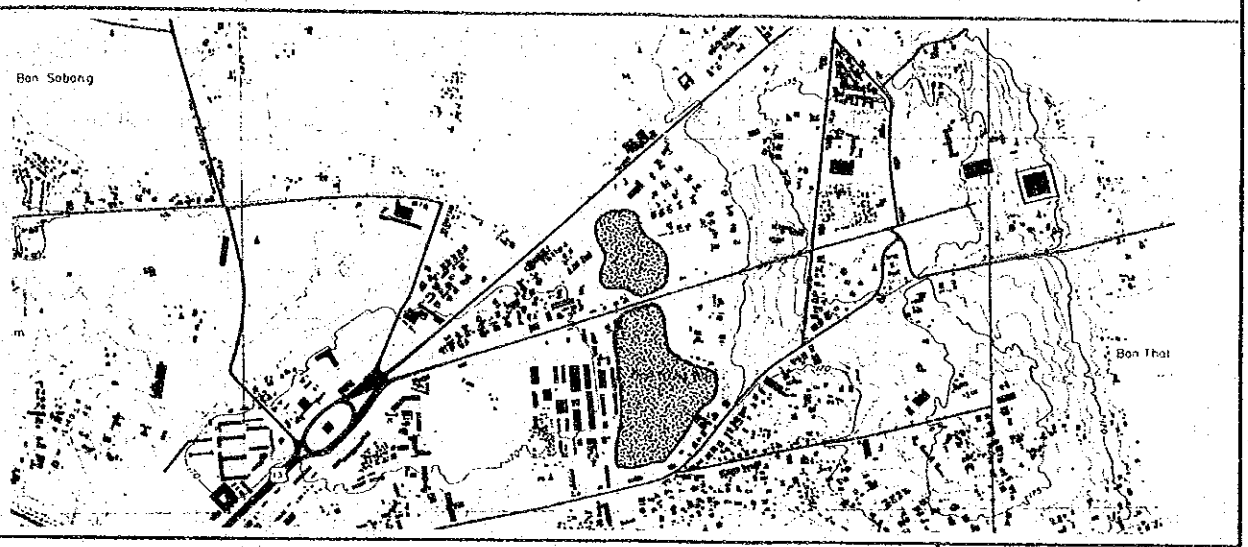
Karte (or Chart) of Waterfront Environmental Survey No.8 Name of River (Nong Bon )




·The waterfront area of the marsh is providing a fine environment for the children to play.

| Present Aspect | | Problems, etc. |
|---|---|---|
| Waterfront Area | River Valley Area | |
| ·The waterhead of the pond is consisting of rain water and city drainage water.<br>·Its water quality is better than that of Nam Psak.<br>·The space of the pond is about 5ha and the water depth is about one meter as average.<br>·The waterfront area is overgrown with water grass and weed presenting the aspect of a natural marsh area. | ·Green belt and residential areas.<br>·There are plants, markets, temples, etc.<br>·It is easier to access to the waterfront area.<br>·The development potential is higher in the waterfront area. | ·The deterioration of the water quality due to the flow of the city drainage water.<br>·The development of housing program. |

# APPENDIX C

# WATER QUALITY

# APPENDIX C. WATER QUALITY

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## C.1. Objectives

The objectives of the water quality survey are summarized as below;

- to collect the existing water quality data
- to survey the river water quality in the Study area
- to assess the existing river water quality in the Study area
- to designate the future river water quality in the priority project area
- to recommend an optimum water quality conservation measure.

## C.2 Existing Condition

### C.2.1 Collected Data

The analysis of the existing river water quality in the Study area are shown in Table C.1. Fig. C.1 shows the location of monitoring station.

Laboratory of Water Quality Analysis, Department of Irrigation, Ministry of Agriculture and Forestry has conducted the regular monitoring works of water quality for the Mekong river system since 1987. The monitoring has been done by sampling water at various stations once every month. The data at the following stations located in and around the study area were collected, Kaolieo (Mekong), Hong Xeng, Hong Ke, Nong Nieng, Salakham and Houa Khoua. The testing items are comprehensive and useful for the study.

NAM PAPA LAO (Water Supply corporation), Ministry of construction has carried out the surveys for pollutant source of river water . The survey is to identify the contribution of industry and livestock to the water pollution.

The contents of collected data are shown in Table C.2 - C.15 and Fig. C.2 - C.4.

### C.2.2 Field Survey and Analysis

The field survey and analysis of water quality were carried out as shown in Table C.16.

The JICA carried out water sampling and analysis during the Study. The sampling and analysis were conducted twice, at the end of dry season (May) and at the end of the rainy season (September). The sample size is about 80. the sampling sites are distributed in the Study area and tallies 20 sites as shown in Fig. C.1.

The result of survey and analysis of water quality shown in Table C.17 - C.20, Fig. C.5. - C.9.

In addition, the existing fauna and flora and the water surface utilization were surveyed to assess the water quality. The surveyed results are listed in Table C.21.

### C.2.3 Assessment

In general, the results of the test indicate that the water quality in terms of COD in the rainy season is improved as compared with that in the dry season. Dilution by rainfall and the consequent increase in run-off might be the reason for the better water quality. As can be seen in Table C.22 the pollutant loads have increased but the increase in run-off exceeded that in the loads.

On the contrary, the relative concentrations of TSS and turbidity were increased in the rainy season. The load which was once silted in the dry season might be transported by the traction force of high flow and be discharged in the run-off.

The concentrations of DO at the sampling sites No. 6,8 and 9 which are located in the urbanized area were improved but that of No. 3 (The Hong Ke) and No. 13 (The Nam Pasak right branch) become worse.

All the samples in the survey of Phase II attested the contamination of coliform. Especially the water sampled at No. 8 and 9 sites showed the infinitive coliform contamination. The poor sanitary condition should be remedied.

The results of water quality test are illustrated in Figs. C.10, C.11 and C.12 together with those average monthly data of the Mekong. The quality of drainage water is poor as compared with that of the Mekong in terms of COD.

However TSS of the Mekong is higher than the drainage water. This proved that the correlation between the qualities of both water has not changed since the dry season.

The result of assessment of water quality is shown in Table C.23 and it is distributed as shown in Fig. C.13.

This table and figure enunciate that the upstream reach of the river in the most urbanized areas is significantly polluted in the Study area. Therefor some measures should be taken to control the water quality.

## C.3 Projection

### C.3.1 General Description

The river water quality in the Study area is affected by the amount of pollutant load generated from domestic and industrial activity and natural load.

The future land use in the Study are is predicted as shown in table C.24. It shows that the ratio or urbanized land use increases more than present due to the increase of population and development of industrial activity, and about one half of the Study area is for residential use.

The population in the Study area, as shown in Table C.25, is over 150,000 in 1988 and is predicted to exceed 300,000 in 2020, in other words, the growth in the said period is twice.

GRDP (Gross Regional Domestic Product), which indicates the index of industrial activity is shown in Table C.26. It indicates that the value of GRDP is 13,543 million Kip in 1988 and is predicted 160,000 million kip in 2020, which is 11 times as much as present.

As mentioned above, the increase of population and development of industry are going on in future causing the increase of domestic waste water, which is the main source of pollutant load in the Study area.

Consequently, in case of lack in execution of some measure, the water quality which is bad even at present, will become worse than present.

### C.3.2 Case Study

#### C.3.2.1 Condition

The future river water quality at the Location No. 3 (Hong Ke) and No. 13 (Nam Pasak) in the Study area, is described as below;

(1) The sources of pollutant load consist of domestic, industrial, institutional, commercial waste water and natural run-off, but in this case they deal with domestic waste water and natural run-off by the following reason;

(a) The main source of pollutant load in the case study area is domestic waste water.

(b) The pollutant load factor and waste water amount are described in the report "THE DISPOSAL OF DOMESTIC WASTE WATER IN URBAN VIENTIANE, S. Sandanam, 1988"

(2) Run-off ratio of pollutant load is same as present.

(3) The target year is 2020 when the goal of "IMPROVEMENT OF DRAINAGE SYSTEM IN VIENTIANE" is complete.

C.3.2.2 Calculation of Future Water Quality

(1) Generated Pollutant Load and Run-off Ratio of Pollutant Load

Table C.27 shows generated pollutant load at present and in future. The run-off ratio of pollutant load was calculated based on the population, catchment area and measurement of run-off load. The result of calculation is shown in Table C.28.

(2) Generated Pollutant Load and Run-off Pollutant Load in Future

The generated pollutant load and run-off pollutant load in future were calculated based on the population, pollutant load factor and run-off ratio of pollutant load. The result of calculation is shown in Table C.29.

(3) Future Discharge and Water Quality

The future water quality was calculated based on the future discharge and run-off pollutant load. The result of calculation is shown in Table C.30.

The future water quality was predicted becoming worse in comparison with present water quality as shown in Table C.31.

### C.3.3 Recommendation of Optimal Water Quality Conservation Measure

The establishment of sewage system needs essentially a temporary measure of water quality conservation, which should be taken until the establishment of sewage system.

This paper recommends some suitable measures for water quality conservation which can be adopted in the river course.

The recommended measures are as follows;

(1) Measures adopted by the Feasibility Study

(a) Purification pack : Screening of suspended solid in the small ditch
(b) Submerged filter : Biofilm process in the secondary canal
(c) Sedimentation box : Removal of sediment in the main canal
(d) Lagoon : Sedimentation and purification in the lagoon "Nong Chanh"

(2) Measure recommended by This Feasibility Study

(a) Intake of water for purification

Moreover, as the existence of natural river bed and cultivation of water plant and fish contributes to the purification of water quality, it should be considered to preserve the function of purification harmonizing with the function of food control.

# TABLES

Table C.1 Content of Existing Water Quality Analysis

| Location | Item | Duration of Collected Date | Interval of Analysis | Organization |
|---|---|---|---|---|
| Kaolieo | Water temperature, electric conductivity, TSS, Ca, Mg, Na, K, Alkalinity, Cl, $SO_4$, T-Fe, $[NO_{3-2}]$-N $NH_4$-N, $PO_4$-P, T-P, Si, DO, CODmn, pH | 1987-1989 | Once a month | L.W.Q.A. |
| Kaolieo | Air and Water temperature, color, odor, Taste, Turbidity, Alkalinity, Ammonia Hydrogen, Nitrite nitrogen, Nitrate nitrogen, pH | 1988 | Generally everyday | Nam Pa Pa Lao |
| Chinaimo | Ditto and, electric conductivity, $NH_4$-N, $KMnO_4$ consumed. | 1988 | Generally everyday | Ditto |
| Nong Nieng | The same as the item of Kaolieo (L.W.Q.A) and T-N | 1986-1989 | Once a month | L.W.Q.A |
| Hong Xeng | Ditto | Ditto | Ditto | Ditto |
| Houa Khoua | Ditto | Ditto | Ditto | Ditto |
| Hong Ke | Ditto | Ditto | Ditto | Ditto |
| Salakham | Ditto | Ditto | Ditto | Ditto |

L.W.Q.A : Laboratory of Water Quality Analysis, Ministry of Agriculture, Forestry, Irrigation and Cooperatives, Department of Irrigation

Nampapa Lao : Ministry of Construction Nampapa Lao Nampapa Department Workshops

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# Table C.2

MEKONG AT VIENTIANE , LAO PDR
SURFACE WATER QUALITY (Kaolieo:L,W,Q,A)

| | Temp [C] | pH | TSS [mg/l] | Cond [mS/M] | Ca [meq/l] | Mg [meq/l] | Na [meq/l] | K [meq/l] | Al [mg/l] | Alk [meq/l] | Cl [meq/l] | SO4 [meq/l] | Total-Fe [mg/l] | (NO3-2)-N [mg/l] | NH4-N [mg/l] | Total-N [mg/l] | PO4-P [mg/l] | Total-P [mg/l] | Si [mg/l] | O2 [mg/l] | COD-MN [MG/L] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 Jan, 87 | 22.4 | 7.7 | 288.0 | 21.1 | 1.216 | .607 | .357 | .052 | | 1.706 | .109 | .425 | .169 | .124 | .062 | | .014 | .016 | 4.700 | 7.900 | 1.8 |
| 17 Feb, 87 | 22.8 | 8.0 | 72.0 | 24.3 | 1.494 | .593 | .396 | .041 | | 1.932 | .235 | .388 | .068 | .001 | .018 | | .005 | .008 | 7.400 | .669 | .6 |
| 17 Mar, 87 | 26.4 | 8.0 | 284.0 | 25.4 | 1.479 | .638 | .400 | .047 | | 1.904 | .030 | .652 | | .043 | | | .003 | .005 | 7.300 | 7.469 | 1.5 |
| 21 Apr, 87 | 27.6 | 7.8 | | 30.1 | 1.650 | .810 | .670 | .048 | | 2.154 | .389 | .625 | .023 | .060 | .018 | | .025 | .020 | 6.800 | 7.000 | 2.1 |
| 18 May, 87 | 32.0 | 8.1 | | 28.7 | 1.592 | .635 | .735 | .051 | | 1.943 | .420 | .679 | .021 | .164 | .016 | | .087 | .140 | 6.200 | 6.820 | 1.2 |
| 16 Jun, 87 | 29.2 | 7.8 | | 26.2 | 1.700 | .349 | .600 | .050 | | 1.787 | .327 | .546 | .334 | .311 | .032 | | .098 | .129 | 6.300 | 6.440 | 1.4 |
| 15 Jul, 87 | 28.8 | 8.1 | | 23.3 | 1.350 | .319 | .374 | .051 | | 1.713 | .193 | .532 | .440 | .290 | .025 | | .121 | .104 | 5.700 | 6.842 | 1.0 |
| 14 Aug, 87 | 28.6 | 7.8 | | 19.3 | 1.360 | .361 | .244 | .051 | | 1.618 | .120 | .386 | .123 | .313 | .005 | | .160 | .247 | 4.880 | 6.850 | .7 |
| 14 Sep, 87 | 28.2 | 7.1 | 1,092.0 | 19.8 | .900 | .780 | .234 | .053 | | 1.549 | .095 | .337 | .033 | .197 | .004 | | .045 | .085 | 5.600 | 6.370 | 1.8 |
| 16 Oct, 87 | 26.6 | 7.6 | 520.0 | 19.3 | 1.060 | .888 | .244 | .040 | | 1.867 | .075 | .390 | .024 | .140 | .009 | | .350 | .092 | 7.100 | 6.960 | 1.2 |
| 16 Nov, 87 | 25.2 | 8.2 | 1,272.0 | 20.3 | 1.060 | .910 | .309 | .041 | | 1.716 | .127 | .408 | .048 | .121 | .025 | | .020 | .190 | 5.800 | 7.290 | 1.2 |
| 22 Dec, 87 | 21.2 | 7.3 | 258.0 | 24.1 | 1.620 | .424 | .365 | .038 | | 1.936 | .163 | .490 | .027 | .236 | .004 | | .039 | .085 | 6.550 | 9.290 | 6.6 |
| 13 Jan, 88 | 21.8 | 7.6 | 110.0 | 24.7 | 1.080 | 1.007 | .344 | .037 | | 1.962 | .250 | .425 | .002 | .198 | .006 | | .029 | .031 | | 8.500 | 1.1 |
| 22 Feb, 88 | 24.0 | 8.3 | 36.0 | 27.3 | 1.602 | .672 | .486 | .040 | | 2.089 | .241 | .533 | .040 | .084 | | | .017 | .044 | | 7.840 | .6 |
| 14 Mar, 88 | 26.4 | 8.4 | 48.0 | 27.3 | 1.718 | .591 | .482 | .056 | | 2.088 | .188 | .641 | | .197 | .006 | | .024 | .027 | | 5.620 | 1.1 |
| 11 Apr, 88 | 27.6 | 8.2 | 360.0 | 30.2 | 1.520 | 1.023 | .550 | .055 | | 2.116 | .340 | .660 | .101 | .978 | .018 | | .028 | .071 | 5.900 | 7.440 | .2 |
| 16 May, 88 | 29.6 | 7.7 | 468.0 | 23.4 | 1.424 | .469 | .360 | .052 | | 1.662 | .326 | .444 | .044 | .395 | .034 | | .066 | .081 | 5.700 | 6.790 | 1.3 |
| 13 Jun, 88 | 28.4 | 8.2 | 260.0 | 20.8 | 1.402 | .345 | .290 | .041 | | 1.867 | .175 | .326 | .029 | .255 | .054 | | .032 | .025 | 5.300 | 8.670 | 1.7 |
| 14 Jul, 88 | 27.8 | 7.9 | 5,716.0 | 17.7 | | | .205 | .040 | | 1.470 | .117 | .309 | .146 | .239 | .062 | | .080 | .168 | 5.400 | 7.800 | 1.6 |
| 14 Aug, 88 | .0 | .0 | | | | | | | | | | | | | | | | | | | .0 |
| 15 Aug, 88 | 26.2 | 7.9 | 4,074.0 | 17.0 | | | .185 | .036 | | 1.508 | .061 | .233 | .060 | .271 | .033 | | .150 | .156 | 6.000 | 6.670 | 1.6 |
| 13 Sep, 88 | 27.2 | 7.7 | 2,754.0 | 19.5 | 1.186 | .374 | .200 | .032 | | 1.470 | .074 | .289 | .067 | .237 | .039 | | .033 | .039 | 6.600 | 6.700 | 2.6 |
| 18 Oct, 88 | 26.0 | 7.9 | 988.0 | 18.0 | 1.194 | .358 | .240 | .044 | | 1.521 | .092 | .342 | 1.922 | .232 | .005 | | .039 | .146 | 6.300 | 9.000 | 1.9 |
| 17 Nov, 88 | 22.8 | 8.1 | 360.0 | 18.6 | 1.403 | .517 | .305 | .030 | | 1.791 | .135 | .448 | .227 | .207 | .018 | | .039 | .046 | 6.600 | 7.860 | .8 |
| 19 Dec, 88 | 22.4 | 8.1 | 104.0 | 22.0 | 1.814 | .275 | .395 | .035 | | 1.921 | .127 | .608 | | .172 | .024 | | .125 | .076 | 7.400 | 8.400 | 1.7 |
| 17 Jan, 89 | 21.8 | 8.2 | 72.0 | 23.3 | 2.030 | .117 | .470 | .012 | | 1.995 | .213 | .540 | .174 | .114 | .023 | | .041 | .041 | 7.000 | 10.200 | .5 |
| 15 Feb, 89 | 22.8 | 8.2 | 25.0 | 25.7 | 1.919 | .298 | .445 | .022 | | 1.968 | .252 | .465 | .235 | .137 | .016 | | .030 | .030 | 6.970 | 8.430 | .0 |
| 15 Mar, 89 | 23.8 | 8.2 | 9.0 | 29.1 | 2.130 | .253 | .600 | .032 | | 1.930 | .271 | .699 | .127 | .090 | .046 | | .047 | .019 | 9.500 | 10.200 | -1.2 |
| 24 Apr, 89 | 26.0 | 8.2 | 1.0 | 30.4 | 2.114 | .308 | .550 | .056 | | 1.955 | .357 | .706 | .078 | .003 | .018 | | .025 | .032 | 7.300 | | .6 |
| 17 May, 89 | 28.6 | 8.0 | 70.0 | 24.8 | 1.502 | .516 | .550 | .053 | | 1.736 | .384 | .623 | .296 | .267 | .035 | | 1.105 | .019 | 6.300 | 8.474 | 2.0 |

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Table C.3 Existing Water Quality Data (Mean Maximum

Location;KAOLIEO (L,W,Q,A )

| Year | Item | Temp C | PH | TSS mg | Cond mS/M | Ca meq/l | Mg meq/l | Na meq/l | K meq/l | Alk meq/l | Cl meq/l | SO4 meq/l | Total Fe mg/l | (NO3 -2)-N mg/l | NH4 -N mg/l | Total -n mg/l | PO4 -P mg/l | Total -P mg/l | Si mg/l | O2 mg/l | COD -MN mg/l |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | 26.6 | 7.8 | 203.5 | 23.5 | 1.400 | 0.626 | 0.409 | 0.047 | 1.818 | 0.190 | 0.488 | 0.119 | 0.166 | 0.019 | | 0.080 | 0.093 | 6.194 | 6.650 | 1.8 |
| 1987 | Max. | 32.0 | 8.2 | 1272.0 | 30.1 | 1.700 | 0.910 | 0.735 | 0.053 | 2.154 | 0.420 | 0.679 | 0.440 | 0.313 | 0.062 | | 0.350 | 0.247 | 7.400 | 9.290 | 6.6 |
| | Min. | 21.2 | 7.1 | 72.0 | 19.3 | 0.900 | 0.349 | 0.234 | 0.038 | 1.549 | 0.075 | 0.337 | 0.021 | 0.001 | 0.004 | | 0.003 | 0.005 | 4.700 | 0.669 | 0.6 |
| | Mean | 25.9 | 8.0 | 220.2 | 22.2 | 1.434 | 5.631 | 0.337 | 0.042 | 1.788 | 0.177 | 0.438 | 0.264 | 0.213 | 0.027 | | 0.055 | 0.075 | 6.133 | 7.607 | 1.3 |
| 1988 | Max. | 29.6 | 8.4 | 5716.0 | 30.2 | 1.814 | 1.023 | 0.550 | 0.056 | 2.116 | 0.340 | 0.660 | 1.922 | 0.395 | 0.062 | | 0.150 | 0.168 | 7.400 | 9.000 | 2.6 |
| | Min. | 21.8 | 7.6 | 36.0 | 17.0 | 1.080 | 0.275 | 0.200 | 0.030 | 1.470 | 0.061 | 0.233 | 0.002 | 0.780 | 0.005 | | 0.017 | 0.025 | 5.300 | 5.620 | 0.0 |
| ※ | Mean | 24.6 | 8.2 | 35.4 | 26.7 | 1.939 | 0.301 | 0.523 | 0.035 | 1.917 | 0.295 | 0.607 | 0.182 | 0.122 | 0.028 | | 0.250 | 0.028 | 7.414 | 9.326 | 0.9 |
| 1989 | Max. | 28.6 | 8.2 | 72.0 | 30.4 | 2.130 | 0.516 | 0.600 | 0.056 | 1.995 | 0.384 | 0.706 | 0.296 | 0.267 | 0.046 | | 1.105 | 0.041 | 9.500 | 10.200 | 2.0 |
| | Min. | 21.8 | 8.0 | 1.0 | 23.3 | 1.502 | 0.117 | 0.445 | 0.012 | 1.736 | 0.213 | 0.465 | 0.078 | 0.003 | 0.016 | | 0.025 | 0.019 | 6.300 | 8.430 | 0.0 |
| | Mean | 25.7 | 7.9 | 648.8 | 22.7 | 1.286 | 0.412 | 0.345 | 0.042 | 1.791 | 0.178 | 0.432 | 0.166 | 0.134 | 0.022 | | 0.071 | 0.068 | 4.808 | 7.231 | 1.5 |
| TOTAL | Max. | 32.0 | 8.4 | 5716.0 | 30.4 | 2.130 | 1.023 | 0.735 | 0.070 | 2.219 | 0.420 | 1.020 | 1.922 | 0.395 | 0.062 | | 1.105 | 0.247 | 9.500 | 10.200 | 6.6 |
| | Min. | 21.2 | 7.1 | 1.0 | 17.0 | 0.900 | 0.117 | 0.200 | 0.012 | 1.470 | 0.061 | 0.233 | 0.002 | 0.001 | 0.004 | | 0.003 | 0.005 | 4.700 | 0.669 | 0.0 |

* -1989: from Jan. to May

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Table C.4 (1) Water Quality at Kaolieo (Nam papa Lao) in year 1988 (1)

| Jan. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Atmosphere temperature | C | 18 | 15 | 20 | 19 | 16 | 20 | 19 | 16 | 22 | 19 | 18 | 21 | 19 | 16 | 24 |
| Water temperature | C | 17 | 13 | 19 | 17 | 15 | 19 | 17 | 15 | 19 | 17 | 16 | 21 | 17 | 14 | 22 |
| Turbidity | ppm | 74 | 72 | 76 | 73 | 72 | 119 | 97 | 89 | 67 | 67 | 69 | 57 | 53 | 70 | 51 |
| Alkalinity | ppm | 76 | 120 | 90 | 78 | 120 | 87 | 80 | 100 | 90 | 80 | 100 | 98 | 80 | 120 | 88 |
| Residual chlorine | ppm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| pH | | 7.3 | 7.5 | 7.4 | 7.3 | 7.5 | 7.4 | 7.4 | 7.5 | 7.5 | 7.3 | 7.6 | 7.4 | 7.3 | 7.5 | 7.4 |
| Color | ppm | 2 | 11 | 6 | 2 | 10 | 8 | 2 | 5 | 4 | 2 | 11 | 5 | 3 | 11 | 8 |

| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | mean | max. | min. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18 | 24 | 23 | 19 | 18 | 20 | 20 | 18 | 21 | 20 | 18 | 25 | 23 | 21 | 18 | 21 | 20 | 25 | 15 |
| 17 | 25 | 21 | 17 | 16 | 19 | 17 | 16 | 20 | 17 | 16 | 24 | 21 | 17 | 17 | 20 | 18 | 25 | 13 |
| 50 | 318 | 44 | 46 | 68 | 59 | 49 | 41 | 37 | 37 | 35 | 1 | 34 | 30 | 35 | 38 | 65 | 318 | 1 |
| 78 | 100 | 84 | 80 | 100 | 90 | 80 | 95 | 85 | 82 | 80 | 85 | 94 | 84 | 90 | 90 | 90 | 120 | 76 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.1 | 0 | 0 | 0 | 0 | 0.0 | 0.1 | 0 |
| 7.3 | 7.5 | 7.4 | 7.3 | 7.5 | 7.4 | 7.3 | 7.5 | 7.4 | 7.3 | 7.5 | 7.3 | 7.4 | 7.3 | 7.5 | 7.4 | 7.4 | 7.6 | 7.3 |
| 3 | 18 | 8 | 3 | 13 | 5 | 2 | 4 | 4 | 2 | 4 | 0 | 5 | 2 | 3 | 4 | 5 | 18 | 0 |

| Feb. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Atmosphere temperature | C | 20 | 23 | 22 | 20 | 26 | 22 | 20 | 22 | 22 | 23 | 20 | 25 | 24 | 23 | 24 |
| Water temperature | C | 18 | 21 | 17 | 18 | 24 | 17 | 21 | 21 | 17 | 21 | 21 | 22 | 17 | 21 | 23 |
| Turbidity | ppm | 39 | 40 | 44 | 35 | 30 | 22 | 24 | 31 | 19 | 1 | 19 | 23 | 22 | 22 | 22 |
| Alkalinity | ppm | 100 | 87 | 80 | 90 | 98 | 82 | 100 | 100 | 80 | 80 | 120 | 98 | 80 | 100 | 90 |
| Residual chlorine | ppm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.01 | 0.01 | 0 | 0 | 0 | 0 |
| pH | | 7.6 | 7.4 | 7.3 | 7.5 | 7.4 | 7.3 | 7.5 | 7.4 | 7.3 | 7.3 | 7.5 | 7.4 | 7.3 | 7.5 | 7.4 |
| Color | ppm | 0 | 5 | 2 | 4 | 4 | 2 | 3 | 5 | 2 | 0 | 3 | 4 | 2 | 3 | 4 |

| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | mean | max. | min. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 28 | 25 | 20 | 20 | 18 | 21 | 20 | 21 | 23 | 23 | 24 | 23 | 23 | 27 | | | 22 | 28 | 18 |
| 17 | 24 | 17 | 18 | 21 | 17 | 18 | 19 | 17 | 21 | 25 | 17 | 21 | 26 | | | 20 | 26 | 17 |
| 19 | 18 | 15 | 17 | 11 | 19 | 17 | 19 | 15 | 16 | 31 | 19 | 16 | 24 | | | 22 | 44 | 1 |
| 82 | 85 | 78 | 120 | 91 | 28 | 180 | 100 | 80 | 100 | 94 | 80 | 100 | 95 | | | 93 | 180 | 28 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | 0.00 | 0.01 | 0 |
| 7.3 | 7.4 | 7.3 | 7.5 | 7.4 | 7.3 | 7.5 | 7.4 | 7.3 | 7.5 | 7.3 | 7.3 | 7.5 | 7.3 | | | 7.4 | 7.6 | 7.3 |
| 2 | 4 | 2 | 3 | 4 | 2 | 3 | 3 | 2 | 3 | 4 | 2 | 3 | 5 | | | 3 | 5 | 0 |

| Mar. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Atmosphere temperature | C | 22 | 23 | 24 | 19 | 21 | 21 | 18 | 20 | 20 | 21 | 21 | 25 | 25 | 28 | 26 |
| Water temperature | C | 17 | 21 | 22 | 17 | 20 | 23 | 17 | 18 | 22 | 17 | 20 | 21 | 20 | 26 | 24 |
| Turbidity | ppm | 16 | 16 | 16 | 12 | 16 | 27 | 10 | 14 | 21 | 18 | 14 | 19 | 14 | 12 | 13 |
| Alkalinity | ppm | 52 | 100 | 98 | 84 | 100 | 95 | 82 | 105 | 94 | 80 | 100 | 92 | 80 | 85 | 91 |
| Residual chlorine | ppm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| pH | | 7.3 | 7.6 | 7.3 | 7.3 | 7.6 | 7.3 | 7.3 | 7.5 | 7.3 | 7.3 | 7.5 | 7.3 | 7.3 | 7.5 | 7.3 |
| Color | ppm | 2 | 3 | 5 | 2 | 3 | 3 | 2 | 4 | 3 | 2 | 4 | 5 | 2 | 3 | 3 |

| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | mean | max. | min. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 | 25 | 24 | 24 | 25 | 28 | 25 | 28 | 26 | 25 | 28 | 27 | 27 | 32 | 27 | 25 | 24 | 32 | 18 |
| 22 | 23 | 24 | 19 | 24 | 27 | 20 | 27 | 25 | 20 | 26 | 26 | 20 | 30 | 26 | 20 | 22 | 30 | 17 |
| 8 | 13 | 11 | 7 | 13 | 10 | 6 | 1 | 10 | 9 | 10 | 11 | 9 | 10 | 14 | 9 | 13 | 27 | 1 |
| 80 | 120 | 99 | 80 | 100 | 86 | 82 | 60 | 81 | 82 | 100 | 85 | 82 | 100 | 90 | 82 | 89 | 120 | 52 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7.3 | 7.5 | 7.3 | 7.3 | 7.5 | 7.3 | 7.3 | 7.2 | 7.3 | 7.3 | 7.6 | 7.3 | 7.3 | 7.5 | 7.3 | 7.3 | 7.4 | 7.6 | 7.2 |
| 2 | 4 | 4 | 2 | 3 | 3 | 0 | 0 | 2 | 2 | 2 | 3 | 2 | 3 | 4 | 2 | 3 | 5 | 0 |

| Apl. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Atmosphere temperature | C | 31 | 29 | 27 | 30 | 30 | 26 | 32 | 27 | 22 | 30 | 28 | 25 | 29 | 28 | 19 |
| Water temperature | C | 30 | 27 | 20 | 28 | 28 | 20 | 29 | 25 | 17 | 28 | 26 | 20 | 28 | 25 | 17 |
| Turbidity | ppm | 13 | 15 | 11 | 14 | 19 | 9 | 12 | 117 | 151 | 145 | 54 | 32 | 38 | 46 | 68 |
| Alkalinity | ppm | 100 | 98 | 80 | 100 | 95 | 80 | 100 | 100 | 82 | 100 | 98 | 80 | 100 | 95 | 82 |
| Residual chlorine | ppm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| pH | | 7.5 | 7.3 | 7.3 | 7.6 | 7.3 | 7.3 | 7.5 | 7.6 | 7.4 | 7.5 | 7.5 | 7.4 | 7.5 | 7.4 | 7.3 |
| Color | ppm | 3 | 6 | 7 | 4 | 4 | 2 | 3 | 10 | 4 | 8 | 10 | 2 | 4 | 5 | 2 |

| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | mean | max. | min. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 28 | 26 | 30 | 27 | 25 | 30 | 29 | 30 | 27 | 27 | 30 | 25 | 22 | 27 | | 27 | 32 | 19 |
| 28 | 26 | 17 | 28 | 26 | 20 | 29 | 26 | 29 | 20 | 20 | 24 | 20 | 21 | 22 | | 24 | 30 | 17 |
| 65 | 113 | 50 | 54 | 44 | 50 | 58 | 31 | 25 | 26 | 68 | 45 | 35 | 30 | 30 | | 49 | 151 | 9 |
| 120 | 89 | 80 | 100 | 91 | 80 | 100 | 93 | 100 | 80 | 80 | 80 | 82 | 80 | 80 | | 91 | 120 | 80 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 |
| 7.5 | 7.6 | 7.3 | 7.5 | 7.5 | 7.3 | 7.5 | 7.5 | 7.5 | | 7.3 | 7.3 | 7.3 | 7.4 | 7.3 | | 7.4 | 7.6 | 7.3 |
| 8 | 13 | 2 | 9 | 7 | 3 | 8 | 8 | 7 | 2 | 2 | 2 | 2 | 2 | 2 | | 5 | 13 | 2 |

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Table C.4 (2) Water Quality at Kaolieo (Nam papa Lao) in year 1988 (2)

| May | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Atmosphere temperature | °C | 27 | 26 | 26 | 23 | 23 | 28 | 27 | | 27 | 26 | 24 | 26 | 25 | 28 | 30 |
| Water temperature | °C | 27 | 26 | 24 | 26 | 22 | 26 | 26 | | 28 | 26 | 26 | 26 | 27 | 26 | 28 |
| Turbidity | ppm | 37 | 53 | 47 | 35 | 58 | 55 | 78 | | 99 | 103 | 191 | 140 | 153 | 170 | 183 |
| Alkalinity | ppm | 89 | 80 | 82 | 84 | 82 | 80 | 84 | | 84 | 82 | 84 | 80 | 82 | 84 | 180 |
| Residual chlorine | ppm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| pH | | 7.5 | 7.3 | 7.4 | 7.4 | 7.3 | 7.3 | 7.4 | | 7.3 | 7.3 | 7.3 | 7 | 7.3 | 7.4 | 7.5 |
| Color | ppm | 5 | 2 | 2 | 2 | 2 | 2 | 2 | | 4 | 4 | 11 | 40 | 44 | 58 | 13 |

| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | mean | max. | min. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24 | 25 | 28 | 29 | 30 | 30 | 31 | 32 | 30 | 31 | 32 | 26 | 32 | 29 | 29 | 29 | 28 | 32 | 23 |
| 26 | 27 | 27 | 28 | 29 | 29 | 28 | 27 | 29 | 28 | 28 | 28 | 29 | 28 | 28 | 28 | 27 | 29 | 22 |
| 250 | 234 | 245 | 283 | 210 | 228 | 206 | 155 | 143 | 140 | 136 | 108 | 89 | 95 | 102 | 174 | 140 | 283 | 35 |
| 84 | 86 | | | | 100 | 101 | | | | | | | | | | 90 | 180 | 80 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7.4 | 7.2 | 7.2 | 7.3 | 7.3 | 7.5 | 7.6 | 7.3 | 7.2 | 7.2 | 7.3 | 7.3 | 7.3 | 7.3 | 7.2 | 7.3 | 7.3 | 7.6 | 7.0 |
| 100 | 30 | 26 | 48 | 22 | 18 | 15 | 17 | 23 | 22 | 25 | 24 | 14 | 20 | 38 | 34 | 22 | 100 | 2 |

| June | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Atmosphere temperature | °C | 27 | 26 | 25 | 28 | 25 | 26 | 27 | 28 | 27 | 30 | 30 | 30 | 28 | 25 | 27 |
| Water temperature | °C | 28 | 28 | 26 | 28 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 29 | 27 | 27 | 27 |
| Turbidity | ppm | 229 | 223 | 150 | 159 | 320 | 323 | 320 | 330 | 297 | 160 | 119 | 145 | 134 | 140 | 128 |
| Alkalinity | ppm | | | | | | | | | | | | 98 | | | |
| Residual chlorine | ppm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| pH | | 7.2 | 7.2 | 7.2 | 7.3 | 7.3 | 7.1 | 7.2 | 7.1 | 7.3 | 7.2 | 7.3 | 7.6 | 7.2 | 7.2 | 7.2 |
| Color | ppm | 57 | 49 | 23 | 43 | 24 | 24 | 43 | 45 | 27 | 34 | 24 | 20 | 26 | 17 | 9 |

| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | mean | max. | min. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 28 | 29 | 23 | 23 | 22 | 28 | 28 | 30 | 30 | 29 | 28 | 29 | 30 | 29 | 27 | | 27 | 30 | 22 |
| 27 | 27 | 27 | 27 | 27 | 27 | 27 | 29 | 28 | 27 | 27 | 28 | 27 | 27 | 27 | | 27 | 29 | 26 |
| 120 | 115 | 131 | 120 | 100 | 92 | 83 | 110 | 100 | 84 | 80 | 79 | 90 | 170 | 160 | | 160 | 330 | 79 |
| | | | | | | | | | | 100 | | | | | | 99 | 100 | 98 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 |
| 7.2 | 7.2 | 7.2 | 7.3 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.5 | 7.2 | 7.3 | 7.2 | 7.2 | | 7.2 | 7.6 | 7.1 |
| 18 | 18 | 32 | 20 | 11 | 19 | 17 | 19 | 20 | 31 | 13 | 14 | 12 | 23 | 10 | | 25 | 57 | 9 |

| July | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Atmosphere temperature | °C | 26 | 26 | 29 | 26 | 25 | 25 | 26 | 30 | 30 | 30 | 26 | 24 | 24 | 28 | 29 |
| Water temperature | °C | 27 | 27 | 27 | 25 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 |
| Turbidity | ppm | 220 | 305 | 530 | 598 | 590 | 600 | 585 | 500 | 589 | 870 | 1030 | 1040 | 525 | 353 | 354 |
| Alkalinity | ppm | | | 100 | | | | | | | | | | | | |
| Residual chlorine | ppm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| pH | | 7.2 | 7.2 | 7.6 | 7.3 | 7.3 | 7.3 | 7.4 | 7.3 | 7.3 | 7.3 | 7.4 | 7.4 | 7.3 | 7.2 | 7.3 |
| Color | ppm | 13 | 35 | 24 | 42 | 45 | 63 | 40 | 46 | 14 | 24 | 20 | 107 | 15 | 14 | 17 |

| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | mean | max. | min. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24 | | 26 | 30 | 30 | 26 | 24 | 30 | 30 | 28 | 25 | 20 | 30 | 28 | 29 | 29 | 27 | 30 | 20 |
| 27 | | 27 | 28 | 28 | 28 | 27 | 27 | 29 | 27 | 27 | 27 | 27 | 27 | 27 | 26 | 27 | 29 | 25 |
| 328 | | 308 | 335 | 310 | 310 | 364 | 528 | 300 | 353 | 354 | 418 | 518 | 760 | 780 | 800 | 515 | 1040 | 220 |
| | | | | | | | | 96 | | | | | | | | 98 | 100 | 96 |
| 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 0 | 12 | 0 |
| 7.3 | | 7.2 | 7.2 | 7.2 | 7.2 | 7.3 | 7.3 | 7.6 | 7.2 | 7.3 | 7.2 | 7.2 | 7.2 | 7.3 | 7.1 | 7.3 | 7.6 | 7.1 |
| 5 | | 21 | 8 | 32 | 18 | 35 | 41 | 13 | 50 | 74 | 47 | 18 | 18 | 22 | 18 | 31 | 107 | 5 |

| Aug. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Atmosphere temperature | °C | 29 | 26 | 26 | 29 | 28 | 28 | 26 | 25 | 28 | 26 | 28 | 27 | 30 | 30 | 24 |
| Water temperature | °C | 27 | 27 | 27 | 28 | 27 | 27 | 25 | 26 | 27 | 27 | 27 | 26 | 27 | 28 | 27 |
| Turbidity | ppm | 885 | 868 | 675 | 965 | 1044 | 998 | 680 | 887 | 900 | 755 | 881 | 985 | 1042 | 940 | 932 |
| Alkalinity | ppm | | | | | | | 100 | | | | | | | | |
| Residual chlorine | ppm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| pH | | 7.3 | 7.2 | 7.3 | 7.2 | 7.4 | 7.4 | 7.5 | 7.3 | 7.2 | 7.2 | 7.2 | 7.3 | 7.4 | 7.6 | 7.2 |
| Color | ppm | 14 | 17 | 16 | 10 | 160 | 92 | 18 | 50 | 258 | 21 | 19 | 22 | 120 | 90 | 100 |

| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | mean | max. | min. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | 24 | 21 | 23 | 23 | 25 | 24 | 26 | 28 | 25 | 27 | 29 | 25 | 25 | 24 | 24 | 26 | 30 | 21 |
| 27 | 27 | 27 | 27 | 27 | 22 | 27 | 27 | 27 | 27 | 27 | 27 | 26 | 27 | 27 | 27 | 27 | 28 | 22 |
| 972 | 843 | 970 | 974 | 852 | 120 | 560 | 474 | 544 | 505 | 515 | 471 | 480 | 533 | 476 | 466 | 748 | 1044 | 120 |
| | | | | | | | | | | | | 100 | | | | 100 | 100 | 100 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7.3 | 7.3 | 7.2 | 7.2 | 7.3 | 7.2 | 7.2 | 7.3 | 7.2 | 7.4 | 7.2 | 7.2 | 7.5 | 7.3 | 7.2 | 7.3 | 7.3 | 7.6 | 7.2 |
| 120 | 100 | 110 | 140 | 100 | 15 | 31 | 21 | 98 | 29 | 57 | 20 | 18 | 63 | 39 | 69 | 66 | 258 | 10 |

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Table C.4 (3) Water Quality at Kaolieo (Nam papa Lao) in year 1988 (3)

| Sept. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Atmosphere temperature | °C | 27 | 28 | 29 | 32 | 24 | 27 | 24 | 27 | 29 | 29 | 31 | 26 | 29 | 26 | 28 |
| Water temperature | °C | 27 | 27 | 27 | 29 | 27 | 27 | 27 | 27 | 27 | 27 | 28 | 27 | 27 | 27 | 27 |
| Turbidity | ppm | 644 | 706 | 1017 | 701 | 583 | 449 | 335 | 298 | 298 | 354 | 350 | 407 | 296 | 287 | 562 |
| Alkalinity | ppm | | | | | | | | | | | | | | 64 | 44 |
| Residual chlorine | ppm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| pH | | 7.3 | 7.3 | 7.4 | 7.6 | 7.3 | 7.2 | 7.3 | 7.2 | 7.3 | 7.2 | 7.0 | 7.3 | 7.2 | 7.2 | 7.3 |
| Color | ppm | 99 | 49 | 130 | 90 | 139 | 57 | 62 | 33 | 19 | 29 | 28 | 21 | 31 | 13 | 15 |

| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | mean | max. | min. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 29 | 26 | 28 | 28 | 26 | 29 | 28 | 26 | 28 | 27 | 26 | 27 | 25 | 29 | 29 | | 28 | 32 | 24 |
| 27 | 27 | 29 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | | 27 | 29 | 27 |
| 758 | 754 | 763 | 600 | 655 | 612 | 591 | 668 | 844 | 480 | 450 | 341 | 312 | 313 | 315 | | 525 | 1017 | 287 |
| 54 | 52 | 100 | 62 | 64 | 64 | 66 | 62 | 66 | 64 | 68 | 62 | 66 | 74 | 70 | | 65 | 100 | 44 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 |
| 7.3 | 7.2 | 7.5 | 7.3 | 7.3 | 7.2 | 7.2 | 7.2 | 7.3 | 7.3 | 7.4 | 7.3 | 7.4 | 7.4 | 7.3 | | 7.3 | 7.6 | 7.0 |
| 7 | 8 | 18 | 27 | 12 | 12 | 14 | 4 | 22 | 9 | 8 | 7 | 3 | 5 | 3 | | 32 | 139 | 3 |

| Oct. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Atmosphere temperature | °C | 29 | 28 | 26 | 28 | 26 | 26 | 24 | 28 | 28 | 26 | 26 | 24 | 26 | 24 | 24 |
| Water temperature | °C | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 |
| Turbidity | ppm | 319 | 250 | 238 | 303 | 618 | 620 | 600 | 560 | 578 | 360 | 720 | 392 | 620 | 461 | 476 |
| Alkalinity | ppm | 68 | 66 | 68 | 64 | 68 | 62 | 72 | 66 | 180 | 72 | 68 | 66 | 64 | 66 | 64 |
| Residual chlorine | ppm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| pH | | 7.3 | 7.3 | 7.3 | 7.3 | 7.4 | 7.3 | 7.4 | 7.4 | 7.5 | 7.3 | 7.3 | 7.4 | 7.4 | 7.4 | 7.3 |
| Color | ppm | 8 | 4 | 3 | 5 | 6 | 5 | 6 | 6 | 19 | 5 | 7 | 7 | 51 | 26 | 13 |

| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | mean | max. | min. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | 24 | 24 | 24 | 27 | 28 | 27 | 28 | 24 | 25 | 28 | 29 | 29 | 26 | 25 | 23 | 26 | 29 | 23 |
| 28 | 27 | 27 | 27 | 26 | 27 | 26 | 24 | 27 | 27 | 27 | 27 | 27 | 27 | 23 | 24 | 27 | 28 | 23 |
| 350 | 384 | 330 | 538 | 600 | 805 | 337 | 250 | 198 | 192 | 190 | 250 | 232 | 277 | 258 | 150 | 402 | 805 | 150 |
| 89 | 68 | 66 | 68 | 66 | 68 | | 64 | 62 | 72 | 68 | 62 | 64 | 66 | 100 | 66 | 72 | 180 | 62 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7.5 | 7.3 | 7.3 | 7.4 | 7.4 | 7.3 | 7.6 | 7.3 | 7.3 | 7.3 | 7.3 | 7.2 | 7.3 | 7.2 | 7.5 | 7.3 | 7.3 | 7.6 | 7.2 |
| 18 | 6 | 3 | 2 | 6 | 4 | 10 | 5 | 3 | 3 | 3 | 3 | 3 | | 18 | | 9 | 51 | 2 |

| Nov. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Atmosphere temperature | °C | 25 | 25 | 24 | 25 | 24 | 26 | 20 | 20 | 19 | 19 | 19 | 19 | 20 | 19 | 20 |
| Water temperature | °C | 27 | 26 | 26 | 26 | 26 | 27 | 21 | 21 | 21 | 22 | 21 | 21 | 22 | 22 | 22 |
| Turbidity | ppm | 150 | 250 | 215 | 231 | 250 | 210 | 156 | 133 | 124 | 115 | 104 | 93 | 30 | 80 | 79 |
| Alkalinity | ppm | 62 | 64 | 66 | 68 | 62 | | 68 | 62 | 66 | 64 | 66 | 64 | 62 | 62 | 64 |
| Residual chlorine | ppm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| pH | | 7.3 | 7.3 | 7.3 | 7.2 | 7.2 | 7.6 | 7.3 | 7.3 | 7.2 | 7.3 | 7.3 | 7.2 | 7.2 | 7.2 | 7.3 |
| Color | ppm | 3 | 2 | 2 | 20 | 32 | 19 | 20 | 14 | 9 | 7 | 7 | 6 | 5 | 5 | 5 |

| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | mean | max. | min. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 | 22 | 20 | 20 | 21 | 18 | 20 | 20 | 22 | 22 | 22 | 18 | 21 | 21 | 19 | | 21 | 26 | 18 |
| 23 | 23 | 24 | 23 | 20 | 20 | 22 | 23 | 23 | 24 | 24 | 19 | 22 | 22 | 22 | | 23 | 27 | 19 |
| 79 | 82 | 72 | 71 | 68 | 76 | 84 | 84 | 83 | 83 | 82 | 88 | 82 | 65 | 58 | | 113 | 250 | 30 |
| 64 | 66 | 64 | 64 | 100 | 66 | 62 | 66 | 62 | 62 | 60 | | 70 | 70 | 68 | | 66 | 100 | 60 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 |
| 7.3 | 7.3 | 7.2 | 7.3 | 7.6 | 7.2 | 7.2 | 7.3 | 7.2 | 7.3 | 7.3 | 7.6 | 7.3 | 7.3 | 7.2 | | 7.3 | 7.6 | 7.2 |
| 5 | | 10 | 6 | 13 | 3 | 6 | 11 | 6 | 8 | 13 | 10 | 9 | 6 | 5 | | 9 | 32 | 2 |

| Dec. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Atmosphere temperature | °C | 19 | 16 | 19 | | 19 | 22 | 22 | 21 | 22 | 19 | 15 | 19 | 18 | 19 | 19 |
| Water temperature | °C | 22 | 14 | 22 | | 22 | 23 | 24 | 23 | 23 | 20 | 16 | 20 | 20 | 20 | 20 |
| Turbidity | ppm | 54 | 72 | 50 | | 63 | 50 | 62 | 53 | 52 | 45 | 58 | 44 | 50 | 54 | 45 |
| Alkalinity | ppm | 68 | 100 | 70 | | 64 | 66 | 64 | 66 | 72 | 64 | 80 | 66 | 68 | 64 | 66 |
| Residual chlorine | ppm | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| pH | | 7.3 | 7.5 | 7.5 | | 7.4 | 7.4 | 7.4 | 7.3 | 7.5 | 7.5 | 7.6 | 7.4 | 7.4 | 7.4 | 7.4 |
| Color | ppm | 4 | 11 | 5 | | 5 | 5 | 6 | 6 | 5 | 5 | 12 | 3 | 2 | 5 | 4 |

| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | mean | max. | min. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18 | 20 | 17 | 19 | 19 | 21 | 20 | 20 | 19 | 20 | | | | | | | 19 | 22 | 15 |
| 20 | 22 | 20 | 20 | 22 | 22 | 21 | 21 | 20 | 21 | | | | | | | 21 | 24 | 14 |
| 45 | 44 | 60 | 43 | 44 | 39 | 41 | 50 | 43 | 40 | | | | | | | 50 | 72 | 39 |
| 64 | 64 | | 48 | 66 | 64 | 66 | 60 | 64 | 62 | | | | | | | 67 | 100 | 48 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 0 | 0 |
| 7.5 | 7.5 | 7.5 | 7.5 | 7.4 | 7.5 | 7.4 | 7.5 | 7.5 | 7.5 | | | | | | | 7.5 | 7.6 | 7.3 |
| 5 | 5 | 8 | 2 | 4 | 3 | 3 | 6 | 4 | 3 | | | | | | | 5 | 12 | 2 |

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# Table C.5 (1) Water Quality at Chinaimo (Nam papa Lao) in year 1988 (1)

LOCATION: CHINAIMO

| Jan. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Atmosphere temperature | C | | | | 24 | 24 | 24 | 24 | 24 | 24 | 25 | 25 | 24 | 25 | 24 | 23 |
| Water temperature | C | | | | 22 | 22 | 21 | 21 | 22 | 21 | 23 | 23 | 22 | 23 | 22 | 22 |
| Turbidity | ppm | | | | 50 | 80 | 90 | 80 | 70 | 100 | 100 | 90 | 80 | 80 | 80 | 90 |
| Color | ppm | | | | 3 | 3 | 4 | 5 | 3 | 4 | 3 | 4 | 3 | 3 | 4 | 4 |
| Odor | | | | | none | none | none | none | none | none | none | none | none | none | none | none |
| Taste | | | | | none | none | none | none | none | none | none | none | none | none | none | none |
| pH | | | | | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.6 | 7.6 | 7.4 | 7.4 | 7.4 | 7.4 | 7.5 |
| Alkalinity | ppm | | | | 92 | 92 | 88 | 90 | 100 | 151 | 154 | 152 | 150 | 150 | 106 | 120 |
| Ammonia nitrogen | ppm | | | | none | none | none | none | none | none | none | none | none | none | none | none |
| Nitrite nitrogen | ppm | | | | none | none | none | none | none | none | none | none | none | none | none | none |
| Nittate nitrogen | ppm | | | | none | none | none | none | none | none | none | none | none | none | none | none |
| KMnO4 | ppm | | | | 6.9 | 5.9 | 6.8 | 6.7 | 6.9 | 7.0 | 7.2 | 7.1 | 7.0 | 7.1 | 7.2 | 7.0 |
| E.C. | ms/hac | | | | 265 | 279 | 273 | 271 | 270 | 284 | 285 | 285 | 282 | 280 | 280 | 282 |
| Fe | ppm | | | | | | | | | | | | | | | |
| Mn | ppm | | | | none | none | none | none | none | none | none | none | none | none | none | none |
| Hg | ppm | | | | none | none | none | none | none | none | none | none | none | none | none | none |

| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | mean | max. | min. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24 | 25 | 24 | 25 | 24 | 24 | 23 | 23 | 24 | 24 | 24 | 24 | 24 | 24 | 24.5 | 24 | 24.1 | 25 | 23 |
| 23 | 22 | 23 | 23 | 22 | 22 | 21 | 21 | 23 | 23 | 23 | 23 | 23 | 23 | 23.5 | 23 | 22.3 | 23.5 | 21 |
| 60 | 70 | 60 | 60 | 60 | 60 | 50 | 50 | 50 | 50 | 50 | 50 | 40 | 50 | 50 | 50 | 66 | 100 | 40 |
| 3 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 4 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 5 | 2 |
| none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | | | |
| none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | | | |
| 7.4 | 7.3 | 7.4 | 7.4 | 7.4 | 7.4 | 7.6 | 7.6 | 7.4 | 7.45 | 7.4 | 7.4 | 7.5 | 6.8 | 6.9 | 6.8 | 7.4 | 7.6 | 6.8 |
| 91 | 95 | 91 | 94 | 92 | 87 | 94 | 94 | 92 | 93 | 92 | 90 | 96 | 95 | 96 | 95 | 104.7 | 154 | 87 |
| none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | | | |
| none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | | | |
| none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | | | |
| 7.1 | 6.9 | 6.7 | 6.8 | 6.9 | 6.8 | 6.9 | 6.8 | 7.0 | 7.1 | 7.2 | 7.1 | 7.2 | 7.0 | 7.4 | 7.3 | 7.0 | 7.4 | 5.9 |
| 279 | 275 | 270 | 272 | 273 | 275 | 278 | 268 | 268 | 270 | 269 | 268 | 269 | 290 | 292 | 289 | 276 | 292 | 265 |
| none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | | | |
| none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | | | |

LOCATION: CHINAIMO

| Feb. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Atmosphere temperature | C | 26 | 27 | 30 | 28 | 27 | 28 | 28 | 28 | 27 | 27 | 28 | 27 | 28 | 29 | 29 |
| Water temperature | C | 24 | 25 | 26 | 26 | 25 | 26 | 26 | 26 | 26 | 25 | 26 | 26 | 26 | 27 | 27 |
| Turbidity | ppm | 40 | 40 | 40 | 40 | 30 | 30 | 40 | 30 | 30 | 30 | 30 | 30 | 30 | 25 | 25 |
| Color | ppm | 3 | 3 | 5 | 4 | 3 | 4 | 5 | 5 | 6 | 4 | 3 | 5 | 4 | 2 | 3 |
| Odor | | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none |
| Taste | | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none |
| pH | | 7.5 | 7.4 | 7.6 | 7.45 | 7.6 | 7.55 | 7.6 | 7.6 | 6.9 | 7.6 | 7.5 | 7.6 | 7.6 | 7.5 | 7.6 |
| Alkalinity | ppm | 96 | 93 | 94 | 93 | 96 | 92 | 91 | 92 | 92 | 94 | 95 | 97 | 95 | 100 | 95 |
| Ammonia nitrogen | ppm | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none |
| Nitrite nitrogen | ppm | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none |
| Nittate nitrogen | ppm | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none |
| KMnO4 | ppm | 6.9 | 7.0 | 7.5 | 8.0 | 7.4 | 7.9 | 7.4 | 7.1 | 8.2 | 7.9 | 7.5 | 7.4 | 7.3 | 7.6 | 7.6 |
| E.C. | ms/hac | 284 | 290 | 296 | 290 | 283 | 285 | 286 | 286 | 292 | 290 | 283 | 278 | 283 | 283 | 283 |
| Fe | ppm | | | | | | | | | | | | | | | |
| Mn | ppm | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none |
| Hg | ppm | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none |

| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | mean | max. | min. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 29 | 27 | 27 | 28 | 28 | 29 | 28 | 28 | 29 | 27 | 29 | | | 28 | | | 27.9 | 30 | 26 |
| 27 | 26 | 25 | 26 | 26 | 27 | 26 | 27 | 27 | 26 | 28 | | | 27 | | | 26.1 | 28 | 24 |
| 30 | 30 | 25 | 50 | 60 | 80 | 60 | 40 | 50 | 40 | 40 | | | 50 | | | 39 | 80 | 25 |
| 4 | 5 | 4 | 5 | 6 | 3 | 6 | 3 | 2 | 3 | 4 | | | 3 | | | 4 | 6 | 2 |
| none | none | none | none | none | none | none | none | none | none | none | | | none | | | | | |
| none | none | none | none | none | none | none | none | none | none | none | | | none | | | | | |
| 7.55 | 7.6 | 7.6 | 7.6 | 7.6 | 7.6 | 7.6 | 7.6 | 7.5 | 7.6 | 7.6 | | | 7.6 | | | 7.5 | 7.6 | 6.9 |
| 92 | 98 | 90 | 100 | 96 | 96 | 96 | 100 | 97 | 96 | 98 | | | 90 | | | 95 | 100 | 90 |
| none | none | none | none | none | none | none | none | none | none | none | | | none | | | | | |
| none | none | none | none | none | none | none | none | none | none | none | | | none | | | | | |
| none | none | none | none | none | none | none | none | none | none | none | | | none | | | | | |
| 7.5 | 8.0 | 8.1 | 8.2 | 7.9 | 7.5 | 7.9 | 7.5 | 7.8 | 7.3 | 7.4 | | | 7.6 | | | 7.6 | 8.2 | 6.9 |
| 275 | 280 | 285 | 292 | 273 | 282 | 273 | 282 | 278 | 290 | 300 | | | 285 | | | 285 | 300 | 273 |
| none | none | none | none | none | none | none | none | none | none | none | | | none | | | | | |
| none | none | none | none | none | none | none | none | none | none | none | | | none | | | | | |

LAO PEOPLE'S DEMOCRATIC REPUBLIC
FEASIBILITY STUDY ON IMPROVEMENT
OF DRAINAGE SYSTEM IN VIENTIANE

JAPAN INTERNATIONAL COOPERATION AGENCY

# Table C.5 (2) Water Quality at Chinaimo (Nam papa Lao) in year 1988 (2)

LOCATION: CHINAIMO

| Mar. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Almosphere temperature | C | 29 | 29 | 27 | 27 | 26 | 26 | 26 | 26 | 26 | 27 | 29 | 28 | 29 | | 29 |
| Water temperature | C | 26 | 26 | 25 | 25 | 24 | 24 | 24 | 24 | 24 | 25 | 27 | 26 | 27 | | 27 |
| Turbidity | ppm | 40 | 40 | 30 | 30 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | | 20 |
| Color | ppm | 5 | 4 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 4 | 4 | 4 | 3 | | 2 |
| Odor | | none | none | none | none | none | none | none | none | none | none | none | none | none | | none |
| Taste | | none | none | none | none | none | none | none | none | none | none | none | none | none | | none |
| pH | | 7.5 | | 7.3 | 7.4 | 7.5 | 7.5 | 7.6 | 7.6 | 7.6 | 7.5 | 7.5 | 7.4 | 7.4 | | 7.5 |
| Alkalinity | ppm | | | | | | | | | | | | | | | |
| Ammonia nitrogen | ppm | none | none | none | none | none | none | none | none | none | none | none | none | none | | none |
| Nitrite nitrogen | ppm | none | none | none | none | none | none | none | none | none | none | none | none | none | | none |
| Nitrate nitrogen | ppm | none | none | none | none | none | none | none | none | none | none | none | none | none | | none |
| KMn04 | ppm | 9.8 | 9.2 | 9.0 | 9.7 | 10.1 | 10.0 | 10.9 | 10.5 | 11.0 | 10.9 | 9.9 | 8.9 | 8.6 | | 8.4 |
| E.C. | ms/hac | 290 | 295 | 300 | 305 | 300 | 310 | 292 | 282 | 310 | 300 | 295 | 289 | 296 | | 294 |
| Fe | ppm | | | | | | | | | | | | | | | |
| Mn | ppm | none | none | none | none | none | none | none | none | none | none | none | none | none | | none |
| Hg | ppm | none | none | none | none | none | none | none | none | none | none | none | none | none | | none |

| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | mean | max. | min. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 29 | 29 | 29 | 30 | 29 | 29 | 29 | 29 | 29 | 29 | 29 | | 29 | 29 | 29 | 29 | 28.3 | 30 | 26 |
| 27 | 28 | 28 | 28 | 28 | 27 | 28 | 28 | 28 | 28 | 28 | | 28 | 27 | 27 | 27 | 26.5 | 28 | 24 |
| 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 30 | | 30 | 30 | 20 | 20 | 29 | 40 | 20 |
| 2 | 2 | 3 | 3 | 4 | 4 | 3 | 3 | 3 | 4 | 5 | | 5 | 4 | 3 | 3 | 3 | 5 | 2 |
| none | none | none | none | none | none | none | none | none | none | none | | none | none | none | none | | | |
| none | none | none | none | none | none | none | none | none | none | none | | none | none | none | none | | | |
| 7.7 | 7.6 | 7.5 | 7.45 | 7.5 | 7.35 | 7.5 | 7.5 | 7.5 | 7.55 | 7.6 | | 7.6 | 7.5 | 7.5 | 7.5 | 7.5 | 7.7 | 7.3 |
| | | | | | | | | | | | | | | | | | | |
| none | none | none | none | none | none | none | none | none | none | none | | none | none | none | none | | | |
| none | none | none | none | none | none | none | none | none | none | none | | none | none | none | none | | | |
| none | none | none | none | none | none | none | none | none | none | none | | none | none | none | none | | | |
| 9.0 | 9.3 | 9.2 | 9.1 | 9.3 | 8.7 | 8.5 | 8.5 | 8.3 | 8.4 | 8.9 | | 9.0 | 8.9 | 8.8 | 8.9 | 9.3 | 11.0 | 8.3 |
| 301 | 292 | 300 | 290 | 285 | 280 | 290 | 280 | 295 | 280 | 283 | | 283 | 290 | 295 | 299 | 293 | 310 | 280 |
| | | | | | | | | | | | | | | | | | | |
| none | none | none | none | none | none | none | none | none | none | none | | none | none | none | none | | | |
| none | none | none | none | none | none | none | none | none | none | none | | none | none | none | none | | | |

LOCATION: CHINAIMO

| Apl. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Almosphere temperature | C | | | | 29 | 28 | 29 | 30 | 27 | 28 | 31 | 29 | 30 | | 30 | 29 |
| Water temperature | C | | | | 27 | 26 | 26 | 29 | 26 | 26 | 27 | 28 | 28 | | 28 | 27 |
| Turbidity | ppm | | | | 40 | 30 | 20 | 30 | 40 | 50 | 60 | 70 | 30 | | 50 | 50 |
| Color | ppm | | | | 6 | 3 | 2 | 4 | 3 | 2 | 1 | 2 | 3 | | 6 | 5 |
| Odor | | | | | none | none | none | none | none | none | none | none | none | | none | none |
| Taste | | | | | none | none | none | none | none | none | none | none | none | | none | none |
| pH | | | | | 7.4 | 7.2 | 7.3 | 7.4 | 7.3 | 7.6 | 7.5 | 7.2 | 7.2 | | 7.6 | 7.5 |
| Alkalinity | ppm | | | | 86 | 94 | 100 | 89 | 89 | 96 | 94 | 96 | 98 | | 98 | 70 |
| Ammonia nitrogen | ppm | | | | none | none | none | none | none | none | none | none | none | | none | none |
| Nitrite nitrogen | ppm | | | | none | none | none | none | none | none | none | none | none | | none | none |
| Nitrate nitrogen | ppm | | | | none | none | none | none | none | none | none | none | none | | none | none |
| KMn04 | ppm | | | | 10.0 | 9.6 | 12.3 | 5.2 | 7.4 | 10.0 | 13.0 | 14.7 | 6.0 | | 7.4 | 6.0 |
| E.C. | ms/hac | | | | 285 | 276 | 270 | 280 | 300 | 290 | 280 | 348 | 290 | | 280 | 283 |
| Fe | ppm | | | | 0.2 | 0.3 | 0.5 | 0.1 | 0.2 | 0.3 | 0.4 | 0.6 | 0.2 | | 0.2 | 0.3 |
| Mn | ppm | | | | | | | | | | | | | | | |
| Hg | ppm | | | | none | none | none | none | none | none | none | none | none | | none | none |

| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | mean | max. | min. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 32 | 30 | 31 | 31 | 33 | 31 | 32 | 30 | | 30 | 31 | 32 | 34 | | | 30.3 | 34 | 27 |
| 29 | 29 | 28 | 28 | 29 | 29 | 30 | 29 | 28 | | 29 | 29 | 28 | 29 | | | 28.0 | 30 | 26 |
| 40 | 30 | 20 | 50 | 60 | 60 | 50 | 40 | 30 | | 30 | 40 | 20 | 30 | | | 40 | 70 | 20 |
| 7 | 6 | 2 | 3 | 5 | 6 | 3 | 4 | 6 | | 6 | 9 | 7 | 8 | | | 5 | 9 | 1 |
| none | none | none | none | none | none | none | none | none | | none | none | none | none | | | | | |
| none | none | none | none | none | none | none | none | none | | none | none | none | none | | | | | |
| 7.4 | 7.0 | 7.1 | 7.5 | 7.6 | 7.4 | 7.6 | 7.4 | 7.5 | | 7.3 | 7.3 | 7.4 | 7.5 | | | 7.4 | 7.6 | 7.0 |
| 100 | 100 | 92 | 96 | 107 | 98 | 90 | 88 | 86 | | 102 | 89 | 100 | 96 | | | | | |
| none | none | none | none | none | none | none | none | none | | none | none | none | none | | | | | |
| none | none | none | none | none | none | none | none | none | | none | none | none | none | | | | | |
| none | none | none | none | none | none | none | none | none | | none | none | none | none | | | | | |
| 5.2 | 14.7 | 3.1 | 12.3 | 10.0 | 7.3 | 8.4 | 7.3 | 6.9 | | 16.4 | 15.3 | 3.1 | 4.7 | | | 9.0 | 16.4 | 3.1 |
| 285 | 285 | 290 | 296 | 290 | 310 | 345 | 295 | 295 | | 290 | 315 | 292 | 290 | | | 294 | 348 | 270 |
| 0.4 | 0.3 | 0.3 | 0.2 | 0.1 | 0.2 | 0.2 | 0.3 | 0.5 | | 0.2 | 0.3 | 0.3 | 0.3 | | | 0.3 | 0.6 | 0.1 |
| | | | | | | | | | | | | | | | | | | |
| none | none | none | none | none | none | none | none | none | | none | none | none | none | | | | | |

LAO PEOPLE'S DEMOCRATIC REPUBLIC
FEASIBILITY STUDY ON IMPROVEMENT
OF DRAINAGE SYSTEM IN VIENTIANE

JAPAN INTERNATIONAL COOPERATION AGENCY

# Table C.5 (3) Water Quality at Chinaimo (Nam papa Lao) in year 1988 (3)

LOCATION: CHINAIMO

| May | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Atmosphere temperature | °C | | 28 | 29 | 28 | 29 | 30 | 31 | 29 | 28 | 30 | | 30 | 29 | 30 | 29 |
| Water temperature | °C | | 26 | 27 | 26 | 27 | 28 | 28 | 28 | 26 | 27 | | 28 | 27 | 28 | 27 |
| Turbidity | ppm | | 70 | 80 | 70 | 70 | 80 | 10 | 70 | 80 | 90 | | 100 | 80 | 70 | 60 |
| Color | ppm | | 6 | 6 | 5 | 3 | 4 | 2 | 2 | 3 | 4 | | 6 | 7 | 6 | 5 |
| Odor | | | none | none | none | none | none | none | none | none | none | | none | none | none | none |
| Taste | | | none | none | none | none | none | none | none | none | none | | none | none | none | none |
| pH | | | 7.7 | 7.6 | 7.4 | 7.3 | 7.6 | 7.7 | 7.6 | 7.3 | 7.5 | | 7.2 | 7.3 | 7.4 | 7.7 |
| Alkalinity | ppm | | 75 | 92 | 93 | 96 | 94 | 92 | 80 | 78 | 79 | | 80 | 94 | 100 | 120 |
| Ammonia nitrogen | ppm | | none | none | none | 0.01 | none | none | none | none | none | | none | none | none | none |
| Nitrite nitrogen | ppm | | none | none | none | | none | none | none | none | none | | none | none | none | none |
| Nittate nitrogen | ppm | | none | none | none | none | none | none | none | none | none | | none | none | none | none |
| KMnO4 | ppm | | | | | | | | | | | | | | | |
| E. C. | ms/hmo | | 265 | 280 | 280 | 295 | 270 | 270 | 280 | 300 | 295 | | 297 | 280 | 260 | 260 |
| Fe | ppm | | 0.2 | 0.3 | 0.4 | 0.5 | 0.3 | 0.2 | 0.2 | 0.2 | 0.1 | | 0.2 | 0.3 | 0.5 | 0.6 |
| Mn | ppm | | | | | | | | | | | | | | | |
| Hg | ppm | | none | none | none | none | none | none | none | none | none | | none | none | none | none |

| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | mean | max. | min. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 31 | 29 | 30 | 30 | | | 32 | 32 | 30 | 30 | 30 | | 28 | 30 | | 29.7 | 32 | 28 |
| 29 | 28 | 27 | 28 | 28 | | | 29 | 29 | 28 | 28 | 28 | | 27 | 27 | | 27.6 | 29 | 26 |
| 50 | 60 | 80 | 90 | 100 | | | 100 | 120 | 100 | 90 | 80 | | 60 | 70 | | 77 | 120 | 10 |
| 4 | 3 | 2 | 3 | 4 | | | 5 | 6 | 3 | 2 | 4 | | 3 | 3 | | 4 | 7 | 2 |
| none | none | none | none | none | | | none | none | none | none | none | | none | none | | | | |
| none | none | none | none | none | | | none | none | none | none | none | | none | none | | | | |
| 7.6 | 7.5 | 7.4 | 7.3 | 7.2 | | | 7.6 | 7.4 | 7.5 | 7.4 | 7.6 | | 7.4 | 7.5 | | 7.5 | 7.7 | 7.2 |
| 100 | 80 | 90 | 90 | 100 | | | 85 | 82 | 80 | 80 | 78 | | 65 | 77 | | 87 | 120 | 65 |
| none | none | none | none | none | | | none | none | none | none | none | | none | none | | | | |
| none | none | none | none | none | | | none | none | none | none | none | | none | none | | | | |
| none | none | none | none | none | | | none | none | none | none | none | | none | none | | | | |
| | | | | | | | | | | | | | | | | #DIV/0 | 0.0 | 0.0 |
| 280 | 280 | 275 | 269 | 275 | | | 273 | 275 | 280 | 280 | 263 | | 269 | 280 | | 277 | 300 | 260 |
| 0.3 | 0.2 | 0.1 | 0.1 | 0.2 | | | 0.3 | 0.4 | 0.3 | 0.2 | 0.05 | | 0.2 | 0.2 | | 0.3 | 0.6 | 0.1 |
| | | | | | | | | | | | | | | | | | | |
| none | none | none | none | none | | | none | none | none | none | none | | none | none | | | | |

LOCATION: CHINAIMO

| June | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Atmosphere temperature | °C | 27 | 28 | 27 | 26 | 26 | 27 | 25 | 26 | 25 | 25 | 24 | | 26 | 27 | 28 |
| Water temperature | °C | 25 | 25 | 26 | 24 | 24 | 25 | 23 | 25 | 23 | 23 | 22 | | 24 | 25 | 26 |
| Turbidity | ppm | 240 | 300 | 160 | 180 | 240 | 240 | 220 | 220 | 180 | 160 | 140 | | 140 | 160 | 140 |
| Color | ppm | 3 | 4 | 6 | 7 | 3 | 5 | 5 | 6 | 3 | 2 | 3 | | 4 | 5 | 5 |
| Odor | | none | none | none | none | none | none | none | none | none | none | none | | none | none | none |
| Taste | | none | none | none | none | none | none | none | none | none | none | none | | none | none | none |
| pH | | 7.3 | 7.4 | 7.5 | 7.6 | 7.4 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.3 | | 7.5 | 7.6 | 7.6 |
| Alkalinity | ppm | 80 | 65 | 92 | 96 | 96 | 100 | 94 | 100 | 73 | 70 | 85 | | 97 | 85 | 94 |
| Ammonia nitrogen | ppm | none | none | none | none | none | none | none | none | none | none | none | | none | none | none |
| Nitrite nitrogen | ppm | none | none | none | none | none | none | none | none | none | none | none | | none | none | none |
| Nittate nitrogen | ppm | none | none | none | none | none | none | none | none | none | none | none | | none | none | none |
| KMnO4 | ppm | 12.3 | 6.9 | 9.6 | 6.3 | 7.4 | 3.1 | 7.4 | 12.3 | 10.0 | 13.0 | 14.7 | | 12.3 | 6.0 | 9.6 |
| E. C. | ms/hmo | 280 | 300 | 240 | 265 | 292 | 275 | 283 | 265 | 280 | 220 | 225 | | 230 | 238 | 245 |
| Fe | ppm | 0.1 | 0.2 | 0.3 | 0.4 | 0.05 | 0.2 | 0.1 | 0.2 | 0.4 | 0.5 | 0.3 | | 0.3 | 0.4 | 0.2 |
| Mn | ppm | | | | | | | | | | | | | | | |
| Hg | ppm | none | none | none | none | none | none | none | none | none | none | none | | none | none | none |

| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | mean | max. | min. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 | 25 | | 24 | 26 | 26 | 26 | 27 | 24 | 25 | 27 | 26 | 24 | 26 | 26 | | 25.9 | 28 | 24 |
| 25 | 23 | | 22 | 24 | 24 | 24 | 23 | 22 | 23 | 25 | 24 | 22 | 24 | 24 | | 23.9 | 26 | 22 |
| 180 | 220 | | 160 | 200 | 240 | 180 | 220 | 180 | 200 | 140 | 180 | 240 | 240 | 220 | | 197 | 300 | 140 |
| 3 | 4 | | 2 | 3 | 4 | 6 | 8 | 3 | 4 | 3 | 6 | 5 | 2 | 6 | | 4 | 8 | 2 |
| none | none | | none | none | none | none | none | none | none | none | none | none | none | none | | | | |
| none | none | | none | none | none | none | none | none | none | none | none | none | none | none | | | | |
| 7.5 | 7.3 | | 7.3 | 7.4 | 7.3 | 7.3 | 7.3 | 7.6 | 7.5 | 7.4 | 7.6 | 7.3 | 7.4 | 7.6 | | 7.4 | 7.6 | 7.2 |
| 80 | 91 | | 85 | 80 | 93 | 92 | 86 | 92 | 85 | 81 | 84 | 87 | 94 | 96 | | 88 | 100 | 65 |
| none | none | | none | none | none | none | none | none | none | none | none | none | none | none | | | | |
| none | none | | none | none | none | none | none | none | none | none | none | none | none | none | | | | |
| none | none | | none | none | none | none | none | none | none | none | none | none | none | none | | | | |
| 7.4 | 5.2 | | 15.6 | 14.7 | 7.4 | 5.2 | 3.1 | 4.7 | 7.4 | 10.0 | 10.0 | 7.3 | 9.6 | 9.0 | | 8.8 | 15.6 | 3.1 |
| 225 | 275 | | 250 | 280 | 245 | 255 | 240 | 230 | 240 | 245 | 255 | 258 | 235 | 255 | | 255 | 300 | 220 |
| 0.3 | 0.4 | | 0.3 | 0.2 | 0.1 | 0.3 | 0.3 | 0.2 | 0.4 | 0.3 | 0.2 | 0.1 | 0.3 | 0.3 | | 0.3 | 0.5 | 0.05 |
| | | | | | | | | | | | | | | | | | | |
| none | none | | none | none | none | none | none | none | none | none | none | none | none | none | | | | |

LAO PEOPLE'S DEMOCRATIC REPUBLIC
FEASIBILITY STUDY ON IMPROVEMENT OF DRAINAGE SYSTEM IN VIENTIANE
JAPAN INTERNATIONAL COOPERATION AGENCY

# Table C.5 (4) Water Quality at Chinaimo (Nam papa Lao) in year 1988 (4)

LOCATION: CHINAIMO

| July | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Atmosphere temperature | C | 27 | 26 | 25 | 24 | 24 | 25 | 26 | 26 | 27 | 26 | 24 | 24 | 23 | 25 | 26 |
| Water temperature | C | 25 | 24 | 23 | 23 | 22 | 23 | 24 | 24 | 25 | 24 | 23 | 22 | 22 | 23 | 24 |
| Turbidity | ppm | 180 | 180 | 280 | 220 | 480 | 270 | 240 | 240 | 200 | 580 | 600 | 280 | 380 | 500 | 480 |
| Color | ppm | 3 | 4 | 3 | 4 | 5 | 6 | 7 | 3 | 4 | 2 | 3 | 5 | 6 | 3 | 4 |
| Odor | | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none |
| Taste | | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none |
| pH | | 7.1 | 7.4 | 7.3 | 7.4 | 7.5 | 7.5 | 7.4 | 7.2 | 7.5 | 7.5 | 7.6 | 7.4 | 7.6 | 7.6 | 7.6 |
| Alkalinity | ppm | 90 | 78 | 91 | 89 | 92 | 95 | 93 | 100 | 92 | 100 | 90 | 79 | 100 | 95 | 96 |
| Ammonia nitrogen | ppm | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none |
| Nitrite nitrogen | ppm | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none |
| Nittate nitrogen | ppm | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none |
| KMnO4 | ppm | 15.3 | 12.3 | 9.6 | 6.9 | 7.3 | 6.3 | 5.2 | 7.4 | 13.2 | 15.6 | 9.6 | 14.7 | 13.0 | 10.0 | 9.6 |
| E.C. | ms/hmo | 260 | 260 | 265 | 325 | 300 | 255 | 325 | 290 | 266 | 310 | 270 | 280 | 270 | 285 | 275 |
| Fe | ppm | | | | | | | | | | | | | | | |
| Mn | ppm | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none |
| Mg | ppm | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none |

| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | mean | max. | min. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | 27 | 24 | 25 | 23 | 26 | 26 | 27 | 24 | 25 | 26 | 27 | | 26 | | 27 | 25.4 | 27 | 23 |
| 25 | 25 | 22 | 23 | 22 | 24 | 24 | 25 | 23 | 23 | 24 | 25 | | 24 | | 25 | 23.6 | 25 | 22 |
| 250 | 270 | 460 | 460 | 500 | 540 | 540 | 460 | 560 | 360 | 360 | 400 | | 360 | | 360 | 379 | 600 | 180 |
| 5 | 2 | 3 | 4 | 6 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | | 2 | | 3 | 4 | 8 | 2 |
| none | none | none | none | none | none | none | none | none | none | none | none | | none | | none | | | |
| none | none | none | none | none | none | none | none | none | none | none | none | | none | | none | | | |
| 8.0 | 7.8 | 7.7 | 7.9 | 7.7 | 7.9 | 7.9 | 7.9 | 7.6 | 7.8 | 7.5 | 8.0 | | 7.6 | | 7.6 | 7.6 | 8.0 | 7.1 |
| 75 | 90 | 85 | 81 | 86 | 86 | 89 | 89 | 87 | 92 | 91 | 90 | | 85 | | 78 | 89 | 100 | 75 |
| none | none | none | none | none | none | none | none | none | none | none | none | | none | | none | | | |
| none | none | none | none | none | none | none | none | none | none | none | none | | none | | none | | | |
| none | none | none | none | none | none | none | none | none | none | none | none | | none | | none | | | |
| 10.0 | 12.1 | 14.7 | 15.6 | 12.1 | 6.9 | 7.4 | 5.2 | 12.1 | 15.6 | 14.7 | 12.1 | | 16.3 | | 10.0 | 11.1 | 16.3 | 5.2 |
| 255 | 270 | 275 | 244 | 265 | 240 | 243 | 252 | 275 | 296 | 232 | 232 | | 292 | | 270 | 272 | 325 | 232 |
| none | none | none | none | none | none | none | none | none | none | none | none | | none | | none | | | |
| none | none | none | none | none | none | none | none | none | none | none | none | | none | | none | | | |

LOCATION: CHINAIMO

| Aug. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Atmosphere temperature | C | 24 | 23 | 24 | 22 | 24 | 23 | 22 | 23 | 25 | 23 | 22 | 24 | 22 | 25 | 24 |
| Water temperature | C | 22 | 21 | 22 | 20 | 23 | 22 | 20 | 21 | 23 | 21 | 20 | 22 | 21 | 23 | 22 |
| Turbidity | ppm | 400 | 500 | 560 | 560 | 540 | 640 | 640 | 580 | 900 | 960 | 720 | 640 | 640 | 620 | 480 |
| Color | ppm | 6 | 3 | 4 | 5 | 3 | 4 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 5 | 3 |
| Odor | | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none |
| Taste | | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none |
| pH | | 7.9 | 7.9 | 7.9 | 7.8 | 7.8 | 7.9 | 7.7 | 7.6 | 7.6 | 7.5 | 8.0 | 7.8 | 7.7 | 7.6 | 7.9 |
| Alkalinity | ppm | 87 | 90 | 87 | 88 | 98 | 72 | 79 | 76 | 62 | 80 | 81 | 78 | 85 | 80 | 86 |
| Ammonia nitrogen | ppm | none | none | none | 0.01 | 0.003 | none | none | none | none | none | 0.01 | 0.002 | none | 0.05 | none |
| Nitrite nitrogen | ppm | none | none | none | none | 0.02 | none | none | none | none | none | 0.02 | 0.001 | none | 0.2 | none |
| Nittate nitrogen | ppm | none | none | none | none | 0.01 | none | none | none | none | 0.05 | none | none | none | none | none |
| KMnO4 | ppm | 5.2 | 12.3 | 6.9 | 10.0 | 6.9 | 10.0 | 8.3 | 6.9 | 7.6 | 12.3 | 10.0 | 11.2 | 6.9 | 9.3 | 9.0 |
| E.C. | ms/hmo | 230 | 229 | 264 | 300 | 220 | 220 | 240 | 220 | 220 | 240 | 225 | 210 | 200 | 280 | 210 |
| Fe | ppm | 0.2 | 0.1 | 0.3 | 0.2 | 0.4 | 0.3 | 0.2 | 0.2 | 0.1 | 0.4 | 0.5 | 0.3 | 0.2 | 0.1 | 0.3 |
| Mn | ppm | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none |
| Mg | ppm | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none |

| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | mean | max. | min. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 23 | 22 | 25 | 26 | 24 | 25 | 22 | 23 | 22 | 25 | 26 | 24 | 22 | 23 | 23 | | 23.5 | 26 | 22 |
| 21 | 20 | 23 | 24 | 22 | 23 | 20 | 23 | 20 | 23 | 24 | 22 | 20 | 21 | 20 | | 21.6 | 24 | 20 |
| 720 | 560 | 520 | 560 | 520 | 560 | 900 | 840 | 560 | 560 | 320 | 400 | 320 | 360 | 400 | | 583 | 960 | 320 |
| 2 | 7 | 3 | 6 | 5 | 6 | 3 | 4 | 5 | 2 | 3 | 5 | 3 | 4 | 5 | | 4 | 8 | 2 |
| none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | | | | |
| none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | | | | |
| 7.5 | 7.6 | 7.5 | 7.4 | 7.5 | 7.6 | 7.7 | 7.2 | 7.6 | 7.6 | 7.4 | 7.3 | 7.5 | 7.4 | 7.3 | | 7.6 | 8.0 | 7.2 |
| 90 | 76 | 97 | 94 | 93 | 86 | 77 | 72 | 92 | 94 | 90 | 70 | 92 | 96 | 78 | | 84 | 98 | 62 |
| none | none | none | none | 0.02 | none | none | none | 0.02 | none | 0.01 | 0.002 | none | none | none | | | | |
| none | none | none | none | 0.02 | none | none | none | 0.1 | none | none | none | none | none | none | | | | |
| none | none | none | none | 0.001 | none | none | none | 0.003 | none | none | none | none | none | none | | | | |
| 8.4 | 15.4 | 12.3 | 9.0 | 10.6 | 12.3 | 11.2 | 5.2 | 7.2 | 5.2 | 7.6 | 12.3 | 7.2 | 8.3 | 15.4 | | 9.3 | 15.4 | 5.2 |
| 200 | 200 | 210 | 220 | 230 | 225 | 200 | 248 | 235 | 220 | 225 | 235 | 280 | 240 | 230 | | 230 | 300 | 200 |
| 0.4 | 0.5 | 0.1 | 0.2 | 0.3 | 0.4 | 0.3 | 0.2 | 0.3 | 0.2 | 0.1 | 0.2 | 0.4 | 0.3 | 0.2 | | 0.3 | 0.5 | 0.10 |
| none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | | | | |
| none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | | | | |

LAO PEOPLE'S DEMOCRATIC REPUBLIC
FEASIBILITY STUDY ON IMPROVEMENT
OF DRAINAGE SYSTEM IN VIENTIANE

JAPAN INTERNATIONAL COOPERATION AGENCY

# Table C.5 (5) Water Quality at Chinaimo (Nam papa Lao) in year 1988 (5)

LOCATION: CHINAIMO

| Spl. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Atmosphere temperature | °C | 24 | | 23 | 24 | 23 | 25 | | | 24 | 23 | 20 | 23 | 23 | | 22 |
| Water temperature | °C | 22 | | 21 | 23 | 22 | 23 | | | 22 | 21 | 19 | 20 | 21 | | 21 |
| Turbidity | ppm | 600 | | 720 | 900 | 720 | 680 | | | 560 | 500 | 560 | 560 | 500 | | 640 |
| Color | ppm | 7 | | 6 | 5 | 3 | 5 | | | 3 | 4 | 3 | 6 | 7 | | 6 |
| Odor | | none | | none | none | none | none | | | none | none | none | none | none | | none |
| Taste | | none | | none | none | none | none | | | none | none | none | none | none | | none |
| pH | | 7.0 | | 7.2 | 7.5 | 7.4 | 7.6 | | | 7.8 | 7.5 | 7.6 | 7.6 | 7.5 | | 7.5 |
| Alkalinity | ppm | 75 | | 93 | 78 | 74 | 64 | | | 78 | 77 | 78 | 80 | 74 | | 90 |
| Ammonia nitrogen | ppm | none | | none | none | none | none | | | none | none | none | none | none | | none |
| Nitrite nitrogen | ppm | none | | none | 0.02 | none | 0.01 | | | none | none | none | none | none | | none |
| Nittate nitrogen | ppm | none | | none | none | none | 0.02 | | | none | none | none | none | none | | none |
| KMnO4 | ppm | 9.6 | | 10.0 | 9.6 | 7.6 | 12.1 | | | 10.0 | 5.2 | 6.3 | 7.4 | 6.9 | | 13.2 |
| E. C. | ms/hmo | 245 | | 235 | 245 | 235 | 230 | | | 180 | 210 | 220 | 225 | 240 | | 210 |
| Fe | ppm | 0.2 | | 0.2 | 0.3 | 0.2 | 0.1 | | | 0.4 | 0.2 | 0.4 | 0.3 | 0.2 | | 0.3 |
| Mn | ppm | none | | none | none | none | none | | | none | none | none | none | none | | none |
| Hg | ppm | none | | none | none | none | none | | | none | none | none | none | none | | none |

| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | mean | max. | min. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24 | 22 | 23 | | 20 | 21 | 20 | 23 | 21 | 20 | 21 | 23 | 24 | 24 | 21 | 20 | 22.3 | 25 | 20 |
| 22 | 20 | 21 | | 19 | 20 | 19 | 22 | 20 | 19 | 20 | 21 | 22 | 23 | 20 | 19 | 20.8 | 23 | 19 |
| 620 | 800 | 560 | | 480 | 500 | 480 | 520 | 500 | 640 | 500 | 580 | 620 | 680 | 620 | 700 | 605 | 900 | 480 |
| 7 | 3 | 4 | | 2 | 3 | 4 | 4 | 3 | 4 | 3 | 5 | 6 | 3 | 2 | 4 | 4 | 7 | 2 |
| none | none | none | | none | none | none | none | none | none | none | none | none | none | none | none | | | |
| none | none | none | | none | none | none | none | none | none | none | none | none | none | none | none | | | |
| 7.4 | 7.5 | 7.6 | | 7.1 | 7.4 | 7.8 | 7.6 | 7.3 | 7.2 | 7.4 | 7.6 | 7.3 | 7.0 | 6.9 | 7.3 | 7.4 | 7.8 | 6.9 |
| 89 | 80 | 80 | | 82 | 76 | 96 | 79 | 80 | 85 | 93 | 90 | 100 | 94 | 86 | 78 | 83 | 100 | 64 |
| none | none | none | | none | none | none | none | none | none | none | none | none | none | 0.01 | none | | | |
| none | none | none | | 0.02 | none | 0.01 | none | 0.02 | none | none | none | none | none | none | none | | | |
| none | none | none | | none | none | none | none | none | 0.05 | none | 0.02 | none | none | 0.01 | none | | | |
| 15.6 | 10.0 | 9.6 | | 14.7 | 13.0 | 10.0 | 9.6 | 7.4 | 6.9 | 10.0 | 12.1 | 14.7 | 15.6 | 9.6 | 10.0 | 10.3 | 15.6 | 5.2 |
| 220 | 253 | 225 | | 230 | 210 | 220 | 235 | 220 | 233 | 250 | 265 | 245 | 220 | 210 | 220 | 228 | 265 | 180 |
| 0.4 | 0.3 | 0.5 | | 0.3 | 0.2 | 0.1 | 0.3 | 0.2 | 0.1 | 0.4 | 0.3 | 0.2 | 0.3 | 0.2 | 0.1 | 0.3 | 0.5 | 0.10 |
| none | none | none | | none | none | none | none | none | none | none | none | none | none | none | none | | | |
| none | none | none | | none | none | none | none | none | none | none | none | none | none | none | none | | | |

LOCATION: CHINAIMO

| Oct. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Atmosphere temperature | °C | | 24 | 25 | | 24 | 24 | 23 | | 24 | 23 | 24 | 24 | 25 | | 24 |
| Water temperature | °C | | 22 | 23 | | 22 | 23 | 21 | | 22 | 21 | 22 | 22 | 23 | | 23 |
| Turbidity | ppm | | 640 | 600 | | 520 | 620 | 640 | | 620 | 600 | 580 | 600 | 540 | | 480 |
| Color | ppm | | 4 | 3 | | 6 | 7 | 6 | | 3 | 5 | 4 | 3 | 6 | | 3 |
| Odor | | | none | none | | none | none | none | | none | none | none | none | none | | none |
| Taste | | | none | none | | none | none | none | | none | none | none | none | none | | none |
| pH | | | 7.4 | 7.6 | | 7.5 | 7.3 | 7.6 | | 7.3 | 7.2 | 7.4 | 7.6 | 7.4 | | 7.3 |
| Alkalinity | ppm | | 92 | 100 | | 94 | 86 | 90 | | 87 | 90 | 86 | 92 | 88 | | 79 |
| Ammonia nitrogen | ppm | | 0.03 | none | | none | none | none | | none | none | none | none | 0.001 | | 0.02 |
| Nitrite nitrogen | ppm | | none | none | | none | none | none | | none | none | none | none | none | | none |
| Nittate nitrogen | ppm | | none | none | | none | none | none | | none | none | none | none | none | | none |
| KMnO4 | ppm | | 9.0 | 9.3 | | 8.4 | 10.0 | 11.2 | | 9.6 | 10.0 | 12.3 | 6.9 | 7.0 | | 7.5 |
| E. C. | ms/hmo | | 272 | 283 | | 300 | 297 | 293 | | 295 | 284 | 293 | 280 | 291 | | 285 |
| Fe | ppm | | 0.2 | 0.3 | | 0.2 | 0.3 | 0.4 | | 0.3 | 0.2 | 0.1 | 0.2 | 0.4 | | 0.3 |
| Mn | ppm | | none | none | | none | none | none | | none | none | none | none | none | | none |
| Hg | ppm | | none | none | | none | none | none | | none | none | none | none | none | | none |

| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | mean | max. | min. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24 | 25 | 23 | 23 | 24 | 22 | 23 | 25 | 23 | 24 | 23 | 25 | 24 | 23 | | 24 | 23.8 | 25 | 22 |
| 22 | 23 | 20 | 22 | 21 | 20 | 21 | 24 | 21 | 22 | 21 | 23 | 22 | 21 | | 22 | 21.9 | 24 | 20 |
| 500 | 520 | 480 | 500 | 400 | 380 | 420 | 320 | 280 | 200 | 220 | 400 | 400 | 280 | | 240 | 461 | 640 | 200 |
| 4 | 5 | 6 | 3 | 4 | 5 | 3 | 5 | 6 | 5 | 4 | 6 | 3 | 4 | | 3 | 4 | 7 | 3 |
| none | none | none | none | none | none | none | none | none | none | none | none | none | none | | none | | | |
| none | none | none | none | none | none | none | none | none | none | none | none | none | none | | none | | | |
| 7.2 | 7.3 | 7.5 | 7.3 | 7.4 | 7.6 | 7.4 | 7.3 | 7.3 | 7.0 | 7.2 | 6.8 | 6.9 | 7.0 | | 7.2 | 7.3 | 7.6 | 6.8 |
| 87 | 92 | 100 | 92 | 88 | 90 | 94 | 86 | 80 | 82 | 83 | 84 | 86 | 85 | | 87 | 88 | 100 | 79 |
| none | none | none | none | none | none | none | none | none | none | none | none | none | none | | none | | | |
| none | 0.01 | none | none | none | none | none | none | none | none | none | none | none | none | | none | | | |
| none | none | none | none | none | none | none | none | none | none | none | none | none | none | | none | | | |
| 7.2 | 5.2 | 8.3 | 11.0 | 6.9 | 7.0 | 7.6 | 10.0 | 12.3 | 6.9 | 8.6 | 10.0 | 7.3 | 6.9 | | 10.0 | 8.7 | 12.3 | 5.2 |
| 283 | 270 | 275 | 283 | 290 | 273 | 290 | 275 | 250 | 270 | 273 | 242 | 235 | 250 | | 250 | 276 | 300 | 235 |
| 0.2 | 0.3 | 0.2 | 0.3 | 0.1 | 0.2 | 0.3 | 0.1 | 0.2 | 0.3 | 0.2 | 0.2 | 0.1 | 0.3 | | 0.1 | 0.2 | 0.4 | 0.10 |
| none | none | none | none | none | none | none | none | none | none | none | none | none | none | | none | | | |
| none | none | none | none | none | none | none | none | none | none | none | none | none | none | | none | | | |

LAO PEOPLE'S DEMOCRATIC REPUBLIC
FEASIBILITY STUDY ON IMPROVEMENT
OF DRAINAGE SYSTEM IN VIENTIANE

JAPAN INTERNATIONAL COOPERATION AGENCY

# Table C.5 (6) Water Quality at Chinaimo (Nam papa Lao) in year 1988 (6)

LOCATION: CHINAIMO

| Nov. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Atmosphere temperature | C | 26 | 25 | 25 | 26 | 24 | 26 | 26 | 24 | 26 | 26 | 27 | 27 | 26 | 25 | 25 |
| Water temperature | C | 24 | 23 | 23 | 24 | 22 | 24 | 24 | 22 | 24 | 24 | 25 | 25 | 24 | 23 | 23 |
| Turbidity | ppm | 200 | 240 | 240 | 240 | 240 | 240 | 240 | 200 | 260 | 320 | 220 | 120 | 120 | 100 | 140 |
| Color | ppm | 3 | 2 | 3 | 6 | 4 | 3 | 4 | 3 | 1 | 3 | 8 | 6 | 5 | 2 | 3 |
| Odor | | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none |
| Taste | | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none |
| pH | | 7.0 | 7.0 | 7.3 | 7.2 | 7.2 | 7.6 | 7.6 | 7.4 | 7.3 | 7.3 | 6.9 | 7.4 | 7.5 | 7.2 | 7.6 |
| Alkalinity | ppm | 82 | 87 | 90 | 85 | 85 | 83 | 85 | 76 | 90 | 88 | 84 | 90 | 82 | 82 | 70 |
| Ammonia nitrogen | ppm | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none |
| Nitrite nitrogen | ppm | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none |
| Nitrate nitrogen | ppm | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none |
| KMnO4 | ppm | 9.3 | 7.4 | 6.0 | 3.1 | 6.9 | 6.9 | 7.1 | 12.0 | 6.8 | 6.6 | 8.4 | 6.2 | 6.0 | 6.4 | 7.0 |
| E. C. | ms/hmo | 270 | 240 | 275 | 250 | 255 | 221 | 253 | 245 | 250 | 245 | 270 | 270 | 260 | 275 | 270 |
| Fe | ppm | 0.2 | 0.1 | 0.2 | 0.3 | 0.4 | 0.2 | 0.2 | 0.1 | 0.2 | 0.4 | 0.1 | 0.2 | 0.3 | 0.1 | 0.2 |
| Mn | ppm | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none |
| Hg | ppm | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none |

| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | mean | max. | min. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 23 | 24 | 24 | 25 | 24 | 21 | 22 | 24 | 20 | 20 | | | 20 | | 20 | | 24.1 | 27 | 20 |
| 21 | 22 | 22 | 23 | 22 | 20 | 20 | 22 | 19 | 19 | | | 19 | | 19 | | 22.3 | 25 | 19 |
| 100 | 200 | 100 | 60 | 70 | 180 | 180 | 120 | 200 | 200 | | | 200 | | 100 | | 179 | 320 | 60 |
| 2 | 2 | 4 | 4 | 2 | 4 | 5 | 4 | 5 | 4 | | | 3 | | 7 | | 4 | 8 | 1 |
| none | none | none | none | none | none | none | none | none | none | | | none | | none | | | | |
| none | none | none | none | none | none | none | none | none | none | | | none | | none | | | | |
| 7.4 | 7.1 | 7.4 | 7.5 | 7.5 | 7.4 | 7.4 | 7.2 | 7.2 | 7.5 | | | 7.3 | | 7.4 | | 7.3 | 7.6 | 6.9 |
| 80 | 78 | 84 | 85 | 75 | 94 | 94 | 100 | 88 | 89 | | | 88 | | 86 | | 85 | 100 | 70 |
| none | none | none | none | none | none | none | none | none | none | | | none | | none | | | | |
| none | none | none | none | none | none | none | none | none | none | | | none | | none | | | | |
| none | none | none | none | none | none | none | none | none | none | | | none | | none | | | | |
| 6.9 | 7.1 | 6.7 | 7.5 | 6.8 | 7.2 | 7.2 | 6.6 | 7.2 | 8.9 | | | 7.0 | | 7.4 | | 7.1 | 12.0 | 3.1 |
| 280 | 280 | 280 | 280 | 275 | 280 | 280 | 290 | 280 | 290 | | | 280 | | 270 | | 267 | 290 | 221 |
| 0.2 | 0.2 | 0.2 | 0.5 | 0.4 | 0.1 | 0.1 | 0.1 | 0.5 | 0.2 | | | 0.1 | | 0.1 | | 0.2 | 0.5 | 0.10 |
| none | none | none | none | none | none | none | none | none | none | | | none | | none | | | | |
| none | none | none | none | none | none | none | none | none | none | | | none | | none | | | | |

LOCATION: CHINAIMO

| Dec. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Atmosphere temperature | C | 21 | | | | 22 | 21 | 21 | 23 | 23 | 24 | | 23 | 22 | 22 | 21 |
| Water temperature | C | 20 | | | | 21 | 20 | 20 | 21 | 21 | 22 | | 21 | 20 | 20 | 19 |
| Turbidity | ppm | 100 | | | | 100 | 100 | 80 | 100 | 60 | 100 | | 80 | 50 | 120 | 80 |
| Color | ppm | 4 | | | | 3 | 5 | 5 | 3 | 8 | 4 | | 3 | 4 | 5 | 6 |
| Odor | | none | | | | none | none | none | none | none | none | | none | none | none | none |
| Taste | | none | | | | none | none | none | none | none | none | | none | none | none | none |
| pH | | 7.6 | | | | 6.9 | 7.6 | 7.6 | 7.8 | 7.5 | 7.3 | | 7.3 | 7.2 | 7.2 | 7.1 |
| Alkalinity | ppm | 86 | | | | 78 | 86 | 85 | 78 | 85 | 93 | | 85 | 85 | 70 | 65 |
| Ammonia nitrogen | ppm | none | | | | none | none | none | none | none | none | | none | none | none | none |
| Nitrite nitrogen | ppm | none | | | | none | none | none | none | none | none | | none | none | none | none |
| Nitrate nitrogen | ppm | none | | | | none | none | none | none | none | none | | none | none | none | none |
| KMnO4 | ppm | 7.3 | | | | 9.6 | 6.0 | 8.6 | 7.8 | 7.3 | 7.1 | | 7.6 | 7.2 | 6.9 | 8.0 |
| E. C. | ms/hmo | 280 | | | | 290 | 280 | 280 | 290 | 290 | 290 | | 290 | 260 | 260 | 260 |
| Fe | ppm | 0.2 | | | | 0.1 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | | 0.1 | 0.2 | | 0.1 |
| Mn | ppm | none | | | | none | none | none | none | none | none | | none | none | none | none |
| Hg | ppm | none | | | | none | none | none | none | none | none | | none | none | none | none |

| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | mean | max. | min. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 | 21 | | 22 | 22 | 20 | 21 | 22 | 23 | 21 | 22 | 22 | 20 | 22 | 22 | 21 | 21.8 | 24 | 20 |
| 21 | 20 | | 20 | 20 | 19 | 19 | 20 | 22 | 19 | 20 | 20 | 19 | 20 | 20 | 19 | 20.1 | 22 | 19 |
| 120 | 100 | | 80 | 100 | 100 | 80 | 100 | 90 | 90 | 100 | 80 | 80 | 80 | 80 | 80 | 90 | 120 | 50 |
| 6 | 3 | | 2 | 4 | 6 | 4 | 4 | 5 | 3 | 3 | 6 | 3 | 3 | 3 | 4 | 4 | 8 | 2 |
| none | none | | none | none | none | none | none | none | none | none | none | none | none | none | none | | | |
| none | none | | none | none | none | none | none | none | none | none | none | none | none | none | none | | | |
| 7.2 | 7.3 | | 7.2 | 7.2 | 7.4 | 7.1 | 7.2 | 7.3 | 7.4 | 7.4 | 7.3 | 7.0 | 7.0 | 7.0 | 7.2 | 7.3 | 7.8 | 6.9 |
| 90 | 100 | | 87 | 87 | 87 | 85 | 89 | 70 | 82 | 89 | 87 | 70 | 71 | 70 | 75 | 83 | 100 | 70 |
| none | none | | none | none | none | none | none | none | none | none | none | none | none | none | none | | | |
| none | none | | none | none | none | none | none | none | none | none | none | none | none | none | none | | | |
| none | none | | none | none | none | none | none | none | none | none | none | none | none | none | none | | | |
| 6.9 | 6.8 | | 8.7 | 6.9 | 7.1 | 7.2 | 6.9 | 6.8 | 10.0 | 7.4 | 8.0 | 6.4 | 6.8 | 9.5 | 7.5 | 7.6 | 10.0 | 6.0 |
| 260 | 270 | | 280 | 240 | 260 | 260 | 290 | 270 | 275 | 270 | 270 | 270 | 270 | 270 | 275 | 273 | 290 | 240 |
| 0.1 | 0 | | 0.15 | 0.2 | 0.3 | 0.05 | 0.2 | 0.1 | 0.2 | 0.2 | 0.3 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.3 | 0.00 |
| none | none | | none | none | none | none | none | none | none | none | none | none | none | none | none | | | |
| none | none | | none | none | none | none | none | none | none | none | none | none | none | none | none | | | |

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# Table C.6

THATLUANG SWAMP AT NONG NIENG , LAO PDR
SURFACE WATER QUALITY

| | Temp [C] | pH | TSS [mg/l] | Cond [mS/M] | Ca [meq/l] | Mg [meq/l] | Na [meq/l] | K [meq/l] | Al [mg/l] | Alk [meq/l] | Cl [meq/l] | SO4 [meq/l] | Total-Fe [mg/l] | (NO3-2)-N [mg/l] | NH4-N [mg/l] | Total-N [mg/l] | PO4-P [mg/l] | Total-P [mg/l] | Si [mg/l] | O2 [mg/l] | COD-Mn [MG/L] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19 Aug. 86 | 30.4 | 6.6 | 84.0 | 13.9 | .756 | ..034 | .469 | .045 | | .776 | .432 | .034 | .509 | .107 | .014 | | .005 | .019 | 2.000 | 2.203 | 5.7 |
| 16 Sep. 86 | 30.7 | 6.9 | 47.0 | 10.0 | .216 | .384 | .372 | .034 | | .609 | .249 | .111 | .576 | .074 | .008 | | .006 | .609 | .950 | 2.710 | 5.6 |
| 15 Oct. 86 | 27.8 | 6.5 | 66.0 | 11.4 | .567 | .193 | .449 | .047 | | .766 | .508 | .202 | .709 | .298 | .021 | | .001 | .107 | 1.750 | .084 | 6.8 |
| 13 Nov. 86 | 25.8 | 6.4 | 260.0 | 16.4 | .534 | ..234 | .565 | .085 | | .720 | .667 | .149 | .491 | .049 | .019 | | .007 | .008 | 1.750 | .975 | *** |
| 16 Dec. 86 | 22.4 | 7.0 | 248.0 | 66.6 | | | 2.040 | .222 | | 1.136 | 2.842 | 1.908 | .143 | .647 | .239 | | .016 | .024 | 5.200 | .960 | 6.4 |
| 16 Jan. 87 | 22.4 | 6.8 | 992.0 | 88.6 | | | 2.680 | .206 | | 1.010 | 3.356 | .751 | .056 | .373 | .297 | | .004 | .007 | 4.870 | 2.063 | 5.2 |
| 18 Feb. 87 | 28.4 | 7.3 | 136.0 | 40.3 | 1.519 | .698 | .955 | .090 | | 2.155 | 1.006 | .240 | .185 | .133 | | | .001 | .007 | 4.870 | 3.396 | 4.0 |
| 17 Mar. 87 | 28.4 | 7.2 | 32.0 | 31.8 | | | .794 | .114 | | 1.902 | .616 | .606 | .025 | .174 | .057 | | .002 | .006 | 5.500 | 3.860 | 8.8 |
| 20 Apr. 87 | 32.4 | 7.2 | | 30.2 | 1.700 | .163 | 1.125 | .089 | | 1.910 | .801 | .404 | .224 | .772 | .019 | | .013 | .013 | | 2.700 | 6.2 |
| 18 May. 87 | 31.2 | 7.2 | | 30.8 | | | 1.585 | 1.185 | | 1.630 | 1.760 | .471 | .224 | .395 | .216 | | .007 | .117 | 6.760 | 1.770 | *** |
| 16 Jun. 87 | 30.6 | 7.0 | | 11.7 | .441 | .211 | .410 | .070 | | .642 | .340 | .100 | 1.750 | .128 | .065 | | .008 | .081 | 4.030 | 3.060 | 4.4 |
| 15 Jul. 87 | 30.3 | 6.6 | | 26.9 | .860 | .345 | 1.260 | .100 | | 1.135 | 1.166 | .413 | 2.548 | .457 | .250 | | .122 | .108 | 3.730 | 1.321 | *** |
| 15 Aug. 87 | 31.8 | 7.5 | 15.3 | .6 | .241 | .500 | .088 | .876 | | .509 | .148 | .123 | .123 | .168 | .029 | | .096 | .145 | 3.020 | 4.020 | 3.7 |
| 15 Sep. 87 | 30.0 | 6.6 | 124.0 | 16.9 | .610 | .027 | .662 | .035 | | .842 | .512 | .079 | .081 | .043 | .134 | | .051 | .063 | 2.400 | | 3.7 |
| 15 Oct. 87 | 30.8 | 6.5 | 36.0 | 12.4 | .440 | .260 | .438 | .044 | | .709 | .375 | .061 | .546 | .019 | .006 | | .008 | .025 | 3.400 | 2.350 | 5.5 |
| 14 Nov. 87 | 26.8 | 7.2 | 604.0 | 37.7 | .650 | .429 | 1.832 | .140 | | .709 | 2.037 | .448 | .063 | .231 | .987 | | .121 | .119 | 4.300 | 2.450 | *** |
| 17 Dec. 87 | 20.2 | 7.2 | 132.0 | 64.3 | 1.620 | .594 | 3.440 | .250 | | 1.579 | 3.684 | .915 | .128 | 1.526 | 2.044 | | .037 | .119 | 4.640 | 1.970 | 5.1 |
| 14 Jan. 88 | 23.2 | 7.3 | 1,320.0 | 35.2 | 1.660 | .487 | 1.100 | .215 | | 2.075 | 1.064 | .444 | .168 | .183 | .080 | | .002 | .091 | 7.100 | 2.600 | 8.9 |
| 23 Feb. 88 | 24.6 | 7.0 | 64.0 | 45.0 | 1.470 | 1.315 | 1.720 | .150 | | 2.071 | 1.840 | .599 | .233 | .030 | .033 | | .074 | .081 | 4.300 | 3.430 | 7.7 |
| 15 Mar. 88 | 29.2 | 7.2 | 114.0 | 37.9 | 1.743 | .562 | 1.130 | .080 | | 2.335 | 1.163 | .373 | .035 | .369 | .100 | | .127 | .189 | 4.200 | 2.160 | 9.9 |
| 11 Apr. 88 | 30.8 | 7.3 | 1,360.0 | 52.0 | 2.400 | .684 | 1.555 | .200 | | 3.287 | 1.280 | .699 | .121 | .665 | 1.347 | | .124 | .199 | 8.100 | 2.940 | 5.3 |
| 23 May. 88 | 32.7 | 6.6 | 48.0 | 11.2 | .429 | .160 | .160 | .075 | | .625 | .337 | .135 | .158 | .242 | .028 | | .047 | .035 | 3.600 | 2.090 | 4.1 |
| 14 Jun. 88 | 29.0 | 6.7 | .1 | 18.5 | .659 | .305 | .750 | .055 | | .984 | .637 | .232 | .661 | .096 | .108 | .461 | .039 | .054 | 4.700 | 1.430 | 9.6 |
| 15 Jul. 88 | 29.6 | 6.9 | 2,044.0 | 21.7 | .778 | .348 | 1.200 | .053 | | 1.168 | .748 | .237 | .258 | .186 | .114 | | .065 | .248 | 3.400 | 3.091 | 6.4 |
| 16 Aug. 88 | 29.5 | 6.4 | 218.0 | 19.8 | | | .820 | .040 | | .942 | .809 | .140 | .463 | .433 | .152 | .142 | .055 | .059 | 2.600 | 2.139 | *** |
| 14 Sep. 88 | 30.4 | 6.9 | 38.0 | 13.3 | .548 | .200 | .445 | .044 | | .792 | .366 | .140 | .362 | .097 | .136 | .142 | .022 | .039 | 3.800 | 3.400 | 5.7 |
| 18 Oct. 88 | 25.4 | 6.8 | 56.0 | 12.4 | .422 | .195 | .421 | .078 | | .616 | .450 | .140 | .916 | .135 | .089 | | .052 | .049 | 2.800 | 3.500 | 4.5 |
| 15 Nov. 88 | 23.6 | 7.0 | 508.0 | 17.6 | .605 | .299 | .850 | .050 | | .709 | 1.018 | .518 | 1.209 | .008 | .336 | | .065 | .104 | 2.560 | 1.210 | 8.5 |
| 19 Dec. 88 | 21.0 | 7.0 | 248.0 | 60.0 | 1.346 | .625 | 3.520 | .260 | | 1.292 | 4.043 | 1.055 | .200 | .118 | .524 | | .225 | .150 | 5.500 | .710 | *** |
| 17 Jan. 89 | 23.6 | 7.1 | 56.0 | 38.8 | 2.200 | .069 | 1.685 | .195 | | 1.268 | 1.427 | 1.552 | .574 | .341 | .037 | | .039 | .072 | 7.500 | 4.660 | 7.7 |
| 15 Feb. 89 | 24.2 | 7.1 | 110.0 | 40.6 | 1.962 | .271 | 1.125 | .047 | | 1.892 | 1.589 | 3.509 | .851 | .469 | .290 | | .047 | .073 | 4.600 | .073 | 8.0 |
| 15 Mar. 89 | 27.4 | 7.0 | 37.0 | 41.0 | 1.933 | .274 | .250 | .019 | | 2.114 | 1.494 | .860 | .205 | .082 | .119 | | .039 | .030 | 5.000 | 2.200 | 7.3 |
| 19 Apr. 89 | 30.6 | 7.3 | 79.0 | 43.2 | 1.956 | .494 | 2.000 | .033 | | 2.330 | 1.311 | .467 | .265 | .468 | .023 | | .142 | .085 | 7.400 | 1.550 | 8.3 |
| 16 May. 89 | 28.4 | 6.7 | 64.0 | 25.2 | .840 | .592 | .950 | .033 | | .982 | 1.129 | .460 | .386 | .629 | .329 | | .105 | .030 | 4.200 | 1.067 | 8.3 |

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Table C.7 Existing Water Quality Data(Mean Maximum Minimum)

Location:NONG NIENG

| Year | Item | Temp C | PH | TSS mg | Cond mS/M | Ca meq/l | Mg meq/l | Na meq/l | K meq/l | Alk meq/l | Cl meq/l | SO4 meq/l | Total Fe mg/l | (NO3 -2)-N mg/l | NH4 -N mg/l | Total -n mg/l | PO4 -P mg/l | Total -P mg/l | Si mg/l | O2 mg/l | COD -MN mg/l |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| * | Mean | 27.4 | 6.7 | 141.0 | 23.7 | 0.518 | 0.211 | 0.779 | 0.087 | 0.801 | 0.939 | 0.481 | 0.485 | 0.235 | 0.060 | | 6.000 | 0.053 | 2.450 | 1.374 | 6.2 |
| 1986 | Max. | 30.7 | 7.0 | 260.0 | 66.6 | 0.756 | 0.384 | 2.040 | 0.222 | 1.136 | 2.842 | 1.908 | 0.709 | 0.709 | 0.239 | | 0.010 | 0.107 | 5.800 | 2.710 | 6.8 |
| | Min. | 22.4 | 6.4 | 47.0 | 10.0 | 0.216 | 0.034 | 0.372 | 0.034 | 0.609 | 0.249 | 0.034 | 0.143 | 0.143 | 0.008 | | 0.001 | 0.008 | 0.950 | 0.084 | 5.6 |
| | Mean | 28.6 | 7.1 | 246.4 | 32.7 | 0.898 | 0.358 | 1.272 | 0.267 | 1.227 | 1.317 | 0.384 | 0.496 | 0.368 | 0.373 | | 0.052 | 0.069 | 4.303 | 2.636 | 5.2 |
| 1987 | Max. | 32.4 | 7.5 | 892.0 | 88.6 | 1.700 | 0.698 | 3.440 | 1.185 | 2.155 | 3.684 | 0.915 | 2.548 | 1.526 | 2.004 | | 0.122 | 0.145 | 6.700 | 4.020 | 8.8 |
| | Min. | 20.2 | 6.1 | 15.3 | 0.6 | 0.241 | 0.027 | 0.088 | 0.035 | 0.509 | 0.148 | 0.061 | 0.025 | 0.019 | 0.006 | | 0.001 | 0.006 | 2.400 | 1.321 | 3.7 |
| | Mean | 27.5 | 6.9 | 108.2 | 28.7 | 1.096 | 0.471 | 1.139 | 0.108 | 1.408 | 1.146 | 0.393 | 0.399 | 0.214 | 0.254 | 0.248 | 0.077 | 0.101 | 4.383 | 2.392 | 7.1 |
| 1988 | Max. | 32.7 | 7.3 | 2044.0 | 60.0 | 2.400 | 1.315 | 1.720 | 0.260 | 3.287 | 4.043 | 1.055 | 1.209 | 0.665 | 1.347 | 0.461 | 0.225 | 0.248 | 8.100 | 3.500 | 9.9 |
| | Min. | 21.0 | 6.4 | 0.1 | 11.2 | 0.422 | 0.160 | 0.160 | 0.040 | 0.616 | 0.337 | 0.135 | 0.035 | 0.008 | 0.028 | 0.142 | 0.022 | 0.039 | 2.500 | 0.710 | 4.1 |
| ※ | Mean | 26.9 | 7.1 | 69.2 | 37.8 | 1.738 | 0.340 | 1.202 | 0.073 | 1.717 | 1.390 | 1.369 | 0.456 | 0.398 | 0.159 | | 0.074 | 0.058 | 5.740 | 1.898 | 7.9 |
| 1989 | Max. | 30.8 | 7.3 | 110.0 | 43.2 | 2.200 | 0.592 | 2.000 | 0.195 | 2.330 | 1.589 | 3.509 | 0.851 | 0.629 | 0.329 | | 0.142 | 0.085 | 7.500 | 4.600 | 8.3 |
| | Min. | 23.6 | 6.7 | 37.0 | 25.2 | 0.640 | 0.069 | 0.250 | 0.019 | 0.982 | 1.129 | 0.460 | 0.205 | 0.082 | 0.023 | | 0.039 | 0.030 | 4.200 | 0.073 | 7.3 |
| | Mean | 27.8 | 6.9 | 257.1 | 30.7 | 0.909 | 0.322 | 1.143 | 0.156 | 1.300 | 1.212 | 0.454 | 0.298 | 0.243 | 0.022 | | 0.059 | 0.076 | 4.144 | 2.178 | 7.2 |
| TOTAL | Max. | 32.7 | 7.5 | 2044.0 | 88.6 | 2.400 | 1.315 | 3.520 | 1.185 | 3.287 | 4.043 | 2.548 | 1.526 | 2.044 | 0.461 | | 0.225 | 0.248 | 8.100 | 4.600 | 12.2 |
| | Min. | 20.2 | 6.1 | 0.1 | 0.6 | 0.216 | 0.027 | 0.088 | 0.019 | 0.509 | 0.148 | 0.034 | 0.025 | 0.008 | 0.006 | | 0.001 | 0.006 | 0.950 | 0.073 | 3.7 |

* 1986: from Aug. to Dec.

1989: from Jan. to May

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# Table C.8

THATLUANG SWAMP AT NONGTENG , LAO PDR
SURFACE WATER QUALITY

| | Temp [C] | pH | TSS [mg/l] | Cond [mS/M] | Ca [meq/l] | Mg [meq/l] | Na [meq/l] | K [meq/l] | Al [mg/l] | Alk [meq/l] | Cl [meq/l] | SO4 [meq/l] | Total-Fe [mg/l] | (NO3-2)-N [mg/l] | NH4-N [mg/l] | Total-N [mg/l] | PO4-P [mg/l] | P.T [mg/l] | Si [mg/l] | DO [mg/l] | COD [MG/L] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19 Aug, 86 | 31.2 | 6.9 | 122.0 | 12.4 | .700 | .024 | .431 | .041 | | .716 | .400 | .050 | .353 | .222 | .020 | | .005 | .181 | 2.400 | 2.772 | 3.0 |
| 16 Sep, 86 | 31.8 | 6.6 | 2.0 | 9.4 | .462 | .141 | .315 | .038 | | .576 | .221 | .110 | .258 | .087 | .065 | | .005 | .006 | .911 | 4.507 | 3.3 |
| 15 Oct, 86 | 28.6 | 7.0 | 144.0 | 16.4 | .554 | .243 | .502 | .064 | | .854 | .467 | .377 | .130 | .550 | .012 | | .009 | .007 | 3.340 | 1.566 | 3.4 |
| 17 Nov, 86 | 25.6 | 7.1 | 284.0 | 22.4 | .760 | .768 | .655 | .089 | | .912 | .804 | .163 | .067 | .066 | .008 | | .002 | .004 | 3.030 | .799 | 4.7 |
| 16 Dec, 86 | 24.2 | 7.3 | 16.0 | 28.5 | | | .626 | .130 | | 1.831 | .579 | .349 | .030 | .237 | .078 | | .021 | .027 | 5.700 | 6.232 | 2.8 |
| 16 Jan, 87 | 22.4 | 7.3 | 8.0 | 26.1 | | | .485 | .072 | | 1.943 | .298 | .479 | .137 | .156 | .049 | | .026 | .043 | 4.540 | 5.345 | 1.2 |
| 17 Feb, 87 | 25.8 | 7.3 | 6.0 | 29.3 | 1.499 | .593 | .627 | .097 | | 2.070 | .547 | .214 | .025 | .107 | | | .001 | .008 | 6.529 | 3.383 | .7 |
| 17 Mar, 87 | 28.2 | 7.2 | 36.0 | 29.1 | | | .656 | .103 | | 1.877 | .739 | .281 | .005 | .091 | | | .013 | .018 | 6.100 | 3.145 | 5.4 |
| 20 Apr, 87 | 32.0 | 7.3 | | 27.5 | 1.250 | .559 | .930 | .052 | | 1.850 | .637 | .321 | .086 | .424 | .021 | | .016 | .008 | 5.800 | 2.800 | 5.1 |
| 18 May, 87 | 31.8 | 7.3 | | 27.6 | | | 1.215 | .145 | | 2.040 | .979 | .387 | .086 | .116 | .115 | | .058 | .104 | 7.100 | .970 | 5.6 |
| 16 Jun, 87 | 31.0 | 6.9 | | 11.3 | .616 | .063 | .370 | .006 | | .653 | .302 | .180 | 1.382 | .121 | .055 | | .058 | .053 | 4.200 | 2.900 | 3.8 |
| 15 Jul, 87 | 31.0 | 7.1 | | 29.6 | 1.130 | .288 | 1.205 | .130 | | 1.463 | 1.057 | .204 | .755 | .472 | .280 | | .093 | .069 | 6.660 | 1.910 | 5.0 |
| 17 Aug, 87 | 28.2 | 7.3 | | 14.1 | .560 | .240 | .422 | .102 | | .839 | .372 | .190 | .123 | .036 | .053 | | .209 | .247 | 3.100 | 3.250 | 3.7 |
| 14 Sep, 87 | 32.0 | 6.6 | 200.0 | 14.0 | .490 | .210 | .440 | .037 | | .671 | .440 | .151 | .155 | .103 | .025 | | .019 | .020 | 3.100 | 2.885 | 2.7 |
| 16 Oct, 87 | 29.8 | 7.0 | 40.0 | 11.8 | .320 | .339 | .630 | .035 | | .669 | .360 | .148 | 1.424 | .027 | .062 | | .010 | .025 | 3.100 | | 8.3 |
| 14 Nov, 87 | 27.9 | 7.1 | 184.0 | 27.9 | .670 | | 1.130 | .027 | | 1.214 | 1.197 | .433 | .067 | .152 | .016 | | .032 | .043 | 5.000 | 2.750 | 4.3 |
| 17 Dec, 87 | 21.8 | 6.5 | 8.0 | 28.8 | 1.470 | .496 | .780 | .110 | | 1.590 | .503 | .483 | .150 | .318 | .083 | | .037 | .053 | 5.500 | 6.920 | 1.9 |
| 14 Jan, 88 | 23.6 | 7.4 | 2.0 | 29.4 | 1.340 | .949 | .586 | .072 | | 2.129 | .479 | .445 | .049 | .287 | .002 | | .024 | .042 | 6.900 | 6.900 | 1.6 |
| 23 Feb, 88 | 24.4 | 7.3 | 8.0 | 33.0 | 1.545 | .787 | .956 | .092 | | 2.116 | .719 | .559 | | .067 | .056 | | .034 | .040 | 5.600 | 2.770 | 3.7 |
| 15 Mar, 88 | 28.8 | 7.1 | 10.0 | 39.2 | 1.515 | .810 | .708 | .048 | | 2.132 | .700 | .430 | | .324 | .117 | | .023 | .132 | 4.800 | 2.766 | 5.6 |
| 11 Apr, 88 | 29.0 | 7.1 | 164.0 | 32.5 | 1.240 | 1.032 | .950 | .060 | | 2.400 | .781 | .208 | .154 | .131 | .162 | | .033 | .054 | 6.112 | 1.544 | 6.1 |
| 23 May, 88 | 32.2 | 6.6 | 36.0 | 10.1 | .380 | .166 | .285 | .047 | | .573 | .300 | .129 | .420 | .190 | .033 | | .040 | .028 | 3.700 | 2.630 | 3.5 |
| 14 Jun, 88 | 30.0 | 7.1 | 40.0 | 20.0 | .797 | .286 | .600 | .045 | | 1.150 | .598 | .156 | .275 | .068 | .048 | | .029 | .042 | 5.400 | 4.300 | 6.0 |
| 15 Jul, 88 | 29.2 | 7.1 | 312.0 | 19.4 | .602 | .411 | 1.230 | .045 | | .961 | .655 | .423 | .211 | .162 | .225 | | .052 | .135 | 3.500 | 2.890 | 5.0 |
| 16 Aug, 88 | 29.6 | 6.9 | 180.0 | 19.0 | | | .760 | .042 | | .942 | .734 | .147 | .196 | .091 | .181 | .095 | .049 | .055 | 3.100 | 3.013 | 4.2 |
| 14 Sep, 88 | 32.8 | 7.0 | | 16.7 | .482 | .124 | .338 | .062 | | .641 | .298 | .122 | .219 | .148 | .097 | .095 | .019 | .027 | 3.100 | 4.970 | 4.5 |
| 18 Oct, 88 | 26.4 | 6.7 | 48.0 | 11.6 | .418 | .179 | .405 | .056 | | .599 | .393 | .157 | .790 | .077 | .091 | | .043 | .044 | 2.600 | 3.400 | 3.6 |
| 15 Nov, 88 | 24.4 | 6.9 | 148.0 | 17.6 | .714 | .289 | .820 | .070 | | .981 | .809 | .287 | .874 | .482 | .166 | | .039 | .072 | 4.300 | 2.890 | 2.2 |
| 19 Dec, 88 | 21.4 | 7.3 | 16.0 | 30.0 | 1.589 | .708 | .950 | .130 | | 2.370 | .619 | .539 | .200 | .457 | .586 | | .078 | .087 | 4.800 | 4.300 | 3.7 |
| 15 Feb, 89 | 23.2 | 7.3 | 20.0 | 30.7 | 2.020 | .259 | .825 | .040 | | 2.188 | .667 | .491 | .178 | .152 | .063 | | .037 | .061 | 6.009 | .060 | 2.3 |
| 15 Mar, 89 | 27.6 | 7.2 | 4.0 | 30.1 | 2.190 | .216 | .600 | .038 | | 2.267 | .484 | .620 | .172 | .123 | .090 | | .043 | .027 | 6.800 | 3.800 | 2.4 |
| 19 Apr, 89 | 30.8 | 7.3 | | 35.0 | 1.858 | .321 | 1.200 | .026 | | 2.250 | .786 | .296 | .139 | .056 | .016 | | .027 | .023 | 5.700 | 1.590 | 4.5 |
| 16 May, 89 | 28.9 | 7.0 | 50.0 | 29.6 | .967 | .687 | .800 | .027 | | 1.573 | .918 | .500 | .164 | .786 | .339 | | .158 | .027 | 5.400 | 3.651 | 5.6 |

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Table C.9 Existing Water Quality Data(Mean Maximum Minimum)

Location;HONG XENG

| Year | Item | Temp C | PH | TSS mg | Cond mS/M | Ca meq/l | Mg meq/l | Na meq/l | K meq/l | Alk meq/l | Cl meq/l | SO4 meq/l | Total Fe mg/l | (NO3 -2)-N mg/l | NH4 -N mg/l | Total -n mg/l | PO4 -P mg/l | Total -P mg/l | Si mg/l | O2 mg/l | COD -MN mg/l |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | 28.3 | 7.0 | 113.6 | 17.8 | 0.619 | 0.294 | 0.506 | 0.072 | 0.979 | 0.494 | 0.209 | 0.168 | 0.232 | 0.367 | | 8.200 | 0.045 | 3.076 | 3.175 | 3.4 |
| * 1986 | Max. | 31.8 | 7.3 | 284.0 | 28.5 | 0.760 | 0.768 | 0.655 | 0.130 | 1.831 | 0.804 | 0.377 | 0.353 | 0.550 | 0.078 | | 0.021 | 0.181 | 5.700 | 6.232 | 4.7 |
| | Min. | 24.2 | 6.6 | 2.0 | 9.4 | 0.462 | 0.024 | 0.315 | 0.038 | 0.578 | 0.221 | 0.050 | 0.030 | 0.066 | 0.008 | | 0.002 | 0.004 | 0.911 | 0.799 | 2.8 |
| | Mean | 28.5 | 7.1 | 69.2 | 23.0 | 0.891 | 0.349 | 0.740 | 0.075 | 1.441 | 0.620 | 0.288 | 0.366 | 0.177 | 0.076 | | 0.048 | 0.058 | 4.893 | 3.296 | 3.9 |
| 1987 | Max. | 32.0 | 7.3 | 200.0 | 29.3 | 1.499 | 0.593 | 1.215 | 0.145 | 2.070 | 1.197 | 0.479 | 1.424 | 0.424 | 0.280 | | 0.209 | 0.247 | 7.100 | 6.920 | 8.3 |
| | Min. | 21.8 | 6.5 | 8.0 | 11.3 | 0.320 | 0.063 | 0.422 | 0.035 | 0.653 | 0.298 | 0.148 | 0.025 | 0.027 | 0.016 | | 0.001 | 0.008 | 3.100 | 0.970 | 0.7 |
| | Mean | 27.7 | 7.1 | 87.6 | 21.9 | 0.966 | 0.522 | 0.716 | 0.064 | 1.416 | 0.590 | 0.300 | 0.338 | 0.207 | 0.145 | 0.095 | 0.038 | 0.063 | 4.492 | 3.530 | 4.2 |
| 1988 | Max. | 32.8 | 7.4 | 312.0 | 33.0 | 1.589 | 1.032 | 1.230 | 0.130 | 2.400 | 0.809 | 0.558 | 0.874 | 0.482 | 0.586 | 0.095 | 0.078 | 0.135 | 6.900 | 6.900 | 6.1 |
| | Min. | 21.4 | 6.6 | 2.0 | 10.1 | 0.380 | 0.124 | 0.285 | 0.042 | 0.573 | 0.298 | 0.122 | 0.049 | 0.067 | 0.002 | 0.095 | 0.019 | 0.027 | 2.600 | 0.400 | 1.6 |
| ※ | Mean | 27.6 | 7.2 | 24.6 | 31.1 | 1.758 | 0.370 | 0.856 | 0.033 | 2.069 | 0.714 | 0.477 | 0.163 | 0.279 | 0.127 | | 0.066 | 0.035 | 6.475 | 2.275 | 3.7 |
| 1989 | Max. | 30.8 | 7.3 | 50.0 | 35.0 | 2.190 | 0.687 | 1.200 | 0.040 | 2.267 | 0.918 | 0.620 | 0.178 | 0.786 | 0.339 | | 0.158 | 0.061 | 8.800 | 3.800 | 5.6 |
| | Min. | 23.2 | 7.0 | 4.0 | 28.6 | 0.967 | 0.216 | 0.600 | 0.026 | 1.573 | 0.484 | 0.296 | 0.139 | 0.056 | 0.016 | | 0.027 | 0.023 | 5.400 | 0.060 | 2.3 |
| | Mean | 28.1 | 7.0 | 63.3 | 22.8 | 0.853 | 0.339 | 0.710 | 0.065 | 1.438 | 0.601 | 0.303 | 0.281 | 0.208 | 0.096 | 0.005 | 0.040 | 0.054 | 4.664 | 3.139 | 3.9 |
| TOTAL | Max. | 32.8 | 7.4 | 312.0 | 35.0 | 2.190 | 1.032 | 1.230 | 0.145 | 2.400 | 1.197 | 0.620 | 1.424 | 0.786 | 0.586 | 0.095 | 0.209 | 0.247 | 8.800 | 6.920 | 8.3 |
| | Min. | 21.4 | 6.5 | 2.0 | 9.4 | 0.320 | 0.024 | 0.285 | 0.026 | 0.573 | 0.221 | 0.050 | 0.025 | 0.027 | 0.002 | 0.060 | 0.001 | 0.004 | 0.911 | | 0.7 |

* 1986: from Aug. to Dec.

1989: from Jan. to May

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# Table C.10

THATLUANG SWAMP AT HOUA KHOA , LAO PDR
SURFACE WATER QUALITY

| | Temp [C] | pH | TSS [mg/l] | Cond [mS/M] | Ca [meq/l] | Mg [meq/l] | Na [meq/l] | K [meq/l] | Al [mg/l] | Alk [meq/l] | Cl [meq/l] | SO4 [meq/l] | Total-Fe [mg/l] | (NO3-2)-N [mg/l] | NH4-N [mg/l] | Total-N [mg/l] | PO4-P [mg/l] | Total-P [mg/l] | Si [mg/l] | DO [mg/l] | COD-MN [MG/L] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19 Aug. 86 | 29.2 | 6.2 | 108.0 | 13.7 | .622 | .132 | .498 | .029 | | .681 | .428 | .158 | .156 | .003 | .011 | | .003 | .267 | 1.400 | | 8.7 |
| 16 Sep. 86 | 29.0 | 7.1 | 2.0 | 8.9 | .339 | .184 | .290 | .025 | | .084 | .347 | .002 | 1.695 | .012 | .002 | | .007 | .012 | .095 | .426 | 3.9 |
| 15 Oct. 86 | 28.0 | 6.2 | | 11.4 | .392 | .225 | .385 | .032 | | .590 | .347 | .211 | 1.543 | .038 | .083 | | .001 | .024 | .956 | .074 | 8.2 |
| 17 Nov. 86 | 25.6 | 6.5 | 298.0 | 8.9 | .700 | .300 | .597 | .099 | | .898 | .690 | .168 | .471 | .077 | .031 | | .008 | .004 | 1.710 | .391 | *** |
| 16 Dec. 86 | 24.6 | 7.4 | 224.0 | 34.6 | 1.260 | .535 | .864 | .244 | | 1.954 | 1.081 | .329 | .179 | .165 | .151 | | .016 | .027 | 4.810 | 6.795 | 9.7 |
| 16 Jan. 87 | 22.4 | 7.0 | 364.0 | 38.5 | | | 1.041 | .198 | | 1.440 | 1.595 | .699 | .157 | .010 | .119 | | .003 | .012 | 5.590 | 3.691 | 9.4 |
| 17 Feb. 87 | 26.4 | 7.4 | 32.0 | 35.1 | 1.411 | .816 | .831 | .094 | | 2.269 | .923 | .349 | .061 | .143 | | | .001 | .008 | 2.861 | 5.351 | 8.2 |
| 17 Mar. 87 | 26.4 | 7.2 | 172.0 | 37.6 | | | .826 | .195 | | 1.788 | 1.281 | .341 | .205 | .643 | .215 | | .021 | .034 | 4.900 | 1.126 | *** |
| 20 Apr. 87 | 36.0 | 7.0 | | 42.9 | 1.550 | .642 | 1.565 | .230 | | 2.170 | 1.402 | .629 | .335 | 1.000 | .031 | | .032 | .033 | 5.000 | 4.590 | 8.4 |
| 19 May. 87 | 32.0 | 7.0 | | 42.9 | | | 1.450 | .185 | | 1.680 | 1.630 | .280 | .335 | .119 | .548 | | .157 | .171 | 5.400 | 1.630 | *** |
| 16 Jun. 87 | 30.0 | 6.8 | | 24.0 | 1.000 | .281 | .920 | .150 | | 1.421 | .670 | .302 | .300 | .455 | .618 | | .077 | .101 | 5.800 | | 5.3 |
| 15 Jul. 87 | 29.8 | 6.4 | | 24.4 | .800 | .356 | .140 | .080 | | 1.024 | 1.610 | .398 | 1.004 | .095 | .136 | | .111 | .071 | 3.630 | | *** |
| 17 Aug. 87 | 27.4 | 7.1 | | 22.6 | .980 | .262 | .728 | .130 | | 1.323 | .653 | .303 | .342 | .462 | .201 | | .130 | .169 | 3.979 | 1.790 | 7.2 |
| 14 Sep. 87 | 28.4 | 6.0 | 72.0 | 15.4 | .600 | .248 | .552 | .032 | | .851 | .479 | .171 | 1.025 | .007 | .023 | | .011 | .014 | 2.300 | | 9.5 |
| 10 Oct. 87 | 29.8 | 7.0 | 40.0 | 11.8 | .320 | .339 | .630 | .035 | | .689 | .380 | .148 | 1.424 | .027 | .062 | | .010 | .025 | 3.160 | | 8.3 |
| 14 Nov. 87 | 28.8 | 7.7 | 152.0 | 20.0 | .950 | .158 | .635 | .018 | | 1.179 | .566 | .273 | .178 | .391 | .306 | | .028 | .077 | 2.700 | 5.750 | 9.5 |
| 17 Dec. 87 | 20.2 | 7.2 | 170.0 | 32.6 | 1.300 | .314 | 1.350 | .190 | | 1.735 | 1.029 | .540 | .133 | 1.139 | .347 | | .025 | .155 | 3.650 | 4.410 | 8.4 |
| 14 Jan. 88 | 23.2 | 7.3 | 1,320.0 | 35.2 | 1.660 | .486 | 1.100 | .215 | | 2.075 | 1.064 | .444 | .168 | .163 | .080 | | .082 | .091 | 7.100 | 2.610 | 8.9 |
| 23 Feb. 88 | 24.2 | 7.2 | 248.0 | 33.5 | 1.428 | .614 | 1.120 | .175 | | 2.184 | .784 | .596 | .111 | .060 | .311 | | .321 | .296 | 3.700 | 2.120 | *** |
| 15 Mar. 88 | 28.6 | 7.1 | 316.0 | 33.5 | 1.523 | .718 | .335 | .085 | | 2.330 | .315 | .135 | .690 | .599 | .279 | | .334 | .165 | 3.800 | 2.115 | *** |
| 11 Apr. 88 | 30.2 | 7.1 | 512.0 | 35.1 | 1.320 | .361 | 1.100 | .125 | | 2.137 | .901 | .550 | .159 | .284 | .010 | | .160 | .177 | 5.500 | .770 | 9.7 |
| 23 May. 88 | 31.4 | 6.5 | | 16.4 | .569 | .264 | .460 | .080 | | .847 | .587 | .137 | .686 | .067 | .029 | | .007 | .036 | 3.600 | | 6.4 |
| 14 Jun. 88 | 28.8 | 6.4 | 20.0 | 16.1 | .586 | .246 | .534 | .186 | | .843 | .558 | .142 | .968 | .051 | .181 | | .028 | .042 | 3.900 | .801 | *** |
| 15 Jul. 88 | 29.2 | 6.7 | 220.0 | 20.7 | .766 | 1.122 | .356 | .056 | | 1.149 | .611 | .322 | .060 | .203 | .179 | | .036 | .160 | 3.000 | 1.279 | 7.9 |
| 16 Aug. 88 | 30.2 | 6.1 | 68.0 | 17.0 | | | .635 | .027 | | .754 | .672 | .162 | .593 | .150 | .160 | .194 | .031 | .042 | 2.000 | 1.356 | *** |
| 14 Sep. 88 | 31.0 | 6.6 | 50.0 | 16.8 | .658 | .266 | .550 | .075 | | .980 | .421 | .199 | .719 | .469 | .038 | .194 | .049 | .101 | 3.700 | 1.750 | 8.2 |
| 18 Oct. 88 | 27.4 | 7.1 | 104.0 | 29.0 | 1.140 | .383 | .850 | .150 | | 1.495 | .786 | .620 | .583 | 1.480 | 1.401 | | .124 | .165 | 5.200 | 2.400 | 7.9 |
| 15 Nov. 88 | 23.6 | 6.4 | 760.0 | 16.7 | .594 | .276 | .880 | .055 | | .646 | 1.002 | .656 | 1.244 | 1.020 | .302 | | .061 | .109 | 2.300 | .740 | *** |
| 19 Dec. 88 | 21.8 | 7.3 | 268.0 | 30.0 | .719 | .625 | 1.550 | .150 | | 1.880 | 1.530 | .867 | .200 | 1.080 | .979 | | .313 | .299 | 3.700 | 4.130 | *** |
| 17 Jan. 89 | 22.2 | 7.1 | 52.0 | 33.9 | 2.054 | .069 | 1.335 | .120 | | 1.419 | 1.051 | 1.232 | .513 | 1.175 | .090 | | .028 | .048 | 3.900 | 5.300 | 6.7 |
| 15 Feb. 89 | 23.4 | 7.0 | 110.0 | 33.7 | 1.829 | .255 | 1.025 | .062 | | 1.940 | 1.022 | 1.375 | 1.427 | .553 | .235 | | .071 | .054 | 3.800 | .054 | *** |
| 15 Mar. 89 | 26.8 | 6.9 | 128.0 | 32.9 | 1.856 | .321 | 1.250 | .032 | | 2.360 | .685 | .509 | .254 | .083 | .228 | | .051 | .037 | 8.800 | 1.500 | *** |
| 19 Apr. 89 | 30.0 | 7.2 | 138.0 | 37.7 | 2.064 | .345 | 1.650 | .026 | | 2.260 | 1.194 | .267 | .165 | .858 | .017 | | .204 | .133 | 7.800 | 1.560 | *** |
| 16 May. 89 | 27.0 | 6.8 | 8.0 | 31.5 | 1.459 | .125 | 1.050 | .033 | | 1.177 | 1.033 | 1.060 | .027 | .814 | 1.379 | | .148 | .037 | 3.900 | 1.220 | 9.5 |



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Table C.11 Existing Water Quality Data(Mean Maximum Minimum)

Location; HONG HUA KHOA

| Year | Item | Temp C | PH | TSS mg | Cond mS/M | Ca meq/l | Mg meq/l | Na meq/l | K meq/l | Alk meq/l | Cl meq/l | SO4 meq/l | Total Fe mg/l | (NO3 -2)-N mg/l | NH4 -N mg/l | Total -n mg/l | PO4 -P mg/l | Total -P mg/l | Si mg/l | 02 mg/l | COD -MN mg/l |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| * | Mean | 27.3 | 6.7 | 158.0 | 15.5 | 0.663 | 0.275 | 0.520 | 0.086 | 0.841 | 0.579 | 0.174 | 0.809 | 0.059 | 0.056 | | 7.000 | 0.067 | 1.794 | 1.922 | 8.7 |
| 1986 | Max. | 29.2 | 7.4 | 298.0 | 34.6 | 1.260 | 0.535 | 0.854 | 0.244 | 1.954 | 1.081 | 0.329 | 1.695 | 0.165 | 0.151 | | 0.016 | 0.267 | 4.810 | 6.795 | 8.9 |
| | Min. | 24.6 | 6.2 | 2.0 | 8.9 | 0.339 | 0.132 | 0.280 | 0.025 | 0.084 | 0.347 | 0.002 | 0.156 | 0.003 | 0.002 | | 0.001 | 0.004 | 0.095 | 0.074 | 8.2 |
| | Mean | 25.8 | 7.0 | 143.1 | 28.9 | 0.995 | 0.368 | 0.889 | 0.128 | 1.465 | 1.018 | 0.369 | 0.457 | 0.370 | 0.236 | | 0.051 | 0.137 | 4.076 | 3.447 | 8.3 |
| 1987 | Max. | 36.0 | 7.7 | 364.0 | 42.9 | 1.550 | 0.816 | 1.565 | 0.230 | 2.269 | 1.630 | 0.699 | 1.424 | 1.139 | 0.618 | | 0.157 | 0.171 | 5.800 | 5.750 | 9.5 |
| | Min. | 20.2 | 6.0 | 32.0 | 11.8 | 0.320 | 0.158 | 0.140 | 0.018 | 0.689 | 0.380 | 0.148 | 0.061 | 0.007 | 0.023 | | 0.001 | 0.012 | 2.300 | 1.126 | 5.3 |
| | Mean | 27.5 | 6.9 | 233.4 | 25.0 | 0.997 | 0.488 | 0.789 | 0.115 | 1.443 | 0.767 | 0.403 | 0.515 | 0.471 | 0.329 | 0.608 | 0.129 | 0.141 | 3.958 | 1.822 | 8.1 |
| 1988 | Max. | 31.4 | 7.3 | 1320.0 | 35.2 | 1.660 | 1.122 | 1.550 | 0.215 | 2.330 | 1.530 | 0.867 | 1.244 | 1.480 | 1.401 | 0.608 | 0.334 | 0.299 | 7.100 | 4.130 | 9.7 |
| | Min. | 21.8 | 6.1 | 20.0 | 16.1 | 0.568 | 0.246 | 0.335 | 0.027 | 0.646 | 0.315 | 0.135 | 0.060 | 0.060 | 0.010 | 0.608 | 0.007 | 0.036 | 2.000 | 0.730 | 6.4 |
| | Mean | 25.9 | 7.0 | 87.2 | 33.9 | 1.852 | 0.223 | 1.262 | 0.053 | 1.831 | 0.997 | 0.889 | 0.477 | 0.697 | 0.390 | | 0.101 | 0.062 | 5.640 | 1.927 | 16.2 |
| * 1989 | Max. | 30.0 | 7.2 | 138.0 | 33.9 | 2.046 | 0.345 | 1.650 | 0.120 | 2.360 | 1.194 | 1.375 | 1.427 | 1.175 | 1.379 | | 0.204 | 0.133 | 8.800 | 5.300 | 9.5 |
| | Min. | 22.2 | 6.8 | 8.0 | 31.5 | 1.459 | 0.069 | 1.025 | 0.026 | 1.177 | 0.685 | 0.267 | 0.027 | 0.083 | 0.017 | | 0.028 | 0.037 | 3.800 | 0.054 | 6.7 |
| | Mean | 27.4 | 6.8 | 175.1 | 26.3 | 0.955 | 0.343 | 0.854 | 0.106 | 1.419 | 0.861 | 0.428 | 0.532 | 0.409 | 0.258 | 0.034 | 0.079 | 0.094 | 3.928 | 1.912 | 9.9 |
| TOTAl | Max. | 36.0 | 7.7 | 1320.0 | 42.9 | 2.046 | 1.122 | 1.650 | 0.244 | 2.360 | 1.630 | 1.375 | 1.695 | 1.480 | 1.401 | 0.608 | 0.334 | 0.299 | 8.800 | 6.795 | 21.5 |
| | Min. | 20.2 | 6.0 | 2.0 | 8.9 | 0.320 | 0.069 | 0.140 | 0.018 | 0.084 | 0.315 | 0.002 | 0.027 | 0.003 | 0.002 | 0.000 | 0.001 | 0.004 | 0.095 | 0.54 | 5.3 |

* 1986: from Aug. to Dec.

1989: from Jan. to May

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# Table C.12 THATLUANG SWAMP AT HONGKE, LAO FOR SURFACE WATER QUALITY

| | Temp (C) | pH | TSS (mg/l) | Cond (uS/M) | Ca (meq/l) | Mg (meq/l) | Na (meq/l) | K (meq/l) | Al (mg/l) | Alk (meq/l) | Cl (meq/l) | SO4 (meq/l) | Total-Fe (mg/l) | (NO3-2)-N (mg/l) | NH4-N (mg/l) | Total-N (mg/l) | PO4-P (mg/l) | Total-P (mg/l) | Si (mg/l) | DO (mg/l) | COD-MN (MG/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 28 Aug. 86 | 30.4 | 7.3 | 22.0 | 34.7 | 1.575 | .425 | .678 | .158 | | 2.151 | .809 | .498 | .145 | .293 | 1.346 | | .096 | .154 | 7.700 | 3.500 | 6.3 |
| 16 Sep. 86 | 29.5 | 6.2 | 99.0 | 29.3 | .953 | .704 | .646 | .156 | | 1.756 | .765 | .072 | .138 | .293 | 1.453 | | .011 | .062 | 5.500 | 12.500 | 5.5 |
| 15 Oct. 86 | 31.9 | 7.2 | 109.0 | 38.6 | 1.400 | .763 | .742 | .172 | | 1.809 | .728 | 1.268 | .057 | 9.413 | .016 | | .081 | .062 | 6.600 | 6.400 | 3.9 |
| 17 Nov. 86 | 25.8 | 7.1 | 284.0 | 22.4 | .760 | .168 | .655 | .099 | | .912 | .304 | .163 | .067 | .066 | .008 | | .062 | .004 | 3.650 | .799 | 4.7 |
| 16 Dec. 86 | 24.9 | 7.5 | 68.0 | 41.3 | 1.825 | .703 | .674 | .187 | | 2.767 | .697 | .567 | .084 | .247 | 7.397 | | .039 | .051 | 6.800 | 4.700 | 4.5 |
| 15 Jan. 87 | 22.8 | 7.3 | 108.0 | 25.0 | 1.116 | .708 | .405 | .673 | | 1.730 | .263 | .423 | .065 | .086 | .079 | | .609 | .016 | 4.980 | 6.800 | 1.1 |
| 17 Feb. 87 | 25.0 | 7.3 | 24.0 | 37.6 | 1.762 | .683 | .826 | .098 | | 2.634 | .912 | .166 | .031 | .118 | .034 | | .902 | .010 | 5.200 | 5.800 | 3.2 |
| 17 Mar. 87 | 28.6 | 7.2 | 68.0 | 42.4 | 1.600 | .874 | .874 | .218 | | 2.597 | 1.042 | .425 | .045 | 1.080 | .112 | | .118 | .148 | 7.700 | 4.354 | 6.8 |
| 20 Apr. 87 | 35.6 | 7.4 | | 46.6 | 2.000 | .606 | 1.560 | .230 | | 2.930 | 1.222 | .533 | .033 | 1.039 | .022 | | .119 | .157 | | 12.000 | 7.5 |
| 19 May. 87 | 31.8 | 7.4 | | 47.0 | | | 1.500 | .215 | | 3.023 | 1.259 | .411 | .033 | 2.920 | .188 | | .266 | .356 | 8.400 | 1.260 | 8.3 |
| 15 Jun. 87 | 32.0 | 7.1 | | 32.4 | | | 1.190 | .190 | | 2.012 | .809 | .479 | .359 | 3.234 | 1.700 | | .310 | .345 | 6.700 | 5.590 | 5.2 |
| 15 Jul. 87 | 31.0 | 7.1 | | 48.7 | 1.704 | .496 | 1.695 | .280 | | 2.891 | .636 | 1.329 | .346 | .055 | 1.659 | | .111 | .178 | 7.700 | 3.010 | 5.5 |
| 17 Aug. 87 | 27.2 | 7.1 | | 2.2 | .600 | .538 | .584 | .174 | | 1.219 | .453 | .115 | .169 | 1.255 | .390 | | .340 | .579 | 3.510 | 2.020 | 3.8 |
| 14 Sep. 87 | 34.8 | 7.0 | 56.0 | 37.9 | 1.000 | 1.048 | 1.170 | .170 | | 2.148 | .699 | .805 | .033 | 1.035 | .011 | | .114 | .083 | 6.600 | 5.068 | 4.4 |
| 16 Oct. 87 | 34.5 | 6.2 | 112.0 | 33.8 | 1.480 | .575 | 1.225 | .205 | | 2.109 | .862 | .256 | .019 | .615 | .836 | | .075 | .091 | 6.300 | 7.600 | 4.3 |
| 14 Nov. 87 | 28.6 | 7.2 | 136.0 | 40.8 | 1.590 | .672 | 1.100 | .037 | | 2.716 | .862 | .773 | .048 | .830 | 1.396 | | .101 | .127 | 6.400 | 2.300 | 5.6 |
| 17 Dec. 87 | 21.8 | 6.6 | 38.0 | 42.5 | 1.900 | .649 | 1.460 | .180 | | 2.511 | .132 | 1.748 | | 2.160 | .572 | | .082 | .123 | 4.900 | 3.790 | 5.5 |
| 14 Jan. 88 | 22.9 | 7.9 | 32.0 | 24.9 | .850 | 1.136 | .360 | .041 | | 1.992 | .245 | .383 | .042 | .165 | .005 | | .044 | .038 | 6.100 | 11.900 | .6 |
| 23 Feb. 88 | 25.4 | 7.1 | | 47.3 | 1.964 | .778 | 1.555 | .180 | | 3.162 | 1.139 | .539 | | .140 | 1.978 | | .098 | .116 | 6.200 | 2.470 | 6.1 |
| 15 Mar. 88 | 28.2 | 7.3 | 20.0 | 48.8 | 2.115 | .847 | 1.310 | .190 | | 3.123 | 1.329 | .306 | | 1.281 | 1.716 | | .187 | .140 | 5.600 | 2.470 | 5.8 |
| 11 Apr. 88 | 30.8 | 7.3 | 1,060.0 | 52.0 | 2.400 | .684 | 1.555 | .200 | | 3.287 | 1.280 | .699 | .121 | .665 | 1.347 | | .124 | .199 | 8.110 | 2.940 | 5.3 |
| 23 May. 88 | 31.2 | 6.7 | 68.0 | 42.4 | 1.571 | .614 | .925 | .123 | | 1.913 | .602 | 1.416 | .035 | 1.043 | 1.198 | | .032 | .062 | 8.200 | 1.510 | 5.4 |
| 14 Jun. 88 | 28.2 | 7.3 | 28.0 | 40.6 | 1.596 | .619 | 1.350 | .182 | | 1.923 | .555 | 1.243 | .058 | .258 | .040 | | .197 | .039 | 7.200 | 1.550 | 8.0 |
| 15 Jul. 88 | 29.6 | 7.2 | 352.0 | 32.3 | 1.263 | .530 | 1.500 | .100 | | 2.073 | .655 | .663 | .086 | .588 | 1.158 | | .181 | .374 | 5.400 | 4.240 | 5.7 |
| 15 Aug. 88 | 30.0 | 6.6 | 4.0 | 37.0 | | | 1.175 | .160 | | 1.932 | .773 | .624 | .096 | .176 | 1.478 | .608 | .086 | .162 | 6.900 | 2.815 | 5.6 |
| 14 Sep. 88 | 32.0 | 7.1 | 144.0 | 16.3 | | | 1.275 | .145 | | 1.470 | .541 | .489 | .057 | .789 | .048 | .608 | .136 | .151 | 7.700 | 4.500 | 5.0 |
| 18 Oct. 88 | 27.4 | 7.3 | 180.0 | 34.6 | 1.342 | .509 | .970 | .140 | | 1.709 | .827 | .580 | .745 | 1.726 | 1.759 | | .358 | .316 | 6.300 | 7.800 | 4.8 |
| 15 Nov. 88 | 23.5 | 6.8 | 84.0 | | 1.677 | .612 | 1.140 | .140 | | 2.014 | 1.014 | .994 | .138 | 1.800 | .839 | | .141 | .176 | 6.900 | 5.040 | (3.3) |
| 17 Nov. 88 | 25.6 | 7.2 | 146.0 | 37.6 | 1.579 | .690 | .655 | .191 | | 2.565 | .119 | .371 | .033 | .183 | .008 | | .060 | .051 | 5.800 | .900 | (5.2) |
| 19 Dec. 88 | 22.0 | 7.2 | 20.0 | 40.0 | 1.916 | .666 | 1.400 | .140 | | 2.438 | 1.154 | 1.024 | .200 | 1.131 | .686 | | .060 | .096 | 5.300 | 4.200 | 7.2 |
| 17 Jan. 89 | 20.8 | 8.0 | 54.0 | 25.2 | 2.007 | .057 | .535 | .120 | | 2.024 | .276 | .557 | .183 | .139 | .026 | | .040 | .039 | 6.600 | 8.500 | .7 |
| 15 Feb. 89 | 22.8 | 7.1 | 25.0 | 43.6 | 2.437 | .331 | 1.250 | .062 | | 3.145 | 1.172 | 1.006 | .132 | 1.222 | 1.686 | | .093 | .110 | 5.800 | .110 | 4.2 |
| 15 Mar. 89 | 25.7 | 6.9 | 105.0 | 51.4 | 2.629 | .263 | 2.100 | .032 | | 3.319 | .177 | 2.256 | .136 | .041 | .235 | | .089 | .150 | 8.900 | | 6.3 |
| 19 Apr. 89 | 29.2 | 7.3 | 58.0 | 61.9 | 2.618 | 3.460 | 2.200 | .112 | | 2.882 | .329 | 1.729 | .243 | .911 | .021 | | .800 | .782 | 10.700 | 1.100 | 6.7 |
| 16 May. 89 | 29.2 | 6.9 | 6.0 | 33.2 | 1.391 | .458 | .850 | .033 | | 1.808 | 1.123 | .780 | .089 | .900 | 2.687 | | .607 | .150 | 5.300 | 1.587 | 9.8 |

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Table C.13 Existing Water Quality Data(Mean Maximum Minimum)

Location; HONG KE

| Year | Item | Temp C | PH | TSS mg | Cond mS/M | Ca meq/l | Mg meq/l | Na meq/l | K meq/l | Alk meq/l | Cl meq/l | SO4 meq/l | Total Fe mg/l | (NO3 -2)-N mg/l | NH4 -N mg/l | Total -n mg/l | PO4 -P mg/l | Total -P mg/l | Si mg/l | O2 mg/l | COD -MN mg/l |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | 28.2 | 7.1 | 114.4 | 33.3 | 1.303 | 0.553 | 0.719 | 0.153 | 1.878 | 0.799 | 0.514 | 0.098 | 2.062 | 2.044 | | 0.046 | 0.071 | 5.926 | 5.380 | 4.9 |
| * 1986 | Max. | 31.0 | 7.6 | 284.0 | 38.6 | 1.825 | 0.763 | 0.874 | 0.187 | 2.767 | 0.887 | 1.268 | 0.145 | 9.413 | 7.397 | | 0.096 | 0.154 | 7.700 | 11.500 | 6.3 |
| | Min. | 24.8 | 6.2 | 22.0 | 22.4 | 0.760 | 0.168 | 0.649 | 0.088 | 0.912 | 0.728 | 0.072 | 0.057 | 0.066 | 0.016 | | 0.002 | 0.004 | 3.030 | 0.799 | 3.9 |
| | Mean | 29.5 | 7.1 | 77.5 | 36.3 | 1.475 | 0.685 | 1.133 | 0.173 | 2.377 | 0.779 | 0.622 | 0.107 | 1.202 | 0.583 | | 0.137 | 0.185 | 6.245 | 4.966 | 5.1 |
| 1987 | Max. | 35.6 | 7.4 | 136.0 | 48.7 | 2.000 | 1.048 | 1.695 | 0.280 | 3.023 | 1.259 | 1.748 | 0.359 | 3.234 | 1.700 | | 0.340 | 0.579 | 8.400 | 12.000 | 8.3 |
| | Min. | 21.8 | 6.2 | 24.0 | 2.2 | 0.600 | 0.496 | 0.405 | 0.037 | 1.219 | 0.132 | 0.115 | 0.019 | 0.055 | 0.011 | | 0.002 | 0.010 | 3.810 | 1.260 | 1.1 |
| | Mean | 46.8 | 7.2 | 89.9 | 36.9 | 1.661 | 0.699 | 1.182 | 0.153 | 2.277 | 0.787 | 0.718 | 0.146 | 0.763 | 0.943 | 0.608 | 0.131 | 0.148 | 6.593 | 4.026 | 5.3 |
| 1988 | Max. | 32.0 | 7.9 | 1060.0 | 52.0 | 2.400 | 1.136 | 1.555 | 0.200 | 3.287 | 1.329 | 1.416 | 0.746 | 1.800 | 1.978 | 0.608 | 0.358 | 0.316 | 8.200 | 11.900 | 8.0 |
| | Min. | 22.0 | 6.6 | 4.0 | 16.3 | 0.850 | 0.509 | 0.360 | 0.041 | 1.470 | 0.119 | 0.306 | 0.033 | 0.140 | 0.005 | 0.608 | 0.032 | 0.038 | 5.300 | 0.900 | 0.6 |
| | Mean | 25.5 | 7.3 | 49.6 | 43.1 | 2.216 | 0.914 | 1.387 | 0.072 | 2.636 | 0.615 | 1.266 | 0.157 | 0.643 | 0.931 | | 0.326 | 0.246 | 7.460 | 2.824 | 5.5 |
| ※ 1989 | Max. | 29.2 | 8.0 | 105.0 | 61.9 | 2.629 | 3.460 | 2.200 | 0.120 | 3.319 | 1.172 | 2.256 | 0.243 | 1.222 | 2.687 | | 0.800 | 0.782 | 10.700 | 8.500 | 9.8 |
| | Min. | 20.8 | 6.9 | 6.0 | 25.2 | 1.391 | 0.057 | 0.535 | 0.032 | 1.808 | 0.177 | 0.557 | 0.089 | 0.041 | 0.021 | | 0.040 | 0.039 | 5.300 | 0.110 | 0.7 |
| | Mean | 27.9 | 7.1 | 100.0 | 36.3 | 1.440 | 0.624 | 1.128 | 0.148 | 2.305 | 0.761 | 0.734 | 0.116 | 1.082 | 0.975 | 0.034 | 0.148 | 0.163 | 6.323 | 4.289 | 5.2 |
| TOTAL | Max. | 35.6 | 8.0 | 1060.0 | 61.9 | 2.620 | 3.460 | 2.200 | 0.280 | 3.319 | 1.329 | 2.256 | 0.745 | 9.413 | 7.397 | 0.608 | 0.800 | 0.782 | 10.700 | 12.000 | 9.8 |
| | Min. | 20.8 | 6.2 | 4.0 | 2.2 | 0.600 | 0.057 | 0.360 | 0.032 | 0.912 | 0.119 | 0.072 | 0.019 | 0.041 | 0.005 | 0.000 | 0.002 | 0.004 | 3.030 | 0.110 | 0.6 |

* 1986: from Aug. to Dec.

1989: from Jan. to May

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# Table C.14 THATLUANG SWAMP AT SALAKHAM , LAO PDR
## SURFACE WATER QUALITY

| | Temp [C] | pH | TSS [mg/l] | Cond [mS/M] | Ca [meq/l] | Mg [meq/l] | Na [meq/l] | K [meq/l] | Al [mg/l] | Alk [meq/l] | Cl [meq/l] | SO4 [meq/l] | Total-Fe [mg/l] | (NO3-2)-N [mg/l] | NH4-N [mg/l] | Total-N [mg/l] | PO4-P [mg/l] | Total-P [mg/l] | Si [mg/l] | DO [mg/l] | COD-Mn [MG/L] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 Aug, 86 | 31.4 | 6.4 | 16.0 | 11.6 | .428 | .020 | .451 | .005 | | .296 | .203 | .451 | .094 | | .043 | | .005 | .016 | 3.000 | 2.992 | 9.3 |
| 16 Sep, 86 | 31.2 | 7.5 | 5.0 | 5.4 | .124 | .132 | .223 | .009 | | .215 | .232 | .028 | .443 | .020 | .022 | | .004 | .026 | | 2.411 | 6.5 |
| 16 Oct, 86 | 28.8 | 6.1 | 164.0 | 8.2 | .245 | .121 | .255 | .022 | | .121 | .236 | .339 | .296 | .391 | .110 | | .001 | .005 | .543 | .921 | 6.2 |
| 17 Nov, 86 | 26.2 | 6.6 | 108.0 | 11.4 | .388 | .132 | .450 | .068 | | .505 | .447 | .165 | .676 | .050 | .340 | | .005 | .009 | .980 | 1.699 | *** |
| 17 Dec, 86 | 26.8 | 7.3 | 280.0 | 15.3 | | | .577 | .116 | | .521 | .657 | .154 | 2.149 | .032 | .351 | | .008 | .021 | 1.320 | 6.191 | 6.8 |
| 17 Jan, 87 | 21.8 | 6.9 | 2,148.0 | 37.5 | | | .917 | .242 | | 1.081 | .992 | .056 | .695 | .176 | 2.425 | | .008 | .022 | 2.780 | | *** |
| 17 Feb, 87 | 24.4 | 6.8 | 340.0 | 64.7 | 1.254 | .813 | 3.170 | .231 | | .383 | 4.774 | .574 | .111 | .054 | 4.731 | | .004 | .034 | 10.520 | 3.844 | 5.0 |
| 17 Mar, 87 | 33.2 | 7.4 | 656.0 | 58.8 | | | 3.299 | .213 | | 1.365 | 3.656 | .446 | .055 | .591 | .449 | | .003 | .024 | 9.200 | 6.241 | *** |
| 20 Apr, 87 | 37.4 | 6.4 | | 35.8 | .759 | .447 | 1.700 | .200 | | .564 | 2.209 | .461 | .351 | .043 | 1.074 | | .011 | .015 | | 9.909 | 5.4 |
| 16 May, 87 | 32.0 | 6.4 | | 35.8 | | | 1.485 | .220 | | .361 | 2.265 | .663 | .351 | .007 | .167 | | .041 | .083 | 1.900 | 2.280 | 3.1 |
| 15 Jun, 87 | 29.0 | 6.3 | | 9.4 | .480 | .009 | .300 | .120 | | .431 | .328 | .198 | 2.577 | .276 | .052 | | .115 | .116 | 1.700 | .180 | *** |
| 14 Jul, 87 | 30.4 | 6.2 | | 18.7 | .359 | .263 | .955 | .019 | | .305 | .544 | .842 | 1.986 | .026 | .021 | | .040 | .050 | .640 | 1.227 | *** |
| 15 Aug, 87 | 30.4 | 7.5 | | 9.5 | .220 | .193 | .403 | .043 | | .319 | .523 | .060 | .347 | .046 | .011 | | .093 | .145 | 1.850 | 1.363 | 9.5 |
| 15 Sep, 87 | 29.8 | 6.1 | 116.0 | 11.9 | .290 | .135 | .576 | .005 | | .271 | .633 | .159 | 1.077 | .011 | .067 | | .006 | .011 | .400 | | *** |
| 16 Oct, 87 | 29.0 | 6.4 | 24.0 | 10.7 | .140 | .257 | .460 | .015 | | .331 | .582 | .032 | 1.595 | .012 | .006 | | .007 | .022 | 1.700 | .468 | 9.3 |
| 16 Nov, 87 | 26.8 | 6.4 | 192.0 | 13.4 | .080 | .042 | .490 | .032 | | .440 | .036 | .128 | .877 | .019 | .027 | | .021 | .043 | .600 | .545 | *** |
| 17 Dec, 87 | 23.8 | 6.8 | 368.0 | 38.8 | .670 | .505 | 2.205 | .150 | | .718 | 2.678 | .429 | .187 | .557 | .272 | | .074 | .179 | 1.840 | 1.598 | *** |
| 14 Jan, 88 | 24.4 | 7.3 | 23.4 | 37.4 | .700 | .096 | 1.890 | .330 | | .644 | 2.254 | 1.316 | 4.750 | .343 | 1.740 | | .392 | .394 | 4.800 | 5.892 | *** |
| 23 Feb, 88 | 24.6 | 7.1 | 168.0 | 53.2 | .896 | .633 | 2.960 | .320 | | .747 | 3.748 | .520 | .496 | .035 | .193 | | .180 | .170 | 7.400 | 3.476 | *** |
| 15 Mar, 88 | 28.4 | 7.2 | 28.0 | 52.9 | 1.114 | .676 | 3.630 | .290 | | .858 | 4.285 | 1.041 | .145 | .156 | .251 | | .425 | .696 | 8.500 | 3.472 | 2.6 |
| 11 Apr, 88 | 31.8 | 7.7 | 156.0 | 56.4 | 1.560 | .767 | 2.300 | .220 | | 1.474 | 3.004 | .280 | .121 | .054 | 1.328 | | .260 | .375 | 5.610 | 12.406 | *** |
| 23 May, 88 | 33.2 | 7.2 | 40.0 | 10.4 | .295 | .090 | .430 | .071 | | .272 | .414 | .213 | .809 | .381 | .039 | | .043 | .056 | 1.100 | .790 | 9.1 |
| 14 Jun, 88 | 29.8 | 6.0 | 132.0 | 11.4 | .302 | .167 | .500 | .014 | | .271 | .641 | .109 | .381 | .041 | .119 | .602 | .042 | .036 | 2.100 | .992 | *** |
| 15 Jul, 88 | 30.1 | 6.3 | 340.0 | 10.1 | .245 | .178 | .700 | .015 | | .339 | .492 | .117 | .619 | .022 | .073 | | .071 | .183 | 1.560 | 2.736 | 9.4 |
| 16 Aug, 88 | 31.2 | 5.7 | 146.0 | 8.8 | | | .275 | .009 | | .339 | .383 | .080 | 1.051 | .026 | .039 | .137 | .031 | .056 | 1.400 | 1.312 | 9.5 |
| 14 Sep, 88 | 31.8 | 7.0 | 12.0 | 7.0 | .236 | .176 | .255 | .024 | | .339 | .236 | .113 | .452 | .015 | .168 | .137 | .012 | .022 | 2.000 | 3.126 | 6.7 |
| 18 Oct, 88 | 27.0 | 6.1 | 72.0 | 11.8 | .309 | .233 | .472 | .068 | | .383 | .624 | .095 | .729 | .037 | .116 | | .105 | .162 | 3.000 | .400 | *** |
| 15 Nov, 88 | 23.6 | 6.3 | 704.0 | 14.7 | .521 | .260 | .620 | .060 | | .659 | .866 | .244 | .691 | .401 | .017 | | .070 | .352 | 3.400 | 1.250 | *** |
| 19 Dec, 88 | 22.6 | 7.3 | 96.0 | 68.0 | 2.309 | .686 | 4.100 | .330 | | 3.576 | .386 | 3.918 | .200 | .042 | .056 | | .273 | .761 | 14.300 | 2.400 | *** |
| 13 Jan, 89 | 24.6 | 7.2 | 60.0 | 69.8 | 2.634 | .024 | 3.995 | .255 | | 2.665 | 3.677 | 3.768 | .141 | .083 | 1.967 | | .319 | .521 | 15.900 | 9.600 | *** |
| 14 Feb, 89 | .0 | .0 | | | | | | | | | | | | | | | | | | | .0 |
| 15 Feb, 89 | 23.4 | 7.5 | 395.0 | 72.3 | 2.077 | .276 | 3.800 | .040 | | 2.763 | 4.128 | .176 | .823 | 1.022 | .284 | | .086 | .207 | 15.600 | .207 | *** |
| 15 Mar, 89 | 27.4 | 9.5 | 142.0 | 70.8 | 1.944 | .238 | 3.850 | .009 | | 2.570 | 4.169 | .633 | .185 | .027 | 1.344 | | .070 | .445 | 17.200 | | *** |
| 19 Apr, 89 | 30.6 | 7.0 | 2.0 | 53.4 | 2.216 | .354 | 1.950 | .076 | | 2.681 | 1.959 | .359 | .248 | .027 | .020 | | .162 | .415 | 15.000 | | 9.5 |
| 16 May, 89 | 28.8 | 7.0 | 46.0 | 41.6 | 1.128 | .383 | 2.600 | .053 | | 1.188 | 2.066 | .828 | .236 | 6.040 | 1.367 | | .071 | .445 | 3.300 | 1.284 | *** |



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Table C.15 Existing Water Quality Data(Mean Maximum Minimum)

Location:SALAKHAM

| Year | Item | Temp C | PH | TSS mg | Cond mS/M | Ca meq/l | Mg meq/l | Na meq/l | K meq/l | Alk meq/l | Cl meq/l | SO4 meq/l | Total Fe mg/l | (NO3 -2)-N mg/l | NH4 -N mg/l | Total -n mg/l | PO4 -P mg/l | Total -P mg/l | Si mg/l | O2 mg/l | COD -MN mg/l |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| * | Mean | 28.8 | 6.8 | 114.6 | 10.4 | 0.296 | 0.101 | 0.411 | 0.044 | 0.332 | 0.355 | 0.263 | 0.732 | 0.123 | 0.173 | | 4.600 | 0.015 | 1.461 | 2.844 | 6.7 |
| 1986 | Max. | 31.4 | 7.5 | 280.0 | 15.3 | 0.428 | 0.132 | 0.577 | 0.116 | 0.527 | 0.657 | 0.451 | 2.149 | 0.391 | 0.351 | | 0.008 | 0.026 | 3.000 | 6.191 | 9.3 |
| | Min. | 26.2 | 6.1 | 5.0 | 5.4 | 0.124 | 0.020 | 0.223 | 0.005 | 0.121 | 0.203 | 0.028 | 0.094 | 0.020 | 0.022 | | 0.001 | 0.005 | 0.543 | 0.921 | 4.8 |
| | Mean | 29.0 | 6.6 | 549.0 | 28.7 | 0.460 | 0.296 | 1.321 | 0.124 | 0.546 | 1.603 | 0.287 | 0.842 | 0.145 | 0.777 | | 0.035 | 0.062 | 3.012 | 2.766 | 7.1 |
| 1987 | Max. | 37.4 | 7.5 | 2148.0 | 64.7 | 1.254 | 0.813 | 3.290 | 0.242 | 1.365 | 4.774 | 0.842 | 2.577 | 0.591 | 4.731 | | 0.115 | 0.179 | 10.520 | 9.900 | 9.5 |
| | Min. | 21.8 | 6.1 | 24.0 | 9.3 | 0.080 | 0.009 | 0.300 | 0.005 | 0.277 | 0.036 | 0.032 | 0.055 | 0.007 | 0.006 | | 0.003 | 0.011 | 0.400 | 0.180 | 3.1 |
| | Mean | 28.3 | 6.8 | 159.7 | 29.4 | 0.770 | 0.360 | 1.511 | 0.146 | 0.825 | 1.444 | 0.670 | 0.870 | 0.160 | 0.345 | 0.292 | 0.159 | 0.272 | 4.601 | 3.186 | 7.5 |
| 1988 | Max. | 33.2 | 7.7 | 704.0 | 68.0 | 2.300 | 0.767 | 4.100 | 0.330 | 3.576 | 4.285 | 3.918 | 4.750 | 0.401 | 1.740 | 0.602 | 0.425 | 0.761 | 14.300 | 12.400 | 9.5 |
| | Min. | 22.6 | 5.7 | 12.0 | 7.0 | 0.236 | 0.090 | 0.255 | 0.014 | 0.271 | 0.236 | 0.080 | 0.121 | 0.015 | 0.017 | 0.137 | 0.012 | 0.022 | 1.100 | 0.400 | 2.6 |
| | Mean | 27.0 | 7.6 | 129.0 | 61.0 | 2.004 | 0.255 | 3.239 | 0.086 | 2.373 | 3.199 | 1.157 | 0.327 | 1.440 | 0.996 | | 0.142 | 0.407 | 13.400 | 3.697 | 9.5 |
| *1989 | Max. | 30.6 | 9.5 | 395.0 | 72.3 | 2.634 | 0.383 | 3.995 | 0.255 | 2.763 | 4.169 | 3.788 | 0.823 | 6.040 | 1.967 | | 0.319 | 0.521 | 17.200 | 9.600 | 9.5 |
| | Min. | 23.4 | 7.0 | 2.0 | 41.6 | 1.128 | 0.024 | 1.950 | 0.009 | 1.188 | 1.959 | 0.176 | 0.141 | 0.027 | 0.020 | | 0.070 | 0.207 | 3.300 | 0.207 | 0.0 |
| | Mean | 28.2 | 6.8 | 175.1 | 32.1 | 0.756 | 0.238 | 1.606 | 0.118 | 0.932 | 1.657 | 0.634 | 0.742 | 0.318 | 0.607 | 0.025 | 0.096 | 0.189 | 5.059 | 2.880 | 7.3 |
| TOTAL | Max. | 37.4 | 9.5 | 1320.0 | 72.3 | 2.634 | 0.813 | 4.100 | 0.330 | 3.576 | 4.774 | 3.918 | 4.750 | 6.040 | 4.731 | 0.602 | 0.425 | 0.761 | 17.200 | 12.400 | 9.5 |
| | Min. | 21.8 | 5.7 | 2.0 | 5.4 | 0.080 | 0.009 | 0.223 | 0.005 | 0.121 | 0.036 | 0.028 | 0.055 | 0.007 | 0.006 | 0.000 | 0.001 | 0.005 | 0.400 | 0.180 | 2.6 |

* 1986: from Aug. to Dec.

1989: from Jan. to May

LAO PEOPLE'S DEMOCRATIC REPUBLIC
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Table C.16 Content of Water Quality Survey and Analysis

| PHASE | Date | The number of time for Analysis | Location | Q | Odor | Color | Temp | pH | DO | BOD | CODMn | Cl | T.P | T.N | TSS | Turbidity | Coliform Col. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| I | 24-25/5/89 | 1 | 1~20 | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | – |
| | 29-30/5/89 | 12 | 7,9 | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | – |
| | 31/5-2/6/89 | 1 | 1～20 | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | – |
| II | 7/9/89 | 1 | 3,6,8,9,13 | ○ | – | – | – | ○ | ○ | – | ○ | ○ | ○ | – | ○ | ○ | ○ |
| | 11/9/89 | 1 | Ditto | ○ | – | – | – | ○ | ○ | – | ○ | ○ | ○ | – | ○ | ○ | ○ |
| | 14/9/89 | 1 | Ditto | ○ | – | – | – | ○ | ○ | – | ○ | ○ | ○ | – | ○ | ○ | ○ |

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Table C.17 Result Of Water Quality Survey and Analysis(First time) in PHASE I

Date: 24-25/05/89

| Location | Q m3/s | Odor | Color | Temp °C | pH | DO (mg/l) | BOD (mg/l) | COD Mn (mg/l) | Cl (mg/l) | T.N (mg/l) | T.P (mg/l) | TSS (mg/l) | Turbidity (mg/l) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | - | Obj | yellow | 30.6 | 6.9 | 0.977 | 27.25 | 51.7 | 43.60 | 0.011 | 1.705 | 60 | 65 |
| 2 | 0.0146 | Un | GY | 36.0 | 7.0 | 5.630 | 5.98 | 8.99 | 28.96 | 0.003 | 0.237 | 80 | 43 |
| 3 | 0.0526 | " | " | 30.8 | 7.5 | 4.250 | 7.66 | 7.74 | 43.67 | 0.025 | 0.978 | 20 | 4 |
| 4 | 0.0090 | " | " | 29.2 | 7.2 | 1.540 | 11.95 | 9.46 | 23.47 | 0.009 | 0.406 | 28 | 14 |
| 5 | 0.0462 | Obj | " | 35.2 | 7.2 | 5.830 | 13.01 | 8.56 | 46.20 | 0.030 | 1.127 | 108 | 65 |
| 6 | - | " | " | 28.2 | 7.1 | 0.180 | 5.54 | 9.44 | 35.10 | 0.004 | 0.337 | 27 | 11 |
| 7 | 0.0003 | Obj | " | 29.4 | 7.3 | 5.880 | 32.63 | 9.79 | 19.99 | 0.015 | 1.042 | 31 | 16 |
| 8 | - | " | " | 29.8 | 7.4 | 0.000 | 10.55 | 10.23 | 1.03 | 0.034 | 1.513 | 8 | 5 |
| 9 | 0.0168 | " | " | 31.0 | 7.3 | 0.860 | 30.45 | 21.36 | 52.96 | 0.035 | 1.810 | 12 | 6 |
| 10 | - | Un | " | 34.6 | 7.3 | 4.670 | 23.20 | 12.55 | 26.23 | 0.033 | 1.705 | 6 | 11 |
| 11 | 0.2948 | " | " | 30.6 | 6.9 | 1.850 | 6.71 | 10.7 | 46.50 | 0.005 | 0.225 | 37 | 13 |
| 12 | 0.0449 | Obj | " | 31.4 | 7.1 | 4.670 | 3.69 | 6.46 | 53.28 | 0.004 | 0.190 | 52 | 21 |
| 13 | 0.0173 | " | " | 32.2 | 7.3 | 4.430 | 5.35 | 7.11 | 45.52 | 0.021 | 0.712 | 18 | 8 |
| 14 | 0.0080 | " | " | 30.0 | 7.3 | 0.720 | 10.60 | 9.06 | 1.06 | 0.031 | 1.134 | 4 | 4 |
| 15 | 0.0570 | " | " | 30.4 | 7.3 | 1.130 | 14.15 | 7.47 | 1.60 | 0.025 | 0.669 | 8 | 5 |
| 16 | 0.0145 | " | " | 30.8 | 7.3 | 0.910 | 11.50 | 10.53 | 1.99 | 0.026 | 0.831 | 12 | 5 |
| 17 | 0.0206 | " | " | 34.2 | 7.3 | 3.750 | 4.25 | 9.77 | 3.55 | 0.004 | 0.139 | 10 | 6 |
| 18 | - | " | " | 31.8 | 7.4 | 10.170 | 4.72 | 6.64 | 9.15 | 0.002 | 0.074 | 22 | 8 |
| 19 | 0.0790 | " | " | 30.0 | 7.1 | 1.960 | 5.75 | 8.02 | 46.70 | 0.002 | 0.120 | 127 | 65 |
| 20 | - | " | " | 31.8 | 7.1 | 4.100 | 6.50 | 3.69 | 8.76 | 0.002 | 0.063 | 16 | 15 |

OBJ - Objectionable
UN - Unobjectionable
GY - Greenish Yellow

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## Table C.18 Result Of Water Quality Survey and Analysis(Second time) in PHASE I

Date: 31/ 5 - 2/06/89

| Location | Q m3/s | Odor | Color | Temp °C | pH | DO (mg/l) | BOD (mg/l) | COD Mn (mg/l) | Cl (mg/l) | T.N (mg/l) | T.p (mg/l) | TSS (mg/l) | Turbidity (mg/l) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | - | Obj | GY | 29.2 | 6.8 | 6.616 | 12.640 | 13.230 | 3.520 | 0.005 | 0.896 | 173 | 40 |
| 2 | 0.0670 | Un | " | 37.0 | 7.7 | 7.474 | 3.085 | 6.970 | 22.160 | 0.003 | 0.091 | 36 | 5 |
| 3 | 0.4469 | " | " | 30.2 | 7.3 | 4.292 | 9.160 | 7.734 | 30.080 | 0.015 | 0.730 | 29 | 4 |
| 4 | 0.0755 | " | " | 28.4 | 7.1 | 2.789 | 8.435 | 8.660 | 23.870 | 0.005 | 0.305 | 65 | 6 |
| 5 | 0.3301 | " | " | 30.6 | 7.3 | 1.969 | 0.110 | 8.050 | 37.140 | 0.015 | 0.772 | 15 | 5 |
| 6 | - | " | " | 29.4 | 6.9 | 2.093 | 9.115 | 10.000 | 35.870 | 0.006 | 0.363 | 0 | 4 |
| 7 | 0.0012 | Obj | " | 30.2 | 7.6 | 3.480 | 28.275 | 9.633 | 0.044 | 0.022 | 0.487 | 158 | 34 |
| 8 | - | " | " | 29.2 | 7.3 | 0.532 | 12.600 | 8.110 | 1.484 | 0.027 | 1.268 | 14 | 5 |
| 9 | 0.0170 | " | " | 29.6 | 7.2 | 0.394 | 32.120 | 10.730 | 0.786 | 0.037 | 2.034 | 39 | 6 |
| 10 | - | Un | " | 32.0 | 6.9 | 2.319 | 31.200 | 12.850 | 6.781 | 0.022 | 1.837 | 45 | 9 |
| 11 | 2.5336 | " | " | 27.4 | 7.2 | 2.853 | 7.170 | 6.061 | 39.230 | 0.004 | 0.154 | 25 | 8 |
| 12 | 1.8916 | " | " | 27.9 | 7.1 | 3.353 | 4.550 | 5.363 | 37.140 | 0.003 | 0.284 | 159 | 48 |
| 13 | 0.0310 | " | " | 30.4 | 7.4 | 3.258 | 15.220 | 7.650 | 33.880 | 0.017 | 1.021 | 17 | 5 |
| 14 | 0.0187 | " | " | 30.6 | 7.1 | 0.816 | 9.370 | 12.050 | 0.349 | 0.028 | 0.828 | 12 | 2 |
| 15 | 0.0740 | " | " | 28.2 | 7.3 | 1.460 | 13.570 | 6.200 | 0.184 | 0.019 | 1.078 | 11 | 7 |
| 16 | 0.0180 | " | " | 28.8 | 7.2 | 0.932 | 17.430 | 10.160 | 0.171 | 0.027 | 1.324 | 15 | 5 |
| 17 | 0.1700 | " | " | 31.0 | 7.1 | 2.128 | 8.720 | 9.130 | 27.590 | 0.003 | 0.238 | 9 | 3 |
| 18 | - | " | " | 29.2 | 7.7 | 7.295 | 11.220 | 4.790 | 7.561 | 0.001 | 0.058 | 6 | 4 |
| 19 | 1.4518 | " | " | 28.0 | 7.1 | 3.162 | 6.475 | 4.992 | 38.870 | 0.002 | 0.106 | 44 | 7 |
| 20 | - | " | " | 29.6 | 6.8 | 2.616 | 6.970 | 4.330 | 7.193 | 0.021 | 0.047 | 7 | 3 |

OBJ - Objectionable
UN - Unobjectionable
GY - Greenish Yellow



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Table C.19 Result of Water Quality Survey and Analysis (Daily Change of Water Quality (No. 7, 9)) in PHASE 1

Date: 29-30/05/89

| Location | No. | Time | Q m3/s | Temp °C | pH | Odor | Color | Turbidity (mg/l) | Cl (mg/l) | TSS (mg/l) | DO (mg/l) | BOD (mg/l) | CODMn (mg/l) | T.P (mg/l) | T.N (mg/l) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 14 50 | 0.0024 | 28.6 | 7.2 | Obj | GY | 206 | 29.55 | 236 | 4.45 | 3.04 | 12.51 | 0.706 | 0.015 |
| | 2 | 16 50 | 0.0019 | 28.8 | 7.2 | " | " | 130 | 36.37 | 248 | 3.36 | 31.83 | 13.60 | 0.929 | 0.005 |
| | 3 | 18 50 | 0.0012 | 28.4 | 7.2 | " | " | 22 | 40.02 | 31 | 3.45 | 33.02 | 12.61 | 1.612 | 0.021 |
| | 4 | 20 50 | 0.0012 | 28.0 | 7.4 | " | " | 10 | 41.31 | 18 | 3.29 | 33.30 | 11.73 | 1.959 | 0.021 |
| | 5 | 22 50 | 0.0011 | 27.6 | 7.5 | UN | " | 8 | 41.86 | 20 | 3.43 | 24.17 | 11.65 | 1.823 | 0.025 |
| 7 | 6 | 00 50 | 0.0010 | 27.2 | 7.4 | " | " | 7 | 39.80 | 28 | 3.66 | 36.73 | 11.30 | 1.606 | 0.021 |
| | 7 | 2 55 | 0.0009 | 27.2 | 7.5 | " | " | 1 | 38.53 | 18 | 3.83 | 36.24 | 11.53 | 1.559 | 0.024 |
| | 8 | 4 40 | 0.0008 | 27.0 | 7.5 | " | " | 8 | 39.64 | 16 | 3.61 | 33.82 | 11.69 | 2.088 | 0.028 |
| | 9 | 6 45 | 0.0008 | 27.2 | 7.6 | " | " | 7 | 37.34 | 20 | 3.59 | 37.99 | 11.03 | 1.329 | 0.021 |
| | 10 | 8 30 | 0.0008 | 27.6 | 7.5 | " | " | 9 | 40.28 | 32 | 3.28 | 11.34 | 12.05 | 4.747 | 0.029 |
| | 11 | 10 40 | 0.0011 | 28.4 | 7.6 | Obj | " | 22 | 32.51 | 72 | 3.17 | 33.19 | 12.09 | 4.770 | 0.026 |
| | 12 | 12 30 | 0.0011 | 29.8 | 7.7 | " | " | 10 | 30.65 | 47 | 3.47 | 29.22 | 11.39 | 4.770 | 0.019 |
| | 1 | 14 30 | 0.0470 | 29.8 | 7.1 | Obj | GY | 8 | 36.63 | 5 | 0.59 | 30.31 | 8.65 | 2.000 | 0.032 |
| | 2 | 16 30 | 0.0290 | 29.6 | 7.1 | " | " | 7 | 27.28 | 23 | 0.55 | 21.32 | 29.25 | 1.118 | 0.027 |
| | 3 | 18 35 | 0.0260 | 28.8 | 7.1 | " | " | 8 | 105.40 | 18 | 0.54 | 26.92 | 11.32 | 4.641 | 0.031 |
| | 4 | 20 30 | 0.0240 | 28.6 | 7.1 | " | " | 2 | 44.30 | 14 | 0.39 | 33.09 | 10.09 | 4.541 | 0.030 |
| | 5 | 22 30 | 0.0280 | 28.4 | 7.2 | " | " | 3 | 38.10 | 9 | 0.21 | 28.46 | 10.68 | 4.700 | 0.028 |
| 9 | 6 | 00 30 | 0.0250 | 28.2 | 7.1 | " | " | 3 | 33.46 | 7 | 0.13 | 21.06 | 10.62 | 4.694 | 0.031 |
| | 7 | 2 30 | 0.0170 | 28.0 | 7.2 | " | " | 5 | 30.45 | 3 | 0.71 | 13.82 | 8.26 | 2.011 | 0.030 |
| | 8 | 4 30 | 0.0190 | 28.0 | 7.2 | " | " | 2 | 27.24 | 2 | 0.13 | 20.93 | 7.59 | 1.471 | 0.030 |
| | 9 | 6 30 | 0.0190 | 28.0 | 7.2 | " | " | 1 | 25.72 | 6 | 0.45 | 28.83 | 7.48 | 1.306 | 0.030 |
| | 10 | 8 20 | 0.0210 | 28.4 | 7.5 | " | " | 1 | 27.04 | 9 | 0.36 | 22.24 | 7.88 | 4.806 | 0.037 |
| | 11 | 10 30 | 0.0190 | 29.3 | 7.3 | " | " | 2 | 32.78 | 17 | 0.44 | 35.30 | 11.56 | 4.794 | 0.038 |
| | 12 | 12 15 | 0.0170 | 30.4 | 7.2 | " | " | 1 | 31.32 | 10 | 0.77 | 31.91 | 10.88 | 4.818 | 0.034 |

OBJ - Objectionable
UN - Unobjectionable
GY - Greenish Yellow



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Table C.20 Result Of Water Quality Survey and Analysis in PHASE II

| NO | Date | Q m3/s | PH | DO mg/l | COD Mn mg/l | CL mg/l | T.P mg/l | TSS mg/l | Turbidity mg/l | Coliform Col/100 ml |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 25/5/89 | 0.0526 | 7.5 | 4.250 | 7.740 | 43.67 | 0.987 | 20 | 4- | - |
| 3 | 2/6/89 | 0.4469 | 7.3 | 4.292 | 7.734 | 30.08 | 0.730 | 29 | 4- | - |
| 3 | 7/9/89 | 0.4432 | 7.2 | 3.142 | 5.013 | 16.55 | 0.176 | 124 | 35+ | Inf |
| 3 | 11/9/89 | 0.1714 | 7.4 | 2.765 | 5.977 | 28.61 | 0.454 | 46 | 19 | 20,200 |
| 3 | 14/9/89 | 1.4367 | 7.1 | 2.121 | 5.186 | 16.87 | 0.383 | 28 | 23 | 18,200 |
| 6 | 24/5/89 | - | 7.1 | 0.180 | 9.440 | 35.10 | 0.337 | 27 | 11- | - |
| 6 | 31/5/89 | - | 6.9 | 2.093 | 10.000 | 35.87 | 0.363 | 0 | 4- | - |
| 6 | 7/9/89 | - | 7.1 | 1.986 | 7.319 | 22.16 | 0.163 | 20 | 3 | 11,000 |
| 6 | 11/9/89 | - | 7.0 | 2.000 | 7.062 | 24.25 | 0.713 | 20 | 5 | 7,600 |
| 6 | 14/9/89 | - | 7.0 | 2.229 | 6.748 | 16.98 | 0.582 | 8 | 7 | 11,200 |
| 8 | 24/5/89 | - | 7.4 | 0.000 | 10.230 | 1.03 | 1.513 | 8 | 5- | - |
| 8 | 31/5/89 | - | 7.3 | 0.532 | 8.110 | 1.48 | 1.268 | 14 | 5- | - |
| 8 | 7/9/89 | 0.4496 | 7.0 | 0.831 | 5.981 | 21.87 | 0.377 | 96 | 26+ | Inf. |
| 8 | 11/9/89 | 0.0942 | 7.1 | 1.141 | 6.056 | 21.24 | 1.004 | 22 | 5+ | Inf |
| 8 | 14/9/89 | 0.1957 | 7.1 | 1.949 | 7.630 | 10.10 | 0.825 | 36 | 14+ | Inf. |
| 9 | 24/5/89 | 0.0168 | 7.3 | 0.860 | 21.360 | 52.96 | 1.810 | 12 | 6- | - |
| 9 | 31/5/89 | 0.0170 | 7.2 | 0.394 | 10.730 | 0.79 | 2.034 | 39 | 6- | - |
| 9 | 7/9/89 | 0.0425 | 7.2 | 1.569 | 5.867 | 52.29 | 1.072 | 22 | 6+ | Inf. |
| 9 | 11/9/89 | 0.0942 | 7.1 | 0.394 | 10.360 | 23.15 | 1.374 | 24 | 3+ | Inf. |
| 9 | 14/9/89 | 0.0295 | 7.2 | 0.750 | 9.149 | 19.18 | 1.074 | 18 | 16+ | Inf. |
| 13 | 24/5/89 | 0.0173 | 7.3 | 4.430 | 7.110 | 45.52 | 0.712 | 18 | 8- | - |
| 13 | 31/5/89 | 0.0310 | 7.4 | 3.258 | 7.650 | 33.88 | 1.021 | 17 | 5- | - |
| 13 | 7/9/89 | 0.3648 | 7.0 | 1.922 | 5.175 | 20.56 | 0.402 | 120 | 40+ | Inf |
| 13 | 11/9/89 | - | 7.0 | 0.425 | 6.339 | 38.85 | 0.865 | 20 | 6 | 16,800 |
| 13 | 14/9/89 | 0.1137 | 7.1 | 0.397 | 6.331 | 2.30 | 0.568 | 24 | 14 | 37,200 |

Remarks:

- -: No data
- Inf.: Infinitive

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Table C.21 List of Fish ,Water Plant and Water Use

Date :26/9/1989

| Location No. | Fish | Water Plant | Water Use |
|---|---|---|---|
| 1 | A,B,C,D,G,H | B,C,E,I | A |
| 2 | A,B,C,D,E,F,G,H,U,Z | B,C,E | A |
| 3 | A,B,C,D,G,H,J,Q | – | AA,B |
| 4 | A,B,C,D,F,H | – | A |
| 5 | A,B,C,D,E,F,G,H | A,B,C,D,E | A,B |
| 6 | A,B,E,F,M | A,B,C | C |
| 7 | H | – | – |
| 8 | A,D,M | B | A |
| 9 | H | – | – |
| 10 | Unknown | – | – |
| 11 | A,C,G,I,J,K,L | B,C,F | AA |
| 12 | A,B,D,E,F,K,R | – | AA,B |
| 13 | A,B,C,D,H | A,B,F | A,D |
| 14 | A,E,F,M | G | A,C |
| 15 | A,E,F,M | A,B,G | A,C |
| 16 | H,P,Q | – | – |
| 17 | C,E,H,M | B,C | AA,B,E |
| 18 | A,B,C,G,H,N | B,C,E,H | A |
| 19 | A,B,C,D,J,K,L,Q,R,S,t,U,V,W,X,Y,Z | B,C,F | AA,E |
| 20 | A,B,C,D,E,F,G,H,K,L,O, | B,C,E | AA |

| Name of Fish | Name of Fish | Kind of Water Use |
|---|---|---|
| A;Pa Ko | T;Pa Soua | AA;Fishing(Active) |
| B;Pa Douk | U;Pa sathong | A;Fishing |
| C;Pa Keng | V;Pa It | B;Irregation |
| D;Pa Kadout | W;Pa Kiang | C;Cultivation |
| E;Pa Ninh(Tilapia) | X;Pa Tiok | D;Washing |
| F;Pa Nai(Common Carp) | Y;P khap khong | E;Bathing |
| G;Pa Khao Mong | Z;Pa Sieu Ao | |
| H;P Sieu | | |
| I;Pa Ka | | |
| J;Pa Lot | Name of Water Plant | |
| K;Pa Kot | A;Phak Bong(Ipomoea) | |
| L;Pa Kagnen | B;Phak Top (Eichhornia) | |
| M;Pa Salit | C;Phak Chok (Pistia) | |
| N;Yen | D;Ne(Hydrilla) | |
| O;Pa Pak | E;Ne(Ceratophyllum) | |
| P;Pa Kat | F;Boualuang(Nelumbo) | |
| Q;Pa Mat | G;Kolokasia (Colocasia) | |
| R;Pa Sou | H;Chok Noi(Salvinia) | |
| S;Pa Meo | I;Phak Beyen(Jussiaea) | |

## Table C.22 Pollutant Load

| No | Date | Q $m^3/s$ | CODmn kg/day | TP kg/day | TSS kg/day |
|---|---|---|---|---|---|
| | 25/5/89 | 0.0526 | 35.2 | 4.45 | 91 |
| | 2/6/89 | 0.4470 | 298.7 | 28.19 | 1120 |
| 3 | 7/9/89 | 0.4432 | 192.0 | 6.74 | 4748 |
| | 11/9/89 | 0.1714 | 88.5 | 6.72 | 681 |
| | 14/9/89 | 1.4367 | 643.7 | 47.54 | 3476 |
| | 24/5/89 | - | | | |
| | 31/5/89 | - | | | |
| 8 | 7/9/89 | 0.4496 | 232.3 | 14.65 | 3729 |
| | 11/9/89 | 0.0942 | 49.3 | 8.17 | 179 |
| | 14/9/89 | 0.1957 | 129.0 | 13.95 | 609 |
| | 24/5/89 | 0.0168 | 31.0 | 2.63 | 17 |
| | 31/5/89 | 0.0170 | 15.8 | 2.99 | 57 |
| 9 | 7/9/89 | 0.0425 | 21.5 | 3.94 | 81 |
| | 11/9/89 | 0.0250 | 22.4 | 2.97 | 52 |
| | 14/9/89 | 0.0295 | 23.3 | 2.74 | 46 |
| | 24/5/89 | 0.0173 | 10.6 | 1.06 | 27 |
| | 31/5/89 | 0.0310 | 20.5 | 2.74 | 46 |
| 13 | 7/9/89 | 0.3648 | 163.1 | 12.67 | 3782 |
| | 11/9/89 | - | | | |
| | 14/9/89 | 0.1137 | 62.2 | 5.58 | 236 |

Table C.23 Assessment Of Water Quality

| Sampling Point | Class * | Fauna species | Water and Water surface Utilization | Note |
|---|---|---|---|---|
| 1 | E | 6 | Fishing | |
| 2 | C | 10 | Fishing | |
| 3 | C(D) | 8 | Fishing(Active), Irrigation | Hong Ke |
| 4 | D | 6 | Fishing | |
| 5 | D | 8 | Fishing, Irrigation | |
| 6 | E | 5 | Cultivation | |
| 7 | D | 1 | - | |
| 8 | E | 3 | Fishing | |
| 9 | E | 1 | | |
| 10 | E | 1 | - | |
| 11 | E(C) | 7 | Fishing(Active) | Nong Nieng |
| 12 | C(C) | 7 | Fishing (Active), Irrigation | Hong Xeng |
| 13 | C | 5 | Fishing, Washing | |
| 14 | E | 4 | Fishing, Cultivation | |
| 15 | D | 4 | Fishing, Cultivation | |
| 16 | E | 3 | - | |
| 17 | D | 4 | Fishing(Active), Irrigation, Bathing | |
| 18 | C | 6 | Fishing | |
| 19 | D | 17 | Fishing(Active), Bathing | |
| 20 | C | 11 | Fishing(Active) | |
| Houa Khoua | D | - | - | |
| Salakham | D | - | - | |
| Kaolieo | A | - | - | |

* ( ):Existing data

| | | | | |
|---|---|---|---|---|
| Class | A | good | COD less than 3 mg/l, | DO more than 6 mg/l |
| | B | fair | COD 5 mg/l-3 mg/l, | DO more than 4 mg/l |
| | C | poor | COD 8 mg/l-5 mg/l, | DO more than 2 mg/l |
| | D | to be improved | COD 8 mg/l-10 mg/l, | DO less than 2 mg/l |
| | E | worst | COD more than 10 mg/l, | DO less than 1 mg/l |

Table C.24 Land Use in the Study Area

Unit :ha

| Year | Central | Residential | Public & Commercial | Industrial | Water | Green | Other | Total |
|---|---|---|---|---|---|---|---|---|
| 1988 | 0.0 | 2,164.4 | 400.6 | 38.2 | 166.7 | 2,499.3 | 349.4 | 5,618.6 |
| 2020 | 230.2 | 2,658.3 | 344.9 | 107.4 | 116.5 | 1,772.2 | 389.1 | 5,618.6 |

Table C.25 Projection of Future POpulation in the Study Area

| Population | | | | Population density(person/km$^2$) | | | | Growth Rate |
|---|---|---|---|---|---|---|---|---|
| 1988 | 2000 | 2010 | 2020 | 1988 | 2000 | 2010 | 2020 | 1988-2020 |
| 157,653 | 201,000 | 251,000 | 305,000 | 2,806 | 3,577 | 4,467 | 5,428 | 2.08% |

Table C.26 Projection of GRDP in the Study Area

Unit:million Kip

| GRDP | | | | | Growth rate p.a |
|---|---|---|---|---|---|
| 1988 | 1990 | 2000 | 2010 | 2020 | 1988-2020 |
| 13,543 | 15,800 | 32,700 | 71,100 | 160,000 | 8.0% |

Table C.27 (1) Pollutant Load Factor of Domestic WasteWater (BOD)

| Item | Present | Future |
|---|---|---|
| Wastewater(lit/person · day) | 105 | 140 |
| Pollutant load(g/person · day) | 45 | 60 |

Table C.27 (2) Pollutant Load Factor of Natural Run Off Water (BOD)

| Item | Present | Future |
|---|---|---|
| Run Off($m^3/s \cdot km^2$) | Deducts Domestic Wastewater from Observation Value | Same as left |
| Pollutant load($g/day \cdot km^2$) | 1.0 | 1.0 |

Table C.28 Estimation of Pollutant Load and Concentration (BOD);Present Condition

| Location No. | Catchment area (km2) (1) | Population (person) (2) | Generated Pollutant Load: Specific Domestic Waste Water Load (g/person day) (3) | Domestic Waste Water Load (kg/day) (4)=(2)*(3) | Specific Natural Load (kg/day km2) (5) | Natural Load (kg/day) (6)=(1)*(5) | Sum (kg/day) (7)=(4)*(6) | Run off Polluant Load * 24/5/-25/5 1989 (kg/day) (8) | Run off Polluant Load * 31/5-2/6 1989 (kg/day) (9) | Run off Ratio of Pollutant Load (10)=((8)+(9))/2/(7) |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 8.18 | 51,891 | 45 | 2,335 | 1.00 | 8.18 | 2,343 | 34.5 | 353.7 | 0.08 |
| 13 | 1.99 | 6,835 | 45 | 308 | 1.00 | 1.99 | 310 | 8.0 | 40.8 | 0.08 |

* Run Off Pollutant Load (BOD)

| Location No. | 24/5/-25/5/1989 Discharge ($m^3$/sec) (1) | Concentration (mg/lit) (2) | Pollutant Load (kg/day) (3)=(1)*(2) | 31/5-2/6/1989 Discharge ($m^3$/sec) (4) | Concentration (mg/lit) (5) | Pollutant Load (kg/day) (6)=(4)*(5) |
|---|---|---|---|---|---|---|
| 3 | 0.0526 | 7.66 | 34.5 | 0.4469 | 9.160 | 353.7 |
| 13 | 0.0173 | 5.35 | 8.0 | 0.0310 | 15.220 | 40.8 |

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Table C.29 Estimation of Pollutant Load and Concentration (BOD) :Future Condition

| Location No. | Catchment area (km2) (1) | Population (person) (2) | Generated Pollutant Specific Domestic Waste Water Load (g/person day) (3) | Generated Pollutant Domestic Waste Water Load (kg/day) (4)-(2)*(3) | Specific Natural Load (kg/day km2) (5) | Natural Load (kg/day) (6)-(1)*(5) | Load Sum (kg/day) (7)-(4)+(6) | Run off Ratio of Pollutant Load (8) | Run off Pollutant load (kg/day) (9)-(7)*(8) |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 9.53 | 85,875 | 60 | 5,153 | 1.00 | 9.53 | 5,163 | 0.08 | 413 |
| 13 | 1.99 | 12,982 | 60 | 779 | 1.00 | 1.99 | 781 | 0.08 | 62 |

Table C.30 Estimation of Discharge and Concentration (BOD) in Future

Date : 24/5 - 25/5/1989

| Location No. | Population at Present (person) (1) | Population in Future (person) (2) | Run off Discharge Existing Run-off Discharge (m3/sec) (3) | Run off Discharge Aditional Run-off Discharge (m3/sec) (4) | Run off Discharge Sum (m3/sec) (5)-(3)+(4) | Run off Pollutant load (kg/day) (6) | Concentration (mg/l) (7)-(6)/(5) |
|---|---|---|---|---|---|---|---|
| 3 | 51,891 | 85,875 | 0.0526 | 0.0761 | 0.1287 | 413 | 37 |
| 13 | 6,835 | 12,982 | 0.0173 | 0.0127 | 0.0300 | 62 | 24 |

Remark:Aditional Run off Discharge =Existing Population*351/person
+ Incresing Population*1401/person

Table C.31 Comparison of Concentration(COD) between Present and Future

| Location NO. | Concentration (mg/lit) | | | | |
|---|---|---|---|---|---|
| | Present | | Future(2020) | | |
| | 24/5-25/5/1989 | 31/5-2/6/1989 | BOD | Conversion Ratio* | COD |
| 3 | 7.7 | 7.7 | 37 | 0.99 | 37 |
| 13 | 7.1 | 7.7 | 24 | 0.99 | 24 |

* Conversion Ratio between BOD and CODMn

| Date | BOD (mg/lit) | CODMn (mg/lit) | CODMn /BOD | Date | BOD (mg/lit) | CODMn (mg/lit) | CODMn /BOD |
|---|---|---|---|---|---|---|---|
| | 27.25 | 51.70 | 1.90 | | 12.640 | 13.230 | 1.05 |
| | 5.98 | 8.99 | 1.50 | | 3.085 | 6.970 | 2.26 |
| | 7.66 | 7.74 | 1.01 | | 9.160 | 7.734 | 0.84 |
| | 11.95 | 9.46 | 0.79 | | 8.435 | 8.660 | 1.03 |
| | 13.01 | 8.56 | 0.66 | | 0.110 | 8.050 | * 73.18 |
| | 5.54 | 9.44 | 1.70 | | 9.115 | 10.000 | 1.10 |
| | 32.63 | 9.79 | 0.30 | | 28.275 | 9.633 | 0.34 |
| 24/5 | 10.55 | 10.23 | 0.97 | | 12.600 | 8.110 | 0.64 |
| -25/5 | 30.45 | 21.36 | 0.70 | | 32.120 | 10.730 | 0.33 |
| 1989 | 23.20 | 12.55 | 0.54 | 31/5 | 31.200 | 12.850 | 0.41 |
| | 6.71 | 10.70 | 1.59 | -2/6 | 7.170 | 6.061 | 0.85 |
| | 3.69 | 6.46 | 1.75 | 1989 | 4.550 | 5.363 | 1.18 |
| | 5.35 | 7.11 | 1.33 | | 15.220 | 7.650 | 0.50 |
| | 10.60 | 9.06 | 0.85 | | 9.370 | 12.050 | 1.29 |
| | 14.15 | 7.47 | 0.53 | | 13.570 | 6.200 | 0.46 |
| | 11.50 | 10.53 | 0.92 | | 17.430 | 10.160 | 0.58 |
| | 4.25 | 9.77 | 2.30 | | 8.720 | 9.130 | 1.05 |
| | 4.72 | 6.64 | 1.41 | | 11.220 | 4.790 | 0.43 |
| | 5.75 | 8.02 | 1.39 | | 6.475 | 4.992 | 0.77 |
| | 6.50 | 3.69 | 0.57 | | 6.970 | 4.330 | 0.62 |
| | | | | Avrage | | | 0.99 |

*:Exclude from Average Calculation

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# *FIGURES*

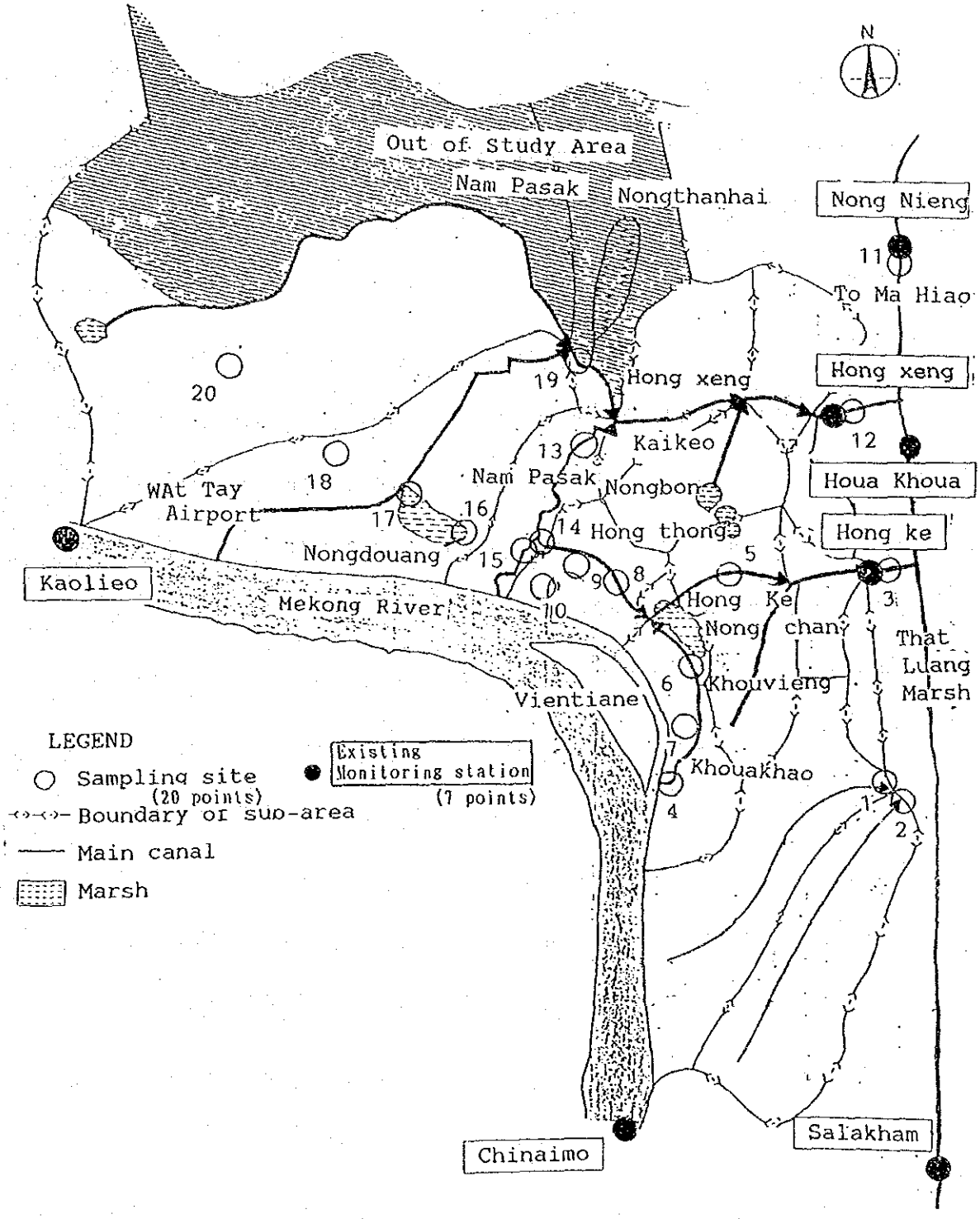


Fig. C.1 Location Map of Water Sampling Site

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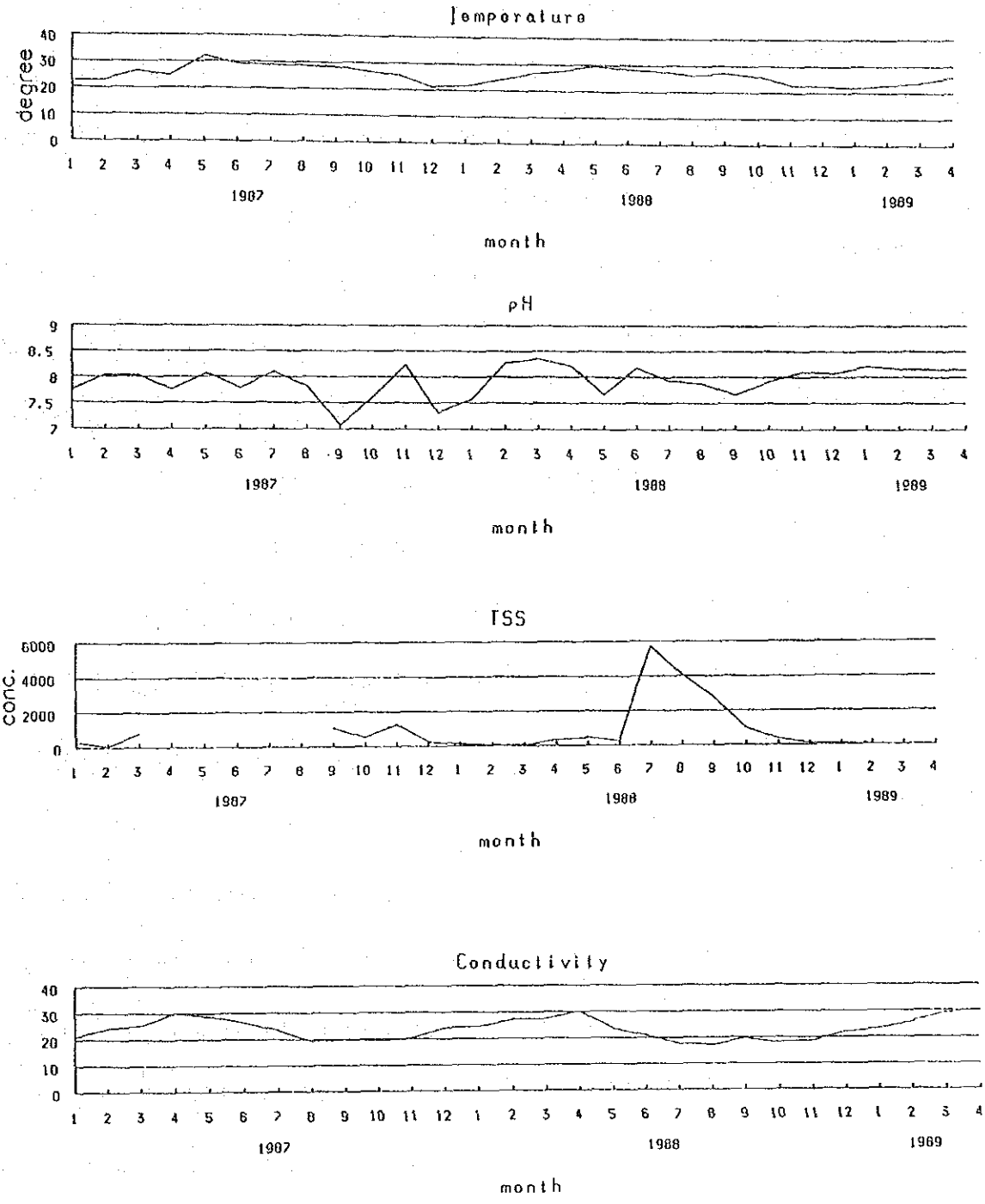


Fig. C.2 (1) Monthly Change oh Water Quality at Kaolieo (L.W.Q.A) between 1987 and 1989 (1)

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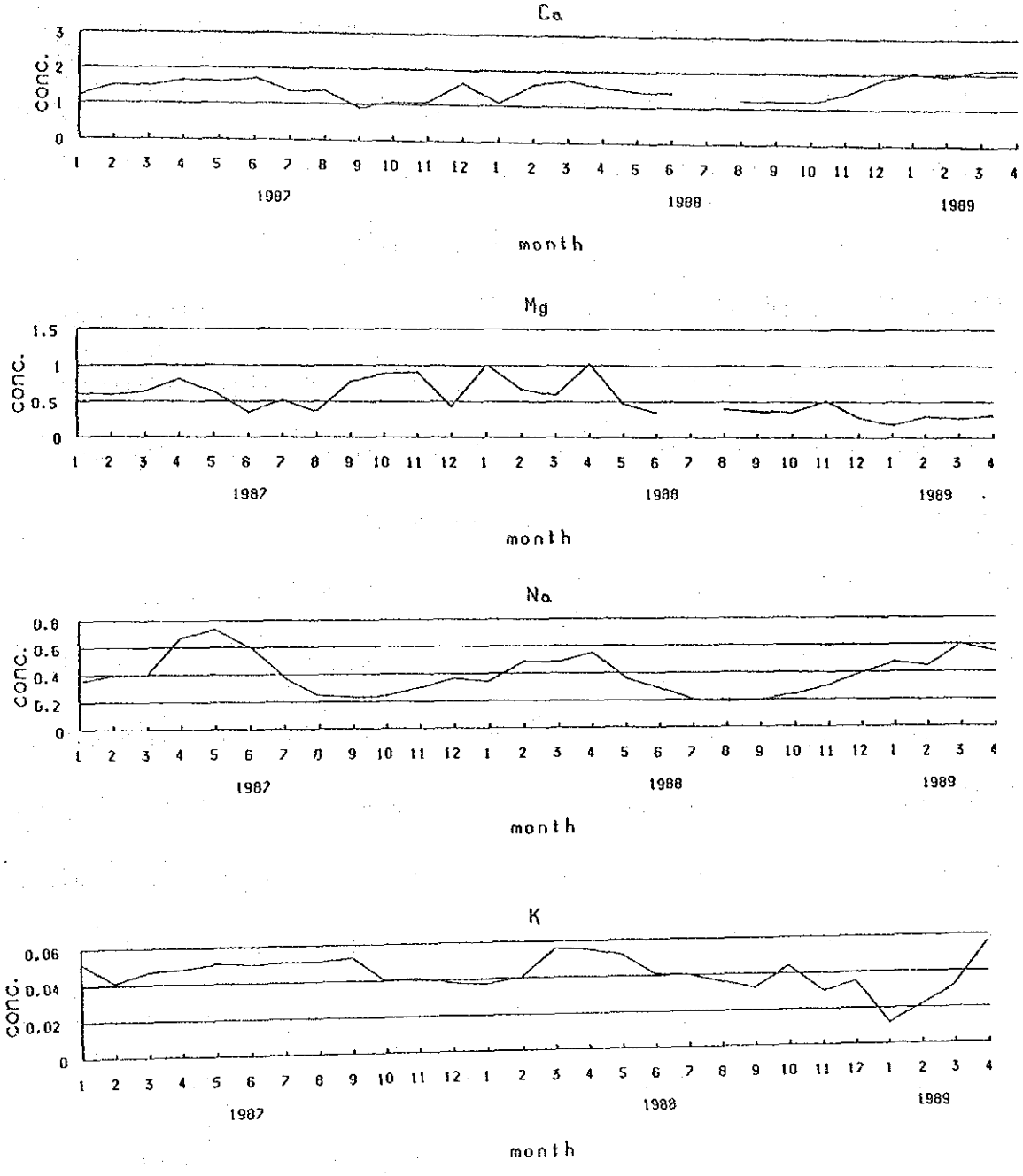


Fig. C.2 (2) Monthly Change oh Water Quality at Kaolieo (L.W.Q.A) between 1987 and 1989 (2)

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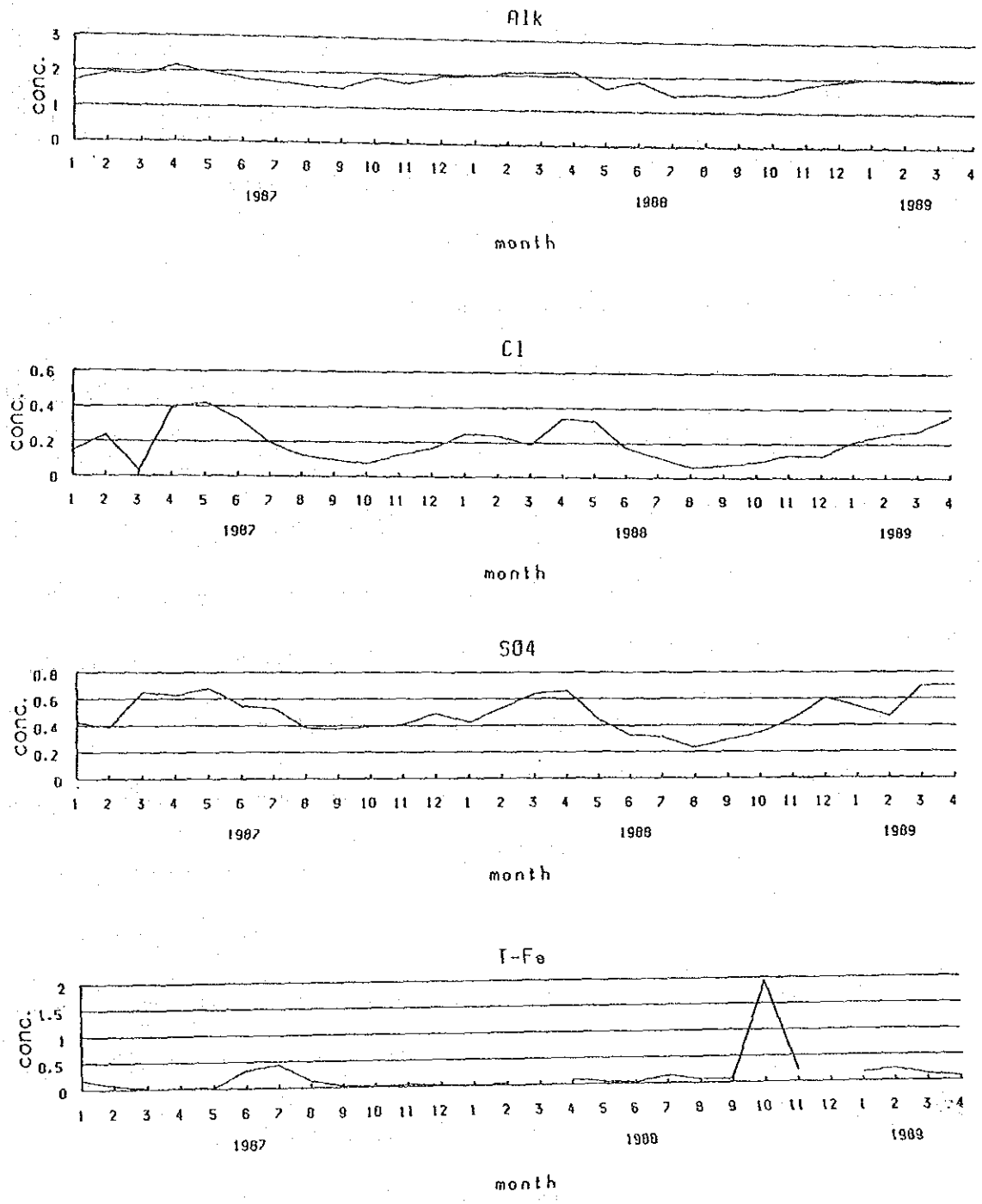


Fig. C.2(3) Monthly Change oh Water Quality at Kaolieo (L.W.Q.A) between 1987 and 1989 (3)

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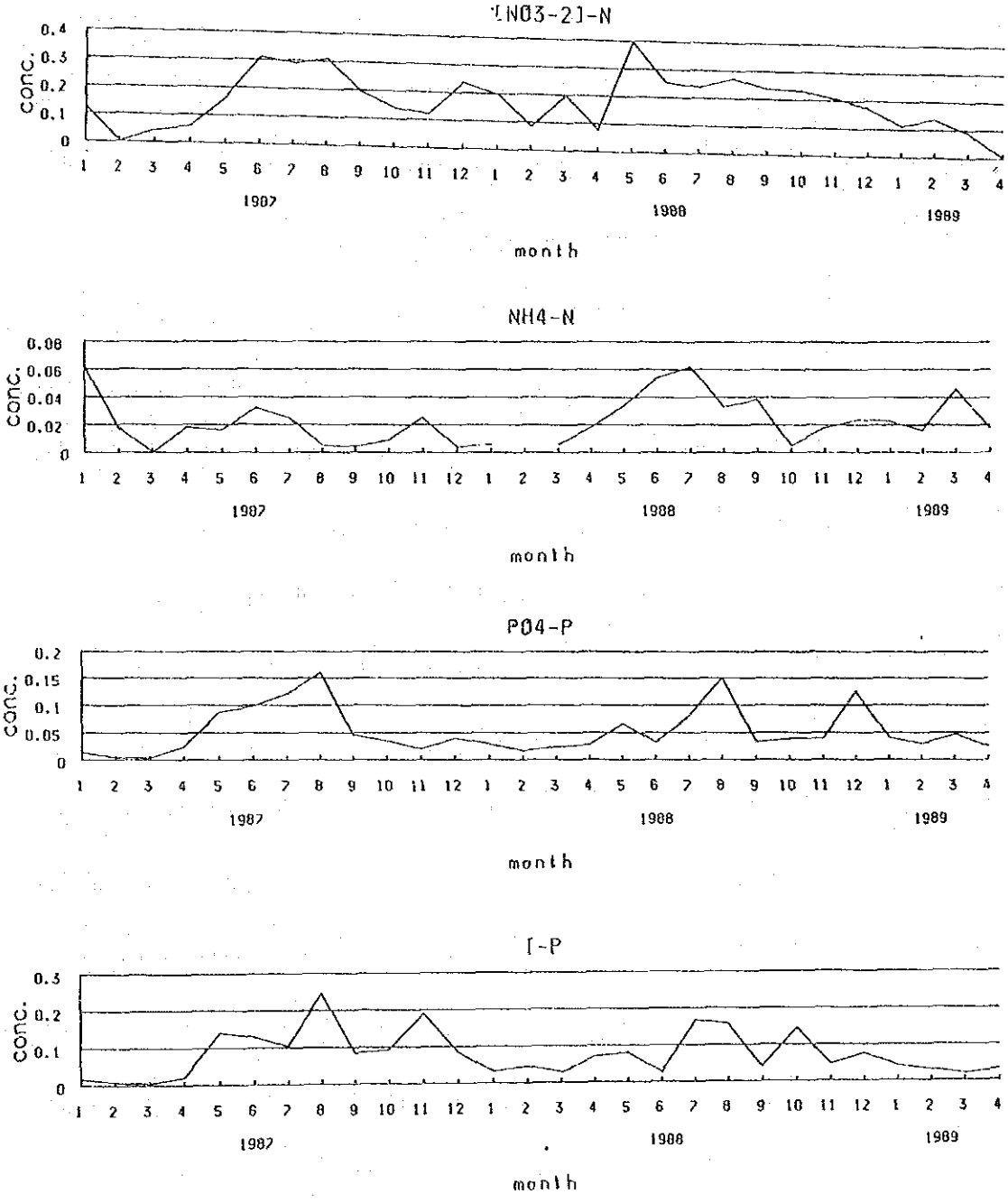


Fig. C.2 (4) Monthly Change oh Water Quality at Kaolieo (L.W.Q.A) between 1987 and 1989 (4)

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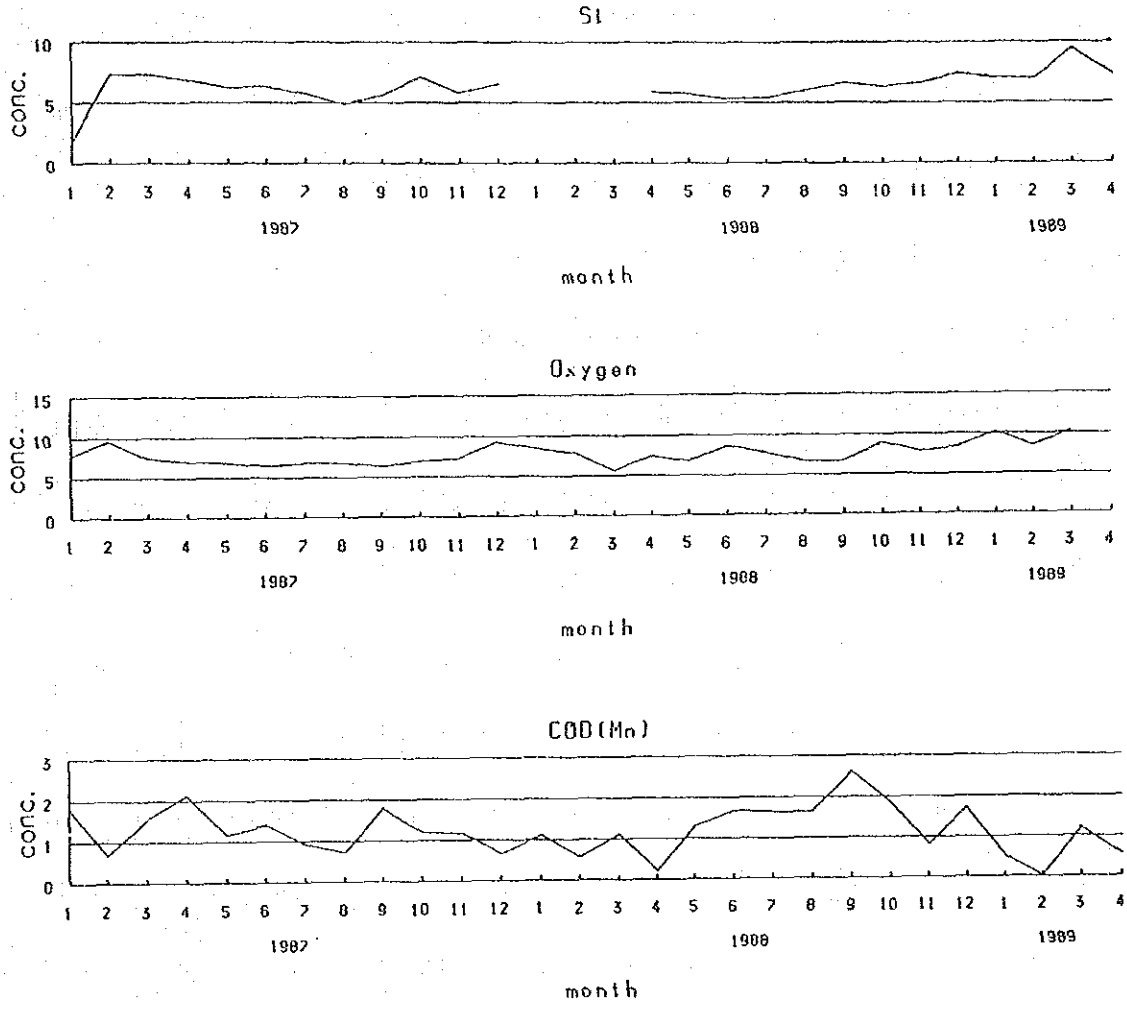


Fig. C.2 (5) Monthly Change oh Water Quality at Kaolieo (L.W.Q.A) between 1987 and 1989 (5)

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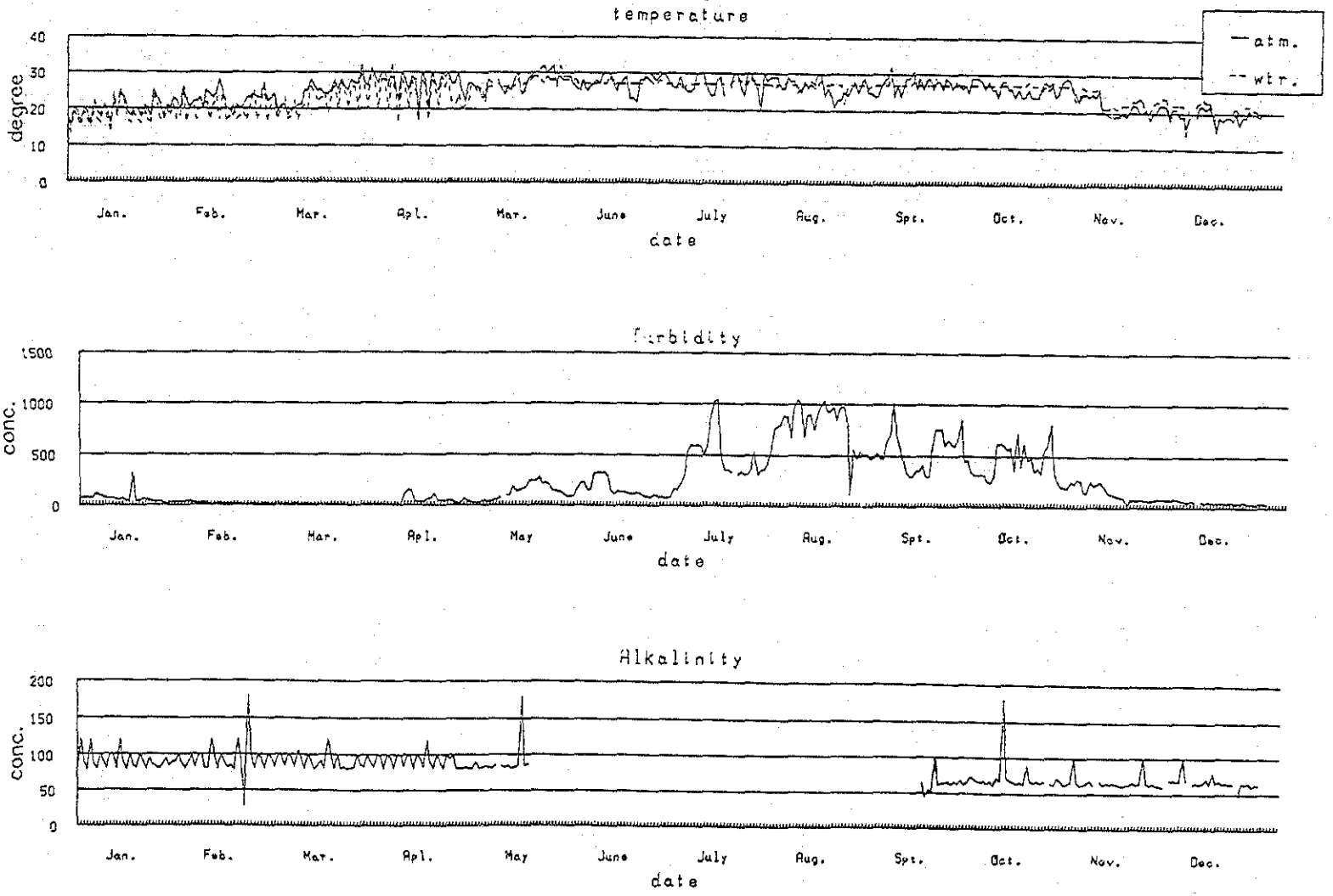


Fig. C.3 (1) Daily Change of Water Quality at Kaolieo (Nam papa Lao) in 1988 (1)

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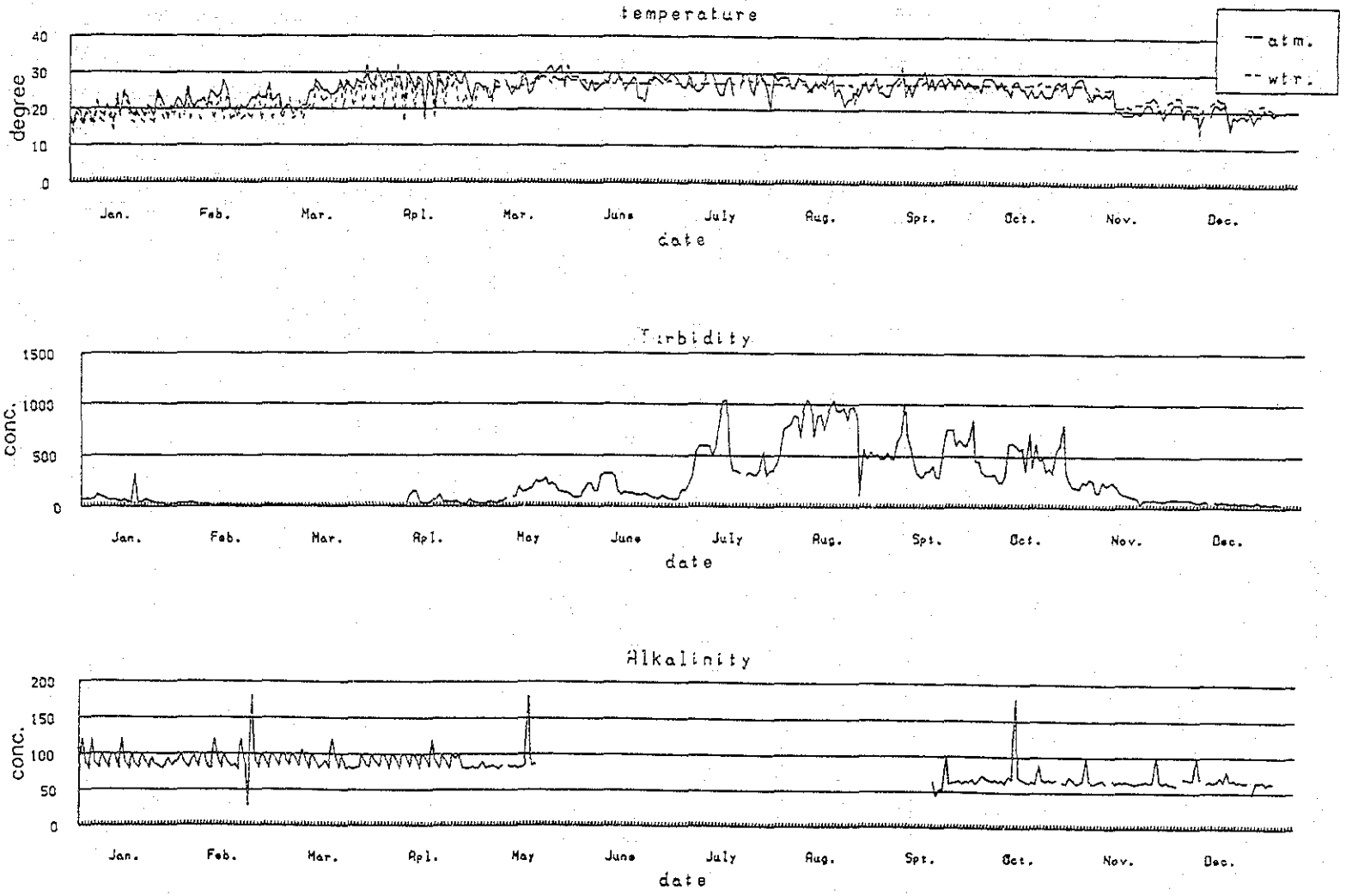


Fig. C.3 (1) Daily Change of Water Quality at Kaolieo (Nam papa Lao) in 1988 (1)

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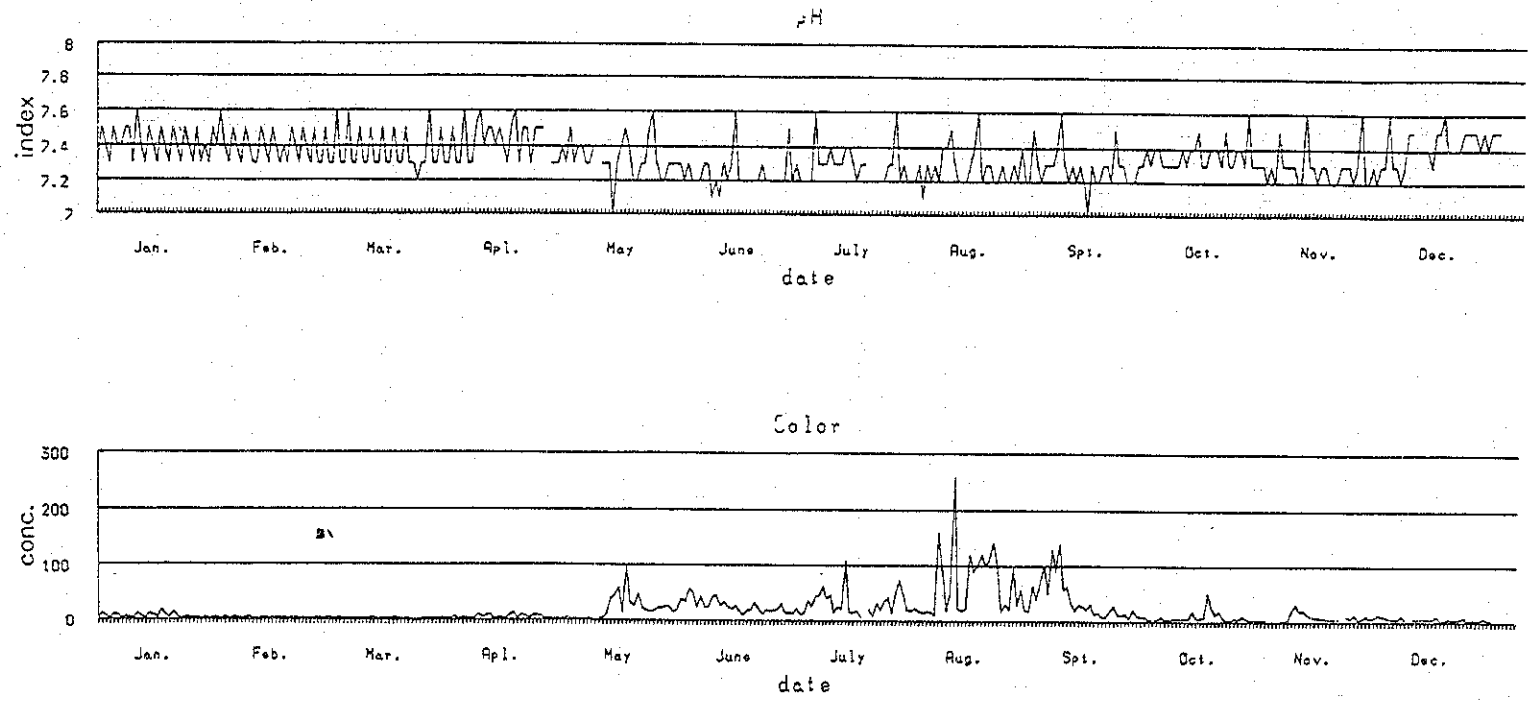


Fig. C.3 (2) Daily Change of Water Quality at Kaolieo (Nam papa Lao) in 1988 (2)

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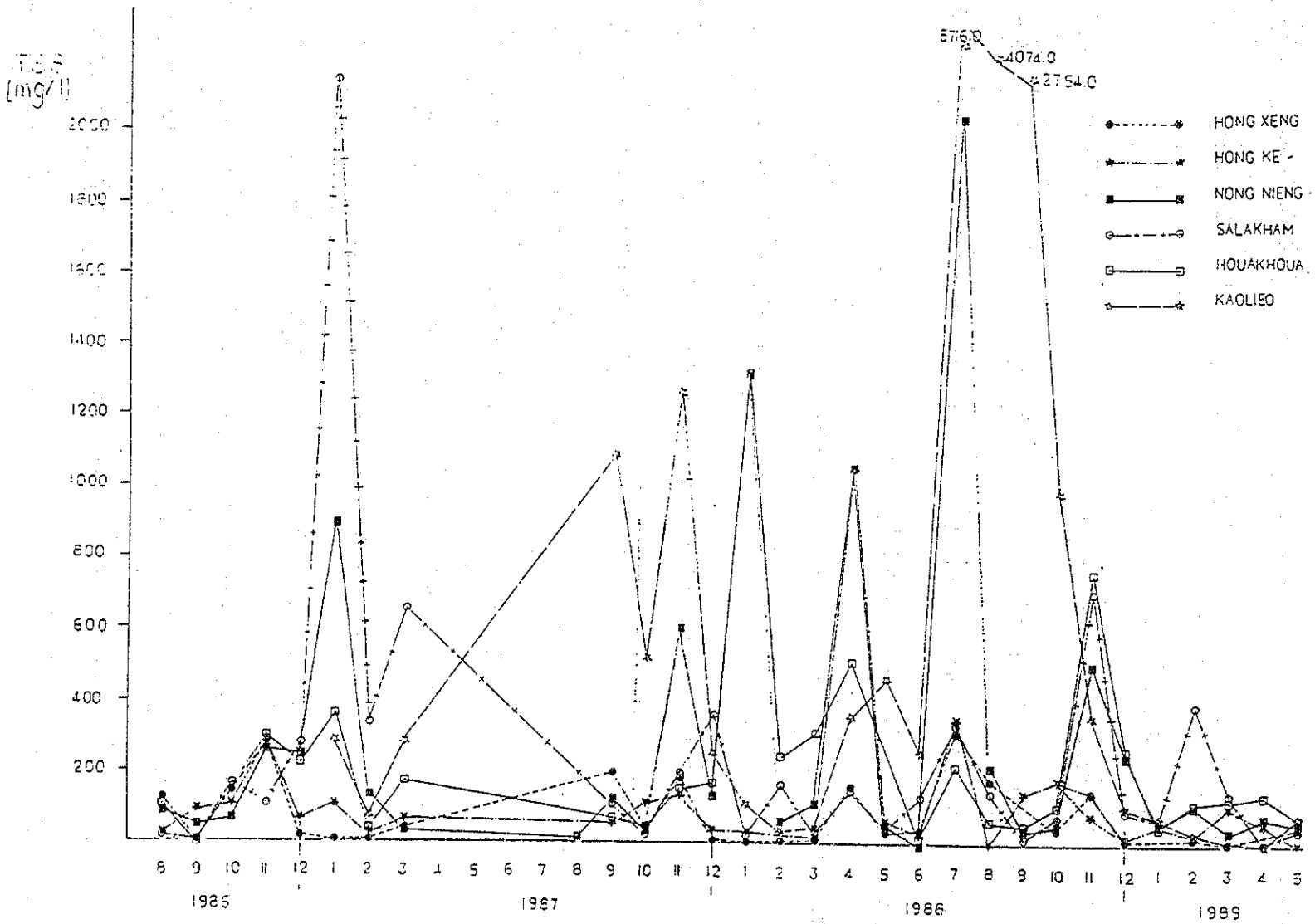


Fig. C.4 (1) MONTHLY CHANGE OF WATER QUALITY (TSS)

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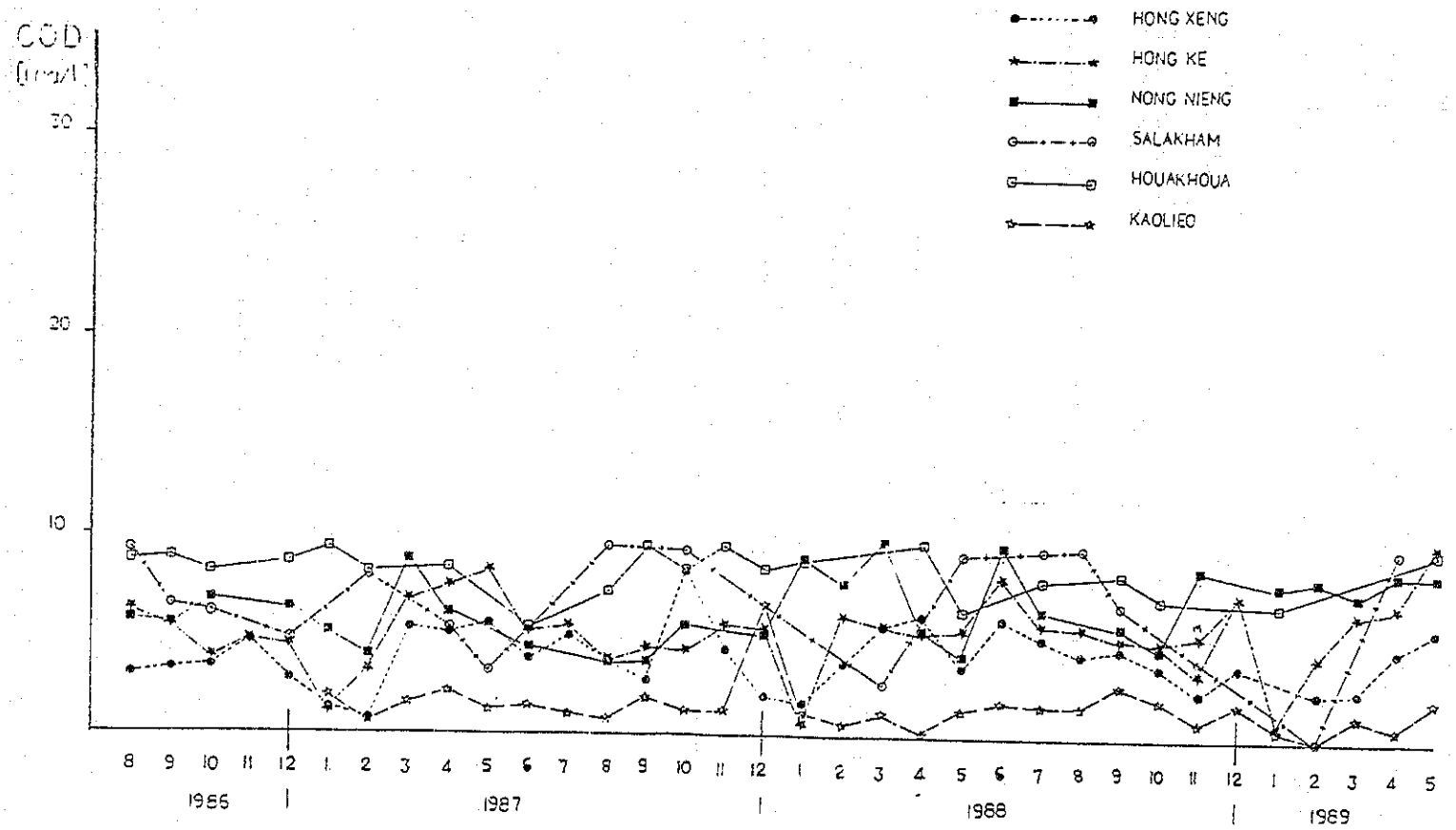


Fig. C.4 (2) MONTHLY CHANGE OF WATER QUALITY (COD)

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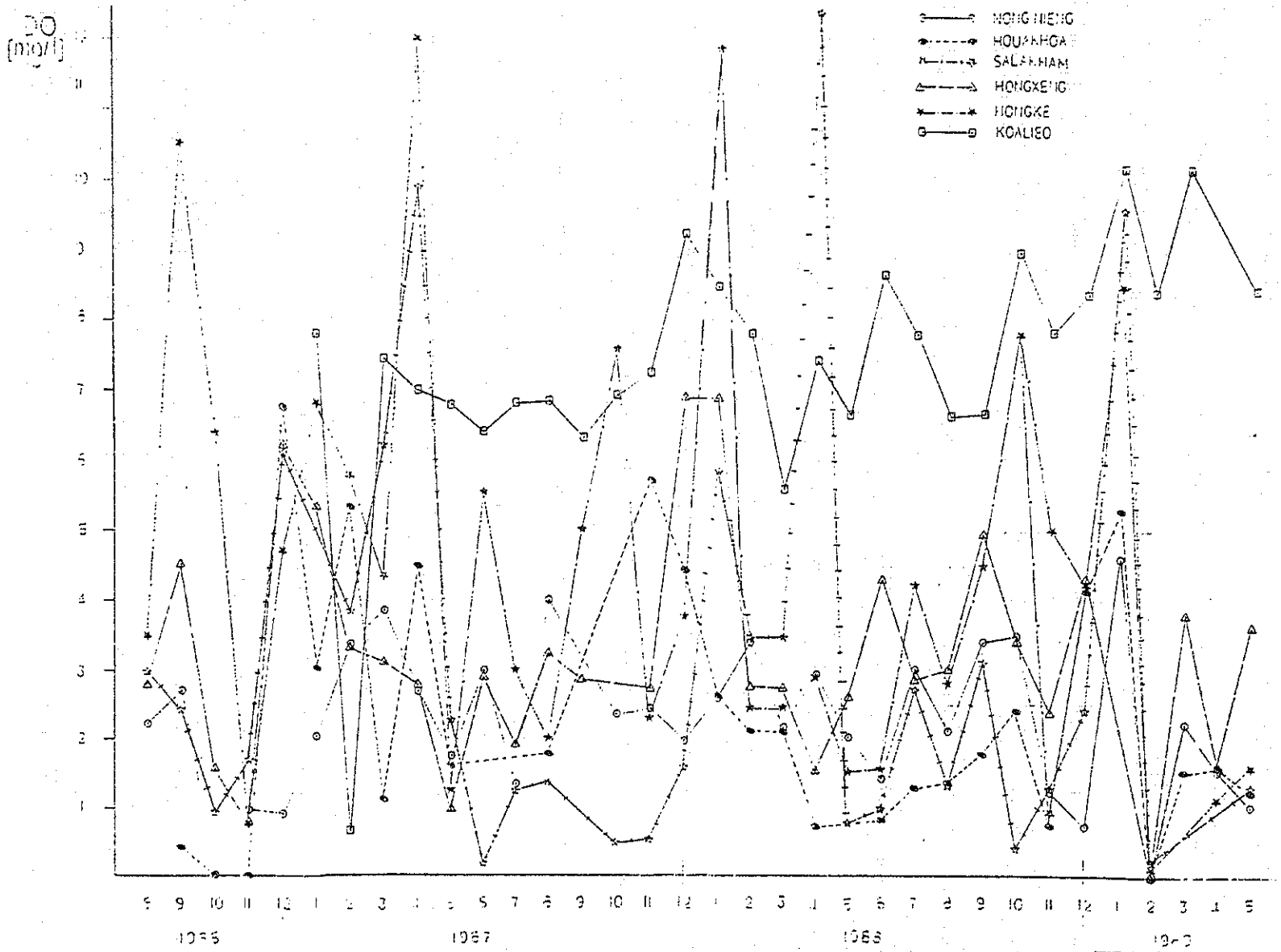


Fig. C.4 (3) MONTHLY CHANGE OF WATER QUALITY (DO)

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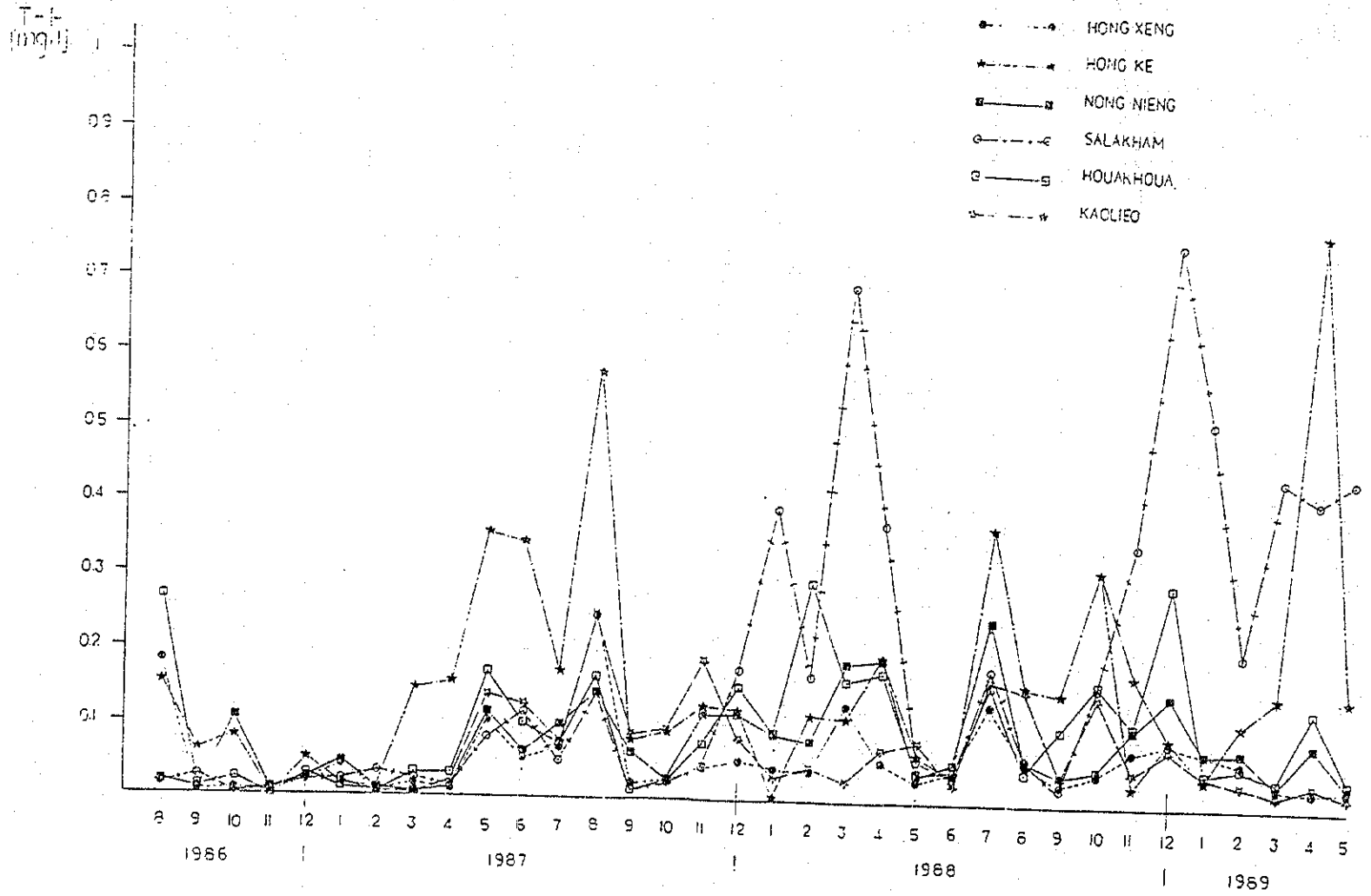


Fig. C.4 (4) MONTHLY CHANGE OF WATER QUALITY (T-P)

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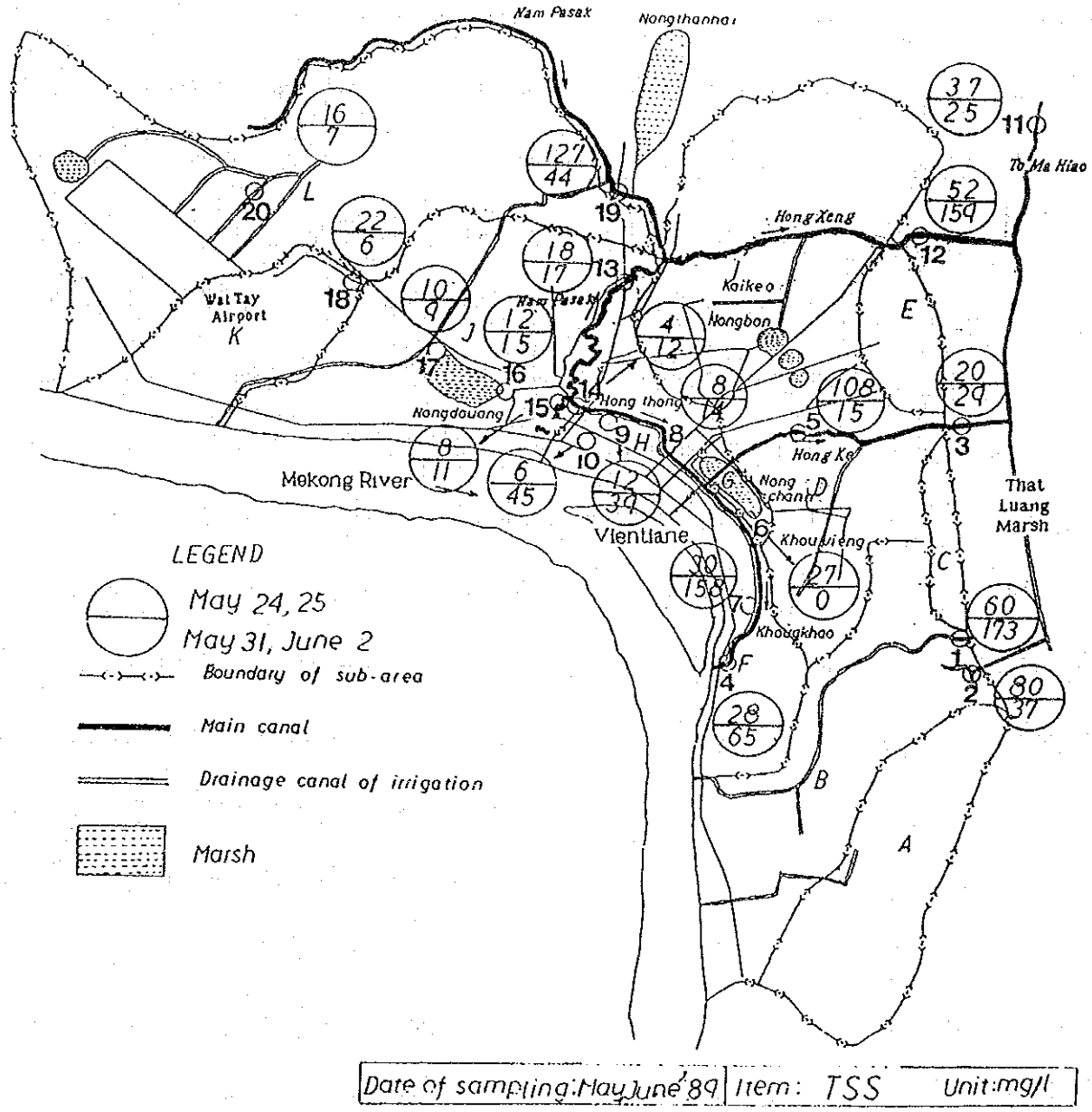


Fig. C.5 Distribution Map of Water Quality (TSS)

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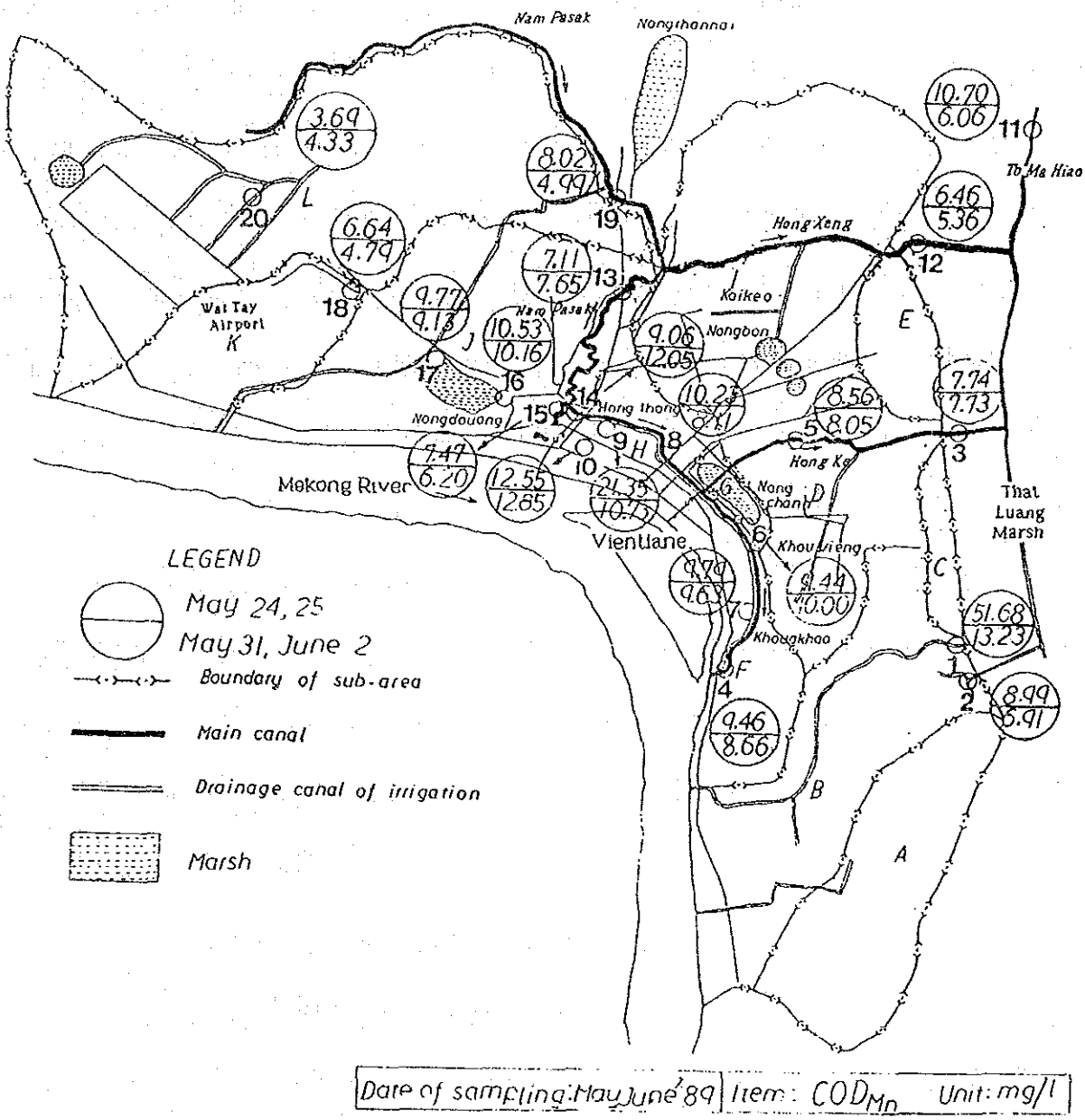


Fig. C.6 Distribution Map of Water Quality (COD Mn)

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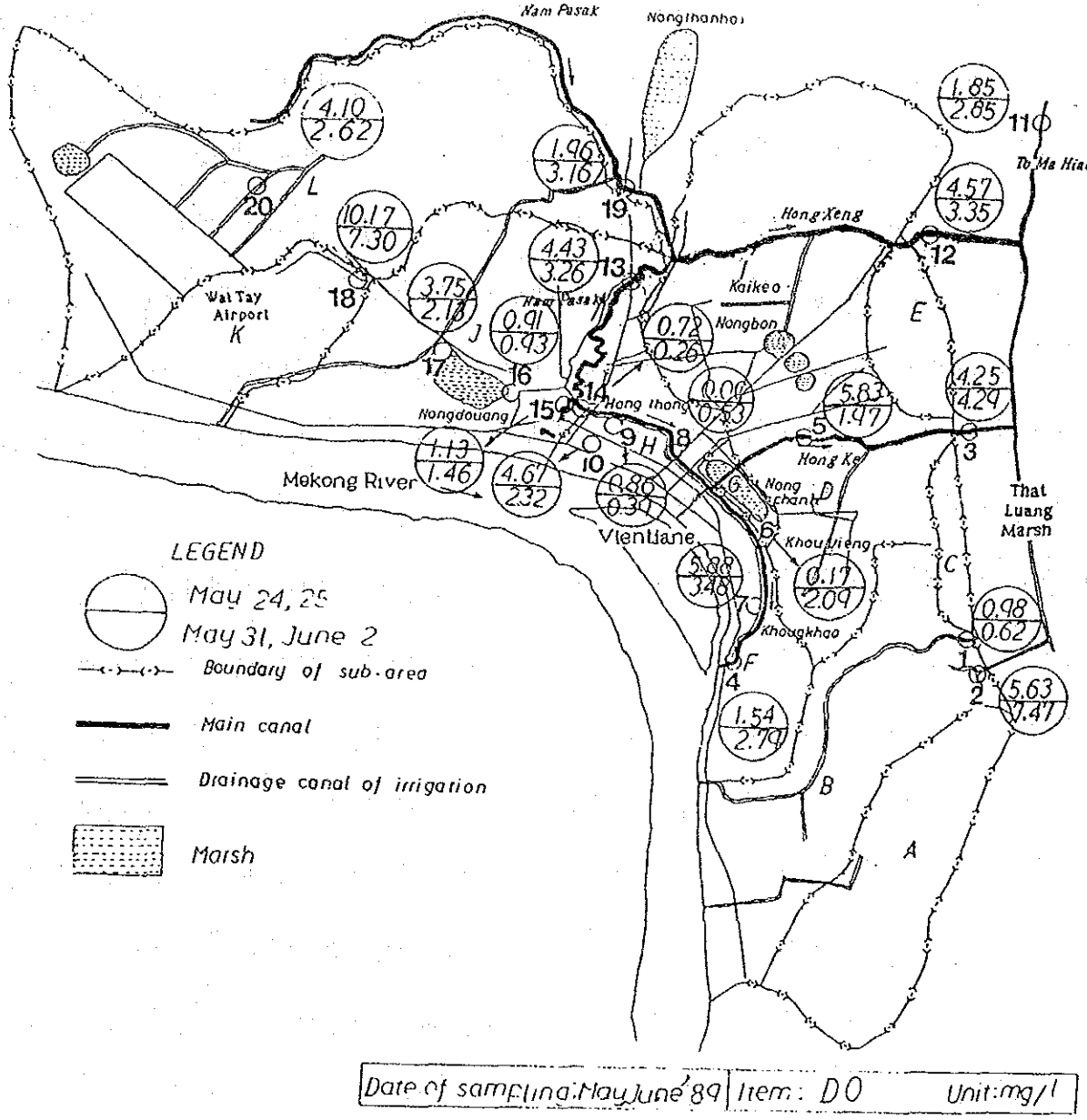


Fig. C.7 Distribution Map of Water Quality (DO)

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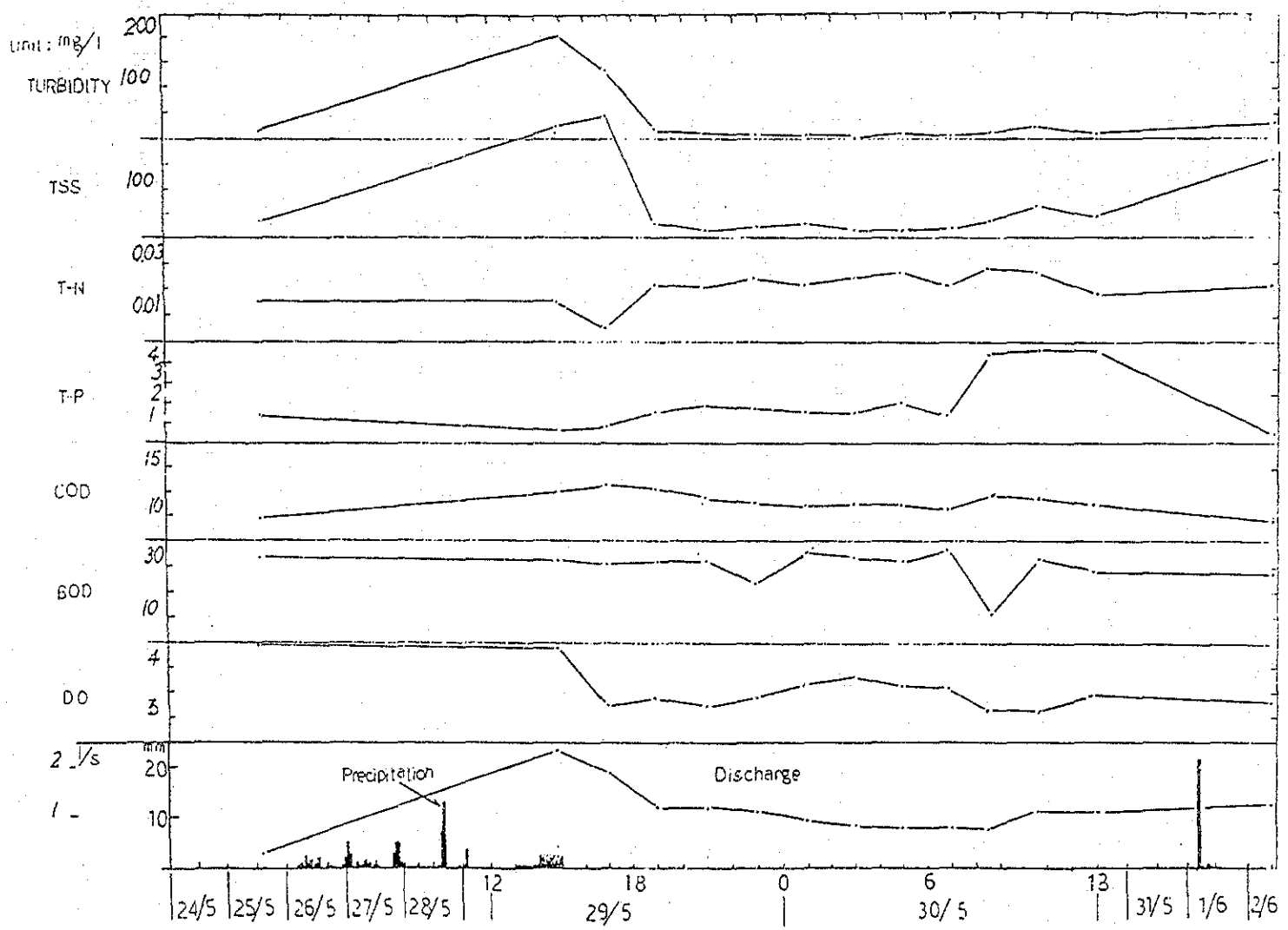


Fig. C.8 Hourly Change of Water Quality (No. 7)

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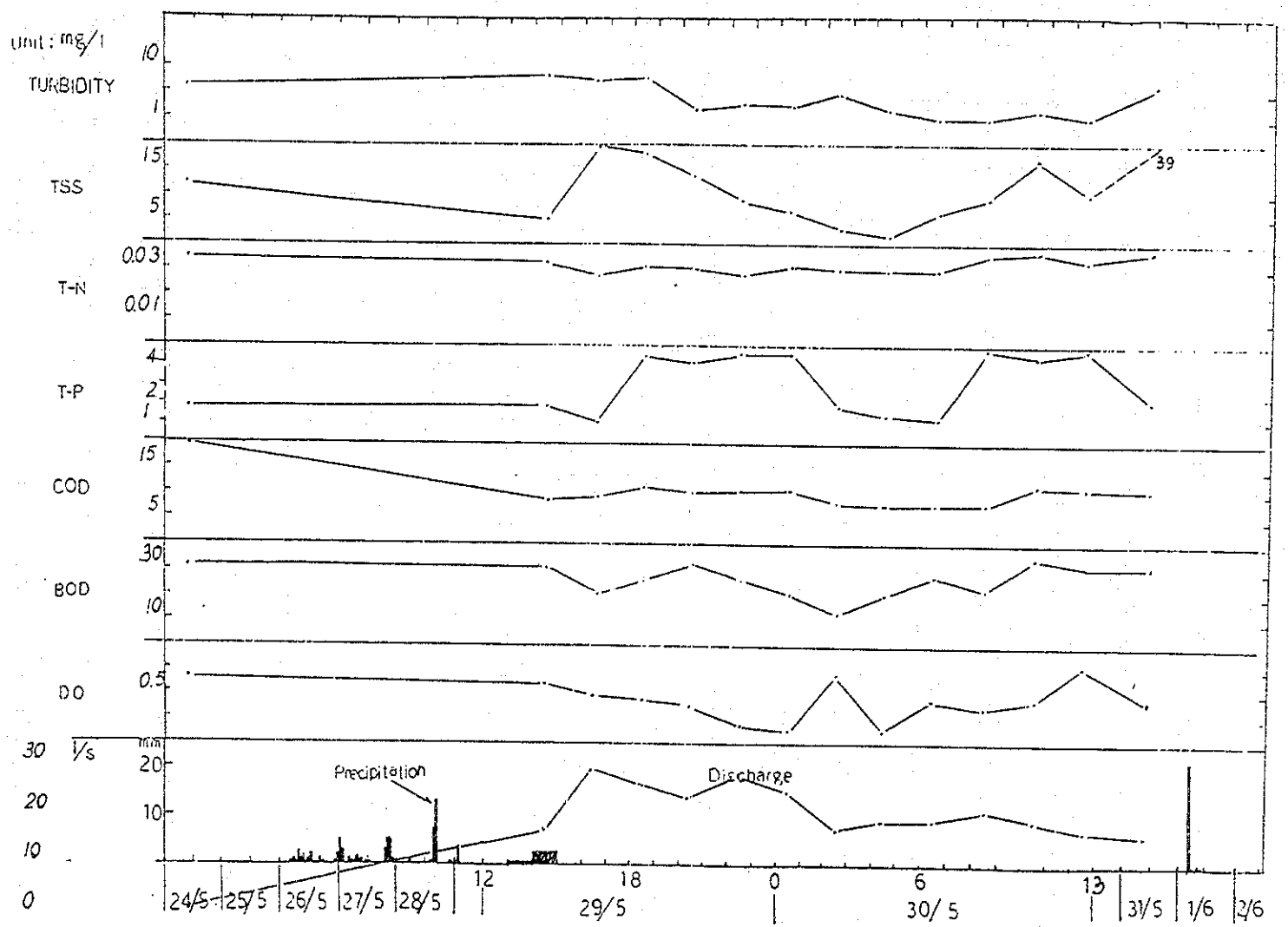


Fig. C.9 Hourly Change of Water Quality (No. 9)

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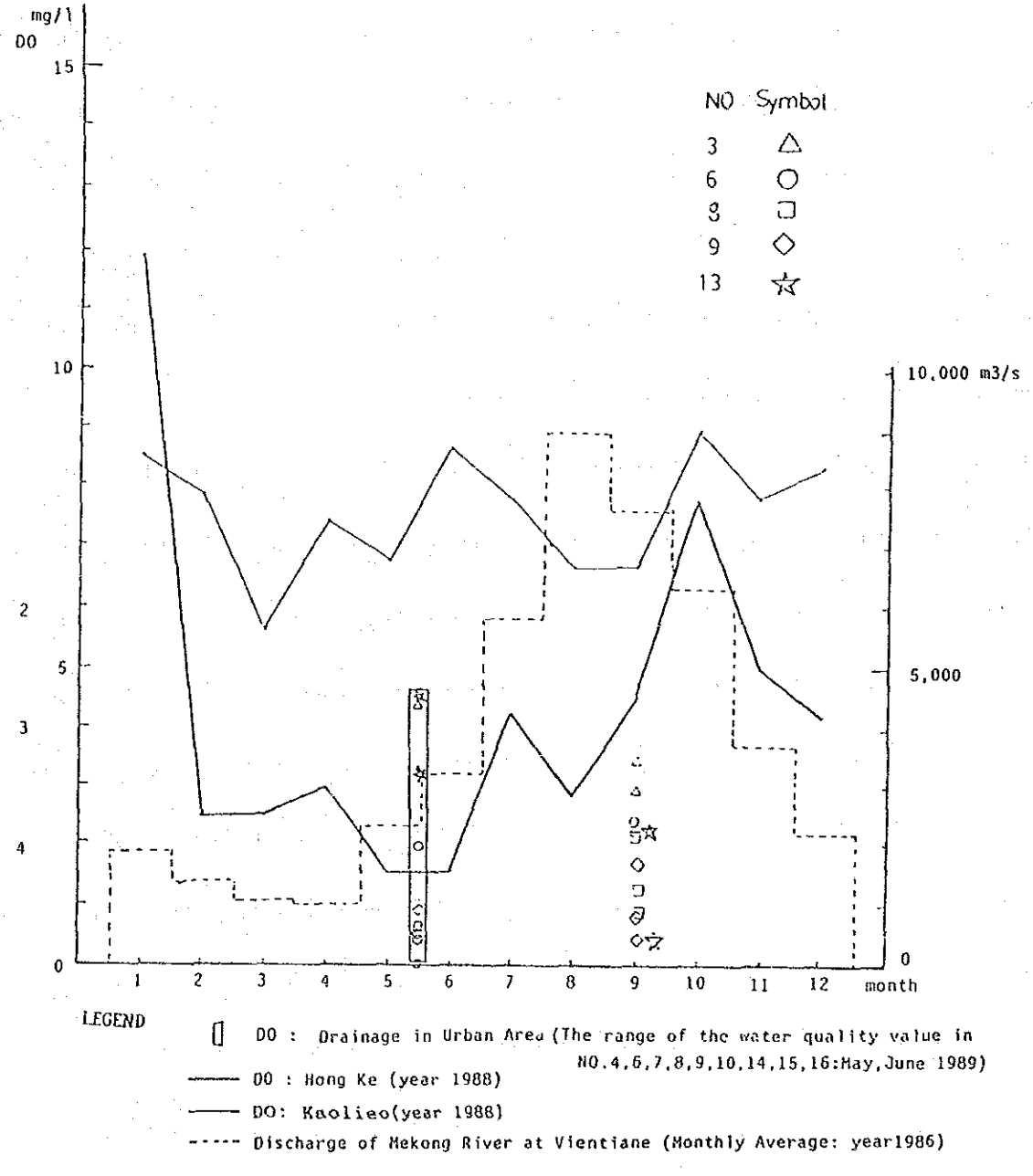


Fig. C.10 Annual Changes of Dissolved Oxygen (DO)

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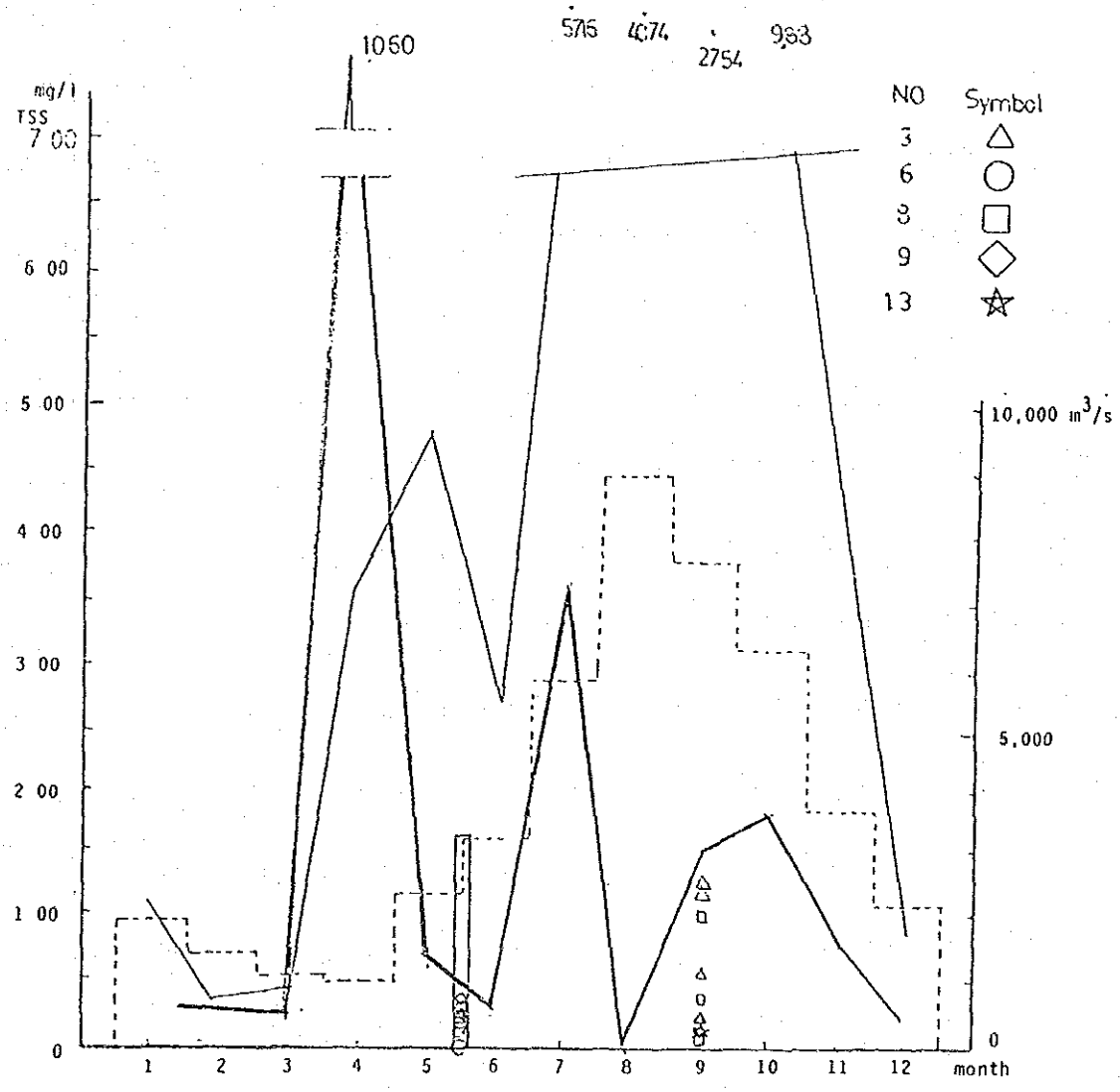


TSS : Drainage in Urban Area (The range of the water quality value in NO.4,6,7,8,9,10,14,15,16:May,June 1989)

TSS : Hong Ke (year 1988)

TSS : Kaolieo(year 1988)

Discharge of Mekong River at Vientiane (monthly average: year 1986)

Fig. C.11 Annual Changes of Total Suspended Solid (TSS)

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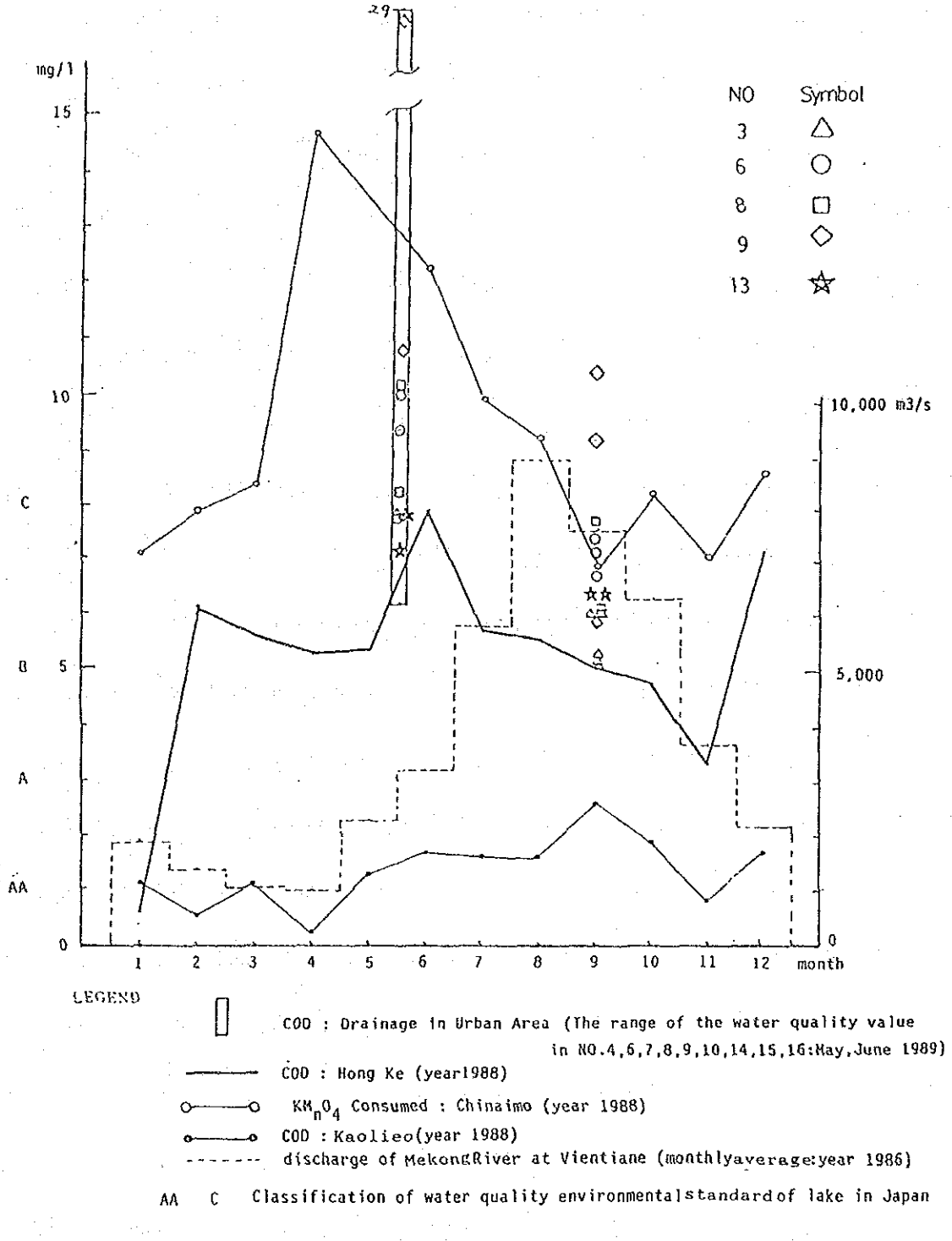


Fig. C.12 Annual Changes of Water Quality ($KM_nO_4$ consumed)

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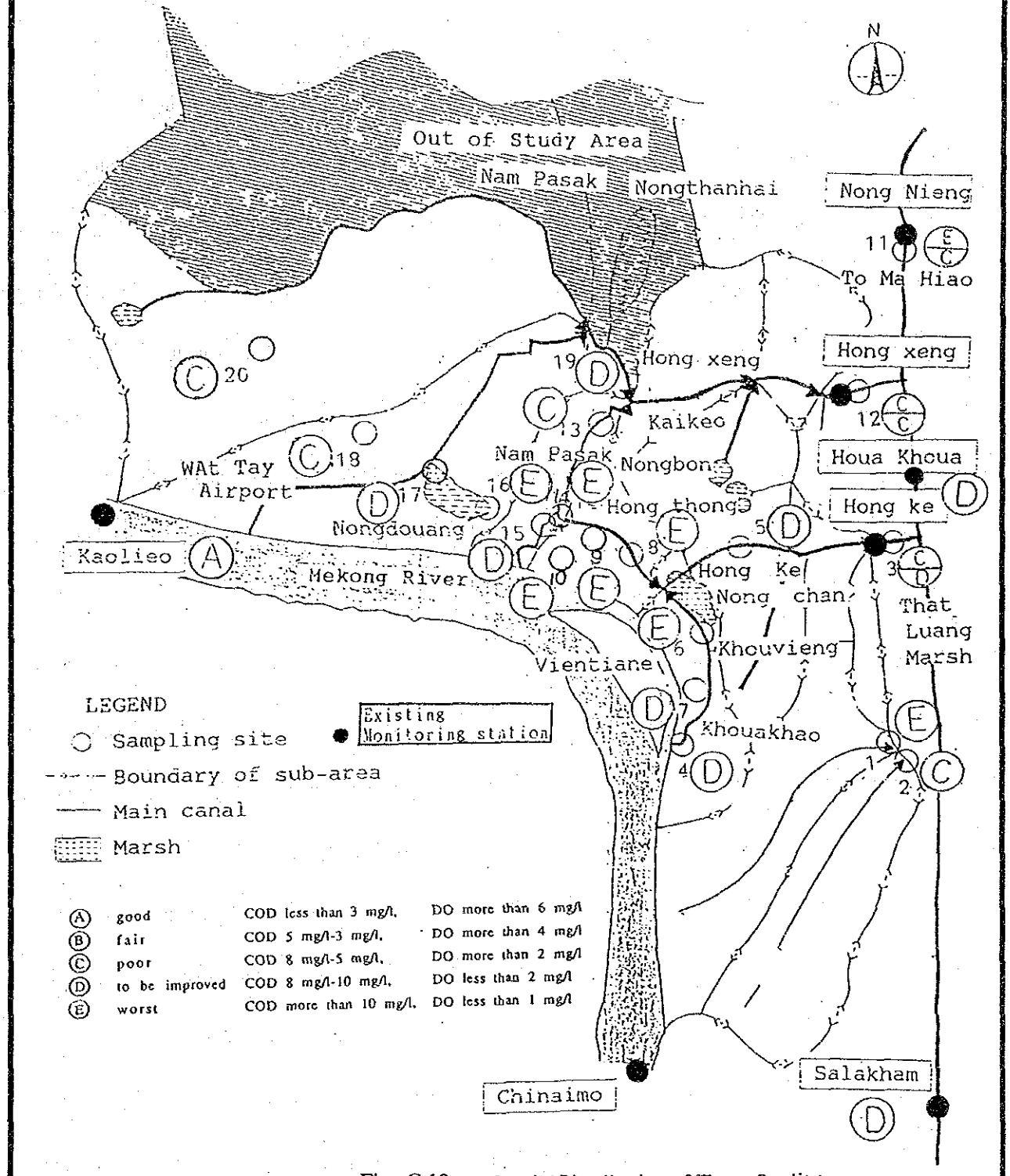


Fig. C.13 Spatial Distribution of Water Quality

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