the APZ where possible, to improve relationships between residential and environmentally sensitive areas.
_ Proposed future residential development should be sized to accommodate predominately 800 to 1,000 square metre lots, with a range of larger lot sizes to encourage a sensitive design response to the environmental constraints of the site and to allow for a softer transition between the built form and the undeveloped / sensitive and significant environmental areas.
_ Smaller allotments could be considered for the site - subject to detailed site planning and a site specific Development Control Plan being prepared to guide the built form outcomes and to mitigate against potential environmental impacts.

7.9.4_Existing and Proposed Land Uses
A review of development applications that have been approved within the past three months (or are pending approval) within one kilometre of the site has been undertaken, in order to assess whether any substantial changes in built form are proposed in the surrounding area. Approved developments of note include the following:
_ There are a number of approved applications for new dwellings on Corymbia Street, which is a newly developed residential area. This is located to the south of the site across Tingira Drive. This area is not visible from the site, and the only potential impact would be increased traffic accessing Corymbia Street from the Parklea Avenue turn-off at Tingira Drive, however this is expected to be minimal.
_ A new sporting facility has been approved within the Croudace Bay Park (14 Parklea Avenue), within walking distance of the site. This will provide additional recreational facilities for future residents of the site.

_ A 4 lot strata subdivision and multiple dwelling housing has been approved at 41 Tallawalla Road (Valentine) and a 3 lot strata subdivision approved at 6 Dilkera Avenue (Valentine). Both of these are located some distance from the site (almost 1km to the south west).

It is considered that there are no substantial proposed land uses in the area which will impact upon the potential development of the site.

Recommendation
None

8 ___ Transport and Infrastructure

8.1_Road Network and Access

Better Transport Futures / Mark Waugh Pty Ltd have completed a Traffic Impact Assessment (attached at Appendix J). Key findings and recommendations are outlined below.

8.1.1_Assessment

Current Road Network Operation

The existing road network works reasonably well with minimal delays noted. However, during the afternoon peak period it can be seen that the right turn out of Tingira Drive suffers from some delays due to the high traffic volumes on Macquarie Drive in this location. This has been identified by the RTA in their desire to upgrade this intersection with signal control, but no date has been set for this work as yet.

Access and Circulation Requirements

Access is to be provided via a new access on to Wyndham Way, between Tingira Drive and Stenhouse Drive. There is an existing gap in the central median opposite the entry to the Telstra substation that can be used to allow for all turning movements. The line marking on Wyndham Way in this location will need to be altered to allow for the turning movements at this location. There is an existing bus stop located where the new access road will connect that will also need to be relocated to the north. The full details for this access will need to be reviewed as part of the future development application and the design and construction will need to be approved by Council.

No vehicle queues are expected at the site entry / exit point.

The new access connection will need to be designed and constructed in accordance with Council's Guide for Residential Subdivision.

Parking Requirements

Parking for the residential element should be provided within the building and driveway as per Council requirements. Parking for the local neighbourhood shops should be provided in a separate parking area and on-street.

It is considered that the parking demand for the local shops is relatively low, with a high number of customers walking of cycling to these facilities. The Council code recognises this with a requirement for 2 spaces for staff only being required.

Generated Traffic

The residential development could generate some 432 vehicle movements per day as a maximum (based on 48 lots) and 270 based on a more realistic development size of 30 lots. It is considered that an additional 270-432 vehicle movements per day will have an acceptable impact upon the local road network, as these roads currently operate well with minimal delays for road users.

The shops could develop some 90 vehicles per hour at peak times, with the majority of these being trips shared with existing trips on the road network.

Wyndham Way has an environmental maximum limit of 500 vehicles per hour. With the current two-way flow of 289 in the AM peak and 326 in the PM peak, the additional flows of 26-41 vehicles per hour associated with the residential development will mean flows will remain within acceptable limits. A peak of 90 trips associated with the shops also mean the flows could remain within these limits.

Impacts on Tingira Drive will be acceptable as this road can carry a peak hour flow of 2,000 vehicles per hour, and current peak hour flows are 1,019 vehicles in the AM peak and 1,025 in the PM peak.

Pedestrian Movements

There are no footpaths or cycling facilities within the immediate vicinity of the site, which reflects the current low demands by users and the comparatively low traffic flows in the locality. The new cycleway (and planned extensions) running alongside Lake Macquarie is considered adequate to service the requirements of the existing and proposed populations considering the minor population increase proposed.

Pedestrian movements are expected between the site and Wyndham Way for buses. Strong pedestrian line for access to foreshore area of Lake Macquarie and the skate park on Macquarie Drive opposite the subject site. There

Transport and Infrastructure

could also be desire for pedestrians to the south towards the service station and school at the corner of Croudace Bay Road and Regal Way.

Pedestrian access will also be required for access to the neighbourhood shops. These pedestrians will be local only and will be from the residential element of the site or the existing residential lots along Wyndham Way.

It can be seen that there will be potentially be a very strong desire line towards the lake foreshore, associated with leisure use along the foreshore as well as use of the skate park, which will typically be for younger people. It will therefore be desirable to provide a path between the site and Macquarie Drive to allow access – this will also require some form of pedestrian crossing on Macquarie Drive. This could be in the form of a raised pedestrian island in the centre of Macquarie Drive that will allow people to cross the road in two movements. When the RTA install traffic signal control at the intersection of Macquarie Drive and Tingira Drive there will be formal pedestrian crossing facilities provided at these lights that will also service the subject site.

Road Safety
It is considered that there will be minimal impact on overall road safety in the area generally as a result of the construction of the proposed residential lots. There have been no recorded accidents at the intersection of Wyndham Way and Tingira Drive over a five year timeframe. Given the overall layout of this intersection, it is considered that there will be no significant change in the safety at this intersection.

The accident data for the intersection of Tingira Drive and Macquarie Drive shows that there have been seven recorded accidents at this location associated with the intersection controls. The majority of these related to the traffic turning right out of or into the side road. This is a reflection of the current issue of delays for traffic turning right out of the side road. The RTA have identified that this intersection requires an upgrade to traffic signals to reduce these delays and also to reduce the accident rate at this location.

It is considered that the additional traffic associated with the proposed development will have a minimal impact upon the road safety at this intersection.

8.1.2_Recommendations
No external road upgrade work, or improvements to site access and circulation, are deemed necessary.

It is recommended that a path is provided to connect the subject site and Macquarie Drive. This should then connect to a raised pedestrian island on Macquarie Drive to allow for ease of crossing to the lake foreshore area and the skate park.

Design will need to comply with Council's Residential Design Guidelines.

Vehicular access to the site is to be provided via Wyndham Way. It is recommended that the gap in the existing median be utilised as an entry/ exit point. Access from Tingira Drive is not identified to be plausible.

Transport and Infrastructure

8.2_Infrastructure

An infrastructure assessment in relation to future development on this site has been undertaken by WorleyParsons (attached at Appendix K). The report considers the availability of utility services to support a residential development. A summary is provided below.

8.2.1_Water Supply

The water supply authority responsible for the proposed development area is Hunter Water Corporation (HWC).

To provide sufficient supply for the proposed development, HWC have given the following advice regarding possible connections into the system. Connection can be made to either of two water networks in the vicinity to the site, discussed below.

_ Connection to the Eleebana High Level System is via the existing 150mm CICL watermain located in Tingira Drive. HWC has indicated there is currently sufficient capacity to supply the development to meet the minimum pressure and fire fighting requirements.

_ Connection to the South Wallsend Reservoir (Low Level System) via the existing 300mm CICL watermain located in Macquarie Drive. Hunter Water's results indicate there is currently sufficient capacity to supply the development to meet the minimum pressure and fire fighting requirements.

8.2.2_Sewer

The authority responsible for sewer reticulation to service the proposed development area is Hunter Water Corporation (HWC).

To service the proposed development, all flows will be transported to the Belmont Waste Water Treatment Works (WWTW) and will be serviced by the Valentine No.1 Waste Water Pump Station (WWPS). HWC has recommended the point of connection will be the 225VC sewer main (AC E7884) located to the west of the development.

The site is traversed by two major sewer mains, as shown in Appendix D, and it may be necessary to replace or divert these mains depending on the development layout.

There is currently sufficient capacity at Valentine No.1 WWPS to cater for the expected loads from the proposed development and there is sufficient capacity at the Belmont WWTW to cater for flows received from the proposed development.

8.2.3_Electricity

The electricity authority responsible for the proposed development area is Energy Australia (EA).

Preliminary assessment indicates that EA has assets adjacent to the proposed development which will allow for a future interconnection to the existing network. The development is expected to require substations, together with high voltage and low voltage distribution to cater for the potential loads of the site.

8.2.4_Telecommunications

The telecommunications authority responsible for the proposed development area is Telstra.

Telstra has advised that the proposed development can be serviced although a network service upgrade would be required. Telstra will also require protection or relocation of its telecommunications infrastructure that may be impacted by activities on the site.

8.2.5_Gas

The authority responsible for the proposed development area is Jemena.

Jemena has advised that the proposed development can be serviced by an existing gas main in the vicinity which has sufficient capacity at this point to meet the required demands.

Transport and Infrastructure

8.3_Stormwater Management

WorleyParsons have undertaken a stormwater assessment for the study area (attached at Appendix G). The following summarises their investigations.

8.3.1_Potential Impacts

A conceptual SWMP was prepared for this potential development area. As part of the process of developing the SWMP, an assessment was undertaken to identify potential stormwater impacts and develop appropriate mitigation measures. Table 8.1 summarises the results of this assessment.

Table 8.1 – Stormwater Impacts and Mitigation Measures

Potential Impacts	Recommended Mitigation Measure
Altering the existing runoff regime into the Endangered Ecological Community (EEC) that is located down gradient of the development area.	Provide 20mm of retention per unit area of impervious surface. Maintain existing catchment configuration to prevent diversion of existing flow paths.
Increasing peak flows downstream of the site.	Hydrologic modelling indicated that there would be a 1% increase in the peak flow at the Macquarie Road culverts during a 100 year ARI event. This minor increase in flow is not expected to increase the flood hazard at Macquarie Road and other downstream areas. As such, no stormwater detention facilities are recommended.
Increasing pollutant loads in runoff from the development area.	Provide stormwater treatment controls to achieve an 80% reduction in sediment loads and 45% reduction in nutrients loads in runoff from the development area. Water quality modelling is to be undertaken to determine the indicative size of stormwater controls. The recommended stormwater controls are summarised below.

8.3.2_Site Opportunities and Constraints Assessment

A site opportunities and constraints assessment was undertaken to establish the most appropriate SWMP for the site.

Identified opportunities include:

_ The 20m bushfire APZ that is located on the western side of the development area would be suitable for stormwater treatment infrastructure as it is located down gradient from the development area and is outside of identified ecological areas and associated buffer zones.
_ It is expected that 30 to 40% of the development area would comprise roof area. This roof area provides opportunities for rainwater harvesting.

Identified constraints include:

_ The site falls to the north-west with average grades of 6%. These steep grades are undesirable for the implementation of source controls such as permeable pavement and road side swales. The steep topography also creates difficulties in installing detention basins or water quality control ponds which would require extensive batters (and footprints) to achieve any meaningful volume.
_ There is a need for an overland flow path to convey runoff from areas up gradient of the development area.
_ The geotechnical assessment undertaken as part of this LES (RCA, 2009) identified soil profiles dominated by clay and sandy clays. While no infiltration tests were undertaken, it is likely that infiltration capacity of the on-site soils would be considered to be low to very low, reducing the effectiveness of any infiltration systems.

8.3.3_Recommendations

On review of the identified site opportunities and constraints as well as the mitigation measures, the following stormwater management measures are recommended:

_ Source Controls - a 5 KL rainwater tank for each dwelling.
_ Stormwater Conveyance - traditional pit and pipe drainage is recommended.
_ Gross Pollutant Traps - to be installed upstream of all bio-retention systems.
_ Bio-Retention Systems – to be constructed within the 20m APZ zone located on the western side of the development area. Water quality modelling indicates that a total of 880 m^2 of bioretention area would be required.

Transport and Infrastructure

The recommended Stormwater Management Plan is presented in Figure 5 of the WorleyParsons Stormwater and Flooding Assessment Report (attached at Appendix G).

9 ___ Social and Economic Investigations

9.1_Social Impact Assessment

A Social Impact Assessment (SIA) has been undertaken by HASSELL (attached at Appendix L). The SIA has been based on development assumptions as per the preferred land use option outlined in the LES, with an estimated 48 residential lots and four small neighbourhood shops.

The key findings and recommendations of the SIA are summarised below.

9.1.1_Key Findings

Demographic and Social Change

The SIA has been prepared based on a potential yield generated by lot sizes of 450sqm in accordance with the Lake Macquarie Development Control Plan No.1, 2009. However it is noted that the surrounding lots are larger than the DCP minimum lot size, ranging from approximately 650sqm to 1,050sqm. Integration of larger scale lots into the development is considered to attract a similar demographic to existing communities in the area. This would assist in integrating the development into the existing social group.

Accommodation and Housing

The proposed development will potentially introduce an additional 48 dwellings to the Eleebana suburb. This will assist in meeting the target for an additional 7,000 infill dwellings for the LGA under the Lower Hunter Regional Strategy, as well as providing housing for the predicted increase in population in the Lake Macquarie LGA. It is not considered that this will create any surplus of housing in the area.

Housing Affordability

Very low income earners in Lake Macquarie are effectively excluded from the housing purchase market as they would need to pay more than 30% of their income on mortgage repayments. Between 2008 and 2009, purchase housing for low income households and moderate income households became substantially more affordable for low and moderate incomes in Lake Macquarie LGA and the Hunter SD meaning more households have the ability to enter the purchase housing market. However, very low income earners remain excluded from the affordable purchase of housing stock.

A considerable number of those on a very low income or low income are in housing stress. In the very low income bracket, 87% are suffering from rental stress and 69% from home purchase stress. Almost half of those on a low income are suffering from rental or home purchase stress. Within the moderate income bracket, rental stress is much reduced at 12%, however home purchase stress is considerable at 27%. Rental stress is proportionately higher than home purchase stress for those on a very low or low income, while home purchase stress is proportionately higher within the moderate income bracket.

Open Space and Recreation

The analysis shows that there is a large amount of regional, district parks and recreational facilities in the Eleebana suburb (or within walking distance of 1km) in relation to the population. It is therefore considered that the future population of the development can use these spaces without creating demand for further recreational spaces.

Transport

Nearly half of all dwellings have 2 motor vehicles (48%) and less than 2% do not have a vehicle at all. 77% of all workers travel to work via car either as driver or as a passenger and 0.8% of the working population of Eleebana travel to work via bus. It is therefore considered that demand for buses is low and two bus routes would be sufficient to service the new development without placing additional strain on the current provision.

The newly created cycleways running alongside Lake Macquarie are considered adequate to service the requirements of the existing and proposed populations.

Access to Community Facilities

The proposed development does not create additional demand for community facilities to service the Eleebana suburb due to the small scale nature of the site.

Employment and Centres

Eleebana is identified as a local centre and the proposed development complies with these requirements by including provision for neighbourhood shops which are close to transport links and can provide employment opportunities.

Social and Economic Investigations

Social amenity
The cohesion of the development and surrounds should be considered further in the future design of the site for development. However, the retention of a high number of trees in the Endangered Ecological Community and on the site itself will assist in retaining the rural character and amenity of Eleebana.

Community, Crime and Public Safety
The design for the development should consider informal surveillance and reduce the opportunities for crime through a Crime Prevention through Environmental Design (CPTED) assessment.

Community Identity and Cohesion
The proposed development is located within an existing residential area and community. It is anticipated that the small sized development would integrate with the existing population by its proximity. Linkages between the existing community and the new development can be created and the two areas would become integrated.

The location of the site also promotes an active lifestyle and reduces the risk of lifestyle diseases such as diabetes and obesity.

9.1.2_Recommendations

_ The lot sizes and proposed population increase is considered a base case scenario for the site and further assessment would be required if lot sizes or numbers vary significantly.
_ Housing should be targeted at family groups, and the older age brackets (55 years+) in order to accommodate an ageing population and to achieve development that is cohesive with the surrounding areas.
_ Future planning should address the issue of housing affordability in Eleebana and Lake Macquarie by increasing the mix of dwellings available in the locality and investigating options to provide affordable housing to low income and target groups.
_ Lot sizes need to be assessed at detailed design of the site and it is suggested that a percentage of the development could be dedicated to larger scale lots to attract a similar demographic to existing communities in the area, and thus ensuring that that the site is cohesive with the existing character of the site.
_ Unlike the Lake Macquarie LGA and Hunter SD, there are no units above two storeys in height in the Eleebana suburb and the majority of dwellings are detached. It is recommended that the development remains consistent with the surrounding area and incorporates these dwelling types into the development.
_ The key principles of Crime Prevention through Environmental Design are outlined in the Department of Planning guideline titled *'Crime prevention and the assessment of development applications' (2001)* should be considered in the design development for the site.

Social and Economic Investigations

9.2_ Economic and Retail Assessment

The recommended land use for the site is residential, with a small neighbourhood shopping centre of one to four shops to serve local residents within the area.

Council has an established Centres Hierarchy, outlined in the Lifestyle 2020 Strategy (refer to section 5.1 of this report). The sub-regional centres of Charlestown and Glendale/Cardiff provide the key retail, shopping and business services for Lake Macquarie. A number of town centres are located in proximity to the site (including Warners Bay, Mount Hutton and Belmont) however these are at a distance of 3.5 to 5 kilometres from the site, and therefore require the use of public transport or a vehicle. There are currently no local centres within walking distance (400 metres) of the site, with the nearest neighbourhood centre being located approximately 1.8 kilometres away at Valentine.

The study area is highlighted with the Lifestyle 2020 Strategy as a neighbourhood centre under investigation.

The provision of a small neighbourhood shopping centre on the site is considered appropriate considering the Council's centres policy, and the fact that there are few retail facilities provided in the area surrounding the site. The provision of shops in this location will provide required facilities for the existing and future population, and some employment opportunities. It is unlikely that the small nature of the proposed retail units will have a significant impact on the local economy, and is unlikely to impact on the Valentine local shops which are located 1.8 kilometres away and will continue to serve the residents of Valentine.

The location of a neighbourhood shopping centre within the site has not been identified as part of the proposed zoning plan. However potentially the only viable location (outside the constrained site area with a proposed conservation zoning) would be on Wyndham Way, south of the access point towards the corner with Tingira Drive.

The Centres policy is supported as a means to concentrate key services in defined locations which are suitable to the population sizes they support.

Recommendation

_ The site presents an opportunity to support a future retail land use based on its location, relationship with other centres and local catchment population. However, this opinion remains independent of environmental constraints for this site.

_ Ensure further economic feasibility analysis is undertaken once a retail concept is identified – based on a potential site area, an economic analysis can assess the potential impacts on surrounding retail centres and the identified retail hierarchy.

10 __ Land Suitability Assessment and Development Option

10.1_Opportunities and Constraints

Following collation of detailed environmental assessment and consideration of the planning framework, all opportunities and constraints have been physically mapped across the site to clearly demonstrate the potential developable area available. Two stages were adopted as a methodology to analyse the opportunities of the site to deliver a potential developable area. These are:

_ 100% protection of endangered species, mapping all environmental constraints; and
_ Protection of approximately 75% of identified threatened species T.juncea and Squirrel Glider habitat, in accordance with Council's *Biodiversity Planning Policy and Guidelines for LEP Rezoning* Proposals (LMCC 2009).

8. Mapping environmental constraints

Map A, over page, maps all environmental opportunities and constraints of the subject site to enable the residual, potential developable land, to be identified. Full conservation of identified threatened flora and fauna species is assumed with relevant vegetative buffer zones applied. The following table provides a summary of site constraints.

Flora	
1	The boundary of the EEC area has been revised based on identification of diagnostic species. As a result the EEC boundary has moved further to the east.
2	The EEC area must be retained with an appropriate buffer.
3	A large subpopulation of the threatened *Tetratheca juncea* plant species occurs within the study area. These have been mapped at 100% retention in accordance with the Eleebana Flora and Fauna Study (Worley Parsons 2010).
4	A number of orchids which are protected under the *National Parks and Wildlife Act 1974* have been identified throughout the site, and it is possible that there may be additional orchids within the developable area which have not been identified by current surveys.
Fauna	
5	The subject site provides known habitat for threatened fauna species, including squirrel gliders, which are protected under the *Threatened Species Conservation Act 1995*. Hollow trees which provide potential squirrel glider habitat have been identified throughout the site. These have been mapped within the potential developable area. It is therefore assumed that a small number of these trees would potentially be removed if they could not be incorporated into a development option.
6	An area of high quality squirrel glider habitat has been identified in the north-east corner of the study area, and has been recommended to be excluded from the developable area (Forest Fauna Surveys Pty Ltd, 2010).
7	There are four vegetation / wildlife corridors on the site. The site has been recognised as containing State significant wildlife corridors and a regionally significant squirrel glider population (Lower Hunter Regional Conservation Plan). Wildlife corridors have been retained.
Stormwater and Flooding	
8	Requirement for riparian buffer zones of 40 metres width on both watercourses on the site.
9	Restriction of development / access away from areas identified as high flood risk.
Bushfire	
10	Bushfire Asset Protection Zones (APZ's) are required around the vegetation areas identified for retention on the site (ranging from 20m to 25m), in order to protect any future development from bushfire risk.
Vehicular Access	
11	Nil access is identified as feasible for the subject site.
Amenity	
	Retain a green corridor to Tingira Drive.

Land Suitability Assessment and Development Option

Opportunity and Constraints Map A

Eleebana LES

Development Opportunity Site
(opportunities & constraints)

KEY

- EEC Area
- Original EEC Boundary (Study Area Boundary)
- Revised EEC Boundary (Including 20m Vegetation buffer)
- Habitat Trees
- T. juncea Individuals
- T. juncea 20m buffer
- T. juncea Habitat
- Squirrel Glider Habitat/Offset Area
- APZ Bushfire Buffer
- Vegetation Setback (extension of established rehabilitation corridor)
- Watercourse Alignment
- Riparian Buffer
- 100 year Flood ARI
- Potential Access
- Biorention Catchment Division
- Native Vegetation Corridor (LMCC) - Crossing Point
- Native Vegetation Corridor (LMCC) - less than 200m width
- Native Vegetation Corridor (LMCC) - Rehabilitation Corridor

Metres
0 35 70 140

Scale @ A4 1:3,500

S

Land Suitability Assessment and Development Option

As demonstrated by Opportunity and Constraints Map A, when each environmental constraint is mapped across the site, an irregular and unfeasible development site results. This is a direct result of the site's high biodiversity and demonstrates the conservational value of the subject site.

_Developable Area
The remnant developable land is approximately 0.9 hectares, and is irregular in shape.

_Impact on Protected Species
As investigated by this study, 100% of the *T.juncea* habitat (including supporting vegetative buffer areas) is retained and the substantial portion of habitat trees for the Squirrel Glider are retained. Some six habitat trees would potentially be compromised.

_Access
The land is isolated, central to the broader study area, with no street frontage. There is nil vehicular access available. Vehicular access could not be provided without compromising threatened species habitat.

_Land Use Zone Recommendation
Based on the detailed analysis of the environmental integrity of the site, and the potential developable area defined by Map A, retaining the full site for Environmental Conservation (Primary) Zone is recommended. This zoning would protect the identified biodiversity of the site.

Through appropriate landscape design controlled access to the site could be achieved, with cross site links connecting residents with Lake Macquarie and the recreation foreshore. Features, including rest areas, an interpretive walkway, board walks and educational plaques could be introduced in a sensitive way to inform the community and visitors about the significant ecological value of the habitat and the species found across the site.

Having regard to the full extent of biodiversity and in seeking to maintain the identified environmental integrity of the site, a Conservation (Primary) Zone 7(1) would be recommended for the full site are as depicted below.

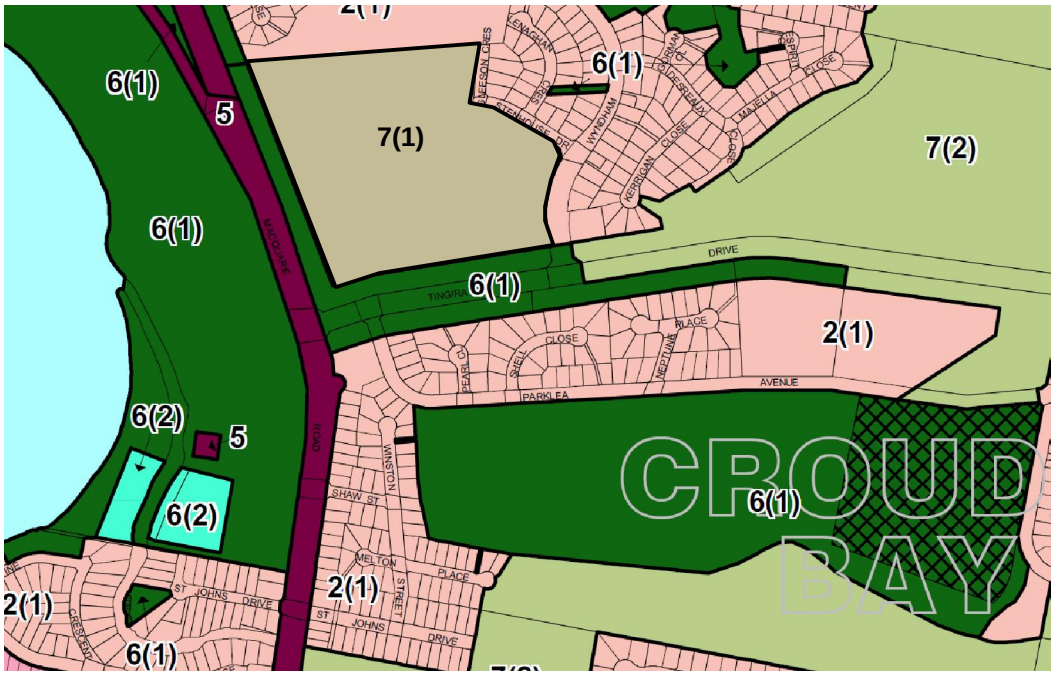

Figure 10.1 _ Rezoning Recommendation 1

A recommendation of a conservation zone is further supported by the following points:

High Biodiversity Value
_The DECC considered the site to have a "high biodiversity value, and a valuable component of other interconnecting bushland patches in the immediate area".

Land Suitability Assessment and Development Option

Habitat for Diverse and Threatened Flora Species

_The threatened flora species T. juncea is widespread over the eastern section of the study site and also occurs sporadically in the southern portion. The subpopulation at the study site is considered to be highly locally significant due to its size and its proximity to other T. juncea patches located within a 500 m radius of the site, which are considered connected under the 'stepping stone principle'. Any development of the site will directly impact on this threatened subpopulation and possibly affect the future genetic viability of nearby populations.

_The study site contains a highly diverse floral assemblage which was not seen at any other site surveyed within 500 m of the site. This included many species of orchid which are often found in conjunction with threatened species, such as the Leafless Tongue Orchid. These orchid species were widespread through open heath and gully areas in the eastern and southern sections of the study site. If development were to occur anywhere in these sections of the study site, direct impacts on these populations would not be avoided.

_The subpopulation of T. juncea at the study site is deemed regionally significant under criteria listed in the Lake Macquarie Tetratheca juncea Conservation Management Plan (Payne 2001) for following reasons:

_Subpopulation contains over 100 plant clumps (83% of all T. juncea populations contain less than 50 plant clumps with 75% containing only 1-20 clumps).

_Some nearby sites could be considered close enough to be regarded as part of same interbreeding population under the stepping stone principle (within 500m).

_T. juncea was most commonly found associated with dry and gently sloping open heath habitat with little shrubby understorey and where native grasses were present – any offset area would need to contain these attributes. The EEC does not present as an appropriate offset habitat.

_As the T. juncea surveys were undertaken at the end of the flowering season, the actual distribution at the site is likely to be greater than that mapped.

_Subpopulations of T. juncea found within 500 m of the study site were much smaller and more fragmented than the subpopulation found at the study site. In some cases T. juncea was found in small pockets of remnant bushland which are highly likely to become degraded over time due to the proximity to roads, housing and anthropogenic influences. The conservation value of the subpopulations at the study site is considered to be higher than that of the other sites within 500m.

_The Bonnet Orchid and Large Tongue Orchid were both found at the study site – these species are often associated with the threatened Leafless Tongue Orchid. According to DECCW the flowering season for the Leafless Tongue Orchid is November to February. Our surveys were conducted in November and December. If the species was to flower later in the season this may have been missed and it cannot be ruled out that the species does not occur here. In addition, it is possible that the species may miss a flowering season.

_The flowering season of the threatened Thick Lipped Spider Orchid is from September to November but flowering is considered most likely between late September to early October (DECC 2005) – hence, this species too may have been missed.

_Potential Grevillea parviflora specimen was found near the recently burned part of the site – too late for positive identification to be made (i.e. flowers almost dead).

_Several other orchid species were found to be very common within the study site – e.g. Slender Hyacinth Orchid, Bonnet Orchid, Large Tongue Orchid. These species were nowhere near as common at sites within 500 m (or nonexistent). All orchids native to NSW are protected under Schedule 13, Part 2, of the NPW Act 1974.

Contribution to Vegetation Corridors

_Study site is considered to form part of a significant vegetation corridor connecting bushland to the north and east (LMCC 2009). In 1999 LMCC determined that "at the very least existing corridors within the city need to be maintained at their current width or enhanced where possible".

_Clearing of remnant native vegetation would remove remnant native vegetation that forms part of an important wildlife corridor for the movement of native fauna such as the threatened Squirrel Glider to areas of habitat to the east and north.

Habitat for Diverse and Threatened Fauna Species

_14 species of threatened fauna listed as potentially occurring in, or known to occur in the study area.

_Development in the eastern or southern sections of the site would reduce the availability of important fauna habitat (a large proportion of trees with suitably sized hollows were found in the eastern part of the study area during previous surveys) (Murray 1996, EcoBiological 2007). Recent comment on the potential impact on fauna habitat (Squirrel Gliders) is provided by Murray (2010) but was not available at time of submission of this report.

_A reduction in the quality of native vegetation will subsequently affect habitat quality for native fauna and the viability of populations that may become isolated as a result of habitat loss.

Land Suitability Assessment and Development Option

Exemplar Site

_The site is considered to be relatively intact and in good condition, especially in comparison to other small fragmented areas of comparable bushland within 500 m in which anthropogenic impacts such as weed infestation, rubbish, and tracks were apparent.

_Compared to the study site, remnant vegetation patches within 500 m did not have a similar slope, aspect grade or drainage as the site.

_Plant diversity (flowering plants) at the site was higher than that observed at the other sites within 500 m.

_The site is accessible, being relatively flat, and is located in a populated area. *T. juncea* populations in this locality tend to be located on steep sloping/ inaccessible sites which prove difficult for the community to interact and experience the native bushland. The accessibility of the site is therefore an opportunity for people to interact and appreciate this habitat of high biodiversity.

_'Ecological function' is comprised of physical conditions (e.g. soil type) and ecological processes (e.g. water and sediment movement, nutrient cycling) that make up a functioning ecological system. Ecological functions are the 'building blocks' of habitat types on which species depend. Given the site's small size and its isolation from continuous areas of vegetation, any alteration or fragmentation of the site resulting from development will increase pressures on ecological processes, and may result in the disruption or loss of ecological functions. A change or disruption to ecological function may result in a change or loss of a habitat and the species which depend on it.

_Alteration or fragmentation of the site resulting from development will lead to an increased susceptibility to weed invasion.

_At present, Tingira Drive and Wyndham Way provide a barrier between the study site and residential development to the north and east. These serve to limit the invasion of exotic plants from nearby residences. Development around the edges of the site, or within the site itself, will result in human disturbance impacts, adversely impacting upon the threatened vegetation and fauna communities support on the site.

Human Disturbance and Exotic Species

_The effects of existing residential development around the site is already evident, including weed invasion at the edges of the site and alongside the main walking trail, illegal rubbish dumping (including domestic and garden rubbish), vandalism, erection of cubby houses, soil mounding and informal track creation (e.g. for trail biking). Weed invasion and other human interference to the site are likely to increase substantially if development were to occur.

_The introduction of domestic fauna (e.g. domestic cats and dogs) may impact on native fauna that currently utilise the area (through predation or disturbance). Indirect evidence of domestic animal activity such as soil disturbance and faeces is currently low.

_Trampling of native vegetation and soil disturbance through increased visitor traffic could potentially lead to fragmentation of vegetation and habitat within the site.

_The necessity for erection of boundary fences and bushfire APZ's around any development will require the clearing of a substantial area of native vegetation, in addition to that required for the development itself. These cleared areas provide increased habitat for exotic species, allow greater access to the site and are associated with substantial disturbance (e.g. use of machinery) in their construction.

_Development will potentially require the installation of additional infrastructure which may require excavation.

_Noise, light and visual disturbance affecting wildlife.

_Cut and fill and hard paving will result in changes to the site hydrology. The nature and location of the storm water currently entering the site may be influencing current vegetation cover and diversity. Any substantial and lasting changes to the local hydrological regime resulting from development (e.g. through changes to drainage or stormwater flows) may have an impact on the ecological values within the site.

As demonstrated by the points above, the integrity of the site is substantial and any development of this land would compromise this environmental biodiversity. A conservation approach is therefore recommended.

Land Suitability Assessment and Development Option

9. Consideration of variation: Protection of approximately 75% of identified threatened species T.juncea and Squirrel Glider habitat, in accordance with Council's Biodiversity Planning Policy and Guidelines for LEP Rezoning Proposals (LMCC 2009).

The key ecological issue defining the potential developable area are the presence of two threatened species (T, juncea and the Squirrel Glider – including the presence of Squirrel Glider habitat trees). In the consideration of rezoning opportunities for this site, Council has requested testing of the development potential of the subject site in accordance with Lake Macquarie *Biodiversity Planning Policy and Guidelines for LEP Rezoning* Proposals (LMCC 2009) which allows some flexibility to the protection of threatened species, and allows some removal of species were it can be demonstrated to be appropriate. The Policy requires the retention of at least 75% of the *T.juncea* population (plus a 20m buffer zone) and 80% of the Squirrel Glider habitat trees.

The Opportunities and Constraints Map B (refer below), demonstrates the potential developable area based on maintaining a minimum of 75% of the Tetratheca juncea plant species population and more than 80% habitat trees for the Squirrel Glider at the subject site (including relevant buffers). The designated wildlife corridor and Squirrel Glider habitat at the northern end of the site is retained. It is noted that removal of the full 25% was required to achieve a 'workable' potential developable area. Key features of the Map are identified in the table below.

Flora	
1	A large subpopulation of the threatened *Tetratheca juncea* plant species occurs within the study area. Council's *Biodiversity Planning Policy and Guidelines for LEP Rezoning* requires the retention of 75% of the population (plus a 20m buffer zone), including 'stepping stone clumps'. These have been mapped at 75% retention.
Fauna	
2	The subject site provides known habitat for threatened fauna species, including squirrel gliders, which are protected under the *Threatened Species Conservation Act 1995*. Hollow trees which provide potential squirrel glider habitat have been identified throughout the site. These have been mapped at above 80% retention, a total of six (of 45) are compromised.
Vehicular Access	
11	There is one point of access identified as feasible for the subject site – along Wyndham Way.
Amenity	
	Green corridor to Tingira Drive desired, not required.

The potential developable area is mapped, and the form of the site has been regulated in consultation with Council's technical staff. The site area is regulated to minimise potential edge effects and to ensure the most efficient use of the site in consideration of adjoining environmentally sensitive lands.

Land Suitability Assessment and Development Option

Opportunity and Constraints Map B

Eleebana LES

Potential Developable Area
Regulated Boundary
(75% T. juncea retained)

KEY

- EEC Area
- Original EEC Boundary (Study Area Boundary)
- Revised EEC Boundary (Including 20m Vegetation buffer)
- Habitat Trees
- T. juncea Individuals
- T.juncea 20m buffer
- T.juncea Habitat
- Regulated Boundary
- Squirrel Glider Habitat/Offset Area
- APZ Bushfire Buffer
- Vegetation Setback (extension of est. rehabilitation corridor)
- Watercourse Alignment
- Riparian Buffer
- 100 year Flood ARI
- Potential Access
- Biorention Catchment Division
- Native Vegetation Corridor (LMCC) - Crossing Point
- Native Vegetation Corridor (LMCC) - less than 200m width
- Native Vegetation Corridor (LMCC) - Rehabilitation Corridor

Metres
0 25 50 100

Scale @ A4 1:3,500

Land Suitability Assessment and Development Option

As demonstrated by Opportunity and Constraints Map B, when 25% of the T.juncea population is removed, a potential developable site area is identified.

_Potential Developable Area
The remnant developable land is approximately 2.1 hectares, and is regular in shape.

It is noted that this site area would need to cater to all site infrastructure requirements, including roads and utilities and their link to the site. It would also be necessary to achieve appropriate emergency vehicle access to the site within this land (potentially a second vehicular entry).

The potential developable area disregards the established green setback to Tingira Drive. Some level of native vegetation screening would be required along this boundary.

_Impact on Protected Species
Approximately 75% of the *T.juncea* habitat (including supporting vegetative buffer areas) is retained and the substantial portion of habitat trees for the Squirrel Glider are retained. Six habitat trees would potentially be compromised out of a total of 45 (approximately 87% retained).

It is noted that the future development and the ongoing use of the site would need to be carefully guided and managed to ensure that no adverse human disturbance impacts result in the loss of biodiversity values on adjoining lands.

_Access
The potential developable area achieves frontage to Wyndham Way and Tingira Drive. Vehicular access is still highly constrained with one opportunity for vehicular access identified along Wyndham Way (where the existing median has an established break). This may limit the size of vehicles able to enter the site.

It is noted that the land falls from Wyndham Way in this location and as such, vehicular access will need to address this.

_Servicing
Based on the identified site area and the environmental sensitivities of the broader site, the ability to service the site was investigated. The following would be a few options for connection of a small lot for development at Eleebana. These options are illustrated below.

Option 1 (Yellow) – Variable Grade Sewer to connection point to the north-west of site (this is the connection point nominated by HWC). A variable grade sewer is similar to a pressure main from a sewer pump station (i.e. no manholes). This option is understood to cross environmentally sensitive land, and there may be some difficulties in gaining environmental approval.

Option 2 (Blue) – Variable Grade Sewer to connection point to the north of site (this is the connection point nominated by HWC). It is noted that this option traverses environmentally sensitive land and may clash with existing stormwater pipes. Further engineering analysis would be required to confirm the feasibility of this option, if this approach isn't ruled out by environmental constraints.

Option 3 (Pink) – Private pump up system to the east of the site. This would consist of a small privately-owned pump station, which would pump flows to the sewer on the east of the site. It is noted that whilst this isn't the connection point nominated by HWC, it drains to the same catchment and is anticipated that there would be no capacity restraints (this would require confirmation with HWC).

Option 4 (Orange) – Conventional gravity sewer to the south of the site. We note that this is not the catchment to which HWC nominated connection. If further consideration is required of this option, confirmation would need to be sought from Hunter Water regarding the capacity of this catchment to receive additional flows. Due to the small development area now being considered, it is not anticipated that this would raise concern. It is anticipated that trenchless technology would be required to cross Tingira Dr, which will be expensive. This option was not previously considered, as it would not have been appropriate for servicing the entire development area, as was initially proposed.

Land Suitability Assessment and Development Option

Figure 10.2 _ Site Servicing Options

If further analysis of all constraints indicates that development of a smaller portion of this land was feasible, a small servicing strategy could be undertaken to determine the best solution to provide sewer servicing to the site.

_Land Use Zone Recommendation

From a straight land use analysis, the identified potential developable area is well positioned to support a range of land uses. The extension of the surrounding residential land use would be appropriate, allowing single dwelling allotments. If designed appropriately, a local scale retail land use combined with a residential function could also be appropriate at this site.

However, based on the high biodiversity value of the broader site, both as a valuable habitat for threatened species and native vegetation corridor, the potential land use opportunities for the identified potential developable area needs to be limited to development or activities which will not result in adverse impacts, or further loss of the biodiversity values identified on the broader site.

Without details of an end use, it is necessary to apply a conservative approach to land use recommendations.

Residential Land Uses Opportunities

It is considered that a low density residential development (approximately 800 – 1000 square metre allotments) or an eco tourism style development will not detract from the character of Eleebana or the environmental integrity of the site if it is designed and integrated in its environmental context appropriately; the future design and development of the land is managed through consultative structure planning; the detailed design would be subject to environmental assessment; and that a site specific development control plan be prepared and adopted for this site prior to Council issuing approval.

Retail Land Use Opportunities

It is understood that Council are considering retail land uses for this site. While it is acknowledged that retail land uses can be designed and operated to address environmental sensitivities, these are the exception and not the rule. It is noted that without details of an end retail use(s) at the site, a retail zoning cannot be recommended. A stand alone commercial or retail zone, permitting larger tenancy footprints with associated truck deliveries, large numbers of customer parking and high customer turnover on the site is not considered appropriate due to the likely operational impacts on the neighbouring lands.

Need for Further Environmental Assessment

Land Suitability Assessment and Development Option

It is Council Policy to resolve all environmental assessment and analysis prior to a rezoning being adopted. This is to rule out further environmental assessment during the development process. In the case of the subject site, the high biodiversity of this land, combined with the ambiguity of future development impacts, it is not possible to explicitly rule out the need for further environmental assessment should the Council proceed with an urban zoning for the identified potential developable lands. This is due to:

_the high biodiversity value of the site
_the occurrence of threatened plant species (other than T.juncea) across the site;
_a number of other orchid species (e.g. C. subulata, which is often found in association with C. hunteriana) were found within the potential developable area. Although not listed as threatened species, all orchids native to NSW are protected under the NPW Act 1974.
_compared to other sites containing remnant vegetation patches within 500 m, the subject site has different topographical features and higher plant diversity. Accordingly, in addition to impacts on T. Juncea, development of the site would result in impacts on other conservation values.
_development of the site is likely to involve cut and fill and/ or importation of fill which is likely to affect site drainage and microclimates, hence potential indirect impacts on T Juncea and possibly habitat trees etc.

Environmental impacts of a new development would not be restricted to those directly associated with the removal of T Juncea and without knowing proposed fill levels, land coverage percentages, slopes etc all potential impacts are not able to be identified and resolved.

10.2_Structure Planning

It is evident that the exclusion of the constrained areas from the 7.64 hectare site results in a potential developable area of approximately 2.1 hectares on the site. This potential development site is comprised of land which is identified to carry plant species of environmental integrity and supports wildlife corridors and fauna habitat trees. While it is possible to achieve a minimum 75% retention of the identified significant species as per Council's requirements, it is important to acknowledge that this option will eliminate threatened flora species and the habitat of threatened fauna species, as well as remove an area of high quality native vegetation. A risk is also introduced with new development potentially impacting upon the retained ecosystems.

It is important to ensure that any future development on the site be undertaken in a way to ensure the environmental integrity of the land is recognised, its relationship to neighbouring environmentally sensitive lands prioritised and the operational impacts of an urban environment managed with regard to its surrounding environmentally sensitive context. The yield of the site, therefore, will not reflect the more conventional site (e.g. allotments of surrounding residential lands).

Detailed structure planning or master planning of this site is required to identify a workable subdivision layout and achievable yield. To provide Council with guidance as to the workability of the identified Development Opportunity site, two indicative development options have been identified. Both options provide a street layout concept for the subject site with a schematic allotment layout. Each layout is supported by a single vehicular entry point via Wyndham Way.

10.3_Zoning recommendation

The zoning recommendations for the site have been informed by the detailed environmental assessments undertaken as part of this LES. While the primary recommendation of this report is to conserve the full site, a secondary recommendation is provided in line with Lake Macquarie *Biodiversity Planning Policy and Guidelines for LEP Rezoning* Proposals. Two zones are recommended conditionally.

_ Zone 7 (1) Conservation (Primary) Zone
_ Zone 2(1) General Residential (subject to detailed design; environmental assessment; and a site specific Development Control Plan being adopted prior to development approval).

The rezoning recommendation is demonstrated below.

Land Suitability Assessment and Development Option

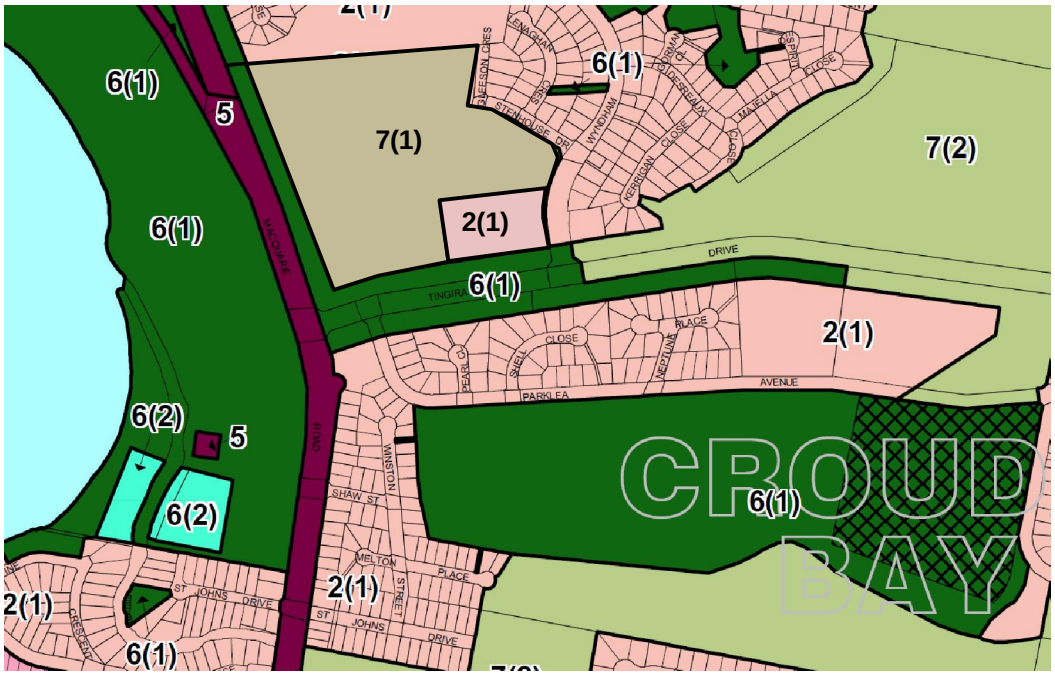

Figure 10.3 _ Rezoning Recommendation 2

An environmental conservation zoning is recommended for the majority of the study area which has been identified as containing significant flora and fauna, in order to protect the environmental values of the site. The site contains significant wildlife corridors that provide connectivity to the surrounding area, and these have been retained (with the exception of one crossing point which was of lesser value than others on the site).

Furthermore, measures have been identified within this report to enhance the environmental values of the site and ensure the resource is not degraded. Recommended measures include: establishing appropriate riparian corridors; stabilising watercourse banks; preparing a vegetation management plan(s) which may include measures such as weed control, ecological thinning, and access restriction; and enhancing habitat for squirrel gliders. These measures are detailed in section 11 of this report.

The mitigation and enhancement measures outlined in this LES will help to ensure that the site is maintained for future generations. Protection of the flora and fauna species (including threatened and vulnerable species) on the site will conserve biological diversity and ecological integrity of the site and the surrounding region.

Council could pursue the rezoning of land at the south eastern edge of the site to enable the future development of low density residential development and potentially a small scale neighbourhood shop/ general store. It would be necessary to undertake detailed subdivision design to determine yield. Council could defer the rezoning of this smaller pocket of the site to enable the consideration of detailed designs for this land. This would enable the Council to keep a more flexible approach to the future zoning of this land.

While a general residential zoning of the site would fulfil permissibility requirements, due to the site's environmental qualities, it is essential that the rezoning of the site for residential land uses be supported by a requirement of a detailed structure plan and site specific development control plan to ensure the efficient and appropriate development of the site. A zoning table comparison is provided below.

Zone (Lake Macquarie LEP 2004)	Comment
Zone 2 (1) Residential Zone Typically low density residential development, allowing for general stores and infrastructure to support the local population.	Would allow for residential land uses and a 'general store'. *general store* means a building or place for the retail sale of convenience goods that may include the facilities of a post office and/or for the sale of take-away food and that has a maximum gross floor area of 75 square metres.

Land Suitability Assessment and Development Option

Zone (Lake Macquarie LEP 2004)	Comment
	Subdivision From 250 square metres (approved dual occupancy) Standard block - 600 square metres This zone would allow the future subdivision of land into individual dwelling allotments, and permit general store development. It will be necessary to ensure minimum allotment sizes are driven by a structure planning process and not the minimum standards established for this zone to ensure a sensitive design outcome. This zone would not allow Council to control the development of the site as one site. This zone is not considered to provide sufficient environmental protection for that land with identified biodiversity.
7 (1) Conservation (Primary) Zone Promotes the conservation of land with ecological, scientific, geological, educational, faunal, floristic or aesthetic values, and aims to preserve and enhance areas of significant vegetation.	Promotes the use of sensitive land for activities which would promote the protection of biological diversity and encourages environmental conservation. Permits residential dwellings. Prohibits retail or general store uses and also prohibits eco tourism uses. Subdivision 40 hectare minimum This zoning will allow for the protection of the environmental integrity of the land with restriction on any future subdivision. This zone would not be appropriate for land identified to have development opportunity.
7 (2) Conservation (Secondary) Zone Promotes protection of environmental lands of high biodiversity, however promotes some types of development where it can be demonstrated that the environmental integrity of the land can be retained.	This zone is more flexible than the 7(1) zone, allowing for a wider diversity of development. Permits residential dwellings, eco tourism facilities, community uses (et al). Prohibits general stores or retail uses. Subdivision 40 hectare minimum This zone is not considered to provide sufficient environmental protection for that land with identified biodiversity. This zone would not be appropriate for land identified to have development opportunity.
7 (3) Environmental (General) Zone Introducing additional flexibility in land uses and development on land identified to have environmental value.	Permits residential dwellings, eco tourism facilities, community uses, retail plant nurseries (et al). Prohibits general stores or retail uses. Subdivision 40 hectare minimum This zone is not considered to provide sufficient environmental protection for that land with identified biodiversity. This zone would not be appropriate for land identified to have development opportunity.
7 (5) Environmental (Living) Zone This zone allows land with	Permits residential dwellings, eco tourism facilities, community uses (et al). Prohibits general stores or retail uses.

Land Suitability Assessment and Development Option

Zone (Lake Macquarie LEP 2004)	Comment
ecological, geological, scientific, scenic and biodiversity values to accommodate minimal impact, low density residential and agricultural development.	Subdivision 2 hectare minimum This zone is not considered to provide sufficient environmental protection for that land with identified biodiversity. This zone would not be appropriate for land identified to have development opportunity.

10.3.1_Site Specific DCP to underpin Residential Zone

Site specific Development Control Plan is to:

_ Ensure future development is consistent in maintaining the environmental integrity of the surrounding context by promoting urban design principles that allow for flexibility and sensitivity to environmental constraints;
_ Provide residential lots predominately sized between 800 square metres and 1,000 square metre lots (minimum) to encourage dwelling location is able to address the environmental constraints and characteristics of the site. Minimum allotment sizes can be varied based on sound detailed design and environmental considerations;
_ Designate a location and form for potential retail facilities at the site to ensure appropriate environmental protection.
_ Encourage cycling and pedestrian access to connect to the Lake;
_ Be based on sound ESD principles;
_ Encourage the implementation of Water Sensitive Urban Design Principles to reduce demand on the water supply;
_ Encourage the use of on-site reuse of grey water to reduce demands on existing sewerage infrastructure;
_ Propose development controls that encourage innovative and eco friendly built forms;
_ Encourage the retention of native vegetation and ensure new planting is restricted to native species;
_ Ensure road reserves provide sufficient space to allow the separation of pedestrian, cycle and road traffic;
_ Provide a detailed list of appropriate landscaping treatments and plants;
_ Retain remnant vegetation, asset protection zones and conservation areas in common open space areas;
_ Promote surveillance of open space areas and not allow blocks to back onto common open space areas;
_ Encourage a range of house types in order to cater for a range of household types, thereby helping to develop upon the existing residential area and to support local services and facilities, such as the public schools.
_ The location of site infrastructure should be designed to minimise impacts on the areas of ecological value within the site.
_ Set built form controls for specific sectors of the site in relation to build height and setbacks.

10.4_Cumulative Impacts and Recommendations

Potential impacts of development have been identified throughout the LES. Consideration is given here to the key potential impacts and any cumulative impacts that may result from site development.

The potential cumulative impacts of site development are considered in Table 11.2, and recommendations for mitigation of impacts provided. A comprehensive list of recommendations, with additional detail, is provided in section 11 of this report.

Land Suitability Assessment and Development Option

Table 11.2 – Potential Cumulative Impacts of Site Development

Potential Impact	Recommendation(s)
Loss of threatened flora species on the site, and subsequent fragmentation / reduction in viability of the wider population	_ Minimum 75% of the *Tetratheca juncea* population to be retained, including stepping stone clumps. _ Buffer zones around *Tetratheca juncea* to be implemented. _ Vegetation Management Plan to be developed to actively manage the retained *Tetratheca juncea* on the site. _ Species Impact Statement for *Tetratheca juncea* to be prepared as part of any proposed future development on the site, and to specify any necessary mitigation measures. _ Additional flora and fauna surveys to be undertaken as part of future structure planning and any future development applications. _ Allotment sizes for proposed development to remain generous to enable retention of substantial areas native flora.
Loss of habitat for threatened fauna species on the site impacting on wider populations	_ No development to be allowed in the high quality squirrel glider habitat in the north-eastern corner of the site. _ Habitat improvements for squirrel gliders to be considered outside the study area including provision of nesting boxes within the EEC, and improvements to Croudace Bay Park.
Interruption of wildlife corridors	_ Identified wildlife corridors that run through the site to be retained, particularly the high quality corridors.
Interaction between residential land use and conservation land may negatively impact upon conservation land values (weed invasion; vegetation trampling; soil disturbance; predation of native fauna by domestic animals; noise, light and visual disturbance to wildlife)	_ Management recommendations as per this Study to be implemented.
Bushfire threat is increased	_ Asset protection zones to be implemented and managed. _ Future development to meet performance based controls outlined in *Planning for Bushfire Protection 2006*.
Increased runoff into watercourses, increased bank erosion, and increase in flooding risk	_ 40 metre wide riparian corridors recommended for both watercourses on the site. _ Rehabilitation and protection measures for watercourses on the site to be implemented. _ Restriction of public access to high flood hazard areas.
Increased traffic and associated impacts	Traffic impacts are expected to be minimal. No measures are recommended.

Provided that the recommendations outlined in this report are implemented, it is considered that cumulative impacts associated with site development can be adequately mitigated.

11 __ Recommendations

Recommendation 1
Based on the identification of the environmental integrity of the site, rezoning the full site Zone 7(1) Conservation (Primary) Zone is recommended. This zoning would protect the identified biodiversity of the site.

Recommendation 2
While the primary recommendation of this report is to conserve the full site, a secondary recommendation is provided in line with Lake Macquarie *Biodiversity Planning Policy and Guidelines for LEP Rezoning* Proposals. This LES has identified a 2.1 hectare parcel of land which is a potential development site.

The future development of this land will result in the removal of identified threatened species and associated habitat, but impacts are considered manageable through retention of 75% of identified threatened species; the requirement for a site specific DCP; and additional environmental assessment at DA stage to ensure end use operational impacts are mitigated. The feasibility of the future development of this site will need to be weighed against the evident environmental costs.

Two zones are recommended conditionally.
_ Zone 7 (1) Conservation (Primary) Zone
_ Zone 2(1) General Residential (subject to detailed design; environmental assessment; and a site specific Development Control Plan being adopted prior to development approval). Council could defer nomination of the preferred zone for this 2.1 hectare pocket of the site to enable the consideration of detailed designs for this land. This would enable the Council to keep a more flexible approach to the future zoning of this land.

Recommendations have been provided within the LES to identify the management and mitigation measures that should be undertaken to ensure that any development of the site can be undertaken in a sustainable way. The recommendations seek to ensure that site development can provide adequate and suitable facilities and services for existing and future residents, whilst ensuring the identified environmental values of the site are protected.

This assessment concludes that a defined area of the Eleebana site could be used to support future development which may include low density residential; an eco tourism facility; or a small component of retail linked with either of these to serve the site and local neighbourhood only.

However, in order to realise the sites potential, it is recommended that future design development exercises for the site undertake the following in response to the findings of this study prior to rezoning of land:

Flora	
General	A number of recommendations and management options have previously been made to protect the integrity of the vegetation and threatened species within the subject site (EcoBiological 2007, Ecotone 2003). Recommendations from these and the flora and fauna study undertaken by WorleyParsons (2010), as discussed below, will aid in the long term conservation and enhancement of the site's ecological values.
Vegetation Management Plan	An appropriate vegetation management plan should be adopted to monitor, maintain and improve the ecological value of the study site and adjacent EEC. This plan should address the requirements of the Lake Macquarie Tetratheca juncea Management Plan (Payne 2001). Key management issues for the site would include: weed control and management; erosion control; maintenance of drainage conditions; fire management; ecological thinning; signage; and access restriction.
Offsets	Any proposed vegetation clearance could be offset with positive management options. Offsets may include agreeing not to clear regrowth, planting, re-seeding or improving habitat by weed control.
Species Impact Statement	If development is proposed on the subject site, a Species Impact Statement for *Tetratheca juncea* will be required.
Clearing of vegetation	If development of the site is to occur, recommendations related to vegetation clearance include the following: _ Hollow bearing trees should be retained where possible and any hollow bearing trees that are proposed for clearing should be checked for wildlife habitation by a qualified and licensed ecologist. _ Any hollow bearing trees should be soft-felled (including several gentle nudges flowed by monitoring for life) to alert any occupying fauna and allow them to self-relocate.

Recommendations

	– A nest box installation and monitoring program within the EEC has been suggested, as the majority of hollows mapped on the subject site occur within the proposed development area. The number of nest boxes should equal the number of hollows removed. They should be attached to mature and remnant trees at a variety of heights and aspects.
Retention of EEC	Under Councils *Biodiversity Planning Policy and Guidelines for LEP Rezoning*, all areas of EEC are to be protected plus a minimum buffer of 20 metres of native vegetation shall be provided to them (LMCC 2009). The EEC adjacent to the study site should be kept intact and managed according to an appropriate vegetation management plan as described above.
Tetratheca juncea Population	Retention of the entire subpopulation of *Tetratheca juncea* at the subject site is recommended (WorleyParsons, 2010). The Council's Addendum to the final Tetratheca juncea Conservation Management Plan (Payne 2000) suggests that conservation of larger populations of the species, in the order of 75 - 80% of plant clumps in these populations, should retain a viable population depending on edge effects (i.e. a maximum of 20 - 25% of a *T. juncea* subpopulation can be removed). According to this plan, EcoBiological (2007) recommended that the main *T. juncea* population be conserved with an additional 20 m buffer (about 87% of the total population). Ecotone (2003) considered the sacrifice of one or both of the smaller patches of *T. juncea* acceptable if the remaining areas were restored, conserved and actively managed on an ongoing basis.
Additional Surveys	There is a possibility that additional orchid species occur at the site in association with the orchid species identified, and that the small-flowered Grevillea is present in the fire-affected area. Any further vegetation survey work would likely reduce the potential developable area by inclusion of the southern section of the site which provides potential habitat for other orchid species including the Leafless Tongue Orchid.
Fauna	
Forest Fauna Surveys Pty Ltd recommendations	The Forest Fauna Surveys report identifies potential development options for the site that will ensure protection of the Squirrel Glider habitat and corridor connectivity. The options provided include the following key components / recommendations: – Maintain corridor connectivity between the site and the larger adjoining Eleebana fragment – with crossing points 3 and 4 identified as the better quality corridor pathways; – Removal of some habitat trees equating to 71% and 73.3% retention (noting that this is below the parameter of 75-80% retention in the LMCC *Biodiversity Planning Policy and Guidelines for LEP Rezoning Proposals*); – No development in the small area of taller forest between the end of Stenhouse Drive and Gleeson Crescent to offset loss of important habitat in central portion of the study area. – Planting and habitat enhancement for Squirrel Gliders in unused portions of Croudace Bay Park (i.e. in proximity to the sediment detention basins). This would require maintenance of the narrow canopy gap across Macquarie Drive, and future road upgrades would need to maintain a canopy gap of less than 35m in width. – Provision of nesting boxes for Squirrel Gliders to compensate for the loss of hollow trees. Recommended for installation in the EEC as the area does not currently support tree hollows. It is noted that this measure requires ongoing maintenance and replacement.
Bushfire	
Asset protection zones	Asset protection zones, along with general principles for other bush fire protection measures such as APZ management, services, access and egress, subdivision design and building location should be used to limit and manage the threat of bushfire attack to any future development of the site.
Performance based controls	The following Performance Based Controls are derived from the information contained in Chapter 4 of PBP 2006. Planning for Bushfire Protection sets out the design issues, and the following are examples that should be considered for the Eleebana site. – Minimise perimeters of urban development that front the bushfire hazards,

Recommendations

	particularly in the western portion of the site; _ Minimise bushland corridors that permit the passage of fire; _ Provide accessible refuge areas, ideally situated within the eastern section of the site away from the main hazard; _ Ensure the ongoing maintenance of APZs, clear and ready access to the public road system and ensure adequate water supply; _ Develop in blocks to minimise internal fuel loads; _ Limit the number of battle-axe style blocks to avoid access difficulties during bushfire. _ Locate as many lots on level ground as possible; _ Where buildings are to be built on slopes they should be constructed using a cut and fill method; _ Consider a static water supply for dwellings located closest to the hazard; and _ Use of concrete slabs rather than raised floors for building construction in areas of lower bushfire threat.
Council controls	Council must ensure that bushfire hazard reduction is not prohibited within an asset protection zone, and as a condition of development consent Council should ensure that a mechanism is established to allow for the ongoing maintenance of the asset protection zones.
Access and Egress	The public road system should provide alternative access or egress for fire fighters and residents during a bushfire emergency if part of the road system is cut off by fire. At least one alternative access road needs to be provided for individual dwellings or groups of dwellings more than 200 metres from a public through-road. The routes of these roads should be selected to ensure that both roads are unlikely to be cut by a fire at the same time, so there is at least one evacuation route. It is recommended that a perimeter road be incorporated into any future subdivision plan for those parts of the site that adjoin bushland. This should be located at the boundary of the proposed inner protection area along the forested wetland part of the site, and along the northern and southern boundary. The section of perimeter road along the western boundary should be linked back into the internal road system in at least one place, depending upon lot layouts.
Geotechnical	
General	A detailed geotechnical investigation will be required at the appropriate stage of development. Recommendations related to excavations, filling, footing design, retaining walls and pavement design as part of future development are provided in the RCA report.
Extractive and Mineral Resources	
General	The Mine Subsidence Board should be consulted during future planning and design stages of on-site structures. Surface development on the site should meet the following guidelines (subject to the improvements being erected on reinforced concrete footings and/or slabs to comply with AS 2870, and improvements are limited to a maximum length of 30 metres): _ Single or two storey timber of steel framed improvements clad with weatherboards or other similar materials. _ Single or two storey brick veneer improvements. _ Full masonry and other types of improvements will be considered for this property under MSB's *Graduated Guidelines for Residential Construction*. The improvements will be subject to length restriction and may require engineering design.
Hydrology, Flooding and Drainage	
General	Due to moderate bank erosion observed in some areas of the Watercourse 2 channel, it is recommended that bank stabilisation works are undertaken to reduce the risk of bank collapse. Public access should be restricted in areas that are categorised as high flood hazard.

Recommendations

Riparian Corridors	Recommended riparian corridors for the identified watercourses on the subject site have been identified, in accordance with the Department of Water & Energy's *"Guidelines for controlled Activities: Riparian Corridors"* (DWE, 2008). A 40 metre wide riparian corridor is recommended for both Watercourse 1 and 2, consisting of: _ A Core Riparian Zone (CRZ) of 10 metres either side of the channel (total CRZ width of 20 metres); and _ A Vegetated Buffer (VB) of 10 metres width either side of the CRZ.
Rehabilitation and Protection Measures	The following rehabilitation and protection measures are recommended: _ Watercourse 1 _Removal of weed species in accordance with the vegetation management plan that is outlined in the Eleebana Flora and Fauna Study (WorleyParsons, 2010). _If development of the north-eastern corner of the site occurs, fencing should be established around the eastern edge of the Vegetation Buffer to discourage public access to the riparian zone. _ Watercourse 2 _Installation of rock armouring along the toe of the channel of the tail-out drain (between cross sections XS 2-6 and XS 2-12) where there is evidence of bank erosion. The rock armouring should comprise appropriate sized rocks that are keyed into the channel bank. Riparian vegetation should be planted between the rocks. The rock armouring will reduce the chance of further erosion of the channel banks and provide protection for the establishment of riparian vegetation within the currently eroded areas. _Removal of weed species in accordance with the vegetation management plan that is outlined in the Eleebana Flora and Fauna Study (WorleyParsons, 2010). _In areas where development directly adjoins the Vegetation Buffer, fencing should be established to discourage public access into the riparian zone, and the tail-out drain, which is considered to be a high flood hazard.
Heritage	
General	In the event that any unanticipated items of Aboriginal cultural heritage are located in the study area at any time in future, any work in that area should cease and notification made to the Aboriginal stakeholders listed in this report. An archaeologist should inspect the find, being either a consultant or from the Department of Environment, Climate Change and Water office in Coffs Harbour. The Aboriginal community groups involved in this study are established as being the principle determinants of the significance of Aboriginal cultural heritage there. No decisions about Aboriginal cultural heritage should be made in the area without consultation with these parties. Consultation should follow the guidelines provided by the Department of Environment, Climate Change and Water. It is noted that Aboriginal stakeholder parties have expressed wishes to be involved in monitoring works in the development area to ensure that unanticipated Aboriginal cultural heritage material is not impacted. Such monitoring is not archaeologically justified nor required under any provisions of the *National Parks and Wildlife Act 1974* – however, the requests are highlighted for the benefit of LMCC should they choose to act upon them. A desire to see signage noting the association of the area with Aboriginal groups has also been expressed. This is also not the subject of independent recommendations in this report, but is again highlighted for consideration at later planning stages.
Road Network and Access	
General	No external road upgrade work, or improvements to site access and circulation, are deemed necessary. It is recommended that a path is provided to connect the subject site and Macquarie Drive. This should then connect to a raised pedestrian island on Macquarie Drive to allow for ease of crossing to the lake foreshore area and the skate park.

Recommendations

	Design will need to comply with Council's Residential Design Guidelines.
Stormwater Management	
General	The following stormwater management measures are recommended: _ Source Controls - a 5 KL rainwater tank for each dwelling. _ Stormwater Conveyance - traditional pit and pipe drainage is recommended. _ Gross Pollutant Traps - to be installed upstream of all bio-retention systems. _ Bio-Retention Systems – to be constructed within the 20m APZ zone located on the western side of the development area. Water quality modelling indicates that a total of 880 m^2 of bioretention area would be required. A recommended Stormwater Management Plan is presented in Figure 5 of the WorleyParsons Stormwater and Flooding Assessment Report (attached at Appendix x).
Visual	
General	It is recommended that any development on the site is lower in height than the vegetation on the site or within the EEC, so that it will not result in additional screening or obscuring of views towards the Lake from surrounding areas. In order to be consistent with surrounding built form, dwellings should generally be restricted to two storeys, and it is noted that this would be lower in height than the vegetation height. A vegetation setback to Tingira Drive is recommended.
Social	
General	_ Housing should be targeted at family groups, and the older age brackets (55 years+) in order to accommodate an ageing population and to achieve development that is cohesive with the surrounding areas. _ Future planning should address the issue of housing affordability in Eleebana and Lake Macquarie by increasing the mix of dwellings available in the locality and investigating options to provide affordable housing to low income and target groups. _ Lot sizes need to be assessed at detailed design of the site and it is suggested that a percentage of the development could be dedicated to larger scale lots to attract a similar demographic to existing communities in the area, and thus ensuring that that the site is cohesive with the existing character of the site. _ Unlike the Lake Macquarie LGA and Hunter SD, there are no units above two storeys in height in the Eleebana suburb and the majority of dwellings are detached. It is recommended that the development remains consistent with the surrounding area and incorporates these dwelling types into the development. _ The key principles of Crime Prevention through Environmental Design are outlined in the Department of Planning guideline titled *'Crime prevention and the assessment of development applications' (2001)* should be considered in the design development for the site.
Policy	
	_ Detailed structure planning of the site should be undertaken to identify optimal subdivision layout, appropriate setbacks, lot sizes and building envelope opportunities in context of the environmental sensitivities of the site. _ The future residential rezoning of the site should be accompanied by a site specific DCP to ensure the appropriate future development of the site. _ Residential zoning should consider restrictions in lot sizes to promote native vegetation retention. _ Any future neighbourhood shops would need to be of a domestic/ residential scale, with operational impacts mitigated in context of its environmental setting. _ Built form should respect optimal urban design outcomes. _ The site should predominantly support an Environmental Conservation zone and the new zone boundaries should recognised the revised EEC boundary as per this Study.

12 __ Conclusion

This Environmental Study has demonstrated the environmental integrity of the subject lands and high biodiversity value presented at the site. Importantly, the study has redefined the EEC boundary; identified the site as supporting threatened species and their habitat; identified land which is essential for conservation to protect identified threatened species; and identified a parcel of land which could be utilised for future development (approximately 2.1 hectares) subject to detailed design and ongoing site management.

The primary recommendation of this LES is the full environmental conservation of the site. This recommendation is supported by:
_the site's high biodiversity value
_the site's habitat supporting diverse and threatened flora species
_the site's contribution to vegetation corridors
_the site offering an exemplar habitat
_the ongoing impacts associated with human disturbance

A secondary recommendation is put forward, recommending the conservation of the majority of the site, with a 2.1 hectare parcel identified for future urban purposes (subject to detailed design; environmental assessment; and a site specific Development Control Plan being adopted prior to development approval). The LES found that adopting Council's Guidelines for retaining at least 75% of T.juncea and habitat trees of the Squirrel Glider, a developable parcel of approximately 2.1 hectares is able to be defined. This secondary recommendation will result in direct environmental impacts including removal of threatened species from the site, and would need to be managed to ensure the future use of this land does not further detract from the environmental integrity of the adjoining lands. This development opportunity will need to be carefully weighed against identified and likely environmental impacts.

Rezoning this parcel of land to enable a low scale residential community at the site is an appropriate extension of the immediately surrounding residential fabric of Eleebana. The development of a residential community at the site will need to be mindful of the important ecological habitat identified on immediately adjoining lands, with conservation of this environmental integrity to remain the first priority of the overall site design and operation. This LES recognises that the end land use for this site is determined by its ability to operate within the identified environmental constraints of the land.

Having regard to the investigations and findings contained in this Study, it is apparent that a small portion of the subject site could be rezoned to permit development for urban purposes, subject to the recommendations contained within this report.