Table 2.8.2 Present Water Quality of Jarak River Basin

(Unit: Mg/l.)

Sampling Point No.	No. 1	No. 2	No. 3
pH Value	4.05	6.04	5.61
B. O.D. (5 days at 20°C	2	10	4
C. O. D.	4	24	8
Suspended Solids	4	6	50
Mercury (Hg)	not detected	trace	trace
Cadmium (Cd)	not detected	not detected	not detected
Chromium, Hexavalent (VI)	not detected	not detected	not detected
Arsenic (As)	nil	trace	nil
Cyanide ('CN)	1.1	nil	nil
Lead (Pb)	0.1	0.1	0.2
Chromium, Trivalent (III)	not detected	not detected	not detected
Copper (Cu)	not detected	0.1	not detected
Manganese (Mn)	0.1	0.1	0.1
Nickel (Ni)	not detected	not detected	not detected
Tin (Sn)	not detected	not detected	not detected
Zinc (Zn)	0.1	0.3	0.1
Iron (Fe)	0.3	1.3	1.4
Phenol	nil	nil	nil
Sulphide (S)	nil	nil	nil
Oil & Grease	nil	nil	nil
Bacteriological Examination:			
Bacterial colonies per ml. growing on nutrient agar in 2 days at 37°C	600	1,000	600
Coliform organisms, probable number per 100 ml.	>1,100	>1,100	>1,100
E. Coli I, probable number per 100 ml.	1,100	1,100	460

(Sampling Date : June 14, 1991, Analyzed by Malayan Testing Laboratory SDN. BHD.)

Table 2.8.3 (1) Flow Rate of Drainage

Run-off Coefficient	Max. Industrial waste water m^3/sec/ha	Mean Velocity m/sec	Inlet Time min
0.65	0.006	1.5	7

Line No.	Area (ha) Each Line	Area (ha) Accumu.	Length (m) Each Line	Length (m) Ext.	Con-Time (min)	Peak Flow m^3/s	IWW Flow (m^3/s) Each Lot	IWW Flow (m^3/s) Accumu.	I.Lot (ha)	T.Flow (m^3/s)
1	4.80	4.80	300.00	300.00	10.33	1.96	0.00	0.00	0.00	1.96
2*	0.90	5.70	300.00	600.00	13.67	2.18	0.00	0.00	0.00	2.18
3*	1.14	6.84	380.00	980.00	17.89	2.43	0.00	0.00	0.00	2.43
4	12.00	18.84	840.00	1820.00	27.22	5.78	0.00	0.00	0.00	5.78
to Pond-3										
5	7.00	7.00	480.00	480.00	12.33	2.75	0.04	0.04	7.00	2.79
6	2.50	9.50	630.00	1110.00	19.33	3.30	0.00	0.04	0.00	3.34
to No.16										
7	8.00	8.00	480.00	480.00	12.33	3.14	0.05	0.05	8.00	3.19
to No.10										
8	2.85	2.85	270.00	270.00	10.00	1.17	0.00	0.00	0.00	1.17
9*	4.56	7.41	500.00	500.00	12.56	2.90	0.03	0.03	4.35	2.92
10	5.00	20.41	370.00	1350.00	22.00	6.78	0.03	0.10	5.00	6.88
to No.12										
11*	6.26	6.26	500.00	500.00	12.56	2.45	0.03	0.03	5.00	2.48
12	0.81	27.48	270.00	2120.00	30.56	8.03	0.00	0.13	0.00	8.17
to No.16										
13	0.72	0.72	240.00	240.00	9.67	0.30	0.00	0.00	0.00	0.30
14	11.00	11.72	500.00	740.00	15.22	4.36	0.07	0.07	11.00	4.43
15	10.00	21.72	430.00	1170.00	20.00	7.45	0.06	0.13	10.00	7.58
16	0.00	58.70	80.00	4480.00	56.78	12.54	0.00	0.30	0.00	12.84
to Pond-3										
17	11.41	11.41	470.00	470.00	12.22	4.49	0.06	0.06	10.00	4.55
18	11.50	22.91	500.00	970.00	17.78	8.16	0.06	0.12	10.00	8.28
to Pond-3										
19*	10.50	10.50	500.00	500.00	12.56	4.11	0.00	0.00	0.00	4.11
20	2.30	12.80	460.00	960.00	17.67	4.57	0.00	0.00	0.00	4.57
to No.23										
21*	6.50	6.50	450.00	450.00	12.00	2.57	0.01	0.01	1.00	2.57
22	0.00	6.50	100.00	550.00	13.11	2.52	0.00	0.01	0.00	2.52
23	0.25	19.55	350.00	1860.00	27.67	5.96	0.00	0.01	0.00	5.96
to Pond-2										
24*	2.36	2.36	120.00	120.00	8.33	1.00	0.01	0.01	2.00	1.01
to No.26										
25*	10.85	10.85	500.00	500.00	12.56	4.24	0.03	0.03	4.35	4.27
26*	5.54	18.75	180.00	800.00	15.89	6.90	0.03	0.07	5.00	6.97
to No.28										
27*	10.50	10.50	500.00	500.00	12.56	4.11	0.05	0.05	9.00	4.16
28	5.00	34.25	260.00	1560.00	24.33	10.97	0.03	0.15	5.00	11.12
29	2.35	36.60	450.00	2010.00	29.33	10.88	0.01	0.16	1.00	11.04
to Pond-2										
30	6.00	6.00	360.00	360.00	11.00	2.42	0.04	0.04	6.00	2.45
31	11.50	17.50	200.00	560.00	13.22	6.76	0.00	0.04	0.00	6.79
to Pond-2										
32*	0.78	0.78	260.00	260.00	9.89	0.32	0.00	0.00	0.00	0.32
33	4.00	4.78	750.00	1010.00	18.22	1.69	0.00	0.00	0.00	1.69
to Pond-1										
34	6.56	6.56	370.00	370.00	11.11	2.64	0.04	0.04	6.00	2.67
35	4.39	10.95	260.00	630.00	14.00	4.17	0.02	0.06	4.00	4.23
36	5.69	16.64	460.00	1090.00	19.11	5.79	0.03	0.09	5.00	5.88
to Pond-1										
37	3.71	3.71	470.00	470.00	12.22	1.46	0.02	0.02	4.00	1.48
38	8.75	12.46	500.00	970.00	17.78	4.44	0.05	0.07	8.00	4.51
39	13.00	25.46	390.00	1360.00	22.11	8.44	0.08	0.15	13.00	8.59
to Pond-1										
TOTAL				23700.00					143.70	

NOTE ; Accumu. : Accumulated Area
Ext. : Extention of Line
Con-Time : Concentration Time
IWW.Flow : Industrial Waste Water Flow
In.Lot : Industrial Lot
T.Flow : Total Flow (Peak Flow + IWW.Flow)
* : Double Line

Tabel 2.8.3(2) Flow Rate of Drainage (Trapezoid)

Line No.	B (m)	b (m)	h (m)	A (m^2)	O (degree)	p (m)	R (m)	E.L. (m)	I	n	V (m/s)	Q (m^3/s)	Qp (m^3/s)
								47.50					
1	1.20	0.70	1.00	0.85	76.00	2.76	0.34	43.56	0.013	0.025	2.25	2.14	1.96
2*	1.20	0.80	0.80	0.80	76.00	2.45	0.33	36.00	0.025	0.025	3.01	2.41	2.18
3*	1.20	0.70	1.00	0.95	76.00	2.76	0.34	28.00	0.021	0.025	2.85	2.71	2.43
4	2.50	1.50	2.00	4.00	76.00	5.63	0.71	26.00	0.002	0.025	1.56	6.23	5.78
								36.35					
5	1.50	0.85	1.30	1.53	76.00	3.53	0.43	32.75	0.008	0.025	1.98	3.03	2.79
6	1.70	1.05	1.30	1.79	76.00	3.73	0.48	28.50	0.007	0.025	2.01	3.60	3.34
								36.35					
7	1.60	0.95	1.30	1.66	76.00	3.63	0.46	32.75	0.008	0.025	2.05	3.41	3.19
								47.50					
8	1.00	0.70	0.60	0.51	76.00	1.94	0.26	39.00	0.031	0.025	2.92	1.49	1.17
9*	1.00	0.60	0.80	0.64	76.00	2.25	0.28	32.75	0.023	0.025	2.60	1.66	2.92
10	2.00	1.10	1.80	2.79	76.00	4.81	0.58	29.46	0.009	0.025	2.62	7.33	6.88
								37.25					
11	1.20	0.80	0.80	0.80	76.00	2.45	0.33	29.46	0.016	0.025	2.37	1.90	2.48
12	2.80	1.80	2.00	4.60	76.00	5.93	0.78	28.50	0.004	0.025	2.02	9.28	8.17
								31.34					
13	1.00	0.70	0.60	0.51	76.00	1.94	0.26	29.50	0.008	0.025	1.44	0.73	0.30
14	3.00	2.00	2.00	5.00	76.00	6.13	0.82	29.00	0.001	0.025	1.11	5.53	4.43
15	3.00	1.60	2.80	6.45	76.00	7.38	0.87	28.50	0.001	0.025	1.25	8.04	7.58
16	2.40	1.20	2.40	4.32	76.00	6.15	0.70	26.00	0.009	0.025	3.00	12.97	12.84
								29.50					
17	3.00	2.00	2.00	5.00	76.00	6.13	0.82	29.00	0.001	0.025	1.14	5.70	4.55
18	3.30	1.80	3.00	7.86	76.00	7.99	0.96	28.50	0.001	0.025	1.23	9.41	8.28
								43.56					
19*	1.50	0.90	1.20	1.44	76.00	3.38	0.43	34.82	0.017	0.025	3.00	4.32	4.11
20	1.80	1.20	1.20	1.80	76.00	3.68	0.49	30.00	0.010	0.025	2.55	4.58	4.57
								34.82					
21*	1.50	0.90	1.20	1.44	76.00	3.38	0.43	33.21	0.004	0.025	1.36	1.95	2.57
22	1.50	0.75	1.50	1.69	76.00	3.84	0.44	30.00	0.010	0.025	2.31	3.90	2.52
23	2.50	1.50	2.00	4.00	76.00	5.63	0.71	29.00	0.003	0.025	1.70	6.82	5.96
								33.21					
24*	1.00	0.70	0.60	0.51	76.00	1.94	0.26	32.68	0.004	0.025	1.09	0.56	1.01
								44.00					
25*	1.20	0.80	0.80	0.80	76.00	2.45	0.33	32.68	0.023	0.025	2.85	2.29	4.27
26*	1.60	0.90	1.40	1.75	76.00	3.79	0.46	31.34	0.007	0.025	2.06	3.61	6.97
								37.25					
27*	1.50	1.00	1.00	1.25	76.00	3.06	0.41	31.34	0.012	0.025	2.39	2.99	4.16
28	2.40	1.25	2.30	4.20	76.00	5.99	0.70	29.50	0.007	0.025	2.66	11.15	11.12
29	3.30	1.95	2.70	7.09	76.00	7.52	0.94	28.75	0.002	0.025	1.57	11.14	11.04
		ERR						29.50					
30	2.00	1.25	1.50	2.44	76.00	4.34	0.56	29.00	0.001	0.025	1.01	2.47	2.45
31	3.00	1.85	2.30	5.58	76.00	6.59	0.85	28.75	0.001	0.025	1.27	7.06	6.79
								43.57					
32*	0.60	0.30	0.60	0.27	76.00	1.54	0.18	35.19	0.032	0.025	2.25	0.61	0.32
33	1.30	0.80	1.00	1.05	76.00	2.86	0.37	29.00	0.008	0.025	1.86	1.96	1.69
								43.57					
34	1.50	1.00	1.00	1.25	76.00	3.06	0.41	39.98	0.010	0.025	2.17	2.71	2.67
35	1.50	0.80	1.40	1.61	76.00	3.69	0.44	36.46	0.014	0.025	2.68	4.32	4.23
36	1.70	0.95	1.60	1.99	76.00	4.04	0.49	29.36	0.014	0.025	2.96	5.17	5.88
								46.11					
37	1.10	0.60	1.00	0.85	76.00	2.66	0.32	40.82	0.011	0.025	1.98	1.69	1.48
38	1.70	1.05	1.30	1.79	76.00	3.73	0.48	34.35	0.013	0.025	2.79	4.98	4.51
39	2.10	1.15	1.90	3.09	76.00	5.07	0.61	28.58	0.010	0.025	2.88	8.89	8.59

NOTE
B : Width of top
b : Width of bottom
h : Depth of water
A : Water section area
O : Angle of trapezoid
p : Wet line length
R : Hydraulic radius
I : Water surface slope
n : Roughness coefficient
V : Velocity
Q : Discharge capacity of ditch
Qp : Design peak flow

Table 2.8.4 FLOW RATE OF COLLECTION PIPE

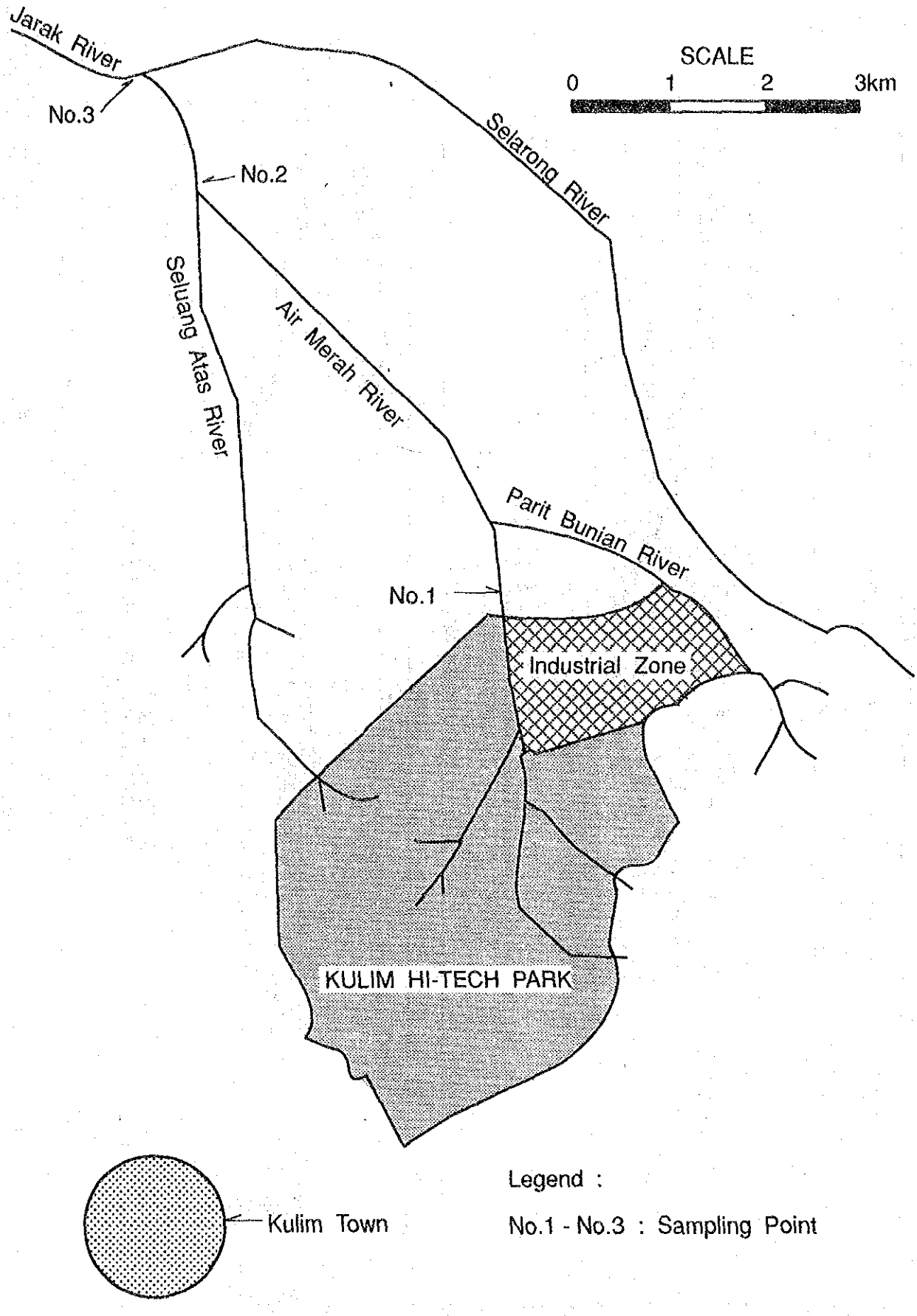
No.	Qi (m^3/s)	d @(m)	R (m)	A (m^2)	I	n	V (m/s)	Q (m^3/s)	L (m)	H (m)	G.L (m)	EL.Pipe (m)	Covering (m)
											36.350	35.150	1.200
1	0.0042	0.300	0.075	0.071	0.0061	0.015	0.926	0.065	250	1.525	34.830	33.625	1.205
2	0.0063	0.300	0.075	0.071	0.0087	0.015	1.106	0.078	230	2.001	32.830	31.624	1.206
to No.4											44.000	42.800	1.200
3	0.0018	0.380	0.095	0.113	0.0280	0.015	2.323	0.263	400	11.200	32.830	31.600	1.230
4	0.0102	0.380	0.095	0.113	0.0047	0.015	0.952	0.108	380	1.786	31.050	29.814	1.236
to No.6											37.000	35.800	1.200
5	0.0021	0.300	0.075	0.071	0.0133	0.015	1.367	0.097	450	5.985	31.050	29.815	1.235
6	0.0184	0.380	0.095	0.113	0.0091	0.015	1.324	0.150	280	2.548	28.500	27.266	1.234
7	0.0268	0.609	0.152	0.291	0.0019	0.015	0.829	0.241	460	0.874	29.000	26.392	2.608
8	0.0352	0.609	0.152	0.291	0.0019	0.015	0.829	0.241	500	0.950	29.500	25.442	4.058
to No.15											34.820	33.620	1.200
9	0.0004	0.300	0.075	0.071	0.0050	0.015	0.838	0.059	460	2.300	33.210	31.320	1.890
10	0.0012	0.300	0.075	0.071	0.0046	0.015	0.804	0.057	140	0.644	32.680	30.676	2.004
to No.12											44.000	42.800	1.200
11	0.0018	0.225	0.056	0.040	0.0343	0.015	1.813	0.072	330	11.319	32.680	31.481	1.199
12	0.0051	0.300	0.075	0.071	0.0071	0.015	0.999	0.071	190	1.349	31.340	29.327	2.013
to No.14											37.250	36.050	1.200
13	0.0038	0.225	0.056	0.040	0.0126	0.015	1.099	0.044	470	5.922	31.340	30.128	1.212
14	0.0114	0.300	0.075	0.071	0.0063	0.015	0.941	0.067	290	1.827	29.500	27.500	2.000
15	0.0487	0.609	0.152	0.291	0.0019	0.015	0.829	0.241	240	0.456	29.060	24.986	4.074
16	0.0495	0.609	0.152	0.291	0.0019	0.015	0.829	0.241	340	0.646	28.750	24.340	4.410
to C.T.P.											43.570	42.370	1.200
17	0.0025	0.300	0.075	0.071	0.0046	0.015	0.804	0.057	250	1.150	42.500	41.220	1.280
18	0.0059	0.300	0.075	0.071	0.0172	0.015	1.555	0.110	280	4.816	37.690	36.404	1.286
19	0.0093	0.300	0.075	0.071	0.0111	0.015	1.249	0.088	300	3.330	34.350	33.074	1.276
20	0.0169	0.300	0.075	0.071	0.0134	0.015	1.372	0.097	320	4.288	30.070	28.786	1.284
21	0.0169	0.380	0.095	0.113	0.0450	0.015	2.944	0.334	80	3.600	28.580	25.186	3.394
22 *	0.0169	0.380	0.095	0.113	0.0300	0.015	2.404	0.273	70	2.100	25.000	23.086	1.914
23	0.0169	0.380	0.095	0.113	0.0050	0.015	0.981	0.111	50	0.250	29.500	22.836	6.664
to C.T.P.													

Pipe Length PVC 225 mm 800.000 m
PVC 300 mm 3160.000 m
RC 380 mm 1260.000 m
RC 609 mm 1540.000 m

22 * : River Crossing Pipe

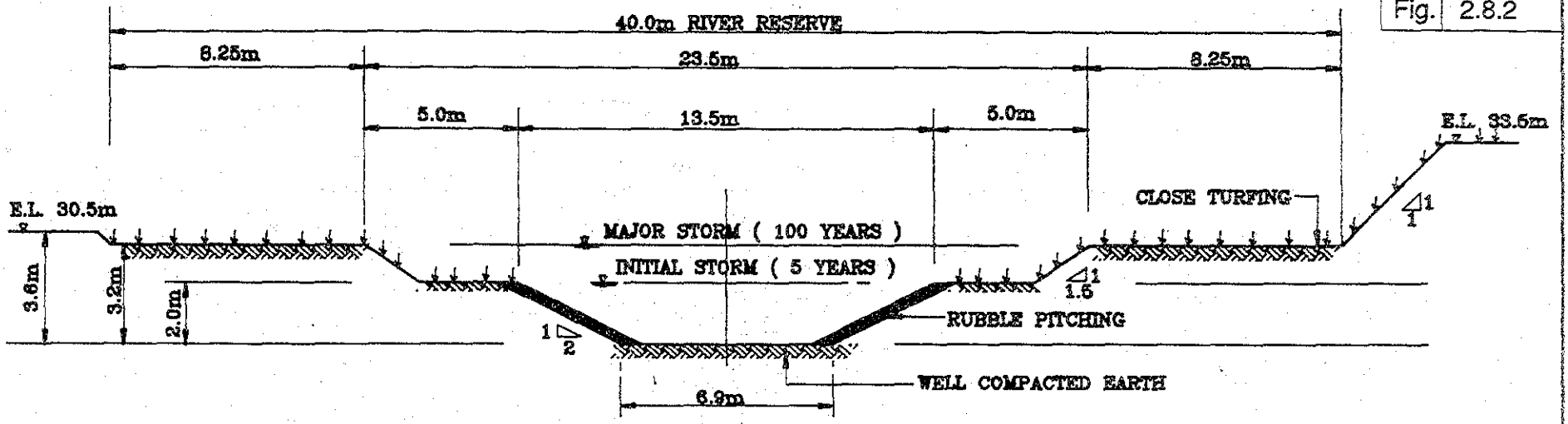
NOTE
Qi : Design flow
Q : Capacity of Pipe
d : Dia. of Pipe
L : Length of Pipe
V : Velocity
R : Hydraulic Radius
I : Slop
n : Roughness Coefficient
H : L*I
G.L.: start/end of pipe line

Fig. 2.8.1



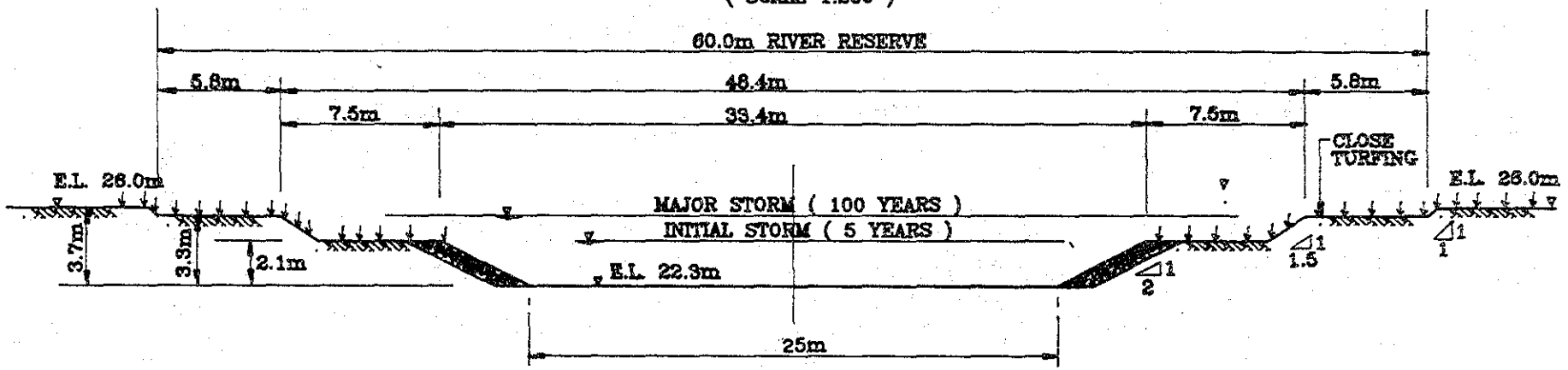
THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE Location of Water Sampling Point

Fig. 2.8.2



PARIT BUNIAN RIVER

(SCALE 1:200)

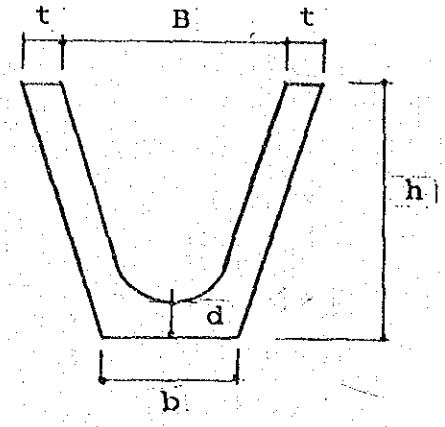


AYER MERAH RIVER

(SCALE 1:300)

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE TYPICAL SECTION FOR ENLARGEMENT

Sub Ditch (Ready-made)



B : 300 - 600 mm

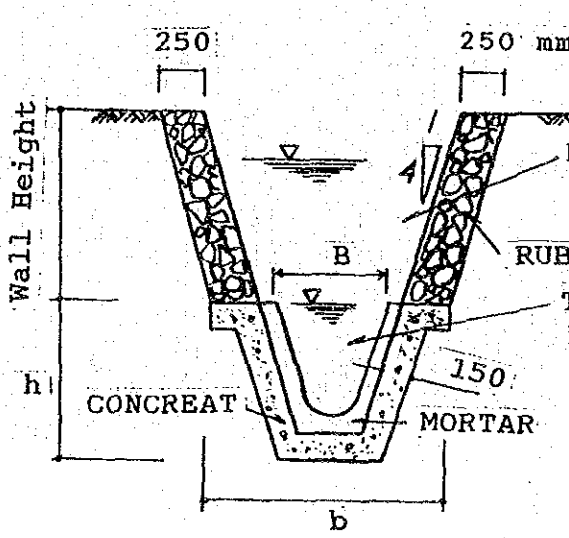
b : 250 - 362 mm

h : 362 - 700 mm

t : 90 - 100 mm

d : 62 - 100 mm

Main Ditch (Field-made)



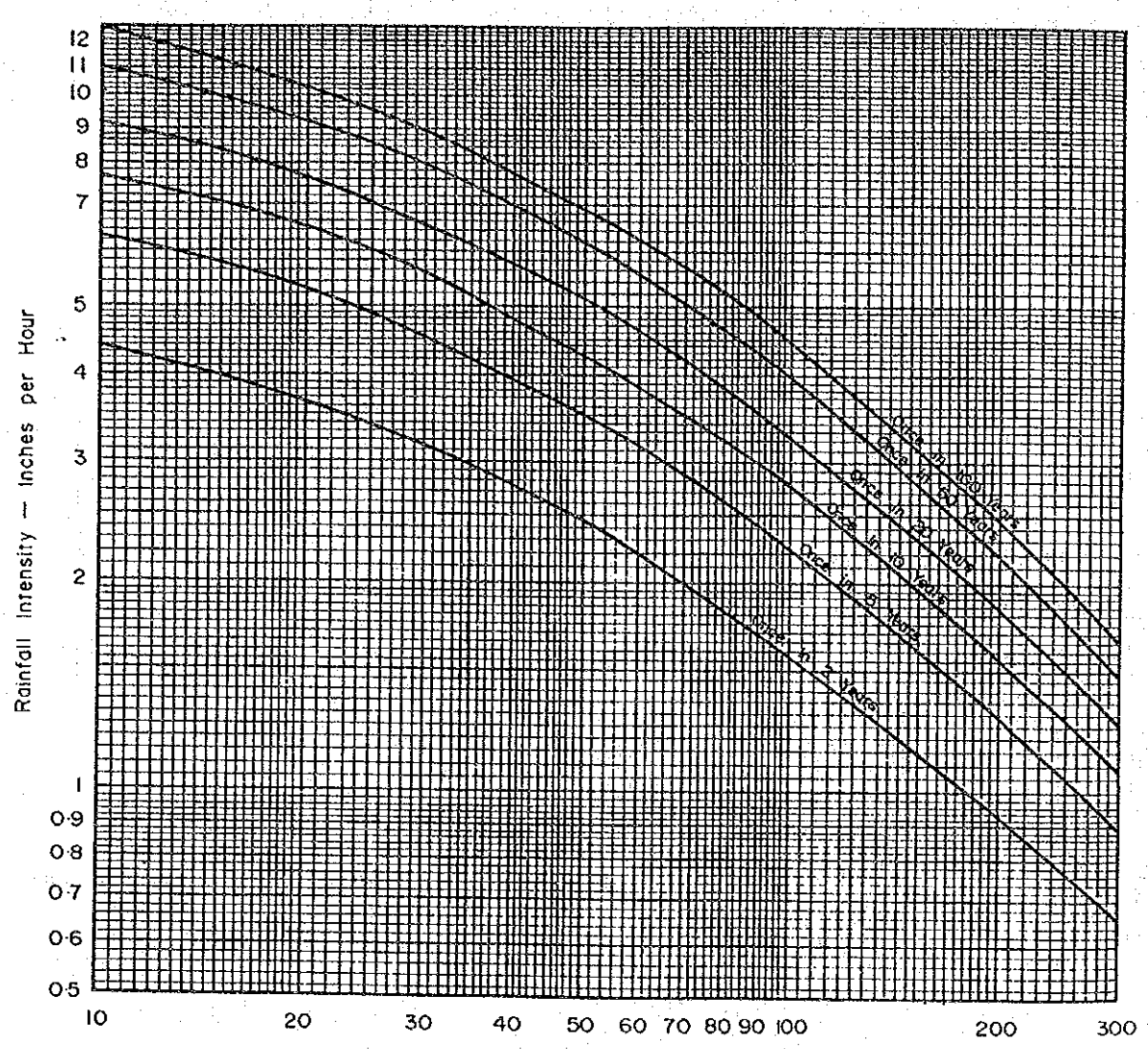
B : 300 - 600 mm

b : 925 - 1275 mm

h : 520 - 850 mm

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE TYPICAL SECTION OF DITCH

Fig. 2.8.4



Rainfall Intensity – Duration – Frequency Relationship – Kulim

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE RAINFALL INTENSITY AT KULIM

2.9 Industrial Waste Management

2.9.1 Present Status of Industrial Waste Management in Malaysia

Factories generate various types of solid wastes. Some of these wastes may be toxic and hazardous while the rest are non-toxic or non-hazardous. The WHO defines hazardous waste as being one that has physical, chemical or biological characteristics which require special handling and disposal procedures to avoid risk to health and/or other adverse environment effects. Hazardous wastes is locally defined as listed under First Schedule, Environmental Quality (Schedules Waste) Regulations 1989.

The non-toxic or non-hazardous components of industrial wastes comprises discarded packaging materials, discards from the production process, food wastes, and unwanted raw materials, wastes. Collectively the toxic and hazardous as well as the non-toxic and non-hazardous components from factories and industrial establishments shall be classified as industrial wastes.

The non-toxic and non-hazardous components generated in industrial estates in Malaysia are presently either collected by local authorities or private contractors (which enter into agreements with the industrial establishments) who then haul these for disposal at municipal disposal sites. In some instances, the factory themselves will transport the waste for disposal at the local municipal disposal site.

The toxic and hazardous components are regulated by the Environmental Quality (Scheduled Waste) Regulations 1989. These wastes are required by these Regulations to be properly managed and disposed of only at approved/licensed disposal sites. Unfortunately such toxic and hazardous disposal sites are non-existent in Malaysia at the moment although there are plans to establish such disposal sites in the near future.

The Department of Environment had started looking for suitable disposed sites as early as 1981. Although 89 sites have been investigated very few seem to be suitable for various technical and social reasons. The New Strait Times on June 11 1991, reported that a site in Negeri Sembilan has been considered for the first central toxic waste disposal site. Unfortunately it is still uncertain, until DOE has studied the preliminary EIA report prepared for the project.

Efforts are also being made to construct similar facilities in Selangor and Johor. Because of the unavailability of such facilities in the country, such wastes are stored on site at each industrial establishment or factory. It is suspected that some of these wastes

may be irresponsibly disposed of at existing municipal disposal sites, as the volume of such wastes increases and occupies precious storage areas at the factories.

As for industrial waste water, each factory is required to construct their own treatment plant and their effluent discharge should meet the standard stipulated in the Environmental Quality (Sewerage and Industrial Effluent) Regulations 1978. The sludge produced, if found to be toxic or hazardous will be stored in the factory yard while waiting for final disposal (refer to Fig. 2.9.1).

According to information from DOE, the first central treatment plant for industrial toxic and hazardous solid wastes shall be constructed and its operation is expected to be started earlier than 1993. Therefore, each factory or newly constructed industrial estate should be provided with temporary storage facility for the industrial toxic and hazardous solid waste with capacity to store such waste equal to an average of five years' amount of generation. It is anticipated that the central treatment facility to be provided by DOE will be ready within 5 years.

2.9.2 Estimation of Generation Rate of Industrial Solid Waste

The generation rate of industrial solid wastes is important for the estimation of the quantity of waste generated from which the sufficiency of the area required for the disposal site can be evaluated.

For the adoption of a generation rate to be applied for this project, generation rates ascertained from previous studies carried out shall be the basis. However, given the varied nature of wastes, a wide variance in generation rates was apparent. These are as follows:

(1) Estimation from Model Plant Industry

An attempt was made to obtain waste generation rates from Japanese Hi-Tech Industrial establishments and factories (Table 2.9.1). The replies indicate that the generation rates could vary from 0 to 0.3 tonnes/day/factory. The mean value is 0.15 ton/day/ha. The survey also indicates that the nature of the wastes generated is very varied and most certainly some of these are unidentified and it is difficult to estimate and detect such wastes.

(2) Solid Waste Management Study for Pulau Pinang and Seberang Prai Municipalities

Total Amount of Industrial Wastes	=	96.20 t/d
Number of factories	=	168
Generation Rate	=	0.57 t/d/factory

The above generation rate was derived from the report "Supporting Report, Volume V, Present Condition Survey - August 1989" which forms part of the Solid Waste Management Study for Pulau Pinang and Seberang Prai Municipalities carried out by JICA in 1989. From the factory survey carried out for this project, 168 factories gave satisfactory responses.

(3) Solid Waste Master Plan Study for Petaling Jaya

Total No. of Factories Surveyed	=	37
Total Amount of Industrial Wastes	=	27.8 t
Therefore, Generation Rate	=	0.75 t/d/factory
	(=	190 kg/ha/d)

The above generation rate was estimated by factory survey as a part of the Master Plan Study on Solid Waste Management for Petaling Jaya which is being carried out by the Local Council of Petaling Jaya. The data as collected from February to June 1991. The factory survey covered 58 factories and industrial establishment of all sizes and production capacities within the Petaling Jaya Municipality, which is a township with a population of 350,000. Of the 58 factories surveyed, only 37 factories gave satisfactory responses. The generation rate is derived based on these companies. These results will be published soon as part of the Master Plan Report for Petaling Jaya which has been studied by our counter part, Engineering and Environmental Consultants Sdn., BHD.

From the generation rates for the three sources and studies above: For source (1) the generation rate may not be an accurate reflection given the very varied and unidentified nature of the wastes. Nevertheless, it still indicates a range of 0 to 0.3 tonnes/day/factory. A more reliable generation rate could perhaps be obtained from sources (2) and (3) above, as these were based on fairly large sampling and also more satisfactory replies from the factories was obtained.

Thus, the generation rate could possibly be in the range of 0.5 to 0.75 tonnes/day/factory. We have adopted the higher value of 0.75 tonnes/day/factory for this project. But this value is included not only industrial solid waste from the process but

also other domestic solid waste. In this industrial park, we propose the construction of the secure storage facility for the solid wastes generated from processes. Therefore, the generation rate solid waste was assumed 0.038 ton/day/ha, which was estimated from 0.15/0.75 x 0.19 = 0.038

2.9.3 Toxicity of Several Chemicals used by High-Tech Industry

Refer to Table 2.9.2.

(1) ACGIH

American Conference of Governmental Industrial Hygienists

(2) AJIM

Association of Japan Industrial Hygienists

(3) TLV–TWA

The Threshold Limit Value-Time Weighted Average–the time-weighted average concentration for a normal 8-hour workday and a 40-hour workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect.

(4) TLV–STEL

Threshold Limit Value-Short Term Exposure Limit–the concentration to which workers can be exposed continuously for a short period of time without suffering from 1) irritation, 2) chronic or irreversible tissue damage, or 3) narcosis of sufficient degree to increase the likelihood of accidental injury, impair self-rescue or materially reduce work efficiency, and provided that the daily TLV-TWA is not exceeded. It is not a separate independent exposure limit, rather it supplements the time-weighted average (TWA) limit where there are recognized acute effects from a substance whose toxic effects are primarily of a chronic nature. STELs are recommended only where toxic effects have been reported from high short-term exposures in either humans or animals.

(5) (C) : (TLV-C)

Threshold Limit Value-Ceiling–the concentration that should not be exceeded even instantaneously.

(6) (A2)

Industrial Substances suspected of Carcinogenic Potential for Man. Chemical Substances of substances associated with industrial processes, which are suspected of inducing cancer, based on either (1) limited epidemiologic evidence, exclusive of clinical reports of single cases, or (2) demonstration of carcinogenesis in one or more animal species by appropriate methods.

(7) AIIH

The meaning of Level is almost same as TLV-TWA expect Maximum Allowance Level Figure.

2.9.4 Construction Plan of the secure Storage Facility

According to the recommendation of DOE, the capacity of the temporary secure storage facility should be provided for a minimum five years.

The estimated amount of the industrial solid waste generated from High-Tech Industries for the first five years of Phase 1.

0.038 ton/ha/d x 250 ha x 365 day/year x 5 years x 0.62 = 10,749 ton

10,749 ton/0.6 ton/m^3 = 17,915m^3

Here : generation rate 0.038 ton/ha/d
(decided, based on the actual records in Japan)

Average production rate 62%
(decided, based on the actual records in Japan)

Density (Specific gravity for Storage) 0.6 ton/m^3
(Decided, based on the Japan Technical Guideline of Sanitary Landfill)

The secure storage facilities, 1 unit, 25m x 100m x 2.5mH = 6250 m^3

For First Stage, 3 units should be constructed.

$$6250\ m^3 \times 3 = 18750\ m^3 > 17{,}915\ m^3$$

So, 3 unit facility is enough for the industrial solid waste generated for the first five years of Phase 1.

Land of 10 ha is prepared for the construction of the further secure storage facility. In this area, total 209,375m³ of secure storage facilities can be constructed. The estimated annual amount of industrial solid waste of Phase 1 and Phase 2 is :

0.038 ton/ha/d x 360 ha x 365 dat/year/0.6 = 8322 m³/year

Amount of 25 years* : 8322 m³ /year x 25=208,050 m³ <209,395 m³

* Assumed the life of Hi-Tech Park of 25 years

So, prepared land is enough for the construction for a secure storage facility for the industrial solid waste which will be generated in the Kulim Hi-Tech Industrial Zone in the future 225 years. However, the land would be used for a factory lot or something else after construction of central industrial solid waste disposal facility by DOE.

For the protection of the ground against toxic materials, special liners should be provided for this facility. A comparison of various liner materials are presented in Table 2.9.3 and polyvinyl chloride sheets (PVCX-normal type) is recommended due to it lower cost and its properties are comparable with other types of liners.

2.9.5 O/M Cost Secure Storage Facility

1)	Labour			
	Operator	$ 600/m x 12 x 2	=	14,400
	Clerk	$ 400/m x 12 x 1	=	4,800
	Supervisor	$ 1,000/m x 12 x 1	=	12,000
	Labour	$ 300/m x 12 x 3	=	10,800
2)	Telephone	$ 200/m x 12	=	2,400
3)	Water	$ 100/x x 12	=	1,200
4)	Electricity	$ 100/m x 12	=	1,200
5)	Petroleum	$ 200/m x 12	=	2,400
		Sub Total		M$ 49,200/year

For full generation of wastes in 250 ha,

0.038 x 250 x 365	=	3,467 ton/year
3,467 ton/0.6	=	5,779 m^3/year
49,200/5779	=	M$ 8.5 /m^3
Container (drum)	=	M$50/0.25 m^3
Total Cost	=	M$ 210 /m^3

2.9.6 Environmental Protection Agreement for Industrial Waste

Because of the nature and complexities of the wastes that are generated from the factories, the management of such wastes requires careful planning, especially when there is a possibility that some wastes might be hazardous and toxic in nature. Based on the disposal concept proposed, it is of utmost importance that the polluters pay a principle be extended not only to each factory, but also to the whole industrial area. An agreement should be made between each individual factory and KSDC to ensure their responsibility to manage their own wastes. Each factory is required to inform KSDC of the nature of wastes that are generated and will agree to transport them in a specified manner to the disposal site. The inventory as well as monitoring and tracking system, should be in accordance with the relevant guidelines and/or existing regulations.

Each factory must agree to adopt the proposed system, and movement of wastes is only restricted to within the industrial area. In addition, each factory should also be informed that for the operation and maintenance of the secure storage facility, they have to bear the operation and maintenance cost depending upon the quantity on the solid waste.

KSDC and individual industry Co., Ltd. exchanges an Agreement for industrial solid waste management from being generated in connection with business activities of individual industries when erecting newly plan in the site of Kulim Hi-Tech Industrial Park.

The purpose of this Agreement lies in industrial solid waste management in connection with the business activities of individual industry's contribution to the well management, operation and maintenance of the secure storage facility being constructed by KSDC. All of these items should be involved in the General Environmental Protection Agreement.

Table 2.9.1 Waste Quantities Estimated in Targeted Model Plant

Production	LSI '000 Pieces/Month	Personal Computer Pieces/Month	Television Receiver Units/Months	NC Machine Tool Pieces/Month	Magnetic Disc Drive Pieces/Month
Capacity	80,000	90,000	60,000	100	20,000
Waste Water (m^3/d)	15,000	160	500	10	200
Solid Waste (kg/d)	8	Not Available	300	Not Available	40
Materials	CaF Al $(OH)_3$ NH_4 Acid Alkali, etc.	Not Available	Cds Al $(OH)_3$ ZnS	Not Available	Acid Alkali Detergent

Production	Bearing '000 Pieces/Month	Magnetic Head Pieces/d	Print Circuit Board Mil. ¥/Month	Compact Disc Pieces/d	Connector Mil. ¥/Month
Capacity	10,000	120,000	70	1,000	1,000
Waste Water (m^3/d)	35	70	Not Available	45	100
Solid Waste (kg/d)	7	14	Not Available	12	30
Materials	Al $(OH)_3$ OIL	Al $(OH)_3$ Acid Alkali	Not Available	Acid Alkali Resist	Acid Alkali Detergent

Production	Plastic Form 100 ton 13,000	VTR '000 Units/Month	LCD (Exc. Assemble) '000 Pieces/Month	TFT–LCD Mil. P./Y (Y.R>-80%)	Total
Capacity	–	90,000	60,000	100	
Waste Water (m^3/d)	30	250	50	2,880	20,230
Solid Waste (kg/d)	8	125	10	Not Available	554
Materials	Resist	Not Available	Not Available	Not Available	

Table 2.9.2 (1) Toxicity of Several Chemicals used by High-Tech Industry

Chemicals	Allowance Level					
	ACGIH				AJIM	
	TLV-TWA		TLV-STEL			
	ppm	mg/m³	ppm	mg/m³	ppm	mg/m³
AsH_3	0.05	0.2			0.05	0.2
$AsCl_3$						
AsF_3						
AsF_5						
As, As_2O_3		0.2				0.5
CF_4						
C_2F_6						
C_3F_8						
CHF_3						
CB_2 or F_6	1,000	6,100	1,200	7,300		
CCl_1F_2	1,000	4,950	1,260	6,200		
CCl_4	5 (A2)	30 (A2)	20 (A2)	125 (A2)	10	65
$C_2Cl_3F_3$						
SF_6	1000	6000	1250	7550		
HF	3	2.5	6	5	3	3
SiF_4						
HCl	5(C)	7 (C)			*5	*7
NH_3	25	18	35	27	25	18
N_2O						
NO	25	30	35	45		
NO_2	3	6	5	10	5	9
SiH_4	5	7				
$SiHCl_3$						
SiH_2Cl_3						
SiO_2						
HiF_4						

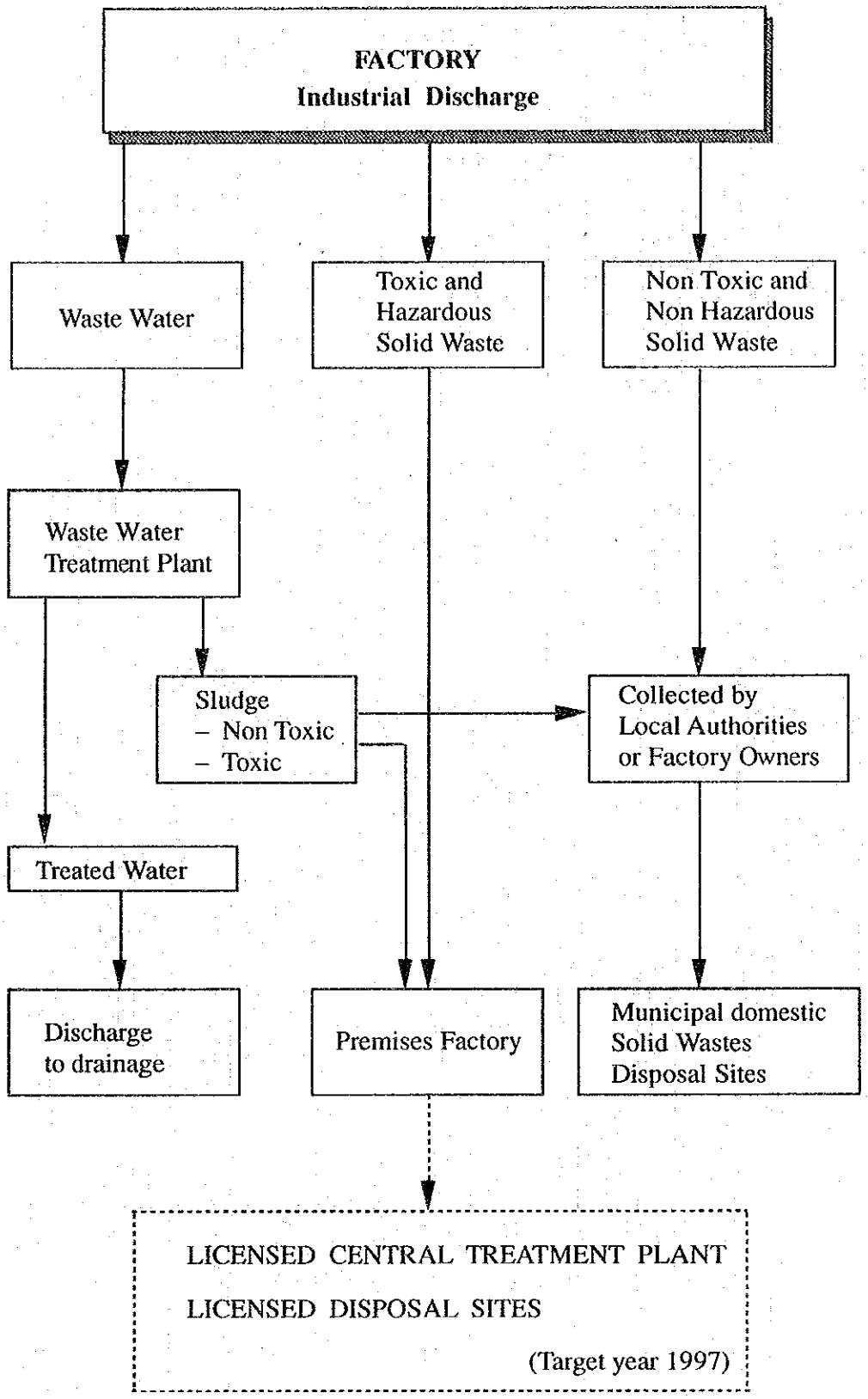
Table 2.9.2 (2) Toxicity of Several Chemicals used by High-Tech Industry

Chemicals	Allowance Level					
	ACGIH				AJIM	
	TLV-TWA		TLV-STEL			
	ppm	mg/m³	ppm	mg/m³	ppm	mg/m³
B_2H_6	0.1	0.1				
BF_3	1 (C)	3 (C)			0.3	0.9
BCl_3						
B_2O_3		10		20		
PH_3	0.3	0.4				
PCl_3	0.2	1.5	0.5	3		
PCl_5	0.1	1			–	1
PBr_6						
$POCl_3$	0.1	0.6	0.5	3		
H_2PO_4		1		3		1
P_2O_2						
CH_3OH	200	260	250	310	200	260
C_2H_5OH	1,000	1,900	–	–		
C_3H_7OH	400	980	500	1,225	400	980
C_2HCl_3	50	270	(150)	(805)	50	270
CH_3CCl_3	350	1,900	450	2,450	200	1,085
CH_3COCH_3	750	1,780	1,000	2,375	200	475
$CH_3COC_2H_5$	200				200	
$CH_3COC_5H_8$	50	235	100	465	100	375
C_7H_8	100	375	150	560	100	375
C_8H_{10}	100	435	150	655	50	870
$C_2H_5OCOCH_8$	400	1,400	–	–	400	1,400
$C_4H_3OCOCH_3$	200	950	250	1,190	200	950

Table 2.9.3 Comparison Table of Physical Property and Characteristics of each Material

Items	Materials	Plastic				Synthetic Rubber		Asphalt Sheet	Concrete
		Polyvinyl chloride		Polyolefine		Vulcanizate	Elastomer		
		Normal type	High elasticity type	EVA (Ethylene-vinylacetate copolymer)	HDPE (High density polyethylene)	EPT (Ethylene-propylene-terpolymer)			
Physical property (at 20°C)	Specific gravity	1.25 ~ 1.35	1.2 ~ 1.3	0.92 ~ 0.95	0.94 ~ 0.97	1.2 ~ 1.3	1.0 ~ 1.3	1.05	–
	Tensile strength (kgf/cm^2)	140 ~ 180	140 ~ 170	100 ~ 197	170 ~ 200	100 ~ 130	140 ~ 210	20 ~ 50	–
	Elongation (%)	300 ~ 350	400 ~ 450	450 ~ 800	500 ~ 700	450 ~ 500	450 ~ 700	100 ~ 130	–
	Tear resistance (kgf/cm)	50 ~ 70	35 ~ 45	60 ~ 80	60 ~ 80	25 ~ 40	50 ~ 70	15 ~ 25	–
Weatherability		Excellent	Excellent	Inferior	Good	Excellent	Excellent	Slightly low	Excellent
Heat resistance		65 ~ 80	65 ~ 80	–	40 ~ 50	100	65	40	–
Low temperature brittleness (°C)		-30	-35	-30	-20	-20 ~ -40	-30	-10	–
Acid resistance		Excellent	Excellent	Weak	Excellent	Weak	Good	Good	Inferior
Alkali resistance		Excellent	Excellent	Good (relatively stable)	Excellent	Good	Good (relatively stable)	Good	Excellent
Oil resistance		Good	Good	Inferior	Excellent	Weak	Good (relatively stable)	Inferior	Good
Workability		Easy	Easy	Relatively easy	Relatively easy	Relatively easy	Relatively easy	Heating device, construction machinery	Construction machinery & form
Joining at site		Easy (Welding)	Easy (Welding)	Relatively easy (Welding)	Relatively easy (Welding)	Needs expert (Bonding)	Relatively easy (Welding)	Needs expert (welding)	Difficult to stop water completely
Repair work		Easy	Easy	Relatively easy	Relatively easy	Relatively easy	Relatively easy	Difficult	Difficult
Resistance to unevenness of the bottom		Some degree	Some degree	Some degree	Some degree	Some degree	Some degree	Some degree	Enough
Durable years (estimated)		15 ~ 25 years	15 ~ 25 years	Approx.10 years	15 ~ 25 years	15 ~ 25 years	15 ~ 25 years	20 years	50 years
Cost (sum of materials cost and construction cost) (¥/m^2) (Domestic cost in Japan) (Thickness of sheet is 1.5 mm)		3,600–	4,000–	4,000–	4,500–	4,000–	4,300–	8,000–	8,000–

Fig. 2.9.1



THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE Present Industrial Waste Management Practices in Malaysia

2.10 Landscaping

2.10.1 Characters of Activities for Basic Design Concept

Basic Design Concept is set up in accordance with the character of activities of the Industrial Estate. The character of activities are analysed based on Basic Design Policy.

The Activities are mainly classified into two characters of both kinetic and quiet zone. The analysis of each activity character is shown in Fig.2.10.1.

2.10.2 Design Criteria

(1) Open spaces and parks

Using the planning standards in Malaysia, the parks and open spaces would be identified and designated in conjunction with the overall land use planning process and worker population distribution in the project. This should be the efficient process of provision of the facilities, as well as their accessibility to the people.

The recreational parks and open spaces shall be planned and provided according to several levels. The hierarchy of parks and open spaces will be as per Tables 2.10.1 and 2.10.2.

Open spaces on this estate are classified in accordance with the planning standard which is adopted to guide planning in Malaysia.

(2) Industrial Facility

Table 2.10.3 shows the Japanese example and Table 2.10.4 shows the Malaysian code.

The landscape plan of each lot in the estate in Kulim, is proposed as below, after consideration of both Malaysian and Japanese Standards. Each lot in this zone will be at a different slope level, due to cut and fill land formation. Therefore, guidelines for landscape plan should be

carefully planned, because the sloped area needs to be allocated within each lot.

Fig. 2.10.3 shows model landscape plan of factory lot. Table 2.10.5 shows the chart of comparison between them among industrial estates.

2.10.3 Example of Landscape Plan in Japan

The enterprises in some estates are asked to abide by the construction agreement for landscape design.

Table 2.10.3 Outline of Landscape Plan of Hakusan Hi-Tech Park, Yokohama

1. Site Utilization:
   a) Building Coverage: 40% of lot area
   b) Floor Area Ratio : 200% of lot area
   c) Maximum Height of Buildings : 31 meters

2. Setback:
   a) 15 meters or more from arterial road
   b) 10 meters or more from collector road

3. Green Areas:
   Not less than 20% of lot area
   Mounds green are created around the lot.

4. Vehicle Entrance: Not more than two gateways

5. Sidewalks:
   2 meter-wide sidewalks are set up along 12 meter-wide roads

6. Pollution Control:
   Antipollution measures are taken in order to establish goodwill with peripheral communities.

7. Others:
   For the design, color, layout, size and material of buildings, fences, plants, signs and advertisements,the landscape is taken into consideration.

2.10.4 Guideline of Landscape Plan in Malaysia

Table 2.10.4 Summary of Guideline for Planning Standard in Malaysia (State of Kedah)

Type of Development		Set Back Line/Building			Remark
		FRONT	SIDE	BACK	
2.2	Industrial Area				
2.2.1	Individual/Detached	9.0m (30ft)			Setback building from land reserve boundary and access road
			6.0m (20ft)	6.0m (20ft)	To the boundary/line
2.2.2	i) Terrace/link	No limitation	4.6m	4.6m	From the road boundary/line and access road
	ii) Terrace/link	No limitation	4.6m (15ft)	4.6m (15ft)	The building set back from side lane boundary reserve and back lane.
	iii) Factory with level/floor	9.0m (30ft)			

Type of Development		Distance between Buildings	Remark
3.1	Housing Estate		
3.1.1	i) 1 or 2 floor for bungalow/detached house	4.5m (15ft)	Distance between walls
	ii) 3 floor or more	6.9m(23ft) or 1/2 from the height building (the highest)	i) The distance between wall for 3 level building or, from wall of a building which posses similar level or same height.
		The average from the minimum total of every building	ii) If two building facing adjacent to one another having different level or height but having more than 2 level
3.2	Industrial Area		
3.2.1	Terrace/Factory	6.0m (20ft)	Distance between 2 building at the end of the block or terrace should not exceed 10 units per terrace

Source : Department of Town and Country Planning; Peninsular Malaysia - K.L. Feb, 1988

2.10.5 Green Network System

Finally, in line with goal of the landscaping plan to improve the well being of the people on the Industrial Estate in Kulim, the Green Network System will provide Recreational amenities for general public as well as estate worker.(see Fig. 2.10.4)

2.10.6 Other Item to be considered

- Hawkers complex or place for both medium and small factories, will be planned in the park adjacent to the factory
- Street furniture and paving are to be designed after setting up the size and area of parks, open spaces and green belts.
- Also, sport facilities such as field, tennis court etc. are treated as integral part of the park and type of sport in the estate is to be made to substantiate this proposal.
- The space along the primary access road shall be reserved for the Green Belt as buffer space where it is adjusted by Urban Zone.

Table 2.10.1 Classification and Standards of Parks and Open Spaces at District Level (Ex. Penang Island)

Category of Open Spaces	Density Standard	Size of Site	Population Served	Maximum Distance Travelled	Facilities & Activities
Neighbour-hood Park & Open Space	1 ha. per 2,500 pop. (1 ac. per 1,000 pop.)	0.2-2 ha. (0.5-5 ac.)	500-5,000	0.4 km (1/4 mile)	Children's play equipment, open space for children and informal games, shade and outdoor furnitures for adults.
Town Park	1 ha. per 2,500 pop. (1 ac. per 1,000 pop.)	4-20 ha. (10-50 ac.)	10,000-50,000	3 km (2 miles)	As above plus picnic areas, gardens, jogging tracks.
Community Park	1 ha. per 2,500 pop. (1 ac. per 1,000 pop.)	20-40 ha. (50-100 ac.)	50,000-(100,000	10 km (6 miles)	As above plus camping sites, walking trials and natural areas.
Regional Park	1 ha. per 2,500 pop. (1 ac. per 1,000 pop.)	> 80 ha. (>200 ac.)	200,000	30 km (20 miles)	As above plus hiking trials and forest preservation areas.

Source : Municipal Council of Penang Island Structure plan 1987

Table 2.10.2 Planning Standards at National Level

TYPES OF DEVELOPMENT	FUNCTIONS	ACREAGE	REMARKS
0	OPEN SPACE		
1	HOUSING AREA	10% of the gross development areas.	i) This includes 30% of area for LLN lines, river and canals reserves, school and oxidation pond. ii) This include 100% of the incidental open space, sport complex and recreational areas in multi storey buildings with condition the use is stated in the strata title.

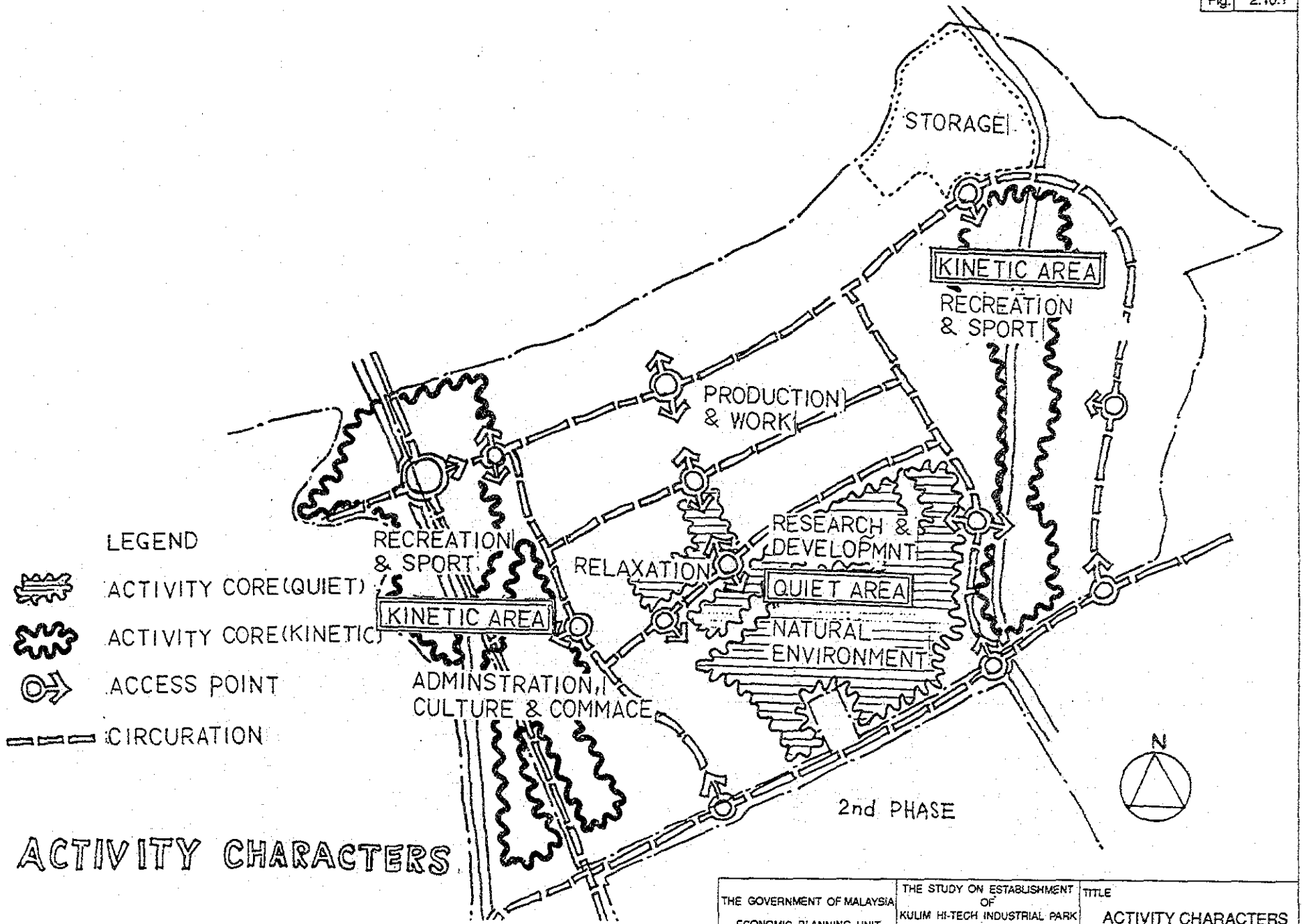
2 GUIDELINES FOR DISTRIBUTION AND SITING

2.1	Play lot	Playing lots for non-school going children.	660m2-4,000m2 (0.16ac-1.0ac.)	Requirements for areas with 500-2,000 pop.
2.2	Play ground	For promoting organised or informal	8,000m2-32,000m2 (2.0ac-8.0ac)	Requirements for areas with 2,000-5,000 pop.
2.3	Neighbourhood playground.	Passive recreational activities. Playgrounds and sports complex with parks for shades, picnic & beautification.	32,000m2-120,000m2 (8.0ac030.0ac)	Requirements for areas with 5,000-20,000 pop.
2.4	Community Open Space	Passive recreation and organised sports acclivities for local residents. Suitable for sports meet & other physical activities. Center for inter gration of social and cultural at all times.	120,000m2-400,000m2 (30ac-100ac)	Requirements for areas with 20,000-50,000 pop.
2.5	Town Parks/ Open Space	Centre for organised sports activity. Centre for recreational gathering for town folks & occasional sports meets. Centre that facilitates for appreciation of natural beauty & its value.	400,000m2-1 km2 (100ac-247ac)	Requirements for areas with 50,000-100,000 pop.
2.6	Regional Parks & Open Space	Centre where people from town, out-skirts, and other parts of the district, where organised seasonal sports competations are promoted for enjoyment of its natural beauty. Enhance the natural environment and the use for research purposes.	1km2-2km2 (247ac-494ac)	
2.7	National Park/Open	A unique area of beautiful landscape, existance of wild life and resources for science & geology research. National heritage and important resources for research.	Not specified.	

Table 2.10.5 Comparison of Landscape Plan (Japan and Malaysia)

Items	Tsukub (Japan)	Hakusan (Japan)	Dallas (USA)	Penang Is. Code	Kedah State Code	Kulim High-Tech (Proposed)
1.Agreement of landscape plan before construction	Yes	Yes	Yes		Yes	Yes
2.Building Coverage	40%	40%	50%	-	-	40-50%
3.Floor Area Ratio	160%	200%	-	-	-	200%
4.Max Height of Building	not too high	>31m	not to be shown	15m above (setback) no limitation 5F + 1.5m setback (over 6F)	60 angle inclination from other building	-
5.Set Back . Front Primer RD . Front Arterial R Collect RD. . Side . Back . Other	25m 1.5m 15m 10m not to be shown 10m (Green Belt, park) 20m (public park, along the primary RD)	15m (15m RD) 12 (12m RD) 10 (10m RD) not to be shown not to be shown not to be shown	MIN.7.62m (25') MIN.3.04m (10') MIN.3.04m No (eaves) - -	 MIN.6m (20') 21m(Average) 2m Yes (eaves) -	 9m (30') 6m (20') 3m (10') 6m (20') Yes (eaves) -	 12m (30m) (20m) 10m Max 6m difference 6m 6m
6.Green Areas within lots	over 30%	over 20%	over 10% .Min.3m (10') along RD.	-	-	over 15%-20%
7.Sidewalk (2m) along 12m wide RD.	not to be shown	2m along the sidewalk	31mRD-1.8m 30m -30m 24m -4.5m	-	-	-
8.Vehicle Entrance & gate	not less than 2 gateway > 9m in Width > 1.5m in Height (10m from RD)	not less than 2 gateway	2 gateway	2 gateway (within Free zone)	1 Custom office, if necessary	1 gateway
9.Pollution Control	Yes	Yes	not to be shown	-	-	Yes
10.Other available open space wall instation instration	Yes No	Yes -	Yes -	 -	Yes, safety lane for Emergency	Yes, transparent fence
Parking screening	Yes	to be taken into consideration	-	-	-	to be taken into consideration
Exterior element	Yes	Yes	Yes	-	Fence Yes (Custom need)	Yes

Fig. 2.10.1

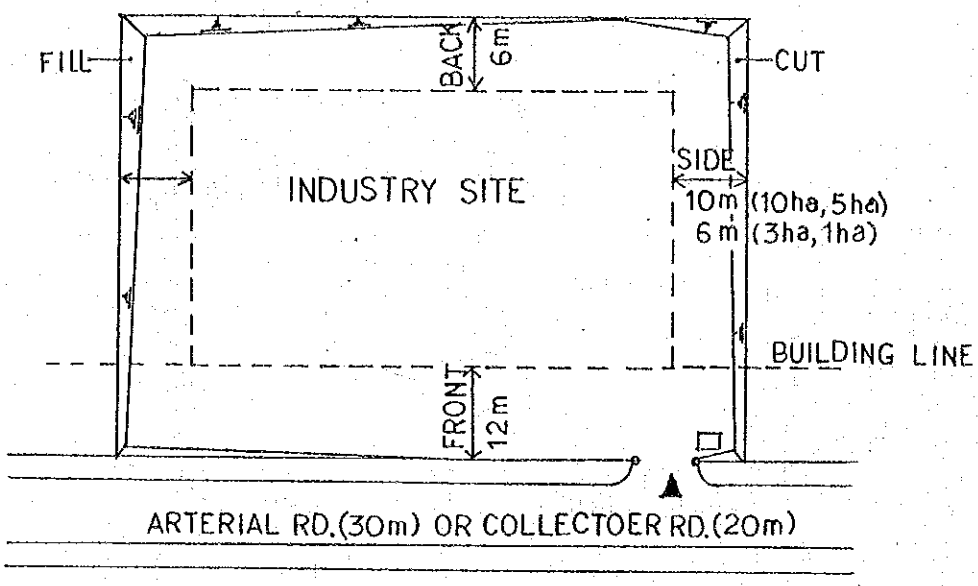


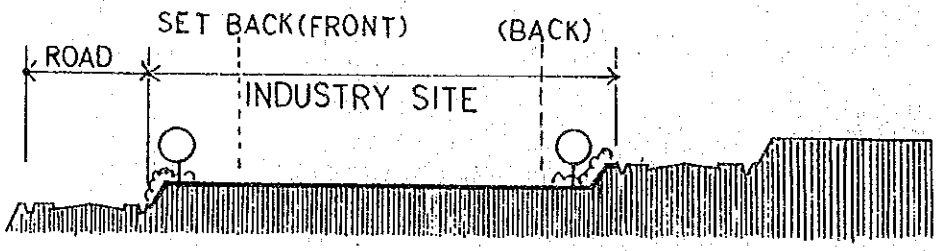
ACTIVITY CHARACTERS

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE ACTIVITY CHARACTERS

Fig. 2.10.2

● MODEL LANDSCAPE PLAN



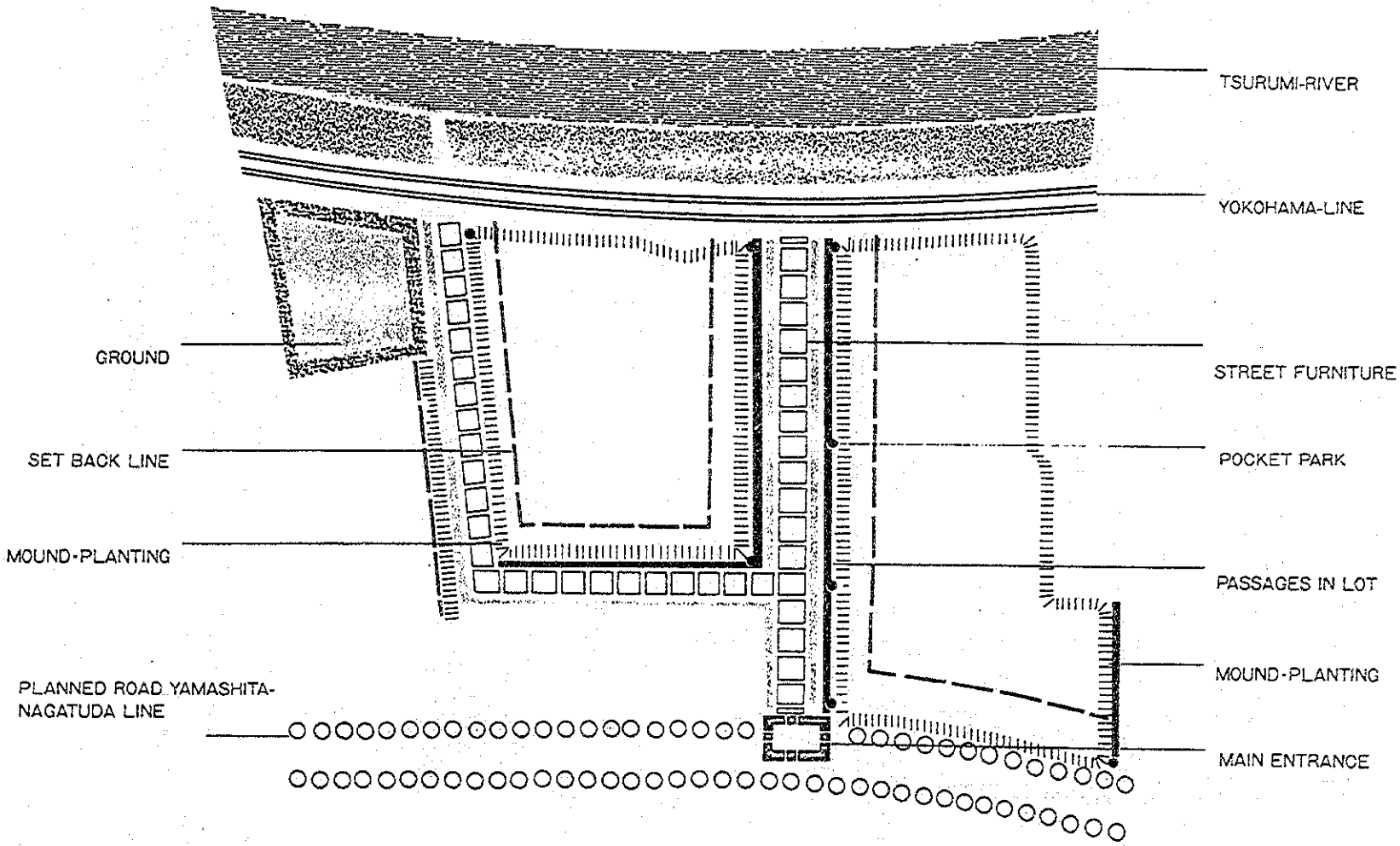


Note:

Inner openspace produced by Set Back will be approximately 15% of lots depending on the length of Frontage. Factory area is allocated 135ha(18%), 135ha x 15% = 20.25ha(8.1%). Therefore,minimum 26.1% is in total percentage on Greenification.

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE MODEL LANDSCAPE PLAN

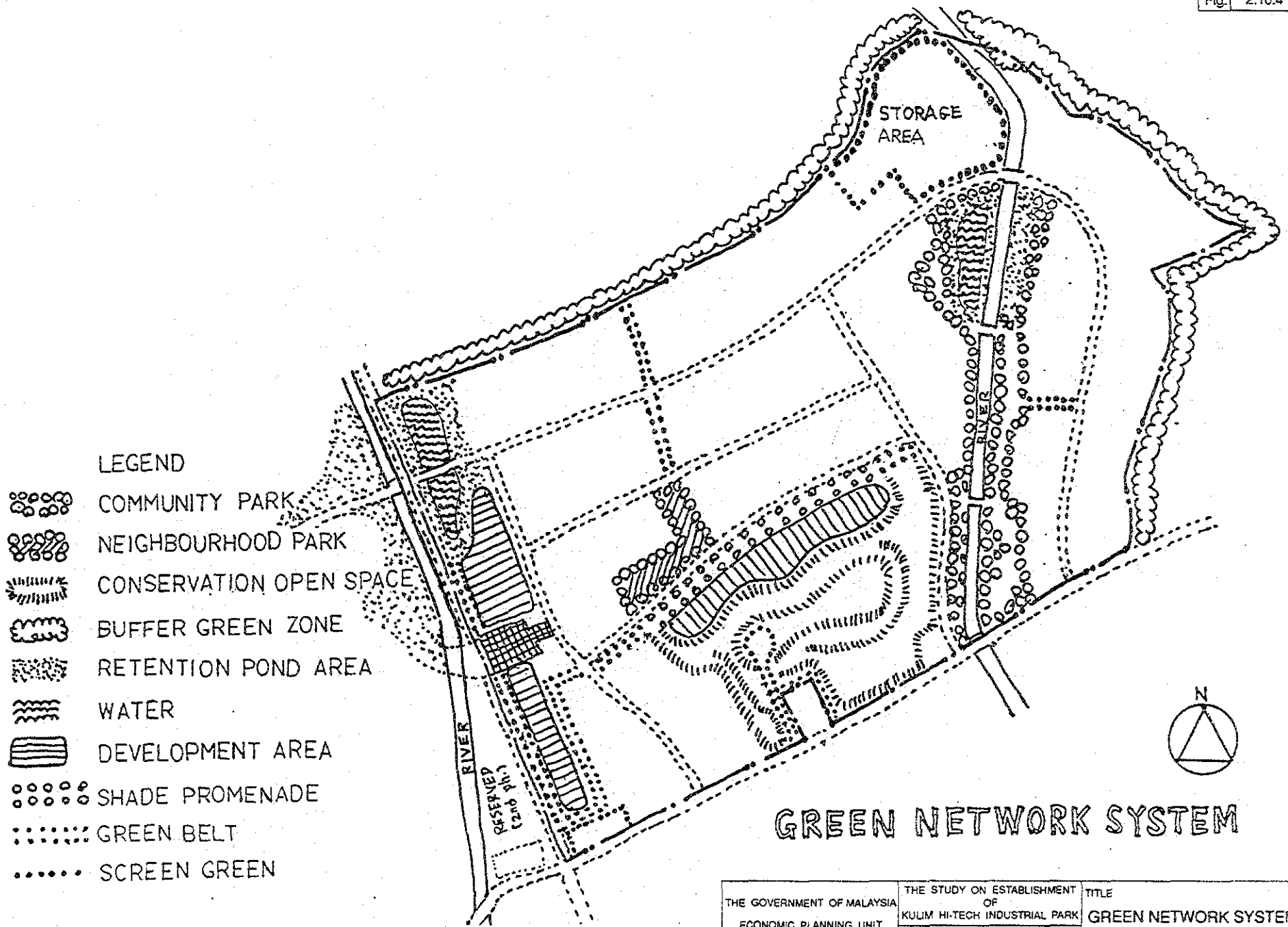
Fig. 2.10.3



Landscape Plan IN HAKUSAN, YOKOHAMA

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE LANDSCAPE PLAN, HAKUSAN

Fig. 2.10.4



GREEN NETWORK SYSTEM

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE GREEN NETWORK SYSTEM

ANNEX 3

FINANCIAL ANALYSIS

3. FINANCIAL ANALYSIS

3.1 Cost Estimate

Table 3.1 Production Rate of Major Equipment

No.	Equipment	Capacity	Production Rate	
1.	Backhoe	0.6 m^3	40 m^3/h.	
2.	Backhoe	0.4 m^3	30 m^3/h.	
3.	Swamp bulldozer	20 t	70 m^3/h.	
4.	Swamp bulldozer	16 t	60 m^3/h.	
5.	Bulldozer	11 t	50 m^3/h.	
6.	Crawler loader	2 m^3	70 m^3/h.	
7.	Crawler loader	1.5 m^3	60 m^3/h.	
8.	Dump truck	10 t	20 m^3/h.	(L = 1 km)
9.	Dump truck	6 t	12 m^3/h.	(L = 1 km)
10.	Dragline	0.6 m^3	35 m^3/h.	
11.	Amphibious excavator	0.6 m^3	25 m^3/h.	
12.	Vibration roller	5 t	100 m^3/h.	
13.	Diesel pile hammer	2.5 t	1 no./hr.	(lit. = 20 m)
14.	Vibration hammer	22 kw	6 nos./hr.	(lit = 2 m)
15.	Motor grader	3.1 m	180 m^3/h.	
16.	Motor Scraper (Twin Engine, 450 ps)	16.5 m^3	70 m^3/h.	(L = 1 km)
17.	Bulldozer	30 t	90 m^3/h.	
18.	Dump truck	1.0 t	60 m^3/h.	

Table 3.2 Unit Prices of Major Construction Materials (site delivery basis)

No.	Material Items	Unit	Unit Price (M$)
1.	Portland cement (50 kg/bag)	bag	9.5
2.	Reinforcing bar, round, *	ton	1,200.0
3.	Re-bar, deformed, *	ton	1,300.0
4.	Diesel oil (light oil)	lit.	0.6
5.	Petrol (gasoline) *	lit.	1.1
6.	Lubricants *	lit.	2.5
7.	Aggregate, fine	cu.m	20.0
8.	Aggregate, coarse, granite	cu.m	35.0
9.	Masonry stone	cu.m	30.0
10.	Wooden materials	cu.m	1,300.0
11.	Bitumen, 80/100 penetration grade *	ton	400.0
12.	Cutback bitumen, *	ton	300.0
13.	Steel sheetpile, 51.0 kg/m with two coasts of coal tar epoxy paint 1 = 8 m, 5 m, and 1.2 m long	sq.m	180.0
14.	– do –, 60.4 kg/m,, 1 = 9.5 m	sq.m	210.0
15.	– do –, 68.3 kg/m	sq.m	250.0
16.	Shaped steel	ton	2,200.0
17.	Steel pipe pile, 600 mm dia.	ton	2,500.0
18.	Wooden pile (Bakau pile), 100 mm dia., 1 = 5.5 m approx.	no.	5.1
19.	– do –, 130 m dia., 1 = 5.5 m	no.	7.2
20.	Ready mixed concrete, G-20	cu.m	135.0
21.	– do –, G-30	cu.m	150.0

Note : * Government controlled price items

Table 3.3 Basic Wage Rates(Base : 8 hours/day)

No.	Descriptions	Wage rates (M$)
1.	Foreman	50.0
2.	Operator, heavy equipment	60.0
3.	Operator, light equipment	50.0
4.	Assistant operator	40.0
5.	Truck driver	40.0
6.	Mechanic	60.0
7.	Assistant mechanic	40.0
8.	Welder	45.0
9.	Rigger	40.0
10.	Electrician	50.0
11.	Concrete worker	30.0
12.	Carpenter	35.0
13.	Mason	40.0
14.	Steel worker	40.0
15.	Painter	35.0
16.	Plumber	35.0
17.	Fitter	35.0
18.	Common labour (general labour)	25.0

Note : Inclusive of site allowances

Cash Flow Summary (Unit: M$ million) (Case-1A)

	Cash Inflow						Cash Outflow								Net Flow	Net Flow
Year	Land Sales	Managemt Fees	Total (ROI)	Equity	Loan	Inflow (ROE)	Invest. Cost	O&M	Sales Cost	Tax	Total (ROI)	Loan Repaymt	Loan Interest	Outflow Total (ROE)	(ROI)	(ROE)
1992	13.50	-	13.50	0.00	22.39	35.89	30.99		0.27	4.63	35.89	0.00	0.00	35.89	-22.39	0.00
1993	30.00	0.17	30.17		21.58	51.75	41.32	0.17	0.60	9.66	51.75	0.00	1.79	53.55	-21.58	-1.79
1994	33.00	0.40	33.40		8.74	42.14	30.99	0.40	0.66	10.09	42.14	0.00	3.52	45.65	-8.74	-3.52
1995	33.00	0.57	33.57			33.57		0.57	0.66	9.84	11.07	0.00	4.22	15.29	22.50	18.28
1996	49.50	0.57	50.07			50.07		0.57	0.99	15.50	17.06	2.24	4.22	23.52	33.01	26.55
1997		0.57	0.57			0.57		0.57			0.57	4.40	4.04	9.01	0.00	-8.44
1998		0.57	0.57			0.57		0.57			0.57	5.27	3.69	9.53	0.00	-8.96
1999		0.57	0.57			0.57		0.57			0.57	5.27	3.26	9.11	0.00	-8.54
2000		0.57	0.57			0.57		0.57			0.57	5.27	2.84	8.68	0.00	-8.11
2001		0.57	0.57			0.57		0.57			0.57	5.27	2.42	8.26	0.00	-7.69
2002		0.57	0.57			0.57		0.57			0.57	5.27	2.00	7.84	0.00	-7.27
2003		0.57	0.57			0.57		0.57			0.57	5.27	1.58	7.42	0.00	-6.85
2004		0.57	0.57			0.57		0.57			0.57	5.27	1.16	7.00	0.00	-6.43
2005		0.57	0.57			0.57		0.57			0.57	5.27	0.73	6.58	0.00	-6.01
2006		0.57	0.57			0.57		0.57			0.57	3.03	0.31	3.91	0.00	-3.34
2007		0.57	0.57			0.57		0.57			0.57	0.87	0.07	1.51	0.00	-0.94
2008		0.57	0.57			0.57		0.57			0.57	-	-	0.57	0.00	0.00
2009		0.57	0.57			0.57		0.57			0.57	-	-	0.57	0.00	0.00
2010		0.57	0.57			0.57		0.57			0.57	-	-	0.57	0.00	0.00
2011		0.57	0.57			0.57		0.57			0.57	-	-	0.57	0.00	0.00
2012		0.57	0.57			0.57		0.57			0.57	-	-	0.57	0.00	0.00
2013		0.57	0.57			0.57		0.57			0.57	-	-	0.57	0.00	0.00
2014		0.57	0.57			0.57		0.57			0.57	-	-	0.57	0.00	0.00
2015		0.57	0.57			0.57		0.57			0.57	-	-	0.57	0.00	0.00
2016		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2017		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2018		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2019		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
Total	159.00	14.82	173.82	0.00	52.71	226.53	103.30	14.82	3.18	49.73	121.30	52.71	35.84	259.58	2.79	-33.05

Note:

1. Equity: Nil
   Loan: 52.71 M$ million
   Interest rate: 8.00%
2. Management Fees: To be collected
3. Tax: To be collected (35%)
4. Dividends: Nil

FIRR (ROI): 1.82%
FIRR (ROE): Not relevant

NPV(60%) NPV(70%)

Income Statement (Case-1A)

Year	Operation Income	O&M Cost	Sales Cost	Gross Profit	Depreci-ation	Interest	Net Profit	Tax	Devidend	Retained Earnings
1992	13.50	-	0.27	13.23		0.00	13.23	4.63		8.60
1993	30.17	0.17	0.60	29.40		1.79	27.61	9.66		17.95
1994	33.40	0.40	0.66	32.34		3.52	28.82	10.09		18.73
1995	33.57	0.57	0.66	32.34		4.22	28.12	9.84		18.28
1996	50.07	0.57	0.99	48.51		4.22	44.29	15.50		28.79
1997	0.57	0.57		0.00		4.04	-4.04			-4.04
1998	0.57	0.57		0.00		3.69	-3.69			-3.69
1999	0.57	0.57		0.00		3.26	-3.26			-3.26
2000	0.57	0.57		0.00		2.84	-2.84			-2.84
2001	0.57	0.57		0.00		2.42	-2.42			-2.42
2002	0.57	0.57		0.00		2.00	-2.00			-2.00
2003	0.57	0.57		0.00		1.58	-1.58			-1.58
2004	0.57	0.57		0.00		1.16	-1.16			-1.16
2005	0.57	0.57		0.00		0.73	-0.73			-0.73
2006	0.57	0.57		0.00		0.31	-0.31			-0.31
2007	0.57	0.57		0.00		0.07	-0.07			-0.07
2008	0.57	0.57		0.00			0.00			0.00
2009	0.57	0.57		0.00			0.00			0.00
2010	0.57	0.57		0.00			0.00			0.00
2011	0.57	0.57		0.00			0.00			0.00
2012	0.57	0.57		0.00			0.00			0.00
2013	0.57	0.57		0.00			0.00			0.00
2014	0.57	0.57		0.00			0.00			0.00
2015	0.57	0.57		0.00			0.00			0.00
2016	0.57	0.57		0.00			0.00			0.00
2017	0.57	0.57		0.00			0.00			0.00
2018	0.57	0.57		0.00			0.00			0.00
2019	0.57	0.57		0.00			0.00			0.00
Total	173.82	14.82	3.18	155.82	0.00	35.84	119.98	49.73	-	70.25

Cash Flow Summary (Unit: M$ million) (Case-1B)

	Cash Inflow						Cash Outflow								Net Flow	Net Flow
Year	Land Sales	Managem Fees	Total (ROI)	Equity	Loan	Inflow (ROE)	Invest. Cost	O&M	Sales Cost	Tax	Total (ROI)	Loan Repaymt	Loan Interest	Outflow Total (ROE)	(ROI)	(ROE)
1992	24.00		24.00	0.00	15.70	39.70	30.99		0.48	8.23	39.70	0.00	0.00	39.70	-15.70	0.00
1993	36.00	0.17	36.17		17.95	54.12	41.32	0.17	0.72	11.91	54.12	0.00	1.26	55.38	-17.95	-1.26
1994	40.50	0.40	40.90		4.25	45.15	30.99	0.40	0.81	12.95	45.15	0.00	2.69	47.84	-4.25	-2.69
1995	27.00	0.57	27.57			27.57		0.57	0.54	8.20	9.31	0.00	3.03	12.34	18.26	15.23
1996		0.57	0.57			0.57		0.57			0.57	1.57	3.03	5.17	0.00	-4.60
1997		0.57	0.57			0.57		0.57			0.57	3.37	2.91	6.84	0.00	-6.27
1998		0.57	0.57			0.57		0.57			0.57	3.79	2.64	7.00	0.00	-6.43
1999		0.57	0.57			0.57		0.57			0.57	3.79	2.33	6.69	0.00	-6.12
2000		0.57	0.57			0.57		0.57			0.57	3.79	2.03	6.39	0.00	-5.82
2001		0.57	0.57			0.57		0.57			0.57	3.79	1.73	6.09	0.00	-5.52
2002		0.57	0.57			0.57		0.57			0.57	3.79	1.42	5.78	0.00	-5.21
2003		0.57	0.57			0.57		0.57			0.57	3.79	1.12	5.48	0.00	-4.91
2004		0.57	0.57			0.57		0.57			0.57	3.79	0.82	5.18	0.00	-4.61
2005		0.57	0.57			0.57		0.57			0.57	3.79	0.51	4.87	0.00	-4.30
2006		0.57	0.57			0.57		0.57			0.57	2.22	0.21	3.00	0.00	-2.43
2007		0.57	0.57			0.57		0.57			0.57	0.42	0.03	1.03	0.00	-0.46
2008		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2009		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2010		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2011		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2012		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2013		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2014		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2015		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2016		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2017		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2018		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2019		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
Total	127.50	14.82	142.32	0.00	37.90	180.22	103.30	14.82	2.55	41.29	120.67	37.90	25.77	225.63	-19.64	-45.41

Note: 1. Equity: 0
Loan: 37.9 M$ million
Interest rate: 8.00%

FIRR (ROI): Negative
FIRR (ROE): Not relevant

2. Management Fees: To be collected
3. Tax: To be collected (35%)
4. Dividends: Nil

Income Statement (Case-1B)

Year	Operation Income	O&M	Sales Cost	Gross Profit	Depreci-ation	Interest	Net Profit	Tax	Devidend	Retained Earnings
1992	24.00		0.48	23.52		0.00	23.52	8.23		15.29
1993	36.17	0.17	0.72	35.28		1.26	34.02	11.91		22.12
1994	40.90	0.40	0.81	39.69		2.69	37.00	12.95		24.05
1995	27.57	0.57	0.54	26.46		3.03	23.43	8.20		15.23
1996	0.57	0.57		0.00		3.03	-3.03			-3.03
1997	0.57	0.57		0.00		2.91	-2.91			-2.91
1998	0.57	0.57		0.00		2.64	-2.64			-2.64
1999	0.57	0.57		0.00		2.33	-2.33			-2.33
2000	0.57	0.57		0.00		2.03	-2.03			-2.03
2001	0.57	0.57		0.00		1.73	-1.73			-1.73
2002	0.57	0.57		0.00		1.42	-1.42			-1.42
2003	0.57	0.57		0.00		1.12	-1.12			-1.12
2004	0.57	0.57		0.00		0.82	-0.82			-0.82
2005	0.57	0.57		0.00		0.51	-0.51			-0.51
2006	0.57	0.57		0.00		0.21	-0.21			-0.21
2007	0.57	0.57		0.00		0.03	-0.03			-0.03
2008	0.57	0.57		0.00			0.00			0.00
2009	0.57	0.57		0.00			0.00			0.00
2010	0.57	0.57		0.00			0.00			0.00
2011	0.57	0.57		0.00			0.00			0.00
2012	0.57	0.57		0.00			0.00			0.00
2013	0.57	0.57		0.00			0.00			0.00
2014	0.57	0.57		0.00			0.00			0.00
2015	0.57	0.57		0.00			0.00			0.00
2016	0.57	0.57		0.00			0.00			0.00
2017	0.57	0.57		0.00			0.00			0.00
2018	0.57	0.57		0.00			0.00			0.00
2019	0.57	0.57		0.00			0.00			0.00
Total	142.32	14.82	2.55	124.95	0.00	25.77	99.18	41.29	-	57.89

Cash Flow Summary (Unit: M$ million) (Case-2A)

	Cash Inflow						Cash Outflow								Net Flow	Net Flow
Year	Land Sales	Managemt Fees	Total (ROI)	Equity	Loan	Inflow (ROE)	Invest. Cost	O&M	Sales Cost	Tax	Total (ROI)	Loan Repaymt	Loan Interest	Outflow Total	(ROI)	(ROE)
1992	13.50		13.50	(20.66)	0.00	13.50	30.99		0.27	0.00	31.26	0.00	0.00	31.26	-17.76	-17.76
1993	30.00	0.17	30.17		11.92	42.09	41.32	0.17	0.60	0.00	42.09	0.00	0.00	42.09	-11.92	0.00
1994	33.00	0.40	33.40		0.00	33.40	30.99	0.40	0.66	0.00	32.05	0.00	0.95	33.00	1.35	0.40
1995	33.00	0.57	33.57			33.57		0.57	0.66	0.00	1.23	0.00	0.95	2.18	32.34	31.39
1996	49.50	0.57	50.07			50.07		0.57	0.99	0.00	1.56	0.00	0.95	2.51	48.51	47.56
1997		0.57	0.57			0.57		0.57			0.57	1.19	0.95	2.72	0.00	-2.15
1998		0.57	0.57			0.57		0.57			0.57	1.19	0.86	2.62	0.00	-2.05
1999		0.57	0.57			0.57		0.57			0.57	1.19	0.76	2.52	0.00	-1.95
2000		0.57	0.57			0.57		0.57			0.57	1.19	0.67	2.43	0.00	-1.86
2001		0.57	0.57			0.57		0.57			0.57	1.19	0.57	2.33	0.00	-1.76
2002		0.57	0.57			0.57		0.57			0.57	1.19	0.48	2.24	0.00	-1.67
2003		0.57	0.57			0.57		0.57			0.57	1.19	0.38	2.14	0.00	-1.57
2004		0.57	0.57			0.57		0.57			0.57	1.19	0.29	2.05	0.00	-1.48
2005		0.57	0.57			0.57		0.57			0.57	1.19	0.19	1.95	0.00	-1.38
2006		0.57	0.57			0.57		0.57			0.57	1.19	0.10	1.86	0.00	-1.29
2007		0.57	0.57			0.57		0.57			0.57	0.00	0.00	0.57	0.00	0.00
2008		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2009		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2010		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2011		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2012		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2013		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2014		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2015		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2016		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2017		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2018		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2019		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
Total	159.00	14.82	173.82	(20.66)	11.92	185.74	103.30	14.82	3.18	0.00	121.30	11.92	8.11	141.33	52.52	44.41

Note:
1. Equity: 20.66 M$ million (30%)
   Loan: 11.92 M$ million
   Interest rate: 8.00%
   FIRR (ROI): 37.99%
   FIRR (ROE): 50.86%
2. Management Fees: To be collected
3. Tax: To be exempted
4. Dividends: Nil

Income Statement (Case-2A)

Year	Operation Income	O&M	Sales Cost	Gross Profit	Depreci-ation	Interest	Net Profit	Tax	Devidend	Retained Earnings
1992	13.50		0.27	13.23		0.00	13.23			13.23
1993	30.17	0.17	0.60	29.40		0.00	29.40			29.40
1994	33.40	0.40	0.66	32.34		0.95	31.39			31.39
1995	33.57	0.57	0.66	32.34		0.95	31.39			31.39
1996	50.07	0.57	0.99	48.51		0.95	47.56			47.56
1997	0.57	0.57		0.00		0.95	-0.95			-0.95
1998	0.57	0.57		0.00		0.86	-0.86			-0.86
1999	0.57	0.57		0.00		0.76	-0.76			-0.76
2000	0.57	0.57		0.00		0.67	-0.67			-0.67
2001	0.57	0.57		0.00		0.57	-0.57			-0.57
2002	0.57	0.57		0.00		0.48	-0.48			-0.48
2003	0.57	0.57		0.00		0.38	-0.38			-0.38
2004	0.57	0.57		0.00		0.29	-0.29			-0.29
2005	0.57	0.57		0.00		0.19	-0.19			-0.19
2006	0.57	0.57		0.00		0.10	-0.10			-0.10
2007	0.57	0.57		0.00		0.00	0.00			0.00
2008	0.57	0.57		0.00			0.00			0.00
2009	0.57	0.57		0.00			0.00			0.00
2010	0.57	0.57		0.00			0.00			0.00
2011	0.57	0.57		0.00			0.00			0.00
2012	0.57	0.57		0.00			0.00			0.00
2013	0.57	0.57		0.00			0.00			0.00
2014	0.57	0.57		0.00			0.00			0.00
2015	0.57	0.57		0.00			0.00			0.00
2016	0.57	0.57		0.00			0.00			0.00
2017	0.57	0.57		0.00			0.00			0.00
2018	0.57	0.57		0.00			0.00			0.00
2019	0.57	0.57		0.00			0.00			0.00
Total	173.82	14.82	3.18	155.82	0.00	8.11	147.71	0.00	-	147.71

Cash Flow Summary (Unit: M$ million) (Case-2B)

	Cash Inflow							Cash Outflow								
Year	Land Sales	Managemt Fees	Total (ROI)	Equity	Loan	Inflow (ROE)	Invest. Cost	O&M	Sales Cost	Tax	Total (ROI)	Loan Repaymt	Loan Interest	Outflow Total (ROE)	Net Flow (ROI)	Net Flow (ROE)
1992	24.00		24.00	(20.66)	0.00	24.00	30.99		0.48	0.00	31.47	0.00	0.00	31.47	-7.47	-7.47
1993	36.00	0.17	36.17		6.04	42.21	41.32	0.17	0.72	0.00	42.21	0.00	0.00	42.21	-6.04	0.00
1994	40.50	0.40	40.90		0.00	40.90	30.99	0.40	0.81	0.00	32.20	0.00	0.48	32.68	8.70	8.22
1995	27.00	0.57	27.57			27.57		0.57	0.54	0.00	1.11	0.00	0.48	1.59	26.46	25.98
1996		0.57	0.57			0.57		0.57		0.00	0.57	0.00	0.48	1.05	0.00	-0.48
1997		0.57	0.57			0.57		0.57			0.57	0.60	0.48	1.66	0.00	-1.09
1998		0.57	0.57			0.57		0.57			0.57	0.60	0.43	1.61	0.00	-1.04
1999		0.57	0.57			0.57		0.57			0.57	0.60	0.39	1.56	0.00	-0.99
2000		0.57	0.57			0.57		0.57			0.57	0.60	0.34	1.51	0.00	-0.94
2001		0.57	0.57			0.57		0.57			0.57	0.60	0.29	1.46	0.00	-0.89
2002		0.57	0.57			0.57		0.57			0.57	0.60	0.24	1.42	0.00	-0.85
2003		0.57	0.57			0.57		0.57			0.57	0.60	0.19	1.37	0.00	-0.80
2004		0.57	0.57			0.57		0.57			0.57	0.60	0.14	1.32	0.00	-0.75
2005		0.57	0.57			0.57		0.57			0.57	0.60	0.10	1.27	0.00	-0.70
2006		0.57	0.57			0.57		0.57			0.57	0.60	0.05	1.22	0.00	-0.65
2007		0.57	0.57			0.57		0.57			0.57	0.00	0.00	0.57	0.00	0.00
2008		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2009		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2010		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2011		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2012		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2013		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2014		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2015		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2016		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2017		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2018		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
2019		0.57	0.57			0.57		0.57			0.57			0.57	0.00	0.00
Total	127.50	14.82	142.32	(20.66)	6.04	148.36	103.30	14.82	2.55	0.00	120.67	6.04	4.11	130.82	21.65	17.54

Note:
1. Equity: 20.66 M$ million (30%)
   Loan: 6.04 M$ million
   Interest rate: 8.00%
   FIRR (ROI): 51.18%
   FIRR (ROE): 73.74%
2. Management Fees: To be collected
3. Tax: To be exempted
4. Dividends: Nil

Income Statement (Case-2B)

Year	Operation Income	O&M	Sales Cost	Gross Profit	Depreci-ation	Interest	Net Profit	Tax	Devidend	Retained Earnings
1992	24.00		0.48	23.52		0.00	23.52			23.52
1993	36.17	0.17	0.72	35.28		0.00	35.28			35.28
1994	40.90	0.40	0.81	39.69		0.48	39.21			39.21
1995	27.57	0.57	0.54	26.46		0.48	25.98			25.98
1996	0.57	0.57		0.00		0.48	-0.48			-0.48
1997	0.57	0.57		0.00		0.48	-0.48			-0.48
1998	0.57	0.57		0.00		0.43	-0.43			-0.43
1999	0.57	0.57		0.00		0.39	-0.39			-0.39
2000	0.57	0.57		0.00		0.34	-0.34			-0.34
2001	0.57	0.57		0.00		0.29	-0.29			-0.29
2002	0.57	0.57		0.00		0.24	-0.24			-0.24
2003	0.57	0.57		0.00		0.19	-0.19			-0.19
2004	0.57	0.57		0.00		0.14	-0.14			-0.14
2005	0.57	0.57		0.00		0.10	-0.10			-0.10
2006	0.57	0.57		0.00		0.05	-0.05			-0.05
2007	0.57	0.57		0.00		0.00	0.00			0.00
2008	0.57	0.57		0.00			0.00			0.00
2009	0.57	0.57		0.00			0.00			0.00
2010	0.57	0.57		0.00			0.00			0.00
2011	0.57	0.57		0.00			0.00			0.00
2012	0.57	0.57		0.00			0.00			0.00
2013	0.57	0.57		0.00			0.00			0.00
2014	0.57	0.57		0.00			0.00			0.00
2015	0.57	0.57		0.00			0.00			0.00
2016	0.57	0.57		0.00			0.00			0.00
2017	0.57	0.57		0.00			0.00			0.00
2018	0.57	0.57		0.00			0.00			0.00
2019	0.57	0.57		0.00			0.00			0.00
Total	142.32	14.82	2.55	124.95	0.00	4.11	120.84	0.00		120.84

Cash Flow Summary (Unit: M$ million) (Case-3A)

	Cash Inflow						Cash Outflow									Net Flow	Net Flow
Year	Land Sales	Managemt Fees	Total Inflow (ROI)	Equity	Loan	Inflow (ROE)	Invest. Cost	O&M	Sales Cost	Tax	Devidenc	Total Outflow (ROI)	Loan Repaymt	Loan Interest	Total Outflow (ROE)	(ROI)	(ROE)
1992	13.50		13.50	(20.66)	3.38	16.88	30.99		0.27	4.63	1.65	37.54	0.00	0.00	37.54	-24.04	-20.66
1993	30.00	0.17	30.17		23.77	53.94	41.32	0.17	0.60	10.20	1.65	53.94	0.00	0.27	54.21	-23.77	-0.27
1994	33.00	0.40	33.40		10.86	44.26	30.99	0.40	0.66	10.56	1.65	44.26	0.00	2.17	46.43	-10.86	-2.17
1995	33.00	0.57	33.57			33.57		0.57	0.66	10.25	1.65	13.14	0.00	3.04	16.18	20.43	17.39
1996	49.50	0.57	50.07			50.07		0.57	0.99	15.91	1.65	19.13	0.34	3.04	22.51	30.94	27.56
1997		0.57	0.57			0.57		0.57				0.57	2.72	3.01	6.30	0.00	-5.73
1998		0.57	0.57			0.57		0.57				0.57	3.80	2.80	7.17	0.00	-6.60
1999		0.57	0.57			0.57		0.57				0.57	3.80	2.49	6.86	0.00	-6.29
2000		0.57	0.57			0.57		0.57				0.57	3.80	2.19	6.56	0.00	-5.99
2001		0.57	0.57			0.57		0.57				0.57	3.80	1.88	6.26	0.00	-5.69
2002		0.57	0.57			0.57		0.57				0.57	3.80	1.58	5.95	0.00	-5.38
2003		0.57	0.57			0.57		0.57				0.57	3.80	1.28	5.65	0.00	-5.08
2004		0.57	0.57			0.57		0.57				0.57	3.80	0.97	5.34	0.00	-4.77
2005		0.57	0.57			0.57		0.57				0.57	3.80	0.67	5.04	0.00	-4.47
2006		0.57	0.57			0.57		0.57				0.57	3.46	0.36	4.40	0.00	-3.83
2007		0.57	0.57			0.57		0.57				0.57	1.09	0.09	1.74	0.00	-1.17
2008		0.57	0.57			0.57		0.57				0.57			0.57	0.00	0.00
2009		0.57	0.57			0.57		0.57				0.57			0.57	0.00	0.00
2010		0.57	0.57			0.57		0.57				0.57			0.57	0.00	0.00
2011		0.57	0.57			0.57		0.57				0.57			0.57	0.00	0.00
2012		0.57	0.57			0.57		0.57				0.57			0.57	0.00	0.00
2013		0.57	0.57			0.57		0.57				0.57			0.57	0.00	0.00
2014		0.57	0.57			0.57		0.57				0.57			0.57	0.00	0.00
2015		0.57	0.57			0.57		0.57				0.57			0.57	0.00	0.00
2016		0.57	0.57			0.57		0.57				0.57			0.57	0.00	0.00
2017		0.57	0.57			0.57		0.57				0.57			0.57	0.00	0.00
2018		0.57	0.57			0.57		0.57				0.57			0.57	0.00	0.00
2019		0.57	0.57			0.57		0.57				0.57			0.57	0.00	0.00
Total	159.00	14.82	173.82	(20.66)	38.01	211.83	103.30	14.82	3.18	51.55	8.26	181.12	38.01	25.85	244.98	-7.30	-33.15

Note:
1. Equity: 20.66 M$ million (20%)
   Loan: 38.01 M$ million
   Interest rate: 8.00%
   FIRR (ROI): Negative
   FIRR (ROE): Negative
2. Management Fees: To be collected
3. Tax: To be paid (35%)
4. Dividends: 8% of the paid-up capital

Income Statement (Case-3A)

Year	Operation Income	O&M	Sales Cost	Gross Profit	Depreci-ation	Interest	Net Profit	Tax	Devidend	Retained Earnings
1992	13.50		0.27	13.23		0.00	13.23	4.63	1.65	6.95
1993	30.17	0.17	0.60	29.40		0.27	29.13	10.20	1.65	17.28
1994	33.40	0.40	0.66	32.34		2.17	30.17	10.56	1.65	17.96
1995	33.57	0.57	0.66	32.34		3.04	29.30	10.25	1.65	17.39
1996	50.07	0.57	0.99	48.51		3.04	45.47	15.91	1.65	27.90
1997	0.57	0.57		0.00		3.01	-3.01			-3.01
1998	0.57	0.57		0.00		2.80	-2.80			-2.80
1999	0.57	0.57		0.00		2.49	-2.49			-2.49
2000	0.57	0.57		0.00		2.19	-2.19			-2.19
2001	0.57	0.57		0.00		1.88	-1.88			-1.88
2002	0.57	0.57		0.00		1.58	-1.58			-1.58
2003	0.57	0.57		0.00		1.28	-1.28			-1.28
2004	0.57	0.57		0.00		0.97	-0.97			-0.97
2005	0.57	0.57		0.00		0.67	-0.67			-0.67
2006	0.57	0.57		0.00		0.36	-0.36			-0.36
2007	0.57	0.57		0.00		0.09	-0.09			-0.09
2008	0.57	0.57		0.00			0.00			0.00
2009	0.57	0.57		0.00			0.00			0.00
2010	0.57	0.57		0.00			0.00			0.00
2011	0.57	0.57		0.00			0.00			0.00
2012	0.57	0.57		0.00			0.00			0.00
2013	0.57	0.57		0.00			0.00			0.00
2014	0.57	0.57		0.00			0.00			0.00
2015	0.57	0.57		0.00			0.00			0.00
2016	0.57	0.57		0.00			0.00			0.00
2017	0.57	0.57		0.00			0.00			0.00
2018	0.57	0.57		0.00			0.00			0.00
2019	0.57	0.57		0.00			0.00			0.00
Total	173.82	14.82	3.18	155.82	0.00	25.85	129.97	51.55	-	70.15

Cash Flow Summary (Unit: M$ million) (Case-3B)

	Cash Inflow						Cash Outflow									
Year	Land Sales	Managemt Fees	Total (ROI)	Equity	Loan	Inflow (ROE)	Invest. Cost	O&M	Sales Cost	Tax	Devidenc	Total (ROI)	Loan Repaymt	Loan Interest	Outflow Total	Net Flow (ROI)	Net Flow (ROE)
1992	24.00		24.00	(20.66)	0.00	24.00	30.99		0.48	8.23	1.65	39.70	0.00	0.00	39.70	-15.70	-15.70
1993	36.00	0.17	36.17		18.39	54.56	41.32	0.17	0.72	12.35	1.65	54.56	0.00	0.00	54.56	-18.39	0.00
1994	40.50	0.40	40.90		4.68	45.58	30.99	0.40	0.81	13.38	1.65	45.58	0.00	1.47	47.05	-4.68	-1.47
1995	27.00	0.57	27.57			27.57		0.57	0.54	8.62	1.65	9.73	0.00	1.85	11.57	17.84	16.00
1996		0.57	0.57			0.57		0.57				0.57	0.00	1.85	2.42	0.00	-1.85
1997		0.57	0.57			0.57		0.57				0.57	1.84	1.85	4.25	0.00	-3.68
1998		0.57	0.57			0.57		0.57				0.57	2.31	1.70	4.57	0.00	-4.00
1999		0.57	0.57			0.57		0.57				0.57	2.31	1.51	4.39	0.00	-3.82
2000		0.57	0.57			0.57		0.57				0.57	2.31	1.33	4.21	0.00	-3.64
2001		0.57	0.57			0.57		0.57				0.57	2.31	1.14	4.02	0.00	-3.45
2002		0.57	0.57			0.57		0.57				0.57	2.31	0.96	3.84	0.00	-3.27
2003		0.57	0.57			0.57		0.57				0.57	2.31	0.78	3.65	0.00	-3.08
2004		0.57	0.57			0.57		0.57				0.57	2.31	0.59	3.47	0.00	-2.90
2005		0.57	0.57			0.57		0.57				0.57	2.31	0.41	3.28	0.00	-2.71
2006		0.57	0.57			0.57		0.57				0.57	2.31	0.22	3.10	0.00	-2.53
2007		0.57	0.57			0.57		0.57				0.57	0.47	0.04	1.08	0.00	-0.51
2008		0.57	0.57			0.57		0.57				0.57			0.57	0.00	0.00
2009		0.57	0.57			0.57		0.57				0.57			0.57	0.00	0.00
2010		0.57	0.57			0.57		0.57				0.57			0.57	0.00	0.00
2011		0.57	0.57			0.57		0.57				0.57			0.57	0.00	0.00
2012		0.57	0.57			0.57		0.57				0.57			0.57	0.00	0.00
2013		0.57	0.57			0.57		0.57				0.57			0.57	0.00	0.00
2014		0.57	0.57			0.57		0.57				0.57			0.57	0.00	0.00
2015		0.57	0.57			0.57		0.57				0.57			0.57	0.00	0.00
2016		0.57	0.57			0.57		0.57				0.57			0.57	0.00	0.00
2017		0.57	0.57			0.57		0.57				0.57			0.57	0.00	0.00
2018		0.57	0.57			0.57		0.57				0.57			0.57	0.00	0.00
2019		0.57	0.57			0.57		0.57				0.57			0.57	0.00	0.00
Total	127.50	14.82	142.32	(20.66)	23.06	165.38	103.30	14.82	2.55	42.57	6.61	163.24	23.06	15.68	201.99	-20.92	-36.61

Note:
1. Equity: 20.66 M$ million (20%) FIRR (ROI): Negative
   Loan: 23.06 M$ million FIRR (ROE): Negative
   Interest rate: 8.00%
2. Management Fees: To be collected
3. Tax: To be paid (35%)
4. Dividends: 8% of the paid-up capital

Income Statement (Case-3B)

Year	Operation Income	O&M	Sales Cost	Gross Profit	Depreci-ation	Interest	Net Profit	Tax	Devidend	Retained Earnings
1992	24.00		0.48	23.52		0.00	23.52	8.23	1.65	13.64
1993	36.17	0.17	0.72	35.28		0.00	35.28	12.35	1.65	21.28
1994	40.90	0.40	0.81	39.69		1.47	38.22	13.38	1.65	23.19
1995	27.57	0.57	0.54	26.46		1.85	24.61	8.62	1.65	14.35
1996	0.57	0.57		0.00		1.85	-1.85			-1.85
1997	0.57	0.57		0.00		1.85	-1.85			-1.85
1998	0.57	0.57		0.00		1.70	-1.70			-1.70
1999	0.57	0.57		0.00		1.51	-1.51			-1.51
2000	0.57	0.57		0.00		1.33	-1.33			-1.33
2001	0.57	0.57		0.00		1.14	-1.14			-1.14
2002	0.57	0.57		0.00		0.96	-0.96			-0.96
2003	0.57	0.57		0.00		0.78	-0.78			-0.78
2004	0.57	0.57		0.00		0.59	-0.59			-0.59
2005	0.57	0.57		0.00		0.41	-0.41			-0.41
2006	0.57	0.57		0.00		0.22	-0.22			-0.22
2007	0.57	0.57		0.00		0.04	-0.04			-0.04
2008	0.57	0.57		0.00			0.00			0.00
2009	0.57	0.57		0.00			0.00			0.00
2010	0.57	0.57		0.00			0.00			0.00
2011	0.57	0.57		0.00			0.00			0.00
2012	0.57	0.57		0.00			0.00			0.00
2013	0.57	0.57		0.00			0.00			0.00
2014	0.57	0.57		0.00			0.00			0.00
2015	0.57	0.57		0.00			0.00			0.00
2016	0.57	0.57		0.00			0.00			0.00
2017	0.57	0.57		0.00			0.00			0.00
2018	0.57	0.57		0.00			0.00			0.00
2019	0.57	0.57		0.00			0.00			0.00
Total	142.32	14.82	2.55	124.95	0.00	15.68	109.27	42.57	-	60.08

ANNEX 4

ENVIRONMENTAL IMPACT ASSESSMENT AND MONITORING

4. ENVIRONMENTAL IMPACT ASSESSMENT AND MONITORING

4.1 Environmental Laws and Regulations in Malaysia

A list of legislative acts related to various environmental aspects in Malaysia is as follows:

1. Local Government Act, 1976 (Act 171) (as at August 15th, 1987)
2. Uniform Building By-Laws, 1984 (G. N 5/78/85) (as at 25th January 1991)
3. Town and Country Planning Act, 1976 (Act 172) (as at 25th August 1990)
4. Street, Drainage and Building Act, 1974 (Act 133) (as at 10th April 1988)
5. Uniform Building By-Laws, 1984 (G.N. 5/78/85) (as at 25th April 1990)
6. Environmental Quality Act, 1974 (Act 127) & Subsidiary Legislations made thereunder (as at 15th January 1991)
7. Environmental Quality (Scheduled Wastes) Regulations 1989.
8. Environmental Quality (Prescribed Premises) (Scheduled Wastes Treatment and Disposal Facilities) Regulations 1989.
9. Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 1987.

4.2 Baseline Data

4.2.1 Existing Environment: Physical System

The proposed site is located about 26 km east of Butterworth and 5 km northeast of Kulim town. The site is situated in the Bukit Mertajam plantation estate and covers an area of approximately 1,450 ha. The site area is located on undulating land in Mukim Padang China of Kulim district. The highest elevation is approximately 138 m. The topography of the area is characterized by gentle slopes with 3 to 10 % gradient from the highest point of Bukit Jelutong. The area is currently occupied with palm and rubber trees previously owned by BMR estate. Although natural vegetation no longer exists in the site, there are several estate workers' houses and estate administration buildings yet to be demolished. Other oil palm and rubber plantations owned by several estates occupy the surrounding areas. To the east of these estates lies the Gunung Bongsu Forest Reserve.

The landuse in Kulim district is predominantly agricultural with approximately 69% of the total landuse devoted to agriculture and agricultural related activities. Forestry is the second most important landuse (23.9%), followed by housing (3.2%). There is only one area designated for Industrial land use in Kulim district at present namely the Kulim Industrial Estate located at the outskirts of Kulim town. The estate occupies 174 ha of flatland, 154 ha of which has been taken up by industrialists at M$ 21.15 per square meter.

The climate of Kedah can is hot and moist. The climate is influenced by seasonal changes in the monsoonal wind systems. Heavy rainfall may be experienced at any time of the year, whilst short dry spells may occur, they are not sufficiently long and regular in their occurrence to be called a dry season. As there is no principle meteorological station in Kulim, the data obtained at Alor Setar was used as it is more representative of the Kulim area than Butterworth. Data on the surface wind speed and direction, sunshine, temperature, relative humidity, rainfall, and air pollution potential was collected.

The two key meteorological parameters which most affect the ability of atmosphere to dilute air pollutant emissions are mixing depth and the average wind speed through the mixing layer. The mixing depth is defined as the height above the earth's surface through which relatively rigorous mixing occurs. Data obtained from Bayan Lepas Airport was used to infer the mixing height at Kulim. There is no need for caution in using this data as Bayan Lepas is situated on an island, and therefore has better ventilation than Kulim. The USA National Meteorological Center would issue an air pollution alert when it is predicted that surface wind speed is less than 4 m/s, sunrise mixing height is less than 500 m, no significant precipitation during 36 hour period, and upper wind at 1500 m is less than 10 m/s. Based on this criteria,

Kulim is prone to air pollution, especially during the dry period during January and June which has less then 10 rain days per month. Another important factor which affects the dispersion of pollutants is the natural topography of the area. Kulim is located in a valley. Gunung Bongsu and Bukit Mertajam on the northeast and west, respectively, will limit the action of prevailing regional wind and result in poor ventilation for Kulim. Also, during the northeast monsoon, the prevailing northeasterly wind will carry any pollutants emitted from the proposed industrial park to Kulim town.

During several field visits, samples of dust, CO, NO_2, and SO_2 were taken in and around the project area. Existing air quality in the proposed project area is generally good. The most polluted areas occurred near the roundabout along Jalan Lunas at Kelang Lama town and around the existing Kulim industrial estate. The pollution is mainly due to both mobile and stationary sources from traffic and factories.

The day and night distribution of noise levels inside the project area indicated that the noise levels are generally low due to absence of any major human activities. The major source of noise is from traffic. The present industries operating in Kulim industrial estate are not very noisy (58 dBA).

The proposed industrial park would be situated in the two catchments of the rivers Sg. Ayer Merah/Sg. Seluang and Sg. Kelang Lama, to the north and south, respectively. Both catchments form part of the Sg. Prai basin. Several measuring stations were identified in the area to estimate the flows in the rivers. The measurements were taken using a current flow meter. According to DID of Kulim district, the flood prone areas are located around Sg. Ayer Merah, Sg. Jarak, Sg. Parit Bunian, Sg. Seluang, and Sg. Kelang Lama. The floods that occurred were mainly of one day duration after only a few hours of rainfall, i.e. flash floods. The flooding extent at Sg. Jarak, north of the park, covers about 0.45 km^2 in area, and 1 m in depth depending on the topography. This condition occurs because all the above rivers are not capable of accommodating the runoff from the surrounding areas. Development of agricultural and natural land increases the area of impermeable surface, thus reducing infiltration into the soil. The existing Kulim industrial estate is a good example as it is also an area prone to flash floods.

The proposed industrial park is flanked by Sg. Jarak and Sg. Kulim. The northern part of the estate is within the Sg. Jarak river basin. There is no water intake point along Sg. Jarak. Water from Sg. Jarak is used for crop irrigation. Discharges into Sg. Jarak need therefore only satisfy Standard B of the Environmental Quality (Sewage and Industrial Effluent) Regulation (EQ(SIE)R), 1979. The southern part of the estate is within the Sg. Kulim river basin. Due to the presence of a drinking water intake point along Sg. Kulim, the quality of any discharge into Sg. Kulim, upstream of the intake point, has to satisfy Standard A limits

as specified in EQ(SIE)R, 1979.

The main source of existing water pollution is the estate houses. The houses generate wastewater which eventually drains into the rivers. The sewage is mainly processed through septic tanks. The existing industries in Kulim Industrial Estate carry out the necessary wastewater treatment in their individual treatment plants and discharge the treated effluent into Sg. Kulim.

Water quality in-situ measurements and sampling were carried out for the purpose of this EIA. Water Temperature(T), pH, dissolved oxygen level (DO), oxidation reduction potential(ORP), and total dissolved solid concentration (TDS) were measured in-situ. Other parameters were analyzed in the laboratory. The sampling points chosen were the points where the streams or rivers enter and exit the proposed project site except where a point is very difficult to access, then the nearest point would be taken as the sampling point. The water quality of the rivers, Sg. Ayer Merah, Sg. Parit Bunian, Sg. Jarak, Sg. Kelang Lama and Sg. Seluang were found to be relatively clean though the pH is slightly acidic, probably due to soil and rain water acidity.

A study of the existing infrastructure, namely, road network, parking situation in Kulim town, bus and taxi services, railways, port and airport facilities to the proposed industrial estate was made. The proposed site is served with a fairly good road network consisting of federal and state roads. All major roads are paved and well maintained. An analysis of the roads in the proposed site indicated that the capacity of certain roads has already been exceeded. This is particularly true for SRK21 from km 2.0 to km 6.0. The existence of Kulim Industrial Estate, schools and housing estates along the road is one of the factors which contributes to the high traffic volume.

4.2.2 Existing Environment: Biological System

Information regarding existing biological systems in the project area, which include the terrestrial vegetation and wildlife, aquatic vegetation, and flora and fauna. Surveys were conducted on all the main habitat types of the project site. Flora and fauna were surveyed at 11 sampling stations. Fish and aquatic fauna were sampled by means of hand nets and by cast netting, whilst insects were sampled by random sweepings along prescribed transact lines. The animals collected were preserved in 75% alcohol, sorted and identified in the laboratory.

The terrestrial floral composition of the area can be categorized into 6 main types, namely, rubber and oil palm habitats, open and disturbed vegetation, riparian and aquatic vegetation, fern and fern allies, weeds and ground cover, and cultivated plants. A total of

about 120 species of flora were identified. Of these, 20 species are cultivated types, 18 riparian, 36 open and disturbed, 11 epiphtes, 11 ferns and fern allies, 12 species of ground cover, and 13 species of weeds.

The project area is very poor in animal diversity. Some common species of animals were recorded, which consist of lowland birds, small mammals, reptiles, amphibians, and a diverse population of insects. No species of special conservation interest were sighted or recorded during the field survey, and there also are no published records of any rare or endangered species in the area.

4.2.3 Existing Environment: Socioeconomic System

Setting up of a new industry can trigger numerous economic impacts through its purchasing pattern of services and materials, its effect on labor market and incomes, its direct and indirect impact on local wealth, and its demand for infrastructure. This in turn sets in motion a whole sequence of circular and cumulative processes.

The data for the socioeconomic study was gathered from three sources. First, published and unpublished secondary data from various government departments and agencies were utilized. These provide general information on the study area and the region at large. Second, primary data was gathered through two questionnaire surveys to provide the detailed information required for the study area. In the first questionnaire survey, a stratified random sampling technique was adopted to facilitate the general questionnaire survey for the surrounding population. A sample of 206 respondents from 21 settlements were interviewed. In the second questionnaire, which was intended for the management division of the factories in the existing Kulim industrial estate, a random interview was carried out involving 20% of the factories. Third, personal interviews with key respondents such as the village headmen, the manager of Bukit Mertajam rubber estate and personnel from various governmental departments were conducted.

Information about the existing population regarding its size, structure and dynamics as well as its settlement pattern was formulated. The economic characteristics regarding which information was collected included occupation, training in specialized skills, employment and unemployment, and income distribution. Information regarding educational facilities, health facilities, postal services, policing services, fire protection services, mosque and other places of worship, waste disposal services, public and private phones, financial institutions and banking facilities, petroleum filling station facilities, entertainment, sport and recreational facilities, housing facilities, and perception of facilities and amenities by the population was collected.

Inadequacy in health related facilities in the district was perceived from the fact there were only 224 hospital beds available to cater to a large number of residents, and they have to be shared with residents in the neighboring district of Bandar Baru. Although the dental services are also provided by private dentists, the facility is still inadequate with a dentist population ratio of 1:25,576, which is below the national average of 1:10,000.

There is a Class C fire brigade located in Kulim town at present, serving not only the 296 sq mile of the district but also the Bandar Baru district. Under the Fifth Malaysian Plan, a Class B fire brigade station was planned to be built near Kulim Industrial Estate to cater for industries in the estate. However, the project is yet to be implemented by the relevant authorities. Apparently the district requires a more effective and adequately staffed and equipped fire protection services as the present services and manpower have to cater to another district as well.

Table 4.2.1 summarizes the respondents' perception on the availability and adequacy of basic facilities in the areas and the likely impact the proposed project will have on existing supply of facilities. In general, both groups of respondents rated the facilities and amenities as fair and sufficient. Most of the local residents were satisfied with electricity, water supplies and educational facilities, while the managers of the factories were very satisfied with clinics, hospital, mosque and places of worship and sewerage system. Among the facilities that the local residents are not satisfied with, in descending order of percentage, are municipal waste disposal services, public telephone, and public transport. The managers were not happy with public transport, road condition, civic center, entertainment, and general development in Kulim town and general surroundings. Recreational facilities, entertainment opportunities, road conditions, and public telephones were among the facilities rated as unsatisfactory by both groups of respondents taken together.

Tables 4.2.2 to 4.2.5 summarize the respondents' opinions and perceptions of the socioeconomic impacts of the proposed Kulim hi-tech park.

Generally, both the residents and the factory personnels gave high ratings for the advantages listed particularly with respect to enhancement in employment and commerce, as well as investment from industrial sector. No disadvantage of significance was expressed by the residents. As for the existing industrial plants, of significance are the perceptions that the proposed project would not benefit their total production, instead it would only worsen their chances to recruit workers, increase labor wages and encourage labor punching. Almost all the respondents agreed that the project would attract labor from outside areas. However, some agreed with reservation, saying that the labor will only come if the wage rate offered is higher than what is being offered in Prai. Currently, the basic wage rate for Prai is M$300 per month,

whilst it is M$220 in Kulim.

As labor is seen as a crucial issue in the development of the proposed project, a question regarding the ease of getting workers, was included in the survey to be asked in the factory personnel. The result shows that the majority said that it is difficult to get workers nowadays. Some of the opinions and feedbacks received during the survey were as follows:

- Labour was of no problem three years ago but starting in 1991, it gets difficult due to the Prai industrial development.
- Labour pinching by the industries in Prai is fairly rampant.
- The proposed project will create employment opportunities, but there is no labor to take them up.
- It is a problem to get good workers of prime working age. What is available is mostly old age persons and young boys.
- Difficulty in also finding workers willing to do shift work
- Employing or finding plant operators and technicians is relatively easy compared to engineers.

The problem of labor shortage in the existing Kulim industrial estate is really acute. Banners advertising for walk in interviews for plant operators were placed everywhere outside the plant fences when the present surveys were conducted. Some of the factories were also found to transport their workers from outside Kulim District or whose workers were staying outside.

Table 4.2.1 Respondents' Perception of Facilities and Amenities

Facilities	Residents (n=206)				Factory Managers (n=9)			
	1	2	3	4	1	2	3	4
Telephone	15.7	30.9	39.7	13.7	11.1	44.4	33.3	11.1
Postal	33.7	59.5	6.3	0.5	66.9	22.2	11.1	0.0
Clinic	32.7	56.6	8.8	2.0	88.9	11.1	0.0	0.0
Education	53.2	42.4	4.4	0.0	66.9	11.1	11.1	11.1
Electricity	57.1	39.0	2.9	1.0	55.8	44.4	0.0	0.0
Water Supply	50.7	33.7	9.8	5.9	44.4	44.4	11.1	0.0
Hospital	34.6	51.7	10.2	3.4	77.8	22.2	0.0	0.0
Road	31.2	37.6	15.6	15.6	0.0	22.2	33.5	44.4
Public Bus	23.4	46.8	22.4	7.3	33.3	11.1	44.4	11.1
Taxi	17.6	49.8	24.9	7.8	33.3	11.1	44.4	11.1
Market	22.0	55.1	16.1	6.8	44.4	33.3	11.1	11.1
Sundry Shop	26.3	61.2	10.2	2.4	55.6	44.4	0.0	0.0
Mosque	37.3	55.9	5.4	1.5	66.7	22.2	11.1	0.0
Civic Center	27.0	43.1	21.1	8.8	44.4	22.2	33.3	0.0
Waste Disposal	12.3	35.5	41.9	10.3	55.6	22.2	22.2	0.0
Sewerage	14.9	45.5	32.2	7.4	66.7	33.3	0.0	0.0
Fire Brigade	19.1	71.6	7.8	1.5	55.6	33.3	11.1	0.0
Policing	32.7	55.6	9.8	2.0	33.3	55.6	11.1	0.0
Entertainment	15.7	41.7	20.1	22.5	0.0	11.1	44.4	44.4
Recreational	21.0	28.3	18.0	32.7	33.3	22.2	11.1	33.3
Development	22.0	63.9	9.8	4.4	33.3	22.2	33.3	11.1

Notes : 1 -Very Satisfied
2 - Fairly Satisfied
3 - Not Satisfied
4 - Extremely Dis-satisfied

Source : Kulim Hi-Tech EIA report, gea sdn bhd., Sept. 1991

Table 4.2.2 Perceived Socioeconomic Advantages Brought About by the proposed Project

Perception	Residents			Factory Personnels		
	1	2	3	1	2	3
Increase employment opportunities	95.6	1.0	3.4	100.0	0.0	0.0
Increases business opportunities	95.6	1.5	2.9	100.0	0.0	0.0
Improve infrastructure	87.8	0.5	11.7	88.9	0.0	11.1
Increase price of land/property	72.2	2.9	24.9	88.9	0.0	11.1
Increase standard of living	84.4	2.0	13.7	77.8	22.2	0.0
Increase investment opportunities	*	*	*	100.0	0.0	0.0

1 Agree
2 Disagree
3 Not sure
* Question not asked

Source : EIA report , GEA Sdn. Bhd, 1991.

Table 4.2.3 Perceived Socioeconomic Disadvantages Brought About by the Proposed Project

Perception	Agree	Disagree	Not Sure
Loss of employment	8.8	64.4	26.8
Loss of income sources	8.4	65.0	26.6
Relocation of settlement	28.6	36.0	35.5
Loss of land property	9.4	39.9	50.7

Source : EIA report, GEA, Sdn. Bhd., 1991.

Table 4.2.4 Perceived Socioeconomic Benefits of the Existing Plants in Kulim Industrial Estate and the Surrounding Area

Perception	Benefit	Does not Benefit	Not Sure
Increase employment opportunities	77.8	11.1	11.1
Increase purchasing power	100.0	0.0	0.0
Increase respective plant production	11.1	55.6	33.3
Improve recruitment of workers	11.1	88.9	0.0
Increase respective plant profit	33.3	55.6	11.1

Source : EIA report, GEA Sdn. Bhd., 1991

Table 4.2.5 Perceived Socioeconomic Disadvantages to the Existing Plants in Kulim Industrial Estate and the Surrounding Area

Perception	Yes	No	Not Sure
Increases labour wages	100.0	0.0	0.0
Cause labour pinching	88.9	11.1	0.0
Threaten the markets of respective plant products	44.4	55.6	0.0
Increase plant operational cost	55.6	44.4	0.0

Source : EIA report, GEA. Sdn. Bhd., 1991

4.3 Project Activities and Major Components

The major components of construction activities which could have impact on the environment and socioeconomy of the project area, can be listed as:

- Setting up of base camps to house workers and a station for equipment used during construction.
- Construction of access roads and river crossings from the existing paved roads to the project site.
- Site clearing which involves clearing of existing houses, existing rubber, oil palm and other trees, and clearing of bushes.
- Earthworks and drainage alterations which involve ground levelling, construction of drains and preparation of foundations.
- Piping and sewering involving digging of trenches and laying of pipes for water and sewage.
- Transportation of materials required for construction of roads, drains sewers, industrial and commercial buildings and houses.
- Supply of utilities, such as water and electricity, required during the construction period for construction activities and workers' sanitation.
- Landscaping involving planting of trees, grass, etc.
- Waste disposal of construction wastes, garbage, etc.
- Employment of labor force for construction activities and jobs for supporting commercial activities such as hawkers, etc.
- Construction of golf course involving ground preparation and landscaping.

Activities involved during industrial operation of proposed hi-tech park can be listed as:

- Mechanical processing such as grinding, cutting and moulding of materials.
- Chemical treatment in metal finishing.
- Biotechnological processing such as production of enzymes and other specific products.

- Operational failure which leads to sudden stoppage of process or breakdown of equipment.
- Industrial wastewater treatment and disposal of resultant sludge.
- Disposal of sewage.
- Discharge of waste gases.
- Discharge of hot gases.
- Disposal of industrial, commercial and municipal solid wastes.
- Transportation of raw materials and products and traffic within the hi-tech park.
- handling and storage of raw materials and products.
- Accidents which would be industrial accidents and those due to fire.
- Water requirements.
- Energy requirements.
- Services.
- Landscaping.
- Pest control.
- Labor force.

Activities during housing operation which could pose significant impact include, building maintenance, maintenance of drainage and sewerage, landscaping, garbage disposal, sewage disposal, transportation and traffic, utilities, amenities, pest control, security, and golf course.

The activities involved during operation of research institutions are mainly laboratory works such as analysis and testing materials and running of lab-scale units.

4.4 Project Impacts and Mitigation Measures

Table 4.6 summarizes the mitigation measures suggested for various project impacts, due to various project activities during construction and during industry and housing operation. The potential significance of the impacts have been graded as being moderately serious(*), can be serious(**) and very serious(***), for all long term(L), short term(S) and permanent(P) impacts identified.

Table 4.4.1 Summary Table for Impacts and Mitigation

ITEM	PROJECT ACTIVITIES	POTENTIAL IMPACTS	POTENTIAL SIG.	MITIGATING MEASURES	REMARKS
A	CONSTRUCTION FOR ALL STAGES				
1	Site Investigation	Temporary increase in noise levels due to boring activities for soil investigation.	S*		This activity is limited to a few localized spots only. Only 10 bore holes are required.
2	Base Camp	Pollution of water and surroundings due to improper discharge of sanitary wastes. As a result, breeding of parasites and pathogens could lead to health hazards and bad odour.	S*	Mobile toilets to be provided. Washing waste-waters should be collected in a temporary treatment pond. Only clear supernatant from the pond should be discharged.	Population in the base camp at the peak of construction is estimated to be in several hundreds.
		The construction and poor maintenance of large base camp could lead to blocked drainage system. This in turn could result in flooding especially along Sg. Ayer Merah, Sg. Parit Bunian and Sg. Kelang Lama.	S**	Good design and proper maintenance of drainage system should be carried out taking into account Sg. Ayer Merah. Sg. Parit Bunian and Sg. Kelang Lama.	The site is not an environmentally sensitive area and there are no endangered species there.
		Loss of fauna and flora at base camp sites.	P		
		Improper garbage disposal can attract pests such as rats, stray cats and dogs.	L*	Ensure proper garbage disposal and hygienic conditions at base camp.	
		Poor sanitation and overcrowding may lead to the out-break of parasitic and communicable diseases.	S**	Proper waste disposal should be ensured and the base camp should be well ventilated.	

Note: * moderately serious
** can be serious
*** very serious

L - Long term impacts
S - Short term impacts
P - Permanent impacts

ITEM	PROJECT ACTIVITIES	POTENTIAL IMPACTS	POTENTIAL SIG.SLP	MITIGATING MEASURES	REMARKS
3	Access Road & Stream Crossing	Erosion and transport of loose earth increase water turbidity and sediment load. This could affect downstream aquatic life.	S**	Disturbed loose earth to be re-compacted as soon as possible. Construction to be completed in as short a time as possible.	
		Reduction in air quality due to increase in dust level and vehicular emission.	S*	Water trough should be provided for vehicles to reduce dispersion of particulate matters.	
		Increase in noise level due to vehicular movement.	S*	Limit working hours to day time only.	
		Haphazard construction and poor arrangement of access road and stream crossing could hinder stream flow and cause in change the existing flow regime. This subsequently could result in flooding.	S*	Proper arrangement of access road and stream crossing should be made.	
		Localised loss of vegetation.	P		The site is presently vegetated mainly by oil palm and rubber trees.
		Possible traffic congestion in Kelang Lama Town.	S*	Passage for construction should avoid Kulim and Kelang Lama Towns.	
		The building of access road may cause potential threat to physical safety due to either accidents of mechanical defaults although only temporarily.	S*	Proper safety procedures should be observed and all equipments should be well maintained.	

ITEM	PROJECT ACTIVITIES	POTENTIAL IMPACTS	POTENTIAL SIG.SLP	MITIGATING MEASURES	REMARKS
4	Site Clearing	Loosening of top soil coupled with earth exposure to weathering leads to erosion resulting in increased water turbidity and sediment load. Increased turbidity could affect the downstream aquatic life.	S*	Loose earth should be re-compacted as soon as possible. Temporary sediment settling ponds/traps should be constructed. Natural vegetation along river banks should be conserved.	Proposed retention ponds can be used as sediment settling ponds.. Fast growing grass seeds may be sprayed onto cleared areas so as to hold surface soil.
		The exposed ground and the movement of construction machinery would increase the dust and noise levels.	S*	Water should be lightly sprayed if necessary during dry period.	Trees located in area designated as green area should be left standing.
				A ring of trees around the construction area should be left standing and cleared only at a later stage of construction to act as dust trap and noise barrier.	
				If noise level at the surrounding residential area is above 65 dBA, day time working hours should be implemented.	
		The removal of vegetation would lead to loss of flora and fauna from the area and can affect the micro-climate and create a small scale heat-island.	S*	vegetation should be cleared in stages according to construction purpose. Total removal of existing trees and ground vegetation to be avoided.	
		Existing drainage pattern would change and could result in haphazard system which in turn could block some channels such as Sg. Ayer Merah. During heavy rain this could lead to flooding.	S**	Temporary drainage system should be established.	It is recommended that the proposed retention ponds be included in the temporary drainage system.
		The aesthetics of the landscape and tranquility of the area will disappear as the vegetation is cleared.	S*	Proper landscaping and revegetation are necessary to replace the lost vegetation.	This will be done at later stages during the construction of buildings.

ITEM	PROJECT ACTIVITIES	POTENTIAL IMPACTS	POTENTIAL SIG.SLP	MITIGATING MEASURES	REMARKS
4	Site Clearing (contd.)	The clearing of the site may cause a threat to physical safety especially if strict safety measures are not observed.	S*	Strict safety measures and well-maintained equipment should be ensured at all times.	
		Nevertheless, employment and commerce will be enhanced due to demand for labour as well as goods and services.	S		The Hindu cemetery can be blended into the natural surrounding with proper landscaping.
		Hindu cemetery in the site could be trespassed.	S*	The preservation of the Hindu cemetery has to be made unobtrusive.	

ITEM	PROJECT ACTIVITIES	POTENTIAL IMPACTS	POTENTIAL SIG.SLP	MITIGATING MEASURES	REMARKS
5	Earthwork & Drainage Alteration	Erosion of loose or bare earth leads to increase in water turbidity and sediment load.	S**	Loose earth to be recompacted as soon as possible. Minimise earthwork through good design in cut and fill. Temporary sediment settling ponds to be provided. Activity to be preferably carried out during dry weather. Exposed slopes and riverbanks should be regrassed as soon as possible.	Proposed retention ponds can be used as sediment settling ponds.
		The air quality will be reduced due to increase in dust and vehicular emission. Visibility in the area will also be reduced.	S*	Water should be lightly sprayed if necessary during dry period. A ring of trees around the construction area should be left standing and cleared only at later stage of construction to act as a dust trap and noise barrier.	Spray fast growing grass seeds on cleared surfaces.
		The operation of construction machinery will increase the noise levels.	S	The machinery should be well serviced to avoid excessive smoke and noise. If noise levels at the surrounding residential areas is above 65 dBA. day time working hours should be implemented.	
		Earthwork could lead to blocked channels and drains. Flash flood would then result from this.	P	Proper maintenance of temporary drainage system should be carried out. Drainage alteration designed to a one in a hundred year flood return period would reduce the probability of flooding and thus enhance the drainage system of the area. Silt traps and retention ponds be employed to reduce pack flows and flash floods.	Existing proposed project site and its surrounding area are experiencing frequent flash floods.
		Individual geomorphic features of the area will be altered. The whole landscape and composition and tranquility of the site will be permanently lost. These features are of special importance to some people.	L	Well-designed drainage systems with good landscaping should be made to compensate for the lost landform features. The effect on tranquility can be reduced if work is restricted to day time only.	

ITEM	PROJECT ACTIVITIES	POTENTIAL IMPACTS	POTENTIAL SIG.SLP	MITIGATING MEASURES	REMARKS
5	Earthwork & Drainage Alteration (contd.)	This activity may cause a threat to physical safety especially if strict safety measures are not observed.	S*	Strict safety measures and well maintained equipment should be ensured at all times.	
6	Piping & Sewering	Earthworks during piping and sewering could increase sediment content in surface runoff.	S	Runoff from site should be directed to the sediment settling ponds.	Sediment settling pond would have been constructed before site clearing and earthworks.
		Insufficient design and improper construction of sewers could lead to surface and ground water pollution and bad odour during operation.	L**	Proper and sufficient sewering to cater for future developments has to be ensured.	
		Underdesigned sewers could result in surcharge and overflowing through manholes.	L**	Good design of sewerage system should be ensured.	
		Increase in noise levels due to operation of machinery.	S	Working hours to be limited to day time.	Certain stages of this activity will involve work adjacent to existing housing areas.
		Interference to traffic flows especially along main roads.	S	Good and proper road signs should be installed at appropriate locations.	
7	Transportation	Increase in noise and dust levels due to transportation of construction materials and machinery.	S*	Water should be lightly sprayed of necessary during dry period. A ring of trees around the construction areas should be left standing and cleared only at later stage of construction to act as dust trap and noise barrier. if noise level at the surrounding residential areas is above 65 dBA. day time working hours should be implemented.	

ITEM	PROJECT ACTIVITIES	POTENTIAL IMPACTS	POTENTIAL SIG.	MITIGATING MEASURES	REMARKS
7	Transportation	Transportation of heavy and big equipment would lead to traffic congestion due to slow moving vehicles. Thus tranquility of the area would also be affected.	S*	The road worthiness of the contractor's lorries and trucks should be ensured at all times. Route for transporting building materials and heavy equipments should avoid the main Lunas-Kelang Lama- Kulim road to avoid traffic congestion. It should also be far from residential areas.	Sufficient road signs should be placed at strategic locations.
8	Piping	Increase in impulse noise levels.	S*	Limit working hours to day time only.	This impact of this activity can be very serious because of the presence of residential areas adjacent to the proposed project site.
		This activity may create a threat to physical safely especially when heavy equipments are not maintained and their safely checked.	S*	Ensure that all equipment used be maintained and checked regularly.	
		The tranquility of the area will be affected.	S*	Observe strict working hours.	
9	Construction & Equipment	Oil and grease from machinery and leaching of building materials such as lime could contribute to water pollution.	S*	Equipment and machinery to be maintained and waste oil to be properly disposed off such that there is minimal discharge of oil and grease to runoff water. Materials such as lime to be kept under cover.	
		Reduction in air quality due to smoke from old machinery.	S*	The construction machinery should be well serviced.	
		Increase in dust level due to movement of construction machinery. This can affect the visibility in and around the construction site.	S*	Water should be lightly sprayed if necessary during dry weather period and water trough should be provided for vehicles.	
		Increase in noise levels and reduction of tranquility of the area.	S*	Working hours should be limited preferably to day time.	
		In this area where a large part of vegetated land is being transformed into buildings, streets and open spaces, a small scale heat island will be formed.	S*	The green area should be maximized and large artificial lakes or fountains should be built.	

		During construction, improper dumping of unused construction materials, plastic sacks and garbage into open drains and channels could result in flash floods.	S**	Proper disposal of garbage, plastic sacks and unused construction materials should be provided.	
		Improper disposal of felled trees will encourage build-up of termite population.	S*	Removal of all felled trees from construction sites. Pesticide trenches to be built for termite control prior to building construction.	
		A potential increase in demand for water power and fuel.		Related local authorities i.e. TEN and JBA should check their capacity and expand if necessary and create contingency plans to maintain the support in an emergency.	
		This activity may create a threat to physical safety especially when heavy equipments are not maintained and their safety checked.	S*	Equipments to be properly maintained and checked for safety.	
		However at this stage a lot of manpower is required and this will lead to an enhancement of employment and commerce.	S		At the peak of construction the worker population is expected to be several hundred persons.
10	Supply of Utilities	There is a potential increase in demand for utilities as a result of recruitment of workers during the construction of the proposed project. The likely impacted utilities will be water supply, electricity and fuel supply.	S*	Related local authorities to check their capacity and create contingency plans to maintain support during failure and emergency.	
11	Landscaping	Improper and insufficient landscaping could load to soil erosion, resulting in increased water turbidity and sediment load.	L	Plant and grass to be tended until they are fully grown.	
		Proper landscaping would minimize the flash flood problem by providing infiltration into the soil through vegetation and interception storage.	L	The time of concentration and time to pack of flood hydrography would increase.	

		Revegetation on the exposed ground would reduce the dust levels, thus improve the air quality. Landscaping would also reduce heat island effect.	L	This is an enhancement to the project site.	
		Proper landscaping with green areas, parks and ponds can enhance tranquility and psychological well-being of residents and workers as well as increase biota, wilderness and aesthetic value of the area.	P	Planting a diverse variety (jungle species) of plant types to serve various functions (shade, barriers, flowering shrubs, genetic conservation etc.) Sufficient green areas to be provided around residential and industrial areas.	Nature park and multi-purpose usage for retention pond need creative landscaping to increase their aesthetic and recreational value.
12	Waste Disposal	Improper disposal of garbage as well as construction materials could produce leachate that would contribute to water pollution and may lead to spread of parasitic and communicable discases. It will also lead to bad odour.	S*	Garbage should be kept closed in proper containers and regularly collected. Construction wastes to be properly disposed off.	Garbage collection has to be done at least twice a week.
13	Labour Force	A project of this nature will undoubtedly require a great number of workers, skilled, semi-skilled and unskilled. As such employment will be greatly enhanced. Nevertheless its availability is seen to be strained as the area is facing a shortage of labour.	S**	The unavailability of local labour should be overcome by bringing in labour from outside or substituted with migrant workers.	
		A large number of working population will create demand for goods and services. This will lead to an enhancement of commerce for the area and a source of extra income for the surrounding population.	S		
14	Golf Course	Construction involves massive earthworks. Sediment carried by runoff would increase river water suspended solid and could be detrimental to river habitat and aquacultural activities downstream.	L*	Runoff collection channels leading to sediment settling pond should be provided.	

		Fertilizers used during grass planting would be carried by runoff and could cause river cutrophication, thus causing damage to aquatic life.	L*	Excessive application of fertilizer should be prevented.	
		Increase in dust levels due to exposed ground prior to re-grassing.	S*	Water should be lightly sprayed if necessary. Regressing should be carried out as soon as possible.	
		Increase in noise levels due to operation of earthwork machinery.	S*	Limit working hours to daytime only.	
		Permanent change in biota and habitat type from plantation to open grounds.	P	Ensure not too much of open space to minimize changes in biota and micro-climate, by planting trees and shrubs of various species. maximize planting of trees around non-golf areas such as club house, car-parks, etc.	
		Reduction in biodiversity as the whole area would be mainly covered by grass only.	P		
		Increase in recreational value of the area.	P		
B	OPERATION INDUSTRY				
15	Mechanical Processing	Increase in noise levels due to operation of machinery such as motor, fan, hydraulic system and vibration induced.	L**	Sound proof housing enclosure or barrier should be constructed for noise producing machinery.	
		Insufficiently treated waste water leads to pollution of surface and ground water notably by suspended solids and oil.	L**	Waste water to be sufficiently treated by on-site plants to meet standard B discharge limits before discharging into the retention and monitoring pond that would eventually discharge into Sg. Jarak or its tributary.	Any discharge into Sg. Kulim or its tributary has to satisfy the Standard A limits of the EQ (SIE) R 1979. Water quality monitoring to be carried out.
				No industrial wastewater should be discharged into Sg. Kulim or its tributary.	

		The various activities of mechanical processing can be a threat to physical safety either due to negligence or mechanical faults. Mechanical processing of plastics and metals will aid in production of polymer product and mechanical products that would increase the GNP of Malaysia. This will reduce import as well as generate more commerce due to this product.	L**	Strict safely measures should be observed at all times and mechanical equipment should be properly maintained.	Species for biological monitoring is given in main report.
16	Chemical Processing	Insufficiently treated industrial effluent leads to pollution of surface and ground water for example by chemicals such as chlorinated organics. The chemical processing which are mainly cleaning of electronic metal parts would aid in production of IC components which is necessary for the electronic industries of Malaysia. This would reduce import of electronic components as well as increase the GNP of the country.	L**	Wastewater to be sufficiently treated to meet Standard B discharge limits before discharging into the retention and monitoring pond that would eventually discharge into Sg. Jarak and its tributary. Avoid use of chlorinated hydro carbon solvents or ensure complete removal of the compounds from waste water for example by ultra-filtration. No industrial wastewater should be discharge into Sg. Kulim or its tributary.	Waste minimisation should be practiced. Any discharge into Sg. Kulim or its tributary has to satisfy the Standard A limits of the EQ (SIE) R, 1979. Water quality monitoring to be carried out according to the program given in Table 9.3.
		Gaseous emissions if not properly treated can cause air pollution.	L**	Installation of appropriate equipment to clean the gas prior to emission to atmosphere.	
		Increase in noise levels from machinery such as pump and compressor.	L*	Noise barrier should be constructed around noisy equipment.	
		Chemical processing can also be a threat to physical safety and the nature of chemicals used could lead to a constant threat to the psychological well-being of the affected persons. Chemical processing may also emit odour.	L**	Stringent safety procedures should be imposed and observed at all times. The intensity of odour emitted should be kept to the minimum.	

17	Biotechnological Processing	Release of dangerous engineered species or micro-organism to water and air could threaten health and ecosystem.	L***	The hazard associated with each species should be known. Dangerous species to be strictly prevented from entering surface water by installing appropriate control system and retention tanks.	Water quality monitoring to be carried out as specified in main report.
		Insufficiently treated industrial effluent leads to pollution of surface and ground water.	L**	Wastewater to be sufficiently treated to meet Standard B discharge limits before discharging into the retention and monitoring ponds that would discharge into Sg. Jarak and its tributary. No industrial wastewater should be discharged into Sg. Kulim or its tributary.	Any discharge into Sg. Kulim or its tributary has to satisfy the Standard A limits of the EQ (SIE) R,1979.
		Increase in noise levels mainly due to electro-mechanical equipment.	L**	Noise barrier should be properly erected around noisy units.	
		Biotechnological processing can be a threat to physical safety and the nature of biotechnological processing could lead to a constant threat to the psychological well being of the affected persons. Biotechnological processing could also emit odour.	L**	Stringent safety procedures should be imposed and observed at all times. The intensity of odour emitted should be kept to the minimum for example by passing odourous gas through de-odouring earth.	
		Production of biotechnological products such as pharmaceuticals would reduce the import of pharmaceutical products, increase the GNP and open up the new areas for production of other pharmaceutical products.			
18	Operational Failure	Operational failure could lead to discharge of insufficiently treated wastewater and thus pollution of surface water system.	S**	Sufficient retention capacity to be provided at each factory to cater for such an event. In the event of failure of wastewater treatment plant, the wastewater generating process has to be immediately stopped.	
		Release of gaseous pollutant into atmosphere could cause air pollution.	S**	Adequate back-up and reliable system should be installed to ensure fail-safe operation.	

		In the event of operational failure project will not be fulfilling its purposes. There will possibly be an increase in demand for back-up system in the supply of utilities and amenities.	L**	A good back-up system supply and equipment for power, water and other utilities should be prepared and an effective set of contingency plans should be created.	The industries to be located at the proposed project do not involve high pressure units or explosive materials. The risk of explosion is very low, if any.
		During operational failure, physical safety will be threatened due to either fire, hazardous spillage or emission.	S**	There should be a clear Emergency Response Procedure. Personnel and operators should be well trained with emergency and safety procedures.	
19	Industrial Wastewater Disposal	Discharge of wastewater or insufficiently treated effluent would lead to water pollution and adverse impact on aquatic ecosystem and downstream aquacultural activities and can adversely impact plant and animal life in downstream farming areas where water is needed for irrigation. Improper disposal may jeorpadise the physical safely and health of the affected person.	L**	Each onsite treatment plant should be installed with a control system that prevents discharge of insufficiently treated effluent. The treatment plants are to discharge only effluent meetng Standard B of the WQ (SIE) R 1979 before discharging into the retention and monitoring ponds that would discharge into Sg. Jarak or its tributary. No industrial wastewater should be discharged into Sg. Kulim or its tributary.	Water quality monitoring should be carried out A monitoring programme is given in Table 9.3.
		Improper disposal of sludges resulting from wastewater treatment could pollute surface and ground water.	L**	Sludges to be handled as hazardous waste and managed according to the EQ (Scheduled waste) R 1979.	Storage facilities for sludge to be provided within industrial zone.
20	Sewage Disposal	Insufficient treatment of sanitary wasters will result in discharge of wastewater high in organics and nutrients , leading to eutrophication and spread of pathogens. Improper disposal may affect the health of those who are in contact with the infected waste.	L**	The operation and performance of the oxidation ditch process of the sewerage treatment plant are to be closely monitored to ensure the treated effluent meets Standard B limits of the EQ (SIE) R 1979 before discharging into Sg. Jarak or its tributary.	Monitoring of surface water quality should be carried out A monitoring programme is given in Table 8.2.
		Untreated sewage may emit odour which threaten the comfort of the surrounding population.	L**	Proper treatment of sewage is necessary to ensure comfort and be located at a reasonably secluded place far from the residential area.	The aerated process to be used for sewage treatment should not create odour problem.

21	Gaseous Emissions	Improperly treated toxic gases from the processes or incinerators can cause air pollution. The pollutant levels predicted using simulation model indicates that under normal operation the impact on air quality is insignificant.	L**	Sufficient removal of gaseous pollutant from waste gas streams has to be ensured. constant monitoring should be carried out and appropriate action to be taken if air quality is found to be deteriorating.	
		The effect of gaseous emissions on physical safety and health is unknown due to insufficient information as to the types of chemicals used. Odour can be a source of discomfort among the affected population.	L**	The gaseous emission should be kept at the minimum so as to reduce the odour pollution.	
22	Atmospheric Heat Discharge	Atmospheric heat discharge and other energy release devices will heat up the atmosphere and together with the increase in built-up area will cause a small scale heat island to be formed.	L	Planting of large trees and having large area of water near the source can to ascertain extent reduce this effect.	No large heat discharge sources would be present at the proposed project site.
23	Solid Waste Disposal	Improper disposal of garbage as well as construction materials could produce leachate that would contribute to water pollution and lead to adverse health effects. Proper disposal will enhance psychological well-being.	S**	Garbage to kept closed in proper containers and regularly collected. Construction wastes to be properly disposed off.	Garbage collection has to be done at least twice a week.
		Open burning of solid waste or incorrect design of incinerator can cause air pollution	L**	Open burning should not be carried out and the incinerator must be designed to handle the expected type of wastes produced by the factory.	
		The solid waste disposed by the proposed industries will have significant adverse impact on the existing maintenance services.	L*	An effective strategy of solid waste collection system should be created and maintained and improved from time to time. The existing services should be revamped to cater for potential increase in demand.	The existing solid waste disposal system is not very effective.
24	Transportation & Traffic	Reduction in air quality due to vehicular emissions.	L*	Water should be lightly sprayed if necessary.	
		Increase in noise levels due to increased traffic in the area.	L*	If noise level exceed 65 dBA. day time working hours should be imposed.	

		Accident of vehicles carrying hazardous material might lead to environmental hazard and threat to physical safety.	L**	Only specially designed vehicles should be used in transportation of hazardous material.	Hazardous wastes will be stored on-site, at a storage tactility to be managed by the management company until a central disposal plant is ready.
		Efficient transportation may lead to an enhancement of commerce and improve the psychological well-being of the people due to easy accessibility. Nevertheless, it can be a threat to physical safety.		Different commuting zones should be created. Pedestrian walkways, bicycle lanes should also be provided and speed breakers be placed at appropriate locations.	
		Increase in traffic volume could lead to congestion along roads leading to the proposed East-West highway.	L*	Roads leading to East-West highway should be improved to increase capacity.	
25	Raw Materials & Product Handling & Storage	Spillage of chemicals due to accidents or leaking containers could lead to surface and ground water pollution.	L*	Spilled chemicals should be immediately collected. Floor of storage areas should be lined with lack proof material e.g. epoxy resin. Storage areas to be properly managed to prevent accidental spillage and leakage from containers.	Guidelines and regulations on chemical management to be strictly followed.
		Improper handing and storage may threat physical safety.	L**	Proper safety procedures should be observed at all times.	
26	Accidents	Accidents such as fire or explosion could disperse chemicals thus leading to surface and ground water pollution.	L	Each plant should be designed for safety with safety assessment carried out at design stage. Plant site should be contained by bunds such that any runoff would be collected by a drain leading to a wastewater treatment plant.	Guidelines and regulation on chemical management to be strictly followed.
		Accidents could lead to discharge of insufficiently treated industrial wastewater	S	There should be sufficient retention capacity at the Hi-Tech Park to prevent discharge of such waste in the event of such an accident.	The proposed retention pond with a capacity of 220,000 m^3 should be sufficient for containment
		Release of toxic gases into the atmosphere can cause air pollution.	S	Industries capable of releasing large amount of toxic gases should be designed with high safety factor. Emergency plan should be provided to handle the situation and designated buffer zone must adhered strictly.	

		During accident, health and care services will immediately be impacted by those involved. Services in this sector will abruptly be restrained, at least for a short time. Accidents may jeopardize physical safety either directly or indirectly.	S S**	Emergency services at hospital and rural clinic should be improved and contingency plan to maintain support during emergency should be created by local health authorities. Stringent safety measures should be taken.	The proposed hospital now being constructed is sufficient to meet this type of demand.
27	Water requirement	During operation, industries will require a large amount of water. The present water supply capacity is likely to be restrained by the proposed project. Demand for water may lead to increase in supply and this in turn will enhance employment in the water supply industry.	L L	JBA should check their capacity and create a contingency plan strategy to maintain support during emergency and failure.	The recent event of water shortages in Malaysia should be taken as a lesson.
28 29	Energy Requirement Services	During operation, the industries will significantly restrain supply of electricity fuel and gas. Increasing demand for services may lead to increase in employment in the service sector and this will further lead to enhancement in commerce through the effect of the multiplier factor.	L L	TEN should check its capacity and expand its supply accordingly. A sound contingency plans should be developed in cased of emergency.	
30	Landscaping	Lack of landscaping (insufficient ground cover) will lead to soil erosion which would increase river water sediment load and could be detrimental to river habitat and aquacultural activities downstream.	L	Landscaping to be regularly maintained to ensure there is enough ground cover.	

		Enhancement of air quality and reduction in noise levels if trees are arranged to act as noise barrier and dust trap. Landscaping will help to weaken the heat island. Enhancement of beauty and recreational value of the area. Beautiful and well maintained landscaping will improve the psychological well-being, tranquility, landscape and composition of the area. Exotic introduced plant species are less suitable than native species and may be pestivorous and/or expensive to maintain. Proper landscaping would minimise the flash flood problem by providing infiltration into the soil through vegetation and interception storage.	P	Well-designed landscaping can provide restful green areas, open pleasant surroundings for the factory workers. Variety in selection of vegetation will increase biota and encourage repopulation of fauna (e.g. birds, butterflies and bees) to the area. Native tropical species to be selected based on various suitable functions e.g. shade screens decorations etc.	Landscaping improves the quality and productivity of the workers in the area. The time of concentration and time to peak of flood hydrography would increase.
31	Pest Control	Air quality can be affected if excessive fogging is carried out. Successful pest control will enhance health but excessive use of chemicals may affect physical health.	S L	Ensure fogging is done properly and not too excessive. Proper pest control should be observed.	
32	Labour Force	The industrial park requires about 13,000 workers, this employment will greatly be enhanced.	L	The existing facilities should be improved. New mosques should be built and public bus services should be upgraded in its capacity. More classrooms should also be supplied.	Once completed the proposed hospital will be sufficient to cater for the expected increase in demand for health care services.

		The presence of these workers will lead to an creasing demand for essential goods and services and this will enhance commerce and further create employment through the multiplier effect. The recruitment of skilled and unskilled new workers will adversely affect the supply of existing utilities and amenities such as school, health care services, places of worship and sundry shops.			
		However, the incoming of workers into the area will change the community structure and the sense of community.	L	Community integration should be encouraged through social gathering and cooperative activities. The landscaping should be well-planned and maintained so as to promote workers productivity and creativity.	
C	OPERATION - HOUSING				
33	Building Maintenance	Well-maintained buildings will give rise to a better psychological well-being attract investors, thus enhancing commerce. Maintenance will make buildings last longer, thus conserve resource.	L		
34	Drainage & Sewerage System Maintenance	Leaking, broken or overflowing sewers leads to pollution of surface and ground water. Poor sewer rehabilitation schedule could affect the performance of sewers. This could reduce its flow capacity and increase seepage which could subsequently cause flooding.	L	Sewer to be regularly checked according to its maintenance programme. Any fault should be immediately repaired.	Maintenance programme for the sewerage system should be drawn up and adequately carried out
		Poorly maintained drains could result in blockage and unheeded growth of weeds. This could cause flash floods and encourage breeding of mosquitoes.	L	Drain and sewer rehabilitation should be done according to a designed schedule.	

		Unhygienic conditions can encourage rats and cockroach infestations of the sewerage system.	L	Proper maintenance of drainage system should be carried out.	
		Natural riparian vegetation can enhance slope stability of earth drains.			
		A well-maintained drainage and sewerage system will minimize health and safety problems. It will also enhance psychological well-being of the residents.	L	The design aspect of the drainage and sewerage system must cope with demand.	
35	Landscaping	Lack of landscaping (insufficient ground cover) could head to soil erosion which would increase river water sediment load and could be detrimental to river habitat and aquacultural activities downstream.	L	Landscaping to be regularly maintained to ensure there is sufficient ground cover and the plants are healthy.	
		Enhance the air quality by reducing the dust levels and reduce heat island effect.	L		
		Properly maintained nature parks and retention ponds can increase biota and wilderness value and tranquility of the place and psychological well-being of the residents and visitors to the area. A well-maintained, landscape very pleasing to the eyes and hence would foster good health and good psychological well-being although it can threaten physical safety.	P	Retention ponds to be stocked with a variety of tropical fishes for sport angling and to control aquatic weeds and mosquito larvae. Water fowls can enhance amusement and leisure values of ponds.	
		It can also attract business ventures; emanate a state of tranquility; enhance landscape and the overall composition of the area.	L**	To avoid mishap proper planting and pruning should be ensured so that traffic view is not hindered and broken and fallen branches can be avoided.	Suitable trees and plants should be planted at appropriate location.
		Proper landscaping would minimize the flash flood problem by providing infiltration into the soil through vegetation and interception storage.	L		The time of concentration and time to teak of flood hydrography would increase.

36	Garbage Disposal	Improper disposal of garbage could lead to pollution of surface water, spread of diseases and bad odour.	S	Garbage to be kept in covered bins that are regularly collected at least twice a week.	
		Open burning of garbage will reduce air quality.	L	Open burning is illegal and should be strictly prohibited.	Until recently open burning was carried out at municipal dumping ground at Jalan Sg. ###
		Clean business premises can enhance commerce.	L**	Business premises should provide sufficient number of attractive garbage bins.	
37	Sewage Disposal	Insufficient treatment of sanitary wastes will result in discharge of wastewater high in organic and nutrients, leading to eutrophication and spread of pathogens. Proper sewage disposal can enhance health and psychological well-being but it can also cause parasitic diseases if improperly disposed.	L	The operation and performance of the Sewage Treatment plant to be closely monitored to ensure effluent meets Standard A of the EQ (SIE) R 1979 before discharging into Sg. Kulim or its tributary Sg. Kelang Lama. The oxidation ditch process to be used for sewage treatment in the industrial zone should be employed here also so as to achieve effluent meeting Standard A.	Standard A is required due to the presence of water intake point downstream (Bt. Tok Alang).
				Standard A effluent will be further retained in retention pond with biological monitoring. Therefore the discharge reaching the river should be of better quality than the Standard A limits.	Monitoring of surface water quality should be carried out. Water quality monitoring programme is given in Table 9.3.
38	Transportation & Traffic	Vehicular emissions will reduce air quality.	L	Major roads should be routed away from residential area. The road and traffic system should be designed for smooth traffic flow to prevent high concentration of vehicles near residential areas.	
		Good transportation and traffic system can enhance physical movement and employment opportunities and at the same time promote commerce. Improperly designed or managed traffic system can be a threat to physical safely and psychological well-being.	L	To minimize traffic accidents, some form of traffic regulations should be imposed such as commercial vehicles should be restricted to the industrial zone only and various forms of speed breakers can be introduced at appropriate locations in the residential area.	