VOLUME 3 - SECTOR IX

ENVIRONMENTAL EVALUATION

THE STUDY ON INTEGRATED URBAN DRAINAGE IMPROVEMENT FOR MELAKA AND SUNGAI PETANI IN MALAYSIA

FINAL REPORT

VOLUME 3: SUPPORTING REPORT ON DRAINAGE STRUCTURE PLAN

SECTOR IX: ENVIRONMENTAL EVALUATION

TABLE OF CONTENTS

SECTOR IX

ENVIRONMENTAL EVALUATION

1. INTRODUCTION

1.1 Purpose of Report

This section of the report details the environmental evaluation of the Drainage Structure Plan for the study areas of Melaka and Sg. Petani. The report addresses existing environmental conditions and examines potential environmental impacts due to the drainage works. Some recommendations are given to minimise adverse environmental impacts.

1.2 Approach and Scope

The existing environment was assessed in terms of sensitive environmental receptors as well as for potential pollution sources to the water quality. Site observations for the retention ponds and existing condition of the main rivers were also conducted. Interviews and discussions were then conducted with the relevant personnel from Jabatan Pengairan Saliran (JPS) and the Local Authorities. A literature review of the study areas was conducted that included previous environmental impact assessments, drainage master plans and river rehabilitation reports for the area. Water quality data was also obtained from local plan reports and Alam Sekitar Malaysia (ASMA). The above field work provided input for the evaluation of the main environmental impacts and the subsequent preliminary screenings. Environmental impacts were assessed in terms of effects from potential urban drainage improvement works as well as effects of existing trends in water quality to urban drainage improvement works. Preliminary recommendations were then formed to tackle the expected environmental impacts.

2. EXISTING ENVIRONMENT

2.1 Sungai Petani Area

2.1.1 Sg. Petani

(a) River System

Sg. Petani is the largest river system in the study area and has several tributaries namely Sg. Air Mendidih, Sg. Gelugor and Sg. Bakar Arang. The river flows through

the Sg. Petani town area until it joins Sg. Merbok. Tidal influence extends up to 7km upstream from the Sg. Merbok confluence. The Sg. Petani river system drains three distinct land use zones which are as the following :-

(a) Agricultural areas in the upper catchment

The area is mainly under padi and rubber cultivation. Streams within these areas are small and shallow with reasonably clear water. Aquatic vegetation comprises mainly of water weeds such as Hydrilla, aroids and the spreading herb *Commelina nudiflora*. Fish found here are expected to be mainly from the Cyrinidae Family and the common genera of *Clarias* (Keli), *Chanua* (Aruan), *Trichogaster* (Sepat) and *Anabas* (Puyu) and *Betta* (Fighting fish).

(b) Urbanised areas in the middle catchment

This area is characterised by residential and other urban development extending close to or by the river banks. This river section is highly polluted with extremely low concentration of dissolved oxygen. Most of this stretch and its tributaries are essentially septic and may be classified as 'ecologically dead' except for the upstream sections. Vegetation here comprise mainly of belukar vegetation, grass and herbaceous plants such as *Commelina nudiflora*. Streams beds in the upper sections are sometimes overgrown by aquatic plants such as *Hydrilla*. Aquatic life is expected to be minimal especially in areas where the dissolved oxygen levels are known to be 2 mg/l or less.

(c) Mangrove and swamps of the lower catchment

This area comprises of the stretch between the confluence of Sg. Petani with Sg. Merbok up to about 5 km upstream. The vegetation here is mainly mangroves, swamps and agricultural land. The river is tidal and is subject to saline intrusion. The brackish condition of the river supports a distinctly different aquatic ecosystem. Mangroves especially the *Rhizophora* line most of the length of the river except in developed areas. Other characteristic vegetation include *Sonneretia alba, Lumuitzera* sp. *Nypha fruticans* and the fern *Acrostichum speciosum*. Benthic forms within the mudflats are characterised by a dominance of crabs of the *Uca* and *Sesarma* species.

Fish species expected to be found are likely to include brackish species such as *Siakap (Lates calcarifer)*, the giant prawn, *Macrobrachium rosenbergi*, the

catfish, *Tachysurus caelatus* and various prawn species. Most fishing and aquaculture activities are undertaken downstream and at Sg. Merbok. Brackish water pond culture of prawns (Tiger prawns) is to be found at the northern banks of Sg. Petani along with freshwater pond culture of fish. Aquaculture is also carried out at the southern bank along Sg. Pasir. Cage culture of fish is undertaken mainly along Sg. Merbok some 10-12km downstream.

(2) Water Quality

Water quality data for the Sg Petani and Sg. Bakar Arang river was obtained from Alam Sekitar Malaysia's (ASMA) sampling station in the area for the year 1998. The water quality for the Sg. Petani river is in Class III of the INWQ Standard with an average Water Quality Index (WQI) of 62.5. The dissolved oxygen (DO) content can reach as low as 0.36 mg/l during the low flow periods. DO content of below 2 mg/l can inhibit aquatic life-forms. Average DO content for the river was at 3.06 mg/l. *E. coli* levels in the water was significantly elevated at an average 70350 cfu/100ml and maximum levels reaching as high as 240,000 cfu/100ml. Elevated levels of *E. coli* is usually an indication of sewage contamination. The Chemical Oxygen Level (COD) was also slightly elevated at 62.0 mg/l.

Water quality for Sg. Bakar Arang is also in Class III of the INWQ Standard with an average Water Quality Index (WQI) of 59.5. The DO content is on average above 2 mg/l while the COD level was slightly elevated at 55.7 mg/l. *E. coli* levels were also elevated at an average of 2000 cfu/100ml.

Visual observation indicates that the river is polluted by rubbish typical of urban rivers. The main pollutants are BOD, COD and *E. coli* thus causing low levels of DO. The table below summarizes some of the main water quality parameters in Sg. Petani and Sg. Bakar Arang.

Table IX-1 : Average Water Quality Concentrations in 1998 (ASMA)

River	DO (mg/l)	PH (mg/l)	COD (mg/l)	SS (mg/l)	NH3-N (mg/l)	E. Coli (cfu/100ml)
Sg. Petani	3.07	6.59	62.0	29	2.80	**70350**
Sg. Bakar Arang	3.60	6.27	55.7	42	2.61	2000

(3) Pollution Sources

The main pollution sources at this catchment are rubbish from the surrounding urban areas especially from commercial centres and squatter houses, the Bakar Arang

Industrial area, septic tank effluent from the surrounding housing areas and the Sg. Petani Industrial area. Rubbish is dumped indiscriminately along the banks of the river that has sometimes led to blockage and flooding. Rotting rubbish tend to contribute heavy organic load into the river. Effluent from septic tanks flow into drains and flows into the retention ponds that eventually drain into the river. There are approximately 8 retention ponds servicing the Petani catchment and are grossly polluted by accumulated sludge and rubbish. Reduced water flow due to rubbish blockage and eutrophication has also led to massive algae bloom and water lily growth. These will eventually die and decompose in the water thus leading again to organic loading into the river thus deteriorating the water quality. The largest retention pond in the entire study area is located in the Taman Ria Industrial area and is badly contaminated with sludge and scum. The three main industrial areas are the Taman Ria Industrial area, the Bakar Arang Industrial area and the Sg. Petani Industrial area which also comprise of a number of heavy industries. Effluents from these industries also drain into the river and may pose an accumulative pollution potential especially in terms of heavy metals.

2.1.2 Sg. Pasir

(1) River System

Sg. Pasir caters for the southern catchment of the study area. The river mainly flows through rural areas except for Taman Sejati Indah and the Bandar Perdana which is currently under construction. The river flows adjacent Kg. Pokok Limau and Kg. Dakwah – areas that are prone to flooding. Visual observation indicates that several wooden houses were located extremely close to the riverbank. Aquaculture is currently carried out at the mouth of the river.

(2) Water Quality

The water quality is unknown but visual observations indicate the river to be polluted by rubbish and infested by water lilies. The river faces similar problems as Sg. Petani in terms of sewage and nutrient loading but is expected to be better due to less influence from urban and industrial sources of pollution.

(3) Pollution Sources

The existing main pollution sources are due to rubbish and septic tank effluent from the surrounding houses. Rubbish in the river is a severe problem here especially when

there are markets besides the river. There is a rubbish trap for Sg. Pasir at Taman Sejati Indah but it is clogged by excessive rubbish accumulation and algal growth. The rubbish traps are cleared twice a year by the MDSP. There are approximately 8 retention ponds servicing the Pasir catchment. Most of the retention ponds are in moderate conditions but is expected to deteriorate unless regular maintenance is implemented. Eutrophication and rubbish accumulation is also a problem in some of the retention ponds. There are no major industrial sources of pollution draining into this catchment since the land use is still largely agriculture. Nevertheless, development pressure is increasingly converting the area to urban development. Other pollution sources are pesticides and fertilizers but these are expected to be minimal.

2.1.3 Sg. Tukung

(1) River System

Sg. Tukung caters for part of the northwest catchment of the study area mainly the Taman Ria housing development and the adjacent Ria Industrial area. There is only one retention pond in this catchment located in Taman Ria. The retention pond is poorly maintained with minimal water flow as well as eutrophicated. The river is also currently being widened and cleared of vegetation.

(2) Water Quality

The water quality is unknown but the river is black in colour and foamy. The main pollutants expected here are high levels of BOD and COD.

(3) Pollution Sources

The existing main pollution sources are due to rubbish and septic tank effluent from the surrounding houses. The Ria industrial area is also expected to contribute significant amounts of pollutant to the river typical of industrial areas.

2.1.4 Sg. Lalang

(1) River System

Sg. Lallang caters for the northeast catchment of the study area mainly the LPK industrial area, the Bukit Makmur industrial area, housing developments and agriculture lands. There is only one retention pond draining into this river namely the one located in the LPK industrial area. The retention pond is in a fairly good

condition and is also used for fish breeding. Observations of the river indicate that the urban monkey *macaca fasicularis* is abundant along the banks of the river especially in the residential areas. Vegetation here comprise mainly of belukar vegetation, grass and herbaceous plants.

(2) Water Quality

The water quality is unknown but visual observations indicate that the river is in moderate condition. No significant infestation of water lilies or rubbish was observed in the urban stretches of the river.

(3) Pollution Sources

The main pollution sources are due to pesticide and fertillzer runoff from the Kelab Cinta Sayang golf course and surrounding agriculture land. Other sources of pollution will be the from domestic sewage, industrial effluents namely the LPK industrial area as well as pollution sources from the construction activities in the northern boundary.

2.1.5 Sg. Layar Besar and Sg. Che Bima

(1) River System

Both these rivers cater for the northwestern catchement of the study area. The area is relatively undeveloped except for residential developments and vast tracts of agricultural land. Sg. Layar Besar is currently undergoing stream widening and clearing works. There are no known retention ponds draining into both these streams.

(2) Water Quality

The water quality is unknown but visual observation indicate that Sg. Layar Besar is slow moving and turbid due to widening works. The main pollutants are suspended solids.

(3) Pollution Sources

There are no major sources of pollution in this area. Some pesticide and fertillzer runoff is expected from the agriculture lands. The military airport camp to the west of Sg. Layar Besar may contribute oil and grease contamination but this is expected to be minimal.

2.2 Melaka

The existing river systems in the Melaka study area comprise of three main rivers that are Sg. Melaka, Sg. Malim and Sg. Lereh which have a total catchment area of approximately 240 km^2 that drain directly into the Melaka Strait.

2.2.1 Sg. Melaka

The main tributaries of the Sg. Melaka are Sg. Tampin, Sg. Durian Tunggal and Sg. Batang Melaka, Sg. Putat and Sg. Cheng. Aquatic plants have covered some stretches of Sg. Melaka especially between Batu Berendam and Malim. Similarly to Sg. Cheng, aquatic plants have covered a stretch between Kerubung and Sg. Cheng - Sg. Melaka confluence. Sg. Melaka has been maintained and cleared from the aquatic plants regularly by the authorities. There is no sand dredging along the Sg. Melaka except for the maintenance works and riverbank improvement works. The lower reaches at the downtown will be dredged to improve and to mitigate flood. The pollution sources are discharge from industrial areas such as Cheng Industrial Park, Kerubung Industrial Park, Batu Berendam Industrial area and Air Keroh Industrial estate. Water quality data show that the deterioration of the water quality in the catchment is caused by an increased pollution load from urban sewage, industrial waste water and silt emission due to insufficient controlled soil erosion and trapping of silt at construction sites, quarries and cleared agricultural land.

The river downstream of the Durian Tunggal Water Intake passes through the built up areas such as industrial and residential and commercial. The Sg. Putat which has its source at the Air Keroh reservoir meets the Melaka River at Batu Berendam. The Sg. Cheng flows through the gelam area before joint into Sg. Melaka at Batu Berendam. The pollution sources are discharge from industrial areas such as Cheng Industrial Park, Kerubung Industrial Park, Batu Berendam Industrial area and Air Keroh Industrial estate. Other pollution sources include domestic sewage and garbage from the informal settlements along the river. Besides this, the other main pollution sources were non-point source pollution. These are mainly pesticide and nutrient-laden runoff from the agricultural land.

A diversion canal (6.5 km) has been constructed connecting Sg. Melaka - Sg. Malim to mitigate seasonal flooding at the downsteram especially Melaka town. Part of the flow from Sg. Melaka is diverted and discharged into the Straits of Melaka at Klebang Besar. There are tidal barrages along Sg. Melaka and Sg. Malim to separate the freshwater zone and the tidal influence zone of the river. Sg. Melaka flows into the sea within the town of Melaka.

There are several DOE's water quality monitoring stations within the Sg. Melaka catchment. River water quality data from 1989 to 1996 were obtained from the Department of Environment.

Table IX-2 Water Quality Indices for Sg. Melaka

	1989	1990	1991	1992	1993	1994	1995	1996
Water Quality Index	80	72	62	70	67	67	71	70
Ammoniacal-N Index	65	53	28	50	47	65	54	43
BOD Index	90	85	72	91	88	87	93	90
SS Index	74	72	73	69	58	47	58	59

The water quality of Sg. Melaka is slightly polluted. Ammoniacal nitrogen, BOD and SS indices also indicate that the water quality of Sg. Melaka has deteriorated. The main sources of pollutants are discharge from industrial areas (such as Air Kroh Industrial Park, Cheng Industrial Park and Batu Berendam Industrial Park), landfill, rubber and oil palm factories.

2.2.2 Sg. Malim

The main tributaries of Sg. Malim are Sg. Air Salak and Sg. Air Hitam. Sg. Air Hitam flows eastely and then southerly before join into the Strait of Melaka. The Sg. Air Hitam passes through the agricultural areas especially rubber estates and also traditional villages. The main pollution sources is mainly form the nutrient-laden runoff and pesticide from the agricultural land. Sg. Ayer Salak flows in the north-east direction before join into Sg. Malim at Pulau Gadong. The Sg. Ayer Salak passes through agricultural areas and Bukit Rambai Industrial Estate.

The major pollution sources are discharges from the industrial estate and nutrient-laden runoff from agricultural area. The water quality is unknown but site observations indicate that the river is in moderate condition. No significant infestation of aquatic weeds or rubbish was observed in the urban stretches of the river. Sg.Lereh main tributaries are Sg. Udang and Sg. Seberang Gajah. The major pollution sources are effluent from the Industrial estates and also nutrien-laden runoff from the agricultural areas. River improvement works has been carried out at a stretch near Kg. Peng Lanjut. The deterioration of the water quality has been reported recently in March 1999. Dead fishes were found flooting along certain stretches of the Sg. Paya Luboh which is one of the tributaries of Sg. Lereh. The contamination of the river has affected livestock and farming activities along the river.