Information Sheet on Ramsar Wetlands (RIS) – 2009-2012 version

Categories approved by Recommendation 4.7 (1990), as amended by Resolution VIII.13 of the 8th Conference of the Contracting Parties (2002) and Resolutions IX.1 Annex B, IX.6, IX.21 and IX. 22 of the 9th Conference of the Contracting Parties (2005).

1. Name and address of the compiler of this form:

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DD MM YY

Designation date | Site Reference Number

2. Date this sheet was completed/updated:

May 2011

3. Country:

Australia

4. Name of the Ramsar site:

The precise name of the designated site in one of the three official languages (English, French or Spanish) of the Convention. Alternative names, including in local language(s), should be given in parentheses after the precise name.

Narran Lake Nature Reserve

5. Designation of new Ramsar site or update of existing site:

This RIS is for (tick one box only)**:**
a) Designation of a new Ramsar site ❑; or
b) Updated information on an existing Ramsar site ☒

6. For RIS updates only, changes to the site since its designation or earlier update:

a) Site boundary and area

The Ramsar site boundary and site area are unchanged: ❑

or

If the site boundary has changed:
i) the boundary has been delineated more accurately ❑; or
ii) the boundary has been extended ☒; or
iii) the boundary has been restricted** ❑

and/or

If the site area has changed:
i) the area has been measured more accurately ❑; or
ii) the area has been extended ☒; or
iii) the area has been reduced** ❑

** **Important note**: If the boundary and/or area of the designated site is being restricted/reduced, the Contracting Party should have followed the procedures established by the Conference of the Parties in the Annex to COP9 Resolution IX.6 and provided a report in line with paragraph 28 of that Annex, prior to the submission of an updated RIS.

b) Describe briefly any major changes to the ecological character of the Ramsar site, including in the application of the Criteria, since the previous RIS for the site:

Continued upstream water extraction post listing combined with a prolonged drought period has changed the hydrological regime of the site, but ecological responses of key biota have not as yet changed significantly since that of the time of listing.

The site was said to meet criterion 6 at the time of listing, however, the available data indicates the site only periodically, not regularly, supports one percent of species of waterbirds. A paucity of data on individual species partly contributes to this, however, even when only considering times when the site supports large numbers of birds the one percent is still not met on a regular basis.

The previous RIS (1999) for the site did not have Criterion 2 as met at the time of listing, however three nationally or internationally listed species are present at the site and therefore this criterion is met. Currently, and at listing, the site meets criteria 1, 2 and 4.

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7. Map of site:

Refer to Annex III of the *Explanatory Note and Guidelines*, for detailed guidance on provision of suitable maps, including digital maps.

a) A map of the site, with clearly delineated boundaries, is included as:

i**) a hard copy** (required for inclusion of site in the Ramsar List): ☒;

ii**) an electronic format** (e.g. a JPEG or ArcView image) ☒;

iii) **a GIS file providing geo-referenced site boundary vectors and attribute tables** ☒.

b) Describe briefly the type of boundary delineation applied:

e.g. the boundary is the same as an existing protected area (nature reserve, national park, etc.), or follows a catchment boundary, or follows a geopolitical boundary such as a local government jurisdiction, follows physical boundaries such as roads, follows the shoreline of a waterbody, etc.

The boundary of the site was extended in 2011 to capture more breeding and feeding habitat for waterbirds. At the time of listing, the site covered 5,531 hectares, however, improved mapping techniques show the actual area at listing was 5,343 hectares. The boundary extension in 2011 expanded the site by 3,104 hectares to make a total of 8,447 hectares (Appendix 1).

The 2011 boundary of the Narran Lake Nature Reserve Ramsar site can be described as comprising the extent of the floodplains within the Narran Lake Nature Reserve. The Nature Reserve itself has been significantly extended since 1999 with the acquisition of neighbouring properties to the west and north. The area of the Ramsar site following the 2011 boundary extension includes the complete area of the former (1999) Ramsar site with extensions of small areas of ephemeral lakes to the east of Clear Lake and Back Lake. Additionally, an area of floodplain to the west and north of the former Ramsar site has been included in the current Ramsar site. These areas are now included due to recent acquisitions of former neighbouring properties. The enlarged 2011 area encompasses the majority of the floodplain dependent vegetation within Narran Lake Nature Reserve.

The Ramsar site is now comprised of a portion of Narran Lake Nature Reserve as gazetted on 28/02/2007 under the *National Parks and Wildlife Act 1974* (NSW). The portions that comprise the Ramsar site are:

- the parcels with DP765343, excluding the road reserve in the north east and north west corners of the Nature Reserve

- the western parcel of DP765344

- a portion of Narran Lake Nature Reserve to the west, adjacent to the western boundary of DP765343.

The boundary commences from the corner of DP765343 nearest to 147°25'37.499"E 29°45'47.877"S (marked as point A on Appendix 1), the Ramsar boundary follows the Narran Lake Nature Reserve in a generally western direction to the point nearest to 147°22'18.985" E 29°45'56.750" S (marked as point B on Appendix 1) where the Ramsar boundary leaves the Nature Reserve boundary and follows the floodplain boundary defined by the extent of hydric soils and floodplain vegetation using ADS40 imagery, in a generally northern direction to where the point nearest to 147°22'8.237" E 29°42'23.354" S meets the Narran Lake Nature Reserve boundary (marked as point C on Appendix 1). The Ramsar boundary follows the Narran Lake Nature Reserve boundary in a generally northern direction to the point nearest to where 147°22'6.492" E 29°42'10.308" S meets the Narran Lake Nature Reserve boundary (marked as point D on Appendix 1) and then heads in a generally eastern direction along floodplain boundary as defined by the extent of hydric soils and floodplain vegetation using ADS40 imagery until it again meets the boundary of the cadastral parcel DP765343 at the point nearest to 147° 24'58.352" E 29° 43'5.516" S (marked as point E on Appendix 1).

- a portion of Narran Lake Nature Reserve adjacent to the east of the parcels listed above, starting at the point on the eastern boundary of DP765343 at the point closest to 147°27'21.579" E 29°42'44.759" S (marked as point F on Appendix 1), the Ramsar boundary heads in a generally easterly then southerly direction along the floodplain boundary distinguished by the extent of hydric soils and floodplain vegetation using ADS40 meeting the cadastre again on the boundary of the western parcel of DP765344 at the point closest to 147°28'23.242" E 29°43'47.865" S (marked as point G on Appendix 1).

- a portion of Narran Lake Nature Reserve adjacent to the east of the parcels listed above, starting at the point on the eastern boundary of western parcel of DP765344 at the point closest to 147°28'37.848" E 29°44'5.131" S (marked as point H on Appendix 1), the Ramsar boundary heads in a generally easterly then southerly direction along the floodplain boundary as distinguished with the ADS40 imagery meeting the cadastre again on the boundary of the western parcel of DP765344 at the point closest to 147°28'41.020" E 29°45'30.253" S (marked as point I on Appendix 1).

8. Geographical coordinates (latitude/longitude, in degrees and minutes):
Provide the coordinates of the approximate centre of the site and/or the limits of the site. If the site is composed of more than one separate area, provide coordinates for each of these areas.

Latitude: 29° 44' S; Longitude: 147° 25' E

9. General location:
Include in which part of the country and which large administrative region(s) the site lies and the location of the nearest large town.

Narran Lake Nature Reserve Ramsar site is located in the central north of New South Wales approximately 70 kilometres south west of Lightning Ridge, 75 kilometres North West of Walgett and 50 kilometres east of Brewarrina. The site is located on the terminal wetland system of the Narran River, a distributary of the Balonne River in the Condamine-Balonne catchment of the Murray-Darling Basin.

10. Elevation: (in metres: average and/or maximum & minimum)

120 – 140 metres ASL

11. Area: (in hectares)

8,447 hectares

12. General overview of the site:
Provide a short paragraph giving a summary description of the principal ecological characteristics and importance of the wetland.

Narran Lake Nature Reserve Ramsar site is part of a large terminal wetland system which supports a range of intermittent wetland types, which when inundated, provide critical habitat for waterbird breeding. In particular, the channelised floodplain, significant stands of lignum and riparian forest and woodlands provide habitat for large colonial waterbird breeding events. Nine colonial species breed at the site, with the site being particularly important for straw-necked ibis (*Threskiornis spinicollis*). Australian pelican (*Pelecanus conspicillatus*), Australian white ibis (*Threskiornis molucca*), glossy ibis (*Plegadis falcinellus*), and royal spoonbill (*Platalea regia*) all breed in significant numbers within the Narran Lakes terminal wetland system. The terminal wetland is listed as an Important Bird Area by Birds Australia and is listed on the Register of the National Estate. It has been identified as a refugia habitat in a semi-arid environment, and exhibits the classic boom and bust ecology of arid and semi-arid intermittent floodplains and wetlands. The fish population has a high degree of 'nativeness', in that the proportions of abundance, biomass and species richness of native species is greater than for alien species, among the highest in the Murray-Darling Basin (MDBC 2008).

13. Ramsar Criteria:
Tick the box under each Criterion applied to the designation of the Ramsar site. See Annex II of the *Explanatory Notes and Guidelines* for the Criteria and guidelines for their application (adopted by Resolution VII.11). All Criteria which apply should be ticked.

1	2	3	4	5	6	7	8	9
☒	☒	☐	☒	☐	☐	☐	☐	☐

14. Justification for the application of each Criterion listed in 13 above:
Provide justification for each Criterion in turn, clearly identifying to which Criterion the justification applies (see Annex II for guidance on acceptable forms of justification).

Criterion 1: A wetland should be considered internationally important if it contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region

This criterion was judged to be met at designation in 1999 using New South Wales as the scale for assessment. The justification for meeting this criterion presented at the time of listing still holds using the current bioregional scale of assessment. The site is unique within the Murray-Darling Drainage Division bioregion for its juxtaposition of highly channelised floodplain with open water wetland habitat. As a terminal wetland system it plays an important hydrological role in the natural functioning of the Narran River. In addition the vast lignum (*Muehlenbeckia florulenta*) (Ramsar wetland type W) dominated floodplain represents one of the largest expanses of relatively intact lignum in NSW (Aldis 1987). The site is part of a largely intact, unmodified terminal wetland ecosystem in good condition.

Criterion 2: A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities.

There are three wetland dependent species supported by the Narran Lake Nature Reserve Ramsar site that are listed as threatened under the national *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act, 1999):

Common name	Scientific name	IUCN Red List	CITES	CMS	National Status
Fish					
Murray cod	*Maccullochella peelii peelii*)	Critically endangered	Not listed	Not listed	Vulnerable (EPBC Act, 1999)
Birds					
Australasian bittern	*Botaurus poiciloptilus*	Endangered	Not listed	Not listed	Endangered (EPBC Act, 1999)
Plants					
Winged peppercress	*Lepidium monoploides*	Not listed	Not listed	Not listed	Endangered (EPBC Act, 1999)

Criterion 4: A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.

Narran Lakes Nature Reserve supports a significant number of migratory species, including 14 species listed under international migratory species treaties and a further 26 species which are migratory within Australia. In addition, the site is important for the critical life stage of breeding. The site supports substantial breeding of waterbirds, with 44 species having been recorded breeding at the site since listing. Significant breeding populations of colonial breeding species including great eastern egret (*Ardea modesta*), glossy ibis (*Plegadis falcinellus*), Australian white ibis (*Threskiornis molucca*) straw-necked ibis (*Threskiornis spinicollis*), and royal spoonbill (*Platalea regia*) are supported at the site (RIS 1999). Narran Lake terminal wetland ecosystem has been identified as one of a handful of wetlands which retain water for a period of time after flooding and therefore, act as a drought refuge in the Murray-Darling Basin (Scott 1997).

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15. Biogeography (required when Criteria 1 and/or 3 and /or certain applications of Criterion 2 are applied to the designation):

Name the relevant biogeographic region that includes the Ramsar site, and identify the biogeographic regionalisation system that has been applied.

a) biogeographic region:

Murray-Darling Basin Drainage Division

b) biogeographic regionalisation scheme (include reference citation):

Australian Drainage Divisions
(Commonwealth of Australia (Bureau of Meteorology) 2011. Australian Hydrological Geospatial Fabric)

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16. Physical features of the site:

Describe, as appropriate, the geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; downstream area; general climate, etc.

The Narran Lake Nature Reserve Ramsar site is part of a larger terminal wetland ecosystem (approximately 100 000 hectares), which has two morphologically distinct systems of lakes, Narran Lake in the south, Clear Lake, Back Lake and Long Arm in the north, and an extensive network of channels

and floodplains. Narran Lake is very flat, uniform in configuration and devoid of perennial vegetation, where as the Ramsar site is relatively complex with areas of open water as at Clear Lake, areas of lignum dominated wetlands as at Back Lake and Long Arm, with woodlands and open forests occurring on the fringes of the river, lakes and the main distributary and channels, all linked by a series of interconnecting floodplain channels. The river channel network is very complex, comprising more than 8000 channels and is very dynamic with over 80 percent of the system changing over the period 1969 to 2003 (Thoms et al. 2007). Overall there is a gradient of decreasing geomorphic complexity from the Ramsar site south to Narran Lake (Rayburg et al. 2009).

The geology of the site consists primarily of Quaternary sediments which include floodplain, outwash areas and drainage flats of black, red and white sandy to silty clay and clayey sand, and silt with areas of black and grey clayey silt and sand deposited in claypans and lakes. The soils of the Ramsar site are generally very fine in texture, with on average over 65 percent silts and clays and are classified as being clayey mud soils according to the standard soil nomenclature (Thoms et al. 2007). Rayburg et al. (2006) identified eight geomorphic units in the Narran Lakes terminal ecosystem, five of which occur within the bounds of the Ramsar site: northern lakes, red soil, north eastern floodplain, north western floodplain and a small area of central western floodplain.

On the eastern edges of the Ramsar site, within the red soil unit, Cretaceous sandstone and quartzite sediments of the Rolling Downs Group are exposed on the ridge country. The ridges are capped in places by Cainozoic silcrete and the slopes have scattered silcretized sandstone cobbles. Soils in this area of the Ramsar site are typically red sandy loams with the higher areas being gravelly. The red soils are soft and erode easily, with minor areas of gullying evident where tracks from stock occurred (NSW NPWS 2000). The red soils are characterised by low pH, organic matter, liquid and plastic limits and clay content while it has the highest sand content. The grey clays of Clear and Back Lakes have high pH, organic matter, liquid and plastic limits and clay content while they have very low sand content (Rayburg et al. 2006; Thoms et al. 2007).

The Rolling Downs sediments are overlain by Quaternary sediments on the wetland and floodplain areas (NSW NPWS 2000). The clays have high shrink-swell potential and when dry, the surfaces of the wetlands are dissected by a large number of medium-to-large cracks ranging from several centimetres to several metres in width and depth (Thoms et al. 2007). The floodplain soils are more similar to the lakes than the red soils, with more intermediate values for each soil variable, although locally high or low values do occur in some locations (Thoms et al. 2007; Rayburg and Thoms 2008). The soil character of the northern lakes is clearly separated from both the north-eastern and north-western floodplains whilst the southern-floodplain is clearly separated from the north-eastern floodplain (Rayburg et al. 2006; Thoms et al. 2007).

The Nature Reserve contains open freshwater areas such as Clear Lake. Back Lake is comprised of an extensive channelised wetland vegetated with lignum (*Muehlenbeckia florulenta*), with stands of river cooba (*Acacia stenophylla*), and river red gum (*Eucalyptus camaldulensis*) on the periphery and along the main distributary channels within the lake. The majority of the eastern side of the Ramsar site is low, gently undulating, sandy and rocky ridge country. A number of semi-saline playa lakes and drainage depressions, which fill from local rainfall, are located in this area east of Clear Lake and Back Lake. Between the Clear Lake and the ridge country is an area of discontinuous aeolian lunettes and sandy levees. These were formed by deflation of the lake beds and accumulation of sand grains and salt by strong westerly winds (NPWS, 1995).

Flooding in the Narran Lakes is predominantly (85 percent) a Summer and Autumn event. However, floods have also been recorded in Narran Lakes in Winter and Spring (Smith, 1993). Annual inflows to the Narran wetlands are highly variable. The main wetlands of the Ramsar site and Narran Lake are inundated in most years (27 out of 32 years) (Thoms et al. 2007) while floodplain areas are inundated with much less regularity and exhibit rapid drying. In Narran Lake, the average time to dry, in the absence of top up events, is about 15 months although this depends on the season in which inundation occurs. In

the Ramsar site, the average time to dry is about ten months, although the shallower parts of this lake may dry much more quickly (for example Long Arm dries in about two months while Back Lake dries in about three months on average) (Thoms et al. 2007).

The local catchment area of the Ramsar site is relatively small (approximately 46 square kilometres), with the wetlands rarely filling from local rainfall events, typically floods are generated in the upper catchment areas of the Condamine (Thoms 2003). Cease to flow conditions occur approximately 60 percent of the time in the Narran River immediately upstream of the Ramsar site. Mean annual flow in the Narran River is about 141,000 megalitres with a standard deviation of greater than 150,000 megalitres and a maximum recorded annual flow of 567,100 megalitres. The high inter-annual variability of flows in the Narran River insures that the Narran Lake Nature Reserve Ramsar site has a complex flood history with periodic wet/dry cycles (Thoms 2003) supporting a classic boom and bust ecology.

Narran Lakes is a terminal lake system and, therefore, outflows from the wetlands within the Ramsar site occur only through drainage to Narran Lake, and by evaporation and seepage. The climate of the Narran Lakes area is semi-arid. Rainfall is highest during summer months with average monthly rainfall of approximately 60 millimetres during January and February (based on data for Walgett). Lowest average rainfall is during late winter (August and September) at approximately 28 millimetres. However, there is considerable variability in rainfall.

Annual average rainfall at Walgett is in the order of 480 millimetres per year. However, there is a moderate amount of inter-annual variation with annual rainfalls ranging from less than 200 millimetres to more than 740 millimetres in the past 40 years.

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17. Physical features of the catchment area:

Describe the surface area, general geology and geomorphological features, general soil types, and climate (including climate type).

Located in the south east of Australia, the Murray-Darling Basin occurs within five states and has a surface area of 1.06 million square kilometres (14 percent of Australia). It covers 14 degrees of latitude (24 to 38 degrees South) from the source of the Warrego River to the headwaters of the Goulburn River in Victoria. Much of the Basin is flat (less than 200 metres ASL), with highlands occurring in the east and south where metamorphic and igneous rocks outcrop, providing the greatest relief in the basin. Sandstones and other sedimentary rocks also outcrop in the Basin (Murray-Darling Basin Ministerial Council 1987).

The Narran Lake Nature Reserve Ramsar site occurs in the Condamine-Balonne catchment, which lies in the northern part of the basin, in southern Queensland and northern New South Wales. It covers approximately 13 percent of the Murray-Darling Basin (CSIRO 2008). Land use is dominated by cattle and sheep grazing, with significant areas of grain. Irrigated crops covered over 112,000 hectares in 2000, 63 percent of which was cotton (CSIRO 2008). Climate across the Murray-Darling Basin is highly variable ranging from sub-tropical in the north of the basin, arid and semi-arid in the west and temperate and cool climates in the south and south east of the basin. The climate of the Condamine-Balonne is semi-arid.

The Condamine-Balonne River originates in the highlands of southeast Queensland and flows for most of its length across an essentially dry landscape that contributes little extra runoff. The catchment has an area of 143,900 square kilometres and is a major tributary of the Barwon-Darling River. Downstream of St George the river splits into several different channels; the Balonne Minor, Culgoa, Briarie, Bokhara, Ballandool and Narran Rivers. Each distributary river has a well-developed floodplain and as a result, the Lower Balonne region, the area between St George (Queensland) and the Barwon River (NSW), is essentially a large floodplain wetland complex (Thoms et al. 2002) referred to as the Lower Balonne floodplain. The climate of the region is semi-arid and flooding usually follows heavy rainfall in the upper catchment in Queensland. The Lower Balonne floodplain straddles the Queensland and NSW borders and is one of the most productive and intensively irrigated river basins. The Lower Balonne floodplain has approximately 357,000 ha of its area in Queensland and 1,631,000 ha in NSW (Thoms et al. 2002). The Lower Balonne floodplain supports a large number of wetlands, with over 3,400 identified. The

Narran River and Lakes system represents about 15 percent of the land area of the Lower Balonne floodplain (Thoms et al. 2002).

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18. Hydrological values:
Describe the functions and values of the wetland in groundwater recharge, flood control, sediment trapping, shoreline stabilization, etc.

Narran Lake Nature Reserve Ramsar site is part of a large terminal wetland ecosystem. Surface water inflows are the dominant source of water in the Ramsar site, with groundwater-surface water interactions considered to be negligible. The main hydrological value of the site is as a drought refuge for aquatic biota, in particular colonial breeding waterbirds, in a semi-arid landscape. Flood control, groundwater recharge, sediment trapping are not considered significant values of the site.

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19. Wetland Types
a) presence:
Circle or underline the applicable codes for the wetland types of the Ramsar "Classification System for Wetland Type" present in the Ramsar site. Descriptions of each wetland type code are provided in Annex I of the *Explanatory Notes & Guidelines*.

Marine/coastal: A • B • C • D • E • F • G • H • I • J • K • Zk(a)

Inland: L • M • <u>N</u> • O • <u>P</u> • Q • <u>R</u> • Sp • Ss • Tp <u>Ts</u> • U • Va •
Vt • <u>W</u> • <u>Xf</u> • Xp • Y • Zg • Zk(b)

Human-made: 1 • 2 • 3 • 4 • 5 • 6 • 7 • 8 • 9 • Zk(c)

b) dominance:
List the wetland types identified in a) above in order of their dominance (by area) in the Ramsar site, starting with the wetland type with the largest area.
The extent of each wetland type is not known at this stage but the following is judged the order of likely dominance:
W, P, N, Ts, Xf, R.

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20. General ecological features:
Provide further description, as appropriate, of the main habitats, vegetation types, plant and animal communities present in the Ramsar site, and the ecosystem services of the site and the benefits derived from them.

Clear Lake provides the majority of open water habitat within the Ramsar site. Back Lake, the Long Arm and the intervening floodplains support a range of wetland dependent flora. Wetland vegetation in the Ramsar site is characterised by three main community types: i) riparian open forest and woodland, ii) lignum shrubland and iii) ephemeral herbfields. Vegetation associations within the Ramsar site are spatially and temporally heterogeneous and reflect historical inundation patterns and dryland topography and geology. The lignum shrublands, in particular, provide critical breeding habitat for the colonial waterbirds. The 2011 boundary extension captures more breeding habitat as well as key feeding areas. Condition and characteristics of the lignum shrubland are driven by flood inundation history. Frequently flooded areas are typically dominated by large, dense, continuous clumps while infrequently flooded areas support many small lignum clumps, and the most frequently flooded habitats lack lignum all together.

The site is significant for supporting waterbird breeding with 44 species recorded breeding at the Ramsar site; the colonial breeding species form the most spectacular breeding colonies. Data on breeding events from 1971 to 1991 indicate that both Clear and Back Lake are important areas for waterbird breeding (Thoms et al. 2002). Narran Lake to the south of the Ramsar site is also important as a waterbird breeding site and also in providing resources for nesting species within the Ramsar site. Waterbirds which occur within the site and are listed at the state level include freckled duck (*Stictonetta naevosa)*, blue-billed duck (*Oxyura australis*), brolga (*Grus rubicunda*), Australasian bittern (*Botaurus poiciloptilus*) (also listed under the EPBC Act), magpie goose (*Anseranas semipalmata*), black-necked stork (*Ephippiorhynchus asiaticus*), and black-tailed godwit (*Limosa limosa*). When all of the waterbodies in the Narran Lakes system fill with

floodwaters, the lakes within and outside the Ramsar site become important breeding sites for colonial nesting waterbirds, with approximately 115,000 nests recorded in March 2012 (P. Terrill, pers. comm., 2013).

Fish surveys have collected 11 native and four introduced species including the Murray cod (*Maccullochella peelii peelii*) which is listed under the EPBC Act. Records for this species are not common, and it is probable that the species was only ever rarely found within the Narran River. Patterns of dominant species varies with different surveys but common species of fish encountered include bony bream (*Nematalosa erebi*), spangled perch (*Leiopotherapon unicolour*), golden perch (*Macquaria ambigua*), carp gudgeons (*Hypseleotris* species), Australian smelt (*Retropinna semoni*), and Murray-Darling rainbowfish (*Melanotaenia fluviatilis*). Supporting the fish population is a diverse and abundant zooplankton and macroinvertebrate fauna (Thoms et al. 2007).

Ecosystem services provided by the site include supporting near-natural wetland types, physical habitat for waterbird breeding, threatened species, cultural heritage values, and spiritual values. Of particular note is the use of the site by Indigenous people as an educational site for intergeneration transfer of knowledge.

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21. Noteworthy flora:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 14, Justification for the application of the Criteria) indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS*.

Hunter (1999) recorded 325 plant species within the Nature Reserve, of which 11 percent were introduced species, with the flora of the Ramsar site being characterised by arid and semi-arid zone species.

Lignum shrublands are dominated by the shrub *Muehlenbeckia florulenta* but may also support scattered trees in varying abundance. River cooba (*Acacia stenophylla)* is particularly abundant in areas fringing Clear Lake and on the floodplain west of Clear Lake while *Eucalyptus camaldulensis* is relatively frequent in shrublands on the eastern edge of Clear and Back lakes (Hunter 1999). Areas of tree dominated floodplain occur throughout the site with several key species: river red gum (*Eucalyptus camaldulensis*), coolibah (*E. coolabahs*), black box (*E. largiflorens*), river cooba *(Acacia stenophylla)* and bignonia emu-bush (*Eremophila bignoniiflora*). Thoms et al. (2007) noted low recent recruitment and high mortality in all commonly occurring tree species. In 2004, seedlings and saplings of river red gum, river coolibah and river cooba were all exhibiting very high levels of mortality and stress (Thoms et al. 2007).

Ephemeral herb field chenopods such as *Sclerolaena* species, *Maireana apressa* and *Atriplex holocarpa*, may be present and even locally abundant, particularly during dry periods (Hunter 1999; Capon 2010). In some areas, especially on patches of red earths, lunettes and playas to the east of Clear Lake, chenopods including *Sclerolaena decurrens* (green copperburr), *Atriplex nummularia* (old man saltbush) and *Halosarcia pergranulata* (samphire) may dominate most of the time and these communities may therefore be more specifically classified as chenopod low open shrublands (McGann et al. 2001). Overall, plant community composition of herbfields within the extent of historic inundation in the Narran Lakes ecosystem tend to be quite distinct from that of the understoreys of adjacent terrestrial communities (Thoms et al. 2007; Capon 2010). *Lepidium monoploides* (winged peppercress) a nationally listed species is found in the shrubland surrounding the ephemeral herbfields. Composition tends to vary along gradients of flood frequency with rarely flooded parts of the floodplain exhibiting the greatest degree of similarity with terrestrial vegetation communities, largely due to the presence of chenopod shrubs (Capon 2010).

During periods of inundation, shallowly flooded low-lying wetland areas such as the Long Arm and Back Lake, support aquatic plants including *Myriophyllum* species (water milfoil), *Vallisneria* species (ribbonweed), *Marsilea drummondii* (nardoo) and charophytes (*Chara* and *Nitella*) (McColl 2006). More deeply flooded areas such as Clear Lake, however, appear to be too turbid to support significant aquatic

plant growth although narrow littoral bands of emergent vegetation comprising *Sporobolus mitchellii* (rat's tail couch) and *Haloragis glauca* may be present (S. Capon pers. observation).

Following the recession of floodwaters, ephemeral herbfields are particularly diverse and productive. Areas that have been shallowly flooded for intermediate durations, such as Back Lake and Long Arm, tend to develop the most species rich communities dominated by annual forbs and monocots including *Centipeda cunninghamii, Ammania multiflora, Polygonum plebeium* and *Cyperus pygmaeus* (James et al. 2007; Thoms et al. 2007; Capon 2010). Although generally lacking aquatic vegetation whilst flooded, Clear Lake also supports significant groundcover production following drawdown, dominated by forbs such as *Cullen cinerea* and then *Malva pressiana* (Australian hollyhock) when dry (McColl 2006).

Hunter (1999) recorded 31 taxa in the fringing herbfields community type from the Nature Reserve including the grasses *Eriochlamys* species (woolly mantle), *Tripogon loliiformis* (five minute grass) and the forbs *Centaurium spicatum* (*Schenkia spicata*), *Lepidium monoplocoides*, *Wahlenbergia fluminalis*, *Pimelea trichostachya*, *Daucus glochidatus*, *Crassula sieberiana*, *Calandrinia pumila* and *Brachyscome ciliaris*. Three exotic taxa were recorded from ephemeral herbfields in the Nature Reserve by Hunter (1999): *Hypochaeris glabra*, *Festuca pratensis* and *Aira cupaniana*. A further 20 exotic species were observed in the vegetation and the soil seed bank during the Narran Lakes Ecosystem Project (McColl, 2006).

Soil seed banks in ephemeral herbfields are likely to be diverse (> 70 species) and spatially heterogeneous, dominated by annual forb and monocot species including *Cyperus pygmaeus, Centipeda cunninghamii, Ammania multiflora* and *Polygonum plebeium* (James et al. 2007).

Invasive weeds found within the Ramsar site include noogoora burr (*Xanthium occidentale*), Bathurst burr (*Xanthium spinosum*), African boxthorn (*Lycium ferrocissimum*) and golden dodder (*Cuscuta campestris*) (NSW NPWS 2000). Noogoora burr is considered a riparian weed, infesting riparian and floodplain habitats. Golden dodder is frequently found amongst the lignum shrublands, occurring in shallow areas of the site. As propagules of all three species are transported from upstream they are not able to be eradicated from the Ramsar site. Lippia (*Phyla canescens*) has also been identified as an invasive species within the Ramsar site. Lippia is a fast growing groundcover which causes degradation of soil and water, displacement of native species and can lead to bank erosion.

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22. Noteworthy fauna:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 14. Justification for the application of the Criteria) indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc., including count data. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

Over 100 species of land birds have been recorded in the area with many showing a preference for the floodplain woodlands (Thoms et al. 2002); including eight vulnerable and one endangered species under the NSW *Threatened Species Act 1995*. These are the black-breasted buzzard (*Hamirostra melanosternon*), little eagle (*Hieraaetus morphnoides*), pink cockatoo (*Lophochroa leadbeateri*), brown treecreeper (*Climacteris picumnus*) white-fronted chat (*Epthianura albifrons*), Australian bustard (*Ardeotis australis*), hooded robin (*Melanodryas cucullata*), grey-crowned babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*), and the barking owl (*Ninox connivens*).

Twenty four species of reptiles including the long-necked tortoise (*Chelodina longicollis*) have been recorded within the site (NSW Atlas data). The RIS (1999) lists 27 native mammals and seven introduced species as occurring at the site. Notable species include the koala (*Phascolarctos cinereus*), for which the combined populations of Queensland, New South Wales and the Australian Capital Territory are listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*, and which is listed in New South Wales as vulnerable and at Narran is at its western most limits, and the yellow-bellied sheathtail-bat (*Saccolaimus flaviventris*). The only wetland dependent mammal present is the water rat (*Hydromys chrysogaster*).

Introduced animals in the Ramsar site include foxes (*Vulpes vulpes*), feral cats (*Felis cattus*), pigs (*Sus scrofa*), rabbits (*Oryctolagus cuniculas*), hares (*Lepus capensis*), European carp (*Cyprinus carpio*) and mosquito fish (*Gambusia holbrooki*). Feral pigs can have significant impacts on waterbird breeding. Control programs are in place for feral pig control, and for fox and hare baiting (NSW NPWS 2000).

23. Social and cultural values:

a) Describe if the site has any general social and/or cultural values e.g., fisheries production, forestry,

The Ramsar site is part of an area which holds great significance for local Aboriginal people, with very high archaeological, traditional and contemporary social and spiritual significance (NSW NPWS 2000). The site is currently used as a site of intergenerational transfer of knowledge with local communities visiting the site on a regular basis (NSW NPWS 2000; Thoms et al. 2002). The Narran Lake terminal ecosystem and neighbouring landscape have been a key focal point for Indigenous people for around 40,000 years, as a meeting place for ceremonial and economic purposes, and as a rich source of food and other materials (Thoms et al. 2002). There are numerous Aboriginal site complexes in the area including shell middens, shell mounds, hearth sites, significant silcrete quarries, artefact scatters and sacred trees. Sites within the Nature Reserve are relatively undisturbed (NSW NPWS 2000)

b) Is the site considered of international importance for holding, in addition to relevant ecological values, examples of significant cultural values, whether material or non-material, linked to its origin, conservation and/or ecological functioning?

If Yes, tick the box ❑ and describe this importance under one or more of the following categories:

i) sites which provide a model of wetland wise use, demonstrating the application of traditional knowledge and methods of management and use that maintain the ecological character of the wetland:

ii) sites which have exceptional cultural traditions or records of former civilizations that have influenced the ecological character of the wetland:

iii) sites where the ecological character of the wetland depends on the interaction with local communities or Indigenous peoples:

iv) sites where relevant non-material values such as sacred sites are present and their existence is strongly linked with the maintenance of the ecological character of the wetland.

24. Land tenure/ownership:

a) within the Ramsar site:

The Ramsar site is wholly encompassed within the Narran Lake Nature Reserve, which is managed by the New South Wales National Parks and Wildlife Service, part of the NSW Office of Environment and Heritage, for conservation purposes. The original gazetted area has been subsequently added to by the acquisition of other neighbouring properties over the past 20 years. The original Nature Reserve (the subject of the original Ramsar nomination) was gazetted in 1988.

b) in the surrounding area:

The majority of land surrounding the Ramsar site is held under Western Lands Leases granted under the *Western Lands Act 1901*, one of the oldest pieces of natural resource management legislation in Australia.

25. Current land (including water) use:

a) within the Ramsar site:

The area within the Ramsar site is managed for conservation purposes.

b) in the surroundings/catchment:

The immediate area surrounding the Ramsar site is part of the semi-arid pastoral zone and is used primarily for sheep and cattle grazing (NSW NPWS 2000). There is considerable water extraction in the catchment with 1,500,000 megalitres of water storages on the Lower Balonne floodplain, predominantly in Queensland.

26. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land (including water) use and development projects:

a) within the Ramsar site:

Feral animals (i.e. pigs and foxes) have a minor impact, as do other invasive species. These threats are addressed through management of the Narran Lake Nature Reserve, consistent with the Plan of Management.

Increased sedimentation from upstream land uses and agricultural development may change the pattern of inundation in the lakes, leading to loss of habitat and changes in the distribution of waters across the floodplain.

b) in the surrounding area:

Grazing has occurred on the Lower Balonne-Culgoa floodplain since the 1840s (Thoms et al. 2002). Introduction of irrigation to the region led to the establishment of irrigated agriculture with the main crop being cotton. By the time of listing the cotton crop on the Balonne-Culgoa floodplain was 38,000 hectares (Thoms et al. 2002). Between 1988 and 1999 water storage on the floodplain expanded from 54,750 megalitres to more than 592,500 megalitres (Thoms et al. 2002). Total storage on the Lower Balonne floodplain is estimated at 1,500,000 megalitres in 2010 (Lower Balonne Floodplain Association, unpublished).

Upstream water extraction is seen as the primary threat to the ecological character of the site, particularly the loss of small to medium sized floods which are required to maintain the condition of critical water bird breeding habitat – e.g. lignum shrublands.

Climate change impacts, such as increased temperature and evaporation, may result in reduced duration of inundation, and a reduction in vegetation and in breeding opportunities for waterbirds.

27. Conservation measures taken:

a) List national and/or international category and legal status of protected areas, including boundary relationships with the Ramsar site:

In particular, if the site is partly or wholly a World Heritage Site and/or a UNESCO Biosphere Reserve, please give the names of the site under these designations.

The site is gazetted as a Nature Reserve and is managed for conservation, with visitor access restricted. The Narran Lakes are also listed in the Directory of Important Wetlands in Australia (Environment Australia 2001).

b) If appropriate, list the IUCN (1994) protected areas category/ies which apply to the site (tick the box or boxes as appropriate):

Ia ☒ Ib ❑; II ❑; III ❑; IV ❑; V ❑; VI ❑

c) Does an officially approved management plan exist; and is it being implemented?:

Yes. Narran Lake Nature Reserve Plan of Management- NSW National Parks and Wildlife Service. The plan of management identifies the need to ensure that water flows to the Narran Lakes system are protected, and to implement a monitoring system in order to determine the success of water management regimes and the impacts of any upstream agricultural development.

d) Describe any other current management practices:
Current management activities include:

- Invasive species control of pigs and foxes.
- Remote sensing of colonial waterbird breeding events
- Monitoring of water flows associated with flooding/ flow events.
- Establishment of an Aboriginal Co-Management Committee to facilitate Aboriginal involvement in the ongoing management of Narran Lake Nature Reserve.

28. Conservation measures proposed but not yet implemented:
e.g. management plan in preparation; official proposal as a legally protected area, etc.

A new Plan of Management for Narran Lake Nature Reserve is being drafted and is expected to be completed by 2014.

Narran Lakes are within the Intersecting Streams Water Resource Plan Area under the Murray-Darling Basin Plan, for which a long-term watering plan must be developed by 2015 (Murray-Darling Basin Authority 2012). A water resource plan must also be developed for the Condamine-Balonne Water Resource Plan Area in Queensland, which is upstream of the Narran River, and is therefore crucial to environmental water flows to the Narran Lakes, by 2015.

29. Current scientific research and facilities:
e.g., details of current research projects, including biodiversity monitoring; existence of a field research station, etc.

Scientific research is periodically carried out within the Ramsar site boundaries, significant recent projects include the Narran Lakes Ecosystem Project and survey/assessment work associated with the 2008 flood and environmental water allocation (Thoms et al. 2007; Kingsford et al. 2008; Jenkins et al. 2009; Capon 2010).

30. Current communications, education, participation and awareness (CEPA) activities related to or benefiting the site:
e.g. visitors' centre, observation hides and nature trails, information booklets, facilities for school visits, etc.

An Aboriginal Co-Management Committee has been established to facilitate incorporation of Aboriginal community aspirations into the management of Narran Lake Nature Reserve. This will include the establishment of day use facilities and educational usage of the Reserve.

31. Current recreation and tourism:
State if the wetland is used for recreation/tourism; indicate type(s) and their frequency/intensity.

The majority of the site is gazetted as a Nature Reserve and, as such, existing public use of the area is limited to visits by the Aboriginal community, educational groups and bird watchers. Public vehicle access to the Nature Reserve is permitted for the above purposes where it will not be detrimental to the natural and cultural heritage values of the area. It is estimated there are less than 1,000 visitors per annum to the Nature Reserve. Due to its remoteness and management primarily for nature conservation, there is no visitor centre at the site.

32. Jurisdiction:
Include territorial, e.g. state/region, and functional/sectoral, e.g. Dept of Agriculture/Dept. of Environment, etc.

Territorial: Government of New South Wales

Functional: NSW Office of Environment and Heritage (OEH), NSW Department of Premier and Cabinet

33. Management authority:
Provide the name and address of the local office(s) of the agency(ies) or organisation(s) directly responsible for managing the wetland. Wherever possible provide also the title and/or name of the person or persons in this office with responsibility for the

NSW National Parks and Wildlife Service (part of OEH).

Address: Area Manager
Narrabri Area
PO Box 72
Narrabri NSW 2390

Phone: 02 6792 7300

34. Bibliographical references:
Scientific/technical references only. If biogeographic regionalisation scheme applied (see 15 above), list full reference citation for the scheme.

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