

PORT KELANG (Alternative)

3/3

Table of Sewage Quantity

Zone - I

Table I.34.

| Zone - | | TABLE OF SEWERAGE CAPACITY | | | | | | | | | | DESIGNED SEWER | | | | | | | | | | Remarks |
|---------------|---------------------|----------------------------|-------|------------|----------------|-----------|-------|---------------------|---------------------|--------------|---------------------|----------------|-------|--------|---------------|---------------------|------------------|-------------|--------------------------|----------------|-----------|---------|
| No. of Sewers | No. of Joint Sewers | Area | | Population | Peaking Factor | Length | | Design Flow | | | | Diameter | Slope | Length | Full Velocity | Full Capacity | Invert Elevation | | Ground Surface Elevation | Earth Covering | | |
| | | Increment | Total | | | Increment | Total | Domestic Waste | Other | Infiltration | Area Flow | | | | | | Total | Begin Point | | | End Point | |
| | | ha | ha | persons | | m | m | m ³ /sec | m ³ /sec | ha | m ³ /sec | mm | % | m | m/sec | m ³ /sec | m | m | m | m | | |
| | | Flow to | | (31) | | | | | | | | | | | | | | | | | | |
| (30) | | 24.4 | | 73 | 7.27 | 488 | | 0.002 | 0.024 | 24.4 | 0.003 | 225 | 3.0 | 400 | 0.62 | 0.025 | -0.206 | -1.406 | 3.05 | 3.05 | | |
| (31) | (29) | 5.5 | 14.9 | 195 | 1.32 | 320 | 720 | 0.004 | 0.045 | 64.9 | 0.005 | 375 | 2.4 | 320 | 0.78 | 0.086 | -1.556 | -2.324 | 3.05 | 4.07 | | |
| (32) | (28) | 1.8 | 11.27 | 27.28 | 2.88 | 120 | 480 | 0.504 | 0.212 | 462.7 | 0.054 | 1050 | 0.9 | 120 | 0.95 | 0.819 | -5.574 | -5.682 | 3.05 | 7.57 | | |
| | | Flow to | | (30) | | | | | | | | | | | | | | | | | | |
| (33) | | 14.3 | | 193 | 1.32 | 300 | | 0.004 | 0.044 | 64.3 | 0.005 | 375 | 2.4 | 300 | 0.78 | 0.086 | -1.372 | 0.652 | 3.05 | 2.04 | | |
| (34) | | 19.2 | 23.5 | 251 | 1.48 | 220 | 520 | 0.005 | 0.050 | 83.5 | 0.007 | 375 | 2.4 | 220 | 0.78 | 0.086 | 0.652 | 0.124 | 3.05 | 2.58 | | |
| (35) | | 25.2 | 108.7 | 321 | 5.07 | 330 | 850 | 0.006 | 0.075 | 108.7 | 0.009 | 450 | 1.9 | 330 | 0.78 | 0.124 | 0.049 | -0.578 | 3.05 | 3.10 | | |
| (36) | | 31.6 | 148.3 | 421 | 5.66 | 500 | 1350 | 0.007 | 0.097 | 148.3 | 0.011 | 450 | 1.9 | 500 | 0.78 | 0.124 | -0.578 | -1.528 | 3.05 | 4.37 | | |
| (37) | | 4.8 | 145.1 | 435 | 5.63 | 220 | 1570 | 0.007 | 0.100 | 145.1 | 0.012 | 450 | 1.9 | 220 | 0.78 | 0.124 | -1.528 | -1.946 | 3.05 | 4.48 | | |
| (38) | (32) | 13.2 | 82.10 | 420.93 | 2.88 | 300 | 5220 | 0.513 | 0.320 | 82.1 | 0.067 | 1200 | 0.8 | 300 | 0.98 | 1.103 | -5.832 | -6.072 | 3.05 | 8.15 | | |
| | | Flow into Treatment Plant | | | | | | | | | | | | | | | | | | | | |
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Zone - 2, 3

Table of Sewage Quantity

Table I.35. 1/3

| No. of Sewers | No. of Joint Sewers | Area | | Population | Peaking Factor | Length | | Design Flow | | | | Designed Sewer | | | | | | Remarks | | | |
|---------------|---------------------|-----------|-------|------------|----------------|-----------|-------|----------------|-------|--------------|-------|----------------|-------|--------|---------------|---------------|---------------------|---------|----------------|----------------|----|
| | | Increment | Total | | | Increment | Total | Domestic Waste | Other | Infiltration | | Diameter | Slope | Length | Full Velocity | Full Capacity | Invert Elevation | | Ground Surface | Earth Covering | |
| | | | | | | | | | | ha | m | | | | | | m ² /sec | | | | ha |
| 1 | | 122.9 | | 11,983 | 3.51 | 710 | | 0.126 | — | 122.9 | 0.010 | 0.136 | 24 | 710 | 0.91 | 0.145 | -0.002 | -1.849 | 3.57 | 3.00 | |
| 2 | | 107.9 | 230.8 | 22,503 | 3.20 | 470 | 1,180 | 0.216 | — | 230.8 | 0.010 | 0.235 | 20 | 470 | 0.97 | 0.275 | -1.999 | -2.939 | 3.35 | 4.69 | |
| 3 | | 17.2 | 248.0 | 24,180 | 3.17 | 290 | 1,470 | 0.230 | — | 248.0 | 0.020 | 0.250 | 20 | 290 | 0.97 | 0.275 | -2.939 | -3.519 | 3.35 | 5.61 | |
| 4 | 3 | 13.1 | 261.1 | 25,466 | 3.15 | 210 | 1,680 | 0.241 | 0.001 | 261.1 | 0.021 | 0.263 | 20 | 210 | 0.97 | 0.275 | 1.675 | 1.255 | 3.51 | 1.58 | |
| 5 | | 24.1 | 285.2 | 27,810 | 3.11 | 310 | 1,990 | 0.260 | 0.003 | 285.2 | 0.023 | 0.286 | 20 | 310 | 1.05 | 0.376 | 1.180 | 0.560 | 3.35 | 2.03 | |
| 6 | | 26.2 | 311.4 | 30,370 | 3.07 | 280 | 2,270 | 0.280 | 0.006 | 311.4 | 0.025 | 0.311 | 20 | 280 | 1.05 | 0.376 | 0.560 | 0.000 | 3.35 | 2.03 | |
| 7 | | 24.5 | 335.9 | 32,764 | 3.04 | 310 | 2,580 | 0.300 | 0.008 | 335.9 | 0.027 | 0.335 | 20 | 310 | 1.05 | 0.376 | 0.000 | -0.620 | 3.05 | 2.91 | |
| 8 | | 27.6 | 363.5 | 35,460 | 3.00 | 590 | 3,170 | 0.319 | 0.010 | 363.5 | 0.029 | 0.358 | 20 | 590 | 1.05 | 0.376 | -0.620 | -1.800 | 3.20 | 4.24 | |
| 9 | | 49.6 | | 4,046 | 3.99 | 780 | | 0.038 | 0.004 | 49.6 | 0.004 | 0.066 | 35 | 780 | 0.94 | 0.104 | 0.238 | -2.422 | 2.77 | 2.10 | |
| 10 | | 11.5 | | 1,124 | 4.92 | 350 | | 0.017 | 0.001 | 11.5 | 0.001 | 0.019 | 40 | 350 | 0.71 | 0.028 | 1.694 | 0.244 | 2.90 | 1.00 | |
| 11 | 9 | 9.7 | 434.3 | 41,378 | 2.93 | 420 | 3,590 | 0.402 | 0.025 | 434.3 | 0.035 | 0.462 | 20 | 420 | 1.13 | 0.498 | 2.797 | -3.637 | 3.20 | 6.00 | |
| 12 | | 35.4 | | 3,459 | 4.19 | 380 | | 0.044 | 0.003 | 35.4 | 0.003 | 0.050 | 25 | 380 | 0.68 | 0.048 | 0.706 | -0.244 | 3.05 | 2.95 | |
| 13 | | 11.2 | 46.6 | 4,553 | 4.03 | 200 | 580 | 0.055 | 0.004 | 46.6 | 0.004 | 0.063 | 25 | 200 | 0.79 | 0.088 | -0.319 | -0.819 | 3.17 | 3.56 | |
| 14 | | 15.4 | 62.0 | 6,037 | 3.87 | 430 | 1,010 | 0.071 | 0.006 | 62.0 | 0.005 | 0.082 | 25 | 430 | 0.79 | 0.088 | -0.819 | -2.432 | 3.17 | 3.56 | |
| 15 | | 16.5 | | 1,612 | 4.67 | 330 | | 0.023 | 0.001 | 16.5 | 0.001 | 0.025 | 40 | 330 | 0.71 | 0.028 | -1.056 | -2.376 | 2.74 | 3.54 | |
| 16 | 11 | 2.8 | 515.6 | 50,321 | 2.86 | 240 | 3,830 | 0.498 | 0.032 | 515.6 | 0.042 | 0.572 | 16 | 240 | 1.14 | 0.724 | -3.787 | -4.171 | 3.20 | 5.99 | |
| | | flow to | | | 20 | | | | | | | | | | | | | | 3.05 | 6.22 | |

PORT KELANG (Alternative)

Table I.36.

Table of Sewage Quantity

| No. of Sewers | No. of Joint Sewers | Area | | Population | Peaking Factor | Length | | Design Flow | | | | Designed Sewer | | | | | | Remarks | | | | | |
|---------------|---------------------|-----------|-------|----------------------------------|----------------|--------|-------|----------------|-------|--------------|-------|----------------|-------|----------|-------|--------|---------------|---------|---------------|---------------------|---------------------|----------------|----------------|
| | | Increment | Total | | | m | m | Domestic Waste | Other | Infiltration | | Area Flow | Total | Diameter | Slope | Length | Full Velocity | | Full Capacity | Invert Elevation | | Ground Surface | Earth Covering |
| | | | | | | | | | | ha | ha | | | | | | | | | m ² /sec | m ² /sec | | |
| 17 | | 41.0 | | 4,006 | 4.10 | 310 | | 0.049 | 0.004 | 41.0 | 0.003 | 0.056 | 2.5 | 310 | 0.79 | 0.088 | -0.352 | -1.577 | 229 | 2.50 | | | |
| 18 | | 24.6 | 65.6 | 6,409 | 3.83 | 330 | 640 | 0.074 | 0.006 | 65.6 | 0.005 | 0.085 | 2.5 | 330 | 0.79 | 0.088 | -1.577 | -2.402 | 229 | 3.44 | | | |
| 19 | | 9.9 | 75.5 | 7,376 | 3.76 | 340 | 880 | 0.083 | 0.007 | 75.5 | 0.006 | 0.096 | 2.5 | 340 | 0.90 | 0.143 | -2.477 | -3.327 | 244 | 4.41 | | | |
| 20 | 16 | 13.4 | 604.7 | 59,026 | 2.79 | 450 | 4280 | 0.592 | 0.040 | 604.7 | 0.049 | 0.681 | 1.6 | 450 | 1.14 | 0.724 | -4.171 | -4.891 | 305 | 5.86 | | | |
| 21 | | 3.4 | 608.1 | 59,358 | 2.79 | 180 | 4460 | 0.595 | 0.034 | 608.1 | 0.049 | 0.698 | 1.6 | 180 | 1.14 | 0.724 | -4.891 | -5.179 | 335 | 7.24 | | | |
| | | Flow to | | | (26) | | | | | | | | | | | | | | | | | | |
| 22 | | 27.5 | | 2,687 | 4.34 | 470 | | 0.035 | 0.002 | 27.5 | 0.002 | 0.039 | 2.5 | 470 | 0.68 | 0.048 | 0.706 | -0.469 | 274 | 2.87 | | | |
| 23 | | 28.2 | 55.7 | 5,442 | 3.93 | 530 | 900 | 0.064 | 0.005 | 55.7 | 0.005 | 0.074 | 2.5 | 530 | 0.79 | 0.088 | -0.544 | -2.732 | 274 | 5.04 | | | |
| | | Flow to | | | (25) | | | | | | | | | | | | | | | | | | |
| 24 | | 14.3 | | 1,397 | 4.77 | 460 | | 0.020 | 0.001 | 14.3 | 0.001 | 0.022 | 4.0 | 460 | 0.71 | 0.028 | 1.644 | -0.196 | 274 | 1.00 | | | |
| 25 | 23 | 7.6 | 77.6 | 7,582 | 3.74 | 260 | 1,160 | 0.085 | 0.001 | 77.6 | 0.006 | 0.092 | 2.5 | 260 | 0.90 | 0.143 | -2.807 | -3.457 | 335 | 6.29 | | | |
| 26 | 21 | 7.3 | 693.0 | 47,653 | 2.75 | 160 | 4,020 | 0.686 | 0.056 | 693.0 | 0.056 | 0.798 | 1.4 | 160 | 1.18 | 1.022 | -5.329 | -5.525 | 335 | 7.32 | | | |
| | | | | Flow into Pumping Station and to | (27) | | | | | | | | | | | | | | | | | | |
| 27 | 26 | 13.9 | 706.9 | 67,943 | 2.74 | 360 | 4980 | 0.689 | 0.060 | 706.9 | 0.057 | 0.806 | 1.4 | 360 | 1.18 | 1.022 | -1.037 | -0.677 | 305 | 1.21 | | | |
| | | Flow to | | | (29) | | | | | | | | | | | | | | | | | | |
| 28 | | 28.1 | | 627 | 5.34 | 640 | | 0.010 | 0.007 | 28.1 | 0.002 | 0.019 | 3.0 | 640 | 0.62 | 0.023 | 0.756 | -2.444 | 310 | 2.00 | | | |
| 29 | 27 | 24.1 | 759.1 | 69,127 | 2.73 | 240 | 5,220 | 0.703 | 0.073 | 759.1 | 0.061 | 0.837 | 1.4 | 240 | 1.18 | 1.022 | -3.194 | -3.530 | 305 | 5.08 | | | |
| | | Flow to | | | (31) | | | | | | | | | | | | | | | | | | |
| 30 | | 22.3 | | 497 | 5.53 | 620 | | 0.008 | 0.006 | 22.3 | 0.002 | 0.016 | 3.0 | 620 | 0.62 | 0.023 | 0.756 | -2.444 | 310 | 2.00 | | | |
| 31 | 29 | 35.6 | 871.0 | 70,418 | 2.72 | 420 | 5,640 | 0.717 | 0.088 | 81.7 | 0.066 | 0.871 | 1.4 | 420 | 1.18 | 1.022 | -3.530 | -4.118 | 305 | 5.15 | | | |
| | | Flow to | | | (33) | | | | | | | | | | | | | | | | | | |
| 32 | | 15.4 | | 343 | 5.83 | 610 | | 0.006 | 0.004 | 15.4 | 0.001 | 0.011 | 3.0 | 610 | 0.62 | 0.023 | 0.756 | -2.444 | 310 | 2.00 | | | |

I.2. Outline of Pumping Stations

Table I.38. Design of Pumping Station

| No. of inter- mediate Pumping Station | Sewerage District | Sewerage Zone | Intermediate Pumping Station | | | | | | | Pumping Station of Treatment Plant | | | | |
|---|----------------------|------------------|---|--|----------------------------|--|------------------------------|-----------------|------------------------------|--|--------------------------------------|-------------|---------------------------|--|
| | | | Maximum Inflow (m ³ /Sec) Pipe (mm) | Diameter Slope of Sewer Pipe (%) | Invert Elevation (m) | Required Force Main Land Space (m ²) (ømm x m) | Diameter of Pumps (mm) | No. of Pumps | Total Pump Head (m) | Maximum Inflow (m ³ /Sec) Pipe (mm) | Diameter of Sewer of Pump (mm) | No. of Pump | Total Pump Head (m) | |
| 1 | Kelang North | 1 | 0.518 ø900 ø450 | 1.2 1.9 | -4.099 -3.348 | 350 ø600x950 | ø300 | 3 | 15 | 0.888 (No. 1) | ø1,200 | 5 | 12 | |
| 2 | " | 1 | 0.489 ø900 | 1.3 | -3.430 | 380 ø300x 30 ø350x 35 | ø500 | 2 | 13 | - | - | - | - | |
| 3 | " | 2 | 0.126 ø525 | 1.5 | -5.321 | 210 ø300x 50 | ø250 | 2 | 12 | 0.935 (No. 2) | ø1,200 | 4 | 12 | |
| 4 | " | 2 | 0.255 ø750 ø300 | 1.3 2.0 | -4.273 -0.044 | 270 ø375x 30 | ø300 | 2 | 11 | - | - | - | - | |
| 5 | Kelang South | 1 | 0.326 ø600 ø525 | 2.0 2.0 | -3.584 -1.763 | 300 ø450x 30 | ø400 | 2 | 10 | 0.784 (No. 3) | ø1,050 | 4 | 12 | |
| 6 | " | 2 | 0.730 ø900 ø300 ø300 | 1.6 2.5 2.0 | -6.451 -3.119 -2.524 | 480 ø600x100 | ø500 | 2 | 11 | 0.794 (No. 4) | ø1,050 | 4 | 13 | |
| 7 | Port Kelang | 1 2 | - 0.250 ø600 | - 2.0 | - -3.519 | - 265 ø375x 50 | - ø400 | - 2 | - 11 | 0.642 (No. 5) 0.927 (No. 6) | ø1,050 ø1,200 | 4 4 | 12 12 | |
| 8 | " | 2 | 0.223 ø525 ø300 ø375 | 1.9 4.0 3.5 | -5.108 -1.554 -4.164 | 255 ø375x 30 | ø300 | 2 | 9 | - | - | - | - | |
| 9 | " | 2 | 0.812 ø1,050 | 1.0 | -4.707 | 500 ø675x 30 | ø650 | 2 | 10 | - | - | - | - | |
| 10 | Kapar | - | 0.072 ø450 | 1.8 | -4.188 | 185 ø225x 30 | ø200 | 2 | 14 | (No. 7a) ø 600 (No. 7b) ø 600 0.248 ø 600 (No. 8) | ø300 ø300 ø300 | 2 2 2 | 10 10 13 | |
| 11 | " | - | 0.096 ø450 | 1.9 | -4.020 | 195 ø225x 30 | ø200 | 2 | 12 | - | - | - | - | |
| 12 | Meru | - | 0.091 ø375 ø225 | 2.6 3.0 | -1.728 1.414 | 195 ø225x 30 | ø200 | 2 | 11 | 0.289 (No. 9) | ø 675 ø400 | 2 | 9 | |

I.3. Design of Treatment Plants

Table I.39. Design Conditions of Treatment Plants

| No. of Plant | Sewerage District (ha) | Sewerage Zone (ha) | Daily Average Inflow (m ³ /day) | Total BOD Load (kg/day) | Design Conditions of Treatment Plants | | | | | | Remarks |
|--------------|------------------------|--------------------|--|-------------------------|---------------------------------------|---------------|--------------|----------------------|----------------------------------|---------------------------|--|
| | | | | | Flow (mm) | Diameter (mm) | Slope (o/oo) | Invert Elevation (m) | Design Required Grand Height (m) | Available Land Space (ha) | |
| 1 | Kelang North | Zone 1 (43) 943 | 33,478 | 5,456 5,575 | ø1,200 | 1.0 | -4.327 | +4,200 | 14 | 12.7 | Excluded Zone-3 (973 ha) |
| 2 | (152) 2,204 | Zone 2 (109) 1,261 | 36,985 | 5,437 5,976 | ø1,200 | 0.8 | -5.043 | +3,400 | 14 | 20.0 | |
| 3 | Kelang South | Zone 1 (689) 659 | 29,019 | 4,398 4,398 | ø1,050 | 1.4 | -6.490 | +3,600 | 12 | 10.0 | Excluded Zone-3 (731 ha) |
| 4 | (689) 1,486 | Zone 2 (-) 827 | 29,300 | 4,786 4,786 | ø1,050 | 1.4 | -4.842 | +3,400 | 13 | 10.0 | |
| 5 | Port Kelang | Zone 1 (-) 635 | 25,536 | 3,759 4,235 | ø1,050 | 0.7 | -5.782 | +3,400 | 10 | 10.0 | Excluded Zone-3 (824 ha) and industrial area |
| 6 | (-) 1,744 | Zone 2,3 (-) 1,109 | 35,414 | 5,512 5,772 | ø1,200 | 0.9 | -0.051 | +3,400 | 14 | 20.0 | |
| 7-a | North Port | Zone 1 (12) 461 | 4,848 | 751 751 | ø 600 | 1.0 | -3.892 | +3,400 | 2 | 3.0 | Excluded Zone-3 (824 ha) and industrial area |
| 7-b | (20) 810 | Zone 2 (8) 349 | 5,431 | 822 822 | ø 600 | 1.5 | 2.231 | +3,400 | 2 | 3.0 | |
| 8 | Kapar (-) 621 | - | 7,183 | 1,051 1,051 | ø 675 | 1.2 | -4.292 | +3,600 | 6 | 10.0 | Excluded Zone (2,528ha) |
| 9 | Meru (-) 573 | - | 10,476 | 589 589 | ø 675 | 1.3 | -3.275 | +4,700 | 7 | 10.0 | |
| Total | (861) 7,438 | | 217,670 | 32,561 33,955 | | | | | | | |

Note: In columns of sewerage district and sewerage zone, () indicates outer area

Table I.40. Design of Stabilization Ponds

| No. of Plant | Facultative Pond | | | | | | | Maturation Pond (two series ponds) | | | | | | | | | | Required Land Space (ha) |
|--------------|--------------------------------------|-----------|-----------|-------|--------|---|--------------------------------------|---|-------------------|-----------------------------------|----------------------|----------|-------|------------------------------------|--------------------------------------|----|--|--------------------------|
| | Q _i (m ³ /day) | Li (mg/l) | Le (mg/l) | D (m) | T (°C) | Required Surface Area A by BOD Loading (ha) | Size of Pond (WxLxDx) (No. of Ponds) | Retention Time $t_f = \frac{A \times D}{Q_i}$ (day) | Ni (No.) | K _b (d ⁻¹) | t _m (day) | Ne (No.) | D (m) | A = $\frac{Q_i \cdot t_m}{D}$ (ha) | Size of Pond (WxLxDx) (No. of Ponds) | | | |
| 1 | 33,478 | 163 | 50 | 1.5 | 22 | 12.7 | 17.0 150x300 xl.5x4 | 8.1 | 4x10 ⁷ | 3.7 | 3 | 30,105 | 1.5 | 6.7 | 150x300 xl.5x4 | 32 | | |
| 2 | 36,985 | 147 | " | " | " | 12.1 | 17.0 " | 7.3 | " | " | " | 33,286 | " | 7.4 | " | 32 | | |
| 3 | 29,019 | 152 | " | " | " | 9.9 | 13.7 150x300 xl.5x3 | 7.0 | " | " | " | 34,660 | " | 5.8 | 150x140 xl.5x3 | 26 | | |
| 4 | 29,300 | 163 | " | " | " | 11.1 | 15.0 150x250 xl.5x4 | 7.7 | " | " | " | 31,616 | " | 5.9 | " | 28 | | |
| 5 | 25,536 | 147 | " | " | " | 8.3 | 11.7 150x250 xl.5x3 | 6.6 | " | " | " | 36,678 | " | 5.1 | 150x120 xl.5x3 | 22 | | |
| 6 | 35,414 | 156 | " | " | " | 12.6 | 17.2 150x300 xl.5x4 | 7.6 | " | " | " | 32,017 | " | 7.1 | 150x130 xl.5x4 | 32 | | |
| 7 | a. 4,848 | 155 | " | " | " | 1.7 | 2.3 80x150x 1.5x2 | 7.4 | " | " | " | 32,852 | " | 1.0 | 60x160 xl.5x1 | 4 | | |
| | b. 5,431 | 151 | " | " | " | 1.8 | 2.6 90x150x 1.5x2 | 7.5 | " | " | " | 32,429 | " | 1.1 | 60x180 xl.5x1 | 5 | | |
| 8 | 7,183 | 146 | " | " | " | 2.3 | 3.3 150x220 xl.5x1 | 6.9 | " | " | " | 35,143 | " | 1.4 | 150x140 xl.5x1 | 10 | | |
| 9 | 10,476 | 137 | " | " | " | 3.1 | 4.5 145x145 xl.5x2 | 6.0 | " | " | " | 40,187 | " | 2.1 | 150x90 xl.5x2 | 10 | | |

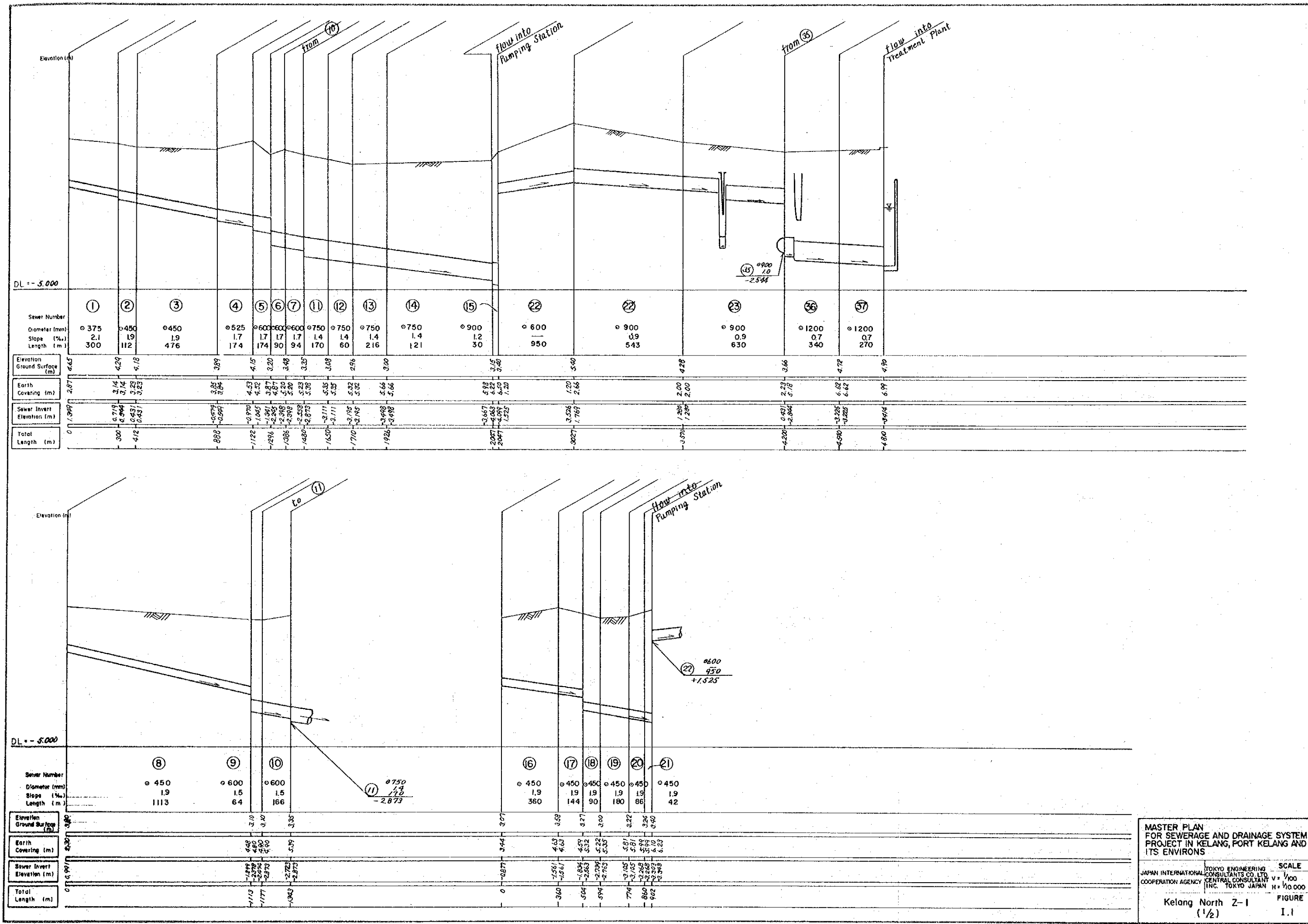
Table I.41. Design of Aerated Lagoons

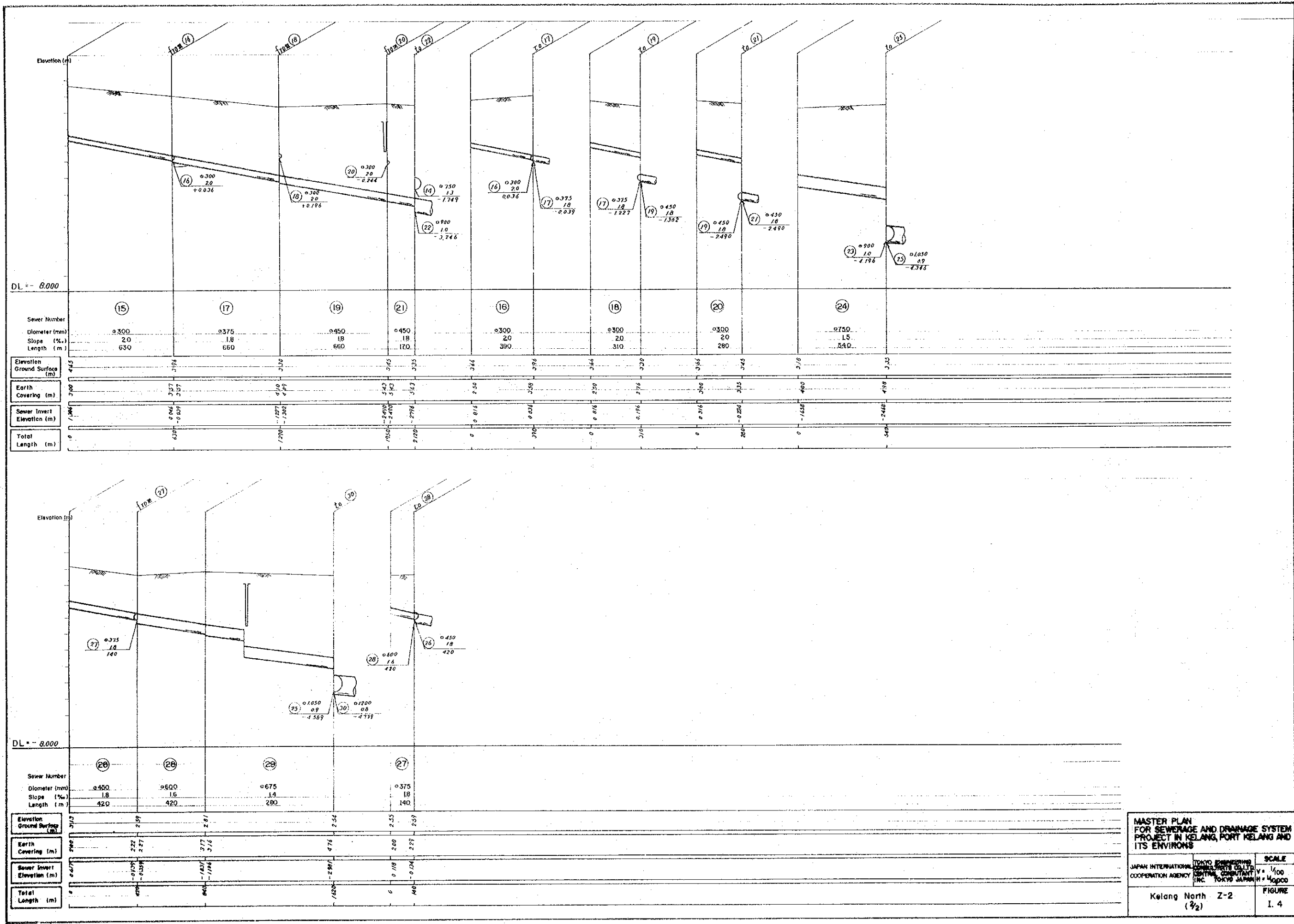
| No. of Plant | Aerated Lagoon (h=3.0m) | | | | | Maturation Pond(two series pond) | | | | | | | | | | Required Land Space (ha) |
|--------------|--------------------------|-----------|----------------------|------------------------|------------------|---|---|-----------------------------|-------------------|-----------------------|----------|----------|-------|------------------------------------|------------------------------------|--------------------------|
| | Qi (m ³ /day) | Li (mg/l) | K (d ⁻¹) | Fe=Li / (1+K.t) (mg/l) | BOD Loading (ha) | Required Size of Pond (WxLxDx No. of Ponds) | Retention Time $t_f = \frac{A \times D}{Q_i}$ (day) | No. of FC/100ml of Effluent | Ni (No.) | Kb (d ⁻¹) | tm (day) | Ne (No.) | D (m) | $A = \frac{Q_i \cdot t_m}{D}$ (ha) | Size of Pond (WxLxDx No. of Ponds) | |
| 1 | 33,478 | 163 | 5.4 | 3 | 10 | 3.6 | 100x125 x3.0x3 | 3.4 | 4x10 ⁷ | 3.7 | 3 | 68,656 | 1.5 | 6.7 | 100x240 x1.5x3 | 14 |
| 2 | 36,985 | 147 | " | " | 9 | 3.6 | " | 3.0 | " | " | " | 77,053 | " | 7.4 | " | 14 |
| 3 | 29,019 | 152 | " | " | 9 | 2.9 | 100x100 x3.0x3 | 3.1 | " | " | " | 74,767 | " | 5.8 | 100x200 x1.5x3 | 12 |
| 4 | 29,300 | 163 | " | " | 10 | 3.2 | 100x110 x3.0x3 | 3.4 | " | " | " | 68,656 | " | 5.9 | " | 13 |
| 5 | 25,536 | 147 | " | " | 9 | 2.5 | 100x125 x3.0x2 | 2.9 | " | " | " | 79,484 | " | 5.1 | 100x250 x1.5x2 | 10 |
| 6 | 35,414 | 156 | " | " | 9 | 3.7 | 100x125 x3.0x3 | 3.2 | " | " | " | 72,613 | " | 7.1 | 100x240 x1.5x3 | 14 |
| 7 | a. 4,848 | 155 | " | " | 9 | 0.5 | 70x70 x3.0x1 | 3.0 | " | " | " | 77,053 | " | 1.0 | 70x140 x1.5x1 | 2 |
| | b. 5,431 | 151 | " | " | 9 | 0.6 | 80x80 x3.0x1 | 3.5 | " | " | " | 66,835 | " | 1.1 | 80x140 x1.5x1 | 2 |
| 8 | 7,183 | 146 | " | " | 8 | 0.7 | 100x50 x3.0x2 | 4.2 | " | " | " | 56,369 | " | 1.4 | 100x100 x1.5x2 | 3 |
| 9 | 10,476 | 137 | " | " | 8 | 1.0 | " | 2.9 | " | " | " | 79,484 | " | 2.1 | 100x125 x1.5x2 | 4 |

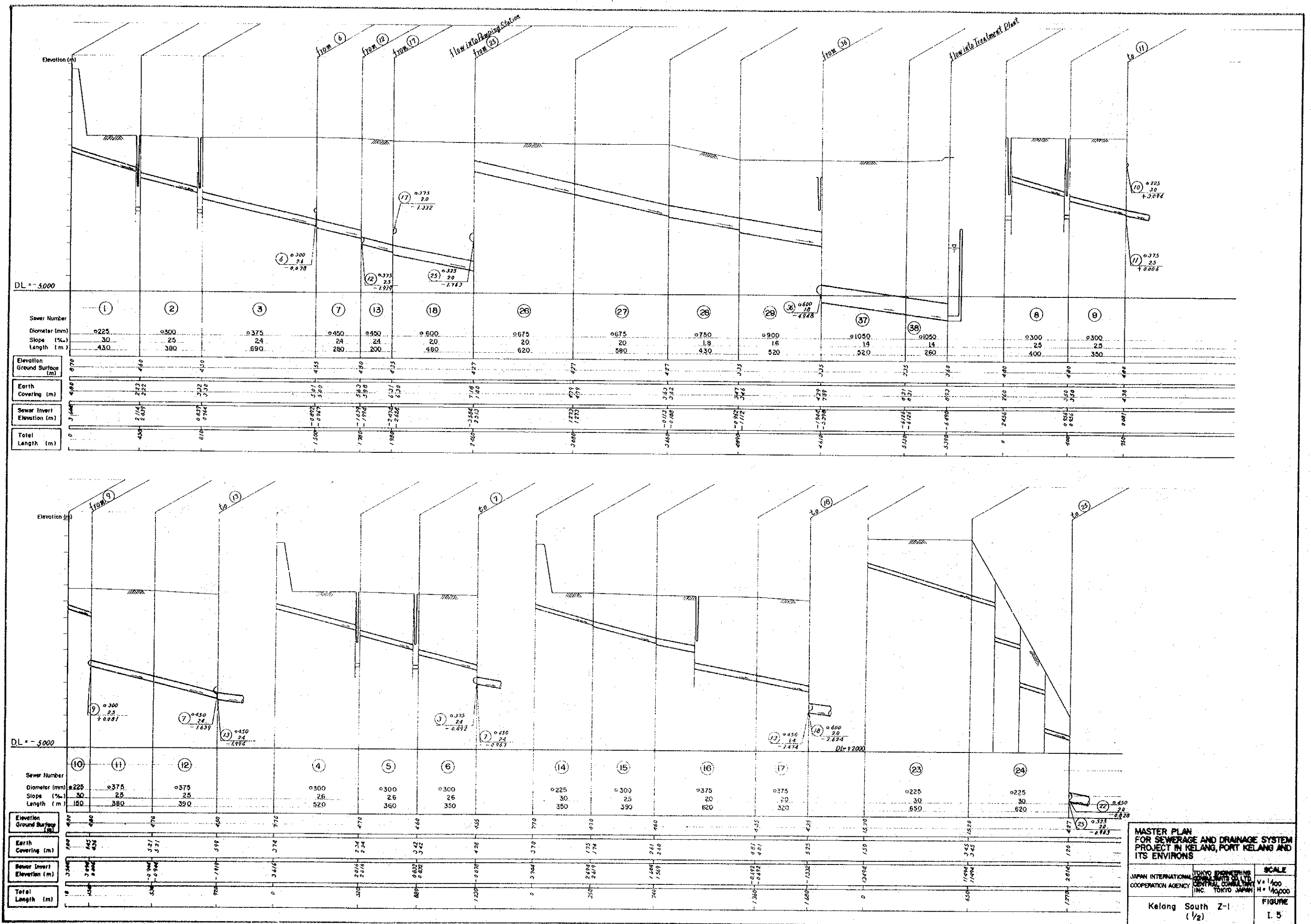
Table I.42. Design of Oxidation Ditches

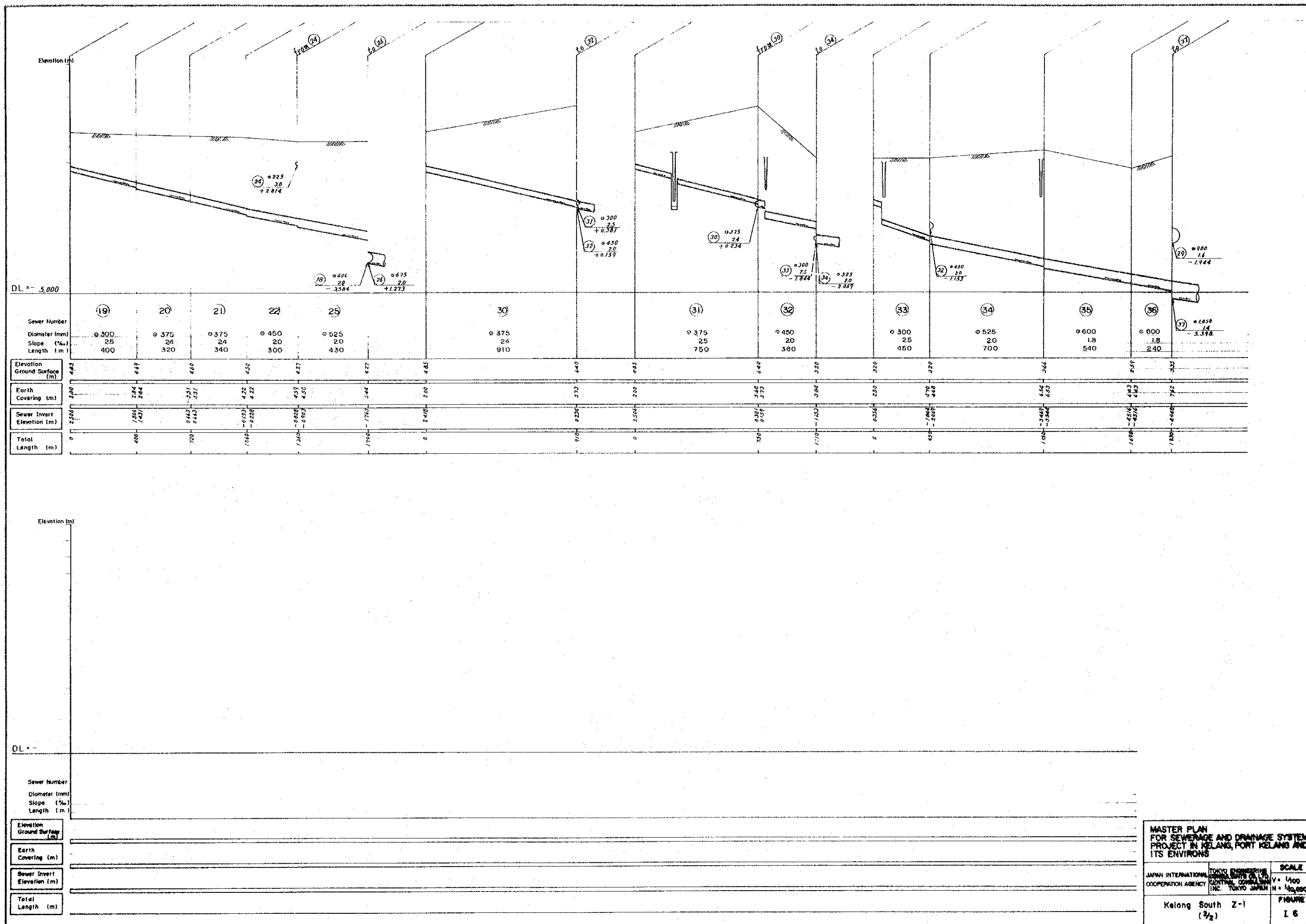
| No. of Plant | Oxidation Ditch (h=2.0m) | | | | | | Sedimentation Tank | | | | Required Land Space (Ha) | | | |
|--------------|--------------------------------|-----------------|---|---------------------------|-------------------------------|--|----------------------------|-------------------------------------|---|---|---|-----------------|--|---|
| | O_i (m ³ /day) | L_i (mg/l) | $V = \frac{Li Qi}{Sv}$ (m ³) | $t = \frac{V}{Q}$ (hr) | $Ro = BOD$ Load (kg/hr) | Oxygen Transfer Rate: N (kgO ₂ /mhr) | $L = \frac{N}{N_0}$ (m) | Ro Size of Ditch (WxLxDx) (m) | Over Flow Rate (m ³ /m ² /day) | Required Area of Tank: A (m ²) | | Depth: h (m) | Required Area of drying belts (m ²) | Required Size of Tank (WxLxDx) No. of Ponds |
| 1 | 33,478 | 163 | 6,821 | 5 | 227 | 1.73 | 131 | 6x600x 2x1 | 30 | 1,200 | $\frac{2 \times Qi \times 2.5}{A}$ = 2.3 | 2,400 | $0.025m^2 \times P$ ø20x2.5 x 4 | 5 |
| 2 | 36,985 | 147 | 6,796 | 5 | 227 | " | 131 | " | " | " | 2.6 | 1,500 | " | 5 |
| 3 | 29,019 | 152 | 5,514 | 5 | 184 | " | 106 | 6x500x 2x1 | " | " | 2.0 | 2,000 | " | 4 |
| 4 | 29,300 | 163 | 5,970 | 5 | 199 | " | 115 | " | " | " | 2.0 | 2,300 | " | 4 |
| 5 | 25,536 | 147 | 4,692 | 5 | 156 | " | 90 | 6x400x 2x1 | " | 850 | 2.5 | 900 | ø23x2.5 x 2 | 3 |
| 6 | 35,414 | 156 | 6,906 | 5 | 230 | " | 133 | 6x600x 2x1 | " | 1,200 | 2.5 | 2,100 | ø20x2.5 x 4 | 8 |
| 7 a. 4,848 | 155 | 939 | 5 | 31 | " | " | 18 | 5x100 x2x1 | " | 160 | 2.5 | 150 | ø10x2.5 x2 | 1 |
| b. 5,431 | 151 | 1,025 | 34 | " | " | " | 20 | 5x100 x2x1 | " | 180 | 2.5 | 400 | ø12x2.5 x2 | 1 |
| 8 | 7,183 | 146 | 1,310 | 4 | 44 | " | 25 | 6x150x 2x1 | " | 400 | 1.5 | 500 | ø16x2.5 x 2 | 2 |
| 9 | 10,476 | 137 | 1,794 | 4 | 60 | " | 35 | " | " | 400 | 2.2 | 300 | " | 2 |

Note: where in γ = Sludge Loading Factor = 0.20 d⁻¹
in L = Length of Rotor
in S = SS Concentration = 4,000 mg/l









MASTER PLAN
FOR SEWERAGE AND DRAINAGE SYSTEM
PROJECT IN KELANG, PORT KELANG AND
ITS ENVIRONS

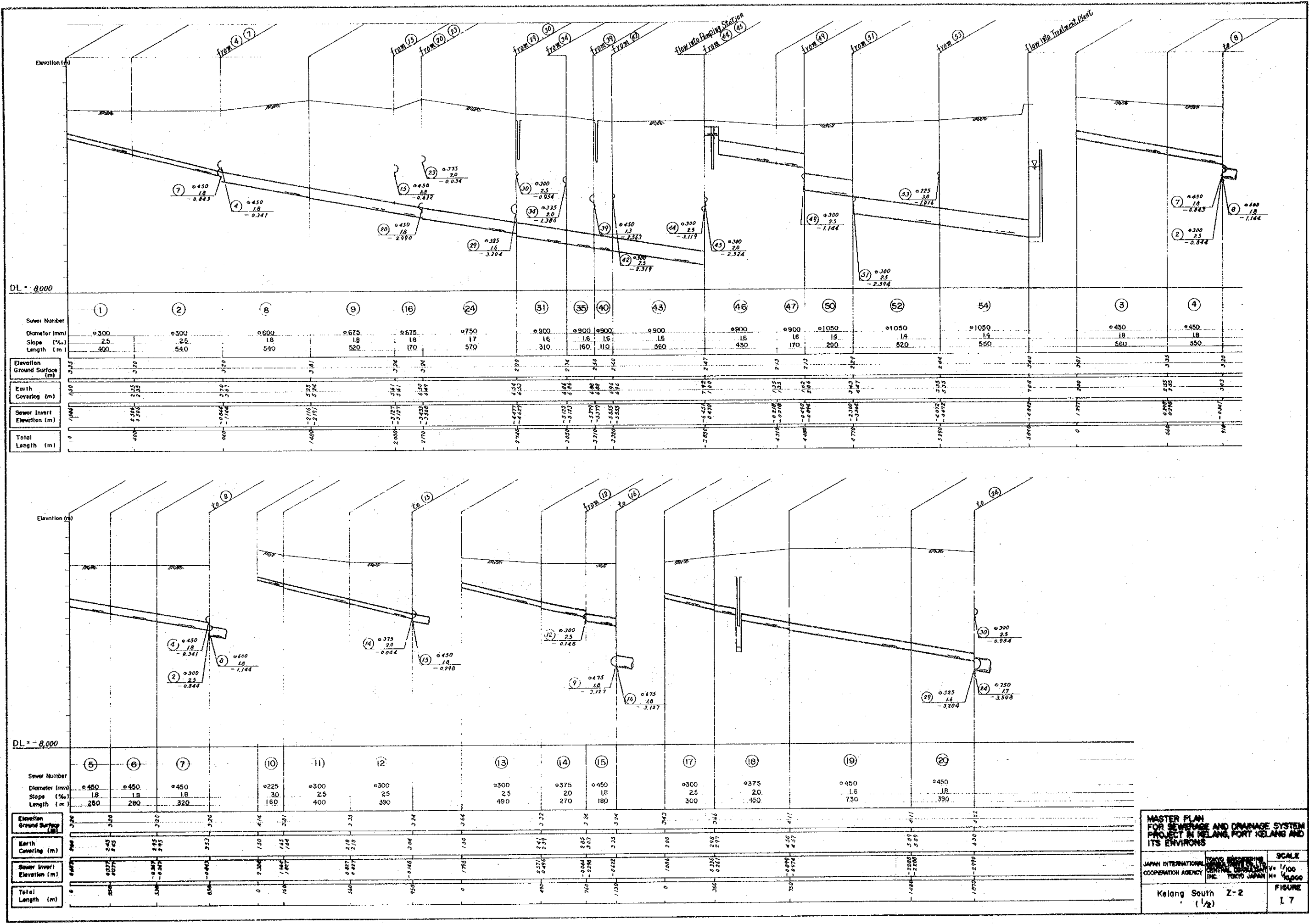
JAPAN INTERNATIONAL COOPERATION AGENCY

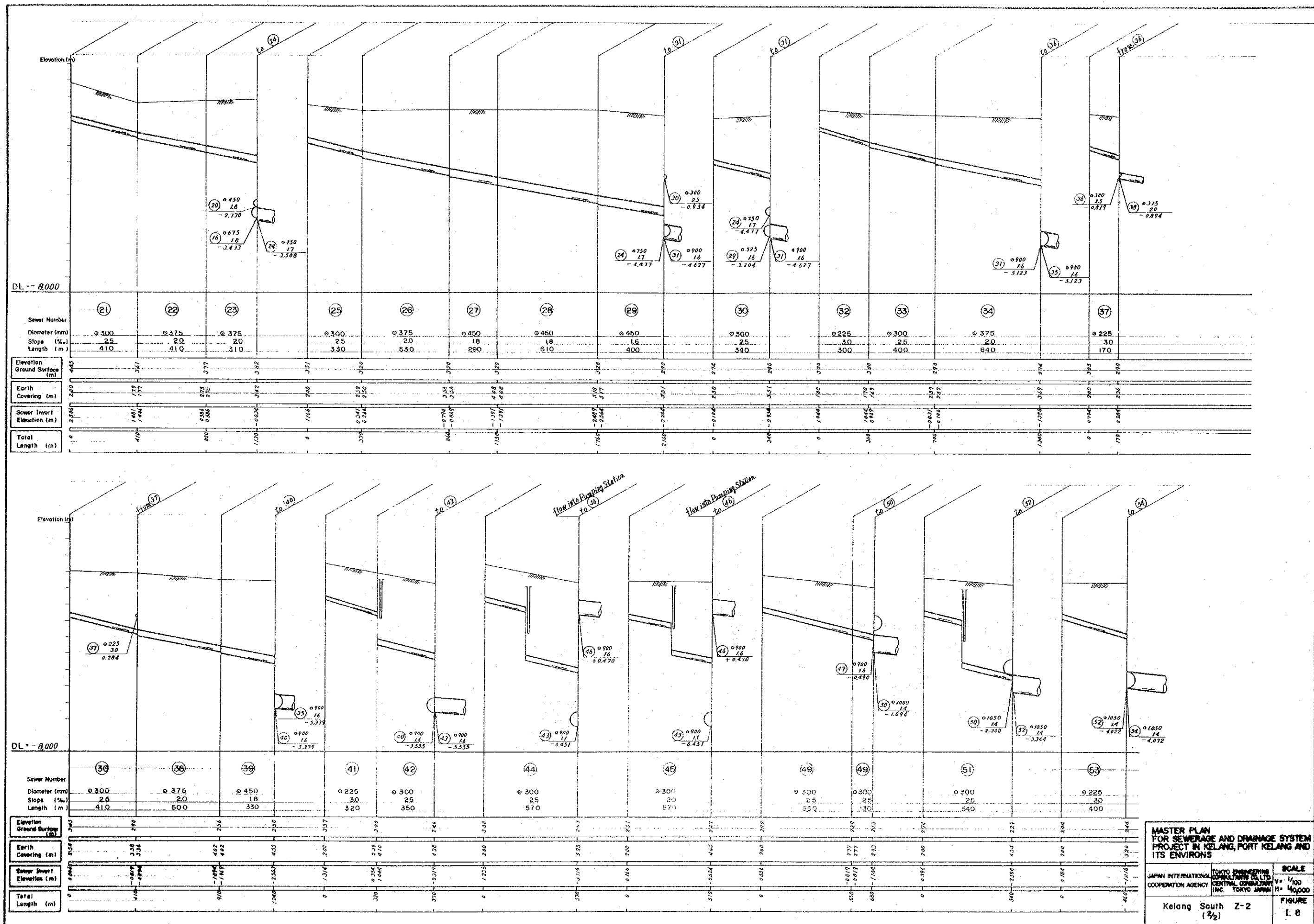
TOYO ENGINEERING CONSULTING CO., LTD.
INC. TOKYO JAPAN

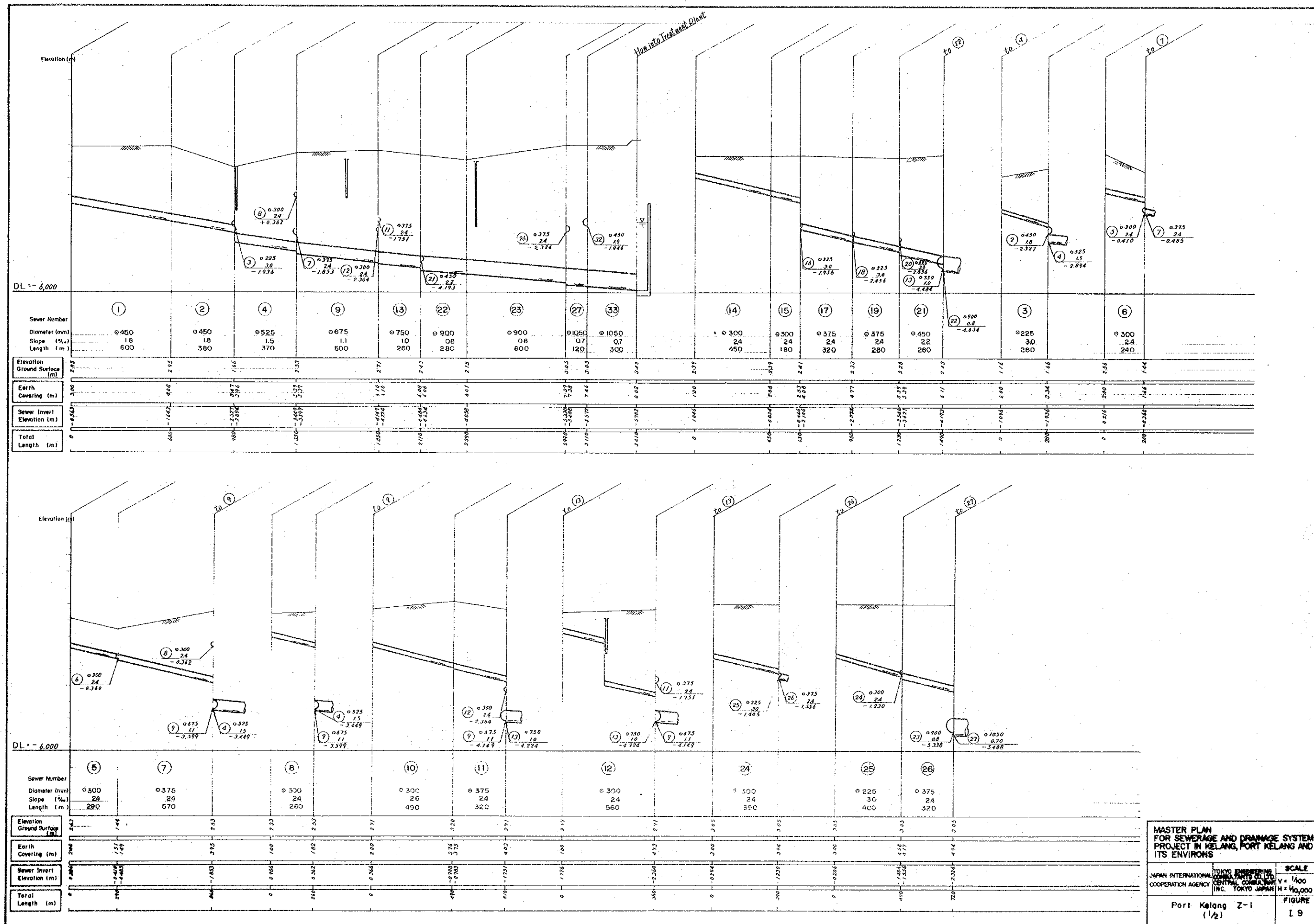
SCALE
V = 1/400
H = 1/50,000

Kelang South Z-1
(1/2)

FIGURE
1.6







MASTER PLAN FOR SEWERAGE AND DRAINAGE SYSTEM PROJECT IN KELANG, PORT KELANG AND ITS ENVIRONS

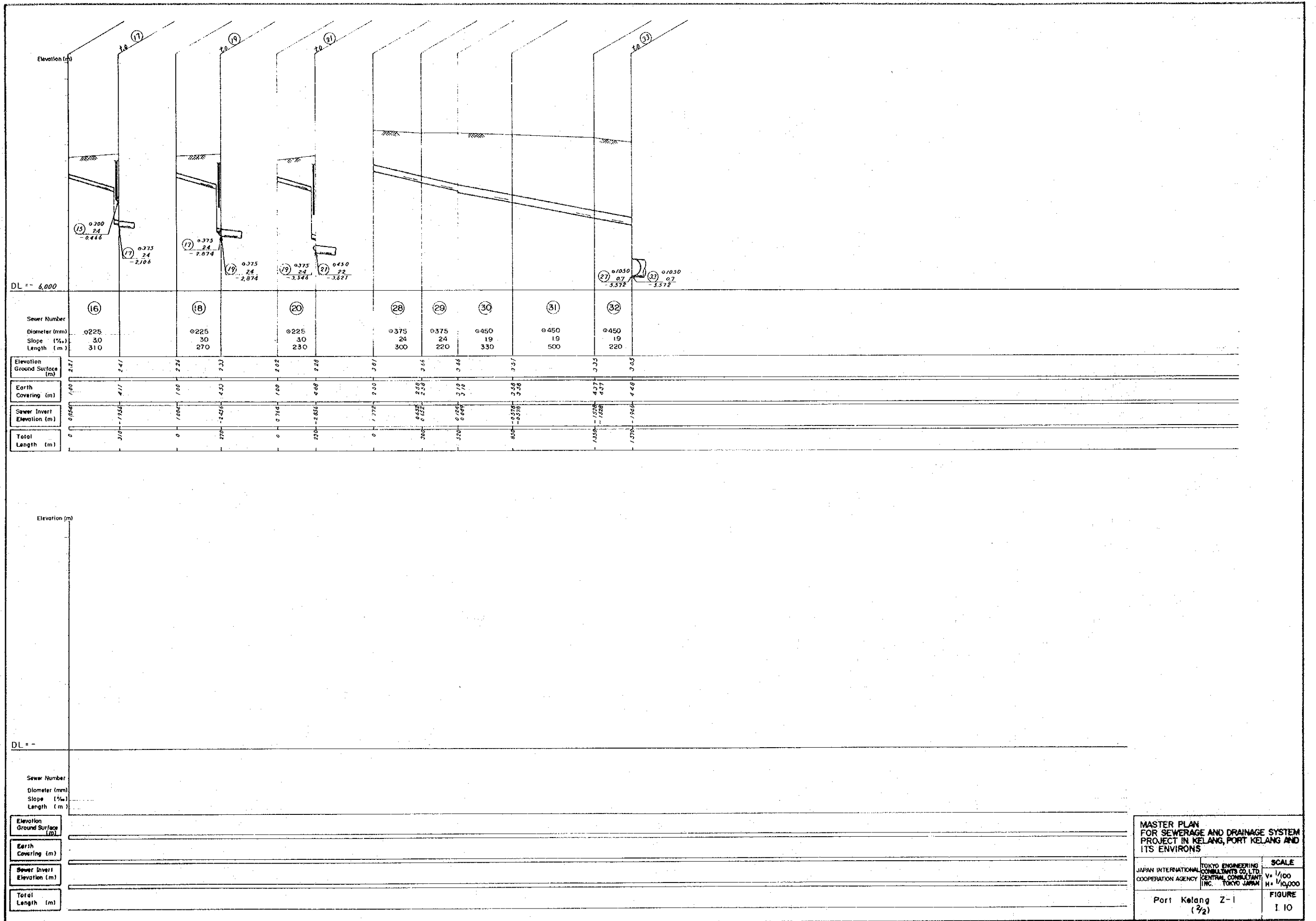
JAPAN INTERNATIONAL COOPERATION AGENCY

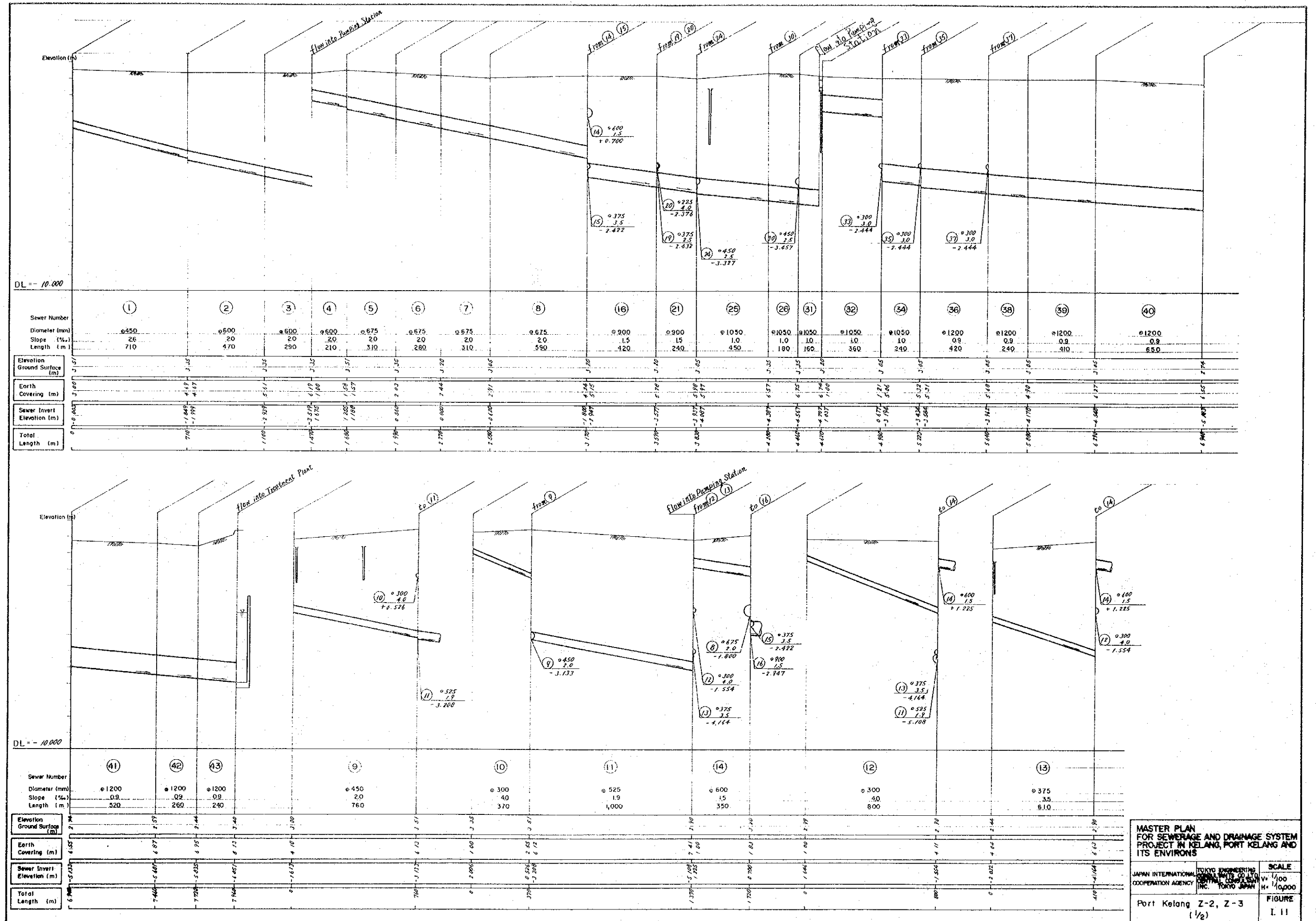
TOKYO ENGINEERING CONSULTANTS CO., LTD. CENTRAL CONSULTING INC. TOKYO JAPAN

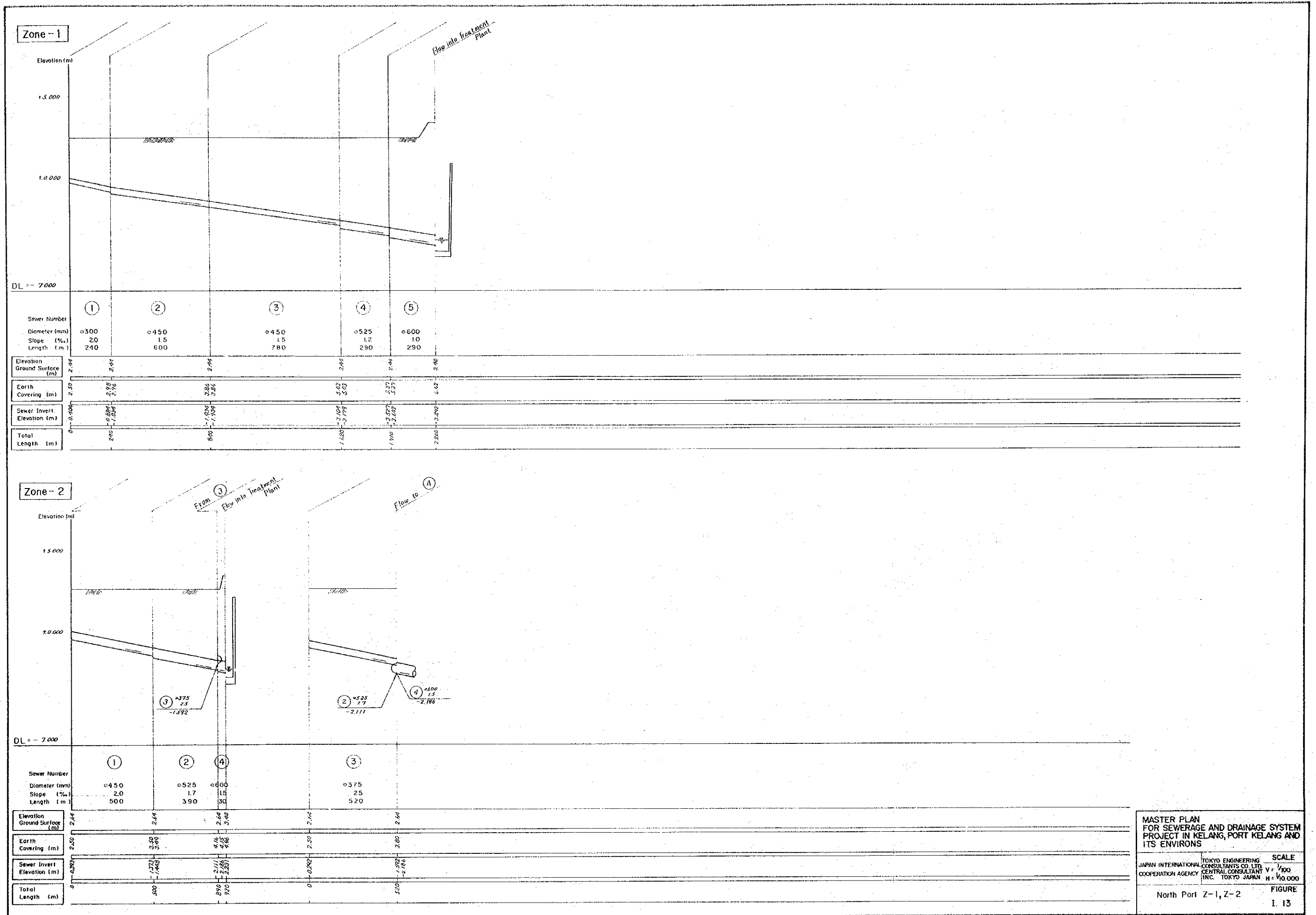
Port Kelang Z-1 (1/2)

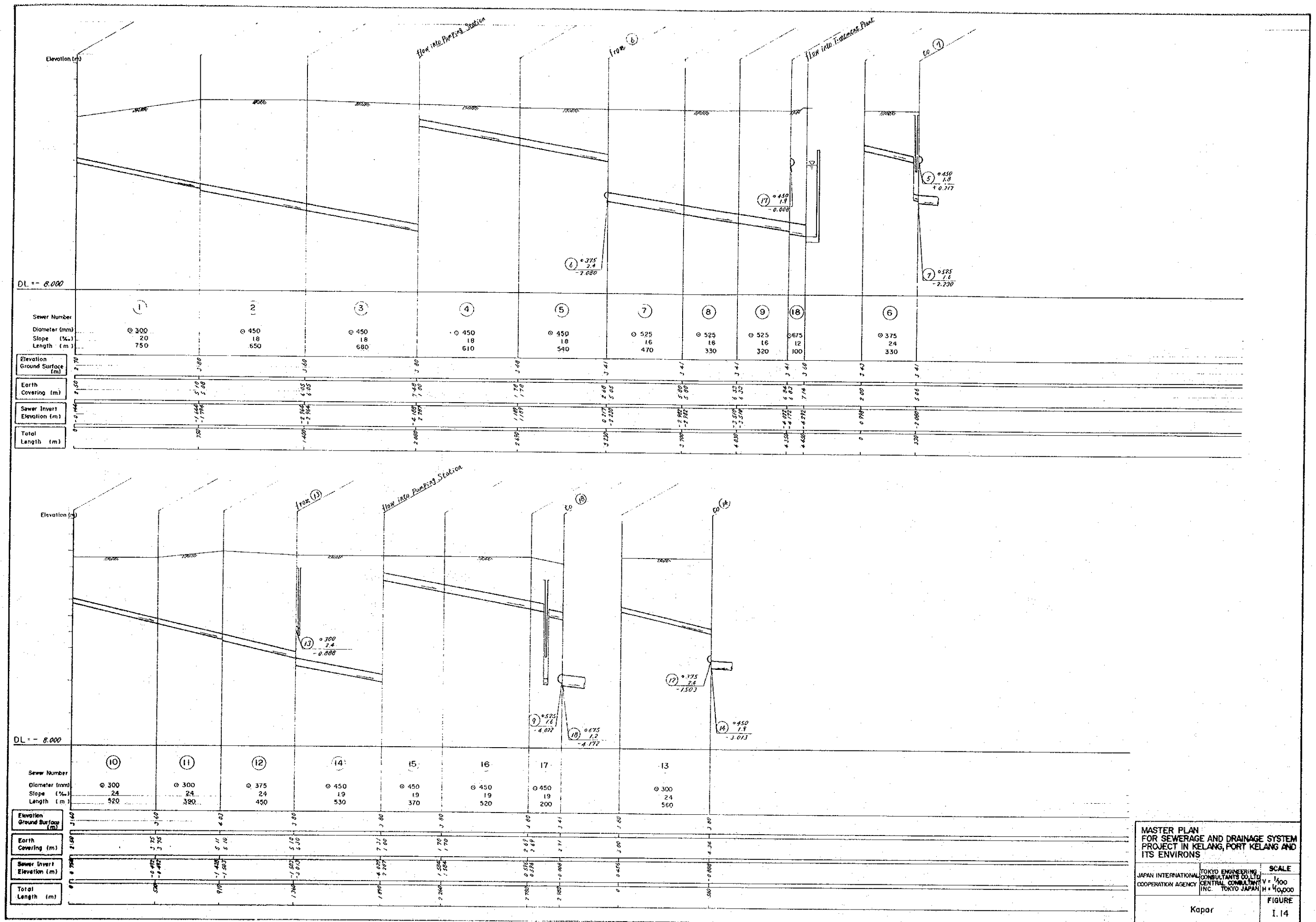
SCALE: V = 1/400 H = 1/10,000

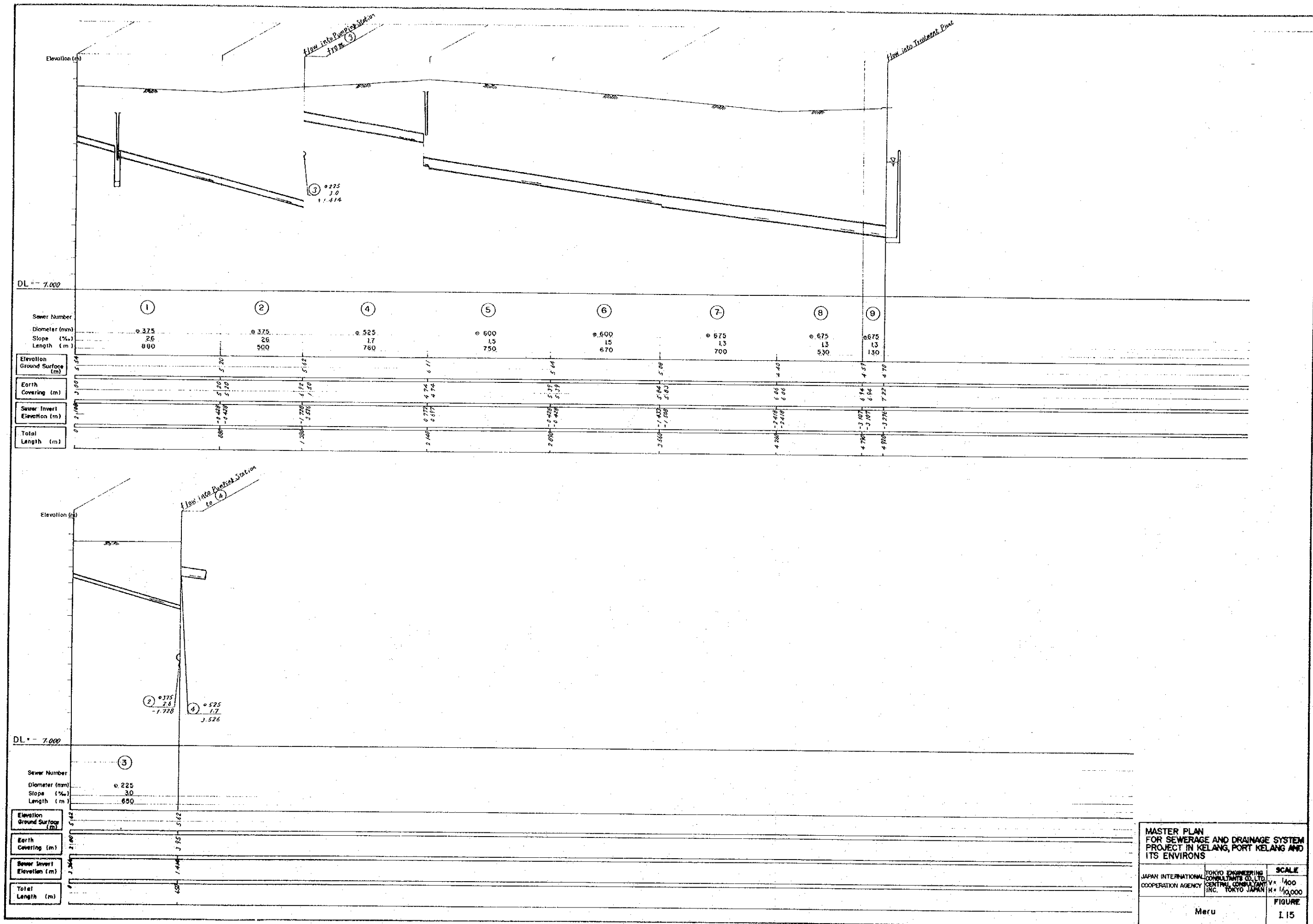
FIGURE 19

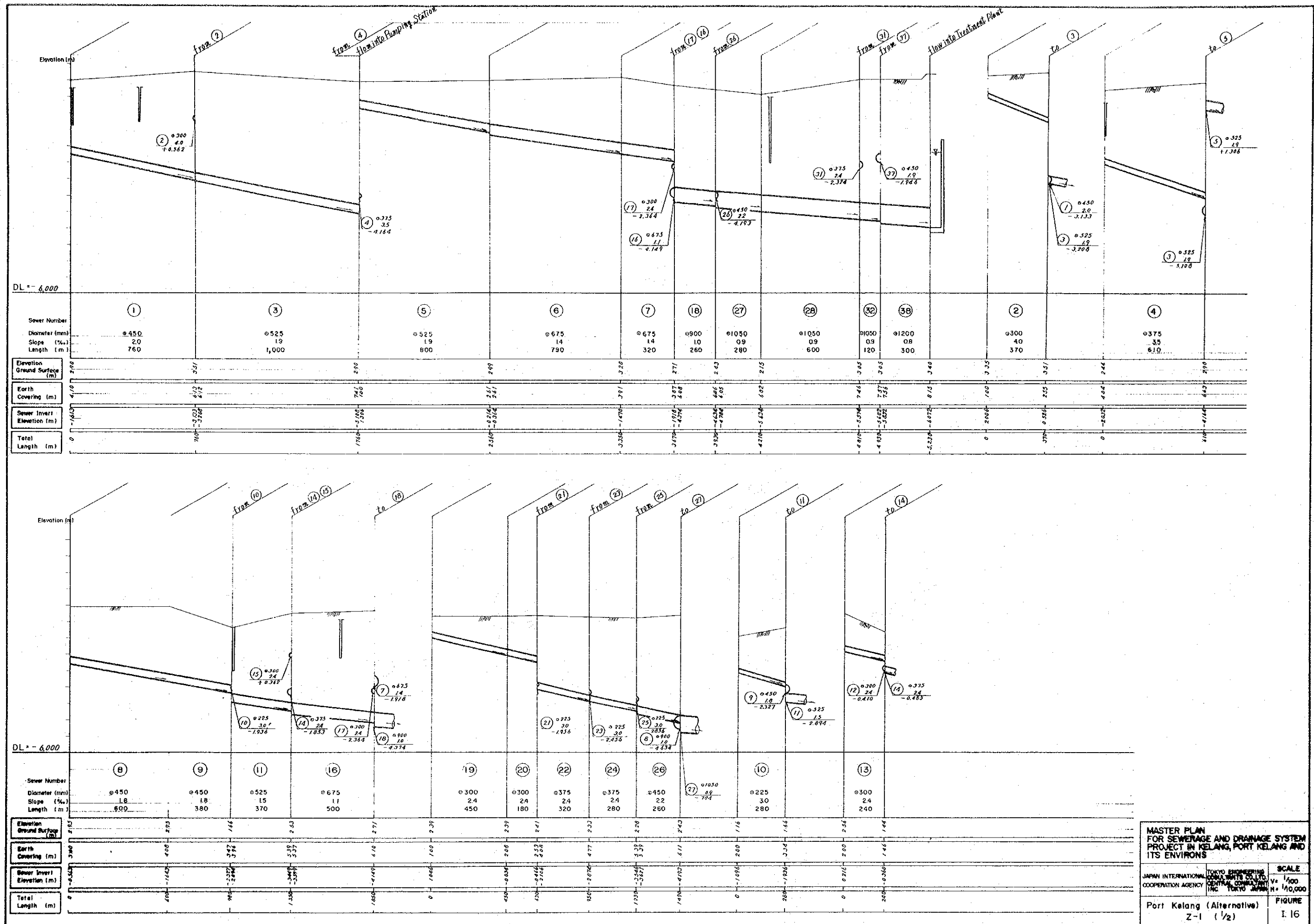


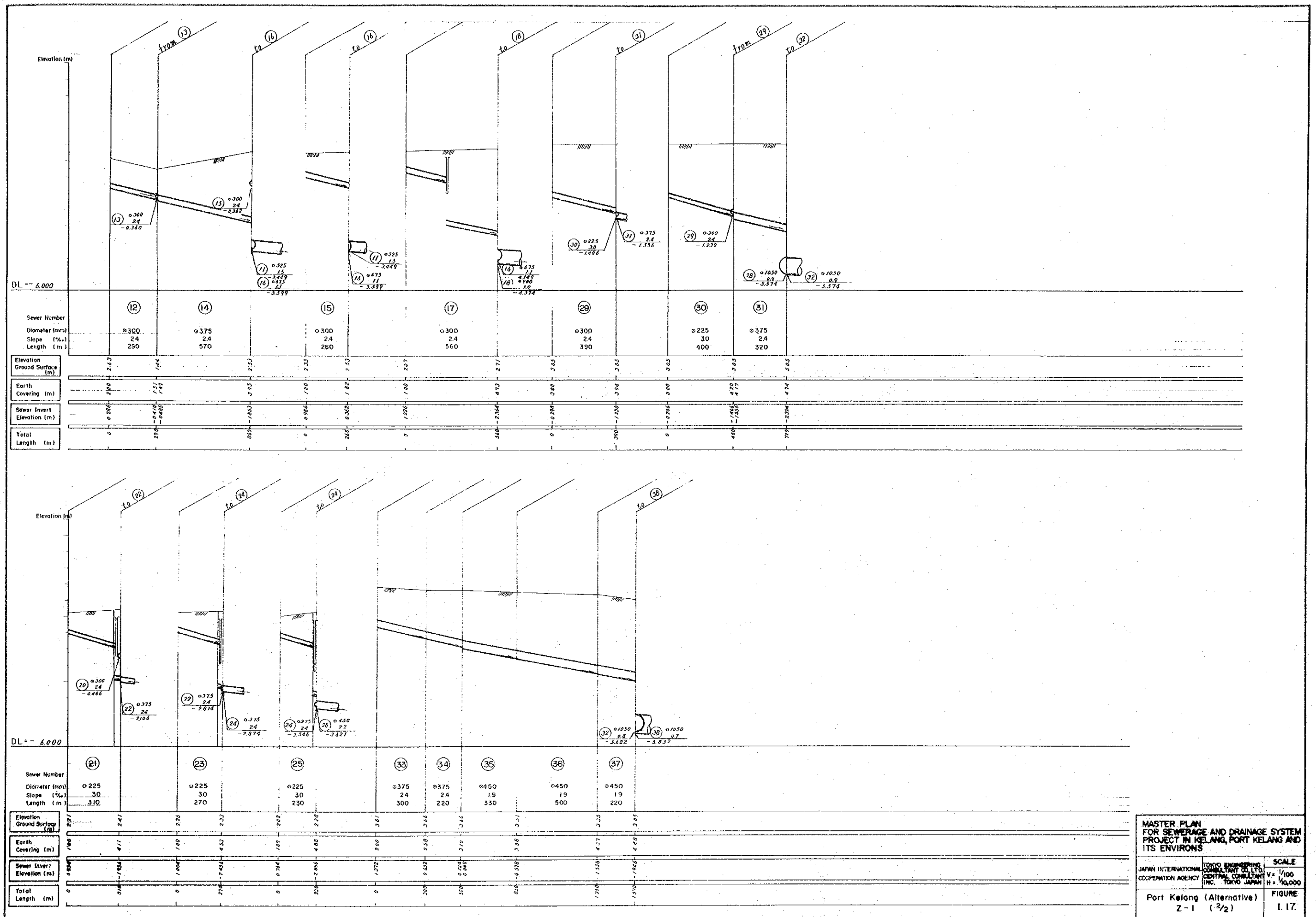


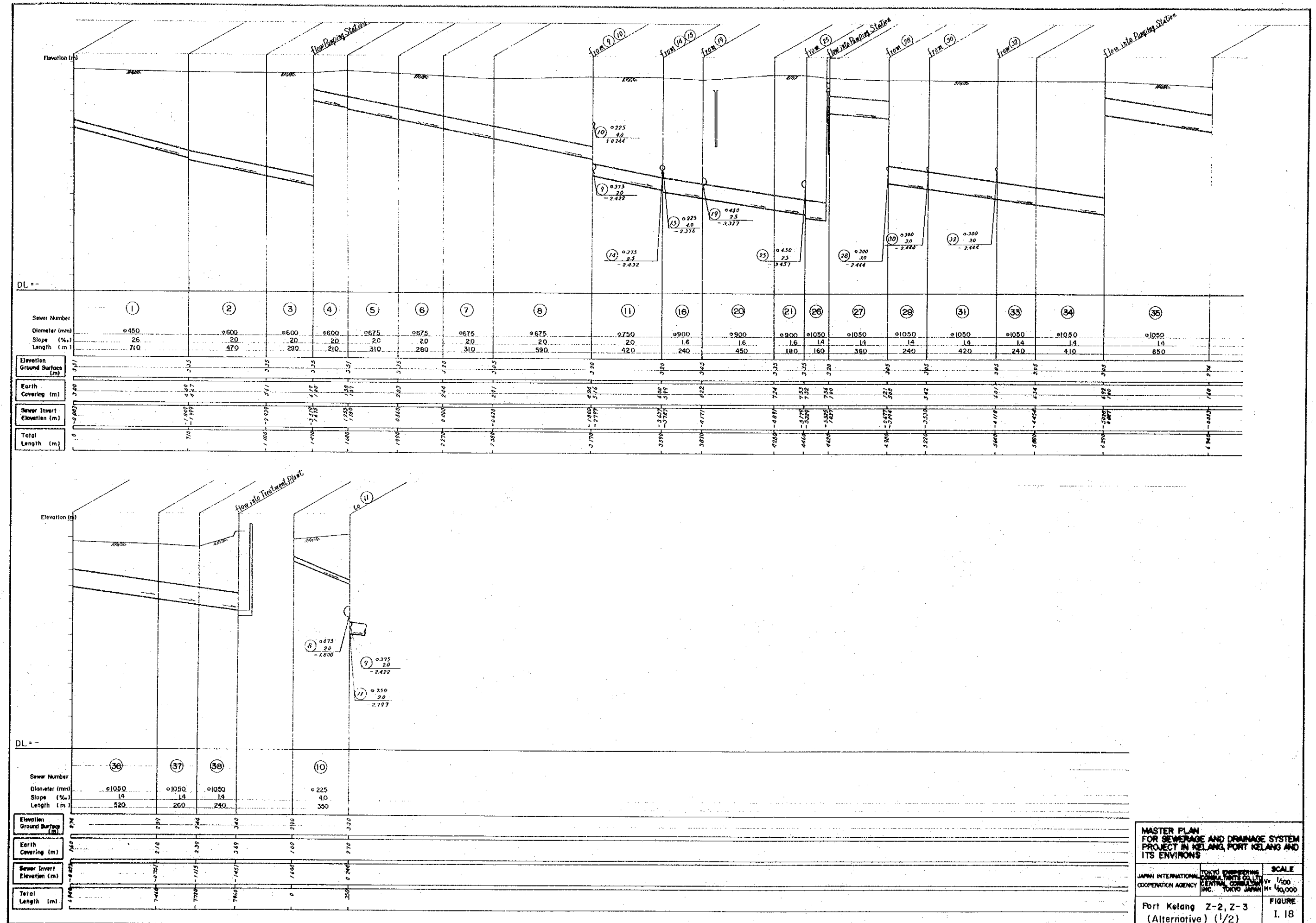


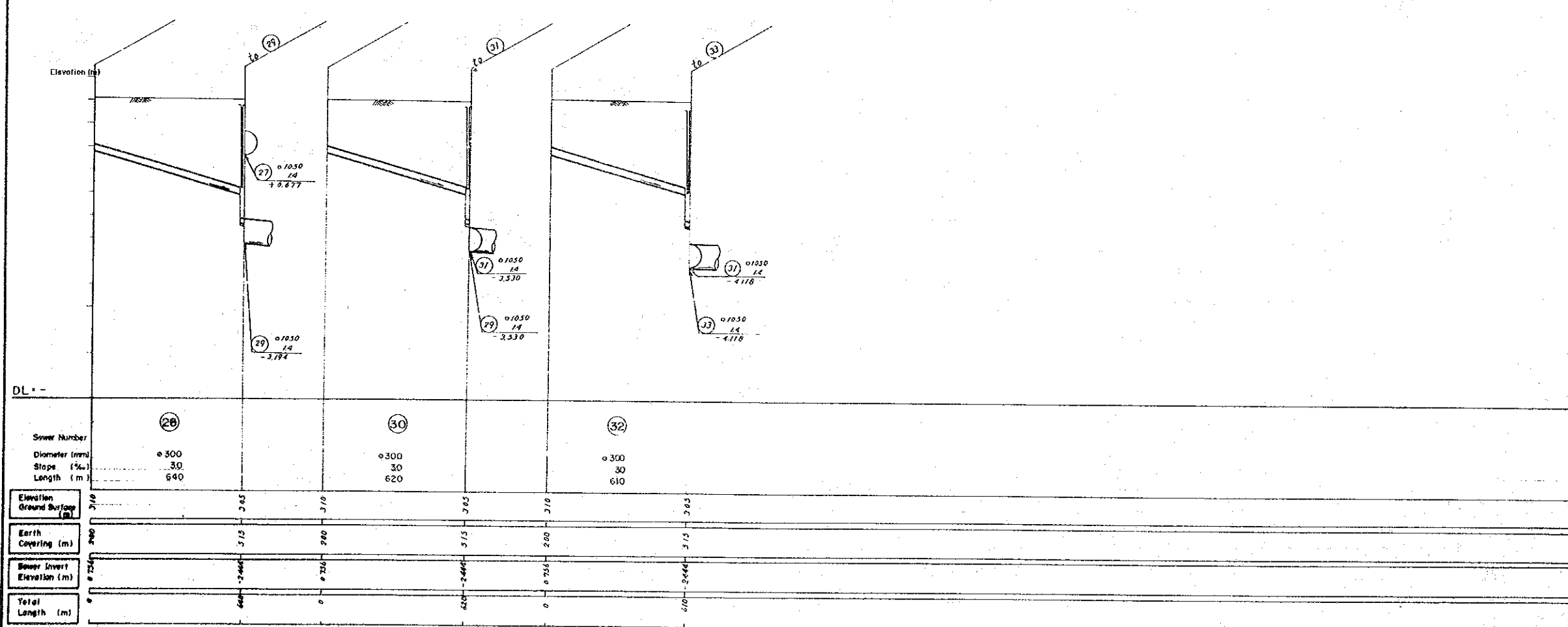
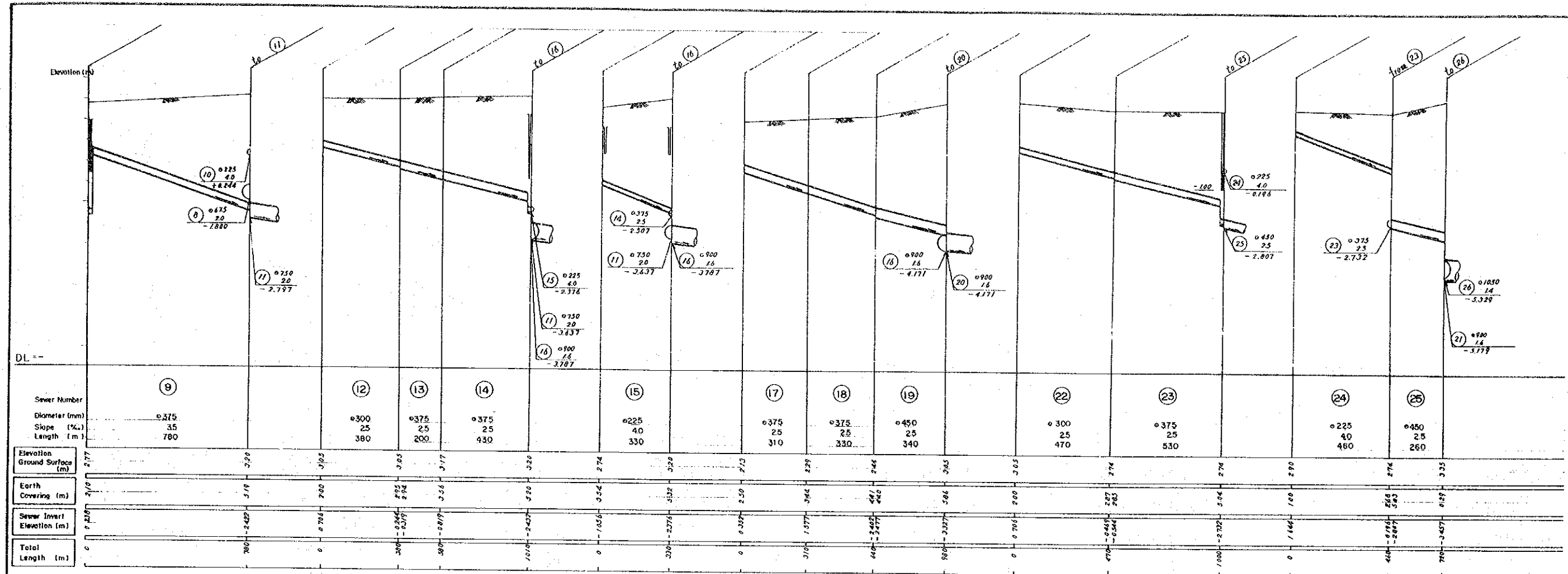












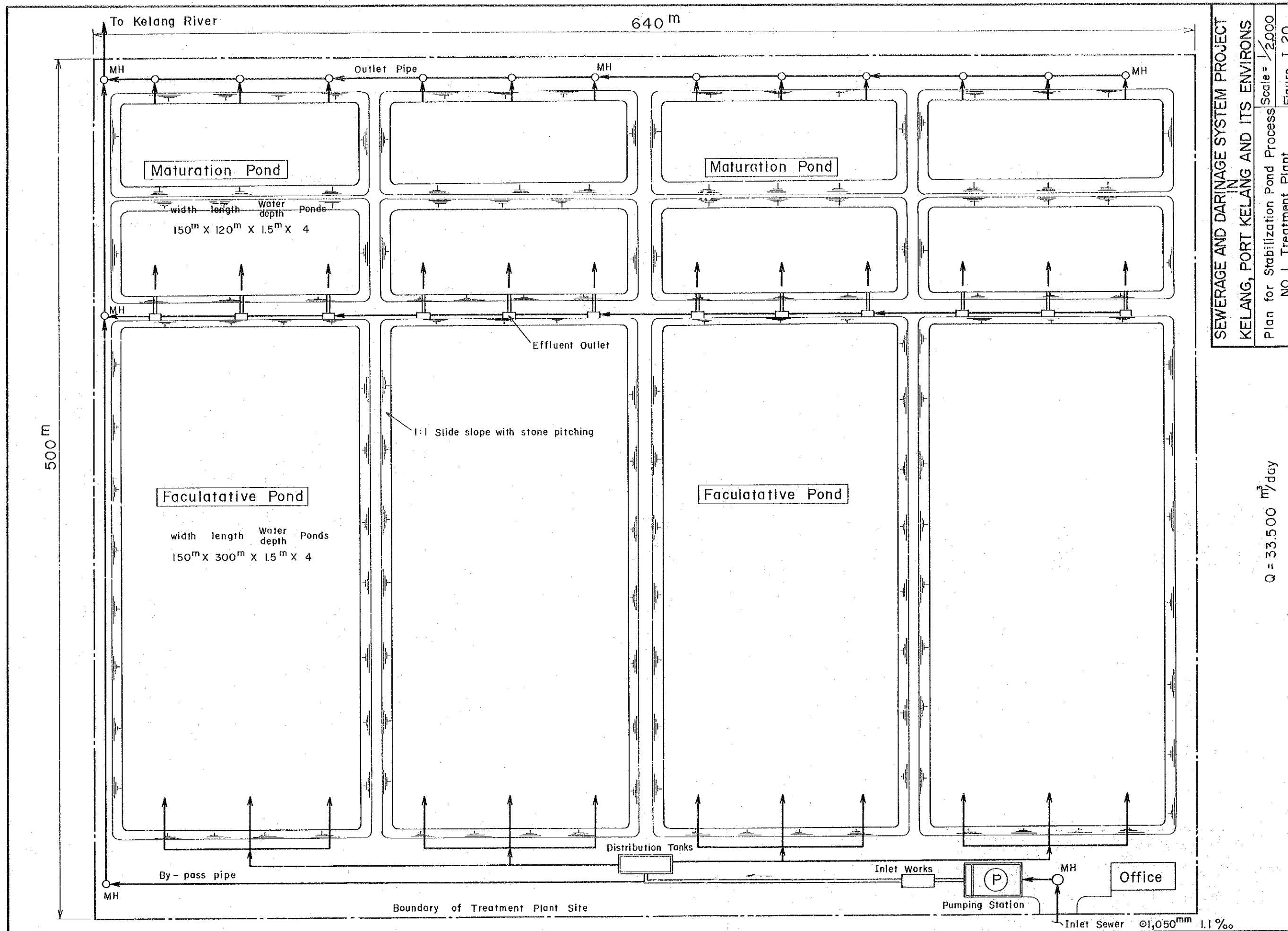
MASTER PLAN
FOR SEWERAGE AND DRAINAGE SYSTEM
PROJECT IN KELANG, PORT KELANG AND
ITS ENVIRONS

JAPAN INTERNATIONAL COOPERATION AGENCY
TOKYO ENGINEERING CONSULTANTS CO., LTD.
CENTRAL BUILDING INC. TOKYO JAPAN

Port Kelang Z-2, Z-3
(Alternative) (2/2)

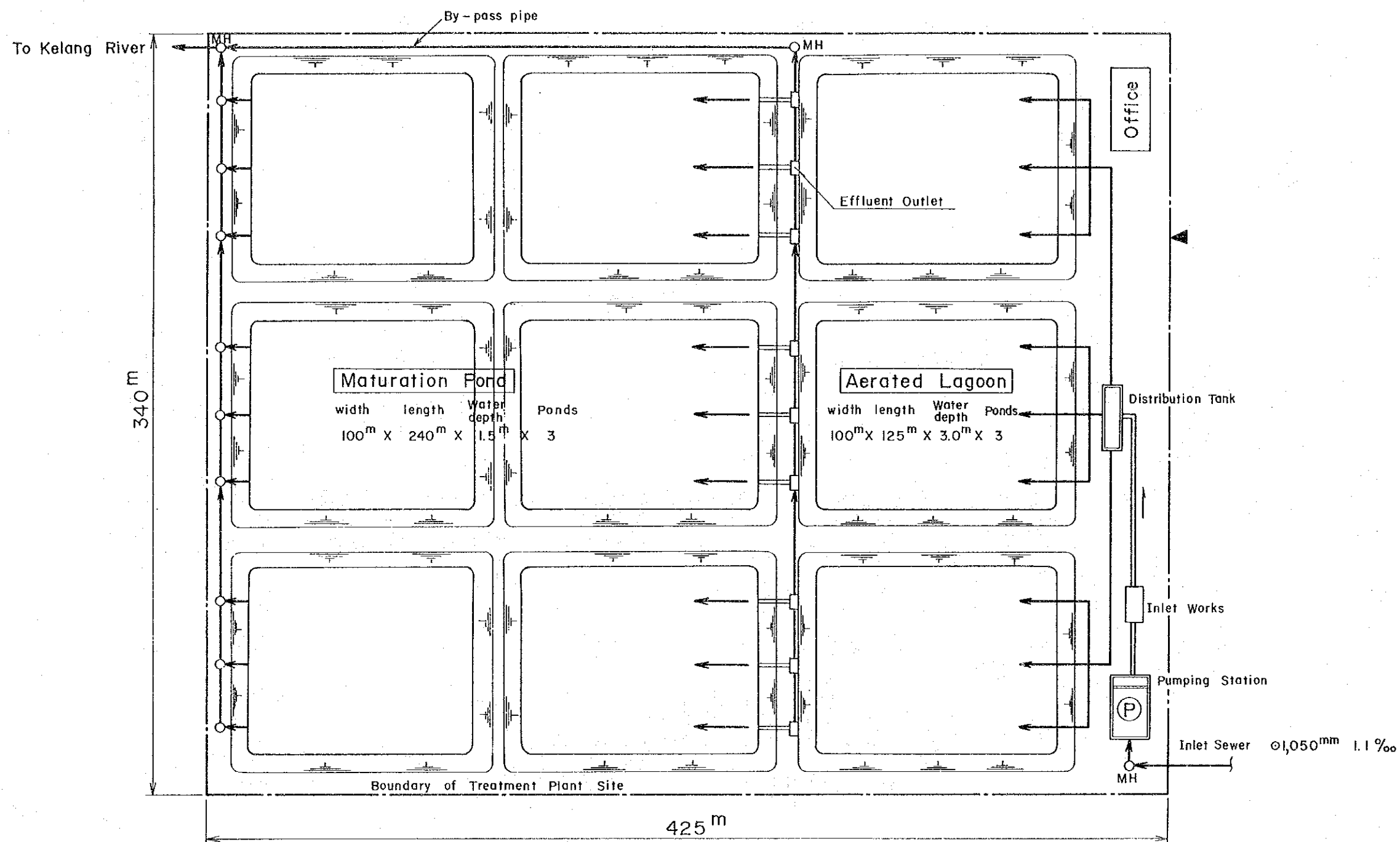
SCALE
V: 1/100
H: 1/10,000

FIGURE
I. 19



SEWERAGE AND DRAINAGE SYSTEM PROJECT
 KELANG, PORT KELANG AND ITS ENVIRONS
 Plan for Stabilization Pond Process Scale = 1/2000
 NO. 1 Treatment Plant Figure I. 20.

Q = 33,500 m³/day

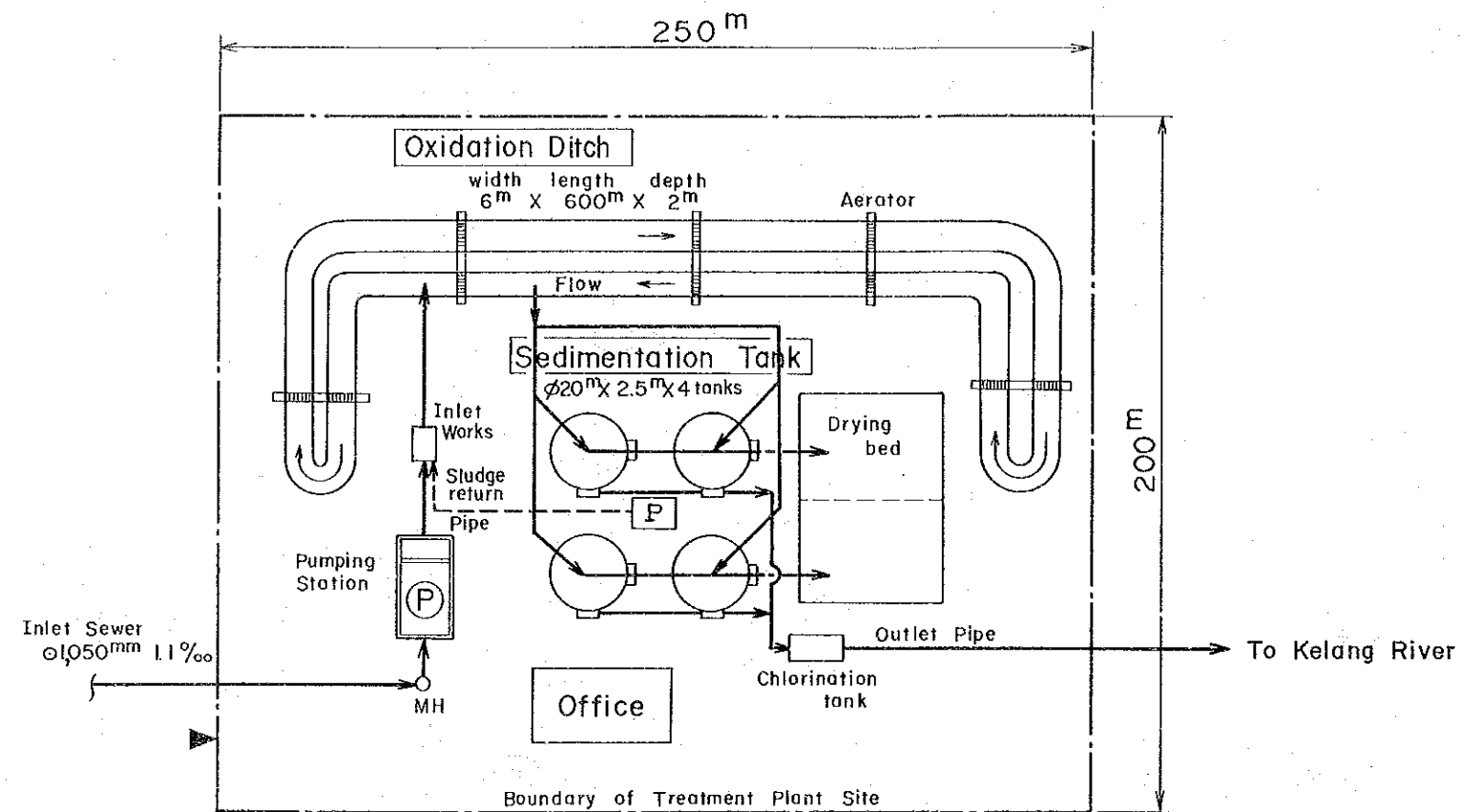


$Q = 33.500 \text{ m}^3/\text{day}$

SEWERAGE AND DRAINAGE SYSTEM PROJECT
IN
KELANG, PORT KELANG AND ITS ENVIRONS

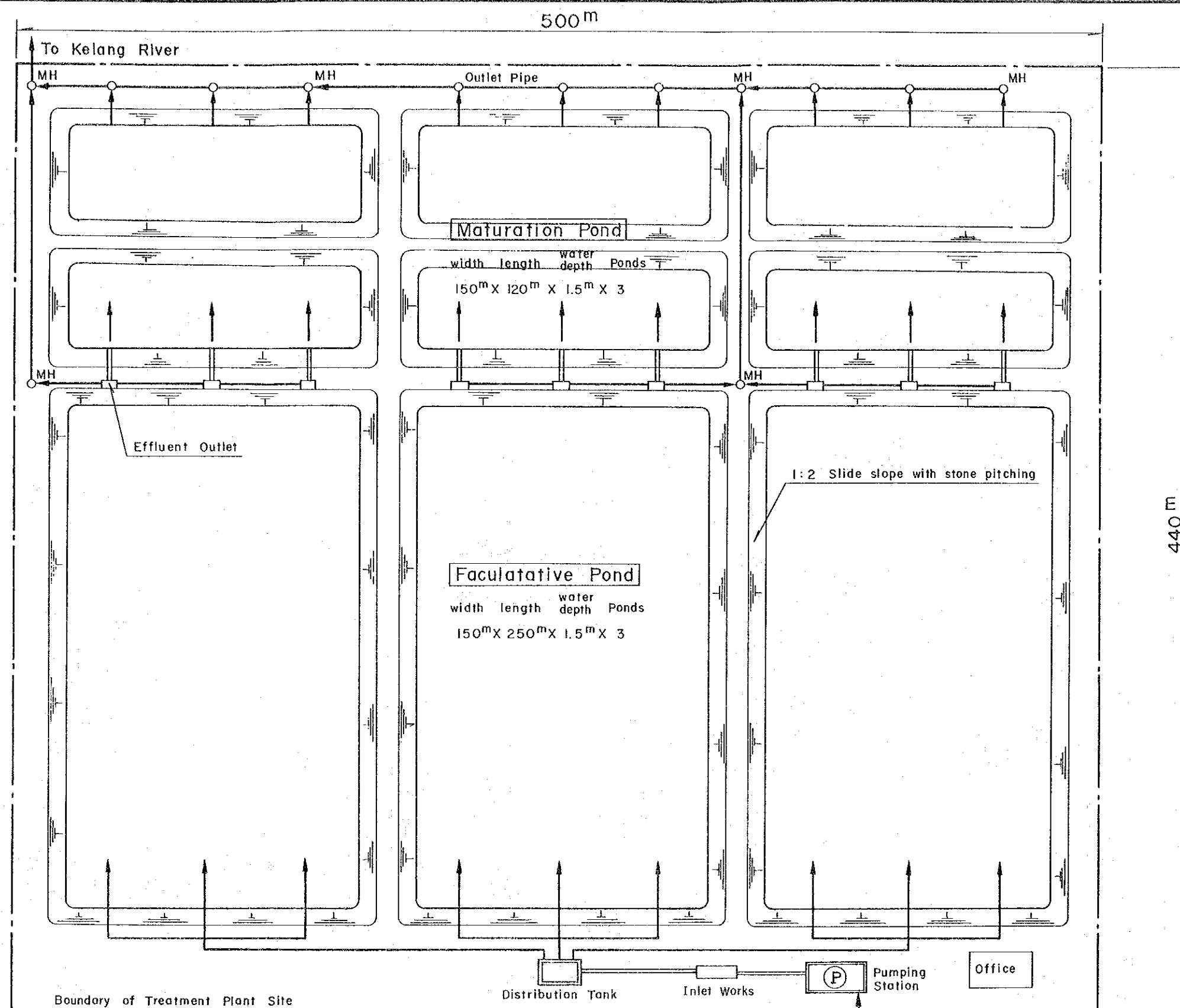
Plan for Aerated Lagoon Process
NO.1 Treatment Plant

Scale = 1/2,000
Figure I. 21.



$Q = 33.500 \text{ m}^3/\text{day}$

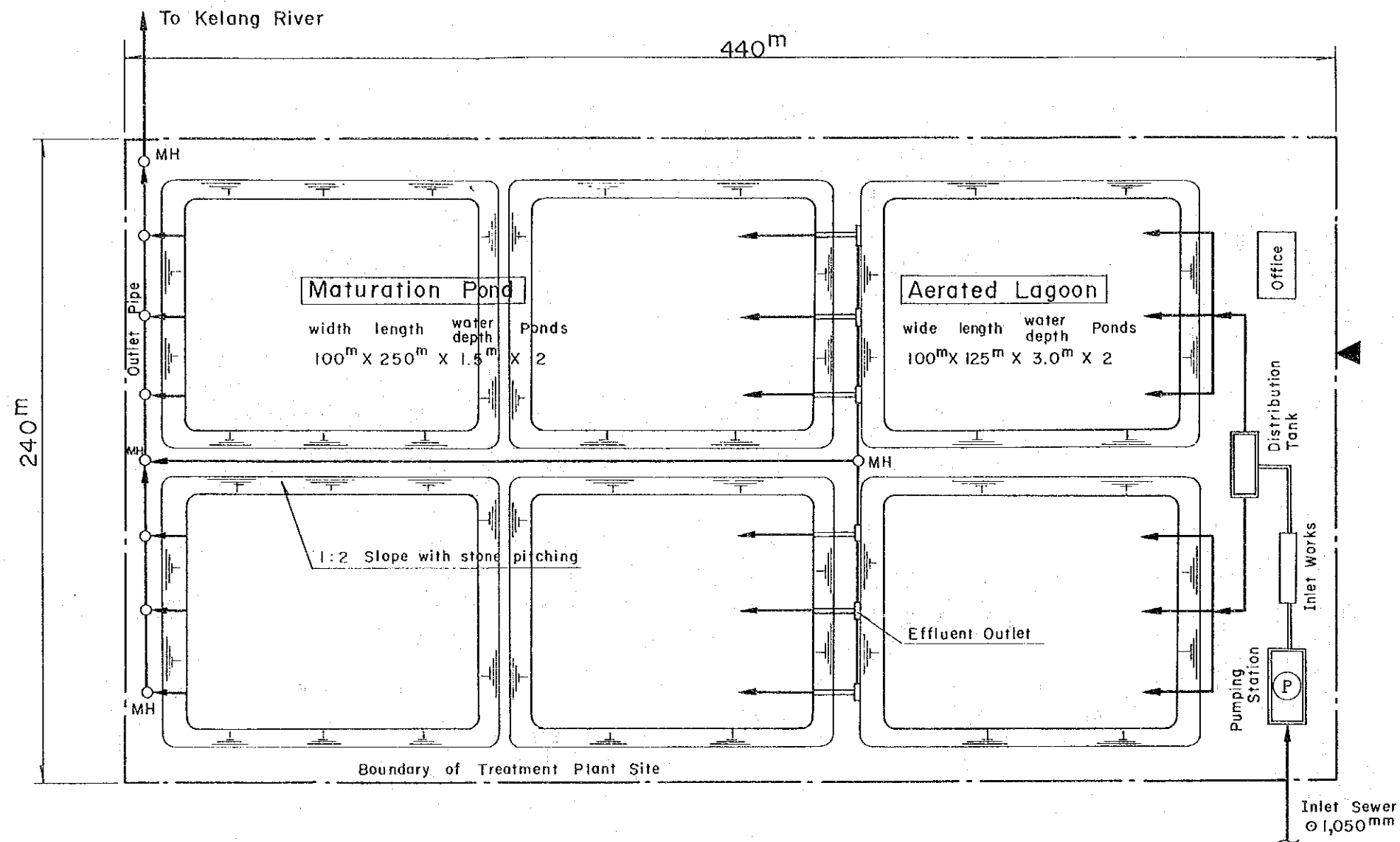
| | |
|--|-----------------|
| SEWERAGE AND DRAINAGE SYSTEM PROJECT IN KELANG, PORT KELANG AND ITS ENVIRONS | |
| Plan for Oxidation Ditch Process | Scale = 1/2,000 |
| NO.1 Treatment Plant | Figure I. 22. |



$Q = 25.500 \text{ m}^3/\text{day}$

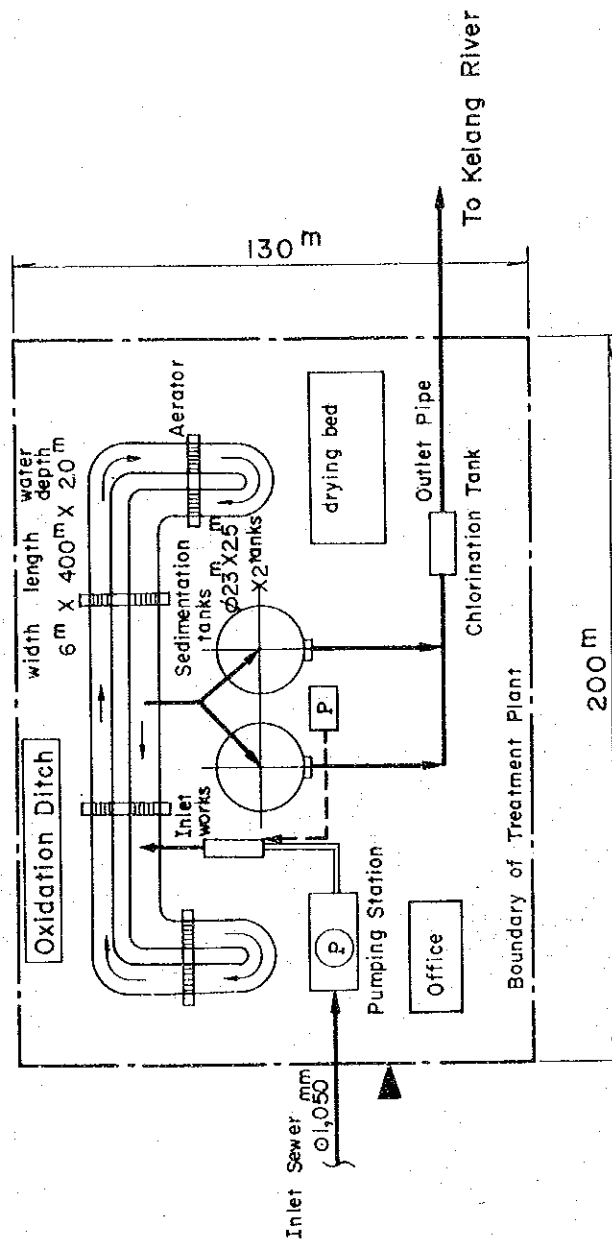
SEWERAGE AND DARINAGE SYSTEM PROJECT
IN
KELANG, PORT KELANG AND ITS ENVIRONS

| | |
|---------------------------------|-----------------|
| Plan for Oxidation Pond Process | Scale = 1/2,000 |
| NO.5 Treatment Plant | Figure I.23. |



$Q = 25,500 \text{ m}^3/\text{day}$

| | |
|--|-----------------------------------|
| SEWERAGE AND DRAINAGE SYSTEM PROJECT IN KELANG, PORT KELANG AND ITS ENVIRONS | |
| Plan for Aerated Lagoon Process NO.5 Treatment Plant | Scale = $1/2,000$ Figure 1.24. |



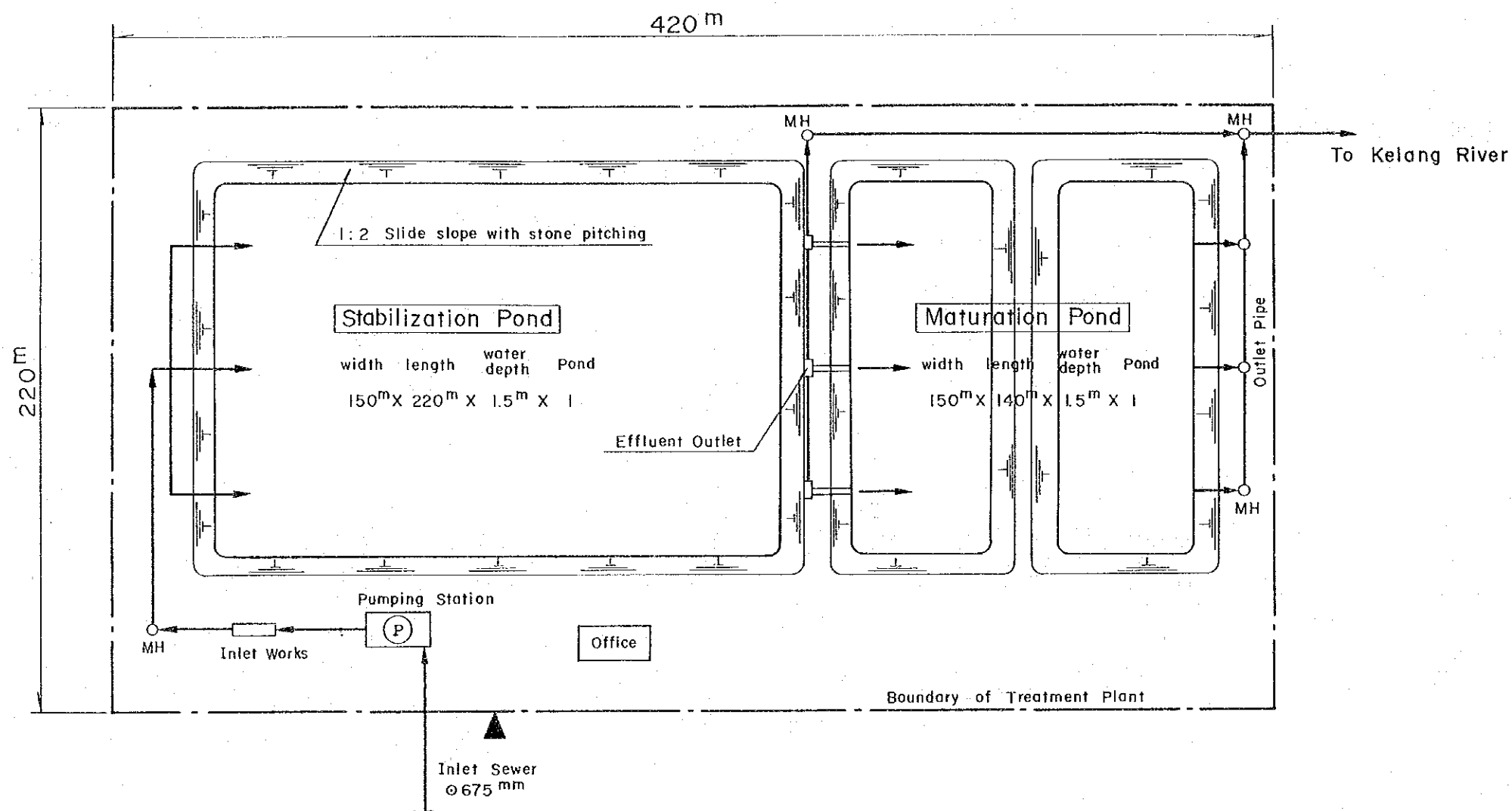
$Q = 25.500 \text{ m}^3/\text{day}$

SEWERAGE AND DRAINAGE SYSTEM PROJECT IN KELANG, PORT KELANG AND ITS ENVIRONS

Plan for Oxidation Ditch Process
NO. 5 Treatment Plant

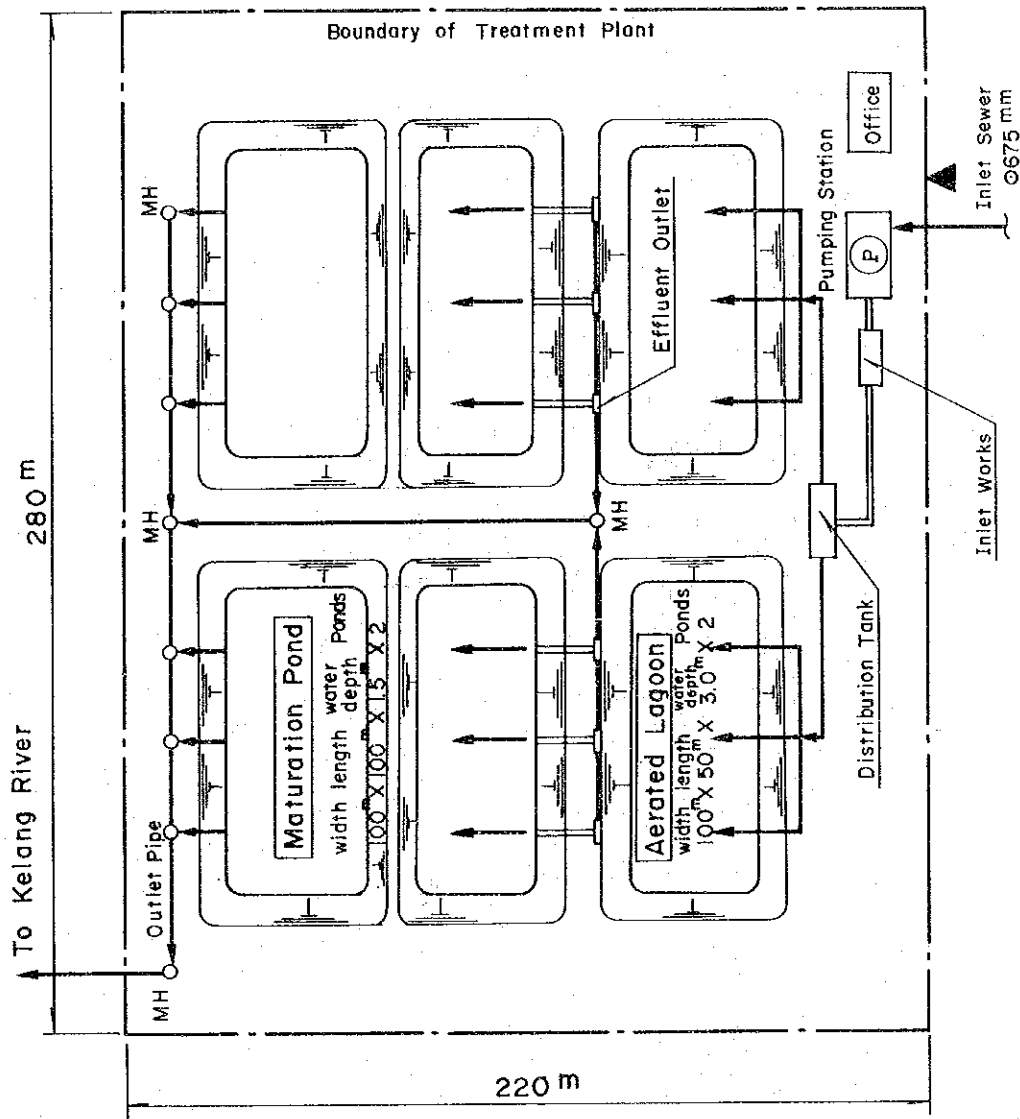
Scale = $\frac{1}{2,000}$

Figure I. 25.



$Q = 7,200 \text{ m}^3/\text{day}$

| | |
|--|----------------------------------|
| SEWERAGE AND DRAINAGE SYSTEM PROJECT IN KELANG, PORT KELANG AND ITS ENVIRONS | |
| Plan for Stabilization Pond Process NO.8 Treatment Plant | Scale = 1/2,000 Figure I. 26. |



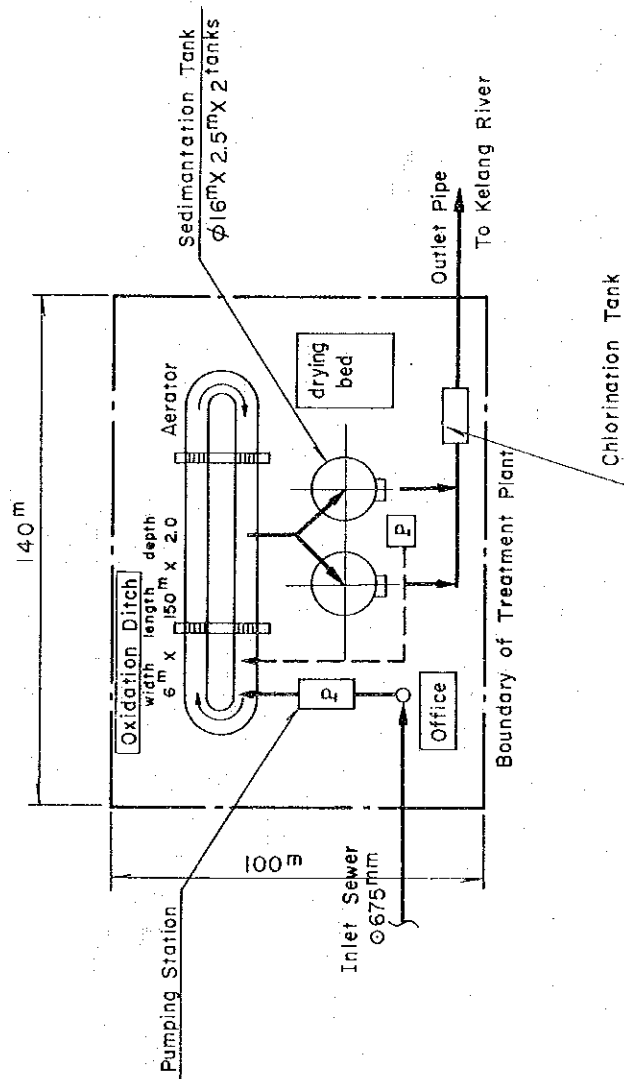
$Q = 7.200 \text{ m}^3/\text{day}$

SEWERAGE AND DRAINAGE SYSTEM PROJECT
IN
KELANG, PORT KELANG AND ITS ENVIRONS

Plan for Aerated Lagoon Process
NO. 8 Treatment Plant

Scale = $\frac{1}{2,000}$

Figure I. 27.



$Q = 7.200 \text{ m}^3/\text{day}$

SEWERAGE AND DRAINAGE SYSTEM PROJECT IN KELANG, PORT KELANG AND ITS ENVIRONS

Plan for Oxidation Ditch Process
NO. 8 Treatment Plant

Scale = $\frac{1}{2,000}$

Figure I. 28.

APPENDIX J

THE JAPAN SEWERAGE WORKS AGENCY (JSWA)

Appendix J. The Japan Sewerage Works Agency (JSWA)

J.1. Background

On April 21, 1970, the Government approved a Class of the Environmental Quality Standard. And consequently, the number of rivers increased, whose water qualities must meet the government standard. And in order to meet the national standard to control the water quality of rivers in Japan, the Government had to construct sewerage systems of local municipalities.

It is very important of employ enough well-trained engineers for sewerage construction. And such engineers are usually concentrated in big cities in Japan. This is because, in large cities, a fairly large amount of work is available continuously at higher pay than in smaller cities. On the other hand, in smaller cities and prefectural governments, there are not enough engineers both of them have not conducted sewage works so far and have not employed engineers in charge of these works. Under these circumstances it would be difficult for them to carry out their sewerage projects particularly big-scale sewerage construction projects. They are not well experienced and it is difficult for such local municipalities to employ specialized engineers, such as sanitary, electric, mechanical engineers, chemists and biologists in charge of planning, constructing, and maintaining sewage treatment plants.

Under these circumstance, the Minister of Construction asked the Central Advisory Committee on City Planning to submit its recommendations on ways to execute the promotion of sewerage construction. And on August 16, 1971, the Committee came up with the recommendations that the Government and local governments must take fundamental measures as soon as possible to provide the system under which engineers are to be pooled and sent to various organizations as the need arises. Along the line of the recommendations, the Ministry of Construction asked the Education Ministry to put more emphasis in providing courses on sanitary engineering in technical colleges and universities. The Ministry of Construction also began preparation, with cooperation of local governments, to establish a

sewerage works organization for the purpose of pooling enough engineers to be dispatched where they are needed, as well as advancing the construction expenses.

Among its many functions, this SCPC's main job is to give various technical assistance to local governments, including the assessment of sewerage construction projects, the planning and actual construction works under commission with their money, as well as other assistance, such as training of engineers and research and technology development and in making it into practical use in cooperation with local governments each giving 50% of the total cost. In short, the SCPC has been working to help local government bodies to promote sewerage works in Japan. However, since then, the application of the water quality standard by the Government was extended to river, lakes, bays and coastal waters throughout Japan, and as a result, the construction of sewerage systems for environmental protection became to be beyond the boundaries of one local government. It came to be recognized, instead, as the national issue to be immediately dealt with in order to conserve the nation's water resources as a whole. Consequently, the main function of the SCPC was being shifted from giving assistance to local governments to taking over their operations to construct sewerage systems by the SCPC.

With the changes in the nature of the SCPC during the first three years after its establishment, the Japan Sewage Works Agency Act was enacted on June 19, 1975, which virtually absorbed the SCPC into a new body, the Japan Sewage Works Agency by enlarging the functions and organizational structure of the former.

J.2. Leagal Aspect

The JSWA is a public corporation which has a special status as stipulated by a special law. Since its operation involves the sewage works which local governments ought to do, the JSWA must work for the benefit of all these local governments. Therefore, the establishment of the JSWA is to be initiated by the representatives of local governments, and the cost of establishing the organ and some operational expenses are to be borne

equally by the central government and local governments, including the cost for training engineers and for research and technology development. Planning and construction of sewerage systems by the JSWA under commission with a local government is to be paid for by the local government concerned. However, since the function of the JSWA is not only to promote common interests among local municipalities by providing sewerage systems to improve the living environments of the people, but also to attain the national goal to control the quality of the public water and to secure water resources of the entire nation, the JSWA is considered to be the same as those established by the central government as far as the control and financial assistance of the Government is concerned.

J.3. Outline of the Functions

The functions of the JSWA are stipulated in the first clause in Article 26 of the Japan Sewage Works Agency Act. The following are some of the major functions of the organization:

(1) Construction of main sewerage facilities.

Under commission from a local government, the JSWA is to construct sewage treatment plants, the trunk sewers to such plants, and the pumping stations.

(2) Designing, construction supervision, and operation and maintenance of the sewerage systems

Under commission from a local government, the JSWA is to plan sewerage systems, supervise their construction, operation and maintenance the sewage treatment plants and the pumping stations.

(3) Technical assistance for sewerage construction

By request of a local government, the JSWA is to give technical assistance for the assessment of the plans, construction, and the operation /maintenance of the plants.

(4) Training of engineers

The JSWA is to give training to national and local civil service

personnel who are in charge of sewage works. Training of those from commercial companies by the JSWA is prohibited.

(5) Qualification tests

The JSWA is authorized to give qualification tests to those who wish to take them, including engineers of both national and local governments as well as those from private companies.

(6) Research and technology development

The JSWA is to conduct research and technology development in the field of sewerage, sewage treatment and pre-treatment, as well as on the practical application of such technology.

(7) Construction of the facilities, and giving technical assistance upon request of public corporations

Under commission from public corporations which are established by special laws, the JSWA is to plan and construct the main sewerage facilities, supervise the actual construction work, and give technical assistance on operation of the facilities.

J.4. Financing and Subsidies

The JSWA receives capital fund and subsidies from the central and local governments. The capital fund covers the costs of land purchase and the construction of the administration building and the laboratory, as well as the deposit for renting the office building, housing for staff members, and others. In other words, the capital fund is used to acquire the fixed property for the operation of the JSWA.

On the other hand, the subsidies are to be spent on personal expenses of the staff in the planning, general affairs, accounting, training, and research and development divisions of the JSWA, as well as travel expenses and operational costs. Subsidies are also used to provide training facilities and testing equipments for training courses.

In principle, the central government and local governments each

contribute half of the combined total amount of the capital fund and subsidies for the operation of the JSWA. With the half to be paid by the local governments, a group of prefectural governments and a group of local municipalities (each with more than 80,000 in population) contribute with the 2 to 1 ratio. In other words, the ratio of contribution to the finances of the JSWA is 50% by the central government, 25% by prefectural governments, and another 25% by local municipalities. This is based on the government recognition that the construction and operation of sewerage systems, in controlling the quality of the public water should be carried out jointly by various governments at different political levels of the nation.

APPENDIX K

STUDY ON PIPE MATERIALS

APPENDIX K. STUDY ON PIPE MATERIALS

K.1. Introduction

Sewers are one of the main components of the sewerage system. They are usually laid under roads to collect and convey wastewaters of various kinds of origin to the point of disposal. Each household, commercial building or factory should be connected to a sewer network; thus, a vast number of sewer pipes, particularly branch sewers are installed. As a sewer collapse may result in costly repairs and replacement, the choice of pipe material is of great importance.

The choice of pipe materials for use in a sewerage system depends on a number of factors, the major ones among which are:

- (a) Local availability
- (b) Availability in the sizes required
- (c) Quality, durability and strength
- (d) Life expectancy and resistance to scour and corrosion
- (e) Method of jointing, ease of assembly and water-tightness
- (f) Ease of handling, transportation and installation
- (g) Cost:
 - i) of materials
 - ii) of handling, transportation and installation
- (h) Flow characteristics
- (i) Ground condition and pipe material resistance to aggressive soil and ground water elements.

Local availability of pipes is the first factor to be considered in the selection of pipe materials for the sewerage project. Based on the data and information obtained in Malaysia, several kinds of pipes are locally available. Some other kinds of pipes can be imported. However, it is obvious that locally manufactured pipes have an advantage over those imported.

There are different size limitations depending on the materials used, which require consideration since various sizes are expected to be used in this Project.

The pipes selected should be of good quality durable and possess the necessary strength to resist external load and working pressure in the case of force mains. In this regard, internationally acceptable standards have been adopted in Malaysia. Also, due to the tropical climate of the Project Area, special consideration must be given to the corrosive effects of hydrogen sulphide on pipes made of concrete.

In order to protect pipes of non-resistant materials such as concrete pipes against hydrogen sulphide attack, various kinds of control measures have been developed and adopted. These control measures result in higher cost of the pipes. However, weighed against the benefit of longer life expectancy, the additional cost involved in adoption of these control measures might be justified from the economic viewpoint.

Infiltration into the sewer should be avoided as much as possible to prevent increase of wastewater requiring treatment. Since one of the main causes of infiltration is defective joints, selection of joints is important.

Cost is one of the main factors among the various factors taken into account. If the other factors are sufficiently satisfied the least expensive material should be selected for adoption. Cost is made up of two components. The first is the cost of pipe including joints and the second is the cost of handling, transportation and installation. In some cases, the higher cost of pipe may be offset to a certain extent by lower cost of handling, transportation and installation. Therefore, cost comparison should be made on the basis of the combined cost of these two components.

In most sewerage projects, cost of the pipe itself accounts for a relatively small portion of the total construction cost. Therefore, the higher cost for better pipe material would only increase the overall project cost by a small percentage. Benefits derived from the more costly pipe in terms of longer life and reduction of maintenance cost might justify its selection.

K.2. Pipe Materials

K.2.1. General

Several kinds of sewer pipes made of suitable materials are locally available in Malaysia at the time of writing of this report. These materials are (a) vitrified clay, (b) centrifugally-cast reinforced concrete, (c) asbestos cement, (d) polyvinyl chloride (PVC), (e) steel, (f) cast iron and (g) high-density polyethylene. Pipes made of other materials, such as fibreglass reinforced plastic mortar (FRPM) and ductile cast iron are used for sewerage systems in developed countries. These pipes are not locally manufactured and thus generally higher in price than that of the aforementioned pipes. Therefore, use of these pipes are not recommended.

K.2.2. Types of Pipe Materials

Description and comments on the various pipe materials are as follows:

(a) Vitrified Clay Pipe

Vitrified clay pipe is made of clay and quartz (SiO_2). These two materials are very common and easily obtained in most parts of the world. The clay mixture is used to form a dense homogeneous pipe, which is then dried and finally fired in a kiln at a temperature of $1,100^\circ\text{C}$ to $1,200^\circ\text{C}$. Through this process, vitrification is obtained and the clay pipe is transformed into hard, impervious, chemically inert pipes of sufficient strength.

Readily available sizes of vitrified clay pipe are 100, 150 225 and 300 mm diameter. They are generally available in lengths of 600 to 1,800 mm, depending on size and make. Larger diameter pipes can be made by special order. However, the price of vitrified clay pipe increases sharply as the diameter increases. For instance, the cost of 300 mm diameter pipes and joints per length increases three times that of 225 mm pipes and joints, while in the case of concrete pipe, the increase is only 1.2 times. The cost of special order larger-diameter pipes might be increased more sharply. Therefore, use of such pipes is not recommended.

There are two manufacturers in Malaysia which produce vitrified clay pipes and joints capable of meeting internationally acceptable standards (pipe: B.S. 65&540, Part 1, 1971; joints: B.S. 65&540, Part 2, 1972). Each manufacturer adopts a different type of flexible joint; namely, rubber ring joints and ringless joints. A rubber ring is used in one joint, placed at the site, either on a spigot end or on a socket end in the case of rubber ring joints. On the other hand, polyurethane gaskets bonded at the factory onto both the inner surface of the socket and the outer surface of the spigot, are used in a ringless joint.

Joint flexibility, required to prevent ground water infiltration, cannot be provided by the previously used rigid cement mortar joint. Both of the two types of joints mentioned above are sufficiently flexible to meet or exceed the requirement of B.S. standard. The ringless joint is superior to the rubber ring joint in water tightness and ease of jointing but higher in cost while the other properties are almost identical. One disadvantage of the ringless joint is that in case the pipe is cut, the gasket on the outer surface of the spigot is removed in the process. In this case, the manufacturer recommends use of cement mortar, while the consultant is of the opinion that a free-type gasket on the inner surface of the socket should be used instead of cement mortar.

Superior features of the vitrified clay pipe compared to pipes of other materials are: chemical resistance to almost every kind of substance, abrasion resistance and consequent durability. Another advantage is its variety of specials, such as junctions and fittings. The main disadvantage is its rather short length which requires more joints, resulting in a longer time required for installation and higher cost; however, in some cases this disadvantage can be offset by the lighter weight of the shorter length pipe which provides ease of handling.

In smaller-diameter pipes, for example, 225 mm or less, cost of the vitrified clay pipe is lower than almost any other kind of material. However, as mentioned previously, cost increases sharply as diameter increases and the cost of a 300 mm diameter pipe per length is more than 1.5 times that of concrete pipe. This difference may not be of much significance if its longer durability is taken into account. Furthermore, the

material cost of pipes forms only a minor portion of the total construction cost of a sewerage system. Therefore, vitrified clay pipe for diameters up to 300 mm is recommended for use.

(b) Centrifugally-Cast Reinforced Concrete Pipe

Centrifugally-cast reinforced concrete pipe is commonly known as concrete spun pipe, which is readily available in a wide range in diameters from 150 to 1,950 mm. Length of the concrete pipe is 1.83 m for sizes up to 375 mm, and 1.52 m or 3.05 m for larger sizes. Various classes, based on Australian Standard 1342, 1973, are also available for different loading conditions. Extra-strength pipes can be produced at the customer's request. Selection of the class of pipe depends on trench conditions, including depth of earth covering, nature of soil and surface loading. There may be a choice of pipe class and bedding combination under a certain circumstance. When a sewer crosses a road with heavy traffic or when extra covering depth is unavoidable, driving method can be applied for installation. Concrete pipes for driving method can also be manufactured.

For larger diameter pipes of more than 600 mm, only those of concrete and steel are available in Malaysia. Since the material cost of reinforced concrete is much less than that of steel, it is naturally preferable to use concrete pipe where larger size pipe is required.

One of the main problems with concrete pipes is that it is affected by acids. Some protective measures are required to prevent pipes from both internal and external corrosion. Prevailing protective measures are as follows:

- i) Use of limestone aggregate, instead of granite, provides alkaline to neutralize acids, which slows corrosion of the cement.
- ii) Use of thick wall pipes, providing an extra concrete layer which can be corroded away without affecting its structural strength.

- iii) Provision of internal lining or external coating with material more resistant to acids.

The first two measures, as well as one of the third measures -- high alumina cement mortar lining -- merely increase life span by two to five times that of ordinary pipes. Recently, a better lining material of higher corrosion resistance; i.e. plasticized PVC, has come into use. Pipes lined with this PVC lining are known as 'plastiline' pipes. The PVC lining consists of an extruded sheet with one surface smooth and the other provided with integral keys to mechanically interlock with the pipe.

Because of the manufacturing process, the minimum diameter of the plastiline pipe is limited to 675 mm and the cost is higher than that of high alumina cement mortar lining pipes by approximately 20 percent. However, considering the total project cost, the higher cost of plastiline pipes is not so significant since the larger diameter pipes form only a small portion of the total sewer network. Also, as mentioned before, the difference may not be of great significance considering its longer durability.

In order to protect concrete pipes from external attack, which usually results from aggressive ground water, control measures are required, such as bitumen (asphalt) coating on the outer surface of concrete pipes. Although this measure is not required so often, care must be taken if the ground water contains acids or other aggressive compounds. However, coating increases the pipe cost by approximately 20 percent.

There are three types of pipes according to the types of end; i.e., butt-end pipe, ogee-end type and spigot-and-socket pipe. For the sewerage project, only the last type can be used because the first two types can not provide joint flexibility, resulting in ground water infiltration. A rubber ring is used in jointing spigot-and-socket pipe.

Taking into account the above-mentioned considerations, concrete pipes are recommended for use with the following types of lining:

| <u>Pipe Diameter</u> | <u>Lining</u> |
|----------------------|----------------------------|
| 375 to 600 mm | High alumina cement mortar |
| 675 mm and above | PVC |

(c) Asbestos Cement Pipe

In water supply system, asbestos cement pipes (A.C. pipes) have long been used. A.C. pipes for non-internal pressure are also produced and used for the sewerage system. Accordingly, there are two types of A.C. pipe; namely, pressure type and non-pressure type. Pressure type A.C. pipes are classified, according to the pressure which the pipe must withstand, into four classes; i.e., A to D. Non-pressure type A.C. pipes are classified according to crushing strength into two classes: Class 35 and Class 50.

The diameter of readily available A.C. pipes are from 100 mm to 600 mm. The pipe length is 4 m, which is longer than most pipes of other materials, due to the lightness of the material. The longer length of the A.C. pipe requires a fewer number of joints, resulting in smooth flow characteristics and shorter installation time.

A.C. pipe is manufactured from a homogeneous mixture of asbestos fibers and Portland cement. This mixture is transferred into a pipe machine to form the pipe, following which it is dried and subjected to an autoclave process. The pipes are autoclaved in an atmosphere of high-pressure saturated steam at 180°C. Through this process, free lime which is readily attacked by sulphuric acids is transformed into a more chemically stable compound. However, perfect transformation can not be expected.

The main disadvantage of the A.C. pipe is its shock load weakness, which requires special care in handling, particularly in installation and backfilling. Bedding for A.C. pipe should also be selected carefully. On the other hand, other advantages of the A.C. pipe are cutting ease and low cost, which is lowest of all types of pipes.

Taking into consideration the above-mentioned factors, A.C. pipes up to 600 mm diameter are recommended for the force main. In the case of the force main, sulphide build-up problem is not significant and internal pressure-resistant pipes are required.

(d) Polyvinyl Chloride (PVC) Pipe

PVC pipes with diameter ranging from 13 mm to 300 mm are locally manufactured in Malaysia. The length of PVC pipes is usually 6.6 m, the longest among the types of pipes discussed here. The connections can be easily carried out by either PVC fittings and solvent cement or rubber ring socket. They are generally used for household plumbing in Malaysia. They are also used widely in water supply pipes of smaller diameter.

PVC pipe is well known for its outstanding properties and performance. It resists corrosion caused by acids, alkalis, oils and salts; it is lightweight and its low coefficient of roughness impedes the build-up of deposits. It has high tensile strength but not being as strong as steel or cast iron, it cannot withstand sharp blows or shock. These factors give the PVC pipe such advantages as ease of handling and installation, water tightness and corrosion resistance. On the other hand, the PVC pipe requires more care in backfilling and making bedding.

As the PVC pipe belongs to the thermoplastic group, it expands when heated and becomes soft. Due to this thermal expansion, the pipe connection is not tight after laying and cooling in the trench. Also, PVC pipes are subject to deterioration if exposed to ultra-violet light. So the pipes should be kept under cover to prevent exposure to sunlight. They can also be attacked by certain kinds of bacteria or mold, and in some cases even by rats.

PVC pipes tend to become more brittle with age, so great care should be taken when laying the pipes to ensure an even bedding without large stones which may later lead to point load being applied to the pipes.

Taking these above-mentioned factors into account, the PVC pipe is not recommended.

(e) Steel Pipe

Steel pipes are locally manufactured in diameter sizes from 150 mm to 2,000 mm. Various standard lengths up to 8 m. are available. As mentioned before, there are only two materials available for diameters larger than 600 mm; namely, steel and reinforced concrete.

The most common jointing method is the spigot-and-socket joint with rubber ring. It can also be welded internally on diameters of 750 mm and larger. However, welding requires high skill to ascertain water tightness. Both of these methods provide sufficient flexibility.

Steel pipes are readily attacked by acids, thus internal and external lining is mandatory. The internal lining may be coal tar enamel, bitumen or cement mortar. The external lining may be asbestos felt wrapping or bitumen. However, these linings are less reliable and easily broken by impact because of the smooth surface of pipes. These difficulties, as well as the high cost of the material, result in less use of steel pipe for gravity sewers.

Steel pipes are also corroded by electric current under certain soil condition. In this case, an additional external cathodic protection should be provided.

A particular advantage of the steel pipe is that it can be easily changed to fit any obstacle encountered; namely, river, culvert, etc. which may reduce the cost of excavation substantially. Other advantages include its superior strength.

From the above-mentioned considerations, steel pipes are recommended to be used for force main.

(f) Cast Iron Pipe

Cast iron pipes of up to the 100 mm in diameter are locally manufactured in Malaysia, but pipes of larger diameter can be produced by special order. The length of the pipe is 4 m. Spigot-and-socket type

joints with flexible O-ring and flanged joints are available. Cast iron is relatively brittle compared with steel. Cement mortar or bitumen is also applied for internal lining.

Advantages of the cast iron pipe include availability of a wide range of fittings, resistance to shock and superior strength. On the other hand, main disadvantages are its high cost, heavy weight and relative unreliability of local manufacturers.

Therefore, the cast iron pipe is not recommended for use in the sewerage system except for pipings in pumping station and treatment plant.

(g) High Density Polyethylene Pipe

Recently, high density polyethylene (HDPE) pipes with diameter from 300 mm to 1,500 mm have come to be locally manufactured. These HDPE pipes have external extrusion in the form of regular corrugation along the length of the pipes.

HDPE pipes can be jointed either by spigot-and-bell system or welding method. Both of the joints as well as the pipe itself provide sufficient flexibility to sustain water tightness. Other superior features of this pipe include its light weight, abrasion resistance and lower roughness coefficient.

These pipes have only recently been used in Malaysia and its use at present is confined to the mining industries. In some neighbouring countries, they are used in the sewerage system. However, performance results have yet to be evaluated.

(h) Fiberglass Reinforced Plastic Mortar Pipe

Fiberglass reinforced plastic mortar pipes (FRPM pipe) have currently come to be used for sewerage systems in some developed countries, but are not yet locally manufactured in Malaysia.

There are several kinds of FRPM pipes according to the manufacturing process and pipe structure. However, fundamental structural components are plastic mortar and fiberglass reinforced plastics, the former sandwiched by the latter which forms the inner and outer surfaces of the pipe. The pipe wall is thin, made possible by the high strength of fiberglass reinforced plastics, which results in a light weight pipe. High corrosion resistance and low roughness coefficient are among the advantages of this pipe.

Since the manufacturing process for this pipe is more complicated than those for pipes of other materials, its cost, especially of the smaller diameter pipes, is comparatively high. In medium and larger diameter pipes, the higher price of materials can be offset to some extent by the lower cost of handling, transportation and installation. Thus, the larger, more than 500 mm, diameter pipe is most commonly used.

Taking into account the current price increase of petro-chemical products, FRPM pipes are expected to be used more often than other pipes, such as the PVC pipe.

(i) Egg-shaped Vibrated and Compressed Concrete Pipe

Egg-shaped, vibrated and compressed concrete pipes have also recently been introduced for sewerage use. Its superior flow characteristic permits installation at a more gradual gradient than that required for circular pipe, resulting in overall energy conservation of the sewerage system.

The egg shape is obtained by use of dense (less than 38 percent of water-cement ratio) concrete and by a manufacturing process using vibration and compression instead of centrifugal force as used in manufacturing circular pipes.

Since the material used is concrete, quality, durability, strength and other characteristics are basically the same as those of centrifugally-cast reinforced concrete pipe described previously. The same methods for installation and jointing as well as kind of bedding can be applied for the egg-shaped pipe, as for circular concrete pipe.

At present, only the smaller, less than 500 mm, diameter pipes are being used in Japan and those of larger diameter are expected to be manufactured later.

K.2.3. Recommended Pipe Materials

Based on the considerations discussed in the foregoing section, the following pipe materials and suitable joints are recommended for adoption in the Kelang Sewerage Project.

(a) Gravity Sewer

i) Diameter up to 300 mm

Vitrified clay pipe with either rubber ring joints or other flexible joints.

ii) Diameter 375 mm and above

Centrifugally-cast reinforced concrete pipe with high alumina cement mortar lining (up to 600 mm) and PVC lining (675 mm and above). Spigot-and-socket type pipe with rubber ring.

(b) Force Main

i) Diameter up to 600 mm

Asbestos cement pressure types or steel pipe with cement mortar internal lining and bitumen external lining.

ii) Diameter 675 mm and above

Steel pipe with cement mortar internal lining and bitumen external lining

APPENDIX L

SELECTION OF PUMP TYPE

APPENDIX L. SELECTION OF PUMP TYPE

L.1. Alternatives Considered

In order to select the most suitable pump type for the proposed sewerage system, a comprehensive study has been carried out. Pump types discussed are 1) Submersible pump and 2) Vertical centrifugal pump. Another type of pump; i.e., screw pump, is considered to be appropriate for handling sewage. However, the total head of two pumping stations are beyond the practical limit of the screw pump. If the screw pump is adopted, two-staged pumping would be required and its economic disadvantage, compared with the other two types, is obvious.

Two pumping stations; namely, Kg. Kuantan and Connaught Wastewater Treatment Plant (CWTP), are constructed during the First Phase. Specifications of these pumping stations are shown in Table L.1.

Table L.1. Specifications of Pumping Stations

| Name of Stations | Capacity (m ³ /min.) | | Number of Pumps | Total Dynamic Head (m) |
|------------------|---------------------------------|------|-----------------|------------------------|
| | Daily Ave. | Peak | | |
| Kg. Kuantan | 11.3 | 29.2 | 3 | 15 |
| CWTP | 23.2 | 53.3 | 5 | 12 |

L.2. Estimated Capital Costs

Capital costs for the two alternatives have been estimated on the basis of engineering design. The results of the estimation are shown in Tables L.2 and L.3.

Table L.2. Construction Cost for Kg. Kuantan Pumping Station

(Unit: M\$1,000)

| | Submersible | Centrifugal |
|------------------------|-------------|-------------|
| Civil Works | 298 | 328 |
| Architectural Works | 240 | 240 |
| Mechanical Works | 403 | 467 |
| Electrical Works | 377 | 377 |
| Land Acquisition Costs | 22 | 22 |
| Total | 1,340 | 1,434 |

Table L.3. Construction Costs for CWTP Pumping Station

(Unit: M\$1,000)

| | Submersible | Centrifugal |
|---------------------|-------------|-------------|
| Civil Works | 871 | 960 |
| Architectural Works | 240 | 240 |
| Mechanical Works | 512 | 550 |
| Electrical Works | 1,041 | 1,041 |
| Total | 2,664 | 2,791 |

L.3. Estimated Annual Operation and Maintenance Costs

The estimated costs for operation and maintenance are based on the procedure described in Section 6.1.5 of the current Report. Annual cost for repairing civil works and buildings is assumed to be 0.25 percent of construction cost and that for mechanical and electrical works is assumed to be 2 percent. Power cost is estimated based on the prevailing unit cost of M\$0.17/kWH.

As described in Section 6.1.5, Kg. Kuantan Pumping Station is planned to be maintained by workers in Connaught Wastewater Treatment Plant. The number of persons required to operated and maintain the CWTP pumping station is estimated to be two persons for either submersible or centrifugal pump. Annual operation and maintenance costs for the two pumping stations are summarized in Table L.4.

Table L.4. Operation and Maintenance Cost

(Unit: M\$1,000/year)

| | Submersible | Centrifugal |
|-------------|-------------|-------------|
| Kg. Kuantan | | |
| Power Cost | 86 | 91 |
| Repair Cost | 17 | 18 |
| Total | 103 | 109 |
| CWTP | | |
| Manpower | 8 | 8 |
| Power Cost | 70 | 75 |
| Repair Cost | 34 | 35 |
| Total | 112 | 118 |

L.4. Total Annual Costs

For cost comparison, all costs are expressed on an annual basis, using the average life of the components, i.e., 30 years for civil works and buildings and 15 years for mechanical and electrical equipment. It is also assumed that annual depreciation payments into the sinking fund would grow at 10 percent per annum. The estimated total annual costs for the alternatives according to type of pump are summarized on Tables L.5 and L.6.

Table L.5. Total Annual Costs for Kg. Kuantan Pumping Station

(Unit: M\$1,000/year)

| Item | Submersible | Centrifugal |
|---------------------------|-------------|-------------|
| Interest at 10% | 97.4 | 104.3 |
| Depreciation | | |
| Civil and Architectural | 3.2 | 4.3 |
| Mechanical and Electrical | 24.5 | 25.5 |
| O & M Cost | 103 | 109 |
| Total | 228.1 | 242.2 |

Table L.6. Total Annual Costs for CWTP Pumping Station

(Unit: M\$1,000/year)

| Item | Submersible | Centrifugal |
|---------------------------|-------------|-------------|
| Interest at 10% | 193.8 | 203.0 |
| Depreciation | | |
| Civil and Architectural | 4.4 | 7.2 |
| Mechanical and Electrical | 48.9 | 50.1 |
| O & M Cost | 112 | 118 |
| Total | 349.1 | 378.2 |

L.5. Conclusion

As shown in Tables L.5 and L.6, total annual costs for the two pumping stations are lower in the case of submersible pumps, compared with that of centrifugal pumps. Advantages and disadvantages of the submersible pumps are summarized below:

L.5.1. Advantages

- 1) Since the submersible pump is installed directly in a wet well, elimination of the dry well substructure results in reduced cost.
- 2) Because of its structure, the submersible pumps station presents fewer problems with respect to flooding.
- 3) As the motor is directly connected to the pump, the submersible pump does not have a long shaft, which would otherwise require lubricating of the intermediate bearing box. This makes the overall pump efficiency higher than that of the other types.
- 4) Since the submersible pump is placed completely in the water, there will be less noise, compared with the other types.

L.5.2. Disadvantages

- 1) One of the disadvantages of the submersible pump is that when pump cleaning is necessary, the unit must be completely withdrawn from the wet well before any work can be done.
- 2) Another disadvantage is its size limitation large diameter pump, for instance more than 1,000 mm can not be manufactured, while practical limitation is less than 1,000 mm.

In view of the above, it is reasonable to consider that the advantages expected from adoption of the submersible pump exceed the disadvantages in the case of both Kg. Kuantan and CWTP pumping stations.

APPENDIX M

FINANCIAL STATEMENT

Table M.1. (1)-1 Projected Income Statement (1983 - 1995)

Alternative A-1 (70%, 3%)*

(Unit: M\$1,000)

| Item | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|-----------------------------|------|------|------|------|------|-------|---------|---------|---------|---------|-------|-------|-------|
| OPERATING REVENUE | | | | | | | | | | | | | |
| Sewerage Charge | - | - | - | - | - | - | 647 | 1,507 | 2,109 | 2,196 | 2,286 | 2,400 | 2,485 |
| Sewerage Tax | - | - | - | - | - | 2,792 | 2,932 | 3,079 | 3,233 | 3,395 | 3,565 | 3,743 | 3,930 |
| Municipality Contribution | 221 | 200 | 235 | 260 | 342 | 656 | 252 | 1,361 | 688 | 496 | 329 | 139 | (14) |
| Total Operating Revenue | 221 | 200 | 235 | 260 | 342 | 3,448 | 3,831 | 5,947 | 6,030 | 6,087 | 6,180 | 6,282 | 6,401 |
| OPERATING EXPENSES | | | | | | | | | | | | | |
| Billing and Collection Fees | - | - | - | - | - | - | 13 | 30 | 42 | 44 | 46 | 48 | 50 |
| Provision for Bad Debts | - | - | - | - | - | - | 6 | 15 | 21 | 22 | 23 | 24 | 25 |
| Payroll | 155 | 166 | 212 | 226 | 262 | 415 | 575 | 613 | 653 | 695 | 740 | 788 | 840 |
| Maintenance | - | - | - | - | - | - | 278 | 309 | 350 | 408 | 443 | 487 | 529 |
| Administration | 16 | 17 | 21 | 23 | 26 | 42 | 58 | 61 | 65 | 70 | 74 | 79 | 84 |
| Total Operating Expenses | 171 | 183 | 233 | 249 | 288 | 457 | 930 | 1,028 | 1,131 | 1,239 | 1,326 | 1,426 | 1,528 |
| NET OPERATING INCOME | 50 | 17 | 2 | 11 | 54 | 2,991 | 2,901 | 4,919 | 4,899 | 4,848 | 4,854 | 4,856 | 4,873 |
| Depreciation | - | - | - | - | - | - | 1,987 | 2,022 | 2,073 | 2,073 | 2,073 | 2,073 | 2,073 |
| Interest | - | - | - | - | - | 2,349 | 2,319 | 3,969 | 3,906 | 3,839 | 3,766 | 3,687 | 3,602 |
| Net Income (Deficit) | 50 | 17 | 2 | 11 | 54 | 642 | (1,405) | (1,072) | (1,080) | (1,064) | (985) | (904) | (802) |

* (Sewerage surcharge rate, Sewerage surcharge tax rate)

Table M.1. (1)-2 Projected Cash Flow Statement (1983 - 1995)

Alternative A-1 (70%)

(Unit: M\$1,000)

| Item | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|--|-------|-------|-------|--------|--------|--------|-------|-------|-------|-------|-------|-------|-------|
| SOURCES OF FUNDS | | | | | | | | | | | | | |
| Net Operating Income | 50 | 17 | 2 | 11 | 54 | 2,991 | 2,901 | 4,919 | 4,899 | 4,848 | 4,854 | 4,856 | 4,873 |
| Increase in Account Payable | 14 | 1 | 4 | 2 | 3 | 14 | 40 | 8 | 8 | 9 | 8 | 8 | 8 |
| Decrease in Current Assets (Less Cash) | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Foreign Loan | - | - | 3,376 | 5,490 | 3,128 | 4,103 | 164 | 555 | - | - | - | - | - |
| Government Loan | 3,677 | 4,146 | 6,546 | 10,446 | 8,566 | 4,354 | 688 | 721 | - | - | - | - | - |
| Government Contribution | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Total Sources | 3,741 | 4,164 | 9,928 | 15,949 | 11,751 | 11,462 | 3,793 | 6,203 | 4,907 | 4,857 | 4,862 | 4,864 | 4,881 |
| APPLICATION OF FUNDS | | | | | | | | | | | | | |
| Capital Expenditure | 3,677 | 4,146 | 9,922 | 15,936 | 11,694 | 8,457 | 852 | 1,276 | - | - | - | - | - |
| Interest | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Foreign Loan | - | - | - | - | - | - | - | 1,682 | 1,652 | 1,620 | 1,585 | 1,546 | 1,503 |
| Government Loan | - | - | - | - | - | 2,349 | 2,319 | 2,287 | 2,254 | 2,219 | 2,181 | 2,141 | 2,099 |
| Amortization of Principal | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Foreign Loan | - | - | - | - | - | - | - | 293 | 323 | 355 | 390 | 429 | 472 |
| Government Loan | - | - | - | - | - | 495 | 525 | 557 | 590 | 625 | 663 | 703 | 745 |
| Total Debt Service | - | - | - | - | - | 2,844 | 2,844 | 4,819 | 4,819 | 4,819 | 4,819 | 4,819 | 4,819 |
| Increase in Current Assets (Less Cash) | 3 | 1 | 1 | 0 | 1 | 3 | 64 | 74 | 52 | 9 | 10 | 11 | 9 |
| Total Applications | 3,680 | 4,147 | 9,923 | 15,936 | 11,695 | 11,304 | 3,760 | 6,169 | 4,871 | 4,828 | 4,829 | 4,830 | 4,828 |
| Net Cash Increase (Decrease) | 61 | 17 | 5 | 13 | 56 | 158 | 33 | 34 | 36 | 29 | 33 | 34 | 53 |
| Cash Available at End of Year | 61 | 78 | 83 | 96 | 152 | 310 | 343 | 377 | 413 | 442 | 475 | 509 | 562 |

Table M.1. (1)-3 Projected Balance Sheet (1983 - 1995)

Alternative A-1 (70%)

(Unit: M\$1,000)

| Item | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|---------------------------------|-------|-------|--------|--------|--------|--------|--------|---------|---------|---------|---------|---------|---------|
| ASSETS | | | | | | | | | | | | | |
| Fixed Assets | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Land | - | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 |
| Utility Plant in Service | - | - | - | - | - | - | 49,686 | 50,538 | 51,814 | 51,814 | 51,814 | 51,814 | 51,814 |
| Less Accumulative Depreciation | - | - | - | - | - | - | 1,987 | 4,009 | 6,082 | 8,155 | 10,228 | 12,301 | 14,374 |
| Net Fixed Assets in Service | - | - | - | - | - | - | 51,845 | 50,675 | 49,878 | 47,805 | 45,732 | 43,659 | 41,586 |
| Construction in Progress | 3,677 | 3,677 | 13,599 | 29,535 | 41,229 | 49,686 | 852 | 1,276 | - | - | - | - | - |
| Total Fixed Assets | 3,677 | 7,823 | 17,745 | 33,681 | 45,375 | 53,832 | 52,697 | 61,951 | 49,878 | 47,805 | 45,732 | 43,659 | 41,586 |
| Current Assets | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Cash | 61 | 78 | 83 | 96 | 152 | 310 | 343 | 377 | 413 | 442 | 475 | 509 | 562 |
| Account Receivable | - | - | - | - | - | - | 54 | 126 | 176 | 183 | 191 | 200 | 207 |
| Inventory | 3 | 4 | 5 | 5 | 6 | 9 | 19 | 21 | 23 | 25 | 27 | 29 | 31 |
| Total Current Assets | 64 | 82 | 88 | 101 | 158 | 319 | 416 | 524 | 612 | 650 | 693 | 738 | 800 |
| Total Assets | 3,741 | 7,905 | 17,833 | 33,782 | 45,553 | 54,151 | 53,113 | 52,475 | 50,490 | 48,455 | 46,425 | 44,397 | 42,386 |
| LIABILITIES AND EQUITY | | | | | | | | | | | | | |
| Long Term Debt | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Foreign Loan | - | - | 3,376 | 8,866 | 11,994 | 16,097 | 15,968 | 16,200 | 15,845 | 15,455 | 15,026 | 14,554 | 14,034 |
| Government Loan | 3,677 | 7,823 | 14,369 | 24,815 | 32,886 | 36,715 | 36,846 | 36,977 | 36,352 | 35,689 | 34,986 | 34,241 | 33,451 |
| Total Long Term Debt | 3,677 | 7,823 | 17,745 | 33,681 | 44,880 | 52,812 | 52,814 | 53,177 | 52,197 | 51,144 | 50,012 | 48,795 | 47,485 |
| Current Liabilities | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Accounts Payable | 14 | 15 | 19 | 21 | 24 | 38 | 78 | 86 | 94 | 103 | 111 | 119 | 127 |
| Current Debt Maturities | - | - | - | - | 495 | 525 | 850 | 913 | 980 | 1,053 | 1,132 | 1,217 | 1,310 |
| Total Current Liabilities | 14 | 15 | 19 | 21 | 519 | 563 | 928 | 999 | 1,074 | 1,156 | 1,243 | 1,336 | 1,437 |
| Equity | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Government Capital Contribution | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Retained Earnings | 50 | 67 | 69 | 80 | 134 | 776 | (629) | (1,701) | (2,781) | (3,845) | (4,830) | (5,734) | (6,536) |
| Total Equity | 50 | 67 | 69 | 80 | 134 | 776 | (629) | (1,701) | (2,781) | (3,845) | (4,830) | (5,734) | (6,536) |
| Total Liabilities and Equity | 3,741 | 7,905 | 17,833 | 33,782 | 45,553 | 54,151 | 53,113 | 52,475 | 50,490 | 48,455 | 46,425 | 44,397 | 42,386 |

Table M.1. (2)-1 Projected Income Statement (1983 - 1995)

Alternative A-2 (50%, 5%)*

(Unit: M\$1,000)

| Item | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|-----------------------------|------|------|------|------|------|-------|---------|-------|-------|-------|-------|-------|-------|
| OPERATING REVENUE | | | | | | | | | | | | | |
| Sewerage Charge | - | - | - | - | - | - | 493 | 1,150 | 1,607 | 1,674 | 1,741 | 1,829 | 1,894 |
| Sewerage Tax | - | - | - | - | - | 4,591 | 4,821 | 5,062 | 5,315 | 5,581 | 5,860 | 6,153 | 6,461 |
| Municipality Contribution | 221 | 200 | 235 | 260 | 342 | 349 | (9) | 1,199 | 574 | 307 | 54 | (227) | (481) |
| Total Operating Revenue | 221 | 200 | 235 | 260 | 342 | 4,940 | 5,305 | 7,411 | 7,496 | 7,562 | 7,655 | 7,755 | 7,874 |
| OPERATING EXPENSES | | | | | | | | | | | | | |
| Billing and Collection Fees | - | - | - | - | - | - | 10 | 23 | 32 | 33 | 35 | 37 | 38 |
| Provision for Bad Debts | - | - | - | - | - | - | 5 | 12 | 16 | 17 | 17 | 18 | 19 |
| Payroll | 155 | 166 | 212 | 226 | 262 | 415 | 575 | 613 | 653 | 695 | 740 | 788 | 840 |
| Maintenance | - | - | - | - | - | - | 278 | 309 | 350 | 408 | 443 | 487 | 529 |
| Administration | 16 | 17 | 21 | 23 | 26 | 42 | 58 | 61 | 65 | 70 | 74 | 79 | 84 |
| Total Operating Expenses | 171 | 183 | 233 | 249 | 288 | 457 | 926 | 1,018 | 1,116 | 1,223 | 1,309 | 1,409 | 1,510 |
| NET OPERATING INCOME | | | | | | | | | | | | | |
| Depreciation | 50 | 17 | 2 | 11 | 54 | 4,483 | 4,379 | 6,393 | 6,380 | 6,339 | 6,346 | 6,346 | 6,364 |
| Interest | - | - | - | - | - | - | 1,987 | 2,022 | 2,073 | 2,073 | 2,073 | 2,073 | 2,073 |
| Net Income (Deficit) | - | - | - | - | - | 3,582 | 3,537 | 5,171 | 5,090 | 5,004 | 4,912 | 4,812 | 4,705 |
| Net Income (Deficit) | 50 | 17 | 2 | 11 | 54 | 901 | (1,145) | (800) | (783) | (738) | (639) | (539) | (414) |

* (Sewerage surcharge rate, Sewerage surcharge tax rate)

Table M.1. (2)-2 Projected Cash Flow Statement (1983 - 1995)

| Alternative A-2 (50%) | | | | | | | | | | | | | | (Unit: M\$1,000) | | | | | | | | | | | | | |
|--|-------|--------|-------|--------|--------|--------|-------|-------|-------|-------|-------|-------|-------|------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|
| Item | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | | | | | | | | | | | | | | |
| SOURCES OF FUNDS | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Net Operating Income | 50 | 17 | 2 | 11 | 54 | 4,483 | 4,379 | 6,393 | 6,380 | 6,339 | 6,346 | 6,346 | 6,364 | | | | | | | | | | | | | | |
| Increase in Account Payable | 14 | 1 | 4 | 2 | 3 | 14 | 39 | 8 | 8 | 9 | 7 | 8 | 9 | | | | | | | | | | | | | | |
| Decrease in Current Assets (Less Cash) | - | - | - | - | - | - | - | - | - | - | - | - | - | | | | | | | | | | | | | | |
| Foreign Loan | - | - | 3,376 | 5,490 | 3,128 | 4,103 | 164 | 555 | - | - | - | - | - | | | | | | | | | | | | | | |
| Government Loan | 3,677 | 24,699 | 6,546 | 10,446 | 8,566 | 4,354 | 688 | 721 | - | - | - | - | - | | | | | | | | | | | | | | |
| Government Contribution | - | - | - | - | - | - | - | - | - | - | - | - | - | | | | | | | | | | | | | | |
| Total Sources | 3,741 | 24,717 | 9,928 | 15,949 | 11,751 | 12,954 | 5,270 | 7,677 | 6,388 | 6,348 | 6,353 | 6,354 | 6,373 | | | | | | | | | | | | | | |
| APPLICATION OF FUNDS | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Capital Expenditure | 3,677 | 24,699 | 9,922 | 15,936 | 11,694 | 8,457 | 852 | 1,276 | - | - | - | - | - | | | | | | | | | | | | | | |
| Interest | - | - | - | - | - | - | - | - | - | - | - | - | - | | | | | | | | | | | | | | |
| Foreign Loan | - | - | - | - | - | - | - | 1,682 | 1,652 | 1,620 | 1,585 | 1,546 | 1,503 | | | | | | | | | | | | | | |
| Government Loan | - | - | - | - | - | 3,582 | 3,537 | 3,489 | 3,438 | 3,384 | 3,327 | 3,266 | 3,202 | | | | | | | | | | | | | | |
| Amortization of Principal | - | - | - | - | - | - | - | - | - | - | - | - | - | | | | | | | | | | | | | | |
| Foreign Loan | - | - | - | - | - | - | - | 293 | 323 | 355 | 390 | 429 | 472 | | | | | | | | | | | | | | |
| Government Loan | - | - | - | - | - | 755 | 800 | 848 | 899 | 953 | 1,010 | 1,071 | 1,135 | | | | | | | | | | | | | | |
| Total Debt Service | - | - | - | - | - | 4,337 | 4,337 | 6,312 | 6,312 | 6,312 | 6,312 | 6,312 | 6,312 | | | | | | | | | | | | | | |
| Increase in Current Assets (Less Cash) | 3 | 1 | 1 | 0 | 1 | 3 | 51 | 56 | 40 | 8 | 7 | 9 | 8 | | | | | | | | | | | | | | |
| Total Applications | 3,680 | 24,700 | 9,923 | 15,936 | 11,695 | 12,797 | 5,240 | 7,644 | 6,352 | 6,320 | 6,319 | 6,321 | 6,320 | | | | | | | | | | | | | | |
| Net Cash Increase (Decrease) | 61 | 17 | 5 | 13 | 56 | 157 | 30 | 33 | 36 | 28 | 34 | 33 | 53 | | | | | | | | | | | | | | |
| Cash Available at End of Year | 61 | 78 | 83 | 96 | 152 | 309 | 339 | 372 | 408 | 436 | 470 | 503 | 556 | | | | | | | | | | | | | | |

Table M.1. (2)-3 Projected Balance Sheet (1983 - 1995)

Alternative A-2 (50%) (Unit: M\$1,000)

| Item | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|---------------------------------|-------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|---------|---------|
| ASSETS | | | | | | | | | | | | | |
| Fixed Assets | | | | | | | | | | | | | |
| Land | - | 24,699 | 24,699 | 24,699 | 24,699 | 24,699 | 24,699 | 24,699 | 24,699 | 24,699 | 24,699 | 24,699 | 24,699 |
| Utility Plant in Service | - | - | - | - | - | - | 49,686 | 50,538 | 51,814 | 51,814 | 51,814 | 51,814 | 51,814 |
| Less Accumulative Depreciation | - | - | - | - | - | - | 1,987 | 4,009 | 6,082 | 8,155 | 10,228 | 12,301 | 14,374 |
| Net Fixed Assets in Service | - | - | - | - | - | - | 72,398 | 71,228 | 70,431 | 68,358 | 66,285 | 64,212 | 62,139 |
| Construction in Progress | 3,677 | 3,677 | 13,599 | 29,535 | 41,229 | 49,686 | 852 | 1,276 | - | - | - | - | - |
| Total Fixed Assets | 3,677 | 28,376 | 38,298 | 54,234 | 65,928 | 74,385 | 73,250 | 72,504 | 70,431 | 68,358 | 66,285 | 64,212 | 62,139 |
| Current Assets | | | | | | | | | | | | | |
| Cash | 61 | 78 | 83 | 96 | 152 | 309 | 339 | 372 | 408 | 436 | 470 | 503 | 556 |
| Account Receivable | - | - | - | - | - | - | 41 | 96 | 134 | 140 | 145 | 152 | 158 |
| Inventory | 3 | 4 | 5 | 5 | 6 | 9 | 19 | 20 | 22 | 24 | 26 | 28 | 30 |
| Total Current Assets | 64 | 82 | 88 | 101 | 158 | 318 | 399 | 488 | 564 | 600 | 641 | 683 | 744 |
| Total Assets | 3,741 | 28,458 | 38,386 | 54,335 | 66,086 | 74,703 | 73,649 | 72,992 | 70,995 | 68,958 | 66,926 | 64,895 | 62,883 |
| LIABILITIES AND EQUITY | | | | | | | | | | | | | |
| Long Term Debt | | | | | | | | | | | | | |
| Foreign Loan | - | - | 3,376 | 8,866 | 11,994 | 16,097 | 15,968 | 16,200 | 15,845 | 15,455 | 15,026 | 14,554 | 14,034 |
| Government Loan | 3,677 | 28,376 | 34,922 | 45,368 | 53,179 | 56,733 | 56,573 | 56,395 | 55,442 | 54,432 | 53,361 | 52,226 | 51,023 |
| Total Long Term Debt | 3,677 | 28,376 | 38,298 | 54,234 | 65,173 | 72,830 | 72,541 | 72,595 | 71,287 | 69,887 | 68,387 | 66,780 | 65,057 |
| Current Liabilities | | | | | | | | | | | | | |
| Accounts Payable | 14 | 15 | 19 | 21 | 24 | 38 | 77 | 85 | 93 | 102 | 109 | 117 | 126 |
| Current Debt Maturities | - | - | - | - | 755 | 800 | 1,141 | 1,222 | 1,308 | 1,400 | 1,500 | 1,607 | 1,723 |
| Total Current Liabilities | 14 | 15 | 19 | 21 | 779 | 838 | 1,218 | 1,307 | 1,401 | 1,502 | 1,609 | 1,724 | 1,849 |
| Equity | | | | | | | | | | | | | |
| Government Capital Contribution | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Retained Earnings | 50 | 67 | 69 | 80 | 134 | 1,035 | (110) | (910) | (1,693) | (2,431) | (3,070) | (3,609) | (4,023) |
| Total Equity | 50 | 67 | 69 | 80 | 134 | 1,035 | (110) | (910) | (1,693) | (2,431) | (3,070) | (3,609) | (4,023) |
| Total Liabilities and Equity | 3,741 | 28,458 | 38,386 | 54,335 | 66,086 | 74,703 | 73,649 | 72,992 | 70,995 | 68,958 | 66,926 | 64,895 | 62,883 |

Table M.1. (3)-1 Projected Income Statement (1983 - 1995)

Alternative A-4 (33%, 4%)* (Unit: M\$1,000)

| Item | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|-----------------------------|------|------|------|------|------|-------|---------|---------|---------|---------|---------|-------|-------|
| OPERATING REVENUE | | | | | | | | | | | | | |
| Sewerage Charge | - | - | - | - | - | - | 346 | 809 | 1,130 | 1,177 | 1,225 | 1,287 | 1,333 |
| Sewerage Tax | - | - | - | - | - | 3,692 | 3,877 | 4,071 | 4,274 | 4,488 | 4,712 | 4,948 | 5,195 |
| Municipality Contribution | 221 | 200 | 235 | 260 | 342 | (247) | (430) | 1,286 | 850 | 664 | 484 | 286 | 110 |
| Total Operating Revenue | 221 | 200 | 235 | 260 | 342 | 3,445 | 3,793 | 6,166 | 6,254 | 6,329 | 6,421 | 6,521 | 6,638 |
| OPERATING EXPENSES | | | | | | | | | | | | | |
| Billing and Collection Fees | - | - | - | - | - | - | 7 | 16 | 23 | 24 | 25 | 26 | 27 |
| Provision for Bad Debts | - | - | - | - | - | - | 3 | 8 | 11 | 12 | 12 | 13 | 13 |
| Payroll | 155 | 166 | 212 | 226 | 262 | 415 | 575 | 613 | 653 | 695 | 740 | 788 | 840 |
| Maintenance | - | - | - | - | - | - | 278 | 309 | 350 | 408 | 443 | 487 | 529 |
| Administration | 16 | 17 | 21 | 23 | 26 | 42 | 58 | 61 | 65 | 70 | 74 | 79 | 84 |
| Total Operating Expenses | 171 | 183 | 233 | 249 | 288 | 457 | 921 | 1,007 | 1,102 | 1,209 | 1,294 | 1,393 | 1,493 |
| NET OPERATING INCOME | | | | | | | | | | | | | |
| Depreciation | 50 | 17 | 2 | 11 | 54 | 2,988 | 2,872 | 5,159 | 5,152 | 5,120 | 5,127 | 5,128 | 5,145 |
| Interest | - | - | - | - | - | - | 1,987 | 2,022 | 2,073 | 2,073 | 2,073 | 2,073 | 2,073 |
| Net Income (Deficit) | - | - | - | - | - | 2,349 | 2,319 | 4,305 | 4,244 | 4,178 | 4,105 | 4,025 | 3,939 |
| | 50 | 17 | 2 | 11 | 54 | 639 | (1,434) | (1,168) | (1,165) | (1,131) | (1,051) | (970) | (867) |

* (Sewerage surcharge rate, Sewerage surcharge tax rate)

Table M.1. (3)-2 Projected Cash Flow Statement (1983 - 1995)

Alternative A-4 (33%)

(Unit: M\$1,000)

| Item | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|--|-------|-------|-------|--------|--------|--------|-------|-------|-------|-------|-------|-------|-------|
| SOURCES OF FUNDS | | | | | | | | | | | | | |
| Net Operating Income | 50 | 17 | 2 | 11 | 54 | 2,988 | 2,872 | 5,159 | 5,152 | 5,120 | 5,127 | 5,128 | 5,145 |
| Increase in Account Payable | 14 | 1 | 4 | 2 | 3 | 14 | 39 | 7 | 8 | 9 | 7 | 8 | 8 |
| Decrease in Current Assets (Less Cash) | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Foreign Loan | - | - | 3,376 | 5,490 | 3,128 | 4,103 | 164 | 555 | - | - | - | - | - |
| Government Loan | 3,677 | 4,146 | 6,546 | 10,446 | 8,566 | 4,354 | 688 | 721 | - | - | - | - | - |
| Government Contribution | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Total Sources | 3,741 | 4,164 | 9,928 | 15,949 | 11,751 | 11,459 | 3,763 | 6,442 | 5,160 | 5,129 | 5,134 | 5,136 | 5,153 |
| APPLICATION OF FUNDS | | | | | | | | | | | | | |
| Capital Expenditure | 3,677 | 4,146 | 9,922 | 15,936 | 11,694 | 8,457 | 852 | 1,276 | - | - | - | - | - |
| Interest | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Foreign Loan | - | - | - | - | - | - | - | 2,018 | 1,990 | 1,959 | 1,924 | 1,884 | 1,840 |
| Government Loan | - | - | - | - | - | 2,349 | 2,319 | 2,287 | 2,254 | 2,219 | 2,181 | 2,141 | 2,099 |
| Amortization of Principal | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Foreign Loan | - | - | - | - | - | - | - | 233 | 261 | 292 | 327 | 367 | 411 |
| Government Loan | - | - | - | - | - | 495 | 525 | 557 | 590 | 625 | 663 | 703 | 745 |
| Total Debt Service | - | - | - | - | - | 2,844 | 2,844 | 5,095 | 5,095 | 5,095 | 5,095 | 5,095 | 5,095 |
| Increase in Current Assets (Less Cash) | 3 | 1 | 1 | - | 1 | 3 | 38 | 40 | 29 | 6 | 6 | 7 | 6 |
| Total Applications | 3,680 | 4,147 | 9,923 | 15,936 | 11,695 | 11,304 | 3,734 | 6,411 | 5,124 | 5,101 | 5,101 | 5,102 | 5,101 |
| Net Cash Increase (Decrease) | 61 | 17 | 5 | 13 | 56 | 155 | 29 | 31 | 36 | 28 | 33 | 34 | 52 |
| Cash Available at End of Year | 61 | 78 | 83 | 96 | 152 | 307 | 336 | 367 | 403 | 431 | 464 | 498 | 550 |

Table M.1. (3)-3 Projected Balance Sheet (1983 - 1995)

Alternative A-4 (33%)

(Unit: M\$1,000)

| Item | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|---------------------------------|-------|-------|--------|--------|--------|--------|--------|---------|---------|---------|---------|---------|---------|
| ASSETS | | | | | | | | | | | | | |
| Fixed Assets | | | | | | | | | | | | | |
| Land | - | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 |
| Utility Plant in Service | - | - | - | - | - | - | 49,686 | 50,538 | 51,814 | 51,814 | 51,814 | 51,814 | 51,814 |
| Less Accumulative Depreciation | - | - | - | - | - | - | 1,987 | 4,009 | 6,082 | 8,155 | 10,228 | 12,301 | 14,374 |
| Net Fixed Assets in Service | - | - | - | - | - | - | 51,845 | 50,675 | 49,878 | 47,805 | 45,732 | 43,659 | 41,586 |
| Construction in Progress | 3,677 | 3,677 | 13,599 | 29,535 | 41,229 | 49,686 | 852 | 1,276 | - | - | - | - | - |
| Total Fixed Assets | 3,677 | 7,823 | 17,745 | 33,681 | 45,375 | 53,832 | 52,697 | 51,951 | 49,878 | 47,805 | 45,732 | 43,659 | 41,586 |
| Current Assets | | | | | | | | | | | | | |
| Cash | 61 | 78 | 83 | 96 | 152 | 307 | 336 | 367 | 403 | 431 | 464 | 498 | 550 |
| Account Receivable | - | - | - | - | - | - | 29 | 67 | 94 | 98 | 102 | 107 | 111 |
| Inventory | 3 | 4 | 5 | 5 | 6 | 9 | 18 | 20 | 22 | 24 | 26 | 28 | 30 |
| Total Current Assets | 64 | 82 | 88 | 101 | 158 | 316 | 383 | 454 | 519 | 553 | 592 | 633 | 691 |
| Total Assets | 3,741 | 7,905 | 17,833 | 33,782 | 45,533 | 54,148 | 53,080 | 52,405 | 50,397 | 48,358 | 46,324 | 44,292 | 42,277 |
| LIABILITIES AND EQUITY | | | | | | | | | | | | | |
| Long Term Debt | | | | | | | | | | | | | |
| Foreign Loan | - | - | 3,376 | 8,866 | 11,994 | 16,097 | 16,028 | 16,322 | 16,030 | 15,703 | 15,336 | 14,925 | 14,465 |
| Government Loan | 3,677 | 7,823 | 14,369 | 24,815 | 32,886 | 36,715 | 36,846 | 36,977 | 36,352 | 35,689 | 34,986 | 34,241 | 33,451 |
| Total Long Term Debt | 3,677 | 7,823 | 17,745 | 33,681 | 44,880 | 52,812 | 52,874 | 53,299 | 52,382 | 51,392 | 50,322 | 49,166 | 47,916 |
| Current Liabilities | | | | | | | | | | | | | |
| Accounts Payable | 14 | 15 | 19 | 21 | 24 | 38 | 77 | 84 | 92 | 101 | 108 | 116 | 124 |
| Current Debt Maturities | - | - | - | - | 495 | 525 | 790 | 851 | 917 | 990 | 1,070 | 1,156 | 1,250 |
| Total Current Liabilities | 14 | 15 | 19 | 21 | 519 | 563 | 867 | 935 | 1,009 | 1,091 | 1,178 | 1,272 | 1,374 |
| Equity | | | | | | | | | | | | | |
| Government Capital Contribution | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Retained Earnings | 50 | 67 | 69 | 80 | 134 | 773 | (661) | (1,829) | (2,994) | (4,125) | (5,176) | (6,146) | (7,013) |
| Total Equity | 50 | 67 | 69 | 80 | 134 | 773 | (661) | (1,829) | (2,994) | (4,125) | (5,176) | (6,146) | (7,013) |
| Total Liabilities and Equity | 3,741 | 7,905 | 17,833 | 33,782 | 45,533 | 54,148 | 53,080 | 52,405 | 50,397 | 48,358 | 46,324 | 44,292 | 42,277 |

Table M.1. (4)-1 Projected Income Statement (1983 - 1995)

Alternative A-5 (70%, 3%)*

(Unit: M\$1,000)

| Item | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|-----------------------------|------|------|------|------|------|-------|---------|---------|---------|---------|---------|---------|-------|
| OPERATING REVENUE | | | | | | | | | | | | | |
| Sewerage Charge | - | - | - | - | - | - | 647 | 1,507 | 2,109 | 2,196 | 2,286 | 2,400 | 2,485 |
| Sewerage Tax | - | - | - | - | - | 2,792 | 2,932 | 3,079 | 3,233 | 3,395 | 3,565 | 3,743 | 3,930 |
| Municipality Contribution | 221 | 200 | 235 | 260 | 342 | 355 | (49) | 1,336 | 663 | 471 | 304 | 114 | (39) |
| Total Operating Revenue | 221 | 200 | 235 | 260 | 342 | 3,147 | 3,530 | 5,922 | 6,005 | 6,062 | 6,155 | 6,257 | 6,376 |
| OPERATING EXPENSES | | | | | | | | | | | | | |
| Billing and Collection Fees | - | - | - | - | - | - | 13 | 30 | 42 | 44 | 46 | 48 | 50 |
| Provision for Bad Debts | - | - | - | - | - | - | 6 | 15 | 21 | 22 | 23 | 24 | 25 |
| Payroll | 155 | 166 | 212 | 226 | 262 | 415 | 575 | 613 | 653 | 695 | 740 | 788 | 840 |
| Maintenance | - | - | - | - | - | - | 278 | 309 | 350 | 408 | 443 | 487 | 529 |
| Administration | 16 | 17 | 21 | 23 | 26 | 42 | 58 | 61 | 65 | 70 | 74 | 79 | 84 |
| Total Operating Expenses | 171 | 183 | 233 | 249 | 288 | 457 | 930 | 1,028 | 1,131 | 1,239 | 1,326 | 1,426 | 1,528 |
| NET OPERATING INCOME | | | | | | | | | | | | | |
| Depreciation | 50 | 17 | 2 | 11 | 54 | 2,690 | 2,600 | 4,894 | 4,874 | 4,823 | 4,829 | 4,831 | 4,848 |
| Interest | - | - | - | - | - | - | 1,987 | 2,022 | 2,073 | 2,073 | 2,073 | 2,073 | 2,073 |
| Net Income (Deficit) | - | - | - | - | - | 2,100 | 2,073 | 4,063 | 4,005 | 3,943 | 3,874 | 3,798 | 3,717 |
| | 50 | 17 | 2 | 11 | 54 | 590 | (1,460) | (1,191) | (1,204) | (1,193) | (1,118) | (1,040) | (942) |

* (Sewerage surcharge rate, Sewerage surcharge tax rate)

Table M.1. (4)-2 Projected Cash Flow Statement (1983 - 1995)

| Alternative A-5 (70%) | | | | | | | | | | | | | | (Unit: M\$1,000) | | | | | | | | | | | | | |
|--|-------|-------|-------|--------|--------|--------|-------|-------|-------|-------|-------|-------|-------|------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|
| Item | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | | | | | | | | | | | | | | |
| SOURCES OF FUNDS | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Net Operating Income | 50 | 17 | 2 | 11 | 54 | 2,690 | 2,600 | 4,894 | 4,874 | 4,823 | 4,829 | 4,831 | 4,848 | | | | | | | | | | | | | | |
| Increase in Account Payable | 14 | 1 | 4 | 2 | 3 | 14 | 40 | 8 | 8 | 9 | 8 | 8 | 8 | | | | | | | | | | | | | | |
| Decrease in Current Assets (Less Cash) | - | - | - | - | - | - | - | - | - | - | - | - | - | | | | | | | | | | | | | | |
| Foreign Loan | - | - | 3,376 | 5,490 | 3,128 | 4,103 | 164 | 555 | - | - | - | - | - | | | | | | | | | | | | | | |
| Government Loan | 3,677 | - | 6,546 | 10,446 | 8,566 | 4,354 | 688 | 721 | - | - | - | - | - | | | | | | | | | | | | | | |
| Government Contribution | - | 4,146 | - | - | - | - | - | - | - | - | - | - | - | | | | | | | | | | | | | | |
| Total Sources | 3,741 | 4,164 | 9,928 | 15,949 | 11,751 | 11,161 | 3,492 | 6,178 | 4,882 | 4,832 | 4,837 | 4,839 | 4,856 | | | | | | | | | | | | | | |
| APPLICATION OF FUNDS | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Capital Expenditure | 3,677 | 4,146 | 9,922 | 15,936 | 11,694 | 8,457 | 852 | 1,276 | - | - | - | - | - | | | | | | | | | | | | | | |
| Interest | - | - | - | - | - | - | - | - | - | - | - | - | - | | | | | | | | | | | | | | |
| Foreign Loan | - | - | - | - | - | - | - | 2,018 | 1,990 | 1,959 | 1,924 | 1,884 | 1,840 | | | | | | | | | | | | | | |
| Government Loan | - | - | - | - | - | 2,100 | 2,073 | 2,045 | 2,015 | 1,984 | 1,950 | 1,914 | 1,877 | | | | | | | | | | | | | | |
| Amortization of Principal | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Foreign Loan | - | - | - | - | - | - | - | 233 | 261 | 292 | 327 | 367 | 411 | | | | | | | | | | | | | | |
| Government Loan | - | - | - | - | - | 443 | 470 | 498 | 528 | 559 | 593 | 629 | 666 | | | | | | | | | | | | | | |
| Total Debt Service | - | - | - | - | - | 2,543 | 2,543 | 4,794 | 4,794 | 4,794 | 4,794 | 4,794 | 4,794 | | | | | | | | | | | | | | |
| Increase in Current Assets (Less Cash) | 3 | 1 | 1 | 0 | 1 | 3 | 64 | 74 | 52 | 9 | 10 | 11 | 9 | | | | | | | | | | | | | | |
| Total Applications | 3,680 | 4,147 | 9,923 | 15,936 | 11,695 | 11,003 | 3,459 | 6,144 | 4,846 | 4,803 | 4,804 | 4,805 | 4,803 | | | | | | | | | | | | | | |
| Net Cash Increase (Decrease) | 61 | 17 | 5 | 13 | 56 | 158 | 33 | 34 | 36 | 29 | 33 | 34 | 53 | | | | | | | | | | | | | | |
| Cash Available at End of Year | 61 | 78 | 83 | 96 | 152 | 310 | 343 | 377 | 413 | 442 | 475 | 509 | 562 | | | | | | | | | | | | | | |

Table M.1. (4)-3 Projected Balance Sheet (1983 - 1995)

Alternative A-5 (70%)

(Unit: M\$1,000)

| Item | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|---------------------------------|-------|-------|--------|--------|--------|--------|--------|---------|---------|---------|---------|---------|---------|
| ASSETS | | | | | | | | | | | | | |
| Fixed Assets | | | | | | | | | | | | | |
| Land | - | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 |
| Utility Plant in Service | - | - | - | - | - | - | 49,686 | 50,538 | 51,814 | 51,814 | 51,814 | 51,814 | 51,814 |
| Less Accumulative Depreciation | - | - | - | - | - | - | 1,987 | 4,009 | 6,082 | 8,155 | 10,228 | 12,301 | 14,374 |
| Net Fixed Assets in Service | - | - | - | - | - | - | 51,845 | 50,675 | 49,878 | 47,805 | 45,732 | 43,659 | 41,586 |
| Construction in Progress | 3,677 | 3,677 | 13,599 | 29,535 | 41,229 | 49,686 | 852 | 1,276 | - | - | - | - | - |
| Total Fixed Assets | 3,677 | 7,823 | 17,745 | 33,681 | 45,375 | 53,832 | 52,697 | 51,951 | 49,878 | 47,805 | 45,732 | 43,659 | 41,586 |
| Current Assets | | | | | | | | | | | | | |
| Cash | 61 | 78 | 83 | 96 | 152 | 310 | 343 | 377 | 413 | 442 | 475 | 509 | 562 |
| Account Receivable | - | - | - | - | - | - | 54 | 126 | 176 | 183 | 191 | 200 | 207 |
| Inventory | 3 | 4 | 5 | 5 | 6 | 9 | 19 | 21 | 23 | 25 | 27 | 29 | 31 |
| Total Current Assets | 64 | 82 | 88 | 101 | 158 | 319 | 416 | 524 | 612 | 650 | 693 | 738 | 800 |
| Total Assets | 3,741 | 7,905 | 17,833 | 33,782 | 45,533 | 54,151 | 53,113 | 52,475 | 50,490 | 48,455 | 46,425 | 44,397 | 42,386 |
| LIABILITIES AND EQUITY | | | | | | | | | | | | | |
| Long Term Debt | | | | | | | | | | | | | |
| Foreign Loan | - | - | 3,376 | 8,866 | 11,994 | 16,097 | 16,028 | 16,322 | 16,030 | 15,703 | 15,336 | 14,925 | 14,465 |
| Government Loan | 3,677 | 3,677 | 10,223 | 20,669 | 28,792 | 32,676 | 32,866 | 33,059 | 32,500 | 31,907 | 31,278 | 30,612 | 29,906 |
| Total Long Term Debt | 3,677 | 3,677 | 13,599 | 29,535 | 40,786 | 48,773 | 48,894 | 49,381 | 48,530 | 47,610 | 46,614 | 45,537 | 44,371 |
| Current Liabilities | | | | | | | | | | | | | |
| Accounts Payable | 14 | 15 | 19 | 21 | 24 | 38 | 78 | 86 | 94 | 103 | 111 | 119 | 127 |
| Current Debt Maturities | - | - | - | - | 443 | 470 | 731 | 789 | 851 | 920 | 996 | 1,077 | 1,166 |
| Total Current Liabilities | 14 | 15 | 19 | 21 | 467 | 508 | 809 | 875 | 945 | 1,023 | 1,107 | 1,196 | 1,293 |
| Equity | | | | | | | | | | | | | |
| Government Capital Contribution | - | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 |
| Retained Earnings | 50 | 67 | 69 | 80 | 134 | 724 | (736) | (1,927) | (3,131) | (4,324) | (5,442) | (6,482) | (7,424) |
| Total Equity | 50 | 4,213 | 4,215 | 4,226 | 4,280 | 4,870 | 3,410 | 2,219 | 1,015 | (178) | (1,296) | (2,336) | (3,278) |
| Total Liabilities and Equity | 3,741 | 7,905 | 17,833 | 33,782 | 45,533 | 54,151 | 53,113 | 52,475 | 50,490 | 48,455 | 46,425 | 44,397 | 42,386 |

Table M.1. (5)-1 Projected Income Statement (1983 - 1995)

Alternative A-6 (70%, 3%)*

(Unit: M\$1,000)

| Item | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|-----------------------------|------|------|------|------|------|-------|---------|-------|-------|-------|-------|-------|-------|
| OPERATING REVENUE | | | | | | | | | | | | | |
| Sewerage Charge | - | - | - | - | - | - | 647 | 1,507 | 2,109 | 2,196 | 2,286 | 2,400 | 2,485 |
| Sewerage Tax | - | - | - | - | - | 2,792 | 2,932 | 3,079 | 3,233 | 3,395 | 3,565 | 3,743 | 3,930 |
| Municipality Contribution | 221 | 200 | 235 | 260 | 342 | 656 | 252 | 1,089 | 416 | 224 | 57 | (133) | (286) |
| Total Operating Revenue | 221 | 200 | 235 | 260 | 342 | 3,448 | 3,831 | 5,675 | 5,758 | 5,815 | 5,908 | 6,010 | 6,129 |
| OPERATING EXPENSES | | | | | | | | | | | | | |
| Billing and Collection Fees | - | - | - | - | - | - | 13 | 30 | 42 | 44 | 46 | 48 | 50 |
| Provision for Bad Debts | - | - | - | - | - | - | 6 | 15 | 21 | 22 | 23 | 24 | 25 |
| Payroll | 155 | 166 | 212 | 226 | 262 | 415 | 575 | 613 | 653 | 695 | 740 | 788 | 840 |
| Maintenance | - | - | - | - | - | - | 278 | 309 | 350 | 408 | 443 | 487 | 529 |
| Administration | 16 | 17 | 21 | 23 | 26 | 42 | 58 | 61 | 65 | 70 | 74 | 79 | 84 |
| Total Operating Expenses | 171 | 183 | 233 | 249 | 288 | 457 | 930 | 1,028 | 1,131 | 1,239 | 1,326 | 1,426 | 1,528 |
| NET OPERATING INCOME | | | | | | | | | | | | | |
| Depreciation | 50 | 17 | 2 | 11 | 54 | 2,991 | 2,901 | 4,647 | 4,627 | 4,576 | 4,582 | 4,584 | 4,601 |
| Interest | - | - | - | - | - | - | 1,987 | 2,022 | 2,073 | 2,073 | 2,073 | 2,073 | 2,073 |
| Net Income (Deficit) | - | - | - | - | - | 2,349 | 2,319 | 3,254 | 3,179 | 3,099 | 3,014 | 2,924 | 2,829 |
| | 50 | 17 | 2 | 11 | 54 | 642 | (1,405) | (629) | (625) | (596) | (505) | (413) | (301) |

* (Sewerage surcharge rate, Sewerage surcharge tax rate)

Table M.1. (5)-2 Projected Cash Flow Statement (1983 - 1995)

(Unit: M\$1,000)

| Alternative A-6 (70%) | Item | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|-----------------------------|--|-------|-------|-------|--------|--------|--------|-------|-------|-------|-------|-------|-------|-------|
| SOURCES OF FUNDS | | | | | | | | | | | | | | |
| | Net Operating Income | 50 | 17 | 2 | 11 | 54 | 2,991 | 2,901 | 4,647 | 4,627 | 4,576 | 4,582 | 4,584 | 4,601 |
| | Increase in Account Payable | 14 | 1 | 4 | 2 | 3 | 14 | 40 | 8 | 8 | 9 | 8 | 8 | 8 |
| | Decrease in Current Assets (Less Cash) | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Foreign Loan | - | - | 3,376 | 5,490 | 3,128 | 4,103 | 164 | 555 | - | - | - | - | - |
| | Government Loan | 3,677 | 4,146 | 6,546 | 10,446 | 8,566 | 4,354 | 688 | 721 | - | - | - | - | - |
| | Government Contribution | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Total Sources | 3,741 | 4,164 | 9,928 | 15,949 | 11,751 | 11,462 | 3,793 | 5,931 | 4,635 | 4,585 | 4,590 | 4,592 | 4,609 |
| APPLICATION OF FUNDS | | | | | | | | | | | | | | |
| | Capital Expenditure | 3,677 | 4,146 | 9,922 | 15,936 | 11,694 | 8,457 | 852 | 1,276 | - | - | - | - | - |
| | Interest | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Foreign Loan | - | - | - | - | - | - | - | 967 | 925 | 880 | 833 | 783 | 730 |
| | Government Loan | - | - | - | - | - | 2,349 | 2,319 | 2,287 | 2,254 | 2,219 | 2,181 | 2,141 | 2,099 |
| | Amortization of Principal | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Foreign Loan | - | - | - | - | - | - | - | 736 | 778 | 823 | 870 | 920 | 973 |
| | Government Loan | - | - | - | - | - | 495 | 525 | 557 | 590 | 625 | 663 | 703 | 745 |
| | Total Debt Service | - | - | - | - | - | 2,844 | 2,844 | 4,547 | 4,547 | 4,547 | 4,547 | 4,547 | 4,547 |
| | Increase in Current Assets (Less Cash) | 3 | 1 | 1 | 0 | 1 | 3 | 64 | 74 | 52 | 9 | 10 | 11 | 9 |
| | Total Applications | 3,680 | 4,147 | 9,923 | 15,936 | 11,695 | 11,304 | 3,760 | 5,897 | 4,599 | 4,556 | 4,557 | 4,558 | 4,556 |
| | Net Cash Increase (Decrease) | 61 | 17 | 5 | 13 | 56 | 158 | 33 | 34 | 36 | 29 | 33 | 34 | 53 |
| | Cash Available at End of Year | 61 | 78 | 83 | 96 | 152 | 310 | 343 | 377 | 413 | 442 | 475 | 509 | 562 |

Table M.1. (5)-3 Projected Balance Sheet (1983 - 1995)

Alternative A-6 (70%)

(Unit: M\$1,000)

| Item | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|---------------------------------|-------|-------|--------|--------|--------|--------|--------|---------|---------|---------|---------|---------|---------|
| ASSETS | | | | | | | | | | | | | |
| Fixed Assets | | | | | | | | | | | | | |
| Land | - | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 |
| Utility Plant in Service | - | - | - | - | - | - | 49,686 | 50,538 | 51,814 | 51,814 | 51,814 | 51,814 | 51,814 |
| Less Accumulative Depreciation | - | - | - | - | - | - | 1,987 | 4,009 | 6,082 | 8,155 | 10,228 | 12,301 | 14,374 |
| Net Fixed Assets in Service | - | - | - | - | - | - | 51,845 | 50,675 | 49,878 | 47,805 | 45,732 | 43,659 | 41,586 |
| Construction in Progress | 3,677 | 3,677 | 13,599 | 29,535 | 41,229 | 49,686 | 852 | 1,276 | - | - | - | - | - |
| Total Fixed Assets | 3,677 | 7,823 | 17,745 | 33,681 | 45,375 | 53,832 | 52,697 | 51,951 | 49,878 | 47,805 | 45,732 | 43,659 | 41,586 |
| Current Assets | | | | | | | | | | | | | |
| Cash | 61 | 78 | 83 | 96 | 152 | 310 | 343 | 377 | 413 | 442 | 475 | 509 | 562 |
| Account Receivable | - | - | - | - | - | - | 54 | 126 | 176 | 183 | 191 | 200 | 207 |
| Inventory | 3 | 4 | 5 | 5 | 6 | 9 | 19 | 21 | 23 | 25 | 27 | 29 | 31 |
| Total Current Assets | 64 | 82 | 88 | 101 | 158 | 319 | 416 | 524 | 612 | 650 | 693 | 738 | 800 |
| Total Assets | 3,741 | 7,905 | 17,833 | 33,782 | 45,533 | 54,151 | 53,113 | 52,475 | 50,490 | 48,455 | 46,425 | 44,397 | 42,386 |
| LIABILITIES AND EQUITY | | | | | | | | | | | | | |
| Long Term Debt | | | | | | | | | | | | | |
| Foreign Loan | - | - | 3,376 | 8,866 | 11,994 | 16,097 | 15,525 | 15,302 | 14,479 | 13,609 | 12,689 | 11,716 | 10,687 |
| Government Loan | 3,677 | 7,823 | 14,369 | 24,815 | 32,886 | 36,715 | 36,846 | 36,977 | 36,352 | 35,689 | 34,986 | 34,241 | 33,451 |
| Total Long Term Debt | 3,677 | 7,823 | 17,745 | 33,681 | 44,880 | 52,812 | 52,371 | 52,279 | 50,831 | 49,298 | 47,675 | 45,957 | 44,138 |
| Current Liabilities | | | | | | | | | | | | | |
| Accounts Payable | 14 | 15 | 19 | 21 | 24 | 38 | 78 | 86 | 94 | 103 | 111 | 119 | 127 |
| Current Debt Maturities | - | - | - | - | 495 | 525 | 1,293 | 1,368 | 1,448 | 1,533 | 1,623 | 1,718 | 1,819 |
| Total Current Liabilities | 14 | 15 | 19 | 21 | 519 | 563 | 1,371 | 1,454 | 1,542 | 1,636 | 1,734 | 1,837 | 1,946 |
| Equity | | | | | | | | | | | | | |
| Government Capital Contribution | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Retained Earnings | 50 | 67 | 69 | 80 | 134 | 776 | (629) | (1,258) | (1,883) | (2,479) | (2,984) | (3,397) | (3,698) |
| Total Equity | 50 | 67 | 69 | 80 | 134 | 776 | (629) | (1,258) | (1,883) | (2,479) | (2,984) | (3,397) | (3,698) |
| Total Liabilities and Equity | 3,741 | 7,905 | 17,833 | 33,782 | 45,533 | 54,151 | 53,113 | 52,475 | 50,490 | 48,455 | 46,425 | 44,397 | 42,386 |

Table M.1. (6)-1 Projected Income Statement (1983 - 1995)

Alternative A-7 (50%, 3%)*

(Unit: M\$1,000)

| Item | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|-----------------------------|------|------|------|------|------|-------|---------|-------|-------|-------|-------|-------|-------|
| OPERATING REVENUE | | | | | | | | | | | | | |
| Sewerage Charge | - | - | - | - | - | - | 493 | 1,150 | 1,607 | 1,674 | 1,741 | 1,829 | 1,894 |
| Sewerage Tax | - | - | - | - | - | 2,792 | 2,932 | 3,079 | 3,233 | 3,395 | 3,565 | 3,743 | 3,930 |
| Municipality Contribution | 221 | 200 | 235 | 260 | 342 | 354 | 86 | 1,116 | 590 | 427 | 283 | 117 | (16) |
| Total Operating Revenue | 221 | 200 | 235 | 260 | 342 | 3,146 | 3,511 | 5,345 | 5,430 | 5,496 | 5,589 | 5,689 | 5,808 |
| OPERATING EXPENSES | | | | | | | | | | | | | |
| Billing and Collection Fees | - | - | - | - | - | - | 10 | 23 | 32 | 33 | 35 | 37 | 38 |
| Provision for Bad Debts | - | - | - | - | - | - | 5 | 12 | 16 | 17 | 17 | 18 | 19 |
| Payroll | 155 | 166 | 212 | 226 | 262 | 415 | 575 | 613 | 653 | 695 | 740 | 788 | 840 |
| Maintenance | - | - | - | - | - | - | 278 | 309 | 350 | 408 | 443 | 487 | 529 |
| Administration | 16 | 17 | 21 | 23 | 26 | 42 | 58 | 61 | 65 | 70 | 74 | 79 | 84 |
| Total Operating Expenses | 171 | 183 | 233 | 249 | 288 | 457 | 926 | 1,018 | 1,116 | 1,223 | 1,309 | 1,409 | 1,510 |
| NET OPERATING INCOME | | | | | | | | | | | | | |
| Depreciation | 50 | 17 | 2 | 11 | 54 | 2,689 | 2,585 | 4,327 | 4,314 | 4,273 | 4,280 | 4,280 | 4,298 |
| Interest | - | - | - | - | - | - | 1,987 | 2,022 | 2,073 | 2,073 | 2,073 | 2,073 | 2,073 |
| Net Income (Deficit) | - | - | - | - | - | 2,100 | 2,073 | 3,012 | 2,940 | 2,864 | 2,783 | 2,697 | 2,607 |
| | 50 | 17 | 2 | 11 | 54 | 589 | (1,475) | (707) | (699) | (664) | (576) | (490) | (382) |

* (Sewerage surcharge rate, Sewerage surcharge tax rate)

Table M.1. (6)-2 Projected Cash Flow Statement (1983 - 1995)

| Alternative A-7 (50%) | | | | | | | | | | | | | | (Unit: M\$1,000) | | | | | | | | | | | | | |
|--|-------|-------|-------|--------|--------|--------|-------|-------|-------|-------|-------|-------|-------|------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|
| Item | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | | | | | | | | | | | | | | |
| SOURCES OF FUNDS | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Net Operating Income | 50 | 17 | 2 | 11 | 54 | 2,689 | 2,585 | 4,327 | 4,314 | 4,273 | 4,280 | 4,280 | 4,298 | | | | | | | | | | | | | | |
| Increase in Account Payable | 14 | 1 | 4 | 2 | 3 | 14 | 39 | 8 | 8 | 9 | 7 | 8 | 9 | | | | | | | | | | | | | | |
| Decrease in Current Assets (Less Cash) | - | - | - | - | - | - | - | - | - | - | - | - | - | | | | | | | | | | | | | | |
| Foreign Loan | - | - | 3,376 | 5,490 | 3,128 | 4,103 | 164 | 555 | - | - | - | - | - | | | | | | | | | | | | | | |
| Government Loan | 3,677 | - | 6,546 | 10,446 | 8,566 | 4,354 | 688 | 721 | - | - | - | - | - | | | | | | | | | | | | | | |
| Government Contribution | - | 4,146 | - | - | - | - | - | - | - | - | - | - | - | | | | | | | | | | | | | | |
| Total Sources | 3,741 | 4,164 | 9,928 | 15,949 | 11,751 | 11,160 | 3,476 | 5,611 | 4,322 | 4,282 | 4,287 | 4,288 | 4,307 | | | | | | | | | | | | | | |
| APPLICATION OF FUNDS | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Capital Expenditure | 3,677 | 4,146 | 9,922 | 15,936 | 11,694 | 8,457 | 852 | 1,276 | - | - | - | - | - | | | | | | | | | | | | | | |
| Interest | - | - | - | - | - | - | - | - | - | - | - | - | - | | | | | | | | | | | | | | |
| Foreign Loan | - | - | - | - | - | - | - | 967 | 925 | 880 | 833 | 783 | 730 | | | | | | | | | | | | | | |
| Government Loan | - | - | - | - | - | 2,100 | 2,073 | 2,045 | 2,015 | 1,984 | 1,950 | 1,914 | 1,877 | | | | | | | | | | | | | | |
| Amortization of Principal | - | - | - | - | - | - | - | 736 | 778 | 823 | 870 | 920 | 973 | | | | | | | | | | | | | | |
| Foreign Loan | - | - | - | - | - | - | 443 | 498 | 528 | 559 | 593 | 629 | 666 | | | | | | | | | | | | | | |
| Government Loan | - | - | - | - | - | 2,543 | 2,543 | 4,246 | 4,246 | 4,246 | 4,246 | 4,246 | 4,246 | | | | | | | | | | | | | | |
| Total Debt Service | - | - | - | - | - | - | - | - | - | - | - | - | - | | | | | | | | | | | | | | |
| Increase in Current Assets (Less Cash) | 3 | 1 | 1 | 0 | 1 | 3 | 51 | 56 | 40 | 8 | 7 | 9 | 8 | | | | | | | | | | | | | | |
| Total Applications | 3,680 | 4,147 | 9,923 | 15,936 | 11,695 | 11,003 | 3,446 | 5,578 | 4,286 | 4,254 | 4,253 | 4,255 | 4,254 | | | | | | | | | | | | | | |
| Net Cash Increase (Decrease) | 61 | 17 | 5 | 13 | 56 | 157 | 30 | 33 | 36 | 28 | 34 | 33 | 53 | | | | | | | | | | | | | | |
| Cash Available at End of Year | 61 | 78 | 83 | 96 | 152 | 309 | 339 | 372 | 408 | 436 | 470 | 503 | 556 | | | | | | | | | | | | | | |

Table M.1. (6)-3 Projected Balance Sheet (1983 - 1995)

Alternative A-7 (50%)

(Unit: MSI,000)

| Item | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|---------------------------------|-------|-------|--------|--------|--------|--------|--------|---------|---------|---------|---------|---------|---------|
| ASSETS | | | | | | | | | | | | | |
| Fixed Assets | | | | | | | | | | | | | |
| Land | - | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 |
| Utility Plant in Service | - | - | - | - | - | - | 49,686 | 50,538 | 51,814 | 51,814 | 51,814 | 51,814 | 51,814 |
| Less Accumulative Depreciation | - | - | - | - | - | - | 1,987 | 4,009 | 6,082 | 8,155 | 10,228 | 12,301 | 14,374 |
| Net Fixed Assets in Service | - | - | - | - | - | - | 51,845 | 50,675 | 49,878 | 47,805 | 45,732 | 43,659 | 41,586 |
| Construction in Progress | 3,677 | 3,677 | 13,599 | 29,535 | 41,229 | 49,686 | 852 | 1,276 | - | - | - | - | - |
| Total Fixed Assets | 3,677 | 7,823 | 17,745 | 33,681 | 45,375 | 53,832 | 52,697 | 51,951 | 49,878 | 47,805 | 45,732 | 43,659 | 41,586 |
| Current Assets | | | | | | | | | | | | | |
| Cash | 61 | 78 | 83 | 96 | 152 | 309 | 339 | 372 | 408 | 436 | 470 | 503 | 556 |
| Account Receivable | - | - | - | - | - | - | 41 | 96 | 134 | 140 | 145 | 152 | 158 |
| Inventory | 3 | 4 | 5 | 5 | 6 | 9 | 19 | 20 | 22 | 24 | 26 | 28 | 30 |
| Total Current Assets | 64 | 82 | 88 | 101 | 158 | 318 | 399 | 488 | 564 | 600 | 641 | 683 | 744 |
| Total Assets | 3,741 | 7,905 | 17,833 | 33,782 | 45,533 | 54,150 | 53,096 | 52,439 | 50,442 | 48,405 | 46,373 | 44,342 | 42,330 |
| LIABILITIES AND EQUITY | | | | | | | | | | | | | |
| Long Term Debt | | | | | | | | | | | | | |
| Foreign Loan | - | - | 3,376 | 8,866 | 11,994 | 16,097 | 15,525 | 15,302 | 14,479 | 13,609 | 12,689 | 11,716 | 10,687 |
| Government Loan | 3,677 | 3,677 | 10,223 | 20,669 | 28,792 | 32,676 | 32,866 | 33,059 | 32,500 | 31,907 | 31,278 | 30,612 | 29,906 |
| Total Long Term Debt | 3,677 | 3,677 | 13,599 | 29,535 | 40,786 | 48,773 | 48,391 | 48,361 | 46,979 | 45,516 | 43,967 | 42,328 | 40,593 |
| Current Liabilities | | | | | | | | | | | | | |
| Accounts Payable | 14 | 15 | 19 | 21 | 24 | 38 | 77 | 85 | 93 | 102 | 109 | 117 | 126 |
| Current Debt Maturities | - | - | - | - | 443 | 470 | 1,234 | 1,306 | 1,382 | 1,463 | 1,549 | 1,639 | 1,735 |
| Total Current Liabilities | 14 | 15 | 19 | 21 | 467 | 508 | 1,311 | 1,391 | 1,475 | 1,565 | 1,658 | 1,756 | 1,861 |
| Equity | | | | | | | | | | | | | |
| Government Capital Contribution | - | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 |
| Retained Earnings | 50 | 67 | 69 | 80 | 134 | 723 | (752) | (1,459) | (2,158) | (2,822) | (3,398) | (3,888) | (4,270) |
| Total Equity | 50 | 4,213 | 4,215 | 4,226 | 4,280 | 4,869 | 3,394 | 2,687 | 1,988 | 1,324 | 748 | 258 | (124) |
| Total Liabilities and Equity | 3,741 | 7,905 | 17,833 | 33,782 | 45,533 | 54,150 | 53,096 | 52,439 | 50,442 | 48,405 | 46,373 | 44,342 | 42,330 |

Table M.1. (7)-1 Projected Income Statement (1983 - 1995)

Alternative B-1 (70%, 3%)*

(Unit: M\$1,000)

| Item | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|-----------------------------|------|------|------|------|------|-------|---------|---------|---------|---------|---------|---------|-------|
| OPERATING REVENUE | | | | | | | | | | | | | |
| Sewerage Charge | - | - | - | - | - | - | 647 | 1,507 | 2,109 | 2,196 | 2,286 | 2,400 | 2,485 |
| Sewerage Tax | - | - | - | - | - | 2,792 | 2,932 | 3,079 | 3,233 | 3,395 | 3,565 | 3,743 | 3,930 |
| Municipality Contribution | 221 | 200 | 235 | 260 | 342 | 1,877 | 1,473 | 607 | (66) | (258) | (425) | (615) | (768) |
| Total Operating Revenue | 221 | 200 | 235 | 260 | 342 | 4,669 | 5,052 | 5,193 | 5,276 | 5,333 | 5,426 | 5,528 | 5,647 |
| OPERATING EXPENSES | | | | | | | | | | | | | |
| Billing and Collection Fees | - | - | - | - | - | - | 13 | 30 | 42 | 44 | 46 | 48 | 50 |
| Provision for Bad Debts | - | - | - | - | - | - | 6 | 15 | 21 | 22 | 23 | 24 | 25 |
| Payroll | 155 | 166 | 212 | 226 | 262 | 415 | 575 | 613 | 653 | 695 | 740 | 788 | 840 |
| Maintenance | - | - | - | - | - | - | 278 | 309 | 350 | 408 | 443 | 487 | 529 |
| Administration | 16 | 17 | 21 | 23 | 26 | 42 | 58 | 61 | 65 | 70 | 74 | 79 | 84 |
| Total Operating Expenses | 171 | 183 | 233 | 249 | 288 | 457 | 930 | 1,028 | 1,131 | 1,239 | 1,326 | 1,426 | 1,528 |
| NET OPERATING INCOME | | | | | | | | | | | | | |
| Depreciation | 50 | 17 | 2 | 11 | 54 | 4,212 | 4,122 | 4,165 | 4,145 | 4,094 | 4,100 | 4,102 | 4,119 |
| Interest | - | - | - | - | - | - | 1,987 | 2,022 | 2,073 | 2,073 | 2,073 | 2,073 | 2,073 |
| Net Income (Deficit) | - | - | - | - | - | 3,358 | 3,315 | 3,270 | 3,222 | 3,172 | 3,118 | 3,062 | 3,001 |
| Net Income (Deficit) | 50 | 17 | 2 | 11 | 54 | 854 | (1,180) | (1,127) | (1,150) | (1,151) | (1,091) | (1,033) | (955) |

* (Sewerage surcharge rate, Sewerage surcharge tax rate)

Table M.1. (7)-2 Projected Cash Flow Statement (1983 - 1995)

| Alternative B-1 (70%) | | | | | | | | | | | | | | (Unit: M\$1,000) | | | | | | | | | | | | | |
|--|-------|-------|-------|--------|--------|--------|-------|-------|-------|-------|-------|-------|-------|------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|
| Item | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | | | | | | | | | | | | | | |
| SOURCES OF FUNDS | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Net Operating Income | 50 | 17 | 2 | 11 | 54 | 4,212 | 4,122 | 4,165 | 4,145 | 4,094 | 4,100 | 4,102 | 4,119 | | | | | | | | | | | | | | |
| Increase in Account Payable | 14 | 1 | 4 | 2 | 3 | 14 | 40 | 8 | 8 | 9 | 8 | 8 | 8 | | | | | | | | | | | | | | |
| Decrease in Current Assets (Less Cash) | - | - | - | - | - | - | - | - | - | - | - | - | - | | | | | | | | | | | | | | |
| Foreign Loan | - | - | - | - | - | - | - | - | - | - | - | - | - | | | | | | | | | | | | | | |
| Government Loan | 3,677 | 4,146 | 9,922 | 15,936 | 11,694 | 8,457 | 852 | 1,276 | - | - | - | - | - | | | | | | | | | | | | | | |
| Government Contribution | - | - | - | - | - | - | - | - | - | - | - | - | - | | | | | | | | | | | | | | |
| Total Sources | 3,741 | 4,164 | 9,928 | 15,949 | 11,751 | 12,683 | 5,014 | 5,449 | 4,153 | 4,103 | 4,108 | 4,110 | 4,127 | | | | | | | | | | | | | | |
| APPLICATION OF FUNDS | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Capital Expenditure | 3,677 | 4,146 | 9,922 | 15,936 | 11,694 | 8,457 | 852 | 1,276 | - | - | - | - | - | | | | | | | | | | | | | | |
| Interest | - | - | - | - | - | - | - | - | - | - | - | - | - | | | | | | | | | | | | | | |
| Foreign Loan | - | - | - | - | - | - | - | - | - | - | - | - | - | | | | | | | | | | | | | | |
| Government Loan | - | - | - | - | - | 3,358 | 3,315 | 3,270 | 3,222 | 3,172 | 3,118 | 3,062 | 3,001 | | | | | | | | | | | | | | |
| Amortization of Principal | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Foreign Loan | - | - | - | - | - | - | - | - | - | - | - | - | - | | | | | | | | | | | | | | |
| Government Loan | - | - | - | - | - | 707 | 750 | 795 | 843 | 893 | 947 | 1,003 | 1,064 | | | | | | | | | | | | | | |
| Total Debt Service | - | - | - | - | - | 4,065 | 4,065 | 4,065 | 4,065 | 4,065 | 4,065 | 4,065 | 4,065 | | | | | | | | | | | | | | |
| Increase in Current Assets (Less Cash) | 3 | 1 | 1 | 0 | 1 | 3 | 64 | 74 | 52 | 9 | 10 | 11 | 9 | | | | | | | | | | | | | | |
| Total Applications | 3,680 | 4,147 | 9,923 | 15,936 | 11,695 | 12,525 | 4,981 | 5,415 | 4,117 | 4,074 | 4,075 | 4,076 | 4,074 | | | | | | | | | | | | | | |
| Net Cash Increase (Decrease) | 61 | 17 | 5 | 13 | 56 | 158 | 33 | 34 | 36 | 29 | 33 | 34 | 53 | | | | | | | | | | | | | | |
| Cash Available at End of Year | 61 | 78 | 83 | 96 | 152 | 310 | 343 | 377 | 413 | 442 | 475 | 509 | 562 | | | | | | | | | | | | | | |

Table M.1. (7)-3 Projected Balance Sheet (1983 - 1995)

(Unit: M\$1,000)

| Item | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|---------------------------------|-------|-------|--------|--------|--------|--------|--------|---------|---------|---------|---------|---------|---------|
| ASSETS | | | | | | | | | | | | | |
| Fixed Assets | | | | | | | | | | | | | |
| Land | - | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 | 4,146 |
| Utility Plant in Service | - | - | - | - | - | - | 49,686 | 50,538 | 51,814 | 51,814 | 51,814 | 51,814 | 51,814 |
| Less Accumulative Depreciation | - | - | - | - | - | - | 1,987 | 4,009 | 6,082 | 8,155 | 10,228 | 12,301 | 14,374 |
| Net Fixed Assets in Service | - | - | - | - | - | - | 51,845 | 50,675 | 49,878 | 47,805 | 45,732 | 43,659 | 41,586 |
| Construction in Progress | 3,677 | 3,677 | 13,599 | 29,535 | 41,229 | 49,686 | 852 | 1,276 | - | - | - | - | - |
| Total Fixed Assets | 3,677 | 7,823 | 17,745 | 33,681 | 45,375 | 53,832 | 52,697 | 51,951 | 49,878 | 47,805 | 45,732 | 43,659 | 41,586 |
| Current Assets | | | | | | | | | | | | | |
| Cash | 61 | 78 | 83 | 96 | 152 | 310 | 343 | 377 | 413 | 442 | 475 | 509 | 562 |
| Account Receivable | - | - | - | - | - | - | 54 | 126 | 176 | 183 | 191 | 200 | 207 |
| Inventory | 3 | 4 | 5 | 5 | 6 | 9 | 19 | 21 | 23 | 25 | 27 | 29 | 31 |
| Total Current Assets | 64 | 82 | 88 | 101 | 158 | 319 | 416 | 524 | 612 | 650 | 693 | 738 | 800 |
| Total Assets | 3,741 | 7,905 | 17,833 | 33,782 | 45,533 | 54,151 | 53,115 | 52,475 | 50,490 | 48,455 | 46,425 | 44,397 | 42,386 |
| LIABILITIES AND EQUITY | | | | | | | | | | | | | |
| Long Term Debt | | | | | | | | | | | | | |
| Foreign Loan | | | | | | | | | | | | | |
| Government Loan | 3,677 | 7,823 | 17,745 | 33,681 | 44,668 | 52,375 | 52,432 | 52,865 | 51,972 | 51,025 | 50,022 | 48,958 | 47,830 |
| Total Long Term Debt | 3,677 | 7,823 | 17,745 | 33,681 | 44,668 | 52,375 | 52,432 | 52,865 | 51,972 | 51,025 | 50,022 | 48,958 | 47,830 |
| Current Liabilities | | | | | | | | | | | | | |
| Accounts Payable | 14 | 15 | 19 | 21 | 24 | 38 | 78 | 86 | 94 | 103 | 111 | 119 | 127 |
| Current Debt Maturities | - | - | - | - | 707 | 750 | 795 | 843 | 893 | 947 | 1,003 | 1,064 | 1,128 |
| Total Current Liabilities | 14 | 15 | 19 | 21 | 731 | 788 | 873 | 929 | 987 | 1,050 | 1,114 | 1,183 | 1,255 |
| Equity | | | | | | | | | | | | | |
| Government Capital Contribution | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Retained Earnings | 50 | 67 | 69 | 80 | 134 | 988 | (192) | (1,319) | (2,469) | (3,620) | (4,711) | (5,744) | (6,699) |
| Total Equity | 50 | 67 | 69 | 80 | 134 | 988 | (192) | (1,319) | (2,469) | (3,620) | (4,711) | (5,744) | (6,699) |
| Total Liabilities and Equity | 3,741 | 7,905 | 17,833 | 33,782 | 45,533 | 54,151 | 53,115 | 52,475 | 50,490 | 48,455 | 46,425 | 44,397 | 42,386 |

Table M.1. (8)-1 Projected Income Statement (1983 - 1995)

Alternative B-2 (33%, 5%)*

(Unit: M\$1,000)

| Item | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|-----------------------------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|
| OPERATING REVENUE | | | | | | | | | | | | | |
| Sewerage Charge | - | - | - | - | - | - | 346 | 809 | 1,130 | 1,177 | 1,225 | 1,287 | 1,333 |
| Sewerage Tax | - | - | - | - | - | 4,591 | 4,821 | 5,062 | 5,315 | 5,581 | 5,860 | 6,153 | 6,461 |
| Municipality Contribution | 221 | 200 | 235 | 260 | 342 | 1,569 | 1,341 | 759 | 273 | 35 | (200) | (455) | (692) |
| Total Operating Revenue | 221 | 200 | 235 | 260 | 342 | 6,160 | 6,508 | 6,630 | 6,718 | 6,793 | 6,885 | 6,985 | 7,102 |
| OPERATING EXPENSES | | | | | | | | | | | | | |
| Billing and Collection Fees | - | - | - | - | - | - | 7 | 16 | 23 | 24 | 25 | 26 | 27 |
| Provision for Bad Debts | - | - | - | - | - | - | 3 | 8 | 11 | 12 | 12 | 13 | 13 |
| Payroll | 155 | 166 | 212 | 226 | 262 | 415 | 575 | 613 | 653 | 695 | 740 | 788 | 840 |
| Maintenance | - | - | - | - | - | - | 278 | 309 | 350 | 408 | 443 | 487 | 529 |
| Administration | 16 | 17 | 21 | 23 | 26 | 42 | 58 | 61 | 65 | 70 | 74 | 79 | 84 |
| Total Operating Expenses | 171 | 183 | 233 | 249 | 288 | 457 | 921 | 1,007 | 1,102 | 1,209 | 1,294 | 1,393 | 1,493 |
| NET OPERATING INCOME | | | | | | | | | | | | | |
| Depreciation | 50 | 17 | 2 | 11 | 54 | 5,703 | 5,587 | 5,623 | 5,616 | 5,584 | 5,591 | 5,592 | 5,609 |
| Interest | - | - | - | - | - | - | 1,987 | 2,022 | 2,073 | 2,073 | 2,073 | 2,073 | 2,073 |
| Net Income (Deficit) | 50 | 17 | 2 | 11 | 54 | 1,112 | (933) | (870) | (863) | (826) | (745) | (667) | (567) |

* (Sewerage surcharge rate, Sewerage surcharge tax rate)

Table M.1. (8)-2 Projected Cash Flow Statement (1983 - 1995)

Alternative B-2 (33%)

(Unit: M\$1,000)

| Item | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|--|-------|--------|-------|--------|--------|--------|-------|-------|-------|-------|-------|-------|-------|
| SOURCES OF FUNDS | | | | | | | | | | | | | |
| Net Operating Income | 50 | 17 | 2 | 11 | 54 | 5,703 | 5,587 | 5,623 | 5,616 | 5,584 | 5,591 | 5,592 | 5,609 |
| Increase in Account Payable | 14 | 1 | 4 | 2 | 3 | 14 | 39 | 7 | 8 | 9 | 7 | 8 | 8 |
| Decrease in Current Assets (Less Cash) | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Foreign Loan | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Government Loan | 3,677 | 24,699 | 9,922 | 15,936 | 11,694 | 8,457 | 852 | 1,276 | - | - | - | - | - |
| Government Contribution | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Total Sources | 3,741 | 24,717 | 9,928 | 15,949 | 11,751 | 14,174 | 6,478 | 6,906 | 5,624 | 5,593 | 5,598 | 5,600 | 5,617 |
| APPLICATION OF FUNDS | | | | | | | | | | | | | |
| Capital Expenditure | 3,677 | 24,699 | 9,922 | 15,936 | 11,694 | 8,457 | 852 | 1,276 | - | - | - | - | - |
| Interest | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Foreign Loan | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Government Loan | - | - | - | - | - | 4,591 | 4,533 | 4,471 | 4,406 | 4,337 | 4,263 | 4,186 | 4,103 |
| Amortization of Principal | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Foreign Loan | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Government Loan | - | - | - | - | - | 968 | 1,026 | 1,088 | 1,133 | 1,222 | 1,296 | 1,373 | 1,456 |
| Total Debt Service | - | - | - | - | - | 5,559 | 5,559 | 5,559 | 5,559 | 5,559 | 5,559 | 5,559 | 5,559 |
| Increase in Current Assets (Less Cash) | 3 | 1 | 1 | 0 | 1 | 3 | 38 | 40 | 29 | 6 | 6 | 7 | 6 |
| Total Applications | 3,680 | 24,700 | 9,923 | 15,936 | 11,695 | 14,019 | 6,449 | 6,875 | 5,588 | 5,565 | 5,565 | 5,566 | 5,565 |
| Net Cash Increase (Decrease) | 61 | 17 | 5 | 13 | 56 | 155 | 29 | 31 | 36 | 28 | 33 | 34 | 52 |
| Cash Available at End of Year | 61 | 78 | 83 | 96 | 152 | 307 | 336 | 367 | 403 | 431 | 464 | 498 | 550 |

Table M.1. (8)-3 Projected Balance Sheet (1983 - 1995)

Alternative B-2 (33%)

(Unit: M\$1,000)

| Item | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|---------------------------------|-------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|---------|---------|
| ASSETS | | | | | | | | | | | | | |
| Fixed Assets | | | | | | | | | | | | | |
| Land | - | 24,699 | 24,699 | 24,699 | 24,699 | 24,699 | 24,699 | 24,699 | 24,699 | 24,699 | 24,699 | 24,699 | 24,699 |
| Utility Plant in Service | - | - | - | - | - | - | 49,686 | 50,538 | 51,814 | 51,814 | 51,814 | 51,814 | 51,814 |
| Less Accumulative Depreciation | - | - | - | - | - | - | 1,987 | 4,009 | 6,082 | 8,155 | 10,228 | 12,301 | 14,374 |
| Net Fixed Assets in Service | - | - | - | - | - | - | 72,398 | 71,228 | 70,431 | 68,358 | 66,285 | 64,212 | 62,139 |
| Construction in Progress | 3,677 | 3,677 | 13,599 | 29,535 | 41,229 | 49,686 | 852 | 1,276 | - | - | - | - | - |
| Total Fixed Assets | 3,677 | 28,376 | 38,298 | 54,234 | 65,928 | 74,385 | 73,250 | 72,504 | 70,431 | 68,358 | 66,285 | 64,212 | 62,139 |
| Current Assets | | | | | | | | | | | | | |
| Cash | 61 | 78 | 83 | 96 | 152 | 307 | 336 | 367 | 403 | 431 | 464 | 498 | 550 |
| Account Receivable | - | - | - | - | - | - | 29 | 67 | 94 | 98 | 102 | 107 | 111 |
| Inventory | 3 | 4 | 5 | 5 | 6 | 9 | 18 | 20 | 22 | 24 | 26 | 28 | 30 |
| Total Current Assets | 64 | 82 | 88 | 101 | 158 | 316 | 383 | 454 | 519 | 553 | 592 | 633 | 691 |
| Total Assets | 3,741 | 28,458 | 38,386 | 54,335 | 66,086 | 74,701 | 73,633 | 72,958 | 70,950 | 68,911 | 66,877 | 64,845 | 62,830 |
| LIABILITIES AND EQUITY | | | | | | | | | | | | | |
| Long Term Debt | | | | | | | | | | | | | |
| Foreign Loan | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Government Loan | 3,677 | 28,376 | 38,298 | 54,234 | 64,960 | 72,391 | 72,155 | 72,278 | 71,056 | 69,760 | 68,387 | 66,931 | 65,388 |
| Total Long Term Debt | 3,677 | 28,376 | 38,298 | 54,234 | 64,960 | 72,391 | 72,155 | 72,278 | 71,056 | 69,760 | 68,387 | 66,931 | 65,388 |
| Current Liabilities | | | | | | | | | | | | | |
| Accounts Payable | 14 | 15 | 19 | 21 | 24 | 38 | 77 | 84 | 92 | 101 | 108 | 116 | 124 |
| Current Debt Maturities | - | - | - | - | 968 | 1,026 | 1,088 | 1,153 | 1,222 | 1,296 | 1,373 | 1,456 | 1,543 |
| Total Current Liabilities | 14 | 15 | 19 | 21 | 992 | 1,064 | 1,165 | 1,237 | 1,314 | 1,397 | 1,481 | 1,572 | 1,667 |
| Equity | | | | | | | | | | | | | |
| Government Capital Contribution | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Retained Earnings | 50 | 67 | 69 | 80 | 134 | 1,246 | 313 | (557) | (1,420) | (2,246) | (2,991) | (3,658) | (4,225) |
| Total Equity | 50 | 67 | 69 | 80 | 134 | 1,246 | 313 | (557) | (1,420) | (2,246) | (2,991) | (3,658) | (4,225) |
| Total Liabilities and Equity | 3,741 | 28,458 | 38,386 | 54,335 | 66,086 | 74,701 | 73,633 | 72,958 | 70,950 | 68,911 | 66,877 | 64,845 | 62,830 |

