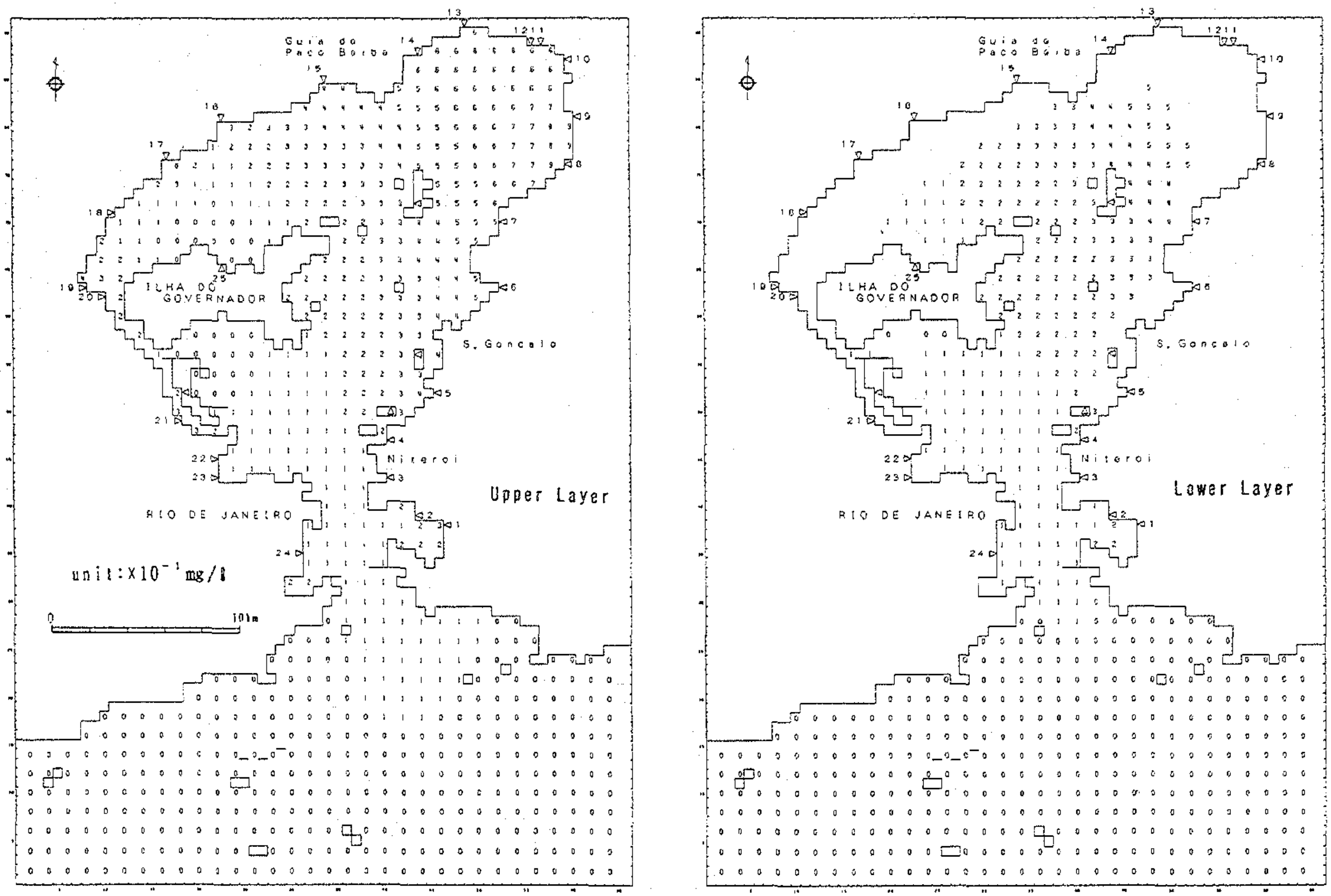
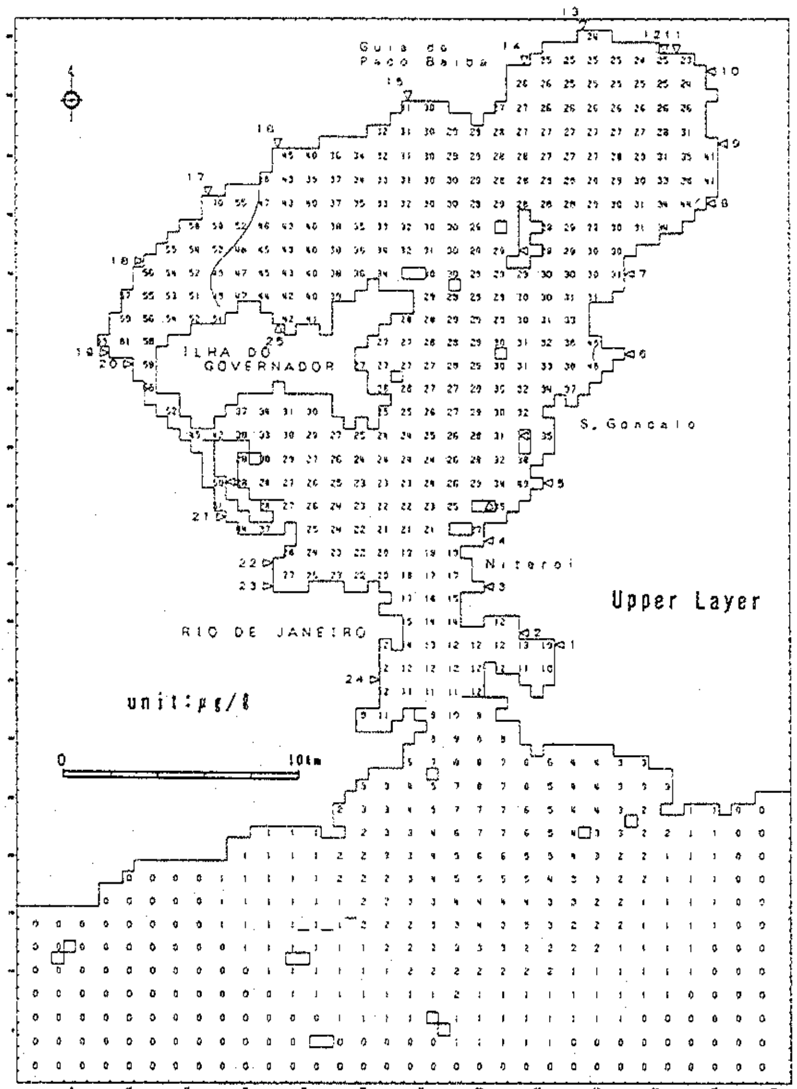



Fig. 4. 3-4(1)　Water Quality Variation from 1991 to 2000 without Measure
(BOD)



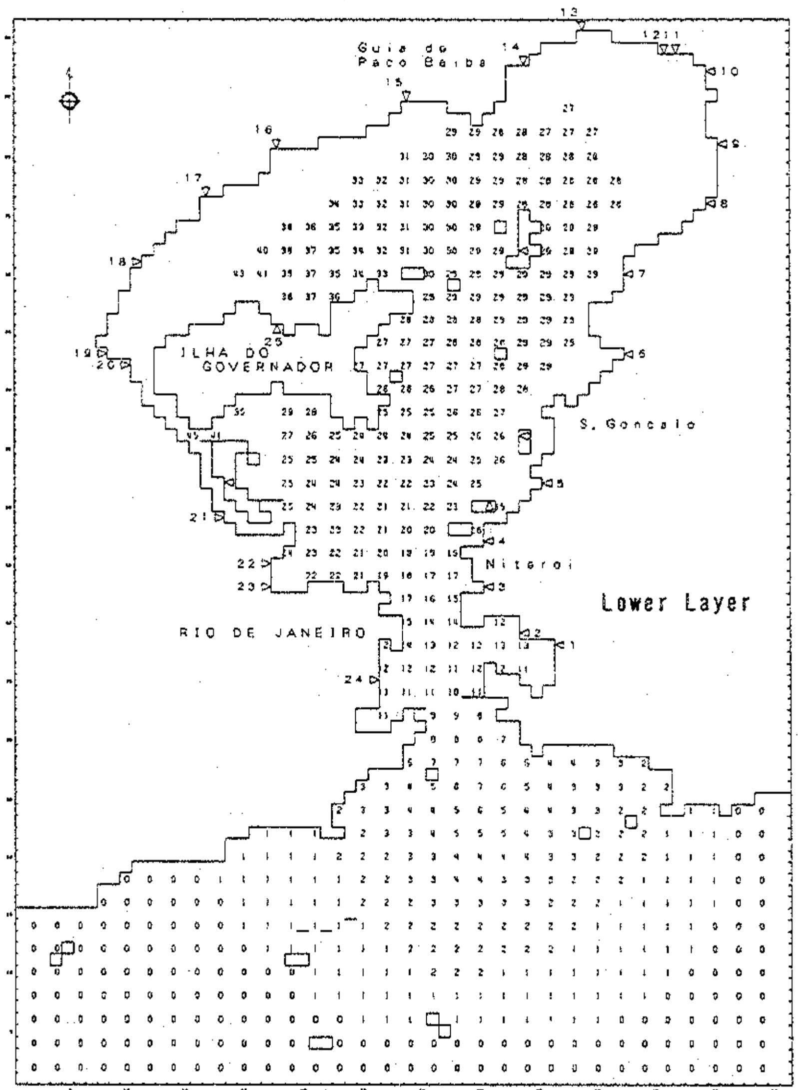




Fig. 4.3-4(2) Water Quality Variation from 1991 to 2000 without Measure

(T-P)

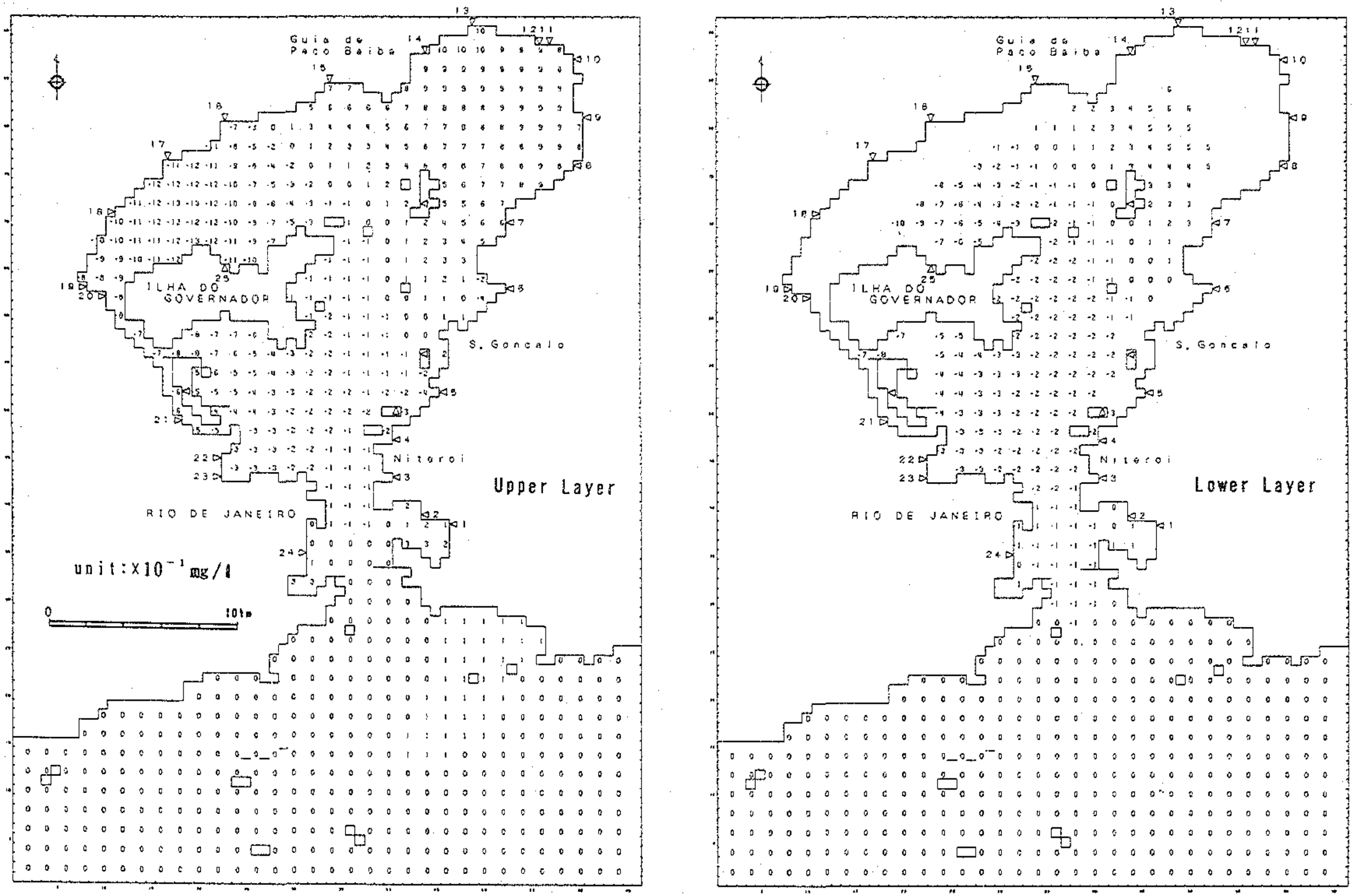
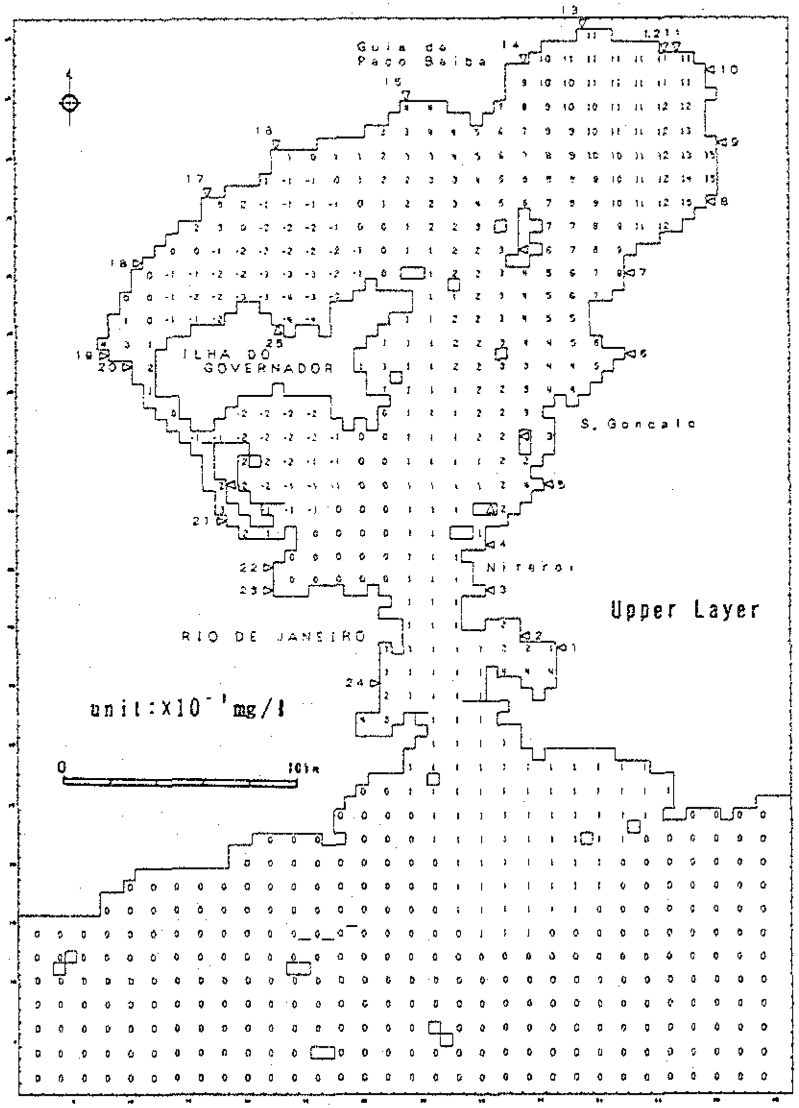



Fig. 4. 3-4(3) Water Quality Variation from 1991 to 2000 without Measure

(DO)



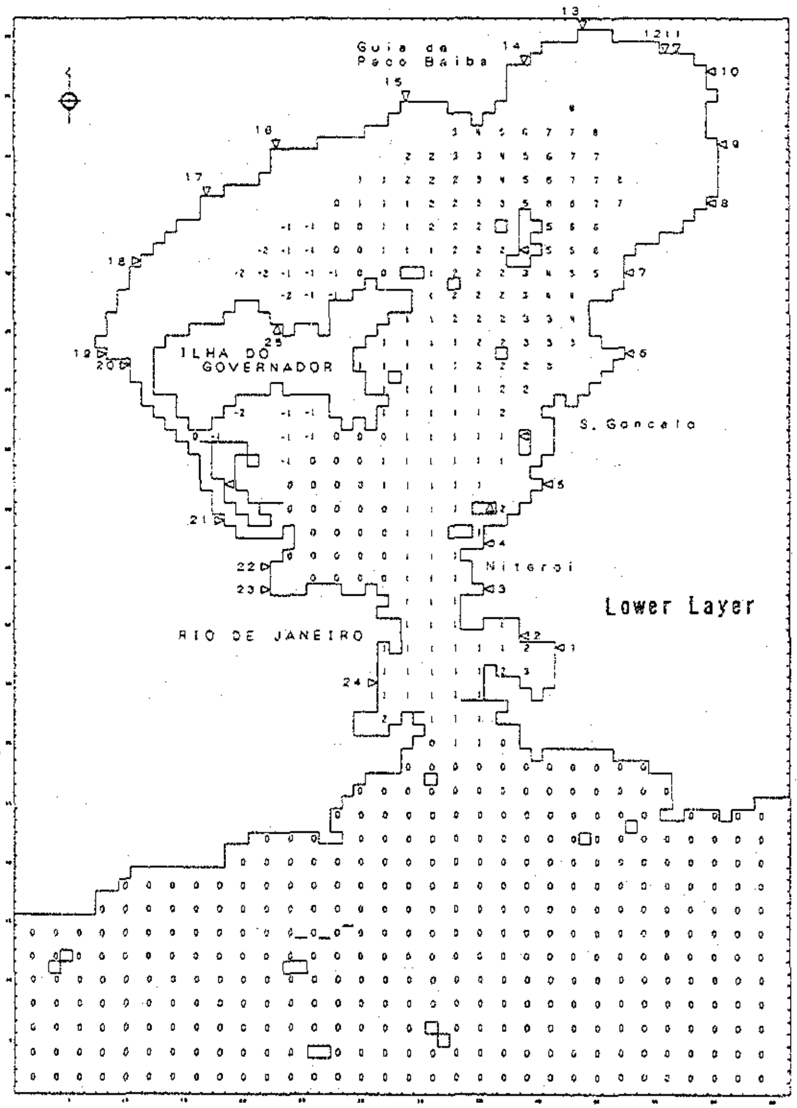




Fig. 4. 3-5(1) Water Quality Variation from 1991 to 2010(scenario-1) without Measure (BOD)

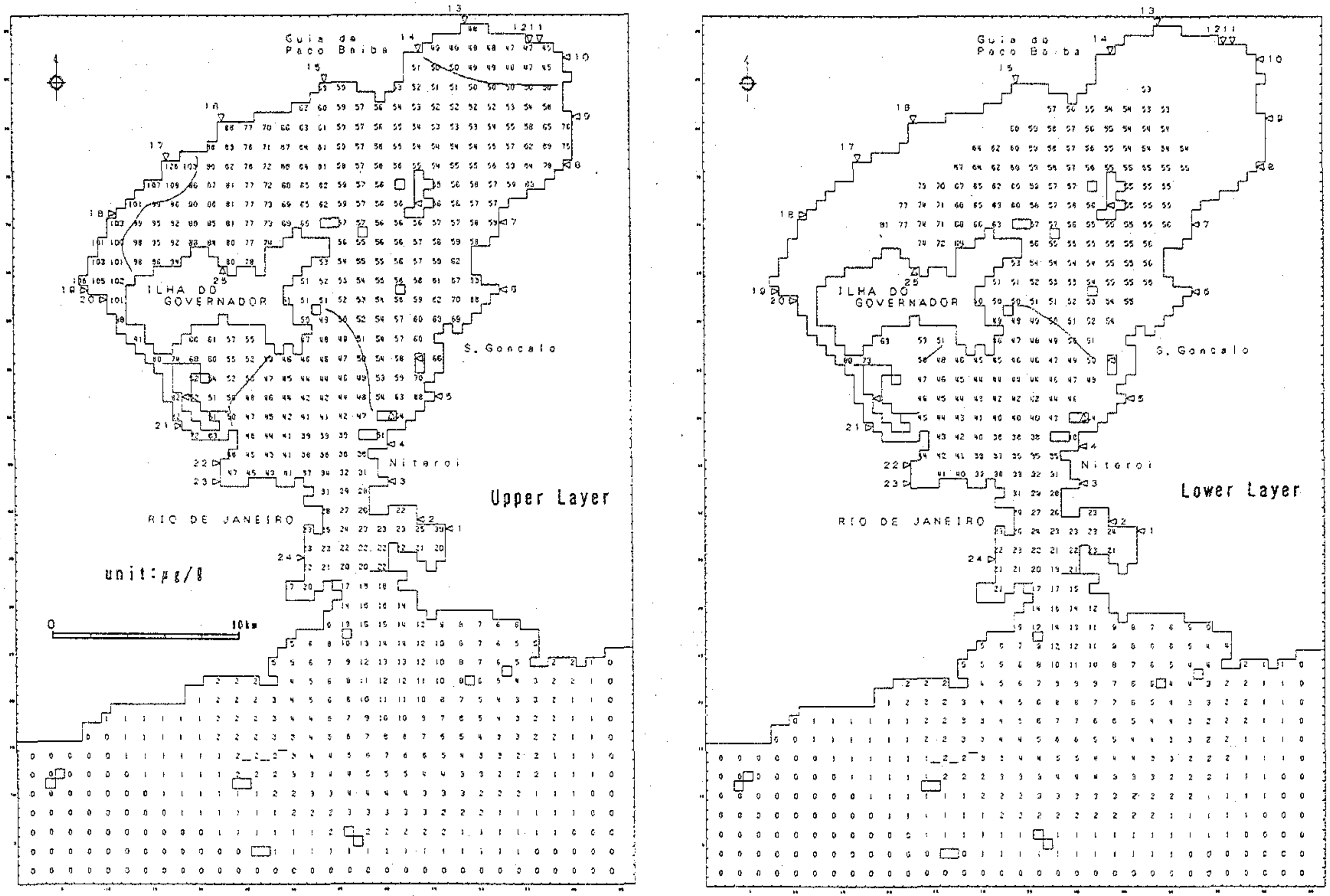



Fig. 4. 3-5(2) Water Quality Variation from 1991 to 2010(scenario-1) without Measure (T-P)

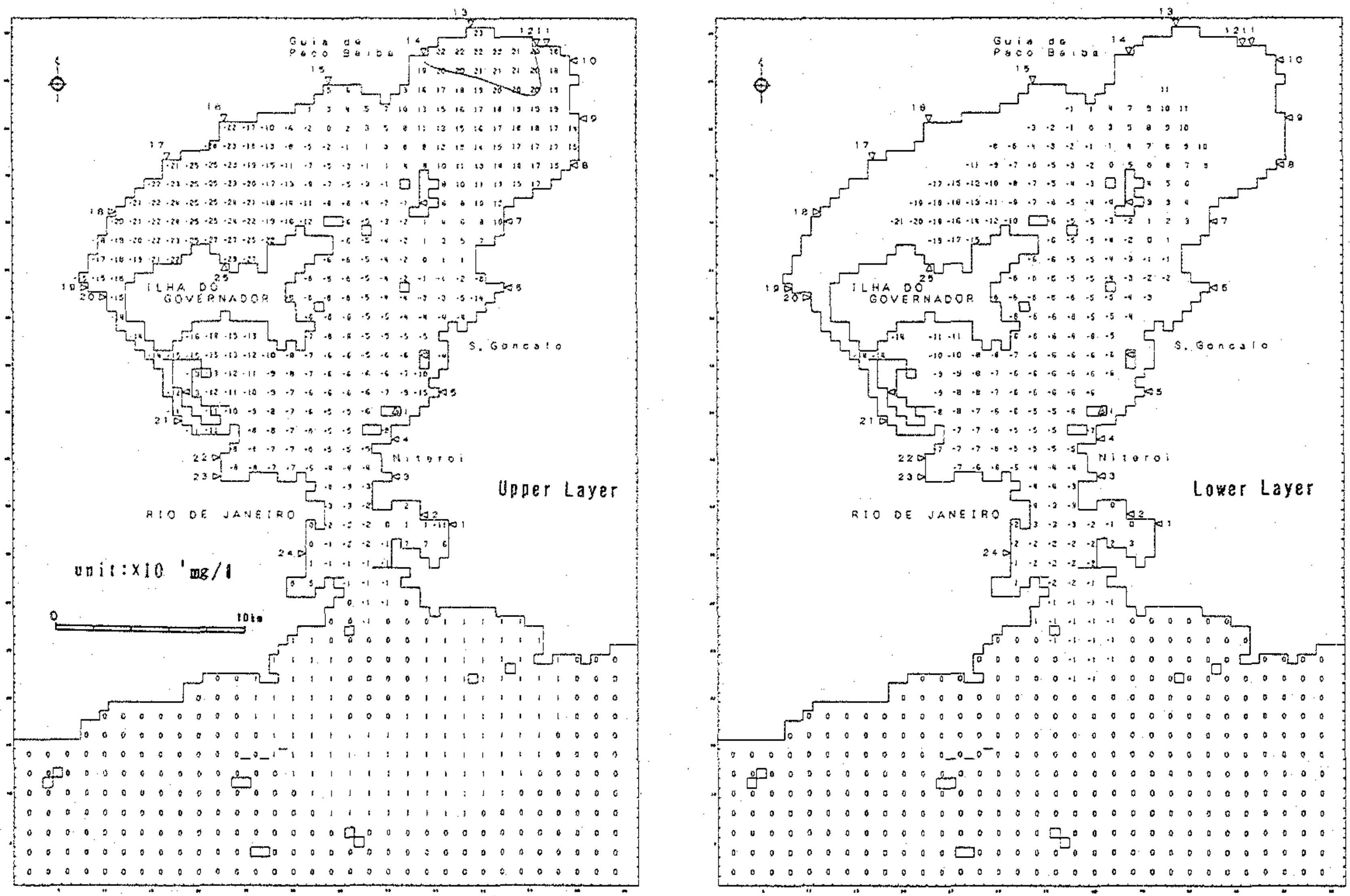



Fig. 4. 3-5 (3) Water Quality Variation from 1991 to 2010(scenario-1) without Measure (DO)

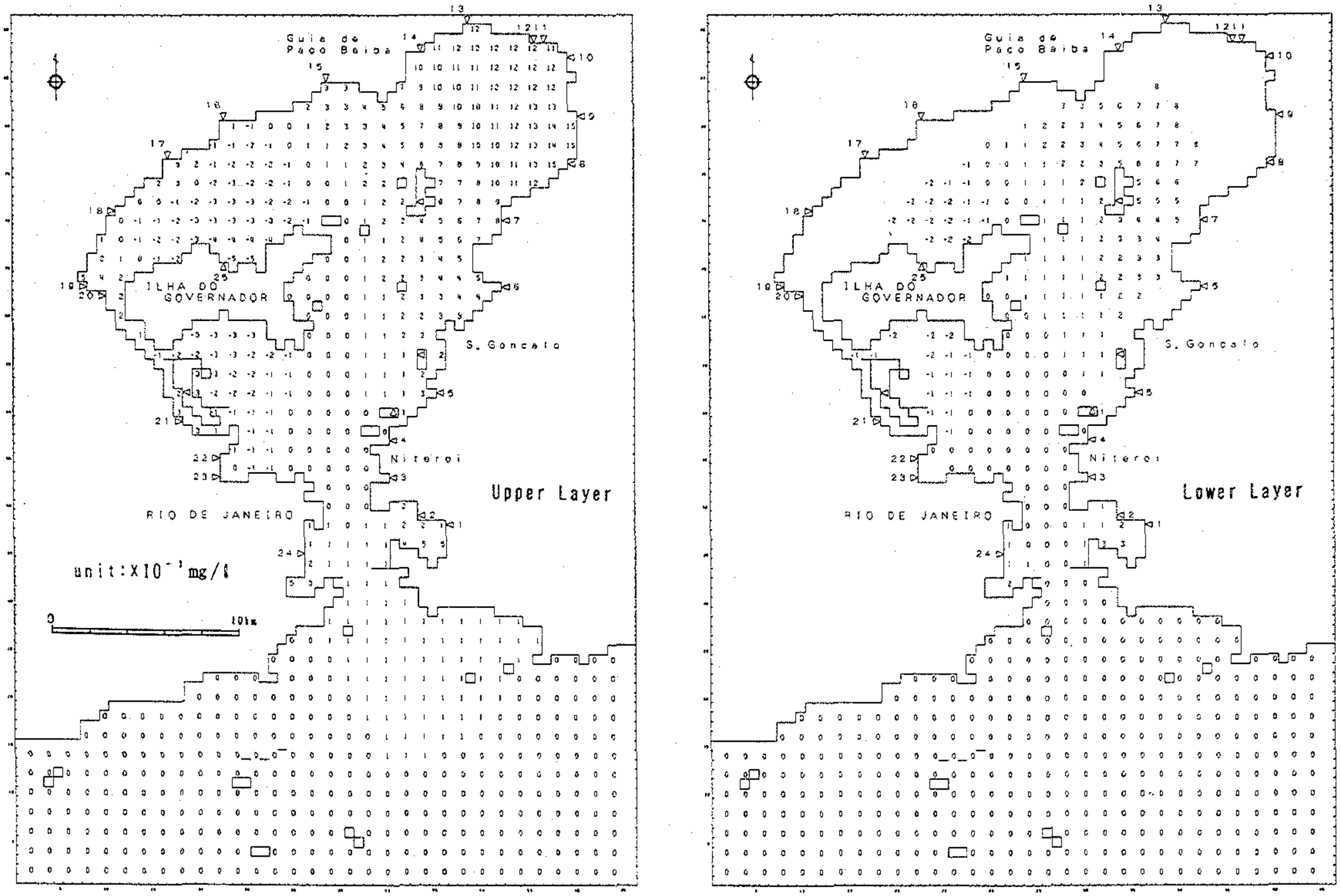



Fig. 4. 3-6(1) Water Quality Variation from 1991 to 2010(scenario-2) without Measure (BOD)

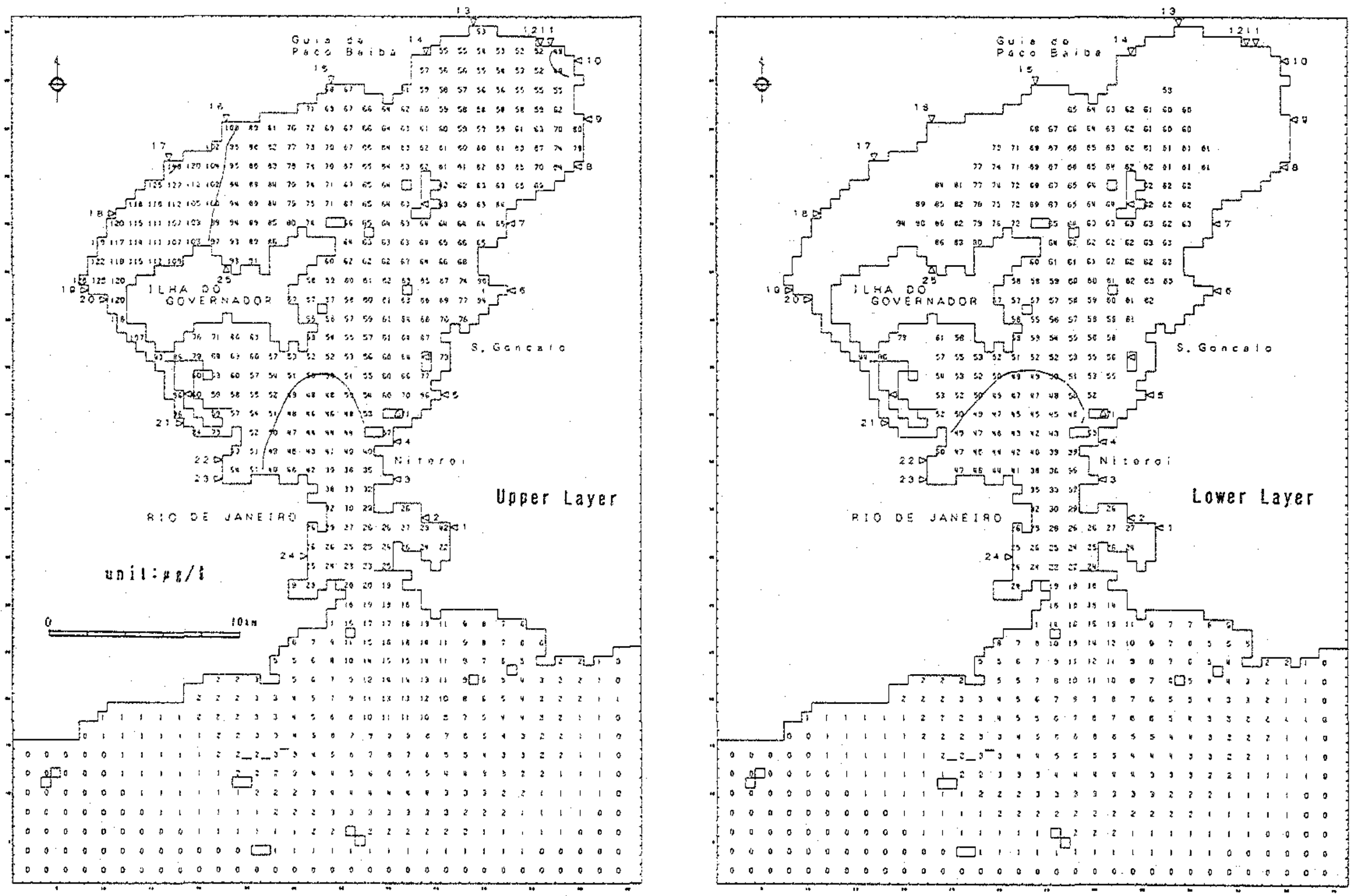



Fig. 4. 3-6(2) Water Quality Variation from 1991 to 2010(scenario-2) without Measure (T-P)

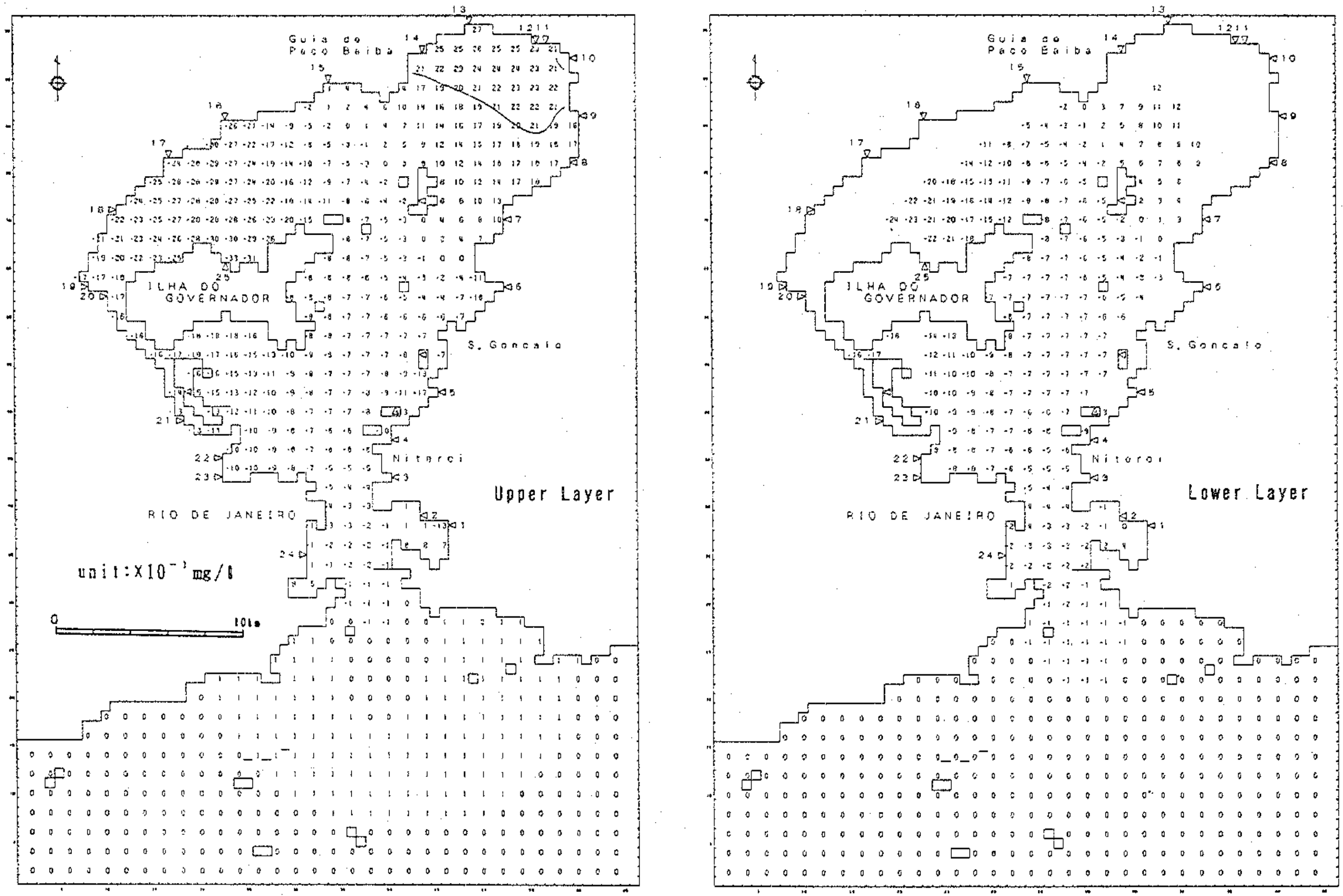



Fig. 4. 3-6(3) Water Quality Variation from 1991 to 2010(scenario-2) without Measure (DO)

## 4.4 Evaluation of Calculation Results

The inflowing loads and river discharges from each basin are summarized in Table 4.4-1 for each case, and the change of loads and discharges are shown in Fig.4.4-1 by each basin.

Fig.4.4-2 and Fig.4.4-3 show the change of the mean water quality in each water area for BOD, T-P and DO.

The future water quality of these indeces is estimated as follows;

- BOD : Strong rise of concentration is seen in Block F situated in the inner northeastern part as 4.6 mg/l in 2000, 4.9 mg/l in 2010 from 4.0 mg/l in 1991.

- T-P : Concentration rise of 0.05 mg/l to 0.1 mg/l is seen in the whole bay.

- DO : Concentration becomes worse in the whole, particularly water areas of Block C, D and E1 show 1 mg/l to 2 mg/l decrease.

Table 4.4-1 External Load from Sub-Basin Groups

| Case | Sub Basin Group | Discharge (m3/s) | BOD (t/day) | PO4-P (t/day) | O-P (t/day) |
|---|---|---|---|---|---|
| 2000 | East | 12.41 | 44.44 | 0.67 | 1.002 |
| | Northeast | 84.23 | 55.58 | 1.28 | 1.920 |
| | Northwest | 71.63 | 114.79 | 2.62 | 3.936 |
| | West | 74.38 | 176.41 | 4.48 | 6.726 |
| | Islands | 4.51 | 8.29 | 0.21 | 0.318 |
| | Total | 247.16 | 399.50 | 9.27 | 13.902 |
| 2010-1 | East | 13.47 | 47.27 | 0.75 | 1.122 |
| | Northeast | 87.75 | 64.27 | 1.49 | 2.232 |
| | Northwest | 76.32 | 127.45 | 2.94 | 4.404 |
| | West | 76.46 | 182.01 | 4.64 | 6.954 |
| | Islands | 4.60 | 8.54 | 0.22 | 0.330 |
| | Total | 258.60 | 429.53 | 10.03 | 15.042 |
| 2010-2 | East | 13.55 | 47.50 | 0.76 | 1.134 |
| | Northeast | 87.82 | 64.47 | 1.49 | 2.239 |
| | Northwest | 78.30 | 132.80 | 3.06 | 4.597 |
| | West | 77.92 | 185.99 | 4.74 | 7.111 |
| | Islands | 4.65 | 8.69 | 0.22 | 0.336 |
| | Total | 262.24 | 439.44 | 10.28 | 15.416 |

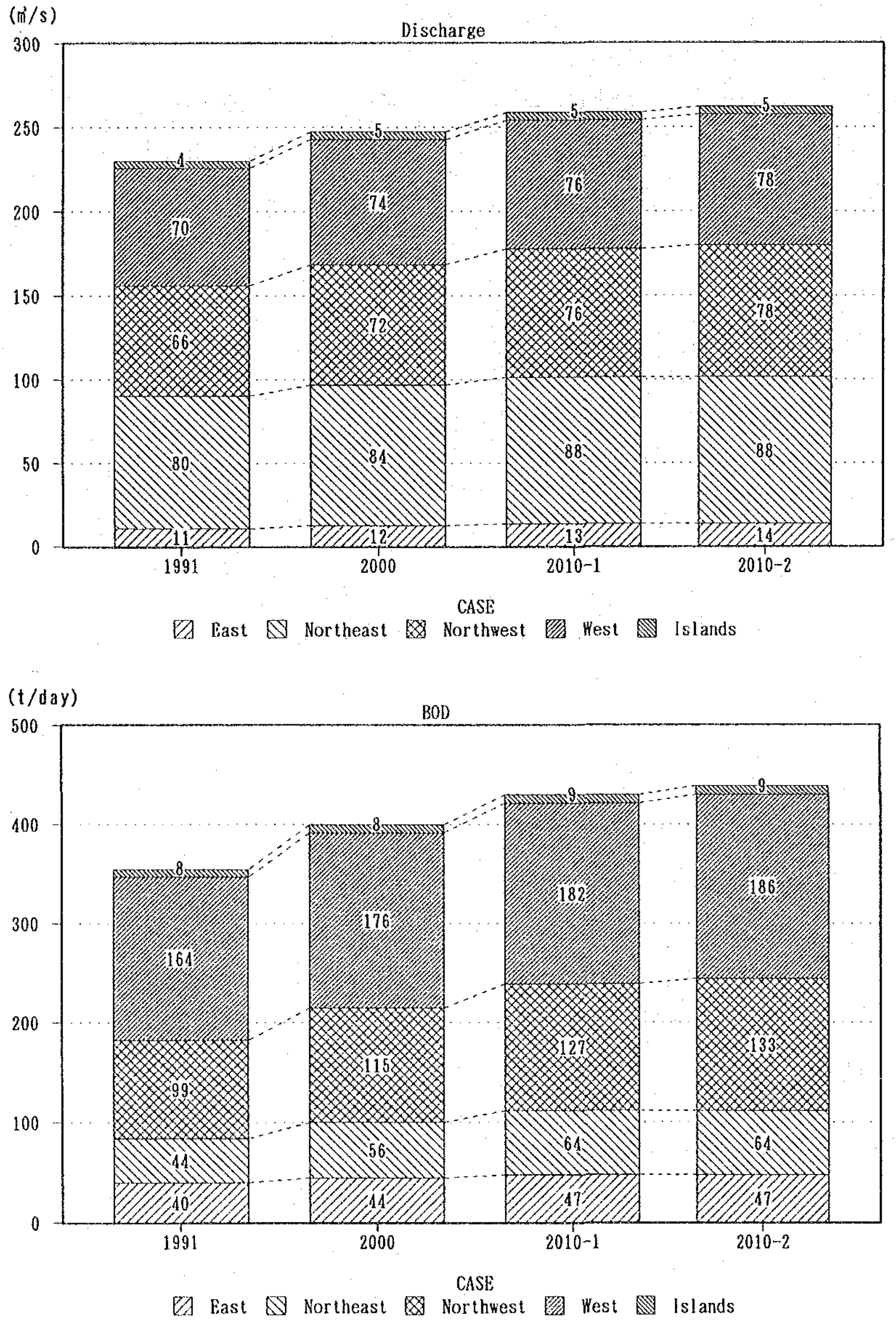
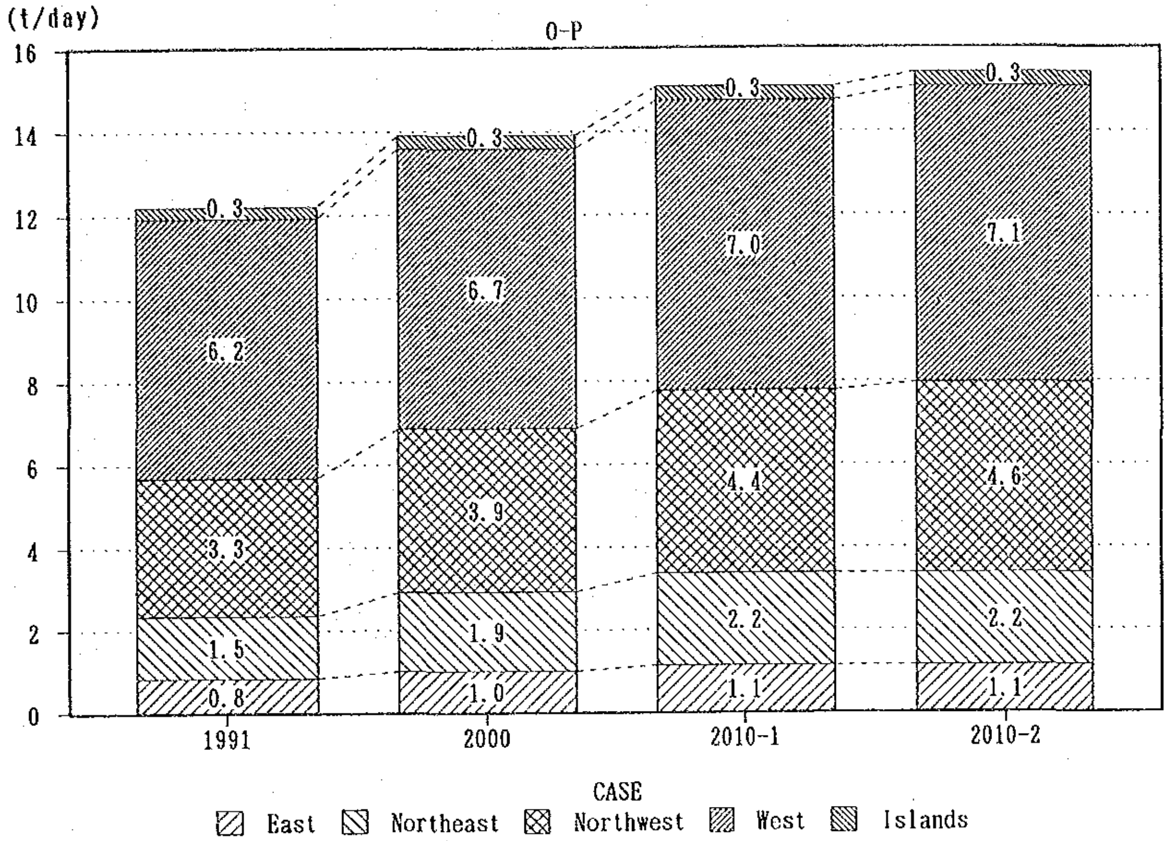



Fig. 4. 4-1(1)　External Load from Sub-Basin Groups



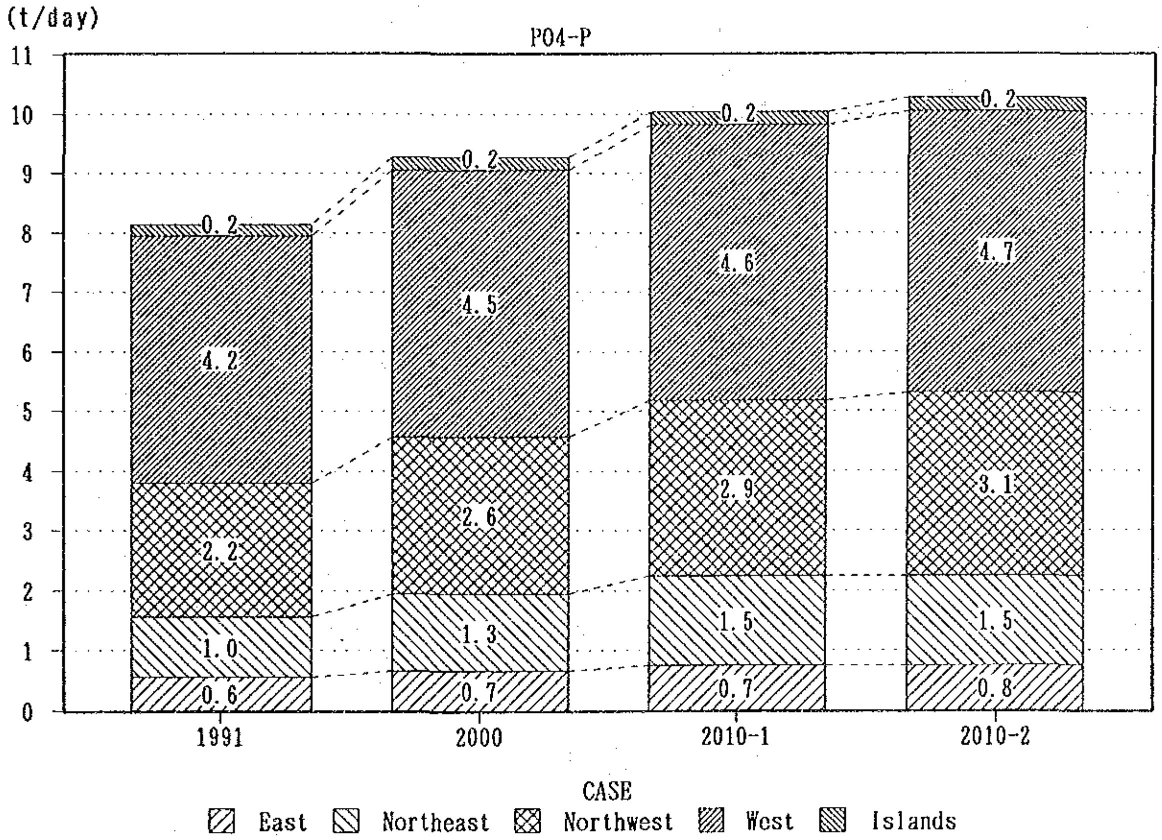




Fig. 4. 4-1 (2) External Load from Sub-Basin Groups

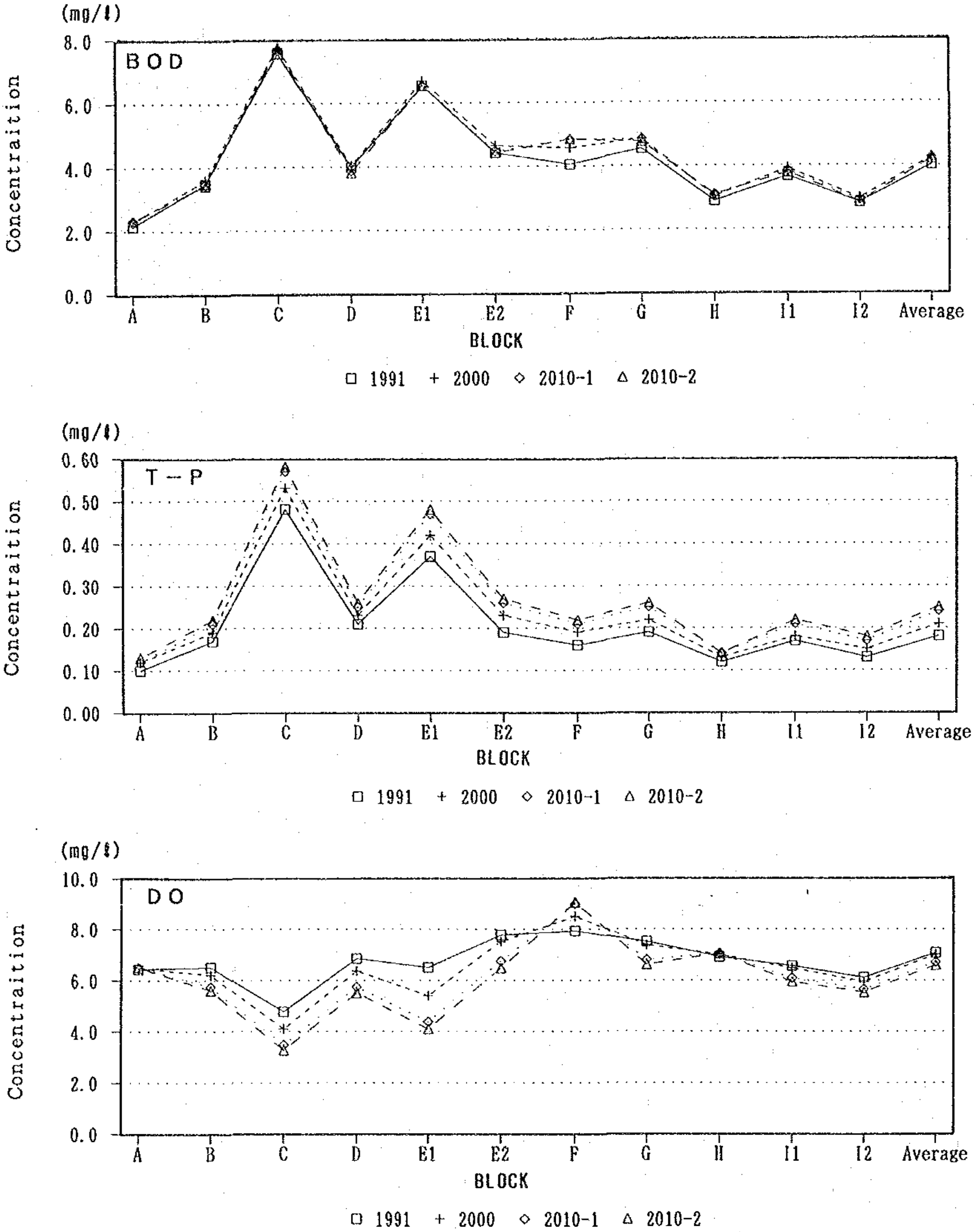



Fig. 4. 4-2 Water Quality Change in each block

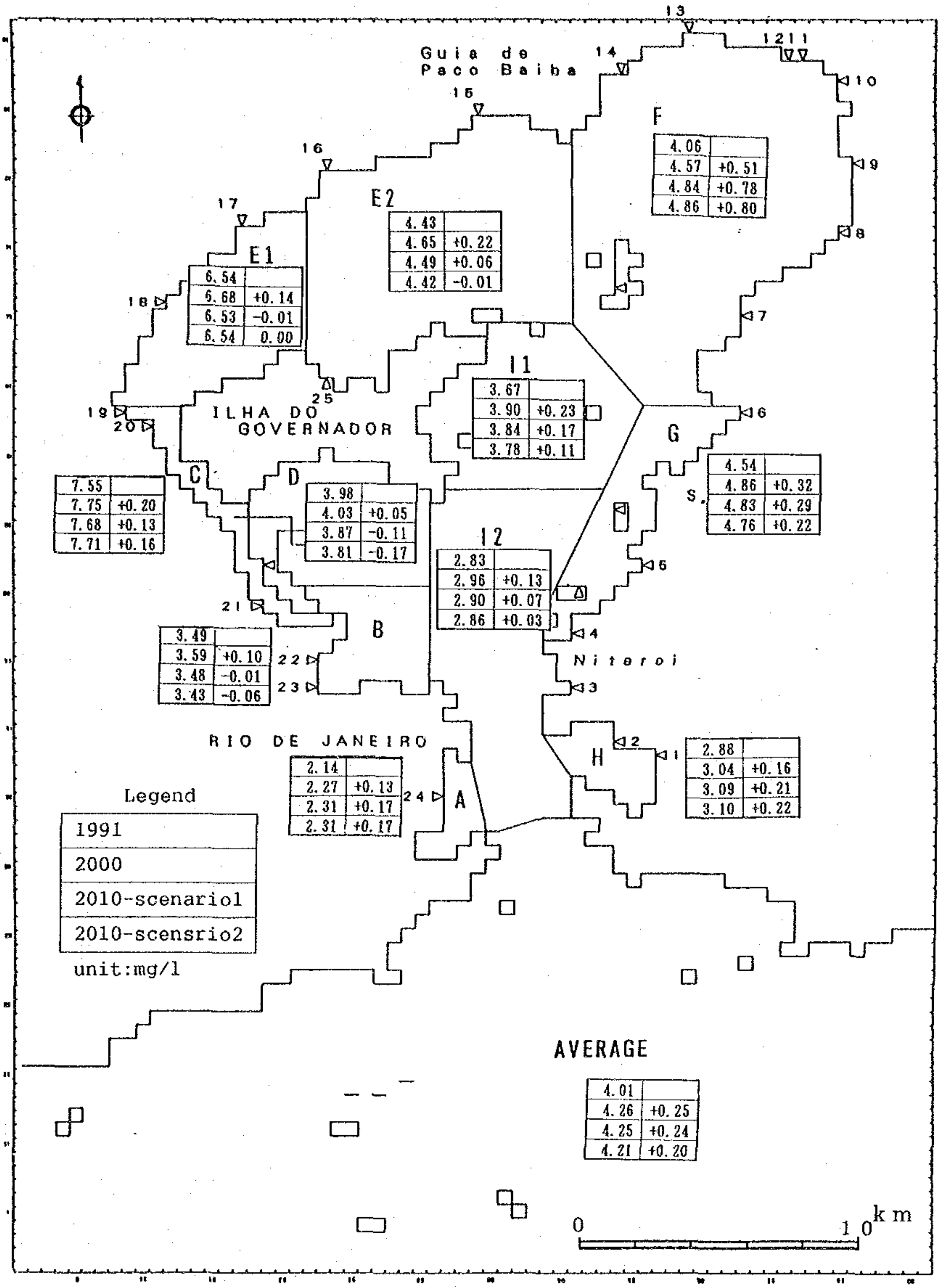



Fig. 4.4-3(1) BOD Concentration and Variation in each Block

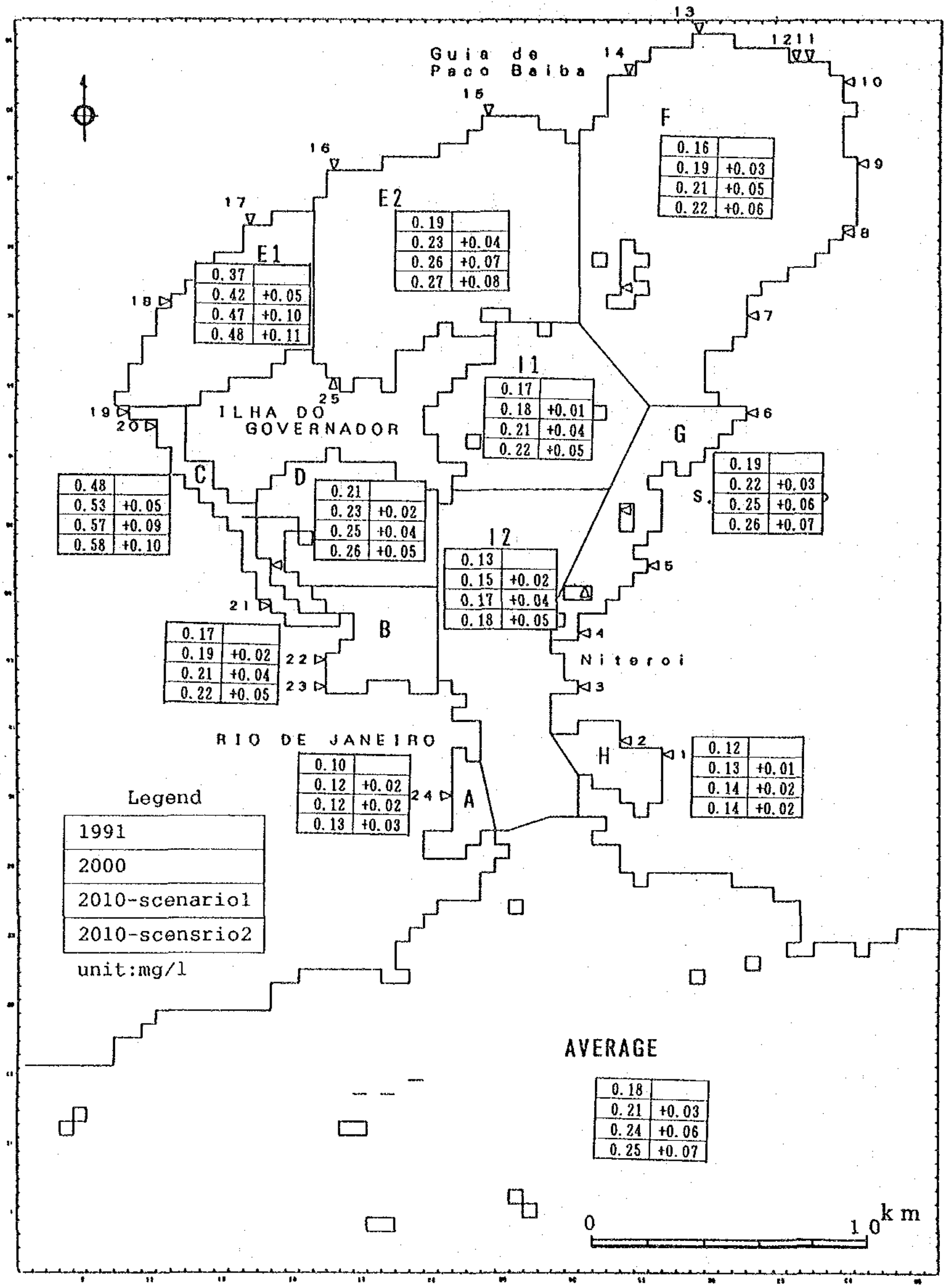



Fig. 4. 4-3(2) T-P Concentration and Variation in each Block

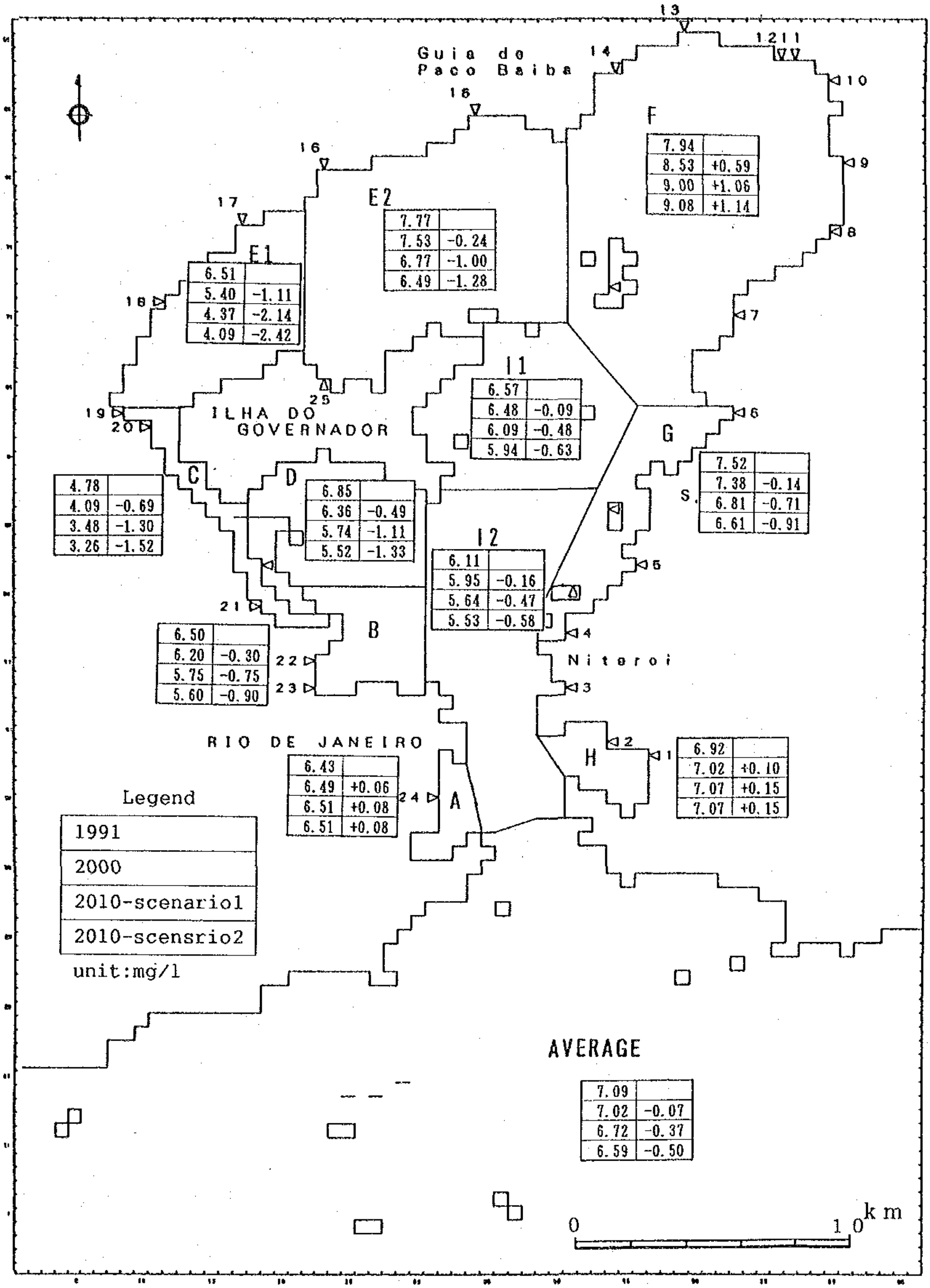



Fig. 4. 4-3(3) DO Concentration and Variation in each Block

# CHAPTER 5

# EFFICIENCY EVALUATION OF SEVERAL MEASURES

### 5.1 Case of Calculation

The efficiency evaluation for applicable measures is performed for the following cases;

(1) IDB/OECF Program

- Case 1-1 : Completion of sewage treatment plants (primary treatment) in the year of 2000.
- Case 1-2 : Completion of sewage treatment plants (secondary treatment) in the year of 2010.

(2) Additional Sewage Treatment Plants

- Case 2 : Case 1-2, plus
  Preparation of additional sewage treatment plants (primary treatment) in urban areas in the year of 2010.

(3) Ocean Outfall System

- Case 3-1 : Case 1-1, plus
  Ocean outfall system applying to sanitary districts south of the Pavuna's sanitary district and south of the Toque-Toque's sanitary district in the year of 2010.
- Case 3-2 : Case 1-1, plus
  Ocean outfall system applying to sanitary districts south of the Penha's sanitary district and south of the Toque-Toque's sanitary district in the year of 2010.
- Case 3-3 : Case 1-1, plus
  Ocean outfall system applying to sanitary districts south of the Alegria's and Fundao's sanitary district and south of the Toque-Toque's sanitary district in the year of 2010.
- Case 3-4 : Case 1-1, plus
  Ocean outfall system applying to sanitary districts south of the Botafogo's sanitary district and south of the Icarai's sanitary district in the year of 2010.

(4) High-Grade Sewage Treatment

Case 4-1 : Case 1-2, plus
20% reduction of T-P from secondary treatment plants of IDB/OECF Program in the year of 2010.

Case 4-2 : Case 1-2, plus
40% reduction of T-P from secondary treatment plants of IDB/OECF Program in the year of 2010.

Case 4-3 : Case 1-2, plus
80% reduction of T-P from secondary treatment plants of IDB/OECF Program in the year of 2010.

(5) Dredging of Polluted Sediments

Case 5-1 : Case 1-2, plus
Dredging of polluted sediments in Block C.

Case 5-2 : Case 1-2, plus
Dredging of polluted sediments in Block D.

Case 5-3 : Case 1-2, plus
Dredging of polluted sediments in Block E1.

Case 5-4 : Case 1-2, plus
Dredging of polluted sediments in Block E2.

(6) Deepening and Widening of Channels

Case 6-1 : Case 1-2, plus
Dredging of channels.

Case 6-2 : Case 1-2, plus
Dredging and widening of channels.

## 5.2 Conditions of Calculation

The inflowing loads used for the above cases are shown in Table 5.2-1 and the total loads for each basin are summarized in Table 5.2-2.

Table 5.2-1(1) External Load used for simulation in Case 1-1

RIVER INFLOW IDB/OECF(PRIMARY) IN 2000 CASE 1-1

| NO | NAME | I | J | Discharge (m3/s) | BOD (t/day) | PO4-P (t/day) | O-P (t/day) |
|---|---|---|---|---|---|---|---|
| River load | | | | | | | |
| 1 | B.-CHARITAS | 46 | 38 | 1.23 | 1.23 | 0.064 | 0.096 |
| 2 | CANAL CANTO DO RIO | 43 | 39 | 0.97 | 0.97 | 0.048 | 0.072 |
| 3 | B.-CATEDRAR | 40 | 43 | 0.90 | 0.87 | 0.044 | 0.066 |
| 4 | B.-NORTE CENTRO | 40 | 47 | 1.01 | 1.01 | 0.052 | 0.078 |
| 5 | RIO BOMBA | 45 | 52 | 4.48 | 5.32 | 0.244 | 0.366 |
| 6 | RIO IMBOASSU | 52 | 63 | 3.82 | 7.85 | 0.200 | 0.300 |
| Eastern Sub Total | | | | 12.41 | 17.25 | 0.652 | 0.978 |
| 7 | B.-ITAOCA | 52 | 70 | 0.89 | 1.84 | 0.048 | 0.072 |
| 8 | RIO ALCANTARA | 59 | 76 | 13.41 | 25.33 | 0.612 | 0.918 |
| 9 | RIO CACEREBU | 60 | 81 | 29.54 | 19.46 | 0.420 | 0.630 |
| 10 | RIO GUAPIMIRIN | 59 | 87 | 32.76 | 5.22 | 0.116 | 0.174 |
| 11 | CANAL DE MAGE | 57 | 88 | 0.70 | 0.45 | 0.012 | 0.018 |
| 12 | RIO RONCADOR | 56 | 88 | 3.78 | 1.96 | 0.044 | 0.066 |
| 13 | RIO IRIRI | 49 | 90 | 1.00 | 0.58 | 0.012 | 0.018 |
| 14 | RIO SURUI | 44 | 87 | 2.15 | 0.74 | 0.016 | 0.024 |
| Northeastern Sub Total | | | | 84.23 | 55.58 | 1.280 | 1.920 |
| 15 | B.-MAUA | 34 | 84 | 0.99 | 0.47 | 0.012 | 0.018 |
| 16 | RIO ESTRELA | 23 | 80 | 15.05 | 15.44 | 0.348 | 0.522 |
| 171 | RIO IGUACU | 17 | 76 | 29.35 | 38.30 | 0.868 | 1.302 |
| 172 | RIO SARAPUI | 17 | 76 | 22.87 | 42.87 | 1.204 | 1.806 |
| 18 | B.-CABO DO BRITO | 12 | 71 | 3.37 | 5.82 | 0.172 | 0.258 |
| Northwestern Sub Total | | | | 71.63 | 102.90 | 2.604 | 3.906 |
| 19 | RIO S.J.DE MERITI | 9 | 63 | 30.19 | 62.53 | 1.724 | 2.586 |
| 20 | RIO IRAJA | 11 | 62 | 9.83 | 15.51 | 0.600 | 0.900 |
| 21 | CANAL DO CUNHA | 19 | 49 | 15.99 | 22.67 | 0.948 | 1.422 |
| 22 | B.-S.CRISTOVAO | 23 | 45 | 1.28 | 1.69 | 0.072 | 0.108 |
| 23 | CANAL DO MANGUE | 23 | 43 | 9.99 | 16.65 | 0.592 | 0.888 |
| 24 | B.-BOTAFOGO | 32 | 35 | 7.10 | 15.04 | 0.444 | 0.666 |
| Western Sub Total | | | | 74.38 | 134.09 | 4.380 | 6.570 |
| 25 | I.DO GAVANADOR | 23 | 66 | 3.76 | 5.45 | 0.172 | 0.258 |
| 26 | I.DO FUNDAO | 18 | 52 | 0.26 | 0.20 | 0.004 | 0.006 |
| 27 | I.DE PAQUETA | 43 | 72 | 0.11 | 0.15 | 0.004 | 0.006 |
| 28 | I.DO ENGENHO | 43 | 56 | 0.25 | 0.53 | 0.016 | 0.024 |
| 29 | I.DE S.CRUZ | 41 | 51 | 0.13 | 0.23 | 0.008 | 0.012 |
| Islands Sub Total | | | | 4.51 | 6.56 | 0.204 | 0.306 |
| River load Total | | | | 247.16 | 316.38 | 9.120 | 13.680 |
| Direct Load | | | | | | | |
| 007 | | 43 | 36 | - | 2.13 | - | - |
| 001 | | 46 | 55 | - | 6.70 | - | - |
| 004 | | 46 | 56 | - | 2.40 | - | - |
| 008 | | 44 | 51 | - | 2.10 | - | - |
| 009 | | 40 | 47 | - | 1.94 | - | - |
| 027 | | 45 | 52 | - | 0.80 | - | - |
| 034 | | 46 | 57 | - | 0.66 | - | - |
| 044 | | 46 | 57 | - | 0.51 | - | - |
| 047 | | 46 | 57 | - | 0.48 | - | - |
| 062 | | 48 | 59 | - | 0.38 | - | - |
| 113 | | 51 | 62 | - | 0.22 | - | - |
| Eastern Sub Total | | | | - | 18.32 | - | - |
| 015 | | 17 | 76 | - | 1.32 | - | - |
| 018 | | 17 | 76 | - | 1.20 | - | - |
| 075 | | 17 | 76 | - | 0.33 | - | - |
| 029 | | 17 | 76 | - | 0.79 | - | - |
| 086 | | 17 | 76 | - | 0.31 | - | - |
| 137 | | 10 | 68 | - | 0.16 | - | - |
| Northwestern Sub Total | | | | - | 4.11 | - | - |
| 030 | | 11 | 62 | - | 0.72 | - | - |
| 042 | | 11 | 62 | - | 0.52 | - | - |
| 051 | | 32 | 36 | - | 0.45 | - | - |
| Western Sub Total | | | | - | 1.69 | - | - |
| Direct Load Total | | | | - | 24.11 | - | - |
| Total | | | | 247.16 | 340.49 | 9.120 | 13.680 |

Table 5.2-1(2) External Load used for simulation in Case 1-2

RIVER INFLOW　　IDB/OECF(SECONDARY) IN 2010　　CASE 1-2

| NO | NAME | I | J | Discharge (m3/s) | BOD (t/day) | PO4-P (t/day) | O-P (t/day) |
|---|---|---|---|---|---|---|---|
| River load | | | | | | | |
| 1 | B.-CHARITAS | 46 | 38 | 1.27 | 0.47 | 0.064 | 0.096 |
| 2 | CANAL CANTO DO RIO | 43 | 39 | 1.00 | 0.37 | 0.048 | 0.072 |
| 3 | B.-CATEDRAR | 40 | 43 | 0.93 | 0.33 | 0.044 | 0.066 |
| 4 | B.-NORTE CENTRO | 40 | 47 | 1.05 | 0.39 | 0.052 | 0.078 |
| 5 | RIO BOMBA | 45 | 52 | 5.00 | 2.86 | 0.272 | 0.408 |
| 6 | RIO IMBOASSU | 52 | 63 | 4.30 | 9.13 | 0.232 | 0.348 |
| Eastern Sub Total | | | | 13.55 | 13.55 | 0.712 | 1.068 |
| 7 | B.-ITAOCA | 52 | 70 | 1.00 | 2.14 | 0.056 | 0.084 |
| 8 | RIO ALCANTARA | 59 | 76 | 14.75 | 28.99 | 0.704 | 1.056 |
| 9 | RIO CACEREBU | 60 | 81 | 30.89 | 22.90 | 0.500 | 0.750 |
| 10 | RIO GUAPIMIRIN | 59 | 87 | 33.25 | 5.97 | 0.132 | 0.198 |
| 11 | CANAL DE MAGE | 57 | 88 | 0.73 | 0.55 | 0.012 | 0.018 |
| 12 | RIO RONCADOR | 56 | 88 | 3.94 | 2.35 | 0.052 | 0.078 |
| 13 | RIO IRIRI | 49 | 90 | 1.05 | 0.69 | 0.016 | 0.024 |
| 14 | RIO SURUI | 44 | 87 | 2.21 | 0.88 | 0.020 | 0.030 |
| Northeastern Sub Total | | | | 87.82 | 64.47 | 1.492 | 2.238 |
| 15 | B.-MAUA | 34 | 84 | 1.03 | 0.56 | 0.012 | 0.018 |
| 16 | RIO ESTRELA | 23 | 80 | 16.19 | 18.47 | 0.420 | 0.630 |
| 171 | RIO IGUACU | 17 | 76 | 31.93 | 45.29 | 1.032 | 1.548 |
| 172 | RIO SARAPUI | 17 | 76 | 25.30 | 43.98 | 1.360 | 2.040 |
| 18 | B.-CABO DO BRITO | 12 | 71 | 3.85 | 6.11 | 0.204 | 0.306 |
| Northwestern Sub Total | | | | 78.30 | 114.41 | 3.028 | 4.542 |
| 19 | RIO S.J.DE MERITI | 9 | 63 | 31.88 | 62.09 | 1.824 | 2.736 |
| 20 | RIO IRAJA | 11 | 62 | 10.25 | 11.10 | 0.612 | 0.918 |
| 21 | CANAL DO CUNHA | 19 | 49 | 16.66 | 13.86 | 0.964 | 1.446 |
| 22 | B.-S.CRISTOVAO | 23 | 45 | 1.33 | 1.02 | 0.076 | 0.114 |
| 23 | CANAL DO MANGUE | 23 | 43 | 10.40 | 13.07 | 0.608 | 0.912 |
| 24 | B.-BOTAFOGO | 32 | 35 | 7.40 | 14.52 | 0.460 | 0.690 |
| Western Sub Total | | | | 77.92 | 115.66 | 4.544 | 6.816 |
| 25 | I.DO GAVANADOR | 23 | 66 | 3.89 | 4.63 | 0.180 | 0.270 |
| 26 | I.DO FUNDAO | 18 | 52 | 0.26 | 0.17 | 0.008 | 0.012 |
| 27 | I.DE PAQUETA | 43 | 72 | 0.11 | 0.16 | 0.004 | 0.006 |
| 28 | I.DO ENGENHO | 43 | 56 | 0.25 | 0.56 | 0.016 | 0.024 |
| 29 | I.DE S.CRUZ | 41 | 51 | 0.14 | 0.24 | 0.008 | 0.012 |
| Islands Sub Total | | | | 4.65 | 5.76 | 0.216 | 0.324 |
| River load Total | | | | 262.24 | 313.85 | 9.992 | 14.988 |
| Direct Load | | | | | | | |
| 007 | | 43 | 36 | - | 2.13 | - | - |
| 001 | | 46 | 55 | - | 6.70 | - | - |
| 004 | | 46 | 56 | - | 2.40 | - | - |
| 008 | | 44 | 51 | - | 2.10 | - | - |
| 009 | | 40 | 47 | - | 1.94 | - | - |
| 027 | | 45 | 52 | - | 0.80 | - | - |
| 034 | | 46 | 57 | - | 0.66 | - | - |
| 044 | | 46 | 57 | - | 0.51 | - | - |
| 047 | | 46 | 57 | - | 0.48 | - | - |
| 062 | | 48 | 59 | - | 0.38 | - | - |
| 113 | | 51 | 62 | - | 0.22 | - | - |
| Eastern Sub Total | | | | - | 18.32 | - | - |
| 015 | | 17 | 76 | - | 1.32 | - | - |
| 018 | | 17 | 76 | - | 1.20 | - | - |
| 075 | | 17 | 76 | - | 0.33 | - | - |
| 029 | | 17 | 76 | - | 0.79 | - | - |
| 086 | | 17 | 76 | - | 0.31 | - | - |
| 137 | | 10 | 68 | - | 0.16 | - | - |
| Northwestern Sub Total | | | | - | 4.11 | - | - |
| 030 | | 11 | 62 | - | 0.72 | - | - |
| 042 | | 11 | 62 | - | 0.52 | - | - |
| 051 | | 32 | 36 | - | 0.45 | - | - |
| Western Sub Total | | | | - | 1.69 | - | - |
| Direct Load Total | | | | - | 24.11 | - | - |
| Total | | | | 262.24 | 337.96 | 9.992 | 14.988 |

Table 5.2-1(3) External Load used for simulation in Case 2

RIVER INFLOW IDB/OECF(SECOND+OP-PRI) IN 2010 CASE 2

| NO | NAME | I | J | Discharge (m3/s) | BOD (t/day) | PO4-P (t/day) | O-P (t/day) |
|---|---|---|---|---|---|---|---|
| **River load** | | | | | | | |
| 1 | B.-CHARITAS | 46 | 38 | 1.27 | 0.47 | 0.064 | 0.096 |
| 2 | CANAL CANTO DO RIO | 43 | 39 | 1.00 | 0.37 | 0.048 | 0.072 |
| 3 | B.-CATEDRAR | 40 | 43 | 0.93 | 0.33 | 0.044 | 0.066 |
| 4 | B.-NORTE CENTRO | 40 | 47 | 1.05 | 0.39 | 0.052 | 0.078 |
| 5 | RIO BOMBA | 45 | 52 | 5.00 | 2.86 | 0.272 | 0.408 |
| 6 | RIO IMBOASSU | 52 | 63 | 4.30 | 6.53 | 0.228 | 0.342 |
| Eastern Sub Total | | | | 13.55 | 10.95 | 0.708 | 1.062 |
| 7 | B.-ITAOCA | 52 | 70 | 1.00 | 2.14 | 0.056 | 0.084 |
| 8 | RIO ALCANTARA | 59 | 76 | 14.75 | 23.23 | 0.688 | 1.032 |
| 9 | RIO CACEREBU | 60 | 81 | 30.89 | 21.28 | 0.496 | 0.744 |
| 10 | RIO GUAPIMIRIN | 59 | 87 | 33.25 | 5.91 | 0.128 | 0.192 |
| 11 | CANAL DE MAGE | 57 | 88 | 0.73 | 0.55 | 0.012 | 0.018 |
| 12 | RIO RONCADOR | 56 | 88 | 3.94 | 2.35 | 0.052 | 0.078 |
| 13 | RIO IRIRI | 49 | 90 | 1.05 | 0.69 | 0.016 | 0.024 |
| 14 | RIO SURUI | 44 | 87 | 2.21 | 0.88 | 0.020 | 0.030 |
| Northeastern Sub Total | | | | 87.82 | 56.03 | 1.468 | 2.202 |
| 15 | B.-MAUA | 34 | 84 | 1.03 | 0.56 | 0.012 | 0.018 |
| 16 | RIO ESTRELA | 23 | 80 | 16.19 | 16.57 | 0.416 | 0.624 |
| 171 | RIO IGUACU | 17 | 76 | 31.93 | 38.46 | 1.016 | 1.524 |
| 172 | RIO SARAPUI | 17 | 76 | 25.30 | 35.62 | 1.340 | 2.010 |
| 18 | B.-CABO DO BRITO | 12 | 71 | 3.85 | 5.69 | 0.204 | 0.306 |
| Northwestern Sub Total | | | | 78.30 | 96.90 | 2.988 | 4.482 |
| 19 | RIO S.J.DE MERITI | 9 | 63 | 31.88 | 43.68 | 1.780 | 2.670 |
| 20 | RIO IRAJA | 11 | 62 | 10.25 | 8.66 | 0.604 | 0.906 |
| 21 | CANAL DO CUNHA | 19 | 49 | 16.66 | 13.86 | 0.964 | 1.446 |
| 22 | B.-S.CRISTOVAO | 23 | 45 | 1.33 | 0.95 | 0.076 | 0.114 |
| 23 | CANAL DO MANGUE | 23 | 43 | 10.40 | 13.07 | 0.608 | 0.912 |
| 24 | B.-BOTAFOGO | 32 | 35 | 7.40 | 11.00 | 0.452 | 0.678 |
| Western Sub Total | | | | 77.92 | 91.22 | 4.484 | 6.726 |
| 25 | I.DO GAVANADOR | 23 | 66 | 3.89 | 3.91 | 0.176 | 0.264 |
| 26 | I.DO FUNDAO | 18 | 52 | 0.26 | 0.17 | 0.008 | 0.012 |
| 27 | I.DE PAQUETA | 43 | 72 | 0.11 | 0.16 | 0.004 | 0.006 |
| 28 | I.DO ENGENHO | 43 | 56 | 0.25 | 0.56 | 0.016 | 0.024 |
| 29 | I.DE S.CRUZ | 41 | 51 | 0.14 | 0.24 | 0.008 | 0.012 |
| Islands Sub Total | | | | 4.65 | 5.04 | 0.212 | 0.318 |
| River load Total | | | | 262.24 | 260.14 | 9.860 | 14.790 |
| **Direct Load** | | | | | | | |
| 007 | | 43 | 36 | - | 2.13 | - | - |
| 001 | | 46 | 55 | - | 6.70 | - | - |
| 004 | | 46 | 56 | - | 2.40 | - | - |
| 008 | | 44 | 51 | - | 2.10 | - | - |
| 009 | | 40 | 47 | - | 1.94 | - | - |
| 027 | | 45 | 52 | - | 0.80 | - | - |
| 034 | | 46 | 57 | - | 0.66 | - | - |
| 044 | | 46 | 57 | - | 0.51 | - | - |
| 047 | | 46 | 57 | - | 0.48 | - | - |
| 062 | | 48 | 59 | - | 0.38 | - | - |
| 113 | | 51 | 62 | - | 0.22 | - | - |
| Eastern Sub Total | | | | - | 18.32 | - | - |
| 015 | | 17 | 76 | - | 1.32 | - | - |
| 018 | | 17 | 76 | - | 1.20 | - | - |
| 075 | | 17 | 76 | - | 0.33 | - | - |
| 029 | | 17 | 76 | - | 0.79 | - | - |
| 086 | | 17 | 76 | - | 0.31 | - | - |
| 137 | | 10 | 68 | - | 0.16 | - | - |
| Northwestern Sub Total | | | | - | 4.11 | - | - |
| 030 | | 11 | 62 | - | 0.72 | - | - |
| 042 | | 11 | 62 | - | 0.52 | - | - |
| 051 | | 32 | 36 | - | 0.45 | - | - |
| Western Sub Total | | | | - | 1.69 | - | - |
| Direct Load Total | | | | - | 24.11 | - | - |
| Total | | | | 262.24 | 284.25 | 9.860 | 14.790 |

Table 5.2-1(4) External Load used for simulation in Case 3-1

RIVER INFLOW BYPASS1 IN 2010 CASE 3-1

| NO | NAME | I | J | Discharge (m3/s) | BOD (t/day) | PO4-P (t/day) | O-P (t/day) |
|---|---|---|---|---|---|---|---|
| River load | | | | | | | |
| 1 | B.-CHARITAS | 46 | 38 | 0.12 | 0.07 | 0.008 | 0.012 |
| 2 | CANAL CANTO DO RIO | 43 | 39 | 0.10 | 0.06 | 0.004 | 0.006 |
| 3 | B.-CATEDRAR | 40 | 43 | 0.09 | 0.05 | 0.004 | 0.006 |
| 4 | B.-NORTE CENTRO | 40 | 47 | 0.10 | 0.06 | 0.004 | 0.006 |
| 5 | RIO BOMBA | 45 | 52 | 4.77 | 6.07 | 0.280 | 0.420 |
| 6 | RIO IMBOASSU | 52 | 63 | 4.30 | 9.13 | 0.232 | 0.348 |
| Eastern Sub Total | | | | 9.48 | 15.44 | 0.532 | 0.798 |
| 7 | B.-ITAOCA | 52 | 70 | 1.00 | 2.14 | 0.056 | 0.084 |
| 8 | RIO ALCANTARA | 59 | 76 | 14.75 | 28.99 | 0.704 | 1.056 |
| 9 | RIO CACEREBU | 60 | 81 | 30.89 | 22.90 | 0.500 | 0.750 |
| 10 | RIO GUAPIMIRIN | 59 | 87 | 33.25 | 5.97 | 0.132 | 0.198 |
| 11 | CANAL DE MAGE | 57 | 88 | 0.73 | 0.55 | 0.012 | 0.018 |
| 12 | RIO RONCADOR | 56 | 88 | 3.94 | 2.35 | 0.052 | 0.078 |
| 13 | RIO IRIRI | 49 | 90 | 1.05 | 0.69 | 0.016 | 0.024 |
| 14 | RIO SURUI | 44 | 87 | 2.21 | 0.80 | 0.020 | 0.030 |
| Northeastern Sub Total | | | | 87.82 | 64.39 | 1.492 | 2.238 |
| 15 | B.-MAUA | 34 | 84 | 1.03 | 0.56 | 0.012 | 0.018 |
| 16 | RIO ESTRELA | 23 | 80 | 16.19 | 18.47 | 0.420 | 0.630 |
| 171 | RIO IGUACU | 17 | 76 | 31.93 | 45.29 | 1.032 | 1.548 |
| 172 | RIO SARAPUI | 17 | 76 | 24.96 | 48.59 | 1.372 | 2.058 |
| 18 | B.-CABO DO BRITO | 12 | 71 | 3.79 | 6.90 | 0.208 | 0.312 |
| Northwestern Sub Total | | | | 77.90 | 119.81 | 3.044 | 4.566 |
| 19 | RIO S.J.DE MERITI | 9 | 63 | 26.16 | 59.87 | 1.524 | 2.286 |
| 20 | RIO IRAJA | 11 | 62 | 4.02 | 8.59 | 0.256 | 0.384 |
| 21 | CANAL DO CUNHA | 19 | 49 | 4.64 | 9.04 | 0.288 | 0.432 |
| 22 | B.-S.CRISTOVAO | 23 | 45 | 0.36 | 0.66 | 0.020 | 0.030 |
| 23 | CANAL DO MANGUE | 23 | 43 | 5.01 | 10.94 | 0.308 | 0.462 |
| 24 | B.-BOTAFOGO | 32 | 35 | 5.91 | 13.93 | 0.376 | 0.564 |
| Western Sub Total | | | | 46.10 | 103.03 | 2.772 | 4.158 |
| 25 | I.DO GAVANADOR | 23 | 66 | 3.80 | 5.70 | 0.184 | 0.276 |
| 26 | I.DO FUNDAO | 18 | 52 | 0.16 | 0.16 | 0.004 | 0.006 |
| 27 | I.DE PAQUETA | 43 | 72 | 0.11 | 0.16 | 0.004 | 0.006 |
| 28 | I.DO ENGENHO | 43 | 56 | 0.25 | 0.56 | 0.016 | 0.024 |
| 29 | I.DE S.CRUZ | 41 | 51 | 0.14 | 0.24 | 0.008 | 0.012 |
| Islands Sub Total | | | | 4.46 | 6.82 | 0.216 | 0.324 |
| River load Total | | | | 225.76 | 309.49 | 8.056 | 12.084 |
| Direct Load | | | | | | | |
| 007 | | 43 | 36 | - | 2.13 | - | - |
| 091 | | 46 | 55 | - | 6.70 | - | - |
| 004 | | 46 | 56 | - | 2.40 | - | - |
| 008 | | 44 | 51 | - | 2.10 | - | - |
| 009 | | 40 | 47 | - | 1.94 | - | - |
| 027 | | 45 | 52 | - | 0.80 | - | - |
| 034 | | 46 | 57 | - | 0.66 | - | - |
| 044 | | 46 | 57 | - | 0.51 | - | - |
| 047 | | 46 | 57 | - | 0.48 | - | - |
| 062 | | 48 | 59 | - | 0.38 | - | - |
| 113 | | 51 | 62 | - | 0.22 | - | - |
| Eastern Sub Total | | | | - | 18.32 | - | - |
| 015 | | 17 | 76 | - | 1.32 | - | - |
| 018 | | 17 | 76 | - | 1.20 | - | - |
| 075 | | 17 | 76 | - | 0.33 | - | - |
| 029 | | 17 | 76 | - | 0.79 | - | - |
| 086 | | 17 | 76 | - | 0.31 | - | - |
| 137 | | 10 | 68 | - | 0.16 | - | - |
| Northwestern Sub Total | | | | - | 4.11 | - | - |
| 030 | | 11 | 62 | - | 0.72 | - | - |
| 042 | | 11 | 62 | - | 0.52 | - | - |
| 051 | | 32 | 36 | - | 0.45 | - | - |
| Western Sub Total | | | | - | 1.69 | - | - |
| Direct Load Total | | | | - | 24.11 | - | - |
| Total | | | | 225.76 | 333.60 | 8.056 | 12.084 |

Table 5.2-1(5) External Load used for simulation in Case 3-2

RIVER INFLOW BYPASS2 IN 2010 CASE 3-2

| NO | NAME | I | J | Discharge (m3/s) | BOD (t/day) | PO4-P (t/day) | O-P (t/day) |
|---|---|---|---|---|---|---|---|
| River load | | | | | | | |
| 1 | B.-CHARITAS | 46 | 38 | 0.12 | 0.08 | 0.008 | 0.012 |
| 2 | CANAL CANTO DO RIO | 43 | 39 | 0.10 | 0.06 | 0.004 | 0.006 |
| 3 | B.-CATEDRAR | 40 | 43 | 0.09 | 0.05 | 0.004 | 0.006 |
| 4 | B.-NORTE CENTRO | 40 | 47 | 0.10 | 0.06 | 0.004 | 0.006 |
| 5 | RIO BOMBA | 45 | 52 | 4.77 | 6.07 | 0.280 | 0.420 |
| 6 | RIO IMBOASSU | 52 | 63 | 4.30 | 9.13 | 0.232 | 0.348 |
| Eastern Sub Total | | | | 9.48 | 15.45 | 0.532 | 0.798 |
| 7 | B.-ITAOCA | 52 | 70 | 1.00 | 2.14 | 0.056 | 0.084 |
| 8 | RIO ALCANTARA | 59 | 76 | 14.75 | 28.99 | 0.704 | 1.056 |
| 9 | RIO CACEREBU | 60 | 81 | 30.89 | 22.90 | 0.500 | 0.750 |
| 10 | RIO GUAPIMIRIN | 59 | 87 | 33.25 | 5.97 | 0.132 | 0.198 |
| 11 | CANAL DE MAGE | 57 | 88 | 0.73 | 0.55 | 0.012 | 0.018 |
| 12 | RIO RONCADOR | 56 | 88 | 3.94 | 2.35 | 0.052 | 0.078 |
| 13 | RIO IRIRI | 49 | 90 | 1.05 | 0.69 | 0.016 | 0.024 |
| 14 | RIO SURUI | 44 | 87 | 2.21 | 0.88 | 0.020 | 0.030 |
| Northeastern Sub Total | | | | 87.82 | 64.47 | 1.492 | 2.238 |
| 15 | B.-MAUA | 34 | 84 | 1.03 | 0.56 | 0.012 | 0.018 |
| 16 | RIO ESTRELA | 23 | 80 | 16.19 | 18.47 | 0.420 | 0.630 |
| 171 | RIO IGUACU | 17 | 76 | 31.93 | 45.29 | 1.032 | 1.548 |
| 172 | RIO SARAPUI | 17 | 76 | 24.96 | 48.59 | 1.372 | 2.058 |
| 18 | B.-CABO DO BRITO | 12 | 71 | 3.79 | 6.90 | 0.208 | 0.312 |
| Northwestern Sub Total | | | | 77.90 | 119.81 | 3.044 | 4.566 |
| 19 | RIO S.J.DE MERITI | 9 | 63 | 31.56 | 66.64 | 1.840 | 2.760 |
| 20 | RIO IRAJA | 11 | 62 | 4.02 | 8.59 | 0.256 | 0.384 |
| 21 | CANAL DO CUNHA | 19 | 49 | 4.64 | 9.04 | 0.288 | 0.432 |
| 22 | B.-S.CRISTOVAO | 23 | 45 | 0.36 | 0.66 | 0.020 | 0.030 |
| 23 | CANAL DO MANGUE | 23 | 43 | 5.01 | 10.94 | 0.308 | 0.462 |
| 24 | B.-BOTAFOGO | 32 | 35 | 5.91 | 13.93 | 0.376 | 0.564 |
| Western Sub Total | | | | 51.50 | 109.80 | 3.088 | 4.632 |
| 25 | I.DO GAVANADOR | 23 | 66 | 3.80 | 5.70 | 0.184 | 0.276 |
| 26 | I.DO FUNDAO | 18 | 52 | 0.16 | 0.16 | 0.004 | 0.006 |
| 27 | I.DE PAQUETA | 43 | 72 | 0.11 | 0.16 | 0.004 | 0.006 |
| 28 | I.DO ENGENHO | 43 | 56 | 0.25 | 0.56 | 0.016 | 0.024 |
| 29 | I.DE S.CRUZ | 41 | 51 | 0.14 | 0.24 | 0.008 | 0.012 |
| Islands Sub Total | | | | 4.46 | 6.82 | 0.216 | 0.324 |
| River load Total | | | | 231.16 | 316.35 | 8.372 | 12.558 |
| Direct Load | | | | | | | |
| 007 | | 43 | 36 | - | 2.13 | - | - |
| 001 | | 46 | 55 | - | 6.70 | - | - |
| 004 | | 46 | 56 | - | 2.40 | - | - |
| 008 | | 44 | 51 | - | 2.10 | - | - |
| 009 | | 40 | 47 | - | 1.94 | - | - |
| 027 | | 45 | 52 | - | 0.80 | - | - |
| 034 | | 46 | 57 | - | 0.66 | - | - |
| 044 | | 46 | 57 | - | 0.51 | - | - |
| 047 | | 46 | 57 | - | 0.48 | - | - |
| 062 | | 48 | 59 | - | 0.38 | - | - |
| 113 | | 51 | 62 | - | 0.22 | - | - |
| Eastern Sub Total | | | | - | 18.32 | - | - |
| 015 | | 17 | 76 | - | 1.32 | - | - |
| 018 | | 17 | 76 | - | 1.20 | - | - |
| 075 | | 17 | 76 | - | 0.33 | - | - |
| 029 | | 17 | 76 | - | 0.79 | - | - |
| 086 | | 17 | 76 | - | 0.31 | - | - |
| 137 | | 10 | 68 | - | 0.16 | - | - |
| Northwestern Sub Total | | | | - | 4.11 | - | - |
| 030 | | 11 | 62 | - | 0.72 | - | - |
| 042 | | 11 | 62 | - | 0.52 | - | - |
| 051 | | 32 | 36 | - | 0.45 | - | - |
| Western Sub Total | | | | - | 1.69 | - | - |
| Direct Load Total | | | | - | 24.11 | - | - |
| Total | | | | 231.16 | 340.46 | 8.372 | 12.558 |

Table 5.2-1(6) External Load used for simulation in Case 3-3

RIVER INFLOW BYPASS3-2 IN 2010 CASE 3-3

| NO | NAME | I | J | Discharge (m3/s) | BOD (t/day) | PO4-P (t/day) | O-P (t/day) |
|---|---|---|---|---|---|---|---|
| River load | | | | | | | |
| 1 | B.-CHARITAS | 46 | 38 | 0.12 | 0.08 | 0.008 | 0.012 |
| 2 | CANAL CANTO DO RIO | 43 | 39 | 0.10 | 0.06 | 0.004 | 0.006 |
| 3 | B.-CATEDRAR | 40 | 43 | 0.09 | 0.05 | 0.004 | 0.006 |
| 4 | B.-NORTE CENTRO | 40 | 47 | 0.10 | 0.06 | 0.004 | 0.006 |
| 5 | RIO BOMBA | 45 | 52 | 4.54 | 6.07 | 0.268 | 0.402 |
| 6 | RIO IMBOASSU | 52 | 63 | 4.30 | 9.13 | 0.232 | 0.348 |
| Eastern Sub Total | | | | 9.25 | 15.45 | 0.520 | 0.780 |
| 7 | B.-ITAOCA | 52 | 70 | 1.00 | 2.14 | 0.056 | 0.084 |
| 8 | RIO ALCANTARA | 59 | 76 | 14.75 | 28.99 | 0.704 | 1.056 |
| 9 | RIO CACEREBU | 60 | 81 | 30.89 | 22.90 | 0.500 | 0.750 |
| 10 | RIO GUAPIMIRIN | 59 | 87 | 33.25 | 5.97 | 0.132 | 0.198 |
| 11 | CANAL DE MAGE | 57 | 88 | 0.73 | 0.55 | 0.012 | 0.018 |
| 12 | RIO RONCADOR | 56 | 88 | 3.94 | 2.35 | 0.052 | 0.078 |
| 13 | RIO IRIRI | 49 | 90 | 1.05 | 0.69 | 0.016 | 0.024 |
| 14 | RIO SURUI | 44 | 87 | 2.21 | 0.88 | 0.020 | 0.030 |
| Northeastern Sub Total | | | | 87.82 | 64.47 | 1.492 | 2.238 |
| 15 | B.-MAUA | 34 | 84 | 1.03 | 0.56 | 0.012 | 0.018 |
| 16 | RIO ESTRELA | 23 | 80 | 16.19 | 18.47 | 0.420 | 0.630 |
| 171 | RIO IGUACU | 17 | 76 | 31.93 | 45.29 | 1.032 | 1.548 |
| 172 | RIO SARAPUI | 17 | 76 | 24.63 | 48.59 | 1.356 | 2.034 |
| 18 | B.-CABO DO BRITO | 12 | 71 | 3.73 | 6.90 | 0.204 | 0.306 |
| Northwestern Sub Total | | | | 77.51 | 119.81 | 3.024 | 4.536 |
| 19 | RIO S.J.DE MERITI | 9 | 63 | 31.25 | 66.64 | 1.820 | 2.730 |
| 20 | RIO IRAJA | 11 | 62 | 9.57 | 16.25 | 0.608 | 0.912 |
| 21 | CANAL DO CUNHA | 19 | 49 | 4.64 | 9.04 | 0.288 | 0.432 |
| 22 | B.-S.CRISTOVAO | 23 | 45 | 0.36 | 0.66 | 0.020 | 0.030 |
| 23 | CANAL DO MANGUE | 23 | 43 | 5.01 | 10.94 | 0.308 | 0.462 |
| 24 | B.-BOTAFOGO | 32 | 35 | 5.91 | 13.93 | 0.376 | 0.564 |
| Western Sub Total | | | | 56.74 | 117.46 | 3.420 | 5.130 |
| 25 | I.DO GAVANADOR | 23 | 66 | 3.71 | 5.70 | 0.176 | 0.264 |
| 26 | I.DO FUNDAO | 18 | 52 | 0.16 | 0.16 | 0.004 | 0.006 |
| 27 | I.DE PAQUETA | 43 | 72 | 0.11 | 0.16 | 0.004 | 0.006 |
| 28 | I.DO ENGENHO | 43 | 56 | 0.25 | 0.56 | 0.016 | 0.024 |
| 29 | I.DE S.CRUZ | 41 | 51 | 0.14 | 0.24 | 0.008 | 0.012 |
| Islands Sub Total | | | | 4.37 | 6.82 | 0.208 | 0.312 |
| River load Total | | | | 235.69 | 324.01 | 8.664 | 12.996 |
| Direct Load | | | | | | | |
| 007 | | 43 | 36 | - | 2.13 | - | - |
| 001 | | 46 | 55 | - | 6.70 | - | - |
| 004 | | 46 | 56 | - | 2.40 | - | - |
| 008 | | 44 | 51 | - | 2.10 | - | - |
| 009 | | 40 | 47 | - | 1.94 | - | - |
| 027 | | 45 | 52 | - | 0.80 | - | - |
| 034 | | 46 | 57 | - | 0.66 | - | - |
| 044 | | 46 | 57 | - | 0.51 | - | - |
| 047 | | 46 | 57 | - | 0.48 | - | - |
| 062 | | 48 | 59 | - | 0.38 | - | - |
| 113 | | 51 | 62 | - | 0.22 | - | - |
| Eastern Sub Total | | | | - | 18.32 | - | - |
| 015 | | 17 | 76 | - | 1.32 | - | - |
| 018 | | 17 | 76 | - | 1.20 | - | - |
| 075 | | 17 | 76 | - | 0.33 | - | - |
| 029 | | 17 | 76 | - | 0.79 | - | - |
| 086 | | 17 | 76 | - | 0.31 | - | - |
| 137 | | 10 | 68 | - | 0.16 | - | - |
| Northwestern Sub Total | | | | - | 4.11 | - | - |
| 030 | | 11 | 62 | - | 0.72 | - | - |
| 042 | | 11 | 62 | - | 0.52 | - | - |
| 051 | | 32 | 36 | - | 0.45 | - | - |
| Western Sub Total | | | | - | 1.69 | - | - |
| Direct Load Total | | | | - | 24.11 | - | - |
| Total | | | | 235.69 | 348.12 | 8.664 | 12.996 |

Table 5.2-1(7) External Load used for simulation in Case 3-4

RIVER INFLOW BYPASS4 IN 2010 CASE 3-4

| NO | NAME | I | J | Discharge (m3/s) | BOD (t/day) | PO4-P (t/day) | O-P (t/day) |
|---|---|---|---|---|---|---|---|
| River load | | | | | | | |
| 1 | B.-CHARITAS | 46 | 38 | 0.12 | 0.08 | 0.008 | 0.012 |
| 2 | CANAL CANTO DO RIO | 43 | 39 | 0.10 | 0.06 | 0.004 | 0.006 |
| 3 | B.-CATEDRAR | 40 | 43 | 0.84 | 0.91 | 0.044 | 0.066 |
| 4 | B.-NORTE CENTRO | 40 | 47 | 0.95 | 1.06 | 0.052 | 0.078 |
| 5 | RIO BOMBA | 45 | 52 | 4.54 | 6.07 | 0.268 | 0.402 |
| 6 | RIO IMBOASSU | 52 | 63 | 4.30 | 9.13 | 0.232 | 0.348 |
| Eastern Sub Total | | | | 10.85 | 17.31 | 0.608 | 0.912 |
| 7 | B.-ITAOCA | 52 | 70 | 1.00 | 2.14 | 0.056 | 0.084 |
| 8 | RIO ALCANTARA | 59 | 76 | 14.75 | 28.99 | 0.704 | 1.056 |
| 9 | RIO CACEREBU | 60 | 81 | 30.89 | 22.90 | 0.500 | 0.750 |
| 10 | RIO GUAPIMIRIN | 59 | 87 | 33.25 | 5.97 | 0.132 | 0.198 |
| 11 | CANAL DE MAGE | 57 | 88 | 0.73 | 0.55 | 0.012 | 0.018 |
| 12 | RIO RONCADOR | 56 | 88 | 3.94 | 2.35 | 0.052 | 0.078 |
| 13 | RIO IRIRI | 49 | 90 | 1.05 | 0.69 | 0.016 | 0.024 |
| 14 | RIO SURUI | 44 | 87 | 2.21 | 0.88 | 0.020 | 0.030 |
| Northeastern Sub Total | | | | 87.82 | 64.47 | 1.492 | 2.238 |
| 15 | B.-MAUA | 34 | 84 | 1.03 | 0.56 | 0.012 | 0.018 |
| 16 | RIO ESTRELA | 23 | 80 | 16.19 | 18.47 | 0.420 | 0.630 |
| 171 | RIO IGUACU | 17 | 76 | 31.93 | 45.29 | 1.032 | 1.548 |
| 172 | RIO SARAPUI | 17 | 76 | 24.63 | 48.59 | 1.356 | 2.034 |
| 18 | B.-CABO DO BRITO | 12 | 71 | 3.73 | 6.90 | 0.204 | 0.306 |
| Northwestern Sub Total | | | | 77.51 | 119.81 | 3.024 | 4.536 |
| 19 | RIO S.J.DE MERITI | 9 | 63 | 31.25 | 66.65 | 1.820 | 2.730 |
| 20 | RIO IRAJA | 11 | 62 | 9.57 | 16.25 | 0.608 | 0.912 |
| 21 | CANAL DO CUNHA | 19 | 49 | 15.33 | 23.75 | 0.956 | 1.434 |
| 22 | B.-S.CRISTOVAO | 23 | 45 | 1.22 | 1.77 | 0.072 | 0.108 |
| 23 | CANAL DO MANGUE | 23 | 43 | 9.81 | 17.45 | 0.604 | 0.906 |
| 24 | B.-BOTAFOGO | 32 | 35 | 5.91 | 13.93 | 0.376 | 0.564 |
| Western Sub Total | | | | 73.09 | 139.80 | 4.436 | 6.654 |
| 25 | I.DO GAVANADOR | 23 | 66 | 3.71 | 5.70 | 0.176 | 0.264 |
| 26 | I.DO FUNDAO | 18 | 52 | 0.25 | 0.21 | 0.008 | 0.012 |
| 27 | I.DE PAQUETA | 43 | 72 | 0.11 | 0.16 | 0.004 | 0.006 |
| 28 | I.DO ENGENHO | 43 | 56 | 0.25 | 0.56 | 0.016 | 0.024 |
| 29 | I.DE S.CRUZ | 41 | 51 | 0.14 | 0.24 | 0.008 | 0.012 |
| Islands Sub Total | | | | 4.46 | 6.87 | 0.212 | 0.318 |
| River load Total | | | | 253.73 | 348.26 | 9.772 | 14.658 |
| Direct Load | | | | | | | |
| 007 | | 43 | 36 | - | 2.13 | - | - |
| 001 | | 46 | 55 | - | 6.70 | - | - |
| 004 | | 46 | 56 | - | 2.40 | - | - |
| 008 | | 44 | 51 | - | 2.10 | - | - |
| 009 | | 40 | 47 | - | 1.94 | - | - |
| 027 | | 45 | 52 | - | 0.80 | - | - |
| 034 | | 46 | 57 | - | 0.66 | - | - |
| 044 | | 46 | 57 | - | 0.51 | - | - |
| 047 | | 46 | 57 | - | 0.48 | - | - |
| 062 | | 48 | 59 | - | 0.38 | - | - |
| 113 | | 51 | 62 | - | 0.22 | - | - |
| Eastern Sub Total | | | | - | 18.32 | - | - |
| 015 | | 17 | 76 | - | 1.32 | - | - |
| 018 | | 17 | 76 | - | 1.20 | - | - |
| 075 | | 17 | 76 | - | 0.33 | - | - |
| 029 | | 17 | 76 | - | 0.79 | - | - |
| 086 | | 17 | 76 | - | 0.31 | - | - |
| 137 | | 10 | 68 | - | 0.16 | - | - |
| Northwestern Sub Total | | | | - | 4.11 | - | - |
| 030 | | 11 | 62 | - | 0.72 | - | - |
| 042 | | 11 | 62 | - | 0.52 | - | - |
| 051 | | 32 | 36 | - | 0.45 | - | - |
| Western Sub Total | | | | - | 1.69 | - | - |
| Direct Load Total | | | | - | 24.11 | - | - |
| Total | | | | 253.73 | 372.37 | 9.772 | 14.658 |

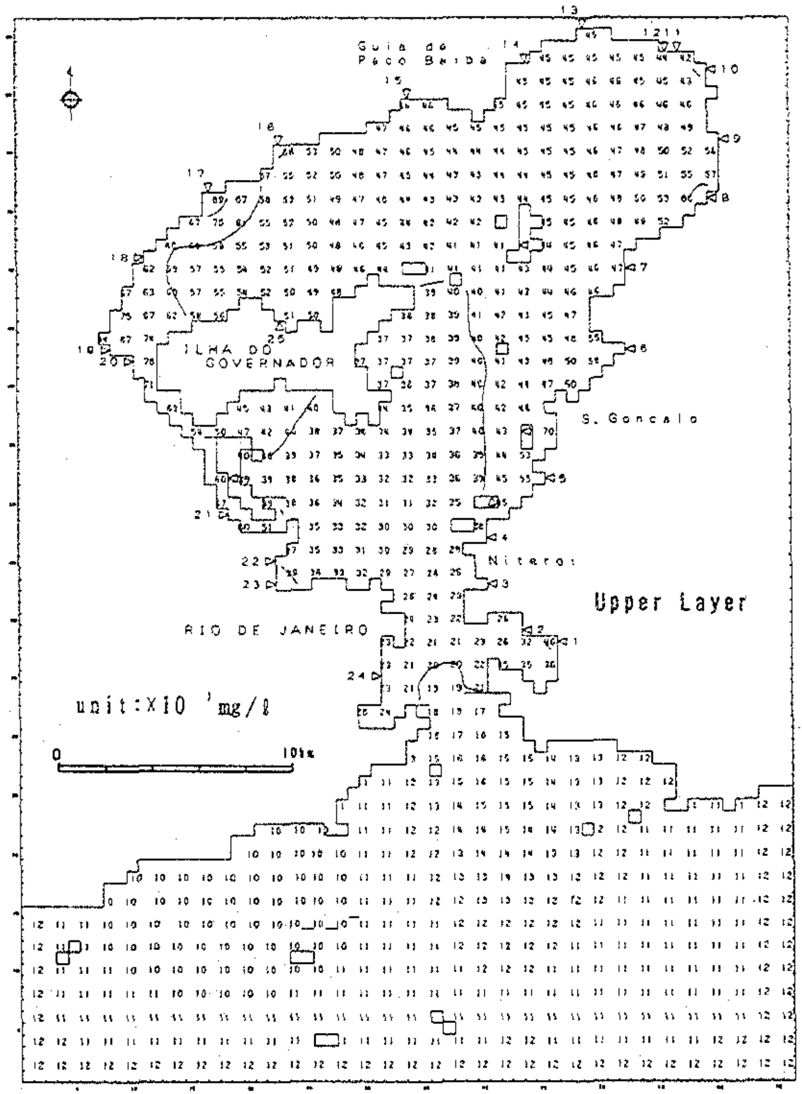
Table 5.2-2 External Load from Sub-Basin Groups

| Case | Sub Basin Group | Discharge (m3/s) | BOD (t/day) | PO4-P (t/day) | O-P (t/day) |
|---|---|---|---|---|---|
| CASE1-1 | East | 12.41 | 35.57 | 0.65 | 0.98 |
| | Northeast | 84.23 | 55.58 | 1.28 | 1.92 |
| | Northwest | 71.63 | 107.01 | 2.60 | 3.91 |
| | West | 74.38 | 135.78 | 4.38 | 6.57 |
| | Islands | 4.51 | 6.56 | 0.20 | 0.31 |
| | Total | 247.16 | 340.49 | 9.12 | 13.68 |
| CASE1-2 | East | 13.55 | 31.87 | 0.71 | 1.07 |
| | Northeast | 87.82 | 64.47 | 1.49 | 2.24 |
| | Northwest | 78.30 | 118.52 | 3.03 | 4.54 |
| | West | 77.92 | 117.35 | 4.54 | 6.82 |
| | Islands | 4.65 | 5.76 | 0.22 | 0.32 |
| | Total | 262.24 | 337.96 | 9.99 | 14.99 |
| CASE2 | East | 13.55 | 29.27 | 0.71 | 1.06 |
| | Northeast | 87.82 | 56.03 | 1.47 | 2.20 |
| | Northwest | 78.30 | 101.01 | 2.99 | 4.48 |
| | West | 77.92 | 92.91 | 4.48 | 6.73 |
| | Islands | 4.65 | 5.04 | 0.21 | 0.32 |
| | Total | 262.24 | 284.25 | 9.86 | 14.79 |
| CASE3-1 | East | 9.48 | 33.76 | 0.53 | 0.80 |
| | Northeast | 87.82 | 64.39 | 1.49 | 2.24 |
| | Northwest | 77.90 | 123.92 | 3.04 | 4.57 |
| | West | 46.10 | 104.72 | 2.77 | 4.16 |
| | Islands | 4.46 | 6.82 | 0.22 | 0.32 |
| | Total | 225.76 | 333.60 | 8.06 | 12.08 |
| CASE3-2 | East | 9.48 | 33.77 | 0.53 | 0.80 |
| | Northeast | 87.82 | 64.47 | 1.49 | 2.24 |
| | Northwest | 77.90 | 123.92 | 3.04 | 4.57 |
| | West | 51.50 | 111.49 | 3.09 | 4.63 |
| | Islands | 4.46 | 6.82 | 0.22 | 0.32 |
| | Total | 231.16 | 340.46 | 8.37 | 12.56 |
| CASE3-3 | East | 9.25 | 33.77 | 0.52 | 0.78 |
| | Northeast | 87.82 | 64.47 | 1.49 | 2.24 |
| | Northwest | 77.51 | 123.92 | 3.02 | 4.54 |
| | West | 56.74 | 119.15 | 3.42 | 5.13 |
| | Islands | 4.37 | 6.82 | 0.21 | 0.31 |
| | Total | 235.69 | 348.12 | 8.66 | 13.00 |
| CASE3-4 | East | 10.85 | 35.63 | 0.61 | 0.91 |
| | Northeast | 87.82 | 64.47 | 1.49 | 2.24 |
| | Northwest | 77.51 | 123.92 | 3.02 | 4.54 |
| | West | 73.09 | 141.48 | 4.44 | 6.65 |
| | Islands | 4.46 | 6.87 | 0.21 | 0.32 |
| | Total | 253.73 | 372.37 | 9.77 | 14.66 |

## 5.3 Results of Calculation

The results of the numerical simulation are shown in figures as concentration distributions. The contents of figures are as follows;

Fig.5.3-1 : BOD, T-P, DO, $PO_4$-P and O-P distribution for Case 1-1.
Fig.5.3-2 : BOD, T-P, DO, $PO_4$-P and O-P distribution for Case 1-2.
Fig.5.3-3 : BOD, T-P, DO, $PO_4$-P and O-P distribution for Case 2.
Fig.5.3-4 : BOD, T-P, DO, $PO_4$-P and O-P distribution for Case 3-1.
Fig.5.3-5 : BOD, T-P, DO, $PO_4$-P and O-P distribution for Case 3-2.
Fig.5.3-6 : BOD, T-P, DO, $PO_4$-P and O-P distribution for Case 3-3.
Fig.5.3-7 : BOD, T-P, DO, $PO_4$-P and O-P distribution for Case 3-4.
Fig.5.3-8 : BOD, T-P and DO distribution for Case 4-1.
Fig.5.3-9 : BOD, T-P and DO distribution for Case 4-2.
Fig.5.3-10: BOD, T-P and DO distribution for Case 4-3.
Fig.5.3-11: BOD, T-P and DO distribution for Case 5-1.
Fig.5.3-12: BOD, T-P and DO distribution for Case 5-2.
Fig.5.3-13: BOD, T-P and DO distribution for Case 5-3.
Fig.5.3-14: BOD, T-P and DO distribution for Case 5-4.
Fig.5.3-15: BOD, T-P and DO distribution for Case 6-1.
Fig.5.3-16: BOD, T-P and DO distribution for Case 6-2.
Fig.5.3-17: BOD, T-P and DO distribution for Case 6-3.
Fig.5.3-18: BOD, T-P and DO distribution for Case 6-4.



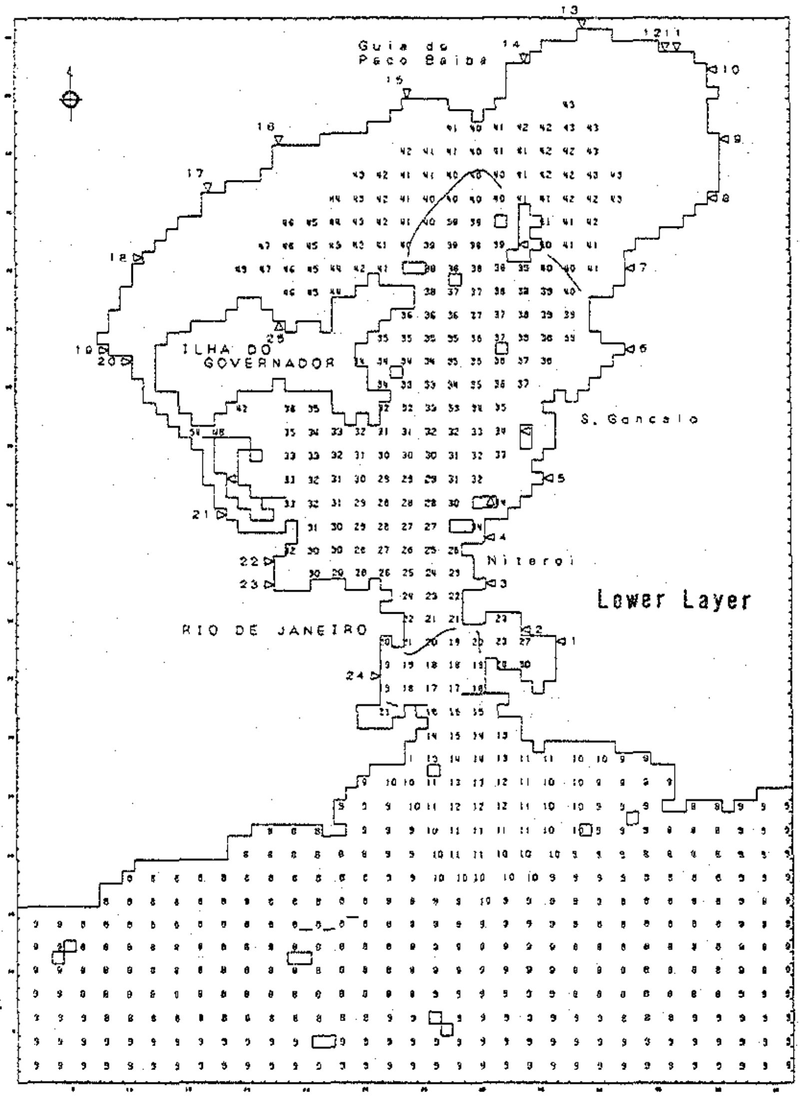




Fig. 5.3-1(1) Calculated Water Quality in Case 1-1 (IDB/OECF Project in 2000)
(BOD)

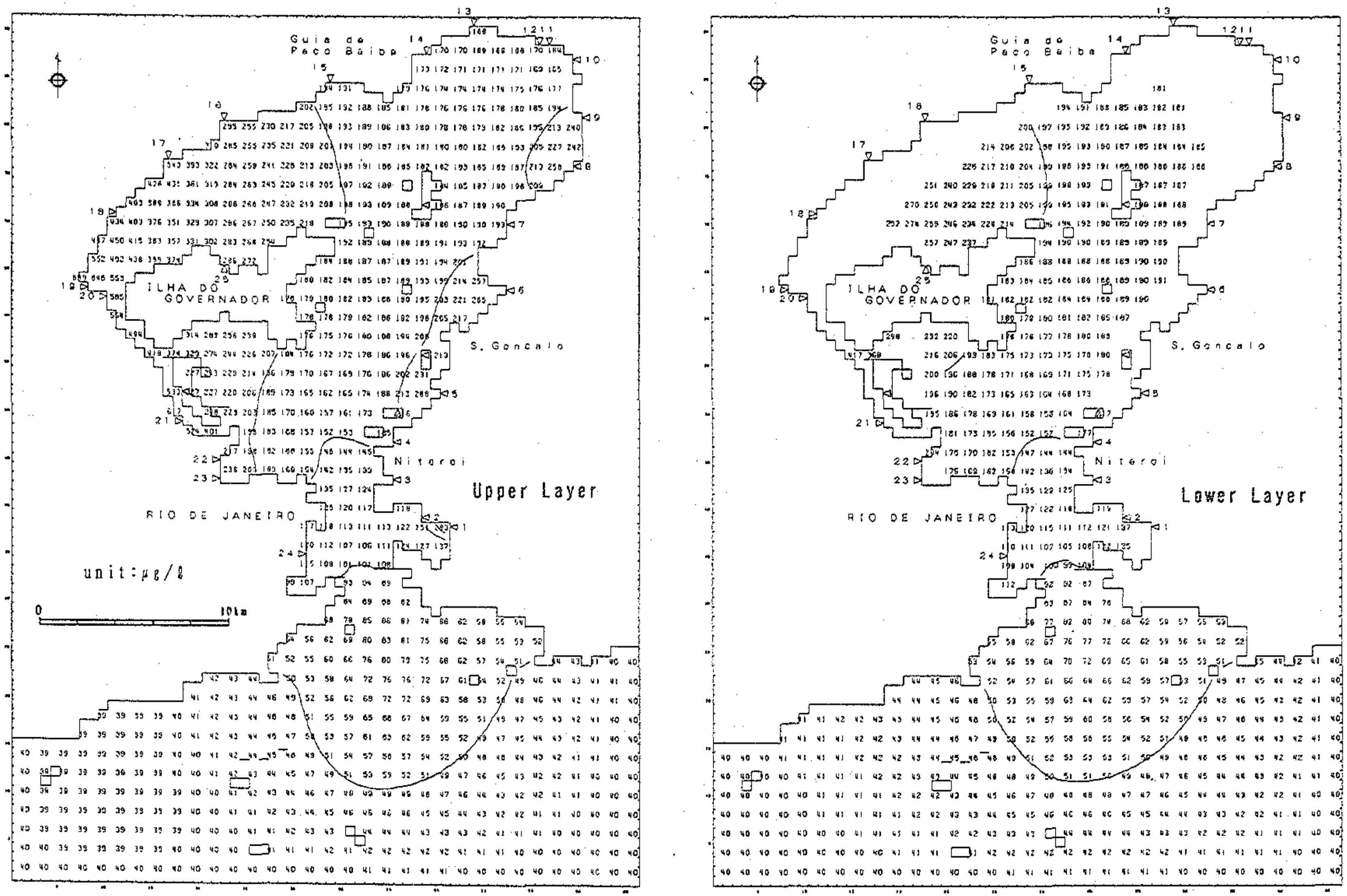



Fig. 5. 3-1(2) Calculated Water Quality in Case 1-1 (IDB/OECF Project in 2000)

(T-P)

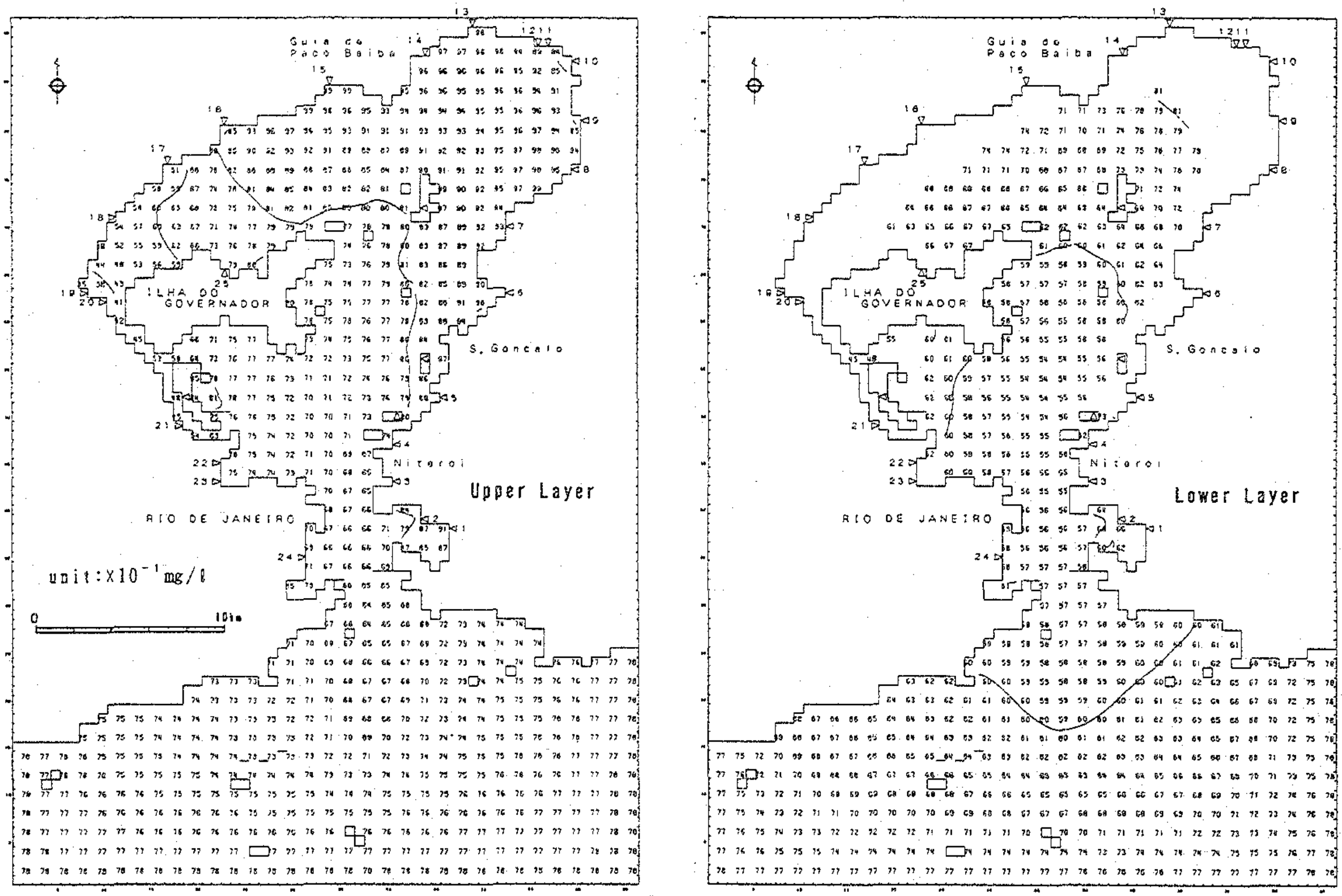



Fig. 5. 3-1(3)  Calculated Water Quality in Case 1-1 (IDB/OECF Project in 2000)
(DO)

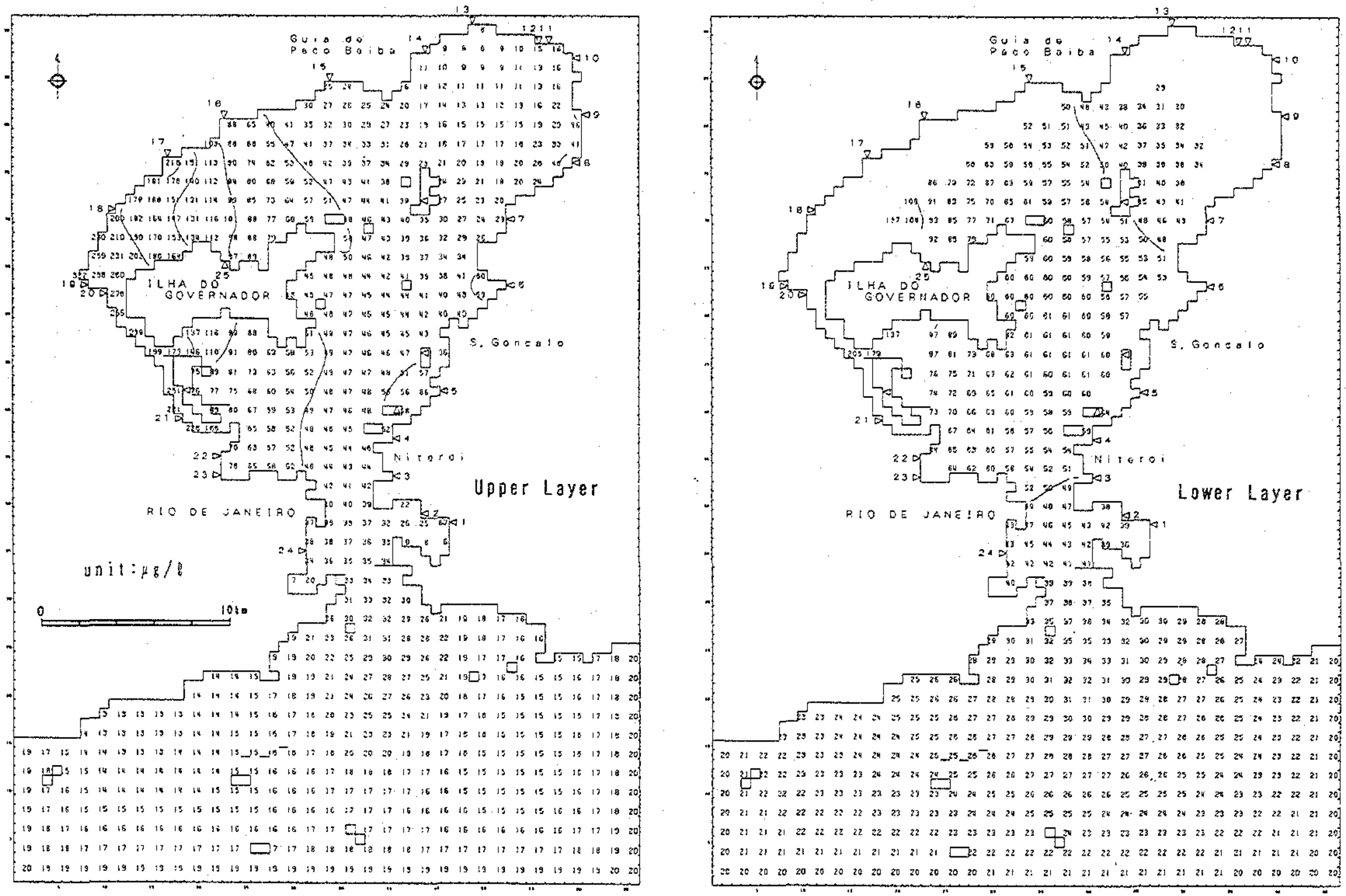
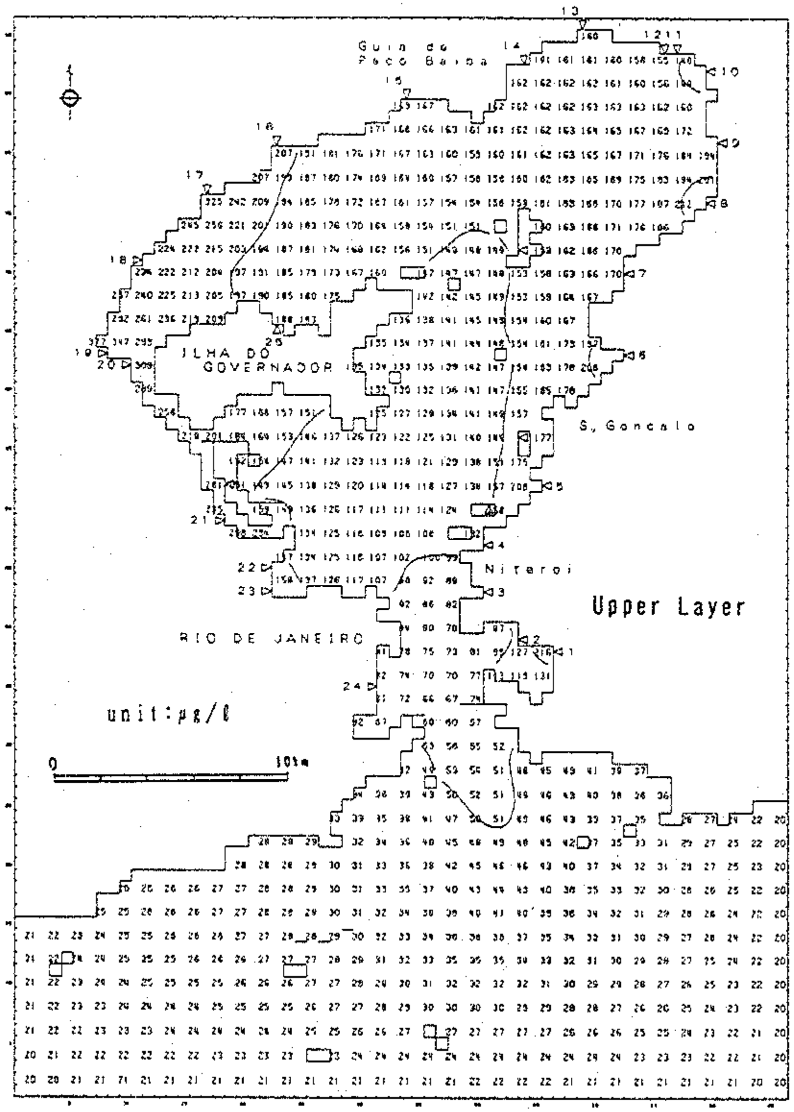



Fig. 5.3-1(4) Calculated Water Quality in Case 1-1 (IDB/OECF Project in 2000)

($PO_4$-P)



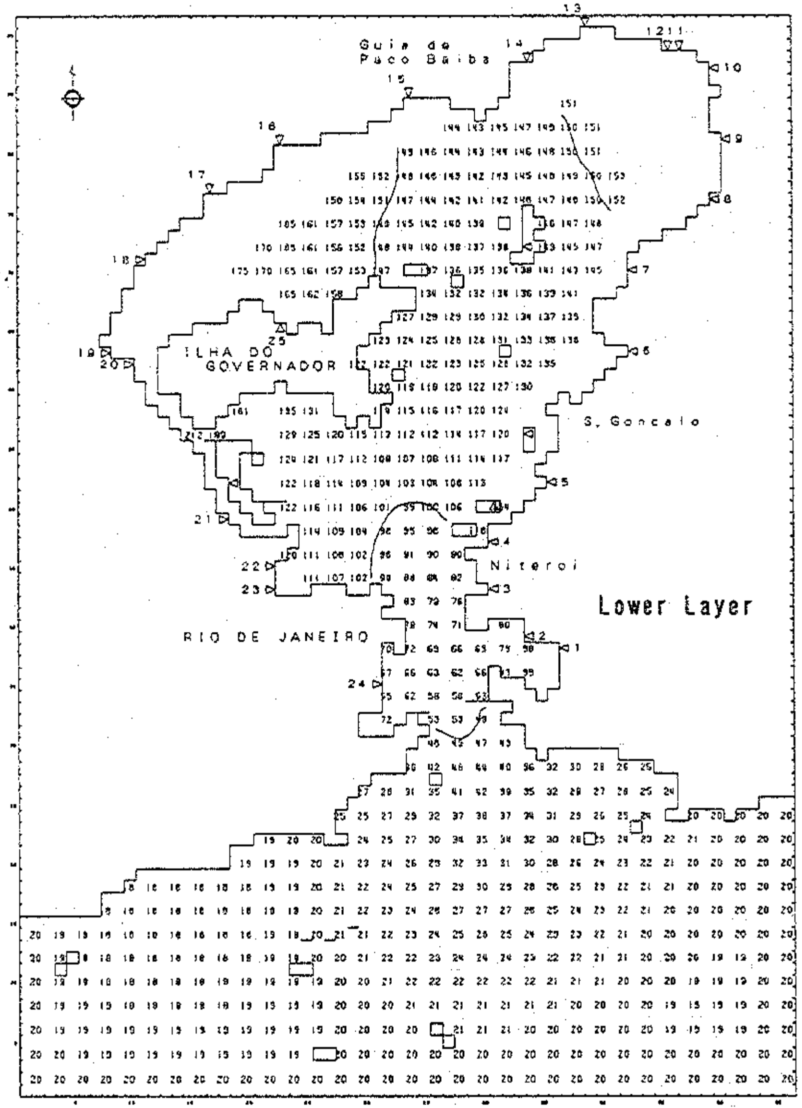




Fig. 5. 3-1(5) Calculated Water Quality in Case 1-1 (IDB/OECF Project in 2000)

(O-P)

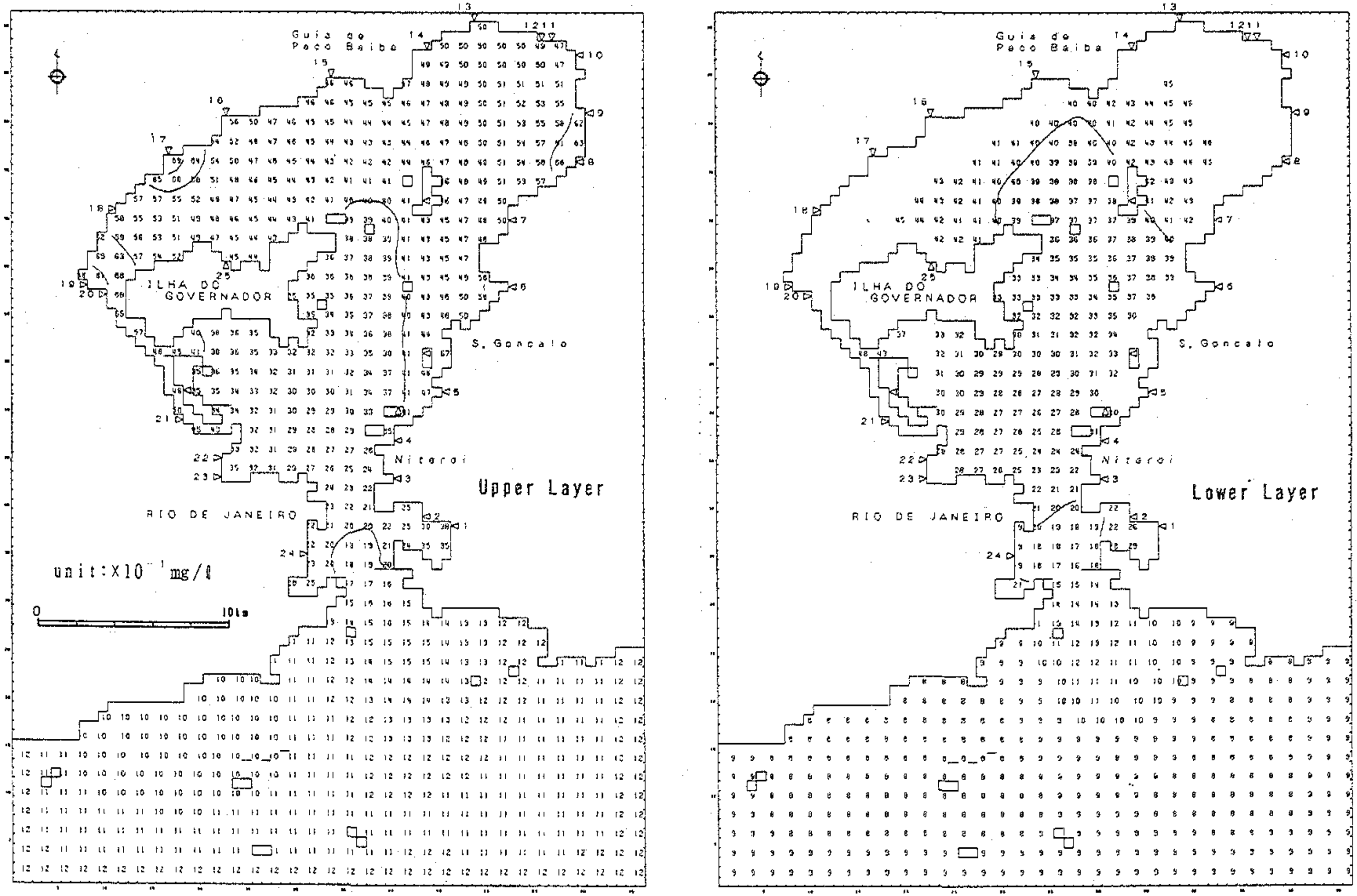



Fig. 5.3-2(1) Calculated Water Quality in Case 1-2 (IDB/OECF Project in 2010)
(BOD)

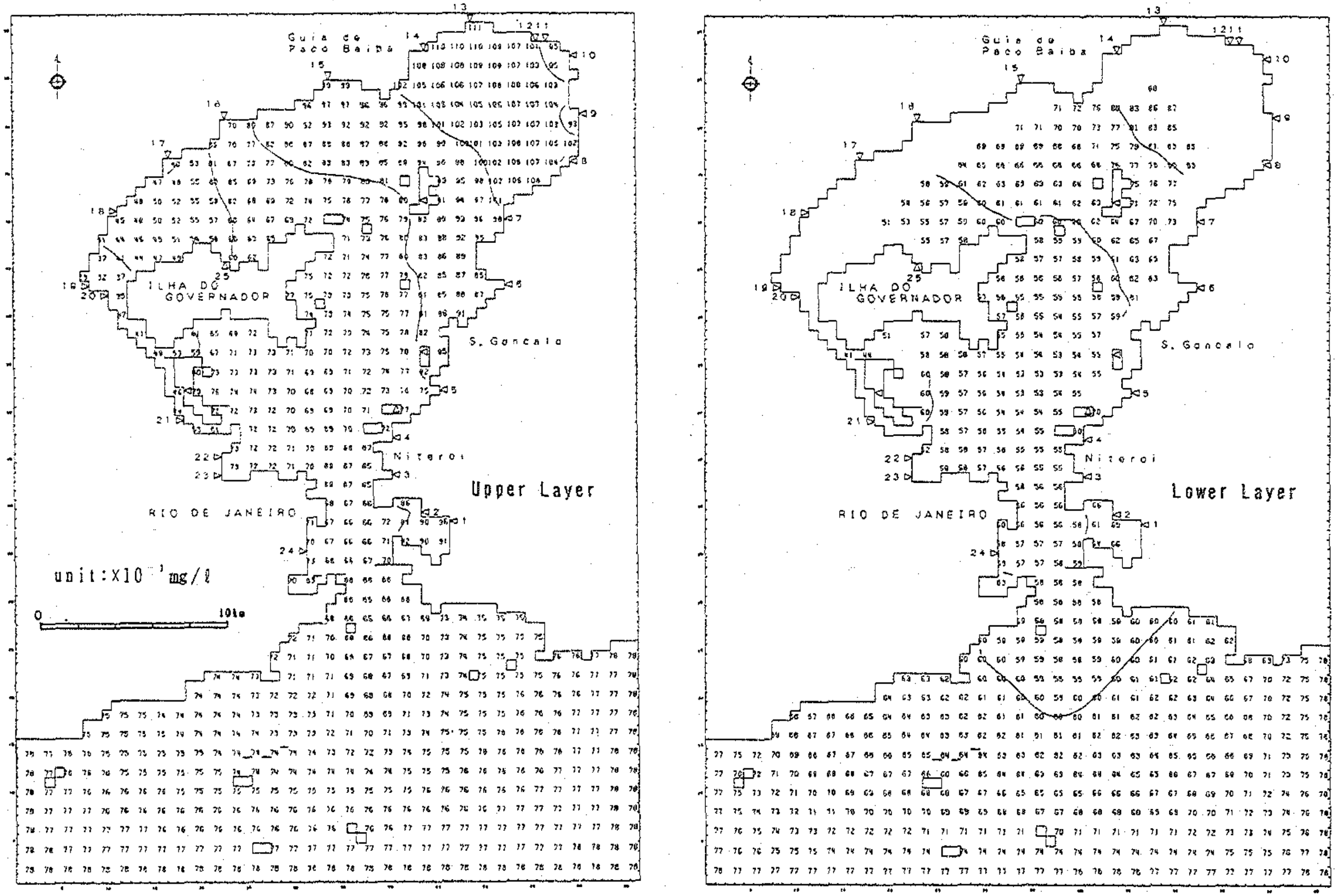



Fig. 5.3-2(2) Calculated Water Quality in Case 1-2 (IDB/OECF Project in 2010)

(DO)

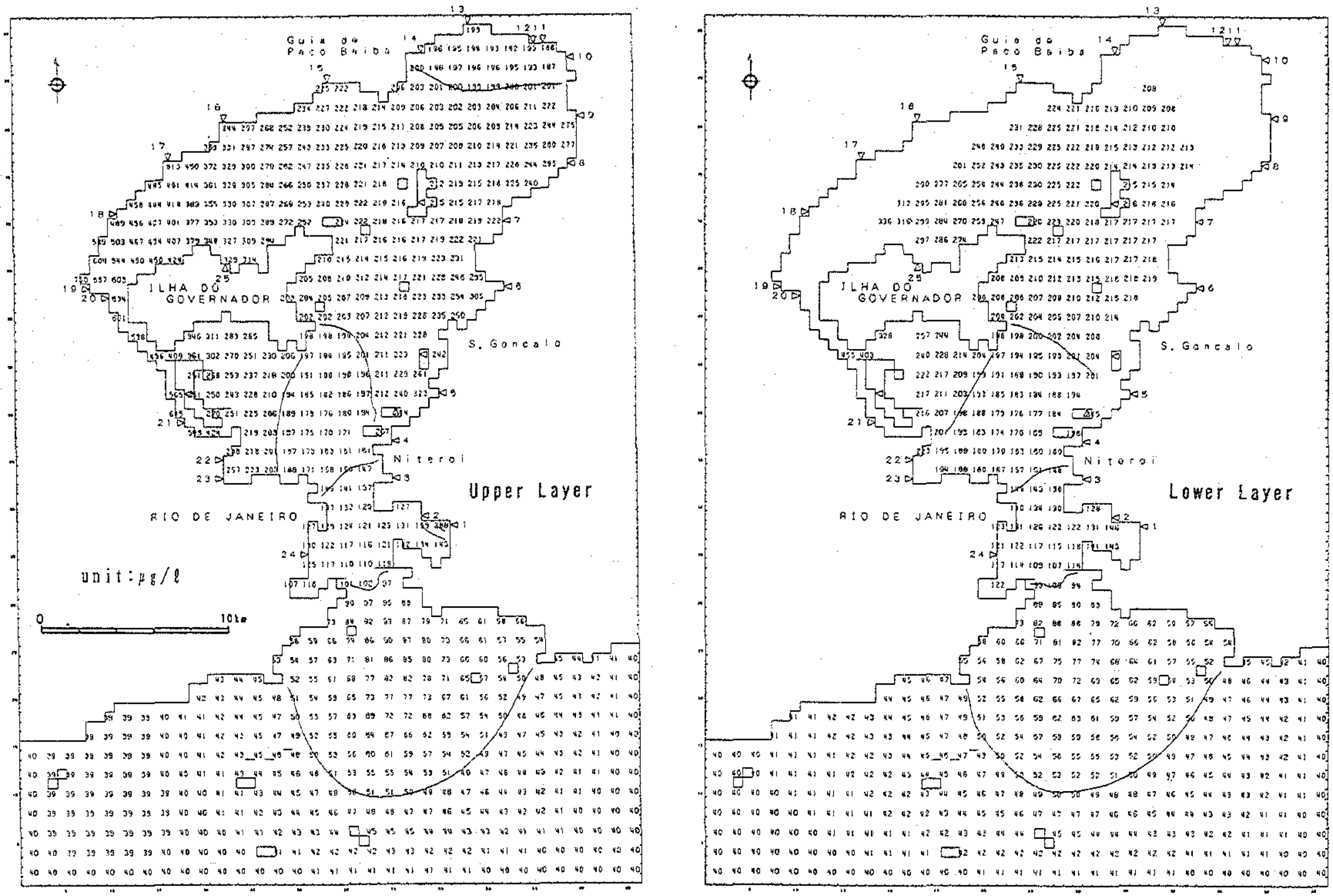
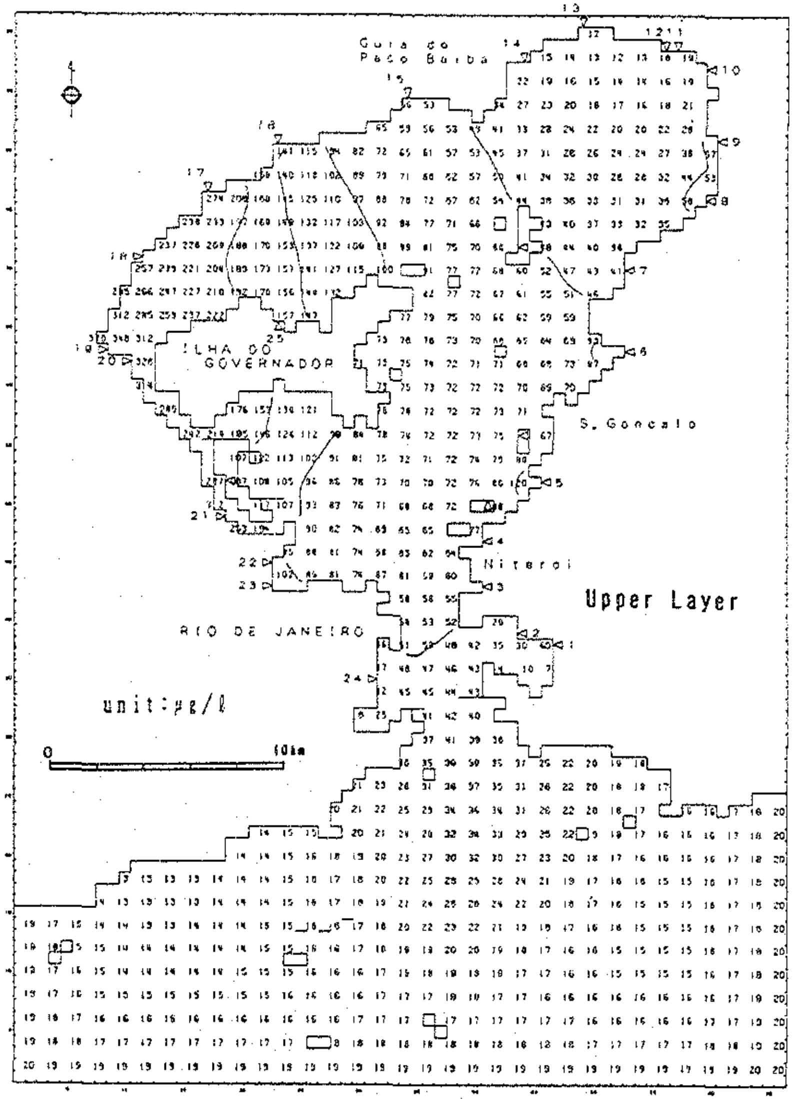



Fig. 5. 3-2(3) Calculated Water Quality in Case 1-2 (IDB/OECF Project in 2010)
(T-P)



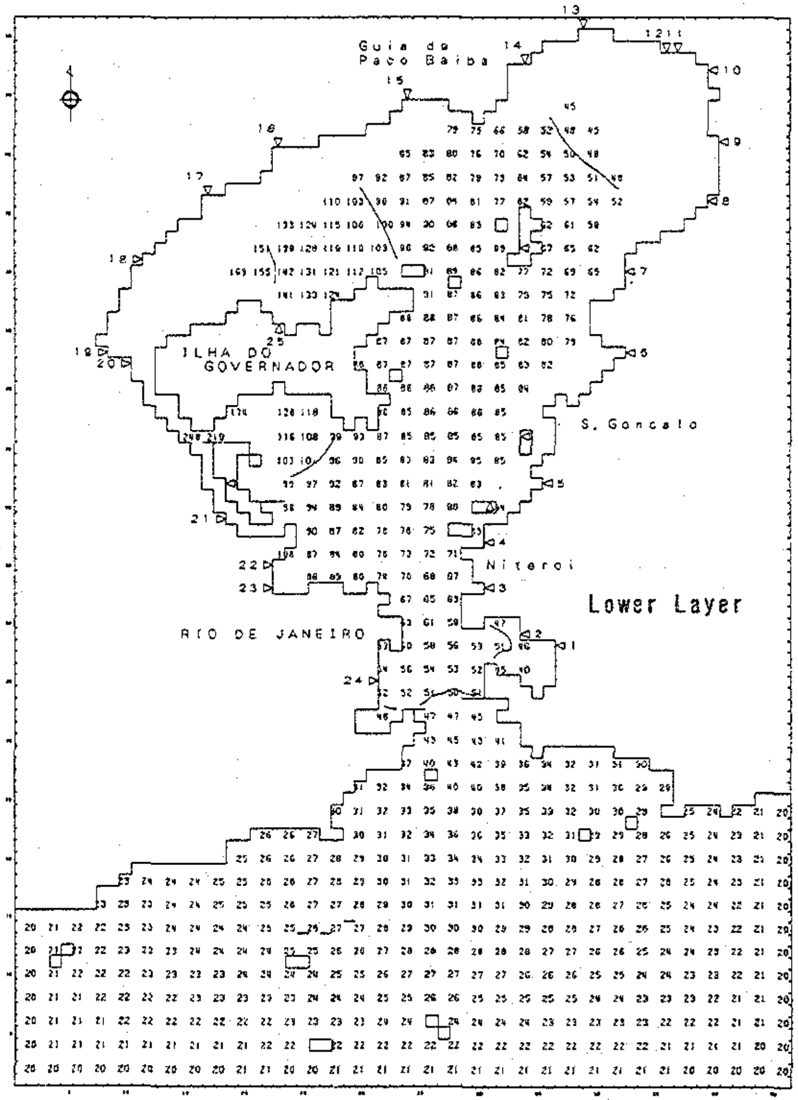




Fig. 5.3-2(4) Calculated Water Quality in Case 1-2 (IDB/OECF Project in 2010) ($PO_4$-P)

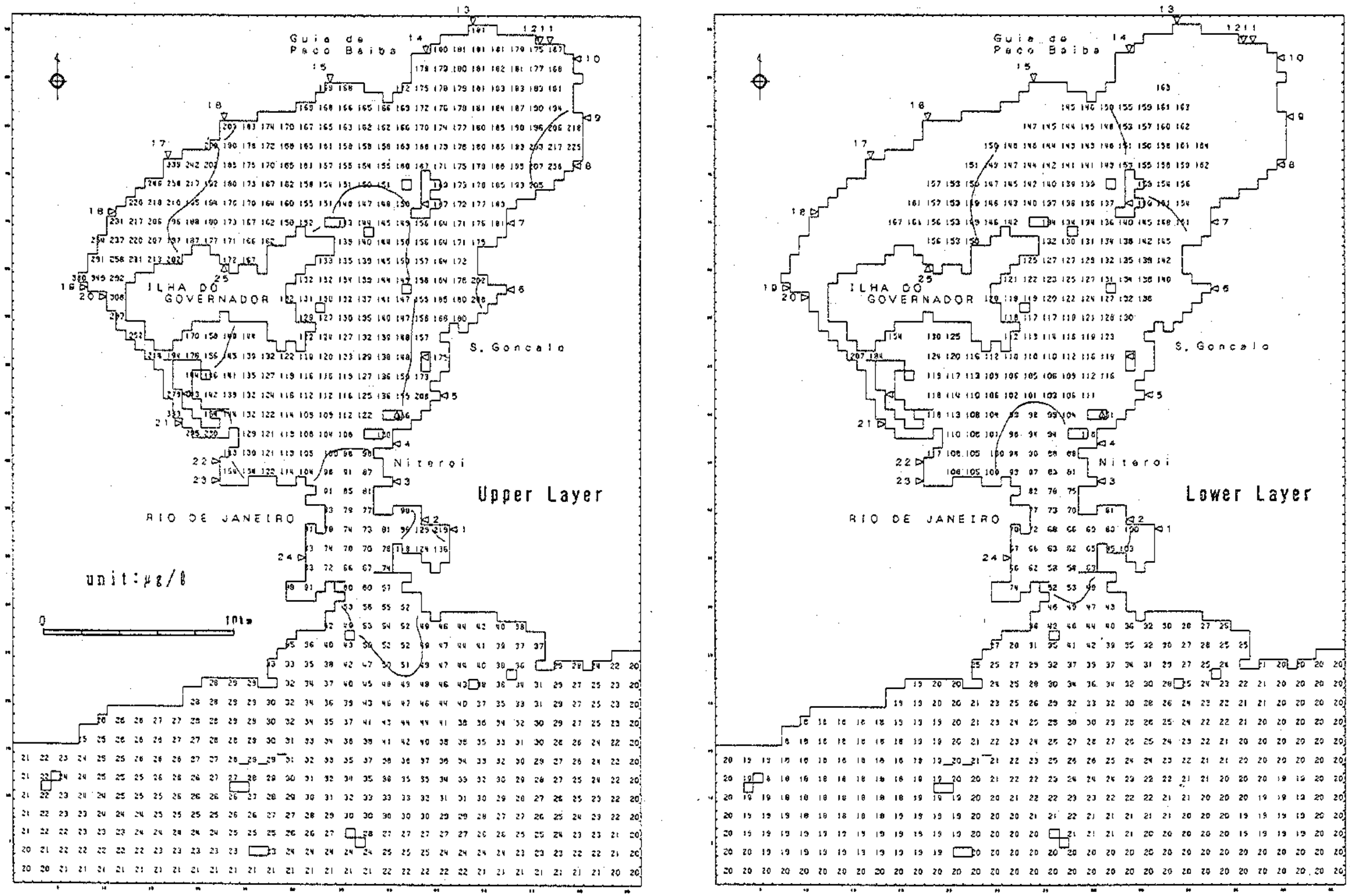



Fig. 5.3-2(5) Calculated Water Quality in Case 1-2 (IDB/OECF Project in 2010) (O-P)

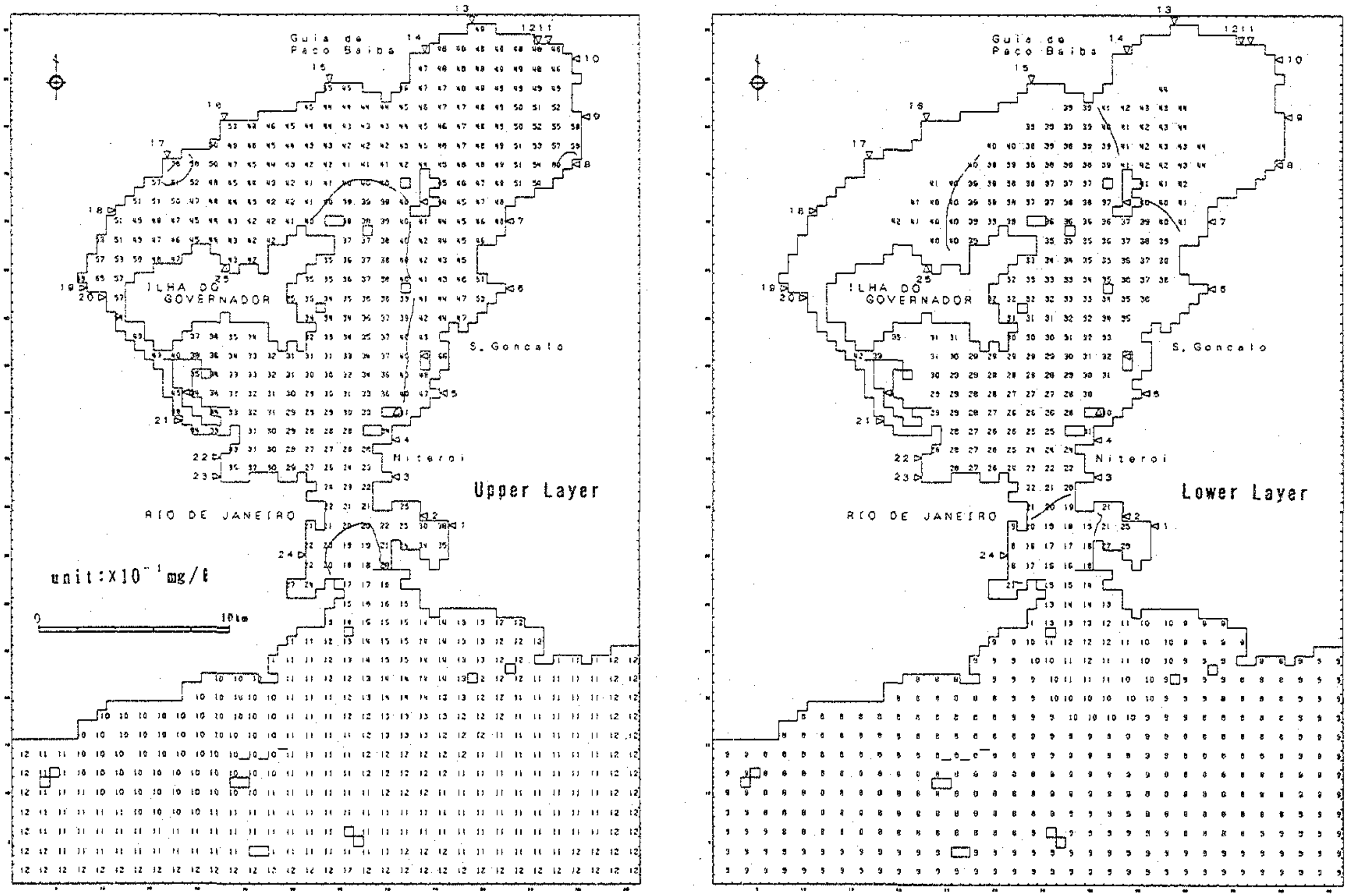
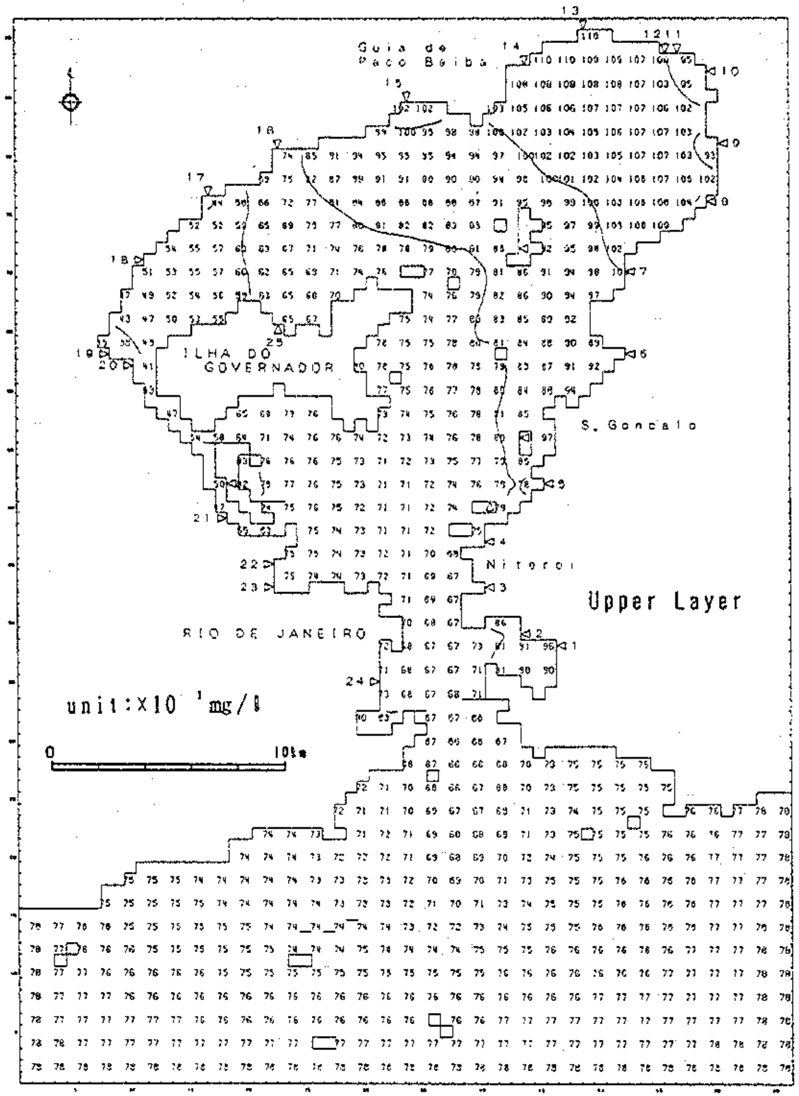



Fig. 5. 3-3(1) Calculated Water Quality in Case 2 (IDB/OECF Project and Optional Sewage Treatment in 2010) (BOD)



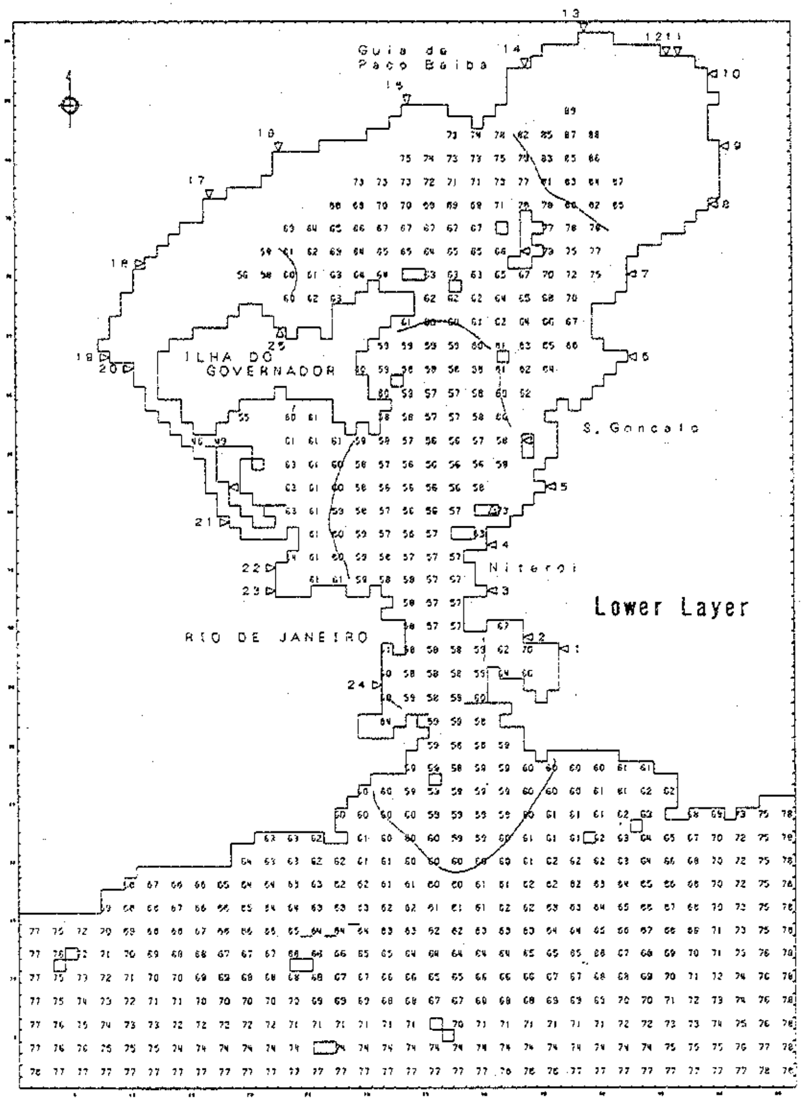
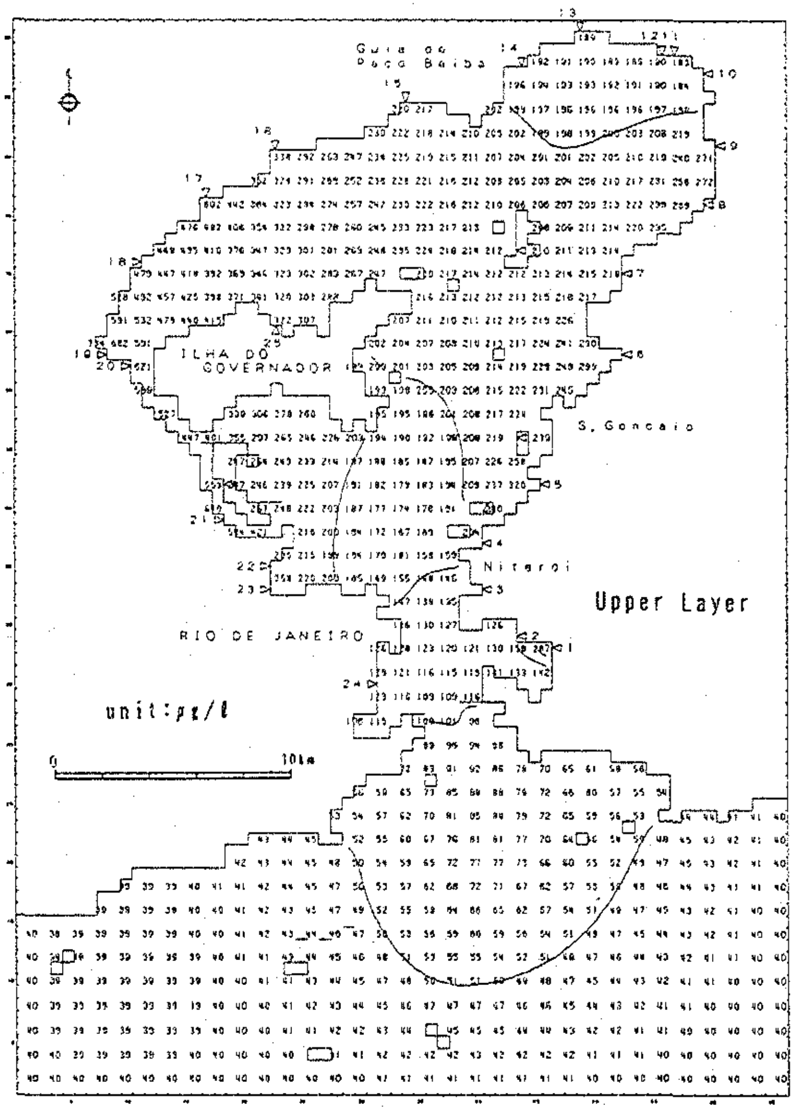




Fig. 5. 3-3(2) Calculated Water Quality in Case 2 (IDB/OECF Project and Optional Sewage Treatment in 2010)
(DO)



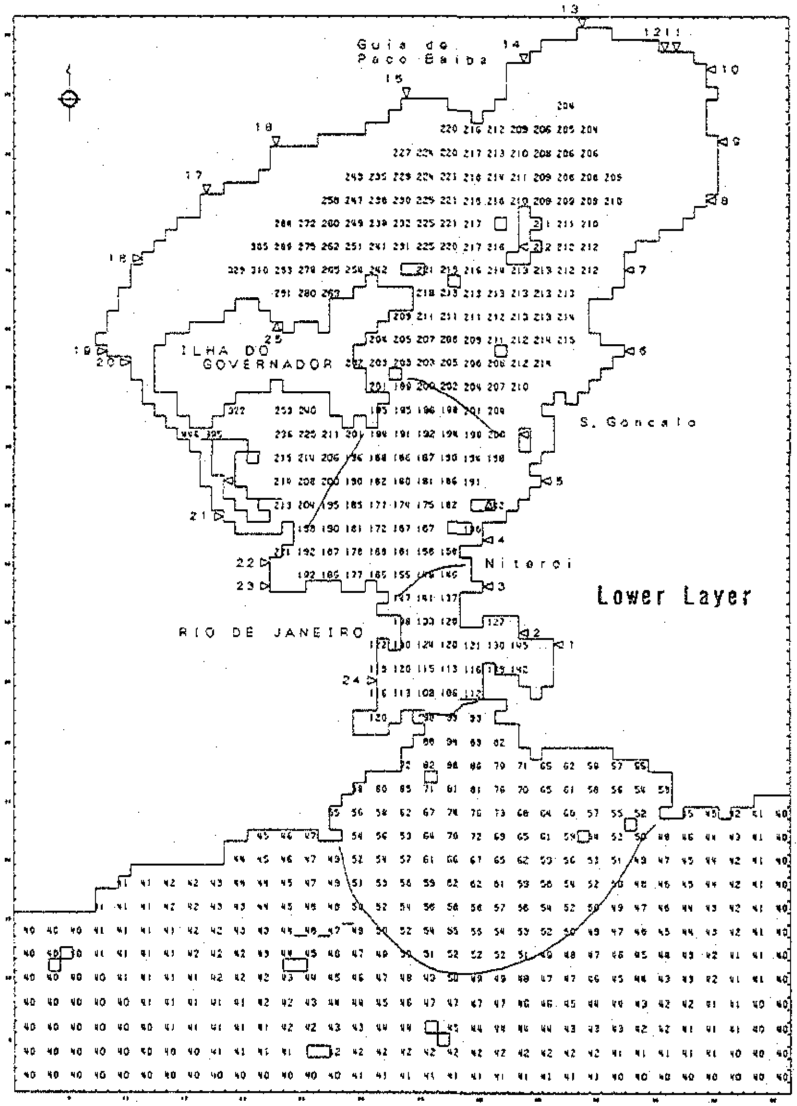




Fig. 5. 3-3(3) Calculated Water Quality in Case 2 (IDB/OECF Project and Optional Sewage Treatment in 2010) (T-P)

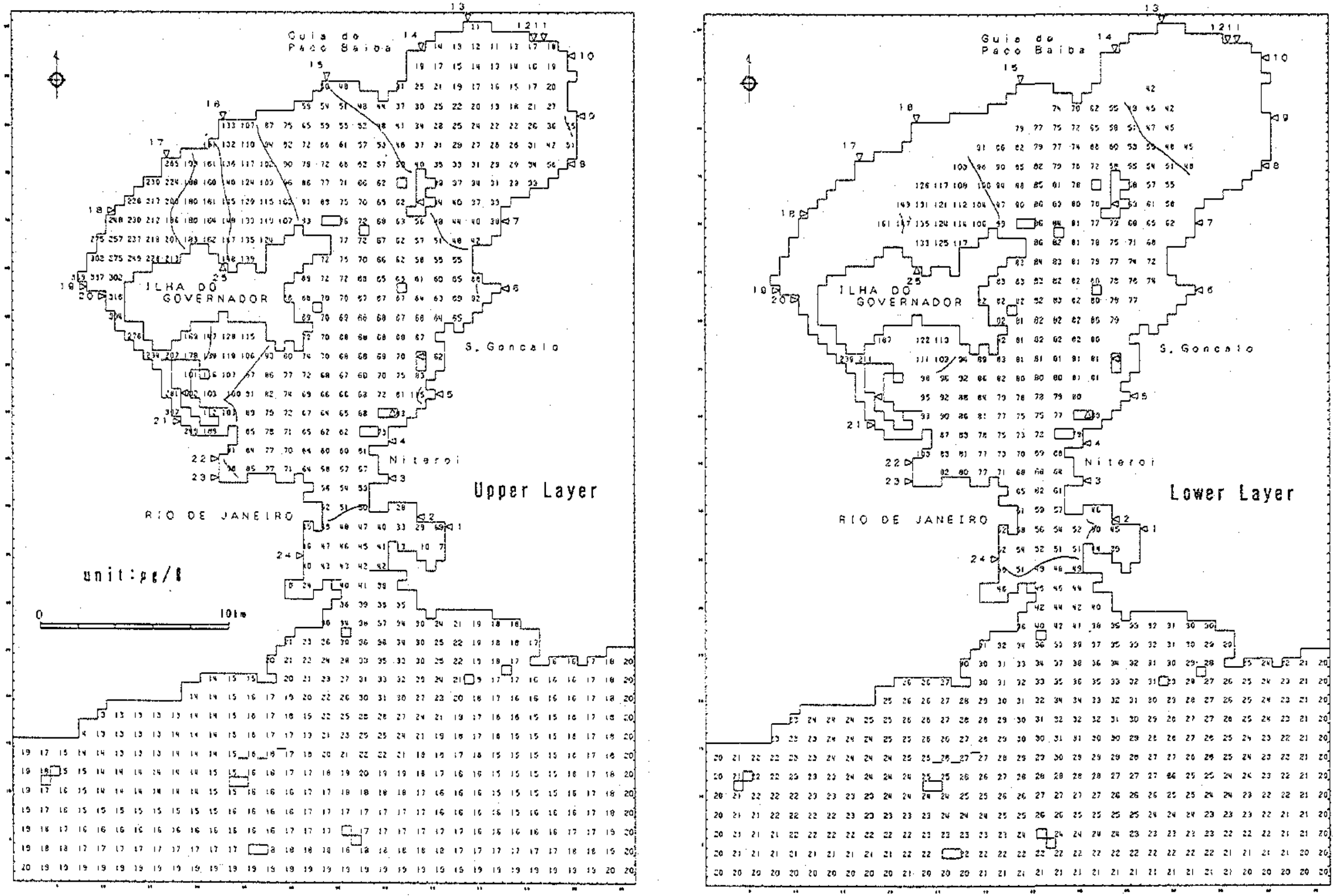



Fig. 5.3-3(4) Calculated Water Quality in Case 2 (IDB/OECF Project and Optional Sewage Treatment in 2010)
($PO_4$-P)

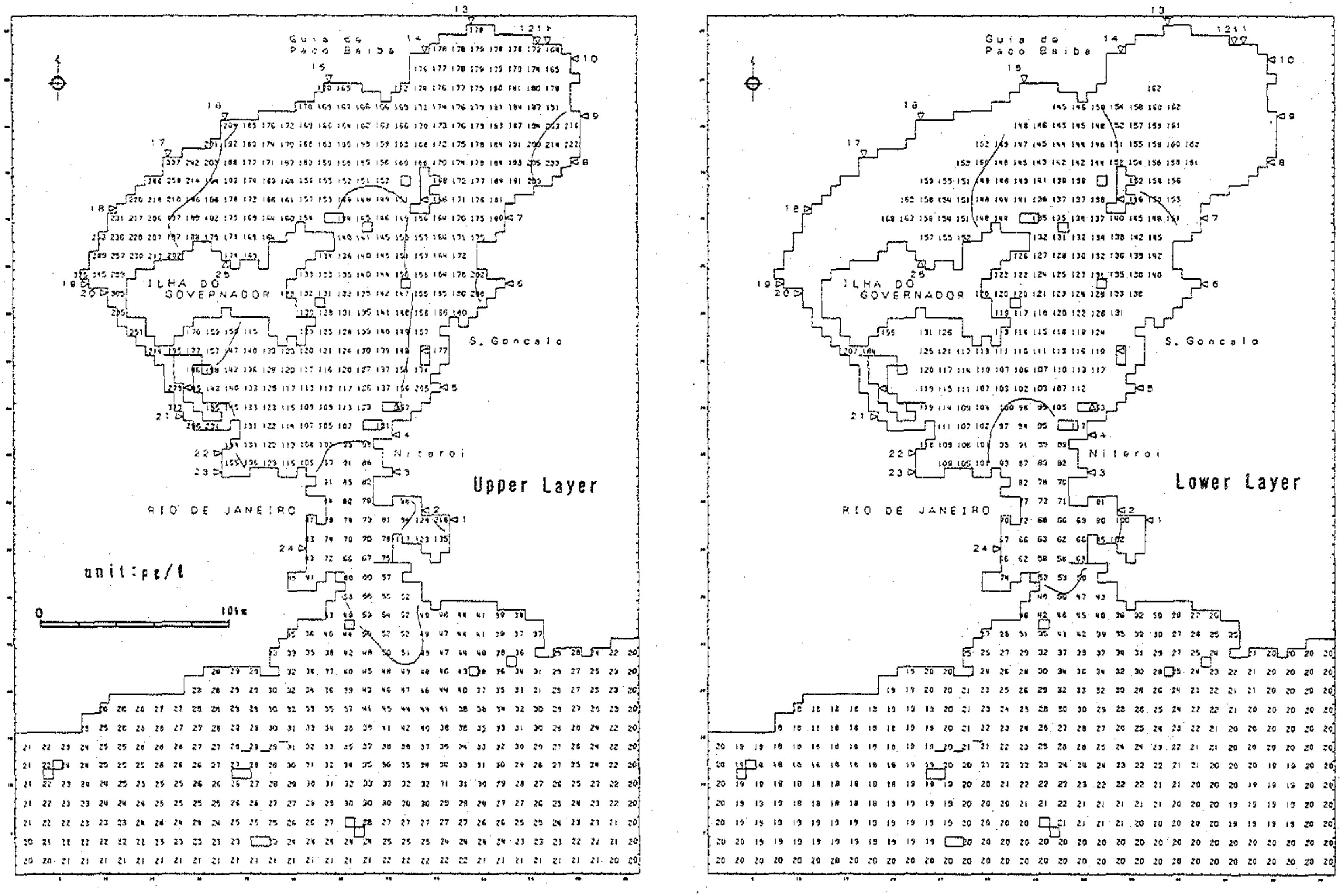



Fig. 5.3-3(5) Calculated Water Quality in Case 2 (IDB/OECF Project and Optional Sewage Treatment in 2010)
(O-P)

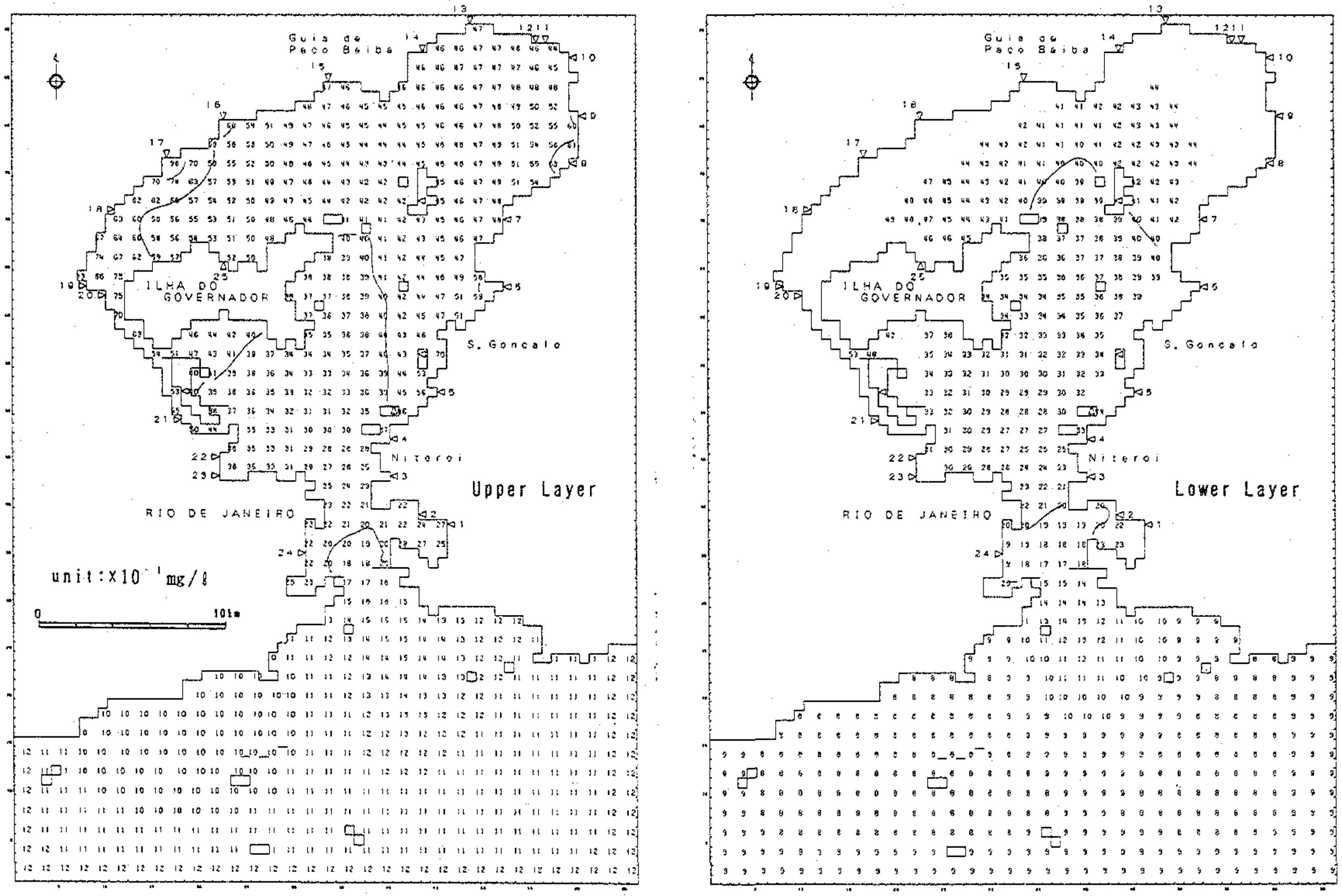



Fig. 5. 3-4(1) Calculated Water Quality in Case 3-1 (Bypass Plan 1 in 2010)
(BOD)

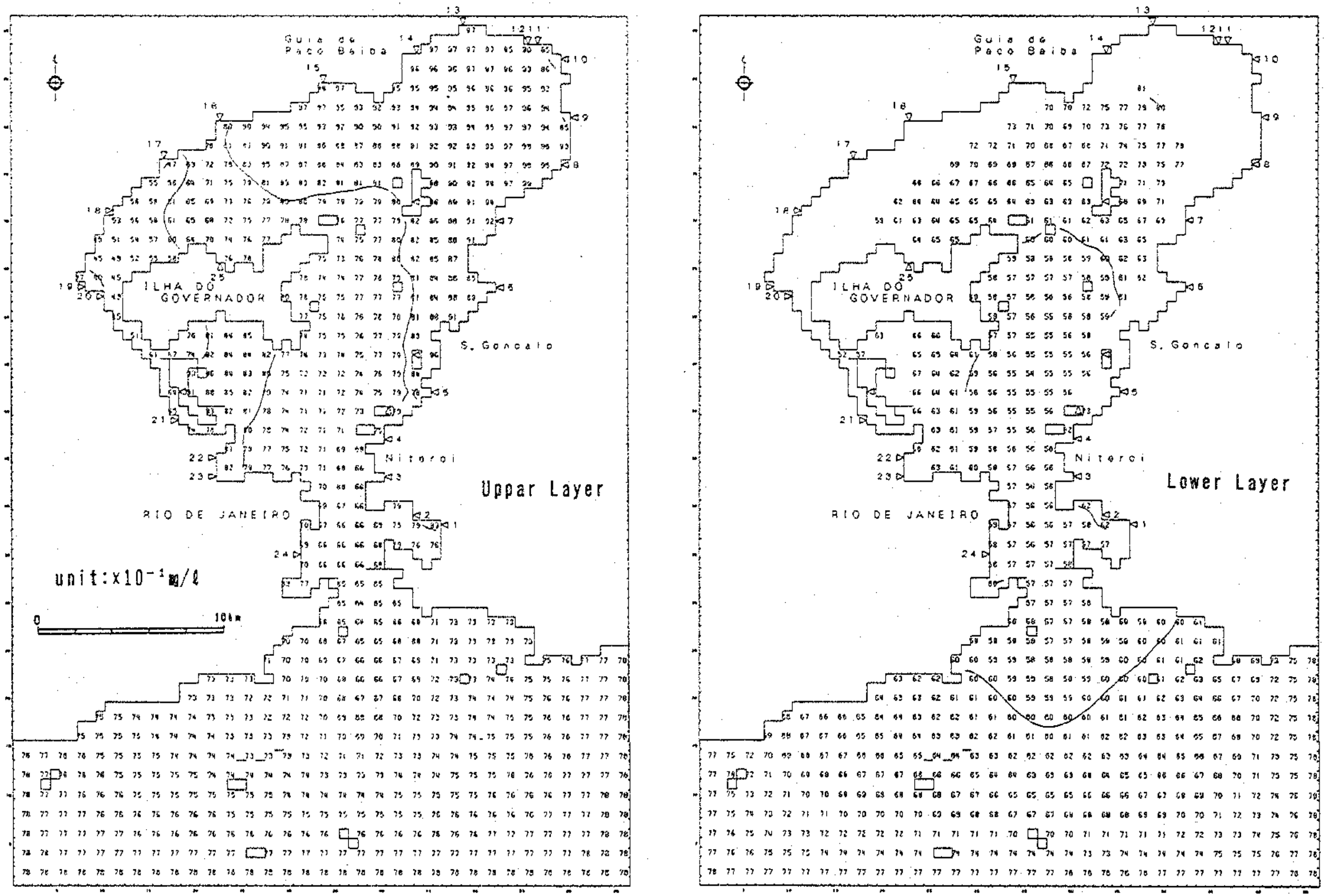



Fig. 5.3-4(2) Calculated Water Quality in Case 3-1 (Bypass Plan 1 in 2010)
(DO)

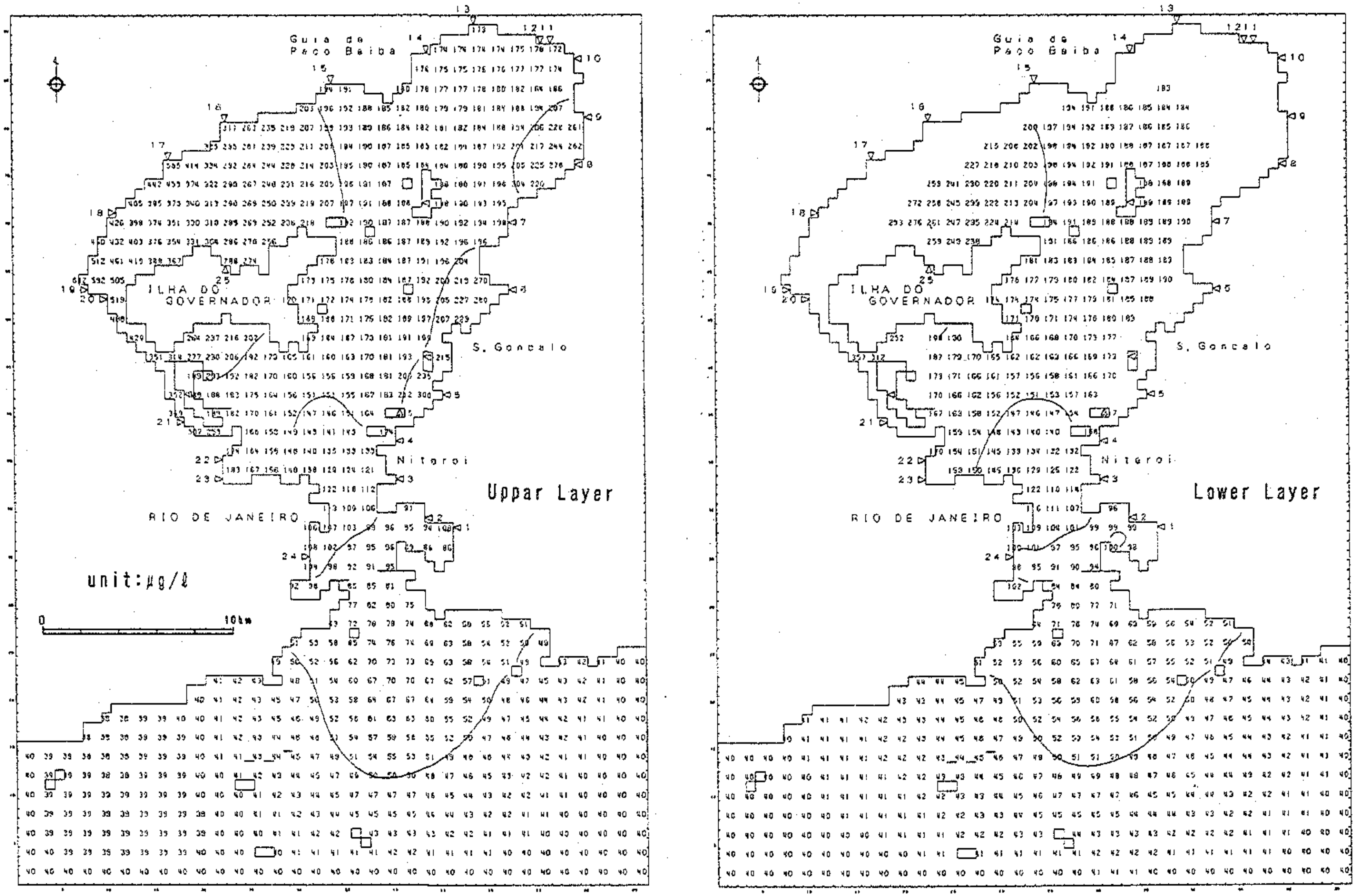



Fig. 5. 3-4(3) Calculated Water Quality in Case 3-1 (Bypass Plan 1 in 2010)

(T-P)

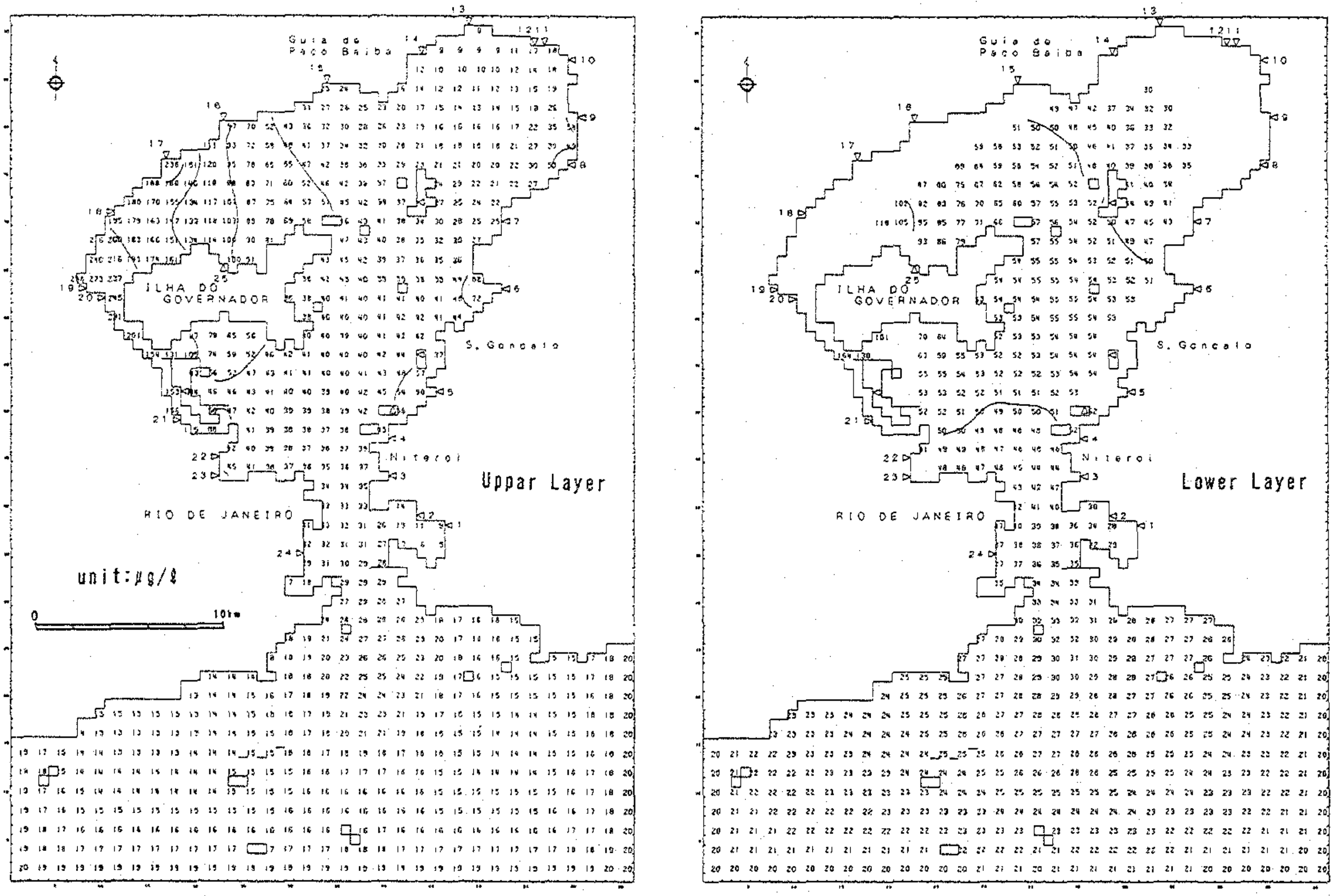



Fig. 5. 3-4(4) Calculated Water Quality in Case 3-1 (Bypass Plan 1 in 2010)
($PO_4$-P)

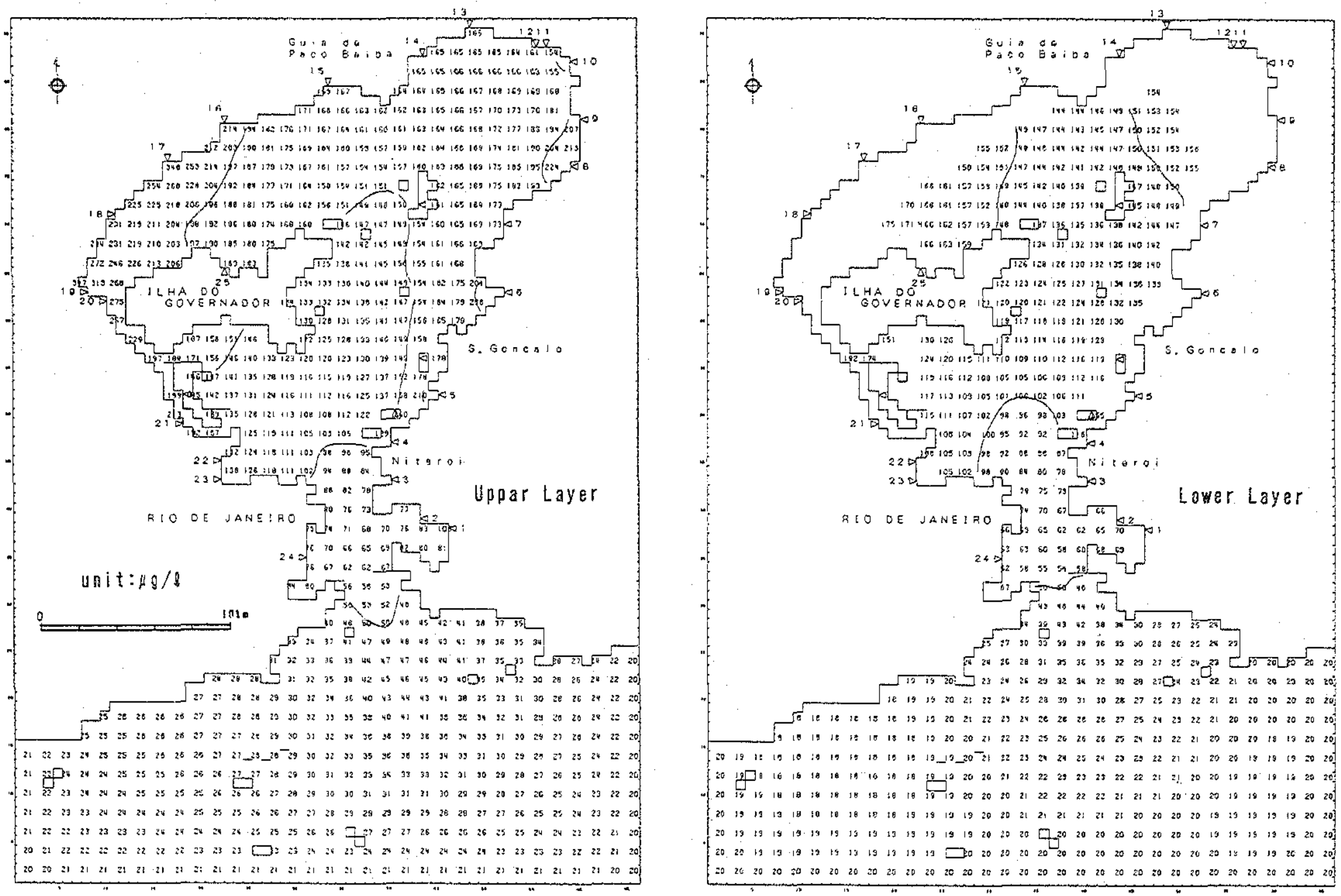



Fig. 5.3-4(5) Calculated Water Quality in Case 3-1 (Bypass Plan 1 in 2010) (O-P)

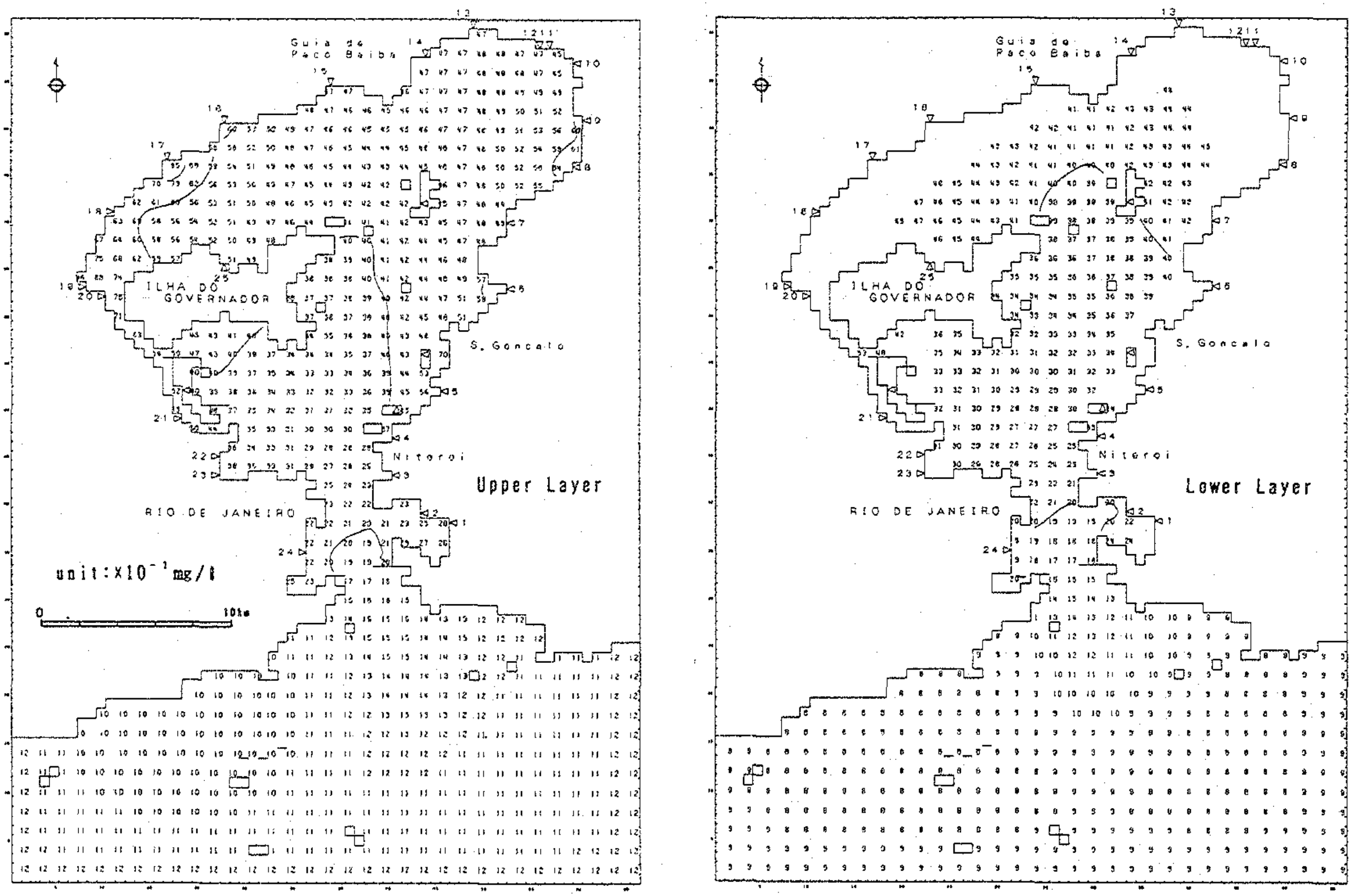
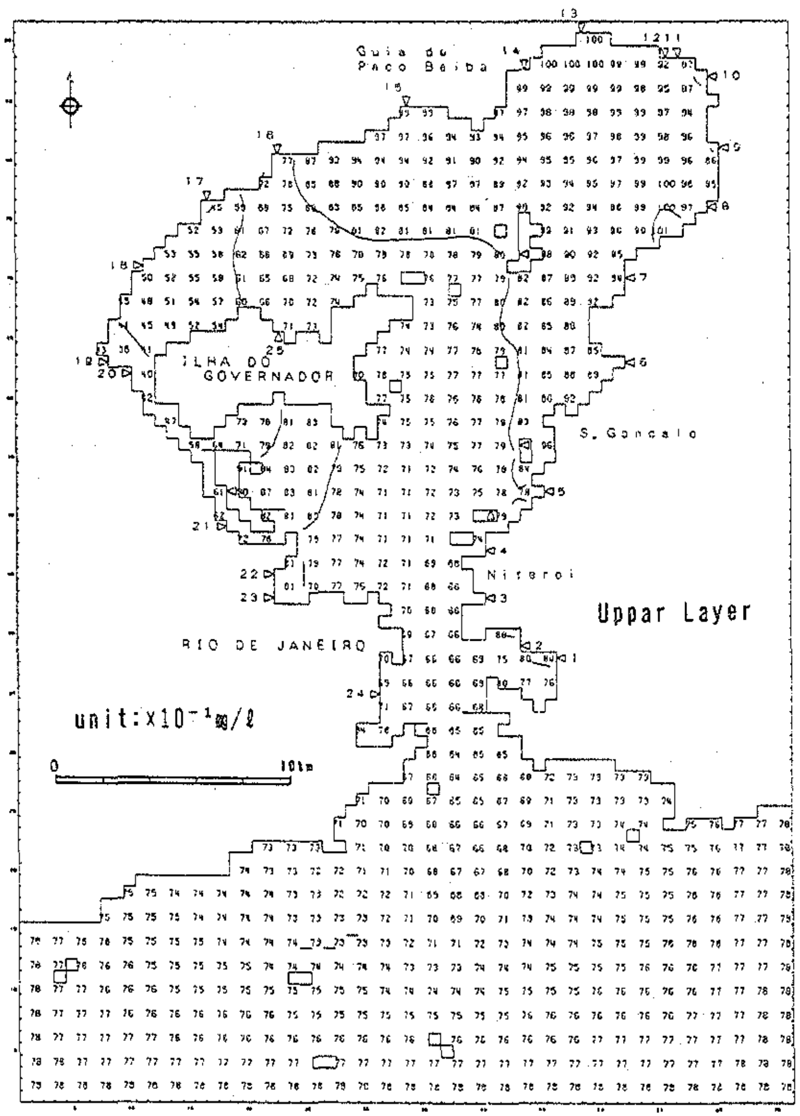



Fig.5.3-5(1) Calculated Water Quality in Case 3-2 (Bypass Plan 2 in 2010)
(BOD)



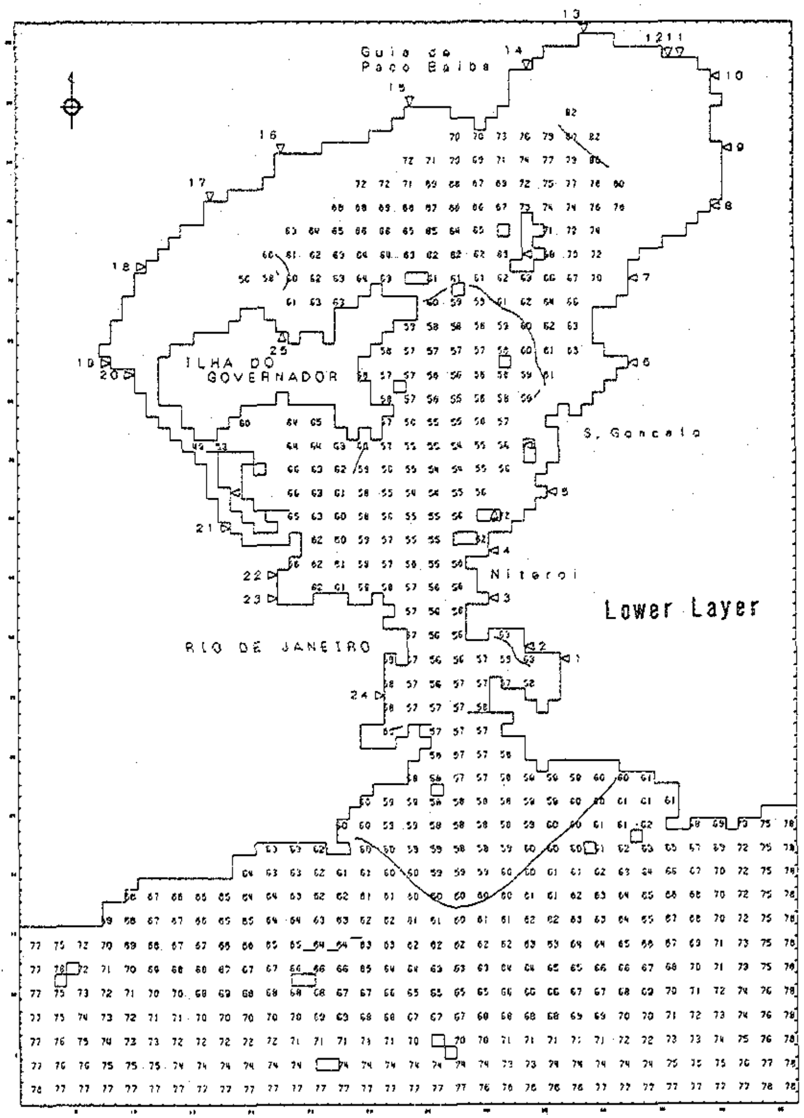




Fig. 5. 3-5(2) Calculated Water Quality in Case 3-2 (Bypass Plan 2 in 2010)
(DO)

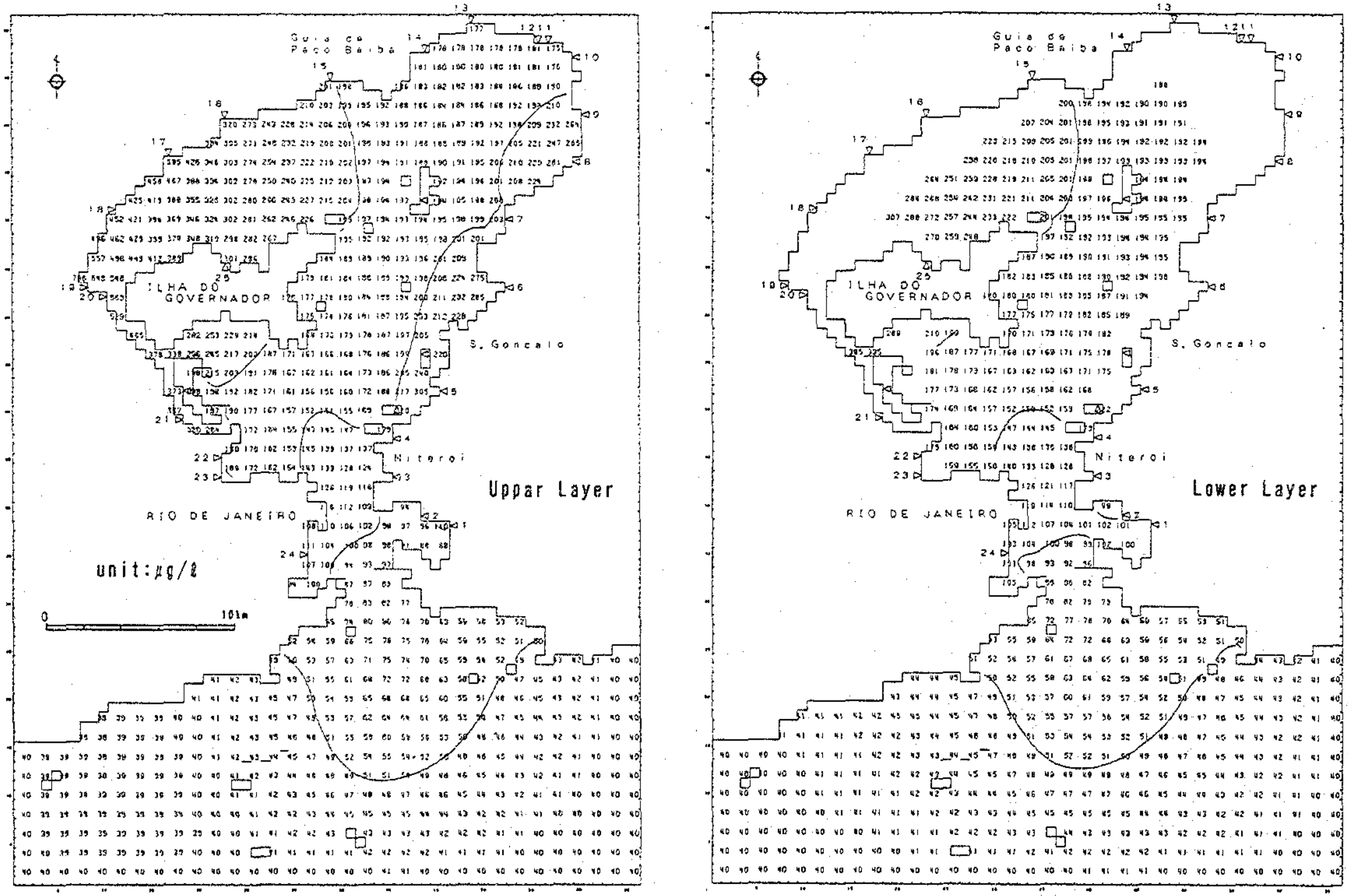



Fig. 5. 3-5(3) Calculated Water Quality in Case 3-2 (Bypass Plan 2 in 2010)
(T-P)

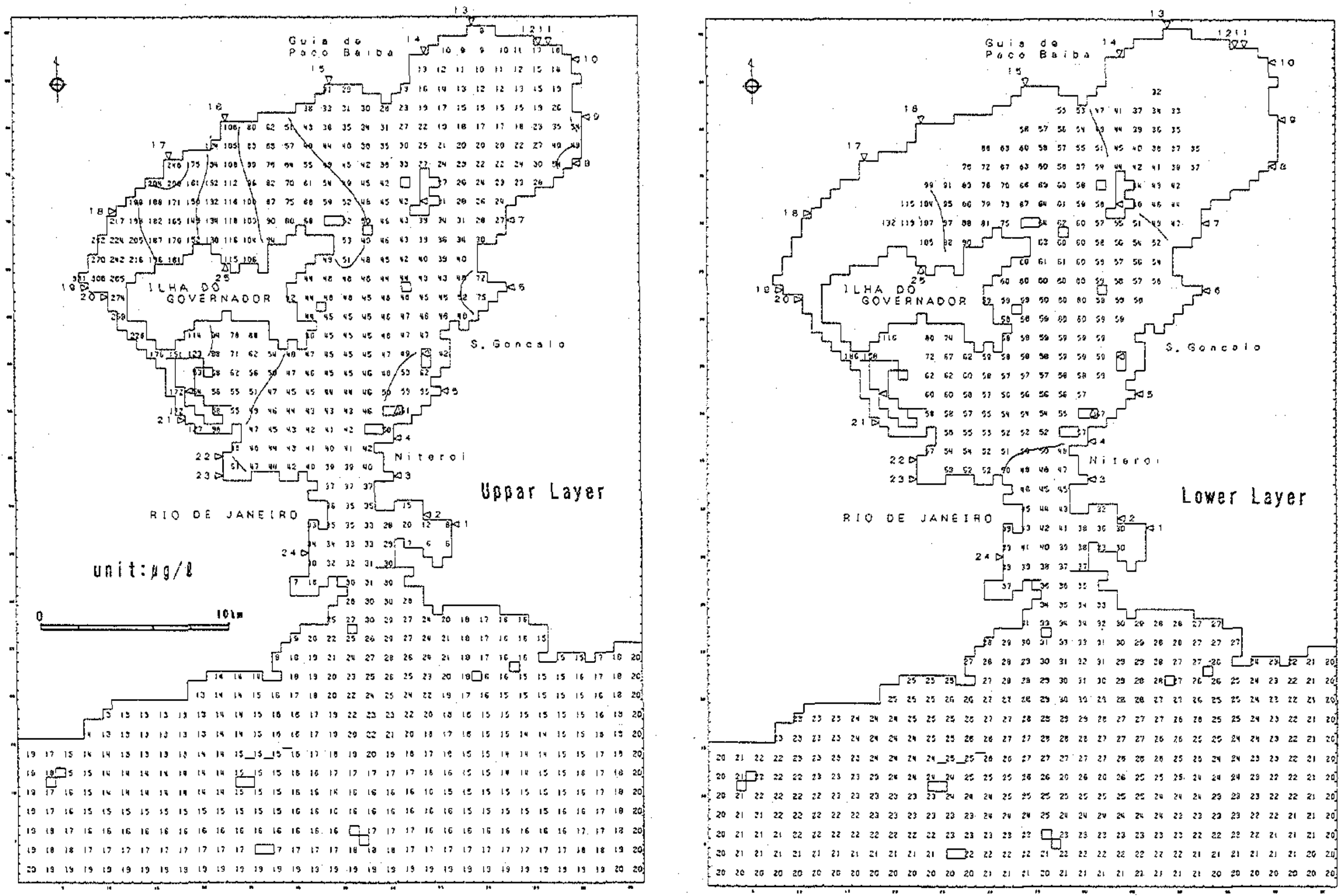



Fig. 5. 3-5(4) Calculated Water Quality in Case 3-2 (Bypass Plan 2 in 2010) ($PO_4$-P)

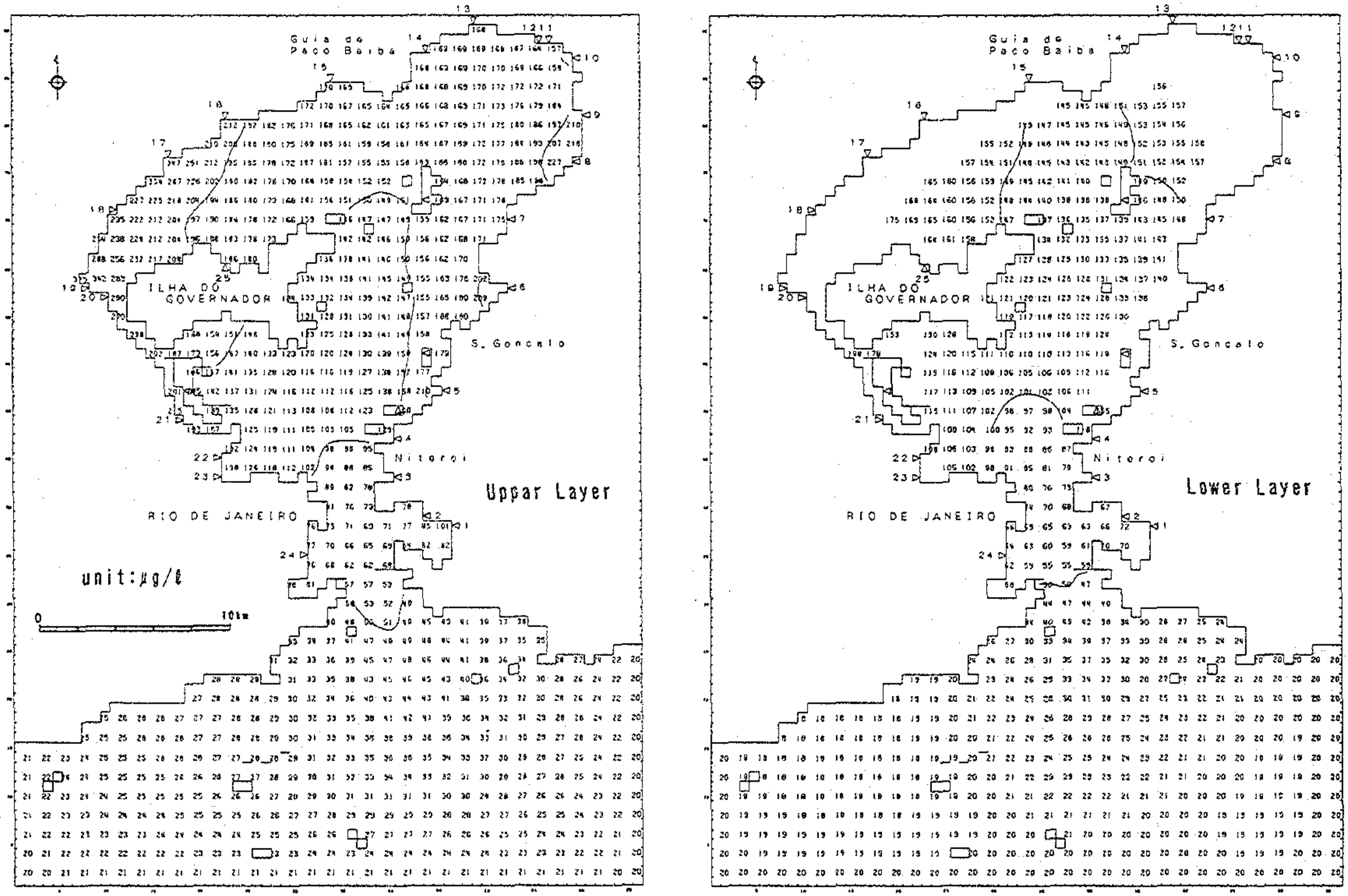
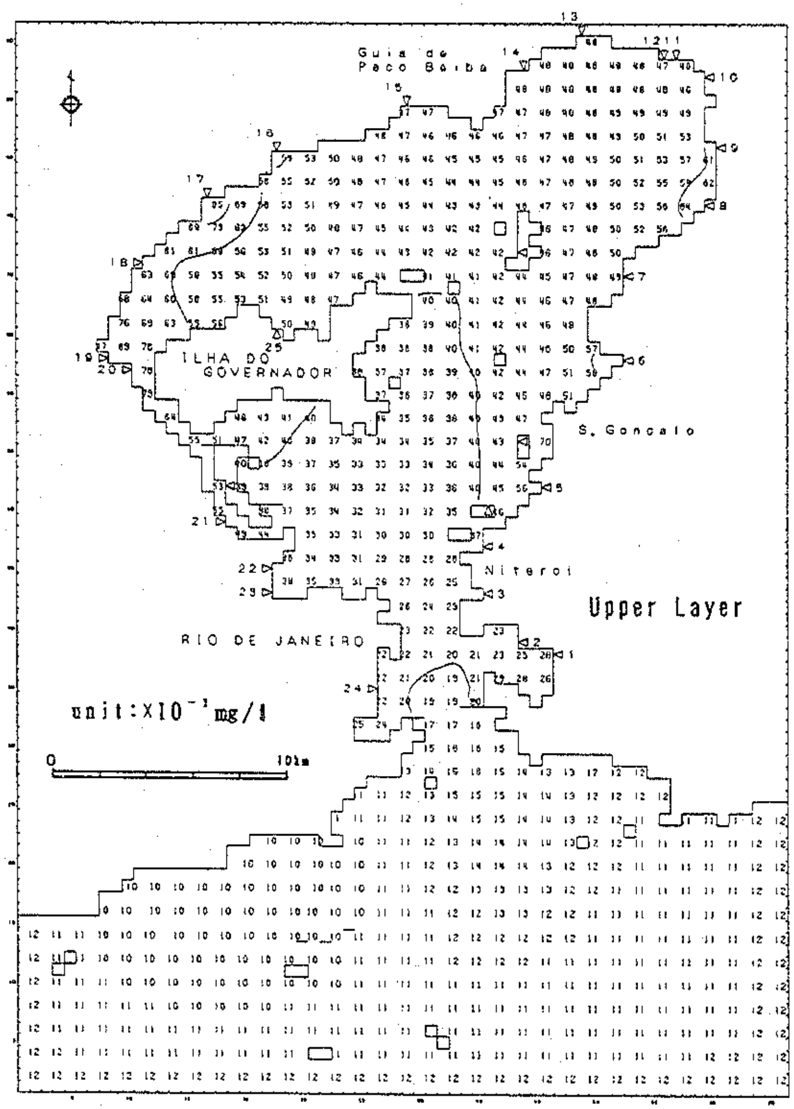



Fig. 5. 3-5(5) Calculated Water Quality in Case 3-2 (Bypass Plan 2 in 2010)
(O-P)



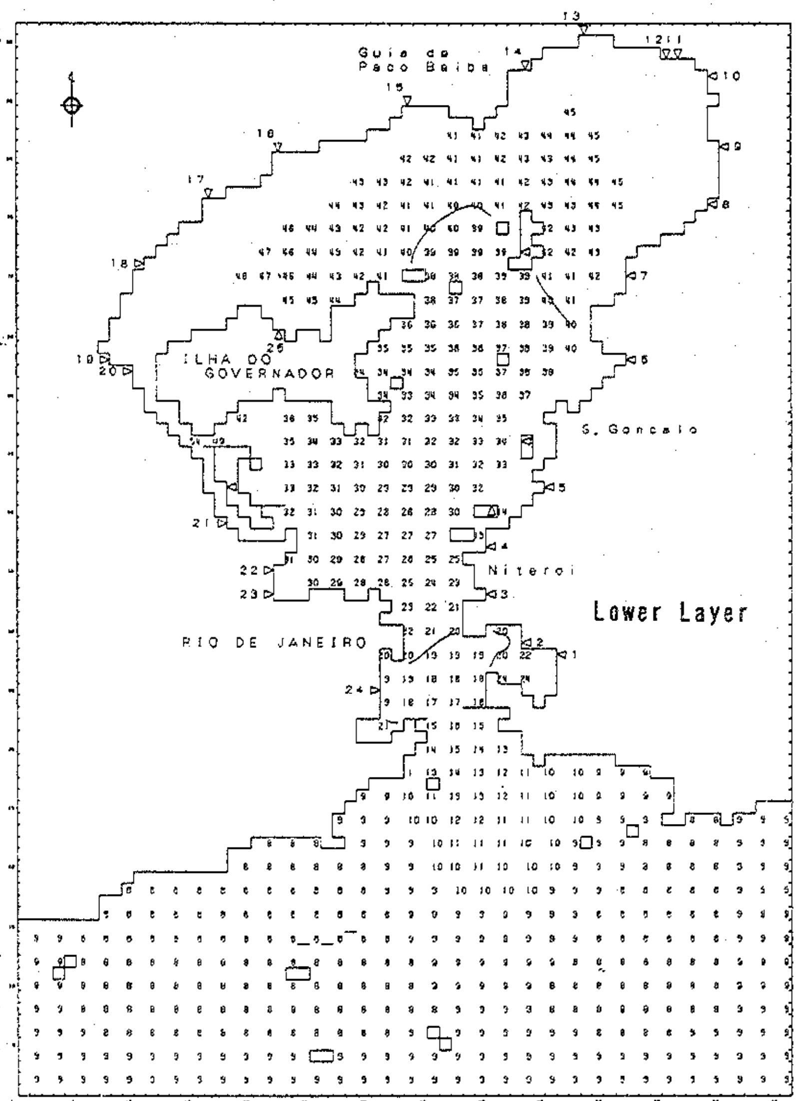
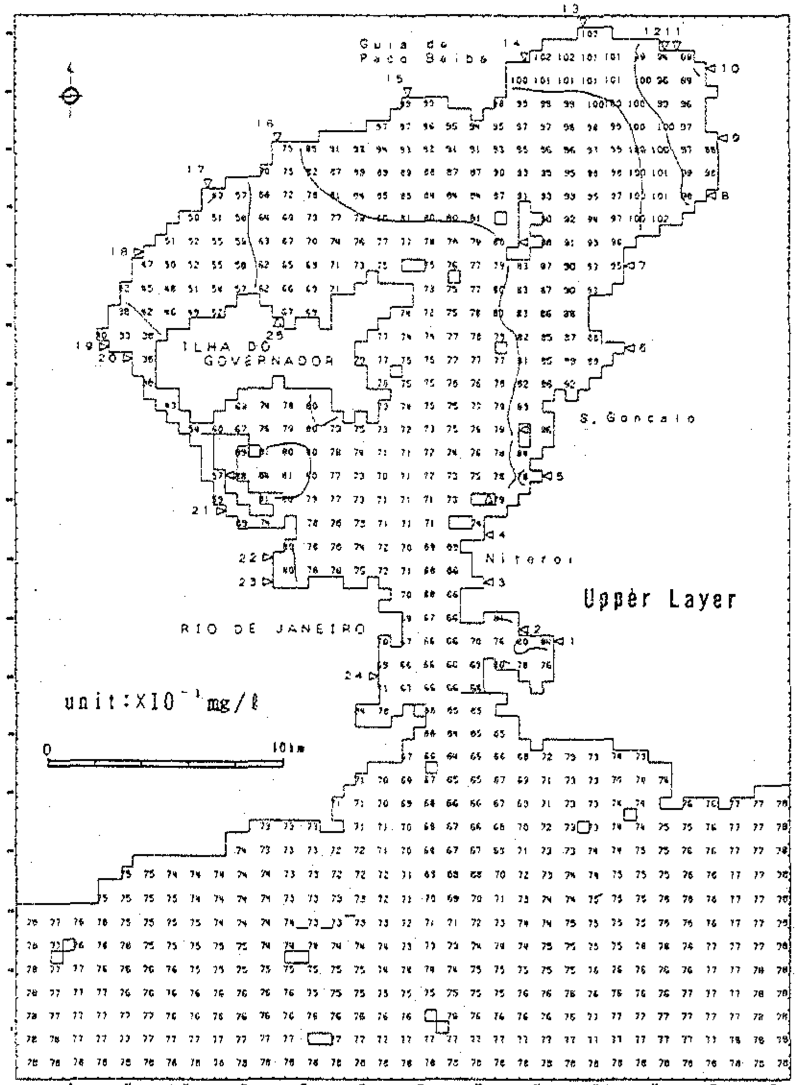




Fig. 5. 3-6(1) Calculated Water Quality in Case 3-3 (Bypass Plan 3 in 2010)
(BOD)



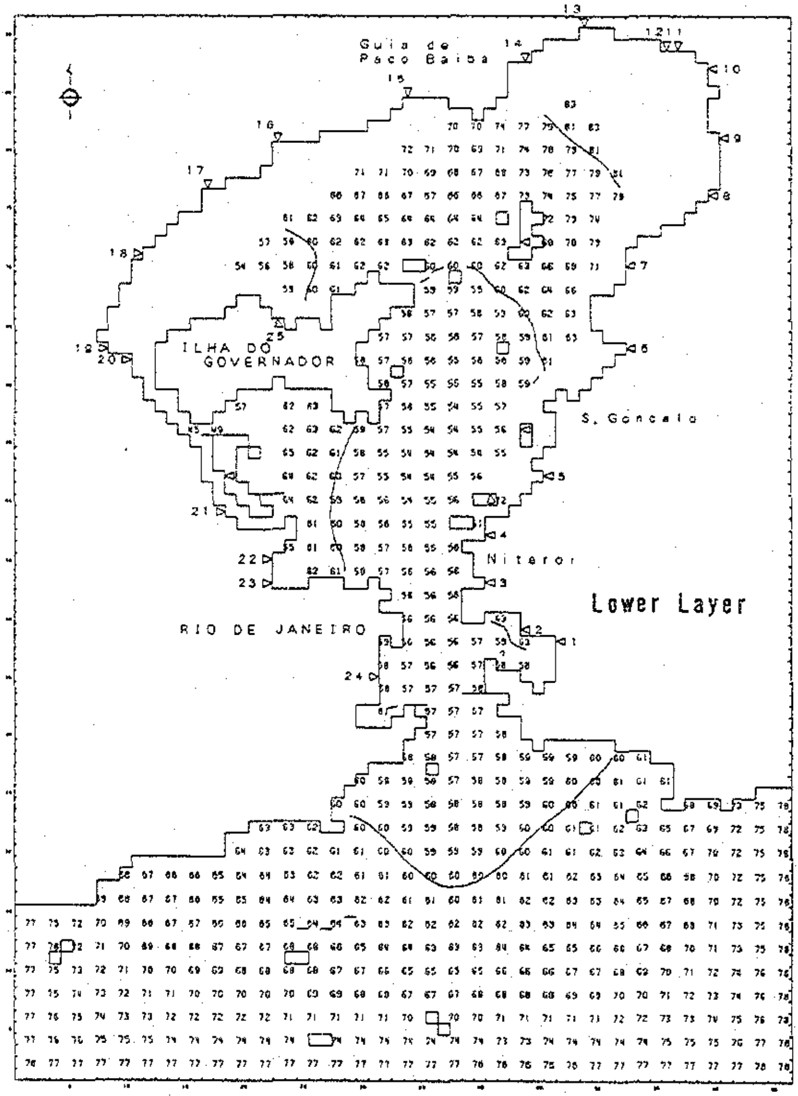




Fig. 5.3-6(2) Calculated Water Quality in Case 3-3 (Bypass Plan 3 in 2010)
(DO)

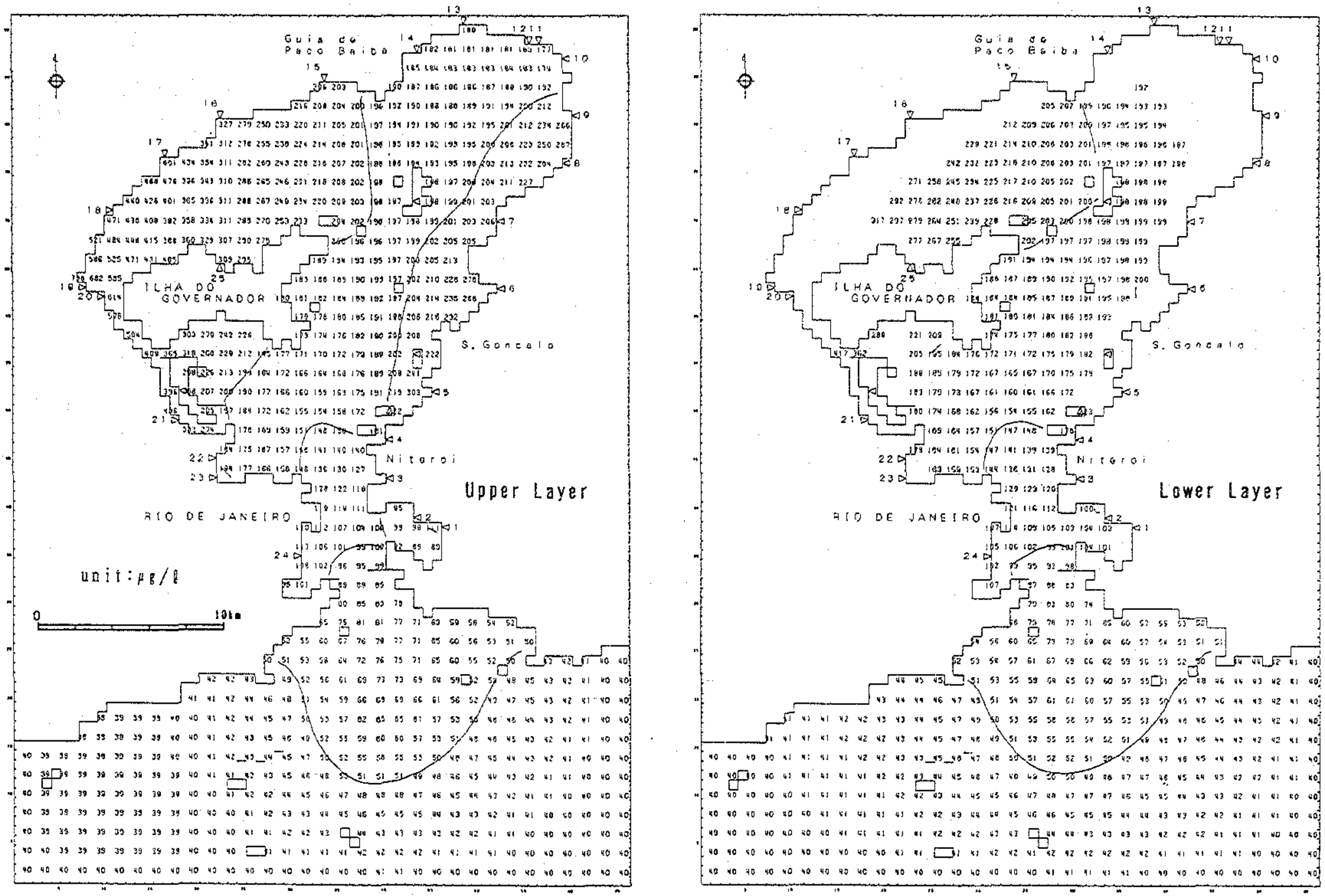



Fig. 5. 3-6(3) Calculated Water Quality in Case 3-3 (Bypass Plan 3 in 2010)
(T-P)

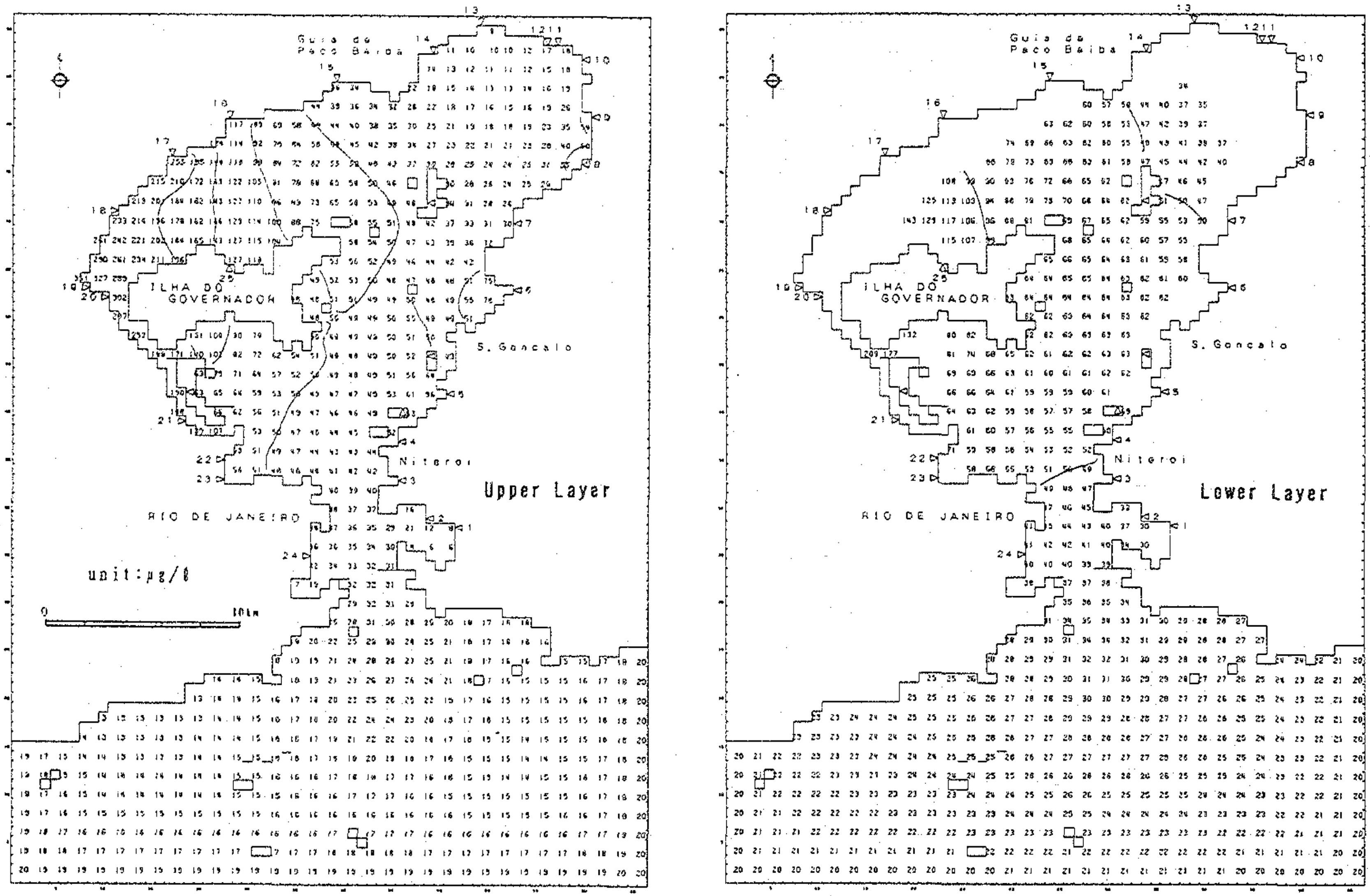



Fig. 5.3-6(4) Calculated Water Quality in Case 3-3 (Bypass Plan 3 in 2010)
($PO_4$-P)

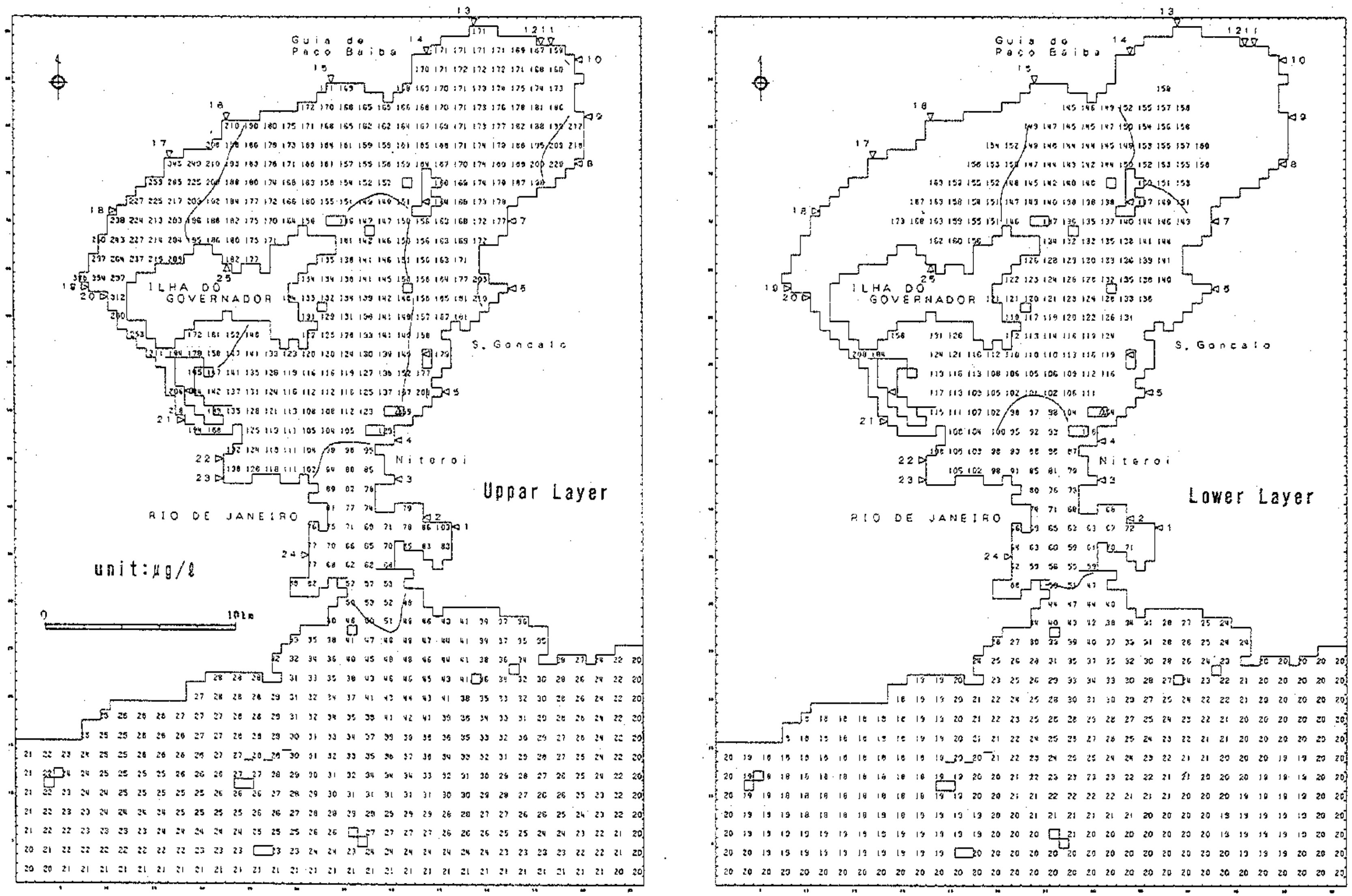



Fig. 5.3-6(5) Calculated Water Quality in Case 3-3 (Bypass Plan 3 in 2010)
(O-P)

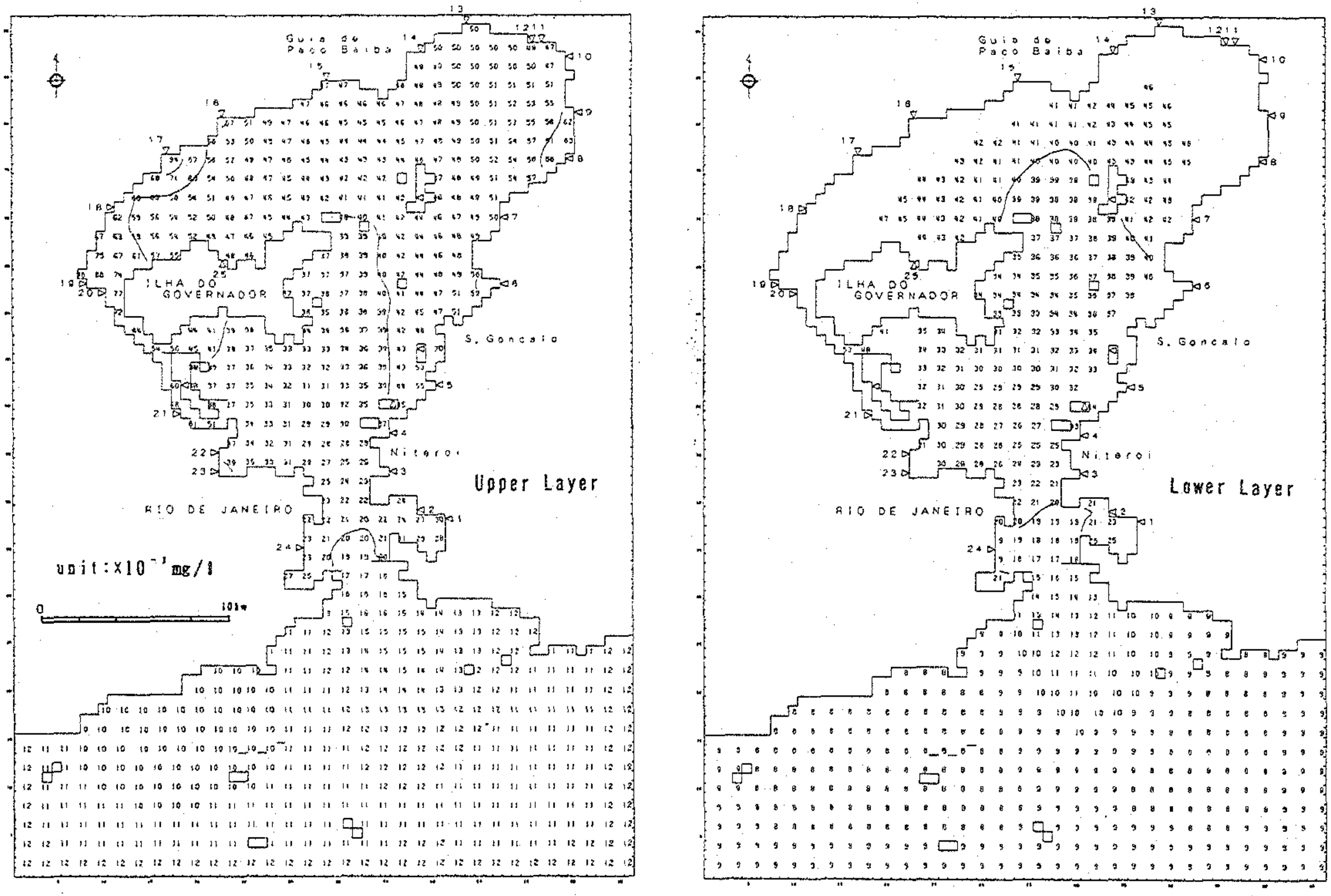



Fig. 5. 3-7(1) Calculated Water Quality in Case 3-4 (Bypass Plan 4 in 2010)
(BOD)

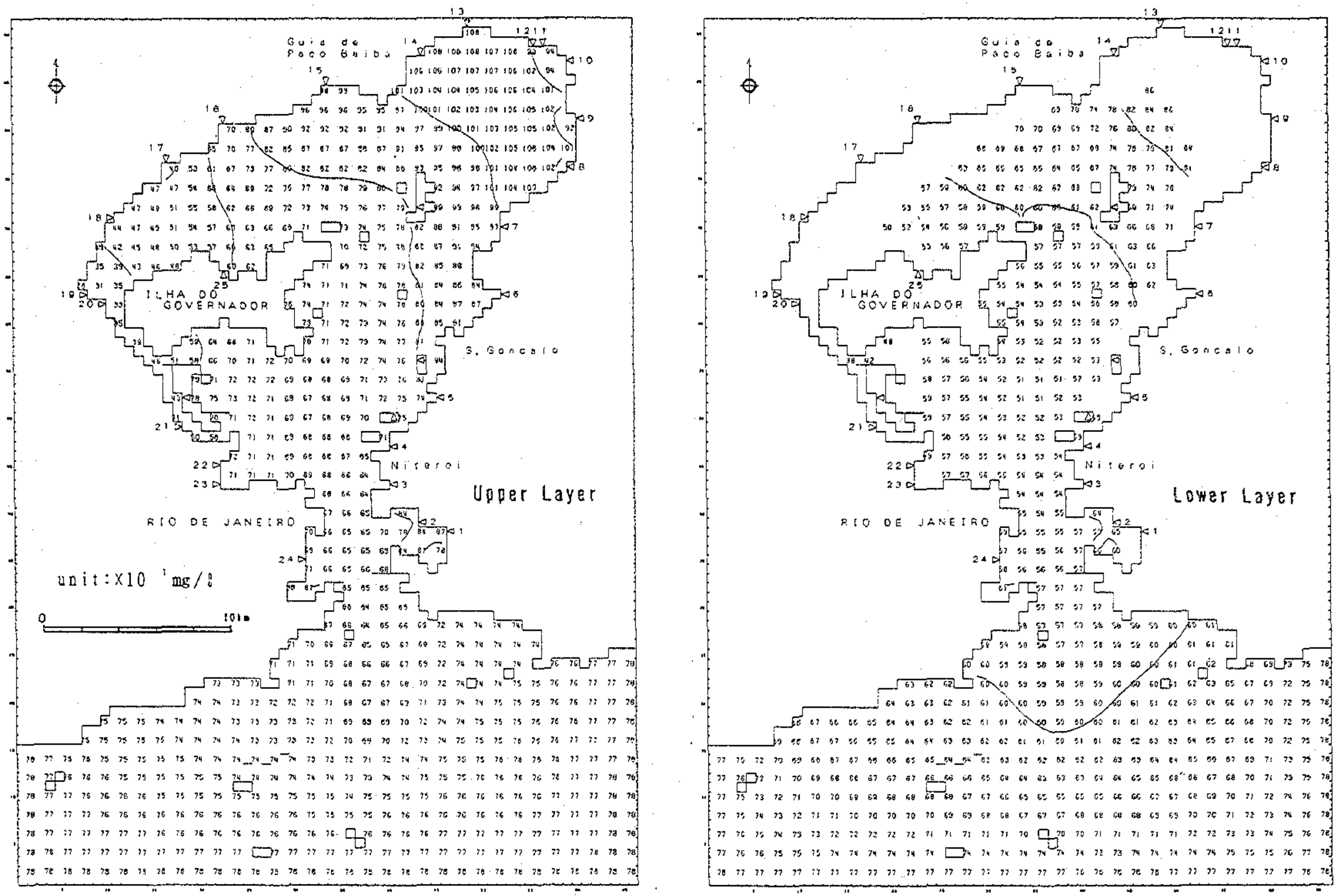



Fig. 5.3-7(2) Calculated Water Quality in Case 3-4 (Bypass Plan 4 in 2010)

(DO)

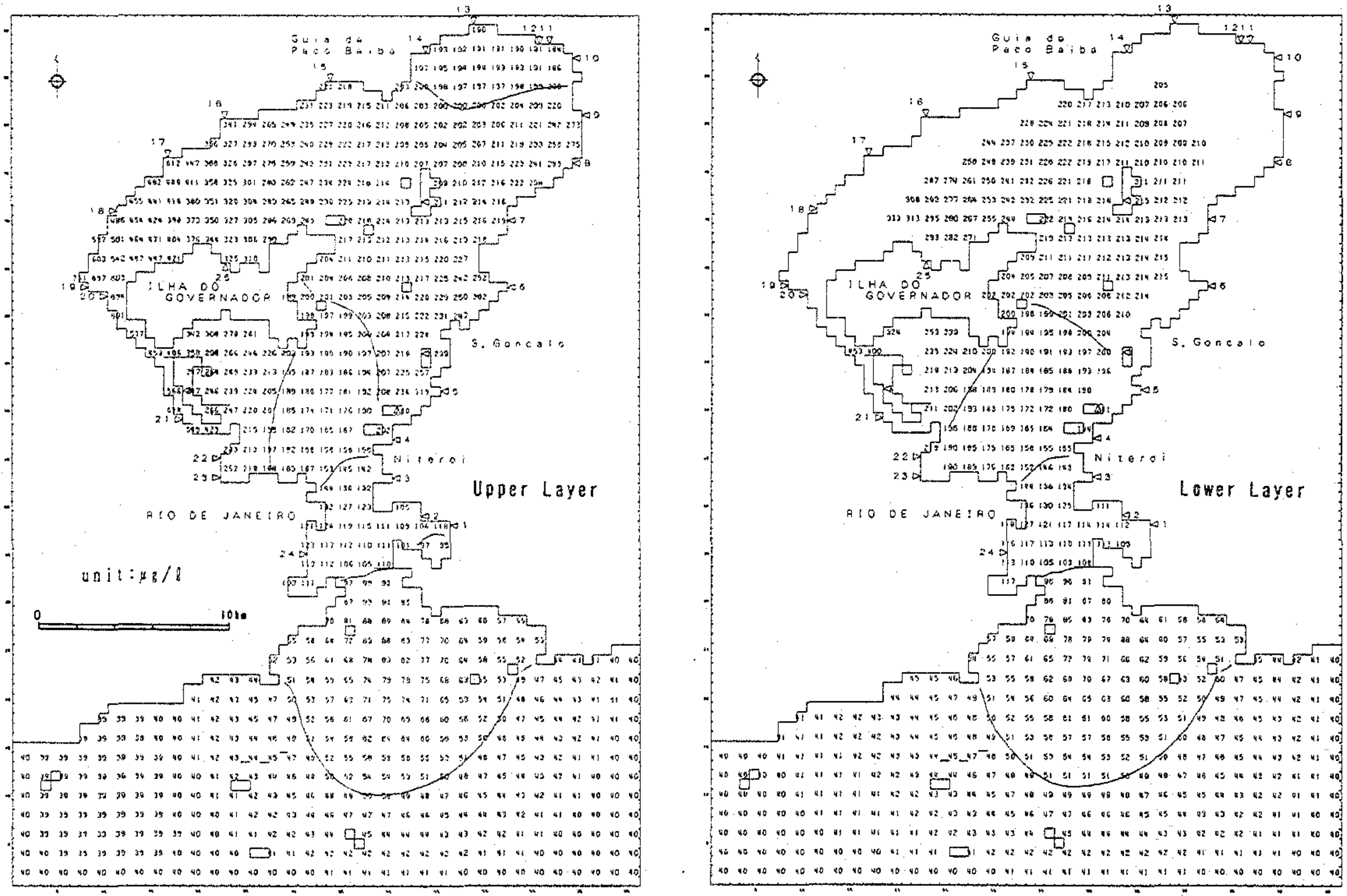



Fig. 5. 3-7(3) Calculated Water Quality in Case 3-4 (Bypass Plan 4 in 2010) (T-P)

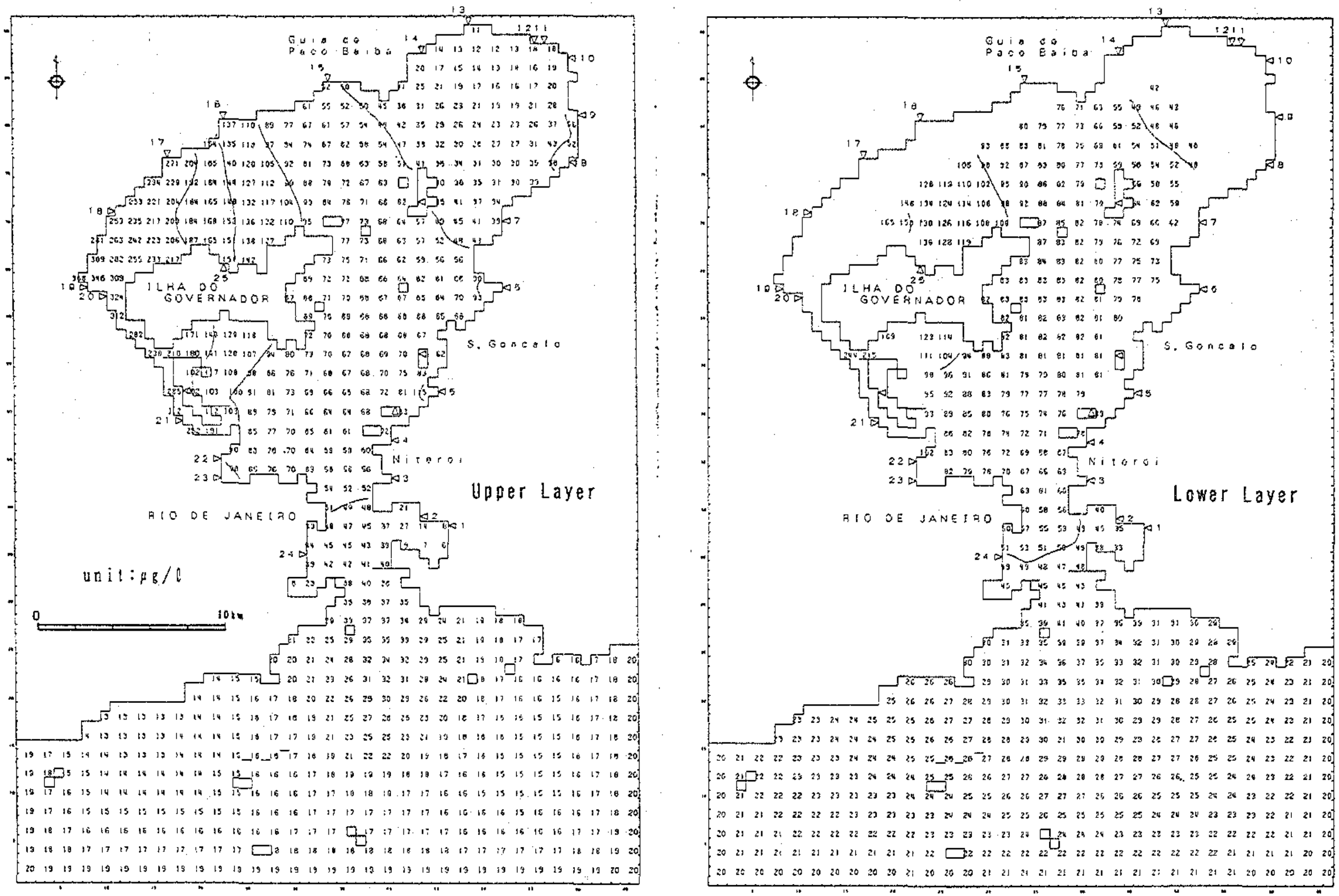



Fig. 5.3-7(4) Calculated Water Quality in Case 3-4 (Bypass Plan 4 in 2010)

($PO_4$-P)

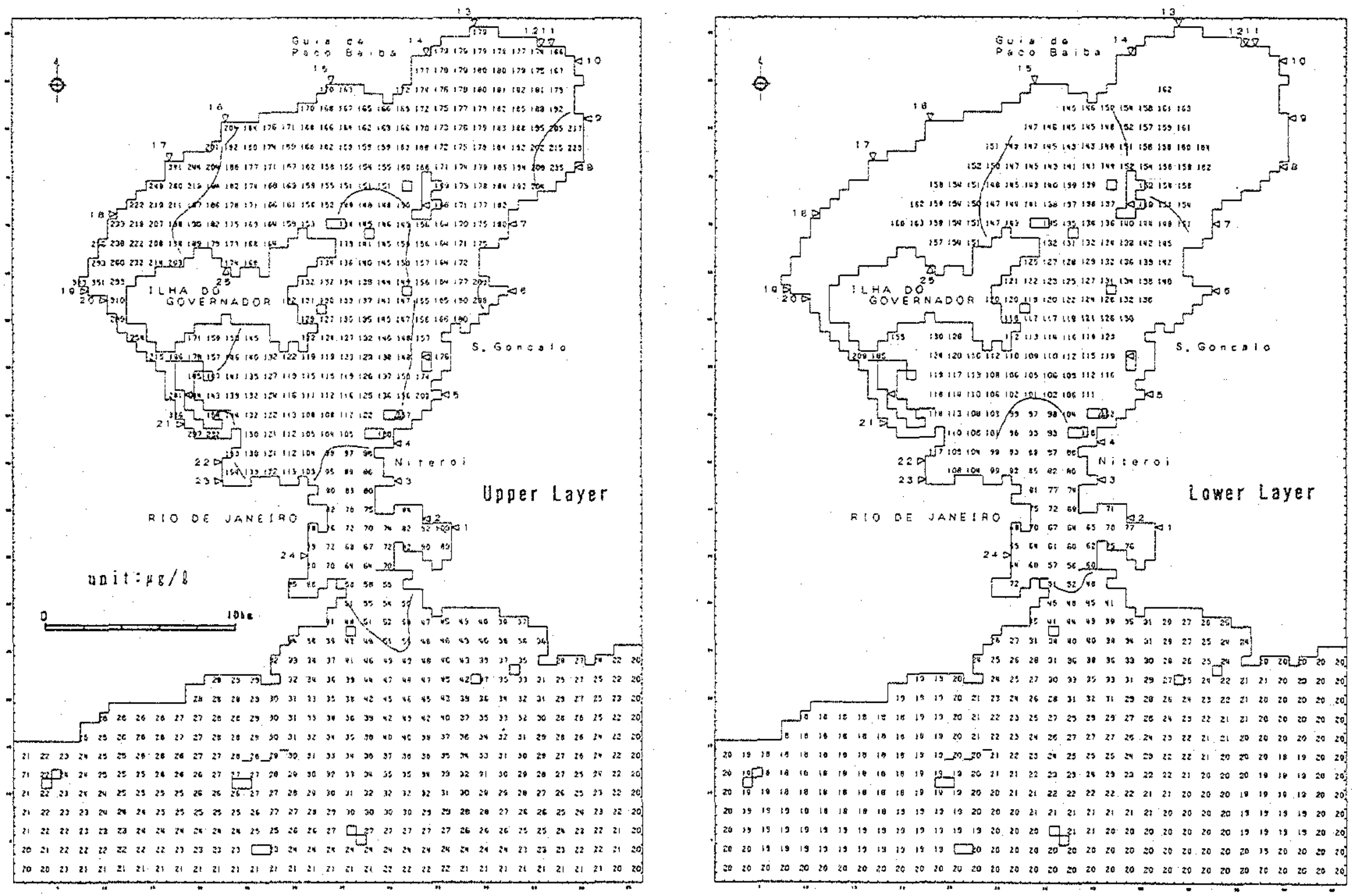



Fig. 5.3-7(5) Calculated Water Quality in Case 3-4 (Bypass Plan 4 in 2010)
(O-P)

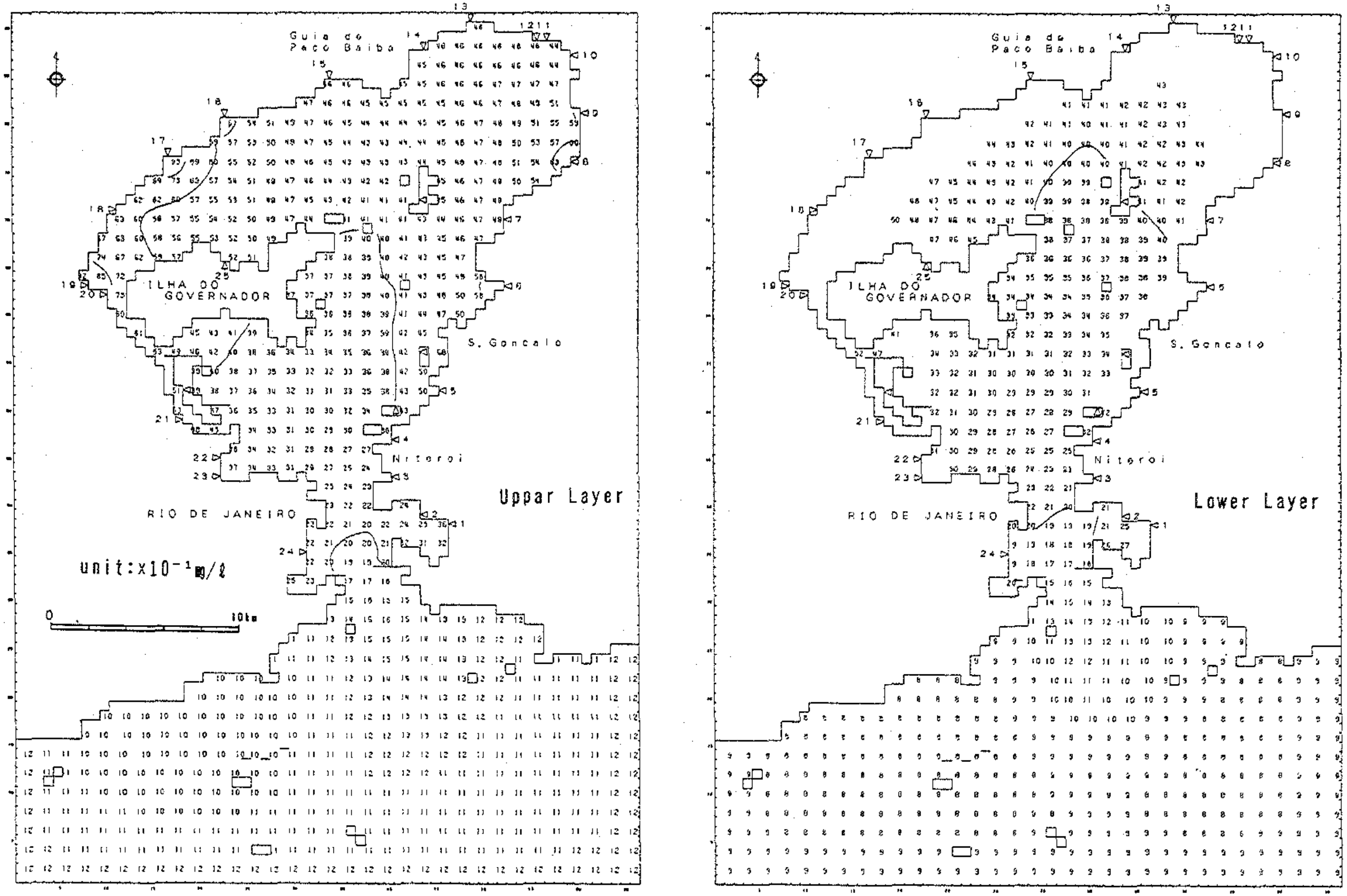
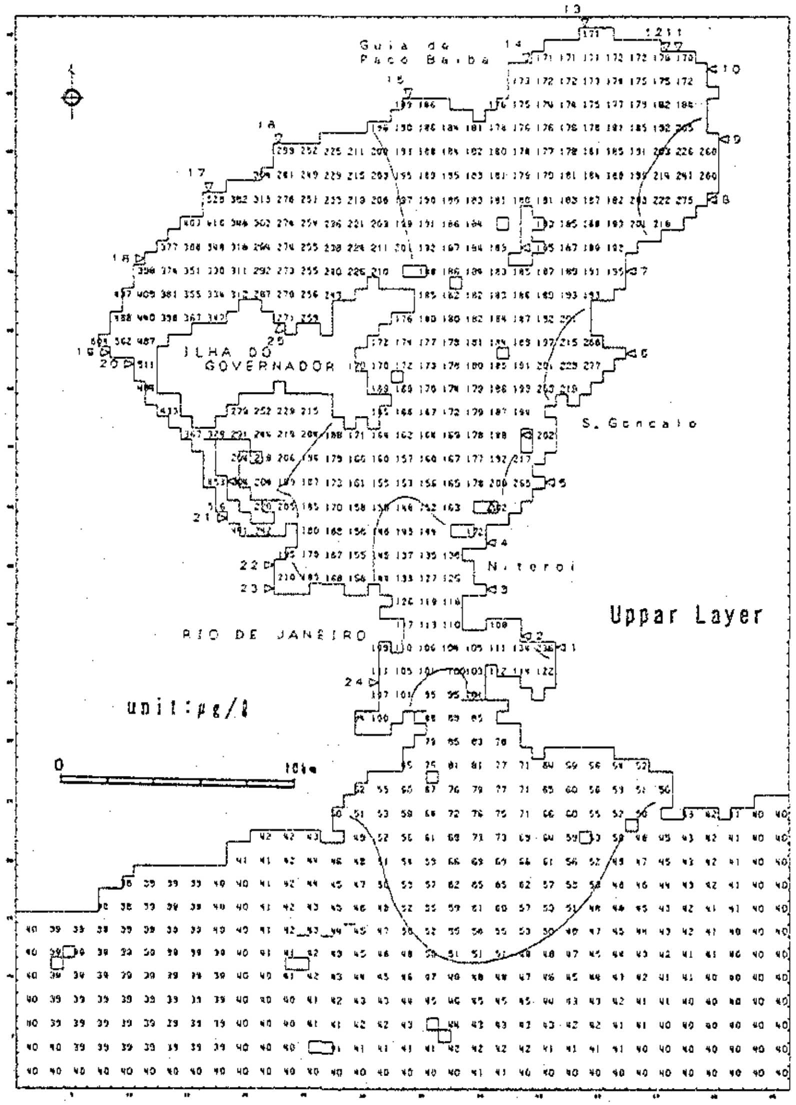



Fig. 5. 3-8(1) Calculated Water Quality in Case 4-1 (BOD)
(20% Reducing T-P load from the object rivers of IDB/OECF program in 2010)



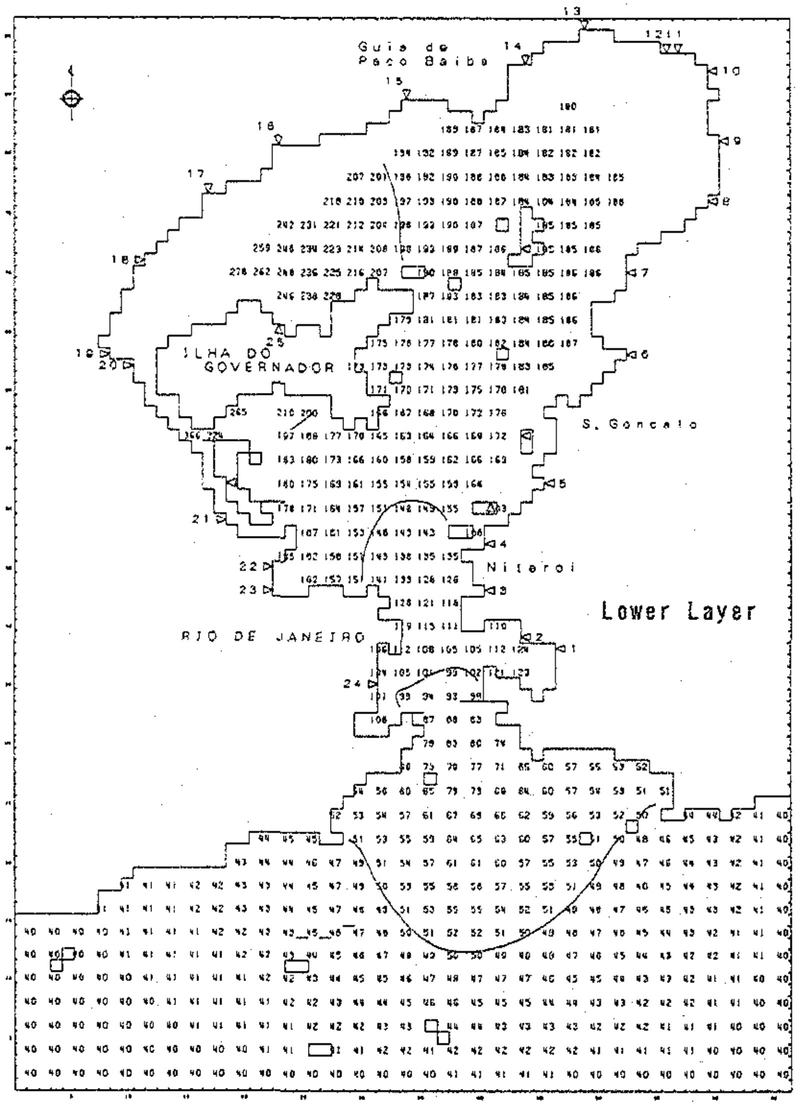




Fig. 5.3-8(2) Calculated Water Quality in Case 4-1 (T-P)
(20% Reducing T-P load from the object rivers of IDB/OECF program in 2010)

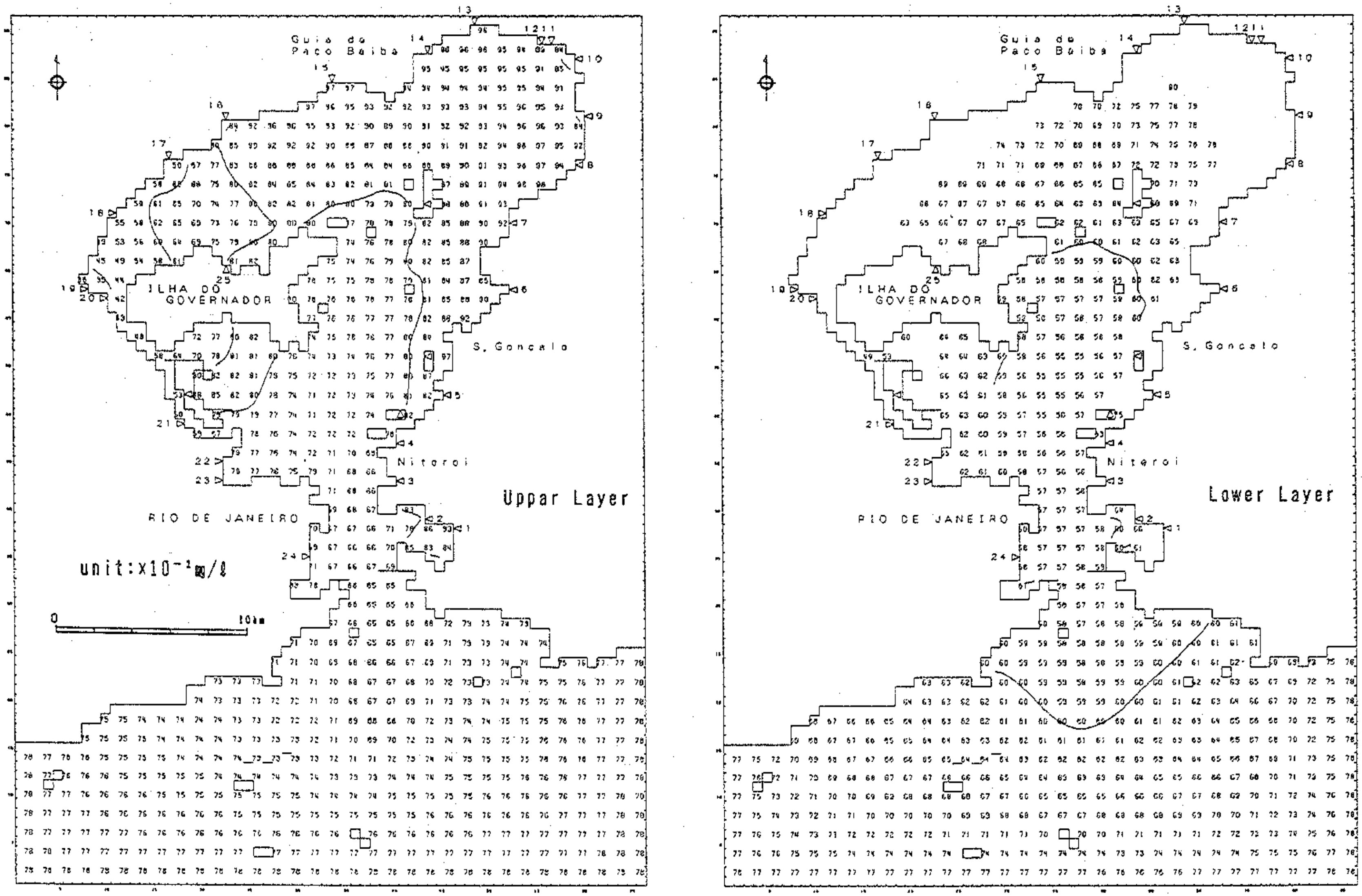



Fig. 5. 3-8(3) Calculated Water Quality in Case 4-1 (DO)

(20% Reducing T-P load from the object rivers of IDB/OECF program in 2010)

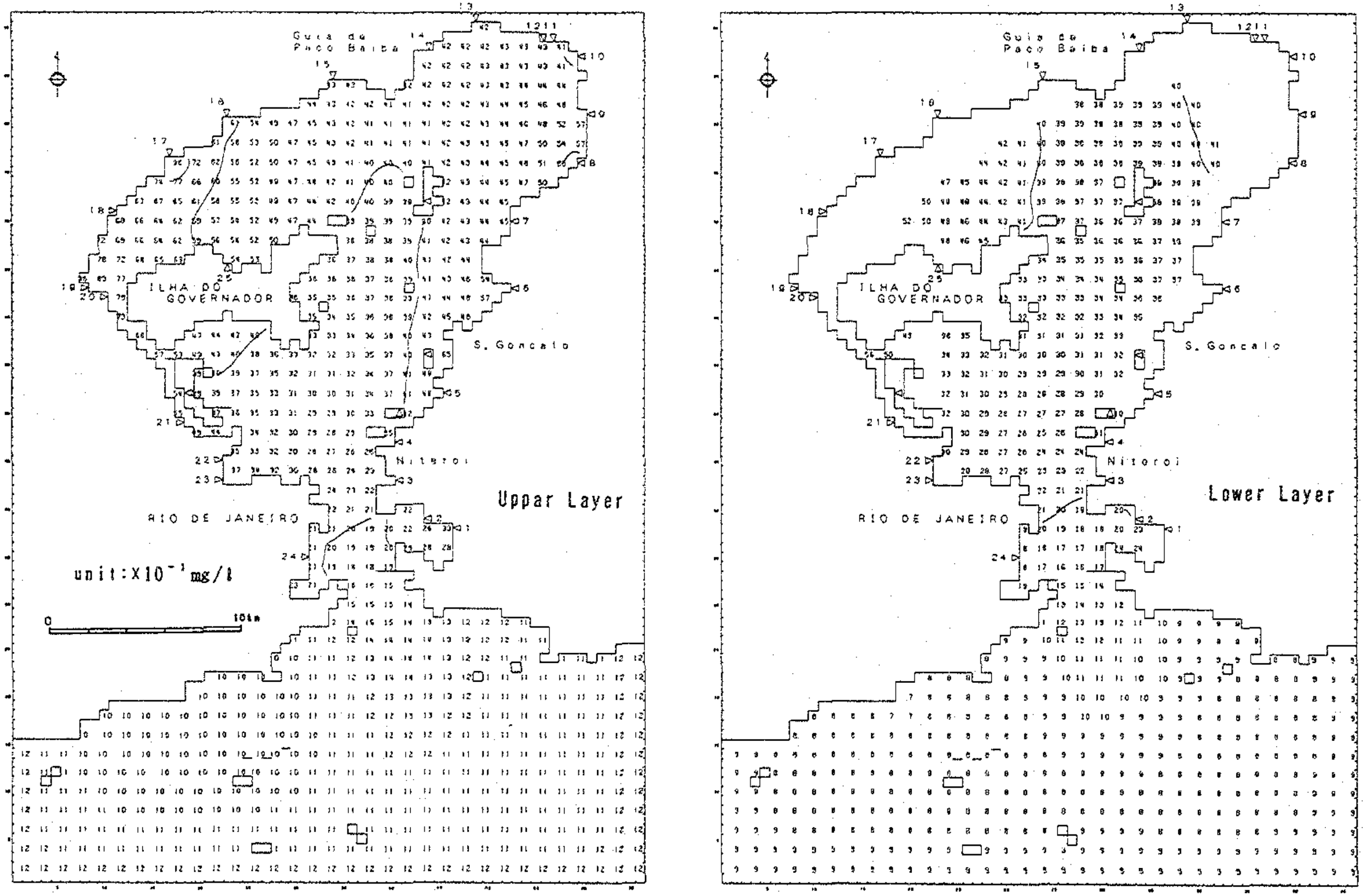
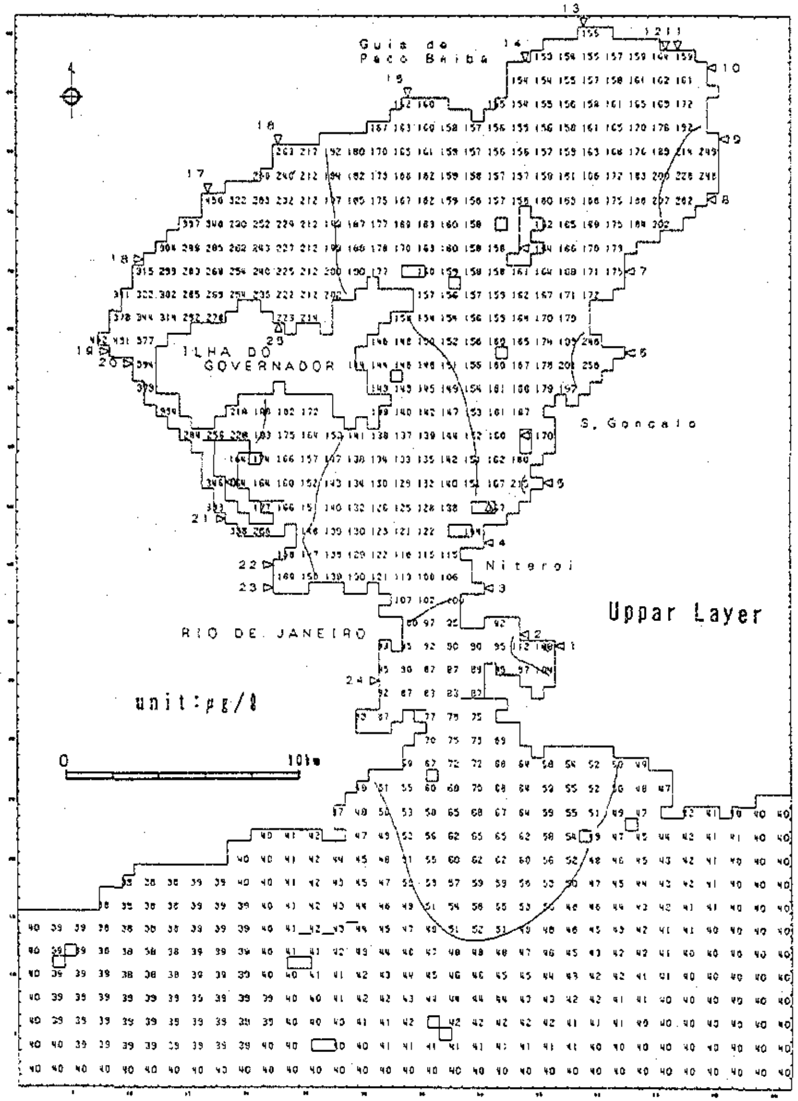



Fig. 5.3-9(1) Calculated Water Quality in Case 4-2 (BOD)
(40% Reducing T-P load from the object rivers of IDB/OECF program in 2010)



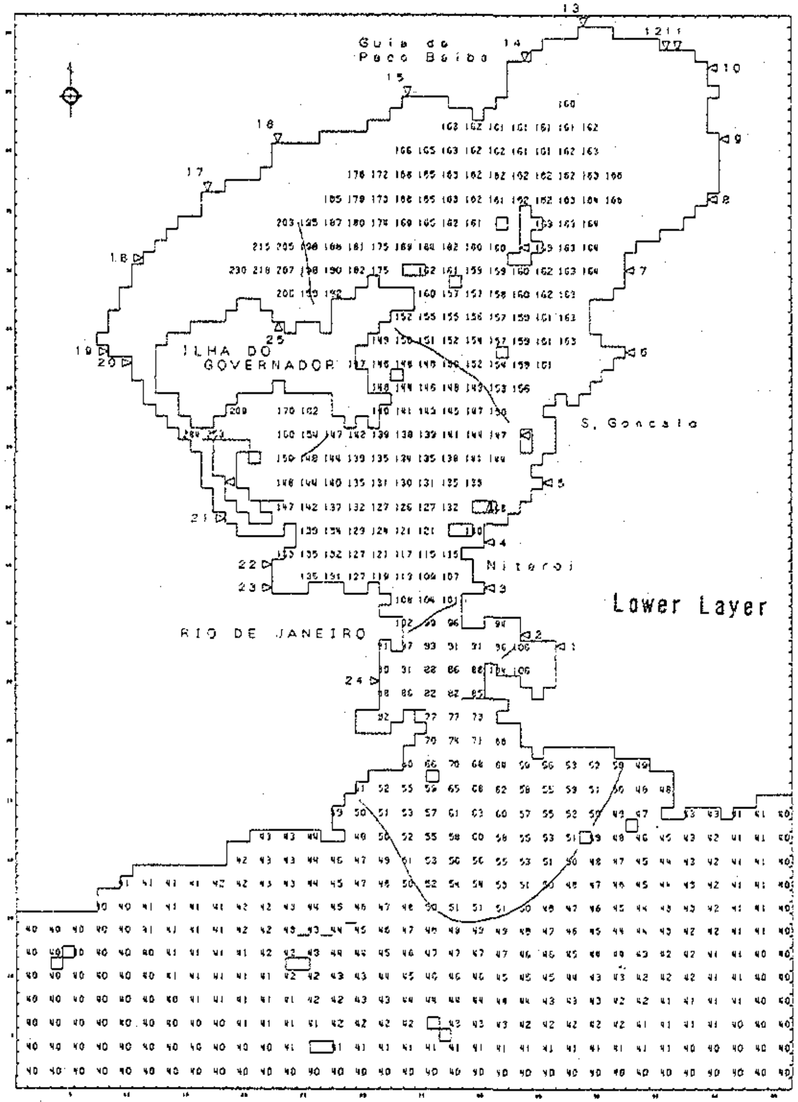




Fig. 5. 3-9(2) Calculated Water Quality in Case 4-2 (T-P)
(40% Reducing T-P load from the object rivers of IDB/OECF program in 2010)

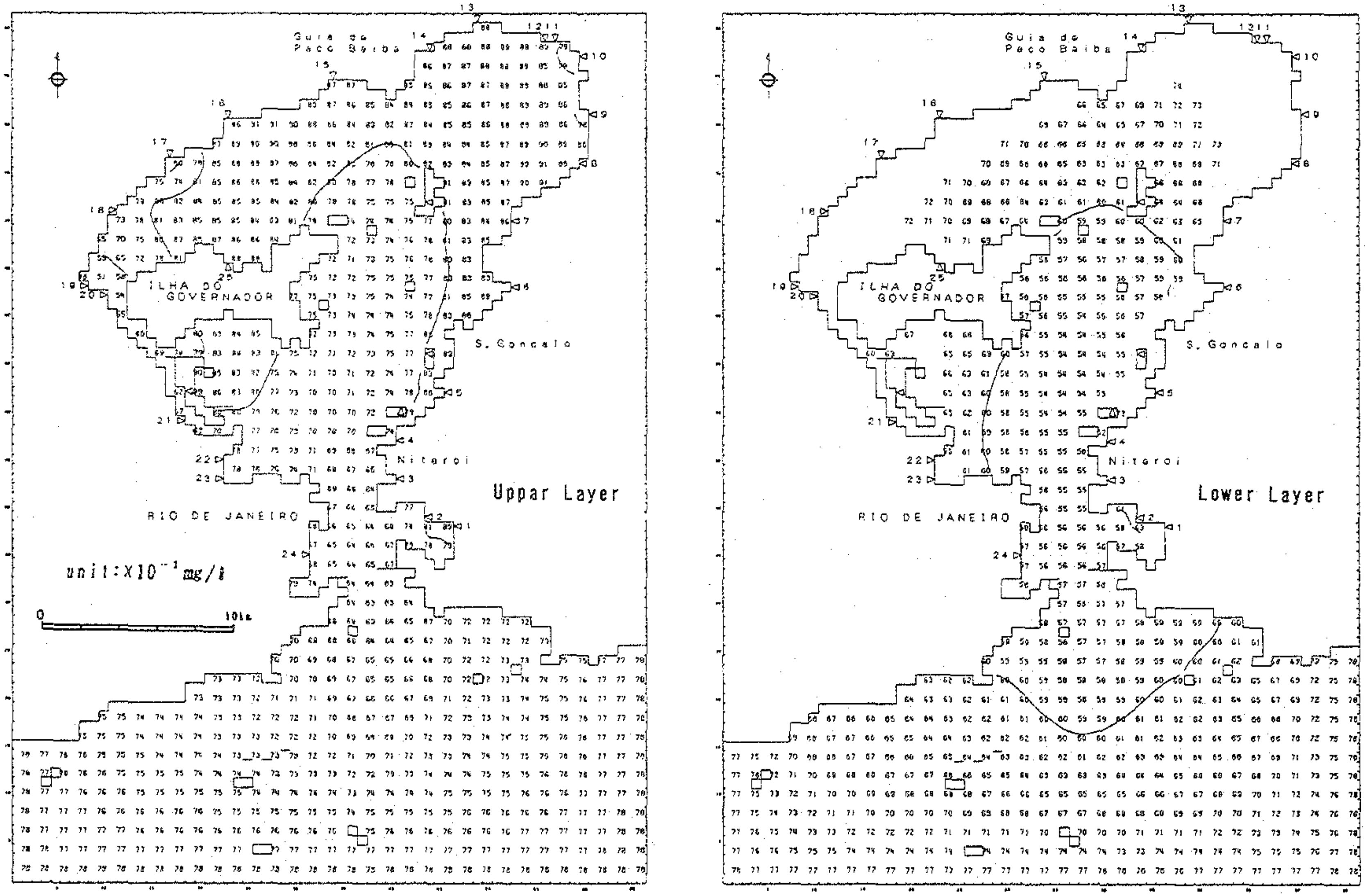



Fig. 5. 3-9(3) Calculated Water Quality in Case 4-2 (DO)
(40% Reducing T-P load from the object rivers of IDB/OECF program in 2010)

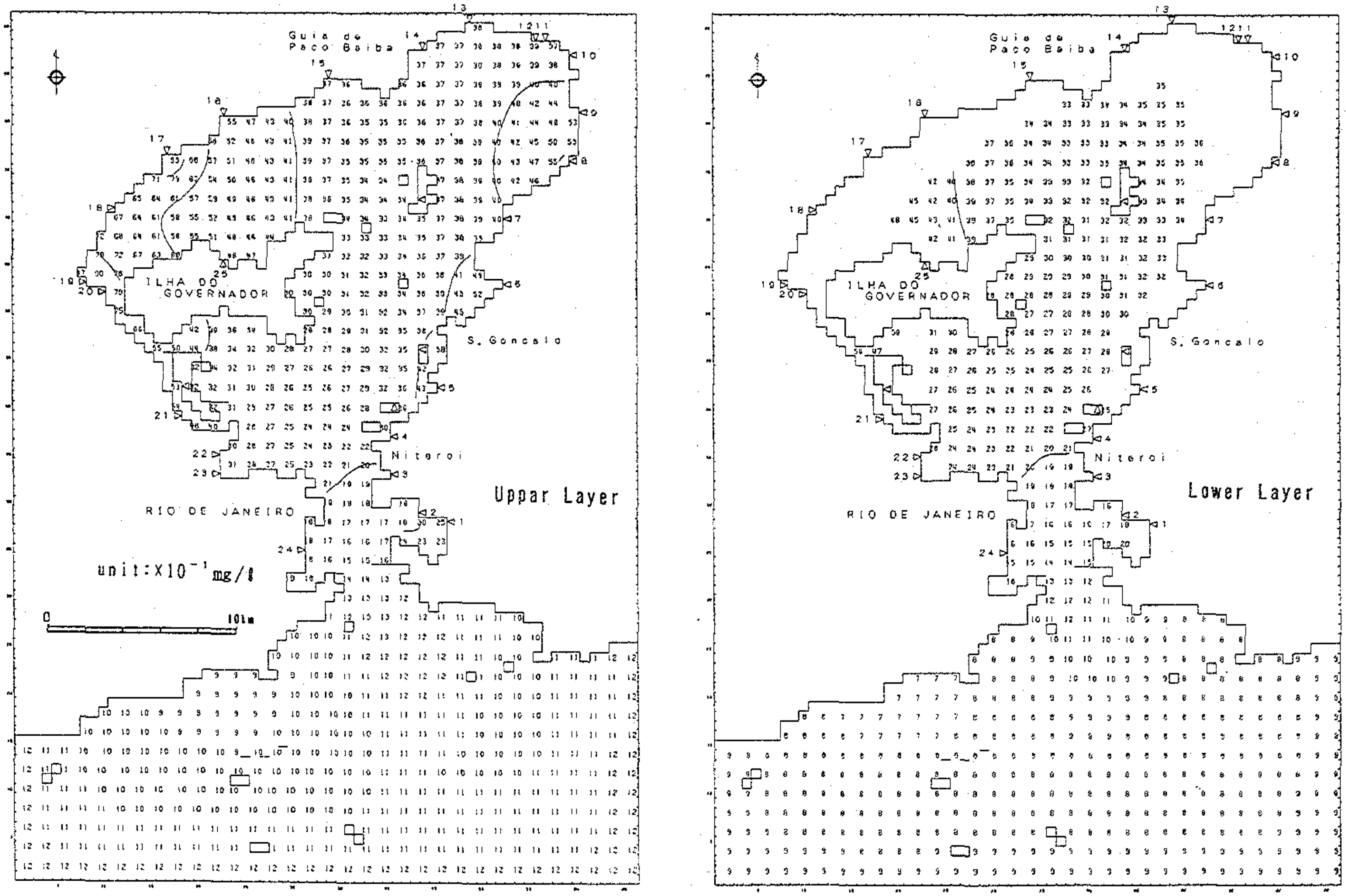



Fig. 5. 3-10(1) Calculated Water Quality in Case 4-3 (BOD)

(80% Reducing T-P load from the object rivers of IDB/OECF program in 2010)

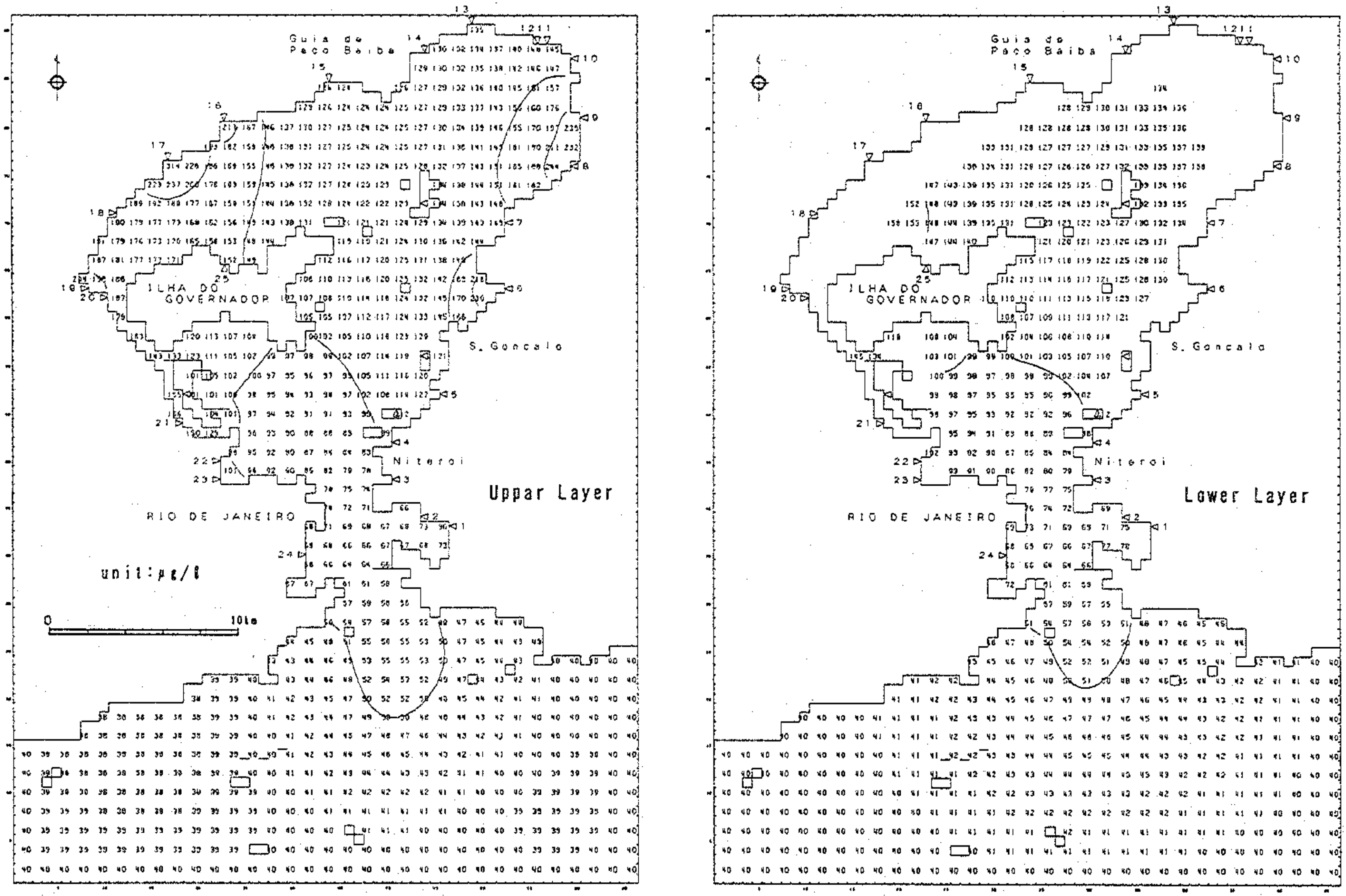
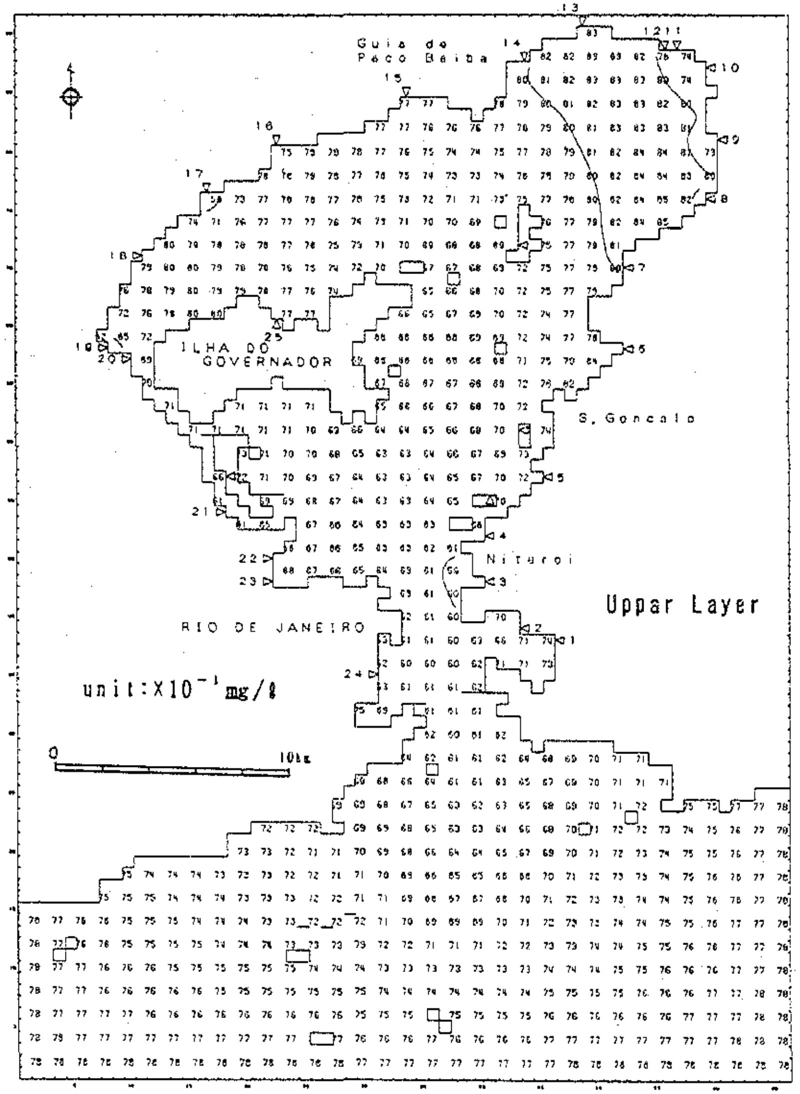



Fig. 5. 3-10(2) Calculated Water Quality in Case 4-3 (T-P)
(80% Reducing T-P load from the object rivers of IDB/OECF program in 2010)



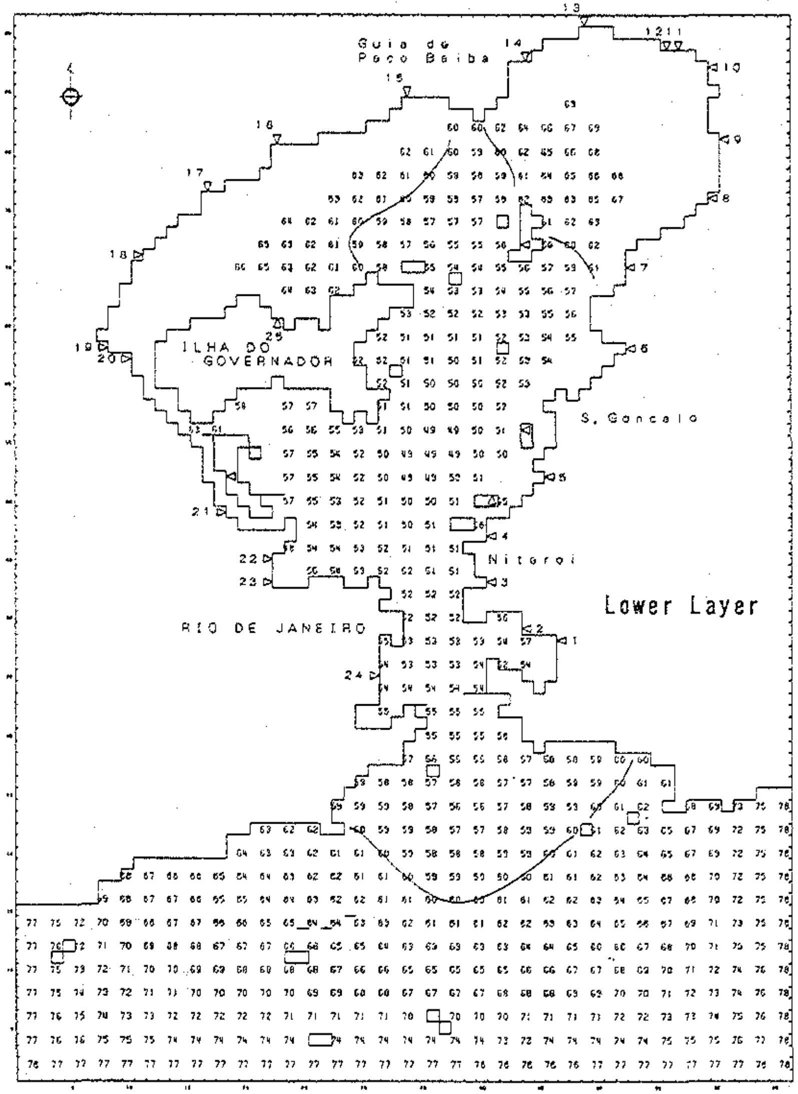
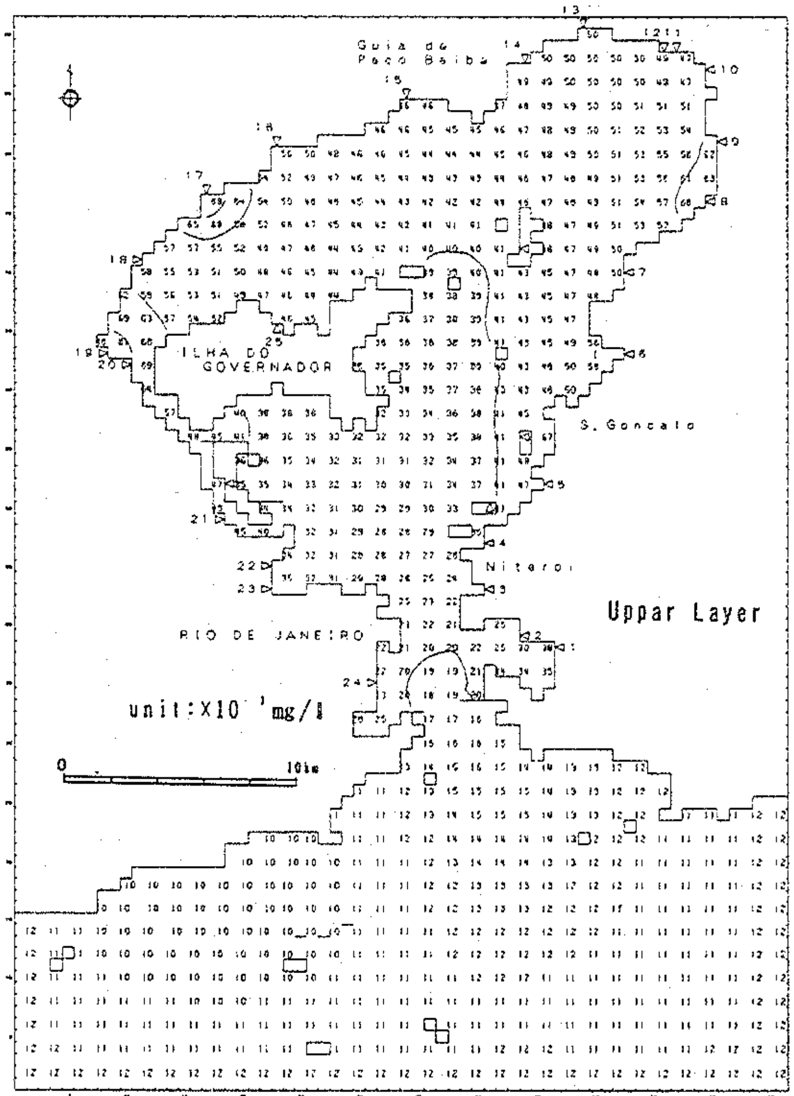




Fig. 5. 3-10(3) Calculated Water Quality in Case 4-3 (DO)
(80% Reducing T-P load from the object rivers of IDB/OECF program in 2010)



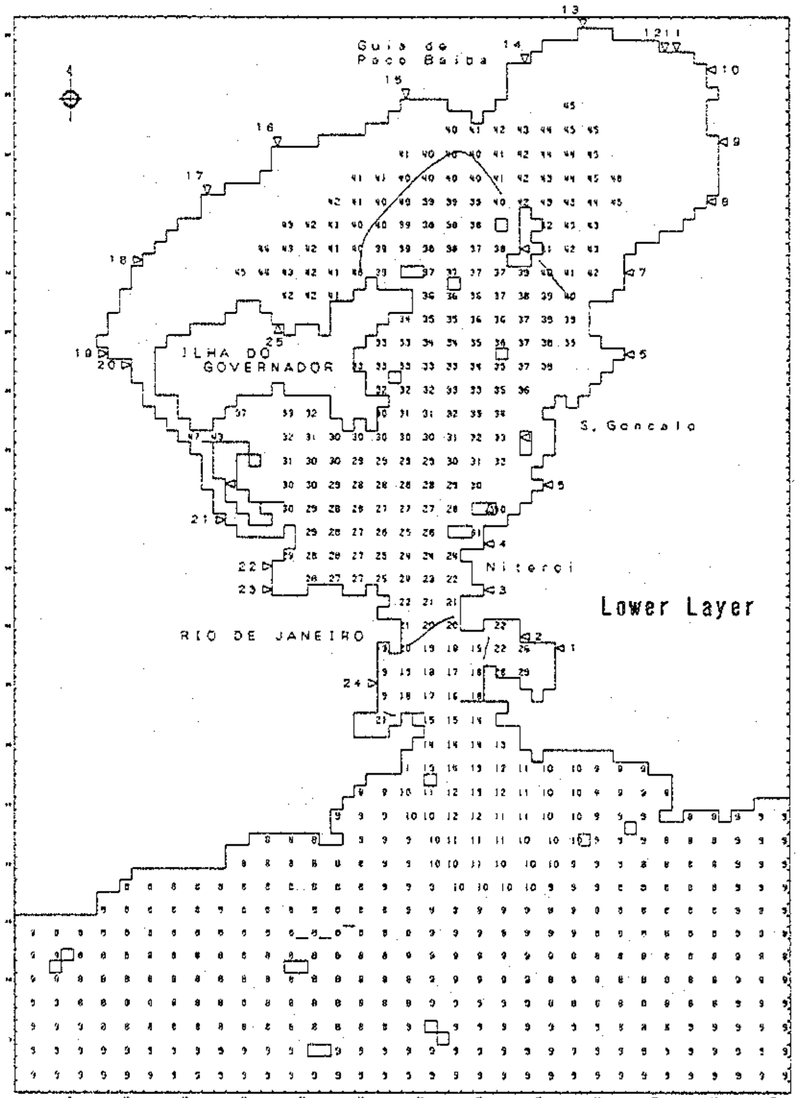




Fig. 5.3-11(1) Calculated Water Quality in Case 5-1 (Dredging the Sediment in Block C in 2010)
(BOD)

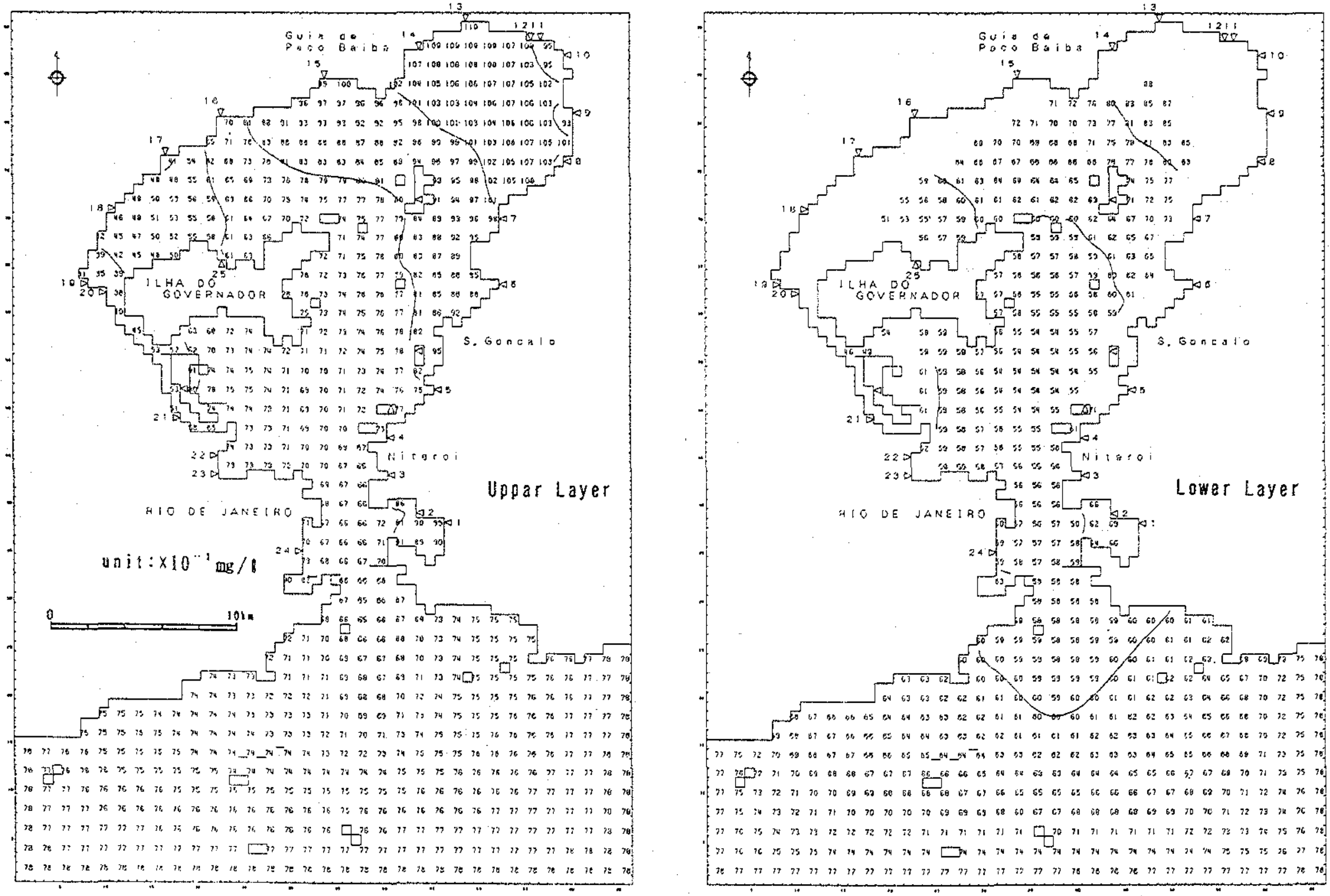



Fig. 5. 3-11(2) Calculated Water Quality in Case 5-1 (Dredging the Sediment in Block C in 2010)
(DO)

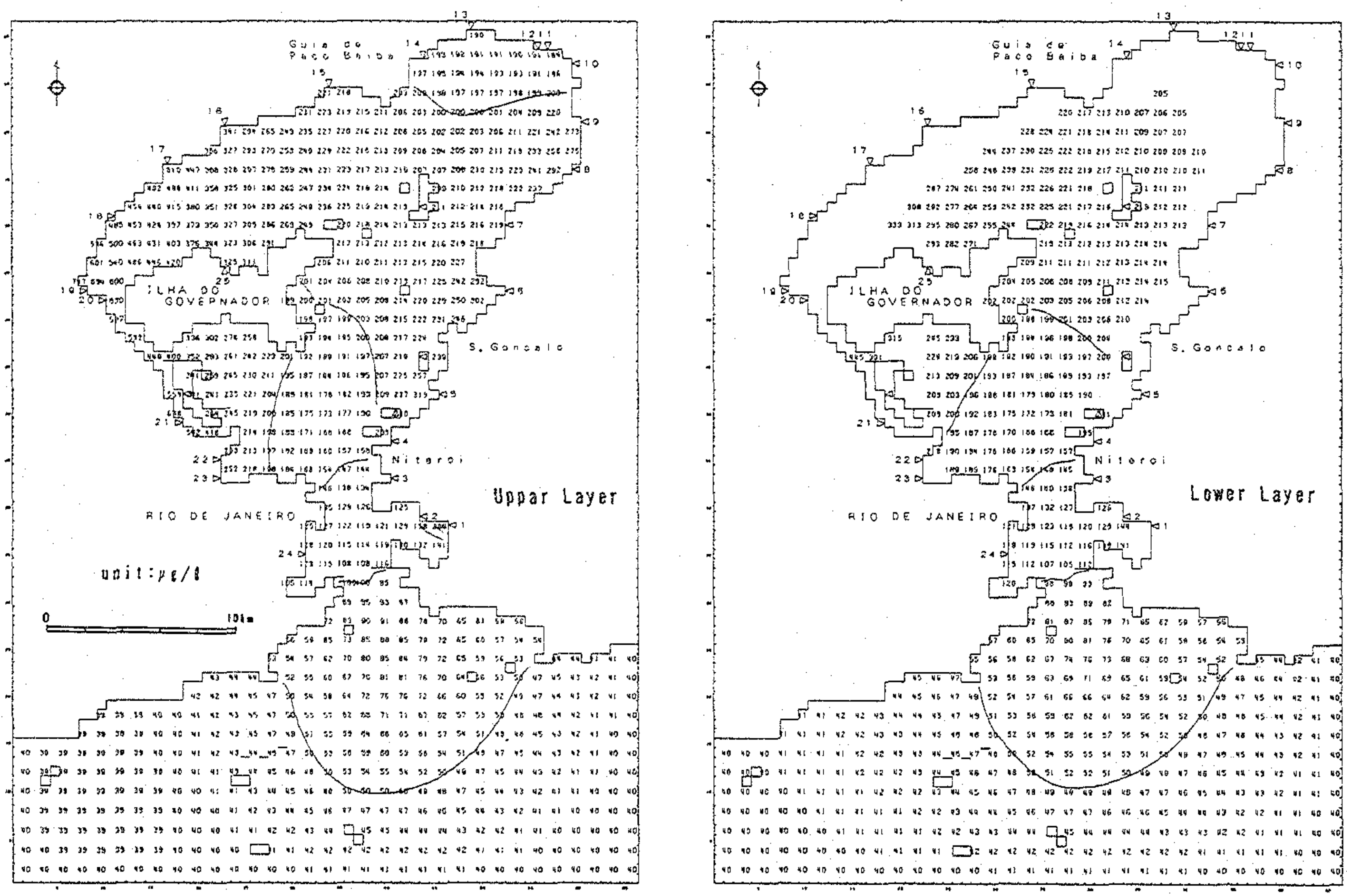
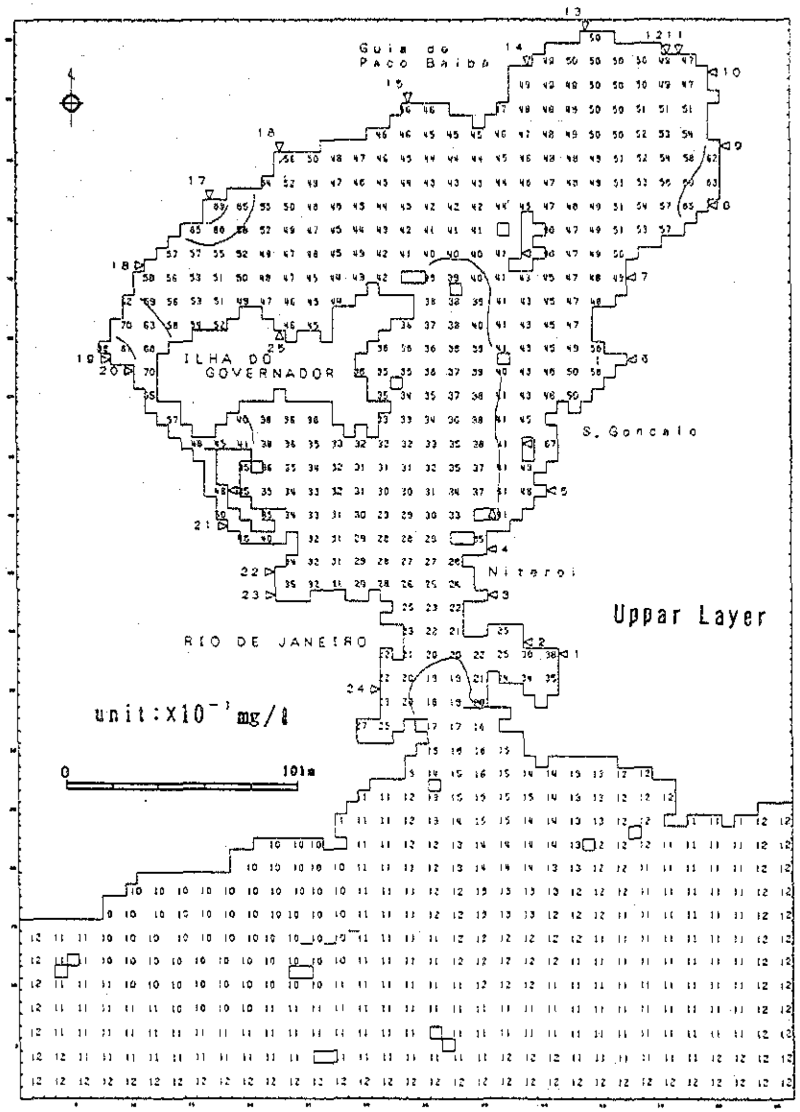



Fig. 5.3-11(3) Calculated Water Quality in Case 5-1 (Dredging the Sediment in Block C in 2010) (T-P)



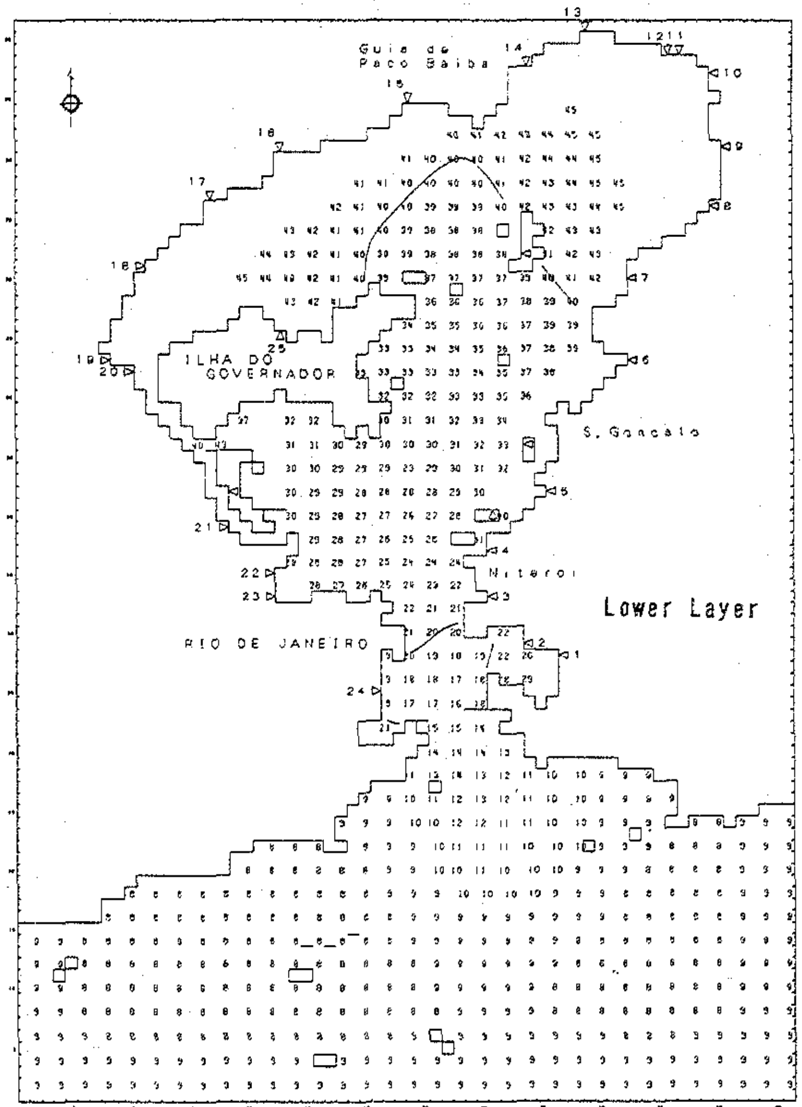




Fig. 5.3-12(1) Calculated Water Quality in Case 5-2 (Dredging the Sediment in Block D in 2010)
(BOD)