

BOD contents at each monitoring point were computed by the equation (3-1) on the basis of estimated values mentioned above and assumptive reaching rates ( $\alpha$ ) of BOD which are defined as ratios of BOD discharged into the rivers and BOD generated ( $L_2/L_1$ ), e.g. 0.4, 0.5, 0.6 and 0.7, and are summerized in Table L-5.

Table L-5 Water Quality (BOD) Computed on the Various  $\alpha$  Values at Monitoring Points

		(BOD mg/l)						
Assumed		Dry Season			Rainy Season			
$\alpha$		a	b	e2	a	b	e1	e2
Computed BOD	40%	8.0	13.0	13.0	2.9	3.3	3.1	3.4
	50%	9.6	15.7	15.7	3.6	4.1	3.9	4.2
	60%	11.1	18.5	18.5	4.3	5.0	4.7	5.0
	70%	12.7	21.2	21.2	5.1	5.8	5.4	5.9
Field Data		14	16	17	3.8	7.0	3.6	2.1

Note:  $\alpha = L_2/L_1 \times 100$

It is noted that computed BOD values of the points a, b, and e2 are close to the field data of the points, in case  $\alpha$  is in a range of 50 to 60%.

#### 4. Future Water Qualities at the Monitoring Points

Water quality simulation at the monitoring points is carried out in two cases, i.e. sewerage system is provided or not, and the results are summarized in Table L-6 and L-7.

Table L-6 Computed Future Water Quality  
Case 1: No Sewerage System is provided

$\alpha$	(BOD mg/l)		
	Monitoring Point		
	a	b	e2
40%	13.6	24.6	23.9
50%	16.6	30.4	29.5
60%	19.7	36.3	35.1
70%	22.8	42.1	40.7

Table L-7 Computed Future Water Quality  
Case 2: Sewerage System is provided

	Monitoring Point		
	a	b	e2
BOD (mg/l)	4.7	5.8	7.2

Note :  $\alpha$  = 100% in this case.

From the results, it is noted that;

- (1) In case no sewerage system is provided, BOD content of the rivers will increase to 1.5 - 2 times of present condition (when  $\alpha$  is in a range of 50 to 60%).
- (2) In case sewerage system is provided, BOD of the rivers will decrease to 1/3 - 2/5 of the present condition.

## 5. Conclusion and Recommendation

In this study, simulation of water quality in the rivers is carried out for the year 2000. The results reveal that water quality will be greatly improved by provision of sewerage treatment facility although this simulation includes many assumptions on BOD reaching rate,  $\alpha$ , purification coefficient,  $k$ , travelling time,  $t$ , and so on.

Therefore, it is suggested that in the future the following data should be fully collected to obtain more dependable results;

- (1) Wastewater quantity generated in each tributary area,
- (2) BOD load discharged into each stretch of the rivers,
- (3) Field data on water quality at the monitoring points.

SUPPLEMENTAL DATA

Gata Opening Data at Tidal Barrage, Sg. Kedah (1)

Date	January		February		March	
	Frequency*	Duration**	Frequency*	Duration**	Frequency*	Duration**
1	2	150	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0	0	0	0	0	0
8	0	0	0	0	0	0
9	1	140	0	0	0	0
10	0	0	0	0	0	0
11	1	155	0	0	0	0
12	0	0	0	0	0	0
13	0	0	0	0	0	0
14	0	0	0	0	0	0
15	0	0	0	0	0	0
16	2	255	0	0	0	0
17	1	60	0	0	0	0
18	1	120	0	0	0	0
19	1	120	0	0	0	0
20	2	180	0	0	0	0
21	0	0	0	0	0	0
22	2	120	0	0	0	0
23	1	85	0	0	0	0
24	0	0	0	0	0	0
25	0	0	0	0	0	0
26	0	0	0	0	0	0
27	0	0	0	0	0	0
28	0	0	0	0	0	0
29	0	0	-	-	0	0
30	0	0	-	-	0	0
31	1	120	-	-	0	0
Total		1,505		0		0

Note: \* Operation times per day  
 \*\* Duration opened minutes per day

Gate Opening Data at Tidal Barrage, Sg. Kedah (2)

Date	April		May		June	
	Frequency*	Duration**	Frequency*	Duration**	Frequency*	Duration**
1	0	0	0	0	1	55
2	0	0	1	45	1	80
3	0	0	1	70	1	65
4	0	0	0	0	1	130
5	1	40	0	0	1	155
6	0	0	2	190	1	135
7	0	0	4	470	2	225
8	0	0	3	720	3	325
9	0	0	2	370	2	310
10	0	0	3	600	2	315
11	0	0	3	845	3	1,000
12	0	0	2	610	2	1,000
13	0	0	2	605	2	1,200
14	0	0	1	1,380	***	900
15	0	0	***	1,440	1	595
16	0	0	***	1,440	2	545
17	0	0	***	1,440	1	220
18	0	0	1	1,290	2	145
19	0	0	1	620	1	115
20	0	0	2	335	1	130
21	0	0	2	330	1	90
22	0	0	2	275	1	75
23	0	0	2	220	1	65
24	0	0	2	225	0	0
25	0	0	2	255	1	70
26	0	0	2	135	1	45
27	0	0	2	155	1	95
28	0	0	1	90	1	150
29	0	0	0	0	2	1,065
30	1	130	1	55	2	755
31	-	-	1	270	-	-
<b>Total</b>		<b>170</b>		<b>14,420</b>		<b>10,055</b>

Notes: \* Operation times per day  
 \*\* Duration opened minutes per day  
 \*\*\* Continuously opened from previous day

Gate Opening Data at Tidal Barrage, Sg. Kedah (3)

Date	July		August		September	
	Frequency*	Duration**	Frequency*	Duration**	Frequency*	Duration**
1	2	710	2	675	2	900
2	2	955	2	680	3	520
3	2	870	2	475	2	1,015
4	1	900	2	275	2	395
5	1	715	2	190	2	565
6	1	775	2	175	2	930
7	1	1,080	2	190	2	1,180
8	1	865	1	100	1	1,230
9	2	690	1	100	***	1,440
10	2	750	2	165	***	1,440
11	2	720	1	115	***	1,440
12	2	480	1	155	***	1,440
13	2	495	1	255	1	1,320
14	2	365	1	140	2	700
15	2	310	1	180	2	850
16	2	370	2	245	2	380
17	2	380	1	100	2	330
18	1	175	2	345	2	305
19	2	635	2	655	1	90
20	2	855	2	375	2	230
21	2	545	2	170	2	495
22	2	395	2	190	2	480
23	2	430	2	135	2	1,085
24	2	400	2	150	2	1,040
25	2	300	1	250	2	1,170
26	2	375	1	65	2	1,050
27	2	495	1	30	2	450
28	1	1,080	1	180	1	240
29	***	1,440	1	160	1	150
30	***	1,440	1	65	1	153
31	1	1,085	2	1,030	-	-
<b>Total</b>		<b>21,120</b>		<b>7,415</b>		<b>23,145</b>

Notes: \* Operation times per day  
 \*\* Duration opened minutes per day  
 \*\*\* Continuously opened from previous day

Gate Opening Data at Tidal Barrage, Sq. Kedah (4)

Date	October		November		December	
	Frequency*	Duration**	Frequency*	Duration**	Frequency*	Duration**
1	1	105	2	740	0	0
2	1	70	2	480	0	0
3	1	105	2	500	0	0
4	2	210	2	600	1	160
5	2	145	2	860	1	60
6	1	120	1	1,260	1	195
7	2	320	***	1,440	1	420
8	2	235	***	1,440	1	1,110
9	2	400	***	1,440	1	600
10	2	285	3	985	1	270
11	2	635	1	720	1	55
12	1	135	2	715	1	100
13	2	620	2	770	0	0
14	2	830	2	805	1	120
15	2	830	2	1,000	1	155
16	2	495	2	1,020	1	155
17	3	640	2	890	1	130
18	2	860	2	1,080	0	0
19	2	690	2	640	0	0
20	2	505	2	1,065	0	0
21	3	1,065	2	1,100	0	0
22	2	1,210	1	1,140	0	0
23	***	1,440	2	605	0	0
24	***	1,440	1	865	0	0
25	***	1,440	1	385	0	0
26	***	1,440	1	240	0	0
27	***	1,440	0	0	0	0
28	***	1,220	1	100	0	0
29	2	770	1	55	0	0
30	2	355	0	0	0	0
31	2	360	-	-	0	0
<b>Total</b>		<b>20,415</b>		<b>22,820</b>		<b>3,490</b>

Notes: \* Operation times per day  
 \*\* Duration opened minutes per day  
 \*\*\* Continuously opened from previous day







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