

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

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

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

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Designation date

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Site Reference Number

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## 2. Date this sheet was completed/updated:

June 2011

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## 3. Country:

Australia

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## 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.

Kakadu National Park.

This Ramsar site is a combination of two Ramsar Sites merged together on 28 April 2010. The two Ramsar Sites were formerly called:

- Kakadu National Park (Stage I) including wetland components of Stage III.
- Kakadu National Park (Stage II).

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## 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

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## 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:**

On 28 April 2010 the two Ramsar sites within Kakadu National Park were combined to form a single Ramsar Site. In addition, approximately 600,000 hectares was added to the Ramsar site to increase the area so that the Ramsar site matches the boundary of the National Park. The additional 600 000 hectares was added from the Stage III area of the Park and includes extensive escarpments and areas of cultural significance to the traditional owners.

No broad scale changes in ecological character were identified in the Ecological Character Description for the Ramsar site (see BMT WBM 2010a).

All Criteria that were met at the time of preparation of the previous RIS (1998) remain applicable to the Ramsar site. Additionally, the three new Criteria (7, 8, 9) that were developed since preparation of the previous RIS (1998) are seen as met by the Ramsar 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.

The boundary of the Ramsar site is identical to that of Kakadu National Park as established by Proclamation made on 5 April 1979 and entered on the Federal Register of Legislative Instruments established under the *Legislative Instruments Act 2003* as instrument F2008B00727, as amended by Proclamations made in 1985, 1987, 1989, 1991 and 2007 and entered on the Register as instruments F2009B00244, F2009B00245, F2009B00246, F2009B00247 and F2007L01463. See Figure 1 and 2 for maps.

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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.

Figure 1 and Figure 2 show the boundaries of Kakadu National Park Ramsar site. The site is located within an indicative bounding box with the following co-ordinates:

- (i) 12°03'S, 131°53'E (NW corner).
- (ii) 12°04'S, 133°00'E (NE corner).
- (iii) 14°00'S, 132°59'E (SE corner).
- (iv) 13°59'S, 131°51'E (SW corner).

The approximate centre of this bounding box is 13°01'S, 132°26'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.

The Ramsar site is located within the Northern Territory in Australia, approximately 200 kilometres east of the Northern Territory's capital city Darwin (Figure 1). The closest township is Jabiru, located within Kakadu National Park.

Kakadu National Park occurs within the following biogeographic regions (see also Section 15):

- Timor Sea Drainage Division, which is relevant to freshwater and estuarine areas, and
- Northern Provincial Bioregion, as outlined in the Integrated Marine Coastal Regionalisation of Australia (IMCRA), which is relevant to marine and coastal areas.

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

Maximum: 464 m

Minimum: 0 m

Average: 105 m

### 11. Area: (in hectares)

Total site area: 1 979 766 hectares.

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### 12. General overview of the site:

Provide a short paragraph giving a summary description of the principal ecological characteristics and importance of the wetland.

The Ramsar site is an iconic destination within Australia, renowned for exceptional beauty and unique biodiversity, and a variety of landforms, habitats and wildlife. It is one of the very few World Heritage sites listed for both its cultural and natural values. It encompasses expansive coastal and inland ecosystems including the following:

- terrestrial ecosystems. This includes both wetland areas, as well as extensive woodlands which occur throughout the site.
- floodplain ecosystems. Specifically, the vast tracts of palustrine wetlands that comprise the seasonally inundated floodplains, and the areas of *Melaleuca* swamp forest. Floodplain ecosystems support high numbers of flora and fauna populations/species that underlie a diversity of services.
- river channel. River channels and the associated riparian vegetation support a diversity of fauna and flora species including threatened species, endemic species, waterbirds, fish and traditional foods. Furthermore, river channels provide opportunities for recreational/tourism activities.
- springs. A number of groundwater fed springs occur in the site, with particularly notable examples occurring in the stone country and adjacent lowland areas. Springs represent important dry season refugia and provide habitats for a range of endemic species.

- billabongs. Billabongs are a particularly important feature of the floodplains. Specifically, billabongs provide areas of deep water habitat for aquatic flora and fauna, as well as dry season refuge for many of the aquatic fauna species that inhabit the floodplains. These fauna species include a diversity of freshwater fish, a large number of waterbirds, certain threatened species (for example, pig-nosed turtles) and a number of traditional food species (for example, file snakes and freshwater turtles). Furthermore, many traditional dietary staple plant species are associated with billabongs (for example, water lilies). Billabongs such as Yellow Water are also of value due to their tourism and recreational significance.
- coastal/marine ecosystems. Specifically, these ecosystems incorporate intertidal mudflats, saltmarsh, mangroves and seagrass. Intertidal mudflats are notable as they support large aggregations of shorebirds.

Wetland habitats are relatively undisturbed, and support a broad range of natural values including threatened and endemic species and a remarkable abundance of waterbirds. The site contains an abundance of archaeological sites and items, and an ongoing 'living culture' is maintained by the traditional owners of Kakadu National Park today who display a fundamental connection with the wetlands of the Ramsar site. The climate of the Ramsar site is tropical with the wet season duration ranging from approximately four-and-a-half to seven months.

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### 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.

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### 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 representative, rare or unique examples of a natural or near-natural wetland type found within the appropriate biogeographic region.*

The wetland types occurring within the Ramsar site are representative of landscape and wetland types found in the bioregion. In particular, the floodplains are outstanding examples of their types in the monsoon tropics, and the river systems are outstanding examples of the series of large rivers in the bioregion. Field Island is also particularly notable in the context of this criterion as it contains all of the coastal wetland types known to occur within the site, including with the exception of coastal freshwater lagoons. This represents a remarkably high level of habitat diversity within a relatively small area.

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

Common name	Scientific name	IUCN	CITES	CMS	National Status
<b>Birds</b>					
Yellow Chat	<i>Epthianura crocea tunneyi</i>	Least Concern	-	-	Endangered
<b>Mammals</b>					
Dugong	<i>Dugong dugon</i>	Vulnerable	Appendix II	Appendix II	Marine and Migratory
<b>Fish</b>					
Speartooth Shark	<i>Glyphis glyphis</i>	Endangered	-	-	Critically Endangered
Northern River Shark	<i>Glyphis garricki</i>	Critically Endangered	-	-	Endangered
Dwarf Sawfish	<i>Pristis clavata</i>	Critically Endangered	Appendix I	-	Vulnerable
Freshwater Sawfish	<i>Pristis microdon</i>	Critically Endangered	Appendix II	-	Vulnerable
<b>Reptiles</b>					
Flatback Turtle	<i>Natator depressus</i>	Data Deficient	-	-	Vulnerable
Pig-nosed Turtle	<i>Carettochelys insculpta</i>	Vulnerable	-	-	-
Green Turtle	<i>Chelonia mydas</i>	Endangered	Appendix I	Appendix I	Vulnerable
Black-necked Stork	<i>Ephippiorhynchus asiaticus</i>	Near Threatened	-	-	-
Saltwater Crocodile	<i>Crocodylus porosus</i>	Least Concern	Appendix II	Appendix II	Marine and Migratory
Northern Quoll	<i>Dasyurus hallucatus</i>	Endangered	-	-	Endangered
Brush-tailed Rabbit-rat	<i>Conilurus penicillatus</i>	Near Threatened	-	-	Vulnerable
False Water Rat/ Water Mouse	<i>Xeromys myoides</i>	Vulnerable	Appendix I	-	Vulnerable
Arnhem Rock-rat	<i>Zygomys maini</i>	Near Threatened	-	-	Vulnerable

**Criterion 3:** *A wetland should be considered internationally important if it supports populations of plants and/or animal species important for maintaining the biological diversity of a particular biogeographic region.*

The Ramsar site supports a high biodiversity. Kakadu National Park is known to support nearly 1600 plant species (Director of National Parks 2007), 59 fish species (Bishop *et al.* 2001), 61 mammal species, 105 reptile species, 26 frog species and 267 bird species (predominantly derived from Kakadu National Park unpublished records). Refer to Appendix C of the Ecological Character Description (BMT WBM 2010a) for species lists.

The Ramsar site supports four regionally endemic<sup>1</sup> wetland-dependent flora species: the Arnhem Land bamboo (*Bambusa arnhemica*), an aquatic grass (*Hygrobloa aquatica*) and the aquatic flowering plants *Nymphoides spongiosa* and *Nymphoides subacuta*.

<sup>1</sup> Occurs exclusively in the Timor Sea Drainage Division

The Ramsar site also supports four regionally endemic fish species: the Magela hardyhead (*Craterocephalus marianae*), the black-blotch grunter (*Pingalla midgleyi*), the exquisite rainbowfish (*Melanotaenia exquisita*), and the butler's grunter (*Syncomistes butleri*). As well as a locally endemic<sup>2</sup> family of freshwater shrimp (Kakaducarididae) that contains two mono-specific genera (*Leptopalaemon gagadji*, *Kakaducaris glabra*), a locally endemic genus of phreatoicidean isopod (*Eophreatoicus*), and seven species of Leptophlebiidae mayfly that are endemic to the bioregion (BMT WBM 2010a).

Two locally endemic flora species occur in the site, both of which can occur in riparian areas (Bayliss *et al.* 1997): *Ternstroemia cheryii* and *Macklinlaya macrosiadea*. Additionally *Hibiscus brennani*, listed as vulnerable under the EPBC Act is endemic to the Northern Territory and is known from only one population at Baroalba Creek, on the Mount Brockman outlier of the western Arnhem Land Plateau. There are no aquatic plant species that are endemic to the site (Bayliss *et al.* 1997).

The site supports one wetland-dependent threatened bird species, the yellow chat (Alligator Rivers) *Epthianura crocea tunneyi*. Yellow chat (Alligator Rivers) is listed as endangered under both the EPBC Act and *Territory Parks and Wildlife Act 2000*. Yellow chat (Alligator Rivers) is endemic to the Northern Territory and is restricted to a small geographic area encompassing the floodplains from the Adelaide River to the East Alligator River, between Oenpelli and Darwin.

The Ramsar site contains the full range of tree and shrub mangrove species that are representative of the bioregion. Mangrove communities in the Kakadu National Park region are floristically diverse, with thirty-eight mangrove tree and shrub species identified including the grey mangrove *Avicennia marina* spider mangrove *Rhizophora stylosa*, and white mangrove *Sonneratia alba* (Wightman 1989).

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

The Ramsar site provides breeding habitat for significant waterbird aggregations, with the most significant breeding colonies located within mangrove communities of the major rivers as well as floodplain freshwater marshes. For example, a waterbird colony near the mouth of South Alligator River, estimated to be up to 5000 waterbirds of varying species (Chatto 2000). Significant breeding aggregations of magpie geese (*Anseranas semipalmata*) occur throughout the floodplains of the site, with the South Alligator floodplains regarded as the third most important area of nesting habitat after the Mary-Adelaide and Daly River floodplains (Bayliss and Yeomans 1990). The Nourlangie floodplain is also known to be an important nesting habitat.

Additionally, the permanent wetlands within the site (particularly billabongs) provide a dry season refuge for a variety of species including waterbirds, such as magpie geese (*Anseranas semipalmata*) and the wandering whistling duck (*Dendrocygna arcuata*) reptiles such as saltwater crocodiles (*Crocodylus porosus*), freshwater crocodiles (*Crocodylus johnstoni*) and freshwater turtles, freshwater fish (such as barramundi), and macrophytes.

**Criterion 5:** *A wetland should be considered internationally important if it regularly supports 20 000 or more waterbirds.*

The total waterbird population for the Alligator Rivers Region during the late dry season is likely to be in excess of 2.5 million birds including geese, ducks, sandpipers and curlews (Morton *et al.* 1993). Notable records of waterbird abundance are presented by Chatto (2003a) who recorded large aggregations of shorebirds from Finke Bay (9000 birds in 1993) and in coastal areas between the South Alligator River and Minimini Creek (12 500 birds in 1992). Furthermore, in excess of 172 000 waterbirds were counted within the upstream South Alligator River floodplains during October 2001 (Chatto 2006).

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<sup>2</sup>Occur exclusively within the catchments of the Ramsar site and the Arnhem Plateau.

**Criterion 6:** *A wetland should be considered internationally important if it regularly supports one percent of the individuals in a population of one species or subspecies of waterbird.*

The Ramsar site supports one percent of the population of the following species (total population size estimated by Wetlands International 2006):

Common name	Scientific name	1% threshold	Maximum count Region	Region Reference
Magpie Goose	<i>Anseranas semipalmata</i>	20,000	2,539,800 ± 1,372,568;	Alligator Rivers Bayliss and Yeomans1990
Wandering Whistling-duck	<i>Dendrocygna arcuata</i>	10,000	Records of 400,000	Alligator Rivers Morton et al. 1990b
Plumed Whistling-duck	<i>Dendrocygna eytoni</i>	10,000	Records of 70,000	Alligator Rivers Morton et al. 1990b
Radjah Shelduck	<i>Tadorna radjab</i>	1,000	Records of 30,000	Alligator Rivers Morton et al. 1990b
Pacific Black Duck	<i>Anas superciliosa rogersi</i>	10,000	Records of 50,000	Alligator Rivers Morton et al. 1990b
Grey Teal	<i>Anas gracilis</i>	20,000	Records of 50,000	Alligator Rivers Morton et al. 1990b
Brolga	<i>Grus rubicunda</i>	1,000	Records of 24,000	Alligator Rivers Morton et al. 1990a
Black-necked Stork (Jabiru)	<i>Ephippiorhynchus asiaticus</i>	300	Records of 1,800	Alligator Rivers Morton et al. 1990a

The following migratory shorebird species have been recorded within Kakadu National Park in numbers which exceed one percent of the estimated population size in the East Asian – Australasian Flyway (Bamford *et al.* 2008):

Common name	Scientific name	1% threshold	Maximum count Region	Region Reference
Marsh Sandpiper	<i>Tringa stagnatilis</i>	1100	Records of 1,600	Chatto 2003a
Little Curlew	<i>Numenius minutus</i>	1,800	Records of 300,000	Morton et al. 1991
Common Sandpiper	<i>Actitis hypoleucos</i>	250	Records of 300	Bamford 1988
Australian Pratincole	<i>Stiltia isabella</i>	5,000- 1,000,000	Records of 30,000	Morton et al. 1991
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	1,600	Records of 4,900	Chatto 2003a

**Criterion 7:** *A wetland should be considered internationally important if it supports significant proportion of indigenous fish subspecies, species or families, life-history stages, species interactions and/ or populations that are representative of wetland benefits and/ or values and therefore contributes to global biodiversity.*

To date, 59 freshwater fish species (i.e. species that have an obligatory freshwater stage) have been recorded in Kakadu National Park (Bishop *et al.* 2001). This represents approximately 20 percent of the total number of fish species found in Australian freshwaters (302 species) and approximately 60 percent of the freshwater fish recorded from the Timor Sea Drainage Division (approximately 100 species) (Allen *et al.* 2002, CSIRO 2009), and is the highest species richness of any catchment in this bioregion (Burrows 2008). Four endemic fish species,

The Ramsar site also supports four regionally endemic fish<sup>2</sup> species a locally endemic family of freshwater shrimp, a locally endemic genus of phreatoicidean isopod (*Eophreatoicus*), and seven species of Leptophlebiidae mayfly that are endemic to the bioregion, which are discussed in more detail above in Criterion 3 (BMT WBM 2010a).

**Criterion 8:** *A wetland should be considered internationally important if it is an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks depend.*

Kakadu National Park provides important habitats, feeding areas, dispersal and migratory pathways, and spawning sites for numerous fish species of direct and indirect fisheries significance. Recreational angling and Indigenous fishing are key uses of the Ramsar site, and are both based mostly on one species barramundi (*Lates calcarifer*). No commercial fishing is allowed within the Ramsar site; however, many commercially significant species occur within the site and are harvested elsewhere.

Many fish (for example, barramundi, threadfin salmon, mullet species) and crustacean (mud crabs, prawns) species spend their juvenile stages in shallow nearshore waters of the site, particularly around mangroves, saltmarsh and seagrass habitats. Species such as barramundi also inhabit freshwater floodplain and billabongs.

**Criterion 9:** *A wetland should be considered internationally important if it should be considered internationally important if it regularly supports one percent of the individuals in a population of one species or subspecies of wetland-dependent non-avian animal species.*

The Ramsar site supports one percent of the population of the following species:

#### Glyphis Sharks

- Northern river shark (*Glyphis garricki*)  
Known to occur in East Alligator River in the Northern Territory (Compagno et al. 2008), the total Australian population is considered to be less than 250 mature individuals and therefore one per cent is estimated to be three individuals (see Ward and Larson 2006a).
- Speartooth shark (*Glyphis glyphis*)  
Mature adults are known to occur in the East Alligator River in the Northern Territory (Compagno et al. 2008) and some rivers on the Cape York Peninsula of Queensland (juveniles also found in the Northern Territory's Adelaide River). The total Australian population is considered to be less than 250 mature individuals and therefore one per cent is estimated to be three individuals (see Ward and Larson 2006b).
- Recent recordings in Kakadu National Park include 7 specimens of *Glyphis* shark (including *G. glyphis* and *G. garricki*) from the West, South and East Alligator Rivers by Larson in 2000 and subsequent work in 2007 when a further 3 *Glyphis* specimens were recorded in the Kakadu National Park.

#### Pig-nosed turtle (*Carettochelys insculpta*)

- Georges and Kennett (1989) found pig-nosed turtles to be widespread between the tidal reaches and the head-waters of the South Alligator River, and that high densities may be present in the upper reaches during the dry season ( $33.8 \pm 11.3$  turtles per hectare in small discrete ponds on the main channel).
- One percent is estimated to be 30 individuals (R. Sims pers. comm. to TSSC 2005).

#### Saltwater crocodile (*Crocodylus porosus*)

- It is estimated that Kakadu National Park contains approximately 15 000 saltwater crocodiles (S. Ward pers. comm. 2009).
  - One percent is estimated to be 600 individuals (Northern Territory Government, n.d.), although it is likely that this figure is based on an underestimate of the actual population size.
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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:**

Terrestrial: Timor Sea Drainage Division

Marine: Northern IMCRA Provincial Bioregion

**b) biogeographic regionalisation scheme** (include reference citation):

Terrestrial: Australian Drainage Divisions. 2001. Geoscience Australia.

Marine: Integrated Marine and Coastal Regionalisation of Australia (IMCRA) Version 4.0, 2006. Department of Environment and Heritage, Canberra.

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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.

There are a broad range of physical features and processes which together control wetland ecosystems within the site. The key processes and interactions between these processes are discussed in the Ecological Character Description (BMT WBM 2010a). The following provides a brief summary of key physical features of the site.

Climate

The warmer wet season is marked by monsoonal depressions bringing heavy rain and occasional tropical cyclones. Over 90 percent of the average rainfall occurs between November and March, with an average annual rainfall of approximately 1500 millimetres. Little or no rain occurs during the cooler dry season extending from May to September. Potential evaporation (2400 – 2700 millimetres per year) exceeds rainfall in most years (Saynor *et al.* 2000). Humidity is generally highest between January and March (greater than 80 percent) and temperatures are high throughout the year (annual mean minimum and maximum temperatures of 22.5°C and 34.2°C, respectively).

Tidal Hydraulics

The interplay between tidal hydrodynamics and seasonal patterns in fluvial hydrology has a profound influence of the ecology of coastal lowland habitats within the site. In the South Alligator River (the largest river within the site), fluvial flows experienced during the wet season are sufficient to flush the tidal channel to fresh water levels over almost the full length of the estuary. As flows recede, tidal processes tend to dominate, with the tidal component extending from the mouth in Van Diemen Gulf to just downstream of Yellow Water for a distance of about 105 kilometres (Petty *et al.* 2005; BMT WBM 2010b). The maximum range in tide height at the mouth is 5.8 metres, with only minor attenuation of tidal amplitude with distance from the sea (BMT WBM 2010b). As discussed below, changes in relative influence of tidal and fluvial processes have a strong influence on geomorphological, water quality and ecological patterns and processes within the coastal lowlands.

Fluvial Hydrology

The Ramsar site contains expansive floodplains, as well as estuarine channels with silty levee banks. In addition it contains the upper reaches of the rivers, which typically follow clefts in the sandstone escarpment, before broadening into braided alluvial channels in the low sandy plains after leaving the plateau country and adjacent hills. These channels then divide and distribute their water widely over the expansive floodplains. The estuary is typically a relatively narrow tidal channel cutting through the floodplains with silty levee banks.

Due to the strong seasonality in rainfall, catchment runoff and stream flows follow a pronounced seasonal pattern. Wet season flows may be a broad 'sheet' of water, kilometres in width, flowing across the floodplains. By the end of the dry season, perennial creeks flow at a much reduced level and annual creeks are generally dry but may still contain patches of stagnant water as well as billabongs within the creek bed (Petty *et al.* 2008). High evaporation during the dry season quickly reduces water levels within isolated waterbodies, although permanent billabongs and the main channels of larger creeks and rivers provide dry season refugia for many wetland flora and fauna species.

### Groundwater

In addition to patterns in surface water hydrology described above, groundwater hydrology has a strong influence of some critical wetland elements. Of particular note are groundwater-dependant freshwater springs that are predominantly situated in the northern-eastern portion of the Stone Country between the South and East Alligator Rivers. Aquifer types within the Ramsar site have been classified as the following (refer Ticknell 2008):

- fractures and weathered rocks with local scale aquifers which occur broadly across the site in the floodplain and catchment areas.
- fractures and weathered rocks with minor groundwater resources and local scale aquifers which occur over the majority of the eastern area.
- fractured and karstic rocks with intermediate to local scale aquifers which occur over small areas mainly in the north-eastern area of the site.
- sedimentary rocks with inter-granular porosity along the lower reaches of the East Alligator River and an area in the south-west of the site.

These springs support groundwater-dependent ecosystems, some of which contain endemic invertebrate species that are thought to have a highly restricted geographic distribution.

### Water Quality

Freshwater streams within the Ramsar site are fairly acidic, primarily due to the presence of acid sulfate soils. Billabong waters generally have elevated conductivity, turbidity, nutrient and chlorophyll a concentrations at the end of the dry season, with a significant improvement in water quality at commencement of the wet season due to flushing of the billabongs (Hart and McGregor 1980).

There is little water quality data for estuarine reaches of the site, however it is known that turbidity, salinity and pH can show marked variations over time in response to seasonal changes in hydrology. Estuarine assemblages therefore tend to have a wide range of tolerances to altered water quality conditions.

### Geology

The Ramsar site is situated in the eastern part of a major geological structure known as the Pine Creek Geosyncline that contains uranium and other ore bodies. In the Stage I and Stage II area, mineralisation is mainly located in a rock formation known as the Cahill Formation, and the rock formations are often masked by younger overlying sequences. Mineralisation in the Stage III area is primarily located in a series of rock formations known as the El Sherana Group and includes gold, platinum and minor uranium deposits. The rock formations are often masked by younger overlying sequences, including the sandstones forming the Arnhem Land escarpment. The sandstone formations of the Arnhem Land escarpment date back about 1700 million years and can be up to 300 metre in depth.

Erosion of the younger rocks has resulted in a deep soil cover over much of the region, with soils that are strongly leached and relatively infertile (Press *et al.* 1995).

The extensive coastal and riverine alluvial plains are of recent origin, often dating back no more than a few thousand years (Press *et al.* 1995). Deeper saline sediments underlying the floodplains are overlain by brackish, organic-rich, acidic soils, which support the freshwater wetlands (Press *et al.* 1995).

### Geomorphology

Rivers in the Northern Territory have several morphological phases and move from one phase to another as they respond to tidal pressure and seasonal freshwater runoff (Chappell and Woodroffe 1984, Petty *et al.* 2005). Different longitudinal regions of the rivers will exhibit distinct morphological features depending on the state of development of the particular region.

Because the flooding tide has higher peak velocities than the ebbing tide, a much higher sediment load can be transported during floods. This sediment is deposited along the tidal channels, gradually forming mud levees at the upper estuary. These levees contain the channel, prevent further saltwater penetration and impound freshwater in large wetlands (Petty *et al.* 2005). During the course of the dry season, the salinity of these wetlands will increase, and in some areas will become quite brackish.

The annual freshwater impoundment maintains the low salinity soil surface of the wetlands, overlying a highly saline subsoil region. Without the impoundment, subsoil salt may emerge resulting in widespread die-off of freshwater species.

Some notable morphological features formed in recent times (several thousand years) include palaeo-channels, dendritic channels and billabongs, which generally form in palaeo-channels. Palaeo-channels are remnant tidal channels that were active during the mid-Holocene, and have since been partially or completely infilled by deposition of tidal sediments (Woodroffe and Mulrennan 1993). They are apparent as billabongs, freshwater swamps and wetlands. As palaeo-channels are some of the lowest-lying topography within a coastal floodplain, they are particularly vulnerable to saltwater intrusion. The intrusion of saltwater can result in the death of freshwater vegetation and development of bare surfaces susceptible to aeolian (wind blown) erosion.

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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 physical features of the catchment areas are broadly similar to that described for the Ramsar site in Section 16 above. Note also that a large proportion of catchment area of the South Alligator, West Alligator and Wildman River catchments are located within the Ramsar site.

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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.

Section 16 above provides a summary of important surface water and groundwater features within the site. The site supports a range of associated hydrological values with these features. Of particular note is that two river systems (that is, South Alligator and Wildman Rivers) are contained almost entirely within the Ramsar site. It is notable that the catchments of these systems are almost entirely located under statutory conservation management.

The wetlands also provided a range of functional hydrological values. For example, the floodplains function as a large retarding basin, storing the water during the wet season and gradually releasing it during the dry season. This process maintains a range of ecological functions, including provision of dry season aquatic refugia and the wetting and drying cycles of floodplain wetlands.

A similar process takes place in the stone country and adjacent lowlands, where groundwater expressions create both perennial and ephemeral spring habitats. Some of these springs provide habitat for endemic invertebrate species (Bayliss *et al.* 1997), monsoon rainforest and riparian vegetation communities. Groundwater also forms a potable water supply for the township of Jabiru, Ranger Uranium Mine and outlying settlements within the Park. Katherine River, which has its headwaters in the Park, provides a source of water for the township of Katherine (located outside the site) and surrounding irrigation 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)

A number of differences exist between the 1998 RISs for the historic (pre-merger) Ramsar sites and the current study in terms of the identification of wetland types that are present. However, differences do not represent an actual change in wetland types over time but instead reflect (i) differences in the interpretation of wetland typology descriptions; and (ii) an increase in knowledge of wetland type distribution since the preparation of the 1998 RISs. While D, J, K, O and Xf are now recognised as being present A, R, Sp and Xp have been excluded.

### 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.

Note that there are some uncertainties regarding the extent and distribution of most wetland types due to the lack of a consistent, systematic mapping of Ramsar wetland habitat types within the site. The following are thought to represent the largest wetland types within the site:

1. Permanent (Tp) and seasonal (Ts) marshes,
2. Freshwater tree-dominated wetlands (Xf),
3. Intertidal forested wetlands (mangroves)(I),
4. Intertidal marshes (H), and
5. Estuarine waters (F).

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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.

A detailed description of the ecological features of the site is provided in the Ecological Character Description (BMT WBM 2010a). The site contains a wide range of habitats that are in near-natural condition, which encompass the diversity of wetland types found in the bioregion. Floodplain habitats in particular are considered outstanding examples of their types in the monsoon tropics. The floodplain wetlands are primarily sedge- and/or grass-dominated meadows that form complex spatial mosaics, and freshwater forests, billabongs and monsoon rainforests are also featured within the landscape. The coastal areas include expansive intertidal mudflats and mangrove forests.

The wetlands provide important habitat for a range of wetland dependent and terrestrial flora and fauna species. The site provides habitats for species of plants, invertebrates and fish that are endemic to the bioregion, and some invertebrate species are thought to be restricted to the site. The site also provides important habitats for a range of threatened marine and freshwater fauna species (see Criterion 2). Many of these species use a variety of habitats to complete their life-cycle.

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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.*

The Ramsar Site supports a large diversity of flora species, including endemic species, as outlined for Criterion 3 above. Other noteworthy flora species include the following:

- A number of flora species are noteworthy in terms of their inclusion in the traditional diet, with the most abundant sources of carbohydrate including waterlilies (e.g. *Nymphaea* spp.) and water chestnut (e.g. *Eleocharis dulcis*) (Cowie *et al.* 2000).
- Particular flora species have a variety of customary uses such as medicine, craft, weapons and utensils. For example, Arnhem Land Bamboo (*Bambusia arnhemica*) is used for spears, craft and didgeridoos, bark from chocolateweed (*Melochia corchorifolia*) is used for making string, and bark from barringtonia / Freshwater mangrove (*Barringtonia acutangula*) is used for poisoning fish (Cowie *et al.* 2000).
- Mangrove communities are noteworthy in terms of their high productivity, they provide important habitat for fauna species (e.g. birds, fish), they provide protection against coastal erosion, they create a buffer against extreme weather events, and they contribute to coastal water quality through sediment trapping.
- *Melaleuca* forests are noteworthy in terms of the structural complexity that they add to the floodplain (e.g. for roosting and nesting), they provide seasonal food resources (e.g. nectar for birds during the wet season), and they are highly productive and contribute a large amount of material to the detrital/debris turnover cycle on the floodplain (Finlayson *et al.* 1993).

Several threatened terrestrial flora species with a known or a likely occurrence in the site, include:

- An undescribed *Acacia* species (*Acacia* sp. Graveside Gorge (V.J. Levitzke 806) NT Herbarium), which is listed as Critically Endangered under the EPBC Act,
- *Hibiscus brennanii* which is Vulnerable under the EPBC Act, and
- *Sauropus filicinum* which is Vulnerable under the EPBC Act.

There are no aquatic plant species that are endemic to the site (Bayliss *et al.* 1997).

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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.*

The Ramsar site supports a remarkable abundance of waterbirds in terms of overall waterbird numbers as well as numbers of individual species (refer Criteria 5 and 6 above). Noteworthy fauna also include threatened species (refer Criterion 2 above), endemic species (refer Criterion 3 above) and species in significant numbers (refer Criterion 9 above). Additionally, noteworthy fauna include the following:

- A large number of fauna species are noteworthy in terms of their inclusion in the traditional diet. In particular, magpie geese (*Anseranas semipalmata*) birds and eggs are regarded as one of the most important animal staples in the traditional diet (Lucas and Russell-Smith 1993). Other major sources of animal protein include freshwater mussels, fish, turtles, and crocodile eggs.
- Waterbirds feed on aquatic invertebrates, vertebrates (for example, fish, frogs) and plant material, and as such are important to ecosystem functioning, particularly with respect to wetland nutrient cycling processes and intensive turning over of floodplain soils.

- Saltwater crocodile (*Crocodylus porosus*) and freshwater crocodile (*C. johnstoni*) are noteworthy in terms of their ecological roles as top predators within the site, as well as in terms of their iconic and cultural values (e.g. totemic, dietary).
- Barramundi (*Lates calcarifer*) is noteworthy in terms of recreational fishing within the site being based almost entirely on this species. It is also a very important indigenous dietary item.

The site does not contain locally endemic (that is restricted to the site) aquatic or terrestrial vertebrate species. There are numerous endemic aquatic species within the site (see Criterion 3 above), but no birds, reptiles or amphibians are restricted to the bioregion. Other noteworthy fauna species include the following nationally threatened species (see BMT WBM 2010a):

Common name	Scientific name	IUCN Status	National
Red goshawk	<i>Erythrotriorchis radiatus</i>	Vulnerable	Vulnerable
Gouldian finch	<i>Erythrura gouldiae</i>	Endangered	Vulnerable, Migratory
Crested shrike-tit (northern), northern shrike-tit	<i>Falcunculus frontatus whitei</i>	-	Vulnerable
Partridge pigeon (eastern)	<i>Geophaps smithii smithii</i>	Near Threatened	Vulnerable
Masked owl (northern)	<i>Tyto novaehollandiae kimberli</i>	Least Concern	Vulnerable
Golden-backed tree-rat	<i>Mesembriomys macrurus</i>	Least Concern	Vulnerable
Bare-rumped sheath-tail Bat	<i>Saccolaimus saccolaimus nudicluniatatus</i>	Least Concern	Critically Endangered
Arnhem land egernia	<i>Bellatorias obiri</i>	-	Endangered
Yellow-snouted gecko	<i>Lucasium (Diplodactylus) occultum</i>	-	Endangered

### 23. Social and cultural values:

a) Describe if the site has any general social and/or cultural values for example, 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 Ramsar site displays significant cultural values, having been continuously inhabited for at least 50 000 years (Roberts *et al.* 1993). The landscape contains a large assemblage of archaeological material including occupation sites, rock art, shell mounds and middens, stone tools and burial sites. An ongoing 'living culture' is maintained by the traditional owners of Kakadu National Park who undertake traditional land management practices, follow customary law and uphold traditions.

Social values include tourism and recreation, as outlined in Section 31 below.

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:

The management of the Ramsar site provides a model of wetland wise use, incorporating traditional knowledge in order to maintain the ecological character and provide a balance between wise-use and competing interests such as nature conservation and tourism. In particular, the following two aspects are notable:

- Sustainable Use: traditional owners and Parks Australia have developed a successful system of wise-use whereby traditional owners can sustainably harvest native plants and animals within the National Park. Resources that are harvested may be used for food, art and craft, medicine and other customs.

- **Threat Management:** Traditional knowledge has assisted Parks Australia in monitoring and managing threats to the Ramsar site, thereby maintaining the ecological character. For example, feral buffalo were causing extensive environmental damage during the 1960s, causing vegetation destruction, soil compaction, weed dispersal, habitat modification and erosion (see Director of National Parks 2007). Bininj and local community members established a buffalo control program to reduce buffalo numbers, and started to restore wetlands in the 1970s. Bininj traditional ecological knowledge regarding the original state of the environment, the impact of buffalo and the management and restoration of wetlands was central to the successful restoration of the wetlands.

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

Traditional owners of the Ramsar site display exceptional cultural traditions. In particular, land management (as described above) is critical in maintaining cultural heritage as Traditional Ecological Knowledge is transferred (e.g. harvesting techniques, species' ecology), traditional languages are used, other cultural practices are undertaken.

A large assemblage of archaeological material (e.g. rock art, shell mounds, stone tools, dugout canoes, fish traps) has provided detailed insight into the hunter-gatherer lifestyle over many thousands of years (Brockwell *et al.* 1995). The floodplain of the South Alligator River alone contains an assemblage of possibly 25,000,000 artefacts (Meehan *et al.* 1985).

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

Traditional owners hold a substantial body of traditional ecological knowledge which includes topics such as fire, species, ecosystems, ecological processes and seasons. A joint management arrangement enables traditional owners to be consulted, make decisions and implement this knowledge in the management of Kakadu National Park, thereby influencing the ecological character of the wetlands.

In particular, fire management is an important interaction that influences the ecological character of the Ramsar site. The present vegetation communities and suites of fauna are dependent on the traditional burning practices established by traditional owners over a long period of time (Russell-Smith 1995), and traditional owners work with Parks Australia to develop fire management strategies and annual burning plans that replicate traditional burning (Director of National Parks 2007).

- 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:

A number of sacred sites are present within the Ramsar site. These sites primarily relate to the activities that took place during the creation era and the travels of the first people, and include significant rock art and occupation sites, burial sites, ceremonial sites, story places and dreaming places (Brockwell *et al.* 1995, Brockwell *et al.* 2001).

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## 24. Land tenure/ownership:

- a) within the Ramsar site:

50 per cent of the Ramsar site is Aboriginal land under the *Aboriginal Land Rights (Northern Territory) Act 1976*, and most of the remaining land is under claim by Aboriginal people. Title to Aboriginal land is held by Aboriginal Land Trusts that have leased their land to the Director of National Parks for the purpose of being managed as a Commonwealth Reserve. Land within the Ramsar site that is not Aboriginal land is vested in the Director.

- b) in the surrounding area:

- Lands to the east are held as the Arnhem Land Aboriginal Reserve.
- Waters of the Van Diemen Gulf to the north are Northern Territory Waters (Crown land).

- Conservation reserves and national parks declared under Northern Territory legislation are situated to the west, south and north.
- Ranger and Jabiluka mineral leases are exclusions within the site's outer boundaries.
- Leasehold properties adjoin the site on some parts of the western boundary.

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**25. Current land (including water) use:**

a) within the Ramsar site:

Principal land uses are conservation management, tourism and education and low levels of hunting and gathering by traditional owners living within and around the Park.

b) in the surroundings/catchment:

Key land use activities in the surrounding areas include:

- conservation management and tourism within the Ramsar site to the north and reserves to the east and south,
- uranium mining undertaken near the East Alligator River in the mineral lease area,
- commercial barramundi fishing in marine waters to the north of the site, and
- inactive pastoral leases and Defence Force training to the west.

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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:**

BMT WBM (2010a) identified a range of factors as having adverse effects on the ecological character of the site. It was also noted however that the ecological character of the site has not significantly diminished since site listing. The following provides a summary of key impacting processes of relevance to the site.

a) within the Ramsar site:

- **Exotic flora:** Weeds are problematic within the site and require ongoing-management, particularly within freshwater habitats. Species that are historically and/or currently notable include mimosa (*Mimosa pigra*), salvinia (*Salvinia molesta*), para grass (*Urochloa mutica*), olive hymenachne (*Hymenachne amplexicaulis*) and mission grass (*Pennisetum polystachion*).
- **Exotic fauna:** Feral animal species have had a notable presence in the past, and require continued management intervention. Particularly notable species include Asian swamp buffalo (*Bubalus bubalis*), which cause excessive habitat damage and cane toads (*Rhinella marina*), which are toxic to most native fauna.
- **Climate change:** Principal threats include increased rate and extent of saltwater inundation into freshwater habitats due to sea level rise and storm surge events, and more intensive fire regimes that eventuate due to hotter dry seasons (refer Bayliss *et al.* 1997, Bartolo *et al.* 2008, BMT WBM 2010b).
- **Tourism and recreation:** Potential threats include disturbance to fauna species at feeding and nesting sites, damage of vegetation, spread of weeds, erosion and pollution. However, the management regime implemented at the site is such that the potential impacts from tourism and recreation activities on ecological character are considered to be a low risk.
- **Damage to archeological resources:** Anthropogenic impacts include theft, vandalism and inappropriate development and tourism, while natural processes including vegetation growth, feral animals, fire damage, tidal inundation and storms.



- Living resource extraction: Over-harvesting of traditional resources (e.g. magpie geese, turtles) by not following cultural protocols or practices can impact on the populations of these species and cause social tensions.

b) in the surrounding area:

The above-described factors that potentially affect the ecological character within the site are also applicable to the surrounding area. In addition, mining activities directly adjacent to the site are also a potential threat. The main threat from mining activities is dispersion of mine waste waters to streams and shallow wetlands, including contamination with radioactive substances (Supervising Scientist 2002).

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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.

The Ramsar site is wholly within the boundaries of Kakadu National Park and the Ramsar site has been listed as a World Heritage Site. World Heritage Sites are protected matters of national environmental significance under the *Environment Protection and Biodiversity Conservation Act 1999*. Any activity potentially leading to impacts to World Heritage Site values must be assessed in accordance with provisions under this Act.

Parks Australia is signatory to a Memorandum of Understanding with the Secretariat of the Pacific Regional Environment Programme (SPREP) to facilitate cooperative nature conservation programs in the South Pacific, which has particular ramifications for marine species that occur in the park.

Japan-Australia, China-Australia and Republic of Korea-Australia Migratory Bird Agreements are applicable to the site (JAMBA, CAMBA, ROKAMBA), as is the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).

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?:

The *Kakadu National Park Management Plan 2007-2014* (Director of National Parks 2007) is implemented through a joint management arrangement by the Australian Government Director of National Parks (through Parks Australia staff) and Aboriginal traditional owners. Management is overseen by the Kakadu Board of Management.

d) Describe any other current management practices:

All current management practices are encompassed by the above-mentioned management plan.

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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.

Continued management under the *Kakadu National Park Management Plan 2007-2014* (Director of National Parks 2007).

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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 Ramsar site provides a wide range of habitats that present a diversity of opportunities for scientific research activities. The following organisations are particularly noteworthy in terms of their contribution to scientific research within Kakadu National Park:

- The Environmental Research Institute of the Supervising Scientist undertakes a range of scientific monitoring and research activities into the environmental impact of uranium mining in the Alligators Rivers Region of Kakadu National Park.
- Several universities have had a long-standing interest in the site, especially Charles Darwin University (CDU).
- The Cooperative Research Centre for Tropical Savannas Management (Tropical Savannas CRC) that was established and supported by the Australian Government.
- Tropical Rivers and Coastal Knowledge (TRaCK), a research consortium led by CDU, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Griffith University, Land and Water Australia, the North Australia Indigenous Land and Sea Management Alliance and the University of Western Australia.

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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.

A variety of information and activities relating to communications, education and public awareness are available within the Ramsar site. These include visitor centres and information bays; an official visitor guide as well as other books and brochures; interpretative signage at locations such as observation hides and along walking tracks; and organised informative tours.

Of particular relevance, the Bowali Visitor Centre features displays, audio-visual presentations and information staff, the Marrawuddie Gallery of Aboriginal fine arts (located at the Bowali Visitor Centre), and the Warradjan Aboriginal Cultural Centre displays detailed information about local Aboriginal culture.

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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.

Kakadu National Park is an iconic destination for both international and Australian visitors. Tourists are attracted to Kakadu National Park for its wildlife and magnificent landscapes, as well as for its ancient cultural heritage including impressive galleries of Aboriginal rock art (Commonwealth of Australia 1988, Director of National Parks 2007). A variety of tourism enterprises exist, including commercial boat cruises, recreational fishing tours, cultural interpretive tours, bird-watching tours, four wheel drive and waterfall tours and multi-day tours throughout the park. Recreational activities within the Ramsar site include bushwalking, swimming, boating and fishing. In terms of visitor numbers, approximately 228 899 people visited Kakadu National Park in 2008 (S. Murray pers. comm. cited in BMT WBM 2010b).

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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 Northern Territory of Australia

Functional: Director of National Parks

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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.

Director of National Parks  
GPO Box 787  
Canberra, ACT 2601

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

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Figure 1.

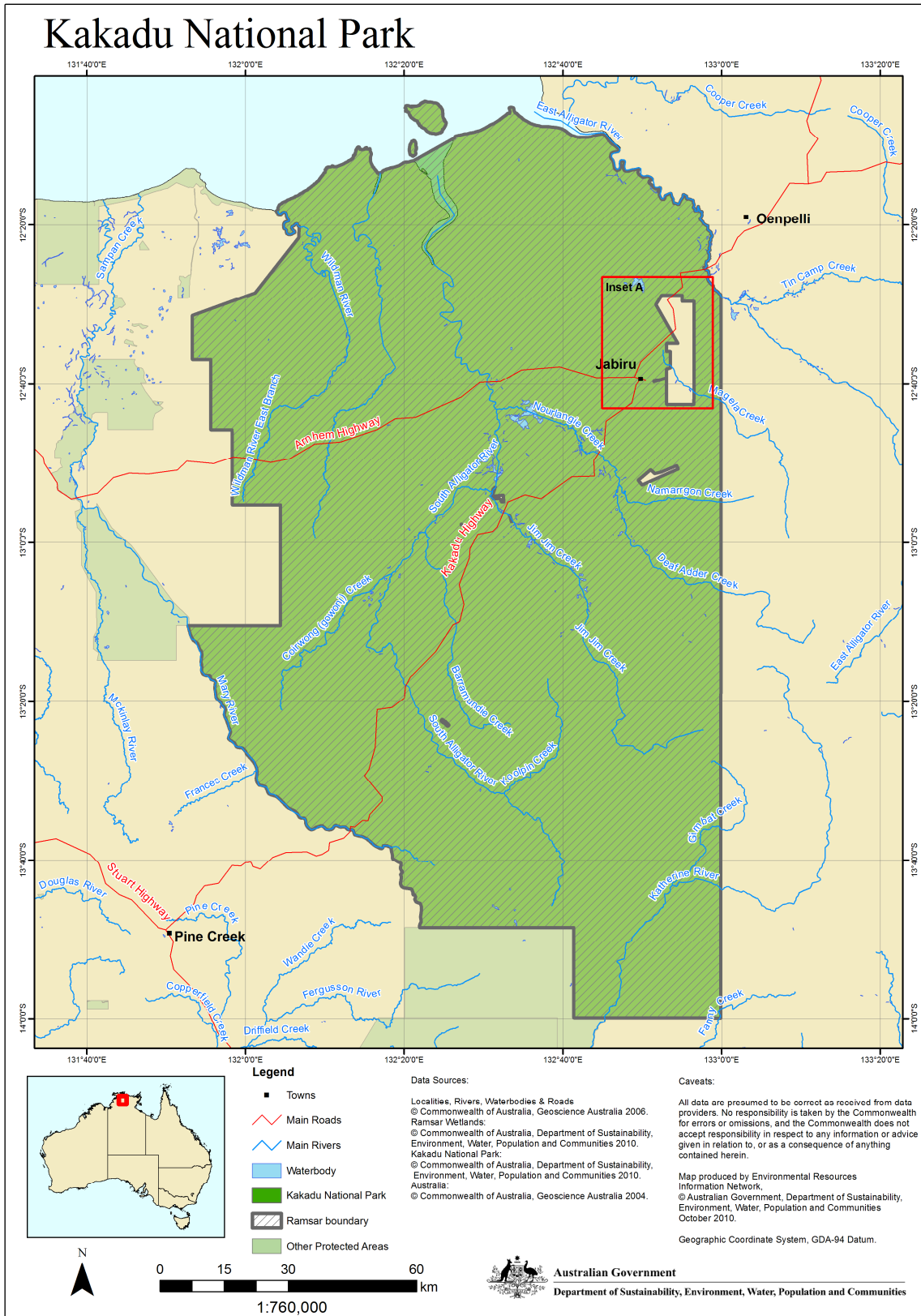


Figure 2.

