Baseline turtle survey

Long-necked Turtle Baseline Survey for Roe Highway Extension Project
Prepared South Metro Connect
Final Report
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South Metro Connect
Final Report

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EXECUTIVE SUMMARY

South Metro Connect commissioned Phoenix Environmental Sciences Pty Ltd (Phoenix) to undertake a baseline survey for the Long-necked Turtle (*Chelodina Oblonga*) (herein referred to as the ‘Oblong Turtle’), within the project area (‘the project area’) of the Roe Highway Extension Project (‘the proposed project’).

The Oblong Turtle is not listed as a species of conservation significance but considered to be of local significance. The survey aimed to collect baseline information on Oblong Turtle populations within the project area, in particular population estimates, dynamics, health and local distribution. It also aimed to identify any potential upland nesting movements.

Twenty three adult Oblong Turtles (16 females and 7 males) and no juveniles were captured at Bibra Lake, representing the minimum population size at the lake. Thirty-seven turtles were seen within the lake but not captured. There were no recaptures. No turtles were seen or captured in North Lake.

The size structure (carapace length) for both male and female captures were within normal ranges based on results from previous surveys. Carapace length in male turtles ranged from 18-23cm (average of 20.5cm) and in female turtles ranged from 18-25cm (average of 22.3cm). No gravid females were caught within this survey.

More than half of the individuals captured (52.1%) had ecological indicators, with algal growth the most prevalent indicator. Eighty five percent of males had ecological indicators present compared with 43% of females. Strong to moderate positive correlations were evident between carapace length and body mass in both sexes. Generally, the turtles sampled were in good to very good condition with only one individual considered to be in satisfactory condition.

The turtle population in Bibra Lake is likely to be substantially larger than the sample size captured, given limitations with sampling, lack of recaptures and lack of juvenile captures. Based on the available data, the minimum population density estimate for the Oblong Turtle within Bibra Lake is approximately 168 turtles in 157ha, approximately 1.058 turtles per ha. This suggests that an area of 0.93ha needs to be surveyed before one turtle is expected to be caught.

The presence of adult turtles suggests that the long-term viability of this population is possible, but also dependant on other habitat requirements. Although no turtles were captured in North Lake anecdotal evidence and opportunistic findings (turtle remains) suggest that they have been previously present in this area.

Terrestrial habitat assessments suggest that turtle populations within these lakes may be restricted in their upland nesting movements due to the presence of retaining walls, steep lake side banks, thick non-native grasslands and the presence of dense *Typha* sp. fringing these wetlands. Increased fragmentation of upland habitats, weed invasion, road mortality and predation are also existing threats to this species which may limit their dispersal and breeding success.
1 INTRODUCTION

South Metro Connect commissioned Phoenix Environmental Sciences Pty Ltd (Phoenix) to undertake a baseline survey for the Long-necked Turtle (*Chelodina Oblonga*) (herein referred to as the ‘Oblong Turtle’), within the project area (“the project area”) of the Roe Highway Extension Project (“the proposed project”).

1.1 BACKGROUND

The Government of Western Australia (Main Roads WA) is planning to extend Roe Highway from its current connection to Kwinana Freeway in Jandakot to Stock Road in Coolbellup. The proposed alignment for the highway between the Kwinana Freeway and North Lake Road is within the existing Primary Regional Roads Metropolitan Regional Scheme (MRS) boundary that divides the Beeliar Regional Park between Bibra Lake and North Lake (Figure 1-1).

The project area is considered to be of high environmental value and as such, extensive biological surveys are required as part of the environmental impact assessment for the proposed project.

This baseline survey was developed in response to local community concern about the potential impact of the proposed project on the Oblong Turtle and to contribute to local knowledge of the Oblong Turtle in the North Lake/Bibra Lake area (Plate 1). The species is not of conservation significance but is of local significance to the project area.

Plate 1 Oblong Turtle caught in Bibra Lake
Figure 1-1
Location of the Roe Highway Extension Project

Datum: GDA94   Projection: MGA z50

Project Area

Kilometres

Datum: GDA94, Projection: MGA z50

Date Modified: 15/02/2011
Author: unknown  J:\Client_Data\Main_Roads\60100953_Roe_Extension\Workspaces\#2011\Technical_Reports\SRE and Inverts Baseline Survey\Figure 1-1 - Location of the Roe Highway Extension Project.mxd
1.2 **SCOPE OF WORK AND SURVEY OBJECTIVES**

Survey design for this baseline study is consistent with the Environmental Protection Authority’s (EPA) Guidance Statement No. 56: *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004) and EPA Position Statement No. 3: *Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA 2002).

The aim of this project was to conduct a baseline survey for the North Lake/Bibra Lake Oblong Turtle population. The specific objectives of the baseline survey were to:

- Estimate the number of individuals (population size at Bibra Lake and North Lake), the population dynamics, health, local distribution;
- Identify any movement patterns within the project area;
- Determine the significance of the results; and
- Identify any management considerations.
2 EXISTING ENVIRONMENT

2.1 INTERIM BIOGEOGRAPHIC REGIONALISATION OF AUSTRALIA (IBRA) REGION

The project area lies within the Swan Coastal Plain (SWA2) subregion of the Interim Biogeographic Regionalisation of Australia v. 6.1 (IBRA) (Thackway and Cresswell 1995). Landforms within the region are composed of colluvial and aeolian sands, alluvial river flats and coastal limestone. The vegetation of the region broadly consists of Banksia and Jarrah-Banksia woodlands on Quaternary marine dunes of various ages and Marri on colluvial and alluvial substrates (Mitchell et al 2002). The subregion includes a complex series of seasonal wetlands associated with low-lying interdunal areas (WAPC 2000a; Mitchell et al 2002).

Rare features of the subregion include Holocene dunes and wetlands and, because it is part of the South West Botanical Province, the subregion is characterised by high species and ecosystem diversity compared to other areas.

2.2 LANDFORMS AND VEGETATION

The region in which the project area resides consists of several interacting landform elements, including Bassendean Sands of the Bassendean Dunes landform, Sands derived from Tamala Limestone (Spearwood Dune System) and Holocene Swamp Deposits (peaty silts within the Spearwood Bassendean Dune interface (Figure 2-1). Vegetation complexes such as plant communities or patterns of vegetation are associated with landforms and soil types that exist at a regional scale (Tingay 1998).

Vegetation complexes within the project area comprise of Bassendean, Herdsman, Karrakatta and Cottesloe complexes (Heddle et al 1980). These complexes and their associated geological soil types are further described as follows:

- Bassendean Complex (central, west and south) – Woodland of Eucalyptus marginata, Corymbia calophylla with well defined second storey of Calytrix fraseriana and Banksia species on the deeper soils and a closed scrub on the moister sites. Soil type is S8 (Sand) - very light grey at surface, yellow at depth, fine to medium-grained, sub-rounded quartz, moderately well sorted, of aeolian origin.

- Herdsman Complex (North Lake and Bibra Lake) - Sedgelands and fringing woodland of Eucalyptus rudis and Melaleuca preissiana, M. raphiophylla and Banksia ilicifolia forest to woodland with Kunzea glabriscens, Acacia saligna and Agonis lineartifolia; Melaleuca teretifolia tall shrubland; and Baumea articulata and Typha orientalis sedgelands. Soil type is Mps (Peaty Silt) - black, friable silt with abundant organic material, variable fine quartz sand content, soft, of lacustrine origin.

- Karrakatta Complex (central and south) - Open forest of Eucalyptus gomphocephala, E. marginata, Corymbia calophylla and woodland of E. marginata and Banksia species. Soil type is S7 (Sand) - pale yellowish brown, medium to coarse-grained sub-angular quartz, trace of feldspar, moderately sorted, of residual origin.

- Cottesloe Complex (central and west) - Open woodland of Eucalyptus gomphocephala, E. marginata and Corymbia calophylla; closed heath on the limestone outcrops. Soil type is LS1 (Limestone) - pale yellowish brown, fine to coarse-grained, sub-angular to well rounded, quartz, trace of feldspar, shell debris, variably lithified, surface kankar of aeolian origin.

In terms of remnant vegetation surrounding the proposed project, vegetation linkages include adjacent bushland to the north and south (Piney Lakes Reserve, Booragoon Lake, Blue Gum Reserve, Samson Park, Wireless Hill, Little Rush Lake, Yangebup and Thompsons Lakes which also form part of Greenways 82 and 90) west (Manning Lake, Coogee Lake) east (Ken Hurst Park and Jandakot Airport)(Tingay 1998).
The project area also forms part of three regionally significant ‘ecological linkages’, which connect Bush Forever sites, Department of Environment and Conservation (DEC) managed estate and adjacent local natural areas. The first linkage lies in a north-south direction east of the Beeliar Wetlands. The second linkage starts in the south-west of the project area and connects the North Lake and Bibra Lake area to the west of the Beeliar Regional Park (Lake Coogee). The third linkage connects the North-Bibra Lake area to remnant bushland to the west.
Soil Types and Vegetation Complexes of the Roe Highway Extension Project

Geological Landforms:
- Cps - Peaty clay
- Mps - Peaty silt
- Ms5 - Sandy silt
- S7 - Pale yellow-brown sand
- LS1 - Limestone
- S8 - Light grey sand (LGS)
- S10 - LGS over brown silt/clay
- Water

Vegetation Complexes:
- Bassendean complex
- Cottesloe complex
- Herdsman complex
- Karrakatta complex
2.3 CLIMATE

Climate conditions for the survey period can be surmised from recordings at Jandakot Airport, approximately 3km to the east of the project area (BOM 2010) (long term data not shown). The mean daily maximum temperature of 31.3°C occurs in February, along with the highest minimum of 16.8°C. July is the coldest month on average, reaching a maximum temperature of 17.8°C. The lowest minimum is shared between July and August, both of which average 6.9°C. Rainfall occurs mainly during the cooler winter months between May and August, peaking in July with an average rainfall of 180.3mm. Annual rainfall is 837mm.

During the survey period, the lowest maximum temperature was 22.9°C (04 October) and the highest was 30.2°C (08 October) Minimum temperatures ranged from a low of 5°C (04 October) to a high of 9.1°C (06 October). The average minimum and maximum temperatures for the survey period were 7.4°C and 25.7°C respectively. No rainfall was recorded during the survey period (Figure 2-2).

![Temperature Graph](image)

Data sourced: Bureau of Meteorology, January 3rd 2011.

**Figure 2-2** Daily minimum and maximum temperatures at Jandakot Airport during the survey period (4-8 October 2010)

2.4 LAND USE

Land use on the Swan Coastal Plain, specifically the Perth Metropolitan area, includes urban, rural residential, roads, other easements and infrastructure, agriculture and plantations, forestry-plantations, conservation land, unallocated crown land, crown reserves, cultivation – irrigated horticulture and dry land agriculture, and grazing (Mitchell et al 2002). Smaller areas are also used for mining and defence.

The impacts of these varying land uses, specifically urbanisation and the subsequent creation of road networks, can have a profound impact on native wildlife. Impacts may occur through habitat loss and fragmentation, the loss of native species and decreases in abundance. In 2000, it was found that only seven out of 33 species of mammals previously recorded on the Swan Coastal Plain during the first 150 years of settlement, still existed (Kitchener et al 1978; How 2000). A subsequent study undertaken in 2009 (WAM 2010) determined avian, mammal and reptile diversity to be relatively low in the Perth Metropolitan area compared to the greater south-west of Western Australia (WAM 2010).
2.5 **Previous Surveys**

No previous Oblong Turtle surveys have been conducted within North Lake and Bibra Lake. A number of biological surveys on the Oblong Turtle have been conducted in other suburban areas of Perth by academic researchers. These include:

- A survey within close proximity, approximately 3-5km north east of the study area in Blue Gum, Booragoon and Piney Lakes (Giles et al 2008);
- A study in Thompson Lake, approximately 7km south of the study area (Clay 1981);
- A survey in Shenton and Perry Lakes, approximately 14km north and 16km north west of the study area respectively (Guyot and Kuchling 1998); and
- A survey in Lake Joondalup, approximately 38km north of the study area (Giles 2009).
3 LIFE HISTORY AND ECOLOGY

The Oblong Turtle (*Chelodina Oblonga*) is endemic to the south-west of Western Australia, where its distribution occurs from Hill River north of Badgingarra, inland to Toodyay, Pingelly and Katanning and south-east to Fitzgerald River National Park (DEC 2009). The Oblong Turtle can be distinguished from the only other freshwater tortoise (or turtle) confined to the south-west, the Western Swamp Tortoise, as its neck is equal to or longer than the length of its shell (Burbidge and Kuchling 2003). This species is carnivorous and has been known to forage on fish, frogs and invertebrates (DEC 2009).

Male turtles are generally smaller than females and have longer and thicker tails. Sexual maturity is deemed to have been reached when carapace length approximates 160-170mm in females (Kuchling 1989) and 130-140mm in males at (Kuchling 1988). Turtles are slow to mature and it may take a decade to reach these particular size classes (Giles 2009).

3.1 HABITAT

The Oblong Turtle is known to reside in permanent and seasonal freshwater rivers, lakes swamps and damplands throughout the south-west region (Guyot and Kuchling 1998; Giles et al 2008). Within the Perth region, the species is commonly found in wetlands/lakes with permanent water, and will migrate to nearby wet, water bodies during dry periods or will aestivate\(^1\) within the sediments at the deepest part of the wetland (Giles et al 2008; Wilson and Swan 2008).

Different habitat types are required by freshwater water turtles to meet their life requirements (Giles et al 2008). These include:

- Adequate depths of water for mating and swimming;
- Sufficient terrestrial buffers surrounding the wetland/lake to provide for nesting and shelter of hatchlings and juveniles;
- Access to food resources within safe foraging areas; and
- Basking and aestivation sites for some species such as the Oblong Turtle.

3.2 BREEDING AND NESTING

The Oblong Turtle generally breeds in July/August with nesting occurring between September/early October (spring) and February (summer) each year (Clay 1981)(G Kuchling 2010 pers. comm., July 9). During nesting season females leave the water in search of suitable sandy soils to lay their eggs with some females laying 2-3 clutches during this time (DEC 2009). In Perth, nesting takes place when temperatures are warm and associated with a low pressure system moving in from the west (Clay 1981)(G Kuchling 2010 pers. comm., July 9). Half of the females of a population may move to nesting sites at the same time (mass movement). Usually, the second half will move to nesting sites approximately two weeks later under similar weather conditions (G Kuchling 2010 pers. comm., July 9). More isolated nesting events by single females can occur later in the year (November to February)(G Kuchling 2010 pers. comm., July 9).

Female freshwater turtles tend to use all available vegetation cover for protecting/hiding when moving to nest sites (possibly to avoid attacks from avifauna) but choose to nest in open areas devoid of dense vegetation (Clay 1981). Nesting has been recorded at an average distance of 87m from the waters edge, with a maximum distance of 105m and minimum distance of 20m (Clay 1981). In Thompson Lake Nature Reserve, this species has been recorded nesting 16m above the lake water level (Clay 1981).

\(^1\) an induced state of reduced metabolic activity and dormancy associated with warm, dry periods.
Approximately 2-16 leathery eggs are laid, with eggs hatching in 3-6 months depending on weather conditions and hatchlings aestivating inside the egg until conditions are suitable for hatching (DEC 2009)(G Kuchling 2010 pers. comm., July 9). Most hatchlings emerge from the nests and move to wetlands in August (Clay 1981), however some may emerge as early as May (G Kuchling 2010 pers. comm., July 9).

\[ \text{3.3 THREATENING PROCESSES} \]

More than 75% of permanent wetlands on the Swan Coastal Plain have been in-filled or significantly modified (Gole 2006) for the purposes of land development and urbanisation. Many wetlands in the Perth metropolitan area occupied by the Oblong turtle have been modified for recreational purposes such as gardens, golf courses and parkland areas (Guyot and Kuchling 1998).

Existing threats to the Oblong Turtle within the survey area include:
\begin{itemize}
  \item Limited access to terrestrial upland nesting habitat;
  \item Increased fragmentation of upland habitat resulting in the loss of terrestrial buffers and reduction of available nest sites;
  \item Increased ‘edge effect – weed invasion’;
  \item Road mortality;
  \item Predation of turtles and eggs by European Foxes and Australian Ravens and possibly wetland birds (particularly Herons, Commorants, Ibis hatchlings);
  \item Inappropriate use of fire (vandalism) in remnant habitats which may lead to the permanent local extinction of Oblong turtles where recolonisation from other lakes is not possible; and
  \item Inbreeding (loss of genetic diversity and fitness).
\end{itemize}
4 METHODOLOGY

4.1 CONSULTATION
Community concern regarding the potential impact of the proposed project on the local Oblong Turtle populations, specifically Bibra Lake, was identified during community consultation undertaken for the project. The baseline investigations were initiated in response to this concern.

4.2 HABITAT ASSESSMENT AND SITE SELECTION
Reconnaisance and aerial images were used to identify potential terrestrial and aquatic habitats (Plate 2) for the Oblong Turtle within the project area. Survey areas (Table 4-1) were chosen on the basis of:

- Habitat condition and suitability for supporting Oblong Turtle populations; and
- Capturing possible terrestrial turtle movements in east-west and north-south directions.

Table 4-1 Location of Oblong Turtle survey areas

<table>
<thead>
<tr>
<th>Area</th>
<th>Environment</th>
<th>Habitat</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Lake</td>
<td>Aquatic</td>
<td>Lake</td>
</tr>
<tr>
<td>North Lake</td>
<td>Terrestrial</td>
<td>Parkland, Revegetated areas and Eucalyptus/Banksia Woodland</td>
</tr>
<tr>
<td>Lower Swamp</td>
<td>Aquatic</td>
<td>Lake (dry)</td>
</tr>
<tr>
<td>Lower Swamp</td>
<td>Terrestrial</td>
<td>Eucalyptus/Melaleuca Woodland</td>
</tr>
<tr>
<td>Horse Paddock Swamp</td>
<td>Terrestrial</td>
<td>Eucalyptus/Melaleuca Woodland</td>
</tr>
<tr>
<td>Bibra Lake</td>
<td>Aquatic</td>
<td>Lake</td>
</tr>
<tr>
<td>Bibra Lake (North)</td>
<td>Terrestrial</td>
<td>Parkland</td>
</tr>
<tr>
<td>Bibra Lake (South)</td>
<td>Terrestrial</td>
<td>Parkland and Eucalyptus/Melaleuca Woodland</td>
</tr>
<tr>
<td>Bibra Lake (East)</td>
<td>Terrestrial</td>
<td>Riparian vegetation and Parkland</td>
</tr>
<tr>
<td>Bibra Lake (West)</td>
<td>Terrestrial</td>
<td>Eucalyptus/Xanthorrhoea Woodland</td>
</tr>
</tbody>
</table>

4.3 SURVEY EFFORT
Surveying for the Oblong Turtle took place from 04 to 08 October 2010 (spring nesting season) within wet lake areas of Bibra Lake, North Lake and upland, terrestrial dry areas fringing these lakes. Wet areas targeted included those fringing the lake’s edge, specifically where Typha sp. and/or submergent/emergent vegetation were present. Open water was not surveyed as this habitat is less likely to harbour individuals and therefore result in the capture of turtles.

Survey work consisted of a combination of hand collection and active searching. Subsequent active searching in upland areas was also conducted following the baseline survey on 27 October and 18 November 2010.

4.3.1 HAND COLLECTION AND NET SCOOPING
Due to insufficient water levels in both Bibra Lake and North Lake (approximately 20-30cm depth), modified funnel traps that were initially proposed to be used for trapping turtles were
disregarded. Hand collection and net scooping, using crab scoops was used instead. A total of 29.4 hours was spent surveying via these methods.

<table>
<thead>
<tr>
<th>Lake Photographs - Bibra Lake</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Lake Photographs - Bibra Lake" /></td>
</tr>
<tr>
<td><img src="image2.png" alt="Lake Photographs - Bibra Lake" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>North Lake</th>
<th>Lower Swamp (Dry)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3.png" alt="North Lake" /></td>
<td><img src="image4.png" alt="Lower Swamp (Dry)" /></td>
</tr>
</tbody>
</table>

Plate 2 Lake habitats surveyed (wet and dry)

4.3.2 ACTIVE SEARCHING

Active searching was used in an attempt to capture upland movement by turtles during the nesting season survey period. This comprised searches of any observable habitats likely to support nesting turtles. Such habitats included upland areas of parkland, remnant bushland and dry lakes/swamps. Where possible, a series of transects 10 meters apart were traversed on foot to inspect these potential nesting habitats. A total of 23.5 hours was spent foraging.

4.4 BIOLOGICAL PARAMETERS RECORDED

In order to investigate and interpret population dynamics, health and breeding conditions, the following measurements were taken:
• Body mass (kg);
• Carapace - length, width and depth (cm);
• Plastron - length, width and depth (cm);
• Ecological Indicators (EI) that provide a relative indication of how well individuals are managing in their wetland environment e.g. the external presence of injuries, scars, leech infestations, algal cover on carapace, spot softening on carapace, lethargic or vigourous movement;
• Sex; and
• Sexual condition: gravid (with eggs).

All captured individuals were marked for recapture identification purposes.

4.5 LIMITATIONS

Limitations of the Oblong Turtle baseline survey are outlined in (Table 4-2).

<table>
<thead>
<tr>
<th>Limitations</th>
<th>Relevant?</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competency / experience of the consultant carrying out the survey.</td>
<td>No</td>
<td>All personnel involved in the field surveys are competent, experienced zoologists.</td>
</tr>
<tr>
<td>Scope (what faunal groups were sampled and were some sampling methods not able to be employed because of constraints such as weather conditions, e.g. pitfall trapping in waterlogged soils or inability to use pitfall traps.)</td>
<td>No</td>
<td>Scope was adequate. Urban related constraints determined upfront and worked around. This was a species-specific targeted survey.</td>
</tr>
<tr>
<td>Proportion of fauna identified, recorded and/or collected.</td>
<td>No</td>
<td>These surveys recorded 23 individuals. Other Oblong Turtle surveys conducted in the nearby vicinity recorded more individuals, however this could be attributed to longer survey periods. Ongoing surveys are likely to support this finding.</td>
</tr>
<tr>
<td>Sources of information e.g. previously available information (whether historic or recent) as distinct from new data.</td>
<td>No</td>
<td>Several monitoring programs have been undertaken in the near vicinity of the project area (Blue Gum, Booragoon and Pinney Lakes). Findings from these surveys have supplemented this baseline survey.</td>
</tr>
<tr>
<td>Timing/weather/season/cycle.</td>
<td>No</td>
<td>The timing of the field survey was based on potentially capturing any seasonal upland nesting movements.</td>
</tr>
<tr>
<td>The proportion of the task achieved and further work which might be needed.</td>
<td>No</td>
<td>The program was implemented as planned with no further investigations required.</td>
</tr>
<tr>
<td>Disturbances (e.g. fire, flood, accidental human intervention etc.) which affected results of survey.</td>
<td>No</td>
<td>No disturbance occurred during the surveys. However the project area is located in an urban bushland, which is subject to numerous ongoing pressures and historic degradation.</td>
</tr>
<tr>
<td>Limitations</td>
<td>Relevant?</td>
<td>Comments</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>-----------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Intensity (in retrospect, was the intensity adequate?)</td>
<td>No</td>
<td>Survey intensity is adequate for investigating baseline information on the resident Oblong Turtle populations within Bibra Lake and North lake.</td>
</tr>
<tr>
<td>Completeness (was relevant area fully surveyed?)</td>
<td>No</td>
<td>All habitat areas specific to the Oblong Turtle were sampled. Windy and overcast conditions and murky, shallow lake areas restricted lake survey sampling. The relatively small data set has limited the interpretations presented in this report. This survey delivered satisfactory results.</td>
</tr>
<tr>
<td>Remoteness and/or access problems.</td>
<td>No</td>
<td>n/a</td>
</tr>
<tr>
<td>Availability of contextual (e.g. biogeographic) information on the region.</td>
<td>No</td>
<td>Adequate information exists.</td>
</tr>
</tbody>
</table>
5 RESULTS

5.1 LOCAL DISTRIBUTION

There are many previous records of the Oblong Turtle within the project area, surrounding lakes approximately 3-7km north east and south of the project area (Blue Gum, Booragoon, Piney and Thompson) and other lakes (Shenton, Perry, and Joondalup, amongst others) throughout the Perth Metropolitan area.

Anecdotal evidence from conversations with local people and opportunistic findings (turtle remains) from Phoenix vertebrate surveys and project walkovers within the area suggest that the Oblong Turtle is a common resident within the project area (Phoenix 2010). Anecdotal evidence in 2010 suggested that no turtles have been seen crossing roads within the project area during the current nesting season compared to 2009, where a few turtles were seen. It was also noted that in the last four years no turtles were seen in horse paddock swamp, as opposed to previous years.

Further, anecdotal evidence suggests that Oblong Turtles have been known to move into neighbouring residential properties perhaps in search of nesting sites.

5.2 POPULATION DENSITY ESTIMATES

A total of 23 individuals were captured in Bibra Lake. The southern and northeastern sections of Bibra Lake captured the most individuals, possibly due to degree of submergent/emergent vegetation cover fringing these areas. In addition to the 23 turtles captured, 37 turtles were seen whilst surveying in Bibra Lake that were not able to be captured due to poor water column visibility and their fast movements. As they were not captured, it was not possible to determine if they were additional individuals to those recorded.

Based on the aquatic area surveyed (21.6ha or 216,000 m²) and the number of captures, the minimum population density estimate of Oblong turtles in Bibra Lake is 167.9 or 168 turtles in 157 ha with approximately 1.058 turtles per ha. However, there were no recaptures during the survey period, suggesting the Bibra Lake population and population density is considerably larger than that recorded.

No live individuals were seen or captured in North Lake. Four turtle shells were found on the shoreline of North Lake with no clear evidence of the cause of mortality. Population estimates of the Oblong turtle in North Lake are unable to be attained based on these results.

5.3 POPULATION DYNAMICS AND STRUCTURE

Of the 23 individuals captured at Bibra Lake, 16 were adult females (69.5%) and seven were adult males (30.4%). No juveniles were recorded. Within the population sampled female turtles outnumbered males by more than two to one (2.2:1).

The size structure (carapace length) for both males and females were within normal ranges based on results from previous surveys. Adult male and female turtles were quite similar in size with the carapace length in male turtles ranging from 18-23cm (Figure 5-1), with an average carapace length of 20.5cm, and female turtles 18-25cm (Figure 5-2), with an average carapace length of 22.3cm (Table 5-1). The standard deviation in carapace length was similar for both sexes; 1.89 for males and 1.79 for females. There was no evidence of recruitment (juveniles) within the population sampled. There was also no evidence of reproduction, with no gravid (with eggs) females captured.
### Figure 5-1
Size structure of male turtles caught from Bibra Lake

### Figure 5-2
Size structure of female turtles caught from Bibra Lake

### Table 5-1
Basic population statistics (carapace length) for turtles caught in Bibra Lake

<table>
<thead>
<tr>
<th></th>
<th>Minimum Carapace Length (cm)</th>
<th>Maximum Carapace Length (cm)</th>
<th>Average Carapace (mean) Length (cm)</th>
<th>Standard Deviation Carapace Length (cm)</th>
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</thead>
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<td>Females</td>
<td>18</td>
<td>25</td>
<td>22.3</td>
<td>1.793507</td>
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### 5.3.1 CONDITION INDEX

In order to assess the general condition of the turtles captured, a condition index based on carapace length in relation to body mass was used. A strong positive correlation exists in male turtles ($R^2 = 0.935$) with the minimum body mass (0.770 kg) recorded at 18cm carapace length and maximum body mass of 1.301 kg recorded at 23cm carapace length (Figure 5-3).
A moderate positive correlation exists between carapace length and body mass in females ($R^2 = 0.6082$) with the minimum body mass (0.910 kg) recorded at 18cm and maximum 25cm at 1.813 kg (Figure 5-4). The extent of scatter in the graphs may be attributed to the relatively small sample size. Two females and one male were shedding plates (12.5% and 14.2% of the population respectively) which is a general indication of growth.

![Figure 5-3](image3.png)  
**Figure 5-3**  
Linear regression comparing carapace length to body mass for male turtles caught in Bibra Lake

![Figure 5-4](image4.png)  
**Figure 5-4**  
Linear regression comparing carapace length to body mass for female turtles caught in Bibra Lake
5.3.2 Ecological Indicators

Of the 23 turtles captured 12 turtles (52.1%) had ecological indicators (EI’s) present, with algal growth on the carapace the most common EI. Generally males had the greatest degree of EI’s present, with 85% displaying EI’s compared with 43% of females (Table 5-2). In total, approximately 57.1% of males and 25.0% of females had a thin layer of algal coverage greater than 80.0%.

One male and two females had a medium layer of algal growth present with the male considered to be in a satisfactory condition, despite recording a combination of two ecological indictors (algal and fungal growth) (Plate 3). Only one male had 20% algal coverage on his carapace. Of the females, 56.2% had clean carapaces, whereas only one of seven males had a clean carapace (14.3%). Consequently, the population is considered to be in good to very good condition.

Table 5-2 Ecological Indicators of male and female turtles caught in Bibra Lake

<table>
<thead>
<tr>
<th>Sex</th>
<th>No Algal Coverage (%)</th>
<th>Thin layer algal coverage (20-79% coverage)</th>
<th>Thin layer algal coverage (greater than 80% coverage)</th>
<th>Medium layer algal coverage (greater than 80% coverage)</th>
<th>Fungal Growth</th>
<th>Total number of individuals with Ecological Indicators present (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>14.2</td>
<td>14.2</td>
<td>57.1</td>
<td>14.2</td>
<td>85</td>
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<tr>
<td>Female</td>
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<td>25</td>
<td>12.5</td>
<td>n/a</td>
<td>43</td>
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</tbody>
</table>

Plate 3 Algal and fungal growth present on an individual.

5.4 Movements

5.4.1 Weather Conditions

A study by Clay 1981 showed that a decrease in barometric pressure caused by an approaching low pressure system was known to initiate the movement of females to nest sites. The lowest barometric pressure recorded during the month of October occurred on the 1st, 9-10th and 27th of the month of which none occurred within the survey period (Figure 5-5). Rainfall followed some of these low pressure systems on the 10-11th and 28-29th. Clay (1981)
also found that females move to nest sites when maximum daily temperatures remain above 17.5°C, however maximum temperatures above 25°C may hinder movements/observations due to increased desiccation and potential mortality (Figure 5-6). During the survey period, daily maximum temperatures were consistently above 17.5°C and on two of the survey days were above 25°C. No upland nesting movements were recorded during the survey period.

Data sourced: Bureau of Meteorology, January 3rd 2011.

**Figure 5-5**  Barometric pressure and rainfall recorded during the month of October 2010
Figure 5-6 Minimum and maximum temperatures recorded during the month of October 2010

5.4.2 ACCESSS TO SUITABLE NESTING HABITAT

A number of factors have been identified as limiting access to potentially suitable upland nesting habitat for the Oblong Turtle within the survey area. These include retaining walls, steep lake side banks, thick non-native grasslands and the presence of dense Typha sp. fringing wetlands.

*Bibra Lake*

The retaining wall situated in the central, western shore of Bibra Lake was identified as restricting turtle movements into bushland areas directly west of the lake. Turtles may enter the southern extent of this bushland although the distance to reach this particular upland area is approximately 150m from the lake itself and based on previous literature turtles are unlikely to travel those distances (Clay 1981).

In the southern end of the lake, banks are steep in sections with pockets of thick Typha sp. and other fringing lakeside vegetation potentially preventing turtles from accessing upland areas beyond the lake. Oblong turtles are generally good climbers on angled slopes, particularly surfaces that are covered with lawn or even over shrubs (G Kuchling 2010 pers. comm., November 26). It is however uncertain if they will climb the steep banks (>45°) situated in this area. Some areas in this southern section have gently sloping banks allowing potential access to the dry, open swamp area south-west of the lake (south of Adventure World) and also the adjacent parkland.

Generally, any potential northern movements from Bibra Lake to Horse Paddock Swamp are restricted by the 30-160m wide, dense patch of Typha fringing the northern tip of Bibra Lake. Oblong turtles are unlikely to cross over these dense areas, especially if there are no openings, clearings or animal tracks present (G Kuchling 2010 pers. comm., November 26). Only one small, open, relatively flat section (north-eastern corner) exists which may allow turtles to potentially cross to upland areas east of Horse Paddock Swamp.
North Lake

Thick non-native grassland and riparian vegetation/sedges fringing the north-western corner of the lake restrict any potential movement to upland areas. The steep banks situated in the central, western side of the lake also restrict westward movements.

Some sections in the south-western and north-eastern upland areas of the lake may be suitable for nesting. These areas are easily accessible from the lake (no thick fringing grasslands preventing access) and they consist of open revegetated patches or pockets of *Eucalyptus/Banksia* woodlands on loose sand.

Horse Paddock Swamp

Horse Paddock Swamp is dense with non-native grasses, with a few bare sand patches present. It is unlikely that turtles will nest in this area or move from Bibra Lake into this area based on their habitat requirements for open, sandy areas, void of dense vegetation. It is also unlikely that turtles will move from North Lake into this area due to the large distances required to traverse (over 215m) (Clay 1981).
6 DISCUSSION AND CONCLUSION

Population estimates for the Oblong Turtle within Bibra Lake are approximately 168 turtles in 157 ha which amounts to approximately 1.058 turtles per ha. This suggests that a rather large area of over 1ha needs to be surveyed before one turtle is expected to be caught. The relatively fast maneuverability/mobility of this species may contribute to this result.

The minimum population size of Oblong Turtles in Bibra Lake is twenty-three individuals (16 adult females and 7 adult males) with an additional 37 individual’s seen within the lake but not captured. Based on the lack of recaptures, it is likely that the size of this population is considerably larger than that recorded. Further surveys could potentially clarify this assumption.

The presence of adult turtles suggests that the long-term viability of the Bibra Lake population is possible, but is also dependant on other habitat requirements such as access to suitable upland nesting habitats, terrestrial buffers, adequate foraging areas and basking and aestivation sites. The lack of juveniles seen and caught may be attributed to their elusive nature and ability to hide easily within the water and amongst the submersent/emergent lake vegetation. The change in survey methodologies from modified funnel traps to hand collection/net scooping as a result of low lake water levels has contributed to the relatively small sample size and the lack of juveniles captured.

Population estimates for the Oblong turtle in North Lake could not be determined based on the lack of captures resulting from this survey effort. This may be attributed to the survey technique (net scooping) within this shallow water body

The size structure in male and female carapace sizes (cm) was comparable to previous turtle surveys in the Perth Metropolitan area (Giles et al 2008; Giles 2009; Guyot and Kuchling 1998). Correlation analysis found strong and moderate, positive correlations between carapace length (cm) and body mass (kg) in male and female sexes, respectively.

Of the sampled population, 52.1% recorded the presence of ecological indicators, with males recording the highest number of indicators present. Overall the data and observations suggest that the Oblong turtles of Bibra Lake are in good to very good condition.

Although the survey was timed to record upland nesting movements, none were observed. It is likely that the weather was too warm during the survey with movements potentially occurring later in the season based on the subsequent weather conditions that occurred in lateOctober 2010.

Limited access to areas of suitable upland nesting habitat may be a risk to the viability of the turtle population in the long-term. Access is restricted in parts of Bibra Lake and North Lake by retaining walls, steep lake side banks, thick non-native grasslands and the presence of dense Typha thickets fringing the shoreline in some areas. Management of both lakes should consider the modification (or removal) of sections of the existing retaining walls to create gently sloping banks allowing easy access for turtles into upland areas. Management of non-native grasses and clearing of small pockets of Typha would also increase access into these terrestrial nesting habitats.

Threatening processes such as increased fragmentation of upland habitats, weed invasion, road mortality and predation remain within the project area and will continue to limited dispersal and disrupt breeding success and recruitment.

The potential impacts from the proposed Roe Highway Extension on the Oblong Turtle within North Lake are negligible and within Bibra Lake negligible to low. The current, limited access to upland nesting areas, particularly the area south of Horse Paddock Swamp may already inhibit any turtle movements into this area. The proposed alignment may cause further habitat loss and fragmentation of upland habitat in this particular area, however the extent of this is minor.

If water quality in Bibra Lake is affected by the project, there may be some effects on the food chains for this species.
7 REFERENCES


EPA (2002). Position Statement No. 3 Terrestrial Biological Surveys as an element of Biodiversity Protection. Perth, Environmental Protection Authority.


WAM (2010) Vertebrate biodiversity in Perth’s urban bushlands. 05/08/2010).


APPENDIX 1 TURTLES RECORDED IN BIBRA LAKE DURING THE OCTOBER 2010 SURVEY
<table>
<thead>
<tr>
<th>Date</th>
<th>Number</th>
<th>Sex</th>
<th>Sexual Condition: Gravid</th>
<th>Body Mass (kg)</th>
<th>Carapace Length (cm)</th>
<th>Carapace Width (cm)</th>
<th>Carapace Depth (cm)</th>
<th>Plastron Length (cm)</th>
<th>Plastron Width (cm)</th>
<th>Plastron Depth (cm)</th>
<th>Health</th>
<th>Ecological Indicators</th>
<th>Survey areas (Bibra Lake)</th>
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<td>11.6</td>
<td>3.5</td>
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<td>shedding plates</td>
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