DRAFT CONSERVATION ADVICE
Wetlands and inner floodplains of the Macquarie Marshes

Submission Centre for Ecosystem Science, University of New South Wales

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Table of Contents

Section 1. Ecological community name and description

Consultation questions/comments on the area inhabited

a. Do you agree with the proposed name for the ecological community? Please provide an appropriate First Nations name that could be used in addition to, or instead of Macquarie Marshes (noting Wambuul is accepted as one of the First Nations names for the river, but we have not proposed it as part of the ecological community name as it is not likely to be the right First Nations word to use for the Marshes themselves).

Comment – We agree with the proposed name for the community

b. Please indicate if you have any changes to better describe the location, physical environment and environmental characteristics for the area in nature inhabited by the ecological community?

Comment – The proposed description of the location, physical environment and environmental characteristics for the proposed critically endangered ecological community is acceptable.

Consultation questions/comments on the species assemblage

a. Do you agree with the vegetation description, including for each of the four main vegetation types associated with the ecological community? Please provide details of how they can be clarified.

Comment – We agree with the use of the IUCN Global Ecosystem Typology in relation to different ecotypes. The boundary of the Threatened Ecological Community will be important as some areas have reduced in their vegetation dependency with terrestrialisation of the wetland as a result of reductions in flooding from river regulation (Bino et al. 2015b). This means there are areas that were once part of the Macquarie Marshes which are now probably semi-desert steppe, temperate subhumid grasslands and temperate woodlands, under the Global Ecosystem Typology.

Further there are also artificial (human developed, T7) ecosystems within the Macquarie Marshes, including annual croplands, constructed lacustrine wetlands and canals, ditches and drains. Their incorporation is fundamental to understanding the ecological character and the pressures affecting the Marshes. Grazing/irrigating private holdings are woven in the broader area and understanding of their impacts is foundational. A conceptual model approach could be used, showing the interactions of the natural and artificial ecotypes.

In relation to the four broad water-dependent vegetation types in Table 1, the groups defined are reasonable but it would be useful to separate out the two woodland communities of river red gum from coolibah and black box woodland because of the different flooding requirements of these groups of species. See our recommendation that coolibah and black box woodland communities should be included as separate communities. Fringing riparian would be better identified as reedbeds (common reed and cumbungi) which are a particularly important feature of the system. The two missing vegetation communities are 1) the aquatic macrophytes which occupy some open water lakes, and 2) water couch grassland. These communities represent the main ones used to track ecosystem changes and are also functionally important (Table 2).

b. Please indicate if any fauna or flora species are incorrectly recorded and provide details.

Comment – There are no incorrectly recorded species that we are aware of.

c. Please provide additional information on common and/or characteristic flora or fauna you would like to see included, particularly commonly encountered or characteristic invertebrates, and any species with important ecological functions in the ecological community. Please suggest further reference information/sources, particularly those from recent surveys and studies and those covering key interactions between species and with habitat.

Comment – Crayfish can be an important fauna species, turning over soils and providing food for many different organisms.

Consultation questions/comments on the functionally important flora species

a. How can the information provided on river red gum, lignum, phragmites (common reed) and/or water couch be improved?

Comment -

This could be improved by identifying some targets for restoration, given some knowledge of the current baseline. Tracking the long-term changes of these groups is important. River cooba Acacia stenophylla *is also an important shrub in relation to flooding regimes. As mentioned earlier, coolibah and black box (highly dynamic in response to wetting and drying) need to also be included and potentially aquatic macrophytes although they are more ephemeral.*

Consideration of fire effects will be important – reed beds in particular have been affected by unplanned fire. Fire intensity (and soil moisture levels) may affect the capacity of rhizomes to regenerate.

b. Please provide information on other functionally important flora and fauna that should be highlighted here and include reference information/sources. Examples might include birds, frogs and fish such as silver perch, golden perch or a group of small-bodied fish.

Comment -

Currently, there are only functionally important flora included. There are other important functionally important fauna, particularly the waterbird community, fish community, frog community and reptile community (including turtles and snakes). These are all important and can be measured and monitored. Ideally a table is included to add these groups in, given their importance to the characterisation of the Macquarie Marshes. There is also an important woodland bird community which could also be tracked (see Blackwood 2010).

Consultation questions/comments on the key ecological processes

a. How can the preceding summaries on key ecological processes be improved using latest data and published studies?

Comment -

It would be most helpful if the ecological processes were focused on the functionality of the ecosystems. The Global Ecosystem Typology has a series of conceptual modes which connects abiotic and biotic processes to the ecological characteristics of each ecotype (Keith et al. 2022). The identification of the main ecotypes (natural) (see above) could then be listed in relation to their functionality with a focus on current understanding of their ecological dynamics. Each one would then receive a description of their ecological processes, including identification of the threats in the literature.

In addition, there are some references which can be used to update this section:

Bowen SM. 2019. Quantifying the water needs of flood-dependent plant communities in the Macquarie Marshes, south-eastern Australia. PhD Thesis, University of Technology Sydney.

Cruz DO, Kingsford RT, Suthers IM, Rayner TS, Smith JA, Arthington AH. 2020. Connectivity but not recruitment: Response of the fish community to a large-scale flood on a heavily regulated floodplain. Ecohydrology **13(3)**:e2194.

Dawson SK, Catford JA, Berney P, Kingsford RT, Capon S. 2020. Land use alters soil propagule banks of wetlands down the soil-depth profile. Marine and Freshwater Research **71(2)**:191-201. doi:10.1071/MF18438

Dawson SK, Kingsford RT, Berney P, Catford JA, Keith DA, Stoklosa J, Hemmings FA. 2017. Contrasting influences of inundation and land use on the rate of floodplain restoration. Aquatic Conservation: Marine and Freshwater Ecosystems **27(3)**:663-674. doi:10.1002/aqc.2749

Dawson SK, Kingsford RT, Berney P, Keith DA, Hemmings FA, Warton DI, Catford JA. 2017. Frequent inundation helps counteract land use impacts on wetland propagule banks. Applied Vegetation Science **20(3)**:459-467. doi:10.1111/avsc.12295

Dawson SK, Warton DI, Kingsford RT, Berney P, Keith DA, Catford JA. 2017. Plant traits of propagule banks and standing vegetation reveal flooding alleviates impacts of agriculture on wetland restoration. Journal of Applied Ecology doi:10.1111/1365-2664.12922

Fullagar A. 2017. Waterbird response to an environmental flow pulse in the Macquarie Marshes. MSc Thesis, UNSW Sydney, 2017.

Kingsford RT, Bino G, Porter JL. 2017. Continental impacts of water development on waterbirds, contrasting two Australian river basins: Global implications for sustainable water use. Global Change Biology doi:10.1111/gcb.13743

Rayner TS, Kingsford RT, Suthers IM, Cruz DO. 2015. Regulated recruitment: native and alien fish responses to widespread floodplain inundation in the Macquarie Marshes, arid Australia. Ecohydrology **8(1)**:148-159.

Sandi SG, Rodriguez JF, Saco PM, Wen L, Saintilan N. 2016. Linking hydraulic regime characteristics to vegetation status in the Macquarie Marshes. 11th International Symposium on Ecohydraulics.

Senanayake IP, Yeo IY, Kuczera GA. 2024. Three Decades of Inundation Dynamics in an Australian Dryland Wetland: An Eco-Hydrological Perspective. Remote Sensing **16(17)**:3310.

Wang B, Chen Y, Lü C. 2015. Evaluating flood inundation impact on wetland vegetation FPAR of the Macquarie Marshes, Australia. Environmental Earth Sciences **74**:4989-5000.

b. Please provide any other relevant functional biology and ecology processes or other elements you think are important to highlight in this section. Please explain your reasons and provide supporting evidence and/or references.

Comment –

As identified above, it would be useful to list each of the functional ecotypes. This section could separately include the major abiotic and biotic threats to ecosystem integrity.

In addition, there are some further references to be included:

Ralph TJ, Hesse PP, Kobayashi T. 2015. Wandering wetlands: spatial patterns of historical channel and floodplain change in the Ramsar-listed Macquarie Marshes, Australia. Marine and Freshwater Research **67(6)**:782-802.

Thomas RF, Kingsford RT, Lu Y, Cox SJ, Sims NC, Hunter SJ. 2015. Mapping inundation in the heterogeneous floodplain wetlands of the Macquarie Marshes, using Landsat Thematic Mapper. Journal of Hydrology **524**:194-213.

Section 2. Identifying areas of the ecological community

Consultation questions/comments on the key diagnostic characteristics

a. In your opinion, please indicate if these key diagnostic characteristics are sufficient to identify the relevant species and areas in nature that should be included in the nationally protected ecological community – and to exclude any vegetation types (/areas) that should be excluded. If not, please show how the key diagnostic characteristics should be amended to ensure appropriate inclusion / exclusion.

Comment – It would be more efficient if the main water dependent ecotypes were listed, rather than the mixture of vegetation and subcommunities listed under hydrology and habitat/ vegetation types. Each can then be a focus for ecological processes (already covered above).

For biological assemblages, there is a predominant focus on vegetation. There is considerable information on fauna and the functionally important groups (see above) which could also be listed.

We would recommend inclusion, not exclusion of coolibah and blackbox communities within the Macquarie Marshes: these communities are flood-dependent (for recruitment and improvements in condition) and representative of the outer floodplain. Although these woodlands are identified nationally as a threatened ecological community, they are part of the hydrological gradient of the subject "ecological community" and their conservation should be linked to the current advice document.

Exclusions should include terrestrial ecosystems as identified although this is sometimes difficult because of the terrestrialisation occurring in the Macquarie Marshes (Bino et al. 2015b). In addition, all human-made water bodies and structures, also including levee banks which are not currently listed but can be most associated with channels but not always.

Consultation questions/comments on additional identification information

a. Please indicate if the survey/sampling requirements appropriate.

Comment – It is important to capitalise on government monitoring programs already in place, such as the Commonwealth Environmental Water Holder's Science Program (Flow-Monitoring, Evaluation and Research) funded by the Commonwealth Environmental Water Holder as well programs undertaken by the NSW Department of Climate Change, Energy, Environment and Water and NSW Department of Primary Industry (Fisheries). These programs are focused on monitoring ecological processes and key flora and fauna in selected areas such as the Macquarie Marshes. There are well established programs focused on the key vegetation communities and ecotypes. Some reference to these programs should be made (see Mason et al. 2022).

Remote sensing is also an important and pragmatic tool for vegetation monitoring programs. Efforts by Wen et al. (2023), Higgisson et al.(2022) provide example approaches.

Wen L, et al. (2023) Monitoring long-term vegetation condition dynamics in persistent semi-arid wetland communities using time series of Landsat data. Science of the Total Environment 905, 167212. doi:10.1016/j.scitotenv.2023.167212

Higgisson, et al., 2022. The role of environmental water and reedbed condition on the response of Phragmites australis reedbeds to flooding. Remote Sens. (Basel) 14, 1868.

Fauna should also be included as the document currently predominantly focuses on flora. The references provided and the programs described above provide a range of useful information relevant to rigorous sampling of the ecological community.

b. Are all the relevant intergrading ecological communities that are listed at state or national level correctly mentioned?

Comment – Yes they are all correctly mentioned.

c. Please explain how we can improve on the information provided to assist with identifying the ecological community, particularly differences to other ecological communities/map/vegetation units (refer also to Appendix B).

Comment – This could be more effectively done by adopting the IUCN Global Ecosystem Typology and then listing the key species and communities to be sampled in each, including the biotic and abiotic drivers. These could also include specific listing of threats.

Consultation questions/comments on condition classes, categories and thresholds

a. Are the condition thresholds appropriate for this ecological community? If not, please suggest and justify alternatives.

Comment – The definition needs to be changed from a focus on 'terrestrial vegetation' to 'flood dependent vegetation'. This allows for a more defined focus on the key categories of vegetation that are central to this nomination. There could be specific thresholds derived for different communities (as identified above), including reedbeds and lignum (Higgisson et al. 2022).

This section could be improved with increasing information on relative state of the Macquarie Marshes with data available. It is also important to include areas of the Macquarie Marshes under active restoration, such as parts of what used to be called Pillicawarrina (see Dawson et al. 2017a; Dawson et al. 2017b; Dawson et al. 2019).

Specific condition threshold appears to pertain only to River Red Gum wetlands (hollow-bearing and biomass metrics). These metrics are useful, but are too prescriptive (e.g. tree density will naturally vary between woodland and forest communities, and 25% native understorey cover should have supporting references). The advice document could also discuss condition metrics for shrubland and non-woody wetlands and consider other metrics including composition, number of seedlings, bare ground and coarse woody debris cover.

b. Please indicate if higher condition classes can also be specified for the national ecological community to guide restoration and monitoring. If so, what are the best indicators of higher condition classes, for each form (seasonal / intermittent wetland, shrubland wetland, woodland/forest) of the ecological community? Could fauna measures such as frog or waterbird diversity or abundance/density also be used as indicators of higher condition classes (e.g. for monitoring and restoration purposes)?

Comment – Condition classes could be developed for different ecotypes in the Macquarie Marshes and the vegetation communities within these, as identified above. There are also clearly strong relationships between flooding regimes and the breeding of waterbirds in rookeries (Kingsford & Johnson 1998; Kingsford & Auld 2005; Bino et al. 2015a). Frog communities are also useful indicators of flow and flooding regimes and could allow development of condition classes (Ocock et al. 2014; Ocock et al. 2016)

Consultation questions/comments on habitat critical to the survival

a. Is the description of areas critical to survival of the ecological community appropriate for this ecological community? If not, please suggest and justify alternatives.

Comment – It is important to not only comment on the status and condition primarily of vegetation communities but also the maintenance of key drivers such as the flow and flooding regimes. The description of a key driver should also include flooding regime. This section would also lend itself well to defining the ecotypes identified under the Global Ecosystem Typology (Keith et al. 2022).

A critical flow and flooding regime should be one which

- *supports the habitat requirements of all waterbirds and is conducive to successful breeding of waterbirds, including rookeries of diverse species;*
- *ensures the current extent of native vegetation of the freshwater ecosystems (including all the natural ecotypes) is sustained in a healthy, dynamic and resilient condition (including various ages classes, species composition, structure, reproduction and recruitment;*
- *supports recruitment opportunities for a range of native aquatic species (for example, native fish, frogs, turtles and invertebrates); and*
- *supports key ecosystem functions (including those summarised in section 1.2.4), particularly those related to hydrological connectivity between the river and the floodplain and flooding regime (frequency, timing, extent).*

We agree that there is no Commonwealth land involved and so no critical habitat can be registered.

Section 3. Cultural significance

Consultation questions/comments on cultural significance

a. Can you provide information to support or clarify information, including anything that you don't agree with, in the draft?

Comment – The Centre for Ecosystem Science employs Danielle Flakelar, a Wayilwan woman who has provided input into the areas below.

"I have recently started with UNSW Centre for Ecosystem Services to enable Wayilwan and other Aboriginal people to access our country, work with scientists and inform decisions about our cultural values and ecological knowledge. This knowledge is shared with our people as well as students of UNSW, so that we can help mitigate the impacts of global climate change, water misuse and pollution of our waterways within Murray-Darling Basin rivers, particularly the Macquarie River.

The information to support the listing of the Macquarie Marshes as an endangered or critically endangered community has provided a strong evidence base which supports my people's understanding of the degradation which has occurred to our country. I support this nomination."

b. Are you able to share extra information about the cultural significance of the ecological community or surrounding landscape? If so, please provide information and advice on appropriate use, including what consent has been obtained or should be sought. Please also direct us to other appropriate people and organisations in the area who may have information.

Comment -

"Wayilwan people are disappointed that we have not been engaged by federal government and we seek to resolve this issue.

The Wayilwan name for Macquarie Marshes is Wammerawa, a very culturally significant place within the Ngiyampaa nation. As a Wayilwan woman and native title rights holder, I am proud to advocate and support for the listing of this highly significant wetlands Wammerawa. Its cultural and ecological values have been changed by diversion of water upstream and land degradation.

Wayilwan country is full of waterways and an important a floodplain landscape which connects our people, land and water up and down the Murray-Darling Basin system. Culturally, economically and spiritually, the Wammerawa sustained our people for at least 6000 years and that management has not been valued or recognised over the past 200 years.

This wetland has had huge impacts from severely changed land and water management regimes, especially the over extraction and diversion of water away from the original water ways of the old Macquarie River.

Wayilwan people have witnessed and not been consulted on highly impactful change through floodplain harvesting, weirs, channels and large storage tanks that have intercepted much of the flows and flooding, below the Burrendong Dam to replenish groundwater supply. Large scale clearing of native vegetation has further diminished groundwater availability and ensured poor quality of soil and waterways which has reduced native species. It has impacted our ability to pass on cultural knowledge and practices.

Section 4. Threats

Consultation questions/comments on threats

a. Is the order of the threats in the Threats table (Table 3) correct (i.e. are they in order of current importance, starting with the greatest current threat)? If not, please indicate the correct order (e.g. by numbering the Threat factors). Have any threats or impacts been missed? If so, what are they?

Comment – For Inappropriate flow regime, there needs to be an expansion to Inappropriate flow and flooding regime.

For the reference to "For example, the primary cause of die-back in mature Eucalyptus camaldulensis (river red gum) trees is reduced water availability (Jensen 2015)", the Macquarie Marshes red gum reference should be added (Catelotti et al. 2015).

There is a need to have a separate sentence which focuses on the impact of structures on the Macquarie Marshes floodplain for interrupting and changing flows (Steinfeld & Kingsford 2013).

In particular, it is important that there is reference to the Bypass channel is identified as a threat because it interrupts water flow across the floodplain. It runs through the Ramsar site and could be effectively decommissioned and improve the Macquarie Marshes flooding.

This section is well written and founded on peer reviewed science which provides strong evidence for why this system needs to be nominated as a critically endangered ecological community.

b. Are any of the listed threats more, or less, severe, or of different timing or scope than currently proposed for this ecological community?

Comment – The most severe and intractable threats are related to changing flow and flooding regimes and climate change. These should be prioritised as the peer reviewed literature overwhelmingly identifies these key problems affecting the ecological community. Further low flows can affect water quality, further affecting integrity.

Invasive plants as a threat: the listed species range from agricultural weeds to invasive environmental weeds. For example *Phyla canescens* and *Lycium ferocissimum* are invasive environmental weeds, while *Hypochaeris* sp. are less important weedy threats.

c. Please supply us with additional details of/information about threats & impacts to the ecological community which you are aware of; and references (and further sources).

Comment – A key missing threat is the potential for changes in rules related to water management within the catchment, as detailed in this paper (Steinfeld et al. 2020). Decisions for water management are critical for the health of the Macquarie Marshes ecological community, with considerable ramifications (McLoughlin et al. 2024). In addition, climate change is increasingly recognised as a key threat. There is also evidence that mining can also

be a major threat, given there is little protection to areas outside the protected area. Fire can also degrade some communities such as river red gums.

Further resources are provided by the following:

Fu B, Pollino CA, Cuddy SM, Andrews F. 2015. Assessing climate change impacts on wetlands in a flow regulated catchment: A case study in the Macquarie Marshes, Australia. Journal of Environmental Management **157**:127-138, https://doi.org/10.1016/j.jenvman.2015.04.021.

Quijano-Baron J, Carlier R, Rodriguez JF, Sandi SG, Saco PM, Wen L, Kuczera G. 2022. And we thought the Millennium Drought was bad: Assessing climate variability and change impacts on an Australian dryland wetland using an ecohydrologic emulator. Water Research **218**:118487.

Yu L, García A, Chivas AR, Tibby J, Kobayashi T, Haynes D. 2015. Ecological change in fragile floodplain wetland ecosystems, natural vs human influence: The Macquarie Marshes of eastern Australia. Aquatic Botany **120**:39-50, https://doi.org/10.1016/j.aquabot.2014.07.002.

Groundwater resources are discussed in both the acid sulphate soils/salinity and mining threats sections. However, groundwater availability is critical to river red gum (and coolabah/black box woodland) condition. It merits a separate threat factor entry – especially as its trend in the Marshes is largely unknown.

Section 5. Conservation of the ecological community

Consultation questions/comments on existing protection and management plans

a. Do you agree with the existing protection description? If not, please suggest changes and provide relevant references.

Comment – The existing protections, as listed, are correct.

b. Are the plans listed above still relevant and correctly referenced?

Comment – They are correctly listed

c. Are there any other management plans that you suggest for inclusion? If so, please provide details (including website links).

Comment - There is a more recent approved plan by the Commonwealth Environmental Water Holder in relation to Monitoring, Evaluation and Research 2.0 for the Macquarie Marshes which is not listed.

Consultation questions/comments on the buffer zones

a. In your opinion, is the advice on buffer zones and recommended minimum buffer distance appropriate? If not, how should the buffer zone advice be amended to ensure appropriate application?

Comment – The buffer zones are primarily relevant to conservation of land areas and also some waterways. The buffer zone is problematic for such a large region. It is difficult to identify a 200m buffer around the floodplain for example and what can and cannot be done in this area. There will be some areas which would benefit from reduced grazing pressure but the predominant issue is related to management and protection of flow and flooding regimes. Given the importance of community support, buffers in the Macquarie Marshes do not seem practical.

Consultation questions/comments on priority actions

a. Please suggest any changes to the draft conservation and recovery actions, including any missing actions, for the ecological community based on your knowledge and expertise (along with references to the source documentation).

Comment – Priority actions need to focus on the primary threats and mitigating their impacts. Each threat listed should have associated priority action. Currently this section is too broad to identify the key actions beyond generic actions of protecting, restoring, communicating and research and monitoring. The first two of protect and restore demand specific actions which can be listed. In particular, the current section does not adequately focus on priority actions in relation to the management of flows and flooding regimes, with a focus on impacts of climate change, floodplain developments and management of water for the entire catchment (see above). Much of this section inappropriately focuses on land management and not water management. There is a need for stronger focus on the mechanisms in place to protect flows to the Macquarie Marshes and the vulnerabilities to this protection. As an example, there is reference to fencing (predominantly a land management conservation initiative) but no detailed water related actions.

The advice on monitoring is not well designed or structured. If the IUCN Global Ecosystem Typology was used as a framework (as put forward at the beginning), then monitoring can focus on appropriate ecosystem functional group transitions. For example, increased water extraction may transition TF 1.3 Permanent marshes to T7 Intensive land use. An impending transition could be identified through monitoring of river gauges, inundation regimes and vegetation condition. Monitoring of quantitative thresholds will promote accountability.

b. This includes further actions that encourage appropriate use of Traditional Ecological Knowledge of First Nations and encourage more involvement of Traditional Owners and Custodians in conservation management, recovery and research.

Comment – This section relies on the advice of a Wayilwan person employed by UNSW.

Section 6. Listing assessment

Consultation questions/comments on criterion 1

More recent data and analysis on trends will be available and will be incorporated when Murray-Darling Basin Plan reports are released soon. In addition to that:

a. Please provide any feedback on the preliminary assessment under Criterion 1 or further data or information that would support or update the assessment?

Comment – The overwhelming scientific evidence as provided in the preliminary advice and additional peer reviewed publications indicates that it is substantial, with a decline exceeding 50%, since 1750. Much of this decline has predominantly occurred since the 1980s when there was full development of water resources in Burrendong Dam but there was also an increase in floodplain harvesting in the 1990s through the establishment of off river storages.

b. If you can provide any additional information, please also provide any relevant references.

Comment – The information is provided in the listed references plus those added in this submission.

In addition, the following reference may be relevant:

Ralph TJ, Hesse PP, Kobayashi T. 2015. Wandering wetlands: spatial patterns of historical channel and floodplain change in the Ramsar-listed Macquarie Marshes, Australia. Marine and Freshwater Research **67(6)**:782-802.

Consultation questions/comments on criterion 2

More recent data and analysis on trends will be available and will be incorporated when Murray-Darling Basin Plan reports are released soon. In addition to that:

a. Please provide any feedback on the preliminary assessment under Criterion 2 or further data or information that would support or update the assessment?

Comment – The Macquarie Marshes are geographically restricted and limited. There are no other wetlands in Australia providing such a combination of vegetation communities. It is the most important site for breeding waterbird rookeries in Australia both in terms of diversity and abundance (Brandis 2010). Its extent and area of occupancy is restricted. In addition, it is demonstrably threatened by hydrological disturbance and climate change along with other identified threatening processes. The evidence supports listing as endangered because of its restricted and limited distribution, given ongoing threats of climate change and cumulative impacts of water resource development in the immediate future.

b. If you can provide any additional information on the nature of the geographic distribution for the ecological community, please also provide any relevant references.

Comment -

No further information.

Consultation questions/comments on criterion 3

More recent data and analysis on trends will be available and will be incorporated when Murray-Darling Basin Plan reports are released soon. In addition to that:

a. Please provide any feedback on the preliminary assessment under Criterion 3 or further data or information that would support or update the assessment regarding trends in functionally significant species?

Comment – Scientific evidence indicates at least a 50% decline in flood dependent vegetation communities, given the long-term reduction in extent and frequency of flooding, on which these vegetation communities are dependent. The reedbeds swamps in the southern Nature Reserve have disappeared because of a lack of flooding. Water couch grassland has suffered a significant reduction in extent (e.g. Bino et al. 2015). A range of independent studies has identified this loss of different vegetation communities. Despite recent increases in environmental flows, there is increasing evidence of likely long-term impacts of climate change in reducing run-off in southeastern Australia (Chiew et al. 2014). Further climate change is likely to increase vulnerabilities to fire. Importantly, the Macquarie Marshes relies on uncontrolled floods for significant opportunities to recover but these are more vulnerable to climate change effects than water held in dams (primary licenced water for general security irrigation (Prosser et al. 2021). Recovery is not probable in the near future, given a limit imposed on additional recovery on environmental flows. This was exacerbated when the Northern Basin Review, removed 11,000 ML a year from a recovery target.

Endangered to Critically Endangered is therefore an appropriate assessment under Criterion 3.

b. If you can provide any additional information, please also provide any relevant references.

Comment – see above

Consultation questions/comments on listing assessment (criterion 4)

a. Please provide any feedback on the preliminary assessment under Criterion 4 or provide further data or information on changes in integrity and processes that would support or update the assessment.

Comment – There are many threats affecting the Macquarie Marshes ecological community, particularly water resource development upstream but also floodplain developments, decisions about management of water and climate change. The scientific evidence is strong and most shows very severe reduction in integrity, through severe degradation of flood dependent vegetation communities and also waterbird breeding aggregations. Restoration of long-lived communities is unlikely given ongoing impacts of water security and use. This provides strong evidence that the Macquarie Marshes ecological community meets the criterion 4 as critically endangered.

Consultation questions/comments on listing assessment (criterion 5)

More recent data and analysis on trends will be available and will be incorporated when Murray-Darling Basin Plan reports are released soon. In addition to that:

a. Please provide any feedback on the preliminary assessment under Criterion 5 or further data or information that would support or update the assessment of rate of detrimental change.

Comment – There is a continuing severe decline in the integrity of the Macquarie Marshes, affecting essential ecological processes, with at least a 50% decline. Under Criterion 5, the Macquarie Marshes ecological community would qualify as endangered.

b. If you can provide any additional information, please also provide any relevant references.

Comment – see above

Consultation questions/comments on listing assessment (criterion 6)

a. Please provide any feedback on the preliminary assessment under Criterion 6 or further data or information that would support or update the assessment?

Comment – Agree there is no quantitative data indicating extinction.

b. If you can provide any additional information, please also provide any relevant references.

Comment - None

Appendix A. Species lists

Consultation questions/comments

a. Please note fauna or flora species incorrectly recorded; please provide details. Please provide information on any other flora and fauna species missing from the description and key interactions between species and with habitat?

Comment

*Tall Knotweed (*Persicaria elatior*) has been found in the Macquarie Marshes (by Nicola Brookhouse in 2022). It is classified as* ***vulnerable*** *(NSW BCA and Commonwealth EPBC) and occurs in damp areas, usually on the edge of standing water (https://plantnet.rbgsyd.nsw.gov.au/cgi-bin/NSWfl.pl?page=nswfl&lvl=sp&name=Persicaria~elatior)*

b. Please provide additional fauna you would like to see included in the lists, particularly commonly encountered fauna, characteristic invertebrates and those with important ecological functions in the ecological community. Please suggest further reference information/ sources.

Comment – This is comprehensive

Appendix B - Relationship to other vegetation classification and mapping systems

Consultation Questions/comments

a. How could we improve on the information provided to assist with identifying the ecological community, particularly differences to other map/vegetation units?

Comment – Include references and scientific information provided in this submission.

b. Is the list of corresponding map/vegetation units complete and accurate?

Comment – Agree with content

c. Should the NSW vegetation class PCT 40 - Coolabah open woodland wetland with chenopod/grassy ground cover on grey and brown clay floodplains be considered part of the ecological community?

Comment – Yes – all coolabah and black box areas should be included as part the community nominated.

d. Should the NSW vegetation class PCT 454 - River Red Gum grassy chenopod open tall woodland (wetland) on floodplain clay soil of the Darling Riverine Plains Bioregion and western Brigalow Belt South Bioregion be considered part of the ecological community?

Comment – If supplied by the Macquarie River and dependent on its flow and flooding it should be included.

Appendix C – Detailed description of biology and ecological processes

Consultation Questions/comments

a. Please note if you agree with the extra information on key biology and ecology in this Appendix. If not, please specify how can it be clarified.

Comment – Not applicable

b. Please provide any fauna or flora species details incorrectly recorded in this Appendix; please provide details.

Comment - None

c. Please provide additional information on fauna you would like to see included, particularly commonly encountered fauna, characteristic invertebrates and those with important ecological functions in the ecological community. Please suggest further reference information/ sources.

Comment - see below

Bino G, Kingsford RT, Porter J. 2015a. Prioritizing wetlands for waterbirds in a boom and bust system: waterbird refugia and breeding in the Murray-Darling Basin. PloS one **10**:e0132682.

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Additional comment

There are several instances in the nomination where Hogendyk (2007) is referenced - published by the Institute of Public Affairs. This is not a peer reviewed paper and does not any data analyses that can contribute to this nomination that is not present elsewhere. Worse, it makes a number of false conclusions. Providing it with legitimacy by listing this reference in this scientific assessment should not occur. It should not be referenced or included.