Attachment 1

Noosa Biodiversity Plan

Biodiversity Assessment Report

Prepared for
Noosa Shire Council

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Abbreviations

Abbreviation	Description
API	Aerial Photography Interpretation
BVG	Broad Vegetation Groups
DEWA	Commonwealth Department of Environment and Water
DFA	Designated Forestry Area

Abbreviation	Description
DNR	Queensland Department of Natural Resources
DoE	Commonwealth Department of Environment
DoEE	Commonwealth Department of Environment and Energy
DPI	Queensland Department of Primary Industries
EBA	Endemic Bird Areas
EHP	Queensland Department of Environment and Protection
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
GIS	Geographic Information System
GRC	Gympie Regional Council
IBA	Important Bird Areas
IPCC	Intergovernmental Panel of Climate Change
LFW	Land for Wildlife
LGA	Local Government Area
MaB	Man and the Biosphere Program
MRCCC	Mary River Catchment Co-ordinating Committee
NC Act	*Nature Conservation Act 1992*
NCAP	Noosa Climate Action Plan
NDL	Noosa & District Landcare
NSW	New South Wales
RE	Regional Ecosystem
SCRC	Sunshine Coast Regional Council
SEQ	South East Queensland
SLATS	Statewide Landcover and Trees Study
TEC	Threatened Ecological Community
TSSC	Threatened Species Scientific Committee
UNESCO	United Nations Educational, Scientific and Cultural Organisation
VCA	Voluntary Conservation Agreements
VM Act	*Vegetation Management Act 1999*
WONS	Weeds of National Significance

Executive summary

The Biodiversity Assessment Report has been prepared to detail the current and future status of biodiversity conservation in Noosa. This is to assist in determining the key issues for local conservation management to be addressed in the Biodiversity Conservation Plan. It is the supporting research document that ensures that the development of planning policy is based on current scientific understanding of biodiversity values across Noosa.

To identify key issues for local conservation management all biodiversity values present across Noosa were identified and ranked according to the values' significance. Similarly, all relevant threats impacting on biodiversity values within the shire were identified and assessed according to the risk they pose to biodiversity values. Values of conservation significance were determined by analysing biodiversity values of high significance that are at high risk to current threatening processes. Issues relevant to local conservation management were considered to be conservation significant values that are currently lacking protection or management at both a State and Federal government level and would benefit from local scale management.

To support this approach, a methodology was developed based on a combination of desktop review and spatial data interrogation and analysis, utilising desktop information, some field validated vegetation records and a range of government supplied spatial data. A detailed mapping exercise was undertaken to spatially identify and rank biodiversity values and threats across the shire. The mapping provided a spatial illustration of the distribution of values and risks, whilst the ranking allowed for areas of conservation significance to be identified and prioritised.

The key result of the Biodiversity Assessment Report are described in the following sections.

Noosa's biodiversity values

Noosa contains a diversity of biodiversity values and natural landscapes within a very confined physical area. Many of the values and landscapes are of great significance and globally unique. Noosa's key biodiversity values include:

- A Shire of 871.6 km2, with ~55% covered in native vegetation, and of this >40,000 ha in remnant condition
- A diverse range of vegetation communities, which can be classified into 61 Regional Ecosystems (REs). While Noosa Shire comprises 1.4% of the total area of South East Queensland (SEQ), it contains representations of 39% of the REs that can occur in the bioregion, including 32% of the total number of Endangered REs across SEQ.
- Unique ecosystems including rare sub-tropical examples of patterned fens (wetland ecosystem), coastal lagoon systems, sand lakes and dune systems.
- A number of ecological communities, flora, fauna and invertebrate species that are recognised and protected under State and Federal environmental law, including the critically endangered lowland rainforest community.
- A great diversity of wildlife and plants (~1,340 species of plants and 348 species of terrestrial vertebrate animals). At least 217 species of birds, 45 species of reptiles, 55 species of mammals, and 31 species of frogs are known from the area. This includes endemic species and relicts from the ancient Gondwanan period when all continents formed one landmass.
- Key fauna species including Koala, Glossy Black Cockatoo, Water Mouse, Ground Parrot, Coxen's Fig Parrot, acid frogs, Cooloola Blind Snake, sea turtles, migratory shorebird species, Mary River Cod and Australian Lungfish.

- Critical habitats, including internationally recognised migratory bird habitats of conservation importance and sea turtle nesting sites. More than half of habitat available within Noosa Shire supports species of conservation value.
- A highly connected network of core habitat areas from a diverse cross-section of ecosystem types and altitudinal ranges.
- A very healthy river system, with the Noosa River rated as A- for the last two years in the SEQ Healthy Waterways Report card process.
- A network of diverse wetlands, which are in good ecological condition and encompass over 16,000 ha. Many are recognised as being of national or state significance.
- An extensive protected reserve system that plays a critical role in conservation management across the SEQ region. Over one third of the shire is covered by protected reserves, the largest being the Cooloola Section of the Great Sandy National Park.

Current threats to Noosa's biodiversity values

Noosa Shire demonstrates a balanced relationship between humans and the environment. The area has been able to retain significant environmental values whilst other areas across the SEQ region have undergone significant development. However, Noosa's biodiversity values are under pressure from a variety of threatening processes. Due to the significance of some of these biodiversity values, the potential consequence of these threatening processes are considerable and important. The key relevant threats identified within the Noosa Shire include:

- **Climate change**. The International Panel on Climate Change (IPCC) has identified SEQ as a climate change vulnerability hotspot, and as a low-lying coastal area within this region, Noosa Shire has high exposure and sensitivity to many of the predicted impacts of climate change.
- **Weed and invasive species**. These have been identified as one of the most significant threats to biodiversity across the shire. Weeds and pests negatively impact not only native biodiversity but also agricultural productivity and tourist enjoyment.
- **Vegetation clearing**. Dating back to the mid-1800s, clearing has been focused around urban and tourist developments along with timber and agricultural industries. To date ~40,000 ha (or ~50%) of Noosa's native vegetation has been cleared. The main contributor of ongoing vegetation loss in the shire to date is the clearing of regrowth vegetation across hinterland areas.
- **Habitat fragmentation and development**. Development of settlements, roads, powerlines and rail lines has been an integral component of the Noosa Shire's development but combined with broader-scale land clearing, has led to fragmentation effects across the area. The resultant loss of connectivity, barriers to movement and edge effects have an on-going detrimental effect on both terrestrial and aquatic biodiversity such as local extinction of species populations, genetic isolation and inbreeding depression.
- **Degrading processes**. Urban and agricultural development along with increasing residential and visitor populations increase processes such as erosion and sedimentation of waterways, increasing production of waste and declines in soil health.
- **Altered fire regimes**. Changes to the natural frequency and intensity of fires can destroy ecological communities, alter recruitment patterns and increase susceptibility to weeds. Within Noosa, fire sensitive species or specific vegetation communities are at risk and include rainforest and dry vine thickets, wet sclerophyll forests, heathlands and Melaleuca wetlands.
- **Conflicts between humans and wildlife**. Conflicts are most common in the more urbanised areas of the shire and as a result of recreational use. Key issues include vehicle and boat strikes to fauna; habitat disturbance activities (including development) in close proximity to

wildlife habitat; illegal or uncontrolled activities such as arson and off-trail access to national parks; and attacks on wildlife by domesticated pets (cats and dogs).

Values of conservation significance within Noosa

Noosa contains a broad spectrum of biodiversity values with each value presenting varying degrees of biodiversity significance. Some values are recognised to be of international importance whilst others are considered to be locally important.

To identify areas within Noosa that contain values of high biodiversity significance, all values within Noosa were ranked and mapped across the shire. Approximately 66% of the shire was found to comprise areas with values that are of high biodiversity significance. These areas occurred mainly within the eastern, coastal parts of the shire as well as along waterways (e.g. Kin Kin Creek, Sandy Creek, Pinbarren Creek, Cooroora Creek, Ringtail Creek and Six Mile Creek), within protection reserves and in scattered pockets of remnant vegetation throughout the hinterland of Noosa.

The majority of identified threatening processes across Noosa are a product of development with the severity and magnitude of these threats often much greater in urban and rural areas. Climate change on the other hand is a global issue and will affect the entirety of Noosa depending on the level of exposure and sensitivity of biodiversity values to climate change.

To identify areas within Noosa that are at high risk to threatening processes, both development risk and climate change vulnerability were assessed and mapped across the shire. Development risk was based on the current land zoning across the shire whilst climate change vulnerability was assessed as a function of exposure and sensitivity of Broad Vegetation Groups (BVGs) to predicted climate change impacts. This high level analysis indicated that approximately 60% or 52,000 ha of the shire has a land zoning that puts it at a higher risk of being exposed to threatening processes compared to surrounding land. Impacts of climate change will be felt across the shire, but will be most prominent for coastal ecosystems, wet lowland forests, heathlands and riparian zones.

Through the examination of both high value and high risk areas a considerable amount of overlap was detected. A large portion of areas of high biodiversity significance were found to occur within identified high risk areas. These areas are considered to contain values of conservation significance. Values within these areas include:

- TECs and regrowth vegetation with potential to be the TEC
- Remnant and regrowth threatened species habitat
- Wetlands
- Remnant and regrowth riparian vegetation
- Ecological corridors & linkages
- Locally / regionally significant species habitat
- Regrowth vegetation analogous to Endangered REs and REs poorly represented in protection reserves.

Current conservation management measures

There are a number of State and Federal environmental laws and policies that protect biodiversity values and address current conservation issues. These statutory measures target values and issues that are relevant at state and national scales such as threatened species, TECs, wetlands and vegetation communities of conservation significance.

At a local scale there are a number of conservation management programs and initiatives that are currently underway within Noosa Shire. These are focused on areas and species of key interest and importance to both the local and the wider community. Some are founded in legislative requirement and are therefore driven and overseen by Council. However, many initiatives are undertaken by the community and are reflective of the unique relationship the residents of Noosa Shire have with their surrounding environment.

Key programs and initiatives include:

- Council environmental operational plans such as the Noosa Shire Koala Conservation Plan
- Environmental Levy Program that funds land acquisition, Noosa Biosphere Reserve Foundation projects and supports Council's Voluntary Conservation Agreement (VCA) Program
- Numerous volunteer programs such as Landcare, Land for Wildlife (LFW) and a variety of bushcare and coastcare groups.

The existing conservation initiatives at a local level demonstrate that there is good momentum across Noosa Shire for undertaking positive environmental programs and activities. Going forward, there is a need for a clear direction and integrated strategy that builds on the information available and the on-going programs of both Council and the community. This will ensure future conservation management actions will be both targeted and effective at managing conservation issues relevant to Noosa.

Future direction for local conservation management across Noosa

There are a number of values of conservation significance across Noosa, which are not currently addressed by existing protection mechanisms governed at a State and Federal level. These conservation values are of relevance to local planning and conservation management. For the Noosa Shire this includes:

- Remnant vegetation
- Locally and regionally significant species habitat
- Endangered regrowth vegetation
- Regrowth vegetation with TEC, riparian, corridor and significant species habitat values.

Climate change as well as weeds and pests are threats that occur across Noosa irrespective of the level of protection. Nonetheless there are management actions that can be done at a local level to reduce these threats and build adaptive capacity through healthy, well connected ecosystems. Both issues require a local scale approach in addition to state and national initiatives.

Drawing from the overall results of this study, and in particular the relevant conservation issues for council, the key conservation priorities that are emerging for biodiversity in Noosa are:

- Protecting and enhancing local and regional values.
- Building resilient ecosystems. Our climate is changing and the key way to mitigate risk and build adaptive capacity is through having strongly resilient ecosystems.
- Maintaining and enhancing connectivity.
- Working together. Biodiversity conservation is everyone's responsibility and together, we can achieve great outcomes.

Utilising these key conservation priorities to develop conservation actions will ensure an effective and targeted approach to future conservation management across the Noosa Shire.

1 Introduction

1.1 Background

Noosa Shire contains extensive biodiversity and landscapes of great significance within a geographically confined area, many of which are globally unique. The local economy of Noosa Shire has a strong reliance on tourism, which is dependent on the natural and diverse scenery and biodiversity of the area. The shire of Noosa is also located entirely within the Noosa Biosphere Reserve®, which is an internationally recognised, UNESCO-designated reserve (Noosa Biosphere Ltd 2014a). Biosphere Reserves are areas with significant environmental values that demonstrate a balanced relationship between humans and the environment, promoting harmony between people and nature through education, conservation and sustainable development (Noosa Biosphere Ltd 2014a). Environmental excellence and sustainability is therefore a key priority for the Noosa community.

Biodiversity conservation is integral to achieving the overall vision of sustainability for the Noosa region. This has been reflected in the planning and policy framework adopted by the Noosa Council to date and is highlighted by the strong environmental focus of managing land use in the region. The recognition of the importance of biodiversity conservation across Noosa is also demonstrated through the on-going investment of resources into community run environmental initiatives, grant programs and partnerships.

Noosa Shire Council is committed to maintaining this strategic direction of environmental excellence and sustainability across both the local planning framework and the on-going conservation management approach within the shire. The Biodiversity Conservation Plan is one of Council's key policy documents that will be developed to fulfil this commitment. The plan will identify the key future conservation priorities and targeted actions for the region and in doing so will guide planning and decision-making as part of the Noosa Council planning scheme, as well as direct future investment. This relates to the management of Council reserves, offsets program/purchases, land acquisitions programs, community grants partnerships and volunteer programs.

The Biodiversity Conservation Plan covers the entire Noosa Shire, and incorporates the outstanding biodiversity values and the local community views. It is one of many other related plans that will inform the development of an overarching Environment Strategy that will synthesise all of Council's and communities environmental aspirations and initiatives.

This Biodiversity Assessment Report has been prepared to detail the current and future status of biodiversity conservation in Noosa in order to assist in determining the key issues for local conservation management that is to be addressed in the Biodiversity Conservation Plan. It is the supporting research document that ensures the development of planning policy is based on current scientific understanding of biodiversity values across Noosa.

1.2 Previous Biodiversity Planning Studies

Detailed studies of Noosa's flora and fauna values were undertaken in 2003 as part of the "Noosa Plan - Choosing Futures" process led by the Noosa Shire Council. Titled "Vegetation of Noosa Shire" (Burrows et al. 2003) and "Fauna & Its Associated Biodiversity Values in Noosa Shire" (Ecotone Environmental Services Pty Ltd, 2003), these studies aimed at assisting in the management and conservation of biodiversity in Noosa Shire with a particularly emphasis on informing the development of the Noosa planning scheme.

The 2003 flora and fauna studies provided more accurate and current information to the previous vegetation studies undertaken in 1995, which were prepared as part of the framework supporting the development of the 1997 Strategic Plan for the Noosa Shire Council. The availability of better quality aerial photography and the development of more refined mapping techniques at the time allowed both studies to detail:

- Vegetation classification and condition across the shire
- Fauna assemblages, habitat associations and corridor linkages
- Species of conservation significance, including regional and local scales
- Relevant key risks and threats with recommended approaches to planning and management.

Now, thirteen years on from the most recent assessments, this Biodiversity Assessment Report builds on all studies undertaken to date. This assessment has used a greater range of currently available information, much of which has been collected using the most up-to-date processes and technology. This assessment provides increased precision and an up-to-date evaluation of biodiversity values, risks and conservation priorities since the preparation of the 2003 studies.

Key elements from the previous studies that have been updated and expanded upon, include information relating to:

- Regional Ecosystem (RE) classification of Noosa's vegetation communities
- Conservation significance of regrowth vegetation and REs
- Extent of representation of REs within protection reserves
- Connectivity and corridor mapping across the shire
- Threatened flora and fauna species, including regionally and locally significant species known to occur in Noosa
- Threats at a local context e.g. vegetation clearing rates, weed invasion
- Conservation significance criteria.

Key changes from previous biodiversity planning studies to the current study includes:

- Separation of the concept of biodiversity significance from conservation significance
- Consideration of climate change risk and the potential impacts to biodiversity values
- Inclusion of ecosystems that contribute to biodiversity including wetlands and waterways
- Analysis of statistical data including biodiversity values' distribution and proportions across the region and threatened species presence
- Utilisation of sophisticated mapping techniques, software and products (e.g. LiDAR)
- Consideration of existing statutory and non-statutory mechanisms and the role of local conservation management and planning.

1.3 Study scope and objectives

The aim of this report is to improve the current understanding of biodiversity values, threats and emerging issues with the purpose of identifying the key future issues for local biodiversity conservation management and planning in Noosa. This will ultimately inform the key priorities and actions to be captured in the Biodiversity Conservation Plan.

The scope of the document is to:

- Review and update existing vegetation mapping available for Noosa Shire

- Review core and connecting habitat areas in Noosa Shire and develop an improved understanding of vegetation network (corridor) planning using leading science
- Review existing vegetation and fauna studies for Noosa Shire in consideration of changes to legislation, land tenure, threatened species listings and emerging biodiversity threats and issues
- Improve understanding of fauna associations with Regional Ecosystems (REs), based on current knowledge
- Outline the current biodiversity values of Noosa Shire
- Use updated information and mapping methods to document, analyse and map biodiversity values for the purpose of developing a Biodiversity Overlay for the new planning scheme and strategic corridor mapping
- Assess the vulnerability of the Broad Vegetation Groups (BVG) of Noosa Shire to climate variability and give a rating from most resilient to least resilient
- Identify future priority areas for actions by Noosa Council based on conservation significance.

For the purpose of this study, the definition of biodiversity has been taken at the ecosystem level of organisation. It is therefore defined as the variety of all habitat types, ecological communities and ecological processes (Natural Resource Management Ministerial Council, 2010). In doing so, the study focusses on the upper hierarchy of biodiversity and encompasses diversity at both a genetic and species level of organisation.

Biodiversity has been described in terms of its components and patterns, including the identification of the various ecosystem types, spatial distribution, complexity and connectivity across the landscape. Threats to biodiversity have been identified and assessed in terms of the potential impact on ecosystem resilience and integrity. Biodiversity value or significance in this study has been defined through a series of criteria representing ecological condition, rarity, significant species habitat value, connectivity and ecological processes. Whereas, conservation significance has been defined as a function of biodiversity significance and risk of threat.

The study is limited to terrestrial sources of biodiversity as well as biodiversity within the terrestrial interface of aquatic and marine environments such as mangrove, saltmarsh and dune systems.

1.4 Study approach

This Biodiversity Assessment Report has been prepared using a variety of desktop information, some field validated vegetation records and a range of government supplied spatial data. The methodology was based on a combination of desktop review, aerial photographic interpretation (API), field survey and spatial data interrogation and analysis. A summary of the spatial and data analysis are listed below.

- Attribution of ecological condition of land across the Local Government Area (LGA)
- Interrogation of LGA based data to identify regional and locally significant values as well as poorly represented values
- Analysis of the relative levels of protection for REs in Noosa compared to the broader SEQ region
- Analyses of patch size and core to edge ratio
- Analysis of ecological connectivity including corridors and habitat nodes
- Identification of significant species, their locations and habitats
- Waterway and wetland mapping
- Identification and mapping of Threatened Ecological Communities (TECs) (Lowland Rainforest and Saltmarsh)

- Proportional analyses of values (comparing Noosa statistics with SEQ region) to determine high and exceptional values
- Detailed analysis of land clearing patterns and rates using Statewide Landcover and Trees Study (SLATS) data
- Time series analysis to identify trends in clearing rates and waterway degradation
- Combined analysis to determine biodiversity significance
- Analysis of development risk
- Climate change vulnerability analysis.

The foundation of the approach was to identify, map and rank biodiversity values and threats that are important and noteworthy to the Noosa region (refer to diagram below). The mapping provided a spatial illustration of the distribution of values and risks across the shire, whilst the ranking allowed for areas of conservation significance to be identified and prioritised.

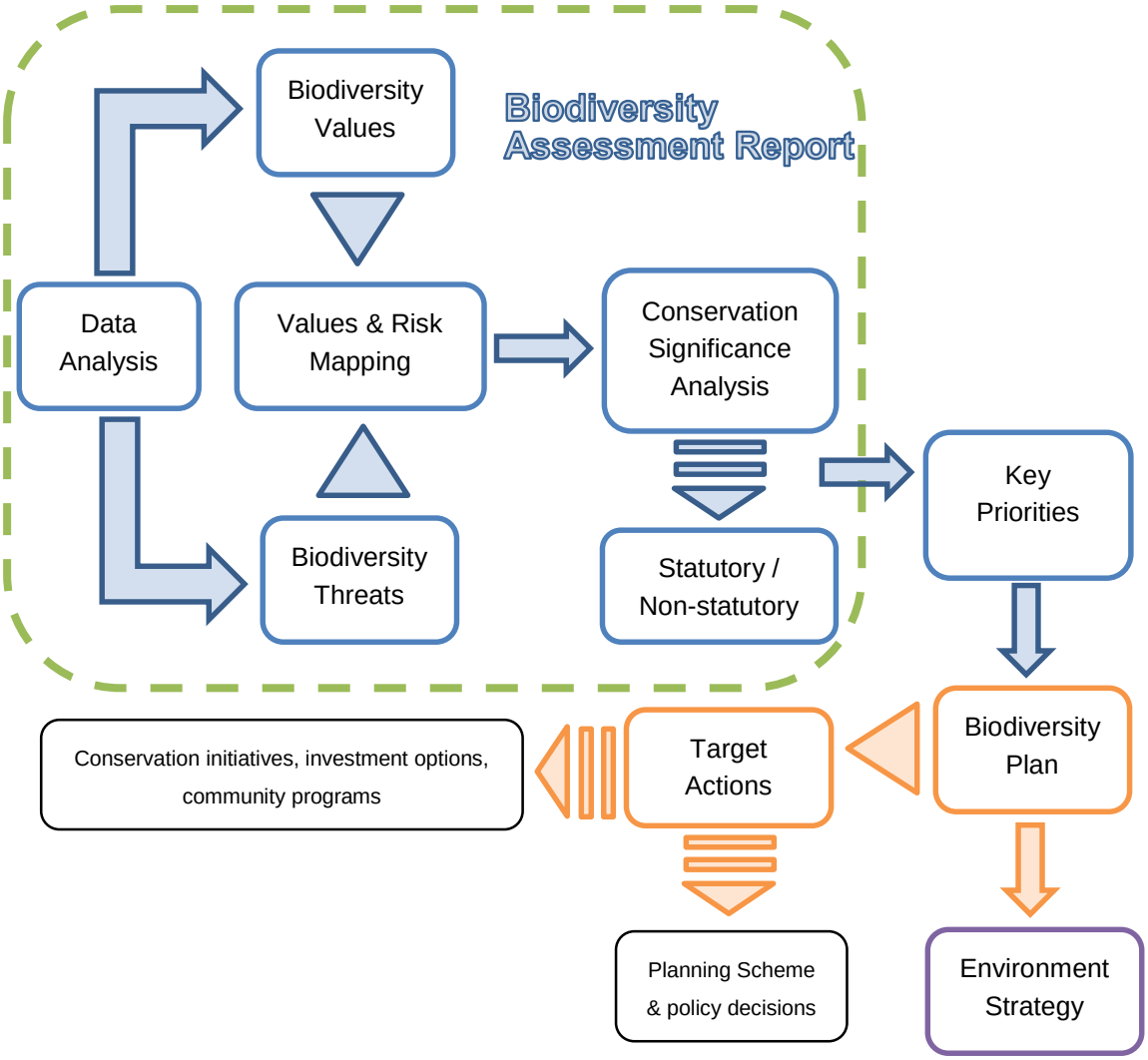
For the biodiversity values map a composite vegetation community and condition map was initially prepared. This integrated current RE Mapping and fine-scale vegetation mapping previously commissioned by Sunshine Coast Regional Council (SCRC), which was further refined and updated utilising latest spatial imagery. This composite mapping provided a base, which was attributed by representative biodiversity values and scored according to level of significance. An overall ranked biodiversity value map was then produced from the accumulated biodiversity value scores.

For the risk map both climate change vulnerability and development risk were individually mapped. Climate change vulnerability was mapped and ranked according to anticipated exposure and sensitivity of BVGs to key climate change impacts such as sea level rise, bushfire and increased temperature and evaporation. Risk (likelihood and severity) of development and associated impacts such as vegetation clearing and habitat fragmentation was based on current Council land use zoning.

Areas of conservation significance or key conservation issues identified in the analysis were further considered in relation to existing statutory and non-statutory protection measures. Conservation issues or areas lacking existing protection or considered to be of relevance to local government planning were highlighted as key priority issues to be addressed through targeted actions in the Biodiversity Conservation Plan.

A detailed reference list is provided that lists the primary documents used in this study, while **Appendix F** provides a detailed summary of the spatial data sets that were both used and generated. A detailed methodology of how the composite vegetation mapping and biodiversity values mapping was compiled and refined is also provided in **Appendix F**.

The study approach as well as the context of the Biodiversity Assessment Report is illustrated in the diagram below.



1.5 Study limitations

The majority of the findings and outcomes of the Biodiversity Assessment Report are based on desktop information. Consequently the study contains limitations that are inherent with desktop data sources. This includes inaccuracies at finer mapping scales and the potential misalignment with actual on the ground conditions.

The intent of the study is to provide a broad overview of biodiversity values and threats across the Noosa and should not be interpreted as an exhausted detailed description. It is therefore recommended that ground-truthing assessments are conducted to confirm the presence or absence of biodiversity values, especially those that are represented spatially. The outcomes and results of the Biodiversity Assessment Report should not take priority over the findings from these field validation surveys.

2 Noosa Shire's Natural Environment

2.1 Location

The Noosa Shire is located within the mid coastline of the South East Queensland (SEQ) Region with the Gympie Regional Council (GRC) LGA occurring to the north and west of the shire and the SCRC LGA occurring to the south (**Figure 1**). The shire encompasses approximately 86,000 hectares of land bordered to the north by the Great Sandy National Park, to the west by the Mary River Valley and to the south by the Maroochy River catchment. This provides connectivity between the highly significant coastal sand masses of the Cooloola/Fraser Island complex and the subtropical coastal forest uplands of the flanking Blackall and Conondale ranges.

Noosa is also part of the biogeographic region known the "Macleay – McPherson Overlap Zone", which is an area of exceptionally high biodiversity, where the northern (Torresian) and southern (Bassian) Australian fauna and flora meet and overlap. Consequently, the region has a rich diversity of plants, birds, bats, fish, reptiles, and amphibians. Noosa Shire provides a stronghold for biodiversity within the SEQ and Northern New South Wales (NSW) region (Lewis et al. 2007) and it has the only substantial area of coastal mainland remnant vegetation between Byron Bay (300 km south in northern NSW) and Bundaberg (250 km to the north).

The Noosa Shire occurs just south of the Great Sandy Strait, an internationally recognised Ramsar Site and important wetland area. The major river system that flows from this area through the Shire is the Noosa River, which originates in the coastal plains and low dunes to the north. This unusual low-lying headwater formation has created a low flow lagoon system that includes a complex of lakes, namely Lake Cootharaba, Lake Cooroibah, Lake Doonella and Lake Weyba. The atypical combination of a freshwater delta and estuarine lake system represents a rare sub-tropical example of this formation (Department of Natural Resources (DNR), 2000).

The major settlement areas within the shire are predominately located in the large contiguous urban coastal area south of the Noosa River as well as across a number of rural hinterland towns and villages. These areas are nestled within a mosaic of vegetation corridors and remnant and regrowth native vegetation.

Noosa's permanent population in 2011 was estimated at just over 48,000; however over 1.5 million people visit the Noosa region each year, with the natural areas of Noosa Shire being the major attraction. The region's National Parks, beaches and the natural appeal/atmosphere are among the top five drivers of visitor satisfaction in Noosa.

2.2 History

The Gubbi Gubbi (or Kabi Kabi) people have been traditional custodians of the land that makes up Noosa Shire for over tens of thousands of years. The abundance of resources within the Noosa Shire mean local indigenous groups had high population densities, and were generally sedentary, with huts recorded around the lakes by early settlers (Flinders 1799, Thomas Pamphlett 1824). Fish, dugong and turtles from the ocean; shellfish and crustaceans within the inter-tidal zone and the expansive stretches of wetlands, swamps and lakes; and birds, marsupials and plants that were abundant in the area provided a variety of food sources (Lewis et al. 2007).

The process of development within Noosa Shire began in the 1800s and followed the typical pattern within Queensland, where early explorers travelled into unsettled areas to assess the natural resource potential

of these areas (Cato, 1979). From the 1820's to the 1960's, early free settlers then exploited the natural resources available in Noosa Shire (Brown 2000, Cato 1979). Forests were cleared for timber and to establish farming areas, and the dispersal and dispossession of indigenous people soon followed (Davies & Salmon, 1995). Large-scale draining of low-lying coastal areas was undertaken, and grazing animals were introduced into the area.

The timber industry formed the foundation of the Noosa Shire economy with the extraction of hardwood and softwood timbers, particularly in the Kin Kin forests, providing building materials and furniture grade timber to the growing settlements around Brisbane. Dairy, oysters, banana, bean, and beef industries soon followed. However, these industries declined in the 1960s and many areas became degraded by lantana and other invasive weeds.

The tourism industry in Noosa dates back to at least the 1870s, with the 1920s seeing the establishment of beach camping. However, an injection of funding to develop Hastings Street in the 1970s and 1980s led to a boom in tourist and holiday accommodation providers and tourism in Noosa Shire. Hastings Street became a global magnet for tourism. This period also saw a conflict between rampant development of Noosa, and the community's desire to retain the natural beauty of the area.

The local environmental movement took shape in 1962 when Dr Arthur Harrold formed the Noosa Parks Association. This organisation immediately began lobbying for the expansion of the Noosa National Park and the protection of Cooloola. Eventually, the Noosa Council began to incorporate strategies of environmental conservation and sensitive development with momentum gaining during 1982 – 1985 and from 1988 and into the 1990's. In 1997 a Strategic Plan set the first limits to growth for the shire based on the carrying capacity of the environment and infrastructure.

In 2007 the entire area within the boundaries of Noosa Shire was declared a biosphere reserve under UNESCO's Man and the Biosphere Program (MaB). Collectively, all biospheres within the MaB program form a world network of like-minded communities (Noosa Biosphere Ltd 2014a).

In 2008, Noosa Council was amalgamated with Maroochy Shire and Caloundra City Councils under a state-wide rationalisation program, to form the SCRC. After a strong community-driven push, Noosa de-amalgamated from SCRC in 2014, to re-establish the independent Noosa Shire and Council that had previously operated from 1910 to 2008.

For more than 50 years, Noosa has been home to one of the earliest and consistently active networks of community conservation groups in Queensland. Noosa Council has an extension service to engage private landholders in voluntary conservation programs, and numerous scientific studies of world standing continue to be undertaken in the area.

2.3 Biophysical Characteristics

The Noosa Shire has a long geological history of volcanic activity, erosion, and deposition which are all processes that formed the underlying geology across Noosa (Lewis et al. 2007).

The oldest known rocks in the area are the conglomerate and sandstone of the Keefton Formation. These are sedimentary rocks which were formed by initial deposition of unconsolidated material. The rocks outcrop only in the south-west comer of the Shire. The Keenon Formation is overlain by the younger sedimentary rocks of the Kin Kin Beds which were deposited in a marine environment (Shields, 1995).

The sedimentary rocks of the Kin Kin Beds were subsequently deformed and folded resulting in alteration of the rocks into low-grade metamorphics in localised areas. These phyllitic beds in the western (inland) parts of the shire resulted in low mountains, hills and steep escarpments that dominate this area today

(Department of Primary Industries (DPI), 1981). These old metamorphic rocks are described as Land Zone 11 under the State Government RE classification system.

During the early to middle Triassic, the Kin Kin beds were intruded by the Woodum Granite, which now form part of the Woondum Range that stretches north of Mount Cooroora. A much smaller, isolated outcrop of another intrusive volcanic is the Cedar Creek Porphyry, which also occurs at Noosa Heads (Shields, 1995). These old volcanic rocks are described as Land Zone 12.

Numerous igneous intrusions have also occurred across the shire since the Jurrasic period, which has resulted in scattered and isolated peaks. Most prominent include Mount Cooroy, Mount Cooran, Mount Cooroora, Mount Tinbeerwah and Mount Pinbarren (DPI, 1981). The remains of tertiary basaltic extrusion also form Black Mountain and the Wahpunga Range just east of Kin Kin. These younger volcanic rocks are described as Land Zone 8.

These volcanic geological formations have created the hilly undulating topography that dominates approximately half of the Noosa Shire area, which includes Noosa's highest point of 488m in the Woondum National Park.

The extensive undulating and level plains, swamps and tidal flats of Noosa's eastern coastal lowlands have been formed by depositional processes since the late Triassic period. During the late Triassic period and early Jurassic period, the deposition of coarse freshwater sediments from the granitic intrusions to the west formed the Myrtle Creek sandstones in the eastern portion of the shire (DPI, 1981). These sandstone rocks are described as land Zone 9-10.

In the more recent Tertiary geological period, clay, silt, sand and gravel have been deposited as alluvium along all major streams across Noosa (Land Zone 3) while finer textured material has been deposited in estuaries and lagoons adjacent to the sea (Land Zone 1). Older alluvial deposit that are now elevated above the early Tertiary alluvium also form the plains and gently undulating rises along the Noosa catchment floodplain (Land Zone 5). Fluctuations in sea level have probably resulted in intrusion of sea water and possibly some marine deposition in these low-lying areas of Noosa (Shields, 1995). The low sandstone hills and freshwater alluvium deposits in which the headwaters of the Noosa River originate are situated at a lower elevation. This unusual formation has resulted in the development of the river's unique coastal lagoon system.

Bordering the coast line of the Noosa Shire are low hilly wave-deposited and windblown sand dunes. On the northern section of the coast from 10 km north of Noosa River to the northern shire boundary, sand dune crests rise from 75-200 m above sea level (Land Zone 2). The northern dunes consist of white and iron-stained quartzose sand and local concentrations of heavy mineral sands, peat and sandrock (DPI, 1981). The sand dunes along the rest of the coast are below 75 m except for the area around Noosa Hill, at the mouth of the Noosa River which rises to 147 m (DPI, 1981). Dunes further inland have become stabilised by vegetation compared with the unstabilised frontal dunes (Shields, 1995).

2.4 Other ecosystem types & services

Other sources of biodiversity in Noosa include the subtropical marine and freshwater environments. Within the shire this includes:

- Sandy and rocky beaches
- Intertidal rocky shores
- Nearshore fringing reefs
- Riverine seagrass beds
- Sheltered intertidal flats

- Freshwater and tidal waterways and lakes
- Mangroves
- Subtidal soft substrates
- Riverine soft substrates
- Pelagic environments.

These freshwater, riverine and marine environments in Noosa form a highly connected network of unique aquatic ecosystems across the landscape, which flow from the Cooloola and mass and hinterland areas of the shire through to the estuarine river system and sea.

Biodiversity as the variety of all habitat types, ecological communities and ecological processes is also fundamental to the production of ecosystem services that human populations rely on. Ecosystem services are the benefits provided to humans through the transformations of resources (or environmental assets, including land, water, vegetation and atmosphere) into a flow of essential goods and services e.g. clean air, water, and food (Department of Environment, Water, Heritage and Arts (DEWA), 2009a).

The diversity of organisms is the direct source of many services, such as food and fibre, and underpins others including clean water and air, through the role of organisms in energy and material cycles. Changes in and the loss of biodiversity directly influences the capacity of an ecosystem to produce and supply essential services, and can affect the long term ability of ecological, economic and social systems to adapt and respond to global pressures (DEWA, 2009a). The degree of biodiversity richness that is necessary to maintain production of ecosystem services is not clear. However, what is known is that ecosystem services are generated by more than one ecosystem type.

Ecosystem services produced by Noosa's diversity of ecosystem types include:

- Climate control
- Carbon sequestration
- Soil formation and maintenance of soil fertility
- Water filtration
- Purification of air
- Pollination
- Erosion control
- Decomposition and recycling of wastes
- Provision of products such as food, water, raw materials, minerals, etc.
- Recreational tourism and cultural services.

The value the Noosa shire residents and visitors place on ecosystem services, particularly in regards to recreational tourism and cultural services is significant. This is an important element in considering the overall value of biodiversity in this area.

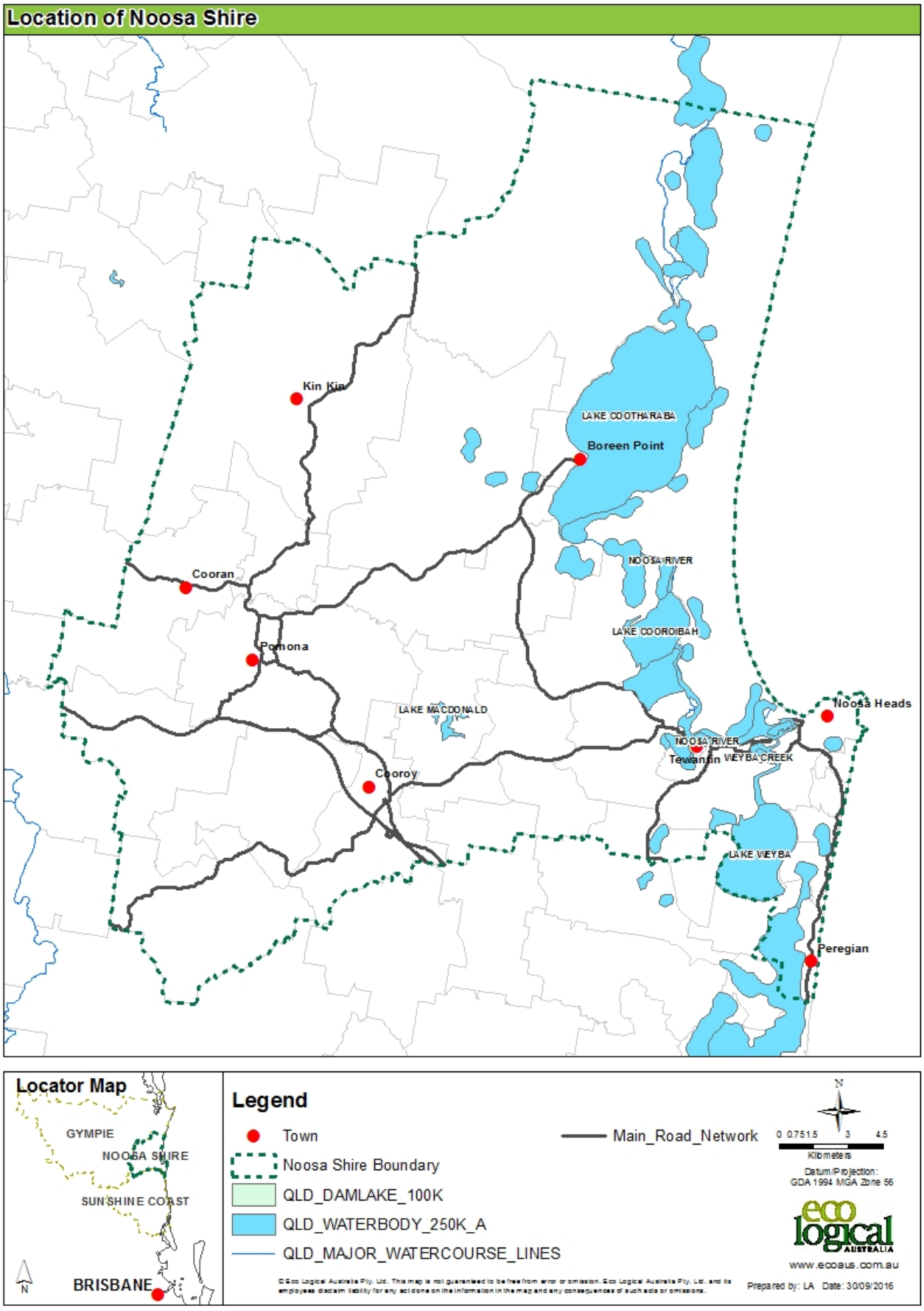


Figure 1: Location of Noosa Shire

3 Biodiversity Values

Noosa contains a diversity of biodiversity values and natural landscapes within a very confined physical area. Many of the values and landscapes are of great significance and globally unique. Noosa's key biodiversity values include:

- A diverse range of vegetation communities that mostly remain in remnant condition
- A significantly high extent and proportion of endangered vegetation as defined by State and Commonwealth legislation
- Unique ecosystems including rare sub-tropical examples of patterned fens, coastal lagoon systems, sand lakes and dune systems
- A highly connected network of core habitat areas from a diverse cross-section of ecosystem types and altitudinal ranges
- Nationally recognised and protected lowland rainforest and saltmarsh ecosystems
- A significantly high proportion of threatened species, including species that are endemic and Gondwana relicts
- Critical habitats, including internationally recognised migratory bird habitats of conservation importance
- The healthiest river system in the SEQ region
- A high proportion of wetlands areas that are internationally or nationally recognised as important or of state significance
- An extensive protected reserve system that plays a critical role in conservation management across the SEQ region.

Noosa provides the last stronghold for many of these biodiversity values that were once prevalent across the entire SEQ region. These factors make Noosa a unique area and an important place for biodiversity conservation.

3.1 Vegetation communities

Within a small area, Noosa Shire has a high diversity of native vegetation communities, from the lowland rainforest, heathlands and Melaleuca communities in the east, to the woodlands and tall open forests of the drier west. This diversity extends to the north-east where the frontal dune communities form part of the Great Sandy complex. A diverse community of mangrove, saltmarsh and seagrass beds also occur along the foreshore of the Noosa River and its lake system, whilst the extinct volcanic plugs (inselbergs) such as Mount Cooroora, Mount Cooroy and Mount Cooran, support montane heath communities.

Overall, Noosa's diverse vegetation can be classified into 27 BVGs (BVGs 1M), which are grouped under the following eight vegetation types:

- Rainforests and scrubs
- Wet Eucalypt open forests
- Eucalypt woodlands
- Eucalypt woodlands on floodplains
- Melaleuca woodlands
- Heaths and other coastal communities
- Wetlands
- Mangroves and saltmarshes

Each vegetation type is associated with a subset of REs, which further describes Noosa's diverse vegetation composition into 61 different communities. REs are vegetation communities that are consistently associated with a particularly combination of geology, landform and soil (termed Land Zone). It is based on a classification system that allows for the categorical grouping and description of vegetation communities with similar attributes.

A high proportion of this vegetation is also of conservation significance and identified as either 'Endangered' or 'Of Concern' under the Queensland *Vegetation Management Act 1999* (VM Act). For an Endangered status this refers to remnant vegetation communities with <10% of the pre-clearing extent remaining across the SEQ region, and for Of Concern status only 10% - 30% of the pre-clearing extent remaining.

As part of the SEQ bioregion, Noosa Shire occupies approximately 1.4% of the total area but contains representations of 39% of the REs that can occur in the bioregion. A complete description of Noosa's vegetation types, BVGs and REs is provided in **Appendix A**. The broad distribution of vegetation types are shown in **Figure 2** and conservation significance discussed further in **Section 3.1.2** and **Section 3.1.3.**

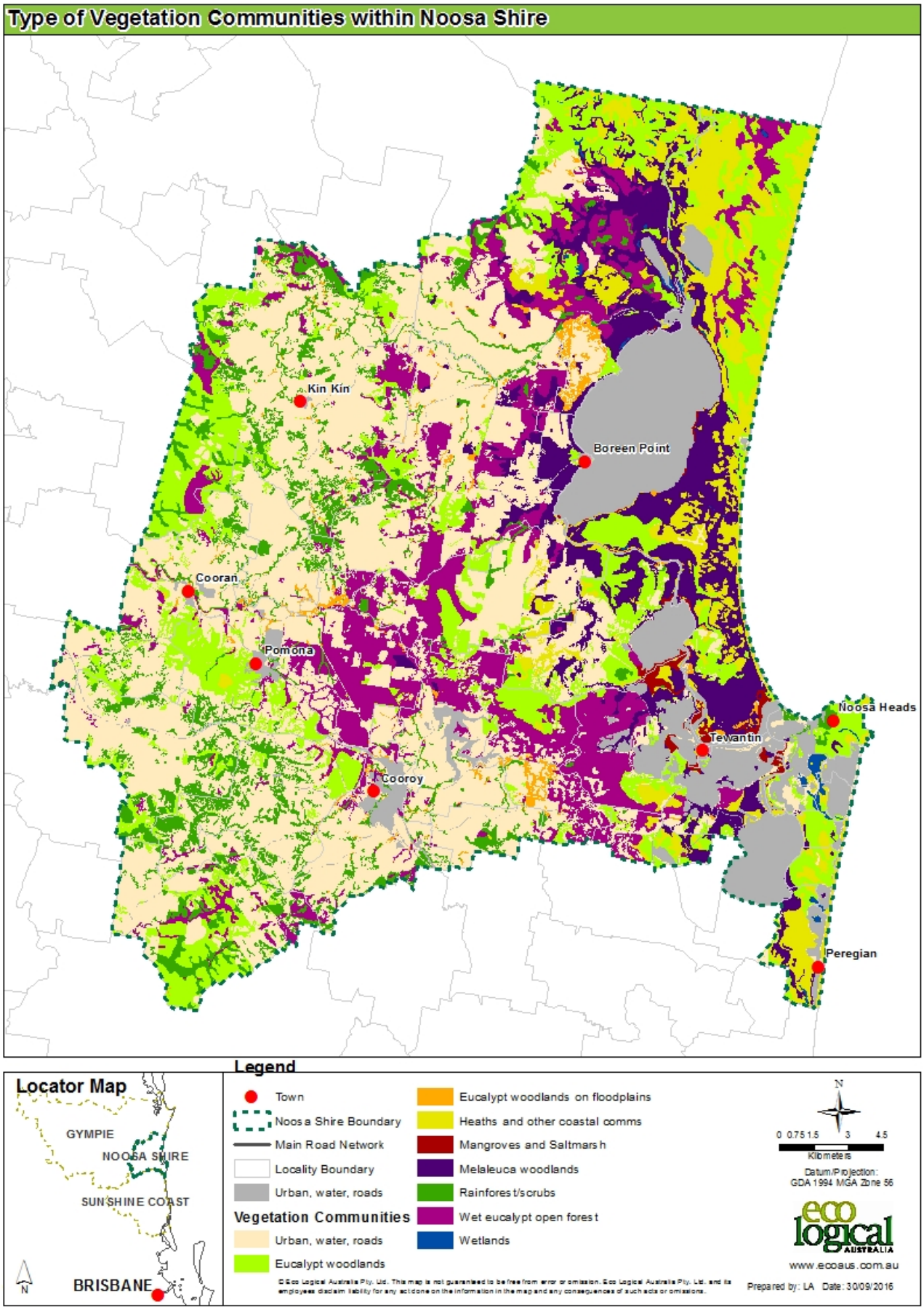


Figure 2: Types of vegetation communities within Noosa Shire

In addition to this high diversity of vegetation communities, the Noosa Shire is unique in that a large portion of the vegetation communities remain largely intact and resemble an undisturbed form. This is referred to as remnant condition, which is defined under the VM Act as a vegetation community comprising:

- more than 50% of the vegetation's undisturbed canopy cover
- averaging more than 70% of the vegetation's undisturbed height
- species characteristic of the vegetation's undisturbed predominant canopy.

The condition of vegetation across Noosa is shown in **Figure 3** and described further in **Section 3.1.1.**

Table 1 provides a summary of both vegetation condition and conservation values for the Noosa Shire. A comparison of these attributes is also provided for the broader SEQ bioregion and neighbouring LGAs. A full description of Noosa's vegetation condition and conservation significance is provided in the following sections.

Table 1: Vegetation condition and conservation status statistics for Noosa and broader region

Attribute	Noosa Shire	SEQ bioregion	Gympie Regional Council	Sunshine Coast Regional Council	Three LGAs*
Vegetation condition					
Remnant	46.8%	43.5%	41.7%	40.6%	41.9%
Conservation significance (based on area of remnant)					
Endangered	11%	4%	3%	4%	4%
Of Concern	28%	20%	26%	19%	24%
Least Concern	62%	76%	72%	77%	72%
Conservation significance (based on total number of REs)					
Endangered	11%	14%	12%	9%	12%
Of Concern	39%	49%	40%	38%	41%
Least Concern	49%	37%	48%	53%	47%

* Noosa Shire, GRC and SCRC

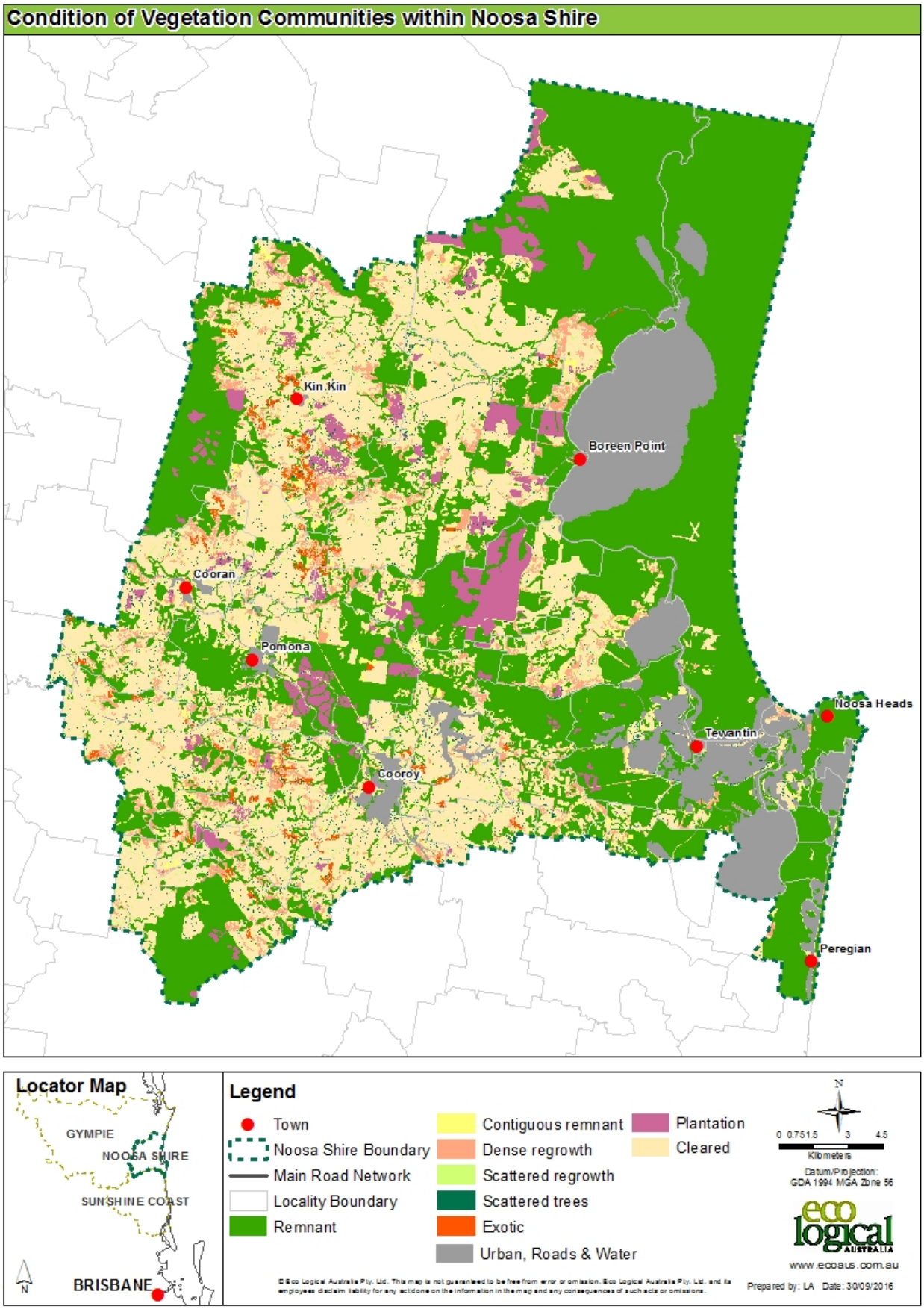


Figure 3: Condition of vegetation communities within Noosa Shire

3.1.1 Vegetation condition classes

Noosa is unique in that it still contains extensive tracts of vegetation in remnant condition (**Figure 3**). In total 40,265 ha of vegetation across Noosa is considered to be in remnant condition, which comprises 46.8% of the land mass (**Table 1**). As highlighted **Table 1,** Noosa has the highest proportion of remnant vegetation compared to the broader SEQ bioregion and to neighbouring LGAs including the GRC and SCRC.

In addition to this, validation studies across the shire (refer to **Appendix F**) have identified 1,622.5 ha of native vegetation that is contiguous with surrounding remnant vegetation (**Figure 3**). Whilst not currently recognised by Queensland State mapping as being in remnant condition, this vegetation appears to be in a similar condition status as adjacent recognised remnant vegetation.

Further to this, approximately 5,071 ha of regrowth vegetation also occurs in Noosa (**Figure 3**). This includes dense regrowth (vegetated patches >1 ha across Queensland State regrowth mapping) and sparse regrowth (vegetated patches < 1ha across Queensland State regrowth mapping). Contiguous remnant and regrowth vegetation comprises 2% and 5.8% of the Noosa land mass, respectively.

Overall, over half of the Noosa Shire region (approximately 55%) remains vegetated with 45% of the area developed, cleared or consisting of exotic or plantation vegetation (**Figure 4**).

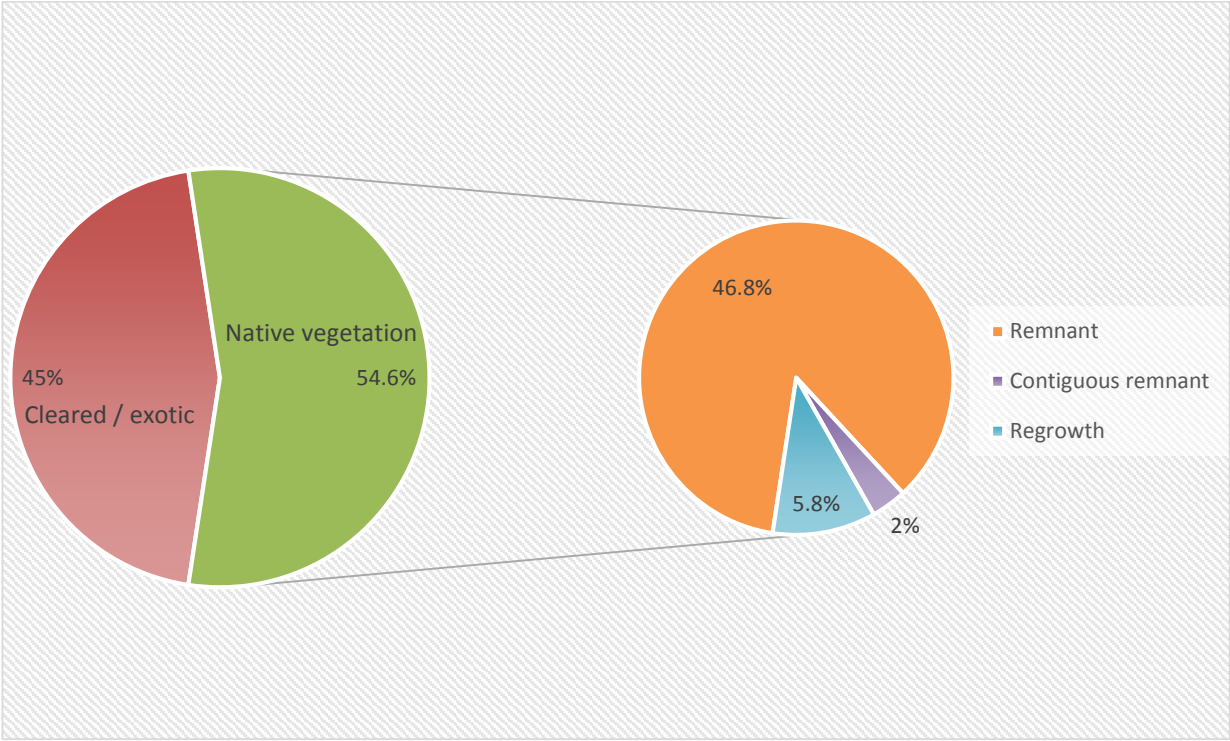


Figure 4: Proportion of vegetation cover and breakdown of vegetation condition across Noosa Shire

3.1.2 Conservation significant communities

Number of Regional Ecosystems of conservation significance

Noosa remains one of the last strongholds for various REs that have been extensively cleared across the SEQ Bioregion. Specifically, the Noosa Shire contains seven REs that are classified as Endangered and 24 classified as Of Concern by the Queensland State Government. A further 12 REs are also considered regionally significant due to their natural limited extent within the shire (<150 ha pre-clear extent) or due

to the substantial reduction in area of extent post European settlement (<30% of pre-clear extent remains in Noosa). Overall, 70.5% of REs within Noosa are of conservation significance (**Figure 5**).

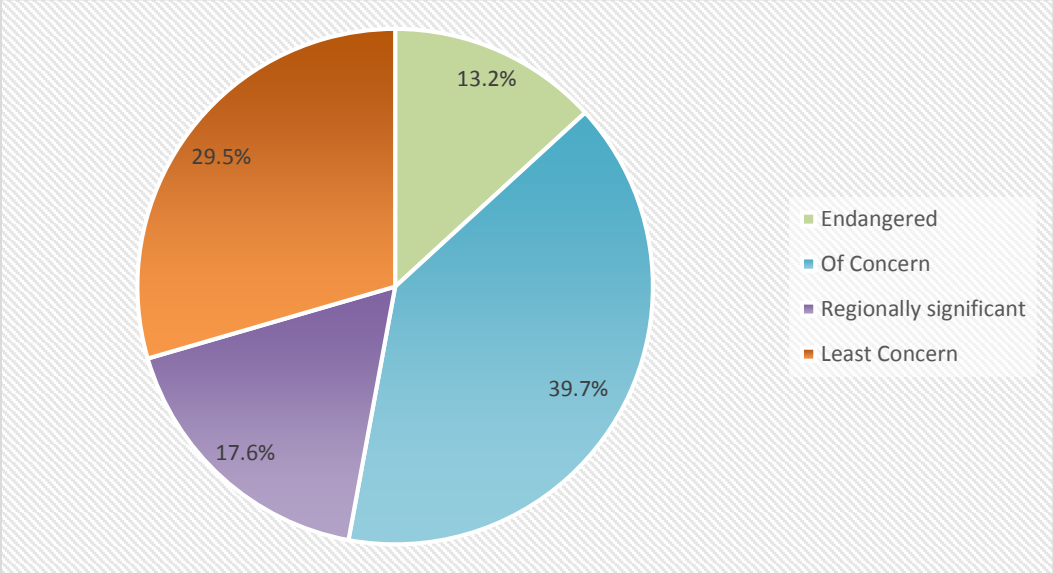


Figure 5: Conservation status proportions for REs within the Noosa Shire

As shown in **Table 1**, the proportion of REs that are of conservation significance within Noosa is relatively consistent with proportions within the broader SEQ bioregion and neighbouring LGA's. This is expected given the significantly larger extent of both areas. In comparison Noosa Shire is considerably smaller, encompassing only 1.4% of the total SEQ bioregion area and 8% of the neighbouring LGA's area. Although the shire is significantly smaller in extent, Noosa contains 32% of the total number of the Endangered REs and 31% of the total number of Of Concern REs that occur in SEQ. It also contains 53% of the total number of the Endangered REs and 54% of the total number of Of Concern REs that occur across the neighbouring LGAs (**Figure 6** and **Figure 7**).

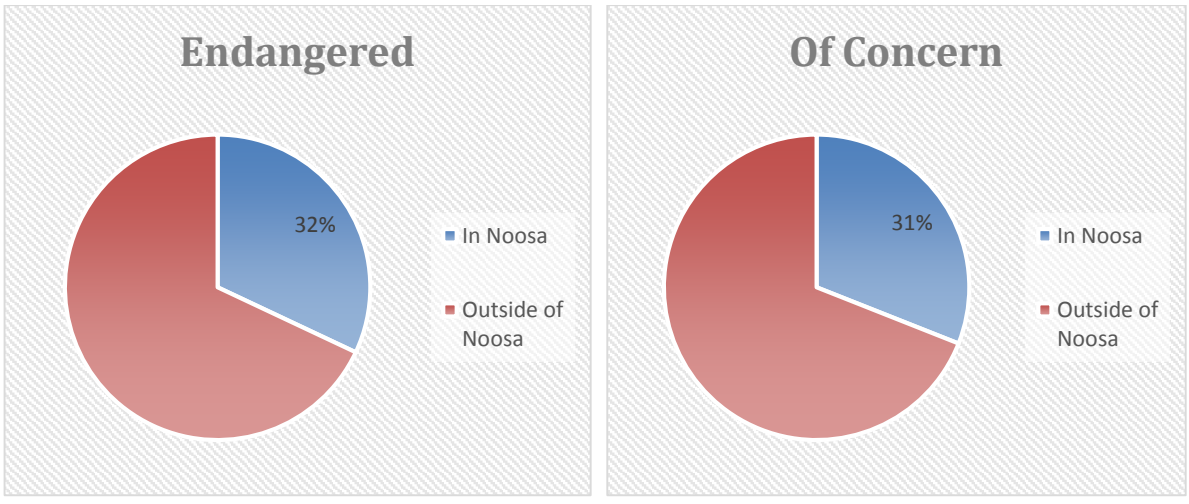


Figure 6: Proportion of Endangered and Of Concern SEQ Bioregion REs within Noosa Shire

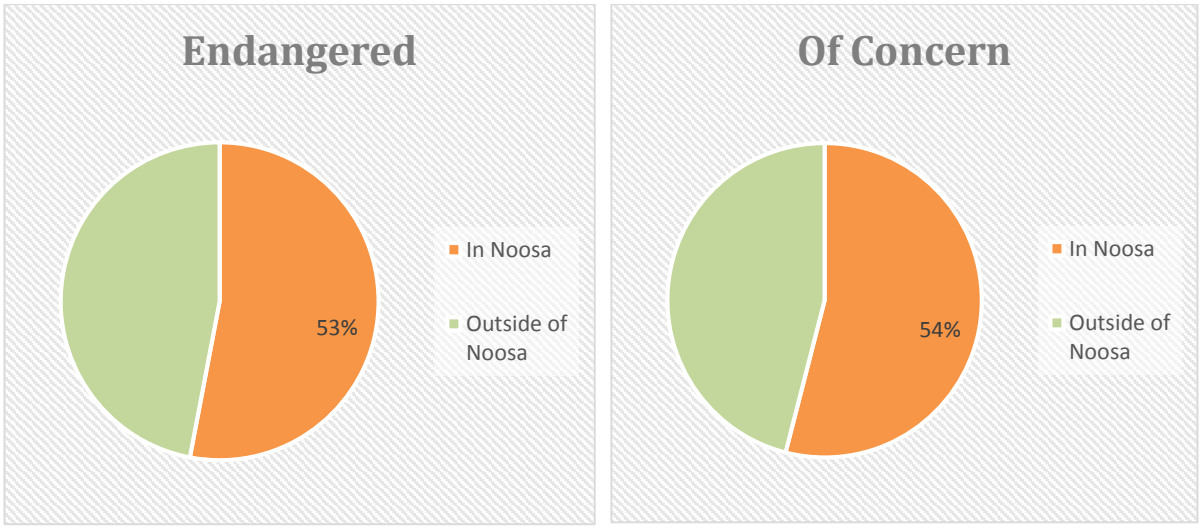


Figure 7: Proportion of Endangered and Of Concern neighbouring LGA REs within Noosa Shire

Area of conservation significant vegetation

Based on remnant vegetation extent, Noosa Shire has the highest proportion of Endangered and Of Concern REs than any other neighbouring LGA or the SEQ bioregion as a whole (**Table 1**). Within Noosa 11% of remnant vegetation is of an Endangered status and 28% is of an Of Concern status. That is out of the 40,265 ha of remnant vegetation, 4,317 ha is Endangered and 11,144 ha is Of Concern.

The shire also contains three Endangered REs and four Of Concern REs of which >10% of their total remnant extent across SEQ falls within Noosa. This means that Noosa, which makes up 1.4% of the SEQ bioregion area, contains a significant proportion of these REs for the size of the shire. These REs include:

- 12.3.1 - Gallery rainforest (notophyll vine forest) on alluvial plains
- 12.5.3 - *Eucalyptus racemosa subsp. racemosa* woodland on remnant Tertiary surfaces
- 12.11.16 - *Eucalyptus cloeziana* open forest on metamorphics +/- interbedded volcanics
- 12.3.4 - *Melaleuca quinquenervia*, *Eucalyptus robusta* woodland on coastal alluvium
- 12.3.2 - *Eucalyptus grandis* tall open forest on alluvial plains
- 12.2.13 - Open or dry heath on dunes and beaches
- 12.9-10.1 - Tall open forest often with *Eucalyptus resinifera, E. grandis*, *E. robusta*, *Corymbia intermedia* on sedimentary rocks.

Noosa's unique Regional Ecosystems

Various REs within Noosa possess important and significant ecological values, including habitat for threatened and migratory species (refer to **Section 2.4**) or critical wetland and riverine ecological functions (refer to **Section 2.6** and **2.7**). Some are also recognised by the Commonwealth Government as TECs (refer to **Section 2.3**). However, of particular significance is RE12.2.15a and RE12.9-10.1.

RE12.2.15a is described as permanent and semi-permanent window lakes on Quaternary coastal dunes and beaches. This wetland is a unique ecosystem known as a patterned fen and is the only subtropical representation known in the world. Noosa contains the largest complex of this ecosystem within the Cooloola Recreation Area, located in the north-eastern corner of the shire in the eastern side of the Noosa River. Smaller areas also occur in the Noosa National Park. The ecosystem not only provides habitat for a variety of rare and threatened species, but also provides an ecological archive of past climatic

changes dating over 12,000 years old (Moss, 2014). Threatened species supported by this ecosystem includes acid frogs, Eastern Ground Parrot (*Pezoporus wallicus*) and fish species such as Honey Blue-eye (*Pseudomugil mellis*) and Oxleyan Pygmy Perch (*Nannoperca oxleyana*).

RE12.9-10.1 is described as a tall open forest of mixed Eucalypt species. The current extent of the RE across the SEQ bioregion is only 4,537 ha of which 82% occurs within Noosa. It is therefore a unique RE within the Noosa Shire with its dominance on sandstone derived soils adjacent to floodplains within the Noosa River catchment. This RE in the Cootharaba area is the habitat for *Boronia keysii*, Noosa floral emblem. As a result of Noosa's extensive protection reserve, Noosa contains and protects the majority of the RE's remaining natural extent.

3.1.3 Modified communities

During the late 1800's through to the mid 1900's the Noosa Shire was extensively cleared for timber resources as well as for the establishment and expansion of agriculture and settlement (Burrows, 2003). Subsequently there is very little true remnant (old growth forest) remaining in Noosa Shire. However, since that time, many of these cleared areas on steep slopes and along waterways have regrown. Whilst initially modified from their original state, these areas are now in remnant condition and have regained the associated ecological and biodiversity values.

In addition to such areas, there are other substantial areas across the shire that are in various stages of succession and regrowth. Whilst not currently in remnant condition, these areas still provide important ecological values and functions including habitat for threatened species, soil stability, landscape connectivity and waterway buffering. Furthermore, these areas are often analogous to REs that are of conservation significance and therefore present considerable potential value through ongoing regeneration. An example of such a community are the scattered canopy trees of *Eucalyptus tereticornis* on alluvial plains, which are associated with the Of Concern RE12.3.11. This modified community is considered to be of significant importance as it provides habitat linkages for Koalas and nesting resources for hollow dependent fauna in an otherwise cleared and highly modified rural landscape.

Modified communities can have degraded biodiversity values in comparison to more natural communities in remnant condition. However, in an urban and rural context where habitat values and resources are scarce, modified communities can play an important role in allowing biodiversity to persist. Planted native and exotic gardens in urban areas can provide a substitute foraging resource for many fauna species. A remaining mature Eucalypt canopy tree within a road reserve can provide a food source and dispersal habitat for Koalas (*Phascolarctos cinereus*). Allocasuarina stands across many of Noosa's built up environments are food trees for the threatened Glossy Black Cockatoos (*Calyptorhynchus lathami*). These modified communities are noteworthy in their contribution to maintaining biodiversity within the urban and rural areas of Noosa.

3.2 Landscape connectivity

Noosa has a diverse network of remnant ecosystem corridors that provide connections throughout the shire and to large vegetated areas in the neighbouring SCRC LGA (Mapleton State Forest and Conondale Range) and GRC LGA (Great Sandy National Park and state forests north of Kin Kin). These connections are recognised as State and Regional corridors under the South East Queensland Biodiversity Planning Assessment (2009) due to their role in maintaining landscape and habitat connectivity for species population dispersal and genetic diversity both at a state and regional scale (**Figure 9**).

Within the Noosa Shire itself, the key landscape elements include:

- Large to medium sized habitat nodes with extensive core habitat (i.e. >10 ha)
- Small sized habitat nodes with the presence of core habitat (i.e. 1 – 10 ha) connected to other habitat nodes (supported)
- Small sized habitat nodes with the presence of core habitat not connected to other habitat nodes (unsupported)
- Patches with no core habitat connected to habitat nodes
- Patches with no core habitat indirectly connected to habitat nodes (stepping stone habitat)
- Ecological corridors of clustered or connected patches that link habitat nodes
- Matrix of cleared areas, scattered trees and sparse regrowth

The large and medium habitat nodes are associated with the extensive coastal lowland vegetation of the Cooloola recreational area and Noosa National Park as well as the hinterland vegetation within the Woondum National Park, West Cooroy State Forest Park, Tuchekoi National Park, Yurol State Forest, Ringtail State Forest and Tewantin National Park. These areas provide extensive core habitat that is of a high quality sufficient to support viable populations of fauna species, particularly threatened and endemic species as well as species that were once more widespread during previous geological periods. These areas provide a critical role in population dynamics both within the shire and broader region as the main source areas for fauna and flora. The large and medium habitat nodes are the second largest landscape element within the shire (**Figure 8**), which demonstrates Noosa's biodiversity significance.

The distribution of the large and medium habitat nodes across the shire provides a cross-section of both coastal and inland habitat types supporting a diverse array of species. This includes rainforest and coastal dune heath and woodlands, riverine and lake systems, wallum heath in the east, through to woodlands and tall open forests of the Cooroy and other plateaux and mountains to the west and north-west. Numerous smaller habitat nodes connected to the larger and medium habitat nodes are also distributed across the shire, providing supporting habitat for species and biota (**Figure 8**). The smaller habitat nodes are sink areas for fauna species dispersing from the larger source habitat areas within the shire.

The habitat nodes frame the entire shire and are separated by a matrix of cleared areas, scattered trees, regrowth and urban areas, which can be a barrier or high risk dispersal option for fauna species (**Figure 8**). This matrix is however bisected by smaller connected patches as well as patch fragments (stepping stone habitat), which maintain a degree of connectivity across Noosa. Areas with a greater proportion of smaller connected patches within the shire form the key ecological corridors across Noosa and maintain important habitat connectivity across the matrix and between the nodes. These corridors include:

- Kin Kin Creek
- Sandy Creek
- Remnant, contiguous remnant and dense regrowth between Kin Kin, Cootharaba and Pomona
- Six Mile Creek
- Remnant, contiguous remnant and dense regrowth between Federal, Black Mountain & Ridgewood
- Ringtail Creek

These corridors consist of small remnant vegetation patches as well as regrowth vegetation interspersed with small cleared areas. These corridors provide both current connectivity values as well as potential future value following regeneration and rehabilitation. Due to the high proportion of existing patch connection, these corridors are of strategic importance for allocating future acquisition investment, rehabilitation resources and funding. Recommended biodiversity conservation management actions include:

- Utilising the corridor mapping to guide land acquisition programs and restoration/revegetation to re-establish contiguous vegetated links to core habitat
- Incorporating corridor mapping into the Planning Scheme to discourage/prevent development within identified corridors and/or require revegetation for such developments to proceed
- Identifying priority corridors for offset delivery of Matters of Local Environmental Significance

Overall, only 2.7% of habitat within the Noosa Shire consists of an isolated patch or unsupported habitat nodes (**Figure 8**). The corridors as well as the habitat nodes across Noosa provide a network from north to south as well as east to west that connects various habitat types and altitudinal ranges, critical for dispersing fauna particularly migratory species as well as fauna species with large home ranges (**Figure 9**). Outside of Noosa's LGA boundaries, the connected network provides linkages to the Maroochy Wallum heath corridor that extends south to Coolum, the Blackall Range that extends south to Mapleton and Obi Obi, Woondum and Beenham Range complex that extends north-west and the Great Sandy Strait region that extends along the coastline to the north of Noosa.

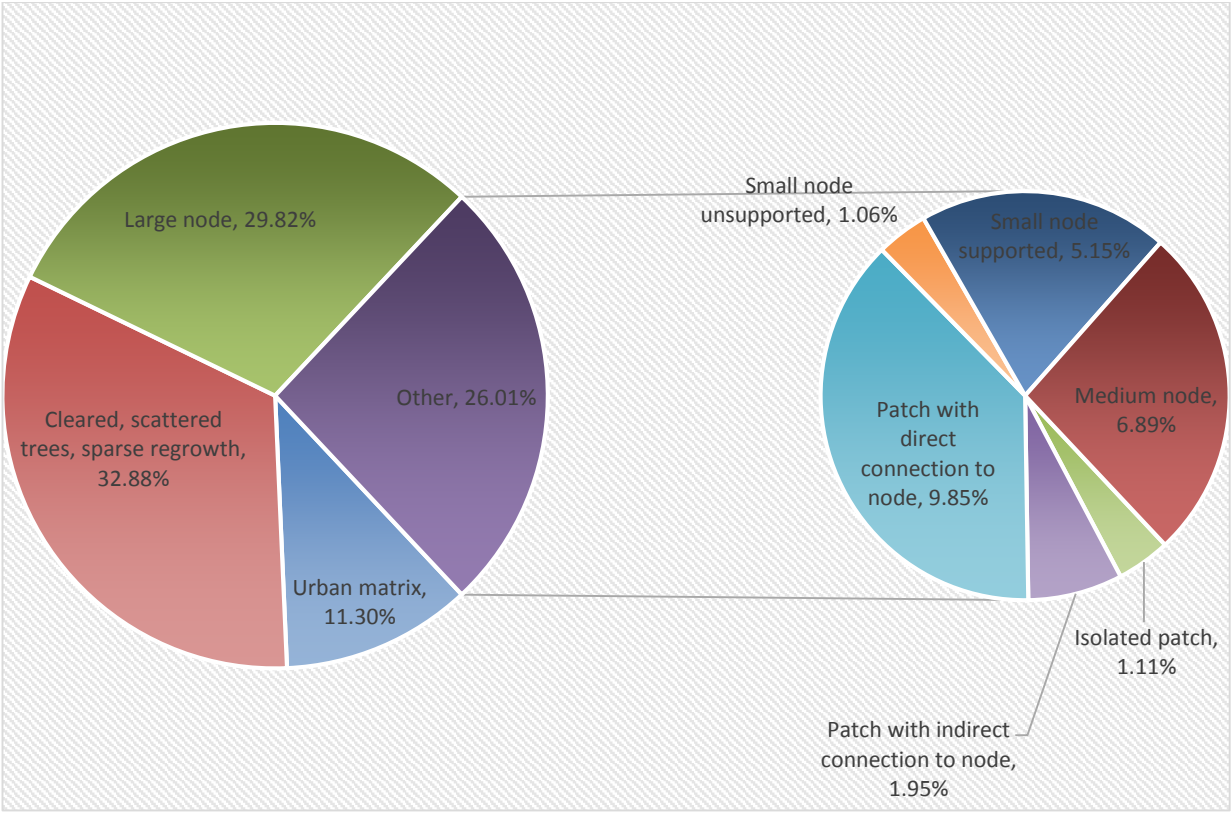


Figure 8: Proportion of landscape elements across the Noosa Shire

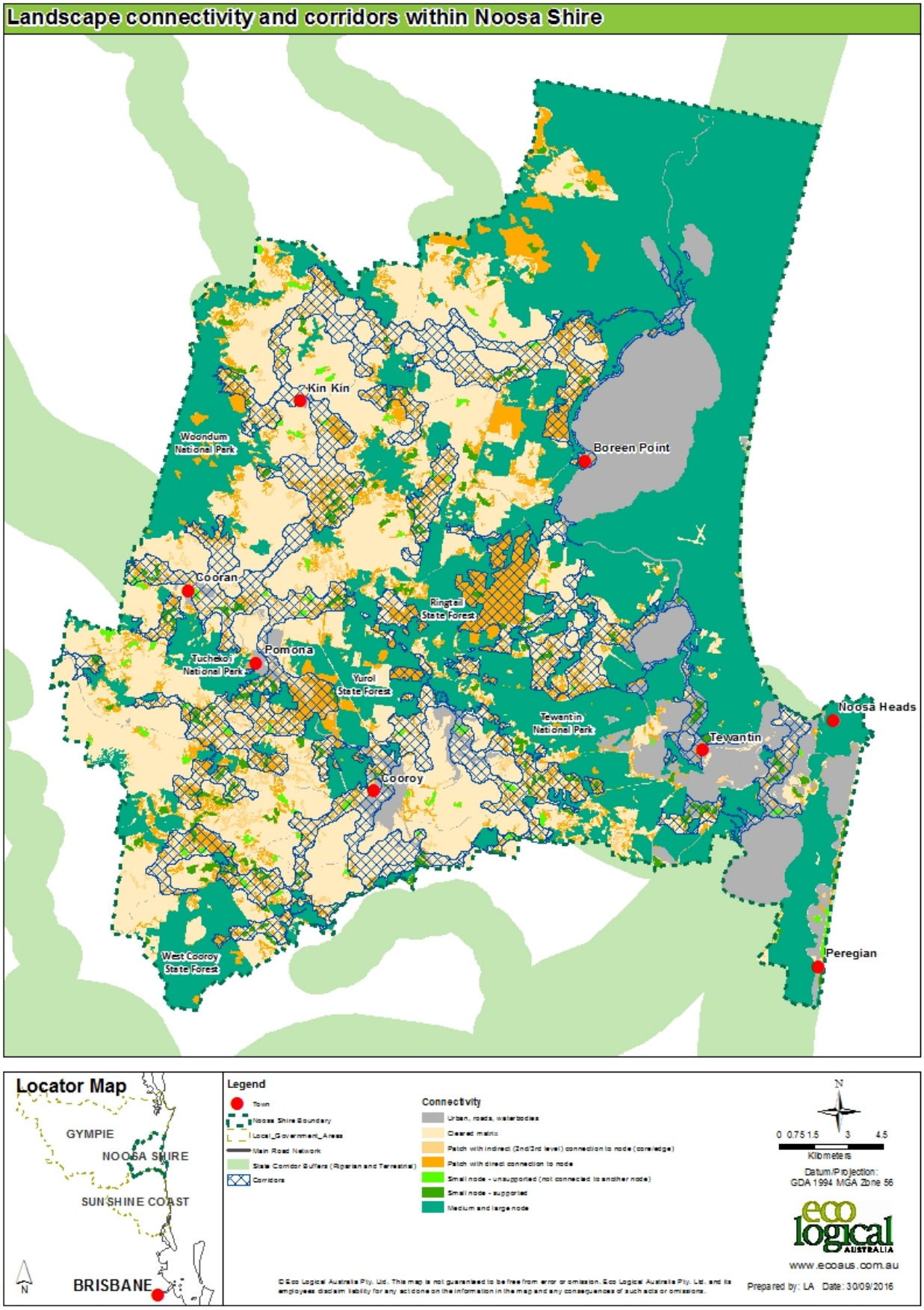


Figure 9: Landscape connectivity and corridor within the Noosa Shire

3.3 Threatened Ecological Communities

The Noosa Shire contains two TECs that are recognised and protected at a Commonwealth level. These are:

- Critically Endangered Lowland Rainforest of Subtropical Australia ("Lowland rainforest")
- Vulnerable Subtropical and Temperate Salt Marsh ("Saltmarsh")

3.3.1 Lowland Rainforest

Lowland rainforests are highly diverse ecological communities, which is a direct reflection of the highly productive ecosystem type. The high structural and floristic diversity provides a large range of shelter, food and water resources utilised by a range of fauna. The diverse fauna assemblage includes a high proportion of frugivorous (seed dispersing) birds, arboreal vertebrates, microbats and flying foxes, as well as invertebrates, that all play a critical role in ecological processes that sustain the rainforest such as decomposition, maintenance of pollination and seed dispersal as well as nutrient cycling (Threatened Species Scientific Committee (TSSC, 2011).

There are several threatened and locally significant fauna species that are dependent or highly reliant on lowland rainforests, such as the Giant Barred Frog (*Mixophyes iteratus*), Marbled Frogmouth (*Podargus ocellatus*), Black-breasted Button-quail (*Turnix melanogaster*), Short-limbed Snake-skink (*Ophioscincus truncatus*), and Black Flying-fox (*Pteropus alecto*) (TSSC, 2011). In the cooler months, there is an influx of birds to lowland rainforests, as part of altitudinal migrations. Overall, the community supports 34 flora species and 12 fauna species listed as threatened under Commonwealth legislation, and 37 flora species and 24 fauna species listed as threatened under Queensland legislation (TSSC, 2011).

Lowland rainforest occurs from Maryborough to the Clarence River near Grafton. In Noosa Shire, this vegetation community is found across the inland areas, typically more than 2km from the coast and in areas lower than 300m elevation (**Figure 11**). Approximately 4,393 ha of the lowland rainforest TEC occurs in Noosa, which forms 90% of Noosa's rainforest communities (**Figure 9**). This contributes 4.6% of the total distribution of the TEC within SEQ. Whilst in a degraded condition and therefore not considered to be of TEC status, 1,900 ha of rainforest regrowth within Noosa has the potential to return back to the lowland rainforest community. These regrowth areas fall outside of the existing regulatory framework but should be recognised for their potential future value. Recommended biodiversity conservation management actions should therefore include protection of such values under the Planning Scheme to ensure a no-net loss approach to protecting and maintaining biodiversity values.

The lowland rainforests in Noosa include relictual Gondwanan flora such as *Agathis* and *Araucaria*, which grow on more fertile soils elsewhere in eastern Australia (Lewis et al. 2007). These sandy areas have a distinctive assemblage of flora and fauna that exhibit a high degree of endemism and are strongly adapted to living in cool sandy environments (Low, 2011). These communities also hold relictual fauna species, which were once more widespread in previous geological periods.

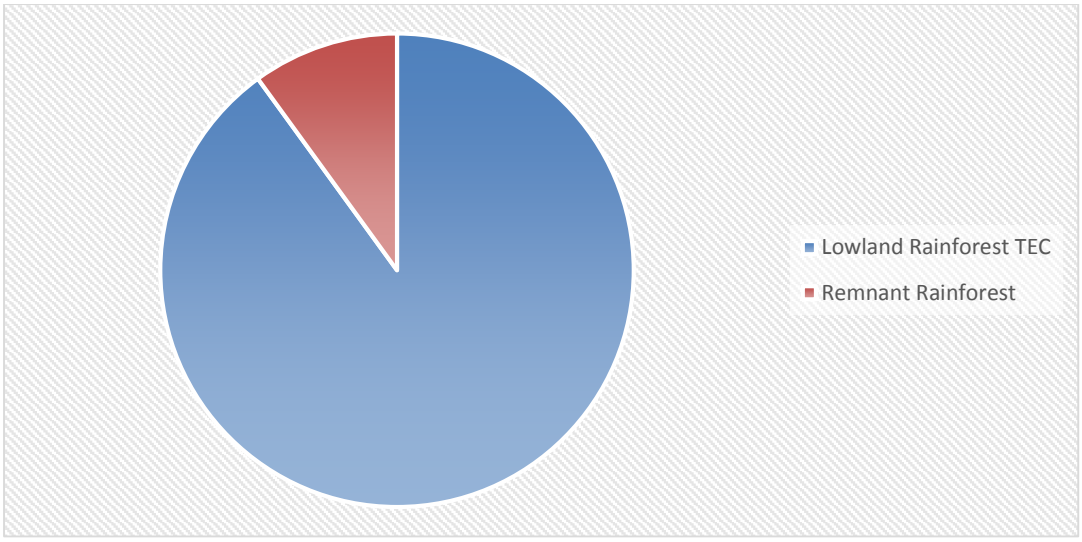


Figure 10: Proportion of Noosa's rainforest vegetation that is the protected Lowland Rainforest TEC

3.3.2 Saltmarsh

Saltmarshes are typically dominated by salt-tolerant vegetation such as chenopods and grasses on soft substrate shores within the intertidal zone commonly associated with estuaries, low wave energy coastlines and embayments (TSSC, 2013). The community provides extensive ecosystem services including surface water filtration, coastline stabilisation, carbon sequestration, coastal productivity, nursery habitat, and food and nutrients for a wide range of marine and estuarine communities. Due to the harsh growing conditions there is a high degree of floral endemism at a species level within saltmarsh communities (TSSC, 2013).

Saltmarshes are inhabited by a wide range of invertebrate fauna such as spiders, moths, molluscs, and crabs. These areas are also important nursery habitat for fish and prawns at high tide. Consequently, these ecological communities provide rich food resources for mobile vertebrates such as insectivorous bats and birds, small raptors, and migratory birds (TSSC, 2013). Saltmarshes are the preferred, and often only, habitat for migratory shorebirds such as the common greenshank *Tringa nebularia*, marsh sandpiper *Tringa stagnatilis*, and Pacific golden plover *Pluvialis fulva*. Saltmarshes are also important habitat for the native water mouse *Xeromys myoides* (TSSC, 2013).

Saltmarsh occurs from SEQ, around the southern coastline to Shark Bay (Western Australia). In Noosa Shire, the TEC occurs as a large complex of small patches ranging from 0.05 ha to 14.4 ha located at the mouth of the Noosa River and Lake Cooroibah (**Figure 11**). The saltmarsh complex is a fish habitat area as well as containing wader habitat and seagrass meadows (SEQ catchments, 2016). Approximately 195 ha of the saltmarsh TEC occurs in Noosa, which contributes 3.1% of the distribution within SEQ.

3.3.3 Littoral Rainforest

The Littoral Rainforest and Coastal Vine Thickets of Eastern Australia is a Commonwealth listed TEC that is known to occur along the eastern coastline of Australia. It is a critically endangered community that provides habitat for over 70 threatened plants and animals as well as acts as an important buffer to coastal erosion and wind damage. The community generally appears as a series of naturally disjunct and localised stands of rainforest and vine thicket on a range of landforms that have been influenced by coastal processes including dunes and flats, headlands and sea-cliffs (DEWA, 2009b).

Whilst the community is not currently recognised on State vegetation mapping as occurring within the Noosa Shire, local knowledge suggests that it does occur in discrete pockets along the coastline. This

includes areas in some coastal dune areas adjacent to inter-dunal swales where in the absence of fire native vegetation communities are developing plant species composition typical of littoral rainforest. Areas on the northern side of the Noosa river mouth, and an area of old growth littoral rainforest at the end of Hastings Street, (the old Noosa Woods area) are also potential areas of the Littoral Rainforest TEC community. Recommended biodiversity conservation management actions should include the undertaking of field validation studies to update RE mapping across the shire and identify areas of Littoral Rainforest TEC for protection.

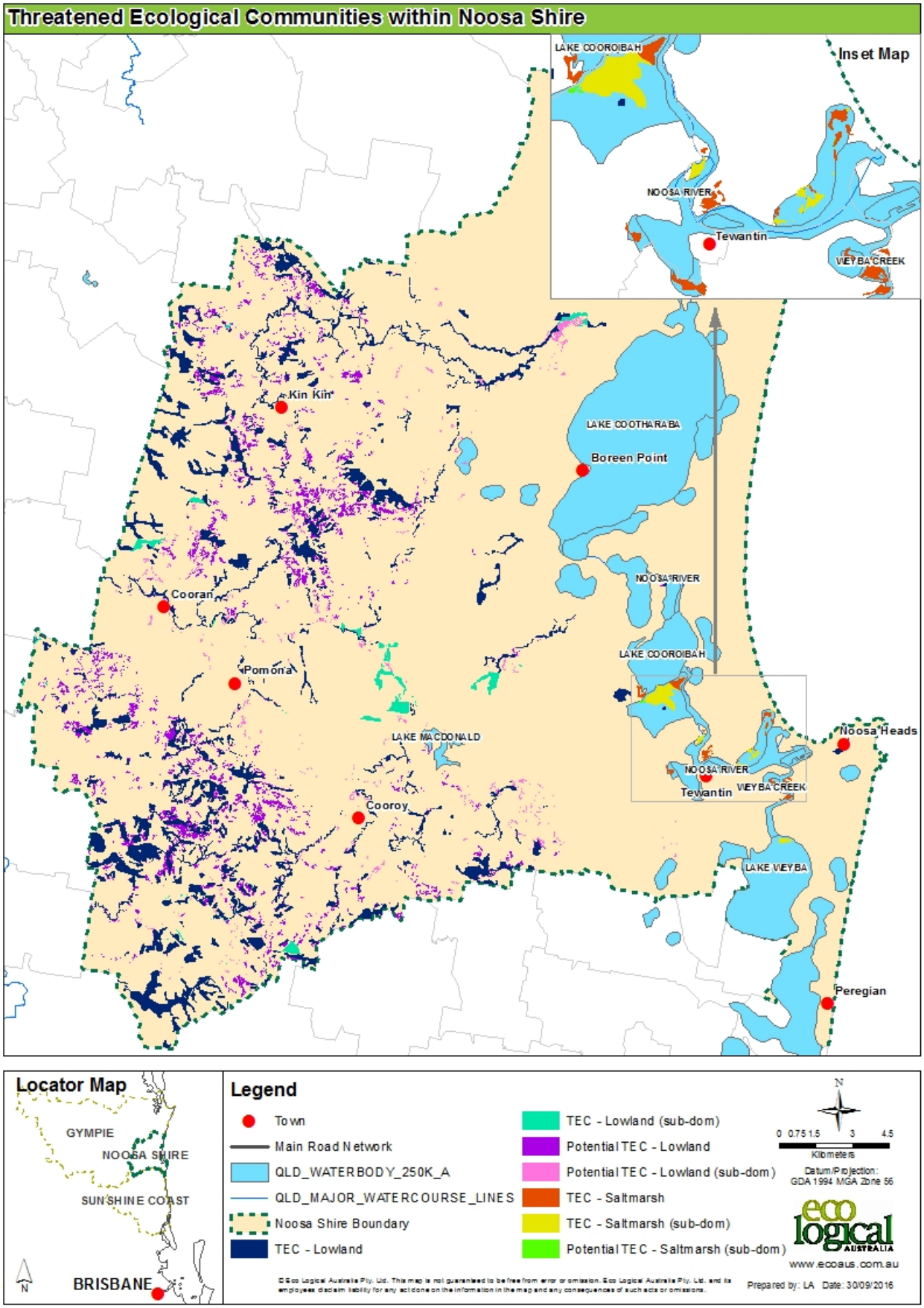


Figure 11: Threatened Ecological Community within Noosa Shire

3.4 Flora and Fauna

The Noosa Shire is home to a great diversity of wildlife and plants (~1,340 species of plants and 348 species of terrestrial vertebrate animals). At least 217 species of birds, 45 species of reptiles, 55 species of mammals, and 31 species of frogs are known from the area. A number of these species are recognised to be of conservation value, which are supported by Noosa's extensive protection reserves and remaining natural habitat.

3.4.1 Fauna species

Approximately 19% (66) of Noosa's fauna assemblage is currently listed as threatened or migratory under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Queensland *Nature Conservation Act 1992* (NC Act). This includes seven frog species, three reptiles, 51 birds and five mammal species. A further 30.7% (107) are considered regionally or locally significant. These species are considered to be of conservation value due to being endemic, conservation dependent, restricted in distribution, hollow or roost site dependent, vulnerable to disturbance, at the limit of their geographic range or outside their species usual range, or suffering local declines. Overall approximately 49% of Noosa's known fauna species are of conservation value.

Whilst Noosa Shire occupies only 1.4% of the SEQ region, it provides habitat for approximately 32% of threatened fauna species known to occur across the entire region. In particular it provides habitat for approximately 58% of the threatened frog species that occur in SEQ and approximately 43% of the threatened bird species (**Figure 12**). These proportions are very significant for the small areal extent of the shire and are a demonstration of the diversity and quality of habitats that occur in Noosa.

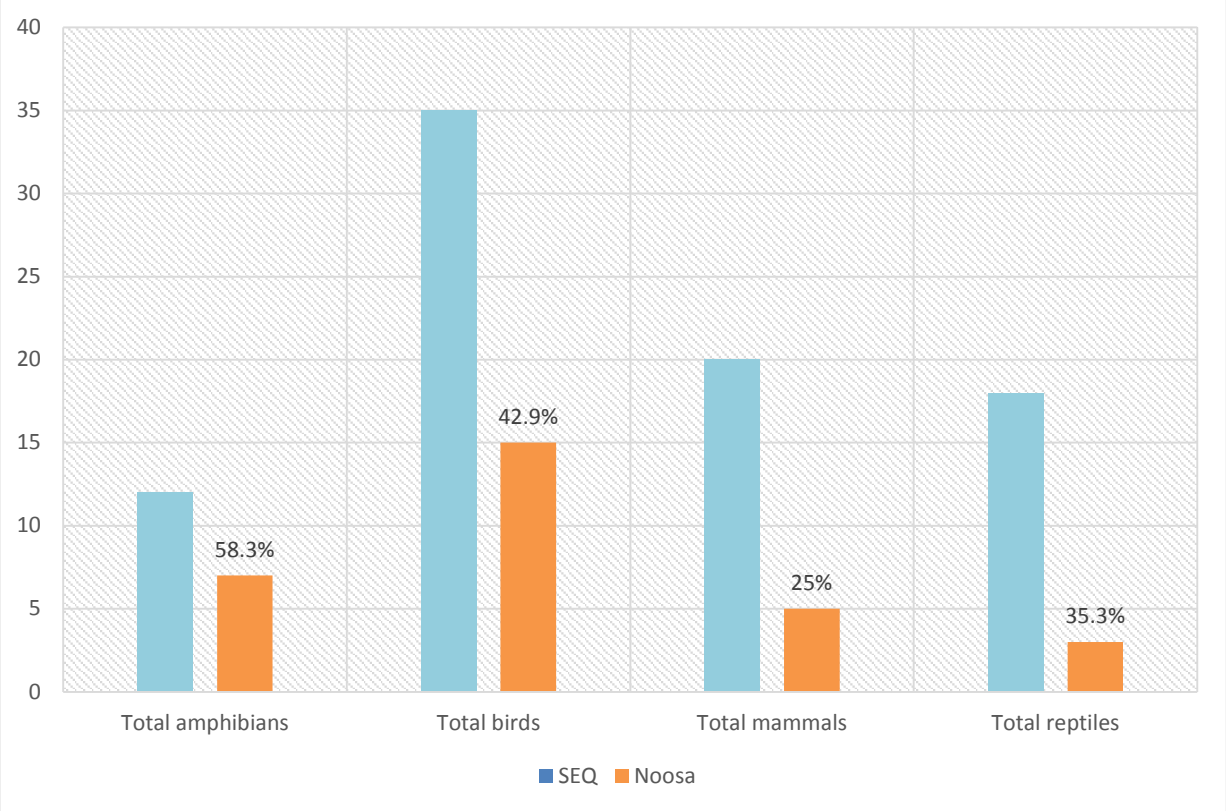


Figure 12: Total number of threatened fauna species recorded within SEQ region and Noosa Shire

Noosa's globally unique ecosystems such as the patterned fens, coastal heaths, rainforests and acid drainage systems also provide habitat for a number of relict and endemic invertebrates, some of which are identified as threatened. In particular, a number of crayfish and earthworm species associated with

the heath environments, swamps and sand dunes are distinctively unique and still yet to be formally described (Lewis *et al.*, 2007). A number of butterfly, moth and grasshopper species with Gondwana affinities also occur within the Cooloola rainforests, along with a diverse assemblage of land snails not seen anywhere else in the world (Lewis *et al.*, 2007).

There are a few species that in particular encapsulate the values that make Noosa such a unique area. These species are considered key and iconic to the region. **Table 2** lists these iconic species as well as their special values that contribute to the environmental significance of the Noosa region. A complete list of species of conservation value, including invertebrate species within the Noosa Shire as well as habitat associations is provided in **Appendix B.**

Table 2: Noosa Shire's key and iconic fauna species

Species	Status*	Local Values
Koala *Phascolarctos cinereus*	Vulnerable	Internationally recognised iconic species for Australia and a point of interest for tourism. Noosa is a stronghold for the threatened species, which is at risk to future climate change impacts. The species is a key value of the Noosa National Park. The Shire has a key position in the conservation of the species.
Grey-headed flying fox *Pteropus poliocephalus*	Vulnerable	Vulnerable species with extensive human-wildlife conflict. The shire is a refuge for the species, providing six roosts that are inhabited by species during their migratory cycle. The species is a long range pollinator, playing a critical role in the persistence of vegetation communities.
Glossy black cockatoo *Calyptorhynchus lathami lathami*	Vulnerable	A healthy population of the vulnerable Glossy Black Cockatoo occurs within Noosa due to a concerted effort by local government authorities and conservation groups to protect remnant stands of *Allocasuarina littoralis* trees and large hollow-bearing trees. The bird species feeds exclusively on the trees cones (orts). Noosa provides this habitat in concentrated stands of the tree within nature strips and numerous protected areas, and has become one of the stronghold locations for the species.
Water mouse *Xeromys myoides*	Vulnerable	Noosa is a stronghold for this threatened species, which is at risk to future climate change impacts and habitat clearing. The Noosa River is identified as key habitat in the species National Recovery Plan and has a key position in the conservation of the species.
Ground parrot *Pezoporus wallicus wallicus*	Vulnerable	This vulnerable listed species is restricted to the coastal heathlands in SEQ. The Noosa region provides important habitat to support one of the few remaining coastal area populations of the species. The species occurs within closed heath / sedgelands and is listed as an important value in the Noosa National Park Management Plan (1999).

Species	Status*	Local Values
Coxen's fig parrot *Cyclopsitta diophthalma coxeni*	Endangered	The species is very rare (100 breeding birds) and little is known about its behaviour or distribution. It was probably most abundant in lowland subtropical rainforest, however, since extensively cleared post European arrival, is now restricted to fragmented remnants of dry and cool rainforest (Department of Environment (DoE), 2016). Noosa Shire occurs within the species suspected range (Coxen's Fig-Parrot Recovery Team, 2001). Council sought funding for the restoration and expansion of the species habitat within the Shire, making Noosa an important conservation area for the species.
Wallum sedgefrog, Wallum rocketfrog, Wallum froglet, Cooloola sedgefrog *Litoria olongburensis, Litoria freycineti, Crinia tinnula, Litoria cooloolensis*	Vulnerable	These species are considered 'Acid frogs' as they typically are associated with nutrient poor and acidic (pH between 3.5 and 6.0) water (Meyer et al. 2006) and are unique to Australia's eastern coastal regions. The species are confined to coastal lowlands and sand islands of south-east Queensland and NSW and inhabit densely vegetated coastal wet heathlands, ferns, sedges, wetlands and swamps (Rowland, 2013). The Shire provides critical mainland coastal habitat for the species, with large populations able to persist in protected reserves of Noosa.
Cooloola blind snake *Anilios silvia*	Near Threatened	This species is endemic to heathlands of the Noosa region (Fraser Island to Sunshine Coast) and occurs in the Great Sandy National Park. Noosa provides refuge for the species as its habitat is at risk from climate change impacts.
Australian lungfish *Neoceratodus forsteri*	Vulnerable	This specie's natural distribution is restricted to the Mary River, Burnett River and its tributaries. It is the sole survivor of species in the Family Ceratodontidae, which is a family of fishes that have been around since prehistoric times.

* Status under the NC Act or EPBC Act

3.4.2 Flora species

Approximately 4% (50) of Noosa's flora assemblage is currently listed as threatened under the Commonwealth EPBC Act and the Queensland NC Act. This accounts for approximately 23% of threatened flora species that occur within the SEQ region, which is a significant proportion given the small extent of the Noosa Shire.

In addition to this, a further 3% (40) of flora species in Noosa are considered regionally or locally significant. These species are considered of conservation value due to being endemic, restricted in distribution or at the limit of their geographic range. Overall approximately 7% of Noosa's known flora species are of conservation value.

There are a few species that in particular encapsulate the values that make Noosa such a unique area. These species are considered key and iconic to the region. **Table 3** lists these iconic flora species as well as their special values that contribute to the environmental values of the Noosa region. A complete

list of species of conservation value within the Noosa Shire as well as habitat associations is provided in **Appendix B.**

Table 3: Noosa Shire's key and iconic flora species

Species	Status*	Local Values
Mt Cooroora She-oak *Allocasuarina rigida subsp. exsul*	Vulnerable	Vulnerable species only found at the summit of Mt Cooroora, near Pomona. Species is a unique part of Noosa's biodiversity and has not been identified outside of the region.
Bacon Wood *Archidendron lovelliae*	Vulnerable	Vulnerable species endemic to Fraser Island and south to Lake Cootharaba. Most populations occur within Great Sandy National Park. The Shire has a key position in the conservation of the species.
Key's Boronia *Boronia keysii*	Vulnerable	Vulnerable species endemic to Noosa River Floodplains, occurring between Kin Kin and Lake Cootharaba. It is found amongst eucalypt and Brushbox in lowland areas up to 20 m above sea level.
Stinking Cryptocarya *Cryptocarya foetida*	Vulnerable	The species is at threat of localised extinction due to small populations. The species is restricted to coastal sands or close to the coast in rainforest or on sand dunes and endemic to SEQ and north NSW. The Noosa region contains 15 known populations.
Swamp Stringbark *Eucalyptus conglomerata*	Endangered	An endangered species, confined to southern coastal Queensland, between Kin Kin and Beerwah. It occurs mostly in the ecotone between wet heath (wallum) and tall open forest communities. The species survival is reliant on protection within conservation reserves in which Noosa has a key position, hosting the northern most limit of the main population with the species occurring in 10 locations across Noosa's National Parks and Conservation Parks.
Habenaria harroldii	Endangered	The species is endangered and occurs on coastal and subcoastal melaleuca swamps, threatened by climate change. Only 3 locations of the species is known, of which two are in Noosa (Atlas of Living Australia, 2016).
Small-fruited Queensland Nut *Macadamia ternifolia*	Vulnerable	The species is considered extremely rare in the wild and is restricted to an area between Mount Pinbarren (northern extent) and Mary Cairncross Park near Maleny (southern extent), a distance of only 50 km (Barry & Thomas 1994). The northern extent occurring within the Noosa region is considered significant due to the genetic isolation of these individuals from other populations. Noosa hosts a stronghold for the species where it occurs in 14 locations within rainforest environments.
Macarthuria complanata	Near Threatened	The species inhabits dry health occurring between Noosa and Rainbow Beach. Noosa provides a stronghold for the species, with 14 known locations.

Species	Status*	Local Values
Pineapple Zamia *Macrozamia pauli-guilielmi*	Endangered	The species is endemic to Queensland, occurring between Brisbane and Bundaberg within coastal heath habitat. Rainbow Beach to Noosa provides a stronghold for the species, with 4 known locations.
Melaleuca cheelii	Near Threatened	The species inhabits wallum country between Bundaberg to Cootharaba. Noosa is within the southern limit of the species range, with Lake Cootharaba hosting 3 known locations.
Wallum Leek-orchid *Prasophyllum wallum*	Vulnerable	The species is a perennial orchid growing in wallum communities and stabilised dunes between Hervey Bay and Coolum. Noosa nature reserves protect the species habitat in its southern distribution limit.
Prostanthera sp. (Mt Tinbeerwah P. R. Sharpe 4781)	Vulnerable	This vulnerable species has a very small area of occupancy (2ha) and is known to occur at only four sites in the Mt Tinbeerwah area near Tewantin (DoE, 2016b). Stands of the species occurs near Harry Spring Environmental Park.
Xanthostemon oppositifolius	Vulnerable	Noosa is one of only three locations where this unique rainforest tree species is known to occur. The species occurs in the Kin Kin 'scrub' or rainforest which is unique to the region. Noosa hosts 32 locations and is a stronghold for the species.

* Status under the NC Act or EPBC Act

3.4.3 Habitat areas

From the rainforest and the dry Eucalypt woodlands of the Noosa Hinterland to the coastal heaths and sand dunes of the Great Sandy Strait, Noosa's remaining natural habitat areas provide a broad range of habitat resources for flora and fauna species of conservation value as well as common species. For species of conservation value, 52.3% of habitat available within the Noosa Shire supports these species. Remnant vegetation contributes the greatest proportion of habitat for conservation value species, whilst other habitats comprising scattered trees or regrowth provide minimal habitat for species of conservation value (**Figure 13**).

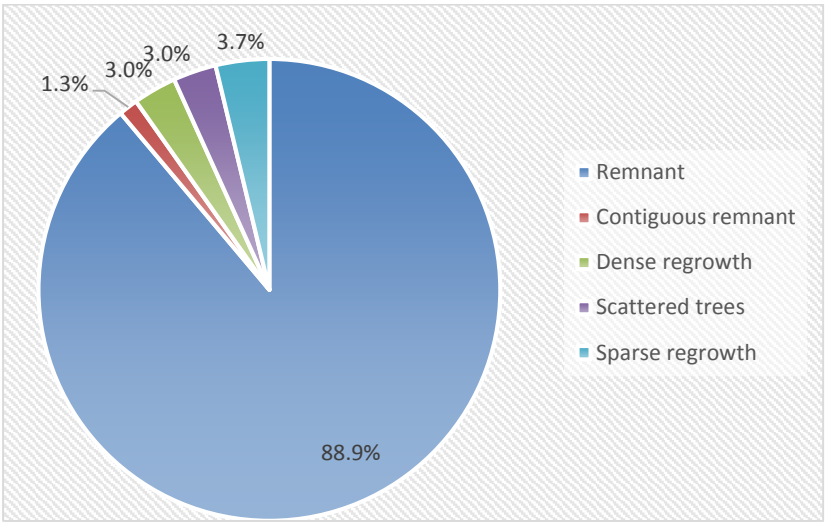


Figure 13: Proportion of habitat condition classes supporting conservation value species

Habitat for species of conservation value is distributed throughout the entire shire (**Figure 14**). The majority of the habitat (58%) supports species within a maximum conservation status of Endangered with only a small proportion (2.7%) supporting species with a maximum conservation status of local or regional significance. Of particularly significance are the lakes of the Noosa River, the Noosa headlands and eastern beaches, which support Critically Endangered species (**Figure 14**).

Noosa is also a key habitat area for migratory bird species, of which the majority are recognised as under threat. Noosa is the northern extent of an Endemic Bird Area (EBA) identified by Birdlife International, which extends along Australia's eastern coast to Mallacoota in Victoria. There are over 2,500 species of bird that are restricted to an area smaller than 50,000 km^2 and EBAs are globally recognised areas that provide habitat for these endemic species (BirdLife International, 2010). Noosa, along with other globally recognised sites provide habitat for nearly all of the world's restricted-range bird species.

The Great Sandy Strait National Park, including habitat fringing Lake Cootharaba and Lake Cooroiabah within the north-eastern corner of the shire are particularly recognised areas within Noosa and have been identified as an Important Bird Area (IBA) by the International Partnership of BirdLife Australia. This area along with other globally recognised IBAs are considered important conservation areas that are critical to the future protection of bird biodiversity and the long-term viability of naturally occurring bird populations (BirdLife International, 2010).

Sunshine Beach within the Noosa Shire is also a successful turtle breeding site. The largely natural beach and dune system remains unaffected by the damaging effects of coastal development seen elsewhere along the Sunshine Coast such as high levels of human activity. The beach provides critical nesting habitat for the Endangered Loggerhead turtle (*Caretta caretta*) and less frequently, the Vulnerable Green turtle (*Chelonia mydas*).

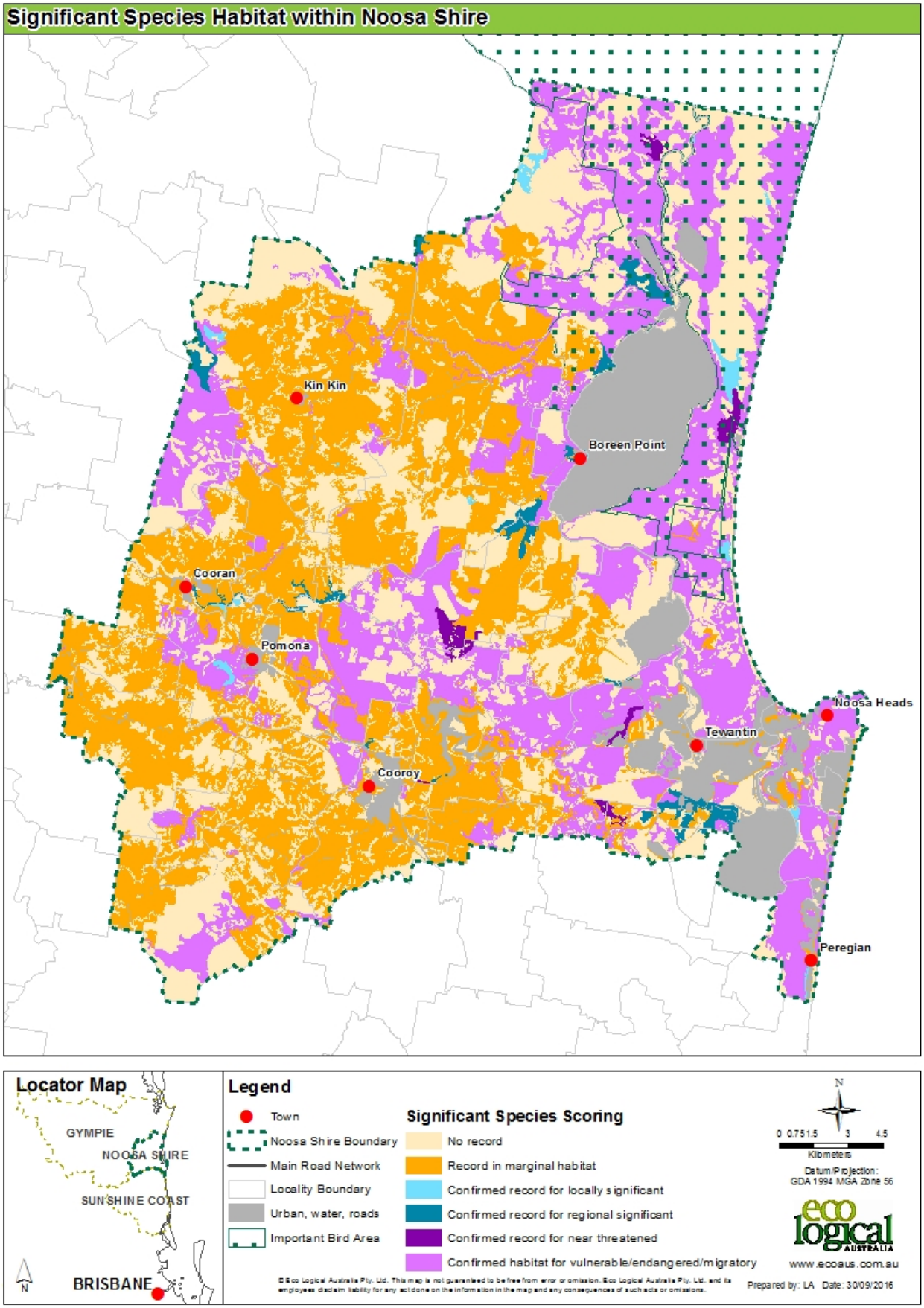


Figure 14: Habitat for species of conservation value within Noosa Shire

3.5 River systems and waterways

The landscapes of Noosa Shire are dominated by the Noosa River catchment, covering the north, east, centre, and south of the shire, and reaching the ocean at Noosa Heads (**Figure 15**). Noosa Shire also has two other river catchments. The upper reaches of the Mary River catchment drains the hinterland south and west from the Cooroy/Pomona/Cooran area before flowing north, outside the western boundary of Noosa Shire, to Hervey Bay. The Maroochy River catchment occurs in the far south of Noosa Shire, and mostly consists of a series of small upper-tributary creeks in high altitude areas that flow south across the shire boundary, eventually entering the ocean at Maroochydore. There are also some small coastal waterways east of the Marcus high dunes which flow to the ocean, such as Burgess Creek, Peregian Creek and Marcus Creek (**Figure 15**).

3.5.1 Noosa River Catchment

The Noosa River system is internationally recognised for its natural, environmental, scenic, cultural and economic values (Noosa Council, 2004). It is consistently recorded as the healthiest river system in SEQ, with a condition score of A- in 2015, according to the Healthy Waterways annual report card (SEQ Waterways, 2016). This means that all key processes are functioning, and critical habitats are in pristine condition. Lower sediment and nutrient loads are also being generated with approximately 96% of the streambanks vegetated, resulting in excellent stream health conditions (SEQ Waterways, 2016). Overall, only 0.1% of the riverine environments within the catchment are considered artificial and highly modified (Department of Environment, Heritage and Protection (EHP), 2016). Areas of High Ecological Value protected under the *Environmental Protection (Water) Policy 2009* (EPP (Water)) have been nominated across large areas of the catchment, including the Noosa River and lakes within the Cooloola sandmass and within the lower reaches within the Noosa National Park (**Figure 15**).

The largely undisturbed Noosa River and the coastal plains are also stronghold refuges for threatened species such as the Ground Parrot, Glossy Black Cockatoo and False Water Rat. The lower Noosa River is a rare example within the subtropics of a choked coastal lagoon system of fresh and saltwater lakes occurring entirely on sand (Lewis *et al.*, 2007). Characteristic fauna is associated with these wetland environments, including a distinctive group of acid frogs. The lower Noosa River and its lakes are also used by many migratory shorebirds for feeding on their journeys north and south. Extensive seagrass meadows also occur.

3.5.2 Mary River Catchment

The Mary River catchment in Noosa Shire is a highly complex region characterised by steeply dissected mountain ranges and narrow valley floors. Much of the area has been cleared for agriculture, although significant stands of rainforest and eucalypt forest remain on many of the steeper slopes, in the less accessible gullies, in the State Forests and along the watercourses. The main tributaries of the catchment that occur within the Noosa Shire are Six Mile Creek, Blackfellow Creekand Middle Creek. Six Mile Creek provides prime habitat for the Mary River Cod, which has suffered population declines since the 1930's and is now listed as endangered at a Commonwealth level (Mary River Catchment Co-ordinating Committee (MRCCC), 2014). The creek also provides known habitat for the Australian Lungfish, which is a prehistoric species currently under threat due to reductions in breeding habitat. The rainforest remnants along Six Mile Creek also provides habitat for the stream dependent and endangered Giant Barred Frog as well as numerous rare and threatened frog species (MRCCC, 2014). Areas of High Ecological Value have been nominated across portions of the catchment, including the waterways within the Woondum National Park, Ridgewood, Black Mountain, Yurol State Forest, Cooroy and Tinbeerwah (**Figure 15**).

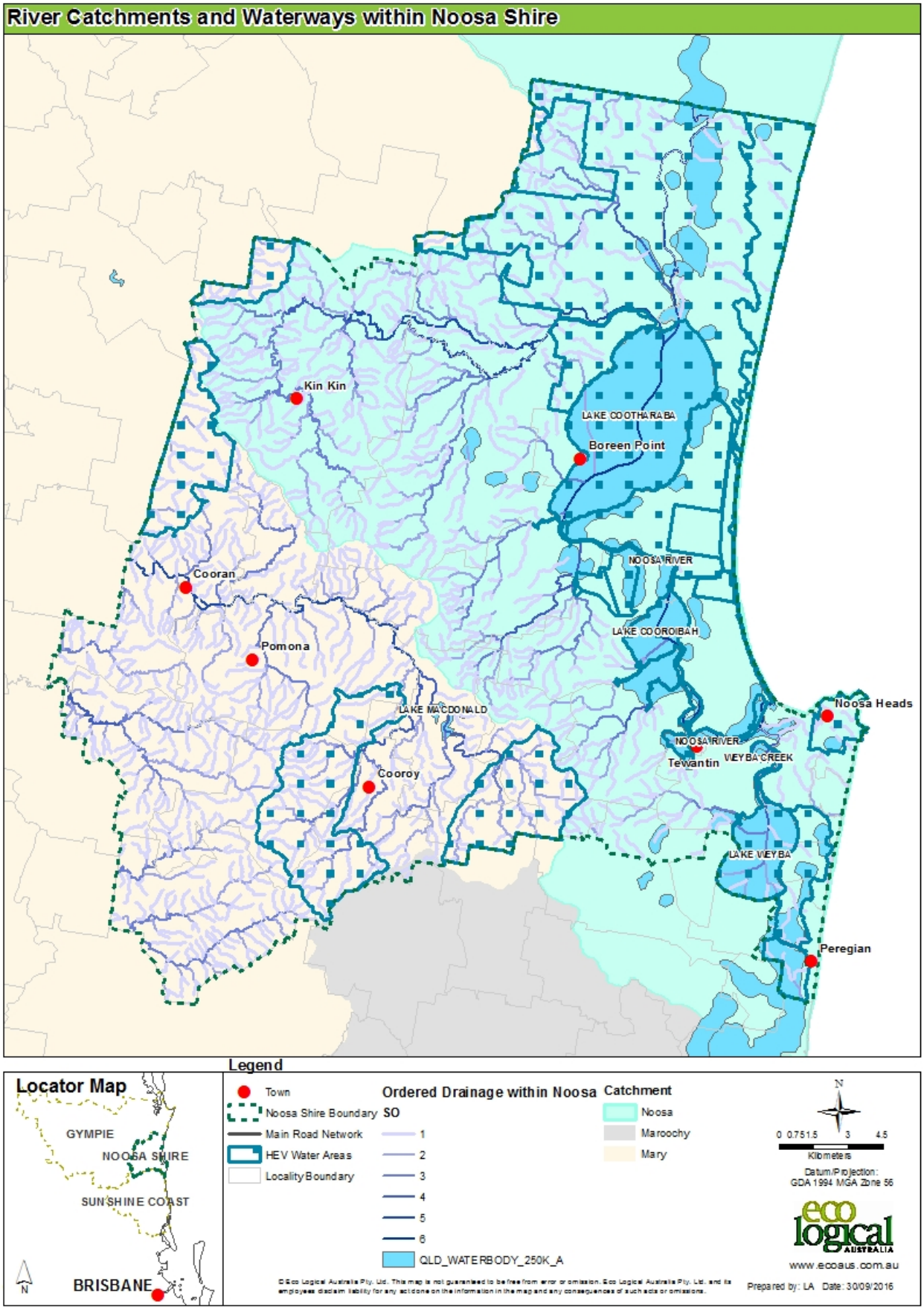


Figure 15: River catchments and waterways within Noosa Shire

3.6 Wetlands

The Noosa Shire is well-known for its high quality and diverse wetlands that provide critical ecosystem services and functions as well as significant ecological values. The extent of wetland areas within the Noosa Shire is 16,890 ha, which comprises 19.4% of the total shire area (EHP, 2016). Compared to the SEQ region and other coastal LGA's, Noosa has the second highest percentage of natural wetland areas after factoring in the extent of artificial wetlands (**Table 4**).

Table 4: Proportion of wetland areas across SEQ region and coastal LGAs

LGA / region	Wetland area (%)	Artificial wetland area (%)
Redland	20.4	3.0
Noosa	19.4	2.7
Sunshine Coast	11.3	9.8
Gold Coast	11.9	25.6
Moreton Bay	10.8	17.5
Brisbane	6.8	15.5
SEQ region	4.5	22.2

Source: Wetland*Info*, 2016

Palustrine and lacustrine wetland systems are the predominant systems within the Noosa area with approximately 195 wetlands identified in the low coastal region of the shire (EHP, 2016) (**Figure 16** and **Figure 17**). Lacustrine wetlands are large, open, water-dominated systems such as lakes whereas Palustrine wetlands are primarily vegetation non-channel environments such as billabongs, swamps and springs. Both wetland types are associated with the Cooloola sand mass, a highly significant area containing the oldest and largest number of independent coastal dune systems recorded in the world.

Within the palustrine and lacustrine wetland systems, the coastal and sub-coastal floodplain tree swamp – *Melaleuca* spp. and *Eucalyptus* spp. is the dominant wetland habitat type. This palustrine wetland type is usually ephemeral in nature and typically has a low pH; however numerous fauna species including birds, bats and reptiles utilise the habitat. This includes threatened species such as the Ground Parrot, Glossy Black Cockatoos and a number of threatened acid frog species that are adapted to the unique conditions (EHP, 2016). This wetland habitat type often receives water from a variety of sources (overbank stream flow, direct stream flow, rainfall, groundwater flow) and can play a role in groundwater recharge and discharge if water table levels and substrate permeability permit (EHP, 2016). Other important roles and functions include buffering of waterways for land based nutrient loads.

Other wetland systems in the Noosa Shire that add to the high diversity of wetland habitat types include estuarine and riverine wetlands, which are associated with the Noosa River system (**Figure 16** and **Figure 17**). This spectacular and extensive system of freshwater, brackish and saline lakes, marshes, heathlands and estuarine wetlands is one of few such complex wetland systems on the entire Eastern Australian seaboard (Lewis *et al*., 2007). It is particularly unique among Queensland estuaries with a transition from fresh water to hypersaline waters in the lakes and contains the largest riverine seagrass beds in SEQ (Lewis *et al*., 2007). It is also a rare subtropical example of a coastal lagoon system developed entirely on sand.

Noosa's unique, diverse and high quality wetlands are recognised at national and state levels. The following sections describe wetland areas of particular significance.

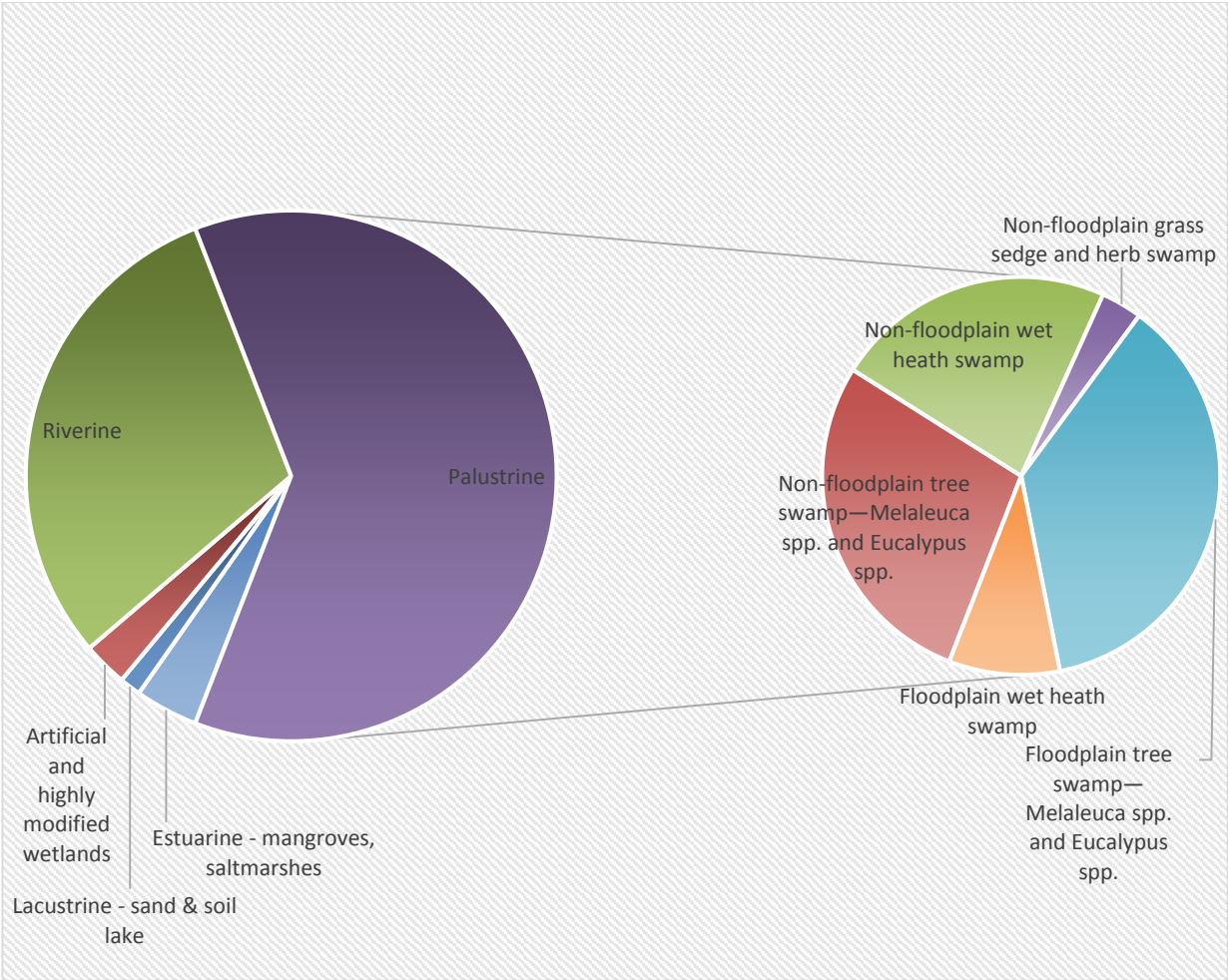


Figure 16: Wetland habitat types within Noosa Shire

3.6.1 Wetlands of International Importance (RAMSAR sites)

The acidic and freshwater wetlands and streams of the Cooloola sand mass within Noosa are part of the Noosa River catchment. The Great Sandy Strait region to the north of the Noosa Shire is recognised as a wetland of international importance and is listed as a Ramsar site.

The Great Sandy Strait region is of significant value and importance to numerous fauna species. The area provides feeding grounds that are frequently or occasionally used by six species of threatened marine turtle, as well as the Dugong (*Dugong dugong*), Water Mouse (*Xeromys myoides*), Illidge's Ant Blue Butterfly (*Acrodipsas illidgei*), and the Oxleyan Pygmy Perch (Department of Environment and Energy (DoEE), 2016). Wetlands along Great Sandy Strait regularly support in excess of 20,000 migratory shorebirds, with 18 species listed under international migratory bird conservation agreements (DoEE, 2016).

The Cooloola sand mass area of the Great Sandy Strait in particular, contains the only subtropical representations in the world of patterned fens, which are a unique wetland type that supports an unusual number of rare and threatened invertebrate species. In particular crayfish, earthworms and other invertebrate species associated with this area exhibit a high degree of diversity and endemism (Lewis *et al*., 2007).

3.6.2 Nationally Important Wetlands

The wetland system of the Noosa River and Lake Weyba are both recognised as nationally important wetlands that are protected by Commonwealth legislation (**Figure 18**). Combined, these areas cover 12,805 ha, comprise 16 different wetlands types (Lewis *et al*., 2007) and meet all six criteria for inclusion as a nationally important wetland area. These are:

1. good example of a wetland type occurring within a biogeographic region in Australia.
2. wetland which plays an important ecological or hydrological role in the natural functioning of a major wetland system/complex.
3. wetland which is important as the habitat for animal taxa at a vulnerable stage in their life cycles, or provides a refuge when adverse conditions such as drought prevail.
4. wetland supports 1% or more of the national populations of any native plant or animal taxa.
5. wetland supports native plant or animal taxa or communities which are considered endangered or vulnerable at the national level.
6. wetland is of outstanding historical or cultural significance

Lake Weyba in particular is recognised by the Queensland Government as a significant habitat for migratory waders (Lewis *et al.*, 2007), and provides habitat for the threatened Water Mouse, acid frog species and numerous flora species including the Swamp Orchid (*Phaius australis*) (Lewis *et al*., 2007).

The habitats within the wetlands of the Noosa River include mangrove communities, salt flats and saltmarshes, melaleuca and eucalyptus swamps, wet heath swamps, grass sedge and herb swamps, window lakes on sand, riverine wetlands, and a small proportion of modified areas such as dams and irrigation channels. The Noosa Wetlands are part of a series of coastal wetlands that provide intermediary habitat for local and migratory fauna that are associated with two nearby Ramsar sites: the Great Sandy Strait to the north, and Moreton Bay to the south.

3.6.3 State Significant Wetlands

The majority of Noosa's wetland areas are recognised by the Queensland State Government as natural wetlands that are of High Ecological Significance (**Figure 18**) or natural wetlands that occur in High Ecological Value freshwater and estuarine areas as defined under the EPP (Water) (refer to **Section 2.5**). These wetlands are considered to be of State significance and as such requiring statutory protection.

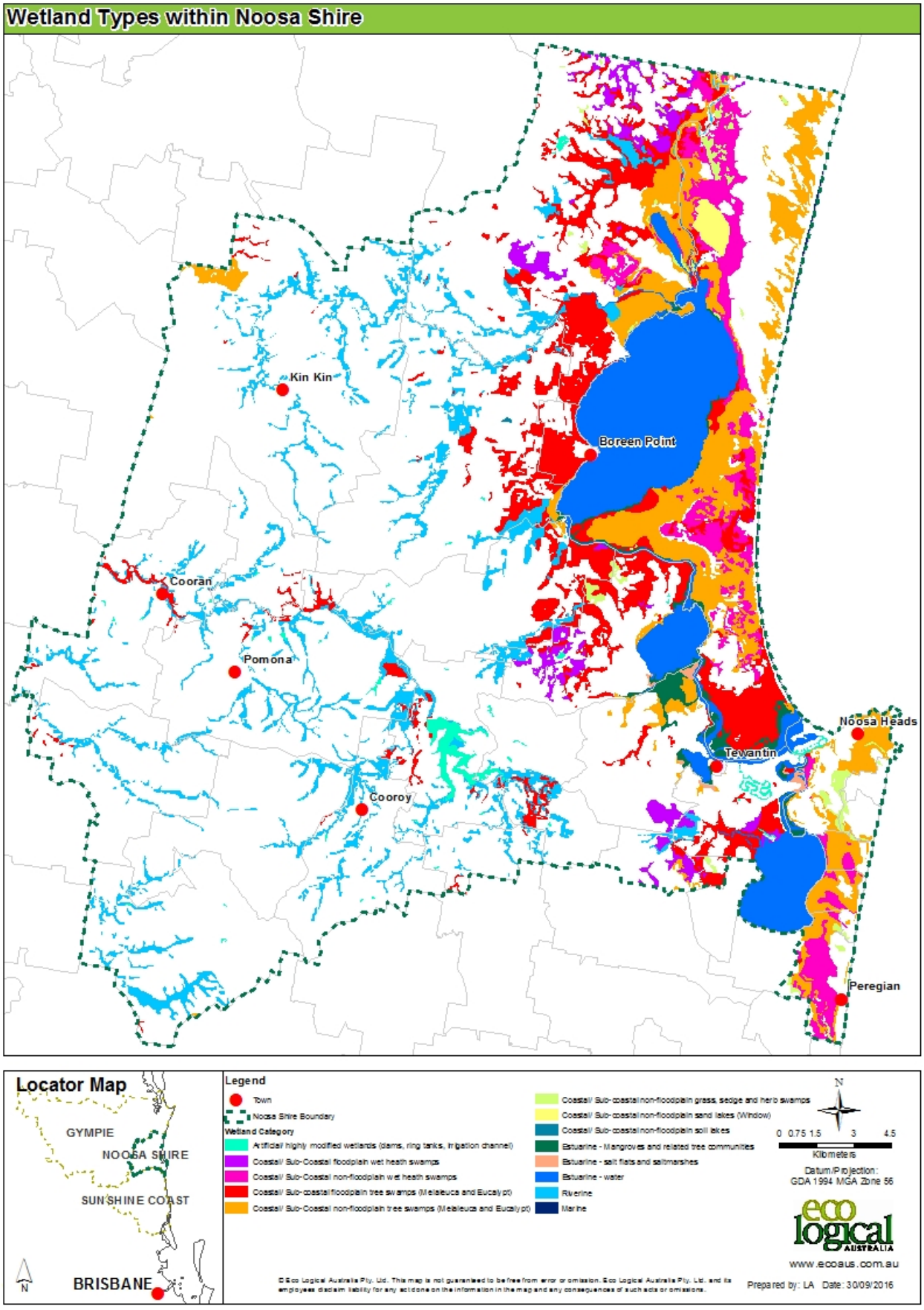


Figure 17: Wetland types within the Noosa Shire

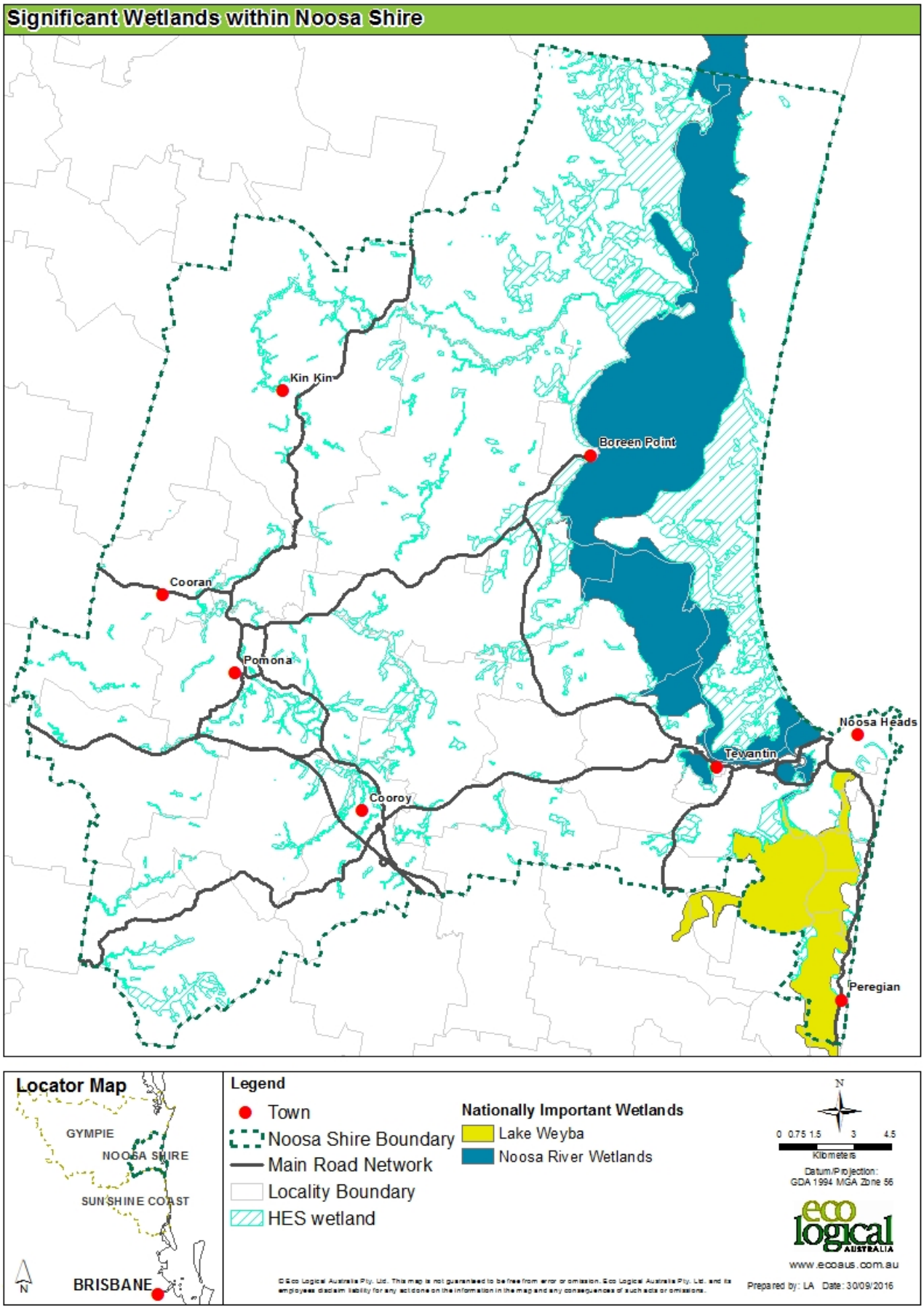


Figure 18: Significant wetlands within Noosa Shire

3.7 Protected Reserves

Noosa's system of protected reserves includes National Parks, Forest Reserves, Conservation Parks, Nature Refuges and Resource Reserves (**Figure 20**). Although not legally an area dedicated for conservation, State Forests and Land for Wildlife (LFW) also contribute to Noosa's protection system. Voluntary Conservation Agreements (VCA's) have binding covenant protection attached to title. Overall, 36.5% of the Noosa Shire is covered by protected reserves with National Parks forming the highest proportion of this area (**Figure 19**). Remnant vegetation is the predominant vegetation type (i.e. approximately 85%) that is protected within the reserves with only minimal areas of other vegetation categories including regrowth, contiguous remnant vegetation and scattered trees included within the protection reserves. The exception to this is State Forest Parks, of which approximately 30% is plantation.

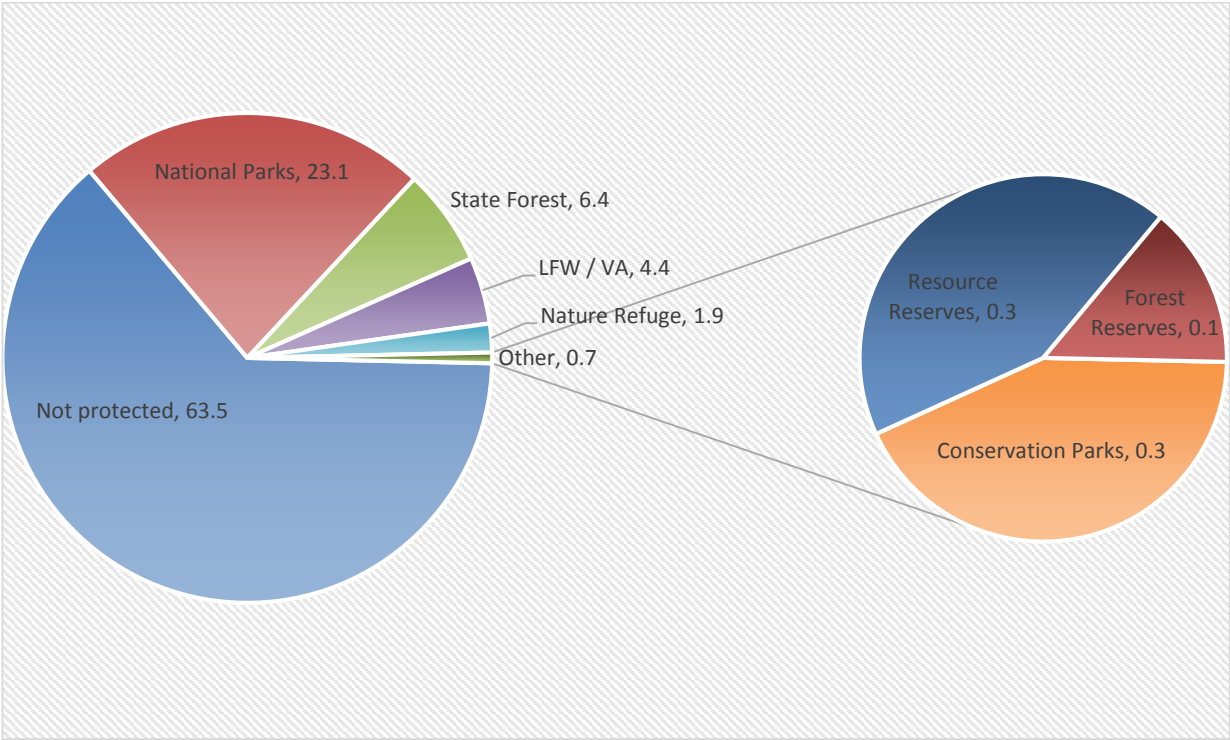


Figure 19: Proportion of protection reserves across Noosa Shire

The largest protected reserve within the Noosa Shire is the Great Sandy Strait National Park, which protects the late Tertiary Cooloola Sandmass and its globally unique habitat, wetland types and geomorphological forms. It is the largest remaining area of vegetated sand dunes in South–Eastern Australia, and together with Fraser Island it represents the stronghold for the region's distinctive flora and fauna.

The distinctive assemblage of biota, includes invertebrates that exhibit a high degree of endemism. The area has been refugia for lowland rainforest as the climate dried out during the Pleistocene period. These areas also include both relictual Gondwanan flora such as Agathis and Araucaria and extensive rainforests and descendants of the Gondwana flora all of which are growing on infertile sandy soils. Elsewhere in eastern Australia such forests are mostly found on more fertile soils.

Noosa's extensive protected reserves play a critical role in conservation management across the SEQ region. The shire contains 16 REs represented within protected reserves that are poorly protected across the remaining bioregion. However, 15 REs are noted to be poorly represented within both Noosa and SEQ. A complete list of under-represented REs is provided in **Appendix A**.

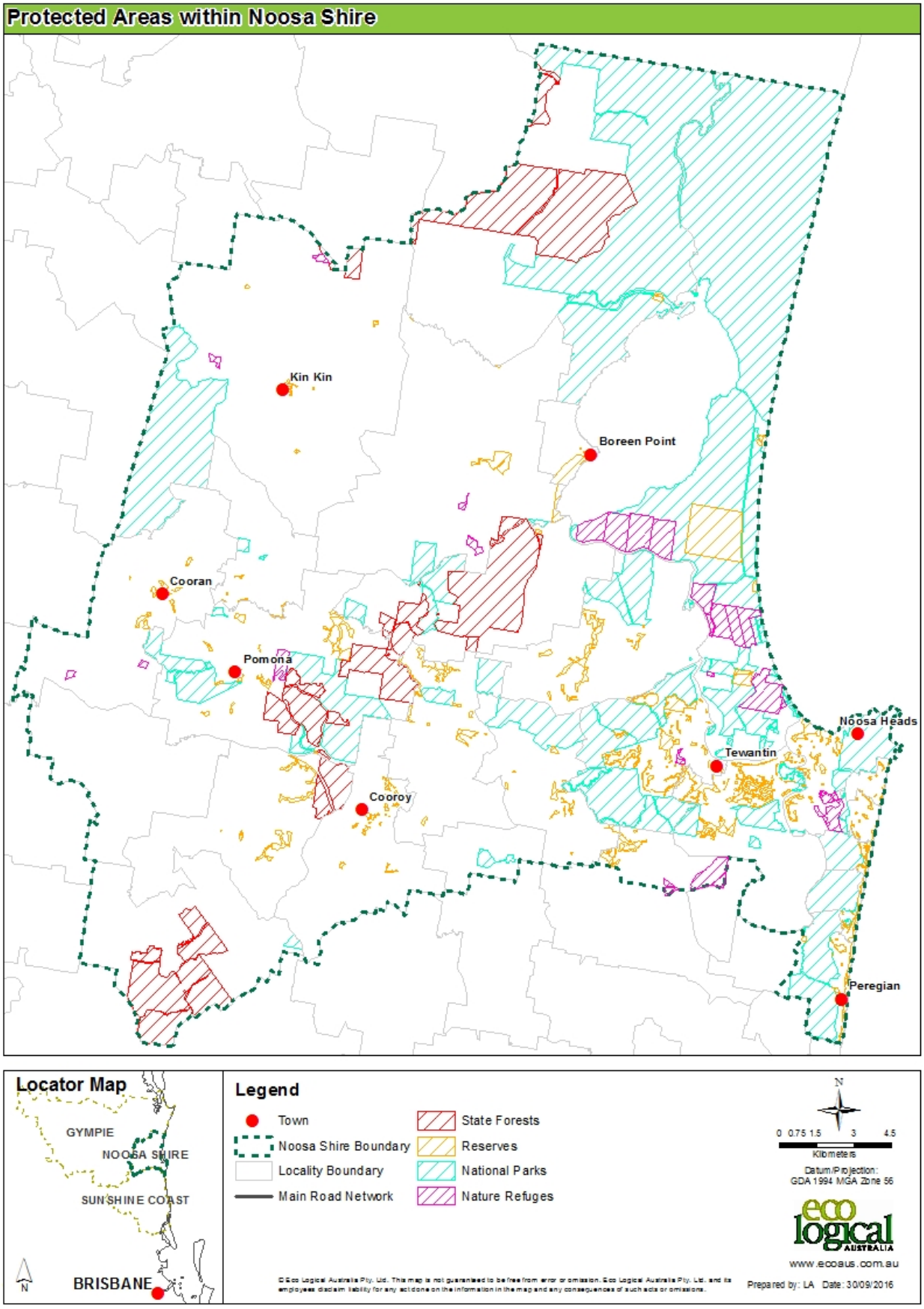


Figure 20: Protected areas within Noosa Shire

4 Biodiversity Threats

The Noosa Shire is a unique area that demonstrates a balanced relationship between humans and the environment, promoting harmony between people and nature through education, conservation and sustainable development. For this reason it is internationally recognised as a Biosphere Reserve and has been able to retain significant environmental values whilst other areas across the SEQ region have undergone significant development.

However, Noosa's biodiversity values are under pressure from a variety of threatening processes. Due to the significance of some of these biodiversity values, the potential consequence of these threatening processes are considerable and important. The key relevant threats identified within the Noosa Shire include:

- Climate change
- Invasive species incursion
- Vegetation clearing, particularly within rural areas (potential threat to landscape connectivity, riverine wetlands, Lowland Rainforest TEC)
- Degrading processes such as erosion and sedimentation of waterways
- Inappropriate fire regimes
- Recreational use
- Habitat fragmentation and barrier effects to key habitat nodes and ecological corridors
- Conflicts between humans and wildlife, particularly in the more urbanised areas of the shire and with increasing visitation.

4.1 Climate change

The SEQ region is one of two climate change vulnerability hot spots in Australia (Intergovernmental Panel on Climate Change (IPCC), 2007). As a low-lying coastal area in SEQ, Noosa Shire has high exposure and sensitivity to the impacts of climate change (Noosa Biosphere, 2012). These impacts will occur across the Noosa Shire, but will be most prominent in coastal areas, wet lowland forests and riparian zones. Whilst some of Noosa's biodiversity values will be able to adapt to climate change through distribution and behaviour changes, many species and ecosystems are particularly vulnerable because they are at their distributional or physiological limits.

The Noosa region's climate has already changed, with consistent trends that can be tracked over the last 100 years. The area is currently experiencing increases in temperature of 0.4-0.6^{o}C every 10 years (Steffen *et al.*, 2009) with mean temperature anomalies increasing (**Figure 21**). Overall, Noosa's mean temperature has increased by around 1^{0}C since 1910 (CSIRO, 2015).

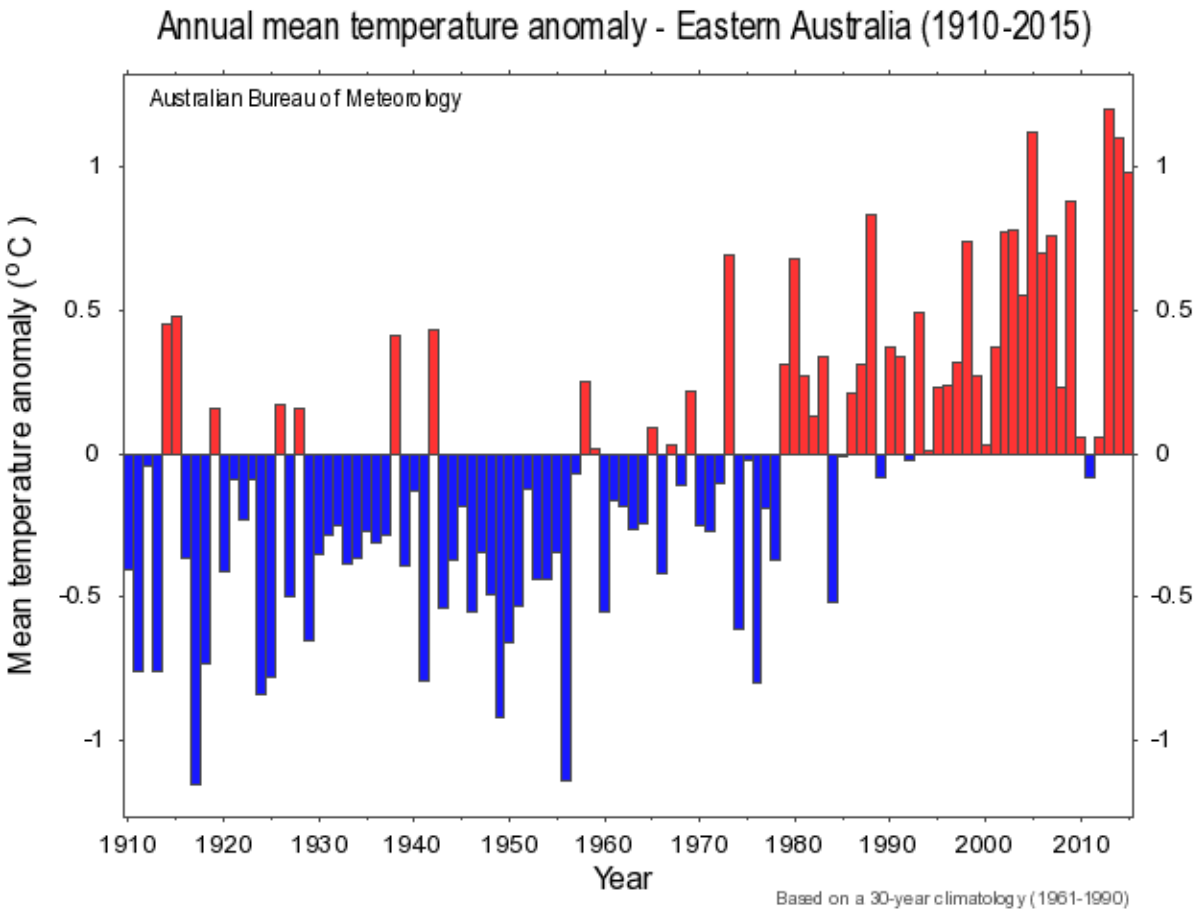
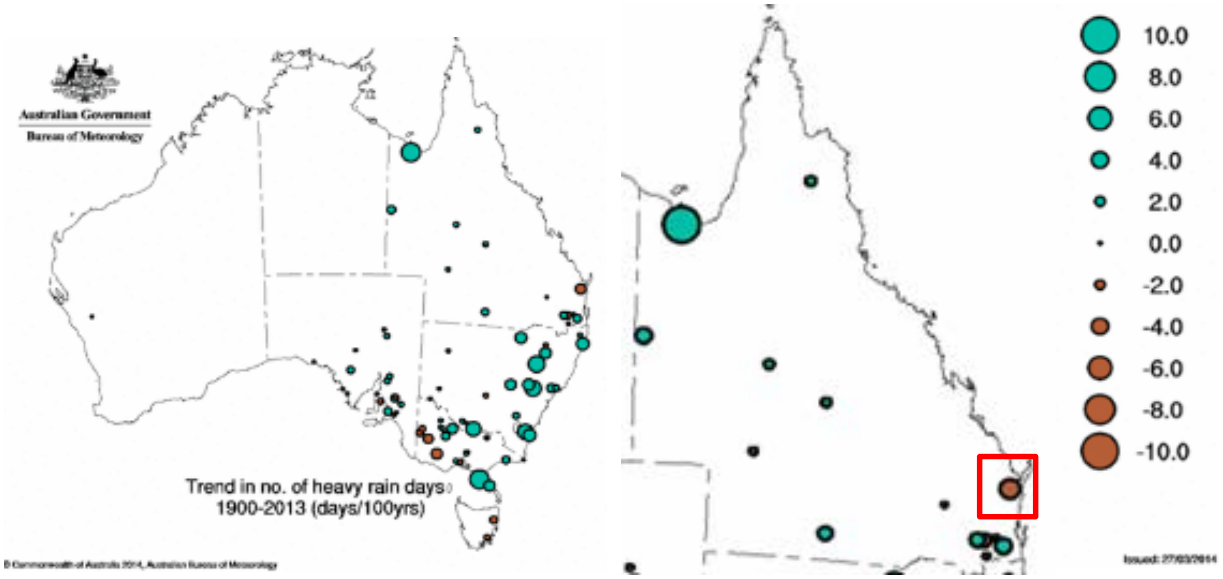


Figure 21: Annual mean temperature anomaly trends for Eastern Australia from 1910 - 2015

Whilst trends in rainfall are not as clear and defined as temperature, there is an apparent increasing occurrence of longer drier periods as well as heavier rainfall events (**Figure 22**). An average sea level rise of 1.2 – 1.4 mm per year has also been recorded for the area (CSIRO, 2015).



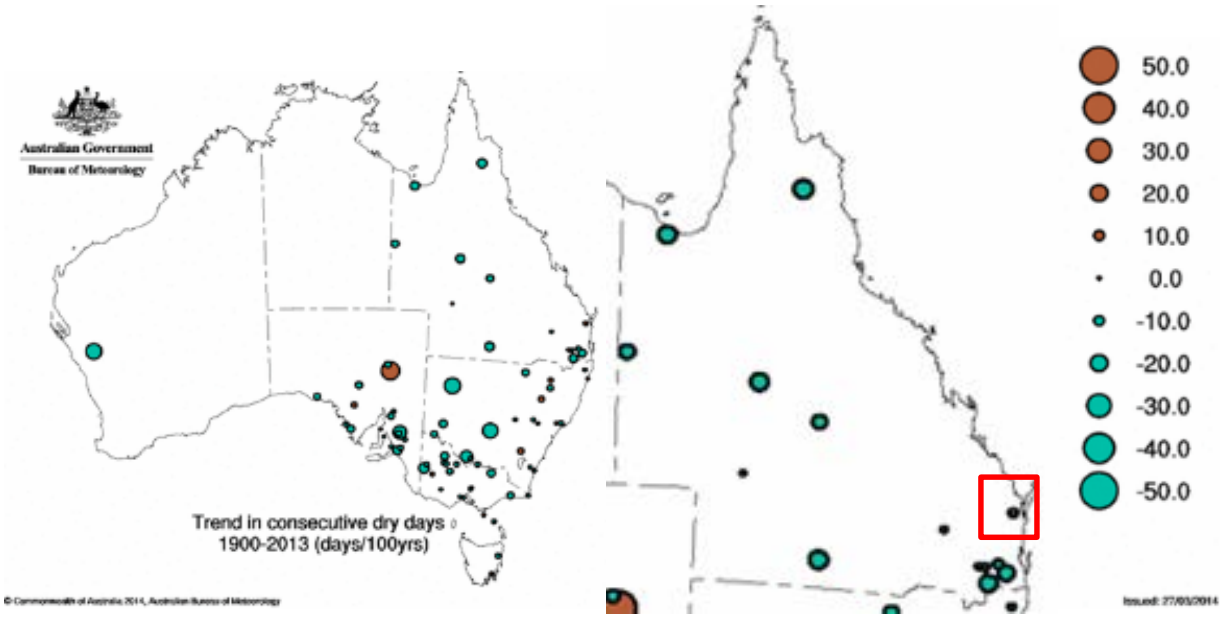


Figure 22: Extreme climatic trends relevant to the Noosa region – heavy rain days (above) and consecutive dry days (below)

Based on these current trends and the predicted future climate changes, the Noosa region is expected to experience the following over the next 35 to 80 years:

- Mean annual temperature increase from 21^{o}C to 22-23^{o}C by 2050 (Noosa Biosphere, 2012)
- An increase in the frequency of extreme temperatures with the number of days over 35^{0}C increasing by 30 days per annum by 2100 (CSIRO, 2015)
- Sea-level rise of 0.3 to 0.65m and 0.8m by 2100 (CSIRO, 2015)
- Southerly tracking cyclones (fewer but longer lived) (SCC, 2010)
- 140% increase in the number of severe storms by 2070 (SCC, 2010; Noosa Council, 2015a)
- Higher storm surges (Gilmore, 2008)

- An increase in extreme rainfall events and rainfall events becoming more intense (CSIRO, 2015; SCC, 2010)
- Evapotranspiration rates 10-11% higher (Low, 2011)
- Increased bushfire risks (Noosa Council, 2015a)
- Increased CO_2 levels in the atmosphere, leading to a decline in the nutritional quality of foliage (Low, 2011)

The anticipated impacts of climate change that are most relevant to the biodiversity of the Noosa Region include:

1. **Increased coastal erosion, coastal hazards and extensive inundation** from sea level rises, storm surge, increased coastal winds, a southern shift and greater intensity of cyclones, and increased storm intensity and/or frequency. Noosa shire has extensive stretches of low-lying coastal and dune ecosystems, which are highly susceptible to coastal erosion and inundations. Sea level rise will significantly impact coastal flora and fauna, particularly wetlands and shorebirds, which feed and breed in low-lying wetland areas. Rising sea levels are likely to result in a contraction of the saltmarsh zone as areas become more regularly or permanently inundated.
2. **More frequent mass die-off of vegetation and vulnerable flora and fauna** due to higher mean temperatures and an increased frequency of extremely hot days. Noosa Shire has several vegetation communities, as well as species of flora and fauna that are susceptible to mass die-off from hot conditions. Communities particularly susceptible to drought-related deaths and die-backs include dune crests, ridgetops, sunny northern slopes, and rainforests where shallow soils overly rock. Impacts to flora and fauna are species-specific, and depend on the species ability to physiologically tolerate, or (for fauna) behaviourally adapt to extended periods of hot conditions. The species most vulnerable to rising temperatures come from large and thermally stable rainforest refugia where they have a limited physiological or behavioural capacity to cool themselves. Flying foxes are one group of fauna that are particularly vulnerable to mass die-offs caused by excessively hot conditions.
3. **Loss of rainforest and expansion of eucalypt forests resulting in greater intensity, spread and frequency of bushfires** due to reduced soil moisture and increased potential evapotranspiration, high temperatures, and more frequent and intense El Niño's and La Niñas. The lowland rainforests of Noosa are particularly vulnerable to the impacts of increased bushfire activity. Fire is a more significant cause of rainforest death than drought, and a more important determinant of rainforest distribution than rainfall. These impacts will be exacerbated by invasive weeds such as lantana, which can increase ground and mid strata fire fuel loads leading to hotter fires.
4. **Loss of saltmarshes and swamps** from encroachment by estuarine and coastal ecosystems (especially mangroves) as sea levels rise. Noosa Shire contains low-lying ecosystems and vegetation communities that are vulnerable to the projected impacts of a warming world. Landward movement and encroachment of estuarine and coastal ecosystems (especially by mangroves) may be at the expense of other communities such as saltmarsh, freshwater wetlands and swamps. Although saltmarshes, swamps and wetlands have the potential to relocate landwards in response to rising sea levels, they occupy higher land than mangroves and their relocation will depend on their ability to migrate and the presence of any barriers to such migration, such as roads and other development and infrastructure.
5. **Reduction or loss of native folivores** due to increased CO_2 concentrations reducing leaf palatability in areas with low soil fertility. Noosa Shire is home to both threatened and common folivores that are likely to decline due to a reduction in leaf nutritional content as the amount of

CO_2 in the atmosphere increases. Plants supplied with extra CO_2 usually produce foliage with a reduced nitrogen content, thicker leaves, and more phenols and tannins. Koalas are particularly susceptible to the impacts of lower nutrient and higher toxin content of foliage.

6. **Increase frequency in flooding** caused by more storm activity and heavier rainfall events. The extensive riparian and wetland ecosystems of the Noosa Shire are expected to experience more frequent damage in the future, due to heavier rainfall events and more extensive and destructive flooding. Vegetation damage, particularly in eucalypt and rainforest communities, may also occur due to hailstorm damage, with both of these ecosystem disturbances projected to increase in frequency and intensity in the Noosa region in the future.
7. **More frequent weed incursions** caused by more frequent and severe flooding, and greater natural ecosystem disturbance. Remnant and regrowth ecosystems within the Noosa Shire, particularly those in urban, agricultural and riparian areas, will become more susceptible to weed invasion in the future, due to increased storm damage. The increased damage to rainforests in particular, provide ideal opportunities for invading weeds to alter ecosystem dynamics and functioning.

The scientific basis of these impacts are detailed in **Appendix D**

4.2 Invasive species

Weeds and pest animals have been identified as one of the most significant biodiversity threats across the shire (Noosa Council, 2015b). Weeds and pest animals outcompete and prey on native species, smother and degrade natural ecosystems, alter fire regimes and can reduce or eliminate ecosystem functions. Weed incursion is often a secondary impact following disturbances such as fire, grazing, nutrient pollution and alterations to natural drainage patterns (Burrows, 2003). It should be noted that some invasive species have become naturalised and in some areas have become an integral component of some ecosystems, providing important function such as soil stabilisation and shelter habitat for fauna species. Subsequent removal of such species in these areas should be carefully managed to ensure a low risk of further impact.

Within the Noosa Shire the primary weed and pest threats can be categorised into five groups:

- Waterway pests – weeds species can dramatically alter environmental and physiochemical conditions and interfere with ecological processes of waterways and waterbodies, and aquatic pest animals can outcompete native species and predate on native aquatic reptiles, frogs, fish, crustaceans and insects.
- Coastal ecosystem pests – residential and tourist development pressures resulting in garden escapees of exotic species becoming prevalent in coastal environments and an increase in pest animals preying on marine wildlife such as nesting marine turtles.
- Rural area pests – exotic weed and pest species can cause loss of production, degradation of pasture, illness and injury to livestock and spread disease.
- Urban area pests – potential point source for weed incursions into neighbouring bushland reserves as well as provide an environment suitable for harbouring certain introduced species.
- Pests within the hinterland– exotic vines are prevalent in areas can smother native vegetation and impacting on fauna habitat.

A complete list of weed and pests species currently threatening Noosa's biodiversity values is provided in **Table 5.**

Table 5: Priority pest weed and animal species in the Noosa Shire, and their impacts on biodiversity and threatened species

Species	Category[1]	Impacts	Affected areas and species
Groundsel bush *Baccharis halimifolia*	3	Replaces plants and destroys wildlife habitat	Saltmarsh, wetlands, moist gullies, forests, disturbed agricultural areas
Mother of millions *Bryophyllum* spp.	3	Poisonous, dominates the understorey	Shady and open woodlands, coastal dunes, grasslands
Bitou bush *Chrysanthemoides monilifera rotundata*	2,3,4,5, Weeds of National Significance (WONS)	Outcompetes and destroys native species	Sandy coastal habitat
Water hyacinth *Eichhornia crassipes*	3, WONS	Destroys habitat, kills fish and other wildlife, depletes oxygen	Static or slow-moving water, wetlands
Glush weed *Hygrophila costata*	3	Outcompetes native water plants, forms mats of dense vegetation	Creekbanks, freshwater wetlands
Salvinia *Salvinia molesta*	3, WONS	Forms thick mats that degrade water quality and destroy habitats	Slow-moving streams and ponds
Laurel clock vine *Thunbergia laurifolia*	N/A	Climbs and smothers native understorey vegetation and mature trees	Lowland rainforest, moist areas at low elevations
Madeira vine *Anredera cordifolia*	3, WONS	Smothers trees, shrubs, understory, and ground layer species, can cause canopy collapse	Lowland rainforest edges, bushland, disturbed areas, waterways
Basket asparagus *Asparagus aethiopicus cv. sprengeri*	3, WONS	Smothering ground cover	Lowland rainforest, coastal dunes and headlands
Climbing asparagus *Asparagus africanus*	3, WONS	Smothers trees and damages ecosystems	Lowland rainforest, other rainforests and vine thickets, riparian areas, bushlands
Camphor laurel *Cinnamomum camphora*	3	Dominates canopy and prevents understorey growth	Riparian areas: lowland rainforest, other rainforests and vine thickets, wet sclerophyll forests
Morning glory *Ipomoea indica*	N/A	Choke seedlings and smother mature plants, including canopy plants	Forest edges

Species	Category[1]	Impacts	Affected areas and species
Lantana *Lantana camara var. camara*	3, WONS	Creates dense fire-prone thickets dominating the understorey, smothers native vegetation	Lowland rainforest, other rainforests and vine thickets, eucalypt forest and woodlands
Cats claw creeper *Dolichandra unguis-cati*	3, WONS	Smothers native vegetation, including trees, changes soil chemistry	Disturbed rainforest and waterways
Broad leaf pepper *Schinus terebinthifolius*	3	Forms dense thickets and chokes out natives	Coastal dunes, wetlands, streambanks
Singapore daisy *Sphagneticola trilobata*	3	Smothers seedlings, ferns and shrubs	Bushland, disturbed areas
Yellow bells *Tecoma stans*	3	Invasive	Waterways, bushland, disturbed areas, grasslands
Common Myna *Acridotheres tristis*	N/A	Aggressive competitor for nesting hollows	Hollow dependent native fauna
Wild dog *Canis lupus familiaris*	3,4,6	Prey on native species and livestock	Koala, water mouse and most ground dwelling native animals
Feral cat *Felis catus*	3,4,6	Prey on native species	Water mouse, ground parrot, native birds and mammals
Feral pig *Sus scrofa*	3,4,6	Destroy native vegetation, prey on native species, soil disturbance & erosion, spread of diseases	Wetlands, wallum heaths, wallum sedgefrog, wallum froglet, water mouse, nesting turtles
European fox *Vulpes vulpes*	3,4,5,6	Prey on native species	Nesting turtles, water mouse, ground parrot, small native mammals
Cane toad *Rhinella murinus*	N/A	Outcompete and prey on native species, toxic to wildlife	Wallum sedgefrog & other native frogs

[1] Restricted matter under the *Biosecurity Act 2014*

The Pest Management Plan is soon to be reviewed through the Pest Management Working Group. Key considerations in the revision will include a greater focus on high value biodiversity areas as identified in the Biodiversity Conservation Plan as well as early intervention where there is practicable and achievable controls with Noosa's identified priority pest species.

4.3 Land clearing

Noosa Shire has a long standing commitment to sustainable development outcomes as the foundation of its growth and development. These sustainability philosophies are well supported by the Noosa community and flow through all aspects of Noosa Council's policies and operations.

Historically, land clearing in Noosa was undertaken to support initial European settlement in the 1853, which was closely followed by the establishment of the timber industry and further agricultural development, particularly dairy farming. Land clearing increased during this period as the industries grew, which further facilitated settlement and ongoing land clearing (Lewis *et al.,* 2007).

In more modern times during the 1970's to 1990's land clearing in Noosa occurred predominantly (86%) within freehold tenure to cater for the continuation of urban settlement (Burrows, 2003). With the majority of productive agricultural land already cleared, clearing activities in rural areas were predominantly associated with maintenance clearing of regrowth vegetation. This particularly occurred in areas west of Cooroy and in the Kin Kin district were substantial areas of rainforest regrowth was regenerating (Burrows, 2003). Nonetheless, extensive clearing of heathland, Melaleuca and Eucalypt forest still occurred across the shire for cattle grazing and sugar cane production (Burrows, 2003).

With the introduction of State and Local vegetation clearing laws in the late 1990's, land clearing of remnant vegetation over the last 20 years has reduced within the shire with a total of 584 ha of remnant vegetation cleared post 1997 or 1% of the remnant vegetation extent. A further reduction has also occurred in recent years with clearing rates of remnant vegetation decreasing by 48.7% post 2006. Similar reductions have occurred across the greater SEQ bioregion and surrounding LGAs (**Table 5**). As expected by the introduction of clearing laws, remnant vegetation communities with an endangered status have undergone less clearing since 2006; however clearing rate reductions in the order of 22% have still occurred for remnant vegetation communities with an of concern and least concern status within the shire (**Table 6**).

To date 40,701 ha of Noosa's remnant vegetation has been cleared following European settlement, which accounts for approximately 50% of the original cover. Whilst land clearing has been extensive across the shire since European settlement, the rate of land clearance compared to the greater SEQ bioregion and surrounding LGAs is lower. This places Noosa in a unique position of containing a larger proportion of existing remnant vegetation compared to other areas in SEQ (**Table 6**).

Table 6: Comparison of Noosa shire's clearing statistics with SEQ bioregion and neighbouring LGAs

Clearing statistic	Noosa Shire	SEQ bioregion	Gympie Regional Council	Sunshine Coast Regional Council
Remnant cleared post European settlement	50%	56%	58%	59%
Remnant cleared post 1997	1%	2%	1%	1%
Clearing rate reduction since 2006	48.7%	45.6%	45.8%	49.7%
Remnant cleared 2006 - 2013				
Endangered	0.19%			
Of Concern	0.31%			
Least Concern	0.31%			
Clearing rate reduction 2006 - 2013				
Endangered	15%			
Of Concern	22%			

Clearing statistic	Noosa Shire	SEQ bioregion	Gympie Regional Council	Sunshine Coast Regional Council
Least Concern	22%			

Whilst the clearing of remnant vegetation has significantly reduced within the shire, the clearing of non-remnant woody vegetation still occurs and is the main contributor of land clearing in Noosa (**Figure 23**). This includes woody vegetation not currently mapped as remnant (contiguous remnant), regrowth vegetation as well as scattered trees, which provides values such as landscape connectivity (refer to **Section 2.2**), potential TEC (refer to **Section 2.3**), potential habitat trees and some threatened species habitat (refer to **Section 2.4.3**). In 2009, the Queensland State Government introduced new laws to regulate the clearing of non-remnant vegetation comprising of mature regrowth (High Value Regrowth) across freehold and leasehold land. These laws, however have since been repealed and no protection measures are currently in place to regulate clearing of non-remnant woody vegetation.

The majority of land clearing of non-remnant woody vegetation occurs within freehold tenure (**Figure 24**) and primarily for pasture development (**Figure 25**). Clearing for settlement has gradually reduced as Noosa reaches its planned population capacity, whereas peaks in clearing for infrastructure development and forestry harvesting have occurred over the last 10 years (**Figure 25**). Yurol State Forest, West Cooroy State Forest and Ringtail State Forest are currently identified as Defined Forestry Areas (DFAs) and are actively managed and harvested by a privately owned company, HQPlantations Pty Ltd. All harvesting is undertaken selectively and in accordance with all State and Commonwealth environmental legislation as well as the *Australian Standard 4780:2013: Sustainable Forest Management.* This is to ensure harvesting is undertaken in a sustainable manner and environmental and cultural vaues are considered at all stages to minimise adverse impacts.

The following sections provide further details on the two main zoning designations where land clearing predominantly occurs – urban and rural areas.

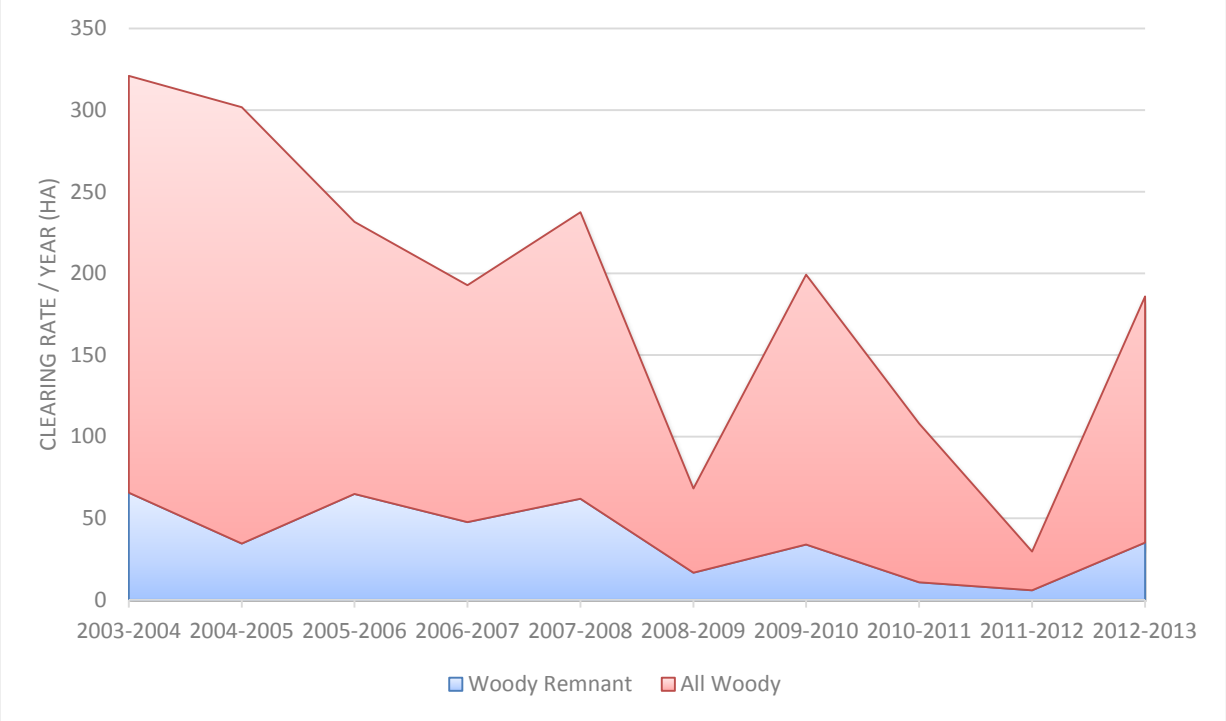


Figure 23: Annual clearing rates of all woody vegetation across Noosa shire 2003 - 2013

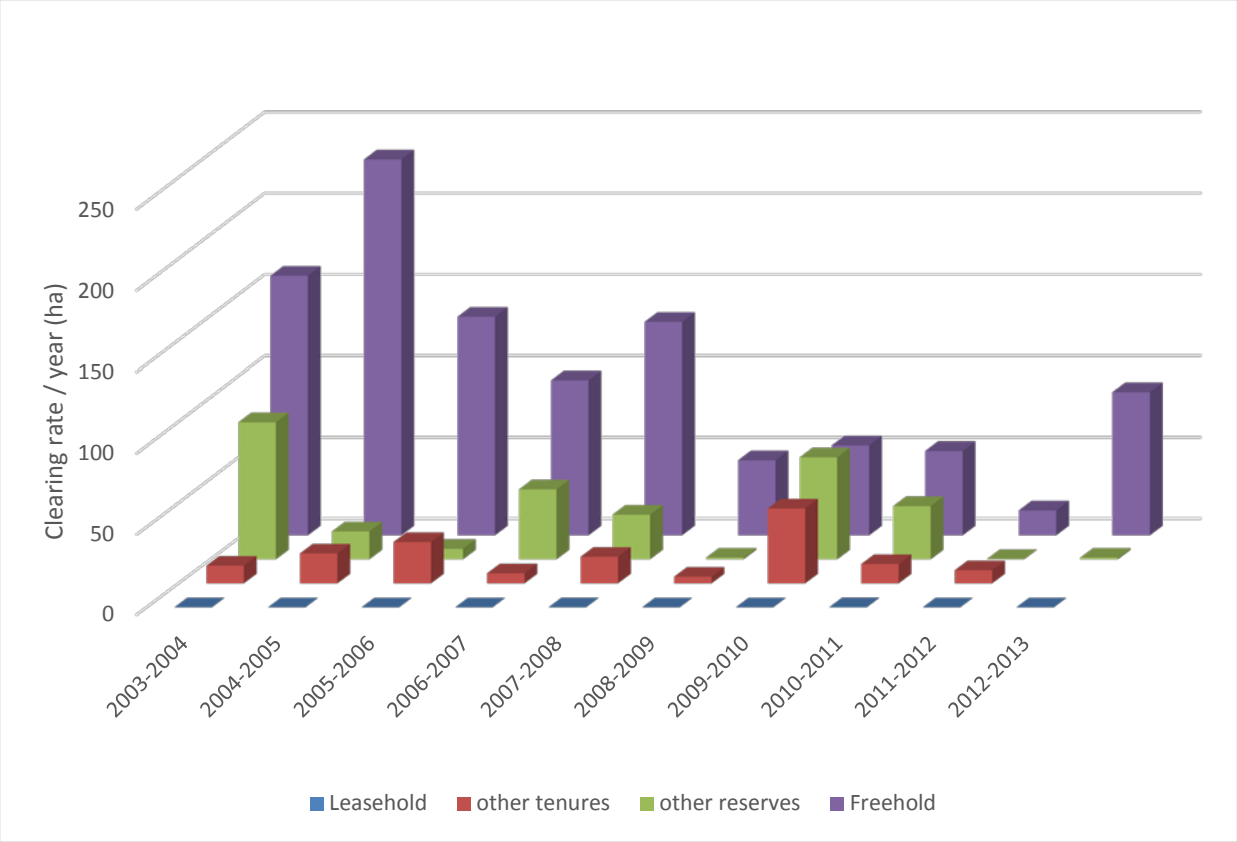


Figure 24: Annual clearing rates in the Noosa Shire by tenure 2003 - 2013

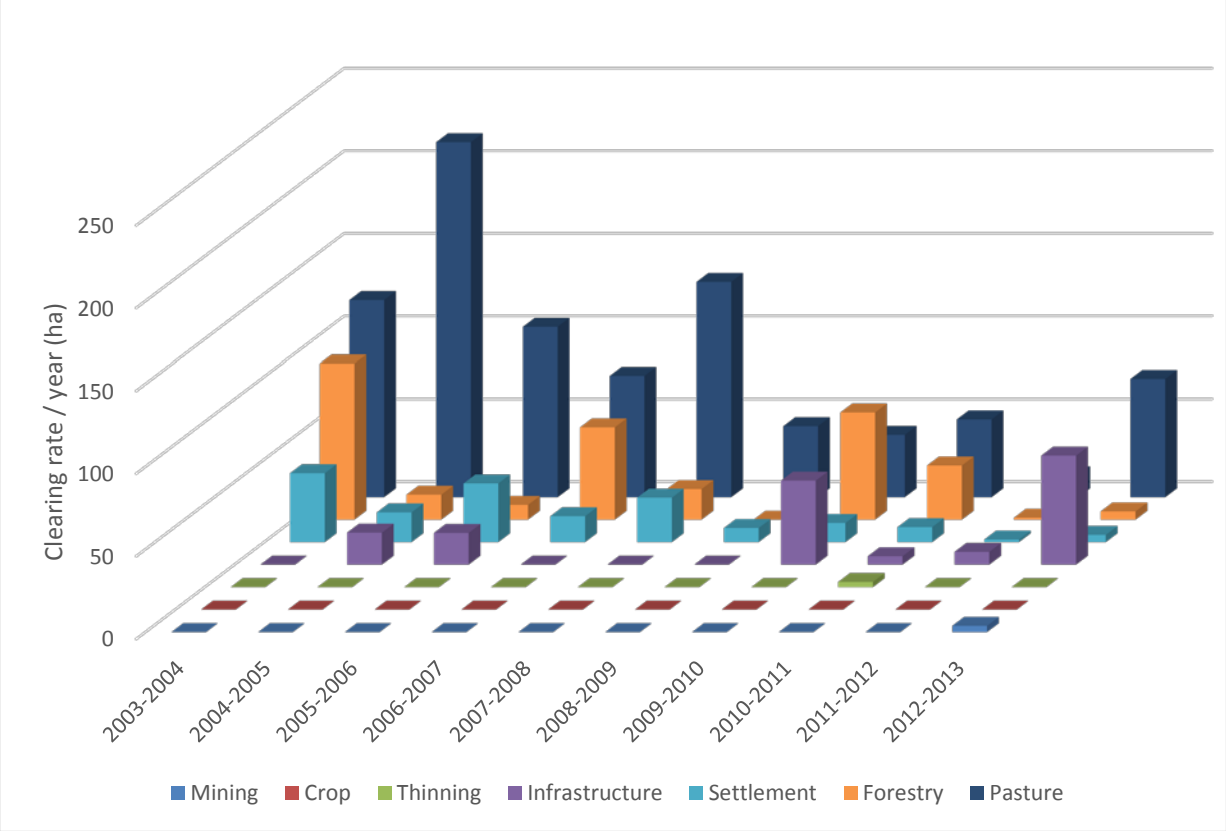


Figure 25: Annual clearing rates in Noosa Shire by land use 2003 - 2013

4.3.1 Urban areas

Noosa has areas of concentrated urban development from Peregian north along the coastal dune strip and along the Noosa River flood plain to Tewantin. Approximately 42.5 % of the Shire's population lives and works in this area (AEC group, 2015). In contrast, the coastal strip north of the Noosa River is very sparsely settled and over 93% (9240 hectares) of land in the North Shore is managed for conservation, and is either in public ownership or managed in trust (AEC group, 2015).

The Noosa Shire population is predicted to grow steadily over the next 10 years and beyond with estimates in the order of 7,000 people entering the shire between 2016 and 2036. This is a 12% increase. However, overall Noosa's annual population growth is slowing (AEC group, 2015). During the 1980's population growth in Noosa was at 16.5%, which dropped down to 5.1% in the mid 1990's. At present, population growth has significantly slowed to 1.3% (AEC group, 2015).

In 2013 – 2014, the number of residential building approvals for the Noosa Shire was lower compared to the broader SEQ region. Major planning approvals submitted in 2014 were associated with retail, industrial and commercial development rather than large residential communities (AEC group, 2015).

At present, approximately 9% of the Noosa Shire has an urban zoning designation. Further residential growth in Noosa will be sustained within existing urban areas, with the remaining future development to be taken up as infill development within these areas. Whilst impacts on biodiversity can be significantly high due to the intensity of development that occurs and legislative exemptions that apply to this zoning designation, the coverage of the area is minimal across Noosa.

4.3.1 Rural areas

Much of the hinterland area of the Shire are farming and forestry production areas, which are dotted with small, well-defined towns and villages (Lewis *et al*., 2007). This comprises approximately 59% of the Noosa Shire area. Rural zoned areas coincide with a number of key areas of biodiversity values and in some case such values are confined within this area. A number of key landscape corridors occur within the rural areas of Kin Kin, Cooran, Pomona, Cootharaba and Cooroy. Similarly, nearly all areas of Lowland Rainforest TEC and potential Lowland Rainforest TEC are restricted to the rural areas of the shire. The majority of riverine wetlands also occurs within rural areas of Noosa as well as waterways within identified High Ecological Value areas.

Land clearing in Noosa primarily occurs for pasture development. The conversion of woodland areas to pasture often requires ongoing control of native regrowth and shrubs through thinning, slashing and burning. Whilst mature canopy trees may initially remain, the ongoing removal of recruiting species eventually results in the complete conversion of areas to cleared grassland (Burrows, 2003). Within Noosa this has particularly occurred across the Eucalypt woodland communities on the alluvial plains. Heathland and Melaleuca wetlands have also been impacted by pasture conversion with large areas slashed, fertilised and sown for exotic grasses (Burrows, 2003).

Based on the extensive coverage of productive agricultural land within the shire combined with the presence of some key biodiversity values, the potential threat to biodiversity is of relevance. The planning scheme can play an important role in helping to resolve land use conflict between prime agricultural land and conservation. Recommended biodiversity conservation management actions should therefore include protection of such values under the Planning Scheme to ensure a no-net loss approach to protecting and maintaining biodiversity values. Vegetation controls for regrowth (i.e. non- remnant woody vegetation) should also be maintained in the Planning Scheme to enable the expansion and protection of biodiversity values associated with the vegetation.

4.4 Altered fire regimes

Altered fire regimes are a change in frequency or intensity of natural fires that native vegetation communities are adapted to. It can be a result of a weed incursion that has altered the understorey fuel loads of a native vegetation community or a deliberately lit un-natural fire event (Burrows, 2003). In both cases the frequency and intensity of fires can be much greater than natural regimes; however a reduction in frequency and intensity can also have a detrimental effect. Fire protection measures associated with nearby urban development can reduce the events of natural fires and impact on communities that are reliant on this process for seeding and recruitment (Burrows, 2003).

The greatest impact of altered fire regimes are on vegetation communities that are fire sensitive or fire specific. Within Noosa this includes:

- Rainforest and dry vine thickets – destruction of communities, reduced recruitment of rainforest seedlings and increased susceptibility to weed invasion due to the introduction of fire
- Wet sclerophyll forests (or ecotonal communities) – invasion by rainforest communities due to the lack of fire and loss of breeding resources such as mature hollow-bearing Eucalypt trees
- Heathland communities – reduction of obligate seeders (plants with fire-activated seedbanks that reproduce only via seed) or species shift to dominant obligate seeder species due to an increase in fire frequency and intensity favouring species or removing species before reaching reproductive maturity
- Melaleuca wetlands –reduced recruitment of native seedlings and increased susceptibility to weed invasion due to the introduction of fire.

Altered fire regimes are an issue where weed incursion is a threat and is common in areas of concentrated development. Recommended biodiversity conservation management actions should therefore include educating the community on such issues as well as ensuring ecological fire regimes are taken into consideration in fire management planning and actions as part of the implementation of Council's Bushfire Management Plan for Council bushland reserves.

4.5 Recreational Use

Disturbances to vegetation communities caused by off-road vehicles, horse riding, bike trails or boating can facilitate secondary impacts such as weed incursion, erosion and waterway sedimentation. Such impacts can lead to altered fire regimes, nutrient loading of waterways and the degradation of biodiversity values of habitats. Within Noosa, impacts from recreational use have been reported for montane heath communities, narrow riparian rainforest communities, foredune communities as well as mangroves and saltmarsh (Burrows, 2003). Recommended biodiversity conservation management actions should therefore include developing strategies to address disturbances to vegetation communities and fauna caused by recreational activities such as no-go zones and reduced speed limits, as well as maintaining signage and bollards, particularly for migratory bird exclusion zones.

4.6 Degradation

Ecosystems within the Noosa Shire are generally in good condition and the integrity of ecosystems are high, particularly in the northern upper catchments of the Noosa River (Mackenzie *et al.*, 2012). However, there are areas where degrading processes have impacted on biodiversity values. Exotic plants and invasive species are considered a primary cause of degradation and a significant threat for the Noosa Shire (refer to **Section 3.2**). However, the risk of degradation that is associated with other processes such as drainage of wetlands, erosion, sedimentation and nutrient pollution of freshwater and marine waterways has varied over the years.

At present, the overall health of the Noosa River catchment is considered to be excellent, with all water quality and aquatic habitat parameters meeting environmental values and water quality objectives as listed under the EPP (Water) (SEQ Waterways, 2016). Results from the recent Ecosystem Health Monitoring Program across SEQ indicate that overall all key processes are functional and habitats are considered in near pristine condition (SEQ Waterways, 2016). However, there are portions of the catchment, particularly in the lower reaches that in isolation show more degraded parameters. Furthermore, over the last six years the health of the Noosa River system has varied for both the marine and freshwater areas of the catchment. Various water quality and aquatic habitat attributes have showed signs in the past of potential degradation.

In previous years for freshwater environments within the Noosa River catchment, health indicators relating to nutrient cycling, fish and invertebrates have shown evidence of moderate disturbance (**Figure 25**). A reduction in these indicates in the past suggests the input of elevated nutrient loads through either a point source or diffuse source as a result of vegetation removal. Increased nutrients and the subsequent invasion of weeds has been reported for a number of coastal creeks in Noosa, including Burgess Creek and sections of Marcus and Castaway Creeks (Burrows, 2003).

Figure 26: Ecosystem health monitoring results for freshwater environments in the Noosa River catchment

Similarly for the marine environments in the Noosa River catchment, elevated turbidity levels have been recorded in previous years suggesting an influx of sediment entering the waterways (**Figure 26**). This is most likely attributed to erosion and runoff that has been accelerated by vegetation clearing and catchment alterations.

Whilst overall the Noosa River catchment is considered to be in high ecological condition, recent estimates indicate that 3,045 tonnes of sediment generated from all types of land use entered the waterways within the Noosa catchment in 2015 (SEQ Waterways, 2016). The removal of vegetation within the catchment as well as ongoing land management practices that result in an increase in sediment laden runoff has been a previous threat and as such will require ongoing consideration.

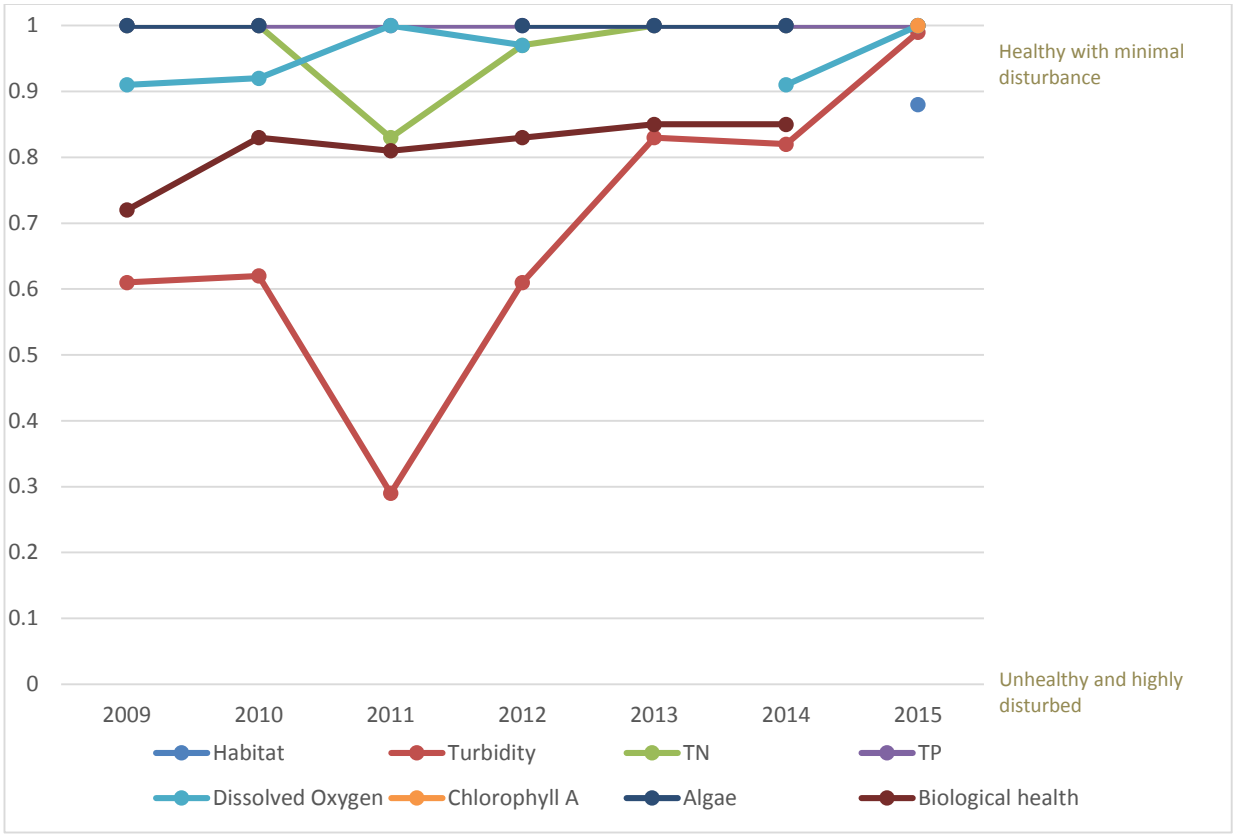


Figure 27: Ecosystem health monitoring results for marine environments in the Noosa River catchment

For the sub-catchment of the Mary River that occurs within the Noosa Shire, the threats of degradation are again variable. Six Mile Creek is the main tributary within the catchment and condition monitoring results in 2000 indicate the presence of moderate and major disturbances to some reaches of the creek system. From the headwaters of Six Mile Creek to Lake MacDonald the in-stream health and riparian habitat trajectory were assessed as degrading due to the low riparian vegetation cover, low macro-invertebrate richness and elevated nutrient levels (Mary River Catchment Coordinating Committee (MRCCC), 2000). Whilst other parts of the Six Mile Creek show minimal to moderate signs of disturbances, degradation processes have been evident in the upper portions of the sub-catchment, particularly within the cleared rural areas of Cooroy.

Draining of wetland to facilitate urban development have historically impacted upon Noosa's heathland and Melaleuca wetland communities (Burrows, 2003). Where wetlands remained, the alteration of natural drainage patterns due to urban developed have also impacted on wetland communities. However, since 2001 changes to the extent of wetland areas within the Noosa Shire have been minimal (**Figure 27**).

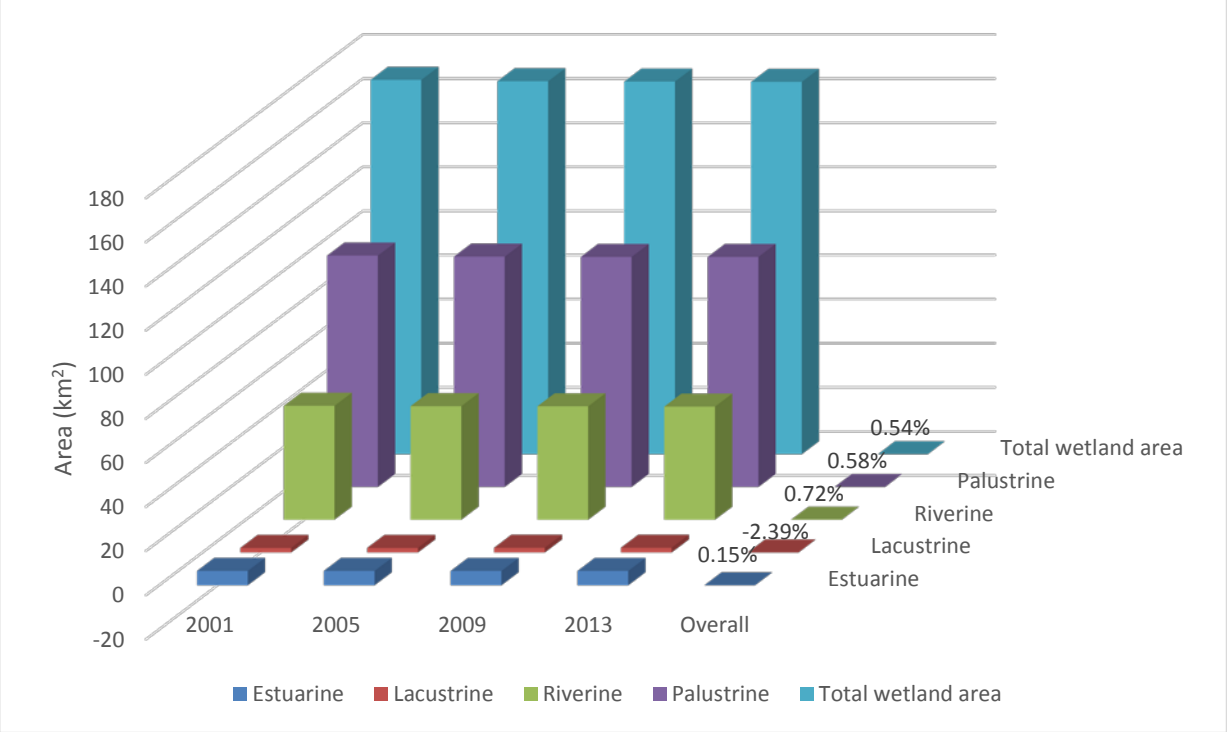


Figure 28: Changes in wetland areas across Noosa Shire from 2001 - 2013

4.7 Habitat fragmentation

Noosa Shire's long history of sustainable environmental management has resulted in a growth management strategy that minimises fragmentation of habitats, and promotes the regeneration of native vegetation to develop habitat corridors in previously disturbed areas. Nonetheless, the construction of linear infrastructure such as roads, powerline easements and rail has been an integral component of the Noosa Shire's development to support the large coastal town and major tourist destination. As discussed in **Section 3.3,** the clearing of vegetation for infrastructure has been one of the main contributors to recent land clearing rates within the Noosa Shire.

Habitat fragmentation as a result of the construction and development of linear infrastructure can cause an array of impacts including:

- Reduced core habitat
- Introduction of edge effects such as weed incursions
- Reduced carrying capacity of habitat patches i.e. the number of species able to be supported
- Genetic isolation and inbreeding depression
- Reduced dispersal abilities and an inability to respond to environmental changes
- Increased mortality rates associated with high risk dispersal options
- Reduced colonisation rates due to barrier effects
- Local extinction of fauna populations

The major linear features that have fragmented habitat areas within the Noosa Shire or are major barriers to key landscape corridors are outlined in **Table 7**. These major linear features are supported by a network of other local roads and tracks that are concentrated around the main settlement nodes within the shire, namely Cooroy, Tewantin, Noosa Heads, Pomona and Cooran. The impacts of fragmentation

are greatest within these concentrated settlement nodes whilst the northern half of the shire, particularly along the eastern coast remains relatively intact. Key habitat nodes mostly impacted by fragmentation within Noosa include Yurol State Forest, Tewantin National Park and Noosa National Park. The key corridor impacted mostly by road barrier effects is Six Mile Creek.

Although fragmentation has occurred across the Noosa Shire, the landscape remains a highly connected with only 2.7% of habitat areas consisting of isolated and linear fragments.

Table 7: Habitat areas impacted by fragmentation in the Noosa Shire

Major linear feature	Location	Fragmented habitat area	Impacted key corridor
Bruce Highway / Old Bruce Highway	South-west corner - Cooroy	Yurol State Forest	Six Mile Creek & Federal, Black Mountain to Ridgewood vegetation corridor
Cooroy Belli Creek Road	South-west corner - Cooroy	West Cooroy State Forest & vegetation to the north	-
Yurol Forest Road	South-west corner – Cooroy	Yurol State Forest	Six Mile Creek
Pomona Connection Road	South-west corner – Pomona	Tuchekoi National Park & Yurol State Forest	-
North Coast Rail Line	South-west corner – Cooroy to Cooran	Yurol State Forest	Six Mile Creek
Cooroy Noosa Road	Southern - Cooroy to Tewantin	Tewantin National Park	-
Eumundi Noosa Road	South-eastern corner – Tewantin	Tewantin National Park	-
Walter Hay Drive	South-eastern corner - Tewantin	Noosa National Park	-
Eenie Creek Road	South-eastern corner – Noosaville	Noosa National Park	-
David Low Way	South-eastern corner - Peregian	Noosa National Park	-
McKinnon Drive	Southern - Cooroibah	Tewantin National Park, Ringtail State Forest and Coolothin Conservation Park	-
Louis Bazzo Drive	Central – Cootharaba	Ringtail State Forest	Six Mile Creek
Greenridge Pinbarren Road	Western – Cooran	-	Six Mile Creek

Major linear feature	Location	Fragmented habitat area	Impacted key corridor
Pomona Kin Kin Drive	Western – Pomona to Kin Kin	Vegetation east and west of the road	Kin Kin Creek & Kin Kin, Cootharaba to Pomona vegetated corridor, Six Mile Creek

4.8 Human-wildlife conflict

Increases in both local resident and visitor numbers to Noosa Shire has increased the incidence and risk of conflict between humans and wildlife. As populations expand and humans encroach into wildlife habitat, both direct and indirect risks are known to occur. Key example of such risks and negative interactions that are relevant in the Noosa context include:

- Vehicle and boat strike
- Habitat disturbance from development and activities in close proximity to wildlife habitat
- Recreational activities such as four wheel driving, trail biking and fishing
- Illegal or uncontrolled activities such as arson and off-trail access to national parks
- Attacks on wildlife by domesticated pets (cats and dogs)

Within Noosa Shire, both Flying-Foxes and Koalas are currently experiencing challenges associated with human-wildlife conflicts. Several Flying-Fox camps occur within the Noosa region and conflicts with Noosa residents can arise due to high amplitude of noise, smell, droppings and perceived health risks resulting from large colonies and dispersal and foraging nature of the species. Currently, the Wallace Park Flying-fox roost is considered a high conflict camp and Council is actively managing the situation under the guidance of a management options report. Koalas are also particularly vulnerable to negative impacts from humans and dogs. Mortality from infectious diseases, car strike and dog attacks are considered primary threats to this iconic species (refer to **Section 1**).

5 Biodiversity Significance and Risk Analysis

The high levels of habitat diversity, condition and extent within the shire result in Noosa being a highly important area for the long term preservation of the flora and fauna biodiversity in the SEQ region. Its unique assemblage of landscapes and ecosystems that retain extensive coverage and viable connectivity also makes Noosa an important area at both a regional and global scale. The Noosa Shire therefore provides an excellent opportunity for biodiversity conservation.

However, a number of threatening processes do exist within Noosa, which have the potential to impact and degrade its unique values. Biodiversity conservation planning that targets key values and addresses the relevant threats is integral to the continued preservation and maintenance of biodiversity across the Noosa Shire.

To produce sound ecological outcomes, the approach to biodiversity conservation planning should involve:

1. Gaining a good understanding of the biodiversity values present
2. Prioritising biodiversity values that are of high conservation significance
3. Gaining thorough knowledge of the relevant threats that are impacting biodiversity values
4. Assessing the level of risk these threats pose to biodiversity values of high biodiversity significance
5. Identifying gaps in current protection measures relating to significant biodiversity values at high risk of impact to ensure a comprehensive system of conservation management
6. Identify specific policies, priorities and actions for implementation.

The biodiversity values present within the Noosa Shire and the relevant threats have been detailed in **Section 2.0** and **Section 3.0**. The following sections present the results of a series of in-depth analyses that have been undertaken to identify and rank areas in terms of biodiversity significance and assess a series of key risks to these areas including climate change and development. The cross analysis of values and risks has identified areas of conservation significance or key conservation issues and priorities.

5.1 Biodiversity significance assessment and mapping

The Noosa Shire contains a range of biodiversity values and natural landscapes within a very confined physical area. Many of the values and landscapes are of great significance and are globally unique. As detailed in **Section 2.0**, Noosa's key biodiversity values include remnant vegetation communities, conservation significant REs, species and habitats, lowland rainforest and saltmarsh TECs, protection reserve system, waterways and wetlands. As demonstrated in **Section 2.0**, the distribution of the values varies across the Noosa Shire. In addition to this, each value presents varying degrees of biodiversity significance with some values recognised to be of international importance whilst others are considered to be locally important.

To gain an understanding of the spatial distribution and extent of values and their varying degrees of biodiversity significance, all biodiversity values within Noosa have been ranked through a scoring system and mapped across the shire.

5.1.1 Methodology for biodiversity significance assessment

Previous fine scale vegetation desktop mapping and recent validated vegetation survey results were integrated with the current Regulated Vegetation (remnant) and regrowth mapping to produce an ecological condition GIS layer. This layer was further refined and validated utilising current (2016) LiDAR data and detecting any recent changes in vegetation extent both from regeneration and clearing.

This ecological condition GIS layer served as a basis for assigning other biodiversity values and assessing biodiversity significance. Latest RE and pre-clearing RE mapping (version 9.0) was used to attribute the base layer with the RE types that occur across Noosa as well as their associated conservation status. The RE and pre-clear RE mapping was also utilised as a surrogate to attribute the base layer with TEC or potential TEC presence, regionally significant RE types and RE types that are under-represented across Noosa's protection reserves (determine through separate analyses). Other datasets utilised to derive additional biodiversity values included records of significant species observations, and Commonwealth and State wetland mapping.

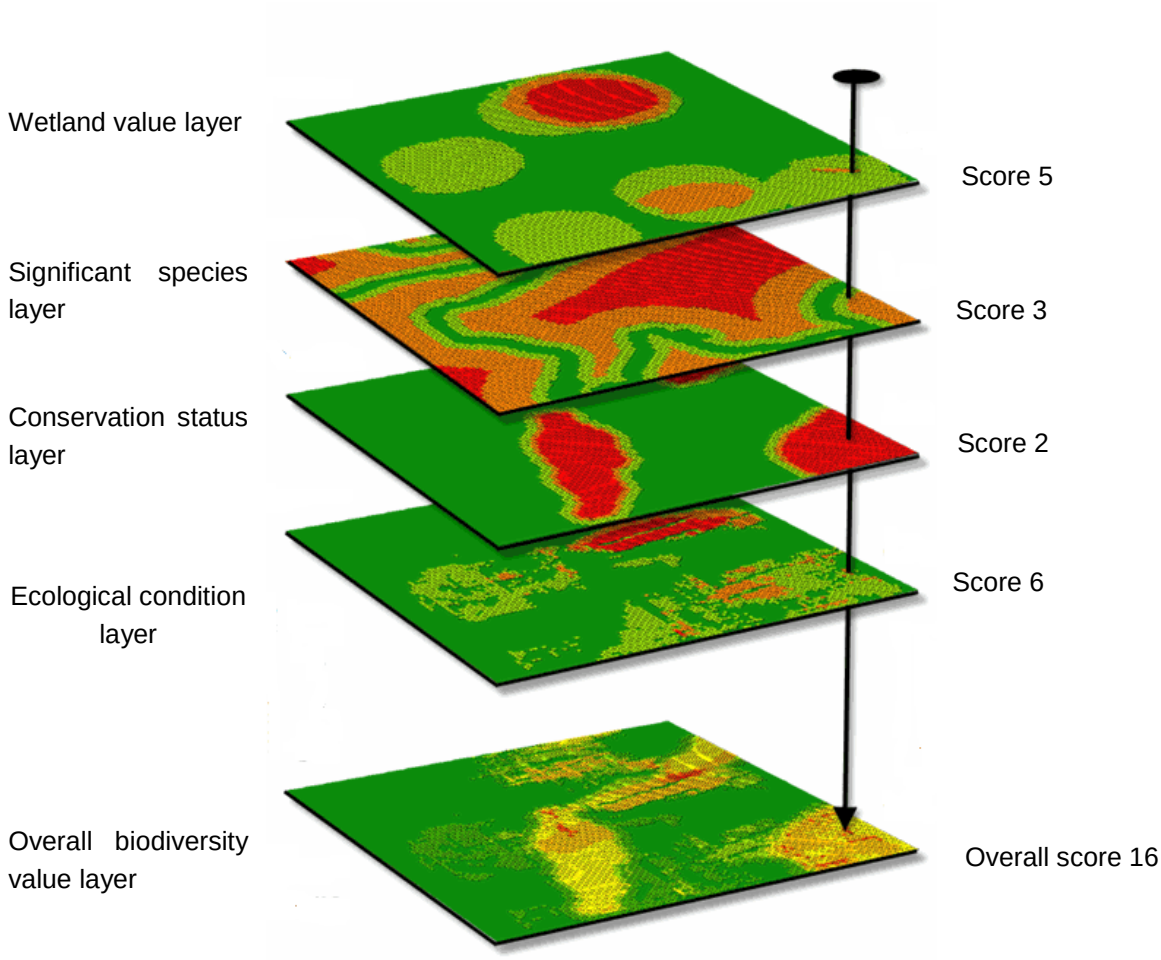
Assessment of landscape connectivity was also undertaken as an additional biodiversity value by utilising the ecological condition GIS layer and applying a modified version of the Queensland Offsets Policy – Landscape Fragmentation tool. Landscape elements including habitat nodes, patches and corridors as well as their degree of connectivity were identified and attributed in the ecological condition GIS layer.

The scoring of each biodiversity value within the base ecological condition layer was applied, with scores attributed to each separately mapped polygon. Scoring was based on the value being present and the degree of significance of the value at a local, regional or State scale. For example the scoring of significant species habitat was based on the presence of a significant species and its level of conservation significance i.e. Near Threatened, Vulnerable or Endangered. The scoring schema sought to maintain similar numbers of classes, maximum values, and interval sizes between scores. This prevented a single value becoming inherently weighted within the consolidated biodiversity layer.

A consolidated biodiversity significance value was developed by adding individual biodiversity value scores at a location, using equal weighting for each value (refer to diagram below). This yielded a total maximum score of 39, in which the highest score for actual locations was 38 and the medium score was 7 (n = 198,359). Scores were split into five intervals based on a percentile scoring system. The scoring range of each interval was based on the assessment of 20th percentile values returned from the scored data.

Minimum values rules were incorporated following the scoring to provide weighting to important values such as TEC, remnant vegetation, riparian vegetation and threatened species habitat.

Further details on the data sources, analyses and scoring for all biodiversity values are provided in **Appendix F**.



5.1.2 Results

The overall results of the biodiversity significance assessment are presented in **Table 8** and **Figure 29**.

Table 8: Summary of biodiversity significance assessment

Biodiversity significance	Total area (ha)	% of LGA
80th percentile	35,259	43.8%
60th percentile	12,331	15.3%
40th percentile	5,639	7%
20th percentile	21,430	26.6%
Lower 20th percentile	5,753 (including 1,769 ha or urban development)	7.1%

Approximately 66% of the shire has been identified as having scored values that fall within the upper 60th percentile range, with the majority of these areas located in the eastern, coastal parts of the shire. The highest biodiversity values are associated with waterways (e.g. Kin Kin Creek, Sandy Creek, Pinbarren Creek, Cooroora Creek, Ringtail Creek and Six Mile Creek), protection reserves and the scattered pockets

of remnant vegetation through the inland rural band of Noosa. In general, and as expected, disturbed and cleared rural areas fall within 20th percentile range with only small pockets of areas falling within the lower 20th percentile range.

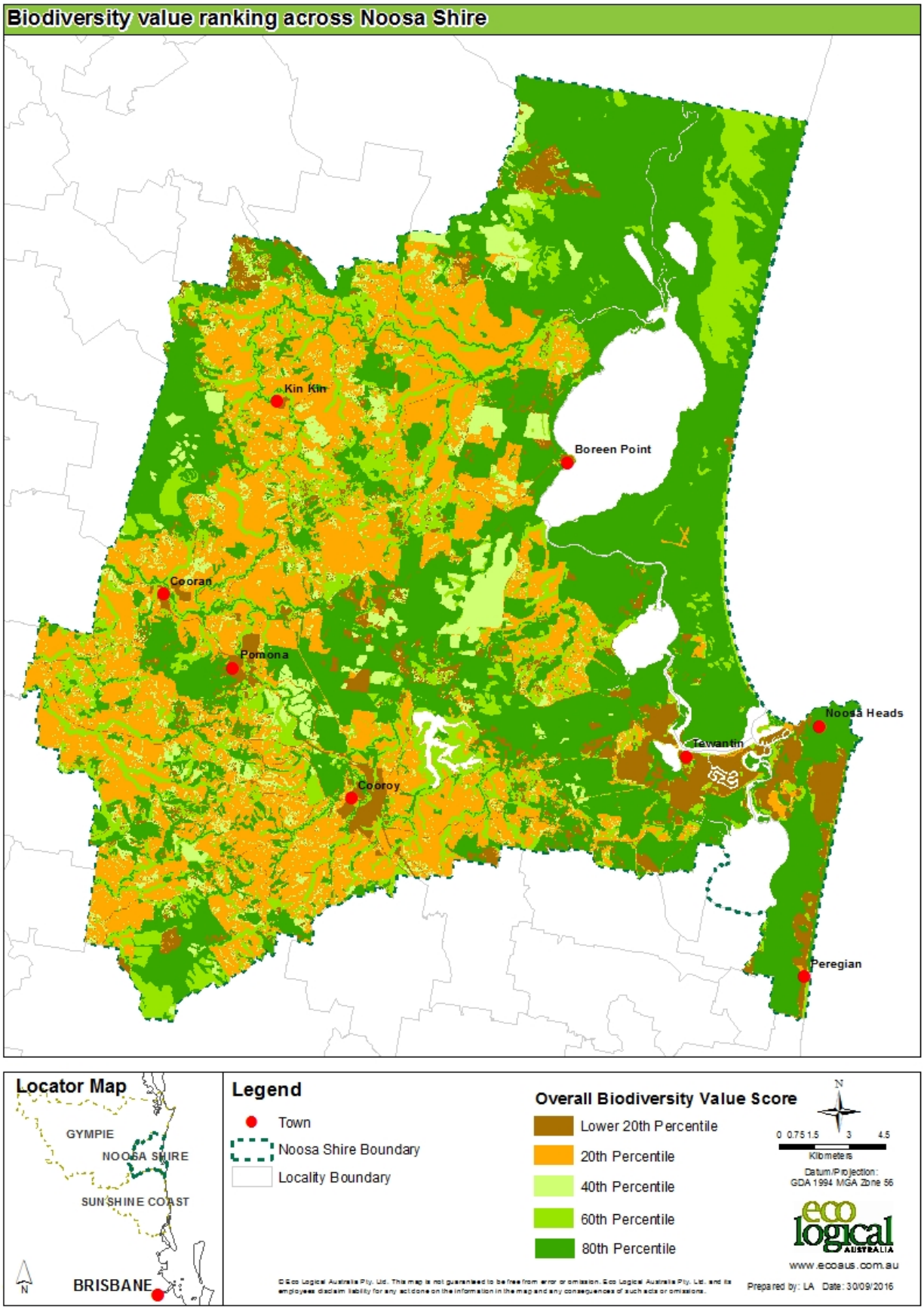


Figure 29: Biodiversity value ranking across the Noosa Shire

5.2 Biodiversity risk assessment

The Noosa Shire is a unique example that demonstrates a balanced relationship between humans and the environment. The shire has been able to retain significant environmental values whilst other areas across the SEQ region have undergone significant development. However, Noosa's biodiversity values are still under pressure from a variety of threatening processes. As detailed in **Section 3.0**, key threats to Noosa's biodiversity are climate change, ongoing incursion of weed and invasive species, clearing of non-remnant vegetation, erosion and sedimentation of waterways, inappropriate fire regimes, degradation through recreational use, human-wildlife conflict, and habitat fragmentation and barrier effects to key habitat nodes and ecological corridors.

The majority of these threats are a product of development across Noosa with the severity and magnitude of these threats often much greater in urban and rural areas. Climate change on the other hand is a global issue and will affect the entirety of Noosa and its biodiversity values to some degree depending on the level of exposure and sensitivity of the values to change. The following spatial analyses have been undertaken to further understand the risks from development and vulnerability to climate change.

5.2.1 Development risk assessment

A broadscale analysis of development risk was undertaken using Noosa Shire's current land zoning and protected areas mapping. Development risk was categorised as either high or low according to the following:

- Low development risk – formally protected areas (e.g. national park), state forest, forest reserves, areas under conservation agreements (VCAs), areas zoned open space conservation
- High development risk – all other areas

The results of this high level analysis indicate that 60% or ~52,000 ha of the shire has a land zoning that puts it at a higher risk of development compared to surrounding land (**Figure 30**). This figure includes land that has already been developed to some extent (e.g. existing urban areas) and where biodiversity values may have already been lost or degraded. It is also important to note that within currently undeveloped areas, there is not a suggestion that all parcels designated as 'high development risk' are intended for development, but rather that the current zoning would more easily allow development to occur.

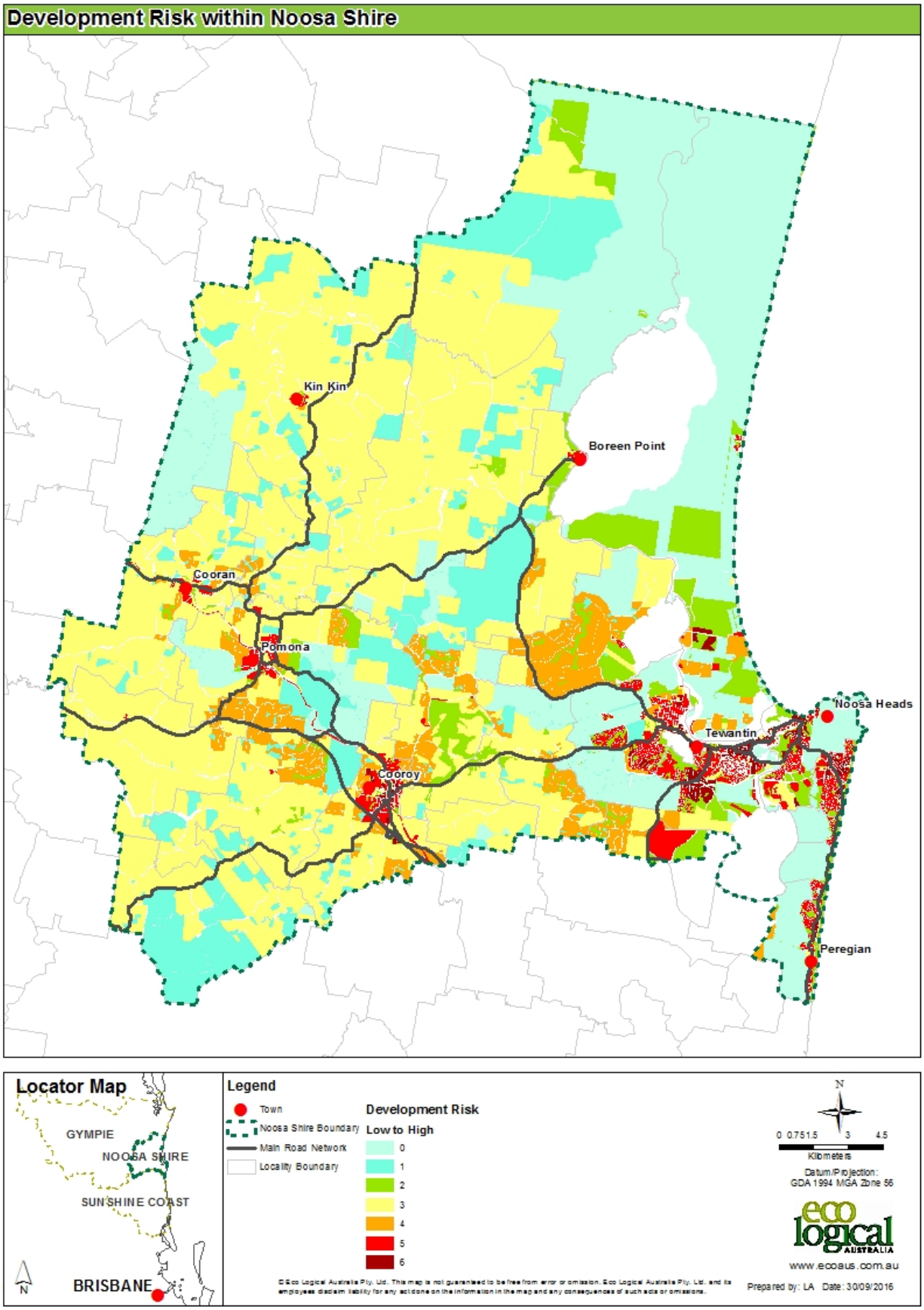


Figure 30: Development risk (low to high)

5.2.2 Climate vulnerability assessment

Climate change vulnerability is a function of exposure and sensitivity. The first step in understanding vulnerability is to assess whether a biodiversity value is exposed to the effects of climate change (e.g. low lying coastal areas are exposed to sea level rise and coastal erosion, whereas the hinterland areas are not). For values that are exposed, an analysis of their sensitivity to climate change effects then determines overall vulnerability, with those values that are both exposed and sensitive determined as being vulnerable to climate change.

This assessment has been undertaken at a landscape scale for BVGs and is therefore somewhat general. This was considered appropriate for this study to provide a 'first pass' of the general patterns of climate change vulnerability within Noosa Shire and to provide direction to future in-depth studies that can be undertaken.

For this assessment, three key features of climate change were considered – sea level rise, increased bushfire risk and a hotter, drier climate (i.e. increased temperature and evaporation). These were chosen as they were deemed to be the primary threats associated with a changing climate (see **Section 4.1**). They were also the climate change effects for which spatial data analysis could be reliably undertaken.

Sea level rise

Exposure to sea level rise was based on the Indicative Erosion Prone Area mapping (Department of Environment and Heritage Protection, 2015), which maps (among other factors) storm surges and erosion risk incorporating future sea level rise prediction (0.8 m rise by 2100 based on 1990 sea levels). **Figure 31** shows the spatial extent of sea level rise exposure within the Noosa Shire. Not surprisingly, these areas are concentrated around the fringes of the coastal waterways of the Noosa River and its associated low flow lagoon system and the Lakes Cootharaba, Cooriobah, Doonella and Weyba. As sea levels rise, low lying vegetation will be inundated and fringing areas increasingly exposure to periodic saline intrusions.

This mapping does not currently consider changes in the salinity profile of freshwater areas (due to lack of reliable data), however this is also likely to be an issue.

Table 9 below provides a quantitative assessment of the total extent of each BVG type that is predicted to be exposed to sea level rise. In terms of the proportional impact to overall BVG extents, the most affected vegetation types are mangrove and saltmarshes, followed by paperbark woodlands. However, BVG types most sensitive to sea level rise impacts are the saltmarshes and paperbark woodlands. Whilst effecting a lower proportion of the BVG type, rainforests, wetlands and heath communities are communities containing significant biodiversity values that would be significantly susceptible to saline incursion and storm tide inundation as a result of sea level rise.

Table 9: Sea level rise vulnerability

BVG 5M	Area at risk from sea level rise (ha)	% of total area of this vegetation type
Rainforest / scrubs	8	0%
Wet Eucalypt	37	0%
Eucalypt woodland	498	4%
Eucalypt woodland on floodplains	36	4%
Paperbark woodlands	**2,973**	**41%**
Heaths and other coastal communities	580	10%
Wetlands	42	18%
Mangroves and Saltmarsh	**418**	**98%**
TOTAL	4,592	

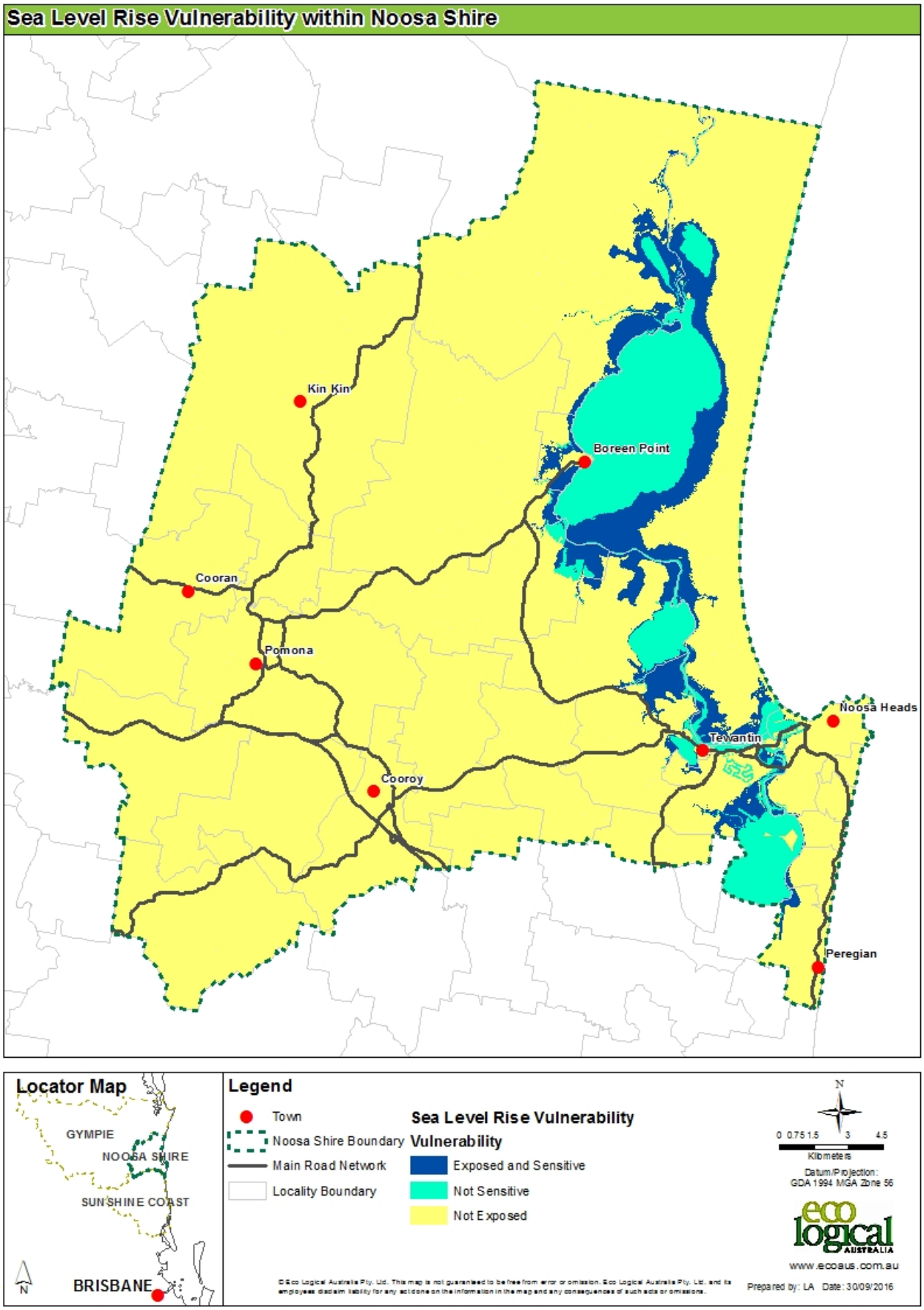


Figure 31: Sea level rise vulnerability

Bushfire risk

Exposure to increased bushfire risk was based on the state government bushfire prone area (2015) mapping. Any areas that are currently mapped as very high, high or medium hazard (along with an impact buffer) were considered to be at risk of future bushfires. Data is not currently available to predict 'new' areas i.e. those outside current hazard areas that may be at increased risk of bushfire threat. However, current literature and prediction data does suggest that the extent of bushfire risk areas will expand across the shire.

Table 10 below provides a quantitative assessment of the total extent of each BVG type that is predicted to be exposed to bushfire. Most vegetation types have close to their entire extent exposed to future bushfires. However, BVG types most sensitive to bushfire are rainforests, wet Eucalypt forest (ecotonal communities), heathlands and wetlands. With exposure to the communities in the order of 84% - 100%, implications have the potential to be significant. This is likely to be further exacerbated by other factors that can cause altered fire regimes such as increased understorey fuel loads from weed incursion.

Combined analysis of bushfire exposure and sensitivity (i.e. vulnerability) is mapped in **Figure 32**.

Table 10: Bushfire exposure across BVGs

BVG 5M	Area at increased bushfire risk (ha)	% of total area of this vegetation type
Rainforest / scrubs	5,674	84%
Wet Eucalypt	10,556	100%
Eucalypt woodland	13,267	100%
Eucalypt woodland on floodplains	975	95%
Paperbark woodlands	7,306	100%
Heaths and other coastal communities	5,481	93%
Wetlands	240	100%
Mangroves and Saltmarsh	199	47%
TOTAL	43,698	

Hotter, drier climate

All areas of Noosa Shire will be affected by a hotter, drier climate due to increased temperatures and evaporation. Similarly, all vegetation types will experience some degree of sensitivity to these effects, although this is likely to be mitigated if communities are able to adapt. It is anticipated, however, that 'wetter' vegetation types such as rainforest, wet eucalypt forests and wetland areas will be most vulnerable. More detailed future analysis could address potential microclimate differences across the shire caused by topographical and other effects.

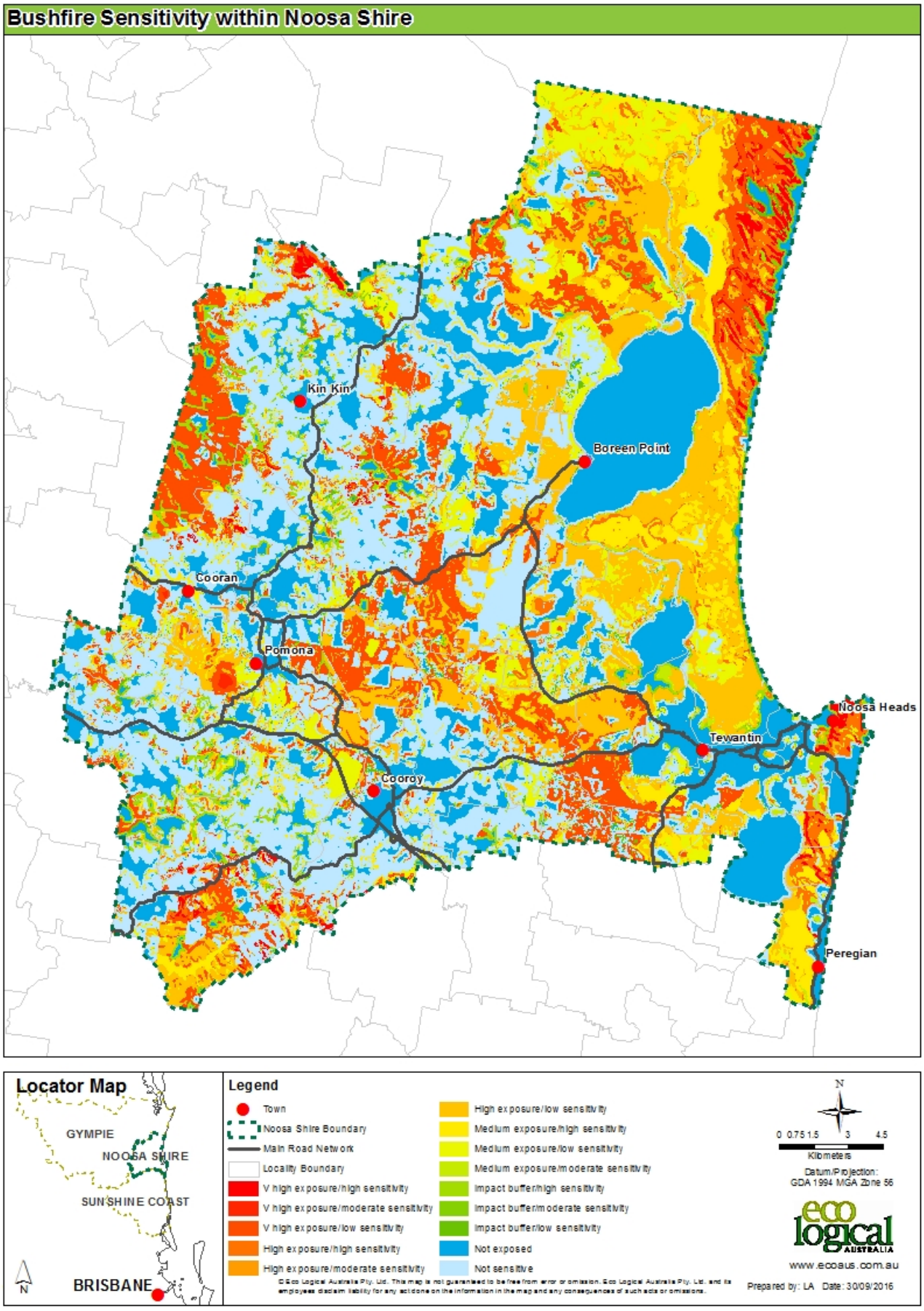
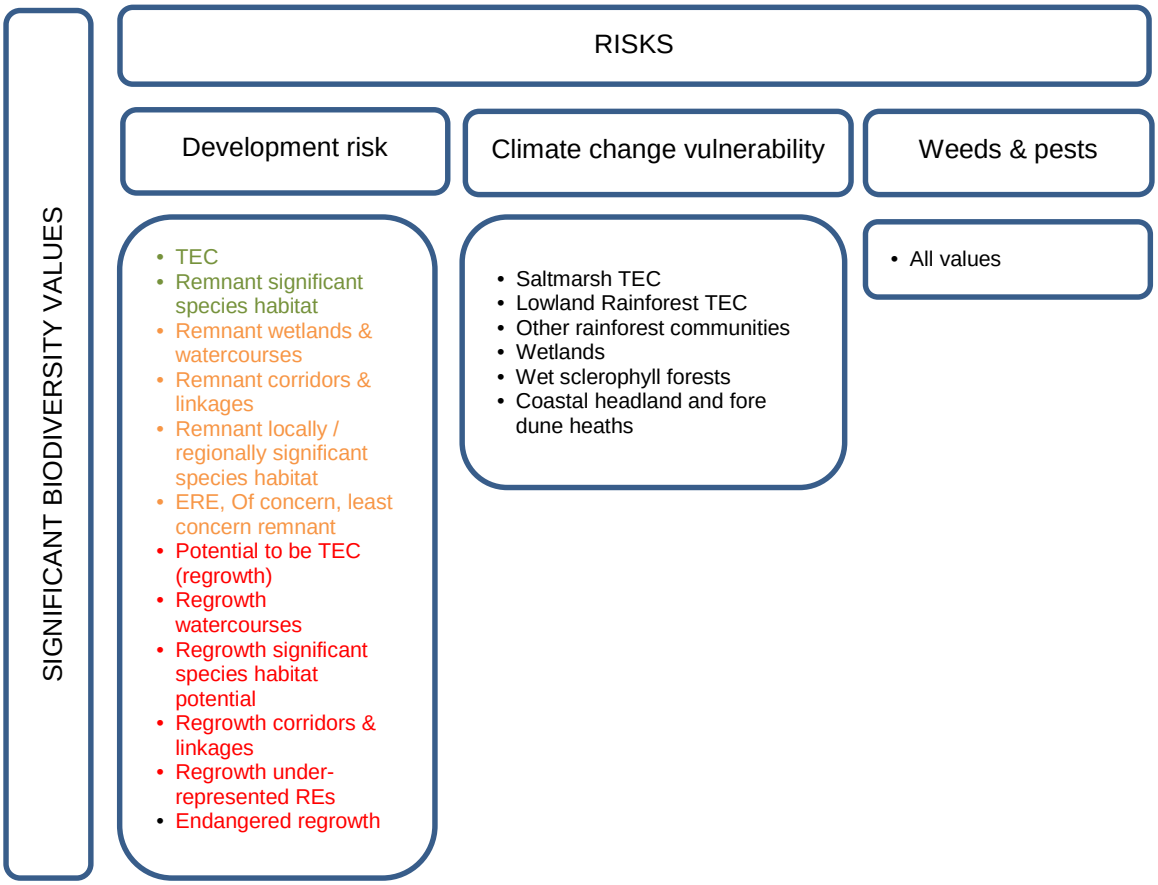


Figure 32: Bushfire vulnerability

5.3 Conservation significance assessment

Areas and issues of conservation significance are considered to be biodiversity values that are of high value and at high risk to threatening processes. Within the Noosa Shire an analysis of significant biodiversity values within development prone and climate change vulnerable areas identified a number of values that are of conservation significance. These are listed in the matrix below.



Within the context of existing statutory and non-statutory mechanisms, a number of these conservation values are already addressed under State and Commonwealth legislation and conservation initiatives. However, others values are only partially protected and some are not addressed or have no level of protection at all. These values are of relevance to planning and conservation management. For the Noosa Shire this includes:

- Remnant vegetation
- Locally and regionally significant species habitat
- Endangered regrowth vegetation
- Regrowth vegetation with TEC, watercourse, corridor and significant species habitat values.

Climate change as well as weeds and pests are threats that occur across Noosa irrespective of the level of protection. Nonetheless there are management actions that can be done at a local level to reduce these threats and build adaptive capacity through healthy, well connected ecosystems, including:

- Taking a proactive risk management approach to weeds and bushfire risk in protected areas
- Maximise the condition and extent of protected areas

- Build knowledge of values, their distribution, condition and threats for terrestrial and aquatic environments
- Build knowledge of climate change risks and identify priority actions for adaptation for biodiversity.
- Improve connectivity for the terrestrial and aquatic ecosystems
- Strengthen partnerships.

6 Noosa Shire Conservation Initiatives

There are a number of conservation management programs and initiatives that are currently underway within Noosa Shire. These are focused on areas and species of key interest and importance to both the local and the wider community. Some are founded in legislative requirement and are therefore driven and overseen by Council. However, many initiatives are undertaken by the community and are reflective of the unique relationship the residents of Noosa Shire have with their surrounding environment.

A summary of the key programs and initiatives is provided below, along with a series of case studies that demonstrate how actions are being implemented on the ground.

6.1 Council Environmental Plans & Operations

Noosa Council has an open and transparent approach to developing operational plans. Draft plans are posted online, where community members can have their say. A number of plans have been developed recently that address biodiversity issues within the shire. They are focused on key environmental values and espouse Noosa Shire's commitment to sustainability. These plans include:

- Carbon Reduction and Energy Efficiency Plan
- Community Jury – Management of the Noosa River
- Noosa Biosphere® Reserve Management Review
- Noosa Shire Koala Conservation Plan 2016 (adopted)
- Noosa Shire Pest Management Plan 2015 (adopted)
- Noosa Shire Bushland Reserve Fire Management Plan (adopted)

One of the Council's primary environmental operations is the management council parks and natural reserves. Noosa Council's Parks and Natural Areas team manages over 160 Bushland Reserves across a range of BVGs from the coast to the hinterland. The reserve system is an essential part of the shire vegetation network and provides habitat and refuge for a range of mammal, bird and reptile species. The Bushland Reserves are managed for weeds, feral animals, fire and recreational use and are highly valued by the Noosa community.

Koalas in Noosa Shire

Within Noosa Shire, the Koala lives in a diverse landscape of natural, rural and urban settings. Visitors are often surprised to encounter koalas in close proximity to residential areas. Concerns have been expressed about the plight of koalas which are now listed as a threatened species, both under Queensland and Commonwealth legislation.

In 2016, Noosa Council developed a Koala Conservation Plan with the aim of conserving and protecting this iconic species.

Council engaged the University of the Sunshine Coast-Dog Detection Centre, to conduct surveys and build on current knowledge of the distribution of koalas across the Shire. This information was then used to update local Koala Habitat Maps and Koala Threat Maps. The Koala Threat Maps identify areas of potential risk to koalas. This enables Council to consider planning and management actions that may help mitigate threats to this important species and protect koalas in perpetuity. Through funding from the Noosa Biosphere Reserve Foundation®, the University has also commenced a Koala Health Mapping research project which will further assist with informing Council and community actions.

6.2 Environment Levy Land Acquisition Program

The Environment Levy Program provides an important funding source for a range of strategic environmental initiatives. Key aims of the Levy are to:

- Protect environmentally significant areas through land acquisition.
- Support Council's VCA Program where such involvement adds to the protection and enhancement of biodiversity and wildlife corridors on private rural properties throughout the shire.
- Provide funding to the Noosa Biosphere Reserve Trust so that Noosa Biosphere Reserve Foundation Ltd may undertake projects that are in keeping with the purpose of the Levy.

Noosa's Environment Levy secures significant riverside land parcel

Noosa Council has secured a significant riverside land parcel for conservation in a major environment levy purchase. The 100-hectare property, off McKinnon Drive, contains remnant koala habitat, provides an important linkage with the riparian corridor along the western side of Noosa River and will help protect water quality. The land parcel, situated on the banks of Noosa River and Cooloothin Creek, overlooks Lake Cootharaba.

Although much of the site was previously cleared, vegetation had substantially regrown, and this level of protection will allow it to naturally regenerate. This is a significant strategic acquisition because it provides an important link with the riparian and wildlife corridors along the western side of Noosa River and complements the biodiversity values of nearby Cooloola National Park.

This purchase will also protect koala habitat from the threat of development and potentially provide a favourable environment for this species.

Noosa's Environment Levy funded the land purchase.

6.3 Volunteer Programs

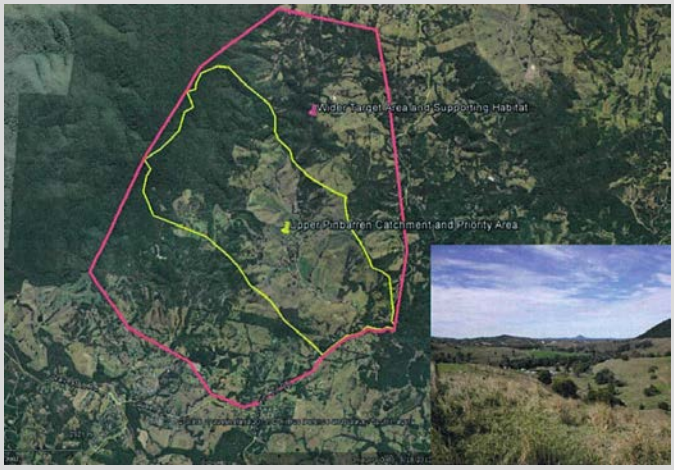
Noosa Council supports many community volunteer programs including Landcare, LFW & VCA, and a variety of bushland care groups. Together in partnership, Council and the community have and continue to make significant contributions to maintaining and improving the local environment.

6.3.1 Landcare

Noosa & District Landcare (NDL) is a dynamic and proactive organisation committed to achieving long term environmental outcomes. With over 20 years of experience in vegetation management and horticulture, NDL provide a diverse range of services including carbon offsets, ecosystem restoration, and native forest establishment. NDL provides training and community education, as well as managing and implementing a range of nature conservation and restoration programs.

Coxen's Fig Parrot Rainforest Restoration Project

The Upper Pinbarren Creek Catchment is home to the rare and elusive Coxen's Fig Parrot *Cyclopsitta diophthalma coxeni*, which is federally listed as Endangered. The few remaining populations are declining due to food shortages and fragmentation of habitat. The protection and rehabilitation of habitat outside protected areas is critical to the survival of this species.



The Coxen's Fig Parrot Rainforest Restoration Project aims to restore the valuable subtropical lowland rainforest corridors throughout the Upper Pinbarren Catchment, which is a known nesting site for this species.

Landcare, in partnership with Dr Ian Gynther is:

- Propagating and replanting Coxen's Fig Parrot food trees
- Restoring subtropical lowland rainforest along Pinbarren Creek, including fencing from stock and installation of off-stream watering points for stock
- Revegetating key Coxen's Fig Parrot habitat corridor linkages between Woondum and Pinbarren National Parks
- Maintaining the Coxen's Fig Parrot Habitat Restoration Project on the Council Road Reserve that has had several sightings of this species
- Treating cats claw creeper and other highly invasive transformer weeds
- Monitoring (audio and visual) the Coxen's Fig Parrot

Recently, Noosa Landcare approved:

1) A major subtropical lowland rainforest habitat restoration and carbon sequestration project involving the planting of 13 900 trees on over 3.5 hectares of potential habitat on five Land for

Wildlife properties, three of which are in the target area for the restoration of Coxen's fig parrot habitat at Pinbarren. This is part of the 20 Million Tree Project

2) A project to propagate 1000 native preferred food trees for Coxen's fig parrot, including local endemic species. This is part of the Australian Bird Environment Foundation Grant and the tubestock will be offered to landholders neighbouring the range of the established site at Upper Pinbarren Creek. This will expand the habitat available beyond the established areas and promotes connectivity.

6.3.2 LFW & VCA Program

Noosa Council provides two levels of landholder-based participation in voluntary conservation. The base level is the LFW Program, which is not legally binding. The VCA program allows the landholder to enter into agreements that are legally binding for current and successive landholders as a nature refuge under Queensland State Government NC Act (Lewis et al. 2007), or, in the case of protective covenants, permanent protection under the *Land Titles Act 1994*. The agreement establishes legal protection, along with binding obligations on the property owner to actively manage, the conservation values of the land (Lewis et al. 2007) and Council provides financial incentives to the landholder to protect and enhance their land.

6.3.3 Bushcare and Coastcare groups

The Bushcare Program within the Noosa Biosphere® is managed by Noosa Council and supported by hundreds of volunteers and many community groups. The aim of the program is to build the capacity of the local community to maintain and care for Noosa's bushland reserves. Currently 18 bushland care groups are registered in the Program.

Heritage Park

Heritage Park Bushland Reserve is a riparian corridor of remnant vegetation in Noosa Parklands, Tewantin. It provides an important linkage with surrounding National Park and is habitat for a number of threatened species including koalas, frogs and the Richmond Birdwing Butterfly (*Ornithoptera richmondia*). Attractive pathways meander through the park providing visitors with recreational and nature based experiences.

The Heritage Park Bushland Care Group has been actively involved in protecting and enhancing the bushland reserve since 2003. The focus of the group has been to restore the natural habitat of the site through weed control and revegetation. A number of nest boxes for birds, possums and gliders have been placed in trees throughout the park and educational signage provides park visitors with information on the parks outstanding natural values.

6.4 Community Grant Partnerships

Noosa Council and the Noosa Biosphere Reserve Foundation® actively works with community organisations to develop and implement biodiversity conservation and restoration projects. Recent examples of such partnerships include the Richmond Birdwing Conservation Network and the Glossy Black Conservancy. The Richmond Birdwing Conservation project is a joint Noosa Council project with

SEQ Catchments to propagate vines and to coordinate planting to restore habitat corridors for the Richmond Birdwing Butterfly in and near subtropical rainforests across southeast Queensland. The Glossy Black Conservancy is supported by numerous local government, including Noosa Shire Council, and other partners, with the aim of conserving the Glossy Black-Cockatoo across SEQ. Council also supports wildlife care programs and the Noosa Biophere Foundation supports the 'Keeping it in Kin Kin' and koala research projects. Noosa and District Landcare also manages several grant projects including 20 million trees, riparian and sub-tropical rainforest projects funded by State and Federal Governments.

Glossy Black Cockatoos

Noosa is a known 'hotspot' for Glossy-black Cockatoos because of its large number of recorded sightings. Noosa Council is a member of the Glossy-black Cockatoo Conservancy and each year a 'Birding Day' is organized with volunteers across the shire to survey and record the presence of this important species. The information is used by the Conservancy to assess the long term health of the cockatoos.

Key to the conservation of this species is the protection and restoration of Glossy-black Cockatoo habitat. Each year, National Tree Day is celebrated with tree planting projects involving Noosa Council, Noosa and District Landcare, Environment Groups, Bushland Care Volunteers and School Groups. The seeds of the Black She-oak (*Allocasuarina littoralis*) are an essential food source for Glossy-black Cockatoos. National Tree Day provides an opportunity to plant feed trees in areas where the cockatoos are known to frequent and thereby provide a long term food source for the birds.

7 Future Conservation Priorities

The existing conservation initiatives at a local level demonstrate that there is good momentum across Noosa Shire for undertaking positive environmental programs and activities. Going forward, there is a need for a clear direction and integrated strategy that builds on the information available and the on-going programs of both Council and the community.

Drawing from the overall results of this study, and in particular the relevant conservation issues for council, the key conservation priorities that are emerging for biodiversity in Noosa are:

- *Protecting local and regional values*. Noosa has a large and significant suite of biodiversity values that are important both locally and beyond. Many of these contribute to regional biodiversity values across SEQ. All require and deserve protection.
- *Building resilient ecosystems*. Our climate is changing and the key way to mitigate risk and build adaptive capacity is through having strongly resilient ecosystems.
- *Maintaining and enhancing connectivity*. Land clearing has resulted in fragmented landscapes that are vulnerable to a suite of threats. Rebuilding connectivity will facilitate movement both at a genetic level to the ecosystem level within and beyond Noosa Shire.
- *Working together*. Biodiversity conservation is everyone's responsibility and together, we can achieve great outcomes.

Utilising these key conservation priorities to develop conservation actions will ensure an effective and targeted approach to future conservation management across the Noosa Shire.

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Appendix A Noosa BVG & RE conservation statuses

1 = BVG description 5M; 2 = BVG description 1M; 3 = Least Concern (LC) REs <150ha extent in Noosa, LC REs <30% pre-clear extent remains in Noosa and 12.2.15a; 4 = <4% of pre-clear extent within protected reserves

Vegetation Type[1]	BVG [2]	RE	Description	VM Class	BD Status	TEC	Regionally Significant [3]	Under Represented [4]
Rainforest / scrubs	2a	12.11.10	Notophyll vine forest +/- Araucaria cunninghamii on metamorphics +/- interbedded volcanics.	L	NC	Lowland	✓	✓
		12.12.16	Notophyll vine forest on Mesozoic to Proterozoic igneous rocks.	L	NC	Lowland	✓	✓
	3a	12.2.3	Araucarian microphyll/notophyll vine forest. Backhousia myrtifolia common in understorey on Fraser Island and Cooloola and forms low canopy in places. Occurs on parabolic dunes.	OC	OC	×	-	×
	4a	12.2.1	Notophyll vine forest on parabolic high dunes.	OC	OC	×	-	×
		12.11.1	Simple notophyll vine forest often with abundant Archontophoenix cunninghamiana (gully vine forest) on metamorphics +/- interbedded volcanics.	L	NC	Lowland	✓	✓
		12.12.1	Simple notophyll vine forest usually with abundant Archontophoenix cunninghamiana (gully vine forest) on Mesozoic to Proterozoic igneous rocks.	OC	OC	Lowland	-	×
	4b	12.3.1	Gallery rainforest (notophyll vine forest) on alluvial plains.	E	E	Lowland	-	×

Vegetation Type[1]	BVG [2]	RE	Description	VM Class	BD Status	TEC	Regionally Significant [3]	Under Represented [4]
	5a	12.5.13a	Microphyll to notophyll vine forest +/- Araucaria cunninghamii. Characteristic species include Araucaria cunninghamii, Cupaniopsis parvifolia, Dendrocnide photinophylla, Rhodosphaera rhodanthema, Flindersia australis, F. schottiana, F. xanthoxyla, Drypetes deplanchei, Olea paniculata, Diospyros geminata, Gossia bidwillii, Excoecaria dallachyana and Vitex lignum-vitae. Argyrodendron trifoliolatum sometimes present especially in subregion 6. Occurs on remnant Tertiary surfaces especially lateritised basalt.	E	E	Lowland	-	×
		12.8.13	Araucarian complex microphyll vine forest on Cainozoic igneous rocks.	OC	OC	Lowland	-	×
		12.9-10.16	Araucarian microphyll to notophyll vine forest on Cainozoic and Mesozoic sediments.	OC	E	×	-	×
Wet Eucalypt open forests	8a	12.3.2	Eucalyptus grandis tall open forest on alluvial plains.	OC	OC	×	-	×
		12.8.9	Lophostemon confertus open forest on Cainozoic igneous rocks.	L	OC	×	✓	×
		12.9-10.1	Tall open forest often with Eucalyptus resinifera, E. grandis, E. robusta, Corymbia intermedia on sedimentary rocks. Coastal.	OC	OC	×	-	×
		12.11.2	Eucalyptus saligna subsp. saligna or E. grandis, E. microcorys, Lophostemon confertus tall open forest on metamorphics +/- interbedded volcanics.	L	NC	×	✓	✓
		12.11.16x1	Eucalyptus cloeziana +/- E. propinqua, E. acmenoides, E. microcorys and E. grandis tall open forest. Occurs on Cainozoic and Mesozoic sediments.	E	E	×	-	×

Vegetation Type[1]	BVG [2]	RE	Description	VM Class	BD Status	TEC	Regionally Significant [3]	Under Represented [4]
		12.12.15a	Eucalyptus grandis and/or E. saligna tall open forest +/- vine forest understorey. Other canopy species include E. microcorys, E. acmenoides, Lophostemon confertus, E. siderophloia, E. propinqua, Corymbia intermedia. Occurs in wet gullies on Mesozoic to Proterozoic igneous rocks.	L	NC	×	×	×
	8b	12.2.8	Eucalyptus pilularis, E. microcorys, E. resinifera and Syncarpia hillii open forest. Occurs on parabolic high dunes.	L	NC	×	×	×
		12.5.6c	Eucalyptus pilularis open forest +/- E. siderophloia, E. propinqua, Corymbia intermedia, E. microcorys, E. acmenoides, E. tereticornis, E. biturbinata, Lophostemon confertus with E. saligna, E. montivaga at higher altitudes. Occurs on remnant Tertiary surfaces. Usually deep red soils.	E	E	×	-	×
		12.9-10.14	Eucalyptus pilularis tall open forest on sedimentary rocks.	L	NC	×	×	×
		12.11.16	Eucalyptus cloeziana +/- E. propinqua, E. acmenoides, E. microcorys and E. grandis open forest. Understory is generally shrubby +/- vine forest species. Occurs on Palaeozoic and older moderately to strongly deformed and metamorphosed sediments and interbedded volcanics, especially phyllite of the Kin Kin Beds.	E	E	×	-	×
		12.12.2	Eucalyptus pilularis tall open forest on Mesozoic to Proterozoic igneous rocks especially granite.	L	NC	×	×	×
Eucalypt woodlands	9a	12.5.6a	Eucalyptus saligna subsp. saligna or E. grandis open forest, often with vine forest understorey. Occurs on remnant Tertiary surfaces. Usually deep red soils.	E	E	×	-	×

Vegetation Type[1]	BVG [2]	RE	Description	VM Class	BD Status	TEC	Regionally Significant [3]	Under Represented [4]
		12.9-10.17	Eucalyptus acmenoides, E. major, E. siderophloia +/- Corymbia citriodora subsp. variegata woodland on sedimentary rocks.	L	NC	×	×	×
		12.11.3	Eucalyptus siderophloia, E. propinqua +/- E. microcorys, Lophostemon confertus, Corymbia intermedia, E. acmenoides open forest on metamorphics +/- interbedded volcanics.	L	NC	×	×	×
		12.12.15	Corymbia intermedia +/- Eucalyptus propinqua, E. siderophloia, E. microcorys, Lophostemon confertus open forest on Mesozoic to Proterozoic igneous rocks.	L	NC	×	×	✓
	9f	12.2.5	Corymbia intermedia +/- Lophostemon confertus +/- Banksia spp. +/- Callitris columellaris open forest on beach ridges usually in southern half of bioregion.	L	OC	×	×	×
	9g	12.2.6	Eucalyptus racemosa subsp. racemosa, Corymbia intermedia, C. gummifera, Angophora leiocarpa and E. pilularis shrubby or grassy woodland to open forest. Occurs on Quaternary coastal dunes and beaches. Dunes with deeply leached soils.	L	NC	×	×	×
		12.3.14a	Eucalyptus racemosa subsp. racemosa woodland to open forest. Other canopy species may include Corymbia intermedia, C. gummifera, Eucalyptus latisinensis, E. tindaliae and Melaleuca quinquenervia. Occurs on Quaternary alluvial plains in near coastal areas.	OC	OC	×	-	×

Vegetation Type[1]	BVG [2]	RE	Description	VM Class	BD Status	TEC	Regionally Significant [3]	Under Represented [4]
		12.5.2a	Corymbia intermedia, Eucalyptus tereticornis woodland. Other species can include Lophostemon suaveolens, Angophora leiocarpa, Eucalyptus acmenoides or E. portuensis, E. siderophloia or E. crebra, Corymbia tessellaris and Melaleuca quinquenervia (lower slopes). Eucalyptus exserta is usually present in northern parts of bioregion. Occurs on complex of remnant Tertiary surfaces +/- Cainozoic and Mesozoic sediments usually in coastal areas with deep red soils.	E	E	×	-	×
		12.5.3	Eucalyptus racemosa subsp. racemosa woodland on remnant Tertiary surfaces.	E	E	×	-	×
		12.5.4	Eucalyptus latisinensis +/- Corymbia intermedia, C. trachyphloia subsp. trachyphloia, Angophora leiocarpa, Eucalyptus exserta woodland on complex of remnant Tertiary surfaces and Cainozoic and Mesozoic sediments.	L	NC	×	✓	✓
		12.5.12	Eucalyptus racemosa subsp. racemosa, E. latisinensis +/- Corymbia gummifera, C. intermedia, E. bancroftii woodland with heathy understorey on remnant Tertiary surfaces.	OC	OC	×	-	×
		12.8.25	Open forest with Eucalyptus acmenoides or E. helidonica on Cainozoic igneous rocks especially trachyte.	OC	OC	×	-	×
		12.9-10.4	Eucalyptus racemosa subsp. racemosa woodland on sedimentary rocks.	L	NC	×	×	×
		12.11.9	Eucalyptus tereticornis open forest on metamorphics +/- interbedded volcanics. Usually higher altitudes.	OC	OC	×	-	×

Vegetation Type[1]	BVG [2]	RE	Description	VM Class	BD Status	TEC	Regionally Significant [3]	Under Represented [4]
		12.12.12	Eucalyptus tereticornis, Corymbia intermedia, E. crebra +/- Lophostemon suaveolens woodland on Mesozoic to Proterozoic igneous rocks.	OC	OC	×	-	×
		12.12.14	Eucalyptus racemosa subsp. racemosa +/- Lophostemon confertus, Syncarpia glomulifera, Eucalyptus acmenoides woodland usually on rocky near coastal areas on Mesozoic to Proterozoic igneous rocks.	OC	OC	×	-	×
	9h	12.8.20	Shrubby woodland with Eucalyptus racemosa subsp. racemosa or E. dura on Cainozoic igneous rocks.	OC	OC	×	-	×
	10b	12.8.24	Corymbia citriodora subsp. variegata open forest on Cainozoic igneous rocks especially trachyte.	E	E	×	-	×
		12.11.5e	Corymbia citriodora subsp. variegata woodland usually including Eucalyptus siderophloia or E. crebra (sub coastal ranges), E. propinqua and E. acmenoides or E. carnea. Lophostemon confertus often present in gullies and as a sub-canopy or understorey tree. Mixed understorey of grasses, shrubs and ferns. Occurs on hills and ranges of Palaeozoic and older moderately to strongly deformed and metamorphosed sediments and interbedded volcanics.	L	NC	×	×	×
		12.12.3	Open forest complex with Corymbia citriodora subsp. variegata, Eucalyptus siderophloia or E. crebra or E. decolor, E. major and/or E. longirostrata, E. acmenoides or E. portuensis on Mesozoic to Proterozoic igneous rocks.	L	OC	×	✓	×

Vegetation Type[1]	BVG [2]	RE	Description	VM Class	BD Status	TEC	Regionally Significant [3]	Under Represented [4]
	11a	12.8.14	Eucalyptus eugenioides, E. biturbinata, E. melliodora +/- E. tereticornis, Corymbia intermedia woodland on Cainozoic igneous rocks.	L	NC	×	×	×
	12a	12.9-10.7a	Eucalyptus siderophloia, Corymbia intermedia +/- E. tereticornis and Lophostemon confertus open forest. Occurs on Cainozoic and Mesozoic sediments in near coastal areas.	OC	OC	×	-	×
	13c	12.9-10.7	Eucalyptus crebra +/- E. tereticornis, Corymbia tessellaris, Angophora leiocarpa, E. melanophloia woodland. Occurs on Cainozoic and Mesozoic sediments.	OC	OC	×	-	×
Eucalypt woodlands on floodplains	16c	12.3.11	Eucalyptus tereticornis +/- Eucalyptus siderophloia, Corymbia intermedia open forest on alluvial plains usually near coast.	OC	OC	×	-	×
	16d	12.3.7b	Riverine wetland or fringing riverine wetland. Naturally occurring instream waterholes and lagoons, both permanent and intermittent. Includes exposed stream bed and bars. Occurs in the bed of active (may be intermittent) river channels.	L	NC	×	✓	✓
Melaleuca woodlands	22a	12.2.7	Melaleuca quinquenervia or rarely M. dealbata open forest on sand plains.	L	OC	×	×	×
		12.3.4	Melaleuca quinquenervia, Eucalyptus robusta woodland on coastal alluvium.	OC	OC	×	-	×
		12.3.5	Melaleuca quinquenervia open forest on coastal alluvium.	L	OC	×	×	×
		12.3.6	Melaleuca quinquenervia +/- Eucalyptus tereticornis, Lophostemon suaveolens open forest on coastal alluvial plains.	L	NC	×	✓	×

Vegetation Type[1]	BVG [2]	RE	Description	VM Class	BD Status	TEC	Regionally Significant [3]	Under Represented [4]
Heaths and other coastal communities	28a	12.1.1	Casuarina glauca woodland on margins of marine clay plains.	OC	E	×	-	×
		12.2.14	Strand and fore dune complex comprising Spinifex sericeus grassland Casuarina equisetifolia subsp. incana woodland/open forest and with Acacia leiocalyx, A. disparrima subsp. disparrima, Banksia integrifolia subsp. integrifolia, Pandanus tectorius, Corymbia tessellaris, Cupaniopsis anacardioides, Acronychia imperforata. Occurs mostly on frontal dunes and beaches but can occur on exposed parts of dunes further inland.	L	NC	×	×	×
	28d	12.2.16	Sand blows largely devoid of vegetation. Sand blows on large sand islands.	OC	OC	×	-	×
	29a	12.2.9	Banksia aemula low open woodland. Mallee eucalypts sometimes present, e.g. Eucalyptus latisinensis. Occurs on Quaternary coastal dunes and sandplains with deeply leached soils.	L	NC	×	×	×
		12.2.12	Closed heath on seasonally waterlogged sand plains.	L	NC	×	×	✓
		12.2.13	Open or dry heath. Characteristic shrubs include stunted Banksia aemula and Allocasuarina littoralis as well as Xanthorrhoea johnsonii, Leptospermum semibaccatum, Phebalium woombye, Dillwynia retorta and Caustis recurvata. Usually occurs on Pleistocene dunes and beach ridges.	OC	E	×	-	×
		12.3.13	Closed heathland on seasonally waterlogged alluvial plains usually near coast.	L	OC	×	×	×
		12.3.14	Banksia aemula low woodland on alluvial plains usually near coast.	OC	OC	×	-	×

Vegetation Type[1]	BVG [2]	RE	Description	VM Class	BD Status	TEC	Regionally Significant [3]	Under Represented [4]
		12.5.9	Sedgeland to heathland in low lying areas on complex of remnant Tertiary surface and Tertiary sedimentary rocks.	OC	OC	×	-	×
		12.5.10	Eucalyptus latisinensis and/or Banksia aemula low open woodland +/- Corymbia trachyphloia subsp. trachyphloia. Diverse understorey of heath species. Occurs on complex of remnant Tertiary surfaces and Tertiary sedimentary rocks.	L	NC	×	✓	×
		12.12.19	Vegetation complex of rocky headlands on Mesozoic to Proterozoic igneous rocks.	OC	OC	×	-	×
	29b	12.8.19	Heath and rock pavement with scattered shrubs or open woodland. Occurs on Cainozoic igneous rocks especially rhyolite and trachyte.	OC	OC	×	-	×
Wetlands	34a	12.2.15a	Lacustrine wetland (e.g. lake). Permanent and semi-permanent window lakes. Occurs as a window into the water table on Quaternary coastal dunes and beaches. Low part of coastal landscape where water collects from both overland flow and infiltration from adjoining sand dunes.	L	NC	×	✓	✓
	34c	12.2.15	Gahnia sieberiana, Empodisma minus, Gleichenia spp. closed sedgeland in coastal swamps.	L	NC	×	×	×
	34f	12.9-10.22	Closed sedgeland/shrubland on sedimentary rocks. Coastal parts.	OC	OC	×	-	×
Mangroves & saltmarshes	35a	12.1.3	Mangrove shrubland to low closed forest on marine clay plains and estuaries.	L	NC	×	×	×
	35b	12.1.2	Saltpan vegetation including grassland, herbland and sedgeland on marine clay plains.	L	NC	Saltmarsh	✓	✓

Appendix B Significant fauna and BVG associations

1 = Critically Endangered (CE); Endangered (E); Vulnerable (V); Near Threatened (NT); Regionally Significant in SEQ (Re); Locally Significant in Noosa (L); 2 = Restricted Distribution (RD); Northern Distribution Limit (NDL); Southern Distribution Limit (SDL); Vulnerable to Disturbance (VDIS); 3 = BVG description 1M

Common Name	Scientific Name	Status [1]	Justification[2]	Habitat Description	BVGs[3]																										
					2a	3a	4a	4b	5a	8a	8b	9a	9f	9g	9h	10b	11a	12a	13c	16c	16d	22a	28a	28d	29a	29b	34a	34c	34f	35a	35b
Amphibians																															
Tusked Frog	*Adelotus brevis*	V	NC Act	Rainforest, wet to dry forest, farmland, woodland, vine forest	x	x	x	x	x	x	x	x								x											
Wallum Froglet	*Crinia tinnula*	V	NC Act	Swamps, heathland, flooded roadside ditches				x														x	x		x				x		
Great Barred Frog	*Mixophyes fasciolatus*	Re	VDIS, RD	Rainforest, wet sclerophyll, riparian, farmland	x	x	x	x	x	x	x	x								x											
Green-thighed Frog	*Litoria brevipalmata*	Re	Rare	Wet sclerophyll, melaleuca swamps, open woodlands, some disturbed areas	x	x	x	x	x	x	x	x								x											
Cooloola Sedgefrog	*Litoria cooloolensis*	NT	NC Act	Coastal: melaleuca woodlands, perched lakes, wallum swamp, dune creeks																		x	x		x			x	x		
Bleating Treefrog	*Litoria dentata*	L	NDL	Swamps and woodlands, esp. wet sclerophyll, farms	x	x	x	x	x	x	x	x	x	x		x	x			x		x			x			x			
Wallum Rocketfrog	*Litoria freycineti*	V	NC Act	Coastal: melaleuca woodlands, perched lakes, swamps, dune creeks																		x	x		x				x		
Wallum Sedgefrog	*Litoria olongburensis*	V	EPBC Act, NC Act	Lowland sandy swamps, creeks and lakes of wallum																		x	x		x				x		
Laughing Treefrog	*Litoria tyleri*	L	NDL	Coastal forest, mid-upland forest, farmland	x				x	x	x	x		x		x	x					x									
Red-eyed Treefrog	*Litoria rothii*	L	NDL	Forest, woodland, rural land, suburbs	x				x	x	x	x	x	x	x	x	x	x	x	x		x									
Stony-creek Frog	*Litoria wilcoxii*	Re	RD/NDL	Rocky streams in rainforest or wet sclerophyll	x	x	x	x	x	x	x	x	x	x	x	x	x			x		x									
Cascade Tree Frog	*Litoria pearsoniana*	V	NC Act	In or adjacent to rainforest and wet sclerophyll forest	x	x	x	x	x																						
Whistling Treefrog	*Litoria verreauxii*	L	NDL / RD	Woodland, forest, grassland, heath, disturbed areas	x				x	x	x	x	x	x	x	x	x	x	x	x		x			x	x					

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					2a	3a	4a	4b	5a	8a	8b	9a	9f	9g	9h	10b	11a	12a	13c	16c	16d	22a	28a	28d	29a	29b	34a	34c	34f	35a	35b
Giant barred frog	*Mixophyes iteratus*	E	EPBC Act, NC Act	Riparian in wet sclerophyll & rainforest along coast and ranges	x			x	x	x	x	x		x		x	x														
Reptiles																																
Death Adder	*Acanthophis antarcticus*	V	NC Act	Many						x	x	x	x	x		x	x			x		x									
Clouded Gecko	*Amalosia jacovae*	Re	Endemic to SEQ	Dry eucalypt forest									x	x	x		x	x	x	x											
Proximus Blind Snake	*Anilios proximus*	Re	Endemic	Well-timbered habitats	x				x	x		x	x	x	x	x	x	x	x	x		x									
Major Skink	*Bellatorias frerei*	Re	RD	Forests, heaths						x	x	x	x	x	x	x	x			x		x									
Land Mullet	*Bellatorias major*	Re	NDL / RD	Rainforests and adj. wet sclerophyll forests	x	x	x	x	x																						
Burrowing Skink	*Calyptotis lepidorostrum*	Re	Endemic / RD	Rainforest, wet & dry sclerophyll, heath	x	x	x	x	x	x	x	x								x											
Frilled Lizard	*Chlamydosaurus kingii*	Re	SDL / RD, VDIS	Woodlands						x	x	x	x	x	x	x	x			x		x									
Three-toed Snake-tooth Skink	*Coeranoscincus reticulatus*	V	EPBC Act	Wet forests and sandy heathlands	x	x	x	x	x	x	x	x								x											
Arcane Striped Skink	*Ctenotus arcanus*	Re	Endemic / RD	Montane forests, heathlands and swamps of SEQ						x	x	x	x	x	x	x	x			x		x			x				x		
Leaden Delma	*Delma plebia*	Re	VDIS	Heath, dry coastal forest, disturbed areas						x	x	x	x	x	x	x	x			x		x									
Collared Delma	*Delma torquata*	V	NC Act	Dry eucalypt woodlands on stony soils or rocky ridges						x	x	x	x	x	x	x	x			x		x									
Southern Snapping Turtle	*Elseya albagula*	CE	EPBC Act & NC Act	Permanent flowing water habitats where there are suitable shelters and refuges (e.g. fallen trees)	N/A																										
Mary River Turtle	*Elusor macrurus*	E	EPBC Act & NC Act	Areas of clear, slow moving water within the Mary River and tributaries	N/A																										
Elf Skink	*Eroticoscincus graciloides*	Re	Rare	Wet lowland forests from Fraser Island to Ipswich area	x	x	x	x	x																						

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Pale-headed Snake	*Hoplocephalus bitorquatus*	Re	VDIS	Dry sclerophyll forest and woodlands, often near water or flood-prone areas	x	x	x	x	x	x	x	x	x	x	x	x	x			x		x									
Stephen's Banded Snake	*Hoplocephalus stephensii*	Re	Rare	Rainforest, wet sclerophyll and rock outcrops						x		x	x	x	x	x	x			x		x									
Murray's skink	*Karma murrayi*	Re	NDL / RD	Rainforests	x		x	x	x																							
Skink	*Lampropholis adonis*	Re	RD	Rainforest edges and clearings, lush creekside vegetation, shaded gorges			x		x	x	x	x	x	x	x	x	x			x		x			x				x		
Friendly Skink	*Lampropholis amicula*	L	Endemic	Dry sclerophyll forest, heathlands, vine thickets			x		x	x	x	x	x	x	x	x	x			x		x			x				x		
Sun Skink	*Lampropholis couperi*	Re	Endemic / RD	Rainforest						x	x	x	x	x		x	x			x		x									
Pale-flecked Garden Skink	*Lampropholis guichenoti*	Re	NDL	Moist heaths																					x				x			
Eastern Tiger Snake	*Notechis scutatus*	Re	NDL	Coastal wetlands and creeks						x	x	x	x	x	x	x	x			x		x			x			x	x		
Yolk-bellied Snake-skink	*Ophioscincus ophioscincus*	Re	Endemic	Wet sclerophyll forest, rainforest, vine thicket, moist gullies in drier habitats	x	x	x	x	x	x	x	x		x		x	x														
Short-limbed Snake-skink	*Ophioscincus truncatus*	Re	Endemic	SEQ, NE NSW. Rainforests and wet sclerophyll and heathlands			x		x	x	x	x								x											
Rose-shaded Skink	*Saproscincus rosei*	Re	Endemic	Rainforest, adj. wet sclerophyll forest	x	x	x	x	x																							
Rough-scaled Snake	*Tropidechis carinatus*	Re	Endemic / RD	Rainforests, moist open air forests and waterways	x	x	x	x	x																x			x	x		
Sand Monitor	*Varanus gouldii*	L	RD	Open dry habitats						x	x	x	x	x	x	x	x			x		x			x				x		
Bandy Bandy	*Vermicella annulata*	Re	Rare	Open forest and woodland						x	x	x	x	x	x	x	x			x		x									
Birds																																
Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	L	Uncommon	Drier inland/coastal woodlands, scrubs, gardens						x		x	x	x		x	x			x		x	x								
Grey Goshawk	*Accipiter novaehollandiae*	Re	Rare	Rainforests, forest gullies and valleys, taller woodlands	x	x	x	x	x	x	x	x	x	x		x	x			x		x									

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Common Sandpiper	*Actitis hypoleucos*	M	EPBC Act (Migratory)	Many wetland habitats of varying salinity																											
Chestnut Teal	*Anas castanea*	Re	RD	Coastal swamps, saltmarshes, tidal mudflats, estuaries and inlets																			x		x			x	x	x	x
Fork-tailed Swift	*Apus pacificus*	M	EPBC Act (Migratory)	Aerial. Coastal and inland areas. Open habitats, dry scrub, heathland, saltmparsh, riparian																											
Great Egret	*Ardea modesta*	M	EPBC Act (Migratory)	Wetland - all salinities and vegetations, natural/artificial																					x			x	x	x	x
Cattle Egret	*Ardea ibis*	M	EPBC Act (Migratory)	Grasslands, woodlands, terrestrial wetlands, pastures																											
Australian Bustard	*Ardeotis australis*	Re	RD	Grasslands, spinifex, open scrublands, grassy woodlands						x	x	x	x	x	x	x	x			x		x									
Australasian Bittern	*Botaurus poiciloptilus*	E	EPBC Act	Terrestrial freshwater wetlands																											
Bush Stone-curlew	*Burhinus grallarius*	Re	RD	Varied. Open woodland, sandplains, coastal scrub						x	x	x	x	x	x	x	x			x		x									
Sharp-tailed Sandpiper	*Calidris acuminata*	M	EPBC Act (Migratory)	Fresh or brackish wetlands with emergent vegetation, saltmarsh																		x	x								
Sanderling	*Calidris alba*	M	EPBC Act (Migratory)	Coastal. Open sandy beaches, sandbars & spits																											
Red Knot	*Calidris canutus*	M	EPBC Act (Migratory)	Intertidal mudflats, sandflats, sandy beaches, estuaries, lagoons																											
Curlew Sandpiper	*Calidris ferruginea*	CE	EPBC Act	Intertidal mudflats in sheltered coastal areas - lagoons, non-tidal swamps, lakes																		x		x							
Red-necked Stint	*Calidris ruficollis*	M	EPBC Act (Migratory)	Sheltered inlets, bays, lagoons, estuaries with intertidal mudflats																			x							x	x
Great Knot	*Calidris tenuirostris*	M	EPBC Act (Migratory)	Sheltered coastal habitats with large intertidal mudflats or sandflats																											
Glossy Black Cockatoo	*Calyptorhynchus lathami*	V	NC Act	Allocasuarina dominated or mixed woodlands						x	x	x	x	x	x	x	x			x		x									
Large-tailed Nightjar	*Caprimulgus macrurus*	L	SDL	Margins of rainforest, vine scrubs, paperbarks, mangroves	x	x	x	x	x																						

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Double-banded Plover	*Charadrius bicinctus*	M	EPBC Act (Migratory)	Wetlands, seagrass beds, open grassy areas																							x	x	x		
Ringed Plover	*Charadrius hiaticula*	M	EPBC Act (Migratory)	Flat sandy or muddy shores																											
Lesser Sand Plover	*Charadrius mongolus*	M	EPBC Act (Migratory)	Coastal littoral and estuarine areas with sandflats and mudflats																					x			x	x		
Greater Sand Plover	*Charadrius leschenaultii*	M	EPBC Act (Migratory)	Beaches, sandy estuarine lagoons																											
White-backed Swallow	*Cheramoeca leucosternus*	L	Uncommon	Open inland areas, watercourses, dunes, ranges and foothills, inland lakes						x		x	x	x	x	x	x			x		x									
White-winged Black Tern	*Chlidonias leucopterus*	M	EPBC Act (Migratory)	Coastal or subcoastal wetlands of all salinities, intertidal sandbanks in Noosa																			x							x	x
Speckled Warbler	*Chthonicola sagittata*	Re	Restricted distribution	Open forest, open woodland						x	x	x	x	x	x	x	x			x		x									
Red-browed Treecreeper	*Climacteris erythrops*	Re	Rare	Tall wet forest, open forest			x		x	x	x	x	x	x		x	x			x		x									
White-headed Pigeon	*Columba luecomela*	Re	Associated with habitat that is restricted	Rainforest	x	x	x	x	x																						
Rufous-throated Honeyeater	*Conopophila rufogularis*	L	NDL	Eucalypt forests, Melaleuca communities, Mangroves	x	x	x	x	x	x		x	x	x	x	x	x			x		x									
Barred Cuckoo-shrike	*Coracina lineata*	Re	RD	Rainforest, open forest	x	x	x	x	x	x	x	x	x	x		x	x			x		x									
Oriental Cuckoo	*Cuculus optatus*	M	EPBC Act (Migratory)	Open forests						x	x	x	x	x		x	x			x		x									
Double-eyed (Coxen's) Fig-Parrot	*Cyclopsitta diophthalma coxeni*	E	EPBC Act, NC Act	Lowland rainforest, riparian vegetation, isolated fig trees	x	x	x	x	x																						
Blue-winged Kookaburra	*Dacelo leachii*	L	SDL	Tropical and subtropical open woodlands, paperbark swamps						x	x	x	x	x	x	x	x			x		x		x				x	x		
Varied Sittela	*Daephoenositta chrysoptera*	Re	Data deficient	Open forest, open woodland						x	x	x	x	x	x	x	x			x		x									

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Eastern Bristlebird	*Dasyornis brachypterus*	E	EPBC Act	Sedgeland, heathland, swampland, shrubland, sclerophyll forest, woodland, rainforest	x				x	x	x	x	x	x	x	x	x	x	x	x			x		x	x		x	x		
Emu	*Dromaius novaehollandiae*	Re	RD	Open forest, open woodland, heathlands						x	x	x	x	x	x	x	x			x		x			x				x		
Letter-winged Kite	*Elanus scriptus*	L	Uncommon	Grasslands with trees, treed riparian areas																x	x										
Black-necked Stork	*Ephippiorhynchus asiaticus*	Re	Rare	Coastal swamps, freshwater wetlands, estuaries, floodplains, open woodland						x		x	x	x	x	x	x			x		x	x		x			x	x	x	x
Red Goshawk	*Erythrotriorchis radiatus*	V	EPBC Act, NC Act	Forest and woodland mosaics with large prey populations & permanent water	x	x	x	x	x	x	x	x	x	x	x	x	x			x		x									
Beach Stone-curlew	*Esacus magnirostris*	V	NC Act	Open, undisturbed beaches, estuarine intertidal sand and mudflats, coastal lagoons																			x		x			x	x	x	x
Peregrine Falcon	*Falco peregrinus*	Re	RD	Rivers, wetlands, plains, open woodlands						x	x	x	x	x	x	x	x			x		x									
Crested Shrike-tit	*Falcunculus frontatus*	Re	RD	Rainforests, eucalypt forests/woodlands						x	x	x	x	x	x	x	x			x		x									
Latham's Snipe	*Gallinago hardwickii*	M	EPBC Act (Migratory)	Wetlands, usually open freshwater wetlands with low dense vegetation e.g. swamps, heathlands, bogs																					x			x	x		x
Gull-billed Tern	*Gelochelidon nilotica*	M	EPBC Act (Migratory)	Beaches, mudflats, wetlands, grasslands																							x	x	x		
Diamond Dove	*Geopelia cuneata*	L	Uncommon	Drier grassy woodlands, scrub near water, wooded watercourses						x		x	x	x	x	x	x			x		x									
Fairy Gerygone	*Gerygone palpebrosa*	L	SDL	Edges of lowland rainforest, vine forest, eucalypt woodland, scrubland, mangroves	x	x	x	x	x	x		x	x	x	x	x	x			x		x									
Brolga	*Grus rubundica*	Re	RD	Freshwater wetlands, swamps in eucalypt forests, floodplains, grasslands, paddocks																					x			x	x		
Black-breasted Buzzard	*Hamirostra melanosternon*	L	Uncommon	Grasslands, sandhills, tropical woodlands	x	x	x	x	x	x																					

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White-throated Needletail	*Hirundapus caudacutus*	M	EPBC Act (Migratory)	Aerial																											
Black Bittern	*Ixobrychus flavicollis*	Re	RD	Tidal creeks, sheltered mudflats, oyster-slats																					x			x	x		
Little Bittern	*Ixobrychus minutus*	Re	RD	Reed-choked freshwater swamps, lakes, rivers, tussocky wetlands																	x							x			
Swift Parrot	*Lathamus discolor*	E	EPBC Act, NC Act	Eucalypt forests and woodlands, banksias, parks & gardens						x	x	x	x	x	x	x	x			x		x									
Yellow-tufted Honeyeater	*Lichenostomus melanops*	Re	RD	Eucalypt forest/woodland with dense shrubby understorey			x		x	x	x	x	x	x	x	x	x			x		x									
Bar-tailed Godwit	*Limosa lapponica*	M	EPBC Act (Migratory)	Intertidal zones, estuaries, coastal lagoons and bays, seagrass, saltmarsh																							x				x
Black-tailed Godwit	*Limosa limosa*	M	EPBC Act (Migratory)	Intertidal flats and spits																											
Broad-billed Sandpiper	*Limicola falcinellus*	M	EPBC Act (Migratory)	Estuarine mudflats, saltmarshes, shallow freshwater lagoons																							x				x
Square-tailed Kite	*Lophoictinia isura*	Re	Rare	Heathlands, woodlands, forests, tropical/subtropical rainforest	x	x	x	x	x	x	x	x	x	x	x	x	x			x		x			x				x		
Black-chinned Honeyeater	*Melithreptus gularis*	Re	Rare	Drier eucalypt forests, woodlands						x	x	x	x	x	x	x	x			x		x									
Rainbow Bee-eater	*Merops ornatus*	M	EPBC Act (Migratory)	Open forests and woodlands, shrublands						x	x	x	x	x	x	x	x			x		x									
Black Kite	*Milvus migrans*	L	Uncommon	Grasslands, gibber deserts, sandhills, tidal flats	x	x	x	x	x	x		x	x	x	x	x	x			x		x									
White-eared Monarch	*Monarcha leucotis*	Re	RD	Rainforest, tall wet forest	x	x	x	x	x	x	x	x								x											
Black-faced Monarch	*Monarcha melanopsis*	M	EPBC Act (Migratory)	Rainforest, subtropical rainforest	x	x	x	x	x	x	x	x	x	x	x	x	x			x		x									
Shining Flycatcher	*Myiagra alecto*	L	Uncommon, SDL	Mangroves, Melaleuca communities																										x	
Satin Flycatcher	*Myiagra cyanoleuca*	M	EPBC Act (Migratory)	Eucalypt forest near watercourses						x	x	x	x	x	x	x	x			x		x								x	

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Turqoise Parrot	*Neophema pulchella*	Re	Rare	Open grassy woodland, coastal heaths, pastures with exotic grasses						x		x	x	x	x	x	x			x		x			x			x	x		
Cotton Pygmy-goose	*Nettapus coromandelianus*	Re	Rare	Deeper freshwater swamps, lagoons, dams																					x			x	x		
Barking Owl	*Ninox connivens*	Re	RD	Open forests, woodlands, dense scrubs, foothills						x	x	x	x	x	x	x	x			x		x									
Powerful Owl	*Ninox strenua*	V	NC Act	Wet and dry sclerophyll forest and woodlands. Riverine woodlands	x	x	x	x	x																						
Eastern Curlew	*Numenius madagascariensis*	CE	EPBC Act, NC Act	Sheltered coasts, estuaries, large intertidal mudflats or sandflats, saltmarsh, beaches																			x		x			x	x	x	x
Little Curlew	*Numenius minutus*	M	EPBC Act (Migratory)	Grassland, sedgeland, floodplains, open woodlands, dry saltmarsh, coastal swamps, flats, beaches														x		x								x	x		x
Whimbrel	*Numenius phaeopus*	M	EPBC Act (Migratory)	Intertidal mudflats of sheltered coasts, sometimes beaches. Occasionally coastal lakes and wetlands																			x		x			x	x	x	x
Logrunner	*Orthonyx temminckii*	Re	Endemic / RD	Rainforest	x	x	x	x	x																						
Osprey	*Pandion cristatus*	M	EPBC Act (Migratory)	Open water, coastal cliffs, beaches, estuaries, mangroves, lakes, broad rivers																											
Ground Parrot	*Pezoporus wallicus*	V	NC Act	Moist and dry dense heathland, and sedgland from Fraser Island to Mooloolah																					x			x	x		
Brush Bronzewing	*Phaps elegans*	L	NDL	Dense scrubs, heaths, forests, woodland with scrubby understorey						x		x	x	x	x	x	x			x		x			x			x	x		
New-holland Honeyeater	*Phylidonyris novaehollandiae*	L	NDL	Eucalypt forests/woodlands with scrubby understorey coastal scrubs, heathlands, mallee-spinifex						x		x		x	x	x	x			x		x			x				x		
Noisy Pitta	*Pitta versicolor*	Re	RD	Rainforests, tropical/subtropical scrubs, eucalypt forests	x	x	x	x	x																						
Eastern Rosella	*Platycerus eximius*	L	NDL	Open grassy forests, woodlands, nearby grasslands						x	x	x	x	x	x	x	x			x		x									

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Glossy Ibis	*Plegadis falcinellus*	M	EPBC Act (Migratory)	Freshwater marshes. Occasionally coastal wetlands and wooded swamps																					x			x	x		
Pacific Golden Plover	*Pluvialis fulva*	M	EPBC Act (Migratory)	Beaches, flats, saltmarsh, estuaries, lagoons, lakes																							x			x	x
Grey Plover	*Pluvialis squatarola*	M	EPBC Act (Migratory)	Estuaries, lagoons, sheltered bays, flats, rocky coasts, near-coastal lakes and swamps																							x	x	x	x	
Marbled Frogmouth	*Podargus ocellatus plumiferus*	V	NC Act	Endemic to subtropical rainforest in SEQ and northern NSW	x	x	x	x	x																						
Grey-crowned Babbler	*Pomatostomus temporalis*	Re	Uncommon, RD	Open forests, woodlands, scrublands						x	x	x	x	x	x	x	x			x		x									
Superb Fruit-dove	*Ptilinopus superbus*	Re	RD	Rainforests and fringes, scrubs, mangroves, wooded stream-margins	x	x	x	x	x																						
Paradise Riflebird	*Ptiloris paradiseus*	Re	RD	Rainforests, wetter eucalypt forests, paperbark woodlands	x	x	x	x	x	x	x	x								x											
Lewin's Rail	*Rallus pectoralis pectoralis*	Re	Rare	Coastal saltwater areas, freshwater swamps and wetlands																					x			x	x		x
Painted Snipe	*Rostratula australis*	E	EPBC Act, NC Act	Freshwater, occasionally brackish wetlands with emergent vegetation																					x			x	x		x
Yellow-throated Scrubwren	*Sericornis citreogularis*	Re	NDL / RD	Coastal mountain rainforests, woodlands, gullies	x	x	x	x	x																						
Regent Bowerbird	*Sericulus chrysocephalus*	Re	RD	Rainforest margins, coastal scrubs	x	x	x	x	x	x	x	x								x											
Diamond Firetail	*Stagonopleura guttata*	Re	Uncommon	Open eucalypt forests/woodlands						x	x	x	x	x	x	x	x			x		x									
Little Tern	*Sternula albifrons*	Re	Back on Track High Priority	Sheltered areas - beaches, inlets, estuaries, lakes, lagoons, deltas																			x							x	x
Caspian Tern	*Hydroprogne caspia*	M	EPBC Act (Migratory)	Sheltered coastal embankments with sandy or muddy margins. Coastal wetlands, especially lakes																			x							x	x

Common Name	Scientific Name	Status [1]	Justification[2]	Habitat Description	BVGs[3]																										
					2a	3a	4a	4b	5a	8a	8b	9a	9f	9g	9h	10b	11a	12a	13c	16c	16d	22a	28a	28d	29a	29b	34a	34c	34f	35a	35b
Southern Emu Wren	*Stipiturus malachurus*	V	NC Act	Heaths, heathy woodlands, montane gullies						x		x	x	x	x	x	x			x		x			x				x		
Zebra Finch	*Taeniopygia guttata*	L	Uncommon	Mulga, spinifex, gibber, grassland, open woodlands/shrublands/scrubs, saltbush, crops, gardens														x		x			x								
Pale-yellow Robin	*Tregellasia capito*	Re	RD	Tropical and subtropical rainforests	x	x	x	x	x																						
Common Greenshank	*Tringa nebularia*	M	EPBC Act (Migratory)	All wetlands, sheltered coastal habitats - mudflats, saltmarsh, mangroves																					x			x	x		
Grey-tailed Tattler	*Tringa brevipes*	M	EPBC Act (Migratory)	Sheltered coasts, intertidal mudflats																			x							x	x
Wandering Tattler	*Tringa incana*	M	EPBC Act (Migratory)	Rocky coasts, beaches																											
Marsh Sandpiper	*Tringa stagnatilis*	M	EPBC Act (Migratory)	Wetlands of all salinities																					x			x	x		
Black-breasted Button-quail	*Turnix melanogaster*	V	EPBC Act, NC Act	SEVT, coastal dune scrubs, rainforest, seasonally dry wet forests	x	x	x	x	x																						
Sooty Owl	*Tyto tenebricosa*	Re	SDL	Tall, wet forests with dense understory in gullies	x				x	x																					
Grass Owl	*Tyto capensis longimembris*	Re	RD	Tall grass, swampy areas (incl. tidal), mangrove-fringes, grassy plains, coastal heaths, grassy woodland, sedges, cultivation														x		x					x			x	x	x	x
Masked Owl	*Tyto n. novaehollandiae*	Re	RD	Rainforest	x	x	x	x	x	x	x	x	x	x	x	x	x			x		x									
Terek Sandpiper	*Xenus cinereus*	M	EPBC Act (Migratory)	Intertidal flats, harbours, lagoons, banks, samphire																								x			x
Russet-tailed Thrush	*Zoothera heinei*	Re	RD	Rainforest, tall wet forest, rain forest margins	x	x	x	x	x	x	x	x								x											
Bassian Thrush	*Zoothera lunulata*	Re	RD	Rainforest, tall wet forest, open forest	x	x	x	x	x																						
Mammals																															

Common Name	Scientific Name	Status [1]	Justification[2]	Habitat Description	BVGs[3]																										
					2a	3a	4a	4b	5a	8a	8b	9a	9f	9g	9h	10b	11a	12a	13c	16c	16d	22a	28a	28d	29a	29b	34a	34c	34f	35a	35b
Spotted-tailed Quoll	*Dasyurus maculatus maculatus*	E	EPBC Act, NC Act	Intact wet forests, eucalypt woodlands, riparian forests, coastal heathlands	x	x	x	x	x																						
Whiptail Wallaby	*Macropus parryi*	L	RD	Open forest, open woodland						x	x	x	x	x	x	x	x			x		x									
Little Bent-wing Bat	*Miniopteris australis*	Re	Roost site dependent	Open forest, open woodland, rainforest, tall wet forest	x	x	x	x	x																						
Bent-wing Bat	*Miniopterus schreibersii*	Re	VDIS	Open forest, open woodland, rainforest, tall wet forest	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x						x	x		
Eastern Freetail-bat	*Mormopterus ridei*	Re	RD	Open forest, open woodland, rainforest, tall wet forest	x	x	x	x	x																						
Eastern Tube-nosed Bat	*Nyctimene robinsoni*	Re	VDIS	Rainforest	x	x	x	x	x																						
Eastern Long-eared Bat	*Nyctophilus bifax*	L	RD	Open forest, rainforest, tall wet forest	x	x	x	x	x																						
Platypus	*Ornithorhynchus anatinus*	Re	NC Act	Freshwater streams						x	x	x	x	x	x	x	x			x		x									
Greater Glider	*Petauroides volans*	Re	EPBC Act	Eucalypt forests			x		x	x	x	x	x	x		x	x			x		x									
Yellow-bellied Glider	*Petaurus australis australis*	Re	RD	Open forest, open woodland, tall wet forest			x		x	x	x	x	x	x	x	x	x			x		x									
Squirrel Glider	*Petaurus norfolcensis*	Re	VDIS	Open forest, open woodland						x	x	x	x	x	x	x	x			x		x									
Brush-tailed Phascogale	*Phascogale tapoatafa*	Re	RD	Rainforest, open forest,	x	x	x	x	x																						
Koala	*Phascolarctos cinereus*	V	EPBC Act, NC Act	Particular eucalyptus forests						x	x	x	x	x	x	x	x			x		x									
Long-nosed Potoroo	*Potorous tridactylus*	V	EPBC Act	Dense coastal scrubs, wet heath with trees, woodlands with heath, inland moist forest and rainforest	x	x	x	x	x	x	x	x	x			x							x		x						
Delicate Mouse	*Pseudomys delicatulus*	Re	SDL	Open forest, open woodland, coastal dunes, heathlands						x	x	x	x	x	x	x	x			x		x	x		x				x		

Common Name	Scientific Name	Status [1]	Justification[2]	Habitat Description	BVGs[3]																											
					2a	3a	4a	4b	5a	8a	8b	9a	9f	9g	9h	10b	11a	12a	13c	16c	16d	22a	28a	28d	29a	29b	34a	34c	34f	35a	35b
Eastern Chestnut Mouse	*Pseudomys gracilicaudatus*	Re	RD	Open forest, heath lands						x	x	x	x	x	x	x	x			x		x									
Black Flying-fox	*Pteropus alecto*	Re	VDIS, roost site dependent	Forests and woodlands	x	x	x	x	x	x	x	x	x	x	x	x	x			x		x									
Grey-headed Flying-fox	*Pteropus poliocephalus*	V	EPBC Act	Rainforest, open forest, woodlands, melaleuca swamps, banksia woodlands	x	x	x	x	x	x	x	x	x	x	x	x	x			x		x									x
Little Red Flying-fox	*Pteropus scapulatus*	Re	VDIS	Rainforest, sclerophyll forest	x	x	x	x	x	x	x	x	x	x	x	x	x			x		x									x
Pale Field-rat	*Rattus tunneyi*	RE	RD	Grasslands, open woodlands						x		x	x	x	x	x	x			x		x									
Eastern Horse-shoe Bat	*Rhinolophus megaphyllus*	Re	Roost site dependent	Rainforest, open forest, tall wet forest	x	x	x	x	x																						
Greater Broad-nosed Bat	*Scoteanax rueppellii*	Re	Rare / RD	Woodland to moist and dry eucalypt forest and rainforest	x			x	x	x	x	x	x	x	x	x	x	x	x	x											
Common Blossom-bat	*Syconicteris australis*	Re	VDIS	Rainforest, open forest, heathlands	x	x	x	x	x	x	x	x	x	x		x	x			x		x									
Short-beaked Echidna	*Tachyglossus aculeatus*	Re	NC act	Variable						x	x	x	x	x	x	x	x			x		x									
Red-legged Pademelon	*Thylogale stigmatica*	Re	VDIS / RD	Rainforest, vine thicket	x	x	x	x	x																						
False Water-rat	*Xeromys myoides*	V	EPBC Act, NC Act	Mangroves, sedgelands, grasslands, wetlands, saltpans																				x			x	x	x	x
Fish																															
Mary River Cod	*Maccullochella mariensis*	E	EPBC Act, NC Act	Large and deep shaded pools with abundant, slowly flowing water	N/A																										
Oxleyan Pygmy Perch	*Nannoperca oxleyana*	E	EPBC Act, NC Act	Acidic freshwater systems which drain through sandy coastal *Banksia spp*-dominated heath or wallum vegetation assemblages	N/A																										
Australian Lungfish	*Neoceratodus forsteri*	V	EPBC Act, NC Act	Still or slow-flowing, shallow, vegetated pools of permanent water	N/A																										

Common Name	Scientific Name	Status [1]	Justification [2]	Habitat Description	BVGs [3]																										
					2a	3a	4a	4b	5a	8a	8b	9a	9f	9g	9h	10b	11a	12a	13c	16c	16d	22a	28a	28d	29a	29b	34a	34c	34f	35a	35b
Honey Blue Eye	*Pseudomugil mellis*	V	EPBC Act, NC Act	Slightly acidic, clear and tannin-stained lakes, streams and wetlands with sandy or muddy bottoms in coastal heath (wallum) ecosystems	N/A																										
Invertebrates																															
Wanderer	*Danaus plexippus plexippus*	M	EPBC Act (Migratory)	Eucalypt forest, Melaleuca forest, heathland and sedgeland	x	x	x	x	x	x	x	x	x	x	x	x	x			x		x	x		x			x	x	x	x
Imperial Jezebel	*Delias harpalyce*	L	NDL	Open woodland, open forest, Melaleuca swamp forest						x	x	x	x	x	x	x	x			x		x	x		x			x	x		
Regent Skipper	*Euschemon rafflesia rafflesia*	Re	Rare	Rainforest, Eucalypt forest	x	x	x	x	x																						
Narrow-banded Awl	*Hasora khoda haslia*	L	NDL	Open woodland, open forest, Melaleuca swamp forest						x	x	x	x	x	x	x	x			x		x	x		x			x	x		
Moonlight Jewel	*Hypochrysops delicia delicia*	L	NDL	Open forest, Melaleuca swamp forest						x	x	x	x	x		x	x			x		x	x		x			x	x		
Richmond Birdwing Butterfly	*Ornithoptera richmondia*	V	NC Act	Rainforest, tall wet forest	x	x	x	x	x	x	x	x								x											
Southern Orange Dart	*Suniana sunias nola*	L	NDL	Open woodland, open forest, Melaleuca swamp forest						x	x	x	x	x	x	x	x			x		x	x		x			x	x		
Varied Sword-grass Brown	*Tisiphone abeona rawnsleyi*	Re	NDL, VDIS, RD	Open woodland, open forest, Melaleuca swamp forest						x	x	x	x	x	x	x	x			x		x	x		x			x	x		

Appendix C Significant flora and BVG associations

1 = Endangered (E); Vulnerable (V); Near Threatened (NT); Regionally Significant in SEQ (Re); Locally Significant in Noosa (L); 2 = Restricted Distribution (RD); Northern Distribution Limit (NDL); Southern Distribution Limit (SDL); Vulnerable to Disturbance (VDIS); 3 = BVG description 1M

Common Name	Scientific Name	Status [1]	Justification[2]	Habitat Description	BVGs[3]																										
					2a	3a	4a	4b	5a	8a	8b	9a	9f	9g	9h	10b	11a	12a	13c	16c	16d	22a	28a	28d	29a	29b	34a	34c	34f	35a	35b
	Acacia attenuata	V	EPBC Act, NC Act	Dry Eucalypt									x	x	x		x	x	x	x											
Tiny Wattle	*Acacia baueri subsp. baueri*	V	NC Act	Dry heath																					x	x					
Toothed Wattle	*Acacia flavescens*	L	SDL	Seacoast, coastal heath, eucalypt forest on sandy coastal soils									x					x					x		x	x					
	Acacia viscidula	L	NDL	Montane areas, rocky areas	x										x				x							x					
Scented Acronychia	*Acronychia littoralis*	E	EPBC Act, NC Act	Rainforest on coastal sand		x	x																								
Kauri Pine	*Agathis robusta*	L	SDL	Coastal rainforest		x	x		x																						
Mt. Emu She-oak	*Allocasuarina emuina*	E	EPBC Act, NC Act	Low coastal heath																					x						
	Allocasuarina rigida subsp. exsul	V	NC Act	Restricted to Mt Cooroora	x										x										x	x					
Bacon Wood	*Archidendron lovelliae*	V	EPBC Act, NC Act	Coastal sandy rainforest		x	x																								
	Argyrodendron actinophyllum subsp. actinophyllum	L	NDL	Rainforest	x		x	x	x																						
	Arthraxon hispidus	V	EPBC Act, NC Act	Freshwater wetlands																							x	x	x		
	Atractocarpus benthamianus	L	NDL	Rainforest	x		x	x	x																						
Jointed Baloghia	*Baloghia marmorata*	V	EPBC Act, NC Act	Rainforest	x		x	x	x																						

Common Name	Scientific Name	Status [1]	Justification[2]	Habitat Description	BVGs[3]																									
					2a	3a	4a	4b	5a	8a	8b	9a	9f	9g	9h	10b	11a	12a	13c	16c	16d	22a	28a	28d	29a	29b	34a	34c	34f	35a	35b
Christmas Bells	*Blandfordia grandiflora*	E	NC Act	Wet heath																					x	x					
Key's boronia	*Boronia keysii*	V	EPBC Act, NC Act	Wet Eucalypt forest on Noosa River plains						x	x	x				x															
Wide Bay boronia	*Boronia rivularis*	NT	NC Act	Dry heath, swampy areas																					x	x	x	x	x		
	Bosistoa medicinalis	L	SDL	Rainforest	x		x	x	x																						
Three-leaved Bosistoa	*Bosistoa transversa*	V	EPBC Act	Rainforest	x		x	x	x																						
	Brunoniella spiciflora	Re	Back on Track high priority	Moist rainforest	x		x		x																						
	Carex breviscapa	V	NC Act	Wetlands																							x	x	x		
	Carronia multisepalea	L	NDL	Rainforest	x		x	x	x																						
	Chamaecrista maritima	Re	RD	Dunes and heathlands		x					x												x	x	x						
Giant Ironwood	*Backhousia subargentea*	L	Endemic	Rainforest	x		x	x	x																						
Southern Corynocarpus	*Corynocarpus rupestris subsp. arborescens*	V	NC Act	Rainforest	x		x	x	x																						
Stinking cryptocarya	*Corynocarpus rupestris subsp. arborescens*	V	EPBC Act, NC Act	Rainforest	x		x	x	x																						
	Cryptocarya onoprienkoana	L	SDL	Rainforest	x		x	x	x																						
Long-leaved Tuckeroo	*Cupaniopsis newmanii*	NT	NC Act	Rainforest	x		x	x	x																						
Durringtonia	*Durringtonia paludosa*	NT	NC Act	Wet coastal heath																					x						

Common Name	Scientific Name	Status [1]	Justification[2]	Habitat Description	BVGs[3]																										
					2a	3a	4a	4b	5a	8a	8b	9a	9f	9g	9h	10b	11a	12a	13c	16c	16d	22a	28a	28d	29a	29b	34a	34c	34f	35a	35b
	Emmenosperma cunninghamii	L	SDL	Rainforest	x		x	x	x																						
White Apple	*Endiandra virens*	L	NDL	Rainforest in Mooloolah Valley	x		x	x	x																						
Bancroft's red gum	*Eucalyptus bancroftii*	Re	NDL	Wallum woodlands - dry heath on sand											x										x						
Swamp Stringybark	*Eucalyptus conglomerata*	E	EPBC Act, NC Act	Wallum woodlands - swampy heath or poor sandy soils											x								x		x						
	Eulophia bicallosa	NT	NC Act	Melaleuca woodlands																		x									
Ball Nut	*Floydia praealta*	V	EPBC Act, NC Act	Rainforest	x		x	x	x																						
	Fontainea rostrata	V	EPBC Act, NC Act	Rainforest	x		x	x	x																						
Northern Pigeonberry Ash	*Galbulimima baccata*	L	SDL	Rainforest from Conondales east to Kin Kin	x		x	x	x																						
	Glycine argyrea	NT	NC Act	Eucalypt on sandy coastal soils north of Noosa							x		x																		
	Gompholobium virgatum var. emarginatum	L	SDL	Dry heath, sandy coastal soils							x		x										x		x						
Thready-barked Myrtle	*Gossia inophloia*	NT	NC Act	Rainforest	x		x	x	x																						
	Grevillea reptans	L	SDL	Dry coastal heath from Cooloola north																					x						
Northern Guioa	*Guioa acutifolia*	L	SDL	Rainforest	x		x	x	x																						
	Habenaria harroldii	E	NC Act	Coastal and subcoastal tree swamps																		x					x				
	Hibiscus divaricatus	L	SDL	Eucalypt forest						x	x	x	x	x	x	x	x	x	x	x											

Common Name	Scientific Name	Status [1]	Justification[2]	Habitat Description	BVGs[3]																										
					2a	3a	4a	4b	5a	8a	8b	9a	9f	9g	9h	10b	11a	12a	13c	16c	16d	22a	28a	28d	29a	29b	34a	34c	34f	35a	35b
	Liparis simmondsii	NT	NC Act	Rainforest	x		x	x	x																						
Brown Bolly Gum	*Litsea leefeana*	L	SDL	Rainforest	x		x	x	x																						
	Lobelia membranacea	NT	NC Act	Eucalypt forest on moist sandy areas							x																				
Macadamia Nut	*Macadamia integrifolia*	V	EPBC Act, NC Act	Drier rainforest				x																							
Bopple Nut	*Macadamia ternifolia*	V	EPBC Act, NC Act	Rainforest	x		x	x	x																						
	Macarthuria complanata	NT	NC Act	Dry heath																					x	x					
	Macrozamia pauli-guilielmi	E	EPBC Act, NC Act	Coastal heath of Tin Can Bay																					x						
Toothed Kamala	*Mallotus megadontus*	V	NC Act	Riverbanks and moist gullies of rainforest	x		x	x	x																						
Soft Kamala	*Mallotus mollissimus*	L	SDL	Riverbanks and moist gullies of rainforest	x		x	x	x																						
Slender Milkvine	*Marsdenia coronata*	V	NC Act	Eucalypt forest on rocky hillsides and ridges															x												
	Medicosma sp. (Mt Mellum P.I.Forster+ PIF25572)	L	Endemic	Rainforest of upper Mooloolah Valley	x		x	x	x																						
	Melaleuca cheelii	NT	NC Act	Coastal Heath of Cooloola district																					x						
Red Pear-fruit	*Mischocarpus australis*	L	NDL	Rainforest	x		x	x	x																						
Sand Muttonwood	*Myrsine arenaria*	L	SDL	Moist eucalypt forests						x		x		x		x	x														
Brush Muttonwood	*Myrsine howittiana*	L	NDL	Higher altitude rainforest along watercourses, north of the Blackall Range	x			x	x																						

Common Name	Scientific Name	Status [1]	Justification[2]	Habitat Description	BVGs[3]																										
					2a	3a	4a	4b	5a	8a	8b	9a	9f	9g	9h	10b	11a	12a	13c	16c	16d	22a	28a	28d	29a	29b	34a	34c	34f	35a	35b
	Myrsine subsessilis subsp. subsessilis	L	NDL	Rainforest	x		x	x	x																						
Corky Cucumber	*Nothoalsomitra suberosa*	NT	NC Act	Wet eucalypt forest						x	x	x	x	x	x	x	x	x	x	x											
Birdwing Butterfly Vine	*Pararistolochia praevenosa*	NT	NC Act	Rainforest south of Kin Kin	x		x	x	x																						
Yellow Swamp Orchid	*Phaius australis*	E	EPBC Act, NC Act	Melaleuca swamps																		x					x	x	x		
	Philotheca glasshousiensis	L	SDL	Montane areas								x														x					
	Philotheca queenslandica	L	NDL	Coastal heath																					x						
	Planchonella eerwah	E	EPBC Act, NC Act	Rainforest, dry forest, Araucaria cunninghami vine-scrub	x		x	x	x																						
	Plectranthus torrenticola	E	EPBC Act, NC Act	Open heathland on rock outcrops, or in dappled shade under eucalypt open forest close to margins of rainforest and often along creek lines, 250-450m											x											x					
Dwarf Plum-pine	*Podocarpus spinulosus*	L	NDL	Open eucalypt forest on sandy soils									x																		
Featherwood	*Polyosma cunninghamii*	L	NDL	Wetter rainforests	x		x		x																						
Ivory Basswodd	*Polyscias australiana*	L	SDL	Rainforest of Cooloola, Eumundi & Fraser Island, with palms near streams			x																								
	Prasophyllum wallum	V	EPBC Act, NC Act	Wallum on dunes - open dry heath. RE 12.2.1																					x						
Dark Greenhood	*Pterostylis nigricans*	NT	NC Act	Coastal heath																					x						
	Pultenaea robusta	L	SDL	Coastal heath																					x						

Common Name	Scientific Name	Status [1]	Justification[2]	Habitat Description	BVGs[3]																										
					2a	3a	4a	4b	5a	8a	8b	9a	9f	9g	9h	10b	11a	12a	13c	16c	16d	22a	28a	28d	29a	29b	34a	34c	34f	35a	35b
Quassia	*Samadera bidwillii*	V	EPBC Act	Lowland rainforest and margins, open forest and woodland			x	x	x	x	x	x	x	x	x	x	x	x	x	x											
Cooloola Ironwood	*Rhodamnia acuminata*	L	SDL	Coastal rainforest		x	x	x	x																						
	Ricinocarpos speciosus	V	NC Act	Wet eucalypt forest on mountains at Springbrook and Mt Mee						x	x	x		x		x	x														
	Romnalda strobilacea	V	EPBC Act, NC Act	Rainforest on basalt	x			x	x																						
	Schoenus scabripes	L	SDL	Heathland, melaleuca quinquinervia forest											x							x			x	x					
	Sloanea australis subsp. australis	L	NDL	Moist rainforests	x		x		x																						
Hairy Hazelwood	*Symplocos harroldii*	NT	NC Act	Wet euc forest, coastal rainforest		x	x	x	x	x																					
Fraser Island Satinay	*Syncarpia hillii*	L	SDL	Wet euc forest, sandy coastal areas		x	x			x	x																				
Red Lilly Pilly	*Syzygium hodgkinsoniae*	V	EPBC Act, NC Act	Coastal rainforest		x	x	x	x																						
Fraser Island Creeper	*Tecomanthe hillii*	NT	NC Act	Coastal rainforest		x	x	x	x																						
	Teratophyllum brightiae	L	SDL	Rainforest	x		x	x	x																						
Swamp Fern	*Thelypteris confluens*	V	NC Act	Freshwater wetlands																							x	x	x		
Glossy Spice Bush	*Triunia robusta*	E	EPBC Act, NC Act	Rainforest	x		x	x	x																						
Northern Vitex	*Vitex melicopea*	L	SDL	Drier rainforest north of Gympie				x																							
Southern Penda	*Xanthostemon oppositifolius*	V	EPBC Act, NC Act	Rainforest	x		x	x	x																						

Common Name	Scientific Name	Status [1]	Justification[2]	Habitat Description	BVGs[3]																										
					2a	3a	4a	4b	5a	8a	8b	9a	9f	9g	9h	10b	11a	12a	13c	16c	16d	22a	28a	28d	29a	29b	34a	34c	34f	35a	35b
	Picris conyzoides	V	NC Act	Dry sclerophyll Eucalypt forest																											

Appendix D Protection Reserves and Biodiversity Values

Protection Reserve	Values							
	ERE	ORE	Significant Flora	Threatened Frogs	Threatened Birds	Threatened Mammals	Threatened Reptiles	Migratory Birds
Goat Island (Noosa River) Conservation Park					-	Grey-headed Flying Fox	-	Whimbrel
Great Sandy National Park			*Archidendron lovelliae; Boronia keysii; Cryptocarpa foetida; Eucalyptus conglomerata; Habenaria harroldii; Macarthuria complanata*	Wallum Sedgefrog; Wallum Rocketfrog; Cooloola Sedgefrog; Wallum Froglet	Glossy-black Cockatoo Ground Parrot	Water Mouse Koala	Cooloola Blind Snake	-
Keyser Island Conservation Park	-	12.3.5	-	-	-	-	-	-
Mount Cooroy Conservation park	12.3.1	12.8.9 12.8.13 12.8.19	*Bosistoa transersa; Nothoalsomitra suberosa*	-	-	-	-	-

Protection Reserve	Values							
	ERE	ORE	Significant Flora	Threatened Frogs	Threatened Birds	Threatened Mammals	Threatened Reptiles	Migratory Birds
Mount Pinbarren National Park	-	12.8.13	*Baloghia marmorata; Floydia praealta*	-	Coxen's Fig Parrot	-	-	Cicada Bird; Rufous Fantail; Spectacled Monarch
Noosa National Park	-	12.2.7 12.12.14	*Cryptocarpa foetida; Eucalyptus conglomerata; Habenaria harroldii; Macarthuria complanata*	Wallum Sedgefrog Wallum Rocketfrog Cooloola Sedgefrog Wallum Froglet	Glossy-black Cockatoo Ground Parrot	Koala	-	-
Ringtail State Forest								
Sheep Island Conservation Park								
Six Mile Creek Conservation Park	12.3.1 12.11.16	12.3.2	-	-	-	-	-	-

Protection Reserve	Values							
	ERE	ORE	Significant Flora	Threatened Frogs	Threatened Birds	Threatened Mammals	Threatened Reptiles	Migratory Birds
Tewantin National Park	12.3.1 12.5.2 12.5.3 12.5.6a/c 12.9-10.16 12.11.16	12.2.7 12.3.2 12.3.4 12.3.5 12.3.13 12.8.9 12.8.19 12.8.20 12.8.25 12.9-10.1	*Acacia attenuate; Acacia bauera* subsp. *Bauera; Allocasuarina rigida* subsp. *Exsul; Eucalyptus conglomerata; Pararistolochia praevenosa; Prostanthera sp.; Symplocos harroldii; Triunia robusta; Xanthostemon oppositifolius; Eucalyptus conglomerata*	Tusked Frog; Wallum Froglet; Green-thighed Frog; Cascade Frog; Giant Barred Frog	Glossy Black Cockatoo; Red-browed Treecreeper	Koala	Elf Skink	Cattle Egret; Eastern Great Egret; Cicada Bird; Rainbow Bee-Eater; Black-faced Monarch; Eastern Osprey; Spectacled Monarch; Rufous Fantail
Tuchekoi National Park	12.3.1	12.3.2 12.8.19 12.8.20 12.8.25 12.12.3	*Allocasuarina rigida* subsp. *exsul*	-	-	-	-	-
Toolara State Forest								

Protection Reserve	Values							
	ERE	ORE	Significant Flora	Threatened Frogs	Threatened Birds	Threatened Mammals	Threatened Reptiles	Migratory Birds
West Cooroy State Forest								
Weyba Creek Conservation Park	12.1.1	-	-	-	-	-	-	-
Woondum National Park						Koala		
Yurol State Forest								

Appendix E Climate Change Impacts Literature Review

Extensive coastal erosion and inundation

Noosa Shire has extensive stretches of low-lying coastal and dune ecosystems, which are highly susceptible to coastal erosion and inundations. Global sea levels are anticipated to rise between 36 cm and 1 m by 2100, with an upper limit of ~2 m based on new ice-sheet understanding (IPCC, 2007, Allison *et al*., 2009). However, these global estimates may increase by up to a factor of four in northern Australia, where sea levels are currently rising at about four times the global average (Steffen *et al*., 2009, Low, 2011). Looking further into the future, sea level will continue to rise for centuries after global temperatures have stabilised, and several meters of sea level rise are to be expected (Allison *et al*., 2009).

Greater storm intensity and/or frequency, increased cyclone activity (Easterling *et al*., 2000; Low, 2011) including the cyclone decay zone shifting south by 200-300 km by 2050 (Leslie and Karoly, 2007), and increased coastal winds, will all lead to greater coastal erosion and more frequent episodic inundation of coastal areas.

Sea level rise will significantly impact coastal fauna, particularly wetland and shorebirds, which feed and breed in low-lying wetlands (Low, 2011). Rising sea levels could result in a contraction of the saltmarsh zone until some decades after future sea levels stabilised. This would have significant consequences for waders and other fauna that feed and breed in saltmarsh and other low-lying areas (Low, 2011).

More frequent mass die-off of vulnerable flora and fauna

Noosa Shire has several species of flora and fauna that are susceptible to mass die-off from hot conditions. Annual mean temperatures in south-east Queensland are expected to increase by up to 1^{o}C by 2020, 2^{o}C by 2050, 4^{o}C by 2075, and up to 6.5^{o}C by 2100 (SCC, 2010). In conjunction with a general warming across the region, there are expected to be an extra 30 days per year of temperatures over 35^{o}C in south-east Queensland by 2100 (SCC, 2010).

Higher mean temperatures and an increased frequency of extremely hot days (Noosa Biosphere, 2012) increase the likelihood of temperatures exceeding the upper critical thermal limit of vulnerable flora and fauna species. These impacts are species-specific, and depend on the species ability to physiologically tolerate, or (for fauna) behaviourally adapt to extended periods of hot conditions.

Higher temperatures can kill seedlings and herbs, leading to unpredictable shifts in vegetation composition in some habitats (Low, 2011). This is particularly critical in areas that are currently acting as cool climate refugia (e.g. rainforests, southerly slopes, shaded creeklines) for susceptible flora and fauna species. The species most vulnerable to rising temperatures come from large and thermally stable rainforest refugia where they have a limited physiological or behavioural capacity to cool themselves (Low, 2011). For example, the cascade treefrog *Litoria pearsoniana* of the Noosa region has a low Critical Thermal Maximum (CTM) of 32-34.4^{o}C (Low, 2011), and is unlikely to survive outside rainforests. In contrast, the wallum rocketfrog *Litoria freycineti* from the same genus has a high CTM of 37.5-39.1^{o}C (Low, 2011) and will have greater capacity to adapt behaviourally within Wallum habitats, to avoid high temperatures.

Flying foxes are one group of fauna that are particularly vulnerable to mass die-offs caused by excessively hot conditions. Mass die-offs within flying-fox roosting colonies are known to occur when temperatures reach maximums of 41.7 to 43.4 °C (Low, 2011). Within the last 15 years, mass die-offs in flying fox

colonies have occurred at Palmwoods, in nine colonies in northern New South Wales, in Ipswich and at Townsville (Low, 2011). A flying fox die-off event in Sydney was recorded by Watkin Tench in 1793 (Low, 2011), showing this to be a natural occurrence, but a higher incidence of such events, with greater mortality rates, can be expected in future. Black Flying Foxes *Pteropus alecto* are particularly vulnerable to mass die-offs due to high temperatures (Low, 2011). Flying fox colony sites have changed over the years, with many now in lowland urban areas (Low, 2002), which experience higher temperatures than the rainforest gullies often used in the past.

Koalas may be also be particularly susceptible to heat stress in humid areas due to their low vagility and reliance on panting to remain cool. Koalas can survive in arid areas where temperatures rise above 40°C, but do not occur in coastal Queensland north of latitude 18°S (Low, 2011). Clifton et al. (2007) attribute this to high night temperatures and humidity reducing the effectiveness of panting. As such, high temperatures in humid lowland areas, such as Noosa, may significantly reduce the ability of koalas to keep cool during the prolonged heatwaves and greater frequency of hot nights that are predicted.

In general, birds and other large mammals are very mobile and have the capacity to respond to rising temperatures by moving location within a given area (Low, 2011). Based on current ecological and physiological knowledge, reptile experts understand that most Queensland reptile species will survive higher temperatures by adjusting behaviour, remaining deep inside refuges (where available) when temperatures rise too high (Low, 2011).

Greater intensity, spread and frequency of bushfires

The lowland rainforests of Noosa are particularly vulnerable to the impacts of increased bushfire activity. Average annual rainfall volumes are projected to decline across the Sunshine Coast, with more winter rain and less rain in other seasons (SCC, 2010). This reduction and seasonal shift in rainfall, combined with an overall reduction in soil moisture, more frequent El Niño's, and increased fuel loads during intense La Niña years, is likely to result in major changes to fire regimes and major shifts in plant composition competitive relationships, particularly from rainforest to eucalypt forest (Steffen *et al*., 2009, Low, 2011).

Fire is a more significant cause of rainforest death than drought (Low, 2011), and a more important determinant of rainforest distribution than rainfall. With higher temperatures and less summer rainfall, there is an increased probability of fires penetrating into rainforest communities, causing a shift to fire-tolerant species and away from cool-adapted species (Steffen *et al*., 2009). Fire is likely to exert a strong influence on the rainforest extent in eastern bioregions (including Noosa), where rainforests are predicted to suffer from increased fire damage leading to weed invasion (Low, 2011). In particular, lantana *Lantana camara* fuels intense fires that seriously damage rainforest margins and, by invading damaged areas, leads to a permanent loss of habitat. In wetter rainforests near the coast green panic *Megathrysus maximus* also increases the risk of damaging fires where it occurs (Low, 2011).

Shifts in ecological community compositions due to altered fire regimes and plant competitive relationships are a particular concern in regions where plants with 'tropical' and 'temperate' distributions overlap, such as southeast Queensland (Low, 2011).

Loss of saltmarshes and swamps

Noosa Shire contains low-lying ecosystems and vegetation communities that are vulnerable to the projected impacts of a warming world. Landward movement and encroachment of estuarine and coastal ecosystems (especially by mangroves) may be at the expense of other communities such as saltmarsh, freshwater wetlands and swamps (Steffen *et al*., 2009, Low 2011).

Although saltmarshes have the potential to relocate landwards in response to rising sea levels, they occupy higher land than mangroves and their relocation will more often be blocked by seawalls and other

human infrastructure, as well as by steep land (Low, 2011). Saltmarshes are vulnerable to complete loss of habitat, especially when bounded on the upper slope by cliff lines or coastal development (Steffen *et al*., 2009, Low, 2011).

In addition, mangrove encroachment on saltmarshes may occur more rapidly than saltmarsh expansion into higher land, which may be occupied by paperbark forests, freshwater sedgelands, or urban areas, resulting in a contraction of the saltmarsh zone until some decades after future sea levels stabilised (Low, 2011). The extent of mangrove invasion of saltmarshes will be determined by localised rainfall changes (Low, 2011).

Mangrove encroachment into saltmarshes is currently occurring at various locations in Queensland and this process, in combination with barriers to landward movement, suggests that climate change will reduce the extent of saltmarsh in many areas (Low, 2011). It is likely that mangroves will benefit from this process (Low, 2011).

One of the wetland ecosystems that is most at-risk from climate change impacts is the freshwater wetlands found immediately upslope of saline wetlands, which form much of the coastline of Queensland e.g. paperbark *Melaleuca* spp. woodlands, and wetlands dominated by spike rush *Eleocharis dulcis* (Low, 2011).

Birds and flying foxes that feed on the nectar of paperbarks *Melaleuca* spp. growing in low-lying swampy areas will also be impacted, where these vegetation communities are unable to migrate upslope (Low, 2011). In southern Queensland, the low-lying *Melaleuca quinquinervia* are a critical winter-spring nectar source for flying foxes and honeyeaters, which are crucial pollinators for these and other dominant tree species in the area (Low, 2011).

More frequent vegetation die-backs

Noosa Shire contains vegetation that will be more susceptible to die-back in the future. The Noosa region is expected to experience longer dry spells (Low, 2011) and 20-40% more frequent droughts by 2030, including more within-year droughts (Low, 2011). In combination with higher temperatures, this will increase drought deaths, alter plant competitive relationships, and increase the risk of fire in some habitats (Steffen *et al.*, 2009). Areas that are particularly susceptible to drought-related deaths and die-backs include dune crests, ridgetops, sunny northern slopes, and rainforests where shallow soils overlay rock. Other rainforest areas are generally resilient to droughts, however, there are known examples of rainforest trees dying during drought, all in the highlands of Southeast Queensland; in Yarraman, Lamington National Park, and on Kroombit Tops (Low, 2011). Eucalypt forests in exposed areas and on shallow soils are particularly susceptible to drought (Low, 2011).

Vegetation die-back, particularly in eucalypt and rainforest communities, may also occur due to cyclone and hailstorm damage, with both of these ecosystem disturbances projected to increase in frequency and intensity in the Noosa region in the future (Leslie and Karoly, 2007, SCC, 2010).

Reduction or loss of native folivores

Noosa Shire is home to both threatened and common folivores that are likely to decline due to a reduction in leaf nutritional content as the amount of CO_2 in the atmosphere increases. Plants supplied with extra CO_2 usually produce foliage with a reduced nitrogen content, and nitrogen is often the limiting resource for herbivorous mammals (Low, 2011). Consequently, mammalian folivores will need to eat more leaves to survive, which may not be possible under some circumstances, or it may lead to higher levels of exposure and predation, and parasitism (Low, 2011). In addition, increases in CO_2 also lead to greater leaf thickness and the production of more secondary compounds such as phenols and tannins, which

reduce leaf palatability. Hovenden and Williams (2010) predicted dramatic consequences for browsing mammals.

It has been suggested that koalas may no longer be able to meet their nutritional requirements in the future, leading to malnutrition and starvation (IUCN Species Survival Commission, 2009). This is particularly concerning given that lactating female koalas already eat 35% more leaves to meet their raised nutritional requirements during this period. It may be possible to partially offset these impacts by preferentially planting eucalypts with a high nitrogen content and low phenol content in koala habitat areas.

More frequent and extensive damage to riparian and wetland areas

The extensive riparian and wetland ecosystems of the Noosa Shire are expected to experience more frequent damage in the future, due to heavier rainfall events and more extensive and destructive flooding (SCC, 2010, Low, 2011). Rainfall events of greater intensity will increase the extent and intensity of wetland silting, loss of soil and nutrients from riparian ecosystems, and result in a greater potential for weed invasion into riparian and wetland areas (Low 2011).

More frequent weed incursions

Remnant and regrowth ecosystems within the Noosa Shire, particularly those in agricultural and riparian areas, will become more susceptible to weed invasion in the future, due to increased storm damage (Steffen *et al*., 2009). Small rainforest remnants and riparian forests are especially prone to weed invasion because of the fertile soils they grow on. The increased damage to rainforests in particular, provide ideal opportunities for invading weeds to alter ecosystem dynamics and functioning (Low, 2011). Camphor laurel *Cinnamomum camphora*, cats-claw creeper *Macfadyena unguis-cati*, and Chinese elm *Celtis sinensis* are some local examples of weeds that are highly invasive on rainforest edges and could increase their competitive edge under climate change (Low, 2011). In rural areas, weeds have more potential to benefit from bird dispersal than native species.

Appendix F Biodiversity values mapping methodology

This appendix provides further details of the methodology used to develop the mapping products and spatial analyses discussed in the main body of this report. The foundation of the approach was to develop a composite vegetation community map that integrated current RE Mapping and fine-scale vegetation mapping previously commissioned by Noosa Shire Council. This composite mapping provided a base for attribution of scored values representative of different biodiversity values and conservation significance. The specific method used to compile and refine this layer is described in the following section.

Compilation and Refinement of Composite Vegetation Mapping

Two complimentary vegetation mapping sources were integrated for analysis, Regional Ecosytem (RE) mapping (RE v9, Queensland Herbarium 2015) and Fine-Scale Vegetation Mapping commissioned by Noosa Council (FSV mapping). Previously the Noosa FSV product integrated earlier RE mapping (RE v.6) with analysis to accurately map the boundaries of remnant vegetation patches, vegetation contiguous with remnant vegetation, and patches of scattered trees.

The 'contiguous' vegetation class within the Noosa FSV product represents vegetation with remnant-like quality located immediately adjacent to designated remnant vegetation. Such areas may be of interest, in a planning sense, as part of potential biodiversity corridors, as impact buffers, or as species habitat. Areas designated as 'Other (Scattered) trees' within the FSV product represent smaller patches of potentially native vegetation not immediately adjacent to remnant vegetation.

The 'contiguous' and 'other trees' designations within the Noosa FSV dataset did not include details of vegetation type or other community details. This information was linked to the relevant polygons using the latest RE pre-clearing dataset (version 9.0). Subsequent analysis of both remnant (RE) and contiguous (FSV) datasets was undertaken using a combination of Lidar data and aerial photograph interpretation (API) to identify recently cleared land, undetected contiguous vegetation, and to improve the assignment of community type within mixed RE polygons (demosaic).

The first objective of vegetation mapping refinement was to enhance the accuracy of vegetation delineation by detecting areas of cleared vegetation currently assigned as remnant or contiguous, or to detect the presence of vegetation with potential biodiversity value. Lidar data involves a detailed array of spot heights of features on the ground surface, and the ground surface itself. Using recent Lidar we developed a GIS model (raster) of the height of surface features above the ground. Low values within this model reflected cleared areas or low vegetation and higher values reflected the presence of tall features, such as trees. We used classification of points inherent within the data to remove points designated as 'buildings' and set a height threshold of 10m to identify the presence of significant woody vegetation. GIS polygons were extracted where the presence of vegetation was not in agreement with vegetation mapping products. Polygons greater than 5 ha were checked through API and assessed as to the presence and value of vegetation. Designations included cleared areas, exotic vegetation, horticulture, plantations, or vegetation with quality consistent with contiguous vegetation in the fine-scale mapping product. Attribution of community

type for vegetation added to the contiguous category was assigned through the API process and through the RE pre-clearing information associated with that location.

The second objective of the Lidar and API analysis was to improve the community assignment of remnant and contiguous vegetation to facilitate better association to values such as conservation significance and Threatened Ecological Communities. Specifically, many vegetation polygons within the RE datasets (both remnant and pre-clearing) consist of mosaic, or mixed, polygons. These polygons have several (up to 5) communities assigned to the same location. Mixed polygons greater than 5 ha were identified and subjected to API to ascertain internal boundaries between comprising vegetation types.

A suite of 'Lidar indices' were developed to support the identification of vegetation communities and the separation of communities within mixed polygons. These indices involved GIS neighbourhood analyses of the previously developed Lidar tree height model and of a Lidar-derived Digital Elevation Model (DEM) of the ground surface. The indices developed included:

- Mean tree height within a 90m x 90m neighbourhood (reflects characteristics of dominant tree species and canopy cover);
- Standard deviation of tree height within a 60m x 60m neighbourhood (potentially reflects canopy cover and diversity of tree species);
- Topographic ruggedness – standard deviation of ground elevation within a 90m x 90m neighbourhood (reflects steepness and proximity to steep terrain);
- Topographic position – difference between elevation at a point and the mean elevation within a 90 x 90m neighbourhood (reflects whether a location is on a ridge, valley, mid-slope, or flat ground)

Vegetation communities were assumed to exhibit a signature for these measures. For example a community with uniform tall trees would look different to a community with a mixture of dominant tree types of varying heights. Example signatures for each index were compiled for the individual REs which commonly comprised mixed polygons. Signatures were selected from protected areas based on the assumption that vegetation would more likely be validated within these areas. Signatures were compiled as reference posters used by API investigators as a visual aid in conjunction with GIS layers representing indices and aerial imagery. Recompiled mixed polygons were then integrated back into the composite vegetation mapping.

A subset of all API validated polygons were ground-truthed as a quality check and adjusted as necessary. Ground-truthing consisted of a rapid assessment technique where information on RE type and condition was recorded for each polygon. Where access was limited, information was gathered via the use of binoculars or through extrapolation using nearby contiguous vegetation. A certainty / reliability score was applied to each assessment as follows:

1 = Ground-truthed (certain); 2 = Not directly ground-truthed but reasonably confident; 3 = Not confident but determination should be in proximity; 4 = uncertain

Any assessments deemed uncertain were not incorporated into the final mapping.

Derivation of the ecological condition 'base layer'

Raw and validated vegetation mapping products were integrated with regrowth, zoning and landuse data to form an Ecological Condition GIS dataset that served as a basis for assigning other biodiversity values. Datasets were compiled based on the following priority:

- Vegetation type classification validated by API/Lidar/Ground-truthing
- RE mapping (v9)
- Major roads (buffered by 10m) from Council roads layer
- Waterways from RE or Noosa zoning layer (identified from gaps in the zoning layer)
- Queensland Herbarium regrowth mapping
- Plantation mapping from RE or Queensland Landuse Mapping
- Urban areas from Noosa Zoning GIS layer
- Horticulture areas from Queensland Landuse Mapping
- Validated contiguous vegetation from Noosa FSV
- Other trees from Noosa FSV mapping

The development of the base layer involved a sequence of GIS overlays and joining attributes from disparate sources. The dataset was progressively categorised based on component datasets, vegetation types and zoning/tenure information. The categories and scoring for the base ecological condition layer is provided in the table below. Subsequent values utilised final categories from the base layer, or other attributes used in the development of the base layer (eg. RE, BVG, landuse, zone).

Overall scoring & minimum values

Following the individual scoring of biodiversity values attributed to the Ecological Condition GIS layer, the overall cumulative biodiversity scores were derived. This was done by adding individual biodiversity value scores at each location, using equal weighting for each value. This approach yielded a potential maximum score of 39, if the highest possible score was achieved for each value.

Consolidated biodiversity significance scores for the Noosa Shire ranged from 1 to 38, with a median of 7 (n = 19,359). In order to provide a spatial comparison of the distribution of biodiversity significance, five categories of biodiversity significance were developed. A range of biodiversity significance scores for each category was calculated, so that the distribution of biodiversity significance scores was even across all five categories. This approach was adopted to facilitate a comparative assessment of biodiversity significance across the shire, and to interpret the large proportion of scores that were skewed towards the low end of the distribution.

The scores pertaining to each category were calculated as follows:

- 0 to 20th percentile (biodiversity significance score of 0-3)
- 21st to 40th percentile (biodiversity significance score of 4-6)
- 41st to 60th percentile (biodiversity significance score of 7-14)
- 61st to 80th percentile (biodiversity significance score of 15-19)
- 81st to 100th percentile (biodiversity significance score of 20-38)

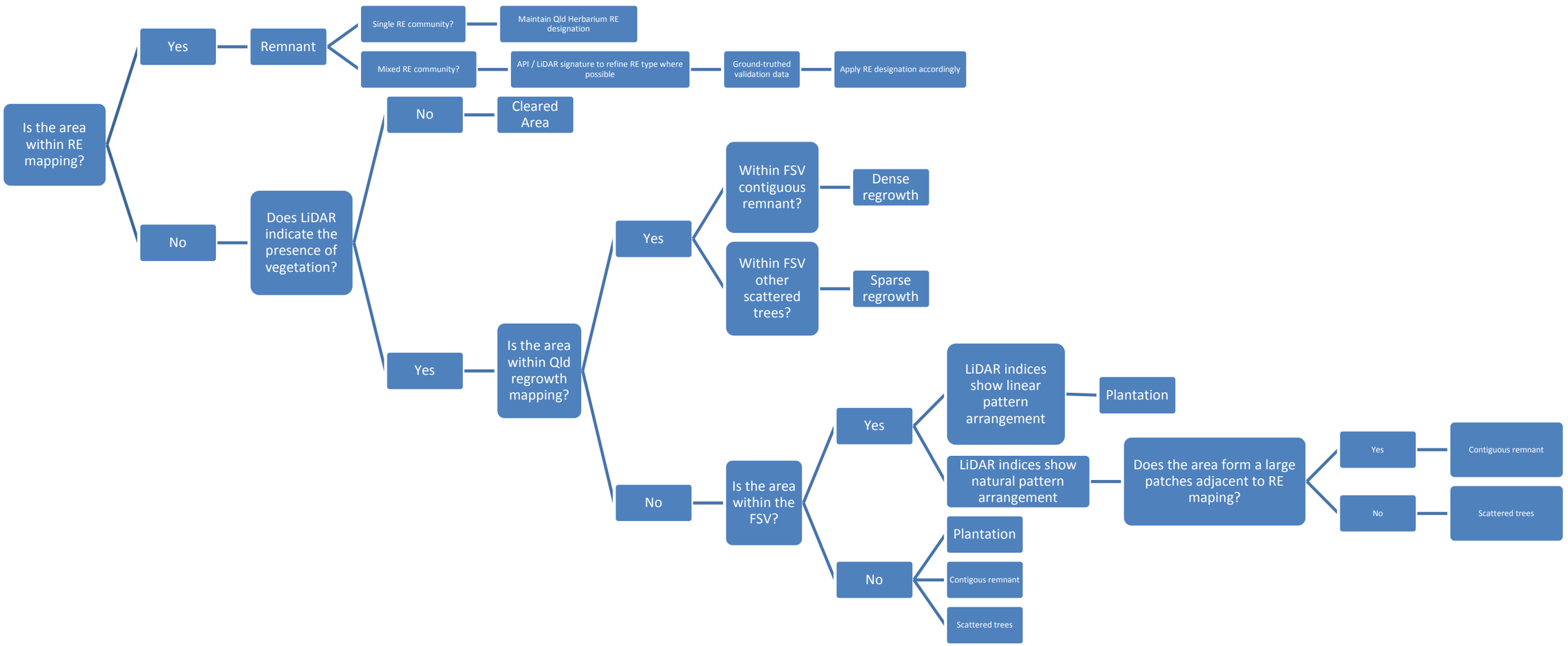
Minimum values rules were incorporated following the scoring to provide weighting to important values such as TEC, remnant vegetation, riparian vegetation and threatened species habitat. The minimum rules and associated percentile ranking is provided in the table below.

Biodiversity value	Minimum value
TEC	80th percentile
Endangered, Vulnerable or Migratory species habitat	80th percentile
Remnant vegetation	60th percentile
Riparian vegetation	60th percentile

The following table provides a summary of the data sources, method and scoring system. The following figure provides a flowchart of the process used to refine spatial data and assign the scores indicated below i.e. non-remnant & urban through to remnant.

Biodiversity value	Data sources	Method	Scoring system	Data output
Ecological condition	RE v 9.0 LiDAR (2016) Regrowth v 6.13 Field validation data Fine Scale Vegetation (FSV) Mapping (2012)	FSV & LiDAR Analysis • Lidar tree model to validate presence/absence of vegetation as per FSV • Local mean tree height, tree height variance and topographic indices derived to determine signatures of REs comprising mixed polygons • Lidar products used with API as part of the vegetation validation and compilation process illustrated below Vegetation validation, refinement and compilation • Undertaken for mixed RE polygons relating to relevant biodiversity values i.e. conservation status, TEC, under-represented RE • Initial API utilising imagery and LiDAR products to divide RE polygons into homogenous REs • Field validation for polygons unable to be split through API • Single RE designated to polygons where possible with level of certainty attributed • Exotic Camphor Laurel stands identified where possible Attribution 1. Urban – an urban overlay was created by selecting applicable residential, industrial, commercial and community services zones from the IPZ zones layer. These were buffered out, then in by 100m to remove gaps for roads. Area attributed as 'urban' 2. Condition attributed as per flow diagram shown below RE code attributed as per RE v 9.0 and field validation data	0 = non-remnant & urban* 1 = non-remnant cleared & plantation 2 = scatter trees 3 = sparse regrowth 4 = dense regrowth 5 = contiguous RE 6 = remnant	Base layer attributed with condition and RE code

* Purpose of the scoring is to provide a ranking system of all ecosystems at a broad LGA scale. It does not indicate a lack of biodiversity values within urban areas



The following table provides details of subsequent analyses, data used and data generated.

Biodiversity value	Data sources	Method	Scoring system	Data output
Conservation status	RE v 9.0 Pre-clear RE v 9.0 Base layer	Regional significance assessment of Least Concern REs • SEQ – from RE SEQ/clipped to Noosa • Pre vs Remnant – from RE layers • LC REs <150ha extent in Noosa • LC REs <30% pre-clear extent remains in Noosa • 12.2.15a Attribution • Selected based on REs assigned as per base layer methods • First RE in multi RE polys is dominant, RE 2-5 = sub dominant • Applied only to remnant, contiguous remnant and dense regrowth areas in the ecological condition layer • Applied to sparse regrowth and scattered trees if status was identified as Endangered	0 = urban area* 1 = plantation 2 = Least concern / sub-dominant regionally significant 3 = Regionally significant / sub-dominant of concern 4 = Of concern / sub-dominant endangered 5 = Endangered	Scored base layer for conservation status
Under represented REs	RE v 9.0 Pre-clear RE v 9.0 Base layer	Under represented RE assessment • QLD protected areas layer intersected with RE mapping – calculate area of each RE in protection • Select those REs from pre-clear layer and calculate original area in Noosa • 10% of pre-clear extent within protected reserves = high representation • 4%-10% of pre-clear extent within protected reserves = medium representation • <4% of pre-clear extent within protected reserves = low representation • Selection of multi RE polys based on RE1 • Classify based on area of pre-clear protected Attribution • Selected based on REs assigned as per base layer methods • First RE in multi RE polys	0 = medium to high preservation in Noosa & medium to high preservation in SEQ 1 = low preservation in Noosa & medium to high preservation in SEQ 2 = medium to high preservation in Noosa & low preservation in SEQ 3 = low preservation in Noosa and low preservation in SEQ	Scored base layer for under represented REs

Biodiversity value	Data sources	Method	Scoring system	Data output
		• Applied only to remnant, contiguous remnant and dense regrowth areas in the ecological condition layer		
Significant species presence	Atlas of Living Australia (2016) Wildlife Online (2016) Significant species list (**Appendix A & B**) Base layer	Significant species records • Threatened species records occurring with Noosa Shire • All common species records that were assessed as locally or regionally significant • Spatially valid points taken after 1980 Attribution • Point record extrapolated across Broad Vegetation Group from base layer	0 = no record 1= record in marginal habitat (sparse regrowth, scattered trees, cleared) 2 = confirmed record for locally significant 3 = confirmed regional 4 = confirmed record for NT 5 = confirmed habitat for V/E/M	Scored base layer for significant species
Wetlands	Farm dams Queensland wetland mapping HES wetland mapping Nationally important wetlands Canal mapping	Attribution • Nationally Important Wetlands mapping layer amended to remove urban areas • Attribution as per wetland data i.e. Nationally Important Wetlands, HES wetlands (referrable wetland mapping) • VMA wetlands attributed from Queensland wetland mapping for REs classified as 100% wetlands • Community containing wetlands attributed from Queensland wetland mapping • highly modified attributed from Queensland wetland mapping • Clipped out canals using state mapping	0 = not a wetland 1 = artificial wetland, highly modified wetlands & community containing small areas of wetlands (0 - 51%) 2 = community containing wetlands (51% – 80%) 3 = VMA wetlands 4 = wetland of High Ecological Significance 5 = Nationally important wetland	Scored wetland layer
TEC	Base layer	Attribution • Selected based on REs assigned as per base layer methods • First RE in multi RE polys is dominant, RE 2-5 = sub dominant • Lowland rainforest TEC REs = 12.3.1; 12.5.13a; 12.8.13; 12.11.1; 12.11.10; 12.12.1 and 12.12.16 • Saltmarsh TEC REs = 12.1.2 • Applied only to remnant, contiguous remnant and dense regrowth areas in the ecological condition layer	0 = Not a TEC 1 = Potential to be TEC sub-dominant 2 = Potential to be TEC 3 = TEC sub-dominant 4 = TEC	Scored base layer for TECs

* Purpose of the scoring is to provide a ranking system of all ecosystems at a broad LGA scale. It does not indicate the complete lack of biodiversity values within urban areas

Connectivity Attribute	Data sources	Method	Scoring system	Data output
Patch size	Base layer	Patch/connectivity base layer developed based on Queensland Offsets Policy – Landscape Fragmentation Tool • Remnant, contiguous, and contiguous regrowth combined to patch/connectivity base • Nodes and patches differentiated by > 1 ha remaining after removing 50m edge effect (core size)t. Large Node has internal core greater than 50 ha, medium 11-50 ha, small 1-10 ha • Node = core + edge • Patch = edge with core < 1 ha or no core • Matrix – area between nodes/patches – retains ecological condition attribute	0 = urban, roads, waterbodies* 1 = cleared, scattered trees, sparse regrowth 2 = patch 3 = small node 4 = medium node 5 = large node	Scored Patch Size Layer
Connectivity	Base layer	Adjacency assessment of proximity between habitat nodes (supported nodes) or degree of connection of patches to nodes • Medium and large nodes assumed to be self-supporting • Small nodes are supported if within 100m of another node • Patches directly connected if within 100m of a node • Patches indirectly connected (2nd level connection) if within 50m of a directly connected patch • 3rd level connection within 50m of a 2nd level connection, and so forth	0 = urban, roads, waterbodies* 1 = cleared, scattered trees, sparse regrowth, patch with no or lower order connection to node 2 - patch with indirect (2nd/3rd level) connection to node (core/edge) 3 - patch with direct connection to node 4 - small node - unsupported (not connected to another node) 5 - small node - supported 6 - medium & large node	Scored Connectivity Layer
Corridor	Base layer	Corridor mapping based on the results of the patch size and connectivity assessment as per above. Corridors identified and mapped by: • Maintaining large and medium nodes as per patch size classification. These were considered the base to which corridors need to connect / link • Identifying areas with high patch connection ratio i.e. areas already acting as a form of link • Identified areas buffered out by 250m to remove internal 'gaps' caused by clearings and then buffered in by 250m to bring corridor external boundaries back to original extent	N/A	Mapped corridors

Core to edge ratio		Edges considered in differentiation between nodes and patches above	N/A	

* Purpose of the scoring is to provide a ranking system of all ecosystems at a broad LGA scale. It does not indicate the complete lack of biodiversity values within urban areas

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