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SOLID WASTE MANAGEMENT STUDY FOR PULAU PINANG AND SEBERANG PERAI MUNICIPALITIES

SUPPORTING REPORT

VOLUME IV

ENVIRONMENTAL EVALUATION

AUGUST 1989

JAPAN INTERNATIONAL COOPERATION AGENCY

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FOR
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ABBREVIATIONS

ABC	:	Action Plan for a Beautiful and Clean Malaysia
BSDS	:	Bakau Street Disposal Site
CIF	:	Cost, Insurance and Freight
DBKL	:	City Hall of Kuala Lumpur
DID	:	Drainage and Irrigation Department
DOE	:	Department of Environment
EIA	:	Environmental Impact Assessment
ENSEARCH	:	Environmental Management and Research Association of Malaysia
EPU	:	Economic Planning Unit
GDP	:	Gross Domestic Product
IKU	:	Public Health Institute
JICA	:	Japan International Cooperation Agency
JKKK	:	Village Development and Security Committee
JPBD	:	Town and Country Planning Department
KEMAS	:	Community Development, Ministry of National and Rural Development
KMDS	:	Kuala Muda Disposal Site
LWL	:	Low Water Level
LA	:	Local Authority
M	:	Million
MC	:	Municipal Council
MPSP	:	Majlis Perbandaran Seberang Perai
MPPP	:	Majlis Perbandaran Pulau Pinang
MOH	:	Ministry of Health
MHLG	:	Ministry of Housing and Local Government
M/P	:	Master Plan
MSWM	:	Municipal Solid Waste Management
NEB	:	National Electricity Board
NEP	:	New Economic Policy
PADS	:	Pantai Acheh Disposal Site
PDC	:	Penang Development Corporation
PERDA	:	Penang Rural Development Authority
PHA	:	Public Health Assistant
PHI	:	Public Health Inspector
PSD	:	Public Services Department, Prime Minister's Department
IKR/PWD	:	Public Works Department
PPC	:	Penang Port Commission
SWM	:	Solid Waste Management
SWMIS	:	Solid Waster Management Information System
TDC	:	Tourist Development Corporation
UDS	:	Urban Drainage System
USM	:	University Sains Malaysia

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IV-I Preliminary Environmental Evaluation

IV-I. Preliminary Environmental Evaluation

I. Pantai Acheh Disposal Site

Chapter 1 Title of Project

The title of the project is Pantai Acheh Disposal Site Development Project.

Chapter 2 Project Initiator

The initiator of the project is Pulau Pinang Municipality.

Chapter 3 Neccesity of the project

The rapid pace of socio-economic development in Malaysia has brought about an increase in the generation of solid waste with increasing complexity. Solid waste collection and disposal has become a social and public health problem of great magnitude and this is evident in the numerous reports published in the mass media in the country. The Malaysian Government is firm in its policy of maintaining clean urban centres and for this purpose the National Cleanliness Campaign was launched throughout the country by the Honourable Prime Minister towards the end of 1983. However, in many areas this campaign failed to have any reasonable effect because of lack of cooperation from the public and most of all due to the inability of the Local Authorities throughout the country to sustain the campaign.

Under the Local Government Act 1976, Local Authorities are given responsibility of collecting and disposing solid waste in urban areas. However, almost all Local Authorities in Malaysia are facing acute difficulties in carrying out such responsibility. This difficulty mainly arises from the shortage of adequate funds, manpower problems, lack of disposal sites, absence of a good management system and the lack of expertise. Waste management has been given very low priority in the past and the problems have been conveniently left to the Local Authorities to manage in the best way possible with their limited financial and manpower resources, without any form of technical aid or financial assistance from any other sources.

To overcome the problems stated earlier and to improve the situation in a systematic manner, the Ministry of Housing and Local Government has decided to prepare and implement a National Solid Waste Management Action Plan. A vital component of the National Action Plan is the preparation of Solid Waste Management Master Plan for each Local Authority in the country. Experience has shown that this is the most effective approach, technically as well as financially, to resolve solid waste management problems and plan for the needs in the years to come. However this approach has not been practiced in Malaysia and not a single Solid Waste Management Master Plan has been prepared for any Local Authority in the country. As such it is very important to carry out the first Solid Waste Management Master Plan and Feasibility Study

project successfully in a Local Authority so that the experience gained can be used to benefit other Local Authorities. At the same time such success will gain the confidence and support of the decision makers at all levels and thus provide a boost to the National Action Plan stated above.

MPPP is the oldest Local Authority in the country whereas MPSP is the largest in term of administration area. Both have important and fast growing development centres for industrial as well as commercial developments. These developments put a heavy strain on the solid waste management systems of both the Municipalities. Therefore both Municipalities must have a good and efficient solid waste management system. Furthermore Penang Island with its beautiful beaches is a major tourist attraction and is a vital link in the national tourist industry which is being actively promoted by the Government as an important source of revenue for the country. MPPP and MPSP is seperated only by a narrow strait. Therefore it is absolutely vital to keep these two areas clean so as not to affect the efforts made in promoting the tourist industry. A seashore polluted by floating refuse will nullify the impact of the best tourist promotion drive.

To be concrete, there are various problems as follows:

Since its foundation in 1974, MPPP has carried out the final disposal through reclaiming the coast in Jelutong. The reclamation has been on makeshift basis without any proper reclamation plan.

Though at the present disposal site, solid waste are covered with earth daily, and the in-site road is paved with gravel (quarry waste) for easy access, except for this, there isn't any particular precaution for environmental protection. Adequate environmental protection measures are urgently required to prevent floating items and leachate from being washed away into the sea, and to avoid complaints from residents about offensive odor and to ward off crow gathering.

The actual disposal fee is a uniform rate of $60 per month per applicant for the use of the dumpsite. Since $60 per month is not a small burden for companies disposing of small quantities, it seems that some of them are doing illegal dumping to save money.

Moreover, in relation to storage and discharge of solid waste, collection and haulage, organization, and finance, there are some problems needing to be resolved respectively.

Chapter 4 Summary of Project

This preliminary environmental evaluation is for the master plan of the solid waste management.

However, since the final design of the project has not been ascertained at the time this report was written, it is not possible to comment specifically on the project summary here. This report has however, tried to present as much views as possible with regards to the preliminary environmental evaluation.

Chapter 5. Project Options

There are 4 potential sites selected by the site selection committee. These options of project sites are Jelutong Area, the Middle Bank, South Eastern Sea Shore and Pantai Acheh and their respective locations are shown in Fig. 5-1.

To determine the possible impacts that the project may cause on to the existing environment, evaluation on environmental acceptability of each project site is carried out. The environmental acceptability consists of factors that protect major public and environmental interests from possible hazards induced to the surroundings by the project.

The extent of impact on each evaluation items is ranked and an overall environmental acceptability on each potential site is made.

The evaluation on environmental acceptability of each project site is summerized in Table 5-1. Principally, the Jelutong Area and the Middle Bank is found to be unsuitable as final disposal sites. The South Eastern Sea Shore and Pantai Acheh, however, requires further detail considerations before it can be conclusively be determined suitable for use as final disposal sites.

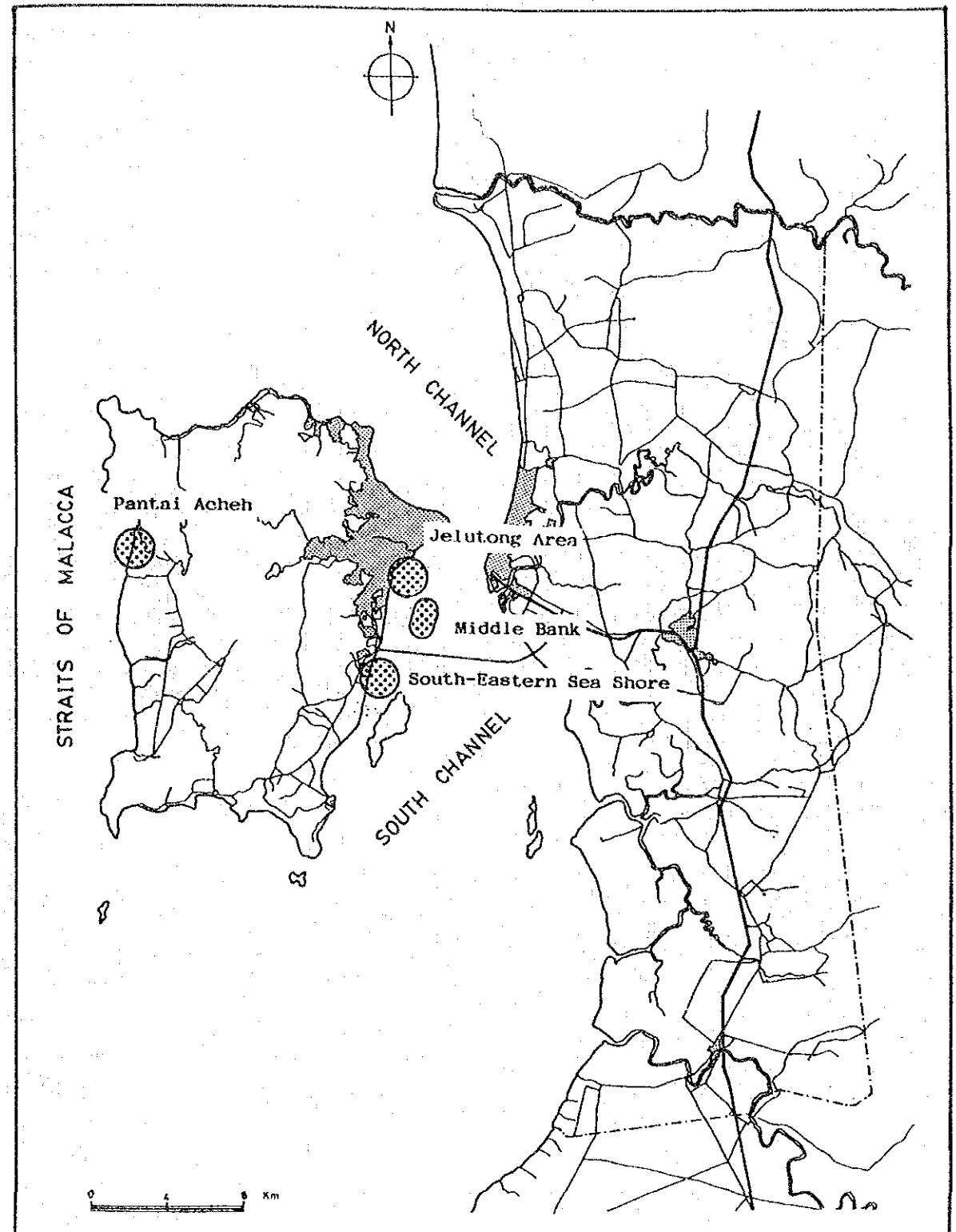


Fig. 5-1. Location of Potential Sites

Source : JICA Study Team

Table 5-1 Evaluation of Potential Site for Final Disposal On Environment Acceptability

Evaluation Items	M P P P			
	Jelutong Area	Middle Bank	South-Eastern Sea Shore	Pantai Acheh
Overall Environmental Acceptability	×	×	Δ	Δ
a. Possibility of drinking water pollution	Nil	Nil	Nil	Nil
b. Impact by surface water pollution	Low	Low	Low	Low
c. Impact of flooding	Low (If proper plan were prepared)	Nil	Low	Low
d. Impact by groundwater pollution	Low	Nil	Low	Low
e. Distance from airport and other public facilities	Adequate	Adequate	Adequate in case of strict sanitary landfill	Adequate
f. Distance from densely populated area	Adequate if proper measures were taken	Adequate	Adequate	Adequate
g. Possibility of dust, noise and odour hazards	High	Low	Low	Low
h. Compatibility with land use of adjacent area	Fair	Poor	Good	Fair
i. Slope stability	Good	Good	Good	Good
j. Impact on inshore or river fishery	Very high	High	High	Fair
k. Impact on terrestrial vegetation and wildlife	Low	Low	Low	Further study
l. Impact on Aquatic/Marine flora and fauna	Fair	High	Fair	Further study
m. Impact on natural landscape	Low	Very high	Low	Fair
n. Impact on historic places or structures	Low	Low	Low	Low
o. Impact on religious places or structures	Low	Low	Low	Low

Note:

For items a, b, c, d, g, j, k, l, m, n & o
: Very high, high, Fair, Low and Nil

For items h & i
: Good, Fair and Poor

For items e & f
: Adequate and inadequate.

Δ means that there are some considerations or further study required for the clearance of some evaluation items.

× means that there is a critical barrier which cannot be cleared or there are some unsuitable points for a candidate site at this stage

Chapter 6. The existing Environment

Although it is best to consider and study the existing environment thoroughly, it should be recognized that such detail investigation within the limited time and financial constraints is not possible. For the purpose related to solid waste management environmental impact evaluation, the existing environmental study is divided into the following components.

(1) Air quality
(2) Water and soil qualities
(3) Noise hazard
(4) Vegetation and Animals
(5) Landscape
(6) Historic and religous places

These existing conditions on the components shall be the baseline cases in measuring the extent of impacts of SWM in the project area.

6.1 Air Quality

The air quality is affected, in the case generated by SWM activities, by pollutants from dust, emission from haulage vehicles and odor. Although there may be other air quality components that may be considered, their impacts are negligible and thus can be omitted.

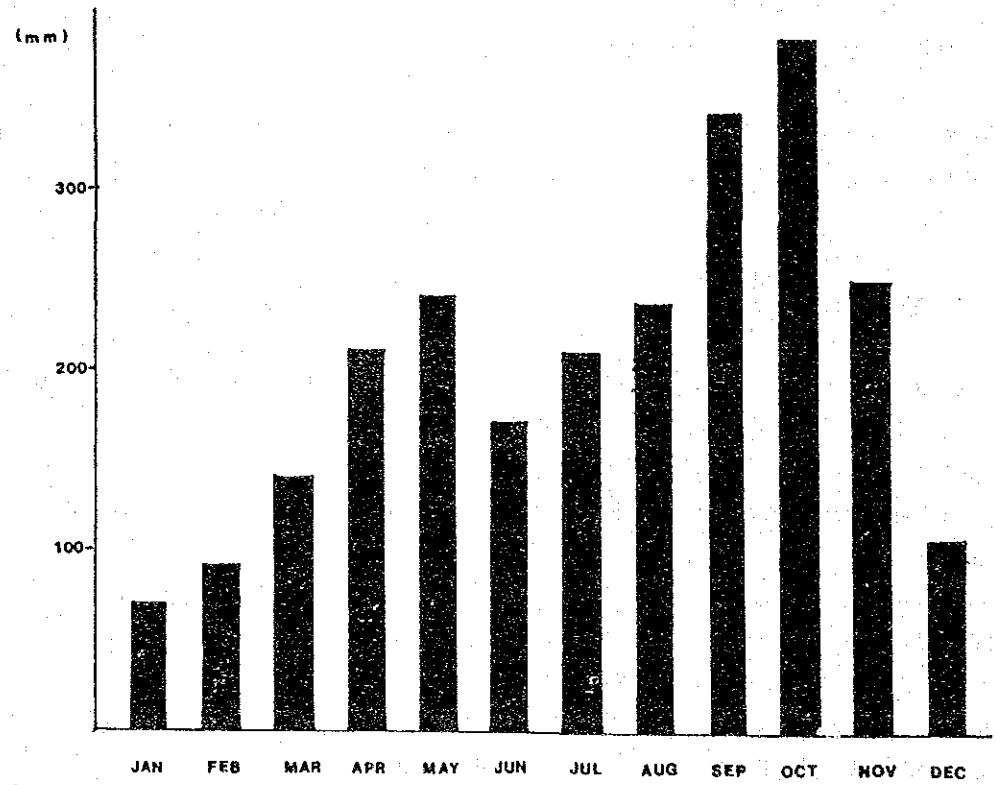
In view of these possible impacts to air quality, factors which would multiply the impacts are studied. Basically, air pollution caused by dust, exhaust concentration and odor is escalated with the presence of favourable meteorological conditions such as wind and rainfall (precipitation). Based on this understanding, the impacts to existing air quality are discussed.

(1) Rainfall

The mean annual rainfall observed over a 35 year period (between 1951 and 1985) is 2,444.7 mm. The mean monthly rainfall distribution during this 35 year period is shown in Fig. 6-1.

It is seen that in September and October, the rainfall intensity exceeds 300 mm . On the other hand, during the months of January and February, less than 100 mm of rain is precipitated. Otherwise, Pulau Pinang has been experiencing ten months which have more than 10 raindays in each month and a total of seven months which have 15 days or more of raindays.

Hence, based on the intensity and number of raindays, it can be deduced that the degree or extent of suspended paticulates and other pollutants can be mitigated naturally. Indirectly, the result of frequent raindays may help keep air pollutants within the satisfactory levels.



No. of Rainday

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951 - 1985 Mean:	7	9	12	17	18	13	15	16	20	23	19	12
Highest:	14	16	21	24	22	19	21	24	24	28	27	22

Annual Mean: 2,444.7 mm

Fig. 6-1 Mean Monthly Rainfall (1951 - 1985)

* Source: Penang International Airport (Bayan Baru)

(2) Wind

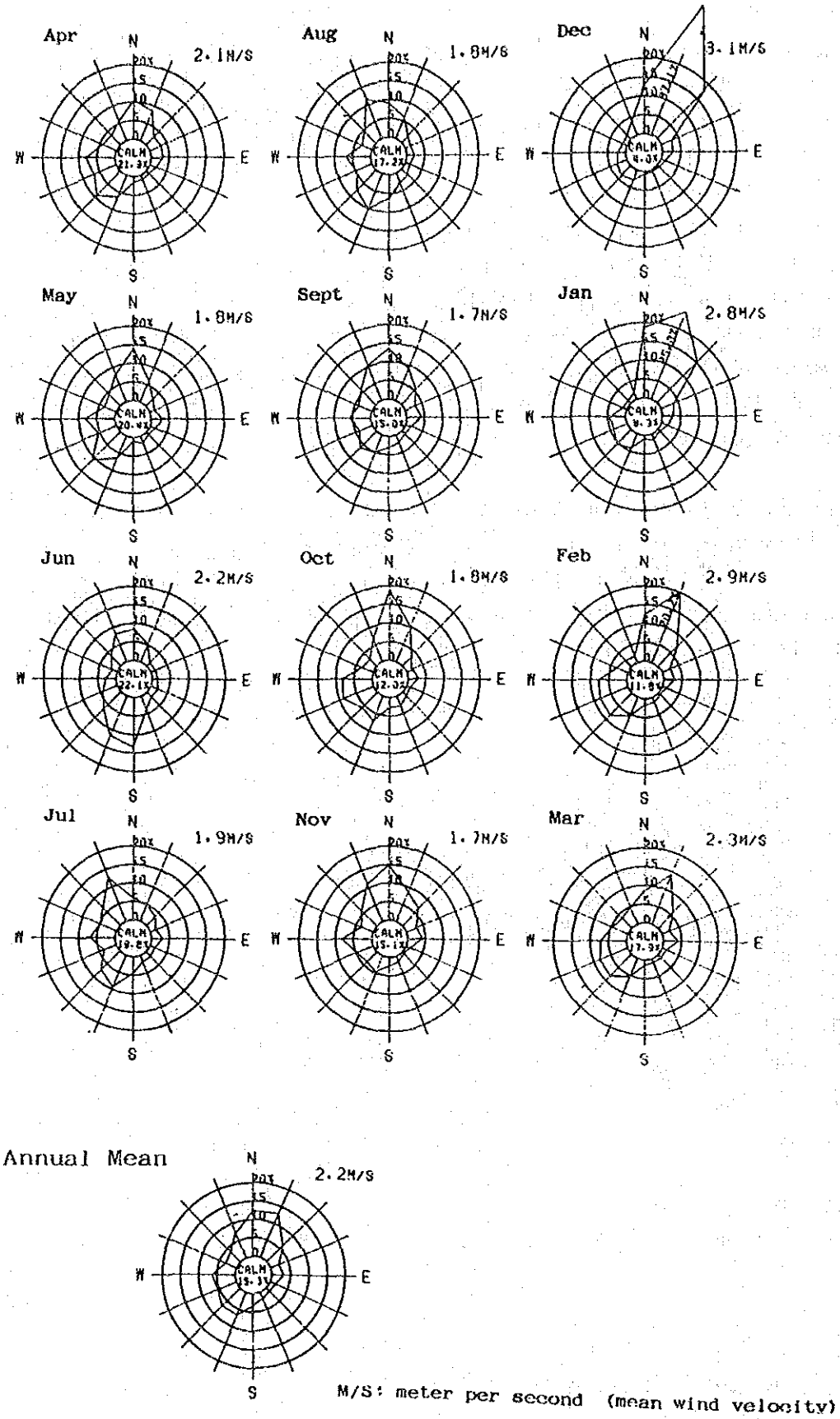
The monthly wind rose and monthly mean wind velocities in 1987 are shown in Fig. 6-2.

Between December and March, the North North-East wind dominates the study area. From April to August, the orientation changes from South-West to South South-West.

The mean wind velocities between December and March are higher than any other months. The wind velocities between December and March ranges between 3.1 m/s to 2.3 m/s.

Between September and November, although North wind is dominant, it is often complemented by the West wind.

The annual mean wind velocity is 2.2 m/s with the various dominant wind directions of North, North North-East, South-West, etc.



M/S: meter per second (mean wind velocity)

Fig. 6-2 Wind Rose and Mean Wind Velocity in Penang International Airport

(3) Dust

There has been no available data on dust or dustfall analysis for Pantai Acheh. However, to enable comparison and study of air quality, the suspended particulate matter concentration gathered over Balik Pulau is adopted and shown in Table 6-1. It can be seen that the concentrations of suspended particulate matter over Balik Pulau has well exceeded the proposed Malaysian Air Quality Standards of 0.05 mg/ m^3 over 24 hours observation for residential/ common zones.

Table 6-1 Concentrations of Suspended Particulate Matter over Balik Pulau

Site	Date	Concentration (mg/m^3)	Malaysian Air Quality Standard
Sacred Heart Secondary School, Balik Pulau.	11.4.83 12.4.83 19.4.83	0.076 0.086 0.101	0.05 mg/m^3 (24 hours)

Source: Penang Structural Plan Technical Report on Environmental Quality

For reference purposes, the data of dustfall survey carried out at Permatang Pauh, between 1st September through 30 October in 1988 is adopted. The result is shown in Table 6-2, and the location map of sampling stations is shown in Fig. 6-3.

It would be interesting to note that although open dumping has been carried out and sometimes spontaneous fires have frequently occured in the existing Permatang Pauh disposal site, volume of dust around the site does not exceed the 30 tons/$miles^2$/month, proposed Malaysian Air Quality Standards.

Table 6-2 Dustfall Analysis for Permatang Pauh Area.

(Unit:tons/miles^2/month)

No.	Station	September	October	Proposed Malaysia Air Quality Standards
1	PDC	8.3	16.8	
2	River Bank	5.4	12.7	
3	Chinese Temple	6.7	17.1	30 : Industrial Zone
4	Open Field	10.6	11.7	
5	Sewage Treatment Plant	6.6	20.1	10 : Residential Zone
6	Oxidation pond (entrance)	9.1	16.8	
7	Oxidation pond	7.8	20.6	8 : Specially protected zone
8	Telecom	4.0	10.6	
9	Malay House	8.6	12.6	
10	School	7.0	10.6	
11	Private House	6.1	11.8	

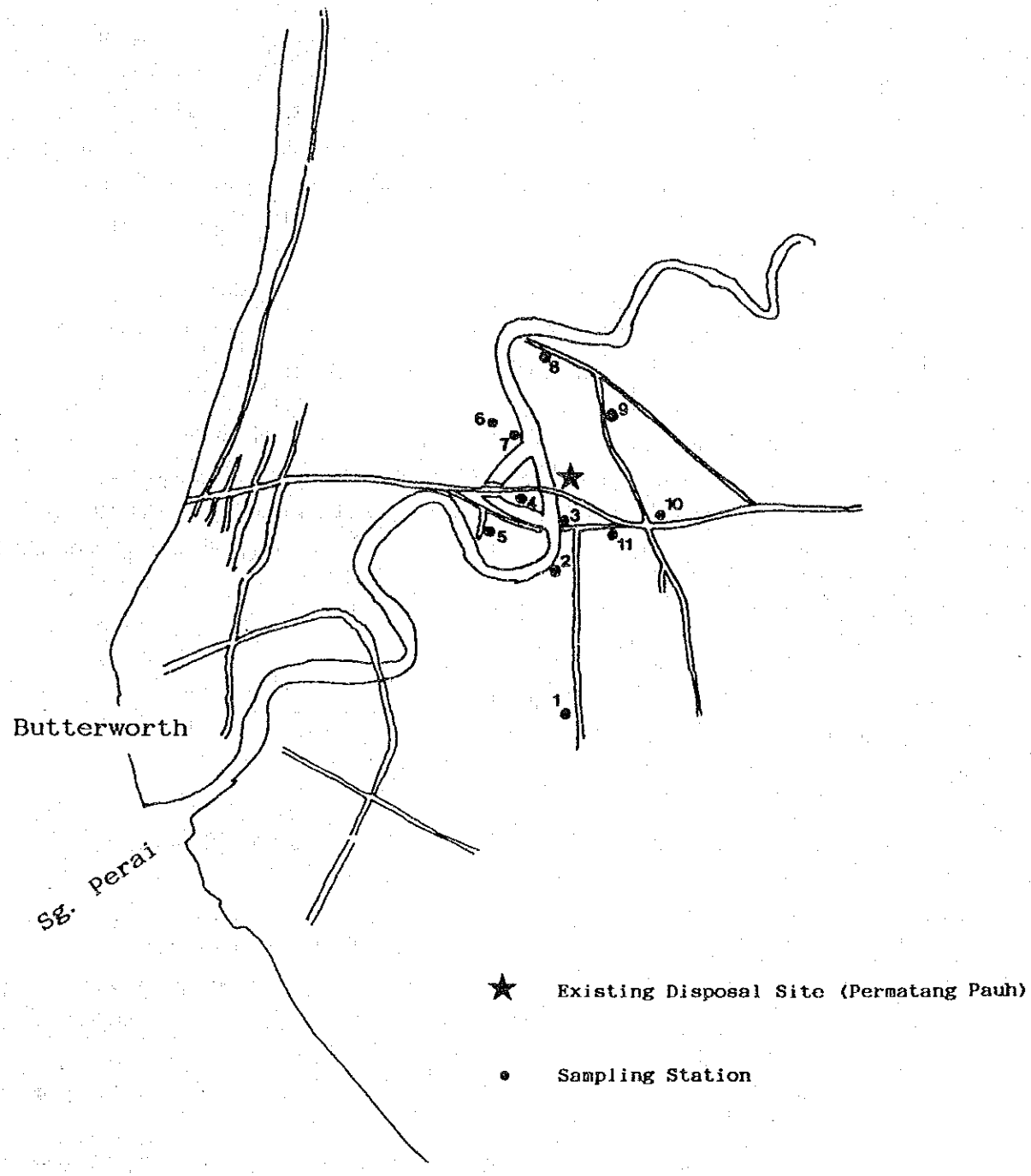


Fig. 6-3 Location Map of Dust Sampling Station

(2) Carbon Monoxide

Based on the island-wide air quality survey conducted by USM in 1981 - 1983, carbon monoxide (CO) exhaust by transportation sector is the single most important air pollutant in the State of Penang. The contribution rates of pollutants by the transportation sector are as follows: CO (99%), HC (85%), NOx (61%) and particulates (62%).

Since there are no data available on carbon monoxide (CO) in the area near Pantai Acheh, data obtained from tests carried out in Balik Pulau Town is adopted and shown in Table 6-3.

For the purpose of comparing the air quality in a local district, carbon monoxide (CO) concentrations in Penang City is shown Table 6-4. Judging from the hourly concentrations, the volume of pollutant in central urban district is twice or three times as much as that of a local district.

(3) Odour

There is no main facility that causes significant objectionable odour near the candidate site in Pantai Acheh.

Table 6-3 Concentration of CO in Balik Pulau

Date	Time	CO(ppm)	Proposed Malaysian Air Quality Standard
12.4.83	7 - 8	3.5	
	8 - 9	2.9	24 hrs. 3.00 ppm
	9 - 10	2.5	
	10 - 11	4.1	8 hrs. 9.00 ppm
	11 - 12	3.6	
	12 - 13	3.4	1 hr. 35.00 ppm
	13 - 14	3.0	
	14 - 15	3.0	
	15 - 16	3.5	
	16 - 17	3.3	
	17 - 18	2.7	

Table 6-4. PENANG CITY: CARBON MONOXIDE CONCENTRATIONS

Site	Sampling Time (h)	Mean CO (ppm)	Max hourly CO (ppm)	Remark
1. Kerbside				
Lebuh Pantai	10	4.5	9.3	
	5	2.9	6.5	
	9	5.5	7.9	
Jalan Sultan Ahmad Shah	6	5.7	11.0	
Jalan Mesjid Negeri	9	5.8	7.1	
	9	5.9	7.7	
	11	4.8	7.0	
Jalan Jelutong	11	5.8	7.5	
	11	6.1	12.4	
	5	5.9	9.6	
	6	6.0	8.7	
Jalan Brick Kiln	4	6.8	7.5	
	10	7.1	10.6	
Lebuh Carnavon	11	4.4	6.3	
Lebuh Chulia	11	4.2	5.8	
Jalan Macalister	11	5.9	8.7	
Jalan Gelugor	11	8.3	12.5	
Balik Pulau Town	11	3.2	4.0	
Jalan Dato Kramat	3	5.0	7.8	
near Dato Kramat Smelting	11	3.3	8.1	
Jalan Dato Kramat/	11	9.1	18.5	*
Jalan York	10	8.4	15.3	

* : exceeds Proposed Malaysia Air Quality Standards

Site	Sampling Time (h)	Mean CO(ppm)	Max hourly CO(ppm)	Remark
Lebuh Bridge	11	9.3	11.3	*
Jalan Ayer Itam	10	5.9	13.5	
near Sek. Menengah Chung Ling	10	5.4	13.4	
2. Roundabout and Junctions				
Jalan Penang Roundabout	5	5.4	9.3	
	6	12.5	17.6	*
	5	12.1	16.7	
	5	3.8	5.7	
	4	11.6	13.3	
	4	5.1	8.5	
	8	8.6	12.0	
	8	10.4	14.2	*
	8	9.6	12.9	*
	9	10.0	13.8	*
Jalan Penang/Jalan Dato Kramat Junction	8	7.3	9.8	
	6	8.8	11.4	
	9	4.7	8.5	
Jalan Dato Kramat/ Jalan Perak Junction	9	7.5	12.0	
Jalan Penang/Jalan Burma Junction	8	6.2	7.1	
	9	9.3	13.3	*
	8	6.6	8.0	
	8	7.8	10.0	
	10	5.9	9.4	
	10	4.7	7.1	
Jalan Brick Kiln/ Jalan Jelutong Junction	10	12.8	22.6	*
	8	16.0	18.2	*

Site	Sampling Time (h)	Mean CO (ppm)	Max hourly CO (ppm)	Remark
3. Ambient				
"Japanese Garden" Taman Guan Joo Seng	6	1.4	1.9	
Polo Ground	9	2.0	3.6	
	10	1.4	2.1	
USM Campus	5	1.3	1.7	
Esplanade	11	2.2	2.6	
Dato Kramat Padang	10	1.6	2.7	
	10	2.0	5.7	
Central Hotel car park	10	3.7	4.9	
	10	2.4	2.9	

6.2 Water Quality

(1) Water Quality

The location and result of water quality analysis, which was carried out in the river and sea area near the candidate site in Pantai Acheh, is shown in Fig. 6-4, Table 6-5 and Table 6-6. The Proposed Interim National Water Quality Standards for Malaysia, which is necessary for evaluation of water quality, is shown on Table 6-7.

Though this standard is prepared for fresh water, it will be applied as means of reference in the evaluation for sea water qualities in this report.

The result of water quality survey conducted in 1982 - 1983, shows that water pollution concentrations at Station 3 in Sungai Pinang have 5 out of the 8 parameters measured which, exeed the Standards Class IV of the proposed Interim Water Quality Standards. The 5 parameters are listed below:

Parameter	Water Quality	Standards
BOD	53	12
COD	218	100
Total suspended Solids	3654	300
F. Coliform	3.8×10^5	5.0×10^3
Total coliform	4.9×10^5	5.0×10^4

Water quality of Station 1 in Pantai Acheh, Station 2 in the sea near the mouth of Sungai Pinang, Station 4 in Bagan Air Itam and Station 5 in Pulau Betong, is below the standard set in Class IV. The water quality survey done between 1987 and 1988, shows one datum of which the BOD is obtained. There has been no COD analysed.

Table 6-6, shows that almost all parameter indices are below the Class IV standards, except some indeces from Station 1 and Station 2.

Judging from the DO and Fecal Coliform indices, it can be deduced that the water pollution has gradually increased since 1983.

(2) Soil

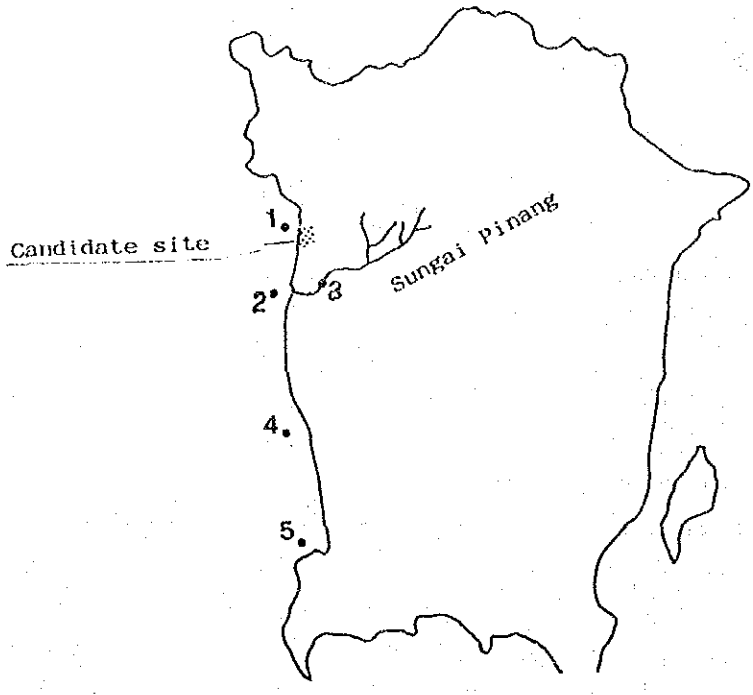
Soil investigation works had already been out in the candidate site at Pantai Acheh, however details of the investigation yet to be completed.

Since the candidate site is similiar topographically to the areas South of its boundaries, it may be possible that the candidate site has the following geological properties. Visual examination of the soil samples indicates a layer of soft dark silty clay down to 10 feet thick.

Examination and laboratory testing of the soil samples indicate that the soil is characterised by a low bulk density and low cohesive strength at high moisture content.

In-situ tests of the soil samples indicate very low permeability capable of retaining water and reducing seepage. Although the average shear strength of the soil is low, the nature of the existing soil is such as that it will be more stabilized and improved after construction with increasing compaction of soil and decreasing of the moisture content.

From the engineering point of view, the soil is suitable for bunds construction.



ST1: Pantai Acheh
ST2: Sungai Pinang (Sea)
ST3: Sungai Pinang (River)
ST4: Bagan Air Itam
ST5: Pulau Betong

Fig. 6-4 Water Sampling Stations near Pantai Acheh

Table 6-5 Results of Water Quality Analysis from 5 Stations near Pantai Acheh

PARAMETERS (UNITS) \ ST.		1	2	3	4	5
Ammoniacal Nitrogen	mg/L	0.27	0.20	1.08	0.30	0.08
BOD	mg/L	2	2	53	1	1
COD	mg/L	34	77	218	25	35
DO	mg/L	5.7	5.5	5.3	5.7	5.9
pH		7.7	7.5	7.0	7.3	7.7
Colour	TCU	-	-	-	-	-
Elect. Cond.	umhos/cm	-	-	-	-	-
Floatables		-	-	-	-	-
Odour		-	-	-	-	-
Salinity	o/oo	-	-	-	-	-
Taste						
Total Diss. Solid	mg/L	-	-	-	-	-
Total Susp. Solid	mg/L	239	216	3654	370	195
Temperature	°C	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-
F. Colif.	counts/ 100mL	2.1×10^{3}	2.9×10^{4}	3.8×10^{5}	7.1×10^{3}	4.8×10
Tot. Colif.	counts/ 100mL	-	-	4.9×10^{5}	-	-

Aug. 1982 ~ Jan. 1983

ST1: Pantai Acheh
ST2: Sungai Pinang (Sea)
ST3: Sungai Pinang (River)
ST4: Bagan Air Itam
ST5: Pulau Betong

Table 6-6 Results of Water Quality Analysis from Station 1 & 2

PARAMETERS	Date	5 Feb 87		17 Jun 87		24 Sept 87		17 Nov 87		9 Feb 88		9 Mar 88		6 Jun 88		21 Sept 88	
	ST. / (units)	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Ammonical Nitrogen	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BOD	mg/L	-	-	-	-	-	-	-	-	-	-	7.5	-	-	-	-	-
COD	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DO	mg/L	5.2	3.2	4.4	3.5	3.8	4.5	3.8	4.0	-	4.6	-	4.0	-	4.0	-	-
pH		7.5	7.6	6.34	5.97	6.01	7.36	7.37	8.07	-	7.23	-	6.3	-	7.12	-	-
Colour	TCU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Elect. Cond.	umhos/cm	34000	18000	29000	9000	6000	1400	1500	180	-	1000	-	900	-	4000	-	150
Floatables		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Odour		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Salinity	‰	20	11	16	5	4	1	1	0	-	1	-	0	-	2	-	1
Taste		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Diss. Solid	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Susp. Solids	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Temperature	℃	36	34	31	29	32	30	30	28	-	27	-	30	-	25	-	30
Turbidity	NTU	88	>90	98	52	25	36	49	32	-	72	-	68	-	81	-	51
F. Colif.	counts/ 100mL	>1.8 $x10^4$	>1.8 $x10^4$	> 1.8 $x10^4$	1.6 $x10^4$	>3.0 $x10^3$	>3.0 $x10^3$	5.2 x10	>3.0 $x10^3$	-	>3.0 $x10^3$	>3.0 $x10^4$	>3.0 $x10^3$	>3.0 $x10^3$	8.0 $x10^2$	-	2.2 $x10^2$
Tot. Colif.	counts/	1.2 $x10^4$	>1.8 $x10^4$	1.8 $x10^4$	>1.8 $x10^4$	1.8 $x10^4$	1.6 $x10^4$	9.0 $x10^3$	>1.8 $x10^4$	-	1.6 $x10^4$	>1.8 $x10^4$	>1.8 $x10^4$	>1.8 $x10^4$	>1.8 $x10^4$	-	8.0 $x10^2$

PH: measurement on the site

ST.1; Sea of Pantai Acheh
ST.2; Sea near mouth of Sungai Pinang

Table 6-7 PROPOSED INTERIM NATIONAL WATER QUALITY STANDARDS FOR MALAYSIA

PARAMETERS	(units)	CLASSES					
		I	IIA	IIB	III	IV	V
Ammoniacal Nitrogen	mg/L	0.1	0.3	0.3	0.9	2.7	>2.7
BOD	mg/L	1	3	3	6	12	>12
COD	mg/L	10	25	25	50	100	>100
DO	mg/L	7	5-7	5-7	3-5	<3	<1
pH		6.5-8.5	6-9	6-9	5-9	5-9	-
Colour	TCU	15	150	150	-	-	-
Elect. Cond.*	µmhos/cm	1000	1000	-	-	6000	-
Floatables		N	N	N	-	-	-
Odour		N	N	N	-	-	-
Salinity*	°/oo	0.5	1	-	-	2	-
Taste		N	N	N	-	-	-
Total Diss. Solid*	mg/L	500	1000	-	-	4000	-
Total Susp. Solids	mg/L	25	50	50	150	300	>300
Temperature	°C	-	Normal ±2	-	Normal ±2	-	-
Turbidity	NTU	5	50	50	-	-	-
F. Colif.**	counts/ 100mL	10	100	400	5000 (20000)[a]	5000 (20000)[a]	
Tot. Colif.	counts/ 100mL	100	5000	5000	50000	50000	>50000

N = No visible floatable materials/debris,
or No objectionable odour,
or No objectionable taste.

* = Related parameters, only one recommended for use

** = Geometric mean

a = Maximum not to be exceeded

CLASS	USES
I	Conservation of natural environment Water supply I - practically no treatment necessary (except by disinfection or boiling only) Fishery I - very sensitive aquatic species
IIA	Water supply II - conventional treatment required Fishery II - sensitive aquatic species
IIB	Recreational use with body contact
III	Water supply III - extensive treatment required Fishery III - common, of economic value, and tolerant species Livestock drinking
IV	Irrigation
V	None of the above

6.3 Noise Hazards

Since there has been no available data on noise for Pantai Acheh at the time this report was written, the data obtained over Balik Pulau is adopted as reference in this study.

There exists very close relationship between the traffic volume and noise level. For this reason, the traffic volume and traffic noise are discussed in the subsequent section.

(1) Traffic Volume

The main source of noise pollution in residential areas comes from vehicles. The traffic volume of cars in Balik Pulau is shown in Table 6-8. Also shown is the traffic volume of vehicles in the main streets of Georgetown surveyed during the same period as those carried out for Balik Pulau.

Comparison of the two tables indicates that the traffic volume in Balik Pulau is relatively smaller than those found in streets of Georgetown. The range of difference is between 8% - 15%.

From Table 6-10, it would be interesting to note that there has been an average yearly increase of 5% in traffic volume in the surveyed streets of Georgetown.

Thus, based on the assumption that the average increase in traffic volume is 5% per year, the number of cars over 11 hour-observation in Balik Pulau would be about 2300 cars in 1988. If the number of motorcycles are assumed equal to the number of cars, the total volume of vehicles would be about 4,600 vehicles/11 hours for Balik Pulau.

It is however necessary to conduct traffic count survey to determine the accuracy of the estimation, over the roads in Pantai Acheh.

Table 6-8 Traffic Count Survey in Balik Pulau

Time	Traffic Count (per hour)
0700 - 0800	110
0800 - 0900	142
0900 - 1000	175
1000 - 1100	167
1100 - 1200	208
1200 - 1300	180
1300 - 1400	141
1400 - 1500	157
1500 - 1600	141
1600 - 1700	174
1700 - 1800	166
Total (11 hrs.)	1,761

4 Dec. 1983 Only cars were counted

Table 6-9 Traffic Count at main streets in Georgetown

No	Site	Traffic Count (11 hrs.)
1	Jalan Jelutong near Shell Station	14,010
2	Jalan Mesjid Negeri opposite Sekolah Menengah Convent Green Lane	20,071
3	Jalan Dato Kramat/Jalan York	15,860
4	Lebuh Bridge	11,883
5	Lebuh Carnavon	13,496
6	Jalan Macalister	11,928
7	Jalan Gelugor	22,562

1982 ~ 1983

Table 6-10 Annual Traffic Volume in Georgetown

(unit: cars/11 hrs.)

No	Site	① '82 ～'83	② '84 ～'85	② / ①
1	Jalan Sultan Ahmad Shah	9,768 (6hrs. '82)	9,622 (6hrs. '85)	0.99
2	Jalan Mesjid Negeri	20,071 ('83)	24,238 ('85)	1.21
3	Jalan Jelutong	14,010 ('82)	16,421 ('84)	1.17
4	Jalan Gelugor	22,562 ('83)	22,504 ('85)	1.00

(2) Traffic Noise

The main sources of noise pollution in Malaysia are from motor vehicles, industries, construction activities and aircrafts. Since 1981, several studies have been conducted by the Department of Environment at various important locations such as urban centres, residential areas surrounding airports to determine main sources of noise pollution and the respective noise exposure levels in these areas.

Motor vehicles were found to contribute significantly to the noise pollution problems in almost all urban centres and some residential areas. Noise levels were measured in all major city/towns in Malaysia. Table 6-11 shows noise measurements conducted in 1981 and 1982, and between 1986 in Penang. Measurements were conducted using the same procedures.

The World Health Organization (WHO) in its document entitled 'Environmental Health Criteria 12 - Noise' recommends that the community/urban daytime Leq value should not exceed 55 dBA beyond which annoyance would increase.

The results of the surveys clearly indicate that the ambient noise levels in Penang were generally higher than the WHO recommended value. The surveys also revealed that many residential quaters, schools and offices were located very close to the main roads having heavy traffic flows. As such these residents were likely to be exposed to noise levels not conducive to healthy living.

(3) Landuse

Residential areas around the candidate site and along the access roads is shown in Fig. 6-5.

The distance from the site to the nearest house is about 100 m. It should also be noted that on both sides of the access roads towards the candidate site are lined with houses.

Table 6-11 Noise Levels in Penang State

No. of Measuring Station	Average Noise Level - dBA (7 am - 7 pm)	Period
50	69.4	1981 - 1982
106	72.1	1984 - 1986

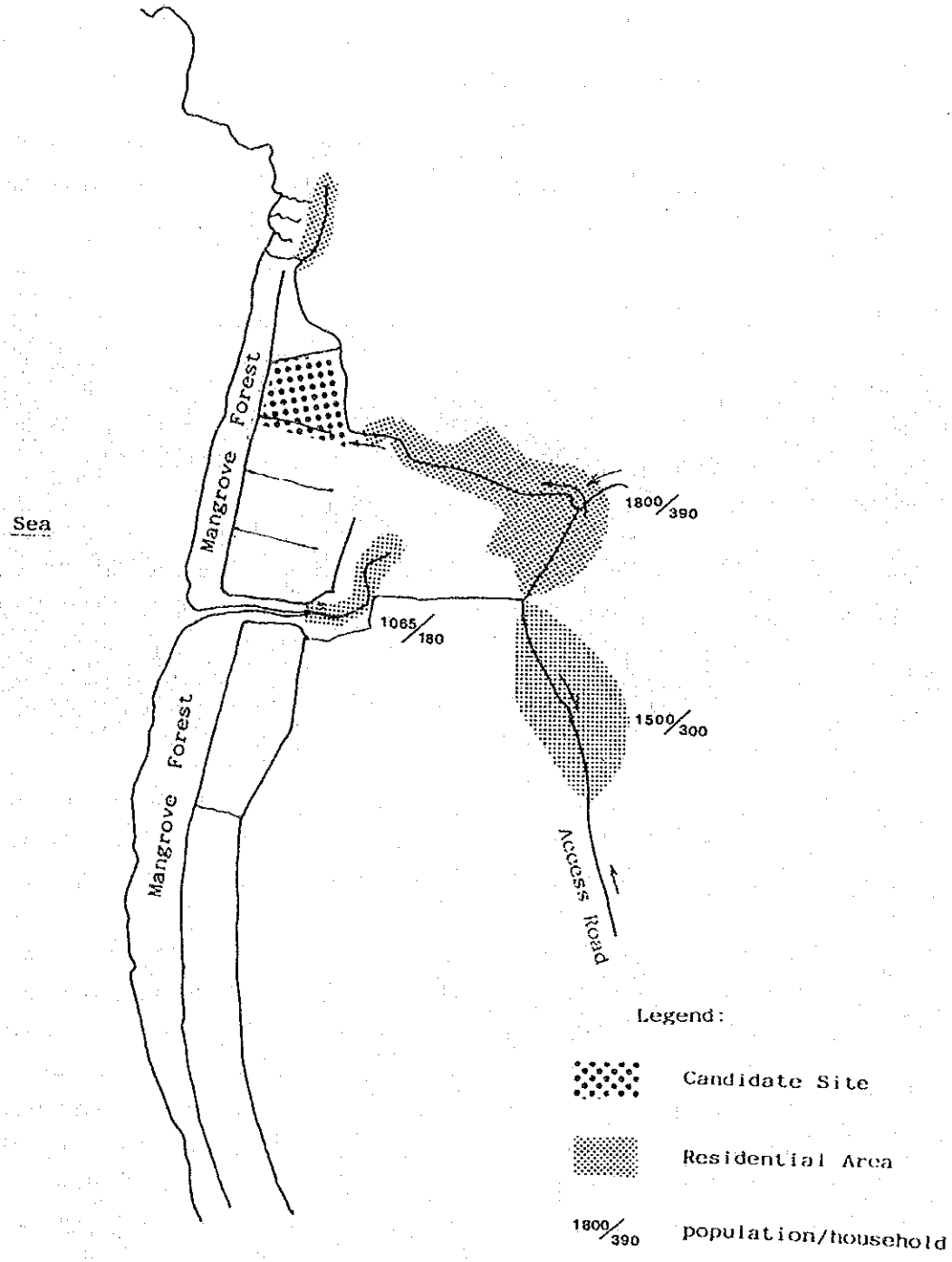


Fig. 6-5 Residential Areas near Pantai Acheh

6.4 Vegetation and Animals

6.4.1 Vegetation

(1) Ecology in the candidate site

The candidate site is covered with tall trees including mangrove as shown in the photograph. Ecology in detail is now under investigation by USM.

(2) The Value of Mangrove

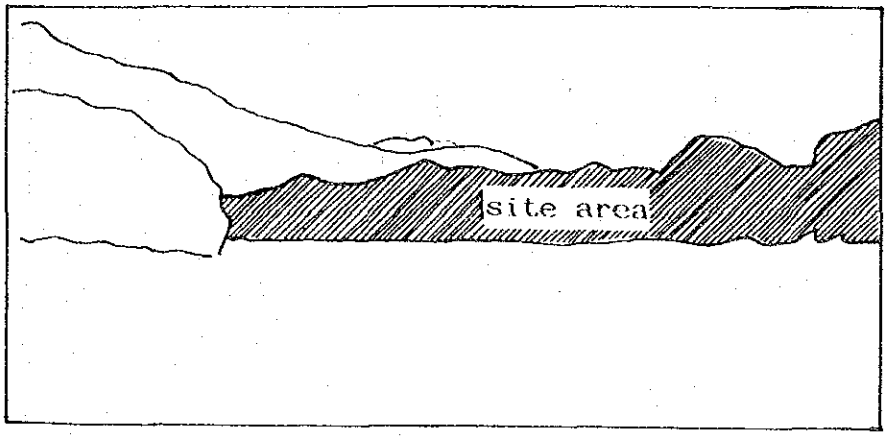
Mangrove forests in Malaysia occur mainly along the west coast of Peninsular Malaysia, at the estuaries of the Sarawak, Rejang and Trusan-Lawas rivers of Sarawak and along the east coast of Sabah (Fig. 6-6).

The areal extent of these forests in Peninsular Malaysia, Sabah and Sarawak has been estimated to be about 120,000 ha, 284,000 ha and 173,000 ha respectively about 351,000 ha occur as forest reserves. The values of the mangrove resource are many and of great importance to the socio-economy of the country.

The importance of the resource derives both from the direct products taken from the mangrove forests and from the amenities provided by the resource from within and beyond their boundaries.

Products taken from the mangrove forests are mainly wood for charcoal, poles and firewood. In terms of economic value per hectare per annum of timber, the mangrove forests have been amongst the most valuable in the country. The leaves of the nipa palm, Nipa fruticans, are used for making roof thatches and cigarette wrappers while the inflorescences are tapped for nipa sugar for conversion to alcohol. In Sabah and Sarawak, mangrove timber is an important source of wood-chips for the manufacture of rayon.

Other natural products harvested from the mangroves ecosystem include many prawn species which are caught in the mangrove waterways or in adjacent coastal waters. Edible mud crabs and



Vegetation at Pantai Aceh Disposal Site

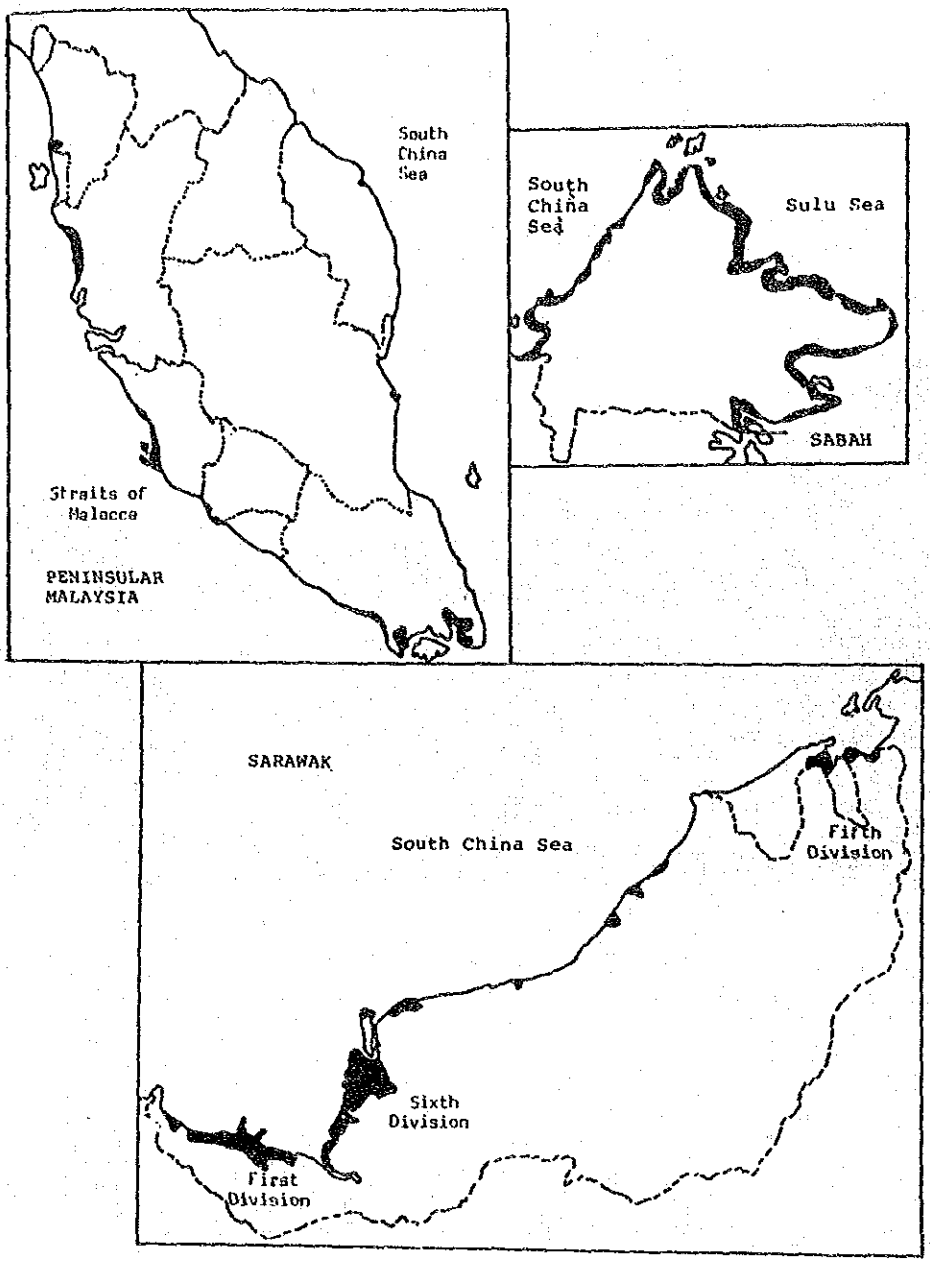


Fig. 6-6 Mangrove Forest in Malaysia

gastropods are common in the mangroves while cockles are abundant on mud flats. Together they provide an important commercial food source. Some prawn species may breed and complete their life cycles in the shallow coastal mangrove waters.

Under natural conditions, mangrove forests act as seaward barriers against coastal erosion and help to stabilise the coastline. Erosion often occurs following removal of mangroves by humans.

6.4.2 Animals

Since the candidate site is covered with tall trees, native mammals, birds and insects can nest and feed. Details of all species habitating this area is available after USM has completed their investigation at this area.

6.5 Landscape

There is no recreational zone, which has excellent landscape to be preserved around the candidate site.

6.6 Historic and Religious Places

There are no historic or religious places and structures around the candidate site.

Chapter 7. Potential Significant Impact

In considering the potential significant impacts, each environmental component is matched with every project activities. The eight environmental components considered are air quality, water quality, noise, vegetation, animals, landscape, historic and religous places and safety. These are matched against site surveying, drilling activities, construction of access roads, site clearing, earthworks as well as landfill and transportation activities. Where relevant, extent of impacts is predicted using the notation specified in Table 7-1.

Details of the table are explained in the following pages.

Table 7-1 Environmental Component Vs Project Activities

Activities		Air Quality	Water Quality	Noise	Vegetation	Animal	Landscape	Historic & Religious Places	Safety
Site Investi-gation	Site Surveying				○				
	Drilling		○						
Construction	Access Road				U	U			
	Site Clearing				U	U	○		
	Earthworks	○	D	●		U			
Operation & Mainte-nance	Landfill	●	●	●		U	○		
	Transportation	●		●					●

D Potentially significant adverse environmental impact for which a design solution has been identified.

U Adverse environmental impact that is potentially significant but about which insufficient information has been obtained to make a reliable prediction.

● Residual and significant adverse environmental impact.

○ Not significant adverse environmental impact.

(1) Site Surveying

The site when surveyed along some traverse lines will be obstructed by trees and bushes. These trees and bushes shall have to be cut to clear the survey path.

Impacts due to small survey clearing against environmental components such as terrestrial vegetation, wildlife, habitats and communities are not anticipated or negligible.

(2) Drilling

Since only two points will be bored and the area used for it is several square meters, no significant impact against the surroundings is foreseen from this work.

(3) Access road

A new access road to the site is proposed and it will be about 200 m in length from the existing road to the site. Now the area along the access road is covered with trees and bushes. When the trees are cut down for construction of the road, impacts on environmental components should be studied and this shall include terrestrial vegetation, wildlife habitats and communities.

There is no necessity to study impact against human environment because the proposed access road is away from human dwellings.

(4) Site Clearing

Before earthworks, in the site clearing, trees and bushes will be cut down and cleared throughout the site. Ecology of the site should be studied. Activities for site clearing are screened by the buffer zone.

(5) Earthworks

After reconstruction of the bund around the site, land within the bund will be subjected to earthworks. The earthworks may cause outflow of muddy water during rainy season, dispersion of dust during dry season and increase in noise level. Noise hazard on to

the wildlife in the mangrove forest, along the 120 m wide area surrounding the existing bund should be studied.

In the case of muddy water on rainy days, a settlingbasin to collect all such flow may be introduced within the bund. After the mud has settled, the clear water may be discharged, thus minimizing its impact to a negligible amount.

Dispersion of dust during construction will be filtered by the 50 m width green belt between the site and houses.

Noise from vehicles during construction may cause some impact against human environment and on to the wildlife in the mangrove forest. Some species of birds were seen habitating in the mangrove forest during reconnaissance survey. Further study should be executed in determining the possible extent of impact on these wildlife.

It is also important not to pile up sand in the mangrove forest and not to injure the mangrove trees during construction. However, since work will be done within the bunded area, there is no possibility of equipment injuring the mangrove trees outside the area.

(6) Landfill

Since leachate from final disposal site is gathered and pumped up back to the site, it will not be discharges directly out of the site.

However, some leachate will permeate into the ground, and only some will be purified after passing through layers of sand and finally flow out into the sea. Therefore, there may be some impact against the ground water due to this.

Odour will be generated during landfill work, but it can be reduced by completely covering the waste with soil. Spontaneous combustion of waste would give off smoke and it is undesirable to the environmet. However, it can be controlled by habitual covering it with soil and timely sprinkling with water. Water trucks shall have to be prepared for sprinkling.

Suspended particulate matter and dust generated from solid waste and residue can also be mitigated by regular timely sprinkling of water and adequate covering soil.

There is a possibility of a tourist resort area development to north of the site and a traditional village center to the south of the site. Therefore, this disposal site will reserve about 50 wide green belts as buffer zones on the north and south areas respectively, and impact against landscape will be abated.

Noise from landfill equipment may give some impact against wildlife in the adjacent mangrove forest. However, to determine its extent, further detailed study is required.

Gas generation in a landfill area due to decomposition of waste cannot be eliminated, but impact can be mitigated because this project will adopt gas dispersion measures in the site.

(7) Transportation

SWM vehicles cause impact to three environmental components of air quality, noise and physical safety.

The number of the vehicles is about 155 vehicles/day, and this corresponds at most 5% - 6% of the general traffic volume. Therefore, volume of exhausted pollutant from the vehicles is less than 5% - 6% of pollutant from general traffic volume.

The traffic noise and traffic safety will not always be in direct proportion to the increase of traffic volume. Noise emission from the SWM vehicles is not very high and traffic safety may not necessarily be decreased.

Chapter 8. Mitigation Measure

8.1 Construction Phase

Before the construction of sanitary landfill begins, bunds which contain the sanitary landfill site and settling basin will be constructed first. This step is to ensure that the muddy flow within the bund is collected and settled before discharging the clear water out of the bunded area. To further eradicate possibility of muddy flow discharge, the discharge is again collected and settled into another basin outside the bund before being discharged finally into the sea.

8.2 Operational Phase

Although sanitary landfill could be the better way of disposal, it is undeniable that nobody would want to have it in front or at the backyard of their houses. Thus, based on this nature of understanding that the buffer zone of green belt is prepared to isolate the site from common view of the public. Its other purposes are to blend the existence of the disposal site with the surroundings and mitigate odor dispersion from the disposal site to the surrounding areas.

The landfill operation area will be divided into several smaller work areas by bunds within the site. The division into smaller operation area would help to reduce the volume of leachate to be treated because of smaller surface permeability area for leachate permeation.

After the first landfill sub-division is completed, a final layer of earth will be applied over the top. In addition to this, the area would be sloped and drains will be provided. Hence, with the existence of these measures, there would be no surface run-off permeating into the ground. All surface run off would be drained directly out of the site as surface water. For the next new

working face, leachate would be abated in the same manner explained previously and the completed sub-division of landfill would be furnished with drains and cover material.

For the remaining areas to be used in the disposal site, water run-off will be discharged directly out of the site as general surface water.

Chapter 9. Residual Impact

The activities which may produce residual impacts on the environmental components are marked ❁ and U in Table 7-1.

The following activities would have residual impact on the environmental components.

Project Activities	Residual Impact
Construction of access roads	Vegetation and Animals
Site Clearing	Vegetation and Animals
Earth works	Noise against human life Noise against animals
Landfill activities	Dust and Odor Water Pollution Noise against human life Noise against animals
Transportation activities	Air pollution due to vehicle exhausts. Noise from haulage vehicles Safety on public roads.

II. Kuala Muda and Pulau Burong Disposal Site

Chapter 1 Title of Project

The title of the project is Kuala Muda & Pulau Burong Disposal Site Development Project.

Chapter 2 Project Initiator

The initiator of the project is Seberang Perai Municipality.

Chapter 3 Neccesity of the project

The rapid pace of socio-economic development in Malaysia has brought about an increase in the generation of solid waste with increasing complexity. Solid waste collection and disposal has become a social and public health problem of great magnitude and this is Evident in the numerous reports published in the mass media in the country. The Malaysian Government is firm in its policy of maintaining clean urban centres and for this purpose the National Cleanliness Campaign was launched throughout the country by the Honourable Prime Minister towards the end of 1983. However, in many areas this campaign failed to have any reasonable effect because of lack of cooperation from the public and most of all due to the inability of the Local Authorities throughout the country to sustain the campaign.

Under the Local Government Act 1976, Local Authorities are given responsibility of collecting and disposing solid waste in urban areas. However, almost all Local Authorities in Malaysia are facing acute difficulties in carrying out such responsibility. This difficulty mainly arises from the shortage of adequate funds, manpower problems, lack of disposal sites, absence of a good management system and the lack of expertise. Waste management has been given very low priority in the past and the problems have been conveniently left to the Local Authorities to manage in the best way possible with their limited financial and manpower resources, without any form of technical aid or financial assistance from any other sources.

To overcome the problems stated earlier and to improve the situation in a systematic manner, the Ministry of Housing and Local Government has decided to prepare and implement a National Solid Waste Management Action Plan. A vital component of the National Action Plan is the preparation of Solid Waste Management Master Plan for each Local Authority in the country. Experience has shown that this is the most effective approach, technically as well as financially, to resolve solid waste management problems and plan for the needs in the years to come. However this approach has not been practiced in Malaysia and not a single Solid Waste Management Master Plan has been prepared for any Local Authority in the country. As such it is very important to carry out the first Solid Waste Management Master Plan, and Feasibility Study

project successfully in a Local Authority so that the experience gained can be used to benefit other Local Authorities. At the same time such success will gain the confidence and support of the decision makers at all levels and thus provide a boost to the National Action Plan stated above.

MPPP is the oldest Local Authority in the country whereas MPSP is the largest in term of administration area. Both have important and fast growing development centres for industrial as well as commercial developments. These developments put a heavy strain on the solid waste management systems of both the Municipalities. Therefore both Municipalities must have a good and efficient solid waste management system. Furthermore Penang Island with its beautiful beaches is a major tourist attraction and is a vital link in the national tourist industry which is being actively promoted by the Government as an important source of revenue for the country. MPPP and MPSP is seperated only by a narrow strait. Therefore it is absolutely vital to keep these two areas clean so as not to affect the efforts made in promoting the tourist industry. A seashore polluted by floating refuse will nullify the impact of the best tourist promotion drive.

To be concrete, there are various problems as follows:

At the existing disposal sites, no environmental protection measures are provided. There are dispersion of solid waste, river contamination by leachate and fire due to spontaneous ignition at many places in the disposal sites. The environmental pollution in and around Permatang Pauh disposal site is sometimes pointed out in the newspapers.

There is no vacant land in Permatang Pauh disposal site where 95% or more solid waste produced in MPSP can be disposed of. At present, solid waste is piled up at the site. And, waste is being reduced by open burning. New disposal sites are required and needed to be solved urgently.

Illegal dumping are seen in many places. In order to reduce illegal dumping, it is necessary to enforce anti-litter laws strictly.

Moreover, in relation to storage and discharge of solid waste, collection and haulage, organization, and finance, there are some problems requiring to be resolved respectively.

Chapter 4 Summary of Project

This preliminary environmental evaluation is for the master plan of the solid waste management.

However, since the final design of the project has not been ascertained at the time this report was written, it is not possible to comment specifically on the project summary here. This report has however, tried to present as much views as possible with regards to the preliminary environmental evaluation.

Chapter 5. Project Options

There are 9 potential sites selected by the site selection committee. These options of project sites are Kuala Muda, Kampong Selamat, Mak Mandin, Prai Barrage, Prai Industrial Complex, Bukit Minyak, Gajah Mati, Pulau Burong and Bukit Tambun and their respective locations are shown in Fig. 5-1.

To determine the possible impacts that the project may cause on to the existing environment, evaluation on environmental acceptability of each project site is carried out. The environmental acceptability consists of factors that protect major public and environmental interests from possible hazards induced to the surroundings by the project.

The extent of impact on each evaluation item is ranked and an overall environmental acceptability on each potential site is made.

The evaluation on environmental acceptability of each project site is summerized in Table 5-1. Principally, 3 sites are found to be unsuitable as final disposal sites. 6 sites, however, require further detail considerations before it can be conclusively be determined suitable for use as final disposal sites.

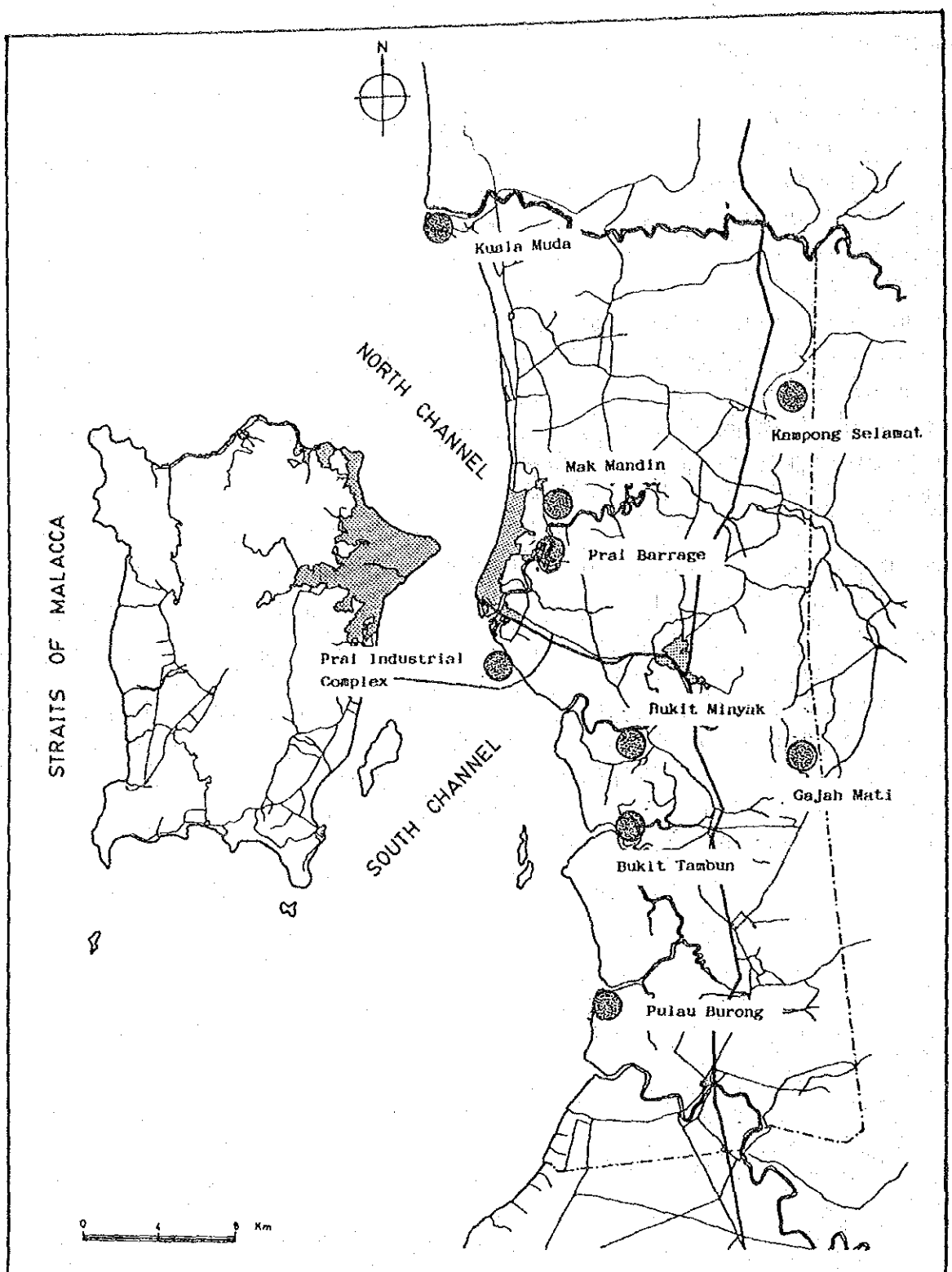


Fig. 5-1 Location of Potential Sites

Source JICA Study Team

Table 5-1 Evaluation of Potential Site for Final Disposal on Environmental Acceptability

Evaluation Items	Kuala Muda	Kampong Selamat	Mak Mandin	Prai Barrage	Prai Industrial Complex	Bukit Minyak	Gajah Mati	Pulau Burong	Bukit Tambun
Overall Environmental Acceptability	△	×	△	×	×	△	△	△	△
a. Possibility of drinking water pollution	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
b. Impact by surface water pollution	Low	High	Fair	Fair	Low	Fair	High	Low	Low
c. Impact of flooding	Low	Very high	Low	Fair	Low	Fair	Nil	Nil	Low
d. Impact by groundwater pollution	Low	High	Fair	Fair	Low	Fair	High	Low	Low
e. Distance from airport and other public facilities	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate
f. Distance from densely populated area	Adequate if buffer zone were prepared	Adequate	Adequate if buffer zone were prepared	Adequate if buffer zone were prepared	Adequate	Adequate	Adequate	Adequate	Adequate
g. Possibility of dust, noise and odour hazards	Fair	Low	Fair	Fair	Low	Fair	Nil	Nil	Nil
h. Compatibility with land use of adjacent area	Fair	Good	Fair	Fair	Good	Fair	Fair	Good	Good
i. Slope stability	Good	Good	Good	Good	Good	Good	Further study	Good	Good
j. Impact on inshore or river fishery	Fair	Low	Fair	High	Fair	Low	Low	Further study	Further study
k. Impact on terrestrial vegetation and wildlife	Further study	Low	Low	High	High	Fair	Fair	Further study	Further study
l. Impact on Aquatic/Marine flora and fauna	Further study	Low	Low	High	High	Low	Nil	Further study	Low
m. Impact on natural landscape	Fair	Low	Low	High	Very high	Low	Low	Low	Low
n. Impact on historic places or structures	Low	Low	Low	Low	Low	Low	Low	Low	Low
o. Impact on religious places or structures	Low	Low	Low	Low	Low	Low	Low	Low	Low

Note:

For items a, b, c, d, g, j, k, l, m, n & o
: Very high, High, Fair, Low and Nil.

For items h & i
: Good, Fair and Poor.

For items e & f
: Adequate and inadequate.

△ means that there are some considerations or further study required for the clearance of some evaluation items.

× means that there is a critical barrier which cannot be cleared or there are some unsuitable points for a candidate site at this stage.

Chapter 6. The Existing Environment

Although it is best to consider and study the existing environment thoroughly, it should be recognized that such detail investigation within the limited time and financial constraints is not possible. For the purpose related to solid waste management environmental impact evaluation, the existing environmental study is divided into the following components.

(1) Air quality
(2) Water qualities
(3) Noise hazard
(4) Vegetation and Animals
(5) Landscape
(6) Historic and religous places

These existing conditions on the components shall be the baseline cases in measuring the extent of impacts of SWM in the project area.

6.1 Air Quality

The air quality is affected, in the case generated by SWM activities, by pollutants from dust, emission from haulage vehicles and odor. Although there may be other air quality components that may be considered, their impacts are negligible and thus can be omitted.

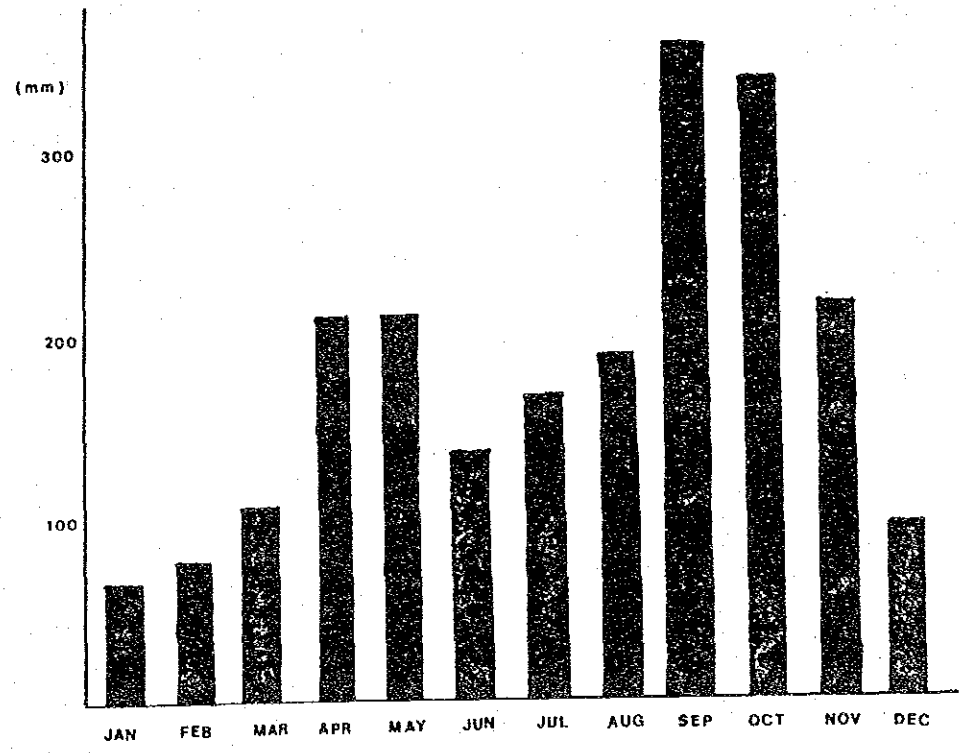
In view of these possible impact to air quality, factors which would multiply the impacts are studied. Basically, air pollution caused by dust, exhaust concentration and odor are escalated with the presence of favourable meteorological conditions such as wind and rainfall (precipitation). Based on this understanding, the impacts to existing air quality are discussed.

(1) Rainfall

The mean annual rainfall observed over a 16 year period (between 1969 and 1985) is 2,158.1 mm. The mean monthly rainfall distribution during this 16 year period is shown in Fig. 6-1.

It is seen that in September and October, the rainfall intensity exceeds 300 mm . On the other hand, during the months of January, February and December less than 100 mm of rain is precipitated. Otherwise, Seberang Perai has been experiencing ten months which have more than 10 raindays in each month and a total of six months which have 15 days or more of raindays.

Hence, based on the intensity and number of raindays, it can be deduced that the degree or extent of suspended paticulates and other pollutants can be mitigated naturally. Indirectly, the result of frequent raindays may help keep air pollutants within the satisfactory levels.



No. of Rainday												
1969 - 1985 Mean:	6	9	11	16	18	13	14	15	21	22	19	12
Highest:	15	17	18	22	22	18	19	23	24	27	28	21

Annual Mean: 2,158.1 mm

Fig. 6-1 Mean Monthly Rainfall (1969 - 1985)

* Source: Butterworth

(2) Wind

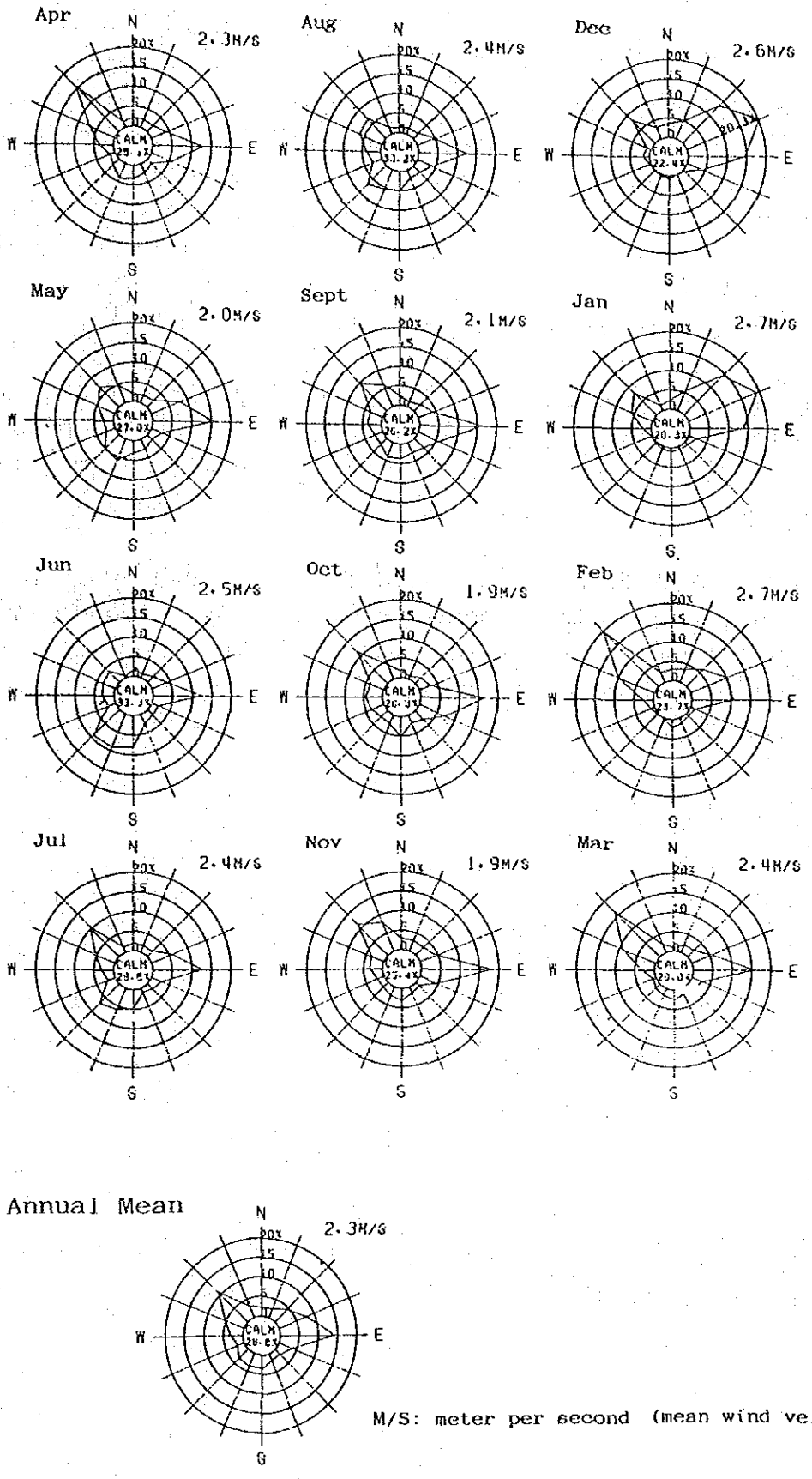
The monthly wind rose and monthly mean wind velocities in 1987 are shown in Fig. 6-2.

Between December and January, the East North-East wind dominates the study area. From February to April, the orientation changes from North-West to East.

The mean wind velocities between December and February are higher than any other months. The wind velocities between December and February ranges between 2.6 m/s to 2.7 m/s.

Between May and November, although East wind is dominant, it is often complemented by the North-West wind.

The annual mean wind velocity is 2.3 m/s with the two dominant wind directions of East and North-West.



Annual Mean

M/S: meter per second (mean wind velocity)

Fig. 6-2 Wind Rose and Mean Wind Velocity in Butterworth

(1) Dust

In Draft Laporan Teknikal of Pelan Struktur Seberang Perai, it is reported that concentrations of dust from many monitoring stations in Seberang Perai range between 25 to 1000 mg/m^2 /day.

This value can be converted into 1.9 to 76.5 tons/miles /month and it exceeds 30 tons/miles^2/month (Industrial Zone) the proposed Malaysian Air Quality Standards.

For this project, around the existing disposal site in Permatang Pauh, dustfall survey has been carried out from 1st September through 30 October in 1988. The result is shown in Table 6-1, and the location map of sampling stations is shown in Fig. 6-3.

It would be intresting to note that although open dumping has been carried out and sometimes spontaneous fire have frequently occured at the existing disposal site, volume of dust around the site does not exceed the 30 tons/miles^2/month, proposed Malaysian Air Quality Standards.

Table 6-1 Dustfall Analysis for Permatang Pauh Area

(Unit:tons/miles^2/month)

No.	Station	Setpember	October	Proposed Malaysia Air Quality Standards
1	PDC	8.3	16.8	
2	River Bank	5.4	12.7	
3	Chinese Temple	6.7	17.1	30 : Industrial Zone
4	Open Field	10.6	11.7	
5	Sewage Treatment Plant	6.6	20.1	10 : Residential Zone
6	Oxidation pond (entrance)	9.1	16.8	
7	Oxidation pond	7.8	20.6	8 : Specially protected zone
8	Telecom	4.0	10.6	
9	Malay House	8.6	12.6	
10	School	7.0	10.6	
11	Private House	6.1	11.8	

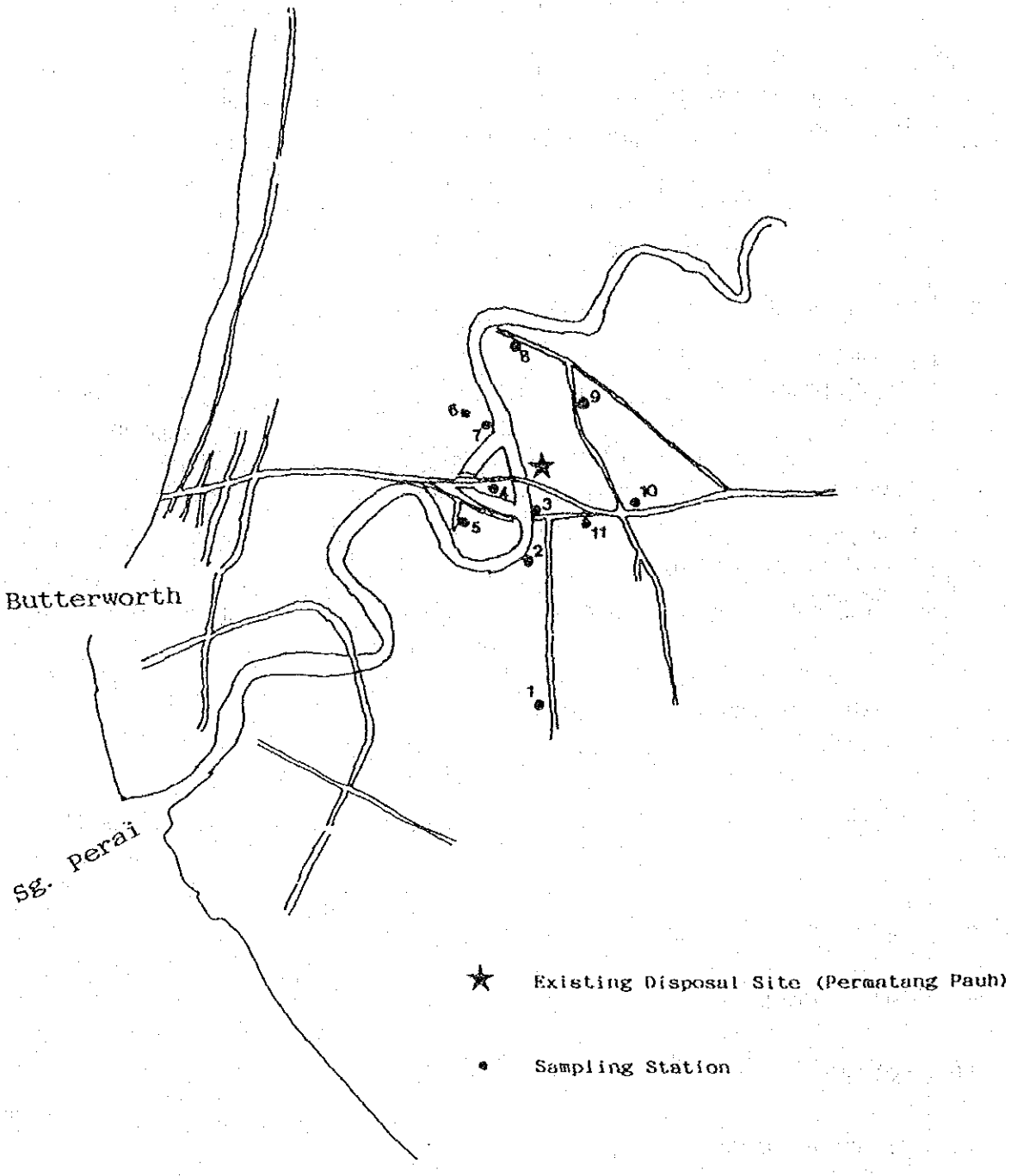


Fig. 6-3 Location Map of Dust Sampling Station

(2) Carbon Monoxide

Based on the Penang island-wide air quality survey conducted by USM in 1981 - 1983, carbon monoxide (CO) exhaust by transportation sector is the single most important air pollutant in the State of Penang. The contribution rates of pollutants by the transportation sector are as follows: CO (99%), HC (85%), NOx (61%) and particulates (62%).

Since there is no data available on carbon monoxide (CO) in the area near Kuala Muda and Pulau Burong, data obtained from tests carried out at Jalan Chain Ferry is adopted and shown in Table 6-2.
All CO concentrations are below the proposed Malaysia Air Quality Standards.

(3) Odour

There are no main facilities that cause significant objectionable odour near the candidate sites in Kuala Muda and Pulau Burong.

Table 6-2. Carbon Monoxide Concentrations at Jalan Chain Ferry, Butterworth

Time	Thu. 12 Nov. 87	Fri. 20. Nov. 87	Mon. 30 Nov. 87	Wed. 9 Dec. 87	Tue. 27 Jan. 88	Mon. 1 Feb. 88	Thu. 4 Feb. 88	Wed. 12 Feb. 88	Tue. 23 Feb. 88	Standards
7 - 8	4.83	7.00	4.43	6.16	7.30	6.05	5.98	5.16	4.41	
8 - 9	4.88	5.98	4.28	5.95	5.54	3.80	4.89	4.90	5.63	
9 - 10	3.09	4.63	5.11	3.57	2.71	1.65	3.76	2.09	1.64	8 hours 9.00 ppm
10 - 11	2.09	3.09	3.29	5.08	3.88	2.66	2.89	3.56	1.88	1 hour 35.00 ppm
11 - 12	4.43	5.00	5.35	2.00	6.39	4.20	3.10	4.23	3.06	
12 - 13	5.43	5.58	5.26	1.43	6.09	5.39	5.71	6.86	4.54	
13 - 14	8.10	4.74	5.16	1.38	6.93	5.25	6.41	9.21	5.53	
14 - 15	3.99	5.06	5.99	1.55	5.64	5.64	5.14	4.50	4.09	
15 - 16	4.11	4.18	5.16	1.51	6.04	5.30	5.18	4.30	4.18	
16 - 17	4.36	6.03	4.98	2.45	7.05	4.88	5.19	5.41	5.63	
17 - 18	5.90	7.15	5.08	6.23	8.15	5.56	5.74	5.40	7.24	
18 - 19	6.91	3.69	4.62	4.25	6.57	2.18	5.82	4.01	4.01	

Standards: Proposed Malaysian Air Quality Standards

6.2 Water Quality

(1) Water Quality

Water quality analysis works had already been carried out in the candidate site at Kuala Muda and Pulau Burong, however details of the analysis has not yet to be completed.

There is, however, no data available on water quality in the area near Pulau Burong.

The location and result of water quality analysis, which was carried out in the river and sea area near the candidate site in Kuala Muda, is shown in Table 6-3 and Table 6-4. The Proposed Interim National Water Quality Standards for Malaysia, which is necessary for evaluation of water quality, is shown on Table 6-5.

Though this standard is prepared for fresh water, it will be applied as means of reference in the evaluation for sea water qualities in this report.

The result of water quality survey shows that sea water pollution concentrations at Station 1 and 2 read their electrical conductivity at 18000 to 35500 during 16 Feb. 1987 and 8 Jun. 1987, which exceed the Standard Class IV of the proposed Interim Water Quality Standards. However, since 26 Oct. 1987, water quality has improved and almost all parameter indices are below the Class IV Standards.

Water quality in Sungai Muda is in satisfactory and good condition, judging from the BOD and DO indices.

Table 6-3 Results of Water Quality Analysis near Kuala Muda

	Date	16/Feb 87		21 Apr 87		8 Jun 87		12 Aug 87		26 Oct 87		8 Dec 87		11 Jan 88		14 Mar 88		4 May 88	
	St	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
PARAMETERS	(UNITS)																		
Ammoniacal Nitrogen	mg/L	0.24	0.49	0.05	0.03	0.10	0.02	0.16	0.13	0.20	0.12	0.08	0.07	0.15	0.15	0.43	0.03	0.14	0.24
BOD	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
COD	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DO	mg/L	4.2	4.6	5.5	5.7	4.7	4.5	3.5	3.5	4.6	5.8	6.1	5.8	4.8	4.7	5.4	5.6	5.0	4.9
PH		6.8	7.4	-	-	7.3	7.7	7.8	7.2	7.5	6.9	6.5	6.9	6.1	6.3	7.4	7.4	8.4	7.6
Colour	TCU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Elec.Cond.	umhos/cm	35500	35500	25000	25000	18000	28000	10	20	60	100	50	100	3000	4000	1500	1800	1500	800
Floatables		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Odour		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Salinity	o/oo	23	22	14.5	14	10	16	0.5	1	0	0	0	0	2	2	2	3	2	7
Taste																			
Total Diss. Solid	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Susp. Solid	mg/L	185	80.5	65	5	80	25	45	30	70	45	125	10	220	45	95	110	45	125
Temperature	C	31	30	32	32.7	31	31	29	29	29	29	27	26	28	28	30	30	28	28
Turbidity	NTU	>100	>100	14	14	58	54	80	75	>100	>100	89	76	>100	37	37	21	99	>100
F. Colif.	counts/ 100mL	$5x10^{2}$	-	$3.0x10^{3}$	-	$1.7x10^{3}$	-	$>3.0x10^{3}$	-	$1.2x10^{3}$	-	$2.2x10^{3}$	-	$8.0x10^{2}$	-	$>3.0x10^{3}$	-	$2.5x10^{2}$	-
Tot. Colif.	counts/ 100mL	$5x10^{2}$	$1.3x10^{2}$	$4.5x10^{4}$	$1.1x10^{2}$	$5.5x10^{3}$	N.D	$5.5x10^{3}$	$>3.0x10^{3}$	$1.3x10^{4}$	$2.0x10^{3}$	$3.5x10^{3}$	$7.8x10$	$3.5x10^{2}$	$5.0x10^{2}$	$2.0x10^{2}$	$>3.0x10^{3}$	$5.0x10^{2}$	$6.0x10^{2}$

ST. 1: near the sea shore
ST. 2: 500m from the sea shore

Table 6-4 Results of Water Quality Analysis in Sungai Muda

PARAMETERS	Date / (units)	11 Jan 88	25 Feb 88	7 Mar 88	18 Apr 88	23 May 88	15 Jun 88
Ammoniacal Nitrogen	mg/L	0.10	0.05	0.18	0.11	0.18	0.28
BOD	mg/L	<1	<1	1	<1	<1	<1
COD	mg/L	20	20	20	20	15	20
DO	mg/L	5.9	4.5	8.0	3.4	4.0	4.4
pH		7.1	8.2	6.4	7.1	7.9	6.5
Colour	TCU	-	-	-	-	-	-
Elect. Cond.	umhos/cm	60	50	50	40	35	90
Floatables		-	-	-	-	-	-
Odour		-	-	-	-	-	-
Salinity	‰	-	-	-	-	-	-
Taste		-	-	-	-	-	-
Total Diss. Solid	mg/L	100	105	80	275	120	130
Total Susp. Solids	mg/L	30	50	15	50	5	25
Temperature	℃	29	29	30	30	29	26
Turbidity	(NTU)	(<5)	(30)	(15)	(30)	(160)	(70)
F. Colif.	counts/ 100mL	-	-	-	-	-	-
Tot. Colif	counts/ 100mL	-	-	-	-	-	-

About 13km upstream the mouth of Sungai Muda

Table 6-5 PROPOSED INTERIM NATIONAL WATER QUALITY STANDARDS FOR MALAYSIA

PARAMETERS	(units)	CLASSES I	IIA	IIB	III	IV	V
Ammoniacal Nitrogen	mg/L	0.1	0.3	0.3	0.9	2.7	>2.7
BOD	mg/L	1	3	3	6	12	>12
COD	mg/L	10	25	25	50	100	>100
DO	mg/L	7	5-7	5-7	3-5	<3	<1
pH		6.5-8.5	6-9	6-9	5-9	5-9	-
Colour	TCU	15	150	150	-	-	-
Elect. Cond.*	µmhos/cm	1000	1000	-	-	6000	-
Floatables		N	N	N	-	-	-
Odour		N	N	N	-	-	-
Salinity*	°/oo	0.5	1	-	-	2	-
Taste		N	N	N	-	-	-
Total Diss. Solid*	mg/L	500	1000	-	-	4000	-
Total Susp. Solids	mg/L	25	50	50	150	300	>300
Temperature	°C	-	Normal ±2	-	Normal ±2	-	-
Turbidity	NTU	5	50	50	-	-	-
F. Colif.**	counts/ 100mL	10	100	400	5000 (20000)[a]	5000 (20000)[a]	
Tot. Colif.	counts/ 100mL	100	5000	5000	50000	50000	>50000

N = No visible floatable materials/debris,
or No objectionable odour,
or No objectionable taste.
* = Related parameters, only one recommended for use
** = Geometric mean
a = Maximum not to be exceeded

CLASS	USES
I	Conservation of natural environment Water supply I -- practically no treatment necessary (except by disinfection or boiling only) Fishery I - very sensitive aquatic species
IIA	Water supply II - conventional treatment required Fishery II - sensitive aquatic species
IIB	Recreational use with body contact
III	Water supply III - extensive treatment required Fishery III - common, of economic value, and tolerant species Livestock drinking
IV	Irrigation
V	None of the above

6.3 Noise Hazards

Since there has been no available data on noise for Kuala Muda and Pulau Burong at the time this report was written, the data obtained from the Pelan Struktur Seberang Perai Report is adopted as the noise condition in local districts.

There exist is very close relationship between the traffic volume and noise level. For this reason, the traffic volume and traffic noise are discussed in the subsequent section.

(1) Traffic Volume

The main source of noise pollution in residential areas comes from vehicles. The traffic volume on roads that coincide along haulage routes to the candidate site is shown in Table 6-6 and the locations in Fig. 6-4. It is predicted that in 1983 there is less than 3,446 vehicles/16 hours on the access road leading to the candidate site in Kuala Muda.

The traffic volume on the access road from Nibong Tebal or Kampong Jawi to Pulau Burong, may be the same as that at Kuala Muda.

It is however, necessary to conduct traffic count survey to determine the accuracy of the estimation, over the roads in Kuala Muda and Pulau Burong.

(2) Traffic Noise

Data on noise collected from the main roads and from the kampong area situated along the roads is shown in Table 6-7 and the locations in Fig. 6-5.

Noise levels over the road having heavy traffic flows are very high and exceed 70 dBA. Whilst in the kampong areas set away from the main roads, noise levels are between 5 to 10 dBA less than noise levels over the road. However, all the noise levels from these areas exeed the 55 dBA, recommended by WHO, with a minimum difference of 10 dBA.

Table 6-6. Traffic Volume over 16 hours observation

(Unit: Vehicles/16hours)

No.	Location	Traffic Volume
1	Titi Mukim-Permatang Bendahari (8.0 mile)	3,446
2	Butterworth-Bagan Ajam-Telok Ayer Tawar(5.0 mile)	19,065
3	Butterworth-Taiping (20.0 mile)	15,564
4	Butterworth-Taiping (10.5 mile)	16,142

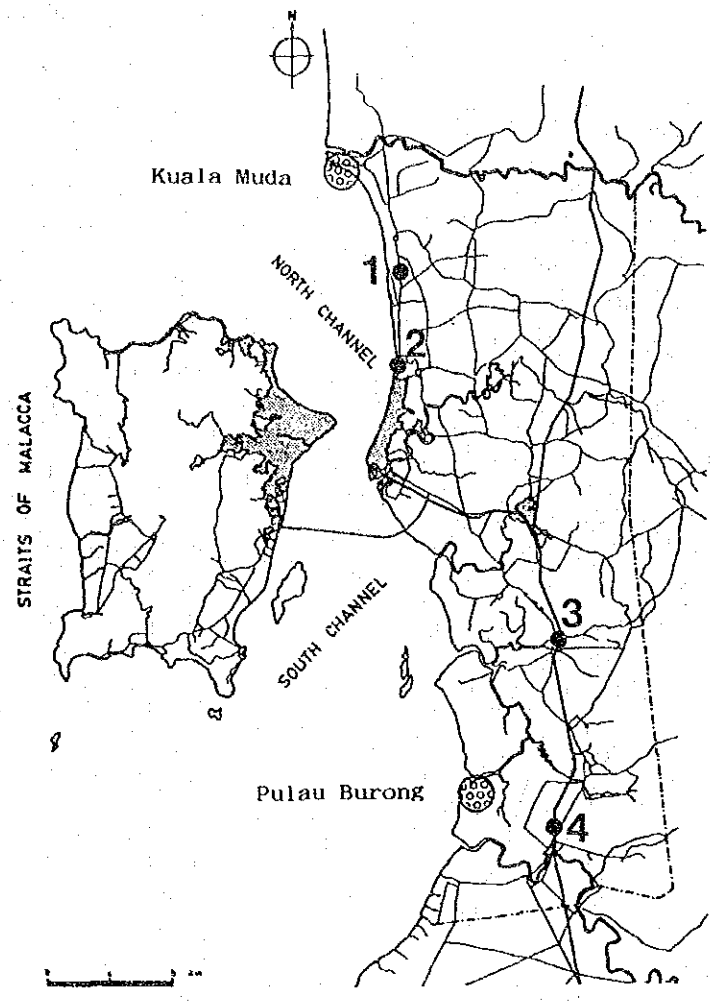


Fig. 6-4 Location of Traffic Count Station

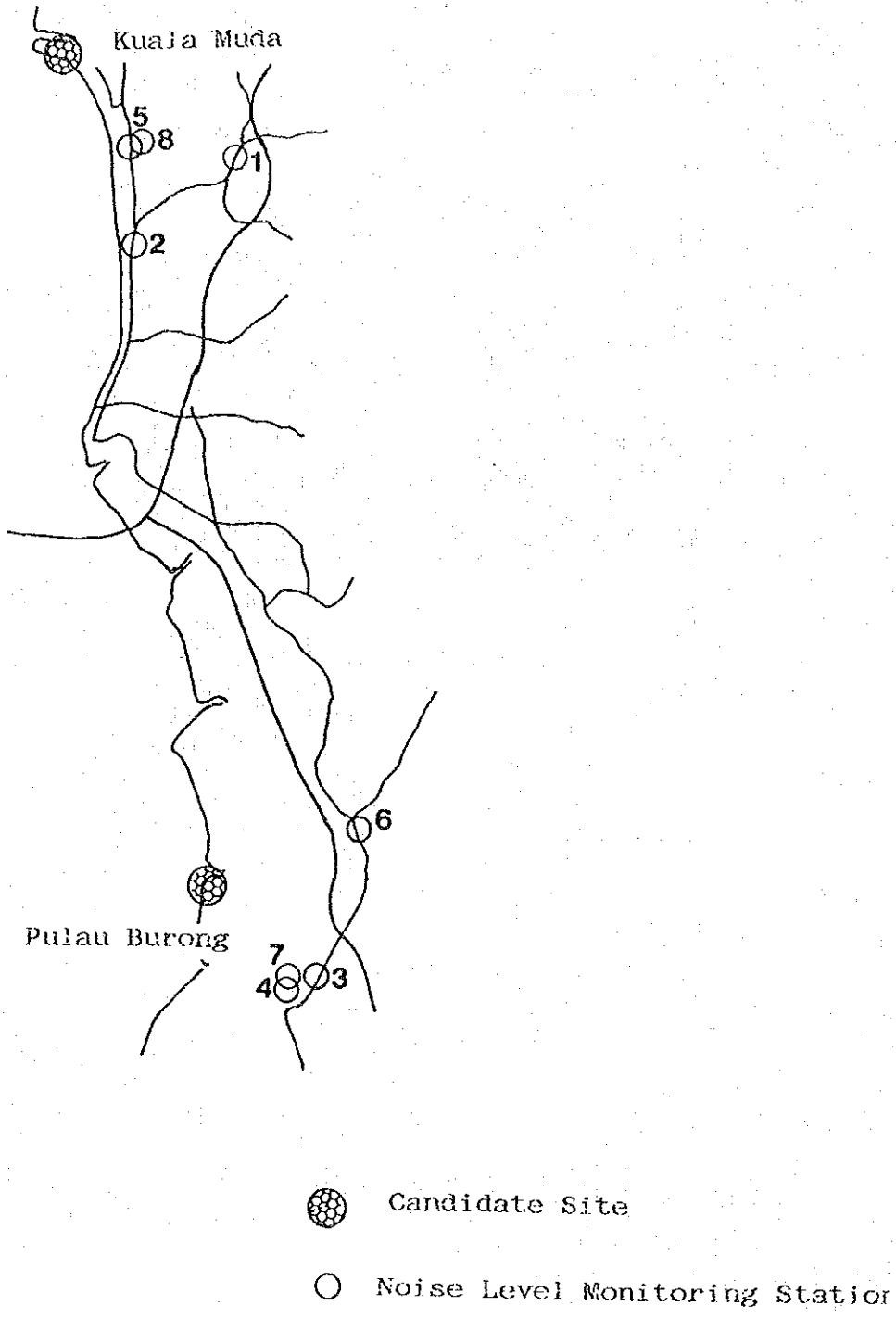


Fig. 6-5 Location of Noise Monitoring stations

Table 6-7. Traffic Noise and Volume in Seberang Perai

ST.	Noise Level (Leq.dBA)	Traffic Volume (Vehicles/hr)	Remark
1	77.5	1339	Kepala Batas
2	77.5	1642	Telok Air Tawar
3	77.1	1894	Jalan Nibong Tebal
4	70.7	979	Jalan Atas, Nibong Tebal
5	66.5	-	Kg. Penaga II
6	65.2	-	Kg. Valdor
7	68.0	-	Nibong Tebal
8	66.5	-	Chinese Primary School, Penaga

(3) Landuse

Residential areas around the candidate sites and along the access roads are shown in Fig. 6-6 and Fig. 6-7.

The distance from the site to the nearest house is about 200 m in Kuala Muda. On the other hand, no houses are situated near the site in Pulau Burong. It should also be noted that on both sides of the access roads towards the candidate site in Kuala Muda are lined with houses.

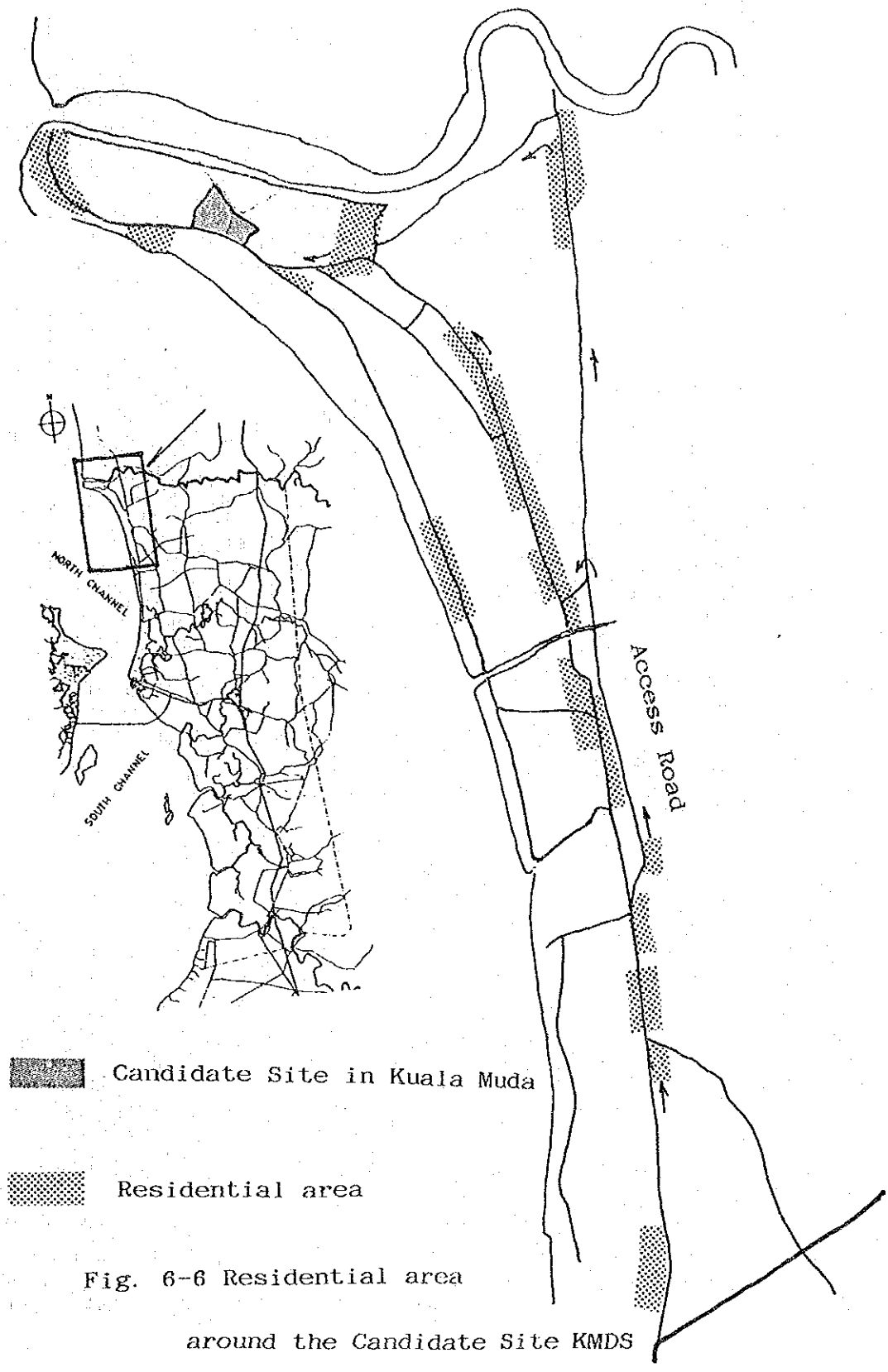


Fig. 6-6 Residential area

around the Candidate Site KMDS

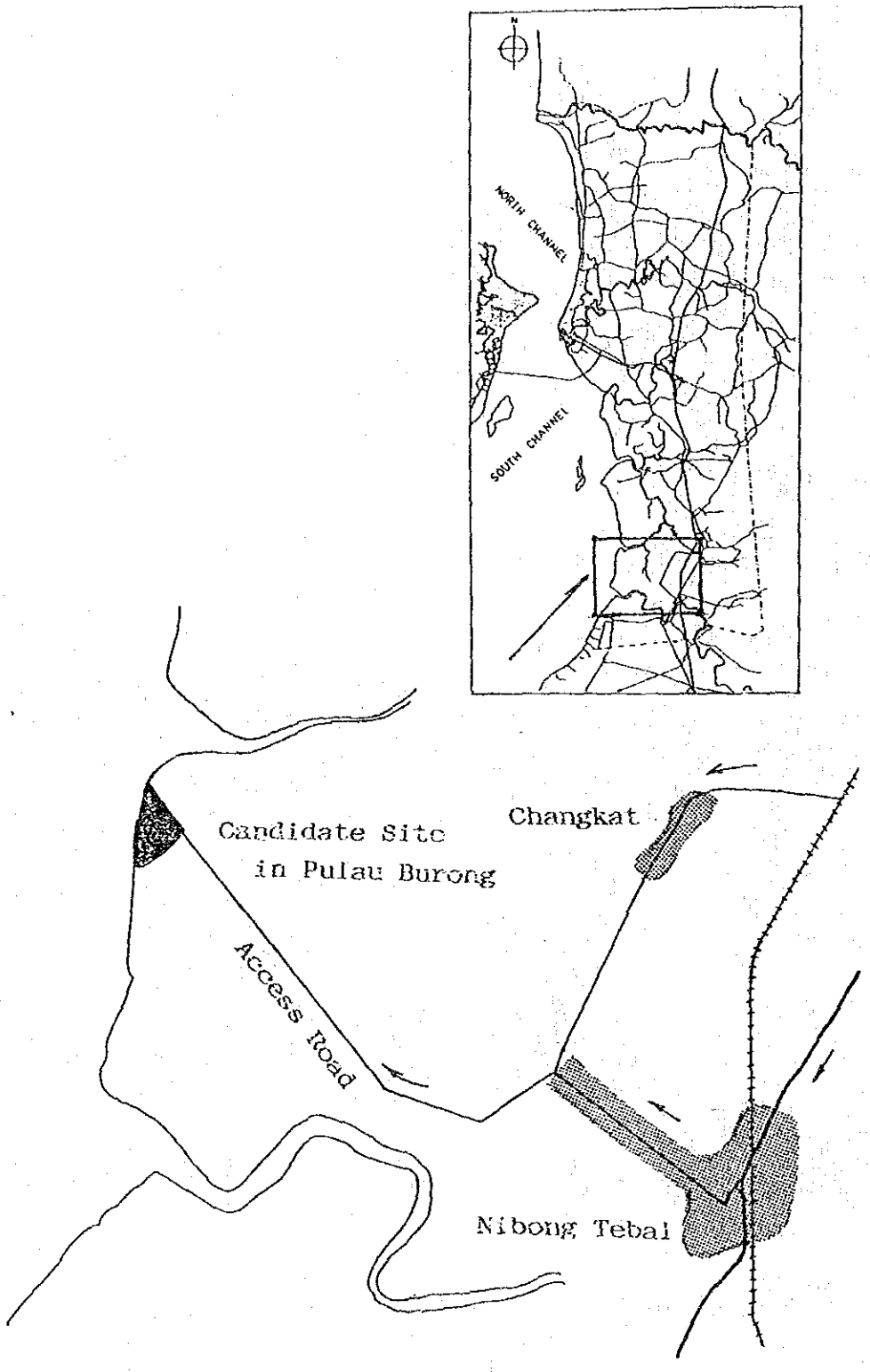


Fig. 6-7 Residential Area around the Candidate Site PBDS

6.4 Vegetation and Animals

6.4.1 Vegetation

(1) Ecology at the candidate site

The inland area of the candidate site in Kuala Muda is covered with trees and bushes. The other candidate site in Pulau Burong is partly cultivated with agricultural crops. The site itself is surrounded by mangrove forest.

Ecology of these sites are now under investigation by USM.

(2) The Value of Mangrove

Mangrove forests in Malaysia occur mainly along the west coast of Peninsular Malaysia, at the estuaries of the Sarawak, Rejang and Trusan-Lawas rivers of Sarawak and along the east coast of Sabah (Fig. 6-8).

The areal extent of these forests in Peninsular Malaysia, Sabah and Sarawak has been estimated to be about 120,000 ha, 284,000 ha and 173,000 ha respectively about 351,000 ha occur as forest reserves. The values of the mangrove resource are many and of great importance to the socio-economy of the country.

The importance of the resource derives both from the direct products taken from the mangrove forests and from the amenities provided by the resource from within and beyond their boundaries.

Products taken from the mangrove forests are mainly wood for charcoal, poles and firewood. In terms of economic value per hectare per annum of timber, the mangrove forests have been amongst the most valuable in the country. The leaves of the nipa palm, Nipa fruticans, are used for making roof thatches and cigarrette wrappers while the inflorescences are tapped for nipa sugar for conversion to alcohol. In Sabah and Sarawak, mangrove timber is an important source of wood-chips for the manufacture of rayon.

Other natural products harvested from the mangroves ecosystem include many prawn species which are caught in the mangrove waterways or in adjacent coastal waters. Edible mud crabs and gastropods are common in the mangroves while cockles are abundant on mud flats. Together they provide an important commercial food source. Some prawn species may breed and complete their life cycles in the shallow coastal mangrove waters.

Under natural conditions, mangrove forests act seaward barriers against coastal erosion and help to stabilise the coastline. Erosion often occurs following removal of mangroves by human.

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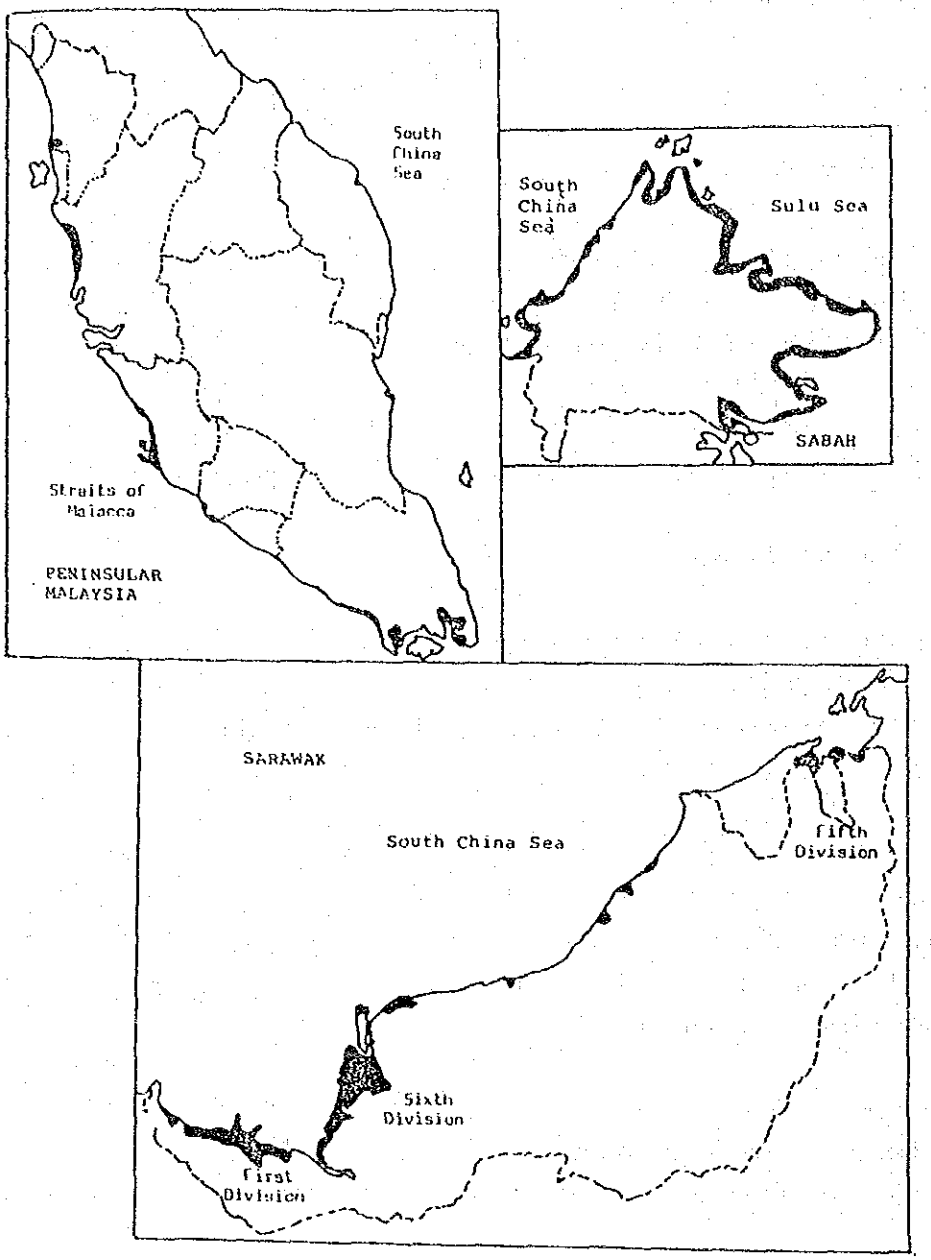


Fig. 6-8 Mangrove Forests in Malaysia

6.4.2 Animals

Native mammals, birds, insects and reptiles habitating the Kuala Muda inland site and in the mangrove forest around Pulau Burong will be studied. The marine fauna in Kuala Muda sea-side site, will also be considerated in the study.

Details of all species habitating these areas are available after USM has completed their investigation at these areas.

6.5 Landscape

There is no recreational zone, which has excellent landscape to be preserved around the candidate sites.

6.6 Historic and Religious Places

There is no historic or religious places and structures around the candidate sites.

Chapter 7. Potential Significant Impact

In considering the potential significant impact, each environmental component is matched with every project activities. The eight environmental components considered are air quality, water quality, noise, vegetation, animals, landscape, historic and religous places and safety. These are matched against site surveying, drilling activities, site clearing, earthworks as well as landfill and transportation activities. Where relevant, extent of impacts is predicted using the notation specified in Table 7-1.

Details of the table are explained in the following pages.

Table 7-1 Environmental Component Vs Project Activities

Activities		Air Quality	Water Quality	Noise	Vegetation	Animal	Landscape	Historic & Religious Places	Safety
Site Investi-gation	Site Surveying				○				
	Drilling		○						
Construc-tion	Site Clearing				U	U	○		
	Earthworks	○	D	●		U			
Operation & Maintenance	Landfill	●	●	●		U	○		
	Transportation	●		●					●

D Potentially significant adverse environmental impact for which a design solution has been identified.

U Adverse environmental impact that is potentially significant but about which insufficient information has been obtained to make a reliable prediction

● Residual and significant adverse environmental impact

○ Not significant adverse environmental impact.

(1) Site Surveying

The site when surveyed along some traverse lines will be obstructed by trees and bushes in Kuala Muda. These trees and bushes shall have to be cut to clear the survey path.

Impacts due to small survey clearing against environmental components such as terrestrial vegetation, wildlife, habitats and communities are not anticipated or negligible.

(2) Drilling

Since only two points will be bored and the area used for it is several square meters, no significant impact against the surroundings is foreseen from this work.

(3) Site Clearing

Before earthworks, in the site clearing, trees and bushes will be cut down and cleared throughout the site in Kuala Muda. Ecology of the site should be studied. Activities for site clearing are screened by the buffer zone.

(4) Earthworks

After reconstruction of the bund around the site, land within the bund will be subjected to earthworks. The earthworks may cause outflow of muddy water during rainy season, dispersion of dust during dry season and increase in noise level.

In the case of muddy water on rainy days, a setting basin to collect all such flow may be introduced within the bund. After the mud has settled, the clear water may be discharged, thus minimizing its impact to a negligible amount.

Dispersion of dust during construction will be filtered by the 50 m width green belt between the site and houses.

Noise from vehicles during construction may cause some impact against human environment and on to the wildlife in the mangrove forest. Some species of birds and monkeys were seen habitating in the mangrove forest during reconnaissance survey. Further study

should be executed in determining the possible extent of impact on these wildlife.

It is also important not to pile up sand in the mangrove forest and not to injure the mangrove trees during construction. However, since work will be done within the bunded area, there is no possibility of equipment injuring the mangrove trees outside the area.

(5) Landfill

Since leachate from final disposal site is gathered and pumped up back to the site, it will not be discharged directly out of the site.

However, some leachate will permeate into the ground, and only some will be purified after passing through layers of sand and finally flow out into the sea. Therefore, there may be some impact against the ground water due to this.

Odour will be generated during landfill work, but it can be reduced by completely covering the waste with soil. Spontaneous combustion of waste would give off smoke and it is undesirable to the environment. However, it can be controlled by habitual covering it with soil and timely sprinkling with water. Water trucks shall have to be prepared for sprinkling.

Suspended particulate matter and dust generated from solid waste and residue can also be mitigated by regular timely sprinkling of water and adequate covering soil.

Buffer zone is prepared between the disposal site and houses, for preservation of landscape, and to mitigate impact of odour and dust during disposal operations.

Noise from landfill equipment may give some impact against wildlife in the adjacent mangrove forest in Pulau Burong. However, to determine its extent, further detailed study is required.

Gas generation in a landfill area due to decomposition of waste cannot be eliminated, but impact can be mitigated because this project will adopt gas dispersion measures in the site.

(6) Transportation

SWM vehicles cause impact to three environmental components of air quality, noise and physical safety.

The number of the vehicles is about 257 vehicles/day in Kuala Muda and 379 vehicles/day in Pulau Burong. Therefore, volume of exhausted pollutant from the vehicles is not much.

The traffic noise and traffic safety will not always be in direct proportion to the increase of traffic volume. Noise emission from the SWM vehicles is not very high and traffic safety may not necessarily be decreased.

Chapter 8. Mitigation Measure

8.1 Construction Phase

Before the construction of sanitary landfill begins, bunds which contain the sanitary landfill site and settling basin will be constructed first. This step is to ensure that the muddy flow within the bund is collected and settled before discharging the clear water out of the bunded area. To further eradicate possibility of muddy flow discharge, the discharge is again collected and settled into another basin outside the bund before being discharged finally into the sea.

8.2 Operational Phase

Although sanitary landfill could be the better way of disposal, it is undeniable that nobody would want to have it in front or at the backyard of their houses. Thus, based on this nature of understanding that the buffer zone of green belt is prepared to isolate the site from common view of the public. Its other purposes are to blend the existence of the disposal site with the surroundings and mitigate odor dispersion from the disposal site to the surrounding areas.

The landfill operation area will be divided into several smaller work areas by bunds within the site. The division into smaller operation area would help to reduce the volume of leachate to be treated because of smaller surface permeability area for leachate permeation.

After the first landfill sub-division is completed, a final layer of earth will be applied over the top. In addition to this, the area would be sloped and drains will be provided. Hence, with the existence of these measures, there would be no surface run-off permeating into the ground. All surface run off would be drained

directly out of the site as surface water. For the next new working face, leachate would be abated in the same manner explained previously and the completed sub-division of landfill would be furnished with drains and cover material.

For the remaining areas to be used in the disposal site, water run-off will be discharged directly out of the site as general surface water.

Chapter 9. Residual Impact

The activities which may produce residual impacts on the environmental components are marked ● and U in Table 7-1.

The following activities would have residual impact on the environmental components.

Project Activities	Residual Impact
Site Clearing	Vegetation and Animals
Earthworks	Noise against human life Noise against animals
Landfill Activities	Dust and Odor Water Pollution Noise against human life Noise against animals
Transportation Activities	Air pollution due to vehicle exhausts. Noise from haulage vehicles Safety on public roads.

IV-II Environmental Evaluation

This report deals with the Environmental Evaluation of impacts on the air quality, the water quality and noise hazard possibly caused by the first phase project (1991-1995) of the Disposal Site Development Project in accordance with the Scope of Work for Solid Waste Management Study for Pulau Pinang and Seberang Perai Municipalities (Kuala Lumpur, November 6, 1987) exchanged between the Malaysian Government and JICA.

This assessment was conducted based on the results of the Preliminary Environmental Evaluation on the above mentioned three items, which JICA Study Team had already submitted to the Technical Committee.

A formal Preliminary Environmental Impact Assessment in accordance with the Environmental Quality Order 1987 is currently conducted by the Malaysian side, and information and data on the air quality, the water quality and noise will be provided from this report.

Whether a formal Detailed Environmental Impact Assessment is conducted by the Malaysian side or not will be judged based on the results of the formal Preliminary Environmental Impact Assessment.

I. Panta: Acheh Disposal Site

Chapter 1 Title of Project

The title of the project is Pantai Acheh Disposal Site Development Project (1991-1995)

Chapter 2 Project Initiator

The initiator of the project is Pulau Pinang Municipality.

Chapter 3 Necessity of the project

The rapid pace of socio-economic development in Malaysia has brought about an increase in the generation of solid waste with increasing complexity. Solid waste collection and disposal has become a social and public health problem of great magnitude and this is evident in the numerous reports published in the mass media in the country. The Malaysian Government is firm in its policy of maintaining clean urban centres and for this purpose the National Cleanliness Campaign was launched throughout the country by the Honourable Prime Minister towards the end of 1983. However, in many areas this campaign failed to have any reasonable effect because of lack of cooperation from the public and most of all due to the inability of the Local Authorities throughout the country to sustain the campaign.

Under the Local Government Act 1976, Local Authorities are given responsibility of collecting and disposing solid waste in urban areas. However, almost all Local Authorities in Malaysia are facing acute difficulties in carrying out such responsibility. This difficulty mainly arises from the shortage of adequate funds, manpower problems, lack of disposal sites, absence of a good management system and the lack of expertise. Waste Management has been given very low priority in the past and the problems have been conveniently left to the Local Authorities to manage in the best way possible with their limited financial and manpower resources, without any form of technical aid or financial assistance from any other sources.

To overcome the problems stated earlier and to improve the situation in a systematic manner, the Ministry of Housing and Local Government has decided to prepare and implement a National Solid Waste Management Action Plan. A vital component of the National Action Plan is the preparation of Solid Waste Management Master Plan for each Local Authority in the country. Experience has shown that this is the most effective approach, technically as well as financially, to resolve solid waste management problems and plan for the needs in the years to come. However, this approach has not been practiced in Malaysia and not a single Solid Waste Management Master Plan has been prepared for any Local Authority in the country. As such, it is very important to carry out the first Solid Waste Management Master Plan

and Feasibility Study project successfully in a Local Authority so that the experience gained can be used to benefit other Local Authorities. At the same time such success will gain the confidence and support of the decision makers at all levels and thus provide a boost to the National Action Plan stated above.

MPPP is the oldest Local Authority in the country whereas MPSP is the largest in term of administration area. Both have important and fast growing development centres for industrial as well as commercial developments. These developments put a heavy strain on the solid waste management systems of both the Municipalities. Therefore both Municipalities must have a good and efficient solid waste management system. Furthermore Penang Island with its beautiful beaches is a major tourist attraction and is a vital link in the national tourist industry which is being actively promoted by the Government as an important source of revenue for the country. MPPP and MPSP are seperated only by a narrow strait. Therefore, it is absolutely vital to keep these two areas clean so as not to affect the efforts made in promoting the tourist industry. A seashore polluted by floating refuse will nullify the impact of the best tourist promotion drive.

To be concrete, there are various problems as follows:

a. Unsatisfactory measurements for environmental conservation

At BSDS, soil covering has been conducted every day, and a soil bund to prevent waste outflow has been built, although it does not function satisfactorily. However, measures for environmental conservation excluding these measures are not satisfactorily implemented. Environmental conservation measures to prevent (i) ocean pollution caused by leachate, (ii) outflow of waste to the sea, (iii) social crows, and (iv) generation of odor, are lacking. Therefore, it is required to shift the current controlled tipping to sanitary landfill.

b. Unsatisfactory plan to ensure disposal sites

MPPP has conducted final disposal by filling the coast in the Jelutong area, but the filling has been vermiculated work. The existing disposal site is permitted to operate until March 1989, and no plan was made about future disposal sites before this study was commenced. It was urgently requested to alleviate the adverse effects on the surroundings and to ensure a site for long-term use.

c. Unimproved organization

As to the management of the existing final disposal site, Engineering Dept. conducts management of equipments, purchase of soil materials and planning of landfill, while Health Dept. is in charge of transportation and management of waste and spraying of chemicals. In addition, the department is involved in acquiring sites in coordination with Secretariate Dept.. However, reexamination of the management system is required in order to secure systematic acquisition and improvement of disposal sites and to promote pollution control measures. It must be necessary to improve the planning section which should conduct at least planning for utilization of finished sites.

d. Illegal dumping

Partly because of the poor fee collection system, illegal dumping is still going on. This stems from the idea that just dumping is good enough.

e. Poor understanding of final disposal

Solid waste management (SWM) can be made only when collection, cleaning, treatment and disposal function perfectly. The current major concern of MPPP's Councillor is collection and cleaning, and his basic idea is "just dumping is good enough" with rather poor understanding of the issue. This seems to be an underlying cause of the above-listed (a) through (d). Even when an incineration plant is built, final disposal is essential for solid

waste management. The necessity of a firm organization/system for adequate disposal is not fully understood. Furthermore, very strict application of penal regulations and full participation of citizens are indispensable for prevention of illegal dumping.

In order to solve all these problems, promotion of this project is urgently required.

Chapter 4 Summary of Project

Landfill development and operation of Pantai Acheh Disposal Site (PADS) for the first phase project (1992-1996) is designed so as to satisfy the DOE standards, a guideline of MHLG, etc. The basic conditions for the design of PADS is summarized as follows;

Items		PADS	Remarks
Area of Site		100 ha	
Wastes to be disposed		Municipal wastes including road, drain and beach cleansing wastes and non-hazardous industrial wastes	
Disposal amounts in 1995		539 ton/day	
Cummulative Disposal Volume (1000m3)	Phase I 1992-1996	1,544	including cover soil
	Phase II & III 1997-2005	3,590	including cover soil
Numbers of incoming vehicles		155 units/day	
Required Area for Phase I		25 ha	
Level of Landfill		3	
Construction Plan		2 stages	1991 and 1996

Based on the above mentioned conditions, the preliminary design of PADS development for Phase I is made and illustrated in Fig.4-1. The proposed project investment components of final disposal in PADS is summarized below;

a. Main facilities

i. Enclosing structure
- Enclosing bund
- Divider

ii. Drainage system
- Surrounding drain
- On-site drain (surface water)
- On-site drain (underground springs)
- Drain for reclaimed area

iii. Access
- Approach road
- On-site road
- Improvement of existing bridge

b. Environment protection facilities

- Buffer zone
- Litter control facilities
- Gas removal facilities
- Leachate collection facilities
- Leachate cycling facilities
- Leachate outlet
- Monitoring facilities

c. Buildings and accessories

- Site office
- Weigh bridge
- Garage and storage building

- Garage and storage building
- Safety facilities
- Fire Prevention facilities
- Car wash
- Utilities

d. Equipment

i. Landfill equipment
- Bulldozer
- Hydraulic excavation

ii. Others
- Water sprinkler truck
- Inspection vehicle

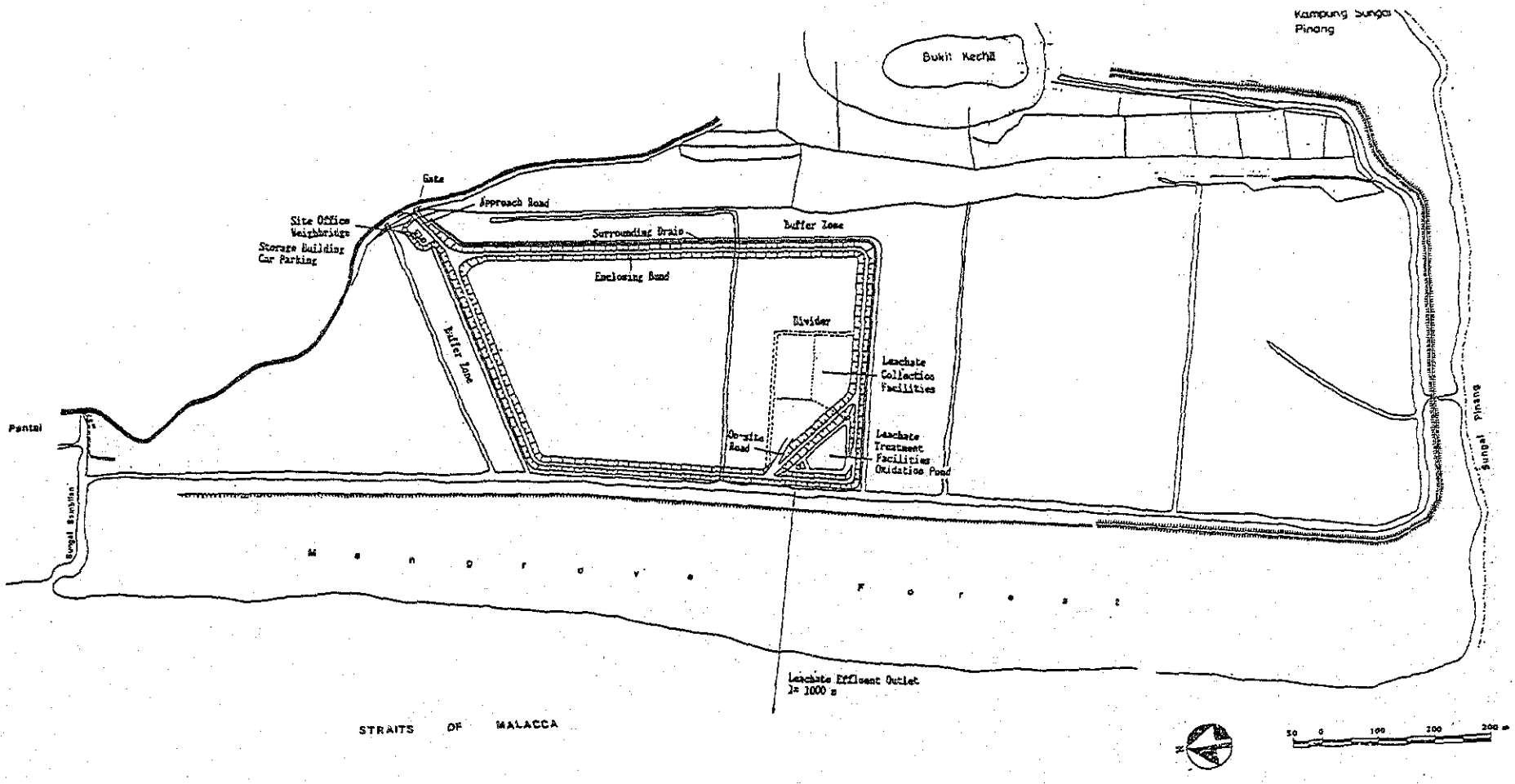
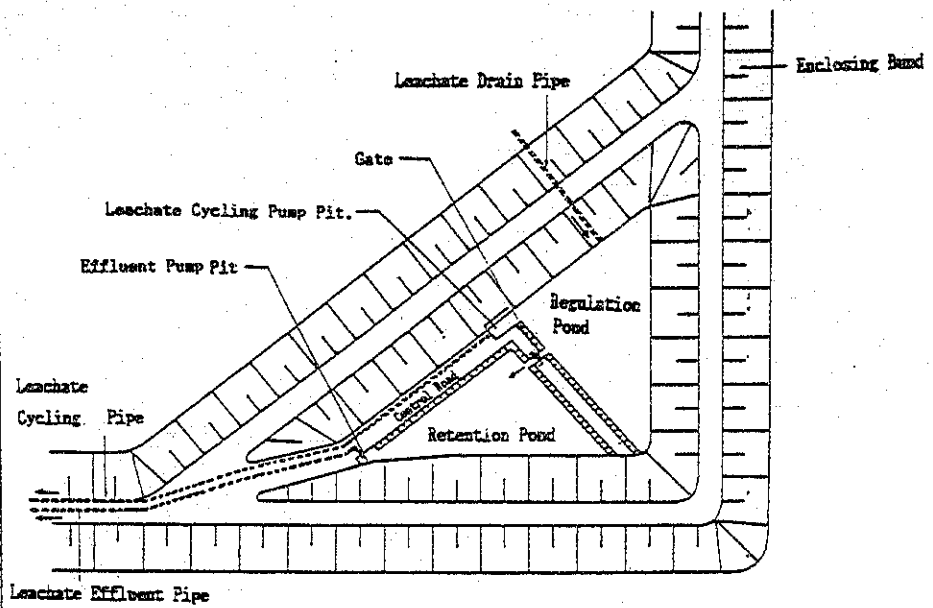
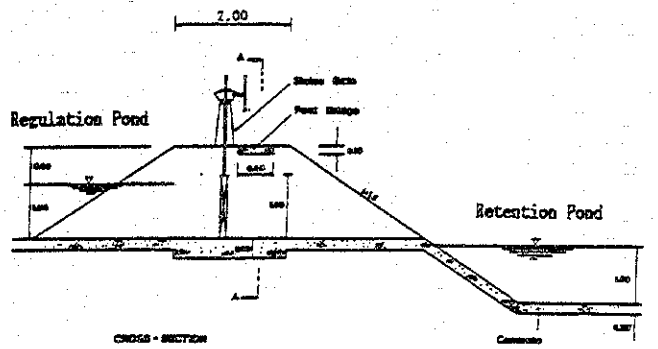


Fig. 4-1 Preliminary Design of PADS



Detail of Gate



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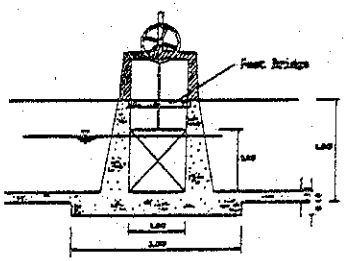
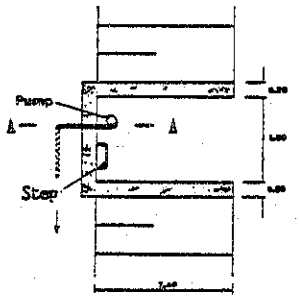


Front Elevation



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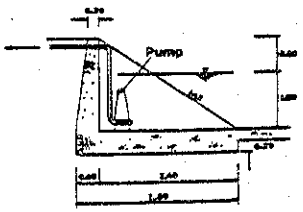
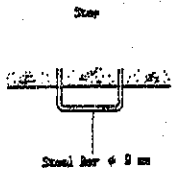




Leachate Cycling And Effluent Pump Pit

LEGEND	Fig. 4-2
	Detail Of Leachate Cycling Facilities
	For PADS
	:
	Source : JICA Study Team
	Scale : As Shown
	Date of Drawings :

THE SOLID WASTE MANAGEMENT STUDY FOR PULAU PINANG AND SEBERANG PERAI

There are 4 potential sites selected by the site selection committee. These options of project sites are Jelutong Area, the Middle Bank, South Eastern Sea Shore and Pantai Acheh. Their respective locations are shown in Fig.5-1.

To determine the possible impacts that the project may cause on to the existing environment evaluation on environmental acceptability consists of factors that protect major public and environmental interests from possible hazards induced to the surroundings by the project.

The extent of impact on each evaluation item is ranked and an overall environmental acceptability on each potential site is evaluated.

The evaluation on environmental acceptability of each project site is summarized in Table 5-1. Principally, the Jelutong Area and the Middle Bank are found to be unsuitable as final disposal sites. Upon evaluation on political, social, legal and technical aspects in addition to the environmental aspect, Pantai Acheh site is finally selected.

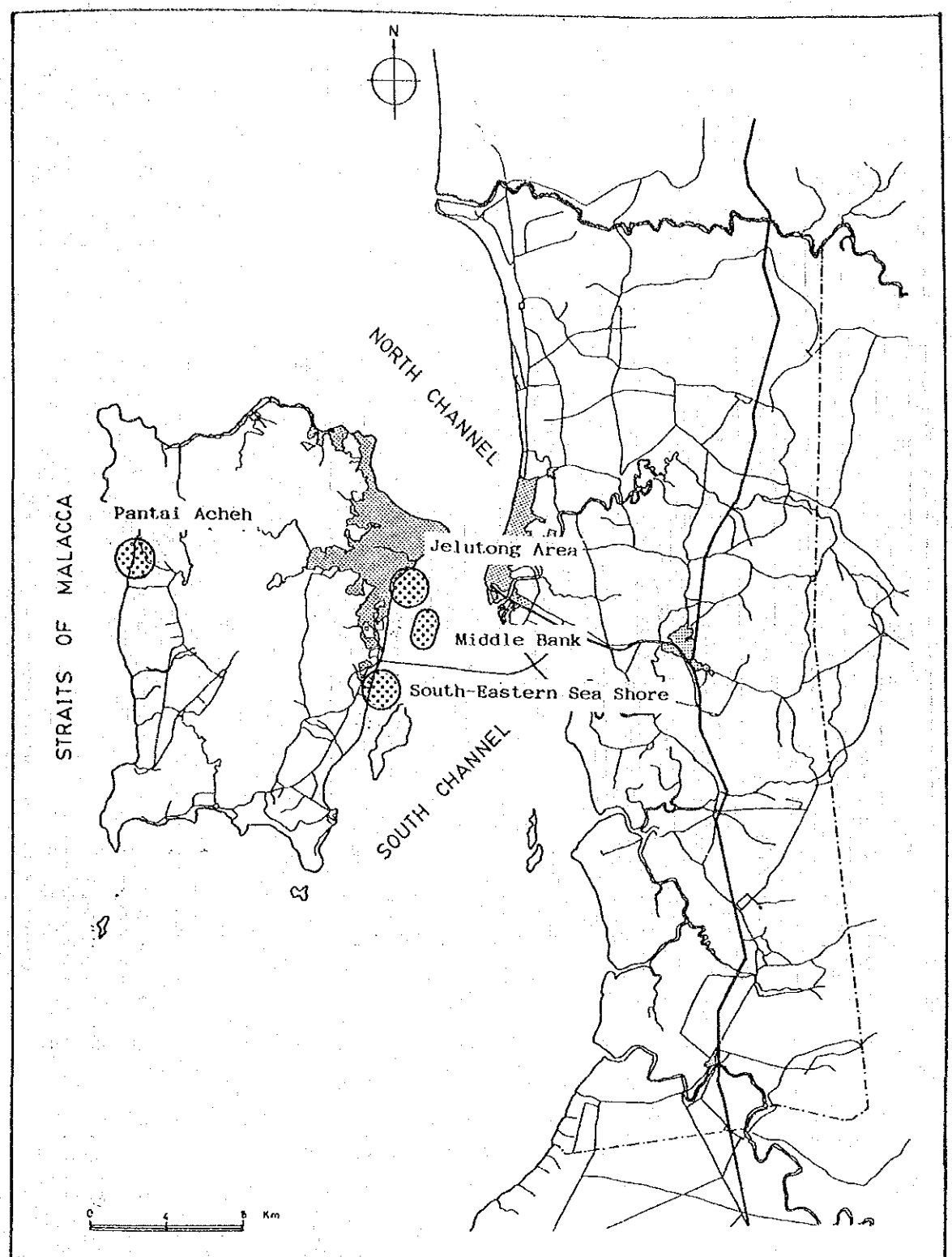


Fig. 5-1. Location of Potential Sites

Source : JICA Study Team

Table5-1 Evaluation of Potential Site for Final Disposal On Environment Acceptability

Evaluation Items	M P P P			
	Jelutong Area	Middle Bank	South-Eastern Sea Shore	Pantai Acheh
Overall Environmental Acceptability	×	×	△	△
a. Possibility of drinking water pollution	Nil	Nil	Nil	Nil
b. Impact by surface water pollution	Low	Low	Low	Low
c. Impact of flooding	Low (If proper plan were prepared)	Nil	Low	Low
d. Impact by groundwater pollution	Low	Nil	Low	Low
e. Distance from airport and other public facilities	Adequate	Adequate	Adequate in case of strict sanitary landfill	Adequate
f. Distance from densely populated area	Adequate if proper measures were taken	Adequate	Adequate	Adequate
g. Possibility of dust, noise and odour hazards	High	Low	Low	Low
h. Compatibility with land use of adjacent area	Fair	Poor	Good	Fair
i. Slope stability	Good	Good	Good	Good
j. Impact on inshore or river fishery	Very high	High	High	Fair
k. Impact on terrestrial vegetation and vildlife	Low	Low	Low	Further study
l. Impact on Aquatic/Marine flora and fauna	Fair	High	Fair	Further study
m. Impact on natural landscape	Low	Very high	Low	Fair
n. Impact on historic places or structures	Low	Low	Low	Low
o. Impact on religious places or structures	Low	Low	Low	Low

Note:

For items a, b, c, d, g, j, k, l, m, n & o
: Very high, high, Fair, Low and Nil

For items h & i
: Good, Fair and Poor

For items e & f
: Adequate and inadequate.

△ means that there are some considerations or further study required for the clearance of some evaluation items.

× means that there is a critical barrier which cannot be cleared or there are some unsuitable points for a candidate site at this stage

Chapter 6. The Existing Environment

Although it is best to consider and study the existing environment thoroughly, it should be recognized that such detail investigation within the limited time and financial constraints is not possible. For the purpose related to solid waste management environmental impact evaluation, the existing environmental study is divided into the following components:

(1) Air quality
(2) Water and soil qualities
(3) Noise hazard
(4) Vegetation and Animals
(5) Landscape
(6) Historic and religious places

The existing conditions of these components shall be the baseline in measuring the extent of impacts of SWM in the project area.

6.1 Air Quality

With the project implementation, the air quality may be affected by pollutants from dust, emission from haulage vehicles and odor. Although there may be other air quality components that may be considered, their impacts are negligible and thus can be omitted.

In view of these possible impacts to air quality, factors which would reduce the impacts are studied. Basically, air pollution caused by dust, exhaust gas and odor are reduced with the presence of favourable meteorological conditions such as winds and rainfall (precipitation). Based on this understanding, the impacts to existing air quality are discussed.

(1) Rainfall

The mean annual rainfall observed over a 35 year period (between 1951 and 1985) is 2,444.7 mm at Penang International Airport. The mean monthly rainfall distribution during this 35 year period is shown in Fig. 6-1. It is seen that in September and October, the rainfall intensity exceeds 300 mm. On the other hand, during the months of January and February, less than 100 mm of rain is precipitated. Pulau Pinang has been experiencing ten months which have more than 10 raindays in each month and a total of seven months which have 15 days or more of raindays.

Hence, based on the intensity and number of raindays, it can be deduced that the degree or extent of suspended particulates and other pollutants can be reduced naturally. Indirectly, frequent raindays may help keep air pollutants within the satisfactory levels.

(2) Wind

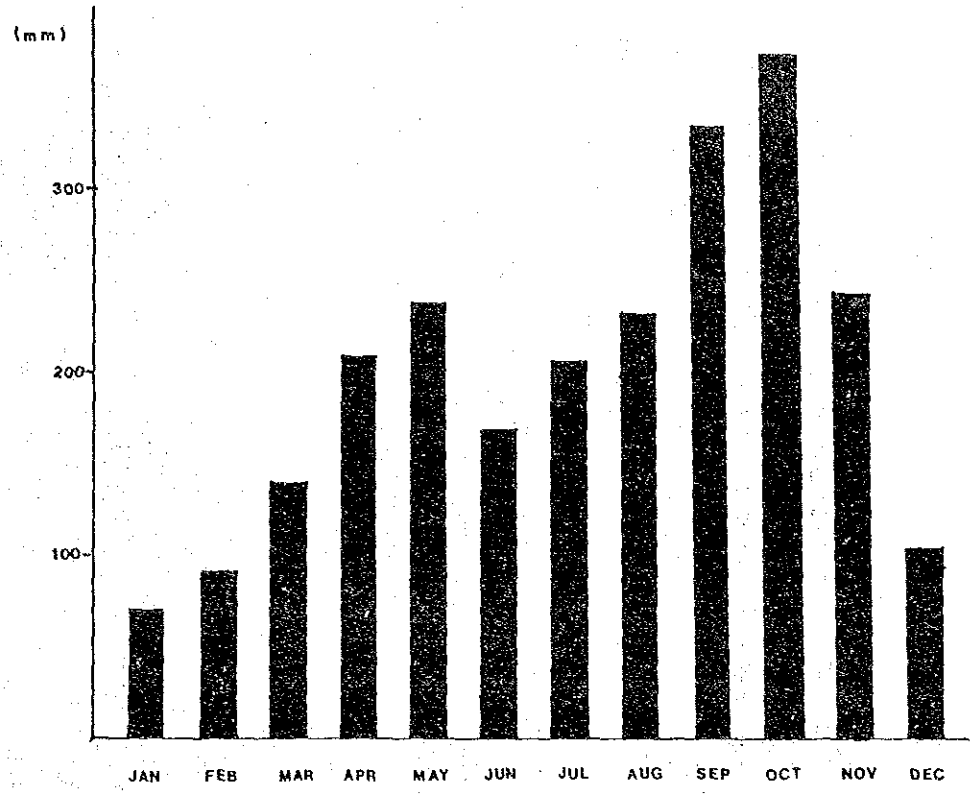
The monthly wind rose and monthly mean wind velocities in 1987 are shown in Fig.6-2.

Between December and March, the North North-East wind dominates the study area. From April to August, the orientation changes from South-West to South South-West.

The mean wind velocities between December and March are higher than any other months. The wind velocities between December and March ranges between 3.1 m/s to 2.3 m/s.

Between September and November, although North wind is dominant, it is often complimented by the West wind.

The annual mean wind velocity is 2.2 m/s with the various dominant wind directions of North, North North-East, South-West, etc.



No. of Rainday

1951 - 1985 Mean:	7	9	12	17	18	13	15	16	20	23	19	12
Highest:	14	16	21	24	22	19	21	24	24	28	27	22

Annual Mean: 2,444.7 mm

Fig. 6-1 Mean Monthly Rainfall (1951 - 1985)

* Source: Penang International Airport (Bayan Baru)

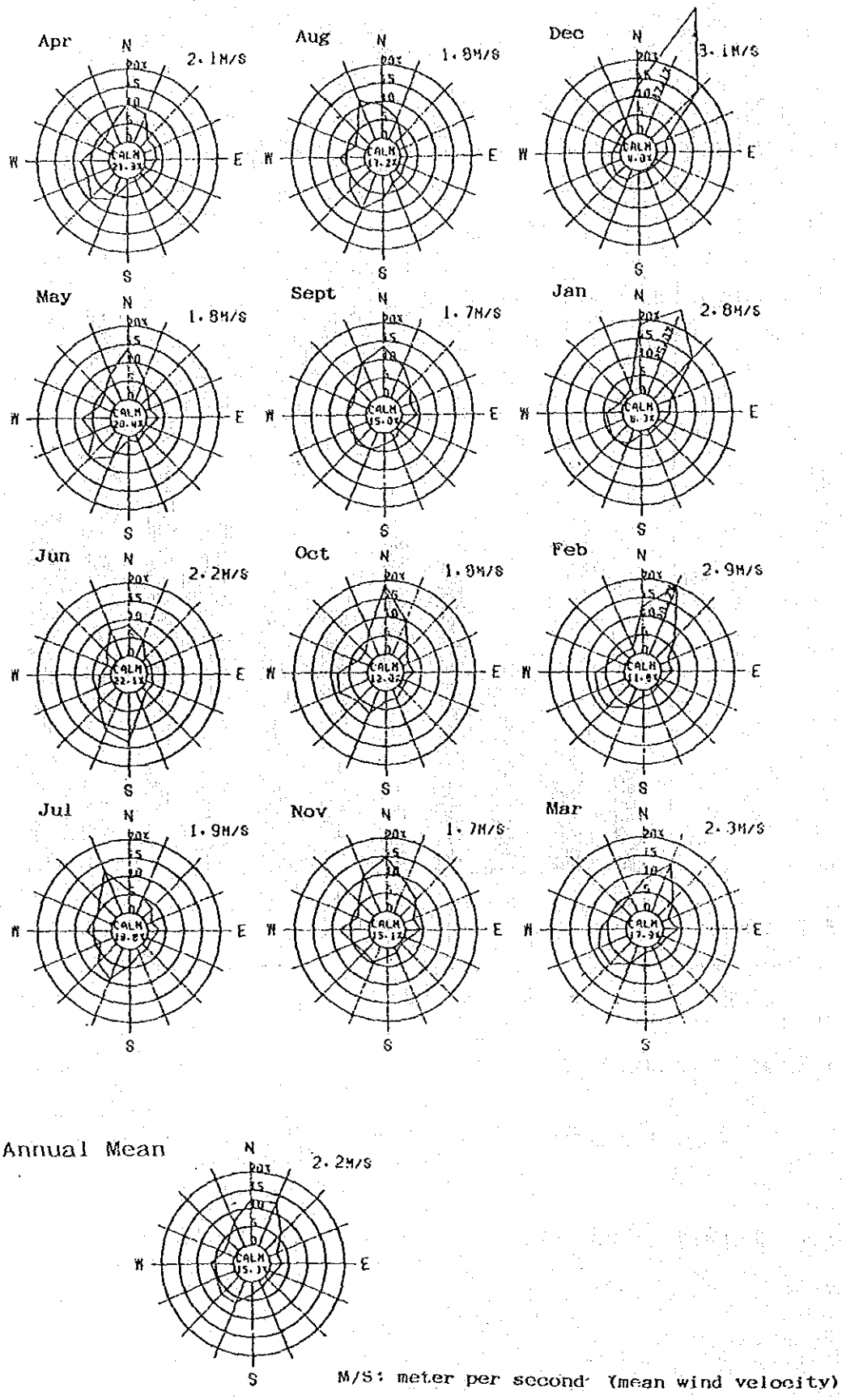


Fig.6-2 Wind Rose and Mean Wind Velocity in Penang International Airport

(3) Dust

There has been no available data on dust or dustfall analysis for Pantai Acheh. However, to enable comaprison and study of air quality, the suspended particulate matter concentration gathered over Balik Pulau is adopted and shown in Table 6-1. It can be seen that the concentrations of suspended particulate matter over Balik Pulau has exceeded the proposed Malaysian Air Quality Standards of 0.05 mg/m3 over 24 hours observation for residential/common zones.

Table 6-1 Concentrations of Suspended Particulate Matter over Balik Pulau

Site	Date	Concentration (mg/m3)	Malaysian Air Quality Standard
Sacred Heart Secondary School, Balik Pulau.	11.4.83	0.076	0.05 mg/m3 (24 hours)
	12.4.83	0.086	
	19.4.83	0.101	

Source: Penang Structural Plan Technical Report on Environmental Quality

For reference purposes, the data of suspended particulate matter and dustfall survey carried out at Permatang Pauh, between 1st September through 30 November in 1988 is adopted. The result is shown in Table 6-2 and Table 6-3, and the location map of sampling stations is shown in Fig. 6-3.

As to the study result of suspended particulates, the only point where the level exceeds the standard 0.10mg/m3 for industrial zone is on the dump site.

It would be interesting to note that although open dumping has been carried out and sometimes spontaneous fires have frequently occured in the existing Permatang Pauh disposal site, volume of dust around the site does not exceed the 30 tons/mile^2/month, proposed Malaysian Air Quality Standards. In October the result at every station exceeds the 10tons /mile^2 /month for residential zone.

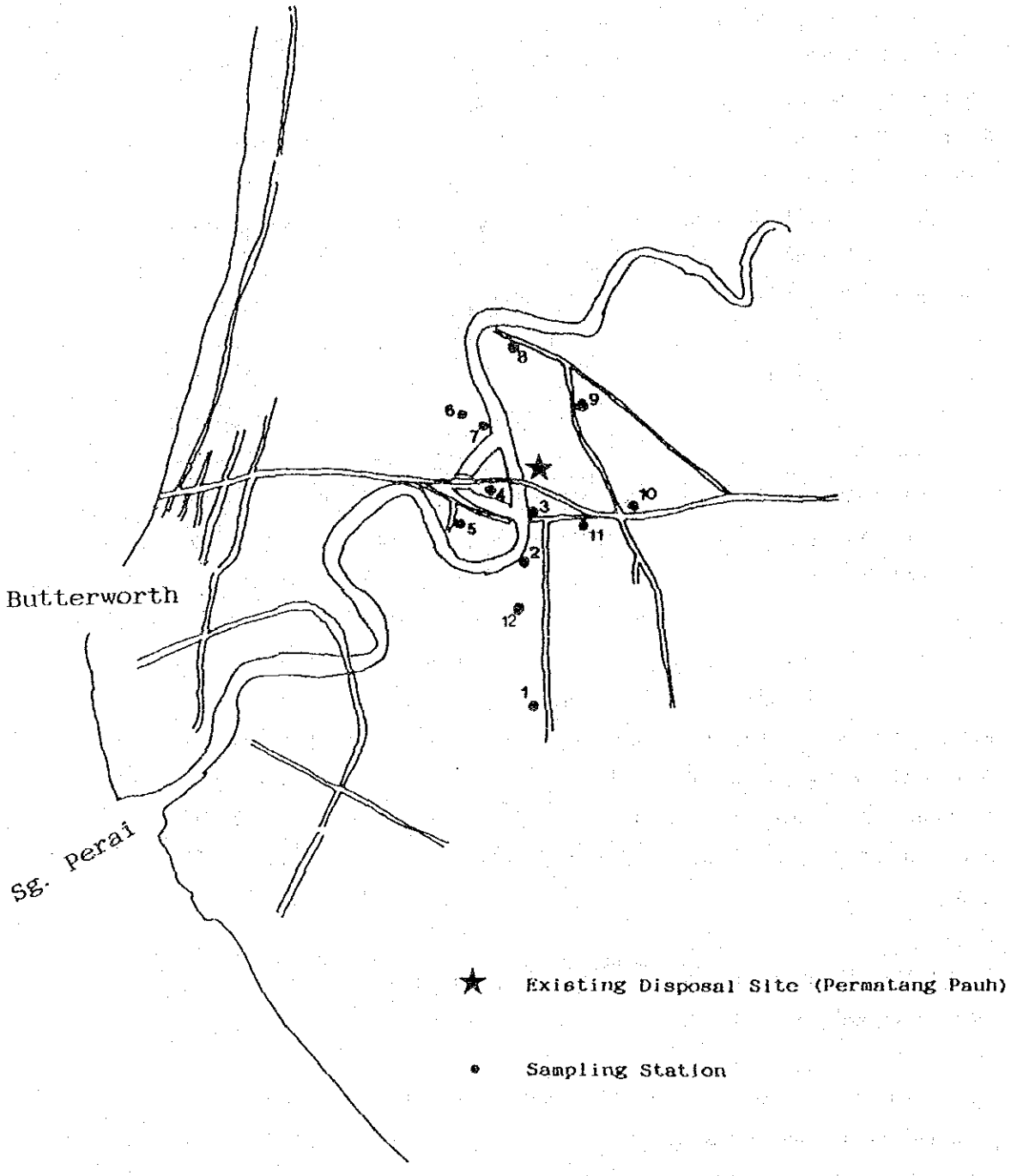


Fig. 6-3 Location Map of Dust Sampling Station

Table 6-2 Total Suspended Particulates Analysis for Permatang Pauh Area

(Unit:mg/m3)

No	Station	Times	Sept.	Oct.	Nov.	Standards*
		1	0.153	0.115	0.186	
		2	0.137	0.116	0.223	
-	Dump Site	3	0.077	0.115	-	
		4	-	0.141	-	
		ave.	0.122	0.122	0.205	
		1	0.067	0.061	0.079	
Oxidation		2	0.064	0.051	0.087	
6	pond	3	-	0.045	-	
(entrance)		4	-	0.070	-	
		ave.	0.066	0.057	0.083	
		1	0.065	0.040	0.045	
8	Telecom	2	0.061	0.046	0.051	24 hours
		3	0.025	0.055	0.040	0.05 mg/m3:
		ave.	0.051	0.047	0.046	Residential/ Common Zone
		1	0.065	0.052	0.028	0.10 mg/m3:
10	School	2	0.035	0.088	0.021	Industrial-
		ave.	0.051	0.070	0.025	Zone
		1	-	-	0.032	
12	JPT Office	2	-	-	0.033	
		3	-	-	0.051	
		ave.	-	-	0.039	

* Proposed Malaysia Air Quality Standards

Table 6-3 Dustfall Analysis for Permatang Pauh Area

(Unit:tons/mile^2/month)

No.	Station	Sept.	Oct.	Nov.	Proposed Malaysia Air Quality Standards
1	PDC	8.3	16.8	10.3	
2	River Bank	5.4	12.7	6.1	
3	Chinese Temple	6.7	17.1	15.6	30 : Industrial Zone
4	Open Field	10.6	11.7	6.9	
5	Sewage Treatment Plant	6.6	20.1	6.6	10 : Residential Zone
6	Oxidation pond (entrance)	9.1	16.8	8.2	
7	Oxidation pond	7.8	20.6	10.7	8 : Specially protected zone
8	Telecom	4.0	10.6	5.7	
9	Malay House	8.6	12.6	5.7	
10	School	7.0	10.6	6.9	
11	Private House	6.1	11.8	9.2	

(3) Carbon Monoxide

Based on the island-wide air quality survey conducted by USM in 1981 - 1983, carbon monoxide (CO) exhaust by transportation sector is the single most important air pollutant in the State of Penang. The contribution rates of pollutants by the transportation sector are as follows: CO (99%), HC (85%), NOx (61%) and particulates (62%).

Since there are no data available on carbon monoxide (CO) in the area near Pantai Acheh, data obtained from tests carried out in Balik Pulau Town are adopted and shown in Table 6-4.

For the purpose of comparing the air quality in a local district with that in a city, carbon monoxide (CO) concentrations in Penang City are shown in Table 6-5. Judging from the hourly concentrations, the volume of pollutant in central urban district is twice or three times as much as that of a local district.

(4) Odour

There is no main facility that causes significant objectionable odour near the candidate site in Pantai Acheh.

Table 6-4 Concentration of CO in Balik Pulau

Date	Time	CO(ppm)	Proposed Malaysian Air Quality Standard
12.4.83	7 - 8	3.5	
	8 - 9	2.9	24 hrs. 3.00 ppm
	9 - 10	2.5	
	10 - 11	4.1	8 hrs. 9.00 ppm
	11 - 12	3.6	
	12 - 13	3.4	1 hr. 35.00 ppm
	13 - 14	3.0	
	14 - 15	3.0	
	15 - 16	3.5	
	16 - 17	3.3	
	17 - 18	2.7	

Table 6-5. PENANG CITY: CARBON MONOXIDE CONCENTRATIONS

Site	Sampling Time (h)	Mean CO (ppm)	Max hourly CO (ppm)	Remark
1. Kerbside				
Lebuh Pantai	10	4.5	9.3	
	5	2.9	6.5	
	9	5.5	7.9	
Jalan Sultan Ahmad Shah	6	5.7	11.0	
Jalan Mesjid Negeri	9	5.8	7.1	
	9	5.9	7.7	
	11	4.8	7.0	
Jalan Jelutong	11	5.8	7.5	
	11	6.1	12.4	
	5	5.9	9.6	
	6	6.0	8.7	
Jalan Brick Kiln	4	6.8	7.5	
	10	7.1	10.6	
Lebuh Carnavon	11	4.4	6.3	
Lebuh Chulia	11	4.2	5.8	
Jalan Macalister	11	5.9	8.7	
Jalan Gelugor	11	8.3	12.5	
Balik Pulau Town	11	3.2	4.0	
Jalan Dato Kramat	3	5.0	7.8	
near Dato Kramat Smelting	11	3.3	8.1	
Jalan Dato Kramat/ Jalan York	11	9.1	18.5	*
	10	8.4	15.3	

* : exceeds Proposed Malaysia Air Quality Standards

Site	Sampling Time (h)	Mean CO(ppm)	Max hourly CO(ppm)	Remark
Lebuh Bridge	11	9.3	11.3	*
Jalan Ayer Itam near Sek. Menengah Chung Ling	10	5.9	13.5	
	10	5.4	13.4	
2. Roundabout and Junctions				
Jalan Penang Roundabout	5	5.4	9.3	
	6	12.5	17.6	*
	5	12.1	16.7	
	5	3.8	5.7	
	4	11.6	13.3	
	4	5.1	8.5	
	8	8.6	12.0	
	8	10.4	14.2	*
	8	9.6	12.9	*
	9	10.0	13.8	*
Jalan Penang/Jalan Dato Kramat Junction	8	7.3	9.8	
	6	8.8	11.4	
	9	4.7	8.5	
Jalan Dato Kramat/ Jalan Perak Junction	9	7.5	12.0	
Jalan Penang/Jalan Burma Junction	8	6.2	7.1	
	9	9.3	13.3	*
	8	6.6	8.0	
	8	7.8	10.0	
	10	5.9	9.4	
	10	4.7	7.1	
Jalan Brick Kiln/ Jalan Jelutong Junction	10	12.8	22.6	*
	8	16.0	18.2	*

Site	Sampling Time (h)	Mean CO (ppm)	Max hourly CO (ppm)	Remark
3. Ambient				
"Japanese Garden" Taman Guan Joo Seng	6	1.4	1.9	
Polo Ground	9	2.0	3.6	
	10	1.4	2.1	
USM Campus	5	1.3	1.7	
Esplanade	11	2.2	2.6	
Dato Kramat Padang	10	1.6	2.7	
	10	2.0	5.7	
Central Hotel car park	10	3.7	4.9	
	10	2.4	2.9	