CHAPTER 4

EXISTING ENVIRONMENT

4.1 INTRODUCTION

The purpose of this chapter is to describe briefly the characteristics of Paya Indah Wetlands before and during the study period. The information to describe the existing physical environment was mostly based on data from the relevant authorities such as the Department of Wildlife and National Parks (DWNP) and previous literatures, as well as from observations during the field survey. It should be noted that the biological components section only describes what species of flora and fauna were available at Paya Indah either in natural condition or imported from outside. This was because this study is more focused on water quality, as a separate exercise is required to carry out ecological or biological study in Paya Indah.

4.2 BACKGROUND

Paya Indah Wetlands is a designated wetland sanctuary covering an area of about 3360 hectares, encompassing two main ecosystems, namely lacustrine and palustrine (DNASB, 2001). The Lacustrine ecosystem encompasses the ex-mining land consisting of degraded tin mine, logged peat swamp forest and large open lakes, while the

pallustrine ecosystem encompasses a peat swamp, which is part of Kuala Langat Permanent Peat Swamp Forest (DNASB et al., 2003).

4.3 EXISTING PHYSICAL ENVIRONMENT

The assessment of existing physical environment is carried out by surveying on important physical components such as meteorological information, lake system and hydrological condition. All these information were obtained from field survey, secondary data from relevant authorities and previous literatures. The purpose of this assessment is to determine the influence of physical environment on the water quality.

4.3.1 Meteorological Condition

Meteorological data were obtained from the Jabatan Meteorologi Malaysia. The data includes monthly wind speed, monthly rainfall and monthly evaporation from December 2006 to February 2007. Due to the fact that wind roses was produced by Jabatan Meteorologi Malaysia on annual basis, only monsoonal wind rose from November to March (1999 – 2006) was used, as it was assumed to have similar patterns with wind condition during the study period (December 2006 to February 2007). The nearest meteorological station, KLIA Sepang meteorological station ($2^{o}44'$N, $101^{o}42'$E) had been set as the reference station, as it is located about 15 km southeast of Paya Indah.

4.3.1.1 Wind profiles

Wind is believed as one of the influencing factors of water quality. When the wind blows on water surface, the wind blows will induce surface current flow, and the surface water will flow to the bottom or demersal layer, depending on the depth of the stagnant water body. Turbulence occurred when the wind- induced surface currents moved from surface to demersal layer of water. The turbulence shall vary the composition of chemical and physical compound e.g. dissolved oxygen and organic material. Besides, wind also carries airborne pollutants such as suspended particulates, SOx, NOx, and heavy metals.

Wind observations at KLIA Sepang are measured by using pressure tube anemograph. Wind direction is analysed according to eight (8) compass points. The limits chosen for the wind speed correspond with the scale for Beaufort Force. The source data used in the measurement are the averages of wind speed and direction in hours. To interpret the wind rose, the concentric dashed circles resemble the various percentage frequencies of time labeled. It should be noted that calm wind is defined as the wind having a speed of less than or equal to 0.2 m/s. The percentage of calm is inscribed in the innermost circle of the wind rose. The total length of each arm is the total percentage frequency of time the wind blows from the direction concerned. The classes of wind speed are differentiated by the sizes and shades of the rectangles inside the arm. A smaller rectangle depicts slower wind speed.

Winds in Paya Indah are mainly governed by the monsoons, as it was proven by monsoonal wind roses in Figure 4.2. During the Northeast Monsoon (between November and March), winds blow mainly from the northeast and north directions, as the arm towards the Northeast was the longest.

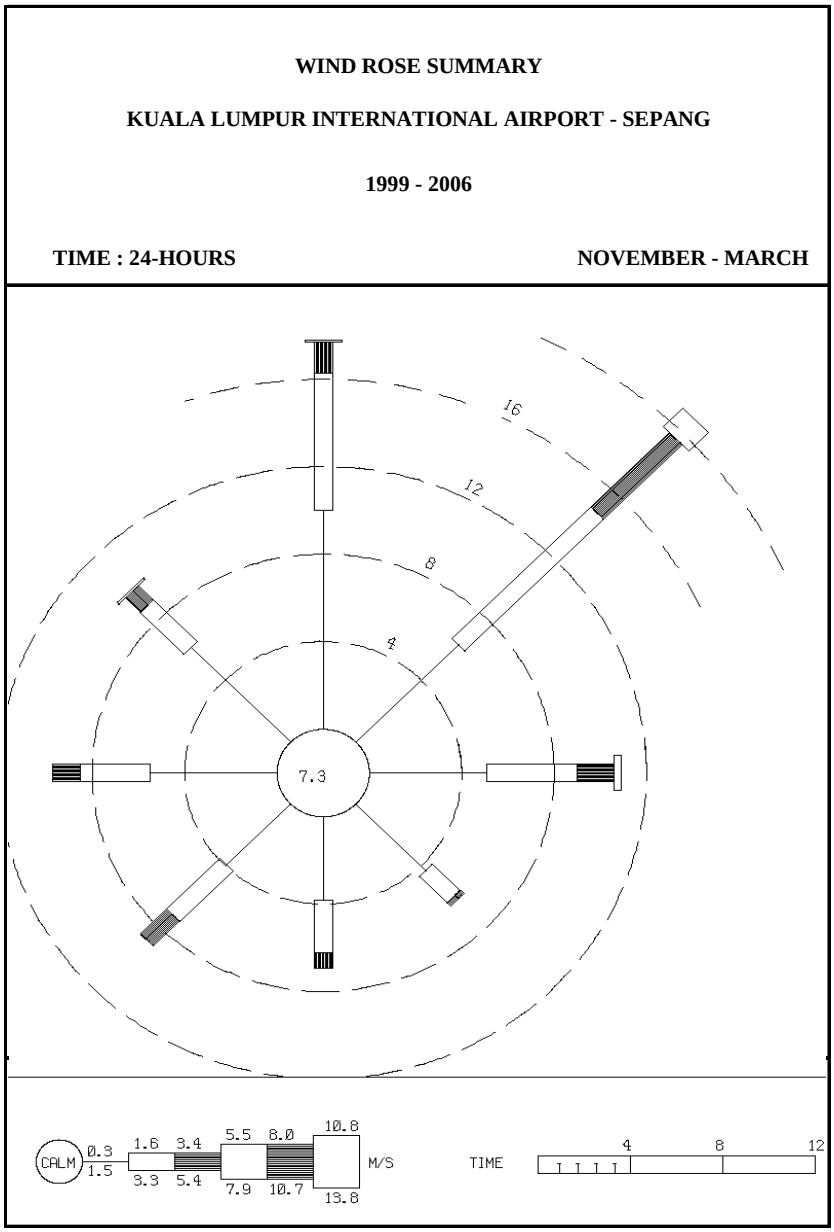

Figure 4.1: Northeast Monsoon wind profile of KLIA Sepang (1999-2006) used as the reference only for wind rose pattern during study period (December 2006 – February 2007). The values will not be taken into account.
Source: Jabatan Meteorologi Malaysia, 2007

The monthly average of surface wind speed of Paya Indah from December 2006 to February 2007 was observed to range from 1.7 m/s to 2.3 m/s, with January 2007 having the highest value at 2.3 m/s. As shown in Figure 4.2, the monthly average surface wind speed was observed to be less significant.

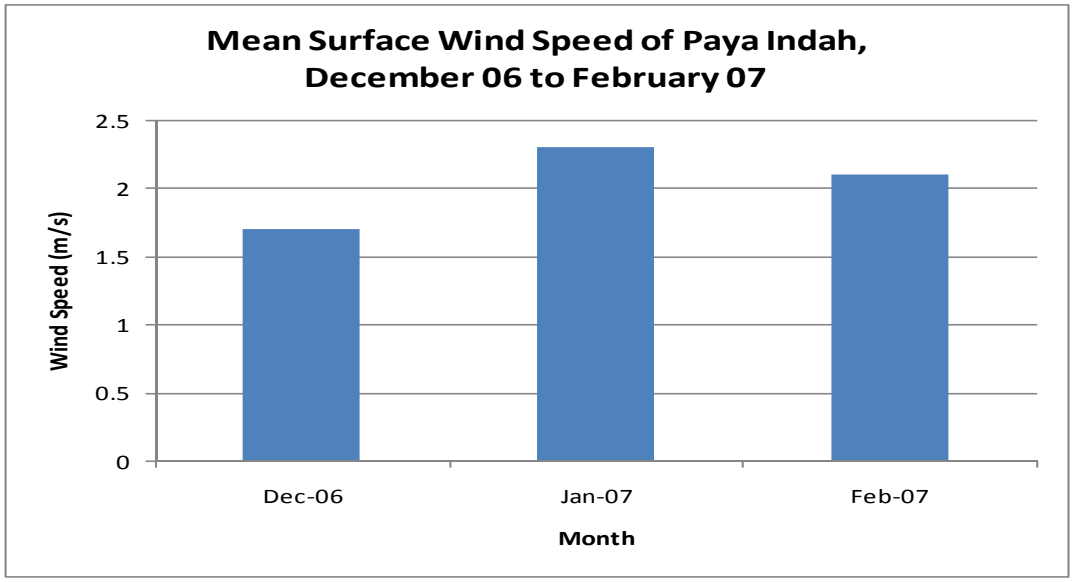

Figure 4.2: Average surface wind speed of Paya Indah from December 2006 to February 2007.
Source: Jabatan Meteorologi Malaysia, 2007

4.3.1.2 Rainfall

Rain also could influence the water quality of Paya Indah, either by altering the composition of water quality parameters such as reducing pH, as recent rainwater is low in pH, and diluting the chemical compounds or increasing the water murkiness. Thus, there is a difference between water quality of a water body during wet weather and dry weather, in terms of values of certain parameters.

It was observed that monthly rainfalls from December 2006 to February 2007 were reduced linearly, as shown in Figure 4.3.The highest monthly rainfall amount was recorded in December 2007 (140.8 mm).

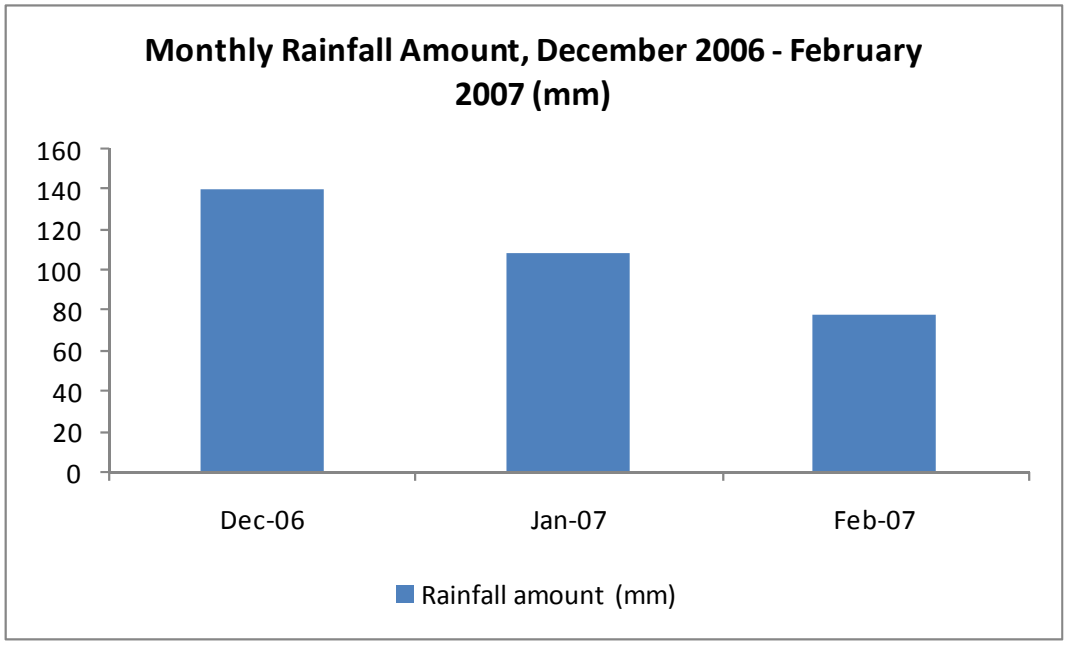

Figure 4.3: Monthly rainfall at KLIA Sepang from December 2006 to February 2007
Source: Jabatan Meteorologi Malaysia, 2007

It was also observed that the monthly number of rain days between December 2006 and February 2007 were reduced in line with the monthly rainfall, as shown in Figure 4.4. The highest number of monthly rain days was recorded in December 2006 (23 days).

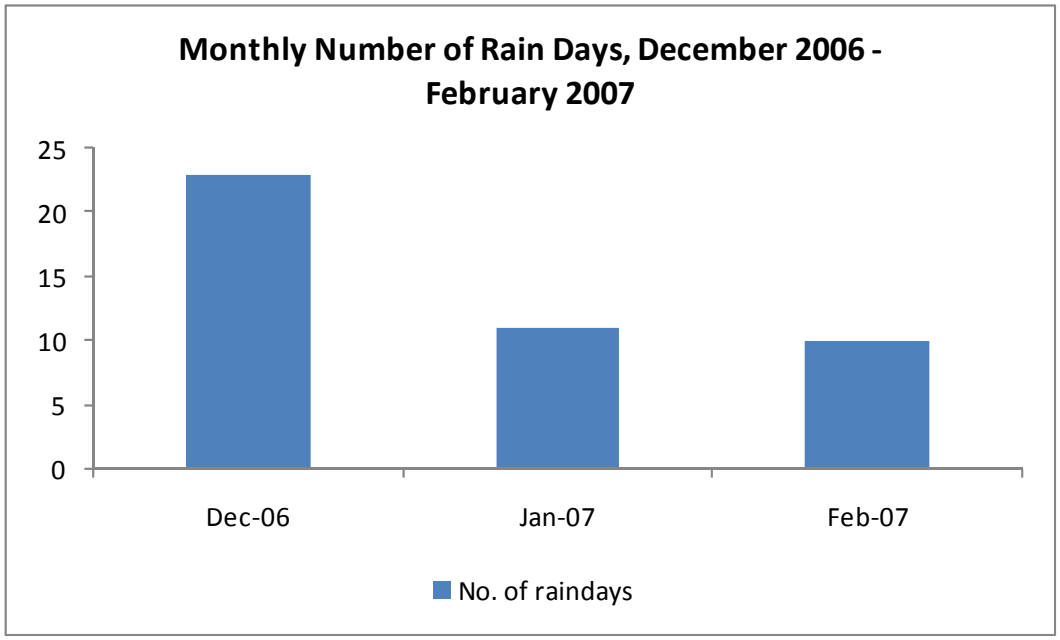

Figure 4.4: Monthly number of rain days at KLIA Sepang from December 2006 to February 2007
Source: Jabatan Meteorologi Malaysia, 2007

4.3.1.3 Evaporation rates

Daily evaporation rate refers to the amount of water evaporated from earth in one day. The daily evaporation rate is measured in millimeter per day (mm/day). Evaporation happens when water is transformed from liquid form to gas form due to the induction by heat source e.g. sunlight, as the water molecules become lighter and being propelled into the atmosphere. A high evaporation rate indicates dry condition.

Evaporation is important as it may influence the water quality. As evaporation rate is higher, possibility of water quality changes is higher. This is because the physical and chemical contents may become more concentrated. Thus water quality of a water body during dry season is different from the water quality of the same water body during wet season.

The monthly mean daily evaporation rates from December 2006 to February 2007 were observed to be increasing linearly, as depicted in Figure 4.5.

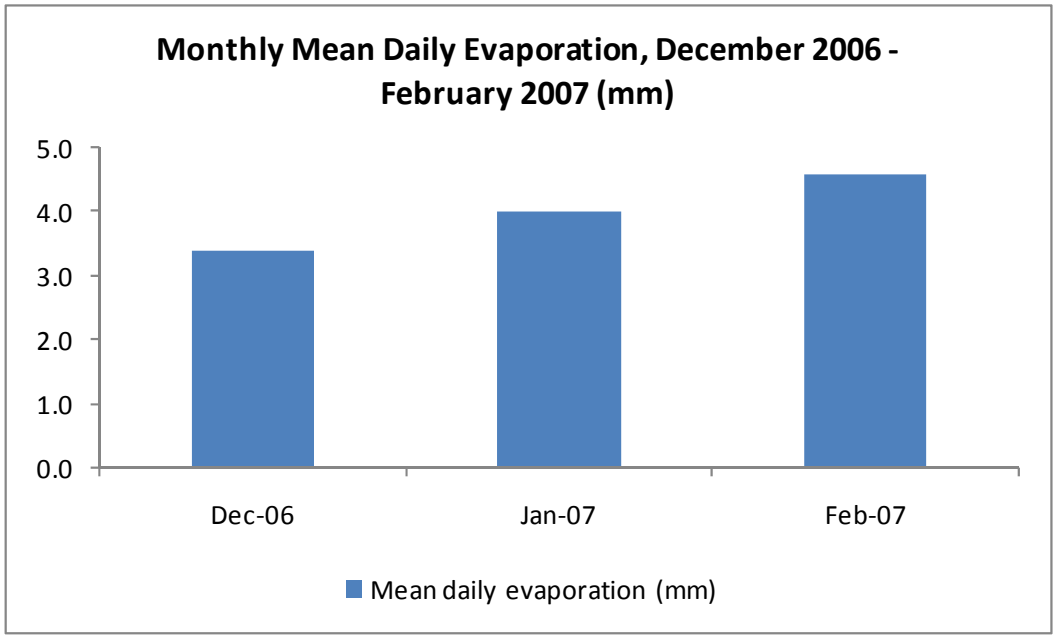

Figure 4.5: Monthly mean daily evaporation rate at KLIA Sepang from December 2006 to February 2007
Source: Jabatan Meteorologi Malaysia, 2007

4.3.2 Lakes System

The lake system of Paya Indah is also important as different lakes may have different water quality. The water quality of each lake was influenced by certain factors such as condition the place where the lake is located (peat swamp, ex-mining area), the use of the lake (mining, hippo shelter etc.), area of the lake, its depth, and the current flow.

According to DNASB (2001), there are thirteen (13) lakes in Paya Indah lakes system, namely Main Lake, Visitor Lake, Marsh Lake, Swamp Hen Lake, Perch Lake, Paddy

Lake, Driftwood Lake, Chalet Lake, Tin Lake, Lotus Lake, Crocodile Lake, Typha Lake and Hippo Lake. Figure 4.6 depicted the location of the respective lakes.

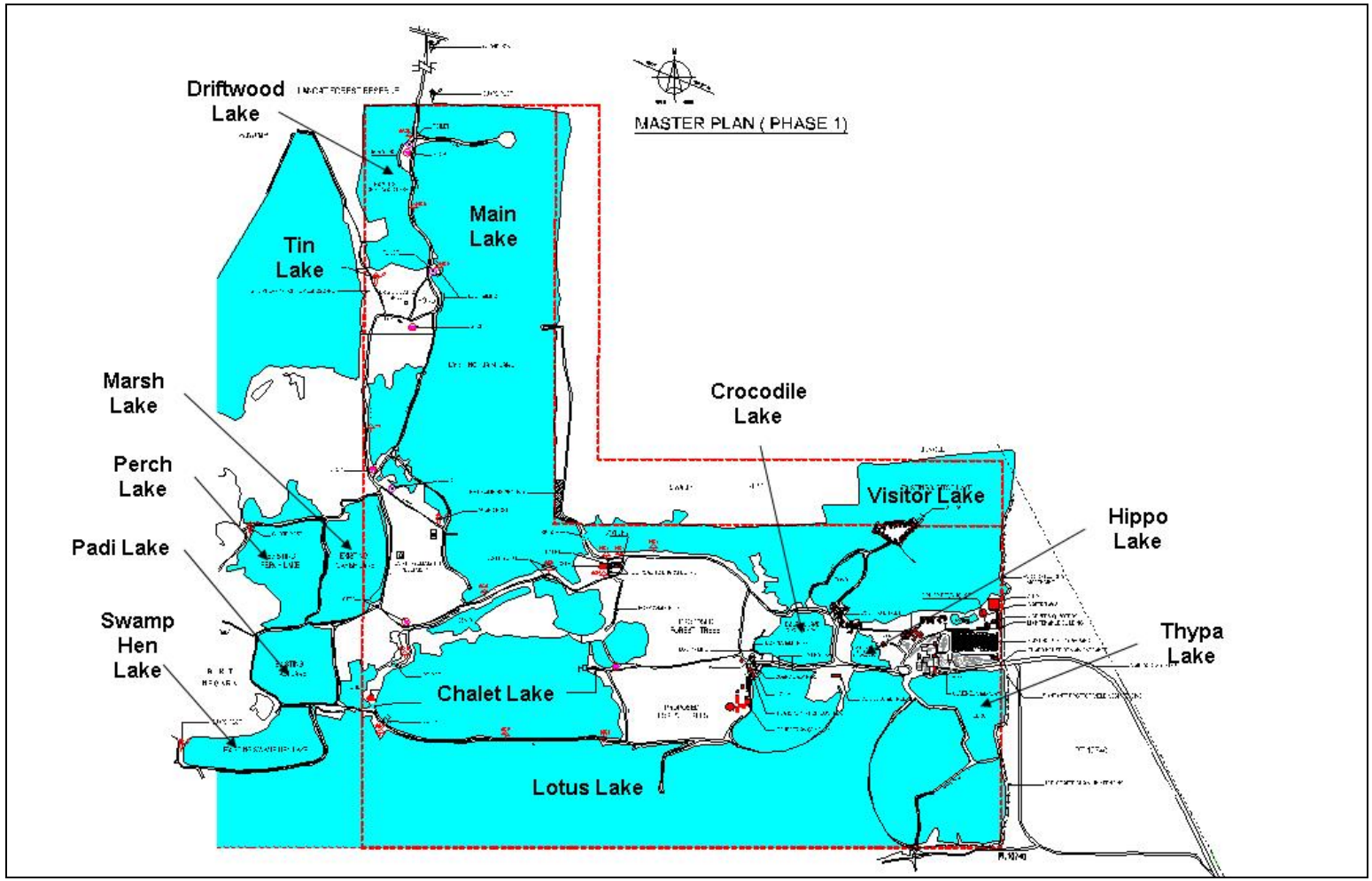

Figure 4.6: Paya Indah lake system
Source: DNASB, 2001

4.3.3 Hydrology of Paya Indah

The study on hydrology was focused on the Paya Indah drainage system and internal circulation among the lakes, as Paya Indah drainage and internal circulation regimes could influence the water quality.

The Paya Indah drainage could be regulated through the control of the water inflow and outflow. Figure 4.7 shows the direction of water flow from outside into Paya Indah, as represented by the dark blue line and arrows. The incoming water flows from the adjacent Kuala Langat Permanent Peat Swamp Forest. This had been affirmed by CETEC (1996) and DNASB (2001). The water then flows from Paya Indah to several drainages within Bukit Cheeding Orang Asli Village before going out to Sg. Sedu.

From the field survey, Paya Indah internal circulation among the lakes was found to be relatively slow and calm, depending on the size of the connections among the lakes, as shown in Figure 4.8. It was also found that the water flow directions among the lakes were mostly southwards, although there were some places where bi-directional flow occurred. Paya Indah water will be finally drained out at the west tip of the Lotus Lake and flows into the external drainage system of Bukit Cheeding Orang Asli Village.

Paya Indah hydrological profile could also be related to its lake system, as the size of the lakes could determine the speed of water movement. Therefore, for the bigger size lakes, the water flow could be slower, as observed in the field survey.

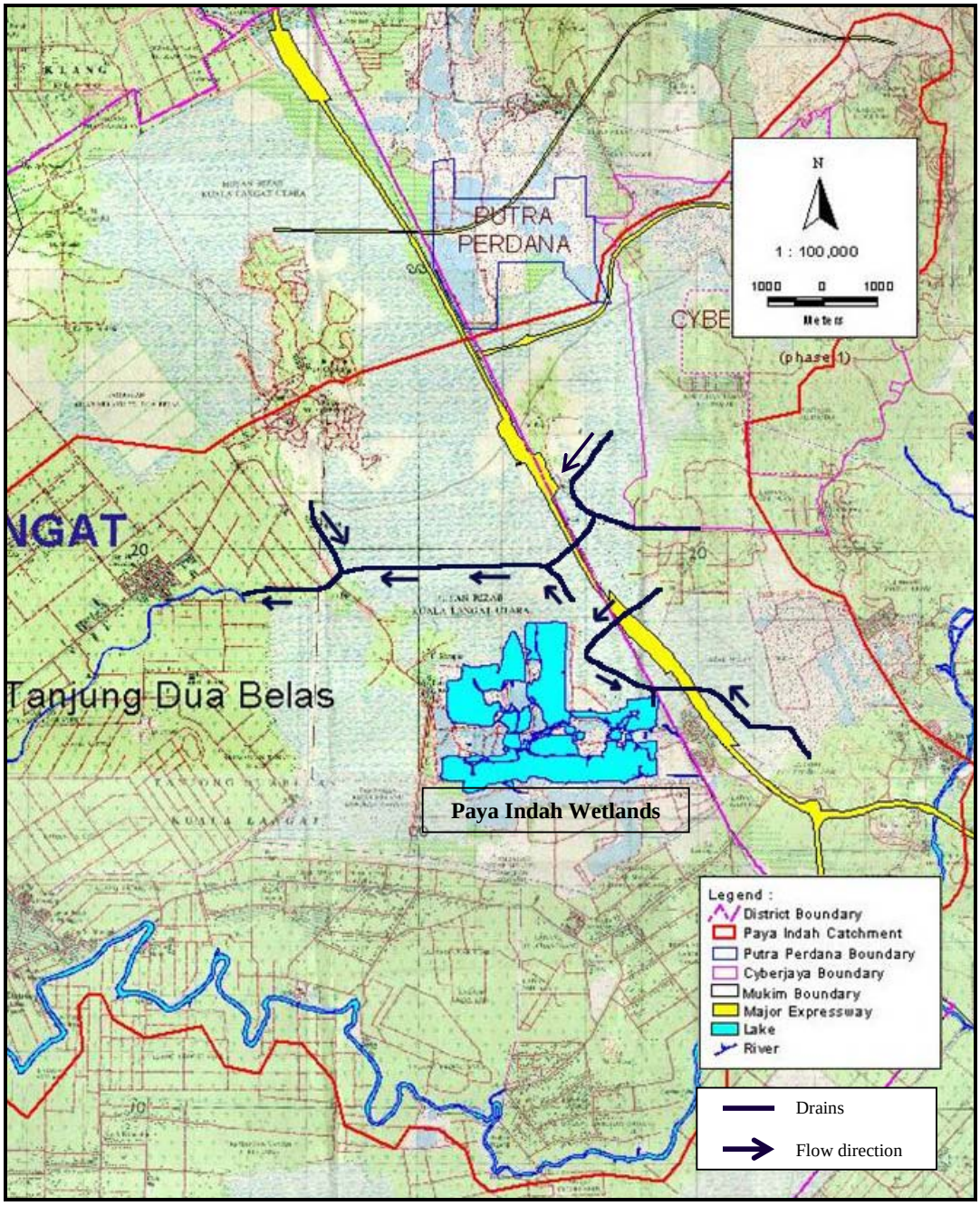

Figure 4.7: Existing drainage system of Paya Indah resembled by dark blue line and arrows

Source: Regenerate from DNASB (2001)

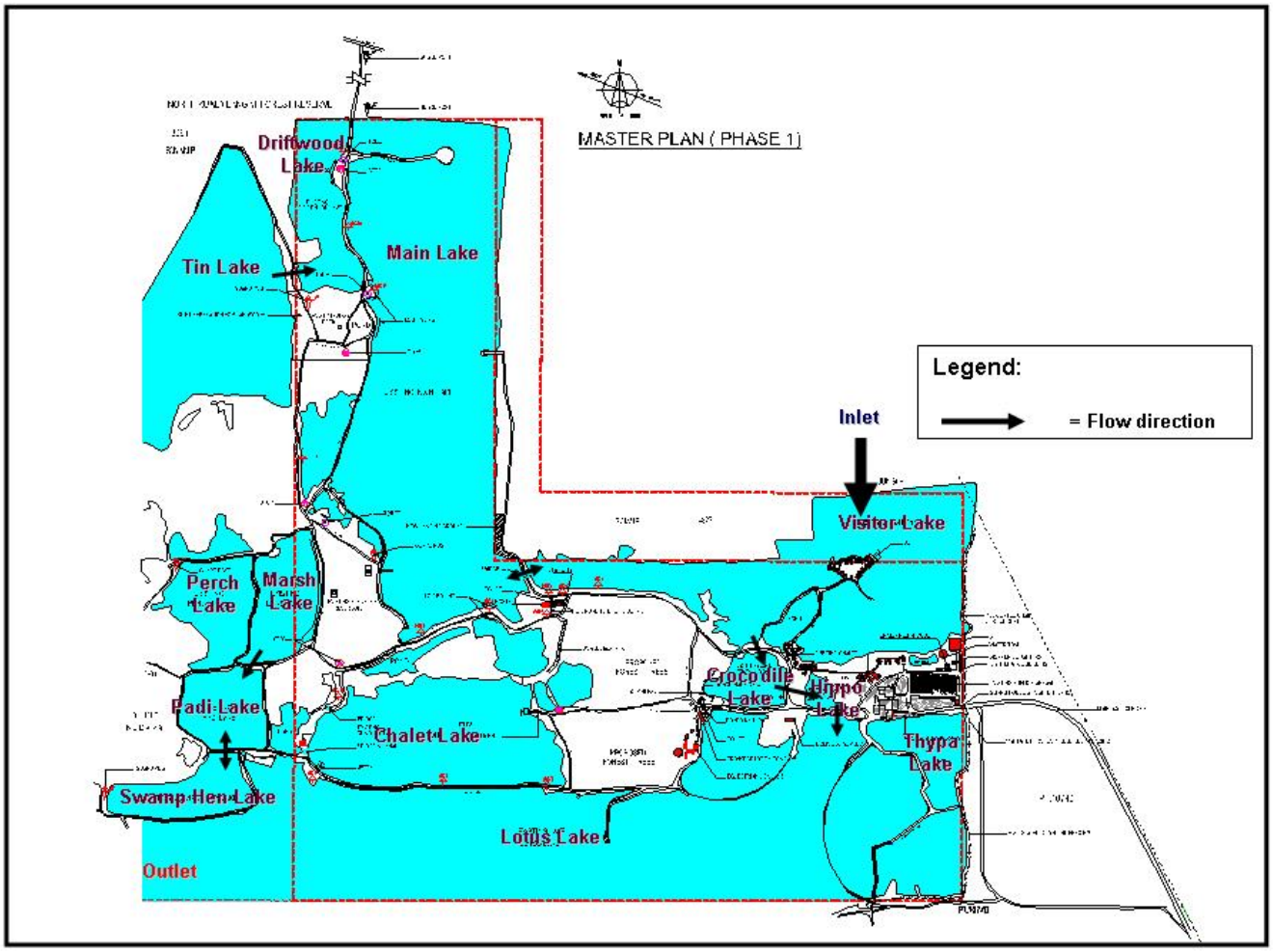

Figure 4.8: Paya Indah internal flow directions
Source: DNASB, 2001

4.3.4 Land Use Profile

Study on land use profile is important as to determine the contribution of land use within Paya Indah vicinity to the water quality degradation. According to the Selangor Town and Country Planning Department, a special plan for Paya Indah conservation had been drafted in 1999. As shown in the Main Land Use Plan 1999 – 2010 obtained from the Local Planning of Paya Indah Vicinity Draft (Figure 4.9), land use surrounding Paya Indah within 1999 and 2010 had been determined. With the total area of 10 974.20 ha, 9 180.13 ha, or 83.65% of land uses had been maintained as they are, 547.32 ha (4.99%) of land uses had been changed (e.g. from agricultural to housing) and gazetted, and 1 246.75 ha (11.36%) of land uses were proposed to be changed. Paya Indah is surrounded by agricultural areas, mainly cultivation of palm oil and small farming by Orang Asli. Kampung Orang Asli Pulau Kempas situated at the northwest of Paya Indah. Perangsang Peatland Paradise has intended to develop the southwest of Paya Indah with housing development projects. Eco-development had been planned at the west, south and southeast of Paya Indah vicinity, comprising 863.94 ha (7.87% of total area, or 69.3% of the total proposed land use change). The eco-development may include conservation of Paya Indah as an eco-tourism destination, bird watching or as one of the Ramsar Wetlands. The North Kuala Langat Peat Swamp Forest comprising 970.50 ha will be maintained as forest reserve.

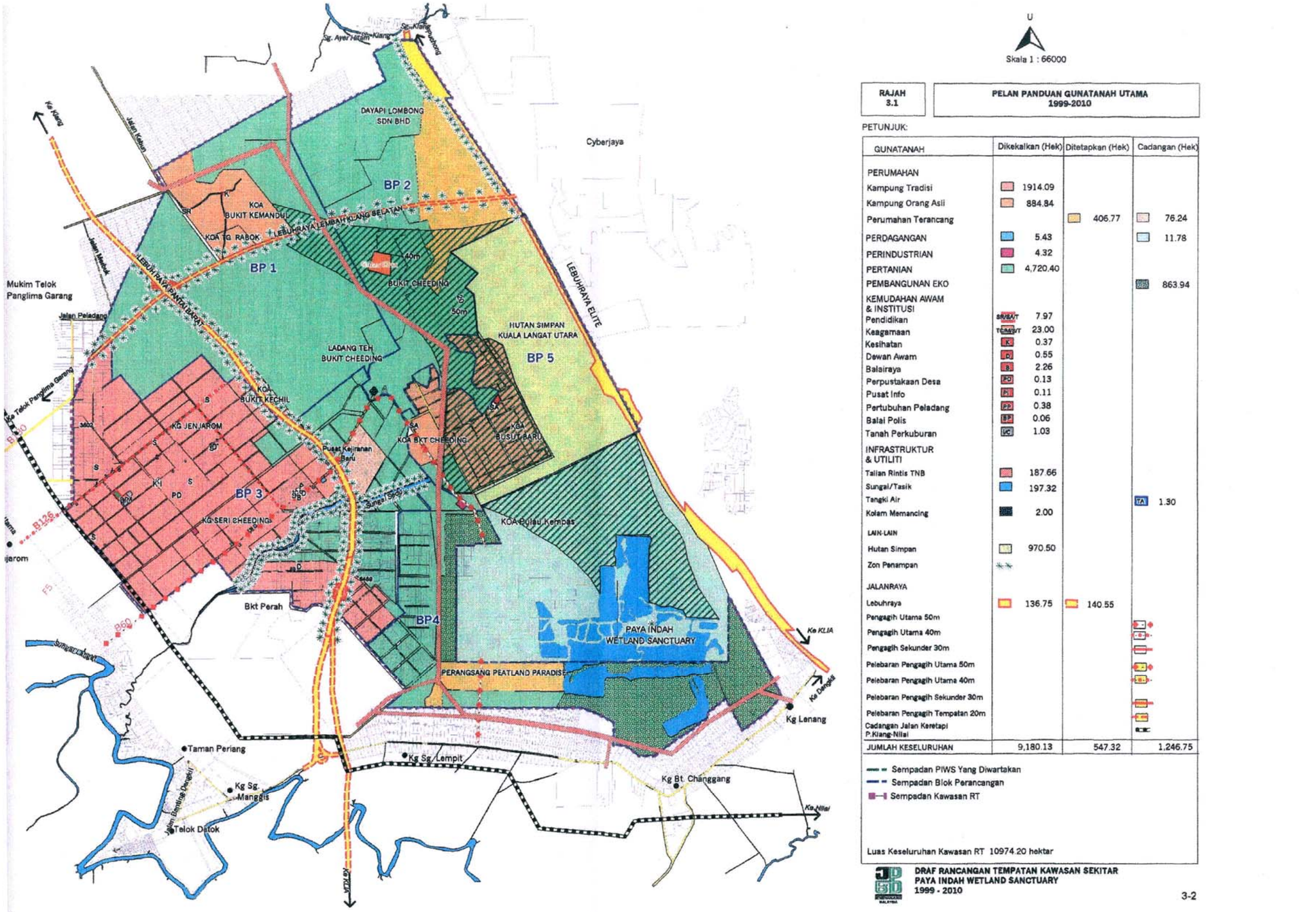

Figure 4.9: Land use pattern of Kuala Langat District as at 1999
Source: Jabatan Perancangan Bandar dan Desa Selangor, 1999

4.1 EXISTING FLORA AND FAUNA

Besides physical environment, existing biological environment of Paya Indah were also taken into account. The biological environment includes existing flora and fauna in Paya Indah ecological system. As there ~~is~~ was no detailed biological or ecological study carried out, the biological information was based on the observations during field survey, review from the previous literatures and feedback from DWNP officials. Thus the existing flora and fauna will be addressed in brief and focused on the available species in Paya Indah. Assessment on existing biological environment is important as to determine the ecological status of Paya Indah whether it is being impacted by the water quality degradation or not.

4.1.1 Flora

Existing flora of Paya Indah could be divided into two categories: terrestrial flora and aquatic flora. The flora species of Paya Indah were derived both from the field survey and the literature review.

4.1.1.1 Terrestrial flora

The terrestrial flora of Paya Indah may comprise natural and cultivated plants. *Acacia mangium* trees (Plate 4.1) were abundant within Paya Indah vicinity, as it can grow everywhere and can adapt with any environmental conditions. Other plants that occurred naturally were grasses, marshes, perch and shrubs. Plate 4.2 shows Perch Lake

where the perch (ferns) are dense. Numerous plants were also planted by DWNP Officials for landscaping purposes such as Terap (*Acoelorrhaphe wrightii*) (Plate 4.3) and also orchard trees, e.g. Durians (*Durian* sp.).

4.1.1.2 Aquatic flora

The aquatic floras observed during the field survey were Lotus (*Nelumbo* sp. and *Nymphaea* sp.) (Plate 4.4) and emerged macrophytes such as Tube Sedge (*Lepironia articulata*) (Plate 4.5), as well as other aquatic flora species derived from Lim et al. (1998), ~~of~~ which were found in Paya Indah such as *Fimbristylis miliacea*, *Eleocharis variegata*, *Polygonum barbatum*, *Eleocharis dulcis*, *Scirpus mucronatus*, *Scirpus grossus* and *Phragmites karka*.

Plate 4.1: *Acacia mangium* trees at Paya Indah

Plate 4.2: Terap (*Acoelorrhaphe wrightii*) trees

Plate 4.3: Perch Lake where the perch is dense

Plate 4.4: Lotus (*Nelumbo* sp.) within Tube Sedge (*Lepironia articulata*) grass

Plate 4.5: Tube sedge (*Lepironia articulata*)

4.1.2 Fauna

Existing fauna of Paya Indah includes terrestrial fauna, aerial fauna and aquatic fauna. The existing fauna information was derived either from the field survey or literature review.

4.1.2.1 Terrestrial fauna

The terrestrial fauna that were observed during the field survey were obviously three (initially four) numbers of Hippopotamus (*Hippopotamus amphibius*) in Hippo Pond, gifts from the Government of Botswana (Plate 4.6) and eleven (11) numbers of water buffalo (*Bubalus bubalis*) (Plate 4.7). Besides, stray dogs also existed in Paya Indah vicinity, as confirmed by a DWNP official, but the numbers of these dogs were not known. The stray dogs were considered as invasive species and caused threat to the foraging migratory birds. Thus the stray dogs were eradicated from Paya Indah to protect the birds. According to The Star (24th February 2006), there were 26 species of mammals at Paya Indah.

Plate 4.6: Hippopotamus (*H. amphibius*) named Kundra in Hippo Pond

Plate 4.7: These footprints at Station W9 shows the presence of Water buffalo (*Bubalus bubalis*) at Paya Indah

Plate 4.8: A placard designated Purple Heron area

4.1.2.2 Aerial fauna

Paya Indah had approximately 210 species of residential and migratory birds (The Star, 24th February 2006) and waterfowls such as Purple Heron (*Ardea purpurea*) (a placard designated the area of Purple Heron is depicted in Plate 4.8), Pelican (*Peleceanus* sp.) and also numerous species of storks and egrets. The migratory birds use Paya Indah as habitat, foraging ground and reproduction rendezvous.

4.1.2.3 Aquatic fauna

The aquatic fauna observed during the field survey comprised approximately eighteen (18) numbers of saltwater crocodiles (*Crocodilus porosus*) in the Crocodile Pond. These crocodiles were introduced by the previous management as part of tourist attraction, and currently maintained by DWNP.

Fish species were also available at Paya Indah, as during the field survey, it was observed that DWNP officials were frequently hunting for predator fishes, possibly Cichlids, Snakeheads (*Channa* sp.) and Walking Catfish (*Clarias* sp.). About 10 years before this exercise, a study had been carried out by Zulkafli and Zahari (1997) to identify the fish species available at Paya Indah. From their survey, they listed down the available fish species at Paya Indah as shown in Table 4.1.

Some of the listed fish species such as Black Tilapia (*Oreochromis mossambicus*), Catfishes (*Clarias* sp. and *Mystus* sp.), Climbing Perch (*Anabas testudineus*) and Snakeheads (*Channa* sp.) could tolerate the recent water quality of Paya Indah. Some of the fish species such as Cyprinidae and Belontiidae were however sensitive to the recent Paya Indah water quality condition. Therefore their number might be reduced after about 10 years in view of the water quality condition of the place.

Table 4.1
Fish species available at Paya Indah

Species Name	English name	Local Name
Anabantidae		
Anabas testudineus	Climbing perch	Puyu
Belontiidae		
Trichogaster pectoralis	Snakeskin gourami	Sepat benua
Trichogaster trichopterus	Three-spot gourami	Sepat ronggeng
Trichopsis vittatus	Croaking gourami	Karim
Bagridae		
Mystus nemurus	Redtail catfish	Baung
Mystus vittatus	Striped dwarf catfish	Lais
Centropomidae		
Chanda siamensis		
Channidae		
Channa striatus	Snakehead	Haruan
Cichlidae		
Oreochromis mossambicus	Black tilapia	Tilapia hitam
Clariidae		
Clarias batrachus	River catfish	Keli kayu
Clarias macrocephalus	Swamp catfish	Keli bunga
Clarias teijsmani	Eel catfish	Limbat
Cyprinidae		
Chela anomalura	Minnow	Seluang
Esomus malayensis	Barb	
Eleotridae		
Oxyeleotris marmorasus	Marble goby	Ketutu
Notopteridae		
Notopterus notopterus	Knife fish	Belida
Pristolepidae		
Pristolep fasciatus	Malayan leaf fish	Kepar

Source: Zulkafli and Zahari (1997)

Plate 4.10: Crocodile Pond where 18 saltwater crocodiles (*Crocodilus porosus*) placed