4. Report on the extent and distribution of individual wetlands in the trial region: Darwin region lagoons

4.1 Existing information on the extent and distribution of Darwin region lagoons

When starting this project, two datasets were available on the extent and distribution of individual wetlands: the inventory by Schult (2004) as summarized in 3.2.1 based on aerial photography and the GIS data layers by Freeman (draft), see section 3.2.5. Both data sets covered only a portion of the Darwin region though with a substantial overlap area.

Importing Schult's data into Freeman's GIS layer revealed that many lagoons were included in both datasets, but also that a considerable number of lagoons was only recorded in one of them. Furthermore, as Schult (2004) calculated the centroid coordinated of the lagoons using Fugawi, they often did not plot centrally in the GIS layer.

There was also a considerable number of lagoons that were not recorded in either of both datasets. It was therefore decided to completely review and redo the wetland mapping component of the project area using the information provided from Schult (2004) and Freeman (draft) and basing the digitising of lagoon boundaries mainly on a Quickbird dataset available for Darwin and the Darwin region (2004) plus utilising GIS information readily available to inform the process.

4.2 The development of a GIS lagoon data layer for the Darwin region lagoons

Figure 1 shows the extent of the wetland mapping within the orange line as defined by the available Quickbird imagery.

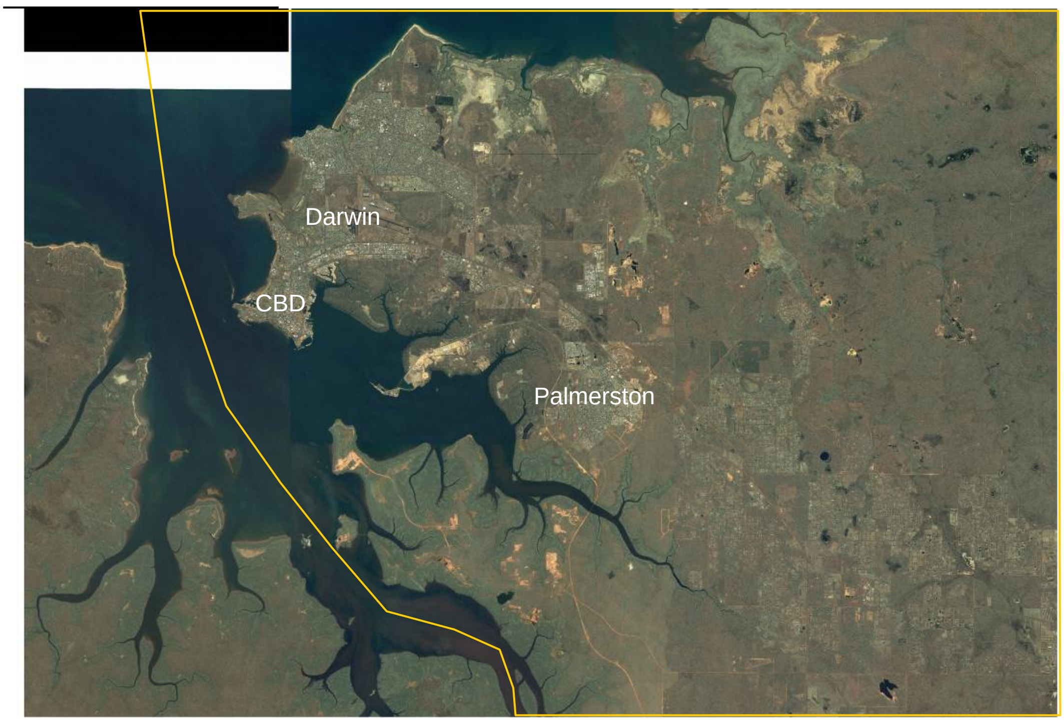

Figure 1: Extent of the wetland mapping of the Darwin region lagoons as defined in this project.

For the mapping process the following data layers were used:

1. Quickbird Satellite Imagery (Digital Globe 2004)
2. Aerial photography series ‘Darwin Rural Stages 1+2’ (2002)
3. Greater Darwin land unit mapping (2004)
4. Cadastre of the Northern Territory (NTCAD_g94)

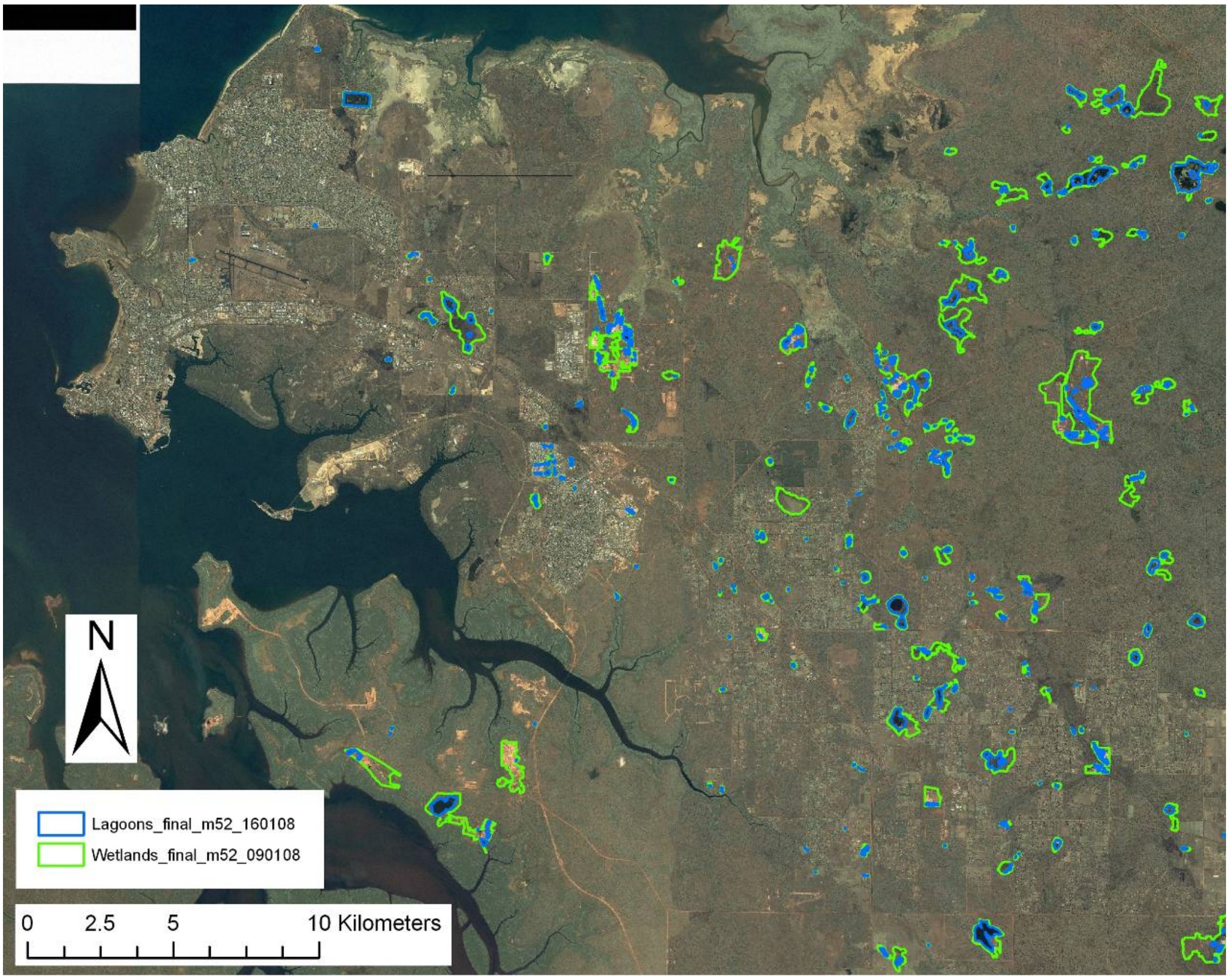

Figure 2: The lagoons of the Darwin region. ‘Lagoons’ refers to the water bodies; ‘wetland’ refers to the wetland complexes.

The mapping process was carried out through identification of a lagoon on the Quickbird imagery using the following decision rules: A wetland was only included, if there was an open water body of 50 m diameter or larger. If the wetland was a tree swamp without an open water body, it was not included in this mapping of lagoons. One disadvantage of the Quickbird imagery is that the individual images that compose the entire image were taken at various times throughout the dry season i.e. between May and October 2003. Information on the date an individual image was captured is not available. The open water area of shallow lagoons decreases over this time, so there is considerable variability within the Quickbird image with respect to the stage of drying an individual lagoon might be at. This variability had to be accepted for the digitizing process.

The aerial photography series ‘Darwin Rural Stages 1+2’ was used to assist in the decision as to whether a lagoon was included in the mapping on the basis of the 50 m diameter rule. However, the aerial photography series is associated with the same problem with photos taken throughout the dry season (2002) with no capture date attached to the individual photo. The aerial photo series at least provides information on lagoon water distribution in another year. Aerial photography or satellite imagery of the area of interest for other years is currently not available to the Department. This was recognised as a limitation to the mapping of the lagoons in the region.

Tree swamps were included in the lagoon map when associated with an open water body of 50 m diameter or larger. To further ensure the exclusion of tree swamps without 50 m open water area from the lagoon map, the Darwin land unit mapping data were consulted. These data include vegetation and soil data that were useful in the decision whether what appeared as a tree swamp in the Quickbird image related to respective vegetation and soils.

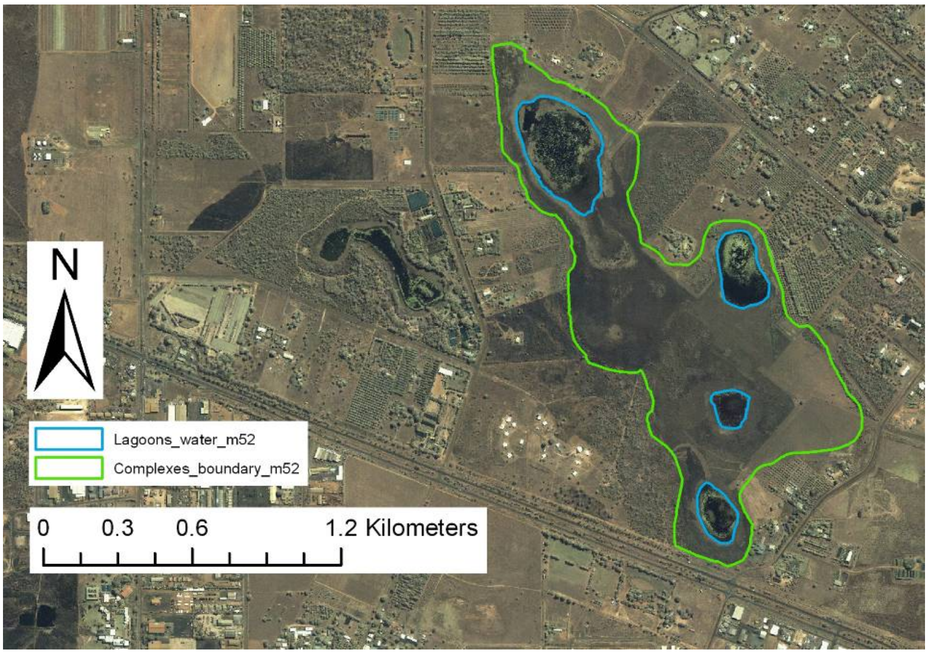

Figure 3: The Knuckeys Lagoons complex includes four lagoon water bodies as derived in the mapping process described.

Plate 1: Aerial view of Knuckeys NW (left) and NE (right) lagoons (arrows) in February 2008: In the wet season the water bodies are connected to a wetland complex as shown for the mapping process in Figure 3 above.

Floodplains were excluded from the lagoon mapping, as in the study area many of these are tidally influenced or partly brackish. The decision on whether a wetland area detected on the Quickbird image was part of a floodplain was assisted by the Darwin land unit mapping.

During the digitising of boundaries, there was a lot of discussion about the boundary of the extent of lagoon water, as well as the boundary of the wetland dependent vegetation. It was decided to map both in order not to reduce information that might be needed for other purposes later, so that two separate GIS layers were created: the water body layer and the wetland boundary layer (see Figure 2). In some instances, several water bodies were within one area of wetland dependent vegetation, i.e. an area that floods and when drying up the water recedes into several depressions; for example, Knuckeys Lagoons (Figure 3, Plate 1). The wetland dependent vegetation boundary was therefore referred to as 'wetland complex', also for the many cases when there was only one water body in a wetland complex.

Names of lagoons were used mainly as documented by Schult (2004). If lagoons did not have a name, they were named in accordance with Schult's naming method by the name of the aerial photograph they were located on and numbered. Few of the small unnamed wetlands received the same 'name', ie. Humpty Doo 1 and Humpty Doo 3 as they were small and spatially very close together.

The lagoons in the study area are presented in Figure 2. Higher resolution maps are attached in Appendix 3.

A summary of the names, sizes and locations of the lagoons is presented in the Appendix 1, Table 37. The lagoons were also classed into two type groups: natural and man-made ones. Although for this project, the main interest was in the natural lagoons, the man-made ones fitted the decision rules and were also mapped. The decision whether a lagoon or wetland was natural or man-made was based on the shape of the lagoons and local infrastructure knowledge. However, this was not followed up using older aerial photographs or historical knowledge due to limited time. Therefore, this categorization is likely to have some errors, but still provides useful guidance. Of the 354 water bodies mapped, 134 are classed as natural, the remaining 220 as man-made. The latter include dams of various sizes, quarries and aquaculture ponds amongst others.

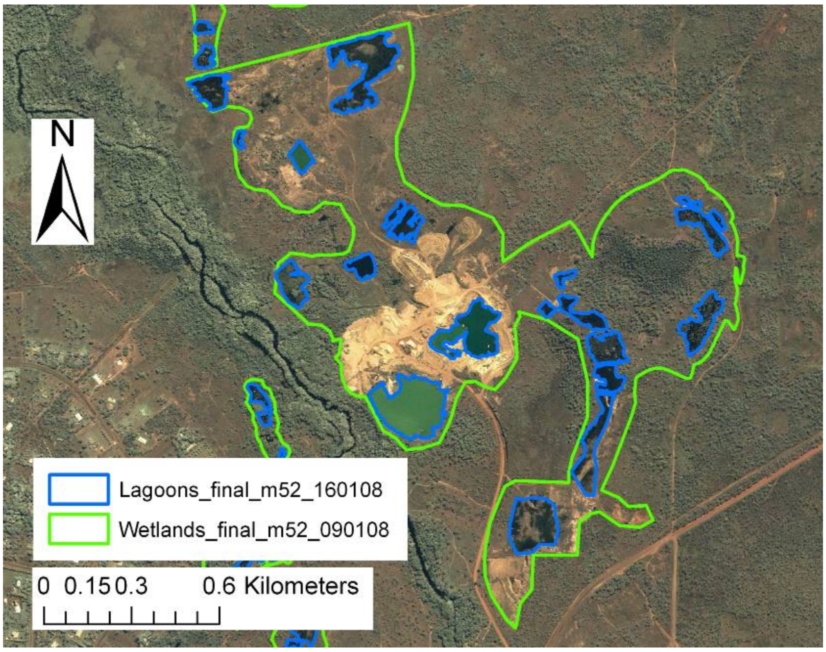

Figure 4: The lagoon complex 'Howard River 5' as an example for a mixed wetland complex containing natural and man-made water bodies. The man-made water bodies in this complex are sand quarries.

The size and location information gathered for the lagoon complex data layer is shown in Appendix 1, Table 38. The 354 lagoons belong to 195 lagoon complexes. The wetland type of natural or man-made was taken according to the lagoon water body classification (Appendix 1, Table 37); there were a few cases of a mixed lagoon complex, which contained natural and man-made water bodies (Figure 4). The 195 lagoon complexes are classed as 92 natural ones, 99 man-made ones and 4 mixed complexes.

4.3 Creation of catchment GIS layer

A GIS based approach was chosen for the catchment disturbance indicator. Hence, the first step was the creation of digitized catchments for the lagoon complexes in the study area. The available catchments GIS data layer by Freeman (draft) was not compatible to the task as the wetland catchments built did not consider the stream network. Additionally the data layer was captured at a very coarse scale. It was decided to create a new data layer which would consider the natural or on occasions modified surface water drainage lines, eg. into rivers and streams, wetlands, depressions, and artificial water bodies.

The best data available to derive catchments was topographic contour data at a 1:10 000 and 1:5 000 scale, which had been created by a NT government agency, but had been withdrawn from use due to labelling and other inconsistencies. These problems were, however, relatively easy to overcome during the process of creating the catchment data layer. The existing Digital Elevation Model (DEM) appeared to be shifted spatially in relation to the Quickbird image used for the mapping of wetland boundaries and could therefore not provide additional information when deriving the catchment layer. An overview of the catchment layer is shown in Figure 5. Several of the catchment boundaries extend beyond the border of the Quickbird image. However, they could be mapped using the contour data layers. Also the land use and vegetation data needed to calculate the catchment disturbance indicators are available outside the Quickbird image.

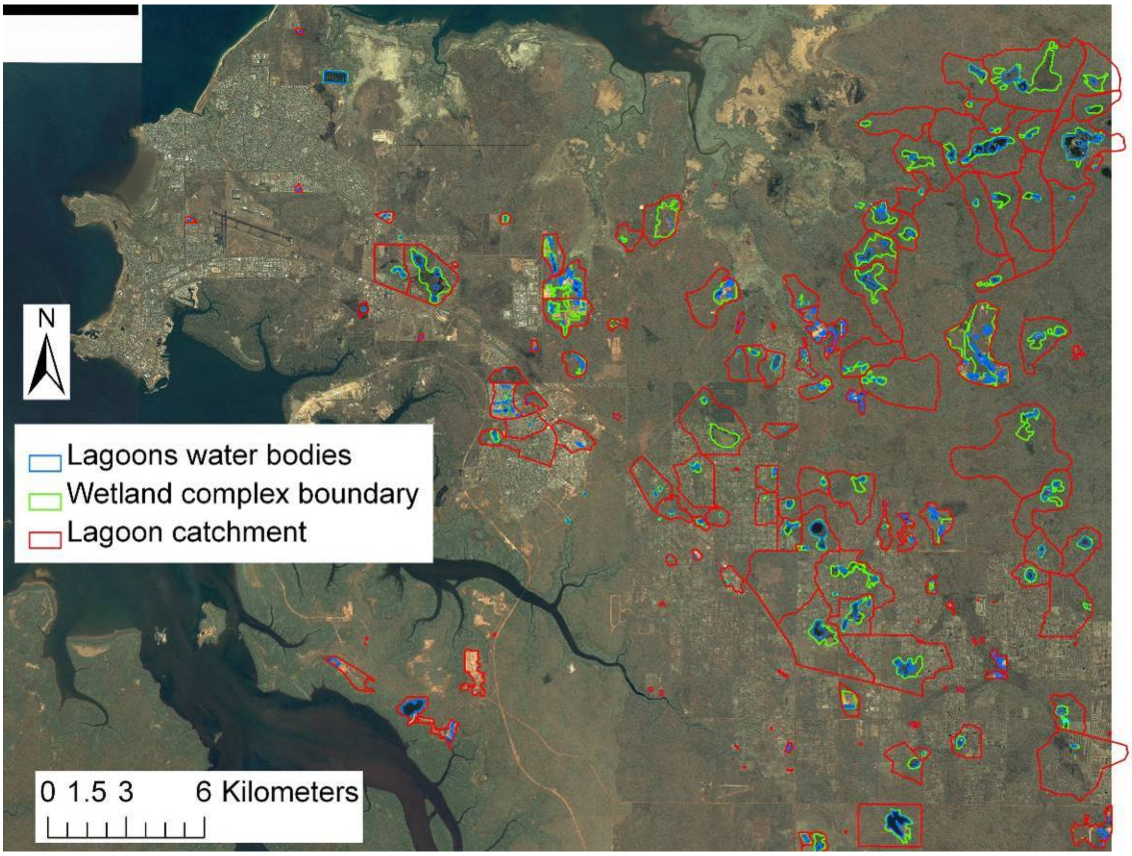

Figure 5: The lagoon complexes and their catchments in the study area.

The attributes of the 144 catchments mapped in the study area are summarized in Appendix 1, Table 39. The names of the catchments reflect the lagoon complex they drain into. It was decided to use letters instead of numbers to distinguish catchments with the same name from the lagoon they drain into.

The lagoon water body mapping rules led to a large number of man-made water bodies being mapped. For a number of these the wetland complex boundary was set as the catchment boundary, i.e. dams with raised walls and aquaculture ponds. For many of the quarry complexes the original relief data did not reflect the apparent situation visible on the imagery, but without spending an extensive amount of time it was not possible to track the catchment area. In these cases either the wetland complex boundary was decided to also be the catchment boundary, or, mostly, the land use parcel boundary was made the catchment boundary.

For few riverine wetlands mapped, mainly near the Howard River, it was not possible to delineate the riverine wetland catchments from the river catchment, as the landscape is very flat. In these cases the wetland complex boundary was also made the catchment boundary.

In urban areas storm-water drainage often overrides the relief in determining surface water flow. In these areas a compromise was used between the relief data, visually observed drainage lines and local knowledge. A fully correct picture would, however, only be obtained when using above and below ground storm-water drainage information, which was beyond the scope of this project.

Two sediment traps east of Palmerston entering Mitchell Creek were mapped according to the decision rules. As these were artificial water bodies that catch a large amount of the urban storm-water from Palmerston it was not feasible to assess the catchment size and these two catchments were not mapped at all.

For two wetlands close to the Howard River estuary the irregularities in the labeling of the relief data (see above) could not be overcome, so that the catchments were also not mapped.

Sixty-five of the 144 catchments are containing natural water bodies, 72 man-made ones and 7 mixed catchments drain into both natural and man-made water bodies (Appendix 1, Table 39).