Information Sheet on Ramsar Wetlands (RIS)

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).

This Ramsar Information Sheet has been converted to meet the 2009 – 2012 format, but the RIS content has not been updated in this conversion. The new format seeks some additional information which could not yet be included. This information will be added when future updates of this Ramsar Information Sheet are completed. Until then, notes on any changes in the ecological character of the Ramsar site may be obtained from the Ecological Character Description (if completed) and other relevant sources.

1. Name and address of the compiler of this form:
Compiled by the Western Australian Department of Conservation & Land Management (DCLM) in 1990.

Updated by Roger Jaensch, Wetlands International - Oceania, on behalf of DCLM in 1998, and by DCLM staff in 2000 and 2003.

FOR OFFICE USE ONLY.
DD MM YY
Designation date | Site Reference Number

All inquiries should be directed to Jim Lane, DCLM, 14 Queen Street, Busselton WA 6280, Australia, (Tel: +61-8-9752-1677; Fax: +61-8-9752-1432; email: jiml@calm.wa.gov.au).

2. Date this sheet was completed/updated:
November 2003

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.

Ord River Floodplain, Western Australia

5. Designation of new Ramsar site or update of existing site:
Ord River Floodplain, Western Australia was designated on 7 June 1990
The previous RIS was dated 1998.

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:

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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.

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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: 14° 51’ S to 15° 46’ S; Longitude: 128° 12’ E to 128° 33’ E

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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.

Ord River Floodplain is in the Shire of Wyndham-East Kimberley (local authority) in the State of Western Australia (population ca. 1.95 million in 2003). It is 8 km east of the town of Wyndham (population ca. 1000 in 2003).

The Ramsar Site as originally nominated in February 1990 comprised: former Nature Reserves 30866, l058, l059, 31636 (now amalgamated as Nature Reserve 42155) and 31967; areas that at the time were proposed for reservation and have since been added to Nature Reserve 31967; and some adjacent marine and estuarine waters and tidal land of Cambridge Gulf and the lower Ord River. The main wetland features of the Site therefore were (and are) the floodplain and associated wetlands of the

lower Ord River and of Parry Creek as well as the intertidal wetlands associated with the East Arm of Cambridge Gulf and the "False Mouths of the Ord".

The Site was extended (see maps) in 2001 to include areas that were added to Nature Reserve 42155 following the original Site nomination. The extension comprises most of the land between the former eastern/southern boundary of the Site and the present eastern/southern boundary of Nature Reserve 42155. Two small areas of the Nature Reserve (totaling approximately 120 hectares on the eastern boundary) were not included in the Site extension because they were subject to a proposal for changes to the Reserve boundary, involving a combination of excisions and additions to the Reserve. A proposed road reserve, intended to accommodate Parry Creek Road (which is currently within the Nature Reserve), is also not included in the Site.

The 2001 extension brought more of the wetlands associated with Goose Creek (e.g. part of Wild Goose Lagoon) and upper Parry Creek (waterholes and gorge wetlands) into the Ramsar Site.

10. Elevation: (in metres: average and/or maximum & minimum)
Approximately at sea level.

11. Area: (in hectares)
141 453 ha

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

A large system of river, seasonal creek, tidal mudflat and floodplain wetlands that supports extensive stands of mangroves important for salt-water crocodiles, and a large number and diversity of waterbirds.

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.
[Justification against former **Criterion 1(a)** under the Pre-1999 Criteria]:
The Site is the best example in Western Australia of an extensive system of wetlands (e.g. grass-dominated wetland) associated with the floodplain and estuary of a major tropical river.

Criterion 2: A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities.
[Justification against former **Criterion 2(a)** under the Pre-1999 Criteria]:
The Site supports a viable population of the globally threatened Saltwater Crocodile *Crocodylus porosus* and the nationally vulnerable Freshwater Sawfish *Microdon pristis.*

Criterion 3: A wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.
[Justification against former **Criterion 2(b)** under the Pre-1999 Criteria]:
The Site includes the most biologically diverse, contiguous floodplain and mangroves system in Western Australia. The Site's mangrove system is the largest (in terms of plant size), most species diverse and structurally complex mangrove system in the Kimberley (to date, 14 of the 16 species of mangrove found in Western Australia have been recorded). Large numbers of waterbirds from most waterbird families, particularly ducks and waders (shorebirds), use the Site (between 13 – 20 000 individuals from up to 54 species have been recorded). In good rainfall years, Parry Lagoons and other seasonal wetlands constitute one of the major breeding areas for waterbirds in the Kimberley region.

Criterion 5: A wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds.
[Justification against former **Criterion 3(b)** under the Pre-1999 Criteria]:
More than 20 000 waterbirds were recorded using the seasonal wetlands on the Ord River Floodplain and Parry Lagoon in 1980 and 1986 (see item 18). Available information indicates that conditions are suitable for use by more than 20 000 waterbirds at least several times within a 25 year period; in the context of wetland availability in Western Australia this is considered sufficient evidence of regular use by 20 000 waterbirds.

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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:
Victoria Bonaparte

b) biogeographic regionalisation scheme (include reference citation):
Interim Biogeographic Regionalisation for Australia (IBRA) Version 5.1 (Cummings and Hardy 2000)

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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 Site is comprised of depositional floodplain and estuarine environments associated with the mouth of the Ord River and Cambridge Gulf. There are three relatively distinct wetland units conserved within the Site. The southern part of the Site is dominated by Parry Creek, including a 20 km length of seasonally flowing creek running through upland environments, and an alluvial floodplain complex. The floodplain is inundated to varying degrees during the wet season and when the rain ceases, except for a few permanent and semi-permanent waterholes associated with incised channels and claypans, it quickly dries out. The upstream (southern) portion of the floodplain is freshwater while the lower (northern) sections, if not inundated by saline water, are surrounded by salty soils.

Extending north from the floodplain of Parry Creek to the Cambridge Gulf is the lower reaches of the Ord River. The upstream reaches of the Ord River within the Site are permanently fresh, however the downstream reaches, when not in flood, quickly become saline due to tidal influence. The tidal amplitude at the coast can be up to 8 m. The upstream end of the river channel is around 150 m wide, increasing to over 5 km wide at the mouth. Processes of sediment deposition dominate along the

entire length of the river on the Site, with broad sandy or gravelly spits occurring along the upstream reaches while unstable mud bars and islands are common near the mouth.

North from the mouth of the Ord River, the Site extends for some distance around the coast to include the False Mouths of the Ord, which consist of a deltaic maze of channels, tidally inundated coastal mudflats and islands. Only the northernmost channel in this complex receives much freshwater input, which comes from the relatively small and ephemeral Emu, Station and Tanmurra Creeks.

The seasonal wetlands south of the Ord River are fresh and sometimes fringed by low shrubs or trees. They are surrounded by a flat, grass-covered plain. The mud flats along the river and the eastern side of Cambridge Gulf support patches of *Sporobolus* grassland and samphire. They are incised by numerous creeks and channels, along which extensive stands of mangroves grow. Mangroves also grow along the Ord River and the seaward side of the mudflats.

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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).

The Ord River has a catchment area of over 50 000 km to the river mouth (Water and Rivers Commission 1999b).

The Site experiences a dry tropical climate with Wyndham having an average annual rainfall of 695 mm per year. Rainfall is monsoonal and is usually restricted to a hot, humid wet season from November to March. The dry season is characterised by warm, dry days with periods of steady south-easterly winds. Average maximum temperatures vary from 39°C in December to 30°C in July.

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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.

The principal hydrological values of the wetland are those of floodplain wetlands and mangrove areas.

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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 • N • O • P • Q • R • Sp • Ss • Tp Ts • U • Va •
Vt • W • Xf • 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.

I, M, G, H, F, N, Xf, Tp, J, W, Y, Ts, K.

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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.

Ten main vegetation associations have been identified within the Site including: dune systems, mudflats, mangals, grassland, low woodland (subdivided into a further 7 associations), sandstone range open woodland, riverine woodland (subdivided into 5 associations), rainforest (aquifer forest) and spring vegetation, major rivers and lagoons (permanent and ephemeral), and savanna woodland (DCLM 1998). A total of 335 native vascular plants from 89 families have been recorded from the Site, and another 16 introduced species are also present (DCLM 1998).

The grassland around the seasonal wetlands is dominated by cane-grass *Oryza australiense*. Parry Lagoons is surrounded by mudflats containing the samphires *Halosarcia indica leiostachya* and *Tecticornia verrucosa* and grasses. At the edge of the water the sedge *Eleocharis brassii* and a low shrub *Aeschynomene indica* occur. In the water a taller shrub, *Sesbania cannabina*, grows seasonally and a variety of water lilies and other aquatics occur, including *Ipomoea diamantinensis*, *Nymphaea gigantea*, *Nymphoides* sp., *Utricularia* sp. and *Ceratophyllum* sp. A few *Terminalia* sp. trees grow in some areas. Seasonal wetlands occurring on black soil plains, including Jobalong Flat, are dominated by sedges, principally *Eleocharis* sp. However, in some cases *Terminalia* sp. trees also occur, together with low shrubs, water lilies (*Nymphaea gigantea*, *Nymphoides indica* and *Nymphoides crenata*) and other aquatics. Permanent waterholes are fringed with a variety of trees, including *Barringtonia acutangula*, *Melaleuca argentea* and *Terminalia platyphylla*. *Pandanus spiralis* occurs around Palm Spring.

The eastern side of Cambridge Gulf has some of the best areas of mangroves in the Kimberley in terms of species diversity, structural complexity, and massiveness of the stands. Fourteen of the 16 species of mangroves known in Western Australia occur within the Site. In the northern part of the Ramsar site zonation is evident in the mangrove community fronting onto Cambridge Gulf. Mangrove species in the seaward zone, a woodland about 8 m high, include *Sonneratia alba*, *Avicennia marina* and *Aegiceras corniculatum*. Behind this, in a woodland 10 m high, grow *Bruguiera parviflora*, *Avicennia marina* and *Aegiceras corniculatum*, and then there is a belt of *Rhizophora stylosa* 12-15 m high. On the landward edge is a 4 m high thicket of *Avicennia marina*, *Ceriops tagal* and *Aegialitis annulata*. Patches of *Sporobolus virginicus* grassland and samphire grow on the mudflats behind the mangroves. Other species of mangrove occur occasionally in the northern section or along the creeks and the Ord River. These include: *Xylocarpus moluccensis*, *Excoecaria agallocha* and *Camptostemon schultzii*. The mangroves support at least six species of insectivorous bat, Black Flying-foxes *Pteropus alecto* and an undescribed species of mosaic-tailed rat *Melomys*.

The seasonal wetlands on the Ord River floodplain support large numbers of waterbirds: totals of 13 000 in May 1979; 20 000 in March 1980; 15 000 in January 1981 and 27 000 in May 1986 have been recorded. They regularly contain more than 10 000 ducks: in May 1986 18 400 ducks were recorded there, including 6 500 Hardheads *Aythya australis* and 6 000 Grey Teal *Anas gracilis*, and in November 1968 15 000 Plumed Whistling Duck *Dendrocygna eytoni* were seen in the Parry Lagoons. The lagoons are also an important site for waders: several thousand Little Curlews *Numenius minutus* and Oriental Pratincoles *Glareola maldivarum* and hundreds of Wood Sandpipers *Tringa glareola* have been counted. The Parry Lagoons are probably the most important site in Australia for Wood Sandpipers and Marsh Sandpipers *Tringa stagnatilis*. In years when local rainfall is good the lagoons and other seasonal wetlands constitute one of the major breeding areas for waterbirds in the Kimberley and an enormous number and diversity can be seen. Fifty-four species were recorded in May 1986. Up to 77 species of waterbirds have been identified in habitats associated with Parry Creek, and a total of 198 bird species have been recorded within the site to date (DCLM 1998).

The Site's fish populations have been little studied. Two species of freshwater fish, the Catfish *Neosilurus hyrtlii* and a Rainbowfish *Melanotaenia splendida*, have been recorded from Parry Lagoons and the Barramundi *Lates calcarifer* is a prominent species targeted by commercial and recreational fishing in the estuarine areas of the Site (DCLM 1998). The regional significance of the

estuarine environments of the Site as breeding and nursery grounds for marine fish and crustaceans is thought to be high but this has yet to be quantified (DCLM 1998).

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.*

There are no nationally rare, threatened or endemic plants known at the Site. However, several species that are under consideration for declaration as "rare flora" at State level occur at the Site, notably *Utricularia aurea.*

Infestations of the exotic weeds Noogoora burr *Xanthium pungens* and *Parkinsonia aculeata* trees are present within the site.

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.*

The lower Ord River contains a high density of (for the Kimberley) Saltwater Crocodiles *Crocodylus porosus,* a species declared "in need of special protection" under the Western Australian Wildlife Conservation Act. Upstream areas (outside of the site) are used for breeding by Saltwater Crocodiles, and 14 of 39 nest found in Western Australia in 1989 were in the upper Cambridge Gulf system. In 1992, 149 non-hatchling Saltwater Crocodiles were counted in the Ord Estuary (within the Site), at a density of 1.5 animal per km (DCLM and G.Webb P/L unpublished data).

The Freshwater Sawfish *Pristis microdon* has been collected from the lower Ord River (Storey, unpublished data). The Freshwater Sawfish is listed as a Vulnerable species under the Commonwealth *Environment Protection and Biodiversity Conservation Act* (1999).

The Site's grasslands are the only area in Western Australia where Zitting Cisticolas *Cisticola juncidis* occur. This bird species is more widespread in the Northern Territory and Queensland.

The Site's mangroves contain 12 of the 13 species of terrestrial bird which are restricted to this type of habitat or rainforest in Western Australia, including the Black Butcherbird *Cracticus quoyi* whose population in WA is limited to the area around Cambridge Gulf.

The False Mouths of the Ord are home to the first known population of the Mosaic-tailed Rat *Melomys burtoni* in Western Australia, and at least 17 bat species are known from the same area (DCLM 1998). Other mammals known from the Site include: the northern Nail-tailed Wallaby *Onychogalea unguifera,* Agile Wallaby *Macropus agilis,* the Long-haired Rat *Rattus villosissimus,* and Woodward's Rock Rat *Zyzomys woodwardi,* which has not been collected for many years (DCLM 1998).

23. Social and cultural values:

a) Describe if the site has any general social and/or cultural values e.g., fisheries production, forestry, religious importance, archaeological sites, social relations with the wetland, etc. Distinguish between historical/archaeological/religious significance and current socio-economic values:

The Site includes a number of historically important sites, notably, the second Halls Creek Road which is of an unusual cobblestone construction, the wireless station at Telegraph Hill and the Goose Hill Station (Ascot Government Station) (DCLM 1998).

Lakes Argyle and Kununurra are within the traditional lands of the Miriuwung and Gajerrong language groups. Past and present cultural significance of the Ord River to the traditional owners is evidenced by the Miriuwung and Gajerrong Native Title claim and hearings, currently before the Federal Court of Australia. Indigenous people have a complex and spiritual tie to the land and waters of the Ord River (Lane 2003). There are numerous significant cultural heritage sites, including ceremonial, mythological and burial sites, associated with the river that are protected by the Western Australian Aboriginal Heritage Act (1972).

A major social value of the Site is tourism although there is a possibility that mining for alluvial diamonds may occur. Mining may, or may not, be compatible with maintaining the ecological character of the wetland.

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:

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24. Land tenure/ownership:
a) within the Ramsar site:
The Nature Reserves are vested in the Conservation Commission. (appointed by the Government of Western Australia) and managed by the Department of Conservation and Land Management on behalf of the Conservation Commission. The purpose of the Nature Reserves is "Conservation of Flora and Fauna". Marine areas within the site are largely non-reserved. The area is subject to Native Title claims by the Miriuwung and Gajerrong people, and the Gwini, Walmbi and Wannubal peoples (DCLM 1998). The Federal Court is currently examining these claims and outcomes are expected by 2005.

b) in the surrounding area:
Surrounding areas are mostly pastoral leasehold land (notably Carlton Hill and Ivanhoe leases), government reserves (e.g. Reserve 20623), and non-reserved marine and estuarine areas.

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25. Current land (including water) use:
a) within the Ramsar site:

The seasonal wetlands are visited regularly by tourists and local residents from Wyndham, which is about 15 km west of Parry Lagoons. The remainder of the reserve area is used for nature conservation and attracts little human usage.

b) in the surroundings/catchment:
The surrounding land is leased for the grazing of cattle, which frequently stray onto the reserves and damage the seasonal wetlands. Mining tenements are held over the majority of the area and exploration for alluvial diamonds is in progress.

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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:
The damming of the Ord River is considered to have dramatically changed the sedimentation processes in the lower Ord River. Evidence suggests that parts of the river and estuary have become shallower because of lack of scouring by floodwaters, with the shallowing exacerbating the rate of sedimentation through increased tidal pumping of sediment into the East Arm of the Ord River Estuary (Warman 1999; Wolanski et al. 2001). Some research indicates that the East Arm may now be geomorphologically unstable as a result of damming and land clearing in the catchment for agriculture and cattle grazing (Wolanski et al. 2001). However, within the lower Ord floodplain, there is evidence that the river channel has a long history of instability that can be seen in recent aerial photographs which show dramatic changes to islands, river bank shape and vegetation over very short periods (DCLM 1998). Recent studies of severe gully erosion in the upper Ord River catchment have revealed that the area is characterised by very high natural erosion rates, and that gully erosion was a predominant feature of the catchment prior to European settlement, contrary to previous beliefs (Callow 2001; Sandercock 2003). Expansion of the Ord River Irrigation Area (ORIA Stage 2 – the M2 Supply Channel) may further exacerbate sedimentation of the Lower Ord River (Wolanski et al. 2001).

Construction of the Kununurra Diversion Dam to form Lake Kununurra and the Ord River Dam to form Lake Argyle has significantly altered the natural flow regime of the lower Ord River. The magnitude and frequency of high flow events have been severely limited by regulation, with a corresponding decrease in the extent and duration of floodplain inundation. Large flood flows are now discharged slowly over a period of many months rather than as the high energy channel forming flows experienced before regulation. There are now constant flows throughout the dry season and the lower reaches of the river no longer dry out to disconnected river pools. In effect, it has been transformed through regulation and the pattern of operation of the dams from a 'dry tropics' to a 'wet tropics' river (Water and Rivers Commission 2003).

To assess how the ecology of the lower Ord River has changed since damming and regulation, the riparian vegetation, invertebrate and fish diversity, abundance and biomass, and ecological processes in the lower Ord River (below the Kununurra Diversion Dam) were compared with the unregulated Pentecost, Dunham and Keep Rivers, which are all located nearby. Preliminary results of the sampling program, which included sites both within and upstream of the Ramsar Site, indicate that regulation appears to have altered the ecology of the lower Ord River in a number of ways, resulting in: reduced diversity of species of native riparian vegetation; increased number and cover of exotic species; alteration of the macroinvertebrate species composition (but not species richness); alteration of the size and species composition of the fish fauna (with large species normally associated with the estuary found in the higher reaches of the river below Lake Kununurra); and increased productivity, with a change from heterotrophic production (food web driven by terrestrial carbon) to autotrophic production (food web driven by algal photosynthesis) (Water and Rivers Commission 2003).

Prior to damming, the mean annual water flow at the mouth of the Ord River was about 4 500 GL (Water and Rivers Commission 1999b). Development of the ORIA Stage 1 has reduced the average

annual river flow to approximately 3 200 GL, and development of Stage 2 may see the flow reduce to about 2 300 GL per year. To balance the environmental water flow requirements of the Ord River with the water requirements of the ORIA and other commercial users in the area (notably diamond mines), the Department of Environment (formerly the Water and Rivers Commission) is currently determining water allocations for the river (Water and Rivers Commission 1999a; EPA 1999; Doupe and Pettit 2002; Trayler et al. 2002, Water and Rivers Commission, 2003; see also item 25).

There is concern about elevated pesticide and nutrient levels in the Ord River downstream of the Kununurra Diversion Dam (Lake Kununurra) resulting from the ORIA (Water and Rivers Commission 1999b, Lund and McCrae 2001, Doupe et al. 1998).

Aquacultured Barramundi *Lates calcarifer* escaping from fish farms in Lake Argyle could threaten the genetic integrity of the wild population present in the site by interbreeding (Doupe and Lymbery 1999).

Frequent intrusion by cattle into the site is causing bank erosion of riverine parts of the site and the landward edge and fringing woodlands of the False Mouths of the Ord, particularly where small creeks discharge, are suffering the greatest disturbance from cattle (Watkins et al. 1997). Continuing efforts must be made to ensure cattle do not stray into the wetland area, and also to ensure that infestations of Noogoora Burr *Xanthium pungens*, an exotic plant, do not spread. Trees of *Parkinsonia aculeata*, another exotic plant, occur around some wetlands near Wild Goose Creek and will need to be eradicated. Other weed species include Leucaena *Leucaena leucocephala* and Neem trees, Date Palms *Phoenix dactylifera* and Jatropha *Jatropha gossypifolia*. The westward movement of the poisonous, introduced Cane Toad *Bufo marinus* into Western Australia may also have a substantial impact on the Site's wildlife, particularly Freshwater Crocodiles which are known to have died from ingesting the toads in Katherine Gorge (Northern Territory).

b) in the surrounding area:
Exploration for diamonds is expected to continue, subject to environmental constraints imposed to minimise disturbance and to maintain wetland ecology and habitat. The question of mining will be assessed by the appropriate State authorities in the event of the discovery of commercial diamonds.

The Ord River Irrigation Area Stage 2 (ORIA Stage 2 – the M2 Channel) expansion may see irrigated agriculture occurring in close proximity to the site (Wesfarmers Sugar Company et al 2000; EPA 2000, 2001). The ORIA Stage 2 proposal is currently undergoing feasibility studies however, if implemented; it will draw irrigation water from Kununurra Dam, thereby further reducing the water flow in the lower Ord River, particularly during the dry season.

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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.

Reserves 30866, 1058, 1059, 31636, 3197 have been declared in the southern half of the wetland area. Since the Site was originally nominated in 1990, changes to the extent, vesting and purpose of the component Nature Reserves have been achieved (see item 13).

The Site is listed on the Register of the National Estate.

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?:
Preliminary management planning work for the Ramsar Site in 1997 was followed by production of a draft "Management Report" by the Western Australian Department of Conservation & Land Management in 1998 (DCLM 1998). With the approval of the Conservation Commission, this document will now be progressed to the status of a formal management plan for the area.

d) Describe any other current management practices:
The Department of Environment (formerly the Water & Rivers Commission) has commenced a project to consider environmental water requirements for the Lower Ord (Water and Rivers Commission 1999a; EPA 1999; Doupe and Pettit 2002). The intent of the project is to provide a basis for the determination of a flow management strategy that takes account of economic, social and ecological requirements. Water allocations for irrigated agriculture (ORIA Stage 1 and 2) and other purposes (notably diamond mines) would be considered in the light of any possible impacts on the Ramsar Site.

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

A number of tenure and/or purpose changes have been proposed, notably, declaration of the proposed Cambridge Gulf Marine Park (approximately 110 500 ha) and Parry Lagoons National Park (approximately 39 500 ha, incorporating part of the Ord River Nature Reserve and all of the Parry Lagoons Nature Reserve) (DCLM 1998). The Ramsar wetland boundary conforms with the boundaries of the existing reserves. It has been recommended that the Ramsar boundaries be modified to conform to include the proposed reserves (DCLM 1998). It has also been proposed to resolve the nature reserve boundaries of the False Mouths of the Ord (currently based on a line drawn at 40 m above the high tide mark) to a new management boundary further inland (thereby increasing the area of the Ord River Nature Reserve) so that it can be clearly identified (DCLM 1998). This will need to be undertaken through negotiation with the owners of the Carlton Hill pastoral lease which adjoins the False Mouths. It has been recommended that part of the Ivanhoe pastoral lease including Goose Creek, which has been identified for irrigated horticultural development as part of the expansion of the Ord River Irrigation Scheme, should be included within the proposed Parry Lagoons National Park (DCLM 1998). Other management measures proposed include: formation of an advisory committee; cooperative management involving the traditional Aboriginal owners; management zoning; further biological surveys; preparation of a fire master plan; and further management of recreational use (DCLM 1998). The Western Australian Department of Fisheries has been reported to be developing a fisheries management plan for the lower Ord River (Watkins et al. 1997).

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

The impact of damming on the fluvial geomorphology of the lower Ord River, and the rapid siltation of the Ord River Estuary have recently been studied (Warman 1999; Wolanski et al. 2001). Other studies have focused on the causes and nature of river channel changes and gully erosion in the upper Ord River catchment (Callow 2001; Sandercock 2003). The relationship between the natural flow regime and riparian vegetation in the Ord River has been identified (Pettit et al. 2001). The hydrology of the Ord River, including water quality, water availability, and current and future water demands has been investigated (Water and Rivers Commission 1999b). To assist in the assessment of the expansion of the ORIA, the Water and Rivers Commission undertook a series of studies into the hydrogeological regime of the ORIA including an airborne geophysical survey, installation of monitoring bores, pumping tests, chemical analyses and groundwater modeling (Water and Rivers Commission 2001). The movement patterns of the Site's Saltwater Crocodiles have been investigated

by radio-tracking; the genetic structure of the population has also been compared with Saltwater Crocodile populations in other Kimberley rivers (Kay In press).

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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.

Walkways and bird viewing platforms have been constructed at Marlgu Lagoon. Interpretive signs about the Site were installed during 1998-99.

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

There is a low level of tourist use, especially of Parry Lagoons. Recreational activities which take place at the Site include fishing, bird-watching, photography, boating and hunting, the last of which is illegal. Commercial tourism activities include scenic tours, bird-watching, fishing charters and Aboriginal tourism. A walking trail on Telegraph Hill, overlooking the established bird hides, is currently under construction. Camping facilities exist at Parry Creek, which also has a restaurant, elevated accommodation units, and caravan facilities.

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

Territorial: The State Government of Western Australia.
Functional: The Conservation Commission (vesting) and the Western Australian Department of Conservation & Land Management (management).

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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 wetland.

The Kimberley Region (based in Kununurra) of the Western Australian Department of Conservation & Land Management.

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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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