Lake Ainsworth
Coastal Management Program

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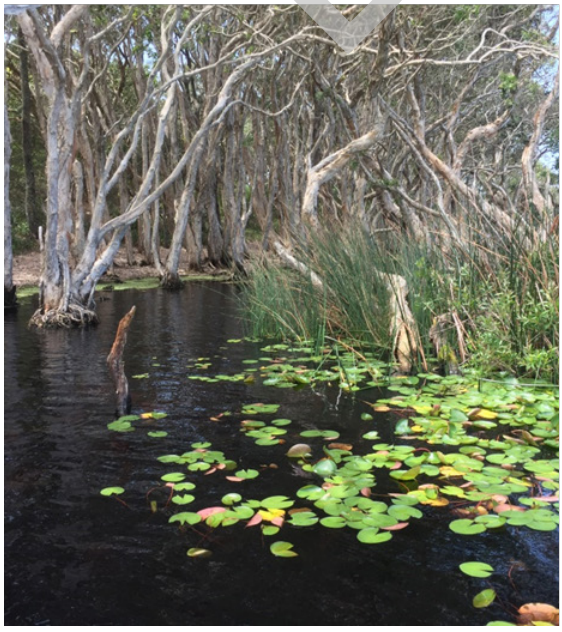

Draft Report

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Front cover photos: Aerial view of Lake Ainsworth, fringing vegetation and sailing boats on the lake

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Hydrosphere Consulting Pty Ltd
Suite 6, 26-54 River Street
PO Box 7059, BALLINA NSW 2478
www.hydrosphere.com.au

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18-009 LAKE AINSWORTH COASTAL MANAGEMENT PROGRAM

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ACKNOWLEDGEMENT TO COUNTRY

Ballina Shire Council acknowledges that the traditional Aboriginal custodians of this Country are the Nyangbul People (also spelt Nhangbul), part of the greater regional Bundjalung-Yugambeh language chain and part of the oldest surviving continuous culture in the world.

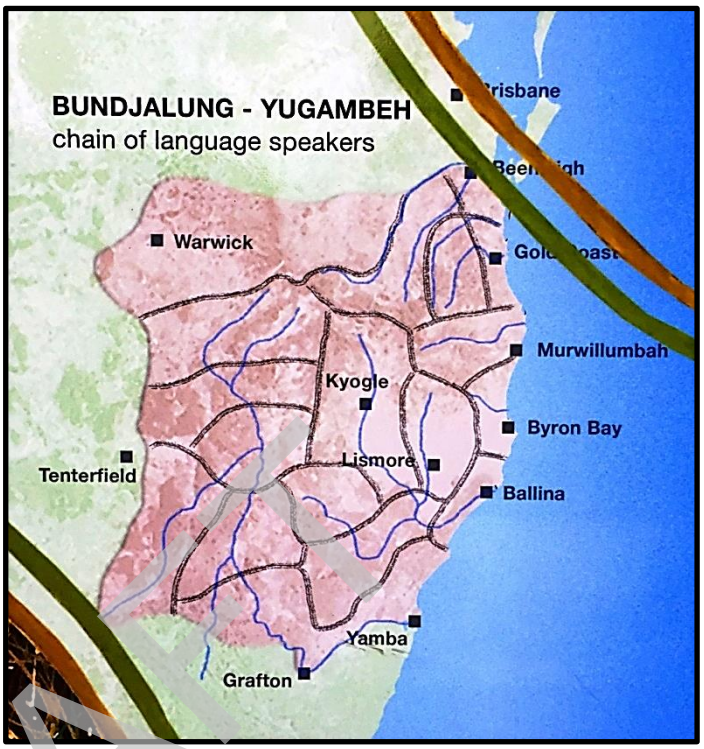

Plate 1: The Bundjalung-Yugambeh region (sign located at Angels Beach Ballina)

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EXECUTIVE SUMMARY

Lake Ainsworth borders the northern end of Lennox Head in Ballina Shire (Northern NSW) and covers an area of approximately 13 ha. The waterbody is surrounded by residential areas and holiday park facilities to the south, barrier dunes and Seven Mile Beach to the east, Newrybar wetlands and coastal heath to the west and north and sport and recreation facilities to the northeast. The study area for this Coastal Management Program (CMP) incorporates both the surface water and groundwater catchments of Lake Ainsworth covering an area of approximately 87 ha.

This CMP for Lake Ainsworth sets the long-term strategy for the coordinated management of the lake with a focus on achieving the objects of the *Coastal Management Act 2016* (*CM Act).* This CMP supersedes the current *Lake Ainsworth Management Plan* (GeoLINK, 2002).

This CMP has been developed in accordance with Stages 1 to 4 of the five stage process for developing and implementing a CMP, as detailed in the Coastal Management Manual (OEH, 2018). The completed stages supporting this CMP include the preparation of:

- *Stage 1 Scoping Study* (Hydrosphere Consulting, 2018) which reviewed the status of current issues and management and identifies the focus of the new CMP.
- *Stage 2 Vulnerabilities and Opportunities Study* (Hydrosphere Consulting, 2019a) incorporating detailed studies of the lake and assessment of threats to inform future management.
- *Stage 3 Management Options Study* (Hydrosphere Consulting, 2019b) that identified and assessed actions to address coastal management issues in an integrated and strategic manner consistent with provisions in Section 14 and 15 of the *CM Act 2016*.

Lake Ainsworth is a freshwater coastal dune window lake characterised by ‘tea’ coloured water and has long been regarded as an important community asset and tourism drawcard. The lake is utilised for a variety of water and shore-based activities including swimming, paddling and picnicking and is also an important educational resource with a rich cultural history.

Lake Ainsworth was in important ceremonial location and campsite for local Aboriginal people. The Ballina-Lennox Head district retains a strong cultural identity with the dialect subgroup known as the *Nyangbul* People, a sub-group of the broader-based *Bundjalung* people (Remnant Archaeology, 2017). The Broad Leaved Paperbark trees bordering the lake have been identified as culturally significant ‘Song Trees’ by local Aboriginal representatives, and are an iconic feature of the lake, providing shade, visual amenity and habitat for wildlife.

Lake Ainsworth is a unique and sensitive ecosystem providing significant ecological value within the local area and is home to a wide variety of plants and animals. Aquatic plants provide important ecosystem functions in the form of nutrient cycling, nutrient uptake, bank stabilisation, runoff filtration as well as providing food and habitat for aquatic fauna. The variety of habitats within the Lake Ainsworth catchment and the presence of both fresh and salt water in close proximity result in a high diversity of birdlife. An estimated 115 different species of birds have been identified in and adjacent to Lake Ainsworth including a number of migratory, vulnerable, threatened, endangered or critically endangered species under the NSW *Biodiversity Conservation Act 2016* or the Commonwealth *Environment Protection and Biodiversity Act, 1999* (EPBC Act) (BES, 2016; BES, 2017; GeoLINK, 2002; GeoLINK, 2017). Two endangered ecological communities (EECs) listed under the *Biodiversity Conservation Act 2016* have been recorded as occurring within the Lake Ainsworth catchment area: Littoral Rainforest located north east of the Sport and Recreation Centre and Swamp Sclerophyll Forest on coastal floodplains which surrounds the Lake and low-lying area west of the Lake Ainsworth Sport and Recreation Centre.

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Preparation of this CMP has included consultation with community and agency stakeholders. This consultation assisted in the understanding of key concerns and issues, priorities for management and development of local management objectives to guide the CMP and the long-term vision for the lake:

> **"*A scenic, healthy lake and surrounds for safe recreation, environmental values, community and culture.*"**

The key management issues currently affecting the health and amenity of Lake Ainsworth include:

- Blue green algae outbreaks – these have occurred periodically for many years, with records of serious outbreaks dating back to the 1980s. Blue green algae impacts on ecological health and recreational use through swimming closures due to public health risks and this is regarded as the highest priority for management by the community.
- Sediment quality – a survey of lake sediments in 2018 has confirmed the continued presence of a central basin of organic-rich muds in the lake which are acidic, oxygen-deficient, high in organic carbon and nutrient-rich. Testing has also indicated that levels of lead and mercury in sediments exceed ANZECC sediment quality guidelines at several locations. The internal cycling of nutrients and particularly phosphorus from lake sediments was confirmed during Stage 2 as the primary factor exacerbating blooms of blue green algae.
- Sunscreen has been identified as a potentially significant pollutant source contributing to frequently observed oily slicks on the water surface during peak use times, and chemical compounds known to effect ecological health. The potential for sunscreen to contribute to the nutrient load of the lake has also been identified which may add to algal bloom issues.
- In 2018, Beachwatch graded three of the four lake swimming sites as 'poor' in terms of contamination with faecal material. Further work is currently underway to confirm the sources of contamination.
- Foreshore erosion is also a key concern for the community with banks actively eroding which is exacerbated by stormwater flows, water level changes, wind and wave action and high levels of pedestrian access. A number of safety hazards have been identified in the vicinity of access points to the lake including potential for falls and trips, exposed roots and uneven ground.
- Litter can impact amenity and ecological values of the lake particularly during peak visitation periods.
- Concerns have been raised regarding dogs in the lake including faeces being left behind which may contribute to water quality decline and microbiological risk to human health as well as impacts of dogs on native wildlife (e.g. disturbance, injury etc.).
- Parking at the lake during peak times (i.e. school holidays, public holidays and long weekends) has been an issue for many decades and with increasing population and tourism pressures into the future, this impact is likely to increase.
- Overcrowding and overuse of the lake during peak holiday periods places high pressure on facilities, parking, recreational amenity and environmental values. Recent (2017) estimates during peak times reveal that visitor numbers now exceed 10 times the estimated carrying capacity of the lake. The carrying capacity represents the maximum number of visitors the area can accommodate without there being excessive deterioration of the environment or declining visitor satisfaction. One community member summed it up saying the lake is being "*loved to death".*
- Increasing use of the relatively 'untouched' western side of the lake was raised as a key concern for many stakeholders.
- Ocean shoreline recession along Seven Mile Beach is a key risk for the management of Lake Ainsworth. Coastal hazard predictions show the potential for ocean breakthrough to the lake within a

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50-year timeframe. Any connection with the ocean is likely to have significant implications for the ecology and public usage of the lake.

- Future lake flooding events may increase with predicted climate change impacts (both in frequency and magnitude).
- There is a general lack of knowledge and understanding of the cultural significance of the lake and many community members have expressed a strong desire to know more about the indigenous history and significance of the lake.
- There are a number of exotic aquatic weeds present within Lake Ainsworth which periodically create nuisance conditions impacting amenity and lake uses.
- A number of exotic aquatic fauna species have been identified in the lake, including typical aquarium species that may have been dumped in the lake, Cane toad and the non-endemic and invasive Redclaw Crayfish.
- The impact of increasing traffic and traffic speed along Camp Drewe Road and concerns about increasing road kill have been raised by the community.
- Riparian vegetation condition varies significantly around the lake with many areas experiencing disturbance through exotic species, a high level of pedestrian traffic, bank erosion, undercutting and exposure of tree roots including culturally significant 'Song Trees' (Broad Leaved Paperbarks) along the foreshore.
- There are also several bare ground areas along foreshores where grass has died, particularly in high use zones in the south-eastern corner, which affects recreational amenity and increases erosion impacts.

This CMP provides a management framework that aims to protect the social, ecological and cultural values associated with the lake and to manage the often conflicting desire for protection of ecological values as well as optimising recreational opportunities. The approach is consistent with the long-term vision, the management objectives and the locally derived community values for the lake. The CMP recognises that the lake has suffered impacts from past and current human use and faces current and future pressures including population increases and natural influences such as flooding, sea level rise and climate change.

The CMP designates general management/use zones around the lake. This approach recognises the key processes influencing the ecological health, recreational amenity and cultural values of the lake as well as key pressures to be faced in the future. Sitting underneath this overall approach are a suite of coastal planning and management actions that have been developed and prioritised based on the assessed risk of the threats to the lake. Actions consist of a combination of studies, investigations and on-ground works and were selected to address the key risks to the lake. Actions are based on professional consideration of the legal, technical and engineering feasibility, the economic viability and the acceptability of actions to the community and stakeholders. Additional management requirements identified to protect the lake from coastal hazard impacts (e.g. coastal recession, oceanic break-through and wave run-up and dune overtopping) have been discussed and will be considered separately in the development of the future Ballina Coastline CMP which will replace the certified the *Ballina coastline CZMP* (GeoLINK, 2016).

A Business Plan has been developed for the CMP which outlines the key components of the funding strategy for the CMP, including the cost of proposed actions, proposed cost-sharing arrangements and other potential funding mechanisms. The CMP actions are expected to be funded through Ballina Shire Council (BSC) and state government contributions, monetary grants and volunteer works by community members and organisations. Management actions have been developed for a ten year period and have been aligned with Council's four year Delivery Programs (DP) under the NSW Integrated Planning and Reporting (IP&R) Framework. This CMP and the progress of the management actions will be reviewed to ensure the actions remain relevant and the implementation of the plan is being achieved.

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CONTENTS

1. INTRODUCTION 1
1.1 Purpose and scope 1
1.2 Area covered by this CMP 1
1.2.1 Social and economic setting 3
1.2.2 Existing management arrangements 3
1.3 Vision, objectives and strategic direction 4
1.3.1 The vision for Lake Ainsworth 4
1.3.2 Lake Ainsworth community values and local management objectives 5
1.3.3 Coastal Management Area objectives 6
1.4 Key stakeholders, their interests and issues 7
1.4.1 Land managers and government agencies 7
1.4.2 Consultation activities 8
1.4.3 The local community 9
1.4.4 Local Aboriginal community representatives 10
1.4.5 Lennox Head Landcare 10
1.4.6 Lake Ainsworth Interest Group (LAIG) 11
1.4.7 Preserving Lake Ainsworth Inc. 11
1.4.8 Lake Ainsworth Wildlife Watch Lennox Head 11
2. SNAPSHOT OF ISSUES 12
2.1 Water quality and blue green algae 12
2.2 Sunscreen pollution 13
2.3 Sediment quality 13
2.4 Litter 13
2.5 Dog access 13
2.6 Foreshore erosion 14
2.7 Overcrowding 14
2.8 Parking 14
2.9 Lack of understanding about indigenous cultural significance 15
2.10 Increasing use of the western side of the lake 15
2.11 Climate change, coastal hazards and flooding 16
2.12 Weeds and pest species 16
2.13 Riparian Vegetation 17

DRAFT

3. OVERALL MANAGEMENT APPROACH 18
4. MANAGEMENT ACTIONS 21
4.1 Actions to be implemented by Ballina Shire Council 24
4.1.1 Water quality 24
4.1.2 Sediment management 25
4.1.3 Bank erosion 26
4.1.4 Catchment management 28
4.1.5 Flooding 30
4.1.6 Flora and fauna 31
4.1.7 Community uses 38
4.1.8 Education 44
4.1.9 Monitoring 46
4.1.10 Management and governance 48
4.1.11 Performance monitoring and review of actions 49
4.2 Actions to be undertaken by public authorities 51
4.2.1 Flooding 51
4.2.2 Flora and fauna 51
5. BUSINESS PLAN 52
5.1 Funding and resources 52
6. MAPPING 56
REFERENCES 59
GLOSSARY AND ABBREVIATIONS 60
APPENDIX 1. LINKS TO THE OBJECTS OF THE *COASTAL MANAGEMENT ACT 2016* AND THE *MARINE ESTATE MANAGEMENT ACT 2014* 63
APPENDIX 2. COASTAL HAZARD CONSIDERATIONS FOR THE FUTURE BALLINA COASTLINE CMP 69
APPENDIX 3. NSW COASTAL MANAGEMENT FRAMEWORK AND MANDATORY REQUIREMENTS 73

FIGURES

Figure 1: Lake Ainsworth CMP study area 2
Figure 2: Lake Ainsworth management zones 19
Figure 3: Summary of Lake Ainsworth CMP management actions 23
Figure 4: Coastal management areas for Lake Ainsworth (excluding coastal vulnerability) 57
Figure 5: Existing land management responsibility 58

DRAFT

PLATES

Plate 1: The Bundjalung-Yugambeh region (sign located at Angels Beach Ballina) I

Plate 2: The long-term vision for Lake Ainsworth.....4

Plate 3: Left: The community survey link provided on project webpage; and Right: The paper version of the survey 9

Plate 4: Lake Wildlife Spotters kids activity booklet produced by the Lennox Head Residents Association and Lennox Head Landcare with support from Ballina Shire Council. 11

Plate 5: Cyanobacteria bloom, Lake Ainsworth January 2019.....12

Plate 6: Main sediment types in Lake Ainsworth: Left: 'gelatinous' organic–rich muds, Right: medium sands 13

Plate 7: Foreshore erosion at the lake 14

Plate 8: Traffic congestion on the eastern road (Source: Google street view, January 2010).....14

Plate 9: Informal access to western side of the lake 15

Plate 10: Coastal dune system separating the lake from Seven Mile Beach.....16

Plate 11: Exposed roots of mature Broad-leaved Paperbark trees along the south-eastern foreshore 17

Plate 13: Aerial image of the dunes separating the lake from the Pacific Ocean 72

Plate 14: Aerial view of Surf Club and potential over-wash areas 1 and 2 72

TABLES

Table 1: Ballina Shire population forecasts 3

Table 2: Lake Ainsworth community values and local management objectives 5

Table 3: Coastal Management Area objectives adopted from the *Coastal Management Act, 2016* 6

Table 4: Summary of management zones, key uses and goals 20

Table 5: Priority Ranking 21

Table 6: Business Plan.....55

Table 7: Alignment of the locally specific coastal management values and objectives with the objects of the *Coastal Management Act 2016* and the *Marine Estate Management Act 2014* 67

Table 8: Addressing the Essential Elements of the *NSW Coastal Management Manual (OEH, 2018)*.....75

DRAFT

1. INTRODUCTION

1.1 Purpose and scope

The purpose of the Lake Ainsworth Coastal Management Program (CMP) is to set the long-term strategy for the coordinated management of the lake with a focus on achieving the objects of the *Coastal Management Act 2016* (*CM Act).*

This CMP incorporates management actions and strategies to address key threats and support a diversity of uses at the lake into the future. This CMP considers the range of timeframes (immediate, 20 years, 50 years, 100 years) where appropriate as required by the *CM Act*. Management actions have been developed to balance and manage uses so that they are compatible with the environmental, social and economic values of the lake with reference to a 10 year management timeframe reflecting the implementation phase of the CMP. Longer-term pressures such as climate change and sea level rise have been considered in the formulation of management actions to ensure resilience against future threats and the conservation of the values of the lake for future generations.

1.2 Area covered by this CMP

Lake Ainsworth is a freshwater coastal dune window lake with naturally acidic (pH 5-7) tannin-stained waters located in the Northern Rivers region of NSW within the Ballina Local Government Area (LGA) (Figure 1). The lake borders the northern end of Lennox Head and covers an area of approximately 13 ha. The waterbody is surrounded by residential areas and holiday park facilities to the south, barrier dunes and Seven Mile Beach to the east, Newrybar wetlands to the west and sport and recreation facilities to the north. The bordering barrier dunes to the east currently prevent ocean water intrusion into the lake.

The boundary of the Lake Ainsworth CMP study area follows the catchment of Lake Ainsworth covering an area of approximately 87 ha (Figure 1). The catchment was defined by the previous Lake Ainsworth Processes Study (AWACS, 1996) and approximates both the surface water and groundwater catchments of the lake, which are the major factors affecting ecological processes and function in this waterbody. While the CMP does consider the impact of coastal hazards from the adjacent coastline, the study area does not encompass the open coast and Seven Mile Beach as this area is dealt with separately in the *Ballina Coastline CZMP* (GeoLINK, 2016) and will be incorporated into the future Ballina Coastline CMP.

This relatively small catchment area contains no major tributaries and is comprised of relatively low relief topography. The majority of the study area is zoned as ‘Deferred Matter’ under the Ballina Local Environmental Plan (BLEP 2012) therefore the BLEP 1987 still applies with these areas zoned as ‘Environmental Protection’. The catchment contains pockets of recreation and accommodation areas (Sport and Recreation Centre and Camp Drewe) to the north, picnic areas along the eastern and southern foreshores and a holiday park comprising cabins and campsites to the south. The vegetation surrounding these areas consists of heathlands and melaleuca wetlands. Natural leaching of humic acids and tannins from these areas enter the lake through groundwater flows which contribute to the characteristic ‘tea’ colour of the water. The catchment area extends predominantly north, parallel to the coastline and away from Lennox Head, and is bordered by a north-south ridge line to the west separating the lake catchment and the Newrybar wetlands.

The Lake Ainsworth catchment area is a popular destination for visitors and locals, providing a natural resource for undertaking various recreational activities such a swimming, kayaking, sailing, fishing, bushwalking, picnics, BBQs, dog walking and bird watching. The waterbody is classed as navigable water under the *Marine Safety Act 1998,* however it’s primarily used by passive craft due to the size, depth and the lack of a public boat ramp. The lake is considered a significant natural icon and drawcard to the area which contributes to the local economy.

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Lake Ainsworth was a significant ceremonial location and campsite for local Aboriginal people. The Ballina-Lennox Head district retains a strong cultural identity with the dialect subgroup known as the *Nyangbul* People, a sub-group of the broader-based *Bundjalung* people (Remnant Archaeology, 2017).

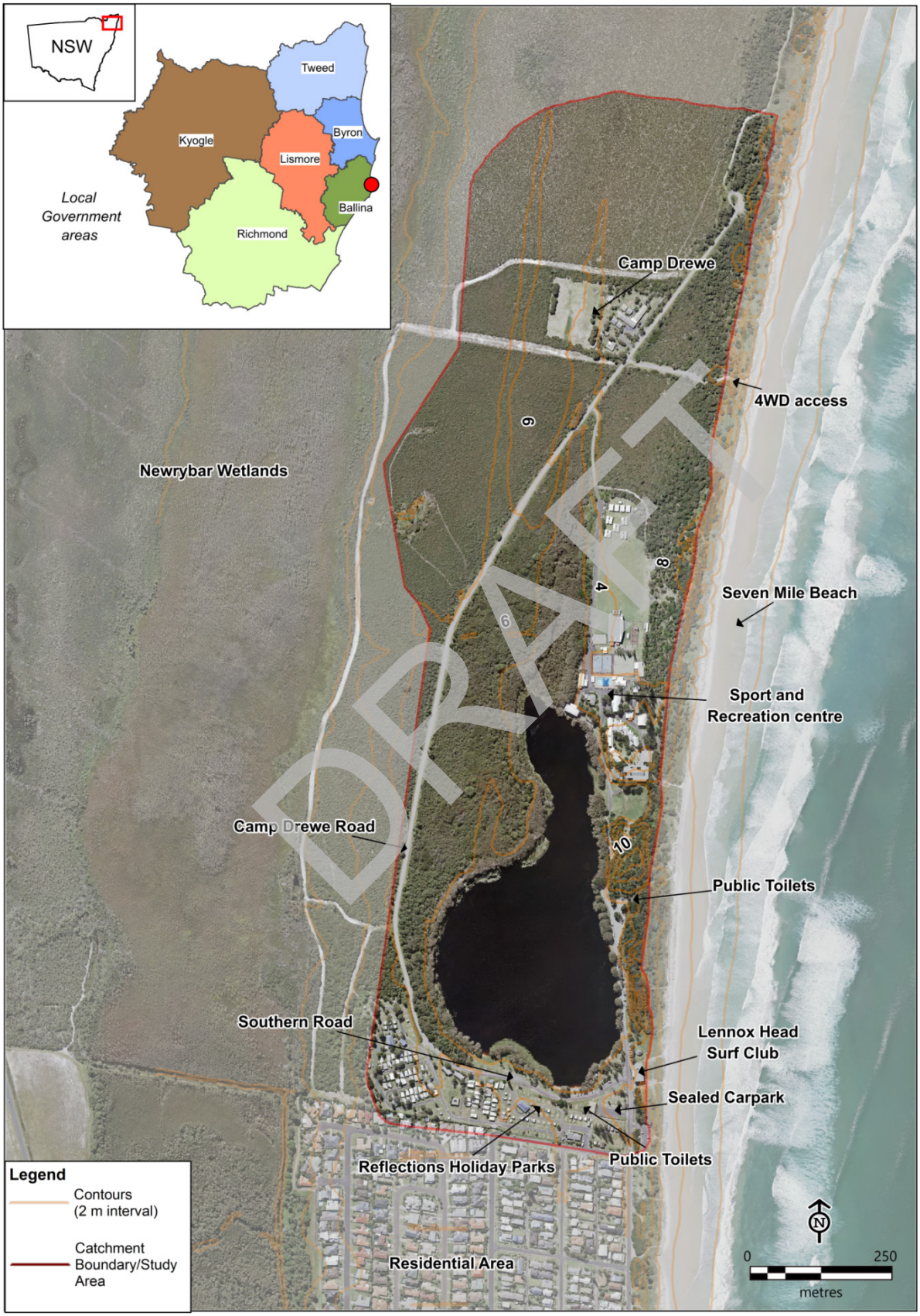

Figure 1: Lake Ainsworth CMP study area

1.2.1 Social and economic setting

Lake Ainsworth is located in Lennox Head on the far north coast of NSW within the Ballina Shire Council (BSC) area. The area is an attractive place to live and visit but is facing major demographic changes due to population growth and increasing tourism. Population forecasts (Table 1) show an increase of 17.6% (7,668 people) between 2018 and 2036 in the Ballina Shire. Lennox Head is predicted to be one of the fastest growing areas with an almost 30% increase in population forecast over this time, primarily due to the high number of greenfield growth areas (.id, 2017). Tourism is a major industry and visitor numbers to the region are growing with a 34% increase in 2018 visitor numbers compared to 2010 (Destination NSW, 2018). The *Far North Coast Regional Strategy* (DoP, 2006) recognises that population growth and tourism will put increased pressure on natural assets such as Lake Ainsworth and the protection of these highly valued environments is a key challenge for the region.

Table 1: Ballina Shire population forecasts

Location	2018	2036	Increase
Ballina Shire	43,570	51,238	17.6%
Lennox Head	6,643	8,613	29.6%

Source: (.id, 2017)

1.2.2 Existing management arrangements

The Lake Ainsworth catchment area is comprised mainly of Crown land managed by different appointed trustees (land managers). Figure 5, Section 6 (Mapping) shows the management arrangements for the catchment area separated into the following areas and management categories:

- Land surrounding the eastern, southern and western shore of the lake is Crown land managed by Council. This also includes the land containing the Lennox Head - Alstonville Surf Lifesaving Club (SLSC) and Seven Mile Beach.
- Land south of the lake is Crown land managed by the NSW Crown Holiday Parks Land Manager (trading as Reflections).
- The northern section of the lake waterbody and surrounding reserves is also Crown land managed by the NSW Office of Sport. This area contains the Lake Ainsworth Sport and Recreation Centre.
- The southern section of the lake waterbody is Crown land with no appointed trustee.
- A small section of the lake bed used for the aerator program is Crown land, held under licence and managed by Council.
- North of the area managed by NSW Office of Sport is Camp Drewe on Crown land leased to the Presbyterian Church.
- A Crown road parcel runs along the southern boundary of Camp Drewe.
- The far northern reaches of the catchment contain freehold land managed by Jali Local Aboriginal Land Council (LALC).
- The small section of land at the southern reaches of the catchment is freehold residential land.

There are numerous management programs being implemented by BSC, government agencies, statutory bodies and community groups in parallel with the preparation of the Lake Ainsworth CMP (refer Scoping Study, Hydrosphere Consulting, 2018 for full list and discussion). Many of these initiatives are related to the management of the water quality of Lake Ainsworth, surrounding infrastructure, vegetation, dune stability and foreshore area management. At the time of writing this CMP, BSC are currently undertaking significant

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foreshore improvement works along the eastern and southern sides of the lake including closure of the eastern road, erosion rehabilitation, and provision of pathways, picnic tables, barbeques, parking and stormwater treatment devices. This CMP complements and informs existing and proposed plans of management and updates and improves various management strategies with current knowledge and understanding of issues.

1.3 Vision, objectives and strategic direction

1.3.1 The vision for Lake Ainsworth

The long term vision for the lake, the community values, and specific local objectives relevant to those values are based on the following sources of information:

- The values, threats and management priorities identified in the *Stage 1 Scoping Study* (Hydrosphere Consulting 2018) and *Stage 2 Vulnerabilities and Opportunities Study* (Hydrosphere Consulting, 2019a) incorporating the findings of stakeholder consultation.
- The most important attributes for Lake Ainsworth nominated by the community and over 275 unique vision statements provided by the community in the Lake Ainsworth Community Survey reported in *Stage 2 Vulnerabilities and Opportunities Study* (Hydrosphere Consulting, 2019a).
- A Lake Ainsworth CMP Steering Committee Vision Workshop undertaken in June 2019.
- The relevant management objectives set out in the *Coastal Management Act 2016* and the objects of the *Marine Estate Management Act 2014*.
- The objectives of the *BSC Community Strategic Plan 2018 - 2028*.

The long-term vision for Lake Ainsworth is shown in Plate 2.

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Plate 2: The long-term vision for Lake Ainsworth

1.3.2 Lake Ainsworth community values and local management objectives

The key values of the estuary held by the local community, along with specific local objectives determined for those values are provided in Table 2. The alignment of these objectives with the objects of CM Act and the objects of the *Marine Estate Management Act 2014* is identified in Appendix 1.

Table 2: Lake Ainsworth community values and local management objectives

Values	Lake Ainsworth local management objectives
Environmental Values	
Water quality	1. to improve and maintain water quality and ecosystem health of the lake and surrounding habitats. 2. to reduce threats and improve the resilience of the lake to all current and future threats.
Natural habitats and biodiversity	3. to protect and enhance the coastal environmental values and natural processes of the lake and enhance natural character, scenic value, biological diversity and ecosystem integrity. 4. to encourage and support plans and strategies to improve the health and resilience of the lake and catchment area.
Recreational, Cultural and Community Values	
Scenic quality and amenity	5. to protect and enhance the recreational, scenic, social and cultural values of the catchment area. (Also linked to objectives 1-4)
Public access to and use of the lake and foreshore	6. to improve and maintain public access and safety, facilities and infrastructure within the catchment area.
Education, engagement and public opinion	7. to actively engage with the public to achieve greater awareness, education and understanding of management issues and actions. 8. to support public participation in the coastal management and planning process.
Aboriginal cultural heritage and practice	9. to understand, protect and respect the aboriginal heritage value of the lake including aboriginal peoples' spiritual, social, customary and economic use of the catchment area.
Coastal risk and adaption to climate change	10. Identify coastal hazard risks and develop actions that increase the adaptive capacity of land managers, the community and natural systems to the predicted impacts of climate change, including increased storm intensity and sea level rise.
Economic Values	
Local economy, jobs and prosperity	11. to support integrated and co-ordinated coastal planning, management and reporting (achieving above objectives will contribute to local economic values through enhanced tourism and associated business activity).

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1.3.3 Coastal Management Area objectives

The Lake Ainsworth CMP encompasses all four coastal management areas defined in the CM Act. Mapping of coastal management areas has been completed by DPE (2017) and is shown in Section 6 - Mapping, Figure 4. The CMP provides a management framework to guide coastal management and planning for Lake Ainsworth, in response to the relevant objectives for each coastal management area from the CM Act (Table 3).

Table 3: Coastal Management Area objectives adopted from the *Coastal Management Act, 2016*

Coastal Management Areas	Coastal Management Area objectives
CMA1 – Coastal Wetlands and Littoral Rainforests[1]	1. To protect coastal wetlands and littoral rainforests in their natural state, including their biological diversity and ecosystem integrity. 2. To promote the rehabilitation and restoration of degraded coastal wetlands and littoral rainforests. 3. To improve the resilience of coastal wetlands and littoral rainforests to the impacts of climate change, including opportunities for migration. 4. To support the social and cultural values of coastal wetlands and littoral rainforests. 5. To promote the objectives of State policies and programs for wetlands or littoral rainforest management.
CMA2 – Coastal Vulnerability Area	6. Managing current and future risks from foreshore/bank erosion, coastal lake instability and tidal inundation. 7. Maintaining public access, use and amenity of foreshores. 8. Encourage land use that reduces exposure to coastal hazards over time. 9. Avoiding adverse impacts on adjoining land, resources and assets. 10. Maintaining essential infrastructure. 11. Improving the resilience of coastal communities.
CMA 3 – Coastal Environment Area	12. To protect and enhance the coastal environmental values and natural processes of the estuaries. 13. To enhance natural character, scenic value, biological diversity and ecosystem integrity. 14. To reduce threats to, and improve the resilience of the estuaries. 15. To maintain and improve water quality and estuary health. 16. To maintain the presence of natural features of foreshores. 17. To maintain and, where practicable, improve public access, amenity and use of estuary foreshores.
CMA 4 – Coastal Use Area	18. To support sustainable coastal economies and ecologically sustainable development. 19. To protect and enhance the scenic, social and cultural values of the study area through: • appropriate type, size and scale of development. • providing adequate public open space and associated public infrastructure. • avoiding adverse impacts of development on cultural and built environment heritage.

1. Objectives also apply to the 'proximity area' surrounding the vegetated area, to ensure that development near the coastal wetlands and littoral rainforest considers downstream effects.

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1.4 Key stakeholders, their interests and issues

An overview of key stakeholders, their interests and issues, and how they have been consulted as part of the CMP is provided in the following sections.

1.4.1 Land managers and government agencies

Ballina Shire Council (BSC)

BSC is responsible for the management of the southern, eastern and western foreshore areas of the Lake and adjoining coastal lands to the east. Council also operate the aerator in the lake and conducts regular water quality monitoring and management of blue green algae alerts. BSC received funding through the 2016/17 NSW Government Coastal and Estuary Grants Program to prepare the Lake Ainsworth CMP and is overseeing all aspects of the CMP development.

Department of Planning, Industry and Environment (DPIE - Crown Lands)

DPIE - Crown Lands is responsible for management of the southern portion of the water body. The department is also responsible for appointing the Crown land managers and administering the leases and licences for the rest of the Crown land within the study area.

NSW Office of Sport

NSW Office of Sport is responsible for the management of the northern portion of the water body, foreshores areas and surrounds to the east, west and north. Lake Ainsworth Sport and Recreation Centre occupies a large area immediately north of the lake and water-based activities on the lake comprise a key element of the Centre's activities. Providing safe access to the water is a key requirement for the Centre which is currently impacted by bank erosion and lake closures due to blue green algae blooms.

NSW Crown Holiday Parks Land Manager

Reflections Holiday Park Lennox Head is situated south of the lake. The park offers a range of accommodation options including unpowered and powered sites and lakeside cabins and the natural beauty of the lake and surrounds is a key drawcard for tourists. Water quality and safe water access are key concerns for the Park.

Lennox Head Surf SLSC

The Lennox Head-Alstonville SLSC is located adjacent to the south-east corner of the lake on BSC managed land.

Jali LALC

Jali LALC is a community body constituted through the NSW *Aboriginal Land Rights Act 1983*. It represents Aboriginal people from Byron Bay to Evans Head to West Alstonville and offers a range of community services. Jali LALC owns freehold land in the north of the Lake Ainsworth catchment and holds cultural knowledge relevant to Lake Ainsworth. Jali LALC bush regenerators have been undertaking restoration works targeting exotic and invasive vegetation within the Lake Ainsworth catchment area.

Department of Planning, Industry and Environment - Environment, Energy and Science – Coast and Estuaries (EES – Coast and Estuaries)

EES – Coast and Estuaries works with local councils and communities to maintain or improve the health of estuaries/lakes and enhance associated recreational experiences in NSW. EES – Coast and Estuaries also works closely with local councils and communities to reduce threats from flooding and coastal storms and ensures that people in NSW are well informed about these risks and better equipped to adapt to climate

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change. EES – Coast and Estuaries has provided funding to Council for the development and preparation of the Lake Ainsworth CMP.

1.4.2 Consultation activities

Achievement of the CMP vision and objectives is reliant on community understanding and effective involvement in the preparation and delivery process. On-going community involvement is required to ensure actions are implemented effectively and in a way that meets community expectations.

A detailed program of community and stakeholder consultation was undertaken during CMP development. Consultation activities included:

- Meetings with the Project Steering Committee made up of the study area land managers and ongoing liaison as required. This group comprised representatives of BSC, DPIE-Crown Lands, NSW Office of Sport, EES - Coast and Estuaries, Reflections Holiday Park, and Lennox Head SLSC. The project team met with the Project Steering Committee throughout the project at key milestones to ensure oversight and involvement at every stage.
- Community online and paper-based survey – There was a strong response to the survey with 327 on-line and 150 hard copy surveys (477 total surveys) completed.
- Project webpage – A project webpage was used to introduce the project, provide a link to the on-line community survey and provide project updates, documents and contact details for further information. The webpage also contained a “Communication Portal” section where the public could provide information and feedback to the project team for consideration. The webpage can be viewed at: www.hydrosphere.com.au/lakeainsworth.
- Media and advertising – various forms of media were utilised to advertise the project and encourage community involvement in the survey and stakeholder meetings including posters, media releases, newspaper articles, radio broadcasts, social media posts, articles in the Lennox Wave (local community magazine) and the BSC Community Connect distributed to Ballina Shire residents.
- Lennox Head market stall - Project staff were present at the market on 9th December 2018 to discuss the project with community members and answer questions.
- Targeted stakeholder consultation with key stakeholder groups including phone calls, email or letters and face-to face meetings - written submissions were provided by members of the community for consideration.
- A community drop-in session was held in November 2018 and provided an opportunity for informal discussions between the community, stakeholders and the project team to discuss issues and obtain feedback during Stage 2 of the CMP. Another community drop-in session will be held during public exhibition of the CMP.
- Notification, registration and face to face meetings with representatives of the local Aboriginal Community to discuss the CMP and to provide an opportunity for informal discussions between community members and the project team about the cultural significance of the lake and potential future management.
- BSC Councillor Workshops at key project stages to provide information and receive feedback.
- Public Display - The Final Draft CMP will be placed on public exhibition. Formal (written) submissions on the Draft CMP will be sought from the community and stakeholder groups. Submissions will be considered in the development of the Final CMP.

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Plate 3: The community survey link provided on project webpage

1.4.3 The local community

The Lake Ainsworth Community Survey (Oct 2018 – Jan 2019) canvassed the local community on a number of topics associated with the lake. The following points provide an overview of community interests and issues expressed through the survey:

- The lake is highly valued for its natural scenic beauty and as a place for relaxation and recreation.
- This natural setting provides an important recreational opportunity with swimming and picnicking/BBQs being the most popular activities followed by paddling activities (canoeing/kayaking/boarding etc.), walking, a place for children/kids parties and wildlife watching/nature appreciation.
- The lake is visited year-round at varying degrees with summer being the most popular season, followed by spring and autumn. While winter was the least popular time, 38% (97) of respondents said they still visited the lake either every day or a few times a week in this season.
- When asked to rate the overall health of the lake, the community gave an average score of 54 out of 100, equating to just slightly better than “neither healthy or unhealthy” on the provided rating scale. The major factors believed to be affecting lake health were cyanobacteria, water quality problems, overcrowding, sunscreen pollution, dogs, rubbish and litter, foreshore erosion and runoff. Many respondents noted that water quality issues and algal blooms were only a problem during summer when overcrowding/over use and hot weather contributed to poor health.
- There were concerns about a number of issues that need to be managed to ensure the health and amenity of the lake into the future. In order of greatest concern, the issues were algal blooms, foreshore erosion, litter, habitat loss, poor water quality, and overcrowding. Over three-quarters of the community provided details of “other” concerns for management consideration including increased use of western side into the future, dogs, low levels of understanding and respect for the lake ecosystem and Aboriginal heritage, lack of education and effective signage, impact of catchment land use, potential future parking issues, anti-social behaviour, not enough garbage bins,

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population growth pressures, lack of management action and concerns about future changes to the lake's natural beauty.

- Management priorities matched the main issues perceived by the community with the highest priorities being (in order of priority) improving water quality, protecting/improving natural habitats/wildlife, better public education about protection of the lake's sensitive ecosystem, addressing foreshore erosion, stormwater treatment and reducing amount of litter/rubbish.
- When asked to imagine the lake in 10 years' time, survey respondents overwhelmingly (89% or respondents) expressed a strong desire for good water quality (no cyanobacteria, no surface scums/safe to swim). Stable foreshores (no erosion) (50%), healthy vegetation (47%) and scenic beauty (45%) and abundant wildlife (40%) were also highly desirable.
- Over half of the survey respondents provided their vision for the lake in 10 years' in their own words. There were a wide range of responses provided, with the most frequently mentioned aspects related to maintaining and preserving the natural beauty of the lake, improved water quality, no erosion and having a safe, clean and family friendly place accessible to all to enjoy nature in peace. Many respondents expressed a desire for the lake to remain as close to nature as possible without major changes to the current aesthetics and feel of the area. There was a desire for improvements to enhance the natural attributes and address key issues (e.g. water quality, foreshore erosion, algal blooms etc.). There was a broad spectrum of visions for the lake with regard to future access ranging from those wanting to see access increased with more parking, to those wanting no change or reduced parking to help control overcrowding and negative social and environmental impacts. Others envisioned encouragement of alternative transport options such as cycling, walking and shuttle bus services to reduce congestion.

1.4.4 Local Aboriginal community representatives

Aboriginal people hold cultural knowledge relevant to determining the cultural significance of the area. The key concerns and interests are water quality (algae, nutrients and sunscreen pollution), bank erosion, protection of flora and fauna especially turtles nesting on western side of road and ducks nesting along western foreshore, the possibility of unexploded bombs at the back of Seven Mile Beach (used historically as bombing range from Evans Head RAAF base), impact of the old Council rubbish tip along the eastern side of Byron Bay Road (Jali land), protection of the western side of the lake due to presence of cultural sites, protection of 'song trees' (melaleucas) along the foreshore that have special cultural significance, the need to keep the area as natural as possible, pests and weeds especially cane toads, ground asparagus, bitou bush and lantana, the need for education around cultural values and desire for local Aboriginal people to be involved in CMP implementation works such as landscaping and bush regeneration.

1.4.5 Lennox Head Landcare

Lennox Head Landcare undertakes vegetation management at the lake and surrounding areas including removal of terrestrial and aquatic weeds, native vegetation plantings, fencing and coastal dune protection works. Key interests and issues nominated by the group in relation to management of Lake Ainsworth were stormwater treatment, provision of appropriate riparian vegetation, use of suitably durable grass type for high use areas, underground replacement or relocation of power lines to reduce vegetation damage from ongoing maintenance, maintenance of existing buffer between Camp Drewe Road and Lake Ainsworth with modifications to rationalise access tracks, restore fencing to protect lake edges, remove parking space along road, manage road runoff, investigation of introduced flora and fauna species in the lake, need for a management structure to coordinate all agencies, effective signage/notice boards to educate and promote understanding of the natural attributes of the lake, sensitivities and key issues and encouraging low-impact use/practices to protect the lake.

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1.4.6 Lake Ainsworth Interest Group (LAIG)

The LAIG represents the Ballina Environment Society, Lennox Head Residents' Association and Lennox Head Landcare. Their key interest and issues include water quality issues and blue-green algae outbreaks, need for an overriding management body to oversee lake management, defining areas of acceptable uses (e.g. boat launching, swimming etc.), western side increasing use pressures, appropriate signage/education (e.g. appropriate behaviour, Aboriginal heritage, keep sunscreens out, litter, name plates for trees and shrubs etc.), parking issues, overcrowding and concerns regarding the planned return of markets to the lake foreshore once foreshore improvement works are complete (e.g. litter, access, loading on top of stormwater swales etc.).

1.4.7 Preserving Lake Ainsworth Inc.

Preserving Lake Ainsworth Inc. is a community group with strong opposition to the planned closure of the eastern road connecting Pacific Parade to the access point to Seven Mile Beach and the Sport and Recreation Centre. Key issues raised by the group include concern about restriction of public access to the lake through closure of the eastern road affecting public use, amenity and social and cultural values, a need for a holistic view of the lake precinct and restoration of the lake, a lack of information from Council and a desire to be involved in all stages of the CMP.

1.4.8 Lake Ainsworth Wildlife Watch Lennox Head

This group is dedicated to preserving the wildlife at Lake Ainsworth and maintaining a healthy lake environment and ecosystems. The key concerns for this group are increased traffic on Camp Drewe Road, causing more road kill and particularly putting turtles at risk which are known to cross the road to access the lake, vehicles speeding along the road, water quality including algae and the effects of sunscreen, litter build up and particularly plastics affecting turtles and other wildlife and a lack of research into wildlife populations at Lake Ainsworth.

Plate 4: Lake Wildlife Spotters kids activity booklet produced by the Lennox Head Residents Association and Lennox Head Landcare with support from Ballina Shire Council.

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2. SNAPSHOT OF ISSUES

The issues currently affecting the health and amenity of Lake Ainsworth are discussed in detail in the *Stage 2 Vulnerabilities and Opportunities Study* (Hydrosphere Consulting, 2019a) and summarised below.

2.1 Water quality and blue green algae

Lake Ainsworth is utilised for a variety of water and shore-based activities including swimming, paddling and picnicking and is also an important educational resource with a rich cultural history and significant ecological value. Despite being subject to periodic blooms of blue green algae, the lake is highly valued for its natural scenic beauty and as a place for relaxation and nature-based recreation. Due to its popularity as a recreational asset, many of the issues raised during community consultation for this CMP relate to the community's expectations regarding these recreational pursuits and circumstances that lead to reduced recreational experiences.

A key driver of this CMP is the ongoing concern of increasing nutrient levels and resulting blue green algae outbreaks in the lake (Plate 5). Blue green algae blooms in the lake have occurred periodically for many years, with records of serious outbreaks dating back to the 1980s. Blue green algae impacts on recreational use through swimming closures due to public health risks and this is regarded as the highest priority for management by the community. On average since 2002, blue green algae alerts have been in place at the lake for approximately 86 days/year (24% of the time). Red alerts (high level of toxic blue-green algae) were in place for an average of 7 days/year with many years having no red alerts and some years having as many as 47 days of lake closure (in 2007). The internal cycling of nutrients and particularly phosphorus from lake sediments was confirmed during Stage 2 as the primary factor exacerbating blooms of blue green algae. In 1997 an aerator was installed to destratify the lake and increase dissolved oxygen levels with the aim of reducing nutrient release from bottom sediments and therefore reducing the occurrence of algal blooms. A review of the aerator program was conducted during Stage 2 of the CMP development which indicated that the current program was not effective in preventing nutrient release from sediments and may be having a net negative impact on overall water quality by facilitating nutrient cycling.

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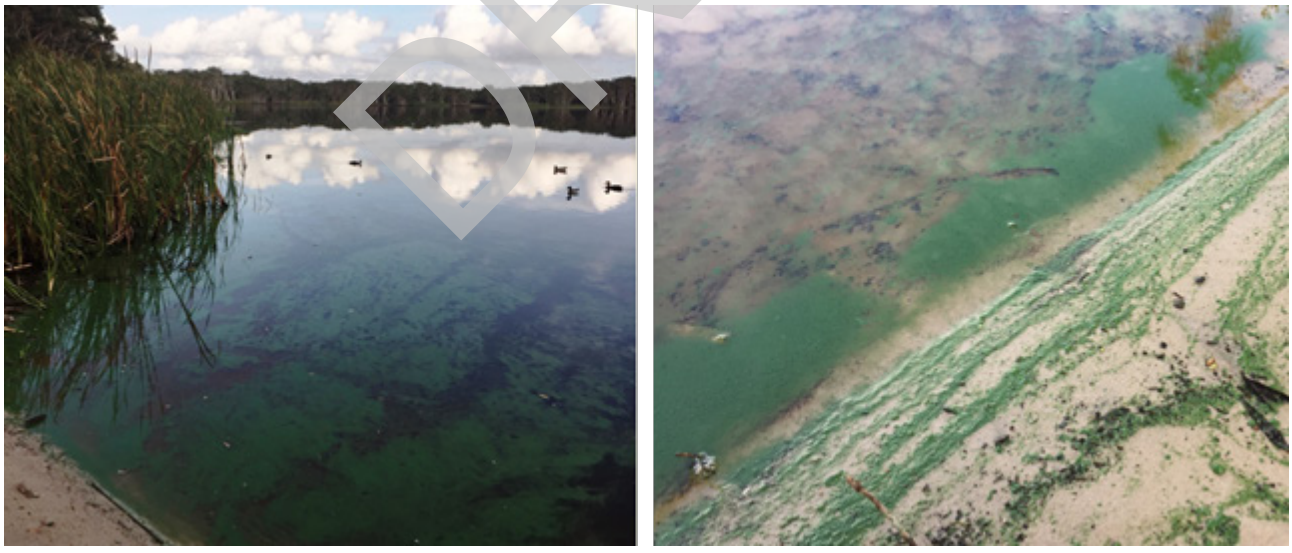

Plate 5: Cyanobacteria bloom, Lake Ainsworth January 2019

In 2018, Beachwatch graded three of the four lake swimming sites as 'poor' in terms of contamination with faecal material. Further work is underway to confirm the sources of contamination.

2.2 Sunscreen pollution

Sunscreen has been identified as a potentially significant pollutant source, not only contributing to frequently observed oily slicks on the water surface during peak times and chemical compounds known to effect ecological health but also as a potential nutrient source contributing to algal blooms. Initial estimations of potential sunscreen load to the lake (i.e. what can be washed off the skin during swimming) equated to approximately 192 L of sunscreen per year (Hydrosphere Consulting, 2019a).

2.3 Sediment quality

A survey of lake sediments in 2018 has confirmed the continued presence of a central basin of organic-rich muds in the lake which are acidic, oxygen-deficient, high in organic carbon and nutrient-rich and have levels of lead and mercury which exceed ANZECC sediment quality guidelines at several sites (Plate 6). There has also been an expansion in the total area of these organic-rich muds compared to sediment mapping completed in 1996.

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Plate 6: Main sediment types in Lake Ainsworth: Left: 'gelatinous' organic–rich muds, Right: medium sands

2.4 Litter

Litter can impact amenity and ecological values of the lake particularly during peak visitation periods. Provision of recycling bins at the lake was also frequently requested during community engagement.

2.5 Dog access

Concerns have been raised regarding dogs being allowed 'off-leash' along lake foreshores and to swim in the Lake despite a no-dog zone being in place for these areas. Key concerns raised were related to dog urine and faeces being left behind which may contribute to water quality decline and microbiological risk to human health as well as impacts of dogs on native wildlife (e.g. disturbance, injury etc.).

2.6 Foreshore erosion

Foreshore erosion is also a key concern for the community with banks actively eroding which is exacerbated by stormwater flows, water level changes, wind action and high levels of pedestrian access (Plate 7). A number of safety hazards have been identified in the vicinity of access points to the lake including potential for falls and trips (due to erosion creating vertical drops up to 0.8 m), exposed roots and uneven ground.

Plate 7: Foreshore erosion at the lake

2.7 Overcrowding

Overcrowding and overuse of the lake during peak holiday periods places high pressure on facilities, parking, recreational amenity and environmental values. Recent (2017) estimates during peak times reveal that visitor numbers now exceed 10 times the estimated carrying capacity of the lake. The carrying capacity represents the maximum number of visitors the area can accommodate without there being excessive deterioration of the environment or declining visitor satisfaction.

Plate 8: Traffic congestion on the eastern road (Source: Google street view, January 2010)

2.8 Parking

There is insufficient parking at the lake during peak times (i.e. school holidays, public holidays and long weekends). This has been an issue for many decades and with increasing population and tourism pressures into the future, this impact is likely to increase. There is concern that this will result in more cars parking along Camp Drewe Road and subsequently greater use of the western side of the lake as well as increased

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parking by lake users extending into town. There were also concerns raised about the distance required to walk from new parking areas to the lake, particularly for disabled people and those carrying children and equipment.

2.9 Lack of understanding about indigenous cultural significance

There is a general lack of knowledge and understanding among the broader community about the indigenous cultural significance of the lake. Through the community survey, the community has expressed a strong desire to know more about the indigenous history and significance of the lake. Increasing understanding would enhance values for the community and visitors and would also be likely to increase the effectiveness of measures to protect cultural heritage at the lake.

2.10 Increasing use of the western side of the lake

Increasing use of the relatively 'untouched' western side of the lake was raised as a key concern for many stakeholders (Plate 9). During consultation it was clear that the community desired the western side of the lake to remain as natural as possible, protecting cultural and environmental values and maintaining visual amenity from the popular recreational areas on the southern and eastern vantage points. The impact of increasing traffic and traffic speed along Camp Drewe Road and concerns about increasing road kill has been identified by the community.

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Plate 9: Informal access to western side of the lake

2.11 Climate change, coastal hazards and flooding

Ocean shoreline recession along Seven Mile Beach is a key risk for the management of Lake Ainsworth. Coastal hazard predictions show the potential for ocean breakthrough to the lake within a 50-year timeframe (GeoLink, 2016). Any connection with the ocean is likely to have significant implications for the ecology and public usage of the lake. The risk of significant wave run-up and over-wash of salt water to Lake Ainsworth during heavy seas is currently low, but will increase with continued sea level rise (Plate 10). The highest risk site is at the Lennox Head Surf Club. Actions to address coastline hazard issues are currently addressed in the *Coastal Zone Management Plan for the Ballina Shire Coastline* (CZMP, GeoLINK, 2016) and will be considered again in the development of the future Ballina Coastline CMP.

There is a risk that future lake flooding events (both in frequency and magnitude) will increase with predicted climate change impacts (i.e. increase in mean sea level coupled with an increase in extreme rainfall and sea-level events). Conversely, increasingly dry winters with increased temperatures as a result of climate change may result in occasional periods of lower lake levels during the latter half of the year than previously seen.

Plate 10: Coastal dune system separating the lake from Seven Mile Beach

2.12 Weeds and pest species

There are a number of exotic aquatic weeds present within Lake Ainsworth which periodically create nuisance conditions impacting amenity and lake uses. A variety of management techniques have been implemented to address exotic weed infestations within the lake, many are ongoing with a high level of success. A number of exotic aquatic fauna species have been identified in the lake, including typical aquarium species that may have been dumped in the lake. Cane toad and the non-endemic and invasive Redclaw crayfish were also identified as pest species in the lake.

2.13 Riparian Vegetation

Riparian vegetation condition varies significantly around the lake. A number of factors contribute to riparian vegetation disturbance including clearing, exotic species, a high level of pedestrian traffic, bank erosion and adjacent disturbed areas (e.g., mown exotic grassed areas or roads). Undercutting and exposure of tree roots is impacting tree health and may cause dieback of significant foreshore trees (Plate 11). The Broad Leaved Paperbark trees have been identified as culturally significant 'Song Trees' by local Aboriginal representatives and are an iconic feature of the lake, providing shade, visual amenity and habitat for wildlife. There are also several bare ground areas along foreshores where grass has died, particularly in high use zones in the south-eastern corner, where shading is also affecting grass cover. This not only impacts the aesthetics and recreational values of the area, but also exposes sediment and banks to erosion.

Plate 11: Exposed roots of mature Broad-leaved Paperbark trees along the south-eastern foreshore

3. OVERALL MANAGEMENT APPROACH

There is a need to protect the social, ecological and cultural values associated with the lake and to manage the often conflicting desire for protection of ecological values as well as optimising recreational opportunities. One of the key aspects of the management approach for this CMP is to accept that some issues cannot be resolved cost-effectively or without compromise.

Water-based recreation is one of the main uses for Lake Ainsworth, with water quality being recognised as a key factor contributing to this activity. Whilst improving water quality generally and providing easy access for swimming and other water-based pursuits is desirable, this may not be practical, affordable or in keeping with other goals for management. The approach for this CMP, for example, is to encourage swimmers to use areas that are best suited for swimming (close to managed access points, suitable water depths, ease of access) by providing facilities near those locations and concentrating management actions that improve this use in the areas that are most suitable in the long term. In taking this approach, other areas are set aside to achieve other management goals where the focus may be, for instance, ecological and cultural heritage protection.

The management approach therefore attempts to delineate management focus areas around and in the lake in order to efficiently achieve the objectives of this plan. This approach recognises the key processes influencing the ecological health and recreational amenity of the lake as well as key pressures to be faced in the future. Management options have been developed and prioritised on this basis with the key aims of recognising these constraints and optimising future management expenditure. Figure 2 shows the main goals for each area of the lake as described in Figure 2.

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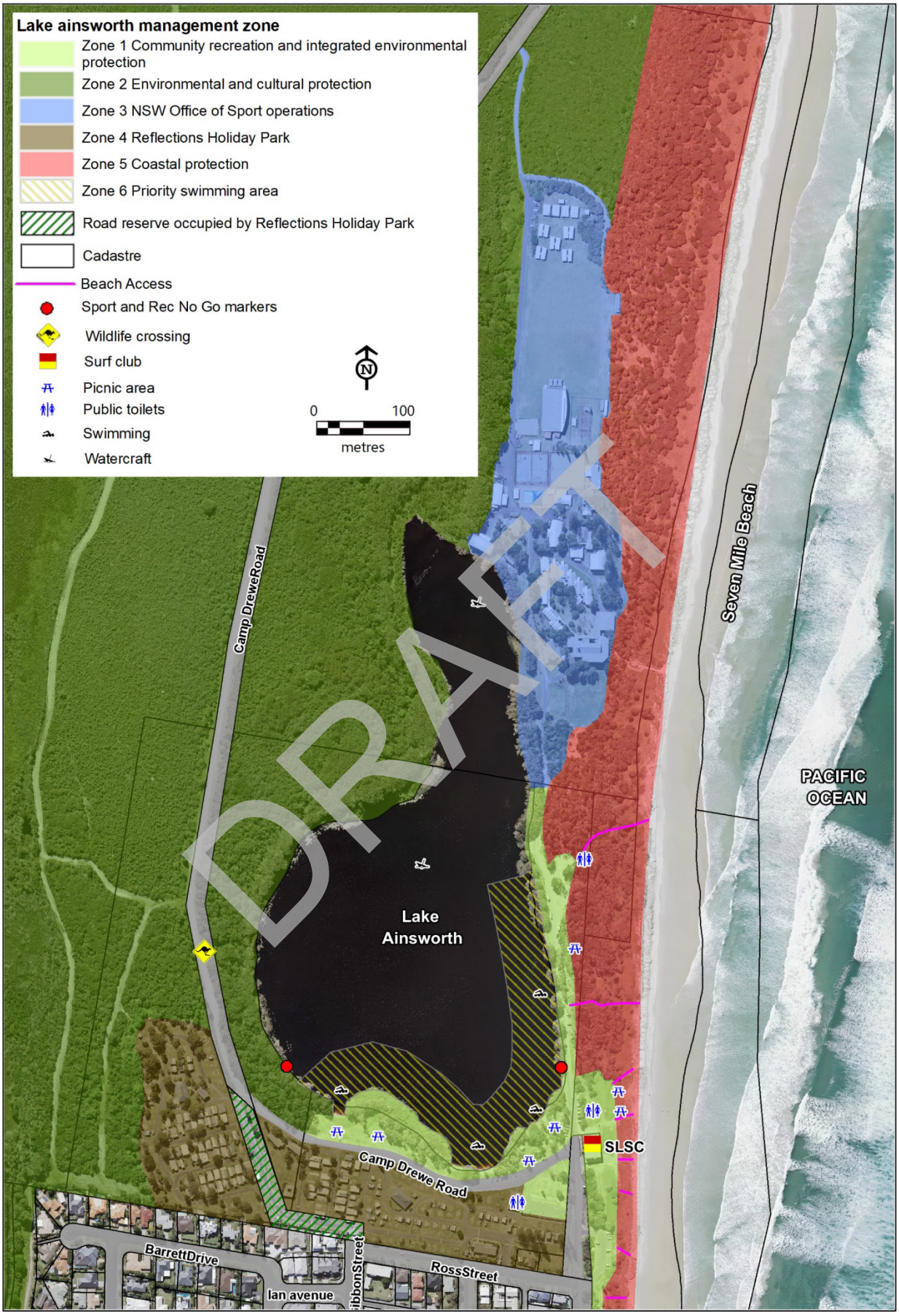

Figure 2: Lake Ainsworth management zones

**Map is indicative only. It is to be used solely for illustrative purposes and does not form any part of local, state or federal planning law.*

Table 4: Summary of management zones, key uses and goals

Zone	Location and use	Management goals
Zone 1 - Community recreation and integrated environmental protection	Crown land managed by Council along the southern foreshore adjacent to Reflections Holiday Park and the eastern foreshore to the border of Zone 3.	Provides improved foreshore access to the lake at key swimming locations, sandy beaches, amenities and a focus of recreational activities. Environmental protection areas are integrated within this zone for riparian vegetation enhancement and stormwater treatment. Pedestrian access is provided along the eastern foreshore with provision for emergency vehicle access if required.
Zone 2 - Environmental and cultural heritage protection	Western and northern shorelines and incorporates Crown land areas managed by NSW Office of Sport and Council.	Provides for enhancement of ecological and cultural heritage values with minimal disturbance. Opportunities for nature appreciation and education would be promoted here. The zone is to remain as natural as possible protecting habitat values, water quality and maintaining scenic amenity from recreational areas on the southern and eastern vantage points. Managing access to the western side of the lake will be important to protect this area now and into the future.
Zone 3 - NSW Office of Sport operations	Crown land leased and managed by NSW Office of Sport comprising the northern shoreline from the Lakeside conference Centre to the gate along the eastern foreshore.	Recognises the management of these areas for education and recreation by NSW Office of Sport.
Zone 4 - Reflections Holiday Park	Land leased and managed by NSW Crown Holiday Parks Land Managers.	Provides for camping and cabin style accommodation and the holiday park.
Zone 5 - Coastal protection	Crown land managed by Council and Crown land leased and managed by NSW Office of Sport.	Provides for protection and enhancement of coastal dune areas immediately east of the lake, recognising the vital role dunes play in protecting the lake from ocean shoreline recession, breakthrough and saline intrusion.
Zone 6 – Priority swimming area	Key water-based recreation areas extending approximately 50m from the shoreline along the southern and eastern foreshores.	Encourages swimmers to use areas best suited for swimming close to managed access points, suitable water depths and facilities. The focus is on providing safe swimming areas with minimal conflict between users. This is a ‘Go-Slow’ area for passive watercraft such as kayaks, canoes and stand up paddle boards with users to manage their watercraft responsibly and safely around swimmers. The Lake Ainsworth Sport and Recreation Centre will restrict their boating activities to areas north of the “No Go” markers positioned on the east and west banks of the lake.

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4. MANAGEMENT ACTIONS

Actions have been developed from the short-listed options described in *Stage 3 Management Options Study* (Hydrosphere Consulting, 2019b) and consist of a combination of studies, investigations and on-ground works. Some actions require additional research or assessment prior to implementation of on-ground works. This is to ensure the appropriate effort, funding and geographical focus of on-ground works is undertaken.

Management strategies and actions have been developed for a ten year period. This CMP and the progress of the management actions should be reviewed to ensure the actions remain relevant and the implementation of the plan is being achieved.

The recommended management actions have been described in terms of:

- Desired Outcome – the specific result to be achieved by implementation of each action.
- Priority Ranking – each action has been assigned a rank and priority according to importance and urgency for implementation. The ranking is based on multi-criteria analysis completed as part of *Stage 3 Management Options Study* (Hydrosphere Consulting, 2019b). The following priority categories have been assigned to the ranking:

Table 5: Priority Ranking

Priority	Description
Fundamental	Actions that are critical for successful implementation of the CMP and important for long-term effective management of the lake
High	Actions of high importance in addressing key threats and issues
Medium	Actions considered of medium importance in addressing threats and issues

- Description of Tasks – an outline of the scope of works required.
- Responsibility – the actions identify the Lead Organisation as well as Support Organisation(s). Lead Organisations are responsible for implementation of the action. Support Organisation(s) may be required and/or requested to assist in implementation of the action, either through on-ground works, or as a potential funding or information source.
- Cost Estimate – an estimate of total costs for implementation over the ten year life of the plan is provided (2020$). Section 5 (CMP Business Plan) provides a breakdown of action costs including capital, operational and maintenance costs. Cost estimates cover the tasks listed in the actions (including preliminary investigations, environmental assessment, approvals and implementation) unless otherwise stated. Cost estimates provided in the action descriptions are preliminary only and are based on the best available information.
- Potential Funding – the CMP actions are expected to be funded through Council and State Government contributions, monetary grants and in-kind contributions. Identification of grants and successful application is an important component of this CMP. A summary of potentially relevant and available grant schemes is given in Section 5.1. It is important to note that many grants and funding sources are only available up to a limited budget and as such, the available grants are changing from year to year. It will be necessary to keep abreast of current funding availability throughout the implementation of the CMP. In most cases it is expected that in-kind contributions will be provided by Council. Collaboration with educational institutions may also provide opportunities for research projects.

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Where actions are implemented through an existing program, additional expenditure and funding have not been included. Similarly, where a study/review is required to determine the appropriate level of expenditure, the cost of the review has been estimated in the action planning. Implementation costs should be confirmed by the results of the review.

- Timing – indicative timeframe for implementation and alignment with Council's four year Delivery Program (DP) under the NSW Integrated Planning and Reporting (IP&R) Framework (refer Section 5, Business Plan for more details) which commenced in 2018/19 (2019). Based on the priorities developed in this CMP, timeframes for management actions have been estimated, pending funding availability. The assumed start date for CMP implementation is 1 July 2020, following Council adoption of the Plan. The CMP has a planning timeframe of ten years therefore the duration of the Plan implementation period is from 1 July 2020 to 30 June 2029. Management actions have been scheduled according to the following timeframes:
    - Short term: year 1 – 3 (DP1 2020 – 2022).
    - Medium term: year 4 – 7 (DP2 2023 – 2026).
    - Long term: year 8 – 10 (DP3 2027 - 2029).
    - On-going: starting year 1 and implemented over the ten year life of the CMP with possible extension beyond that period.

  Actions within the CMP align with Council's key services identified in the BSC *Delivery Program 2019-2023*. Timing of the delivery of actions should be based on the priorities developed for this CMP but will also depend on the availability of funding.
- Location – location of actions within Lake Ainsworth.
- Performance targets – performance targets for each action which can be used to measure the level of success. Identified targets incorporate those consistent with Council's Community Strategic Plan and targets specific to each action where applicable.

The actions are described in the following sections and have been grouped into management units. Figure 3 provides an overview of CMP management actions for Lake Ainsworth.

In addition to management actions to be implemented as part of this CMP, Appendix 2 details additional management requirements identified to protect the lake from coastal hazard impacts (e.g. coastal recession, oceanic break-through and wave run-up and dune overtopping). The *Coastal Zone Management Plan for the Ballina Shire Coastline* (CZMP, GeoLINK, 2016) currently provides a framework for open coast hazard management but will be replaced by a Coastline CMP in the future (i.e. by December 2021).The management requirements identified during the development of this Lake Ainsworth CMP will be considered separately in the development of the future Ballina Coastline CMP.

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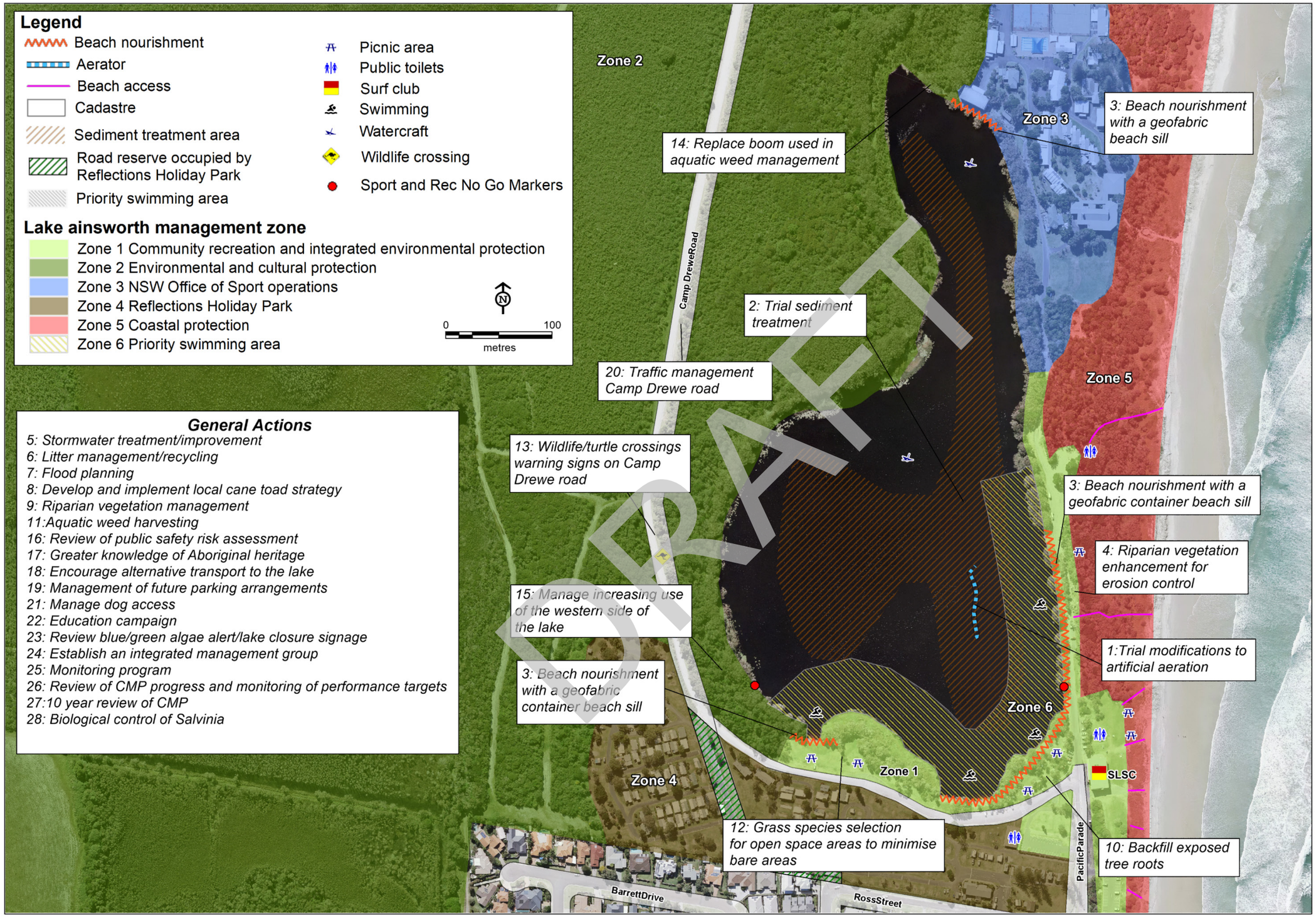

Figure 3: Summary of Lake Ainsworth CMP management actions

**Map is indicative only. It is to be used solely for illustrative purposes and does not form any part of local, state or federal planning law.*

4.1 Actions to be implemented by Ballina Shire Council

4.1.1 Water quality

Action 1: Trial modifications to artificial aeration

Desired Outcome	Determine the best aerator regime for the lake for water quality improvements
Priority ranking	High (1)
DESCRIPTION OF TASKS:	
Conduct a trial to test the effects of modifying the aeration program on lake water quality and specifically the incidence of blue green algae blooms. The following modifications are proposed: 1. **Phase 1 Aerator Trial:** a. Design monitoring program for the trial to assess the effectiveness of modifications. Design of the monitoring program will need to provide adequate replication of previous monitoring to allow for comparison with previous water quality results under different aerator regimes. Key areas to be assessed include dissolved oxygen levels through the water column (depth profiles) with a focus on the sediment/water interface at a number of locations around the lake. This will be critical to determining the effectiveness of the modified regime and identifying the 'zone of influence' for the aerators. Overall water quality conditions will also be assessed incorporating measurements of blue green algae, nutrients, DO, pH and temperature at surface and at depth (profiles). b. Trial spring/ summer aeration program with continuous operation (24 hour aeration, opposed to the current program where aerators operate 12 hours overnight) and monitor conditions. c. Trial a gradual start-up procedure in spring to observe the effect on water quality conditions in the initial aerator operation period (i.e. aim to allow acclimation and avoid a major turnover event). d. Reporting of trial completed including analysis of monitoring data. Based on the results, further management is to be recommended. This may include: • Continuation of the modified regime if water quality improvements were observed, • Consider the need for additional diffusers spaced around the lake (if the 'zone of influence' of current aerators is considered inadequate) or • If Phase 1 trials do not improve water quality conditions to an acceptable level, move to Phase 2. 2. **Phase 2 Aerator Trial:** a. Trial one year without artificial aeration (i.e. turn off aerators). This will allow for the assessment of seasonal changes and comparison with previous water quality conditions under past aerator regimes. b. Monitoring as described for Phase 1 above with an additional focus on development of anoxic (low oxygen) zones at depth to provide forewarning of potential low dissolved oxygen events developing under stratified conditions. c. Reporting of trial including recommendations for further management.	
Lead Organisation	BSC
Support Organisation	EES – Coast and Estuaries
Total Cost Estimate (10 yr)	$110,000 (allowance of $10,000 for extended aerator operation Yr2, $50,000 for monitoring Yr2 & Yr3)
Potential Funding Sources	BSC, NSW Coastal and Estuary Grants Program
Timing	Short term (DP1 2020-2023)
Location	In-lake, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area
Performance Targets	• Design of monitoring program complete prior to spring aeration September 2020. • Phase 1 trial report complete by June 2021. • Phase 2 trial report complete by June 2022.

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4.1.2 Sediment management

Action 2: Trial sediment treatment

Desired Outcome	To improve and maintain water quality and ecosystem health of the lake and surrounding habitats
Priority ranking	High (2)

DESCRIPTION OF TASKS:

Conduct a trial to test the suitability and effectiveness of application of a phosphorus binding agent (e.g. Phoslock™) to lake sediments in order to improve water quality and specifically the incidence of blue green algae blooms. The following stages are proposed:

1. Liaison with regulatory authorities including DPI Fisheries to determine and obtain approvals as required.
2. **Phase 1 test-tube study:**
   a. Laboratory tests and simulated lake environments using sediment and water from the lake (i.e. out-of-lake 'test-tube' studies).
   b. The study would determine aspects such as application rates, longevity of treatment, timing and evaluation of potential risks (e.g. effects on colour, water clarity, and water chemistry). If results of the out of lake studies were positive, move to next phase. A report should be finalised to confirm the next steps. This may include recommendations for community consultation and provision of results.
3. **Phase 2 mesocosm study:**
   a. Small-scale in-lake study where areas of the lake are isolated to test how the treatment effects water quality. 'Mesocosms' are routinely used for this purpose to isolate the water column from the lake surface to the lake bottom.
   b. The study would assess the same aspects described for Phase 1 above, but allow for conditions to be assessed in 'real-life' subject to lake conditions (e.g. weather, hydrodynamics, aquatic fauna etc.). Dependant on design and location the study could also allow for the community to observe the process and effects first hand. If results of the in-lake studies were positive, move to next phase.
4. **Phase 3 lake application:**
   a. Typical lake application would involve binding agent granules or slurry being directly added to the water via a barge or boat. The compound is designed to settle out through the water column binding phosphate and eventually collect as a thin (< 2 mm) layer over sediments creating a barrier layer and preventing further phosphorus release.
   b. Monitoring will be required to assess the effectiveness of the treatment. Design of the monitoring program will need to provide adequate replication of previous monitoring to allow for comparison with previous water quality results.

Lead Organisation	BSC
Support Organisation	EES – Coast and Estuaries, DPI Fisheries
Total Cost Estimate (10 yr)	$220,000 (allowance of $40,000 for Phase 1 and 2 studies, $160,000 for lake application in Yr4 and $10,000/yr monitoring in Yr4 & Yr5)
Potential Funding Sources	BSC, NSW Coastal and Estuary Grants Program
Timing	Short-Medium term (DP1 2020-2022 and DP2 2023-2026)
Location	In-lake, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area
Performance Targets	• Phase 1 report completed by June 2023. • Phase 2 study established by September 2023. • Phase 3 lake application, assumed to be complete by June 2024, (timing to be confirmed by Phase 2 results).

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4.1.3 Bank erosion

Action 3: Beach nourishment with a geofabric container beach sill

Desired Outcome	Improved public safety and amenity of foreshores and stabilisation of bank erosion and riparian vegetation
Priority ranking	High (3)
DESCRIPTION OF TASKS:	
1. Detailed design of erosion controls including consideration of: a. Preferred option to nourish the lake's recreational beaches with clean sand and installation of buried geofabric containers along beach faces (i.e. parallel to the shoreline) to act as sills to maintain minimum beach levels and reduce the rate of sand loss. b. The size and placement depth of geofabric containers requires detailed design to achieve the most effective configuration. Trials are currently underway at the lake which will help inform further design. c. Sill(s) are to be located away from the key recreational use elevations. d. Sources of nourishment material and associated costs. Utilisation of scraped sand from the lake would be much more cost effective and should be considered where this is appropriate and can be achieved without negative impact on environmental and aesthetic values. e. Nourishment could also incorporate infilling around exposed tree roots to improve tree health and protect riparian vegetation (refer Action 10: Backfill exposed tree roots). f. Clean up of remnant materials/infrastructure such as fencing, log revetment, etc. g. Maintenance of erosion controls as informed by the annual erosion monitoring (refer Action 24: Monitoring program). 2. Liaison with regulatory authorities including DPI Fisheries. 3. Undertake environmental assessment and obtain approvals. 4. Seek funding approval. 5. Implementation.	
Lead Organisation	BSC, NSW Office of Sport
Support Organisation	EES – Coast and Estuaries, DPI Fisheries
Total Cost Estimate (10 yr)	$265,000 (Allowance of $50,000 for detailed design, $200,000 for nourishment with geobags and $5,000 for maintenance every three years)
Potential Funding Sources	BSC, NSW Office of Sport , NSW Coastal and Estuary Grants Program
Timing	Short- term initial works (DP1 2020-2022) and ongoing maintenance (DP1 - DP3 2020-2029)
Location	Zone 1, Zone 2, Zone 3, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area
Performance Targets	• Detailed design completed by June 2022. • Public safety assessment assigns low risk to all foreshores by June 2023.

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Action 4: Riparian vegetation enhancement for erosion control

Desired Outcome	Improved public safety and amenity of foreshores and stabilisation of bank erosion and riparian vegetation
Priority ranking	High (7)
DESCRIPTION OF TASKS:	
1. Conduct an assessment of riparian vegetation along the eastern and southern foreshores following completion of Foreshore Improvement Works. This assessment will determine areas for further riparian revegetation and/or enhancement along shorelines for greater erosion protection. 2. Plan works considering the balance between access requirements, bank protection and ecological values. Provision for managing access to these areas will need to be considered as part of the design of works. 3. Carry out initial works as required (i.e. planting, fencing, access provision). 4. Follow up weed control and maintenance will be needed for at least 3-5 years. Depending on the success of works maintenance may be scaled back as native vegetation becomes established. Riparian Condition Assessment (refer Action 24: Monitoring program) to inform ongoing management.	
Lead Organisation	BSC
Support Organisation	EES – Coast and Estuaries, Lennox Landcare
Total Cost Estimate (10 yr)	$70,000 (Allowance of $20,000 for initial planning and planting work, $5,000/yr for ongoing maintenance)
Potential Funding Sources	BSC, NSW Coastal and Estuary Grants Program
Timing	Short- term initial works (DP1 2020-2022) and ongoing maintenance (DP1 - DP3 2020-2029)
Location	Zone 1, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area
Performance Targets	• Riparian assessment completed by June 2021.

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4.1.4 Catchment management

Action 5: Stormwater treatment/improvement

Desired Outcome(s)	Best-practice stormwater treatment systems are installed and maintained Continuation of low-impact land management practices in the catchment
Priority ranking	Medium (17)
DESCRIPTION OF TASKS:	

Stormwater management:

1. Best practice stormwater treatment and improvement to be implemented during the design, retrofit and/or upgrade of any development including roads and parking facilities in the catchment. Designs to include measures to reduce erosion through management of concentrated overland flows.
2. Regularly assess the condition and performance of stormwater treatment systems and devices (refer Action 24: Monitoring program).
3. On-going maintenance/ asset renewal/ replacement of stormwater treatment systems.

Land management practices:

1. Continue practices to prevent grass clippings from entering stormwater drains and/or the lake (e.g. use a catcher when mowing and remove clippings).
2. Continue policy of no fertiliser use within lake foreshore areas and Reflections Holiday Park. Continue best-practice management of fertiliser application to sports oval on NSW Office of Sport managed land including minimising fertiliser use in general and avoiding use before, during or immediately after rainfall. Encourage best-practice management of fertiliser application within all catchment areas including residential areas through Action 22: Education campaign.
3. Continue careful management and use of materials imported to the catchment that may introduce nutrients or contamination (e.g. mulch, compost, soil, blue metal, pesticides and herbicides etc.).
4. Large public events within the study area should be supported by an appropriate environmental assessment that addresses and mitigates any potential adverse impacts on the lake and surrounding natural environment.

Lead Organisation	BSC
Support Organisation	NSW Office of Sport, NSW Crown Holiday Parks Land Managers, EES – Coast and Estuaries
Total Cost Estimate (10 yr)	Staff time and allowance of $40,000 for maintenance/ asset renewal/ replacement of stormwater treatment systems
Potential Funding Sources	BSC
Timing	Ongoing maintenance (DP1 - DP3 2020-2029)
Location	Catchment area (all zones), CMA1 – Coastal Wetlands and Littoral Rainforests, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area
Performance Targets	• Best practice stormwater treatment and improvement implemented for all new development. • Water quality monitoring does not indicate stormwater pollution impacts

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Action 6: Litter management/recycling

Desired Outcome	Improve waste management and education to reduce litter impacting on amenity, water quality and wildlife.
Priority ranking	High (8)
DESCRIPTION OF TASKS:	
1. Assess adequacy of general waste bins and waste collections and provide additional bins and collections as required. 2. Provide recycling bins in addition to general waste bins at the lake. 3. During peak times such as long weekends and school holiday periods, consider increased frequency of rubbish collection and/or placement of additional bins (either standard bins or small temporary skip bin, with cover) on site to reduce the likelihood of overflow and litter polluting the lake environment. 4. Acknowledge and support community groups/individuals that regularly clean up litter at the lake. 5. Reinforce messaging through the education program (refer Section 4.1.8 Education).	
Lead Organisation	BSC
Support Organisation	EES – Coast and Estuaries, North East Waste, Community groups/individuals who regularly clean up litter at the lake
Total Cost Estimate (10 yr)	$50,000 (Allowance of $5,000/yr for extra bins and collection services during peak times)
Potential Funding Sources	BSC, NSW Coastal and Estuary Grants Program, NSW EPA Waste Less, Recycle More initiative.
Timing	Ongoing (DP1 - DP3 2020-2029)
Location	Lake and surrounds (all zones), CMA1 – Coastal Wetlands and Littoral Rainforests, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area
Performance Targets	• Recycling bins in place by June 2021. • Reduction in volume of waste collected during Clean up Australia Day

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4.1.5 Flooding

Action 7: Flood planning

Desired Outcome	Ensure all development and management actions in the study area are suitable for the location and/or are adaptive to changing flooding risk.
Priority ranking	Medium (12)
DESCRIPTION OF TASKS:	
1. Future development in the catchment and all actions implemented as part of this CMP will need to consider the potential future flood risk. 2. Lake Ainsworth catchment to be included in the review of the *Ballina Floodplain Risk Management Plan* (BMT WBM, 2015). Plan works considering the balance between access requirements, bank protection and ecological values. Provision for managing access to these areas will need to be considered as part of the design of works.	
Lead Organisation	BSC
Support Organisation	EES – Coast and Estuaries
Total Cost Estimate (10 yr)	Staff time
Potential Funding Sources	n/a
Timing	Short- term (DP1 2020-2022)
Location	Flood risk areas identified in *Stage 2 Vulnerabilities and Opportunities Study* (Hydrosphere Consulting, 2019a), CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area
Performance Targets	• Review of *Ballina Floodplain Risk Management Plan* includes the Lake Ainsworth catchment.

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4.1.6 Flora and fauna

Action 8: Develop and implement local cane toad management strategy

Desired Outcome	Reduce cane toad numbers and their undesirable impacts on native wildlife.
Priority ranking	Medium (18)
DESCRIPTION OF TASKS:	
1. Develop an integrated local Cane Toad Management Strategy for the lake, considering the range of control methods discussed in *Stage 2 Vulnerabilities and Opportunities Study*. Consult with NSW DPI and NPWS and NSW Office of Sport regarding regional and local cane toad management. 2. Implement program. 3. Review data, methods and strategy on an annual basis.	
Lead Organisation	BSC
Support Organisation	EES – Coast and Estuaries, NPWS, DPI
Total Cost Estimate (10 yr)	$55,000 (Allowance of $20,000 for strategy development and $5,000/yr for implementation and review)
Potential Funding Sources	BSC, NSW Coastal and Estuary Grants Program
Timing	Ongoing (DP1 - DP3 2020-2029)
Location	Lake and surrounds(all zones), CMA1 – Coastal Wetlands and Littoral Rainforests, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area
Performance Targets	• Local Cane Toad Management Strategy completed by June 2023. • Annual reviews completed.

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Action 9: Riparian vegetation management

Desired Outcome	To improve condition and extent of natural fringing vegetation around lake.
Priority ranking	Medium (13)
DESCRIPTION OF TASKS:	
1. Complete regular maintenance, weed control and enhancement of foreshore vegetation for all foreshores. 2. Further planting of native reed beds along lake foreshores is also considered appropriate in some areas to assist in ongoing erosion control, managing access, enhancing habitat value and minor nutrient uptake. 3. Fencing as required to protect sensitive areas.	
Lead Organisation	BSC
Support Organisation	EES – Coast and Estuaries, Lennox Landcare
Total Cost Estimate (10 yr)	$120,000 (Allowance of $30,000 in the first year to establish new areas including fencing and $10,000/yr for ongoing works weed control and maintenance)
Potential Funding Sources	BSC, NSW Coastal and Estuary Grants Program
Timing	Ongoing (DP1 - DP3 2020-2029)
Location	Lake foreshores Zone 1, Zone 2, Zone 3, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area
Performance Targets	• Riparian condition assessment completed annually shows improved condition ratings.

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Action 10: Backfill exposed tree roots

Desired Outcome(s)	To improve the health of Broad-leaved Paperbark trees along lake foreshores To reduce trip hazards, access issues and improve public safety To improve and maintain water quality and ecosystem health of the lake
Priority ranking	High (4)
DESCRIPTION OF TASKS:	
1. Backfill exposed roots of mature Broad-leaved Paperbark trees along the south-east foreshore with suitable sand. Ideally the sand should match the natural substrate and have minimal nutrient/fertiliser content. This option can be integrated with the nourishment of the lake's beaches (refer Action 3: Beach nourishment with a geofabric container beach sill). 2. Provide vegetation cover over the placed sediment either as turf or native groundcovers will assist in preventing movement of the placed material either through pedestrian access or wind and wave action. 3. Temporary fencing may be required to prevent pedestrian access in the short term to allow vegetation cover to establish. 4. Monitor tree health and root cover and maintain as needed.	
Lead Organisation	BSC
Support Organisation	EES – Coast and Estuaries
Total Cost Estimate (10 yr)	$56,000 (Allowance of $50,000 for additional backfill, fencing and groundcovers, $2,000 every three years for maintenance)
Potential Funding Sources	BSC, NSW Coastal and Estuary Grants Program
Timing	Short- term initial works (DP1 2020-2022) and ongoing maintenance (DP1 - DP3 2020-2029)
Location	Lake foreshores Zone 1, Zone 2, Zone 3, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area
Performance Targets	• Action 16: Review of public safety risk assessment assigns low risk to all foreshores by June 2021.

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Action 11: Aquatic weed harvesting

Desired Outcome	To reduce aquatic weeds and improve recreational opportunities and aesthetics.
Priority ranking	Medium (21)
DESCRIPTION OF TASKS:	
1. Continue manual harvest of aquatic weeds from the lake by community volunteers as needed to control outbreaks. 2. BSC to continue to assist in removal and disposal of the harvested plants. 3. Ensure disposal of weeds to registered waste facility. If left to decompose on lake shore, rotting vegetation can create aesthetic issues (odour, visual) and nutrients and contaminants may be re-introduced to lake. 4. Annual review of program.	
Lead Organisation	BSC
Support Organisation	EES – Coast and Estuaries, Lennox Landcare, NSW Office of Sport
Total Cost Estimate (10 yr)	$10,000 (Allowance of $1,000/yr for transport and disposal of weeds)
Potential Funding Sources	BSC, NSW Coastal and Estuary Grants Program
Timing	Ongoing (DP1 - DP3 2020-2029)
Location	In-lake, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area
Performance Targets	• Annual review of program including assessment of aquatic weed abundance

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Action 12: Grass species selection for open space areas to minimise bare areas

Desired Outcome	Enhanced aesthetics, recreational values and protection against erosion.
Priority ranking	Medium (11)
DESCRIPTION OF TASKS:	
1. Monitor success of new turf installed as part of Foreshore Improvement Works. 2. If required, complete further investigation of durable grass types for high use areas along the lake foreshore. Ideal characteristics would include being able to withstand dry conditions and high levels of foot traffic, while being shade tolerant and salt resistant. The ability for grasses to spread via runners or wind-dispersed seed and impacts on nearby natural vegetation areas should also be considered. 3. Selection of suitable grass species. 4. If required, purchase and install alternative turf. 5. Provide adequate weed guards/edging to separate turfed areas from natural riparian vegetation and revegetation areas. Edging to extend down into the soil to prevent the spread of underground grass runners invading natural areas.	
Lead Organisation	BSC
Support Organisation	EES – Coast and Estuaries, Lennox Landcare
Total Cost Estimate (10 yr)	Staff time, and allowance of $85,000 to replace turf in Zone 1 if required
Potential Funding Sources	BSC, NSW Coastal and Estuary Grants Program
Timing	Short-Medium term (DP1 2020-2022 and DP2 2023-2026)
Location	Lake foreshores Zone 1, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area
Performance Targets	• Recommendations for alternate grass species by June 2023 if current turf unsatisfactory.

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Action 13: Wildlife/turtle crossing warning signs on Camp Drewe Road

Desired Outcome	Raise awareness of the presence of native fauna and need for care to be taken to avoid road kill.
Priority ranking	Medium (14)
DESCRIPTION OF TASKS:	
1. Review current signage in consultation with local community and particularly wildlife groups in Lennox Head. 2. Design signage and placement considering potential nesting areas, known crossing locations and seasonality. 3. Promote and educate through Action 22: Education campaign. 4. Monitor road kill (refer Action 24: Monitoring program) and review signage as needed. Linked to Action 20: Traffic management Camp Drewe Road (measures to manage traffic speed)	
Lead Organisation	BSC
Support Organisation	EES – Coast and Estuaries, RMS
Total Cost Estimate (10 yr)	$10,000 (staff time and allowance of $5,000 for new signage and $5,000 for replacement/renewal at Yr5)
Potential Funding Sources	BSC, NSW Coastal and Estuary Grants Program
Timing	Short-Medium term (DP1 2020-2022 and DP2 2023-2026)
Location	Camp Drewe Road, Zone 2, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area
Performance Targets	• Review complete September 2020. • Signage installed December 2020.

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Action 14: Replace boom used in aquatic weed management

Desired Outcome	Allow for effective ongoing control of aquatic weeds when high densities occur.
Priority ranking	Medium (20)
DESCRIPTION OF TASKS:	
1. Determine boom specifications and investigate most effective options. 2. Obtain quotes. 3. Replace boom.	
Lead Organisation	BSC
Support Organisation	EES – Coast and Estuaries
Total Cost Estimate (10 yr)	$10,000 (Allowance of $10,000 for boom replacement)
Potential Funding Sources	BSC, NSW Coastal and Estuary Grants Program
Timing	Short- term (DP1 2020-2022)
Location	In-lake, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area
Performance Targets	• Boom replaced by June 2021.

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4.1.7 Community uses

Action 15: Monitor and manage increasing use of the western side of the lake

Desired Outcome(s)	To preserve the relatively 'untouched' ecosystem along the western shoreline, while providing formalised access to a limited section in order to reduce impacts resulting from concentrated use. To protect habitat values, water quality, Aboriginal Heritage, scenic values and ecosystem health of the lake.
Priority ranking	High (10)

DESCRIPTION OF TASKS:

Develop an overall concept for the western side of the lake in order to appropriately protect environmental and cultural values while managing increasing visitor pressures.

1. Engineering design: key considerations and priorities would include:
   a. Review results of monitoring western foreshore usage collected over 1 year as part of Action 24: Monitoring program.
   b. Establishment of ecological and cultural heritage protection areas for the majority of the western side.
   c. Educational facilities and weed management.
   d. Provision for creating more formalised access in the south-western corner. Formal access is restricted to the south-west corner of the western side and is to be in keeping with low-impact, natural-looking access (i.e. no concrete and bitumen). This area would provide a combination of ecological protection and additional passive recreational opportunities. It acknowledges the likelihood of increased use of the western side of the lake and seeks to manage and confine access to this corner while protecting the remaining western side as an ecological protection zone.
   e. Informal parking along Camp Drewe Road will also need to be restricted to manage visitor numbers and access to the western shoreline.
   f. Rationalise access to the western side of the lake by selecting a preferred access path and formalising this route, while closing off and revegetating the remaining tracks. This may involve removal of existing fencing and provision of formal tracks with fencing as required to direct pedestrians away from sensitive areas (e.g. lake edges).
   g. There is also opportunity for pedestrian/shared path facilities along Camp Drewe Rd with the purpose of providing separation between pedestrians and traffic and increased amenity for dog walkers, bikes etc.
   h. Community consultation including local Aboriginal representatives.
2. Approvals: development consent (and environmental assessment).
3. Construction to be staged based on established priorities and available funding.

Lead Organisation	BSC
Support Organisation	EES – Coast and Estuaries
Total Cost Estimate (10 yr)	$300,000 (Allowance of $25,000 concept development, $75,000 detailed design, approvals and consultation and $200,000 construction)
Potential Funding Sources	BSC, NSW Coastal and Estuary Grants Program
Timing	Short-Medium term (DP1 2020-2022 and DP2 2023-2026)
Location	Western side of lake, Zone 2, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area
Performance Targets	• Monitoring of monitoring western foreshore usage complete by June 2021. • Engineering design complete by June 2022. • Approvals received by December 2022.

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Action 16: Review of public safety risk assessment

Desired Outcome	To ensure public safety at lake access points
Priority ranking	High (5)
DESCRIPTION OF TASKS:	
1. Once the Lake Ainsworth Foreshore Improvement Works program has been finalised, review and update the public risk assessment completed as part of *Stage 2 Vulnerabilities and Opportunities Study*. 2. Based on the results of the updated assessment, recommend actions for any remaining risk areas.	
Lead Organisation	BSC
Support Organisation	EES – Coast and Estuaries
Total Cost Estimate (10 yr)	$10,000 (Allowance of $5,000 for assessments at Yr2 and Yr7)
Potential Funding Sources	BSC, NSW Coastal and Estuary Grants Program
Timing	Short-Medium term (DP1 2020-2022 and DP2 2023-2026)
Location	Lake foreshores Zone 1, Zone 2, Zone 3, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area
Performance Targets	• Public safety assessment complete by June 2022.

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Action 17: Greater acknowledgement of Aboriginal heritage

Desired Outcome	To identify culturally appropriate ways to better acknowledge the indigenous history of the lake surrounding habitats.
Priority ranking	High (9)
DESCRIPTION OF TASKS:	
1. Planning and design of potential options which may include dedicated signage, educational materials and field days to allow for appropriate acknowledgement. 2. Stakeholder engagement: consultation with the range of stakeholders identified during Stage 2 will be important to reflect the diversity of groups and agree on the best way forward. 3. Implementation. 4. Integrate with Action 22: Education campaign for promotion and dissemination of information.	
Lead Organisation	BSC
Support Organisation	EES – Coast and Estuaries, Jali LALC
Total Cost Estimate (10 yr)	$55,000 (Allowance of $40,000 for consultation, planning and concept design, $15,000 for implementation (e.g. signage, educational materials etc.)
Potential Funding Sources	BSC, NSW Coastal and Estuary Grants Program
Timing	Short- term initial planning work (DP1 2020-2022) and ongoing implementation (DP1 - DP3 2020-2029)
Location	Lake and surrounds (all zones), CMA1 – Coastal Wetlands and Littoral Rainforests, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area
Performance Targets	• Planning and design and consultation complete by June 2022. • Implementation and education underway by June 2023.

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Action 18: Encourage alternative transport to the lake

Desired Outcome	To reduce congestion, parking pressure and vehicle use, leading to lower carbon emissions/pollution and increased safety. It also encourages exercise and community connectivity with associated increased health benefits.
Priority ranking	Medium (16)
DESCRIPTION OF TASKS:	
1. Planning and design of potential options which may include provision of bike racks and mobility scooter parking, a peak time shuttle bus service through town to the lake (i.e. summer holidays, Easter and October long weekends) and improved connectivity of walking and cycling pathways to the lake. 2. Stakeholder engagement: community consultation to determine preferred options and likely uptake. 3. Implementation/construction. 4. Integrate with Action 22: Education campaign to raise awareness of these additional services and facilities and promote use.	
Lead Organisation	BSC
Support Organisation	EES – Coast and Estuaries
Total Cost Estimate (10 yr)	$220,000 (staff time and allowance of $20,000 for implementation, $25,000/yr for peak time shuttle bus service)
Potential Funding Sources	BSC, NSW Coastal and Estuary Grants Program
Timing	Ongoing (DP1 - DP3 2020-2029)
Location	Lennox Head and Lake surrounds (Zone 1), CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area
Performance Targets	• Planning and design and consultation complete by June 2023. • Implementation and education underway by June 2024.

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Action 19: Management of future parking arrangements

Desired Outcome	To evaluate the extent of parking issues following completion of Foreshore Improvement Works and assist in directing further management effort.
Priority ranking	High (6)
DESCRIPTION OF TASKS:	
1. Review results of car parking monitoring conducted as part of Action 24: Monitoring program 2. Based on monitoring results recommend additional parking management. 3. Planning and design of new parking arrangements as needed. 4. Consideration and approval by BSC Local Traffic committee. 5. Implementation.	
Lead Organisation	BSC
Support Organisation	EES – Coast and Estuaries
Total Cost Estimate (10 yr)	Staff time
Potential Funding Sources	BSC, NSW Coastal and Estuary Grants Program
Timing	Short-Medium term (DP1 2020-2022 and DP2 2023-2026)
Location	Parking areas along Camp Drewe Road (Zone 2) and urban areas of Lennox Head, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area
Performance Targets	• Report on parking monitoring program results completed by June 2022.

Action 20: Traffic management Camp Drewe Road

Desired Outcome	To improve public safety and reduce likelihood of wildlife road kill on Camp Drewe Road.
Priority ranking	Medium (15)
DESCRIPTION OF TASKS:	
1. Review of appropriate treatments consistent with best practise to improve the road safety for Camp Drewe Road. 2. Liaise with RMS regarding suitable speed limits (recommend no higher than current 50km/hr limit). 3. Liaise with NSW Police to highlight the issue and ensure enforcement of speed limits (e.g. extra patrols).	
Lead Organisation	BSC
Support Organisation	RMS, NSW Police
Total Cost Estimate (10 yr)	$30,000 (staff time and allowance of $30,000 for road treatments)
Potential Funding Sources	RMS, BSC, NSW Coastal and Estuary Grants Program
Timing	Short-Medium term initial review and liaison work (DP1 2020-2022 and DP2 2023-2026) and ongoing (DP1-DP3 2020-2029)
Location	Camp Drewe Road (Zone 2), CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area
Performance Targets	• Review complete by June 2021.

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Action 21: Manage dog access

Desired Outcome	Reduction in the number of dogs in the lake and foreshore areas, reducing the inputs of urine and faeces to the lake and reduced impacts on native wildlife at the lake.
Priority ranking	Medium (23)
DESCRIPTION OF TASKS:	
1. Review current dog access arrangements at the lake as documented in the *BSC Companion Animal Management Plan* (BSC, 2017) and consideration of the following: a. Continue to provide dog access north of the Lennox Head SLSC to Seven Mile Beach. b. Consider removal of the on leash area along the eastern side of the lake, making all lake foreshore areas and immediate surrounds 'dog free'. Access to Seven Mile Beach will be maintained at SLSC track only. 2. Depending on outcomes of review, provide additional signage and education as required. 3. Continue Ranger presence and enforcement in the area. 4. Encourage dog walkers who drive to Seven Mile Beach to access the off-leash area of beach via the horse track at the end of Camp Drewe Road (north of 4wd track) where parking is plentiful. Achieved through Action 22: Education campaign. 5. Continue to provide dog poo bag dispensers and waste bins at suitable access points to the off-leash area at Seven Mile Beach and other locations.	
Lead Organisation	BSC
Support Organisation	EES – Coast and Estuaries
Total Cost Estimate (10 yr)	$10,000 (staff time and allowance of $10,000 for signage and bins/bags)
Potential Funding Sources	BSC, NSW Coastal and Estuary Grants Program
Timing	Short-Medium term (DP1 2020-2022 and DP2 2023-2026) and ongoing (DP1-DP3 2020-2029)
Location	Lake foreshores Zone 1, Zone 2, Zone 3, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area
Performance Targets	• Review of *BSC Companion Animal Management Plan* (BSC, 2017) completed by June 2021.

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4.1.8 Education

Action 22: Education campaign

Desired Outcome	To inform the community about the values of the lake and its unique ecosystem components and sensitivities to human impact. The overall aim is to foster a higher level of understanding, respect and stewardship, translating into positive changes in behaviour.
Priority ranking	Fundamental

DESCRIPTION OF TASKS:

1. Planning: develop a multi-faceted campaign to educate and promote understanding of the natural attributes of the lake, sensitivities and key issues and encouraging low-impact use/practices to protect the lake. Issues to be covered include:
    a. Education about fertiliser use/garden waste management/compost etc. for all catchment land managers and residents to the south of the lake.
    b. Sensitivity of lake ecosystems, need for protection etc.
    c. Groundwater/surface water interactions, emphasising the link between what is added to the surface of land (e.g. fertiliser, manure, herbicides, pesticides etc.) and what can be transported through groundwater flows to the lake.
    d. Types of fertiliser, application rates, timing with rainfall etc.
    e. Information on health risks of exposure to cyanobacteria blooms and revised signage.
    f. Sunscreen pollution:
        - Key risks of sunscreen to human health, water quality and wildlife.
        - Encourage use of more environmentally friendly sunscreen, wear UV resistant clothes instead (e.g. rash shirt etc.), avoid hottest part of day, apply sunscreen 20 minutes before swimming etc.
    g. Promote the key goals of the management zones described in Section 3 (including signage to mark the 'priority swimming areas').
    h. Impacts of dogs on native wildlife and water quality.
    i. Promotion of the horse track at the end of Camp Drewe Road (north of 4wd track) as a place to park and walk dogs on the leash-free beach. The aim is to reduce parking pressure around the lake.
    j. "No Camping/fires" signage along Camp Drewe Road to deter illegal camping and camp fires in bushland.
    k. Pest fish species education - an educative program coupled with facilities for accepting unwanted aquarium fish. Information could include relevant pest species identification information, impacts of aquarium fish releases to the wild, dumping of aquarium fish is prohibited and alternatives to dumping aquarium fish.
    l. Native wildlife present in the area, habitat values and key risks including discussion of what the community and visitors can do to conserve wildlife (i.e. Camp Drewe Road wildlife crossing).
    m. Results of components.
    n. Outcomes of Action 17: Greater acknowledgement of Aboriginal heritage.
    o. Educational programs should target the local community as well as visitors to the area and may involve:
        - Installation of attractive and engaging signage at key locations around the lake (which may replace existing signage).
        - Leaflets/flyers/letterbox drop.
        - Webpage.
        - Social media posts and promotion.
        - Posters.
        - Information days/activities.
        - School programs.
        - Educational videos.
2. Consultation with local community groups (e.g. Lennox Landcare, Wildlife Watchers etc.) during design of the

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program will assist in developing appropriate and relevant information/methods and draw on community educational knowledge and resources. 3. Implement program. Review program on an annual basis. 4.	
Lead Organisation	BSC
Support Organisation(s)	EES – Coast and Estuaries, North East Waste, Beachwatch, WaterNSW, The Lennox Wave magazine, Lennox Head Landcare
Total Cost Estimate (10 yr)	$140,000 (Staff time and allowance of $30,000 for design of campaign, $20,000 for signage and materials, $10,000/yr ongoing implementation)
Potential Funding Sources	BSC, NSW Coastal and Estuary Grants Program
Timing	Short- term initial planning work (DP1 2020-2022) and ongoing implementation (DP1 - DP3 2020-2029)
Location	n/a
Performance Targets	• Planning and design and complete by June 2021. • Implementation and education underway by September 2021.

Action 23: Review blue green algae alert/lake closure signage

Desired Outcome	Better communication of risks associated with algal blooms with a view to reducing swimmers during high risk periods.
Priority ranking	Medium (22)
DESCRIPTION OF TASKS:	
1. Review the current signage including text, images, symbols as well as placement and sizing to ensure effective communication of public health risks. 2. Recommend improvements to signage to more effectively communicate public health risks associated with blue green algae blooms as well as complementary actions to promote and educate about the risks of blooms. 3. Implement – create new signage and deploy at most effective locations. Promote and educate through Action 22: Education campaign.	
Lead Organisation	BSC
Support Organisation	EES – Coast and Estuaries, WaterNSW, NSW Health
Total Cost Estimate (10 yr)	$5,000 (staff time and $5,000 allowance for new signage)
Potential Funding Sources	BSC, NSW Coastal and Estuary Grants Program
Timing	Short- term (DP1 2020-2022)
Location	Lake swimming locations, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area
Performance Targets	• Review complete by August 2020. • Implementation new signage by November 2020.

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4.1.9 Monitoring

Action 24: Monitoring program

Desired Outcome(s)	To track performance of actions implemented as part of the CMP and allow for timely maintenance and adaptive management measures to be implemented as required. To better understand the level of issues and priority for management.
Priority ranking	Fundamental

DESCRIPTION OF TASKS:

1. Planning: develop a multi-discipline monitoring program to provide better information and inform effective management. Components for inclusion are:
   a. Water quality – ongoing monitoring of water quality to allow for assessment of changes as a result of management actions. This task involves an initial review of current/past monitoring program and documentation of an ongoing water quality monitoring plan.
   b. Blue green algae - continuation of current monitoring in line with National Health and Medical Research Council guidelines (NHMRC, 2008) and existing BSC processes.
   c. Automatic water level and water quality - continuation of current monitoring via the automatic water level and water quality recorder managed by MHL on behalf of EES – Coast and Estuaries. Addition of dissolved oxygen and pH probes to the automatic recorder to allow for real-time monitoring of these aquatic health indicators (particularly important with regard to proposed changes to the aerator program).
   d. Sediment extent - it is proposed that the extent of the organic rich mud sediment be assessed every 5 years by repeating the methodology implemented as part of Stage 2 of the CMP. This will provide information about relative rates of sedimentation over time. If reductions in algal blooms are achieved through other management actions, monitoring sediment extent will allow for an assessment of whether reduced algal blooms reduces the rate of sedimentation.
   e. Hydrology and groundwater – conduct groundwater monitoring in the catchment to replicate that undertaken as part of the 1996 Estuary Processes Study and allow for assessment of current groundwater conditions and more accurate modelling of groundwater outflows and lake water balance completed as part of Stage 2 of the CMP development.
   f. Erosion - monitor the performance of the lake foreshore erosion controls and conduct timely maintenance as required. Formal assessment by repeating the Erosion Assessment conducted as part of Stage 2 studies is recommended annually. The current Foreshore Improvement Works along the southern and eastern foreshores of the lake include formalised pedestrian pathways and wheelchair accessible ramps to the water, coupled with bank erosion amelioration works. It will be necessary to monitor the new access points created to ensure access is functioning as intended, and if necessary trigger maintenance or further work as required. There is also a need to monitor future access pressure on the western side following closure of the eastern road to minimise/mitigate any worsening of erosion.
   g. Riparian vegetation - Formal assessment by repeating the Riparian Condition Assessment conducted as part of Stage 2 studies is recommended annually, recommendations to inform riparian restoration works.
   h. Investigations of sunscreen pollution – design a monitoring program to provide further information on the nature of sunscreen pollution and potential impacts on ecology and particularly nutrient concentrations. Monitoring could involve testing lake water for chemicals of concern, assessing the nutrient composition of common sunscreens and/or physical assessment of sunscreen slicks on the lake surface.
   i. Investigate sources of Enterococci (faecal contamination) - determine whether wildlife/dogs or human waste is the source of faecal matter to the lake. This investigation is currently underway at the lake. Results will determine whether follow up monitoring is needed.
   j. Increasing use of the western side – monitor visitor numbers, access points and subsequent impacts on bank erosion, vegetation, ecosystem values, cultural heritage and amenity (Action 15: Monitor and manage increasing use of the western side of the lake). It is recommended that monitoring be conducted over one year to capture seasonal variation. Results will be used to assist in developing concept design for the western foreshore.

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k. Parking - monitor car parking patterns following the closure of the eastern road with a focus on assessing parking along Camp Drewe Road and into suburban areas of Lennox Head and subsequent impacts on environmental values, amenity and public safety. Also track the effectiveness of and dog walker use of beach access at the end of Camp Drewe Road. It is recommended that monitoring is conducted over a year to capture seasonal changes in demand. The information will assist in evaluating the extent of the problem and potential further management options for the western side.

l. Assessment of wildlife populations and impact of Camp Drewe Road – This will involve monitoring of all wildlife road fatalities/injuries along Camp Drewe Road with a particular focus on turtles. A register of community sightings should also be established and advertised to encourage community members to share information. Details to be captured include species name/common name, approximate age (e.g. juvenile/adult), date of observation, observation type (e.g. fatality, injury) location (GPS coordinates if possible), photograph, and details of outcome (e.g. transported to vet/ wildlife carer in the case of injury, or disposal in the case of fatality). The location of turtle nesting sites and crossing locations should be determined to assist in placement of any future traffic control structures and signage (Action 13: Wildlife/turtle crossing warning signs on Camp Drewe Road). It would be ideal to monitor over 1 year to capture seasonal changes, and may potentially be a suitable post-graduate student study.

2. Implement monitoring program

3. Review results of program on an annual basis.

Lead Organisation	BSC
Support Organisation	EES – Coast and Estuaries, Southern Cross University
Total Cost Estimate (10 yr)	$343,000 (Total allowance of $73,000 for program design and equipment, $270,000 ongoing implementation across all components over 10 years)
Potential Funding Sources	BSC, NSW Coastal and Estuary Grants Program, Southern Cross University
Timing	Initial design short-term (DP1 2020-2022) ongoing implementation (DP1 - DP3 2020-2029)
Location	All zones, CMA1 – Coastal Wetlands and Littoral Rainforests, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area
Performance Targets	• Planning and design and complete by June 2021. • Implementation underway by September 2021.

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4.1.10 Management and governance

Action 25: Establish an integrated management group

Desired Outcome	To ensure coordinated and cooperative management for ongoing and effective management of the lake.
Priority ranking	Fundamental
DESCRIPTION OF TASKS:	
1. Formalise roles of the existing Lake Ainsworth CMP Steering Committee to oversee CMP implementation and review. This includes appointment of the following key roles: a. Chairperson to chair meetings. b. Secretary to organise and host meetings and distribute minutes and oversee group administration. 2. As a minimum, meetings should be held twice a year, and more frequently as required to discuss implementation milestones, funding and emerging issues etc.	
Lead Organisation	BSC
Support Organisation(s)	EES – Coast and Estuaries, NSW Office of Sport, NSW Crown Holiday Parks Land Managers, DPIE - Crown Lands, Lennox Head SLSC, Jali LALC, local Aboriginal representatives, representatives of local community groups as relevant.
Total Cost Estimate (10 yr)	Staff time
Potential Funding Sources	n/a
Timing	Ongoing (DP1 –DP3 2020-2029)
Location	n/a
Performance Targets	• Membership of management group and roles appointed by September 2020. • Meetings held twice a year.

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4.1.11 Performance monitoring and review of actions

Action 26: Review of CMP progress and monitoring of performance targets

Desired Outcome	Continuous improvement towards the CMP objectives across the full range of issues.
Priority ranking	Fundamental
DESCRIPTION OF TASKS:	
Documentation of the effectiveness of the proposed actions will be reported as part of Council's State of the Environment (SoE) Reporting and IP&R framework including progress towards the performance targets included for each action.	
Lead Organisation	BSC
Support Organisation	EES – Coast and Estuaries, DPI Fisheries, DPIE - Crown Lands, North Coast LLS
Total Cost Estimate (10 year)	Included in existing Council reporting
Potential Funding Sources	n/a
Timing	Annually (IP&R reporting); every three years (SoE reporting)
Location	Lake Ainsworth
Performance Targets	• IP&R reporting annually • SoE reporting every three years

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Action 27: Ten year review of CMP

Desired Outcome	Management actions and approaches remain appropriate for the long term.
Priority ranking	Fundamental
DESCRIPTION OF TASKS:	
The CMP and the specified management actions should be reviewed to ensure they are being achieved and are resulting in the desired outcomes. A ten year review (or earlier if warranted by legislative or management changes or improved scientific understanding) of the CMP is required to consider: • Results of the SoE Reporting. • Results of IP&R Reporting. • Review of status of CMP actions including overall success and any barriers to the effective implementation. • Any new or updated scientific knowledge. • Data provided by Action 24: Monitoring program. • Prevailing community attitudes, government policy and strategic planning status.	
Lead Organisation	BSC
Support Organisation	EES – Coast and Estuaries, DPI Fisheries, DPIE - Crown Lands, North Coast LLS
Total Cost Estimate (10 year)	$50,000 (Allowance of $50,000 for review at Yr10)
Potential Funding Sources	EES – Coast and Estuaries Estuary Management Program, BSC
Timing	Long term (Yr10, DP3 2027-2029)
Location	Lake Ainsworth
Performance Targets	• Review and reporting undertaken by June 2030. • Adoption and gazettal of the amended CMP as required.

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4.2 Actions to be undertaken by public authorities

4.2.1 Flooding

Action 5: Flood planning - NSW Office of Sport

Desired Outcome	Ensure all development or management option in the study area is suitable for the location and/or is adaptive to changing flooding risk.
Priority ranking	Medium (12)
DESCRIPTION OF TASKS:	
1. Future development in the catchment and all actions implemented as part of this CMP will need to consider the potential future flood risk. 2. Emergency management plans for Lake Ainsworth Sport and Recreation Centre should be updated with future flooding risk and contingencies for the potential closure of Camp Drewe Road due to flooding.	
Lead Organisation	NSW Office of Sport
Support Organisation	BSC,EES – Coast and Estuaries
Total Cost Estimate (10 yr)	Staff time
Potential Funding Sources	n/a
Timing	Short- term (DP1 2020-2022)
Location	Flood risk areas identified in *Stage 2 Vulnerabilities and Opportunities Study* (Hydrosphere Consulting, 2019a), CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area
Performance Targets	• Emergency management plans for Lake Ainsworth Sport and Recreation Centre updated by June 2021.

4.2.2 Flora and fauna

Action 28: Biological control of Salvinia

Desired Outcome	To provide ongoing control of Salvinia in the lake.
Priority ranking	Medium (19)
DESCRIPTION OF TASKS:	
1. DPI to continue biological control of Salvinia at the lake. 2. Review results of program on an annual basis.	
Lead Organisation	DPI
Support Organisation	BSC, EES – Coast and Estuaries
Total Cost Estimate (10 yr)	No additional costs
Potential Funding Sources	n/a
Timing	On-going (DP1 - DP3 2020-2029)
Location	In-lake, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area
Performance Targets	• Annual implementation.

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5. BUSINESS PLAN

The business plan outlines the key components of the funding strategy for the CMP, including the cost of the proposed actions, proposed cost-sharing arrangements and other potential funding mechanisms.

The intent of implementation of this CMP is in meeting the objectives developed for the environmental, social, recreational and commercial values of the lake as identified in Section 1.2.1. This Business Plan (summarised in Table 6) specifies:

- Action ID number and name.
- Cost estimate.
- Timing.
- Cost benefit distribution – A key driver in meeting these objectives is the protection and improvement of lake health bringing about subsequent public benefits (e.g. through improved recreational potential and amenity) or vice-versa. None of the recommended actions aim to benefit private interests although they may do so indirectly as a consequence of improved lake health (e.g. to commercial businesses in the nearby area including tourism operators and food and beverage outlets). No cost-sharing with private parties has been proposed.
- Economic analysis and funding category – three categories are provided as follows:
    - Category 1 – economic analysis complete, action funded under normal operating budget or existing programs and grants and not expected to impact on current resourcing levels.
    - Category 2 – economic analysis complete, action subject to funding.
    - Category 3 – no economic analysis, action subject to detailed costing, economic analysis and funding.

5.1 Funding and resources

The CMP actions are expected to be funded through BSC and state government contributions, monetary grants and volunteer works by community members and organisations.

Some actions are funded under Council's normal operating budgets throughout the ten year period, or through existing programs and grants, particularly within Delivery Program 1 (up until 2023). Where actions require Council staff resources, actual costs have only been applied where it is expected that implementation will exceed current resourcing levels, in which case, additional funding is required.

Council operates an annual budget primarily through rates and charges (e.g. water, sewer and waste) as well as fees, investment revenues, loans, property management and operating grants. It will not be possible for BSC to implement all actions identified in this CMP without additional sources of funding. As such, identification of grants and the submission of successful funding applications is an important component of this CMP. A list of current possible sources of external federal, state and local funding is provided below. However, it is important to note that many grants and funding sources change year to year, are only available up to a limited budget, or require significant co-funding commitment. It is also important to note that accurate estimates of project costs, particularly for on ground works cannot be developed until survey and design tasks have been completed, with these tasks often incurring significant costs. It will be necessary to keep abreast of current funding availability throughout the implementation of the CMP and take advantage of funding opportunities as they arise. In each case, the precise amount of funding available will not be known until it has been awarded.

Agencies responsible for delivery of actions in this CMP have been consulted during the development of the CMP and have indicated support for the actions. However, delivery of the actions will depend on the

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availability of funding which is yet to be confirmed. Despite the priority of each action listed in the CMP, the timeframe of implementation will be influenced by the availability of resources and funding.

Certification of this CMP will facilitate eligibility for funding of key actions through the NSW Coastal and Estuary Grants Program. Actions will be prioritised for future applications for external funding with matching contributions from the budgets of relevant Council programs.

Key sources of funding identified for the CMP actions are:

- BSC funds - generated through rates, fees and charges, investment revenues, loans, property management and operating grants.
- NSW Coastal and Estuary Grants Program – provided by the NSW Government and administered by EES – Coast and Estuaries to support local government work to improve the health of NSW coasts and estuaries under several streams:

    Planning stream – for planning and studies including investigation, design and cost-benefit analyses for infrastructure works recommended in a certified CMP. The funding round for the planning stream is open for 10 months from August-June each year.

    - Implementation stream for each of the four CMAs with priority given to projects that reduce risk from coastal hazards and projects that enhance environmental resilience and the natural environment. Examples projects include but are not limited to:
        - Weed management, vegetation rehabilitation, signage and education programs in coastal wetland and littoral rainforest areas (CMA 1);
        - Design and implementation of erosion reduction structures and beach nourishment works in coastal vulnerability areas (CMA 2);
        - Ecosystem health monitoring, community education, stormwater management, revegetation, protection of Aboriginal heritage and riparian corridor management in coastal environment/coastal use areas (CMA 3 and CMA 4).

    The funding round for the implementation stream is open for one month (August-September) each year.
- Increasing Resilience to Climate Change program – a partnership program between Local Government NSW (LGNSW) and EES – Coast and Estuaries to encourage:
    - Implementation of actions to address identified climate risks.
    - Regional consideration of climate change impacts in decision making.
    - Implementation of climate change adaptation actions beyond business-as-usual projects and programs.
    - Enhanced adaptive capacity.
- DPIE – Crown Lands:
    - Crown Reserves Improvement Fund Program for development and maintenance projects and to improve land and facilities on Crown land. Funding under this program is subject to a competitive grant application process and eligibility requirements which may change from year to year and in accordance with departmental priorities.
- The NSW Environment Trust – administered by EES – Coast and Estuaries to fund a broad range of projects which enhance the environment of NSW. Relevant streams include environmental education, protecting our places (for the sharing and protection of Aboriginal Cultural knowledge and the protection, restoration and enhancement of culturally significant Aboriginal Land), research, restoration and rehabilitation projects and waste avoidance and resource recovery.

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- NSW EPA Waste Less, Recycle More initiative - a set of programs including “Council Litter Prevention Grants”, managed by the NSW Environment Protection Authority and NSW Environmental Trust. The initiative includes programs for local government, business, industry and the community. Relevant examples of recent grants awarded under the program include “Butt-free Byron Shire” a program aimed at changing littering behaviour through collaborative community engagement, education and enforcement with a focus on cigarette butts (Byron Shire, $100,000). The NSW Government has allocated $802 million over 9 years for Waste Less, Recycle More. The initiative will run until 2020–2021.
- Commonwealth Community Led Grants - Indigenous Advancement Strategy grant funding for Aboriginal people and communities to devise strategies that will support their community and the people living in it and to carry out projects that address an emerging need or opportunity.
- Human resources and in-kind contributions are also, or may be required from:
    - BSC,
    - DPIE – Crown Lands,
    - EES – Coast and Estuaries,
    - NSW Office of Sport,
    - Crown Holiday Parks Land Manager,
    - Lennox Head SLSC,
    - DPI - Fisheries,
    - North East Waste,
    - RMS,
    - NSW Police,
    - North Coast LLS,
    - Jali LALC,
    - Lennox Head Landcare,
    - Other volunteer and community groups,
    - Educational and research institutions.

Where actions are being sufficiently implemented through an ongoing concurrent program, additional expenditure and funding have not been included.

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Table 6: Business Plan

No.	Action/Year	Priority Ranking	Total 10 yr cost	Total 10 yr capital cost	Total 10 yr operational cost	DP1 (2020-2022)			DP2 (2023-2026)				DP3 (2027-2029)			Cost benefit distribution (private vs. Public)	Business Plan Category
						Yr1	Yr2	Yr3	Yr4	Yr5	Yr6	Yr7	Yr8	Yr9	Yr10		
			$'000	$'000	$'000	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029		
Water quality																	
1	Trial modifications to artificial aeration	High	**110**		**110**	60	50									100% public	2
Sediment Management																	
2	Trial sediment treatment	High	**220**		**220**			40	170	10						100% public	2
Bank Erosion																	
3	Beach nourishment	High	**260**	**250**	**10**		50	200			5			5		100% public	2
4	Riparian vegetation enhancement for erosion control	High	**65**	**20**	**45**		25	5	5	5	5	5	5	5	5	100% public	2
Catchment Management																	
5	Stormwater treatment/ improvement	Medium	**40**		**40**					20					20	100% public	2
6	Litter management/ recycling	High	**50**		**50**	5	5	5	5	5	5	5	5	5	5	100% public	2
Flooding																	
7	Flood planning	Medium				no additional cost										100% public	1
Flora and Fauna																	
8	Local cane toad management strategy	Medium	**55**		**55**			20	5	5	5	5	5	5	5	100% public	2
9	Riparian vegetation management	Medium	**110**	**30**	**80**		30	10	10	10	10	10	10	10	10	100% public	2
10	Backfill exposed tree roots	High	**56**	**50**	**6**	50		2			2			2		100% public	2
11	Aquatic weed harvesting	Medium	**10**		**10**	1	1	1	1	1	1	1	1	1	1	100% public	2
12	Grass species selection and install	Medium	**85**	**85**						85						100% public	1&2
13	Wildlife/ turtle crossing warning signs on Camp Drewe Road	Medium	**10**	**5**	**5**	5				5						100% public	2
14	Replace boom	Medium	**10**	**10**		10										100% public	1
Community Uses																	
15	Monitor and manage western side of the lake	High	**300**	**300**			100	200								100% public	2
16	Review of public safety risk assessment	High	**10**		**10**		5					5				100% public	2
17	Greater acknowledgement of Aboriginal Heritage	High	**55**	**15**	**40**		40	15								100% public	2
18	Encourage alternative transport to the lake	Medium	**220**	**20**	**200**			45	25	25	25	25	25	25	25	100% public	2
19	Management of future parking arrangements	High				no additional cost										100% public	1
20	Traffic management Camp Drewe Road	Medium	**30**	**30**		30										100% public	2
21	Manage dog access	Medium	**10**	**10**			10									100% public	2
Education																	
22	Education campaign	Fundamental	**140**	**20**	**120**	30	30	10	10	10	10	10	10	10	10	100% public	2
23	Review blue green algae alert/ lake closure signage	Medium	**5**	**5**		5										100% public	2
Monitoring																	
25	Monitoring program	Fundamental	**343**	**73**	**270**	58	100	35	25	30	20	15	25	20	15	100% public	1&2
Management and Governance																	
24	Establish an integrated management group	Fundamental				no additional cost										100% public	1
Performance Monitoring and Review of Actions																	
26	Review of CMP progress	Fundamental				no additional cost										100% public	1
27	10 year review of CMP	Fundamental	**50**		**50**										50	100% public	2
Actions to by Other Public Authorities																	
28	Biological control of Salvinia	Medium				no additional cost										100% public	1
TOTALS			**2244**	**923**	**1321**	**254**	**446**	**588**	**256**	**211**	**88**	**81**	**86**	**88**	**146**		

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Notes:
1. Years correspond to end of financial year i.e. 2020 is Year 1 (start 1st July 2020, end 30th June 2021) etc.
2. Timing is dependent on Ministers approval of CMP and approval of funding where applicable.
3. Shaded cells - actions with no additional costs allocated as part of this CMP.
4. Business Plan Categories:

Category 1 – economic analysis complete, action funded under normal operating budget or existing programs and grants and not expected to impact on current resourcing levels.

Category 2 – economic analysis complete, action subject to funding.

Category 3 – no economic analysis, action subject to detailed costing, economic analysis and funding.

6. MAPPING

Mapping is provided in the following section as follows:

- Figure 4: Coastal management areas for Lake Ainsworth (excluding coastal vulnerability) - The Lake Ainsworth CMP encompasses all four coastal management areas defined in the CM Act:
    - CMA1 – Coastal Wetlands and Littoral Rainforests – large tracts of coastal wetland lie west of Camp Drewe Road as part of the Newrybar Swamp.
    - CMA2 – Coastal Vulnerability Area – although not currently mapped by DPE (2019), the coastal dune areas directly east of the lake are identified as being subject to current and future coastal hazards in the *Ballina Shire Coastline CZMP* (GeoLINK, 2016).
    - CMA 3 – Coastal Environment Area
    - CMA 4 – Coastal Use Area

    Mapping of coastal management areas has been completed by DPE (2019) and is shown in Figure 4. No changes to these current coastal management areas are proposed as part of this CMP.
- Figure 5: Existing land management responsibility - The existing land management arrangements within the catchment were interpreted from lot data obtained from the NSW Government spatial services and Land Register data obtained from BSC as well as discussions with Council and DI – Crown Lands.

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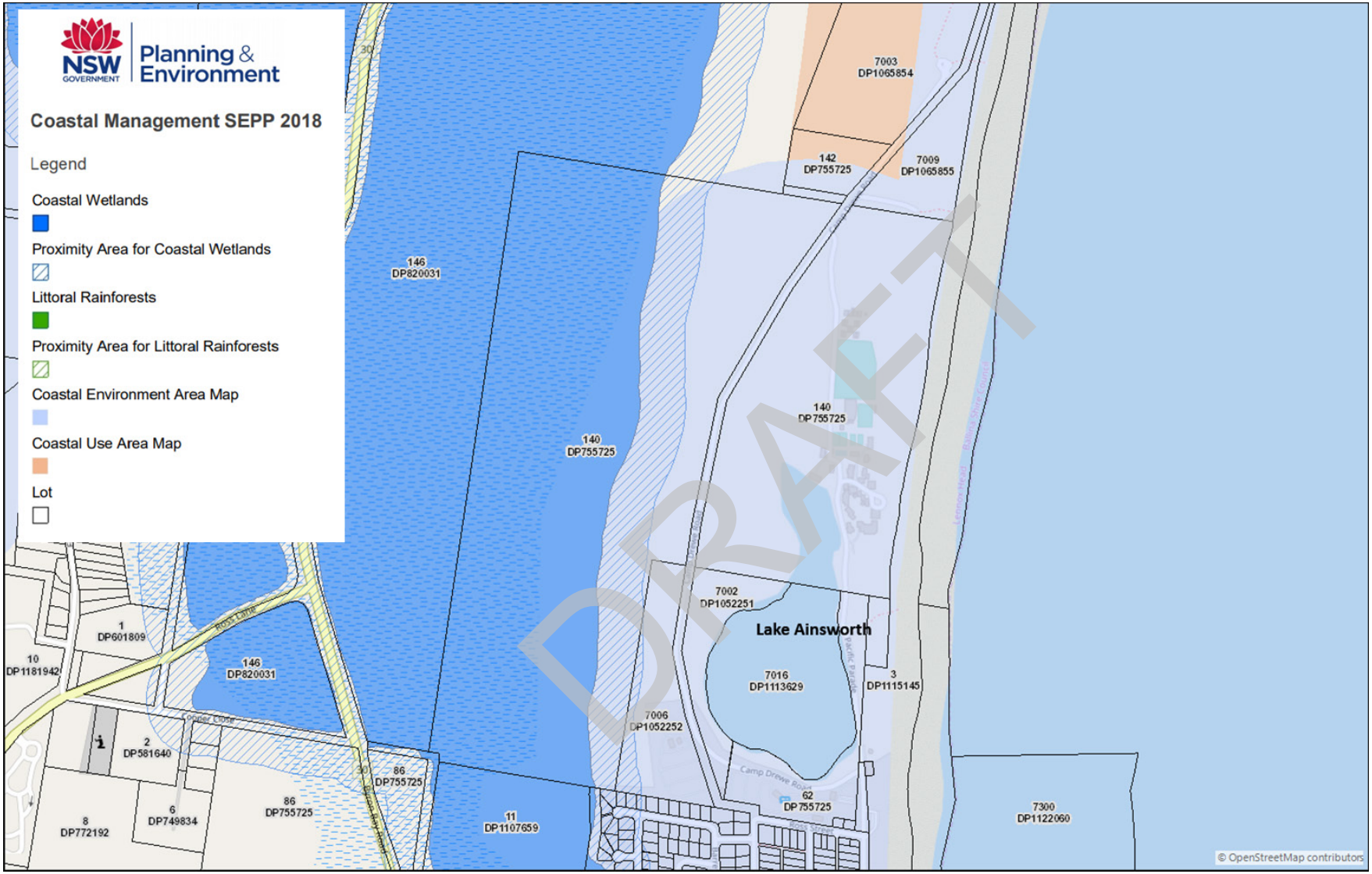

Figure 4: Coastal management areas for Lake Ainsworth (excluding coastal vulnerability)

Source: DPE (2019)

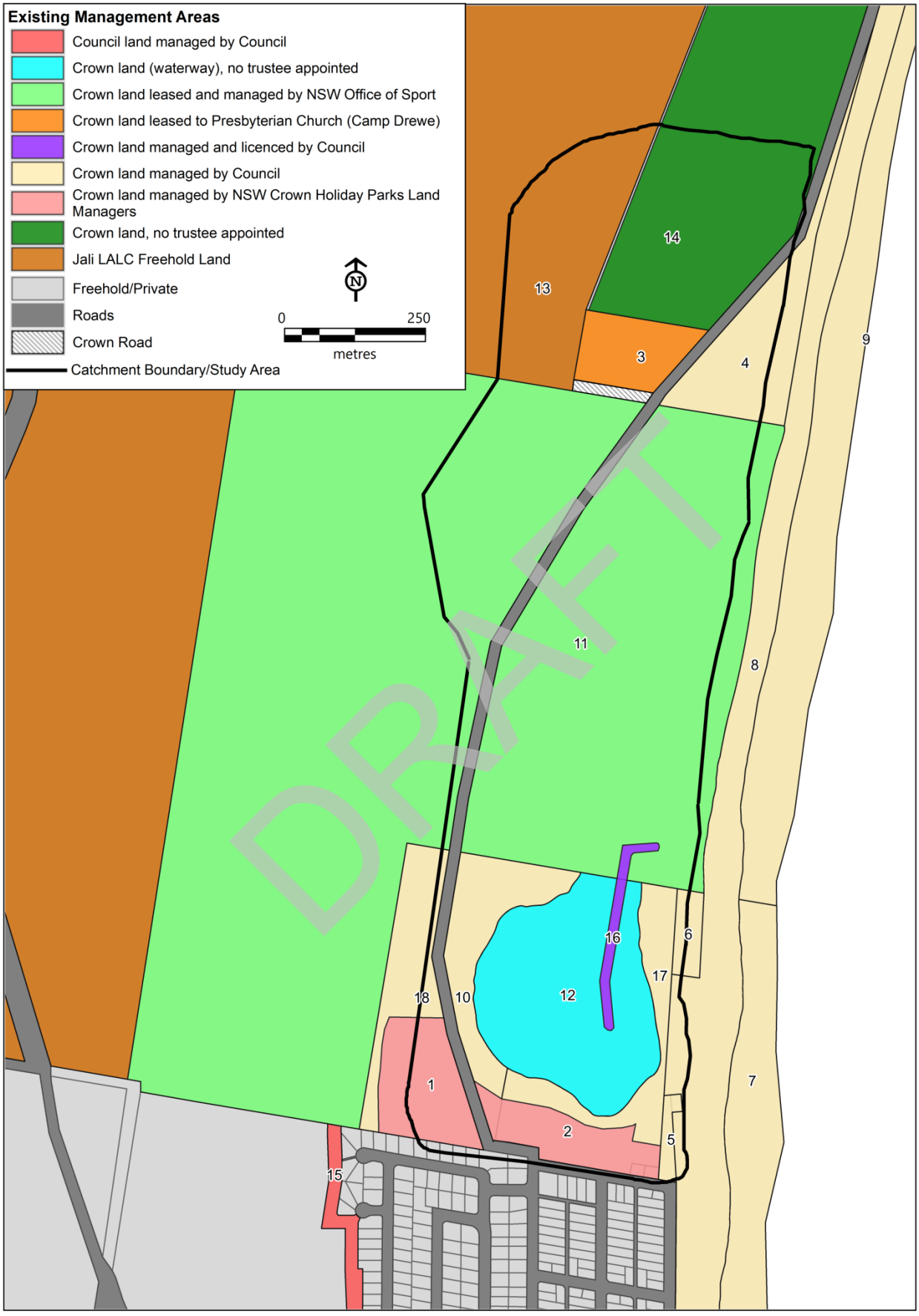

Figure 5: Existing land management responsibility

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GLOSSARY AND ABBREVIATIONS

Amenity	A desirable or useful feature or facility of a building or place
ANZECC	Australian and New Zealand Environment and Conservation Council- provided governments and communities with a set of tools for assessing and managing ambient water quality and sediment quality in natural and semi-natural water resources.
Aquatic	Living or growing in water, not on land.
BFRMP	Ballina Floodplain Risk Management Plan
BOM	Bureau of Meteorology
BSC	Ballina Shire Council
CBMP	Cape Byron Marine Park
CMA	Coastal Management Area
CMP	Coastal Management Program
CZMP	Coastal Zone Management Plan
Dissolved Oxygen	Oxygen dissolved in the water (oxygen saturation). Often abbreviated to DO
DP	Council's four year Delivery Program
DPI Fisheries	Department of Planning, Industry and Environment Regions, Industry, Agriculture and Resources Department of Primary Industries Fisheries
DPIE - Crown Lands	Department of Planning, Industry and Environment, formerly DI Lands
Ecology	The interactions between organisms and their environment
Ecosystem	Refers to all the biological and physical parts of a biological unit (e.g. an estuary, forest, or planet) and their interconnections.
EES – Coast and Estuaries	Department of Planning, Industry and Environment - Environment, Energy and Science – Coast and Estuaries, formerly known as OEH Coasts and Estuaries
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
Foreshore Improvement Works	Lake Ainsworth precinct project under construction in 2018/2019. Once completed, the $1.7M investment will include additional barbeques, pathways, picnic tables, formalised parking, erosion rehabilitation and landscaping.
Foreshore	That part of the shore that lies between the mean high tide mark and the mean low tide mark
Hydrodynamics	The motion of a fluid and interactions with its boundaries
Hydrology	The study of water and its properties, including precipitation onto land and returning to oceans
IP&R	NSW Integrated Planning and Reporting Framework
LEP	Local Environmental Plan
LGA	Local Government Area
LLS	Local Land Services
MEMA	Marine Estate Management Authority
MHL	Mainly Hydraulics Laboratory
NPWS	National Parks and Wildlife Service
OEH	Office of Environment and Heritage (now EES- Coasts and Estuaries)

DRAFT

Riparian	Of, on or relating to the banks of a watercourse
SCU	Southern Cross University
SEPP	State Environmental Planning Policy
SLSC	Surf Life Saving Club
SoE	State of Environment
Terrestrial	Living or growing on land (not aquatic)
The lake	Lake Ainsworth
Turbid	Cloudy or dirty (not clear)
Turbidity	A measure of the amount of light-attenuating particles in a water body.
VMP	Vegetation Management Plan

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Appendix 1. LINKS TO THE OBJECTS OF THE *COASTAL MANAGEMENT ACT 2016* AND THE *MARINE ESTATE MANAGEMENT ACT 2014*

This Appendix provides more information on the linkages between the CMP with the objects of the:

- *Coastal Management Act 2016.*
- *Marine Estate Management Act 2014.*

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The focus of this CMP is to achieve the 13 objects of the *Coastal Management Act 2016* (CM Act) through the development of a long term management strategy. Table 7 identifies linkages between the locally specific objectives developed for the CMP (refer Section 1.3) with the objects of the CM Act being:

> *(a) to protect and enhance natural coastal processes and coastal environmental values including natural character, scenic value, biological diversity and ecosystem integrity and resilience, and*
>
> *(b) to support the social and cultural values of the coastal zone and maintain public access, amenity, use and safety, and*
>
> *(c) to acknowledge Aboriginal peoples' spiritual, social, customary and economic use of the coastal zone, and*
>
> *(d) to recognise the coastal zone as a vital economic zone and to support sustainable coastal economies, and*
>
> *(e) to facilitate ecologically sustainable development in the coastal zone and promote sustainable land use planning decision-making, and*
>
> *(f) to mitigate current and future risks from coastal hazards, taking into account the effects of climate change, and*
>
> *(g) to recognise that the local and regional scale effects of coastal processes, and the inherently ambulatory and dynamic nature of the shoreline, may result in the loss of coastal land to the sea (including estuaries and other arms of the sea), and to manage coastal use and development accordingly, and*
>
> *(h) to promote integrated and co-ordinated coastal planning, management and reporting, and*
>
> *(i) to encourage and promote plans and strategies to improve the resilience of coastal assets to the impacts of an uncertain climate future including impacts of extreme storm events, and*
>
> *(j) to ensure co-ordination of the policies and activities of government and public authorities relating to the coastal zone and to facilitate the proper integration of their management activities, and*
>
> *(k) to support public participation in coastal management and planning and greater public awareness, education and understanding of coastal processes and management actions, and*
>
> *(l) to facilitate the identification of land in the coastal zone for acquisition by public or local authorities in order to promote the protection, enhancement, maintenance and restoration of the environment of the coastal zone, and*
>
> *(m) to support the objects of the Marine Estate Management Act 2014*."

Similarly, the Marine Estate Management Act 2014 (MEM Act) provides several objects, as identified below, for which linkages with the locally specific objectives of this CMP are identified in Table 7:

> *(a) to provide for the management of the marine estate of New South Wales consistent with the principles of ecologically sustainable development in a manner that:*
>
> *(i) promotes a biologically diverse, healthy and productive marine estate, and*
>
> *(ii) facilitates:*
>
> *1) economic opportunities for the people of New South Wales, including opportunities for regional communities, and*
>
> *2) the cultural, social and recreational use of the marine estate, an*
>
> *3) the maintenance of ecosystem integrity, and*

DRAFT

4) the use of the marine estate for scientific research and education,

(b) (b) to promote the co-ordination of the exercise, by public authorities, of functions in relation to the marine estate,

(c) (c) to provide for the declaration and management of a comprehensive system of marine parks and aquatic reserves.

The *2018 - 2028 Marine Estate Management Strategy* (MEMA, 2018) details how the Marine Estate Management Authority will achieve the vision for the NSW Marine Estate over the next ten years. The Strategy recognises that effective coastal and marine management needs to be holistic, coordinated and evidence-based. The Strategy:

- Sets the policy directions for managing the marine estate as a single continuous system.
- Identifies management priorities based on the findings of the NSW marine estate threat and risk assessment.
- Balances economic growth, use and conservation of the marine estate.

The Strategy coordinates all aspects of marine estate management under one framework. This involves all relevant NSW Government agencies, integration with local government, industry, stakeholders and communities. The final Strategy will be released in 2018, supported by a detailed implementation plan and Marine Integrated Monitoring Program that will monitor the progress of the Strategy's actions and address key knowledge gaps.

Many of the Strategy initiatives and actions are relevant to the management of Lake Ainsworth and have been addressed during the development of this CMP as shown Table 7.

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Table 7: Alignment of the locally specific coastal management values and objectives with the objects of the *Coastal Management Act 2016* and the *Marine Estate Management Act 2014*

Values of the CMP Study Area	Locally Specific CMP Objectives	Alignment with objects of the CM Act 2016													Alignment with objects of the MEM Act 2014						
		(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(a)(i)	(a)(ii)1	(a)(ii)2	(a)(ii)3	(a)(ii)4	(b)	(c)
Environmental Values																					
Water quality	1. To improve and maintain water quality and ecosystem health of the lake and surrounding habitats. 2. To reduce threats and improve the resilience of the lake to all current and future threats;	✓				✓			✓		✓				✓		✓	✓		✓	
Natural habitats and biodiversity	3. To protect and enhance the coastal environmental values and natural processes of the lake and enhance natural character, scenic value, biological diversity and ecosystem integrity. 4. To encourage and support plans and strategies to improve the health and resilience of the lake and catchment area.	✓				✓	✓	✓	✓		✓		✓		✓			✓		✓	
Recreational, Cultural and Community Values																					
Scenic quality and amenity	5. To protect and enhance the recreational, scenic, social and cultural values of the catchment area (also linked to objectives 1-4)	✓	✓		✓		✓	✓	✓		✓					✓	✓			✓	
Public access to and use of the river and foreshore	6. To improve and maintain public access and safety, facilities and infrastructure within the catchment area.		✓		✓	✓	✓	✓	✓	✓	✓					✓	✓			✓	
Education, engagement and public opinion	7. To actively engage with the public to achieve greater awareness, education and understanding of management issues and actions. 8. To support public participation in the coastal management and planning process.		✓	✓	✓		✓	✓	✓	✓	✓	✓			✓		✓		✓	✓	
Aboriginal cultural heritage and practice	9. To understand, protect and respect the aboriginal heritage value of the lake including aboriginal peoples' spiritual, social, customary and economic use of the catchment area.	✓	✓	✓					✓		✓	✓					✓		✓	✓	
Coastal risk and adaption to climate change	10. Identify coastal hazard risks and develop actions that increase the adaptive capacity of land managers, the community and natural systems to the predicted impacts of climate change, including increased storm intensity and sea level rise.	✓				✓	✓	✓	✓	✓	✓	✓	✓		✓			✓	✓	✓	
Economic Values																					
Local economy, jobs and prosperity	11. To support integrated and co-ordinated coastal planning, management and reporting (achieving above objectives will contribute to local economic values through enhanced tourism and associated business activity)		✓		✓		✓		✓	✓	✓				✓	✓		✓		✓	

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Appendix 2. COASTAL HAZARD CONSIDERATIONS FOR THE FUTURE BALLINA COASTLINE CMP

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Coastal hazard issues relevant to Lake Ainsworth

The continued recession of Seven Mile Beach and increased risk of erosion as a consequence of climate change (i.e. sea-level rise and storm events) has the potential to result in periodic or permanent opening of Lake Ainsworth to the sea. This has been identified as a key issue in the *Coastal Zone Management Plan for the Ballina Shire Coastline* (CZMP, GeoLINK, 2016). Oceanic breakthrough to the lake would substantially alter the ecosystem functions of the waterbody and surrounding habitats by changing the salinity, water chemistry and water level regime of the waterbody.

Weather events resulting in storm surges and abnormal waves have the potential to overtop the bordering dune system along Seven Mile Beach at points of low elevation (i.e. beach access tracks). This could result in saline input into Lake Ainsworth, localised flooding along the eastern side of the catchment, localised erosion along the dune system and lake foreshore, and disruption of public use via impeded access. Investigations as part of Stage 2 of this CMP indicated that the risk of significant wave run-up and over-wash of salt water to Lake Ainsworth during heavy seas is currently low, but will increase with continued sea level rise. The highest risk site is at the Surf Club, where risks can be mitigated by temporary minor works as required.

Actions currently proposed as part of the Ballina Coastline CZMP

Extension of current sea walls along Seven Mile Beach and beach nourishment to provide continuous shoreline protection is recommended in the existing certified CZMP (GeoLINK, 2016). The CZMP recommends protection of landward assets (rather than a 'retreat' option) for the section of coast between Byron Street and the Sport and Recreation Centre. Consideration as part of Stage 2 of this CMP has confirmed that this option is the best option for long-term protection of Lake Ainsworth.

The Emergency Action Subplan in the CZMP (GeoLINK, 2016) sets out a plan for coastal emergencies including responsibilities and actions to prepare for and manage wave run-up and dune overtopping events in Lennox Head north of Byron Street. The actions focus on preventing entry of seawater into buildings, and damage to infrastructure. There is currently no mention of actions (e.g. sand-bagging) to prevent over wash to Lake Ainsworth.

Additional measures required to protect the lake

The coastline CZMP protection strategy is regarded as sound and fully compatible with the on-going management requirements for Lake Ainsworth. As part of this CMP, a number of additional measures relevant to the ongoing protection of Lake Ainsworth and have been identified which should be considered as part of the future coastline CMP development:

1. The coastline CZMP suggests that any sea wall option protecting Lake Ainsworth could be located further landward than in other areas, however it would be advantageous to protect as much of the dune system as practical, for ecological, aesthetic and risk mitigation purposes (Plate 12). Therefore a more easterly alignment is recommended.

2. Any works along Seven Mile Beach will need to consider groundwater outflows from Lake Ainsworth through the dunes and ensure no adverse impacts on lake hydrology (e.g. restriction of outflows, flooding impacts etc.).

3. A response strategy to extreme swell/high water conditions should be formulated to combat the potential for wave run-up and marine over-wash into the Lake Ainsworth basin. It is considered that the only notable current risk is at the Surf Club access ramp area and that a short-term emergency response in this area would be feasible and effective. Given the good accessibility and the proximity to the Surf Club (Plate 13) which itself would also warrant protective measures, a strategy to deploy short-term defences such as sand bags to prevent over wash into the lake and foreshore areas

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would mitigate any current risk associated with wave run-up. This should be incorporated into the coastline CMP Emergency Action Subplan. There is a need for a detailed evaluation of future wave run-up risk associated with sea level rise. Any redevelopment of the Surf Club should consider these aspects in design and construction.

4. Further analysis and correction of discrepancies in recent LiDAR data to ensure an accurate monitoring of coastline sand reserves to the east of Lake Ainsworth. For future acquisition, particular focus should be placed on proper discrimination and classification of LiDAR returns to ensure appropriate analysis can be undertaken.

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Plate 12: Aerial image of the dunes separating the lake from the Pacific Ocean

Plate 13: Aerial view of Surf Club and potential over-wash areas 1 and 2

Appendix 3. NSW COASTAL MANAGEMENT FRAMEWORK AND MANDATORY REQUIREMENTS

This appendix lists the mandatory requirements for the preparation of a coastal management program (stages 1 to 4, NSW Coastal Management Manual (OEH, 2018)) and how they have been addressed in this CMP.

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Table 8: Addressing the Essential Elements of the *NSW Coastal Management Manual (OEH, 2018)*

Mandatory Requirements		Where addressed in this CMP
Purpose of a coastal management program		
2.	A CMP is to consider a range of timeframes and planning horizons including immediate, 20 years, 50 years, 100 years and (if council considers it relevant based on expert advice) beyond.	The timeframe of risks assessed are discussed in *Stage 2 Vulnerabilities and Opportunities Study* (Hydrosphere Consulting, 2019a).
3.	A CMP is to consider a broad range of coastal management issues and management actions with a focus on achieving the objects and objectives of the CM Act.	The range of coastal management issues are summarised in Section 2 and discussed in detail in *Stage 1 Scoping Study* (Hydrosphere Consulting 2018) and *Stage 2 Vulnerabilities and Opportunities Study* (Hydrosphere Consulting, 2019a). A broad range of management actions were assessed as part of the *Stage 3 Management Options Study* (Hydrosphere Consulting, 2019b) and refined in Section 4.
Where and when a coastal management program is prepared		
4.	A CMP must include the rationale for selecting the area to be covered by a CMP and identify whether it applies to: i) all or part of the coastal zone of one local government area; or ii) all or part of the coastal zone of adjoining local government areas that share a coastal sediment compartment or estuary (where adjoining local government areas share a coastal sediment compartment or estuary - refer to Schedule 1 of the CM Act - a CMP that addresses an area comprising that coastal sediment compartment or estuary must reflect this regional context)	The rationale for selecting the CMP study area is provided in Section 1.2.
5.	A CMP must identify: i) any proposed amendments to mapping of the relevant coastal management areas; ii) evidence to support any proposed amendments or additions to the area of the four coastal management areas in the relevant area; and iii) information about these proposed amendments that can support the preparation of a planning proposal and, in particular, that could be forwarded along with a planning proposal to the Greater Sydney Commission (if the planning proposal relates to the Greater Sydney Region) or the Minister (for elsewhere) to inform a Gateway determination under section 3.34 of the EP&A Act.	No changes to the mapped CMAs are recommended at this time.

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Mandatory Requirements		Where addressed in this CMP
How a coastal management program is prepared		
6.	During preparation of a CMP, a council is to: i) identify the scope of the CMP; ii) determine and assess coastal risks, vulnerabilities and opportunities (including without limitation risks to environmental, social and economic values and benefits); and iii) evaluate and select coastal management options.	The scope of the CMP was identified in the Brief to Consultants and in the subsequent preparation of the *Stage 1 Scoping Study* (Hydrosphere Consulting, 2018). The range of coastal risks, vulnerabilities and opportunities are discussed in detail in the *Stage 2 Vulnerabilities and Opportunities Study* (Hydrosphere Consulting, 2019a) and summarised in Section 2. A broad range of management actions were assessed as part of the *Stage 3 Management Options Study* (Hydrosphere Consulting, 2019b) and refined in Section 4.
7.	A council may choose not to repeat steps (or parts of steps) in subparagraphs (ii) or (iii) of mandatory requirement 6 for the area the subject of the proposed CMP (or parts of that area) if those tasks have already been undertaken for the coastal management of that area, provided that council first considers: i) whether the existing assessment of coastal risks, vulnerabilities and opportunities, or the existing evaluation of coastal management options, that council proposes to rely on enables council to prepare the CMP in accordance with mandatory requirement 8 below and sections 14 and 15 of the CM Act; ii) the effectiveness of the existing coastal management of that area; and iii) whether any circumstances concerning the coastal management of that area have changed.	N/A
Matters to be dealt with in a coastal management program		
8.	A CMP must: i) provide a description of how the objects of the CM Act have been considered and promoted in preparing the CMP;	The objects of the CM Act are reflected in the specific local objectives developed for this CMP (Section 1.2.1). The alignment of the objects of the CM Act and the MEM Act with the specific local objectives of the CMP is shown in Appendix 1.
	ii) provide a description of how the objectives of the coastal management areas covered by the CMP have been given effect to in preparing the CMP;	The management objectives for each coastal management areas have been used to guide the development of specific local objectives developed for this CMP (Section 1.2.1).
	iii) identify the key coastal management issues affecting the areas to which the CMP is to apply and how these have been considered;	The range of coastal management issues are summarised in Section 2 and discussed in detail in *Stage 1 Scoping Study* (Hydrosphere Consulting 2018) and *Stage 2 Vulnerabilities and Opportunities Study* (Hydrosphere Consulting, 2019a).
	iv) identify any coastal management actions required to address those key coastal management issues in an integrated and strategic manner;	Management actions are provided in Section 4.

DRAFT

Mandatory Requirements		Where addressed in this CMP
	v) identify how the coastal management actions in (iv) have been considered and evaluated (including, without limitation, how council has evaluated the coastal management actions in light of the functions and responsibilities council has under legislation other than the CM Act);	A description of how management options were evaluated and selected is provided in *Stage 3 Management Options Study* (Hydrosphere Consulting, 2019b).
	vi) identify any environmental protection works, on land identified as 'coastal wetlands' or 'littoral rainforests' on the Coastal Wetlands and Littoral Rainforests Area Map under the CM SEPP, that are proposed to be carried out by or on behalf of a public authority;	N/A
	vii) identify any coastal protection works that are proposed to be carried out by or on behalf of a public authority;	Refer to Appendix 1 for discussion of coastal hazards to be addressed as part of the Ballina Coastline CMP.
	viii) set out the recommended timing for the proposed coastal management actions;	The proposed timing (i.e. in which Delivery Program(s) of Council's IP&R Framework) of action is specified in the Business Plan (Section 5).
	ix) identify a proposed monitoring, evaluation and reporting program in relation to the CMP, including by identifying key indicators, trigger points and thresholds relevant to the CMP; and	A monitoring program is provided in Sections 4.1.9 and 4.1.11.
	x) include a business plan.	A Business Plan is provided in Section 5.
9.	The business plan included in the CMP must identify: i) all proposed coastal management actions identified elsewhere in the CMP; ii) the full proposed capital, operational and maintenance costs, and recommended timing, of proposed coastal management actions; iii) any proposed cost-sharing arrangements and any other viable funding mechanisms for the proposed coastal management actions to ensure delivery of those actions is consistent with the timing for their implementation under the CMP; and iv) the distribution of costs and benefits of all proposed coastal management actions.	A Business Plan is provided in Section 5.
10.	Where coastal hazards have been identified in a coastal management area, a CMP must identify proposed coastal management actions for those hazards.	Refer to Appendix 1 for discussion of coastal hazards to be addressed as part of the Ballina Coastline CMP.
11.	If the CM Act requires that a coastal zone emergency action subplan be prepared, it must identify any requirements for how emergency coastal protection works, within the meaning of the CM SEPP, are to be carried out.	N/A - Refer to Appendix 1
12.	A CMP must demonstrate how a council has considered: i) projected population growth and demographic changes; and ii) projected use of coastal land for infrastructure, housing, commercial, recreational and conservation purposes	Projected growth and land use changes are considered in detail in *Stage 1 Scoping Study* (Hydrosphere Consulting 2018).

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Mandatory Requirements		Where addressed in this CMP
13.	A CMP must demonstrate how a council has considered: i) current and future risks, at timeframes of immediate, 20 years, 50 years, 100 years and (if council considers it relevant based on expert advice) beyond; ii) (if council considers it relevant) current and future risks of potentially high consequence, low probability events that may affect the relevant area; iii) the effects of projected climate change and how it may affect the relevant area; iv) the local and regional scale effects of coastal processes; and v) the ambulatory and dynamic nature of the shoreline and how it may affect the relevant area.	The timeframe of risks assessed are discussed in *Stage 1 Scoping Study* (Hydrosphere Consulting 2018) and *Stage 2 Vulnerabilities and Opportunities Study* (Hydrosphere Consulting, 2019a).
14.	A CMP is to include the following sections: i) Executive summary ii) Introduction iii) A snapshot of issues iv) Actions to be implemented by the council v) Actions to be implemented by public authorities vi) A business plan vii) Coastal zone emergency action subplan (where relevant) ix) Maps x) Reference list	The CMP has been formatted according to Mandatory Requirement 14.
Consultation on the coastal management program		
15.	A draft CMP must be exhibited for public inspection at the main offices of the councils of all local government areas within the area to which the CMP applies, during the ordinary hours of those offices, for a period of not less than 28 calendar days before it is adopted. This mandatory requirement does not prevent community consultation, or other consultation, in other ways.	Public exhibition of the CMP will be undertaken in accordance with Mandatory Requirement 15.
Review, amendment and replacement of a coastal management program		
16.	When implementing a CMP, a council must: i) carry out the monitoring, evaluation and reporting program in the CMP (MER); and ii) monitor key indicators, trigger points and thresholds identified in the MER.	A monitoring program is provided in Sections 4.1.9 and 4.1.11 with indicators provided in action descriptions Section 4.
17.	Councils must report on the implementation of a CMP through the IP&R framework on an annual, four yearly and ten-yearly basis.	Alignment of the CMP with Council's IP&R Framework is discussed in Section 4.

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Mandatory Requirements		Where addressed in this CMP
Implementation of a coastal management program		
18.	When an adjoining council or a public authority is affected, or is likely to be affected, by implementation of some aspect of a CMP, a council must liaise with that authority when implementing that aspect of the CMP.	Section 4.2 discusses actions to be undertaken by Public Authorities
19.	Councils must maintain sufficient information and records about its management of the relevant parts of the coastal zone that will enable it to demonstrate: i) how the CMP has been implemented ii) what has been achieved in connection with the CMP, including whether coastal management actions have been carried out within the timeframes identified in the CMP.	Monitoring, evaluation and reporting of implementation is discussed in Section 4.1.11.

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