

To estimate the wave height and period, for example under the following wave conditions.

Wind velocity = 16 m/sec

Wind duration = 9 hours

Fetch length = 1,800 km (NE direction to Luzon isl. Philippine)

The first pair of the values with the wind velocity and duration are read from the chart as:

Wave height = 3.0 m

Wave period = 6.6 sec

The latter pair of the values with the wind velocity and fetch length are read from the chart as:

Wave height = 6.0 m

Wave period = 10.6 sec

Since first pair of the values are clearly smaller than the latter one. the following values shall be taken as the estimated wave height and period.

Wave height = 3.0 m

Wave period = 6.6 sec

#### Appendix-I.2.4.5 Wave attenuate due to Bottom Friction

When the waves in deep sea move into river, the wave height will be attenuated by bottom friction of the river. The wave attenuation due to bottom friction is obtained by the following formula proposed by Bretschneider and Reid.

$$K_r = \frac{H_2}{H_1} = \left[ 1 + \frac{64 \cdot \pi^3 \cdot f \cdot \Delta \cdot H_1}{3 \cdot g^2 \cdot h^2} \times (h/T^2)^2 \times \frac{K_s^2}{\sin h^3 (2\pi h/L)} \right]^{-1}$$

- Where,  $K_r$  : Ratio of wave attenuation  
 $H_1$  : Initial wave height = 3.0 m  
 $H_2$  : Wave height at the proposed site  
 $f$  : Coefficient of friction = 0.01 ~ 0.02  
 $\Delta$  : Distance of propagation = 30,000 m  
 $g$  : Acceleration of gravity = 9.8 m/sec  
 $h$  : Water depth = 10 m  
 $T$  : Wave period = 6.6 sec  
 $K_s$  : Shoaling coefficient = 0.92 (see Figure 2.4.5.1)  
 $L$  : Wave length at water depth  $h$  = 55.2 m (see Table 2.4.5)

In case of  $f=0.01$

$$\frac{H_2}{H_1} = \left[ 1 + \frac{64 \cdot \pi^3 \times 0.01 \times 30,000 \times 3.0}{3 \times 9.8^2 \times 10^2} \times (10/6.6^2)^2 \times \frac{0.92^2}{\sin h^3 (2\pi \times 10/55.2)} \right]^{-1}$$

= 0.498

$$\therefore H_2 = 3.0 \times 0.498 = 1.494 \text{ m}$$

In case of  $f=0.02$

$$\frac{H_2}{H_1} = \left[ 1 + \frac{64 \cdot \pi^3 \times 0.02 \times 30,000 \times 3.0}{3 \times 9.8^2 \times 10^2} \times (10/6.6^2)^2 \times \frac{0.92^2}{\sin h^3 (2\pi \times 10/55.2)} \right]^{-1}$$

= 0.332

$$\therefore H_2 = 3.0 \times 0.332 = 0.996 \text{ m}$$

$H_0'$  : Converted initial wave height

Initial wave length  $L_0 = 1.56 T^2 = 1.56 \times 6.6^2 = 68.0 \text{ m}$

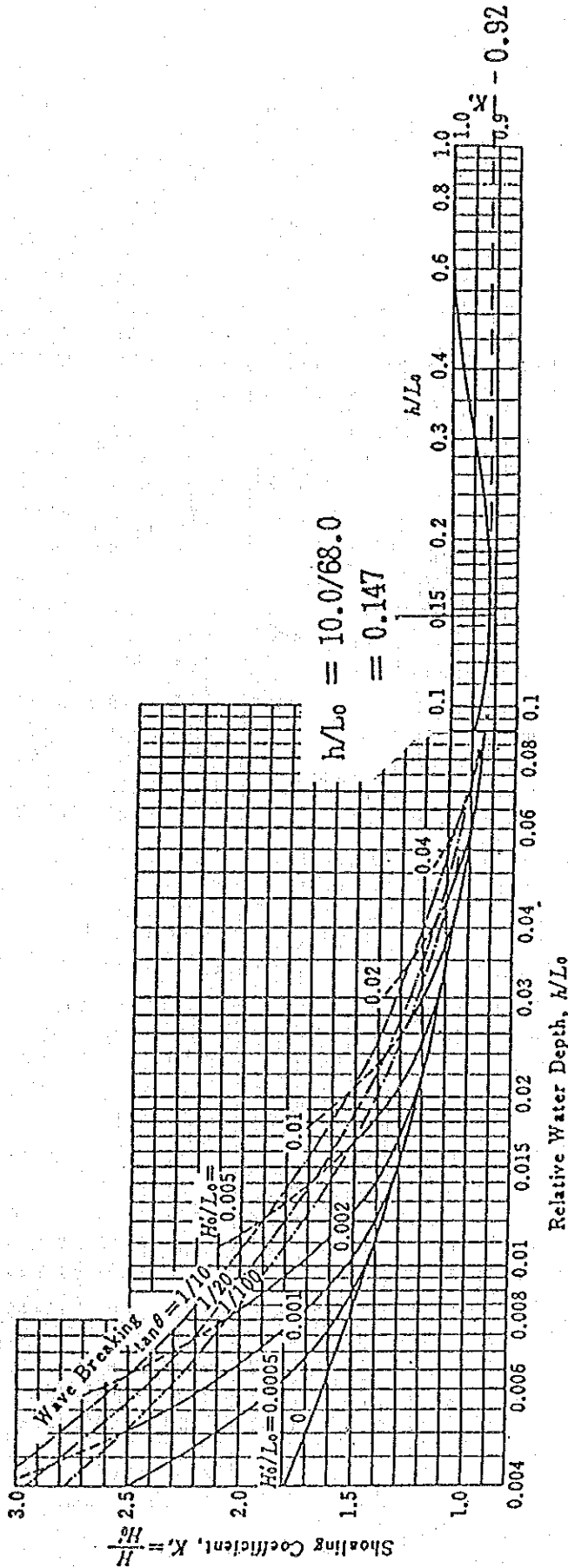
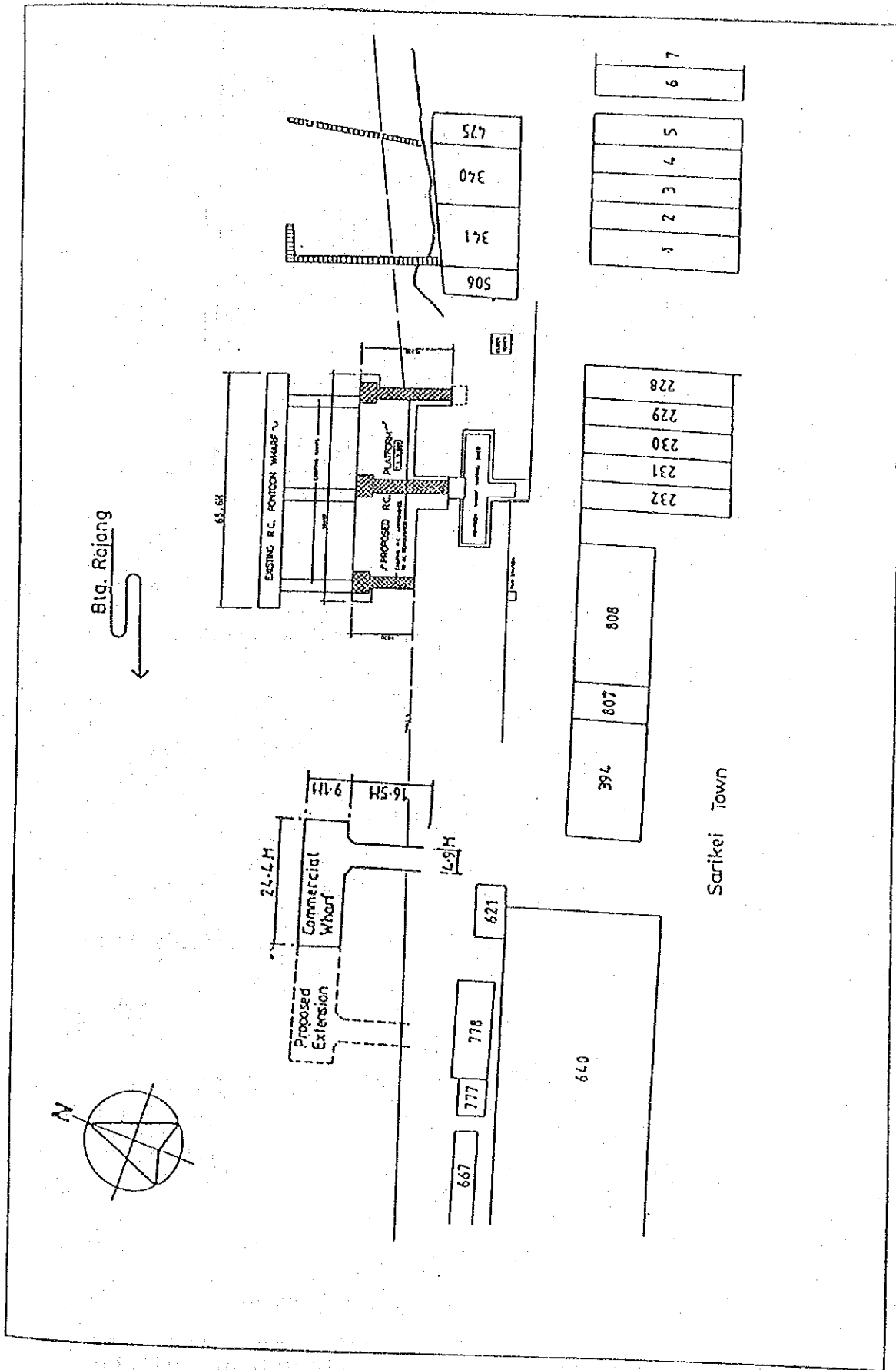


Figure-2.4.5.1 Diagram of nonlinear wave shoaling

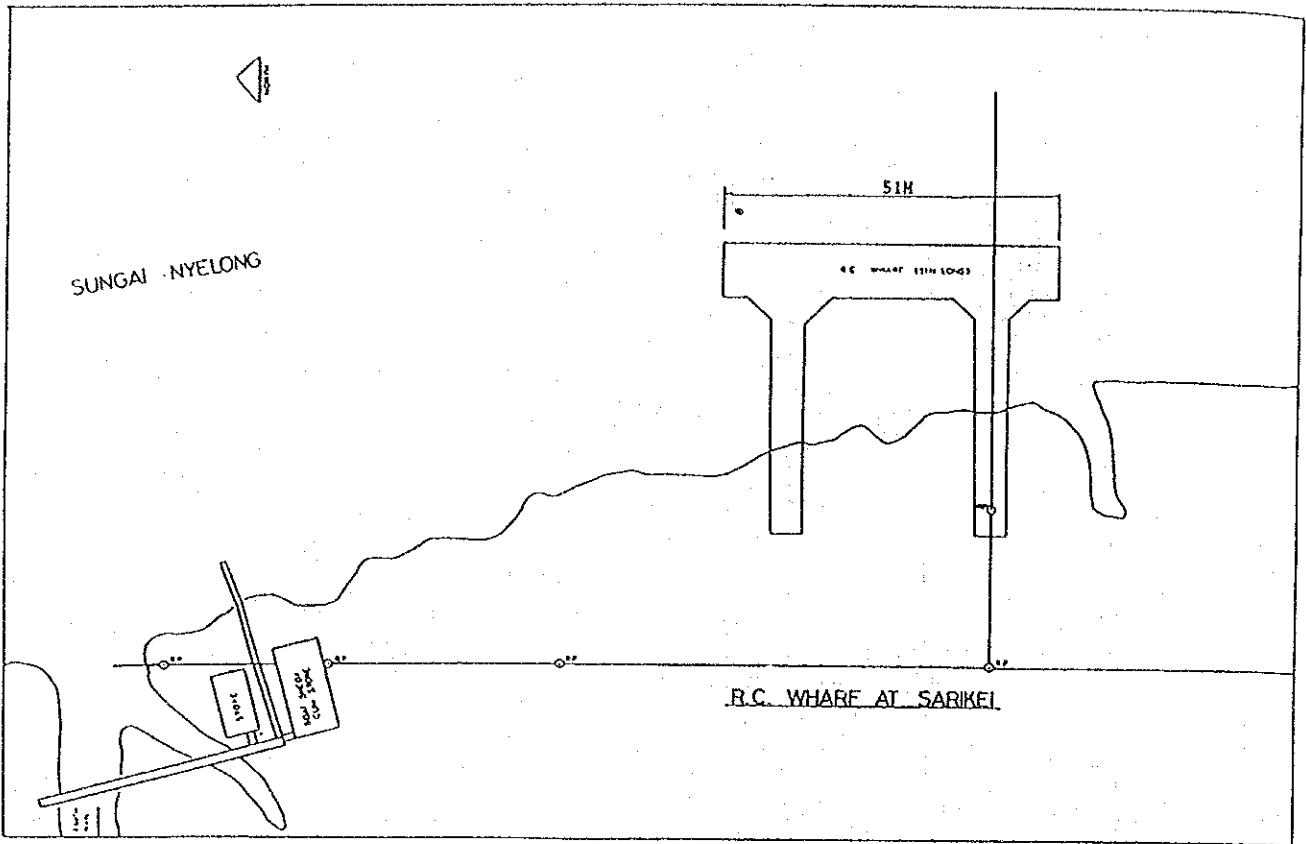
Table-2.4.5.1 List of Wavelength and Celerity for a Given Wave Period and Water Depth

| Wave period<br>(s) | 6.0                |                    | 7.0                |                    | 8.0                |                    | 9.0                |                    | 10.0               |                    |
|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
|                    | Wave-length<br>(m) | Cel-erity<br>(m/s) | Wave-length<br>(m) | Cel-erity<br>(m/s) | Wave-length<br>(m) | Cel-erity<br>(m/s) | Wave-length<br>(m) | Cel-erity<br>(m/s) | Wave-length<br>(m) | Cel-erity<br>(m/s) |
| 0.5                | 13.16              | 2.19               | 15.39              | 2.20               | 17.62              | 2.20               | 19.84              | 2.20               | 22.06              | 2.21               |
| 1.0                | 18.43              | 3.07               | 21.61              | 3.09               | 24.78              | 3.10               | 27.94              | 3.10               | 31.09              | 3.11               |
| 1.5                | 22.36              | 3.73               | 26.29              | 3.76               | 30.19              | 3.77               | 34.08              | 3.79               | 37.95              | 3.80               |
| 2.0                | 25.57              | 4.26               | 30.14              | 4.31               | 34.67              | 4.33               | 39.18              | 4.35               | 43.68              | 4.37               |
| 2.5                | 28.31              | 4.72               | 33.46              | 4.78               | 38.56              | 4.82               | 43.62              | 4.85               | 48.67              | 4.87               |
| 3.0                | 30.71              | 5.12               | 36.39              | 5.20               | 42.01              | 5.25               | 47.58              | 5.29               | 53.13              | 5.31               |
| 3.5                | 32.84              | 5.47               | 39.02              | 5.57               | 45.13              | 5.64               | 51.18              | 5.69               | 57.19              | 5.72               |
| 4.0                | 34.75              | 5.79               | 41.42              | 5.92               | 47.98              | 6.00               | 54.48              | 6.05               | 60.92              | 6.09               |
| 4.5                | 36.49              | 6.08               | 43.61              | 6.23               | 50.61              | 6.33               | 57.53              | 6.39               | 64.40              | 6.44               |
| 5.0                | 38.07              | 6.34               | 45.63              | 6.52               | 53.05              | 6.63               | 60.38              | 6.71               | 67.64              | 6.75               |
| 6.0                | 40.84              | 6.81               | 49.24              | 7.03               | 57.47              | 7.18               | 65.57              | 7.29               | 73.58              | 7.36               |
| 7.0                | 43.19              | 7.20               | 52.39              | 7.48               | 61.37              | 7.67               | 70.20              | 7.80               | 78.92              | 7.89               |
| 8.0                | 45.19              | 7.53               | 55.16              | 7.88               | 64.86              | 8.11               | 74.38              | 8.26               | 83.77              | 8.38               |
| 9.0                | 46.91              | 7.82               | 57.61              | 8.23               | 68.01              | 8.50               | 78.19              | 8.69               | 88.22              | 8.82               |
| 10.0               | 48.37              | 8.06               | 59.78              | 8.54               | 70.85              | 8.86               | 81.68              | 9.08               | 92.32              | 9.23               |
| 11.0               | 49.62              | 8.27               | 61.72              | 8.82               | 73.44              | 9.18               | 84.89              | 9.43               | 96.12              | 9.61               |
| 12.0               | 50.69              | 8.45               | 63.44              | 9.06               | 75.80              | 9.48               | 87.85              | 9.76               | 99.67              | 9.97               |
| 13.0               | 51.60              | 8.60               | 64.98              | 9.28               | 77.96              | 9.74               | 90.59              | 10.07              | 102.98             | 10.30              |
| 14.0               | 52.38              | 8.73               | 66.35              | 9.48               | 79.93              | 9.99               | 93.14              | 10.35              | 106.07             | 10.61              |
| 15.0               | 53.03              | 8.84               | 67.58              | 9.65               | 81.73              | 10.22              | 95.51              | 10.61              | 108.98             | 10.90              |
| 16.0               | 53.58              | 8.93               | 68.66              | 9.81               | 83.39              | 10.42              | 97.71              | 10.86              | 111.71             | 11.17              |
| 17.0               | 54.04              | 9.01               | 69.63              | 9.95               | 84.90              | 10.61              | 99.77              | 11.09              | 114.29             | 11.43              |
| 18.0               | 54.42              | 9.07               | 70.49              | 10.07              | 86.29              | 10.79              | 101.68             | 11.30              | 116.71             | 11.67              |
| 19.0               | 54.74              | 9.12               | 71.25              | 10.18              | 87.56              | 10.95              | 103.47             | 11.50              | 119.00             | 11.90              |
| 20.0               | 55.00              | 9.17               | 71.92              | 10.27              | 88.72              | 11.09              | 105.14             | 11.68              | 121.16             | 12.21              |
| 22.0               | 55.39              | 9.23               | 73.03              | 10.43              | 90.76              | 11.35              | 108.14             | 12.02              | 125.12             | 12.51              |
| 24.0               | 55.65              | 9.28               | 73.89              | 10.56              | 92.46              | 11.56              | 110.76             | 12.31              | 128.66             | 12.87              |
| 26.0               | 55.83              | 9.30               | 74.54              | 10.65              | 93.86              | 11.73              | 113.04             | 12.56              | 131.83             | 13.18              |
| 28.0               | 55.94              | 9.32               | 75.03              | 10.72              | 95.02              | 11.88              | 115.01             | 12.78              | 134.66             | 13.47              |
| 30.0               | 56.02              | 9.34               | 75.40              | 10.77              | 95.97              | 12.00              | 116.72             | 12.97              | 137.19             | 13.72              |
| 35.0               | 56.11              | 9.35               | 75.96              | 10.85              | 97.64              | 12.20              | 120.03             | 13.34              | 142.38             | 14.24              |
| 40.0               | 56.14              | 9.36               | 76.22              | 10.89              | 98.61              | 12.33              | 122.26             | 13.58              | 146.25             | 14.63              |
| 45.0               | 56.15              | 9.36               | 76.33              | 10.90              | 99.16              | 12.39              | 123.75             | 13.75              | 149.10             | 14.91              |
| 50.0               | 56.15              | 9.36               | 76.39              | 10.91              | 99.46              | 12.43              | 124.71             | 13.86              | 151.16             | 15.12              |
| 55.0               | 56.15              | 9.36               | 76.41              | 10.92              | 99.63              | 12.45              | 125.32             | 13.92              | 152.64             | 15.26              |
| 60.0               | 56.15              | 9.36               | 76.42              | 10.92              | 99.72              | 12.46              | 125.71             | 13.97              | 153.68             | 15.37              |
| 65.0               | 56.15              | 9.36               | 76.42              | 10.92              | 99.77              | 12.47              | 125.95             | 13.99              | 154.41             | 15.44              |
| 70.0               | 56.15              | 9.36               | 76.42              | 10.92              | 99.79              | 12.47              | 126.10             | 14.01              | 154.91             | 15.49              |
| 75.0               | 56.15              | 9.36               | 76.43              | 10.92              | 99.81              | 12.48              | 126.19             | 14.02              | 155.25             | 15.53              |
| 80.0               | 56.15              | 9.36               | 76.43              | 10.92              | 99.81              | 12.48              | 126.25             | 14.03              | 155.49             | 15.55              |
| Deepwater waves    | 56.15              | 9.36               | 76.43              | 10.92              | 99.82              | 12.48              | 126.34             | 14.04              | 155.97             | 15.60              |

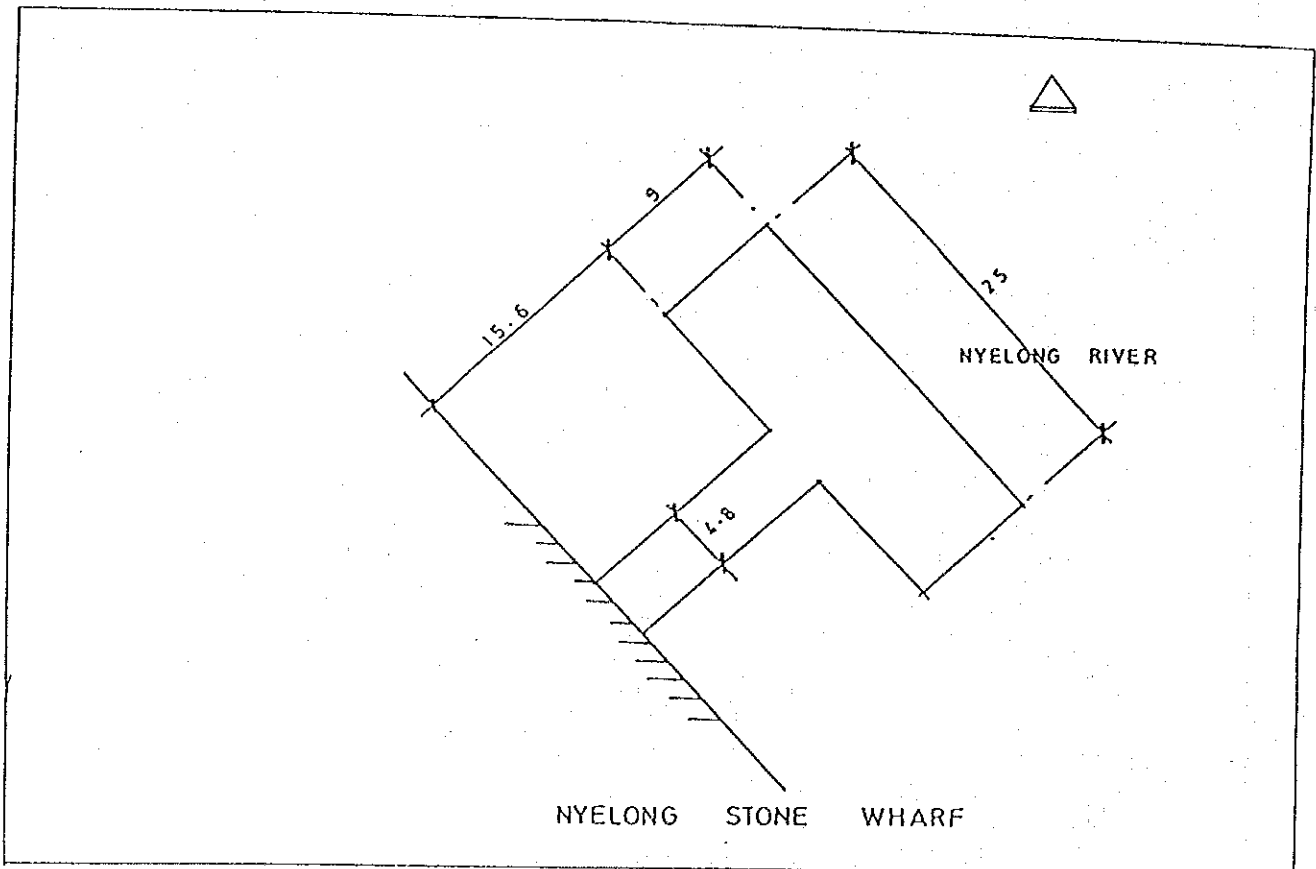
$$L = (59.78 - 48.37) \times 0.6 + 48.37 = 55.2 \text{ m}$$



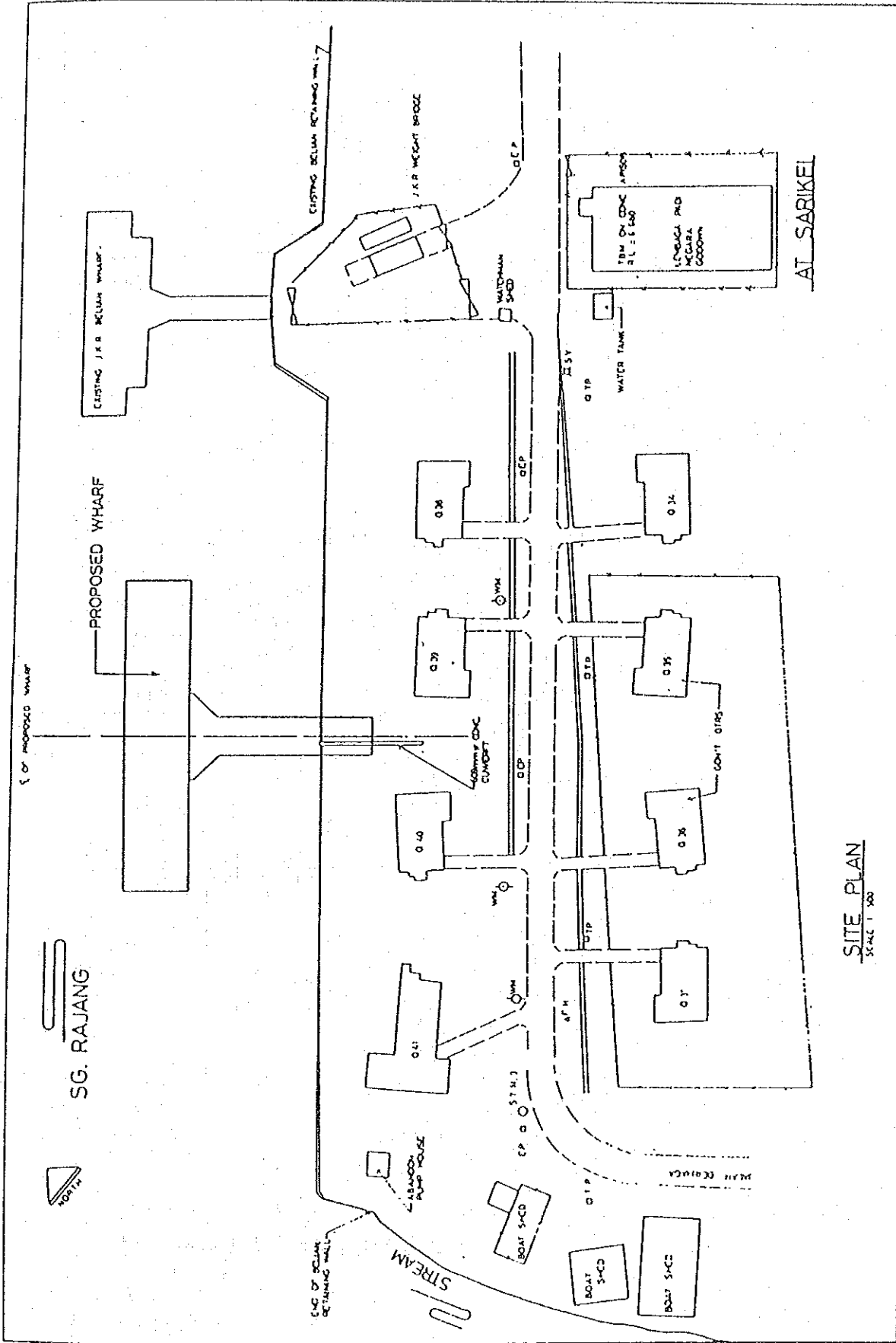
Appendix-I.3.4.1 JKR Wharf Facilities at Sarikei



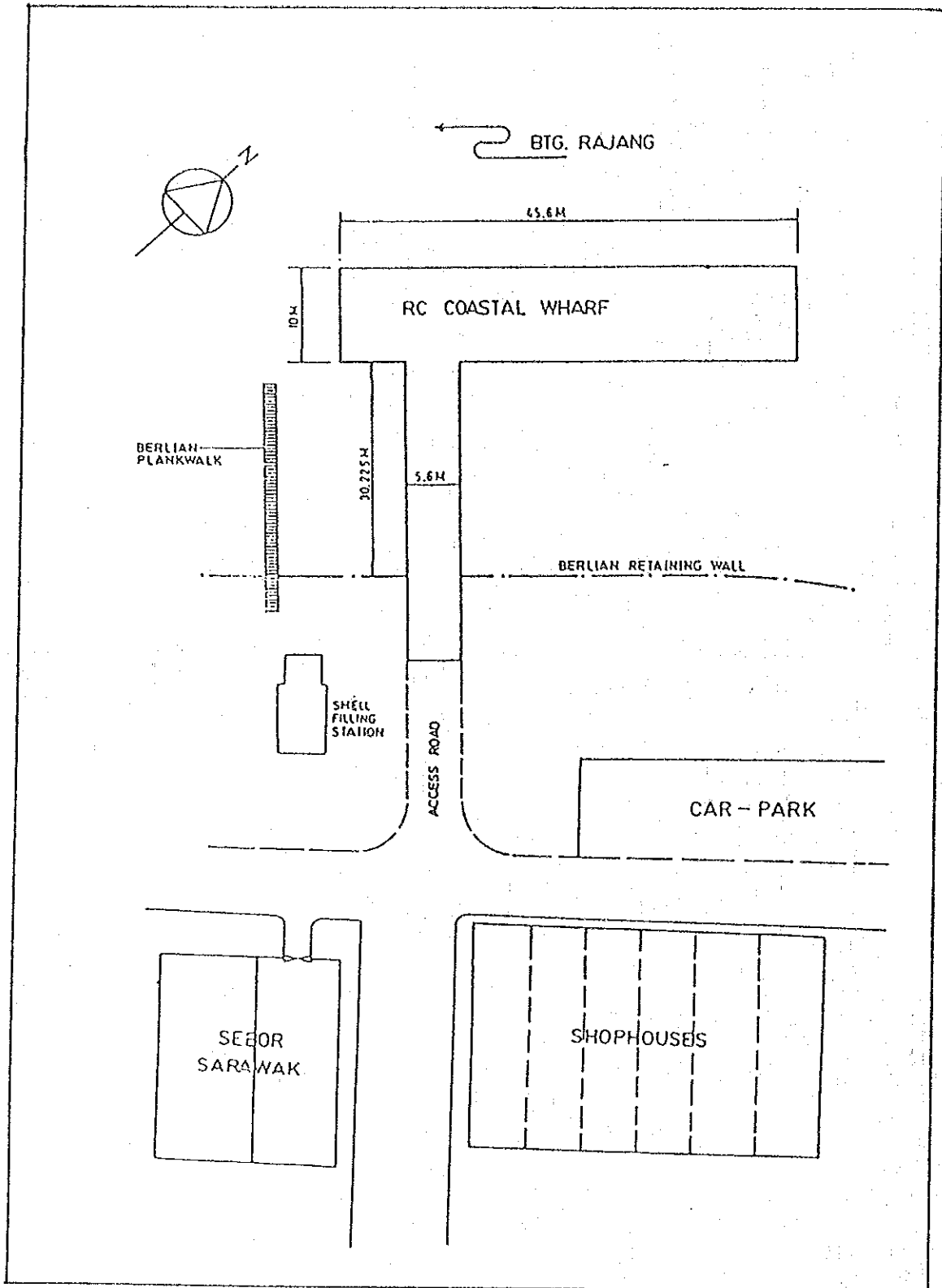
Appendix-I.3.4.2 New R.C. Wharf (JKR) at Sarikei



Appendix-I.3.4.3 Nyolong R.C. Wharf (JKR Old) at Sarikei



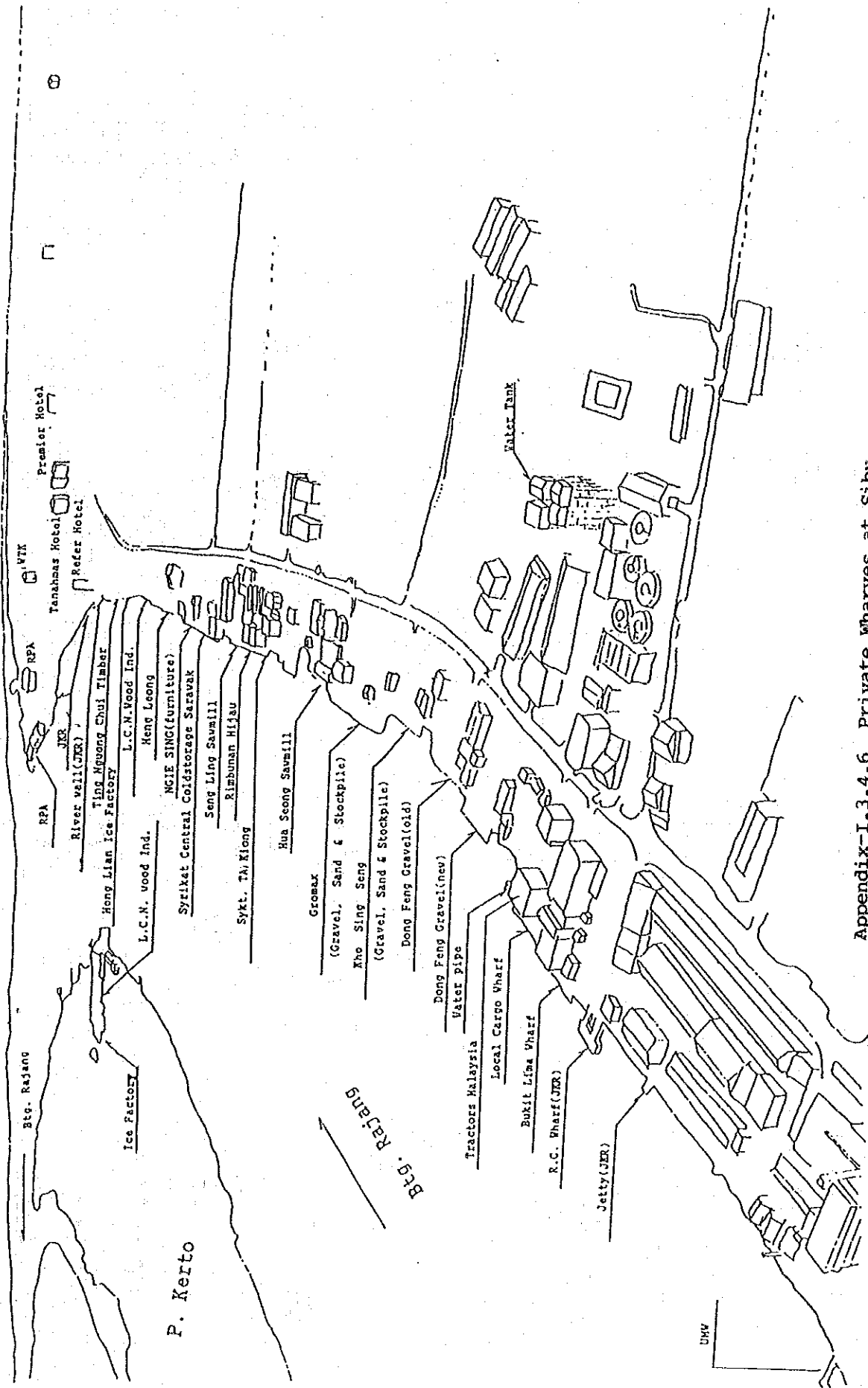
Appendix-I.3.4.4 Proposed New R.C. Wharf (JKR) at Sarikei



Appendix-I.3.4.5 JKR Wharf Facilities at Bintangor



Btg. Igan



Appendix-I.3.4.6 Private Wharves at Sibuluan

**Appendix-II.2.4.1 Relationship between DWT and Full Draught of Ships  
Operated in the World**

**1. General Cargo Ship**

(Vessels)

| Full Draught (in m) | DWT          |              |              |              |              |              |              |              |              |                |                |                |            | Total         |
|---------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|----------------|----------------|----------------|------------|---------------|
|                     | UNKNOWN      | <- 999       | 1,000 -1,499 | 1,500 -1,999 | 2,000 -2,999 | 3,000 -3,999 | 4,000 -4,999 | 5,000 -7,499 | 7,500 -9,999 | 10,000 -12,499 | 12,500 -14,999 | 15,000 -19,999 | >- 20,000  |               |
| UNKNOWN             | 815          | 498          | 92           | 50           | 25           | 16           | 8            | 18           | 9            | -              | 9              | 3              | 1          | 1,544         |
| < - 1.99            | 23           | 94           | 1            | 1            | 1            | -            | -            | 1            | -            | -              | -              | -              | -          | 121           |
| 2.0 - 2.49          | 47           | 319          | 3            | -            | -            | 1            | -            | -            | -            | -              | -              | -              | -          | 370           |
| 2.5 - 2.99          | 77           | 886          | 35           | 1            | 1            | -            | -            | -            | -            | -              | -              | -              | -          | 1,000         |
| 3.0 - 3.49          | 77           | 1,509        | 137          | 75           | 101          | 8            | -            | -            | -            | -              | -              | -              | -          | 1,907         |
| 3.5 - 3.99          | 58           | 769          | 711          | 127          | 31           | 107          | 1            | -            | -            | -              | -              | -              | -          | 1,804         |
| 4.0 - 4.49          | 41           | 131          | 465          | 445          | 139          | 16           | 55           | -            | -            | -              | -              | -              | -          | 1,292         |
| 4.5 - 4.99          | 31           | 18           | 111          | 303          | 284          | 91           | 14           | 1            | -            | -              | -              | -              | -          | 853           |
| 5.0 - 5.49          | 18           | 13           | 24           | 109          | 515          | 181          | 46           | 11           | -            | -              | -              | -              | -          | 917           |
| 5.5 - 5.99          | 14           | 2            | 3            | 6            | 161          | 410          | 79           | 62           | 5            | -              | 1              | -              | -          | 743           |
| 6.0 - 6.49          | 5            | -            | 1            | 4            | 25           | 233          | 307          | 107          | -            | -              | -              | -              | -          | 682           |
| 6.5 - 6.99          | 13           | -            | -            | 1            | 6            | 28           | 235          | 752          | 29           | -              | -              | -              | -          | 1,064         |
| 7.0 - 7.49          | 1            | -            | -            | -            | -            | 2            | 76           | 445          | 226          | 1              | -              | 1              | -          | 752           |
| 7.5 - 7.99          | 6            | -            | -            | -            | -            | 1            | 1            | 178          | 299          | 85             | 3              | 1              | -          | 574           |
| 8.0 - 8.49          | 5            | -            | -            | -            | -            | -            | -            | 15           | 175          | 209            | 27             | -              | -          | 431           |
| 8.5 - 8.99          | 5            | -            | -            | 1            | -            | -            | 3            | 2            | 47           | 281            | 164            | 189            | 1          | 693           |
| 9.0 - 9.49          | 6            | -            | -            | -            | -            | -            | -            | -            | 8            | 69             | 471            | 443            | 4          | 1,001         |
| 9.5 - 9.99          | 5            | -            | -            | -            | -            | -            | -            | 1            | -            | 24             | 199            | 278            | 91         | 598           |
| 10.0 - 10.49        | 1            | -            | -            | -            | -            | -            | -            | -            | -            | -              | 34             | 93             | 130        | 258           |
| 10.5 - 10.99        | 1            | -            | -            | -            | -            | -            | -            | -            | -            | -              | -              | 15             | 41         | 57            |
| 11.0 - 11.49        | -            | -            | -            | -            | -            | -            | -            | 1            | -            | -              | -              | -              | 1          | 2             |
| 11.5 - 11.99        | -            | -            | -            | -            | -            | -            | -            | -            | -            | -              | -              | 2              | 5          | 7             |
| > - 12.00           | -            | -            | -            | -            | -            | -            | 2            | -            | 1            | -              | -              | -              | 4          | 7             |
| <b>Total</b>        | <b>1,249</b> | <b>4,239</b> | <b>1,583</b> | <b>1,123</b> | <b>1,289</b> | <b>1,094</b> | <b>827</b>   | <b>1,594</b> | <b>799</b>   | <b>669</b>     | <b>908</b>     | <b>1,025</b>   | <b>278</b> | <b>16,677</b> |

Lloyd's Register

**2. Container Ship**

(Vessels)

| Full Draught (in m) | DWT      |           |              |              |              |                |                |                |                |                |                |                |           | Total        |
|---------------------|----------|-----------|--------------|--------------|--------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-----------|--------------|
|                     | UNKNOWN  | <- 2,499  | 2,500 -4,999 | 5,000 -7,499 | 7,500 -9,999 | 10,000 -14,999 | 15,000 -19,999 | 20,000 -22,499 | 22,500 -24,999 | 25,000 -29,999 | 30,000 -39,999 | 40,000 -49,999 | >- 50,000 |              |
| UNKNOWN             | 1        | -         | -            | 1            | -            | -              | 1              | -              | -              | -              | -              | -              | -         | 3            |
| < - 2.99            | -        | 8         | -            | -            | -            | -              | -              | -              | -              | -              | -              | -              | -         | 8            |
| 3.00 - 3.49         | -        | 1         | -            | -            | -            | -              | -              | -              | -              | -              | -              | -              | -         | 1            |
| 3.50 - 3.99         | 1        | 3         | 1            | -            | -            | -              | -              | -              | -              | -              | -              | -              | -         | 5            |
| 4.00 - 4.49         | 2        | 9         | 7            | -            | -            | -              | -              | -              | -              | -              | -              | -              | -         | 18           |
| 4.50 - 4.99         | -        | 22        | 6            | -            | -            | -              | -              | -              | -              | -              | -              | -              | -         | 28           |
| 5.00 - 5.49         | -        | 3         | 10           | 1            | -            | -              | -              | -              | -              | -              | -              | -              | -         | 14           |
| 5.50 - 5.99         | -        | 2         | 38           | 8            | -            | -              | -              | -              | -              | -              | -              | -              | -         | 48           |
| 6.00 - 6.49         | 1        | 1         | 8            | 28           | 6            | -              | -              | -              | -              | -              | -              | -              | -         | 44           |
| 6.50 - 6.99         | -        | -         | 5            | 49           | 24           | -              | -              | -              | -              | -              | -              | -              | -         | 78           |
| 7.00 - 7.49         | -        | -         | 1            | 3            | 13           | 4              | -              | -              | -              | -              | -              | -              | -         | 21           |
| 7.50 - 7.99         | -        | -         | -            | 6            | 42           | 12             | 4              | -              | -              | -              | -              | -              | -         | 64           |
| 8.00 - 8.49         | 1        | -         | -            | 1            | 16           | 37             | 11             | -              | -              | -              | -              | -              | -         | 66           |
| 8.50 - 8.99         | -        | -         | -            | -            | -            | 19             | 3              | -              | -              | -              | -              | -              | -         | 22           |
| 9.00 - 9.49         | -        | -         | -            | -            | 3            | 20             | 38             | 12             | -              | -              | -              | -              | -         | 73           |
| 9.50 - 9.99         | -        | -         | -            | -            | -            | 7              | 38             | 13             | 2              | 6              | 3              | -              | -         | 69           |
| 10.00 - 10.49       | -        | -         | -            | -            | -            | -              | 4              | 25             | 19             | 28             | 16             | 10             | -         | 102          |
| 10.50 - 10.99       | -        | -         | -            | -            | -            | -              | 5              | 12             | 24             | 38             | 20             | 2              | -         | 101          |
| 11.00 - 11.49       | -        | -         | -            | -            | -            | -              | 1              | 1              | 5              | 26             | 25             | 4              | -         | 62           |
| 11.50 - 11.99       | -        | -         | -            | -            | -            | -              | -              | -              | 2              | 12             | 80             | 44             | 9         | 147          |
| > - 12.00           | 1        | -         | -            | -            | -            | -              | -              | -              | -              | -              | 23             | 52             | 21        | 97           |
| <b>Total</b>        | <b>7</b> | <b>49</b> | <b>76</b>    | <b>97</b>    | <b>104</b>   | <b>103</b>     | <b>126</b>     | <b>57</b>      | <b>61</b>      | <b>98</b>      | <b>161</b>     | <b>102</b>     | <b>30</b> | <b>1,071</b> |

Lloyd's Register

### 3. Dry Bulk Carrier

(Vessels)

| Full Draught (in m) | DWT     |         |                 |                 |                 |                 |                 |                 |                 |                 |                 |                   |           | Total |
|---------------------|---------|---------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-------------------|-----------|-------|
|                     | UNKNOWN | < 9,999 | 10,000 - 14,999 | 15,000 - 19,999 | 20,000 - 24,999 | 25,000 - 29,999 | 30,000 - 34,999 | 35,000 - 39,999 | 40,000 - 49,999 | 50,000 - 74,999 | 75,000 - 99,999 | 100,000 - 149,999 | > 150,000 |       |
| UNKNOWN             | 1       | -       | -               | 1               | 1               | -               | -               | -               | 1               | -               | -               | -                 | -         | 4     |
| < - 5.99            | 2       | 35      | -               | 1               | -               | -               | -               | -               | -               | -               | -               | -                 | -         | 39    |
| 6.0 - 6.99          | -       | 23      | 1               | -               | -               | -               | -               | -               | 1               | -               | -               | -                 | -         | 24    |
| 7.0 - 7.99          | -       | 30      | 36              | -               | -               | 1               | -               | -               | -               | -               | -               | -                 | -         | 67    |
| 8.0 - 8.99          | -       | 6       | 109             | 79              | 2               | -               | 1               | -               | -               | -               | -               | -                 | -         | 197   |
| 9.0 - 9.99          | -       | -       | 24              | 378             | 331             | 210             | 13              | 16              | -               | 3               | -               | -                 | -         | 975   |
| 10.0 - 10.99        | 1       | -       | -               | 12              | 153             | 603             | 280             | 204             | 56              | -               | -               | -                 | -         | 1,309 |
| 11.0 - 11.99        | -       | -       | -               | -               | -               | 9               | 101             | 260             | 247             | 13              | -               | 1                 | -         | 631   |
| 12.0 - 12.99        | -       | -       | -               | -               | -               | -               | 1               | 4               | 79              | 366             | 16              | -                 | -         | 466   |
| 13.0 - 13.99        | -       | -       | -               | -               | -               | 2               | 1               | -               | -               | 224             | 39              | 1                 | -         | 267   |
| 14.0 - 14.99        | -       | -       | -               | -               | -               | -               | -               | -               | -               | 24              | 39              | 9                 | -         | 72    |
| 15.0 - 15.99        | -       | -       | -               | -               | -               | -               | -               | -               | -               | -               | 2               | 40                | -         | 42    |
| 16.0 - 16.99        | -       | -       | -               | -               | -               | -               | -               | -               | -               | -               | -               | 105               | 5         | 110   |
| 17.0 - 17.99        | -       | -       | -               | -               | -               | -               | -               | -               | -               | -               | -               | 31                | 41        | 72    |
| 18.0 - 18.99        | -       | -       | -               | -               | -               | -               | -               | -               | -               | -               | -               | -                 | 26        | 26    |
| > - 19.00           | -       | -       | -               | -               | -               | -               | -               | -               | -               | -               | -               | -                 | 9         | 9     |
| Total               | 4       | 94      | 170             | 471             | 487             | 825             | 397             | 484             | 384             | 630             | 96              | 187               | 81        | 4,310 |

Lloyd's Register

### Appendix-II.3.3.1 Flying Distance of Coal Dust

Figure-1 shows the relationship between wind and the flying distance of coal dust in a down wind direction. In this figure, wind is presented as a production of an average velocity and a frequency of wind (8 directions or 45 degrees each). Moreover, we measure the flying distance as a distance from the dust source to the point where cumulative coal dust weight per sq. m in a month is 1.0 or 0.5 .

We can rarely see very small amounts of coal dust in the case of 1.0g/sq. m/month and cannot see any coal dusts in the case of 0.5g/sq. m/month. The maximum recorded wind velocity at port areas in Sarawak was about 8m/s (hourly average) and the frequency is less than 15% (see I.2 Natural Conditions)

Therefore, we assume the worst case as follows:

- average wind velocity            8m/s
- frequency                            15%

Then, the production of there is 120 (8 x 15). Consequently, we can estimate a flying distance in the worst case from Figure-1 as follows:

- 0.8 km (1.0g/m<sup>2</sup>/month)
- 1.2 km (0.5g/m<sup>2</sup>/month)

Then, we can conclude that the minimum distance from the coal handling facility to a residential area is 1.2 km.

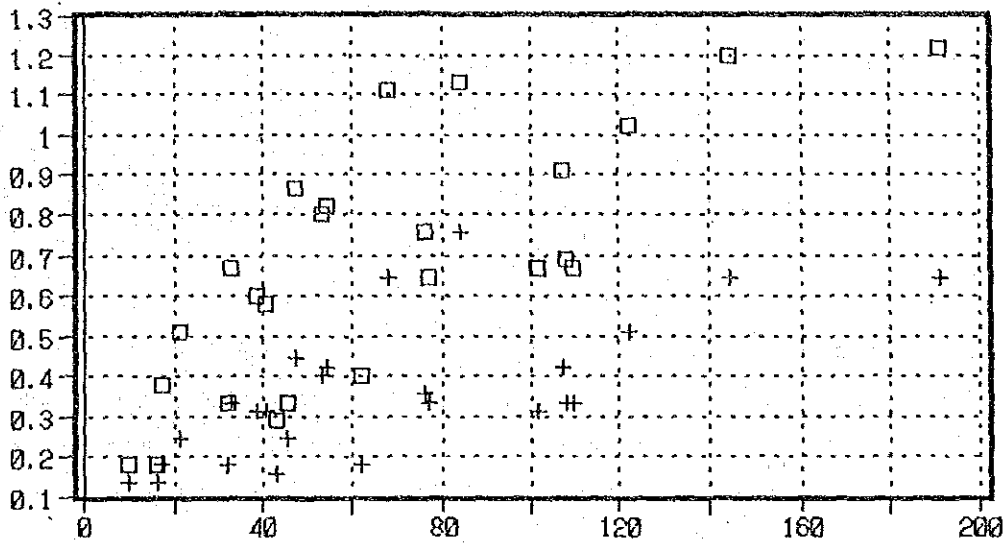


Figure-1 Flying Distance of Coal Dust (M)

\* This figure was made based on experiments and simulations prepared for Coal yard at Port of Kita-Kyushu, Japan.

#### Appendix-II.3.5.1 Possible Port Development Sites beyond 2010

##### 1. The Adjoining Areas to the Present Wharves

###### (1) Sibul Center

There is no room for expansion of port facilities.

###### (2) Sibul South

The eastern area of the proposed new terminal can be developed and about 200m wharf extension is possible. However, the western area is not suitable to the expansion because the area is near the inner corner of the river and has a tendency to sedimentation.

###### (3) Sarikei

After the wharf extension of the Master Plan scheme, there is no more room for expansion of port facilities.

###### (4) Bintangor

There is no room for expansion of port facilities.

###### (5) Sungei Merah

The size of ships calling at this area is restricted due to the depth and width at the entrance to the Igan River from the Rajang River. So, this area is not suitable for further development.

###### (6) Tg. Sebulal

It depends on the exploitation of the waterfront area by timber industry. However, there is a room for wharf expansion both south and north of the proposed timber products terminal. As STIDC will occupy the south area, only several hundred meters of expansion will be possible on the south area. On the other hand, as the north area is reserved for additional industrial development, all the waterfront of the northern area could be used for further port development.

###### (7) The opposite side of Tg. Sebulal

This area is basically so swampy that the area is not suitable for further development except for the coal terminal expansion.

## 2. New Area

The Port development site should be selected from natural conditions such as navigable depth, topographical conditions and waterfront stability (especially no sedimentation), and socio-economic conditions such as distance to industrial/urban areas and situation of infrastructure. However, we selected the further possible sites considering only the natural conditions because we cannot forecast the future socio-economic situation accurately.

### (1) Navigable Depth

When we consider a navigable depth, we should fix the target ship size. Considering that the current main ship size for general cargo transport are about 5,000DWT classes at Sibuh Center and that navigable depth for the Rajang Port Area except Tg. Manis Area is -7.5 to -9m, we fix 5,000DWT as the target ship size for further port development.

As stated in II.2, sites A and E have a basin and an approach from the estuary deep enough for 5,000DWT class ships (Figure-1)

### (2) Topography

Site A has a relatively high land level and is located on the south bank of Rajang River and is accessible to the existing urban area easily. The south bank of site E has a similar situation, while the north bank is separated with Rajang River. Although the north bank can be connected with Sibuh town by bridge over Igan River, but it is not ease to construct the bridge over Igan River because many ships such as oil tankers frequenting the river require the high clearance from water. Consequently site A and site E (the south bank) are the possible areas.

### (3) Sedimentation

Figure-2 and 3 show water depth conditions in site A and site E. These maps show the areas which have no tendency of sedimentation.

## 3. Conclusion

Figure-4 shows the possible further port development sites in Rajang Port.

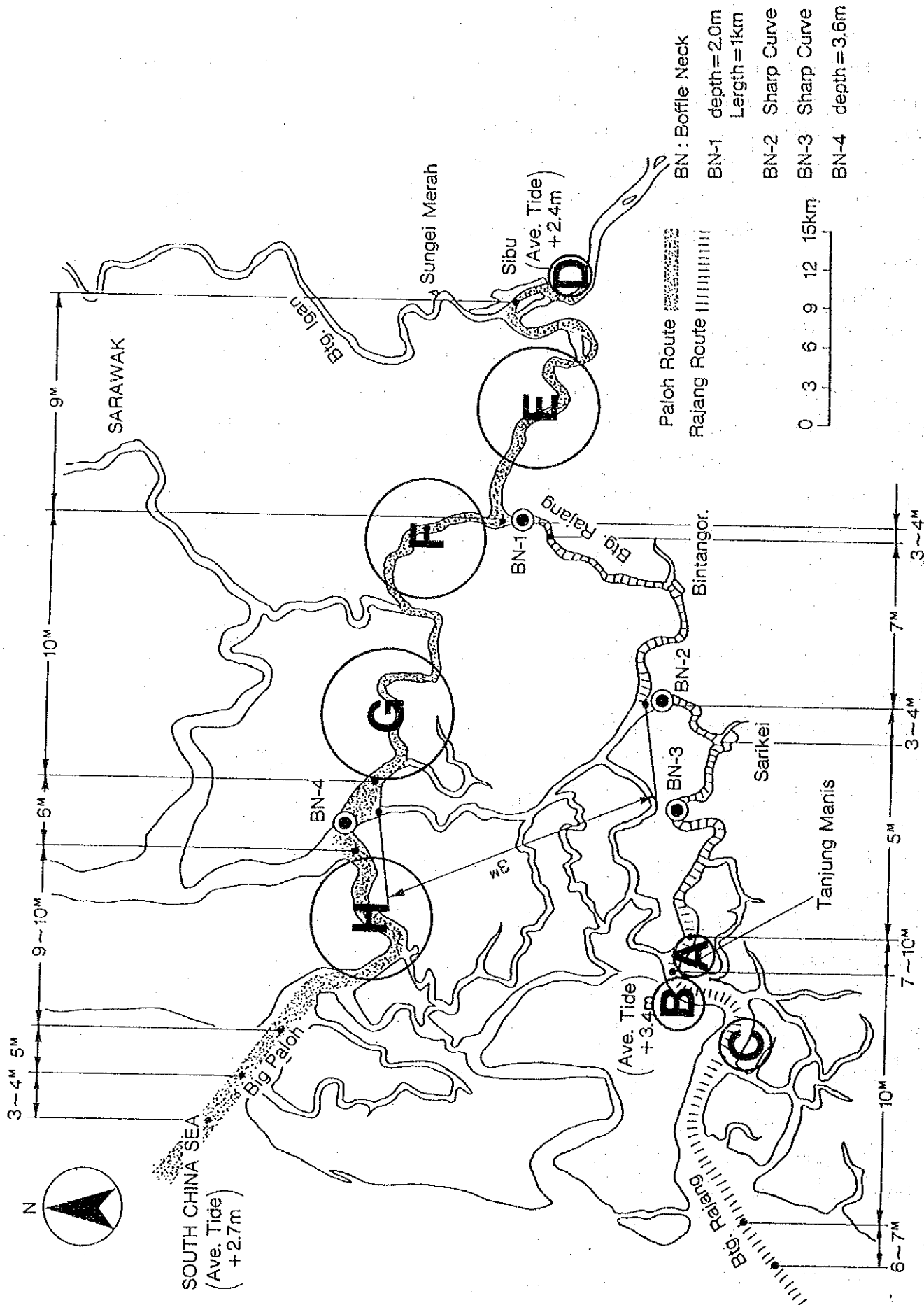


Figure-1 Navigable Depth of Rajang and Paloh Routes and Candidate Sites for Development



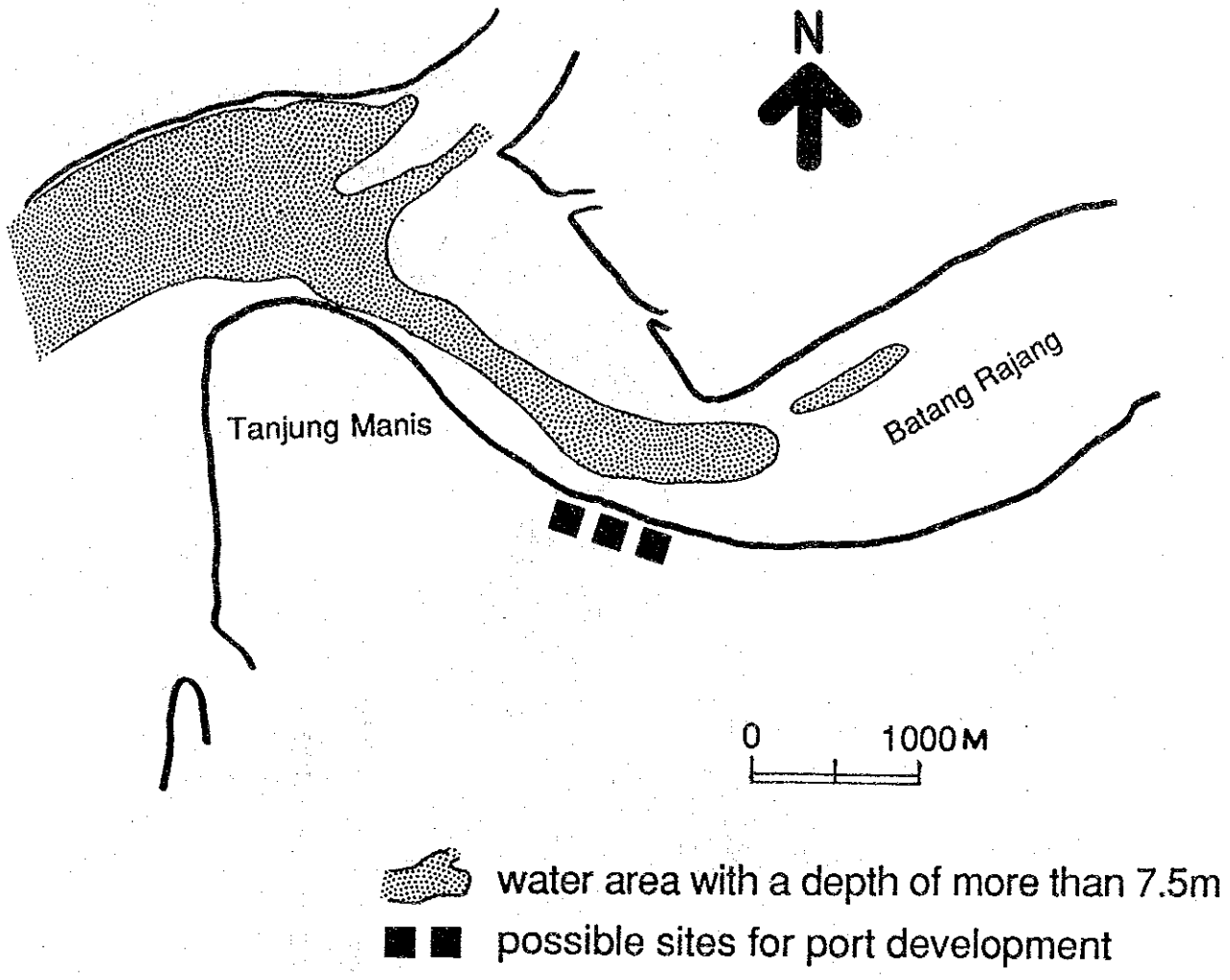


Figure-2 Water Area and Possible Site for Port Development at Site A

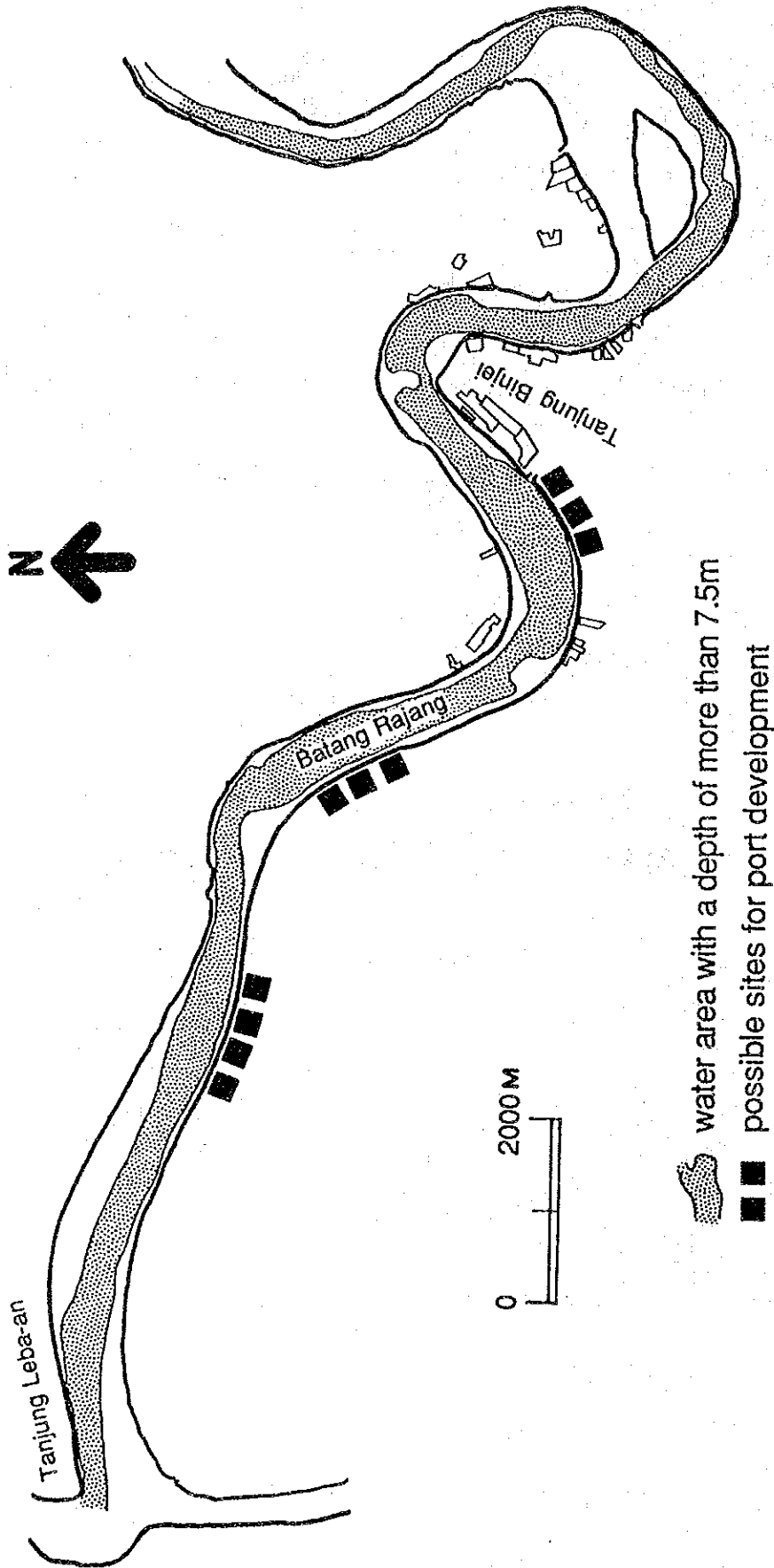


Figure-3 Water Area and Possible Site for Port Development at Site E

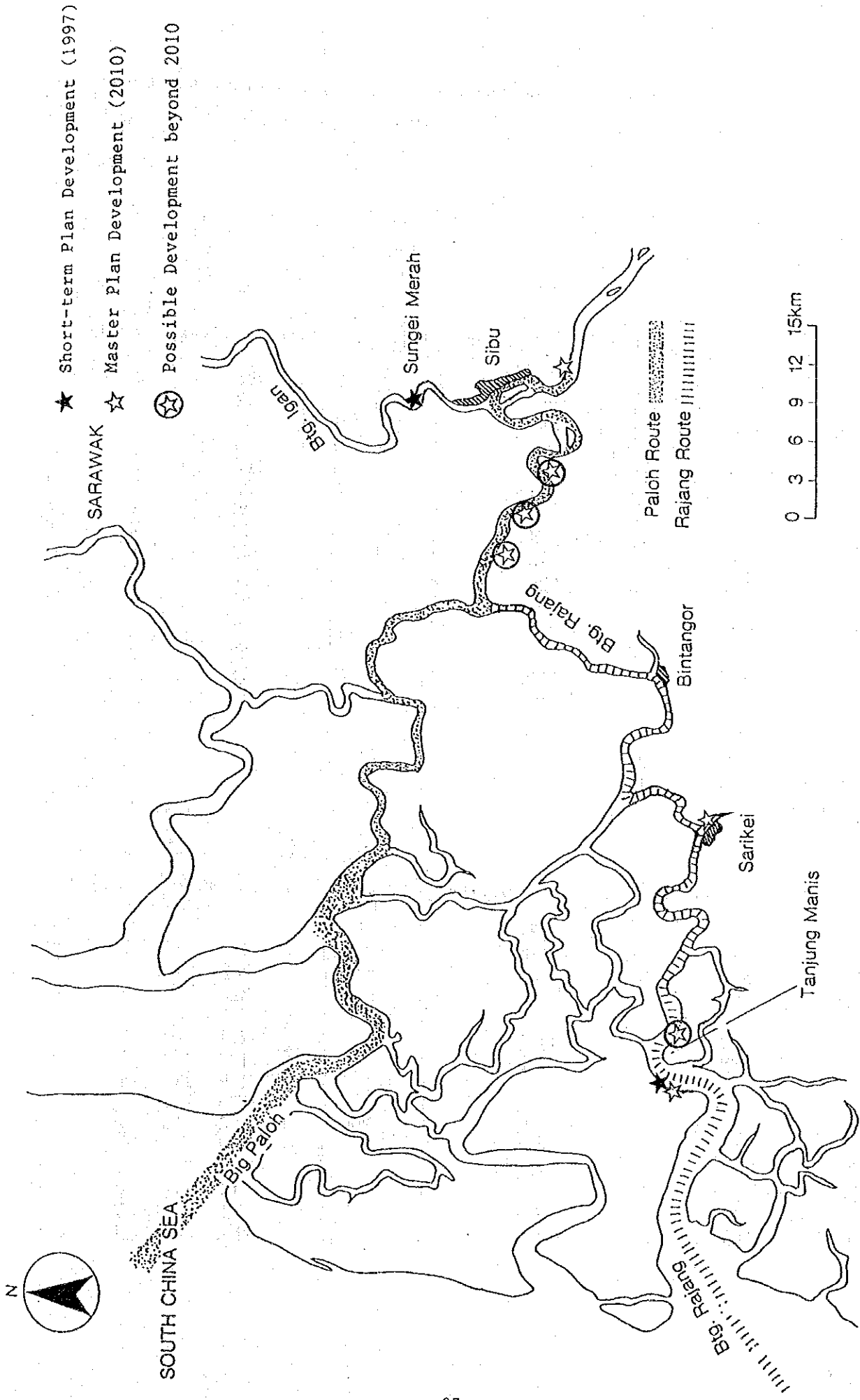


Figure-4 Development Sites for Short-term Plan, Master Plan and beyond 2010

Appendix-II.4.1.1 Population of the Hinterland by District, Age Group and Community (1960, 1970, 1980 and 1990)

(Source: Census of Population)

POPULATION 1960  
by COMMUNITY  
by AGE GROUP  
Betong

| AGE GROUP | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|-------|---------|----------|---------|-------|-------|
| 0- 4      | 2174   | 1       | 2000  | 2       | 0        | 465     | 0     | 4642  |
| 5- 9      | 2068   | 0       | 2002  | 1       | 0        | 512     | 1     | 4584  |
| 10-14     | 879    | 0       | 1129  | 0       | 0        | 348     | 1     | 2357  |
| 15-19     | 1006   | 19      | 1105  | 2       | 0        | 258     | 2     | 2392  |
| 20-24     | 799    | 11      | 897   | 3       | 0        | 209     | 0     | 1919  |
| 25-29     | 925    | 9       | 1050  | 1       | 0        | 139     | 1     | 2125  |
| 30-34     | 800    | 4       | 928   | 1       | 0        | 150     | 2     | 1885  |
| 35-39     | 714    | 1       | 878   | 0       | 0        | 112     | 2     | 1707  |
| 40-44     | 607    | 3       | 770   | 0       | 0        | 140     | 1     | 1521  |
| 45-49     | 506    | 0       | 635   | 0       | 0        | 128     | 1     | 1270  |
| 50-54     | 418    | 0       | 651   | 0       | 1        | 141     | 2     | 1213  |
| 55-59     | 219    | 0       | 358   | 0       | 0        | 82      | 1     | 660   |
| 60-64     | 201    | 0       | 491   | 0       | 0        | 65      | 0     | 757   |
| 65-       | 288    | 0       | 888   | 1       | 0        | 83      | 0     | 1260  |
| TOTAL     | 11604  | 48      | 13782 | 11      | 1        | 2832    | 14    | 28292 |

POPULATION 1970  
by COMMUNITY  
by AGE GROUP  
Betong

| AGE GROUP | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|-------|---------|----------|---------|-------|-------|
| 0- 4      | 2602   | 6       | 2226  | 4       | 1        | 445     | 1     | 5285  |
| 5- 9      | 2496   | 5       | 2486  | 4       | 2        | 481     | 2     | 5476  |
| 10-14     | 1699   | 5       | 1766  | 3       | 1        | 382     | 2     | 3858  |
| 15-19     | 1577   | 15      | 1519  | 3       | 1        | 320     | 2     | 3437  |
| 20-24     | 1358   | 9       | 1192  | 3       | 1        | 261     | 1     | 2825  |
| 25-29     | 1310   | 7       | 1121  | 2       | 1        | 213     | 2     | 2656  |
| 30-34     | 1002   | 4       | 1029  | 2       | 1        | 182     | 2     | 2222  |
| 35-39     | 863    | 3       | 925   | 1       | 1        | 139     | 2     | 1934  |
| 40-44     | 663    | 3       | 806   | 1       | 1        | 139     | 1     | 1614  |
| 45-49     | 619    | 2       | 665   | 1       | 1        | 118     | 1     | 1407  |
| 50-54     | 478    | 1       | 667   | 1       | 1        | 117     | 2     | 1287  |
| 55-59     | 328    | 1       | 466   | 1       | 0        | 77      | 1     | 874   |
| 60-64     | 288    | 1       | 481   | 1       | 0        | 67      | 0     | 838   |
| 65-       | 412    | 2       | 778   | 1       | 1        | 109     | 0     | 1303  |
| TOTAL     | 15695  | 64      | 16127 | 28      | 13       | 3050    | 19    | 34996 |

POPULATION 1980  
by COMMUNITY  
by AGE GROUP  
Betong

| COMMUNITY | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|-------|---------|----------|---------|-------|-------|
| AGE GROUP |        |         |       |         |          |         |       |       |
| 0- 4      | 2822   | 10      | 2273  | 5       | 2        | 389     | 2     | 5503  |
| 5- 9      | 2726   | 10      | 2772  | 6       | 3        | 411     | 2     | 5930  |
| 10-14     | 2382   | 9       | 2263  | 5       | 2        | 385     | 2     | 5048  |
| 15-19     | 2022   | 8       | 1812  | 4       | 2        | 356     | 2     | 4206  |
| 20-24     | 1808   | 6       | 1392  | 3       | 1        | 293     | 2     | 3505  |
| 25-29     | 1590   | 5       | 1101  | 2       | 1        | 271     | 2     | 2972  |
| 30-34     | 1124   | 4       | 1047  | 2       | 1        | 199     | 2     | 2379  |
| 35-39     | 944    | 4       | 897   | 2       | 1        | 153     | 1     | 2002  |
| 40-44     | 667    | 3       | 777   | 1       | 1        | 125     | 1     | 1575  |
| 45-49     | 681    | 3       | 643   | 1       | 1        | 97      | 1     | 1427  |
| 50-54     | 499    | 2       | 628   | 1       | 1        | 83      | 1     | 1215  |
| 55-59     | 410    | 2       | 535   | 1       | 0        | 65      | 0     | 1013  |
| 60-64     | 353    | 2       | 432   | 1       | 0        | 62      | 0     | 850   |
| 65-       | 503    | 3       | 605   | 1       | 1        | 127     | 0     | 1240  |
| TOTAL     | 18531  | 71      | 17177 | 35      | 17       | 3016    | 18    | 38865 |

POPULATION 1990  
by COMMUNITY  
by AGE GROUP  
Betong

| COMMUNITY | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|-------|---------|----------|---------|-------|-------|
| AGE GROUP |        |         |       |         |          |         |       |       |
| 0- 4      | 3722   | 11      | 2491  | 6       | 3        | 436     | 2     | 6671  |
| 5- 9      | 3274   | 10      | 2468  | 6       | 3        | 427     | 2     | 6190  |
| 10-14     | 2964   | 10      | 2648  | 6       | 3        | 424     | 2     | 6057  |
| 15-19     | 2652   | 9       | 2576  | 6       | 3        | 436     | 2     | 5684  |
| 20-24     | 2335   | 8       | 1980  | 5       | 2        | 388     | 2     | 4720  |
| 25-29     | 1980   | 7       | 1532  | 3       | 2        | 339     | 2     | 3865  |
| 30-34     | 1650   | 5       | 1228  | 3       | 1        | 285     | 2     | 3174  |
| 35-39     | 1354   | 4       | 999   | 2       | 1        | 232     | 2     | 2594  |
| 40-44     | 977    | 3       | 947   | 2       | 1        | 168     | 1     | 2099  |
| 45-49     | 838    | 3       | 825   | 2       | 1        | 136     | 1     | 1806  |
| 50-54     | 635    | 3       | 697   | 1       | 1        | 102     | 1     | 1440  |
| 55-59     | 605    | 3       | 658   | 1       | 1        | 86      | 1     | 1355  |
| 60-64     | 411    | 2       | 511   | 1       | 1        | 70      | 1     | 997   |
| 65-       | 700    | 3       | 953   | 1       | 1        | 168     | 1     | 1827  |
| TOTAL     | 24097  | 81      | 20513 | 45      | 24       | 3697    | 22    | 48479 |

POPULATION 1960  
by COMMUNITY  
by AGE GROUP  
Saratok

| COMMUNITY | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|-------|---------|----------|---------|-------|-------|
| AGE GROUP |        |         |       |         |          |         |       |       |
| 0- 4      | 1238   | 5       | 2342  | 12      | 0        | 358     | 2     | 3957  |
| 5- 9      | 1150   | 4       | 2327  | 5       | 0        | 409     | 7     | 3902  |
| 10-14     | 660    | 1       | 1403  | 3       | 0        | 303     | 4     | 2374  |
| 15-19     | 602    | 5       | 1144  | 9       | 1        | 161     | 9     | 1931  |
| 20-24     | 523    | 3       | 910   | 10      | 1        | 151     | 3     | 1601  |
| 25-29     | 574    | 3       | 1040  | 5       | 0        | 129     | 1     | 1752  |
| 30-34     | 532    | 3       | 1090  | 1       | 1        | 118     | 1     | 1746  |
| 35-39     | 464    | 1       | 803   | 2       | 1        | 125     | 2     | 1398  |
| 40-44     | 437    | 2       | 934   | 1       | 0        | 116     | 0     | 1490  |
| 45-49     | 242    | 1       | 512   | 0       | 0        | 90      | 2     | 847   |
| 50-54     | 301    | 0       | 704   | 1       | 0        | 126     | 1     | 1133  |
| 55-59     | 118    | 0       | 262   | 0       | 0        | 67      | 1     | 448   |
| 60-64     | 177    | 3       | 568   | 0       | 0        | 34      | 2     | 784   |
| 65-       | 313    | 0       | 887   | 0       | 1        | 47      | 0     | 1248  |
| TOTAL     | 7331   | 31      | 14926 | 49      | 5        | 2234    | 35    | 24611 |

POPULATION 1970  
by COMMUNITY  
by AGE GROUP  
Saratok

| COMMUNITY | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|-------|---------|----------|---------|-------|-------|
| AGE GROUP |        |         |       |         |          |         |       |       |
| 0- 4      | 1498   | 7       | 2519  | 11      | 1        | 387     | 2     | 4425  |
| 5- 9      | 1423   | 7       | 2810  | 8       | 1        | 425     | 5     | 4679  |
| 10-14     | 1074   | 5       | 2049  | 7       | 1        | 358     | 3     | 3497  |
| 15-19     | 932    | 7       | 1651  | 9       | 2        | 273     | 5     | 2879  |
| 20-24     | 826    | 5       | 1283  | 8       | 1        | 233     | 3     | 2359  |
| 25-29     | 783    | 4       | 1173  | 5       | 1        | 211     | 2     | 2179  |
| 30-34     | 616    | 4       | 1166  | 3       | 1        | 166     | 1     | 1957  |
| 35-39     | 526    | 2       | 934   | 3       | 1        | 144     | 2     | 1612  |
| 40-44     | 425    | 3       | 927   | 2       | 1        | 126     | 1     | 1485  |
| 45-49     | 333    | 2       | 639   | 2       | 0        | 98      | 2     | 1076  |
| 50-54     | 305    | 1       | 725   | 2       | 0        | 108     | 1     | 1142  |
| 55-59     | 188    | 1       | 450   | 1       | 0        | 68      | 1     | 709   |
| 60-64     | 199    | 3       | 540   | 1       | 0        | 50      | 1     | 794   |
| 65-       | 312    | 2       | 801   | 1       | 1        | 92      | 0     | 1209  |
| TOTAL     | 9440   | 53      | 17667 | 63      | 11       | 2739    | 29    | 30002 |

POPULATION 1980  
by COMMUNITY  
by AGE GROUP  
Saratok

| COMMUNITY | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|-------|---------|----------|---------|-------|-------|
| AGE GROUP |        |         |       |         |          |         |       |       |
| 0- 4      | 1791   | 9       | 2754  | 10      | 2        | 426     | 2     | 4994  |
| 5- 9      | 1730   | 10      | 3359  | 11      | 2        | 450     | 2     | 5564  |
| 10-14     | 1512   | 9       | 2742  | 10      | 2        | 421     | 1     | 4697  |
| 15-19     | 1283   | 8       | 2196  | 8       | 2        | 390     | 1     | 3888  |
| 20-24     | 1148   | 6       | 1686  | 6       | 1        | 321     | 2     | 3170  |
| 25-29     | 1009   | 5       | 1334  | 4       | 1        | 297     | 2     | 2652  |
| 30-34     | 713    | 4       | 1269  | 4       | 1        | 218     | 1     | 2210  |
| 35-39     | 599    | 3       | 1087  | 3       | 1        | 167     | 1     | 1861  |
| 40-44     | 423    | 3       | 941   | 2       | 1        | 137     | 1     | 1508  |
| 45-49     | 432    | 3       | 779   | 3       | 0        | 107     | 1     | 1325  |
| 50-54     | 317    | 2       | 762   | 2       | 0        | 91      | 1     | 1175  |
| 55-59     | 261    | 2       | 648   | 2       | 0        | 71      | 0     | 984   |
| 60-64     | 224    | 2       | 524   | 1       | 0        | 68      | 0     | 819   |
| 65-       | 319    | 3       | 733   | 2       | 0        | 139     | 0     | 1196  |
| TOTAL     | 11761  | 69      | 20814 | 68      | 13       | 3303    | 15    | 36043 |

POPULATION 1990  
by COMMUNITY  
by AGE GROUP  
Saratok

| COMMUNITY | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|-------|---------|----------|---------|-------|-------|
| AGE GROUP |        |         |       |         |          |         |       |       |
| 0- 4      | 2297   | 12      | 3031  | 14      | 3        | 465     | 1     | 5823  |
| 5- 9      | 2020   | 11      | 3004  | 13      | 3        | 455     | 2     | 5508  |
| 10-14     | 1829   | 11      | 3222  | 14      | 3        | 452     | 2     | 5533  |
| 15-19     | 1636   | 10      | 3134  | 13      | 3        | 464     | 2     | 5262  |
| 20-24     | 1441   | 9       | 2409  | 11      | 2        | 413     | 2     | 4287  |
| 25-29     | 1222   | 7       | 1865  | 8       | 2        | 361     | 2     | 3467  |
| 30-34     | 1018   | 5       | 1494  | 6       | 1        | 303     | 2     | 2829  |
| 35-39     | 835    | 5       | 1216  | 5       | 1        | 247     | 2     | 2311  |
| 40-44     | 603    | 4       | 1152  | 4       | 1        | 180     | 1     | 1945  |
| 45-49     | 517    | 4       | 1004  | 4       | 1        | 145     | 1     | 1676  |
| 50-54     | 392    | 3       | 848   | 3       | 1        | 108     | 1     | 1356  |
| 55-59     | 373    | 3       | 800   | 3       | 1        | 92      | 1     | 1273  |
| 60-64     | 253    | 2       | 622   | 2       | 1        | 75      | 0     | 955   |
| 65-       | 432    | 4       | 1160  | 3       | 1        | 179     | 1     | 1780  |
| TOTAL     | 14868  | 90      | 24961 | 103     | 24       | 3939    | 20    | 44005 |

POPULATION 1960  
by COMMUNITY  
by AGE GROUP  
Sibu

| COMMUNITY | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|-------|---------|----------|---------|-------|-------|
| AGE GROUP |        |         |       |         |          |         |       |       |
| 0- 4      | 1263   | 399     | 2398  | 22      | 4        | 9925    | 49    | 14060 |
| 5- 9      | 1054   | 369     | 2256  | 7       | 2        | 10568   | 40    | 14296 |
| 10-14     | 637    | 228     | 1314  | 2       | 3        | 7387    | 18    | 9589  |
| 15-19     | 663    | 337     | 1222  | 12      | 21       | 4712    | 12    | 6979  |
| 20-24     | 507    | 286     | 1127  | 21      | 33       | 3802    | 16    | 5792  |
| 25-29     | 516    | 248     | 1255  | 17      | 38       | 2808    | 31    | 4913  |
| 30-34     | 505    | 223     | 1270  | 7       | 27       | 2270    | 48    | 4350  |
| 35-39     | 380    | 187     | 957   | 2       | 20       | 1985    | 26    | 3557  |
| 40-44     | 343    | 177     | 920   | 6       | 12       | 2031    | 25    | 3514  |
| 45-49     | 262    | 116     | 590   | 0       | 10       | 1760    | 17    | 2755  |
| 50-54     | 221    | 87      | 605   | 0       | 10       | 1701    | 22    | 2646  |
| 55-59     | 149    | 54      | 269   | 0       | 1        | 1117    | 10    | 1600  |
| 60-64     | 128    | 62      | 373   | 0       | 2        | 891     | 6     | 1462  |
| 65-       | 176    | 43      | 453   | 0       | 0        | 1090    | 7     | 1769  |
| TOTAL     | 6804   | 2816    | 15009 | 96      | 183      | 52047   | 327   | 77282 |

POPULATION 1970  
by COMMUNITY  
by AGE GROUP  
Sibu

| COMMUNITY | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|-------|---------|----------|---------|-------|-------|
| AGE GROUP |        |         |       |         |          |         |       |       |
| 0- 4      | 1555   | 797     | 2687  | 44      | 49       | 9543    | 49    | 14724 |
| 5- 9      | 1427   | 813     | 2975  | 41      | 56       | 10109   | 43    | 15464 |
| 10-14     | 1119   | 702     | 2190  | 35      | 43       | 8331    | 29    | 12449 |
| 15-19     | 1005   | 656     | 1830  | 34      | 49       | 6751    | 26    | 10351 |
| 20-24     | 860    | 524     | 1491  | 30      | 42       | 5527    | 30    | 8504  |
| 25-29     | 787    | 451     | 1344  | 23      | 40       | 4789    | 40    | 7474  |
| 30-34     | 620    | 342     | 1313  | 16      | 29       | 3613    | 43    | 5976  |
| 35-39     | 501    | 318     | 1065  | 12      | 24       | 2878    | 28    | 4826  |
| 40-44     | 387    | 270     | 964   | 11      | 21       | 2536    | 24    | 4213  |
| 45-49     | 356    | 249     | 720   | 9       | 15       | 2058    | 16    | 3423  |
| 50-54     | 274    | 192     | 717   | 6       | 16       | 1844    | 18    | 3067  |
| 55-59     | 211    | 161     | 499   | 6       | 8        | 1351    | 10    | 2246  |
| 60-64     | 181    | 142     | 474   | 5       | 10       | 1208    | 7     | 2027  |
| 65-       | 255    | 196     | 632   | 6       | 12       | 2142    | 9     | 3252  |
| TOTAL     | 9538   | 5813    | 18901 | 278     | 414      | 62680   | 372   | 97996 |



POPULATION 1980  
by COMMUNITY  
by AGE GROUP  
Sibu

| COMMUNITY | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL  |
|-----------|--------|---------|-------|---------|----------|---------|-------|--------|
| AGE GROUP |        |         |       |         |          |         |       |        |
| 0-4       | 2172   | 1361    | 3540  | 76      | 104      | 11161   | 58    | 18472  |
| 5-9       | 2099   | 1427    | 4317  | 83      | 121      | 11768   | 55    | 19870  |
| 10-14     | 1834   | 1324    | 3524  | 75      | 93       | 11021   | 46    | 17917  |
| 15-19     | 1556   | 1112    | 2822  | 63      | 86       | 10203   | 46    | 15888  |
| 20-24     | 1392   | 872     | 2167  | 44      | 59       | 8409    | 50    | 12993  |
| 25-29     | 1224   | 747     | 1715  | 33      | 49       | 7773    | 56    | 11597  |
| 30-34     | 865    | 533     | 1631  | 29      | 37       | 5714    | 45    | 8854   |
| 35-39     | 727    | 515     | 1397  | 24      | 33       | 4375    | 36    | 7107   |
| 40-44     | 513    | 418     | 1210  | 17      | 33       | 3573    | 26    | 5790   |
| 45-49     | 524    | 433     | 1001  | 20      | 24       | 2788    | 19    | 4809   |
| 50-54     | 384    | 336     | 979   | 14      | 25       | 2372    | 17    | 4127   |
| 55-59     | 316    | 302     | 833   | 13      | 17       | 1869    | 11    | 3361   |
| 60-64     | 272    | 252     | 674   | 10      | 19       | 1778    | 10    | 3015   |
| 65-       | 387    | 390     | 942   | 14      | 25       | 3642    | 12    | 5412   |
| TOTAL     | 14265  | 10022   | 26752 | 515     | 725      | 86446   | 487   | 139212 |

POPULATION 1990  
by COMMUNITY  
by AGE GROUP  
Sibu

| COMMUNITY | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL  |
|-----------|--------|---------|-------|---------|----------|---------|-------|--------|
| AGE GROUP |        |         |       |         |          |         |       |        |
| 0-4       | 3001   | 1685    | 3885  | 87      | 154      | 12384   | 42    | 21238  |
| 5-9       | 2640   | 1591    | 3850  | 83      | 138      | 12114   | 56    | 20472  |
| 10-14     | 2390   | 1530    | 4129  | 84      | 144      | 12045   | 59    | 20381  |
| 15-19     | 2138   | 1433    | 4017  | 78      | 135      | 12366   | 55    | 20222  |
| 20-24     | 1883   | 1251    | 3088  | 66      | 104      | 11006   | 51    | 17449  |
| 25-29     | 1597   | 1009    | 2390  | 48      | 83       | 9612    | 56    | 14795  |
| 30-34     | 1331   | 743     | 1915  | 36      | 60       | 8079    | 54    | 12218  |
| 35-39     | 1092   | 667     | 1559  | 29      | 49       | 6588    | 52    | 10036  |
| 40-44     | 788    | 498     | 1476  | 24      | 42       | 4781    | 37    | 7646   |
| 45-49     | 676    | 497     | 1287  | 23      | 39       | 3849    | 30    | 6401   |
| 50-54     | 512    | 415     | 1087  | 16      | 33       | 2885    | 20    | 4968   |
| 55-59     | 488    | 400     | 1026  | 17      | 31       | 2437    | 18    | 4417   |
| 60-64     | 331    | 301     | 797   | 11      | 24       | 1992    | 13    | 3469   |
| 65-       | 565    | 521     | 1486  | 20      | 50       | 4772    | 20    | 7434   |
| TOTAL     | 19432  | 12541   | 31992 | 622     | 1086     | 104910  | 563   | 171146 |

POPULATION 1960  
by COMMUNITY  
by AGE GROUP  
Mukah

| COMMUNITY | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|-------|---------|----------|---------|-------|-------|
| AGE GROUP |        |         |       |         |          |         |       |       |
| 0- 4      | 42     | 1289    | 2191  | 1       | 0        | 477     | 20    | 4020  |
| 5- 9      | 35     | 1356    | 2065  | 7       | 0        | 556     | 20    | 4039  |
| 10-14     | 21     | 874     | 1151  | 2       | 0        | 379     | 13    | 2440  |
| 15-19     | 19     | 680     | 1122  | 2       | 5        | 196     | 5     | 2029  |
| 20-24     | 20     | 473     | 851   | 3       | 9        | 152     | 4     | 1512  |
| 25-29     | 22     | 561     | 1001  | 3       | 10       | 116     | 8     | 1721  |
| 30-34     | 17     | 513     | 887   | 3       | 6        | 146     | 8     | 1580  |
| 35-39     | 11     | 508     | 966   | 1       | 1        | 131     | 5     | 1623  |
| 40-44     | 8      | 487     | 719   | 4       | 0        | 127     | 7     | 1352  |
| 45-49     | 11     | 388     | 504   | 1       | 1        | 122     | 2     | 1029  |
| 50-54     | 8      | 353     | 486   | 2       | 0        | 83      | 2     | 934   |
| 55-59     | 3      | 203     | 207   | 0       | 0        | 57      | 2     | 472   |
| 60-64     | 9      | 245     | 271   | 0       | 0        | 53      | 1     | 579   |
| 65-       | 16     | 320     | 362   | 0       | 0        | 64      | 5     | 767   |
| TOTAL     | 242    | 8250    | 12783 | 29      | 32       | 2659    | 102   | 24097 |

POPULATION 1970  
by COMMUNITY  
by AGE GROUP  
Mukah

| COMMUNITY | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|-------|---------|----------|---------|-------|-------|
| AGE GROUP |        |         |       |         |          |         |       |       |
| 0- 4      | 66     | 1446    | 2297  | 5       | 4        | 431     | 12    | 4261  |
| 5- 9      | 61     | 1518    | 2507  | 9       | 5        | 481     | 12    | 4593  |
| 10-14     | 48     | 1223    | 1788  | 6       | 4        | 381     | 8     | 3458  |
| 15-19     | 42     | 1001    | 1528  | 5       | 6        | 278     | 4     | 2864  |
| 20-24     | 39     | 755     | 1168  | 4       | 7        | 225     | 4     | 2202  |
| 25-29     | 37     | 722     | 1084  | 4       | 7        | 196     | 6     | 2056  |
| 30-34     | 26     | 570     | 999   | 3       | 5        | 174     | 5     | 1782  |
| 35-39     | 20     | 558     | 956   | 2       | 2        | 143     | 4     | 1685  |
| 40-44     | 15     | 489     | 771   | 3       | 2        | 126     | 4     | 1410  |
| 45-49     | 16     | 450     | 593   | 2       | 2        | 110     | 2     | 1175  |
| 50-54     | 13     | 373     | 577   | 2       | 1        | 83      | 2     | 1051  |
| 55-59     | 9      | 280     | 391   | 1       | 1        | 61      | 2     | 745   |
| 60-64     | 11     | 271     | 367   | 1       | 1        | 58      | 1     | 710   |
| 65-       | 16     | 391     | 504   | 1       | 1        | 97      | 3     | 1013  |
| TOTAL     | 419    | 10047   | 15530 | 48      | 48       | 2844    | 69    | 29005 |

POPULATION 1980  
by COMMUNITY  
by AGE GROUP  
Mukah

| COMMUNITY | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|-------|---------|----------|---------|-------|-------|
| AGE GROUP |        |         |       |         |          |         |       |       |
| 0- 4      | 93     | 1692    | 2547  | 9       | 8        | 413     | 3     | 4765  |
| 5- 9      | 90     | 1775    | 3106  | 10      | 9        | 435     | 3     | 5428  |
| 10-14     | 79     | 1647    | 2536  | 9       | 7        | 407     | 2     | 4687  |
| 15-19     | 67     | 1384    | 2030  | 7       | 7        | 377     | 2     | 3874  |
| 20-24     | 60     | 1085    | 1559  | 5       | 5        | 311     | 3     | 3028  |
| 25-29     | 53     | 929     | 1234  | 4       | 4        | 287     | 3     | 2514  |
| 30-34     | 37     | 663     | 1173  | 3       | 3        | 211     | 2     | 2092  |
| 35-39     | 31     | 641     | 1005  | 3       | 3        | 162     | 2     | 1847  |
| 40-44     | 22     | 520     | 870   | 2       | 3        | 132     | 1     | 1550  |
| 45-49     | 23     | 539     | 720   | 2       | 2        | 103     | 1     | 1390  |
| 50-54     | 17     | 417     | 704   | 2       | 2        | 88      | 1     | 1231  |
| 55-59     | 14     | 375     | 599   | 2       | 1        | 69      | 1     | 1061  |
| 60-64     | 12     | 313     | 485   | 1       | 1        | 66      | 1     | 879   |
| 65-       | 17     | 485     | 678   | 2       | 2        | 135     | 1     | 1320  |
| TOTAL     | 615    | 12465   | 19246 | 61      | 57       | 3196    | 26    | 35666 |

POPULATION 1990  
by COMMUNITY  
by AGE GROUP  
Mukah

| COMMUNITY | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|-------|---------|----------|---------|-------|-------|
| AGE GROUP |        |         |       |         |          |         |       |       |
| 0- 4      | 106    | 1976    | 2831  | 11      | 14       | 442     | 2     | 5382  |
| 5- 9      | 93     | 1866    | 2805  | 11      | 12       | 433     | 3     | 5223  |
| 10-14     | 85     | 1793    | 3009  | 11      | 13       | 430     | 3     | 5344  |
| 15-19     | 76     | 1680    | 2927  | 10      | 12       | 442     | 3     | 5150  |
| 20-24     | 67     | 1466    | 2250  | 9       | 9        | 393     | 3     | 4197  |
| 25-29     | 56     | 1183    | 1741  | 6       | 7        | 343     | 3     | 3339  |
| 30-34     | 47     | 871     | 1395  | 5       | 5        | 288     | 3     | 2614  |
| 35-39     | 39     | 782     | 1136  | 4       | 4        | 235     | 3     | 2203  |
| 40-44     | 28     | 584     | 1076  | 3       | 4        | 171     | 2     | 1868  |
| 45-49     | 24     | 583     | 938   | 3       | 3        | 137     | 2     | 1690  |
| 50-54     | 18     | 487     | 792   | 2       | 3        | 103     | 1     | 1406  |
| 55-59     | 17     | 469     | 748   | 2       | 3        | 87      | 1     | 1327  |
| 60-64     | 12     | 353     | 581   | 1       | 2        | 71      | 1     | 1021  |
| 65-       | 20     | 611     | 1083  | 3       | 4        | 170     | 1     | 1892  |
| TOTAL     | 688    | 14704   | 23312 | 81      | 95       | 3745    | 31    | 42656 |

POPULATION 1960  
by COMMUNITY  
by AGE GROUP  
Kanowit

| COMMUNITY | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|-------|---------|----------|---------|-------|-------|
| AGE GROUP |        |         |       |         |          |         |       |       |
| 0- 4      | 40     | 20      | 2794  | 1       | 2        | 1006    | 2     | 3865  |
| 5- 9      | 38     | 15      | 2379  | 0       | 2        | 951     | 2     | 3387  |
| 10-14     | 27     | 7       | 1221  | 2       | 1        | 607     | 2     | 1867  |
| 15-19     | 28     | 7       | 1296  | 3       | 1        | 397     | 0     | 1732  |
| 20-24     | 20     | 11      | 1077  | 2       | 1        | 353     | 1     | 1465  |
| 25-29     | 24     | 10      | 1306  | 1       | 3        | 303     | 2     | 1649  |
| 30-34     | 16     | 5       | 1222  | 1       | 1        | 257     | 2     | 1504  |
| 35-39     | 17     | 7       | 1064  | 0       | 0        | 165     | 2     | 1255  |
| 40-44     | 16     | 3       | 890   | 0       | 1        | 220     | 1     | 1131  |
| 45-49     | 17     | 3       | 662   | 0       | 0        | 196     | 1     | 879   |
| 50-54     | 10     | 6       | 663   | 0       | 1        | 191     | 0     | 871   |
| 55-59     | 4      | 2       | 334   | 0       | 0        | 141     | 0     | 481   |
| 60-64     | 4      | 2       | 448   | 0       | 0        | 109     | 0     | 563   |
| 65-       | 6      | 2       | 603   | 0       | 0        | 118     | 0     | 729   |
| TOTAL     | 267    | 100     | 15959 | 10      | 13       | 5014    | 15    | 21378 |

POPULATION 1970  
by COMMUNITY  
by AGE GROUP  
Kanowit

| COMMUNITY | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|-------|---------|----------|---------|-------|-------|
| AGE GROUP |        |         |       |         |          |         |       |       |
| 0- 4      | 83     | 29      | 2996  | 3       | 3        | 861     | 2     | 3977  |
| 5- 9      | 80     | 27      | 3120  | 3       | 4        | 851     | 2     | 4087  |
| 10-14     | 66     | 22      | 2173  | 3       | 3        | 649     | 2     | 2918  |
| 15-19     | 59     | 19      | 1905  | 3       | 3        | 515     | 1     | 2505  |
| 20-24     | 51     | 18      | 1506  | 2       | 2        | 438     | 1     | 2018  |
| 25-29     | 48     | 16      | 1427  | 2       | 3        | 393     | 2     | 1891  |
| 30-34     | 33     | 10      | 1347  | 2       | 2        | 306     | 2     | 1702  |
| 35-39     | 30     | 10      | 1162  | 1       | 1        | 218     | 2     | 1424  |
| 40-44     | 23     | 7       | 991   | 1       | 1        | 222     | 1     | 1246  |
| 45-49     | 24     | 7       | 781   | 1       | 1        | 187     | 1     | 1002  |
| 50-54     | 17     | 8       | 772   | 1       | 1        | 171     | 0     | 970   |
| 55-59     | 11     | 5       | 537   | 1       | 1        | 130     | 0     | 685   |
| 60-64     | 10     | 4       | 527   | 1       | 1        | 111     | 0     | 654   |
| 65-       | 15     | 6       | 725   | 1       | 1        | 171     | 0     | 919   |
| TOTAL     | 550    | 188     | 19969 | 25      | 27       | 5223    | 16    | 25998 |

POPULATION 1980  
by COMMUNITY  
by AGE GROUP  
Kanowit

| AGE GROUP | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|-------|---------|----------|---------|-------|-------|
| 0- 4      | 120    | 35      | 2976  | 4       | 4        | 651     | 1     | 3791  |
| 5- 9      | 116    | 36      | 3628  | 5       | 5        | 686     | 1     | 4477  |
| 10-14     | 101    | 34      | 2962  | 4       | 4        | 643     | 1     | 3749  |
| 15-19     | 86     | 28      | 2372  | 3       | 4        | 595     | 1     | 3089  |
| 20-24     | 77     | 22      | 1822  | 2       | 2        | 490     | 1     | 2416  |
| 25-29     | 68     | 19      | 1441  | 2       | 2        | 453     | 1     | 1986  |
| 30-34     | 48     | 14      | 1371  | 2       | 2        | 333     | 1     | 1771  |
| 35-39     | 40     | 13      | 1174  | 1       | 1        | 255     | 1     | 1485  |
| 40-44     | 28     | 11      | 1017  | 1       | 1        | 208     | 0     | 1266  |
| 45-49     | 29     | 11      | 841   | 1       | 1        | 163     | 0     | 1046  |
| 50-54     | 21     | 9       | 823   | 1       | 1        | 138     | 0     | 993   |
| 55-59     | 17     | 8       | 700   | 1       | 1        | 109     | 0     | 836   |
| 60-64     | 15     | 6       | 566   | 1       | 1        | 104     | 0     | 693   |
| 65-       | 21     | 10      | 792   | 1       | 1        | 212     | 0     | 1037  |
| TOTAL     | 787    | 256     | 22485 | 29      | 30       | 5040    | 8     | 28635 |

POPULATION 1990  
by COMMUNITY  
by AGE GROUP  
Kanowit

| AGE GROUP | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|-------|---------|----------|---------|-------|-------|
| 0- 4      | 161    | 50      | 3581  | 5       | 4        | 771     | 1     | 4573  |
| 5- 9      | 141    | 47      | 3548  | 5       | 4        | 754     | 1     | 4500  |
| 10-14     | 128    | 46      | 3806  | 5       | 4        | 750     | 2     | 4741  |
| 15-19     | 115    | 43      | 3702  | 5       | 3        | 770     | 1     | 4639  |
| 20-24     | 101    | 37      | 2846  | 4       | 3        | 685     | 1     | 3677  |
| 25-29     | 86     | 30      | 2203  | 3       | 2        | 598     | 2     | 2924  |
| 30-34     | 71     | 22      | 1765  | 2       | 2        | 503     | 1     | 2366  |
| 35-39     | 58     | 20      | 1437  | 2       | 1        | 410     | 1     | 1929  |
| 40-44     | 42     | 15      | 1361  | 1       | 1        | 298     | 1     | 1719  |
| 45-49     | 36     | 15      | 1186  | 1       | 1        | 240     | 1     | 1480  |
| 50-54     | 27     | 12      | 1002  | 1       | 1        | 180     | 1     | 1224  |
| 55-59     | 26     | 12      | 946   | 1       | 1        | 152     | 0     | 1138  |
| 60-64     | 18     | 9       | 734   | 1       | 1        | 124     | 0     | 887   |
| 65-       | 30     | 16      | 1370  | 1       | 1        | 297     | 1     | 1716  |
| TOTAL     | 1040   | 374     | 29487 | 37      | 29       | 6532    | 14    | 37513 |

POPULATION 1960  
by COMMUNITY  
by AGE GROUP  
Dalat

| COMMUNITY | Malays | Melanau | Iban | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|------|---------|----------|---------|-------|-------|
| AGE GROUP |        |         |      |         |          |         |       |       |
| 0- 4      | 24     | 1194    | 871  | 0       | 1        | 302     | 8     | 2400  |
| 5- 9      | 20     | 1256    | 820  | 1       | 0        | 353     | 7     | 2457  |
| 10-14     | 11     | 809     | 458  | 1       | 0        | 240     | 5     | 1524  |
| 15-19     | 11     | 630     | 447  | 1       | 5        | 125     | 2     | 1221  |
| 20-24     | 11     | 437     | 338  | 0       | 14       | 97      | 2     | 899   |
| 25-29     | 12     | 519     | 398  | 1       | 10       | 73      | 3     | 1016  |
| 30-34     | 10     | 476     | 353  | 0       | 6        | 93      | 3     | 941   |
| 35-39     | 6      | 471     | 383  | 0       | 2        | 83      | 2     | 947   |
| 40-44     | 4      | 451     | 285  | 0       | 1        | 81      | 2     | 824   |
| 45-49     | 6      | 360     | 200  | 0       | 1        | 78      | 1     | 646   |
| 50-54     | 5      | 328     | 193  | 0       | 0        | 52      | 1     | 579   |
| 55-59     | 2      | 189     | 82   | 0       | 0        | 36      | 1     | 310   |
| 60-64     | 5      | 227     | 108  | 0       | 0        | 35      | 0     | 375   |
| 65-       | 6      | 294     | 144  | 0       | 0        | 42      | 0     | 486   |
| TOTAL     | 133    | 7641    | 5080 | 4       | 40       | 1690    | 37    | 14625 |

POPULATION 1970  
by COMMUNITY  
by AGE GROUP  
Dalat

| COMMUNITY | Malays | Melanau | Iban | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|------|---------|----------|---------|-------|-------|
| AGE GROUP |        |         |      |         |          |         |       |       |
| 0- 4      | 38     | 1369    | 934  | 1       | 5        | 280     | 5     | 2632  |
| 5- 9      | 35     | 1438    | 1018 | 2       | 5        | 312     | 4     | 2814  |
| 10-14     | 28     | 1157    | 727  | 2       | 4        | 248     | 3     | 2169  |
| 15-19     | 24     | 948     | 621  | 2       | 6        | 180     | 2     | 1783  |
| 20-24     | 22     | 715     | 475  | 1       | 10       | 146     | 2     | 1371  |
| 25-29     | 21     | 684     | 440  | 1       | 7        | 127     | 2     | 1282  |
| 30-34     | 16     | 541     | 406  | 1       | 5        | 113     | 2     | 1084  |
| 35-39     | 12     | 528     | 388  | 1       | 3        | 92      | 2     | 1026  |
| 40-44     | 8      | 463     | 313  | 0       | 2        | 82      | 2     | 870   |
| 45-49     | 9      | 426     | 241  | 1       | 2        | 71      | 1     | 751   |
| 50-54     | 7      | 355     | 235  | 0       | 1        | 54      | 1     | 653   |
| 55-59     | 5      | 267     | 159  | 0       | 1        | 40      | 1     | 473   |
| 60-64     | 6      | 257     | 150  | 0       | 1        | 39      | 0     | 453   |
| 65-       | 8      | 369     | 205  | 0       | 1        | 63      | 0     | 646   |
| TOTAL     | 239    | 9517    | 6312 | 12      | 53       | 1847    | 27    | 18007 |

POPULATION 1980  
by COMMUNITY  
by AGE GROUP  
Dalat

| COMMUNITY | Malays | Melanau | Iban | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|------|---------|----------|---------|-------|-------|
| AGE GROUP |        |         |      |         |          |         |       |       |
| 0- 4      | 52     | 1568    | 1012 | 2       | 9        | 262     | 1     | 2906  |
| 5- 9      | 50     | 1645    | 1234 | 2       | 10       | 276     | 1     | 3218  |
| 10-14     | 44     | 1525    | 1008 | 2       | 8        | 259     | 1     | 2847  |
| 15-19     | 37     | 1282    | 807  | 2       | 7        | 239     | 1     | 2375  |
| 20-24     | 33     | 1005    | 620  | 1       | 5        | 197     | 1     | 1862  |
| 25-29     | 29     | 860     | 490  | 1       | 4        | 182     | 1     | 1567  |
| 30-34     | 21     | 615     | 466  | 1       | 3        | 134     | 1     | 1241  |
| 35-39     | 17     | 594     | 399  | 1       | 3        | 103     | 1     | 1118  |
| 40-44     | 12     | 482     | 346  | 0       | 3        | 84      | 1     | 928   |
| 45-49     | 12     | 499     | 286  | 1       | 2        | 65      | 0     | 865   |
| 50-54     | 9      | 387     | 280  | 0       | 2        | 56      | 0     | 734   |
| 55-59     | 8      | 348     | 238  | 0       | 1        | 44      | 0     | 639   |
| 60-64     | 6      | 290     | 193  | 0       | 2        | 42      | 0     | 533   |
| 65-       | 9      | 449     | 269  | 0       | 2        | 85      | 0     | 814   |
| TOTAL     | 339    | 11549   | 7648 | 13      | 61       | 2028    | 9     | 21647 |

POPULATION 1990  
by COMMUNITY  
by AGE GROUP  
Dalat

| COMMUNITY | Malays | Melanau | Iban | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|------|---------|----------|---------|-------|-------|
| AGE GROUP |        |         |      |         |          |         |       |       |
| 0- 4      | 59     | 1846    | 1134 | 3       | 15       | 283     | 1     | 3341  |
| 5- 9      | 52     | 1743    | 1124 | 3       | 14       | 277     | 1     | 3214  |
| 10-14     | 47     | 1676    | 1206 | 3       | 14       | 275     | 1     | 3222  |
| 15-19     | 42     | 1570    | 1173 | 3       | 13       | 283     | 1     | 3085  |
| 20-24     | 37     | 1370    | 901  | 2       | 10       | 252     | 1     | 2573  |
| 25-29     | 32     | 1105    | 698  | 2       | 8        | 220     | 1     | 2066  |
| 30-34     | 26     | 814     | 559  | 1       | 6        | 185     | 1     | 1592  |
| 35-39     | 22     | 731     | 455  | 1       | 5        | 151     | 1     | 1366  |
| 40-44     | 16     | 545     | 431  | 1       | 4        | 109     | 1     | 1107  |
| 45-49     | 13     | 545     | 376  | 1       | 4        | 88      | 1     | 1028  |
| 50-54     | 10     | 455     | 317  | 1       | 3        | 66      | 0     | 852   |
| 55-59     | 10     | 438     | 300  | 1       | 3        | 56      | 0     | 808   |
| 60-64     | 7      | 330     | 233  | 0       | 2        | 46      | 0     | 618   |
| 65-       | 11     | 571     | 434  | 1       | 5        | 109     | 0     | 1131  |
| TOTAL     | 384    | 13739   | 9341 | 23      | 106      | 2400    | 10    | 26003 |

POPULATION 1960  
by COMMUNITY  
by AGE GROUP  
Sarikei

| COMMUNITY | Malays | Melanau | Iban | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|------|---------|----------|---------|-------|-------|
| AGE GROUP |        |         |      |         |          |         |       |       |
| 0-4       | 324    | 702     | 1130 | 7       | 22       | 2553    | 17    | 4755  |
| 5-9       | 293    | 689     | 1027 | 7       | 19       | 2839    | 16    | 4890  |
| 10-14     | 192    | 416     | 563  | 4       | 10       | 2037    | 10    | 3232  |
| 15-19     | 175    | 406     | 593  | 4       | 10       | 1310    | 7     | 2505  |
| 20-24     | 135    | 325     | 487  | 3       | 9        | 1078    | 7     | 2044  |
| 25-29     | 141    | 346     | 549  | 3       | 10       | 827     | 7     | 1883  |
| 30-34     | 118    | 293     | 499  | 3       | 10       | 752     | 8     | 1683  |
| 35-39     | 103    | 281     | 460  | 2       | 8        | 615     | 7     | 1476  |
| 40-44     | 94     | 253     | 393  | 2       | 8        | 612     | 6     | 1368  |
| 45-49     | 68     | 194     | 284  | 1       | 5        | 565     | 5     | 1122  |
| 50-54     | 63     | 170     | 273  | 1       | 5        | 528     | 4     | 1044  |
| 55-59     | 31     | 96      | 149  | 1       | 2        | 393     | 2     | 674   |
| 60-64     | 36     | 112     | 181  | 1       | 2        | 286     | 2     | 620   |
| 65-       | 51     | 154     | 262  | 0       | 3        | 384     | 3     | 857   |
| TOTAL     | 1824   | 4437    | 6850 | 39      | 123      | 14779   | 101   | 28153 |

POPULATION 1970  
by COMMUNITY  
by AGE GROUP  
Sarikei

| COMMUNITY | Malays | Melanau | Iban | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|------|---------|----------|---------|-------|-------|
| AGE GROUP |        |         |      |         |          |         |       |       |
| 0-4       | 448    | 807     | 1220 | 15      | 16       | 2485    | 12    | 5003  |
| 5-9       | 423    | 824     | 1322 | 16      | 15       | 2690    | 11    | 5301  |
| 10-14     | 340    | 659     | 950  | 13      | 9        | 2226    | 8     | 4205  |
| 15-19     | 294    | 581     | 827  | 12      | 9        | 1790    | 7     | 3520  |
| 20-24     | 253    | 458     | 650  | 8       | 8        | 1474    | 8     | 2859  |
| 25-29     | 233    | 424     | 592  | 7       | 8        | 1283    | 8     | 2555  |
| 30-34     | 173    | 325     | 552  | 6       | 7        | 1011    | 8     | 2082  |
| 35-39     | 148    | 313     | 488  | 5       | 6        | 793     | 6     | 1759  |
| 40-44     | 114    | 266     | 420  | 4       | 6        | 699     | 5     | 1514  |
| 45-49     | 104    | 243     | 328  | 4       | 4        | 587     | 4     | 1274  |
| 50-54     | 82     | 198     | 319  | 3       | 4        | 521     | 4     | 1131  |
| 55-59     | 57     | 151     | 232  | 3       | 2        | 401     | 2     | 848   |
| 60-64     | 54     | 141     | 216  | 2       | 2        | 339     | 2     | 756   |
| 65-       | 77     | 209     | 306  | 2       | 3        | 599     | 3     | 1199  |
| TOTAL     | 2800   | 5599    | 8422 | 100     | 99       | 16898   | 88    | 34006 |



POPULATION 1980  
by COMMUNITY  
by AGE GROUP  
Sarikei

| COMMUNITY | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|-------|---------|----------|---------|-------|-------|
| AGE GROUP |        |         |       |         |          |         |       |       |
| 0- 4      | 626    | 1009    | 1458  | 25      | 11       | 2720    | 9     | 5858  |
| 5- 9      | 605    | 1059    | 1778  | 27      | 12       | 2868    | 8     | 6357  |
| 10-14     | 529    | 982     | 1452  | 24      | 10       | 2686    | 7     | 5690  |
| 15-19     | 449    | 825     | 1162  | 21      | 9        | 2487    | 7     | 4960  |
| 20-24     | 401    | 647     | 893   | 14      | 6        | 2050    | 8     | 4019  |
| 25-29     | 353    | 554     | 706   | 11      | 5        | 1895    | 9     | 3533  |
| 30-34     | 249    | 396     | 672   | 9       | 4        | 1393    | 7     | 2730  |
| 35-39     | 210    | 382     | 575   | 8       | 3        | 1066    | 5     | 2249  |
| 40-44     | 148    | 310     | 498   | 5       | 3        | 871     | 4     | 1839  |
| 45-49     | 151    | 322     | 412   | 7       | 2        | 680     | 3     | 1577  |
| 50-54     | 111    | 249     | 403   | 5       | 3        | 578     | 3     | 1352  |
| 55-59     | 91     | 224     | 343   | 4       | 2        | 456     | 2     | 1122  |
| 60-64     | 78     | 187     | 277   | 3       | 2        | 433     | 2     | 982   |
| 65-       | 112    | 289     | 388   | 4       | 3        | 888     | 2     | 1686  |
| TOTAL     | 4113   | 7435    | 11017 | 167     | 75       | 21071   | 76    | 43954 |

POPULATION 1990  
by COMMUNITY  
by AGE GROUP  
Sarikei

| COMMUNITY | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|-------|---------|----------|---------|-------|-------|
| AGE GROUP |        |         |       |         |          |         |       |       |
| 0- 4      | 805    | 1268    | 1405  | 30      | 21       | 2989    | 6     | 6524  |
| 5- 9      | 708    | 1197    | 1392  | 29      | 19       | 2924    | 8     | 6277  |
| 10-14     | 641    | 1151    | 1493  | 29      | 20       | 2908    | 8     | 6250  |
| 15-19     | 574    | 1078    | 1453  | 27      | 19       | 2985    | 8     | 6144  |
| 20-24     | 505    | 941     | 1117  | 23      | 14       | 2657    | 7     | 5264  |
| 25-29     | 429    | 759     | 864   | 17      | 12       | 2320    | 8     | 4409  |
| 30-34     | 357    | 559     | 693   | 12      | 8        | 1950    | 7     | 3586  |
| 35-39     | 293    | 502     | 564   | 10      | 7        | 1590    | 7     | 2973  |
| 40-44     | 212    | 374     | 534   | 8       | 6        | 1154    | 5     | 2293  |
| 45-49     | 181    | 374     | 465   | 8       | 5        | 929     | 4     | 1966  |
| 50-54     | 138    | 312     | 393   | 6       | 5        | 696     | 3     | 1553  |
| 55-59     | 131    | 301     | 371   | 6       | 4        | 588     | 2     | 1403  |
| 60-64     | 89     | 226     | 288   | 4       | 3        | 481     | 2     | 1093  |
| 65-       | 152    | 392     | 538   | 7       | 7        | 1152    | 3     | 2251  |
| TOTAL     | 5215   | 9434    | 11570 | 216     | 150      | 25323   | 78    | 51986 |

POPULATION 1960  
by COMMUNITY  
by AGE GROUP  
Maradong

| COMMUNITY | Malays | Melanau | Iban | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|------|---------|----------|---------|-------|-------|
| AGE GROUP |        |         |      |         |          |         |       |       |
| 0- 4      | 393    | 178     | 1011 | 4       | 0        | 2289    | 10    | 3885  |
| 5- 9      | 326    | 173     | 982  | 1       | 0        | 2461    | 4     | 3947  |
| 10-14     | 248    | 100     | 535  | 1       | 0        | 1609    | 5     | 2498  |
| 15-19     | 245    | 110     | 543  | 2       | 1        | 978     | 2     | 1881  |
| 20-24     | 208    | 94      | 413  | 6       | 0        | 750     | 5     | 1476  |
| 25-29     | 195    | 93      | 492  | 3       | 1        | 540     | 2     | 1326  |
| 30-34     | 151    | 75      | 520  | 1       | 2        | 490     | 7     | 1246  |
| 35-39     | 137    | 70      | 383  | 1       | 1        | 436     | 2     | 1030  |
| 40-44     | 126    | 61      | 371  | 0       | 0        | 444     | 2     | 1004  |
| 45-49     | 84     | 42      | 208  | 1       | 0        | 413     | 2     | 750   |
| 50-54     | 82     | 40      | 256  | 0       | 0        | 396     | 3     | 777   |
| 55-59     | 33     | 19      | 85   | 0       | 0        | 327     | 3     | 467   |
| 60-64     | 44     | 24      | 168  | 0       | 0        | 227     | 2     | 465   |
| 65-       | 73     | 38      | 223  | 0       | 0        | 270     | 2     | 606   |
| TOTAL     | 2345   | 1117    | 6190 | 20      | 5        | 11630   | 51    | 21358 |

POPULATION 1970  
by COMMUNITY  
by AGE GROUP  
Maradong

| COMMUNITY | Malays | Melanau | Iban | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|------|---------|----------|---------|-------|-------|
| AGE GROUP |        |         |      |         |          |         |       |       |
| 0- 4      | 472    | 189     | 1161 | 7       | 3        | 2014    | 6     | 3852  |
| 5- 9      | 429    | 191     | 1291 | 6       | 3        | 2146    | 3     | 4069  |
| 10-14     | 356    | 147     | 921  | 5       | 3        | 1665    | 3     | 3100  |
| 15-19     | 319    | 136     | 795  | 5       | 3        | 1287    | 2     | 2547  |
| 20-24     | 281    | 111     | 608  | 6       | 2        | 1032    | 4     | 2044  |
| 25-29     | 253    | 102     | 563  | 4       | 2        | 878     | 2     | 1804  |
| 30-34     | 185    | 77      | 562  | 2       | 2        | 692     | 4     | 1524  |
| 35-39     | 160    | 73      | 451  | 2       | 2        | 560     | 2     | 1250  |
| 40-44     | 128    | 62      | 410  | 1       | 1        | 502     | 2     | 1106  |
| 45-49     | 108    | 53      | 290  | 2       | 1        | 424     | 2     | 880   |
| 50-54     | 90     | 45      | 309  | 1       | 1        | 383     | 2     | 831   |
| 55-59     | 57     | 32      | 197  | 1       | 1        | 309     | 2     | 599   |
| 60-64     | 57     | 31      | 209  | 1       | 1        | 253     | 1     | 553   |
| 65-       | 86     | 48      | 287  | 1       | 1        | 420     | 1     | 844   |
| TOTAL     | 2981   | 1297    | 8054 | 44      | 26       | 12565   | 36    | 25003 |

POPULATION 1980  
by COMMUNITY  
by AGE GROUP  
Maradong

| AGE GROUP | Malays | Melanau | Iban | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|------|---------|----------|---------|-------|-------|
| 0- 4      | 554    | 201     | 1322 | 9       | 5        | 1758    | 2     | 3851  |
| 5- 9      | 535    | 211     | 1612 | 10      | 6        | 1853    | 2     | 4229  |
| 10-14     | 467    | 195     | 1316 | 9       | 5        | 1736    | 1     | 3729  |
| 15-19     | 397    | 164     | 1054 | 7       | 4        | 1607    | 1     | 3234  |
| 20-24     | 355    | 129     | 809  | 5       | 3        | 1324    | 2     | 2627  |
| 25-29     | 312    | 110     | 640  | 4       | 3        | 1224    | 2     | 2295  |
| 30-34     | 221    | 79      | 609  | 3       | 2        | 900     | 1     | 1815  |
| 35-39     | 185    | 76      | 522  | 3       | 2        | 689     | 1     | 1478  |
| 40-44     | 131    | 62      | 452  | 2       | 2        | 563     | 1     | 1213  |
| 45-49     | 134    | 64      | 374  | 2       | 1        | 439     | 1     | 1015  |
| 50-54     | 98     | 50      | 365  | 2       | 1        | 374     | 1     | 891   |
| 55-59     | 81     | 45      | 311  | 2       | 1        | 294     | 0     | 734   |
| 60-64     | 69     | 37      | 252  | 1       | 1        | 280     | 0     | 640   |
| 65-       | 99     | 58      | 352  | 2       | 1        | 574     | 0     | 1086  |
| TOTAL     | 3638   | 1481    | 9990 | 61      | 37       | 13615   | 15    | 28837 |

POPULATION 1990  
by COMMUNITY  
by AGE GROUP  
Maradong

| AGE GROUP | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|-------|---------|----------|---------|-------|-------|
| 0- 4      | 709    | 256     | 1303  | 11      | 9        | 1962    | 1     | 4251  |
| 5- 9      | 624    | 242     | 1291  | 11      | 8        | 1919    | 1     | 4096  |
| 10-14     | 565    | 232     | 1385  | 11      | 8        | 1909    | 1     | 4111  |
| 15-19     | 505    | 218     | 1347  | 10      | 7        | 1959    | 1     | 4047  |
| 20-24     | 445    | 190     | 1035  | 9       | 6        | 1744    | 1     | 3430  |
| 25-29     | 377    | 153     | 802   | 6       | 5        | 1523    | 1     | 2867  |
| 30-34     | 314    | 113     | 642   | 5       | 3        | 1280    | 1     | 2358  |
| 35-39     | 258    | 101     | 523   | 4       | 3        | 1044    | 1     | 1934  |
| 40-44     | 186    | 76      | 495   | 3       | 2        | 758     | 1     | 1521  |
| 45-49     | 160    | 76      | 432   | 3       | 2        | 610     | 1     | 1284  |
| 50-54     | 121    | 63      | 365   | 2       | 2        | 457     | 0     | 1010  |
| 55-59     | 115    | 61      | 344   | 2       | 2        | 386     | 0     | 910   |
| 60-64     | 78     | 46      | 267   | 1       | 1        | 316     | 0     | 709   |
| 65-       | 133    | 79      | 498   | 3       | 3        | 756     | 0     | 1472  |
| TOTAL     | 4590   | 1906    | 10729 | 81      | 61       | 16623   | 10    | 34000 |

POPULATION 1960  
by COMMUNITY  
by AGE GROUP  
Daro

| COMMUNITY<br>AGE GROUP | Malays | Melanau | Iban | Bidayuh | Other B. | Chinese | Other | TOTAL |
|------------------------|--------|---------|------|---------|----------|---------|-------|-------|
| 0- 4                   | 42     | 1882    | 51   | 1       | 0        | 175     | 4     | 2155  |
| 5- 9                   | 35     | 1848    | 50   | 0       | 0        | 188     | 1     | 2122  |
| 10-14                  | 27     | 1059    | 27   | 0       | 0        | 123     | 2     | 1238  |
| 15-19                  | 26     | 1171    | 27   | 0       | 1        | 75      | 1     | 1301  |
| 20-24                  | 23     | 1000    | 21   | 0       | 0        | 58      | 1     | 1103  |
| 25-29                  | 20     | 986     | 25   | 0       | 0        | 42      | 1     | 1074  |
| 30-34                  | 16     | 796     | 26   | 0       | 1        | 37      | 3     | 879   |
| 35-39                  | 14     | 744     | 19   | 0       | 0        | 33      | 1     | 811   |
| 40-44                  | 14     | 645     | 19   | 0       | 0        | 34      | 1     | 713   |
| 45-49                  | 9      | 444     | 10   | 0       | 0        | 32      | 1     | 496   |
| 50-54                  | 9      | 424     | 12   | 0       | 0        | 31      | 1     | 477   |
| 55-59                  | 3      | 209     | 4    | 0       | 0        | 25      | 1     | 242   |
| 60-64                  | 5      | 252     | 8    | 0       | 0        | 17      | 0     | 282   |
| 65-                    | 8      | 401     | 12   | 0       | 0        | 20      | 1     | 442   |
| TOTAL                  | 251    | 11861   | 311  | 1       | 2        | 890     | 19    | 13335 |

POPULATION 1970  
by COMMUNITY  
by AGE GROUP  
Daro

| COMMUNITY<br>AGE GROUP | Malays | Melanau | Iban | Bidayuh | Other B. | Chinese | Other | TOTAL |
|------------------------|--------|---------|------|---------|----------|---------|-------|-------|
| 0- 4                   | 46     | 1810    | 53   | 2       | 0        | 140     | 3     | 2054  |
| 5- 9                   | 42     | 1842    | 60   | 1       | 0        | 149     | 1     | 2095  |
| 10-14                  | 35     | 1413    | 42   | 1       | 0        | 116     | 2     | 1609  |
| 15-19                  | 32     | 1314    | 36   | 1       | 1        | 89      | 1     | 1474  |
| 20-24                  | 28     | 1067    | 28   | 1       | 0        | 72      | 1     | 1197  |
| 25-29                  | 24     | 972     | 26   | 1       | 0        | 61      | 1     | 1085  |
| 30-34                  | 18     | 737     | 26   | 1       | 1        | 48      | 2     | 833   |
| 35-39                  | 15     | 700     | 21   | 1       | 0        | 39      | 1     | 777   |
| 40-44                  | 13     | 587     | 19   | 0       | 0        | 35      | 1     | 655   |
| 45-49                  | 11     | 507     | 14   | 0       | 0        | 30      | 1     | 563   |
| 50-54                  | 9      | 428     | 14   | 0       | 0        | 27      | 1     | 479   |
| 55-59                  | 5      | 307     | 9    | 0       | 0        | 22      | 1     | 344   |
| 60-64                  | 5      | 292     | 10   | 0       | 0        | 18      | 0     | 325   |
| 65-                    | 9      | 456     | 14   | 0       | 0        | 29      | 1     | 509   |
| TOTAL                  | 292    | 12432   | 372  | 9       | 2        | 875     | 17    | 13999 |

POPULATION 1980  
by COMMUNITY  
by AGE GROUP  
Daro

| AGE GROUP | Malays | Melanau | Iban | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|------|---------|----------|---------|-------|-------|
| 0- 4      | 60     | 2124    | 67   | 2       | 0        | 135     | 1     | 2389  |
| 5- 9      | 58     | 2228    | 81   | 2       | 0        | 142     | 1     | 2512  |
| 10-14     | 50     | 2066    | 66   | 2       | 0        | 133     | 1     | 2318  |
| 15-19     | 43     | 1736    | 53   | 1       | 0        | 123     | 1     | 1957  |
| 20-24     | 38     | 1361    | 41   | 1       | 0        | 102     | 1     | 1544  |
| 25-29     | 34     | 1165    | 32   | 1       | 0        | 94      | 1     | 1327  |
| 30-34     | 24     | 833     | 31   | 1       | 0        | 69      | 1     | 959   |
| 35-39     | 20     | 805     | 26   | 1       | 0        | 53      | 0     | 905   |
| 40-44     | 14     | 653     | 23   | 0       | 0        | 43      | 0     | 733   |
| 45-49     | 14     | 677     | 19   | 0       | 0        | 34      | 0     | 744   |
| 50-54     | 11     | 524     | 18   | 0       | 0        | 29      | 0     | 582   |
| 55-59     | 9      | 471     | 16   | 0       | 0        | 23      | 0     | 519   |
| 60-64     | 7      | 393     | 13   | 0       | 0        | 22      | 0     | 435   |
| 65-       | 11     | 608     | 18   | 0       | 0        | 44      | 0     | 681   |
| TOTAL     | 393    | 15644   | 504  | 11      | 0        | 1046    | 7     | 17605 |

POPULATION 1990  
by COMMUNITY  
by AGE GROUP  
Daro

| AGE GROUP | Malays | Melanau | Iban | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|------|---------|----------|---------|-------|-------|
| 0- 4      | 74     | 2608    | 63   | 2       | 1        | 145     | 1     | 2894  |
| 5- 9      | 65     | 2463    | 63   | 2       | 1        | 142     | 1     | 2737  |
| 10-14     | 59     | 2367    | 67   | 2       | 1        | 141     | 1     | 2638  |
| 15-19     | 53     | 2217    | 65   | 2       | 1        | 145     | 1     | 2484  |
| 20-24     | 46     | 1936    | 50   | 2       | 0        | 129     | 1     | 2164  |
| 25-29     | 39     | 1561    | 39   | 1       | 0        | 113     | 1     | 1754  |
| 30-34     | 33     | 1149    | 31   | 1       | 0        | 95      | 1     | 1310  |
| 35-39     | 27     | 1032    | 25   | 1       | 0        | 77      | 1     | 1163  |
| 40-44     | 19     | 770     | 24   | 1       | 0        | 56      | 0     | 870   |
| 45-49     | 17     | 770     | 21   | 1       | 0        | 45      | 0     | 854   |
| 50-54     | 13     | 643     | 18   | 0       | 0        | 34      | 0     | 708   |
| 55-59     | 12     | 618     | 17   | 0       | 0        | 29      | 0     | 676   |
| 60-64     | 8      | 466     | 13   | 0       | 0        | 23      | 0     | 510   |
| 65-       | 14     | 806     | 24   | 0       | 0        | 56      | 0     | 900   |
| TOTAL     | 479    | 19406   | 520  | 15      | 4        | 1230    | 8     | 21662 |

POPULATION 1960  
by COMMUNITY  
by AGE GROUP  
Julau

| COMMUNITY |  | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--|--------|---------|-------|---------|----------|---------|-------|-------|
| AGE GROUP |  |        |         |       |         |          |         |       |       |
| 0-4       |  | 9      | 16      | 3278  | 3       | 3        | 259     | 2     | 3570  |
| 5-9       |  | 8      | 12      | 2792  | 0       | 3        | 245     | 2     | 3062  |
| 10-14     |  | 6      | 6       | 1434  | 3       | 1        | 156     | 2     | 1608  |
| 15-19     |  | 5      | 6       | 1521  | 6       | 3        | 102     | 0     | 1643  |
| 20-24     |  | 4      | 10      | 1263  | 2       | 1        | 91      | 1     | 1372  |
| 25-29     |  | 4      | 8       | 1533  | 2       | 6        | 78      | 2     | 1633  |
| 30-34     |  | 3      | 5       | 1435  | 1       | 3        | 67      | 2     | 1516  |
| 35-39     |  | 3      | 6       | 1249  | 0       | 1        | 43      | 2     | 1304  |
| 40-44     |  | 3      | 2       | 1044  | 1       | 0        | 56      | 1     | 1107  |
| 45-49     |  | 3      | 3       | 777   | 1       | 0        | 50      | 1     | 835   |
| 50-54     |  | 2      | 4       | 778   | 0       | 0        | 49      | 1     | 834   |
| 55-59     |  | 1      | 3       | 391   | 0       | 0        | 36      | 0     | 431   |
| 60-64     |  | 1      | 2       | 525   | 0       | 0        | 28      | 0     | 556   |
| 65-       |  | 1      | 3       | 708   | 0       | 0        | 30      | 0     | 742   |
| TOTAL     |  | 53     | 86      | 18728 | 19      | 21       | 1290    | 16    | 20213 |

POPULATION 1970  
by COMMUNITY  
by AGE GROUP  
Julau

| COMMUNITY |  | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--|--------|---------|-------|---------|----------|---------|-------|-------|
| AGE GROUP |  |        |         |       |         |          |         |       |       |
| 0-4       |  | 15     | 21      | 3073  | 6       | 5        | 193     | 2     | 3315  |
| 5-9       |  | 15     | 20      | 3201  | 5       | 5        | 192     | 2     | 3440  |
| 10-14     |  | 13     | 15      | 2230  | 6       | 4        | 146     | 2     | 2416  |
| 15-19     |  | 11     | 14      | 1955  | 7       | 5        | 116     | 1     | 2109  |
| 20-24     |  | 9      | 14      | 1544  | 4       | 3        | 99      | 1     | 1674  |
| 25-29     |  | 8      | 11      | 1464  | 4       | 5        | 88      | 2     | 1582  |
| 30-34     |  | 6      | 7       | 1382  | 3       | 3        | 70      | 2     | 1473  |
| 35-39     |  | 5      | 8       | 1193  | 2       | 2        | 50      | 2     | 1262  |
| 40-44     |  | 5      | 5       | 1016  | 2       | 1        | 50      | 1     | 1080  |
| 45-49     |  | 5      | 5       | 801   | 2       | 1        | 42      | 1     | 857   |
| 50-54     |  | 3      | 5       | 792   | 1       | 1        | 39      | 1     | 842   |
| 55-59     |  | 3      | 5       | 551   | 1       | 1        | 29      | 0     | 590   |
| 60-64     |  | 2      | 4       | 540   | 1       | 1        | 25      | 0     | 573   |
| 65-       |  | 3      | 5       | 744   | 1       | 1        | 39      | 0     | 793   |
| TOTAL     |  | 103    | 139     | 20486 | 45      | 38       | 1178    | 17    | 22006 |

POPULATION 1980  
by COMMUNITY  
by AGE GROUP  
Julau

| AGE GROUP | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|-------|---------|----------|---------|-------|-------|
| 0- 4      | 25     | 29      | 3492  | 11      | 8        | 167     | 1     | 3733  |
| 5- 9      | 24     | 31      | 4259  | 12      | 9        | 176     | 1     | 4512  |
| 10-14     | 21     | 28      | 3477  | 10      | 7        | 165     | 1     | 3709  |
| 15-19     | 18     | 24      | 2784  | 9       | 6        | 153     | 1     | 2995  |
| 20-24     | 16     | 19      | 2138  | 6       | 4        | 126     | 1     | 2310  |
| 25-29     | 14     | 16      | 1692  | 5       | 4        | 116     | 1     | 1848  |
| 30-34     | 10     | 11      | 1609  | 4       | 3        | 86      | 1     | 1724  |
| 35-39     | 8      | 11      | 1378  | 3       | 2        | 66      | 1     | 1469  |
| 40-44     | 6      | 9       | 1193  | 2       | 2        | 54      | 1     | 1267  |
| 45-49     | 6      | 9       | 987   | 3       | 2        | 42      | 0     | 1049  |
| 50-54     | 4      | 7       | 966   | 2       | 2        | 36      | 0     | 1017  |
| 55-59     | 4      | 6       | 822   | 2       | 1        | 28      | 0     | 863   |
| 60-64     | 3      | 5       | 665   | 1       | 1        | 27      | 0     | 702   |
| 65-       | 4      | 8       | 930   | 2       | 2        | 55      | 0     | 1001  |
| TOTAL     | 163    | 213     | 26392 | 72      | 53       | 1297    | 9     | 28199 |

POPULATION 1990  
by COMMUNITY  
by AGE GROUP  
Julau

| AGE GROUP | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|-------|---------|----------|---------|-------|-------|
| 0- 4      | 32     | 41      | 4006  | 12      | 6        | 188     | 1     | 4286  |
| 5- 9      | 28     | 39      | 3970  | 12      | 6        | 184     | 2     | 4241  |
| 10-14     | 25     | 37      | 4258  | 12      | 6        | 183     | 2     | 4523  |
| 15-19     | 23     | 35      | 4142  | 11      | 5        | 188     | 2     | 4406  |
| 20-24     | 20     | 30      | 3184  | 9       | 4        | 167     | 2     | 3416  |
| 25-29     | 17     | 24      | 2464  | 7       | 3        | 146     | 2     | 2663  |
| 30-34     | 14     | 18      | 1974  | 5       | 2        | 123     | 2     | 2138  |
| 35-39     | 12     | 16      | 1607  | 4       | 2        | 100     | 2     | 1743  |
| 40-44     | 8      | 12      | 1522  | 3       | 2        | 73      | 1     | 1621  |
| 45-49     | 7      | 12      | 1327  | 3       | 2        | 58      | 1     | 1410  |
| 50-54     | 5      | 10      | 1121  | 2       | 1        | 44      | 1     | 1184  |
| 55-59     | 5      | 10      | 1058  | 2       | 1        | 37      | 1     | 1114  |
| 60-64     | 4      | 7       | 822   | 2       | 1        | 30      | 0     | 866   |
| 65-       | 6      | 13      | 1533  | 3       | 2        | 72      | 1     | 1630  |
| TOTAL     | 206    | 304     | 32988 | 87      | 43       | 1593    | 20    | 35241 |

POPULATION 1960  
by COMMUNITY  
by AGE GROUP  
Kapit

| COMMUNITY | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|-------|---------|----------|---------|-------|-------|
| AGE GROUP |        |         |       |         |          |         |       |       |
| 0- 4      | 55     | 154     | 3415  | 1       | 95       | 354     | 4     | 4078  |
| 5- 9      | 56     | 114     | 2583  | 2       | 78       | 380     | 1     | 3214  |
| 10-14     | 27     | 47      | 1290  | 2       | 31       | 226     | 0     | 1623  |
| 15-19     | 31     | 99      | 1775  | 4       | 50       | 170     | 1     | 2130  |
| 20-24     | 25     | 80      | 1444  | 3       | 45       | 140     | 2     | 1739  |
| 25-29     | 20     | 81      | 1630  | 0       | 60       | 122     | 5     | 1918  |
| 30-34     | 19     | 98      | 1526  | 2       | 52       | 102     | 4     | 1803  |
| 35-39     | 17     | 81      | 1732  | 2       | 54       | 94      | 1     | 1981  |
| 40-44     | 19     | 77      | 1262  | 1       | 46       | 88      | 1     | 1494  |
| 45-49     | 12     | 45      | 1143  | 0       | 33       | 72      | 1     | 1306  |
| 50-54     | 10     | 44      | 917   | 0       | 27       | 81      | 1     | 1080  |
| 55-59     | 4      | 24      | 612   | 0       | 9        | 48      | 1     | 698   |
| 60-64     | 8      | 35      | 617   | 0       | 10       | 44      | 1     | 715   |
| 65-       | 12     | 31      | 901   | 0       | 4        | 36      | 1     | 985   |
| TOTAL     | 315    | 1010    | 20847 | 17      | 594      | 1957    | 24    | 24764 |

POPULATION 1970  
by COMMUNITY  
by AGE GROUP  
Kapit

| COMMUNITY | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|-------|---------|----------|---------|-------|-------|
| AGE GROUP |        |         |       |         |          |         |       |       |
| 0- 4      | 77     | 91      | 3701  | 6       | 142      | 363     | 7     | 4387  |
| 5- 9      | 76     | 73      | 3758  | 7       | 149      | 386     | 5     | 4454  |
| 10-14     | 56     | 39      | 2677  | 6       | 101      | 299     | 4     | 3182  |
| 15-19     | 52     | 61      | 2498  | 6       | 79       | 259     | 4     | 2959  |
| 20-24     | 45     | 50      | 1957  | 5       | 54       | 213     | 5     | 2329  |
| 25-29     | 38     | 49      | 1781  | 2       | 45       | 193     | 7     | 2115  |
| 30-34     | 30     | 53      | 1682  | 3       | 34       | 148     | 6     | 1956  |
| 35-39     | 26     | 46      | 1644  | 3       | 31       | 121     | 4     | 1875  |
| 40-44     | 21     | 42      | 1310  | 2       | 31       | 104     | 3     | 1513  |
| 45-49     | 18     | 27      | 1131  | 2       | 23       | 83      | 2     | 1286  |
| 50-54     | 14     | 26      | 1010  | 1       | 23       | 80      | 2     | 1156  |
| 55-59     | 10     | 15      | 779   | 1       | 16       | 55      | 2     | 878   |
| 60-64     | 11     | 20      | 688   | 1       | 17       | 53      | 2     | 792   |
| 65-       | 15     | 20      | 981   | 1       | 24       | 80      | 2     | 1123  |
| TOTAL     | 489    | 612     | 25597 | 46      | 769      | 2437    | 55    | 30005 |



POPULATION 1980  
by COMMUNITY  
by AGE GROUP  
Kapit

| AGE GROUP | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|-------|---------|----------|---------|-------|-------|
| 0-4       | 107    | 36      | 4338  | 10      | 202      | 406     | 9     | 5108  |
| 5-9       | 103    | 38      | 5289  | 11      | 233      | 428     | 9     | 6111  |
| 10-14     | 90     | 35      | 4318  | 10      | 180      | 400     | 7     | 5040  |
| 15-19     | 76     | 29      | 3458  | 8       | 165      | 371     | 7     | 4114  |
| 20-24     | 68     | 23      | 2656  | 6       | 113      | 306     | 8     | 3180  |
| 25-29     | 60     | 20      | 2101  | 4       | 94       | 282     | 9     | 2570  |
| 30-34     | 42     | 14      | 1998  | 4       | 72       | 208     | 7     | 2345  |
| 35-39     | 36     | 14      | 1711  | 3       | 64       | 159     | 6     | 1993  |
| 40-44     | 25     | 11      | 1482  | 2       | 63       | 130     | 4     | 1717  |
| 45-49     | 26     | 11      | 1226  | 3       | 47       | 101     | 3     | 1417  |
| 50-54     | 19     | 9       | 1199  | 2       | 48       | 86      | 3     | 1366  |
| 55-59     | 16     | 8       | 1020  | 2       | 34       | 68      | 2     | 1150  |
| 60-64     | 13     | 7       | 825   | 1       | 36       | 65      | 2     | 949   |
| 65-       | 19     | 10      | 1155  | 2       | 49       | 132     | 2     | 1369  |
| TOTAL     | 700    | 265     | 32776 | 68      | 1400     | 3142    | 78    | 38429 |

POPULATION 1990  
by COMMUNITY  
by AGE GROUP  
Kapit

| AGE GROUP | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|-------|---------|----------|---------|-------|-------|
| 0-4       | 142    | 92      | 4843  | 13      | 247      | 470     | 7     | 5814  |
| 5-9       | 125    | 87      | 4799  | 12      | 221      | 459     | 9     | 5712  |
| 10-14     | 113    | 83      | 5147  | 12      | 231      | 457     | 10    | 6053  |
| 15-19     | 101    | 78      | 5007  | 11      | 216      | 469     | 9     | 5891  |
| 20-24     | 89     | 68      | 3849  | 10      | 167      | 417     | 9     | 4609  |
| 25-29     | 76     | 55      | 2979  | 7       | 133      | 365     | 9     | 3624  |
| 30-34     | 63     | 40      | 2387  | 5       | 96       | 306     | 9     | 2906  |
| 35-39     | 52     | 36      | 1943  | 4       | 78       | 250     | 9     | 2372  |
| 40-44     | 37     | 27      | 1840  | 3       | 67       | 181     | 6     | 2161  |
| 45-49     | 32     | 27      | 1604  | 3       | 63       | 146     | 5     | 1880  |
| 50-54     | 24     | 23      | 1355  | 2       | 52       | 109     | 3     | 1568  |
| 55-59     | 23     | 22      | 1279  | 2       | 49       | 92      | 3     | 1470  |
| 60-64     | 16     | 16      | 993   | 2       | 39       | 76      | 2     | 1144  |
| 65-       | 27     | 28      | 1853  | 3       | 80       | 181     | 3     | 2175  |
| TOTAL     | 920    | 682     | 39878 | 89      | 1739     | 3978    | 93    | 47379 |

POPULATION -- 1960  
by COMMUNITY  
by AGE GROUP  
Song

| COMMUNITY | Malays | Melanau | Iban | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|------|---------|----------|---------|-------|-------|
| AGE GROUP |        |         |      |         |          |         |       |       |
| 0- 4      | 34     | 38      | 1584 | 1       | 3        | 98      | 1     | 1759  |
| 5- 9      | 34     | 28      | 1198 | 1       | 3        | 104     | 0     | 1368  |
| 10-14     | 17     | 12      | 598  | 1       | 1        | 62      | 0     | 691   |
| 15-19     | 19     | 25      | 824  | 0       | 2        | 47      | 0     | 917   |
| 20-24     | 16     | 20      | 669  | 0       | 2        | 38      | 1     | 746   |
| 25-29     | 12     | 19      | 756  | 0       | 3        | 33      | 3     | 826   |
| 30-34     | 12     | 23      | 707  | 0       | 2        | 28      | 2     | 774   |
| 35-39     | 10     | 20      | 804  | 0       | 2        | 25      | 1     | 862   |
| 40-44     | 12     | 19      | 585  | 0       | 1        | 24      | 0     | 641   |
| 45-49     | 7      | 11      | 530  | 0       | 1        | 19      | 0     | 568   |
| 50-54     | 7      | 11      | 425  | 0       | 1        | 22      | 0     | 466   |
| 55-59     | 2      | 6       | 284  | 0       | 1        | 13      | 0     | 306   |
| 60-64     | 5      | 8       | 287  | 0       | 1        | 12      | 0     | 313   |
| 65-       | 8      | 9       | 417  | 0       | 0        | 9       | 0     | 443   |
| TOTAL     | 195    | 249     | 9668 | 3       | 23       | 534     | 8     | 10680 |

POPULATION 1970  
by COMMUNITY  
by AGE GROUP  
Song

| COMMUNITY | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|-------|---------|----------|---------|-------|-------|
| AGE GROUP |        |         |       |         |          |         |       |       |
| 0- 4      | 51     | 25      | 1838  | 3       | 5        | 107     | 2     | 2031  |
| 5- 9      | 50     | 19      | 1867  | 3       | 6        | 113     | 2     | 2060  |
| 10-14     | 37     | 11      | 1330  | 3       | 4        | 88      | 2     | 1475  |
| 15-19     | 34     | 16      | 1241  | 2       | 3        | 77      | 2     | 1375  |
| 20-24     | 30     | 13      | 972   | 2       | 2        | 62      | 2     | 1083  |
| 25-29     | 26     | 12      | 885   | 1       | 2        | 57      | 3     | 986   |
| 30-34     | 19     | 13      | 835   | 1       | 1        | 44      | 3     | 916   |
| 35-39     | 16     | 12      | 817   | 1       | 1        | 36      | 2     | 885   |
| 40-44     | 14     | 11      | 651   | 1       | 1        | 31      | 1     | 710   |
| 45-49     | 12     | 7       | 562   | 1       | 1        | 25      | 1     | 609   |
| 50-54     | 10     | 7       | 502   | 1       | 1        | 24      | 1     | 546   |
| 55-59     | 6      | 4       | 387   | 1       | 1        | 16      | 1     | 416   |
| 60-64     | 7      | 5       | 342   | 1       | 1        | 15      | 1     | 372   |
| 65-       | 10     | 6       | 488   | 1       | 1        | 24      | 1     | 531   |
| TOTAL     | 322    | 161     | 12717 | 22      | 30       | 719     | 24    | 13995 |

POPULATION 1980  
by COMMUNITY  
by AGE GROUP  
Song

| AGE GROUP | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|-------|---------|----------|---------|-------|-------|
| 0- 4      | 65     | 9       | 2012  | 5       | 7        | 111     | 3     | 2212  |
| 5- 9      | 63     | 9       | 2454  | 5       | 8        | 117     | 3     | 2659  |
| 10-14     | 55     | 9       | 2003  | 5       | 6        | 110     | 3     | 2191  |
| 15-19     | 47     | 7       | 1604  | 4       | 5        | 102     | 3     | 1772  |
| 20-24     | 42     | 6       | 1232  | 3       | 4        | 84      | 3     | 1374  |
| 25-29     | 37     | 5       | 975   | 2       | 3        | 78      | 3     | 1103  |
| 30-34     | 26     | 3       | 927   | 2       | 2        | 57      | 3     | 1020  |
| 35-39     | 22     | 3       | 794   | 1       | 2        | 44      | 2     | 868   |
| 40-44     | 15     | 3       | 688   | 1       | 2        | 36      | 1     | 746   |
| 45-49     | 16     | 3       | 569   | 1       | 2        | 28      | 1     | 620   |
| 50-54     | 12     | 2       | 556   | 1       | 2        | 24      | 1     | 598   |
| 55-59     | 10     | 2       | 473   | 1       | 1        | 19      | 1     | 507   |
| 60-64     | 8      | 2       | 383   | 1       | 1        | 18      | 1     | 414   |
| 65-       | 12     | 3       | 536   | 1       | 2        | 36      | 1     | 591   |
| TOTAL     | 430    | 66      | 15206 | 33      | 47       | 864     | 29    | 16675 |

POPULATION 1990  
by COMMUNITY  
by AGE GROUP  
Song

| AGE GROUP | Malays | Melanau | Iban  | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|-------|---------|----------|---------|-------|-------|
| 0- 4      | 89     | 23      | 2303  | 6       | 9        | 132     | 3     | 2565  |
| 5- 9      | 78     | 22      | 2282  | 6       | 8        | 129     | 4     | 2529  |
| 10-14     | 71     | 21      | 2447  | 6       | 8        | 128     | 4     | 2685  |
| 15-19     | 63     | 20      | 2381  | 5       | 7        | 132     | 4     | 2612  |
| 20-24     | 56     | 17      | 1830  | 4       | 6        | 117     | 3     | 2033  |
| 25-29     | 47     | 14      | 1417  | 3       | 5        | 102     | 4     | 1592  |
| 30-34     | 40     | 10      | 1135  | 2       | 3        | 86      | 4     | 1280  |
| 35-39     | 32     | 9       | 924   | 2       | 3        | 70      | 3     | 1043  |
| 40-44     | 23     | 7       | 875   | 2       | 2        | 51      | 2     | 962   |
| 45-49     | 20     | 7       | 763   | 2       | 2        | 41      | 2     | 837   |
| 50-54     | 15     | 6       | 644   | 1       | 2        | 31      | 1     | 700   |
| 55-59     | 14     | 6       | 608   | 1       | 2        | 26      | 1     | 658   |
| 60-64     | 10     | 4       | 472   | 1       | 1        | 21      | 1     | 510   |
| 65-       | 17     | 7       | 881   | 1       | 3        | 51      | 1     | 961   |
| TOTAL     | 575    | 173     | 18962 | 42      | 61       | 1117    | 37    | 20967 |

POPULATION 1960  
by COMMUNITY  
by AGE GROUP  
Belaga

| COMMUNITY | Malays | Melanau | Iban | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|------|---------|----------|---------|-------|-------|
| AGE GROUP |        |         |      |         |          |         |       |       |
| 0- 4      | 20     | 54      | 51   | 0       | 724      | 40      | 2     | 891   |
| 5- 9      | 21     | 40      | 39   | 1       | 596      | 43      | 1     | 741   |
| 10-14     | 10     | 17      | 20   | 0       | 237      | 26      | 0     | 310   |
| 15-19     | 11     | 35      | 27   | 0       | 383      | 20      | 0     | 476   |
| 20-24     | 10     | 28      | 21   | 0       | 343      | 16      | 0     | 418   |
| 25-29     | 7      | 29      | 24   | 0       | 458      | 13      | 2     | 533   |
| 30-34     | 7      | 33      | 23   | 0       | 404      | 11      | 1     | 479   |
| 35-39     | 7      | 29      | 26   | 0       | 411      | 10      | 1     | 484   |
| 40-44     | 7      | 27      | 19   | 0       | 344      | 10      | 1     | 408   |
| 45-49     | 4      | 16      | 17   | 0       | 248      | 8       | 1     | 294   |
| 50-54     | 4      | 16      | 13   | 0       | 208      | 9       | 1     | 251   |
| 55-59     | 2      | 9       | 9    | 0       | 70       | 6       | 0     | 96    |
| 60-64     | 3      | 12      | 9    | 0       | 79       | 5       | 0     | 108   |
| 65-       | 5      | 11      | 13   | 0       | 29       | 5       | 0     | 63    |
| TOTAL     | 118    | 356     | 311  | 1       | 4534     | 222     | 10    | 5552  |

POPULATION 1970  
by COMMUNITY  
by AGE GROUP  
Belaga

| COMMUNITY | Malays | Melanau | Iban | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|------|---------|----------|---------|-------|-------|
| AGE GROUP |        |         |      |         |          |         |       |       |
| 0- 4      | 29     | 33      | 56   | 2       | 1085     | 42      | 4     | 1251  |
| 5- 9      | 29     | 26      | 57   | 3       | 1139     | 44      | 4     | 1302  |
| 10-14     | 21     | 14      | 42   | 2       | 773      | 35      | 3     | 890   |
| 15-19     | 19     | 22      | 39   | 2       | 604      | 30      | 3     | 719   |
| 20-24     | 17     | 17      | 30   | 1       | 413      | 25      | 3     | 506   |
| 25-29     | 14     | 17      | 27   | 1       | 345      | 22      | 4     | 430   |
| 30-34     | 12     | 18      | 26   | 1       | 264      | 17      | 3     | 341   |
| 35-39     | 10     | 16      | 25   | 1       | 235      | 14      | 3     | 304   |
| 40-44     | 8      | 15      | 20   | 1       | 232      | 13      | 2     | 291   |
| 45-49     | 7      | 10      | 17   | 1       | 171      | 10      | 2     | 218   |
| 50-54     | 6      | 10      | 15   | 1       | 176      | 10      | 2     | 220   |
| 55-59     | 4      | 6       | 12   | 1       | 124      | 7       | 1     | 155   |
| 60-64     | 4      | 7       | 11   | 0       | 132      | 6       | 1     | 161   |
| 65-       | 6      | 8       | 14   | 1       | 178      | 10      | 1     | 218   |
| TOTAL     | 186    | 219     | 391  | 18      | 5871     | 285     | 36    | 7006  |

POPULATION 1980  
by COMMUNITY  
by AGE GROUP  
Belaga

| COMMUNITY | Malays | Melanau | Iban | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|------|---------|----------|---------|-------|-------|
| AGE GROUP |        |         |      |         |          |         |       |       |
| 0- 4      | 40     | 13      | 65   | 3       | 1524     | 46      | 6     | 1697  |
| 5- 9      | 39     | 13      | 79   | 4       | 1761     | 49      | 6     | 1951  |
| 10-14     | 34     | 12      | 65   | 3       | 1364     | 46      | 5     | 1529  |
| 15-19     | 29     | 10      | 52   | 3       | 1250     | 42      | 5     | 1391  |
| 20-24     | 26     | 8       | 40   | 2       | 855      | 35      | 5     | 971   |
| 25-29     | 22     | 7       | 31   | 1       | 714      | 32      | 6     | 813   |
| 30-34     | 16     | 5       | 30   | 1       | 546      | 24      | 5     | 627   |
| 35-39     | 13     | 5       | 26   | 1       | 486      | 18      | 4     | 553   |
| 40-44     | 9      | 4       | 22   | 1       | 480      | 15      | 3     | 534   |
| 45-49     | 10     | 4       | 18   | 1       | 353      | 12      | 2     | 400   |
| 50-54     | 7      | 3       | 18   | 1       | 364      | 10      | 2     | 405   |
| 55-59     | 6      | 3       | 15   | 1       | 255      | 8       | 1     | 289   |
| 60-64     | 5      | 2       | 12   | 0       | 273      | 7       | 1     | 300   |
| 65-       | 7      | 4       | 17   | 1       | 367      | 15      | 1     | 412   |
| TOTAL     | 263    | 93      | 490  | 23      | 10592    | 359     | 52    | 11872 |

POPULATION 1990  
by COMMUNITY  
by AGE GROUP  
Belaga

| COMMUNITY | Malays | Melanau | Iban | Bidayuh | Other B. | Chinese | Other | TOTAL |
|-----------|--------|---------|------|---------|----------|---------|-------|-------|
| AGE GROUP |        |         |      |         |          |         |       |       |
| 0- 4      | 53     | 33      | 73   | 4       | 1874     | 54      | 5     | 2096  |
| 5- 9      | 47     | 31      | 72   | 4       | 1677     | 53      | 6     | 1890  |
| 10-14     | 43     | 30      | 78   | 4       | 1751     | 52      | 6     | 1964  |
| 15-19     | 38     | 28      | 75   | 4       | 1641     | 54      | 6     | 1846  |
| 20-24     | 34     | 24      | 58   | 3       | 1265     | 48      | 6     | 1438  |
| 25-29     | 28     | 20      | 45   | 2       | 1004     | 42      | 6     | 1147  |
| 30-34     | 24     | 14      | 36   | 2       | 730      | 35      | 6     | 847   |
| 35-39     | 19     | 13      | 29   | 1       | 591      | 29      | 6     | 688   |
| 40-44     | 14     | 10      | 28   | 1       | 505      | 21      | 4     | 583   |
| 45-49     | 12     | 10      | 24   | 1       | 478      | 17      | 3     | 545   |
| 50-54     | 9      | 8       | 20   | 1       | 396      | 13      | 2     | 449   |
| 55-59     | 9      | 8       | 19   | 1       | 371      | 11      | 2     | 421   |
| 60-64     | 6      | 6       | 15   | 1       | 295      | 9       | 1     | 333   |
| 65-       | 10     | 10      | 28   | 1       | 603      | 21      | 2     | 675   |
| TOTAL     | 346    | 245     | 600  | 30      | 13181    | 459     | 61    | 14922 |

Appendix-II.4.1.2 Population Forecast

by District and Community

POPULATION 1995  
by COMMUNITY  
by DISTRICT

| COMMUNITY | Malays | Melanau | Iban   | Bidayuh | Other B. | Chinese | Other | TOTAL  |
|-----------|--------|---------|--------|---------|----------|---------|-------|--------|
| DISTRICT  |        |         |        |         |          |         |       |        |
| Betong    | 26625  | 88      | 22050  | 49      | 27       | 3890    | 22    | 52751  |
| Saratok   | 16501  | 98      | 26947  | 112     | 27       | 4162    | 20    | 47867  |
| Sibu      | 21647  | 13543   | 34677  | 668     | 1202     | 111343  | 576   | 183656 |
| Mukah     | 765    | 15812   | 25155  | 88      | 106      | 3956    | 32    | 45914  |
| Kanowit   | 1176   | 414     | 32335  | 42      | 34       | 7015    | 15    | 41031  |
| Dalat     | 436    | 14961   | 10206  | 26      | 120      | 2570    | 11    | 28330  |
| Sarikei   | 7389   | 12956   | 15948  | 298     | 214      | 34179   | 102   | 71086  |
| Maradong  | 5048   | 2032    | 11480  | 87      | 69       | 17417   | 11    | 36144  |
| Daro      | 537    | 21002   | 566    | 17      | 4        | 1310    | 9     | 23445  |
| Julau     | 231    | 332     | 35688  | 95      | 48       | 1685    | 20    | 38099  |
| Kapit     | 1037   | 745     | 43603  | 98      | 1937     | 4259    | 97    | 51776  |
| Song      | 636    | 187     | 20320  | 45      | 69       | 1174    | 38    | 22469  |
| Belaga    | 393    | 270     | 658    | 34      | 14690    | 498     | 64    | 16607  |
| TOTAL     | 82421  | 82440   | 279633 | 1659    | 18547    | 193458  | 1017  | 659175 |

POPULATION 2000  
by COMMUNITY  
by DISTRICT

| COMMUNITY | Malays | Melanau | Iban   | Bidayuh | Other B. | Chinese | Other | TOTAL  |
|-----------|--------|---------|--------|---------|----------|---------|-------|--------|
| DISTRICT  |        |         |        |         |          |         |       |        |
| Betong    | 30289  | 101     | 24576  | 55      | 32       | 4229    | 23    | 59305  |
| Saratok   | 18722  | 111     | 29952  | 127     | 32       | 4508    | 21    | 53473  |
| Sibu      | 24419  | 14917   | 38325  | 736     | 1360     | 119937  | 587   | 200281 |
| Mukah     | 864    | 17401   | 27778  | 99      | 122      | 4259    | 34    | 50557  |
| Kanowit   | 1315   | 454     | 35377  | 46      | 39       | 7478    | 16    | 44725  |
| Dalat     | 492    | 16432   | 11247  | 28      | 138      | 2763    | 12    | 31112  |
| Sarikei   | 8739   | 14975   | 18493  | 352     | 259      | 38624   | 112   | 81554  |
| Maradong  | 5734   | 2255    | 12781  | 99      | 78       | 18902   | 12    | 39861  |
| Daro      | 617    | 23522   | 638    | 20      | 5        | 1438    | 10    | 26250  |
| Julau     | 261    | 365     | 39196  | 106     | 55       | 1803    | 21    | 41807  |
| Kapit     | 1155   | 812     | 47532  | 108     | 2160     | 4523    | 100   | 56390  |
| Song      | 733    | 215     | 22871  | 51      | 79       | 1288    | 40    | 25277  |
| Belaga    | 439    | 298     | 720    | 37      | 16384    | 530     | 66    | 18474  |
| TOTAL     | 93779  | 91858   | 309486 | 1864    | 20743    | 210282  | 1054  | 729066 |

POPULATION 2005  
by COMMUNITY  
by DISTRICT

| COMMUNITY | Malays | Melanau | Iban   | Bidayuh | Other B. | Chinese | Other | TOTAL  |
|-----------|--------|---------|--------|---------|----------|---------|-------|--------|
| DISTRICT  |        |         |        |         |          |         |       |        |
| Betong    | 33733  | 115     | 27615  | 63      | 37       | 4545    | 23    | 66131  |
| Saratok   | 20727  | 125     | 33457  | 144     | 37       | 4812    | 22    | 59324  |
| Sibu      | 27503  | 16618   | 43551  | 829     | 1560     | 130284  | 604   | 220949 |
| Mukah     | 960    | 19092   | 31091  | 113     | 141      | 4555    | 35    | 55987  |
| Kanowit   | 1459   | 499     | 39540  | 52      | 45       | 7986    | 16    | 49597  |
| Dalat     | 542    | 17880   | 12484  | 31      | 157      | 2931    | 13    | 34038  |
| Sarikei   | 9708   | 16455   | 20737  | 390     | 299      | 41393   | 116   | 89098  |
| Maradong  | 6388   | 2485    | 14367  | 113     | 92       | 20306   | 13    | 43764  |
| Daro      | 672    | 25281   | 702    | 22      | 6        | 1508    | 11    | 28202  |
| Julau     | 298    | 409     | 44766  | 124     | 65       | 1968    | 23    | 47653  |
| Kapit     | 1289   | 894     | 53486  | 125     | 2452     | 4863    | 105   | 63214  |
| Song      | 814    | 238     | 25583  | 57      | 92       | 1376    | 41    | 28201  |
| Belaga    | 492    | 331     | 815    | 42      | 18673    | 573     | 69    | 20995  |
| TOTAL     | 104585 | 100422  | 348194 | 2105    | 23656    | 227100  | 1091  | 807153 |

POPULATION 2010  
by COMMUNITY  
by DISTRICT

| COMMUNITY | Malays | Melanau | Iban   | Bidayuh | Other B. | Chinese | Other | TOTAL  |
|-----------|--------|---------|--------|---------|----------|---------|-------|--------|
| DISTRICT  |        |         |        |         |          |         |       |        |
| Betong    | 37470  | 130     | 30390  | 72      | 43       | 4844    | 23    | 72972  |
| Saratok   | 22967  | 141     | 36733  | 163     | 43       | 5120    | 22    | 65189  |
| Sibu      | 30306  | 18104   | 47540  | 913     | 1738     | 137791  | 605   | 236997 |
| Mukah     | 1065   | 20920   | 34140  | 128     | 162      | 4846    | 36    | 61297  |
| Kanowit   | 1627   | 551     | 43641  | 60      | 52       | 8539    | 18    | 54488  |
| Dalat     | 597    | 19448   | 13608  | 35      | 180      | 3092    | 13    | 36973  |
| Sarikei   | 10658  | 17864   | 22562  | 427     | 332      | 43634   | 121   | 95598  |
| Maradong  | 7117   | 2737    | 15856  | 130     | 106      | 21715   | 14    | 47675  |
| Daro      | 752    | 27944   | 776    | 25      | 8        | 1619    | 12    | 31136  |
| Julau     | 328    | 443     | 48497  | 139     | 75       | 2064    | 22    | 51568  |
| Kapit     | 1427   | 977     | 58532  | 140     | 2740     | 5157    | 108   | 69081  |
| Song      | 907    | 264     | 28277  | 66      | 107      | 1471    | 42    | 31134  |
| Belaga    | 542    | 362     | 890    | 47      | 20830    | 607     | 72    | 23350  |
| TOTAL     | 115763 | 109885  | 381442 | 2345    | 26416    | 240499  | 1108  | 877458 |

### Appendix-II.5.2.1 Calculation of Berth Occupancy Rate

The berth occupancy rate can be calculated as follows:

$$b = T_s / T_o / n$$

$$T_s = (T_h + T_b + T_i) \times N_s$$

$$T_h = W \times l_f / R_h$$

$$N_s = V / (W \times l_f)$$

b: berth occupancy rate

V: annual throughput (ton)

W: average ship size (DWT)

$l_f$ : load factor of ship (0.9 - 1.0)

$T_o$ : operation hours per year (D x H)

D: annual working days

H: daily working hours

$T_b$ : hours needed for ships' berthing and departure

$T_i$ : idling (stand by) hours within working hours ( $T_h \times r_i$ )

$r_i$ : idling rate (gang stand by hours / working hours)

$R_h$ : handling rate of crane ( $R_c \times C_n$ )

$R_c$ : handling rate per crane (see Appendix-II.5.2.2)

$C_n$ : number of crane

n: number of berth

$$D = 350 \text{ days}$$

$$H = 14 \text{ or } 21 \text{ hours (2 or 3 shifts)}$$

$$T_b = 2 \text{ hours (3,000DWT or more)}$$

$$1 \text{ hours (below 3,000DWT)}$$

$$0 \text{ hour (Barges)}$$

$$r_i = 0.3$$

$$C_n = 3 \text{ (ships of 3,000DWT class or more)}$$

$$2 \text{ (ships of 2,000 - 3,000DWT)}$$

$$1 \text{ (ships of 1,000DWT, Barges)}$$

There is the maximum berth occupancy rate by number of berth in group. The handling capacity through the berth can be determined so that berth occupancy is at the maximum rate (Table-1).



On the other hand, the required number of berths can be determined if other conditions are given.

(Example) - The Handling Capacity thorough Berths at Sibu center

Average ship size (W): 1,740 GRT (regarded as DWT)

Load factor (lf) : 0.91

Loading/unloading rate (Rc):

Break Bulk Cargo

Palletized 50 t/h

Non-palletized 30 t/h

Recommended maximum berth occupancy rate: 0.65 (b)

Annual ship arrivals (Ns) =  $V / (W \times lf)$

$$= V / (1,740 \times 0.91) = V / 1,583$$

Service hours per ship (ts) =  $T_h + T_i + T_b$

(Palletized) =  $W \times lf / (Rc \times 2) + T_i + T_b$

$$= 1,740 \times 0.91 / 100 + 8 + 1 + 1$$

$$= 25.8 \text{ hours}$$

(Non-palletized) =  $1,740 \times 0.91 / 60 + 8 + 1 + 1$

$$= 36.4 \text{ hours}$$

Total service hours (Ts) =  $N_s \times t_s$

Palletized =  $25.8 \times V / 1,583$

$$= 0.0163V$$

Non-palletized =  $36.4 \times V / 1,583$

$$= 0.0230V$$

Working hours per year (To) =  $D \times H$

$$= 350 \times 14$$

$$= 4900 \text{ hours}$$

Berth occupancy rate (b) =  $T_s / T_o$

$$= 0.65$$

therefore,

$$V = 0.65 \times 4900 / 0.0163 \quad \text{Palletized}$$
$$= 195,000 \text{ t/y}$$

$$= 0.65 \times 4900 / 0.0230 \quad \text{Non-palletized}$$
$$= 138,000 \text{ t/y}$$

$$Vt = V \times n$$
$$= 195,000 \times 5 \quad \text{Palletized}$$
$$= 975,000 \text{ t/y}$$
$$= 138,000 \times 5 \quad \text{Non-palletized}$$
$$= 690,000 \text{ t/y}$$

Table-1 UNCTAD'S Recommendation on Berth Occupancy

| No. of Berths<br>in Group | Recommended Maximum<br>Berth Occupancy |
|---------------------------|--|
| 1                         | 0.4                                    |
| 2                         | 0.5                                    |
| 3                         | 0.55                                   |
| 4                         | 0.6                                    |
| 5                         | 0.65                                   |
| 6 - 10                    | 0.7                                    |

\* for break bulk cargo

## Appendix-II.5.2.2 Loading/Unloading Rate of Cranes

### (1) General Cargo

Handling rate of a crane can be calculated as follows;

$$Q = 60 / C_t \times w \times r$$

Q: handling rate per hour

$C_t$ : cycle time (minutes)

2 minutes

w: tonnage per cycle

non-palletized: 3 tons

palletized: 5 tons

r: handling efficiency rate (0.7)

#### non-palletized cargo

$$Q = 60 / 2 \times 3 \times 0.7 = 63 \text{ ton/hour}$$

#### Palletized cargo

$$Q = 60 / 2 \times 5 \times 0.7 = 105 \text{ ton/hour (mobile crane)}$$

(Present handling rate per gang at Sibu is 63.6t/hour.)

### (2) Coal

$$Q = 60 / C_t \times V \times W \times r_1 \times r_2$$

Q: handling rate per hour

$C_t$ : cycle time (minutes)

mobile crane: 2.5 minutes

ship crane: 3 minutes

V: grab capacity ( $m^3$ )

5 - 10  $m^3$  (ave. 7.5  $m^3$ )

w: unit weight of coal (1.0 ton/ $m^3$ )

$r_1$ : grab efficiency rate (0.8)

$r_2$ : operating rate (0.7)

$$Q = 60 / 2.5 \times 7.5 \times 0.8 \times 0.7 = 101 \text{ ton/hour (mobile crane)}$$

$$Q = 60 / 3 \times 7.5 \times 0.8 \times 0.7 = 84 \text{ ton/hour (ship crane)}$$

### (3) Containers

17 TEU/hour (1500DWT or more)

10 TEU/hour (barge)

### Appendix-II.5.2.3 Berth Occupancy Estimation at Each Wharf

#### Berth Occupancy 1997

| Wharf                  | Berth Nos | Cargo        |           | Ship Size | Handling Equipment | H. E. Nos | Handling Rate/crane | Daily Work Hour | Berth Occupancy |
|------------------------|-----------|--------------|-----------|-----------|--------------------|-----------|---------------------|-----------------|-----------------|
|                        |           | Conventional | Container |           |                    |           |                     |                 |                 |
| Sibu Center            | 4         | 549000       |           | 3000      | Ship Crane         | 2 - 3     | 63                  | 14              | 63              |
|                        |           |              | 13500     | 3000      | Ship Crane         | 2         | 17TEU               |                 |                 |
|                        |           |              | 8900      | 1000      | Ship Crane         | 1         | 10TEU               |                 |                 |
| Sarikei                | 2         | 121000       |           | 1500      | Ship Crane         | 2         | 63                  | 14              | 58              |
|                        |           |              | 2100      | 1500      | Ship Crane         | 1         | 17TEU               |                 |                 |
|                        |           |              | 1500      | 1000      | Ship Crane         | 1         | 10TEU               |                 |                 |
| Bintangor              | 1         | 22000        |           | 1500      | Ship Crane         | 2         | 63                  | 14              | 3               |
|                        |           |              | 200       | 1500      | Ship Crane         | 1         | 17TEU               |                 |                 |
| Timber Terminal (Deep) | 2         | 896000       |           | 5000      | Mobile/Ship C      | 3         | 63                  | 14              | 54              |
|                        |           |              | 13800     | 10000     | Mobile/Ship C      | 2         | 17TEU               |                 |                 |
| (Shallow)              | 3         | 409000       |           | 1000      | Ship Crane         | 1         | 60                  | 21              | 45              |
|                        |           |              | 7400      | 1000      | Ship Crane         | 1         | 10TEU               |                 |                 |
| Coal Terminal (Deep)   | 1         | 250000       |           | 15000     | Converyor          | 1         | 250                 | 14              | 24              |
|                        |           |              | 27000     | 1500      | Ship Crane         | 2         | 60                  |                 |                 |
| (Shallow)              | 2         | 500000       |           | 1000      | Ship Crane         | 1         | 84                  | 21              | 56              |

#### Berth Occupancy 2010

| Wharf                  | Berth Nos | Cargo        |           | Ship Size | Handling Equipment | H. E. Nos | Handling Rate | Daily Work Hour | Berth Occupancy |
|------------------------|-----------|--------------|-----------|-----------|--------------------|-----------|---------------|-----------------|-----------------|
|                        |           | Conventional | Container |           |                    |           |               |                 |                 |
| Sibu Center            | 4         | 400000       |           | 3000      | Ship Crane         | 2 - 3     | 63            | 14              | 60              |
|                        |           |              | 20000     | 3000      | Ship Crane         | 2         | 17TEU         |                 |                 |
|                        |           |              | 15000     | 1000      | Ship Crane         | 1         | 10TEU         |                 |                 |
| Sibu South             | 4         | 256000       |           | 2000      | Ship Crane         | 2         | 63            | 14              | 55              |
|                        |           |              | 16800     | 2000      | Ship Crane         | 2         | 17TEU         |                 |                 |
|                        |           |              | 9400      | 1000      | Ship Crane         | 1         | 10TEU         |                 |                 |
| Sarikei                | 3         | 154000       |           | 1500      | Ship Crane         | 2         | 63            | 14              | 56              |
|                        |           |              | 5700      | 1500      | Ship Crane         | 1         | 17TEU         |                 |                 |
|                        |           |              | 3900      | 1000      | Ship Crane         | 1         | 10TEU         |                 |                 |
| Bintangor              | 1         | 32000        |           | 1500      | Ship Crane         | 2         | 63            | 14              | 53              |
|                        |           |              | 500       | 1500      | Ship Crane         | 1         | 17TEU         |                 |                 |
|                        |           |              | 100       | 1000      | Ship Crane         | 1         | 10TEU         |                 |                 |
| Timber Terminal (Deep) | 5         | 2111000      |           | 5000      | Mobile/Ship C      | 3         | 63            | 14              | 50              |
|                        |           |              | 94000     | 10000     | Mobile/Ship C      | 2         | 17TEU         |                 |                 |
| (Shallow)              | 5         | 816000       |           | 1000      | Ship Crane         | 2         | 60            | 21              | 55              |
|                        |           |              | 20600     | 1000      | Ship Crane         | 1         | 10TEU         |                 |                 |
| Coal Terminal (Deep)   | 1         | 600000       |           | 20000     | Converyor          | 1         | 250           | 14              | 59              |
|                        |           |              | 52000     | 2000      | Ship Crane         | 2         | 60            |                 |                 |
| (Shallow)              | 4         | 1100000      |           | 1000      | Ship Crane         | 1         | 84            | 21              | 61              |

#### Appendix-II.5.2.4 Cargo Handling Equipment

(1) Sibul, Sarikei and Bintangor

The container and general cargo handling system at these wharves is as shown in Figure-1 and 2.

- Container Cargo

- a. Apron <-> container yard with tractor
- b. Tractor <-> container yard with large forklift
- c. Container yard <-> CFS with large forklift
- d. Vanning/devanning in CFS with small forklift
- e. CFS <-> Truck with small forklift

- General Cargo

- f. Apron <-> Transit shed with small forklift
- g. Transit shed <-> Truck with small forklift

Required equipment at Sibul Center in 1997 can be calculated as follows:

i) Tractor

- for operation a.

$$n = C \times T / e \quad (1)$$

$$T = ( T_l + T_d ) / 3600 + D / v$$

n: required no. of tractors

C: TEUs handled per hour

T: cycle time of equipment (hour)

T<sub>l</sub>: time for loading on equipment (sec)

T<sub>d</sub>: time for discharging from equipment (sec)

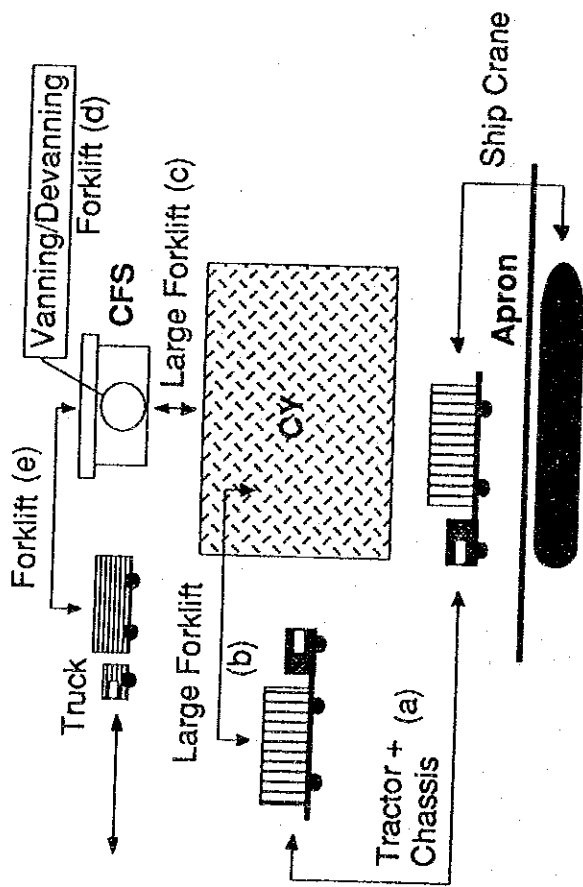
D: driving distance of equipment (km, up and down)

v: driving speed of equipment (km/h)

e: efficiency rate of operation

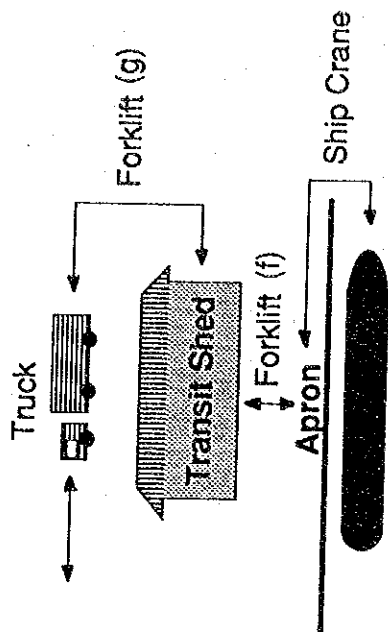
Parameters will be as follows:

$$C = 17 \times 2 \text{ (cranes)} = 34 \text{ TEUs}$$



Cargo Handling System  
Containers  
Sibu, Sarikei and Bintangor

Figure-1



Cargo Handling System  
General Cargo  
Sibu, Sarikei and Bintangor

Figure-2

$$Tl = 20 \text{ sec}$$

$$Td = 30 \text{ sec}$$

$$D = 0.4 \text{ km}$$

$$v = 10 \text{ km/h}$$

$$e = 0.75$$

then,

$$T = ( 20 + 30 ) / 3600 + 0.4 / 10 = 0.054 \text{ h}$$

$$n = 34 \times 0.054 / 0.75 = 2.4$$

Consequently, three tractors will be required in 1997.

## ii) Large Forklift

- for operation b.

equation (1) can be used

Parameters will be as follows:

$$C = 17 \times 2 \text{ (cranes)} = 34 \text{ TEUs}$$

$$Tl = 60 \text{ sec}$$

$$Td = 60 \text{ sec}$$

$$D = 0 \text{ km}$$

$$e = 0.75$$

then,

$$T = ( 60 + 60 ) / 3600 = 0.033 \text{ h}$$

$$n = 34 \times 0.033 / 0.75 = 1.5$$

- for operation c.

equation (1) can be used.

In 1997, parameters will be as follows:

$$C = p \times Cy / ( Dy \times Hd )$$

$$p = 1.3 : \text{day peak ratio}$$

$$Cy = 27000 : \text{TEU handled per year}$$

$$Dy = 350 : \text{annual working days}$$

$$Hd = 14 : \text{daily working hours}$$

$$C = 1.3 \times 27000 / ( 350 \times 14 ) = 7.2$$

$$Tl = 60 \text{ sec}$$

$$Td = 60 \text{ sec}$$

$$D = 0.2 \text{ km}$$

$$v = 5 \text{ km/h}$$

then,

$$T = ( 60 + 60 ) / 3600 + 0.2 / 5 = 0.073$$

$$n = 7.2 \times 0.073 / 0.75 = 0.7$$

As operation c can be done when operation b is not done, the no. of large forklifts required can be determined based on operation b. Consequently, the required no. of large forklifts is two.

### iii) Small Forklift

- for operation d.

$$n = W / (Fh \times e) \quad (2)$$

$$W = p \times w \times Cy / ( Dy \times Hd )$$

$$T = ( Tl + Td ) / 3600 + D1 / v1 + D2 / v2 + Tw / 60$$

$$Fh = FO / T$$

w: tonnage handled per hour

Fh: capacity of equipment per hour

FO: capacity of equipment (ton)

w: average tonnage per TEU

D1: driving distance of equipment (km, with cargo)

v1: driving speed of equipment (km/h, with cargo)

D2: driving distance of equipment (km, without cargo)

v2: driving speed of equipment (km/h, without cargo)

Tw: waiting time per one cycle (min)

Parameters will be as follows:

$$p = 1.3$$

$$w = 12$$

$$Cy = 13500$$

$$Dy = 350$$



$H_d = 14$   
 $T_1 = 120$   
 $T_d = 120$   
 $D_1 = 0.03$   
 $v_1 = 3$   
 $D_2 = 0.03$   
 $v_2 = 4$   
 $T_w = 4$   
 $FO = 3$

then,

$$W = 1.3 \times 12 \times 13500 / ( 350 \times 14 ) = 43$$

$$T = ( 120+120 ) / 3600 + 0.03 / 3 + 0.03 / 4 + 4 / 60 = 0.15$$

$$F_h = 3 / 0.15 = 20$$

$$n = 43 / ( 20 \times 0.75 ) = 2.9$$

- for operation e.  
equation (2) can be used.

Parameters will be as follows:

$p = 1.3$   
 $w = 12$   
 $C_y = 13500$   
 $D_y = 350$   
 $H_d = 14$   
 $T_1 = 60$   
 $T_d = 60$   
 $D_1 = 0.03$   
 $v_1 = 3$   
 $D_2 = 0.03$   
 $v_2 = 4$   
 $T_w = 4$   
 $FO = 3$

then,

$$W = 1.3 \times 12 \times 13500 / ( 350 \times 14 ) = 43$$

$$T = ( 60 + 60 ) / 3600 + 0.03 / 3 + 0.03 / 4 + 4 / 60 = 0.12$$

$$Fh = 3 / 0.15 = 20$$

$$n = 43 / ( 25 \times 0.75 ) = 2.3$$

- for operation f.

$$n = W / ( Fh \times e ) \quad (3)$$

$$W = p \times V / ( Dy \times Hd)$$

$$T = ( Tl + Td ) / 3600 + D1 / v1 + D2 / v2 + Tw / 60$$

$$Fh = FO / T$$

V: tonnage handled per year

Parameters will be as follows:

$$p = 1.3$$

$$V = 549000$$

$$Dy = 350$$

$$Hd = 14$$

$$Tl = 60$$

$$Td = 60$$

$$D1 = 0.03$$

$$v1 = 3$$

$$D2 = 0.03$$

$$v2 = 4$$

$$Tw = 4$$

$$FO = 3$$

then,

$$W = 1.3 \times 549000 / ( 350 \times 14 ) = 146$$

$$T = ( 60 + 60 ) / 3600 + 0.03 / 3 + 0.03 / 4 + 4 / 60 = 0.12$$

$$Fh = 3 / 0.12 = 25$$

$$n = 146 / ( 25 \times 0.75 ) = 7.8$$

- for operation g.

Same as calculation for f.

$$n = 7.8$$

As these operations could possibly be carried out simultaneously, the

required no. of forklifts can be obtained as sum of these respective no. as follows:

$$2.9 + 2.3 + 7.8 + 7.8 = 21$$

iv) Conclusion

Cargo will be handled at Sibuh South, Sarikei and Bintangor as it is at Sibuh Center. And it is assumed that the cargo handling system in 2010 will be the same as in 1997. Table-1 ~ 7 show the equipment required for operations a to g in 1997 and 2010.

Table-1 Required Equipment (Sibuh Center, 1997)

| Parameter | O P E R A T I O N |       |       |       |       |        |        |
|-----------|-------------------|-------|-------|-------|-------|--------|--------|
|           | a                 | b     | c     | d     | e     | f      | g      |
| Fh        |                   |       |       | 19.9  | 25.4  | 25.4   | 25.4   |
| FO        |                   |       |       | 3     | 3     | 3      | 3      |
| C         | 34                | 34    | 7.2   |       |       |        |        |
| Cy        |                   |       | 27000 | 13500 | 13500 |        |        |
| W         |                   |       |       | 43    | 43    | 145.7  | 145.7  |
| V         |                   |       |       |       |       | 549000 | 549000 |
| w         |                   |       |       | 12    | 12    |        |        |
| P         |                   |       | 1.3   | 1.3   | 1.3   | 1.3    | 1.3    |
| T         | 0.054             | 0.033 | 0.073 | 0.151 | 0.118 | 0.118  | 0.118  |
| Tl        | 20                | 60    | 60    | 120   | 60    | 60     | 60     |
| Td        | 30                | 60    | 60    | 120   | 60    | 60     | 60     |
| D         | 0.4               | 0     | 0.2   |       |       |        |        |
| v         | 10                | 10    | 5     |       |       |        |        |
| D1        |                   |       |       | 0.03  | 0.03  | 0.03   | 0.03   |
| v1        |                   |       |       | 3     | 3     | 3      | 3      |
| D2        |                   |       |       | 0.03  | 0.03  | 0.03   | 0.03   |
| v2        |                   |       |       | 4     | 4     | 4      | 4      |
| Tw        |                   |       |       | 4     | 4     | 4      | 4      |
| Dy        |                   |       | 350   | 350   | 350   | 350    | 350    |
| Hd        |                   |       | 14    | 14    | 14    | 14     | 14     |
| e         | 0.75              | 0.75  | 0.75  | 0.75  | 0.75  | 0.75   | 0.75   |
| n         | 2.4               | 1.5   | 0.7   | 2.9   | 2.3   | 7.6    | 7.6    |

Table-2 Required Equipment (Sibu Center, 2010)

| Parameter | O P E R A T I O N |       |       |       |       |        |        |
|-----------|-------------------|-------|-------|-------|-------|--------|--------|
|           | a                 | b     | c     | d     | e     | f      | g      |
| Fh        |                   |       |       | 19.9  | 25.4  | 25.4   | 25.4   |
| FO        |                   |       |       | 3     | 3     | 3      | 3      |
| C         | 34                | 34    | 10.6  |       |       |        |        |
| Cy        |                   |       | 40000 | 20000 | 20000 |        |        |
| W         |                   |       |       | 63.7  | 63.7  | 106.1  | 106.1  |
| V         |                   |       |       |       |       | 400000 | 400000 |
| w         |                   |       |       | 12    | 12    |        |        |
| P         |                   |       | 1.3   | 1.3   | 1.3   | 1.3    | 1.3    |
| T         | 0.054             | 0.033 | 0.073 | 0.151 | 0.118 | 0.118  | 0.118  |
| Tl        | 20                | 60    | 60    | 120   | 60    | 60     | 60     |
| Td        | 30                | 60    | 60    | 120   | 60    | 60     | 60     |
| D         | 0.4               | 0     | 0.2   |       |       |        |        |
| v         | 10                | 10    | 5     |       |       |        |        |
| D1        |                   |       |       | 0.03  | 0.03  | 0.03   | 0.03   |
| vl        |                   |       |       | 3     | 3     | 3      | 3      |
| D2        |                   |       |       | 0.03  | 0.03  | 0.03   | 0.03   |
| v2        |                   |       |       | 4     | 4     | 4      | 4      |
| Tw        |                   |       |       | 4     | 4     | 4      | 4      |
| Dy        |                   |       | 350   | 350   | 350   | 350    | 350    |
| Hd        |                   |       | 14    | 14    | 14    | 14     | 14     |
| e         | 0.75              | 0.75  | 0.75  | 0.75  | 0.75  | 0.75   | 0.75   |
| n         | 2.4               | 1.5   | 1     | 4.3   | 3.3   | 5.6    | 5.6    |

Table-3 Required Equipment (Sibu South, 2010)

| Parameter | O P E R A T I O N |       |       |       |       |        |        |
|-----------|-------------------|-------|-------|-------|-------|--------|--------|
|           | a                 | b     | c     | d     | e     | f      | g      |
| Fh        |                   |       |       | 19.9  | 25.4  | 25.4   | 25.4   |
| FO        |                   |       |       | 3     | 3     | 3      | 3      |
| C         | 34                | 34    | 8.9   |       |       |        |        |
| Cy        |                   |       | 33600 | 16800 | 16800 |        |        |
| W         |                   |       |       | 53.5  | 53.5  | 67.9   | 67.9   |
| V         |                   |       |       |       |       | 256000 | 256000 |
| w         |                   |       |       | 12    | 12    |        |        |
| P         |                   |       | 1.3   | 1.3   | 1.3   | 1.3    | 1.3    |
| T         | 0.054             | 0.033 | 0.073 | 0.151 | 0.118 | 0.118  | 0.118  |
| Tl        | 20                | 60    | 60    | 120   | 60    | 60     | 60     |
| Td        | 30                | 60    | 60    | 120   | 60    | 60     | 60     |
| D         | 0.4               | 0     | 0.2   |       |       |        |        |
| v         | 10                | 10    | 5     |       |       |        |        |
| D1        |                   |       |       | 0.03  | 0.03  | 0.03   | 0.03   |
| vl        |                   |       |       | 3     | 3     | 3      | 3      |
| D2        |                   |       |       | 0.03  | 0.03  | 0.03   | 0.03   |
| v2        |                   |       |       | 4     | 4     | 4      | 4      |
| Tw        |                   |       |       | 4     | 4     | 4      | 4      |
| Dy        |                   |       | 350   | 350   | 350   | 350    | 350    |
| Hd        |                   |       | 14    | 14    | 14    | 14     | 14     |
| e         | 0.75              | 0.75  | 0.75  | 0.75  | 0.75  | 0.75   | 0.75   |
| n         | 2.4               | 1.5   | 0.9   | 3.6   | 2.8   | 3.6    | 3.6    |

Table-4 Required Equipment (Sarikei, 1997)

| Parameter | O P E R A T I O N |   |       |       |       |        |        |
|-----------|-------------------|---|-------|-------|-------|--------|--------|
|           | a                 | b | c     | d     | e     | f      | g      |
| Fh        |                   |   |       | 19.9  | 25.4  | 25.4   | 25.4   |
| FO        |                   |   |       | 3     | 3     | 3      | 3      |
| C         | 17                |   | 1.1   |       |       |        |        |
| Cy        |                   |   | 4200  | 2100  | 2100  |        |        |
| W         |                   |   |       | 6.7   | 6.7   | 32.1   | 32.1   |
| V         |                   |   |       |       |       | 121000 | 121000 |
| w         |                   |   |       | 12    | 12    |        |        |
| p         |                   |   | 1.3   | 1.3   | 1.3   | 1.3    | 1.3    |
| T         | 0.053             |   | 0.053 | 0.151 | 0.118 | 0.118  | 0.118  |
| Tl        | 60                |   | 60    | 120   | 60    | 60     | 60     |
| Td        | 60                |   | 60    | 120   | 60    | 60     | 60     |
| D         | 0.1               |   | 0.1   |       |       |        |        |
| v         | 5                 |   | 5     |       |       |        |        |
| D1        |                   |   |       | 0.03  | 0.03  | 0.03   | 0.03   |
| vl        |                   |   |       | 3     | 3     | 3      | 3      |
| D2        |                   |   |       | 0.03  | 0.03  | 0.03   | 0.03   |
| v2        |                   |   |       | 4     | 4     | 4      | 4      |
| Tw        |                   |   |       | 4     | 4     | 4      | 4      |
| Dy        |                   |   | 350   | 350   | 350   | 350    | 350    |
| Hd        |                   |   | 14    | 14    | 14    | 14     | 14     |
| e         | 0.75              |   | 0.75  | 0.75  | 0.75  | 0.75   | 0.75   |
| n         | 1.2               |   | 0.1   | 0.45  | 0.35  | 1.7    | 1.7    |

Table-5 Required Equipment (Sarikei, 2010)

| Parameter | O P E R A T I O N |   |       |       |       |        |        |
|-----------|-------------------|---|-------|-------|-------|--------|--------|
|           | a                 | b | c     | d     | e     | f      | g      |
| Fh        |                   |   |       | 19.9  | 25.4  | 25.4   | 25.4   |
| FO        |                   |   |       | 3     | 3     | 3      | 3      |
| C         | 17                |   | 3     |       |       |        |        |
| Cy        |                   |   | 11400 | 5700  | 5700  |        |        |
| W         |                   |   |       | 18.1  | 18.1  | 40.9   | 40.9   |
| V         |                   |   |       |       |       | 154000 | 154000 |
| w         |                   |   |       | 12    | 12    |        |        |
| p         |                   |   | 1.3   | 1.3   | 1.3   | 1.3    | 1.3    |
| T         | 0.053             |   | 0.053 | 0.151 | 0.118 | 0.118  | 0.118  |
| Tl        | 60                |   | 60    | 120   | 60    | 60     | 60     |
| Td        | 60                |   | 60    | 120   | 60    | 60     | 60     |
| D         | 0.1               |   | 0.1   |       |       |        |        |
| v         | 5                 |   | 5     |       |       |        |        |
| D1        |                   |   |       | 0.03  | 0.03  | 0.03   | 0.03   |
| vl        |                   |   |       | 3     | 3     | 3      | 3      |
| D2        |                   |   |       | 0.03  | 0.03  | 0.03   | 0.03   |
| v2        |                   |   |       | 4     | 4     | 4      | 4      |
| Tw        |                   |   |       | 4     | 4     | 4      | 4      |
| Dy        |                   |   | 350   | 350   | 350   | 350    | 350    |
| Hd        |                   |   | 14    | 14    | 14    | 14     | 14     |
| e         | 0.75              |   | 0.75  | 0.75  | 0.75  | 0.75   | 0.75   |
| n         | 1.2               |   | 0.2   | 1.21  | 0.95  | 2.1    | 2.1    |

Table-6 Required Equipment (Bintangor, 1997)

| Parameter | O P E R A T I O N |   |   |       |       |       |       |
|-----------|-------------------|---|---|-------|-------|-------|-------|
|           | a                 | b | c | d     | e     | f     | g     |
| Fh        |                   |   |   | 20.4  | 26.3  | 25.4  | 25.4  |
| FO        |                   |   |   | 3     | 3     | 3     | 3     |
| C         |                   |   |   |       |       |       |       |
| Cy        |                   |   |   | 200   | 200   |       |       |
| W         |                   |   |   | 0.6   | 0.6   | 5.8   | 5.8   |
| V         |                   |   |   |       |       | 22000 | 22000 |
| w         |                   |   |   | 12    | 12    |       |       |
| p         |                   |   |   | 1.3   | 1.3   | 1.3   | 1.3   |
| T         |                   |   |   | 0.147 | 0.114 | 0.118 | 0.118 |
| Tl        |                   |   |   | 120   | 60    | 60    | 60    |
| Td        |                   |   |   | 120   | 60    | 60    | 60    |
| D         |                   |   |   |       |       |       |       |
| v         |                   |   |   |       |       |       |       |
| D1        |                   |   |   | 0.03  | 0.03  | 0.03  | 0.03  |
| v1        |                   |   |   | 5     | 5     | 3     | 3     |
| D2        |                   |   |   | 0.03  | 0.03  | 0.03  | 0.03  |
| v2        |                   |   |   | 4     | 4     | 4     | 4     |
| Tw        |                   |   |   | 4     | 4     | 4     | 4     |
| Dy        |                   |   |   | 350   | 350   | 350   | 350   |
| Hd        |                   |   |   | 14    | 14    | 14    | 14    |
| e         |                   |   |   | 0.75  | 0.75  | 0.75  | 0.75  |
| n         |                   |   |   | 0.04  | 0.03  | 0.3   | 0.3   |

Table-7 Required Equipment (Bintangor, 2010)

| Parameter | O P E R A T I O N |   |   |       |       |       |       |
|-----------|-------------------|---|---|-------|-------|-------|-------|
|           | a                 | b | c | d     | e     | f     | g     |
| Fh        |                   |   |   | 20.4  | 26.3  | 25.4  | 25.4  |
| FO        |                   |   |   | 3     | 3     | 3     | 3     |
| C         |                   |   |   |       |       |       |       |
| Cy        |                   |   |   | 500   | 500   |       |       |
| W         |                   |   |   | 1.6   | 1.6   | 8.5   | 8.5   |
| V         |                   |   |   |       |       | 32000 | 32000 |
| w         |                   |   |   | 12    | 12    |       |       |
| p         |                   |   |   | 1.3   | 1.3   | 1.3   | 1.3   |
| T         |                   |   |   | 0.147 | 0.114 | 0.118 | 0.118 |
| Tl        |                   |   |   | 120   | 60    | 60    | 60    |
| Td        |                   |   |   | 120   | 60    | 60    | 60    |
| D         |                   |   |   |       |       |       |       |
| v         |                   |   |   |       |       |       |       |
| D1        |                   |   |   | 0.03  | 0.03  | 0.03  | 0.03  |
| v1        |                   |   |   | 5     | 5     | 3     | 3     |
| D2        |                   |   |   | 0.03  | 0.03  | 0.03  | 0.03  |
| v2        |                   |   |   | 4     | 4     | 4     | 4     |
| Tw        |                   |   |   | 4     | 4     | 4     | 4     |
| Dy        |                   |   |   | 350   | 350   | 350   | 350   |
| Hd        |                   |   |   | 14    | 14    | 14    | 14    |
| e         |                   |   |   | 0.75  | 0.75  | 0.75  | 0.75  |
| n         |                   |   |   | 0.1   | 0.08  | 0.4   | 0.4   |

n: Required no. of tractors, forklifts, etc.  
Fh: capacity of equipment per hour  
FO: capacity of equipment (ton)  
C: TEUs handled per hour  
Cy: TEU handled per year  
W: tonnage handled per hour  
V: tonnage handled per year  
w: average tonnage per TEU  
p: day peak ratio  
T: cycle time of equipment (hour)  
Tl: time for loading on equipment (sec)  
Td: time for discharging from equipment (sec)  
D: Driving distance of equipment (km, up and down)  
v: driving speed of equipment (km/h)  
Dl: driving distance of equipment (km, with cargo)  
vl: driving speed of equipment (km/h, with cargo)  
D2: driving distance of equipment (km, without cargo)  
v2: driving speed of equipment (km/h, without cargo)  
Tw: waiting time per one cycle (min)  
Dy: annual working days  
Hd: daily working hours  
e: efficiency rate of operation  
n: required no. of equipment

Table-8 and 9 shows the required equipment at each wharf in 1997 and 2010 based on the Table-1 - 7.

Table-8  
 Required Cargo Handling Equipment (1997)  
 SibU, Sarikei and Bintangor

| Equipment    | Capacity | Sibu Center | Sibu South | Sarikei | Bintangor | Total |
|--------------|----------|-------------|------------|---------|-----------|-------|
| Mobile Crane | 150 ton  |             |            |         |           | 0     |
| Tractor Head |          | 3           |            |         |           | 3     |
| Chassis      | 20,40ft  | 3           |            |         |           | 3     |
| Forklift     | 25,42ton | 2           |            | 1       |           | 3     |
| Forklift     | 3 ton    | 21          |            | 5       | 1         | 27    |

Table-9  
 Required Cargo Handling Equipment (2010)  
 SibU, Sarikei and Bintangor

| Equipment    | Capacity | Sibu Center | Sibu South | Sarikei | Bintangor | Total |
|--------------|----------|-------------|------------|---------|-----------|-------|
| Mobile Crane | 150 ton  |             |            |         |           | 0     |
| Tractor Head |          | 3           | 3          |         |           | 6     |
| Chassis      | 20,40ft  | 3           | 3          |         |           | 6     |
| Forklift     | 25,42ton | 2           | 2          | 1       |           | 5     |
| Forklift     | 3 ton    | 19          | 14         | 7       | 1         | 41    |



(2) Tg. Manis Timber Terminal

The container and general cargo handling system at these wharves is as shown in Figure-3 to 8.

- Container Import (laden and empty)
  - a. Apron <-> container yard with tractor
  - b. Tractor <-> container yard with large forklift
  - c. Container yard <-> CFS with large forklift
  - d. Devanning in CFS with small forklift
  - e. CFS -> Truck with small forklift
  
- Container Riverine Transport (empty)
  - f. Apron (shallow wharf) <-> container yard with tractor
  - g. Tractor <-> container yard with large forklift
  
- Container Export
  - h. Truck -> CFS with small forklift
  - i. Vanning in CFS with small forklift
  - j. CFS <-> container yard -> Tractor with large forklift
  - k. Container yard -> Tractor with large forklift
  - l. Container yard -> Apron with tractor
  
- General Cargo Import
  - m. Apron -> transit shed with small forklift
  - n. transit shed -> truck with small forklift
  
- Timber Products Riverine Transport
  - o. Apron (shallow wharf) -> transit shed/CFS with truck
  - p. Truck -> transit shed/CFS with small forklift
  
- Timber products Export (non-container)
  - q. Truck -> transit shed with small forklift
  - r. transit shed -> truck with small forklift
  - s. Transit shed -> apron with truck

Required equipment at the Tg. Manis Timber Terminal in 1997 can be calculated as follows:

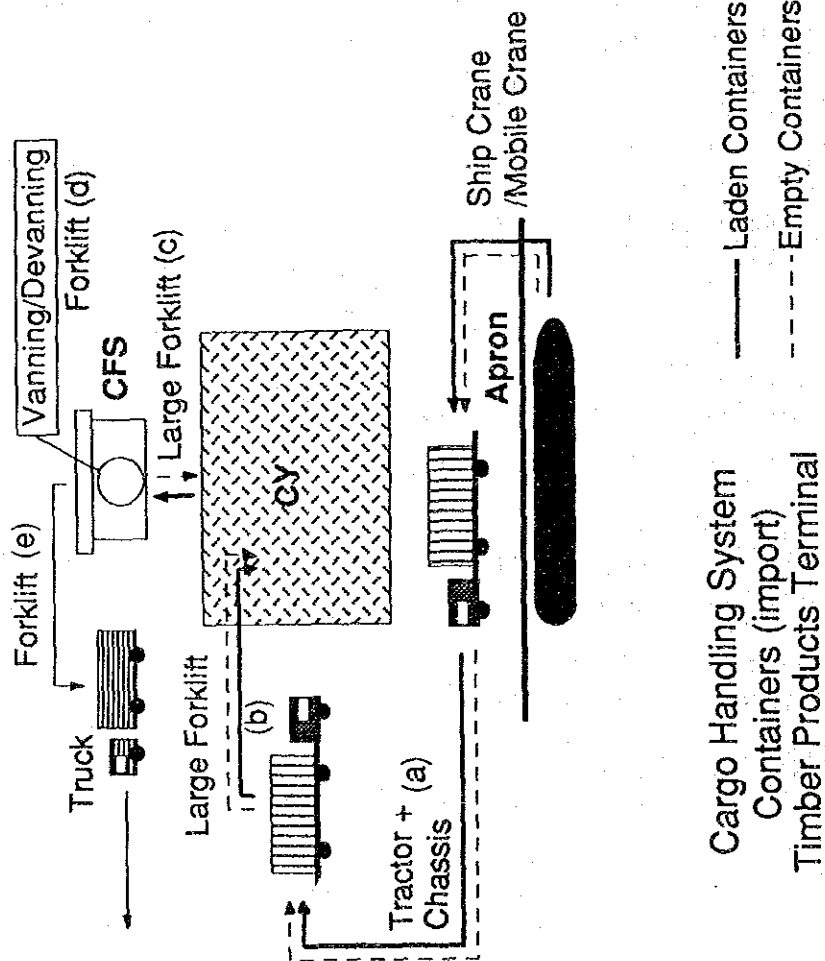


Figure-3

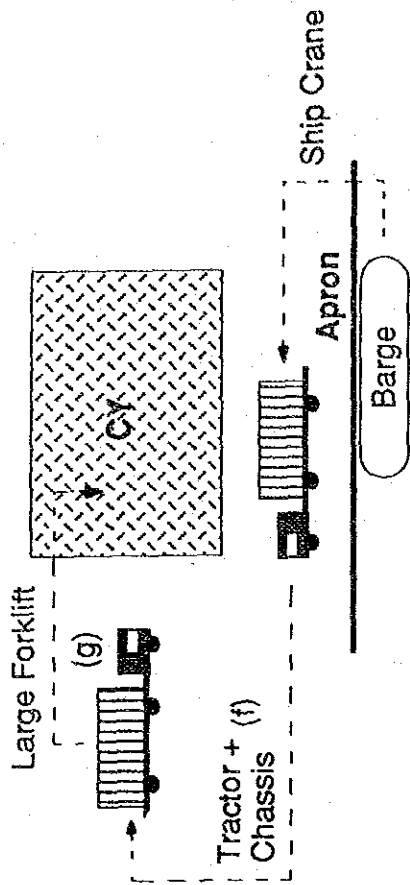
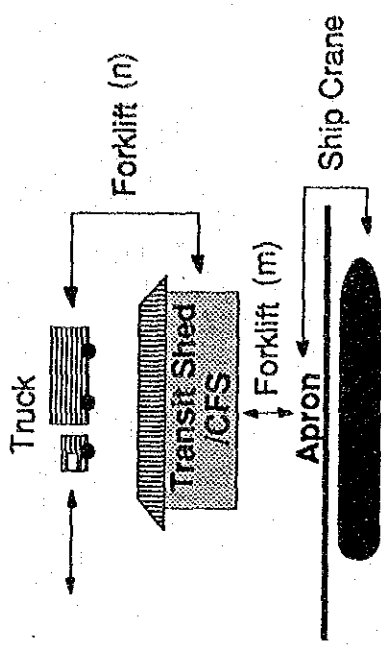


Figure-4

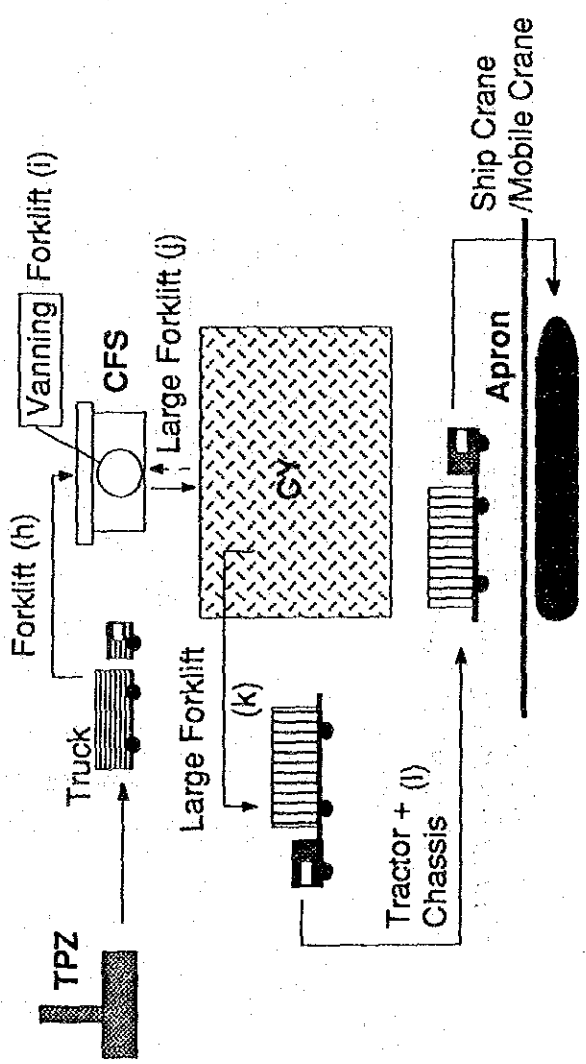
Cargo Handling System  
Containers (Riverine Transport, empty, in)  
Timber Products Terminal

Cargo Handling System  
Containers (import)  
Timber Products Terminal



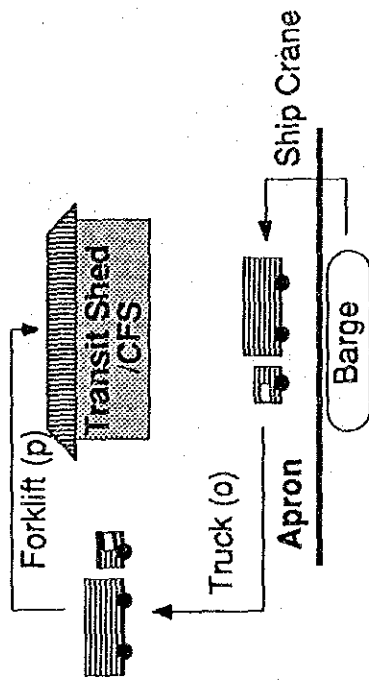
Cargo Handling System  
General Cargo (Import/Export)  
Timber Products Terminal

Figure-6



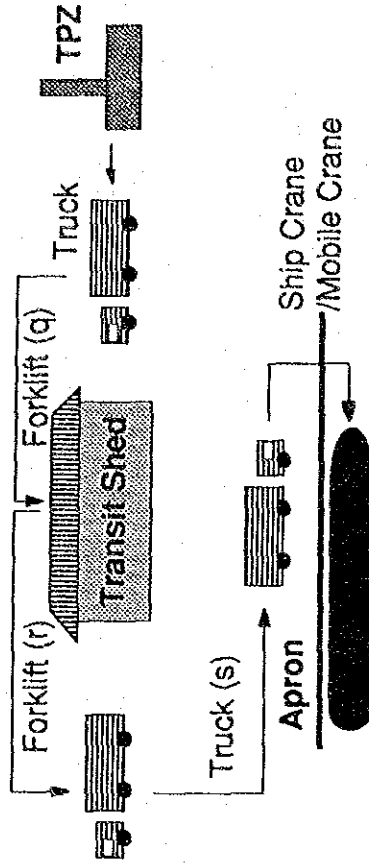
Cargo Handling System  
Containers (Export)  
Timber Products Terminal

Figure-5



Cargo Handling System  
 Timber Products (Riverine Transport; in)  
 Timber Products Terminal

Figure-7



Cargo Handling System  
 Timber Products (Export, non-container)  
 Timber Products Terminal

Figure-8

i) Tractor

- for operation a or l,  
equation (1) can be used.

Parameters will be used.

$$C = 17 \times 2 \text{ (cranes)} \times 2 \text{ (ships)} = 68 \text{ TEUs}$$

$$T_l = 20 \text{ sec}$$

$$T_d = 30 \text{ sec}$$

$$D = 1.0 \text{ km}$$

$$v = 10 \text{ km/h}$$

$$e = 0.75$$

then,

$$T = ( 20 + 30 ) / 3600 + 1.0 / 10 = 0.114 \text{ h}$$

$$n = 68 \times 0.114 / 0.75 = 10.4$$

- for operation f,  
equation (1) can be used.

Parameters will be as follows:

$$C = 10 \times 2 \text{ (ships)} = 20 \text{ TEUs}$$

$$T_l = 20 \text{ sec}$$

$$T_d = 30 \text{ sec}$$

$$D = 1.0 \text{ km}$$

$$v = 10 \text{ km/h}$$

$$e = 0.75$$

then,

$$T = ( 20 + 30 ) / 3600 + 1.0 / 10 = 0.114 \text{ h}$$

$$n = 20 \times 0.114 / 0.75 = 3.0$$

As operation f can be done when neither operation a nor l is done, the no. of tractors required can be determined based on operation a or l. Consequently, the required no. of tractors in 1997 is 11.

ii) Large Forklift

- for operation b or k.  
equation (1) can be used.

Parameters will be as follows:

$$C = 17 \times 2 \text{ (cranes)} \times 2 \text{ (ships)} = 68 \text{ TEUs}$$

$$T_l = 60 \text{ sec}$$

$$T_d = 60 \text{ sec}$$

$$D = 0 \text{ km}$$

$$e = 0.75$$

then,

$$T = ( 60 + 60 ) / 3600 = 0.033 \text{ h}$$

$$n = 68 \times 0.033 / 0.75 = 3.0$$

- for operation c and j.  
equation (1) can be used.

Parameters will be as follows:

$$C = p \times C_y / ( D_y \times H_d )$$

$$p = 1.3 : \text{day peak ratio}$$

$$C_y = 6400 : \text{TEU handled per year}$$

$$D_y = 350 : \text{annual working days}$$

$$H_d = 14 : \text{daily working hours}$$

$$= 1.3 \times 6400 / ( 350 \times 14 ) = 1.7$$

$$T_l = 60 \text{ sec}$$

$$T_d = 60 \text{ sec}$$

$$D = 0.4 \text{ km}$$

$$v = 5 \text{ km/h}$$

then,

$$T = ( 60 + 60 ) / 3600 + 0.4 / 5 = 0.113 \text{ h}$$

$$n = 1.7 \times 0.113 / 0.75 = 0.3$$

As operations c and j can be done when operation b or k is not done, no. of large forklifts required can be determined based on operation b or k. Consequently, the required no. of large forklifts is three.

iii) Small Forklift

- for operations d and i,  
equation (2) can be used.

Parameters will be as follows:

$$p = 1.3$$

$$w = 20$$

$$C_y = 11000$$

$$D_y = 350$$

$$H_d = 14$$

$$T_1 = 120$$

$$T_d = 120$$

$$D_1 = 0.03$$

$$v_1 = 3$$

$$D_2 = 0.03$$

$$v_2 = 4$$

$$T_w = 4$$

$$F_O = 3$$

then,

$$W = 1.3 \times 20 \times 11000 / ( 350 \times 14 ) = 58$$

$$T = (120+120) / 3600 + 0.03 / 3 + 0.03 / 4 + 4 / 60 = 0.15$$

$$F_h = 3 / 0.15 = 20$$

$$n = 58 / (20 \times 0.75) = 3.9$$

- for operations e and h,  
equation (2) can be used.

Parameters will be as follows:

$$p = 1.3$$

$$w = 20$$

$$C_y = 11000$$

$$D_y = 350$$

$$H_d = 14$$

$$T_1 = 60$$

$$T_d = 60$$

$$D_1 = 0.03$$

$$\begin{aligned}
v_1 &= 3 \\
D_2 &= 0.03 \\
v_2 &= 4 \\
T_w &= 4 \\
FO &= 3
\end{aligned}$$

then,

$$\begin{aligned}
W &= 1.3 \times 12 \times 11000 / ( 350 \times 14 ) = 58 \\
T &= (60 + 60) / 3600 + 0.03 / 3 + 0.03 / 4 + 4 / 60 = 0.12 \\
F_h &= 3 / 0.12 = 25 \\
n &= 58 / (25 \times 0.75) = 3.1
\end{aligned}$$

- for operations m.  
equation (3) can be used.

Parameters will be as follows:

$$\begin{aligned}
p &= 1.3 \\
v &= 28000 \\
D_y &= 350 \\
H_d &= 14 \\
T_l &= 60 \\
T_d &= 60 \\
D_l &= 0.03 \\
v_1 &= 3 \\
D_2 &= 0.03 \\
v_2 &= 4 \\
T_w &= 4 \\
FO &= 3
\end{aligned}$$

then,

$$\begin{aligned}
W &= 1.3 \times 28000 / ( 350 \times 14 ) = 7.4 \\
T &= (60 + 60) / 3600 + 0.03 / 3 + 0.03 / 4 + 4 / 60 = 0.12 \\
F_h &= 3 / 0.12 = 25 \\
n &= 7.4 / ( 25 \times 0.75 ) = 0.4
\end{aligned}$$



- for operation n.

Same as calculation for m.

$$n = 0.4$$

- for operation p.

$$n = W / ( Fh \times e ) \quad (4)$$

$$T = ( Tl + Td ) / 3600 + D1 / v1 + D2 / v2$$

$$Fh = FO / T$$

Parameters will be as follows:

$$W = 58.5 \times 3 \text{ (ships)} = 175.5$$

$$Tl = 60$$

$$Td = 60$$

$$D1 = 0.03$$

$$v1 = 3$$

$$D2 = 0.03$$

$$v2 = 4$$

$$FO = 3$$

then,

$$T = (60 + 60) / 3600 + 0.03 / 3 + 0.03 / 4 = 0.051$$

$$Fh = 3 / 0.051 = 58.8$$

$$n = 175.5 / ( 58.8 \times 0.75 ) = 4.0$$

- for operations q.

equation (2) can be used.

Parameters will be as follows:

$$p = 1.3$$

$$v = 457000$$

$$Dy = 350$$

$$Hd = 14$$

$$Tl = 60$$

$$Td = 60$$

$$D1 = 0.03$$

$$v1 = 3$$

$$D2 = 0.03$$

$$v2 = 4$$

$$Tw = 4$$

$$FO = 3$$

then,

$$W = 1.3 \times 457000 / ( 350 \times 14 ) = 121$$

$$T = (60 + 60) / 3600 + 0.03 / 3 + 0.03 / 4 + 4 / 60 = 0.12$$

$$Fh = 3 / 0.12 = 25$$

$$n = 121 / ( 25 \times 0.75 ) = 6.5$$

- for operations r.

equation (4) can be used.

Parameters will be as follows:

$$W = 63.3 \times 3 \text{ (cranes)} \times 2 \text{ (ships)} = 379.8$$

$$T1 = 60$$

$$Td = 60$$

$$D1 = 0.03$$

$$v1 = 3$$

$$D2 = 0.03$$

$$v2 = 4$$

$$FO = 3$$

then,

$$T = (60 + 60) / 3600 + 0.03 / 3 + 0.03 / 4 = 0.051$$

$$Fh = 3 / 0.051 = 58.8$$

$$n = 379.8 / ( 58.8 \times 0.75 ) = 8.6$$

As these operation could possibly be carried out simultaneously, the required no. of small forklifts required can be obtained as the sum of these respective no. as follows:

$$3.9 + 3.1 + 0.4 + 0.4 + 4.0 + 6.5 + 8.6 = 27$$

iv) Truck

- for operations o.

equation (4) can be used.

Parameters will be as follows:

$$W = 58.5 \times 3 \text{ (ships)} = 175.5$$

$$T1 = 150$$

$$Td = 300$$

$$D1 = 0.5$$

$$v1 = 20$$

$$D2 = 0.5$$

$$v2 = 20$$

$$FO = 5$$

then,

$$T = (150 + 300) / 3600 + 0.5 / 20 + 0.5 / 20 = 0.175$$

$$Fh = 5 / 0.175 = 28.6$$

$$n = 175.5 / ( 28.6 \times 0.75 ) = 8.2$$

- for operations s.

equation (4) can be used.

Parameters will be as follows:

$$W = 63.3 \times 3 \text{ (cranes)} \times 2 \text{ (ships)} = 379.8$$

$$T1 = 300$$

$$Td = 150$$

$$D1 = 0.5$$

$$v1 = 20$$

$$D2 = 0.5$$

$$v2 = 20$$

$$FO = 5$$

then,

$$T = (300 + 150) / 3600 + 0.5 / 20 + 0.5 / 20 = 0.175$$

$$Fh = 5 / 0.175 = 28.6$$

$$n = 379.8 / ( 28.6 \times 0.75 ) = 17.7$$

As these operation cannot be carried out simultaneously, the required no. of trucks can be determined based on operation s. Consequently, the required no. of truck will be 18.

v) Conclusion

Similarly, the required equipment in 2010 can be calculated based on the cargo volume in 2010.

Table-10 and 11 show the required equipment in 1977 and 2010.

Table-10  
Required Cargo Handling Equipment (1997)  
Tg. Manis Timber Products Terminal

| Equipment    | Capacity | T.Manis<br>Timber |
|--------------|----------|-------------------|
| Mobile Crane | 150 ton  | 1                 |
| Tractor Head |          | 11                |
| Chassis      | 20,40ft  | 11                |
| Forklift     | 25,42ton | 3                 |
| Forklift     | 3 ton    | 27                |
| Truck        | 5 ton    | 18                |

Table-11  
Required Cargo Handling Equipment (2010)  
Tg. Manis Timber Products Terminal

| Equipment    | Capacity | T.Manis<br>Timber |
|--------------|----------|-------------------|
| Mobile Crane | 150 ton  | 2                 |
| Tractor Head |          | 11                |
| Trailer      | 20,40ft  | 11                |
| Forklift     | 25,42ton | 3                 |
| Forklift     | 3 ton    | 78                |
| Truck        | 5 ton    | 27                |

(3) Tg. Manis Coal Terminal

Coal handling system at Tg. Manis Coal Terminal is as shown in Figure-9 and 10.

- a. Apron (shallow) -> coal yard with dump truck
- b. Handling in coal yard with shovel loader
- c. Coal yard -> apron with dump truck
- d. Apron -> ship with small shovel loader and shiploader

Required equipment at the Tg. Manis Coal terminal in 1997 can be calculated as follows:

i) Dump Truck

- for operation a.

equation (4) can be used.

Parameters will be as follows:

$$W = 84 \times 3 \text{ (ships)} = 252$$

$$Tl = 420$$

$$Td = 60$$

$$D = 0.5$$

$$v = 20$$

$$FO = 10$$

then,

$$T = ( 420 + 60 ) / 3600 + 0.5 / 20 = 0.158$$

$$Fh = 10 / 0.158 = 63.3$$

$$n = 252 / ( 63.3 \times 0.75 ) = 5.3$$

- for operation c.

equation (4) can be used.

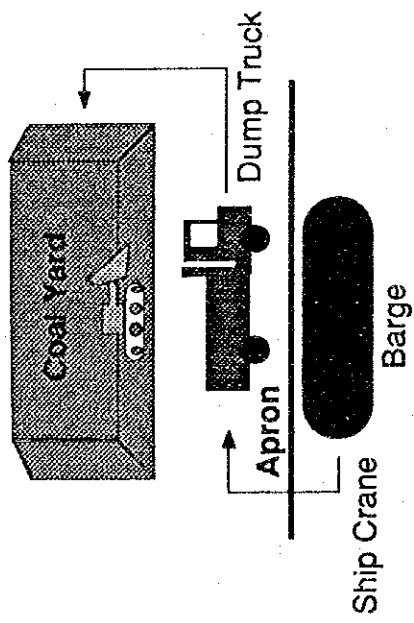
Parameters will be as follows:

$$W = 250$$

$$Tl = 120$$

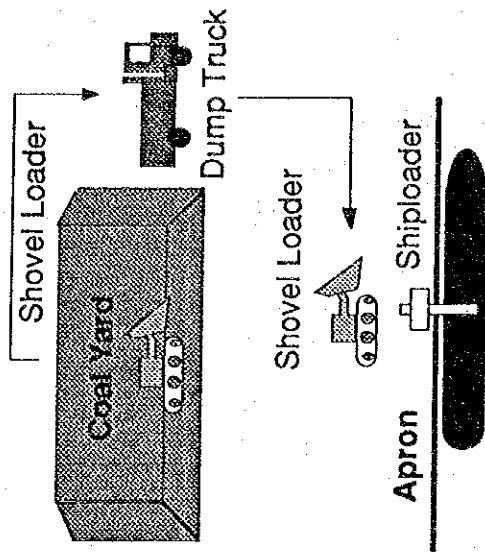
$$Td = 60$$

$$D = 0.5$$



Cargo Handling System  
Coal (Riverine Transport, in)  
Coal Terminal

Figure-9



Cargo Handling System  
Coal (Export)  
Coal Terminal

Figure-10

$$v = 20$$

$$FO = 10$$

then,

$$T = ( 120 + 60 ) / 3600 + 0.5 / 20 = 0.075$$

$$Fh = 10 / 0.075 = 133$$

$$n = 250 / ( 133 \times 0.75 ) = 2.5$$

As these operation cannot be carried out simultaneously, the required no. of trucks can be determined based on operation a. Consequently, the required no. of trucks will be five.

ii) Shovel Loader

$$n = W / ( Fh \times e ) \quad (5)$$

$$Fh = FO / T$$

Parameters will be as follows:

$$W = 250$$

$$T = 1 \text{ min} = 0.0167 \text{ hour}$$

$$FO = 3$$

then,

$$Fh = 3 / 0.0167 = 180$$

$$n = 250 / ( 180 \times 0.75 ) = 1.9$$

iii) small shovel Loader

equation (5) can be used

Parameters will be as follows:

$$W = 250 \text{t/h}$$

$$T = 0.25 \text{ min} = 0.0041 \text{ hour}$$

$$FO = 1$$

then,

$$Fh = 1 / 0.0041 = 240$$

$$n = 250 / ( 240 \times 0.75 ) = 1.4$$

iv) Ship Loader

One unit with capacity of 250 ton/h will be required.

v) Conclusion

Similarly, the required equipment in 2010 can be calculated based on the cargo volume in 2010. Table-12 and 13 show the required equipment in 1997 and 2010.

Table-12  
Required Cargo Handling Equipment (1997)  
Tg. Manis Coal Terminal

| Equipment     | Capacity         | T.Manis |
|---------------|------------------|---------|
|               |                  | Coal    |
| Truck         | 10 ton           | 4       |
| Shovel Loader | 3 m <sup>3</sup> | 2       |
| Shovel Loader | 1 m <sup>3</sup> | 2       |
| Shiploader    | 250 t/h          | 1       |

Table-13  
Required Cargo Handling Equipment (2010)  
Tg. Manis Coal Terminal

| Equipment     | Capacity         | T.Manis |
|---------------|------------------|---------|
|               |                  | Coal    |
| Truck         | 10 ton           | 9       |
| Shovel Loader | 3 m <sup>3</sup> | 2       |
| Shovel Loader | 1 m <sup>3</sup> | 2       |
| Shiploader    | 250 t/h          | 1       |



Appendix-II.6.2.1 Proposal for the New Navigation Markes Arrangement

LEGEND

LATERAL MARKS

Port hand Marks



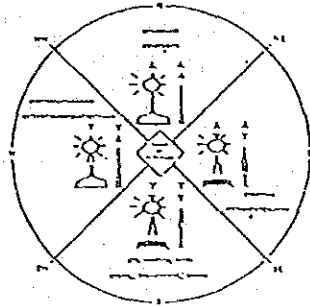
Light (when fitted)



Starboard hand Marks



Cardinal Marks



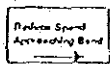
ISOLATED DANGER MARKS



SAFE WATER MARKS



NOTICE BOARD



LEADING BEACON

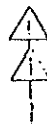


Figure-6.2.1(1)

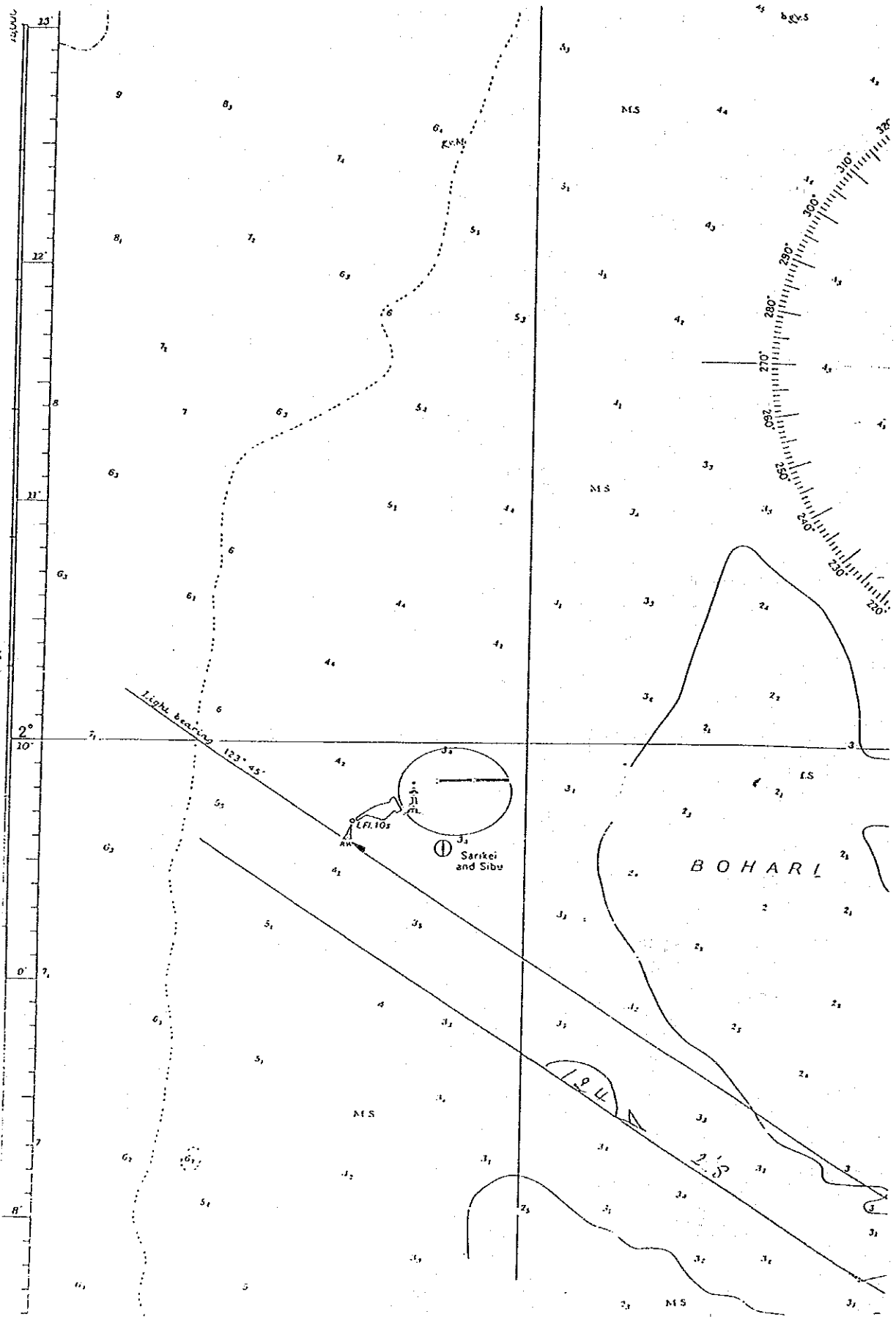


Figure-6.2.1(2)

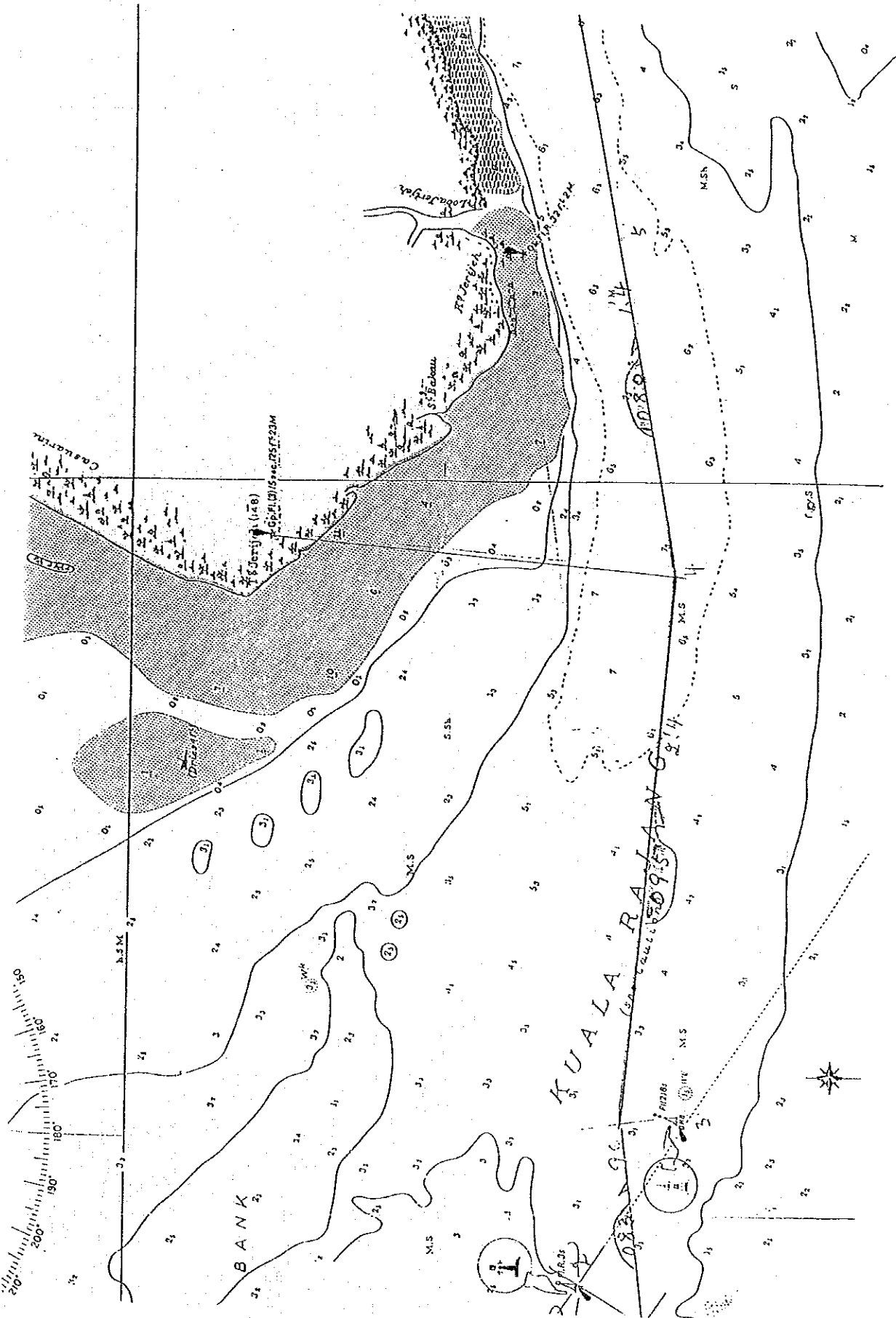


Figure-6.2.1(3)

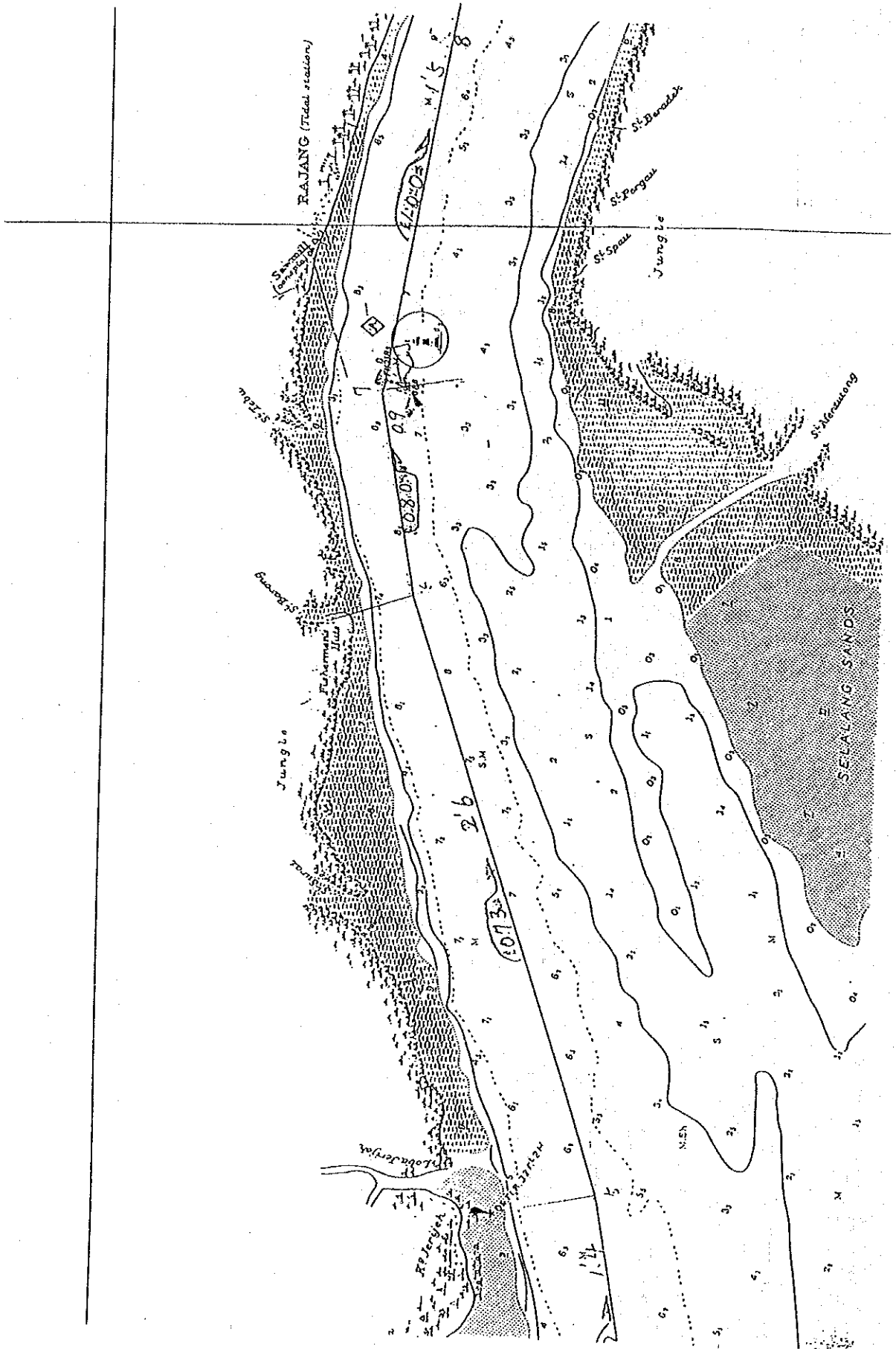


Figure-6.2.1(4)

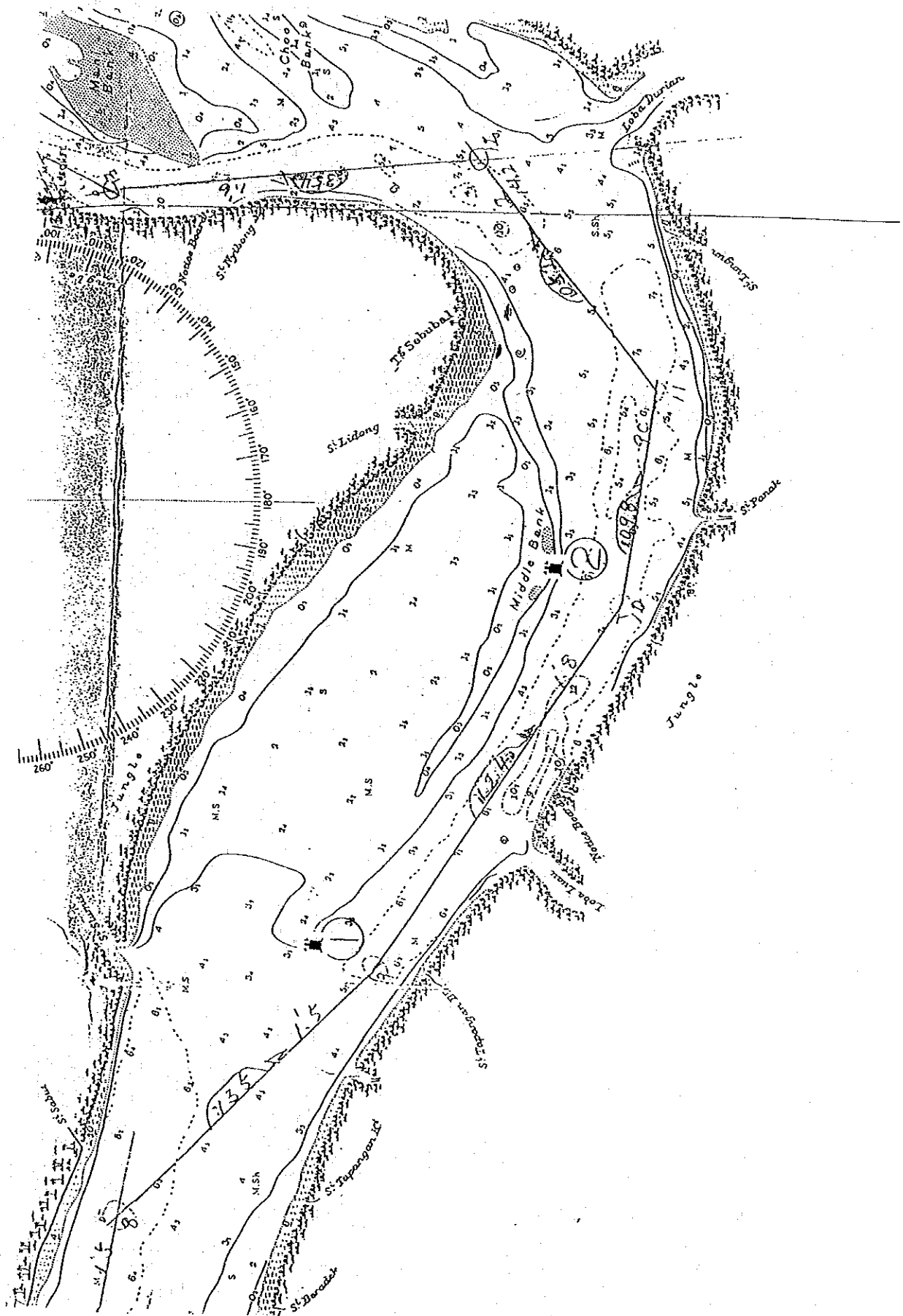


Figure-6.2.1(5)

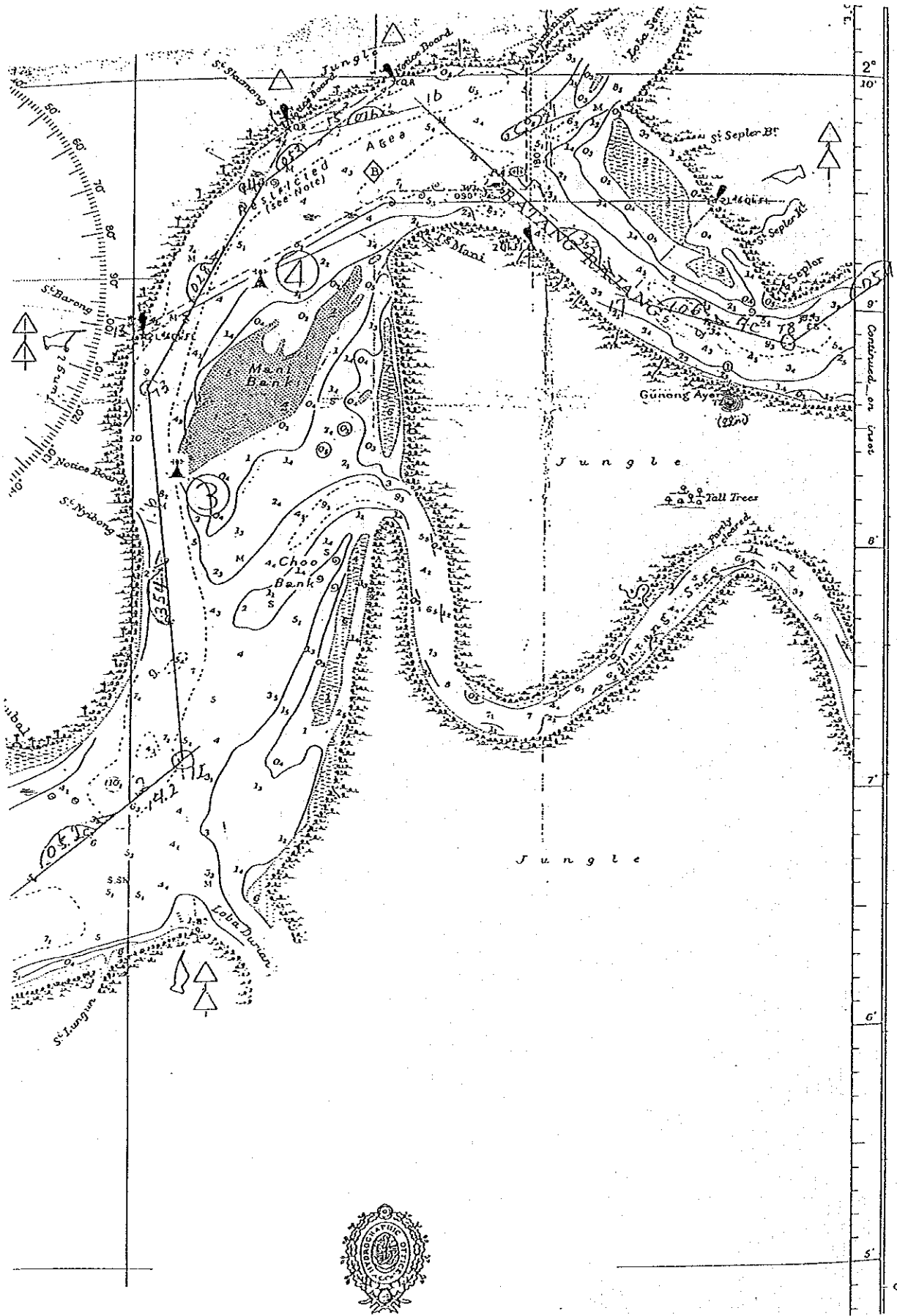


Figure-6.2.1(6)

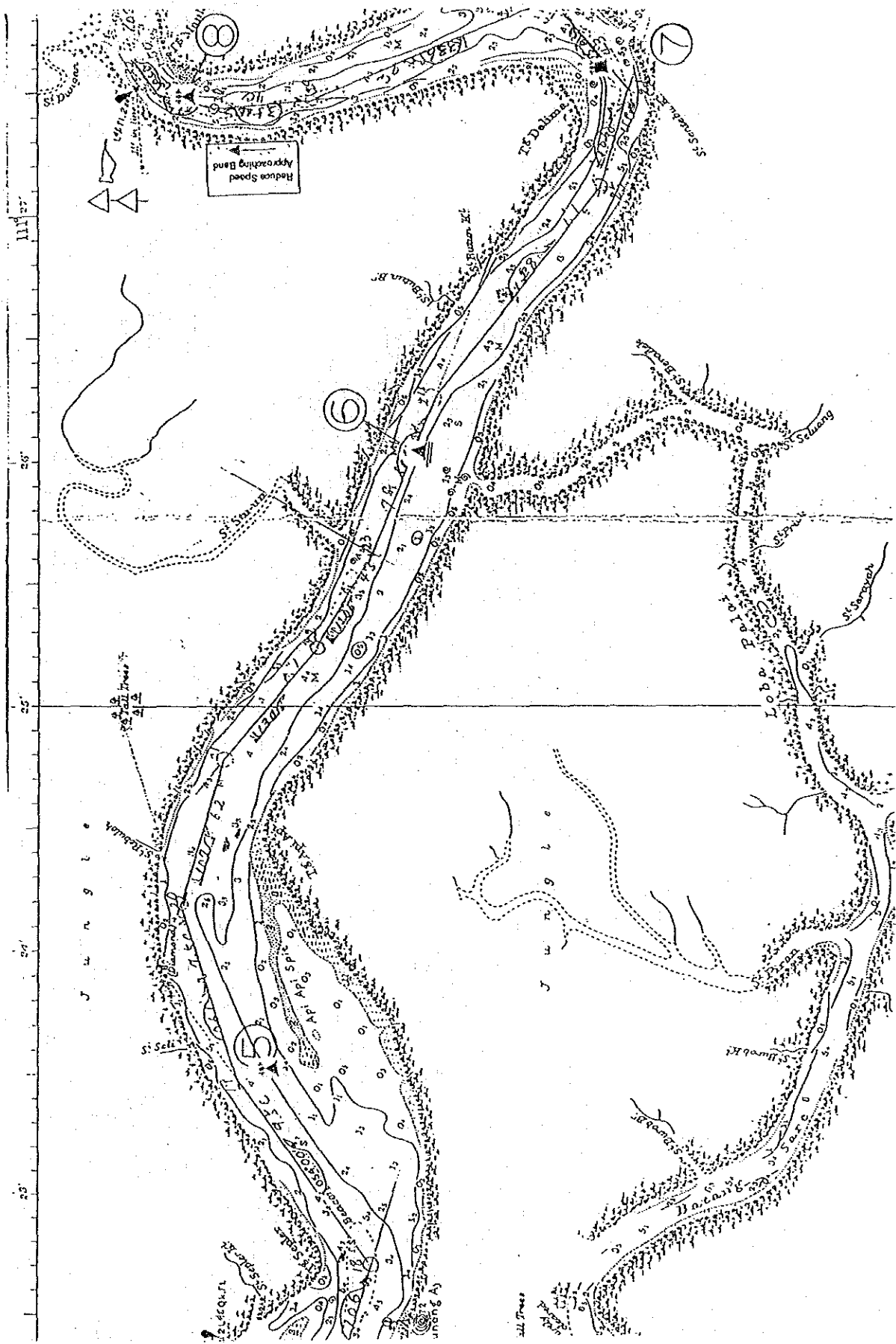


Figure-6.2.1(7)

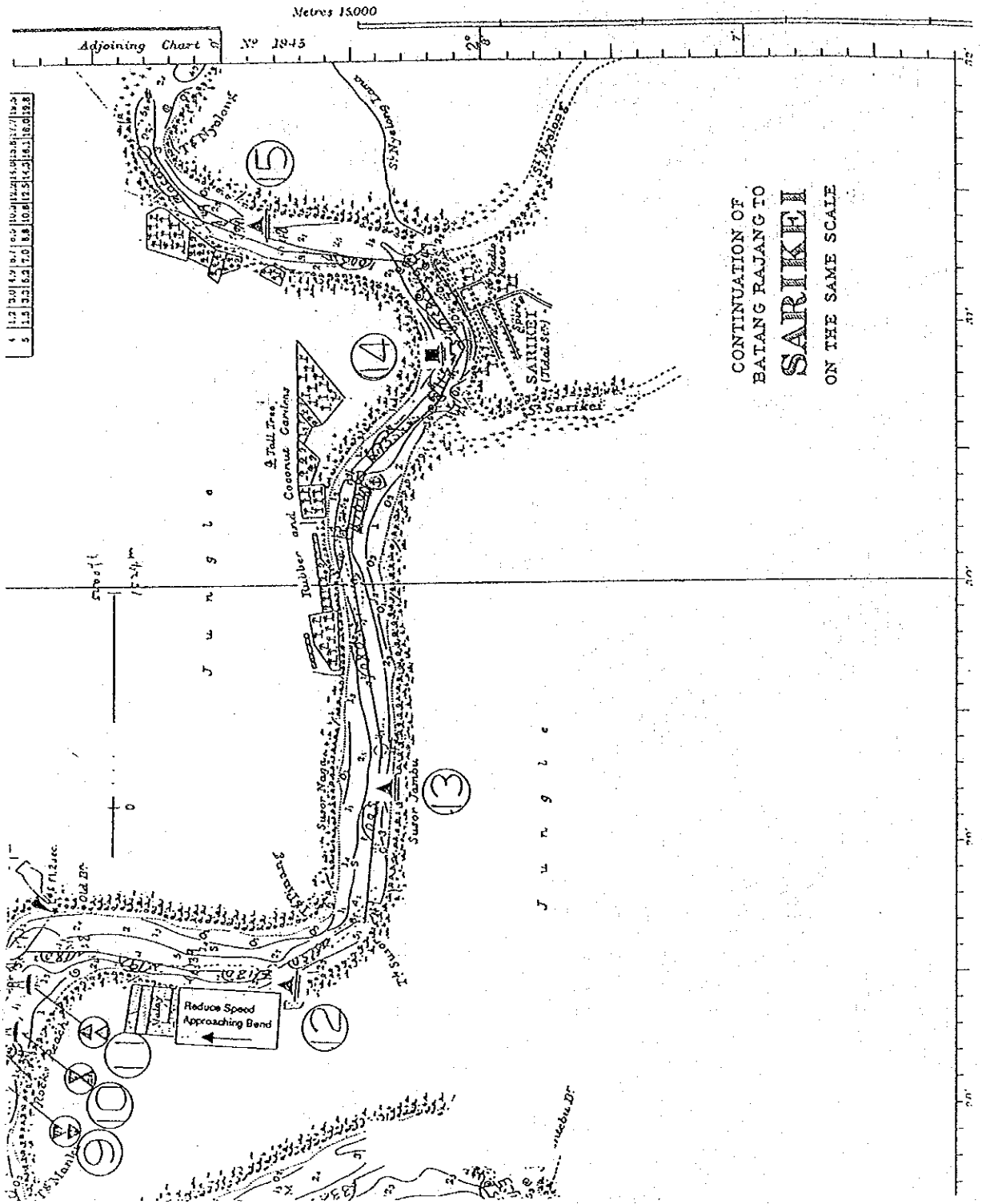
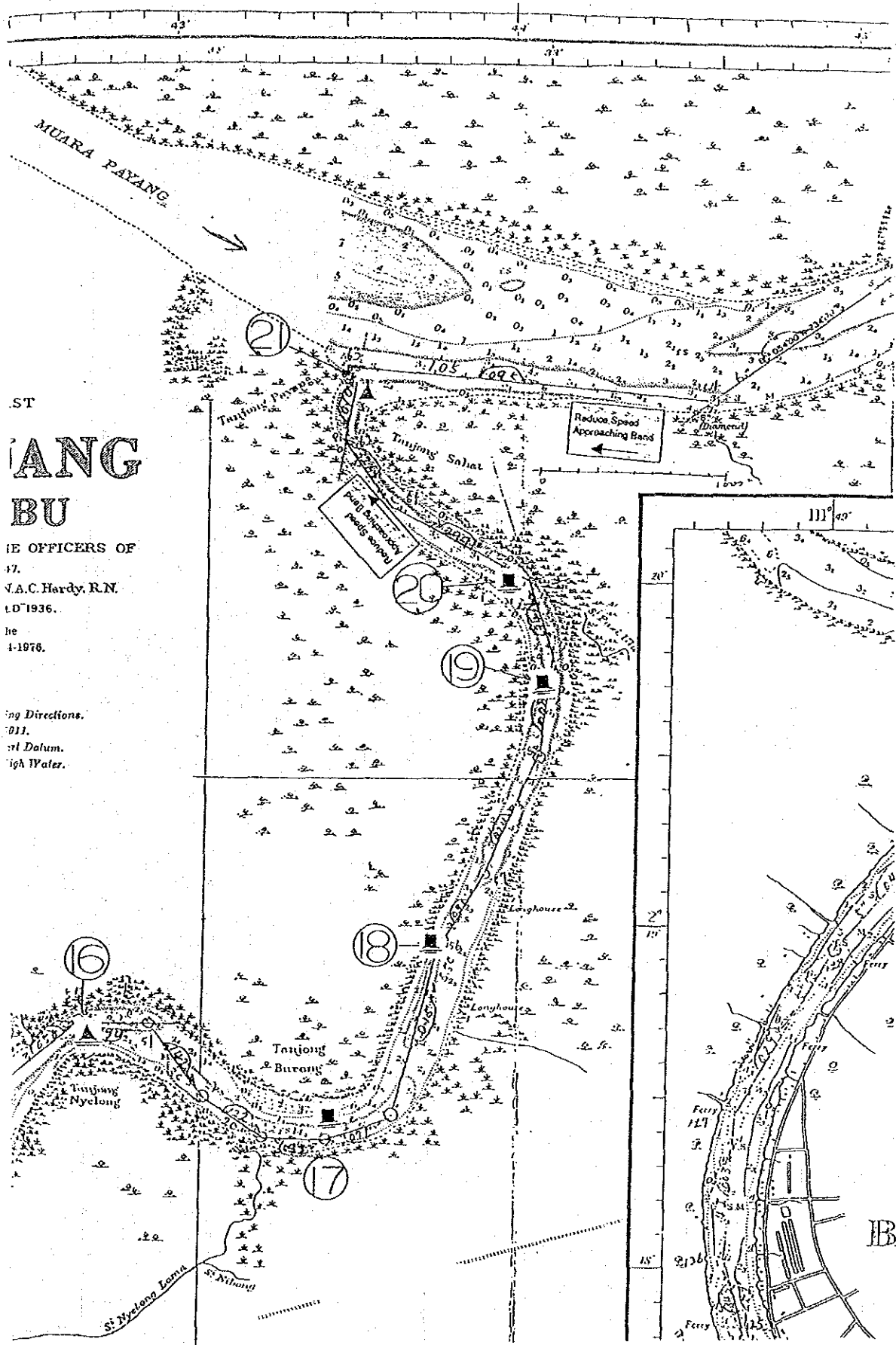


Figure-6.2.1(8)





ST  
**LANGBU**  
 CHIEF OFFICERS OF  
 No. 17.  
 V.A.C. Hardy, R.N.  
 L.D. 1936.  
 Date  
 1-1976.

Sounding Directions.  
 011.  
 Chart Datum.  
 High Water.

Figure-6.2.1(9)

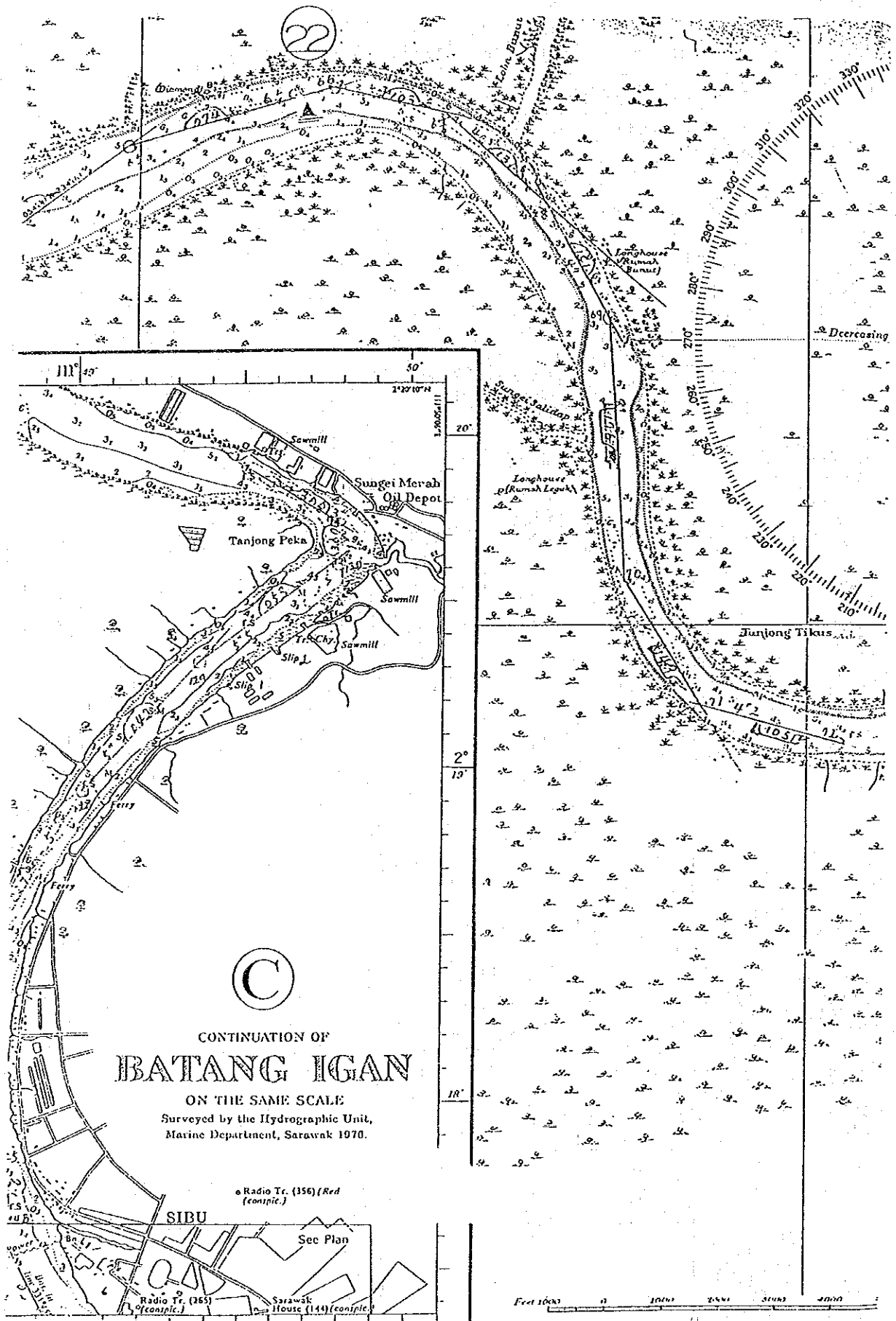
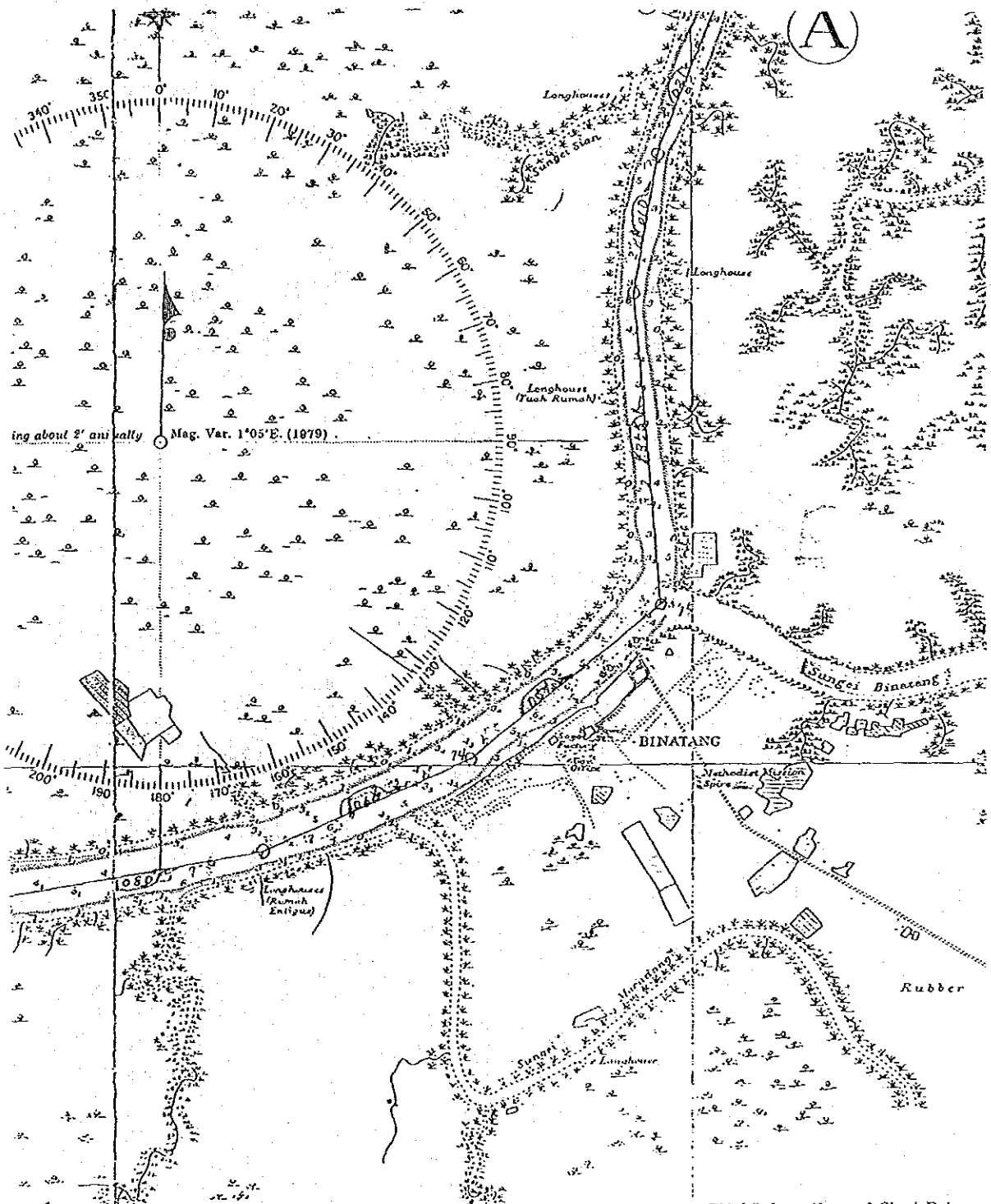


Figure-6.2.1(10)



Tidal Information and Chart Datum

| Place   | Height above datum of soundings |            |            |             |                                  |      |
|---------|---------------------------------|------------|------------|-------------|----------------------------------|------|
|         | Average Heights                 |            |            |             | Heights at Spring near the Solst |      |
|         | High Water                      |            | Low Water  |             | High Water                       | Low  |
|         | Mean Higher                     | Mean Lower | Mean Lower | Mean Higher | Mean Higher                      | Mean |
| Sarikci | 14.6 feet                       | 11.1 feet  | 3.3 feet   | 6.5 feet    | 16.2 feet                        | 0.4  |
| Leba-An | 12.2 "                          | 10.9 "     | 3.9 "      | 5.5 "       | 13.9 "                           | 0.5  |
| Sibu    | 10.7 "                          | 8.6 "      | 1.7 "      | 6.7 "       | 11.7 "                           | 3.2  |

Figure-6.2.1(11)

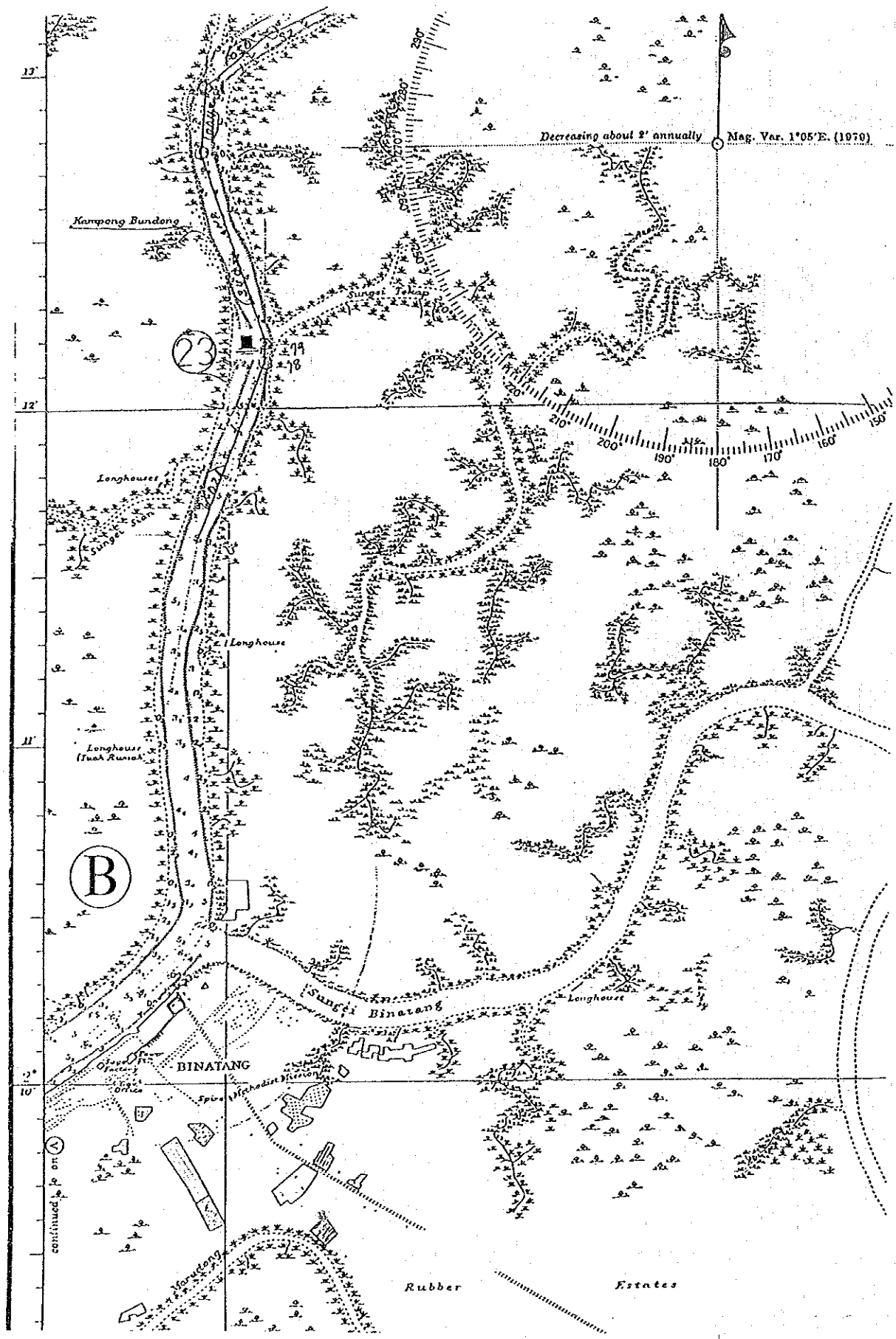


Figure-6.2.1(12)

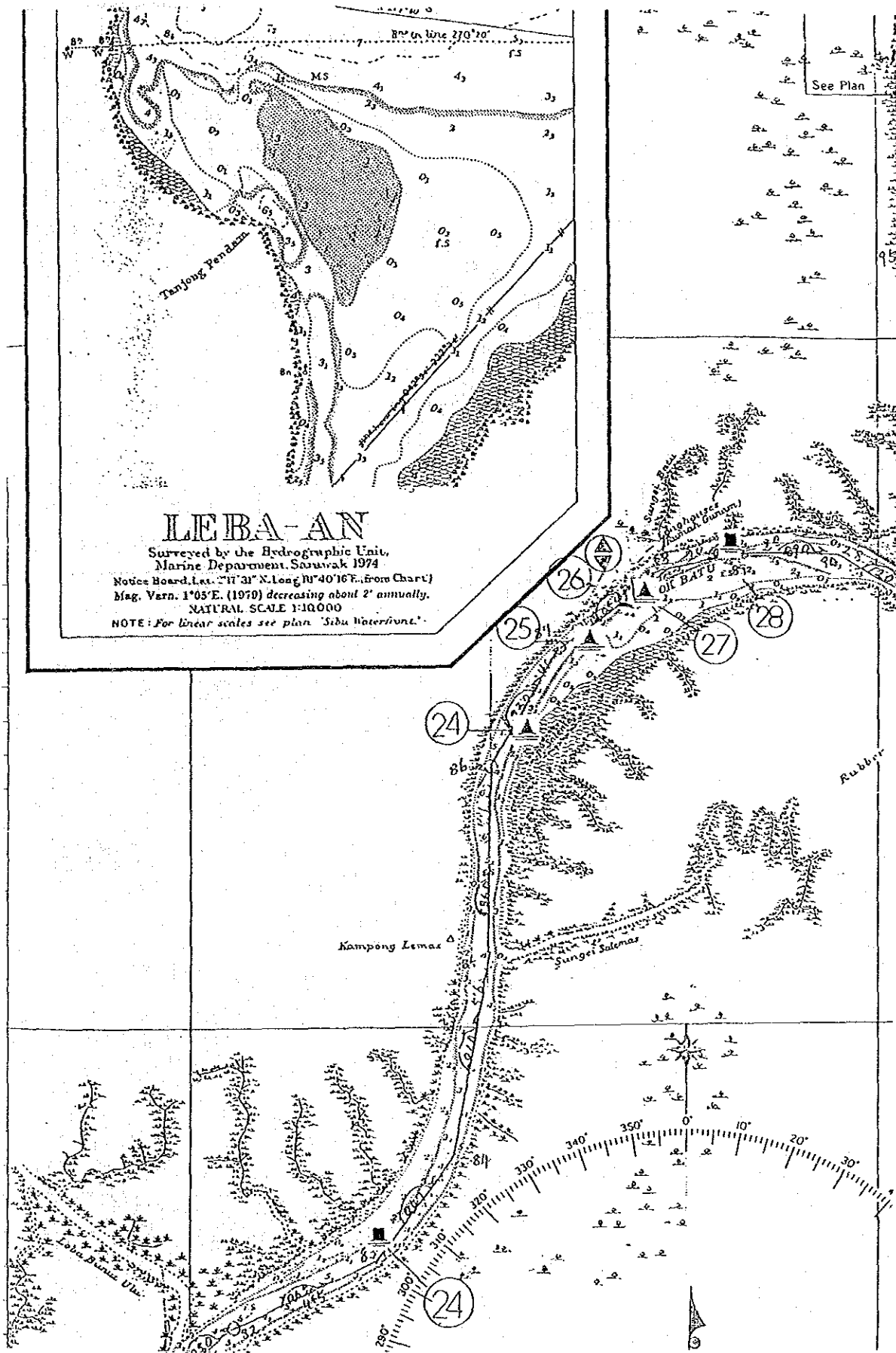


Figure-6.2.1(13)

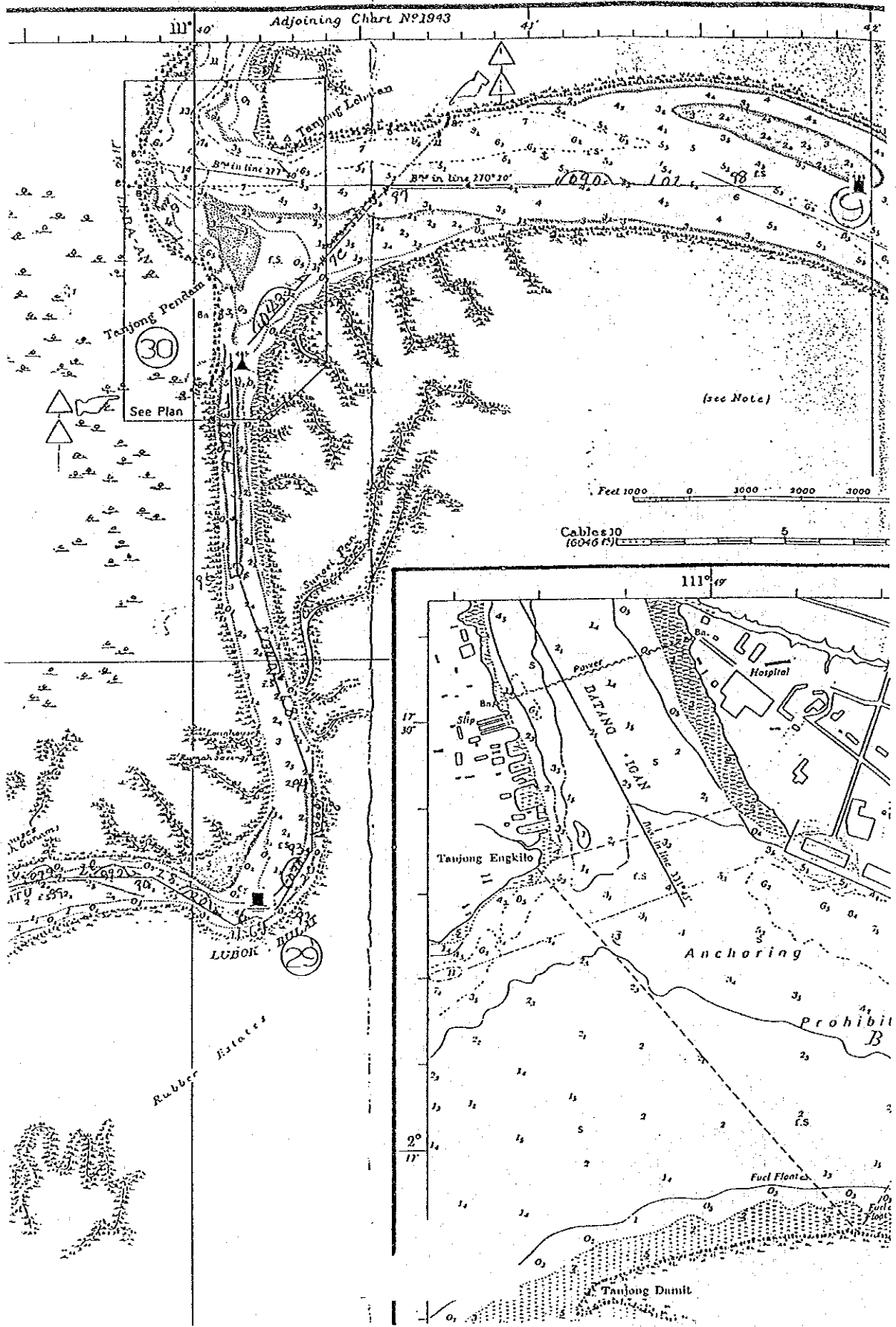


Figure-6.2.1(14)

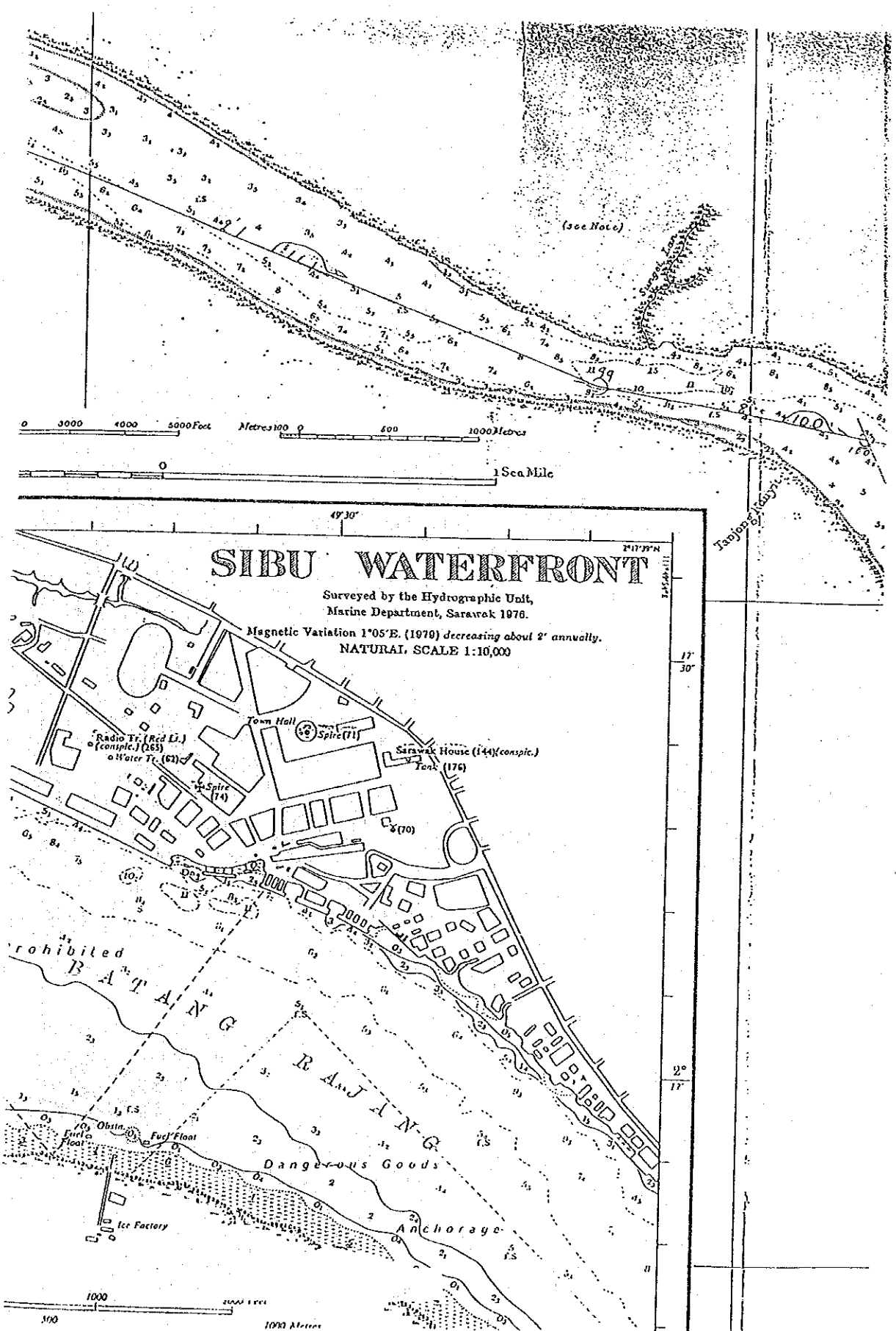


Figure-6.2.1(15)

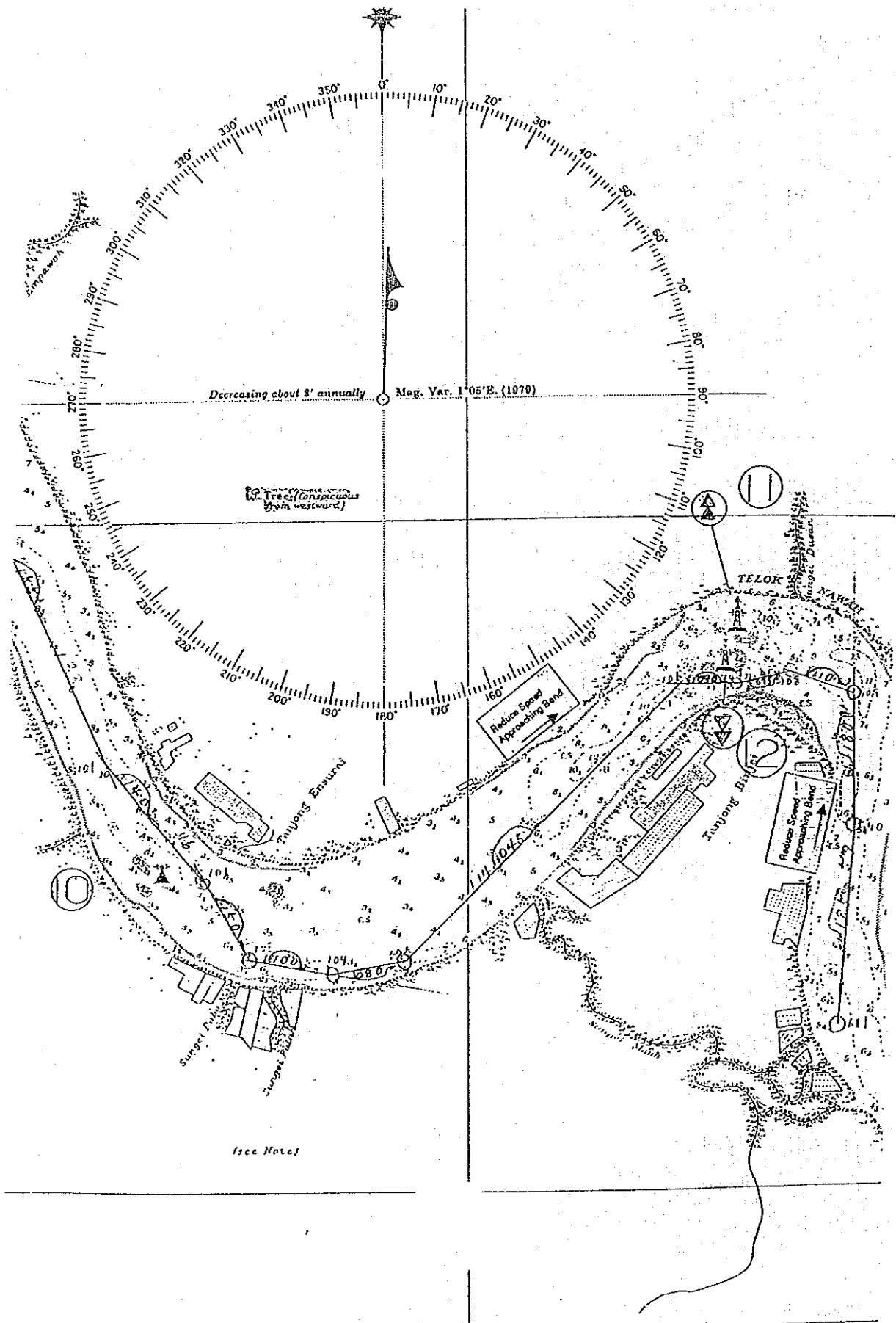


Figure-6.2.1(16)



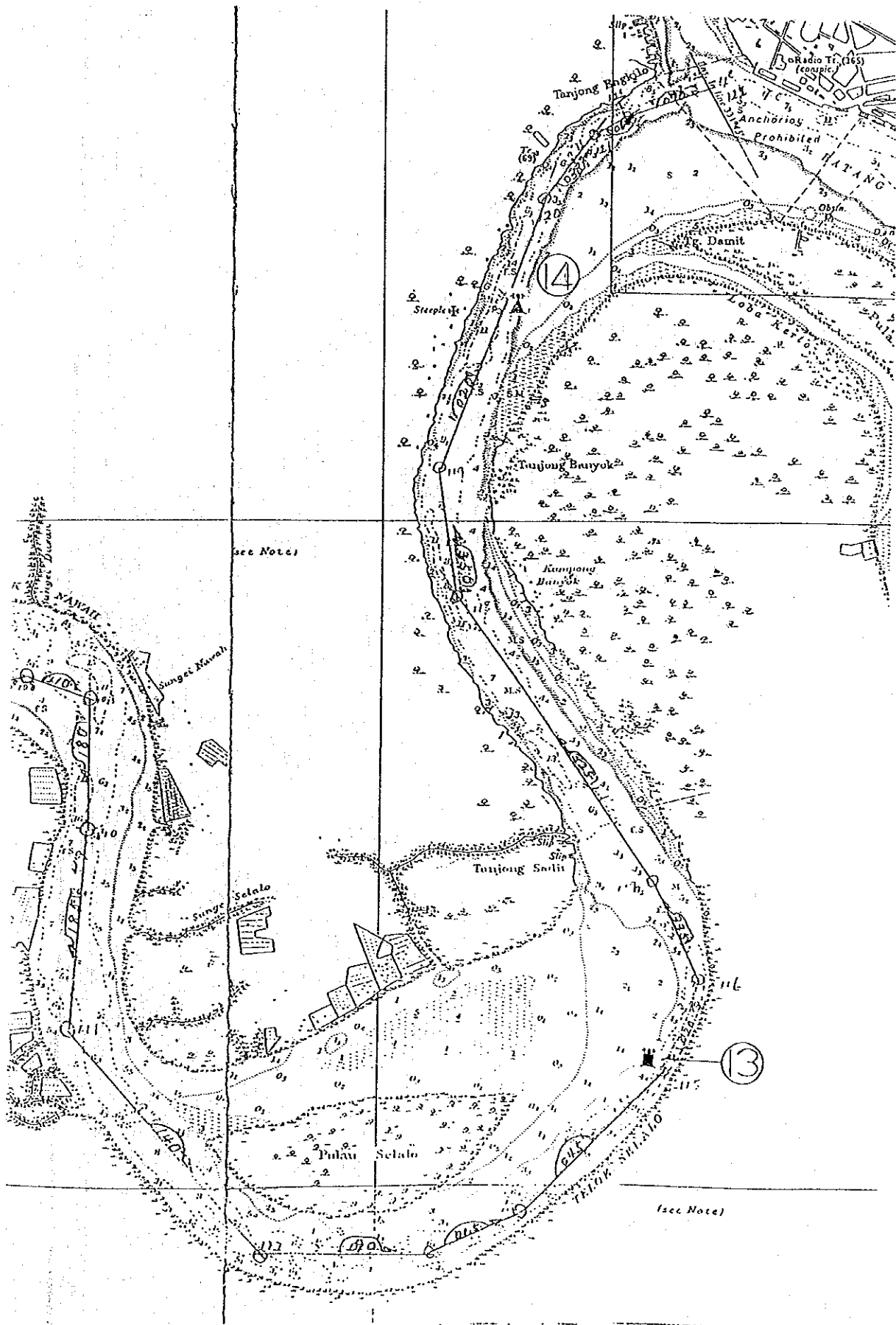


Figure-6.2.1(17)

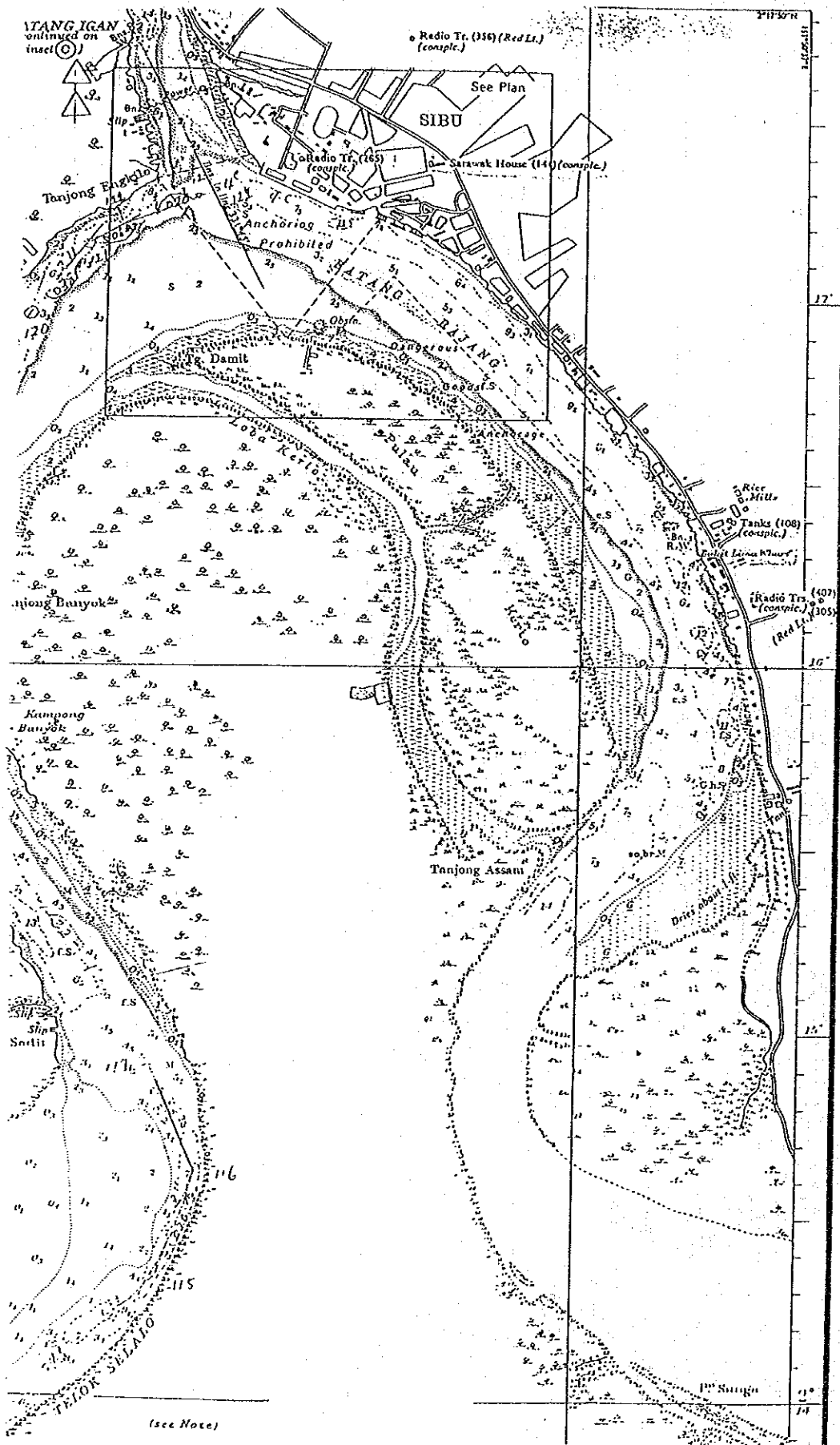


Figure-6.2.1(18)



Figure-6.2.1(19)

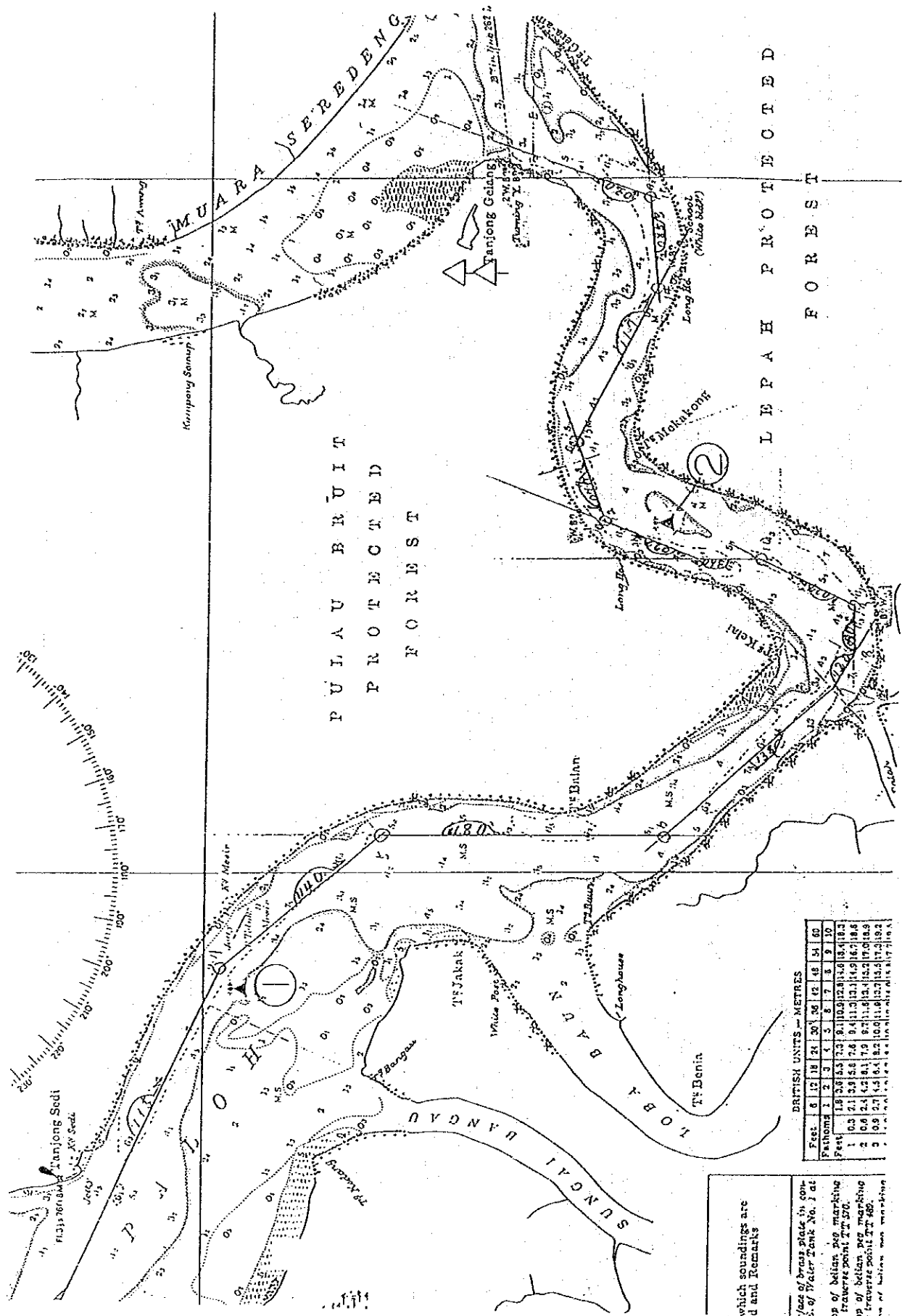


Figure-6.2.1(20)