JAPAN INTERNATIONAL COOPERATION AGENCY
MINISTRY OF ENVIRONMENT
THE REPUBLIC OF LITHUANIA

STUDY ON THE SEWERAGE SYSTEM IMPROVEMENT OF BIRZAI AND SKUODAS TOWN IN THE REPUBLIC OF LITHUANIA

FINAL REPORT

VOLUME III

SUPPORTING REPORT (BIRZAI)

FEBRUARY 1999

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1 GENERAL

1.1 PRESENT SYSTEM FOR WATER QUALITY SURVEY AND MANAGEMENT

The present system for the water quality survey is summarized as follows:

(a) River

Regional offices of the MOE are in charge of water sampling and laboratory testing for their respective control areas (municipalities). Each regional office carries out the sampling and tests directly, or requests the local Water Company to perform the survey in its area. The results are regularly submitted to the Combined Research Center of MOE in Vilnius. The research center compiles all the data collected from the regional offices and inputs them in their computer data base system.

In regard to environmental management, the municipality of Birzai falls under jurisdiction of the Panevėžys Regional office of the MOE. The municipality of Skuodas falls under jurisdiction of the Klaipėda Regional office.

There are 47 rivers and 99 sampling stations in the country used for the water quality survey by the MOE. Sampling stations related to the proposed project are as follows:

- The Tatula River (Birzai): 3 locations (1.8 km, 17.5 km and 18.8km from the confluence with the Musa river)
- The Bartuva River (Skuodas): 2 locations (48 km and 55 km from the river mouth)

The sampling locations were selected at significant places including both up-and-downstream sides of discharge points of effluent. The location map for the water sampling stations by MOE is shown in Figure 1.1.

(b) Lake/Reservoir/Pond

In Lithuania, there are 2,834 lakes over 0.5 ha in surface area. Among them, seven lakes were selected by the MOE for water quality surveys. The lakes in and around Birzai as well as Skuodas were not included.

In Birzai and Skuodas, water quality surveys in the lakes/reservoirs/ponds are carried out by the MOH but only for locations where people enjoy water recreation, mostly swimming. Testing is usually limited to bacteria. Sampling period is generally only the summer season. The Sirvenos Lake in Birzai and the Skuodas Lake in Skuodas are included in the locations sampled by the MOH.

(c) Groundwater

There are two organizations in charge of sampling and water quality surveys of groundwater. National groundwater monitoring is performed by the Geological Survey of Lithuania (MOE) and is financed from the national budget. Groundwater monitoring for waterworks is under the responsibility of the companies carrying out groundwater exploitation.

The national groundwater monitoring covers 42 monitoring stations including those in Birzai and Skuodas. In Karajimiskis village located west of the Birzai town, there are eight wells, which have been monitored since 1979. In Rusupiai village located east of the Skuodas town, there are two monitoring wells installed since 1962. The location map of these wells is shown in Figure 1.2.

(d) Sewage Treatment Plant

The Water Company is in charge of conducting water quality surveys at the STPs. In Birzai, the State Company "Agro Labo" carries out the water sampling and analyses. In Skuodas, "PALANGOS LABORATORIJA" carries out the sampling and analyses under direction of the Water Company in Palanga. The Water Companies in Birzai and Skuodas cooperate in the survey and receive the results. The location map of the sewage treatment plant is shown in Figure 1.3.

(e) Major Pollution Sources

There are several major pollution sources in Birzai as well as in Skuodas, such as factories, hospitals, restaurants and schools. Sampling and analyses at these locations are the same as those for the sewage treatment plants. The location map of major pollution sources (together with STP locations) is shown in Figure 1.3.

1.2 PRESENT SYSTEM OF FLOW MEASUREMENT

The Meteohydrological Service (MOE) carries out river flow measurement. The Meteo-hydrological Service was formerly an independent organization during the Soviet period but now belongs to the MOE. There are 76 river flow measurement stations in the country. Many of them have comparatively long-term records (nearly 30 years or more). The location map of flow measurement stations in Lithuania is shown in Figure 1.4. Periods of flow measurement of the rivers in the project area are shown in Figure 1.5. The following rivers are included:

(a) Apascia River

(b) Agluona River

(c) Tatula River

(d) Bartuva River

1.3 PRESENT WATER QUALITY STANDARDS AND CRITERIA

The Republic of Lithuania intends to become an official member country of the EU. It is therefore necessary for Lithuania to adjust to the EU water quality standards although the EU water registration methods are currently undergoing a fundamental reappraisal.

The order of MOE called "Waste Water Pollution Standards (LAND 10-96)" was approved in July 1997. The standards aim at setting water quality improvement goals and regulating pollution of inland and territorial waters by domestic and industrial waters. There are two categories of standards as follows:

(a) Main standards for pollutants for wastewater discharged to surface waters

(b) Pollution standards for wastewater discharged into municipal sewer collection system

The essential parts of "LAND 10-96" are presented in Table 1.1.

The water quality standards for other sectors (drinking water, river water, lake water, groundwater, water for fish, source for water supply, etc.) are not yet updated. In general, the previous USSR standards are comparable with the standards and recommendations of HELCOM, EU, WHO, World Bank and other European countries.

The draft of "Drinking Water Standards" has been finalized and will be approved soon. The major parts of the drinking water standards (final draft) are presented in Table 1.2. Present river water quality is generally evaluated according to currently applied maximum allowable concentrations that conform to requirements of the fishing sector (shown in Table 1.3) and also water quality classifications (shown in Table 1.4). The river water quality standards currently used are those used during the previous USSR period and are based on the requirements for fish that live in clean water (such as trout and salmon).

In addition to the Lithuanian standards, the Japanese standards are attached for reference evaluation (see Sections 2.4 and 3.4) as follows:

(a) Water Quality Standards for Rivers and Lakes/Ponds in Japan (Table 1.5)

(b) Effluent Standards For Sewerage Systems in Japan (Table 1.6)

1.4 JICA SURVEY

The Study Team conducted water sampling and water quality analysis, including flow measurement, of raw sewage, major pollution sources (factories), alternative rivers which could receive final effluent, and groundwater. Sampling and laboratory tests were sub-contracted to a local firm (VIKTA Laboratory, through UAB Ekoprojektas) under supervision of the Study Team.

2 WATER QUALITY SURVEY FOR THE PROJECT IN BIRZAI

2.1 PRESENT CONDITIONS RELATED TO THE SURVEY IN BIRZAI

2.1.1 River System and Lakes

The river systems and lake in and around Birzai town are shown in Figure 2.1. The major rivers related to the study are listed, in order, from east to west as follows:

(a) The Roveja River
(b) The Apascia River
(c) The Agluona River
(d) The Juodupe River
(e) The Tatula River
(f) The Sirverios Lake

2.1.2 River Runoff Data

The Meteohydrological Service (MOE) carries out river flow measurements at the following rivers:

(a) The Apascia River
(b) The Agluona River
(c) The Tatula River

The flow measurement stations in Birzai are shown in Figure 2.2. The monthly mean discharge records at the flow measurement stations (including that in the Bartuva River) are summarized in Table 2.1. The runoff is relatively large from February to April and small from July to October.

The mean discharges together with the river lengths and catchment areas at the representative locations of the following rivers are summarized in Table 2.2.

(a) The Roveja River
(b) The Obelaukias River
(c) The Apascia River
(d) The Agluona River
(e) The Juodupe River
(f) The Tatula River

Note: The Bartuva and Luoba Rivers in Skuodas are also included in the table for reference.

In the table, the annual mean discharges of the Roveja, Obelaukias, and Juodupe Rivers are estimated by using the annual specific discharge of a river with long-term measurement records.

2.1.3 Water Use

There are three kinds of water bodies; river, groundwater, and lake. Water bodies are used mainly for the following activities/purposes, at present.

(A) River water

(a) Water supply for irrigation/agricultural use

There are no intakes, as far as known from our field reconnaissance. If there is any, water intake from the river would be necessary only during the dry period in the spring and summer. The agricultural irrigation method used in Lithuania is mostly rainfed farming. The use of river water for agriculture is limited.

(b) Drainage

Rain water drains into the rivers or lake/ponds in Birzai, through drainage ditches and from the ground surface.

(c) Recreation

Leisure fishing is popular in Lithuania. In Birzai, some locations along the rivers are used for fishing, but are limited in number. Boating and swimming has been seen but not is common along the river.

The river is not used for commercial fisheries, transportation, sand-mining or as a source of drinking water, at present.

(B) Groundwater

(a) Water supply for domestic and industrial use

The water supply source is primarily from groundwater. The public water supply and factories take water from deep wells. Individual houses without public water supply service take water either from deep or shallow wells.

(b) Water supply for irrigation use

No definite information was obtained on agricultural use of groundwater, but a portion of the well water may be used for farming or landscaping.

(C) Lakes

(a) Water Supply

Water from the lake is not used as a water supply for domestic use. Some factories may use the water for industrial use.

(b) Drainage

Some rainwater drains into the Sirvenos Lake directly through ditches and the ground surface. The Apascia and Agluona Rivers drain into the lake.

(c) Recreation

Leisure fishing, boating and swimming are popular in summer.

2.2 EXISTING WATER QUALITY RECORDS IN BIRZAI

The existing water quality records are classified as follows:

(a) River water
(b) Lake/Reservoir/Pond water
(c) Groundwater
(d) STP wastewater
(e) Pollution sources

(1) Existing Water Quality Records for River Water

The annual records (1994-1997) for river water quality obtained from the MOE are presented in the tables listed as follows:

(a) The Tatula River (1.8 km from the confluence to the Musa River) ;
Tables 2.3 – 2.6
(b) The Tatula River (17.5 km from the confluence to the Musa River) ;
Tables 2.7 – 2.10
(c) The Tatula River (18.8 km from the confluence to the Musa River) ;
Tables 2.11 – 2.14

Summaries of river water quality records (1994-1997) at the respective stations are presented in the following tables:

(a) The Tatula River (1.8 km from the confluence to the Musa River) ;
Table 2. 15
(b) The Tatula River (17.5 km from the confluence to the Musa River) ;
Tables 2.16
(c) The Tatula River (18.8 km from the confluence to the Musa River) ;
Tables 2.17

(2) Existing Water Quality Records for Lake/Reservoir/Pond

There are records of bacteria present for the Sirvenos Lake from the Human Health Center of MOH in Birzai as shown in Table 2.18.

(3) Existing Water Quality Records for Groundwater

The summarized records, in the annual report (1996) prepared by the Geological Survey of Lithuania (MOE), are presented in Table 2.19 as a representative of the existing water quality records for groundwater.

Beside the above, the survey results for the Birzai area in 1994 showed the following conditions:

Item	Urban area	Surrounding area
Total No. of well surveyed	13 wells	6 wells
Exceeding the standard of NO_2- N (45mg/l)	9 wells	2 wells
Exceeding the standard of NO_3-N (3.3mg/l)	1 well	0
Exceeding the standard of NH_4-N (2.0mg/l)	2 wells	1 well

(4) Existing Water Quality Records for the STP Wastewater

The water quality monitoring records for the STP are presented in Table 2.20.

(5) Existing Water Quality Records for Pollution sources

The water quality monitoring records at various pollution sources (taken by the Water Company) are summarized as shown in Table 2. 21.

2.3 WATER QUALITY SURVEY IN BIRZAI BY THE JICA STUDY TEAM

2.3.1 Water Sampling and Laboratory Tests

Water sampling points in Birzai are shown in Figure 2.3. Items for water quality testing were selected in consideration of the study and the conditions at the pollution sources as follows:

(a) Raw Sewage (at STP and factories)

For all samples

Water temperature, pH, Suspended Solids, BOD (Total), BOD (Soluble), COD, Total-N, PO_4-P, Total-P, and Influent flow measurement (at STP)

For samples an selected days

NH_4-N, NO_2-N, NO_3-N, Cl^-, ABS, DO, Oil, Total coliforms, and Alkalinity (as $CaCO_3$)

(b) River/Lake Water

Water temperature, Color, Odor, pH, Transparency, Electric Conductivity, Suspended Solids, BOD, COD, Total-N, PO_4-P, Total-P, Flow Measurement, NH_4-N, NO_2-N, NO_3-N, Cl^-, ABS, DO, Oil, and Total coliforms

(c) Ground Water Quality

Water temperature, Color, Odor, pH, Transparency, Electric Conductivity, Suspended Solids, BOD, COD, Total-N, PO_4-P, Total-P, Flow Measurement, NH_4-N, NO_2-N, NO_3-N, Cl^-, ABS, DO, Oil, Total coliform group

The sampling locations and frequency were selected as follows:

(a) Raw Sewage (at STP and factories)

1) Point of inflow at the Treatment Plant

4 days (2 days/month x 2 months)

13 samples/day (every 2 hours for 24 hours)

Total = 52 samples

2) Point of discharge at the dairy products factory

4 days (2 days/month x 2 months)

5 samples/day (every 2 hours from 8:00 to 16:00 hours)

Total = 20 samples

3) Point of discharge at the brewery

4 days (2 days/month x 2 months)

5 samples/day (every 2 hours from 8:00 to 16:00 hours)

Total = 20 samples

(b) River/Lake Water

Sampling was carried out in the following rivers and locations:

1) The Roveja River; at approximately 2 km upstream of the dairy factory
2) The Apascia River; at a bridge approximately 0.5km upstream of Sirvenos Lake
3) The Agluona River ; at a bridge approximately 1km upstream of Sirvenos Lake
4) The Tatula River; at approximately 0.5 km upstream from the confluence with the Juodupe River.
5) The Tatula River; at approximately 0.5km downstream from the confluence with the Juodupe River
6) The Juodupe River; at approximately 0.1 km upstream of the discharge point from the existing STP.
7) The Juodupe River; at approximately 0.1km downstream of the discharge point from the existing STP

The sampling and frequency were selected as follows:

2 days/month (one each for dry and rainy weather) x 2 months

1 sample/day

Total = 4 samples/point

Note: For the Juodupe River, only one sample per month at the two locations.

(c) Ground Water Quality

Sampling was carried out from the following wells:

1) North side of Sirvenos Lake
2) In the town area
3) Southside of the town
4) At approximately 2 km southwest of town.
5) At approximately 5 km west of town

The sampling and frequency were selected as follows::

3 days/month

1 sample/day

Total = 3 samples/point

The following tables show summaries of the survey, which are explained above.

(a) Quantity of Water Quality Survey (Table 2.22)

(b) Summary of Water Sampling Date (Table 2.23)

2.3.2 Results of Water Quality Analysis

The survey results obtained are presented in the following tables:

(a) S.T.P Influent (Tables 2.24 to 2.27)

(b) Dairy Factory Effluent (Tables 2.28 to 2.31)

(c) Brewery Effluent (Tables 2.32 to 2.35)

(d) Rivers (Tables 2.36 to 2.42)

(e) Groundwater (Tables 2.43 to 2.47)

(f) Lake (Tables 2.48 and 2.49)

A summary of the records was prepared as follows:

(a) S.T.P Influent (Table 2.50)

(b) Dairy Factory Effluent(Table 2.51)

(c) Brewery Effluent(Table 2.52)

(d) Rivers(Table 2.53)

(e) Groundwater (Table 2.54)

(f) Lake (Table 2.55)

In addition to above, results of the water quality tests for the supernatant of raw sewage, which were taken and settled in 1 litter cylinder by the Study Team staff at the STP, are shown in Table 2.56. The test was carried out additionally for preliminary design of the STP.

2.4 EVALUATION OF WATER QUALITY FOR BIRZAI

An evaluation was made against the water quality standards as explained in Section 1.3. Essential and representative parameters, for which standards are available, were selected for evaluation. In addition, mean values are used for comparison with the standards. The maximum and minimum values are not always reliable to use in evaluations, mainly due to an occasional inaccuracy in sampling and testing.

The evaluation is to be carried out in the following manner:

(a) Comparison of the existing records with the standards,

(b) Comparison of the JICA survey results with the standards(and/or the existing records), and

(c) General evaluation based on the comparison.

(1) Birzai Sewage Treatment Plant

The evaluation was made using the "Waste Water Pollution Standards (LAND 10-96)" as discussed in Section 1.3.

(a) Comparison of the existing records with the standards

Summary of the existing records (STP, Birzai)

Unit: mg/l

Item	Inflow (Mean)	Outflow (Mean)	Standard (Outflow)
BOD_7	509.8	***194.0***	15
SS	239.8	***61.7***	30
T-N	43.9	***32.4***	20
T-P	5.0	***3.9***	15

Note: The values in italic and bold exceed the standard.

(b) Comparison of the JICA survey results with the existing records

Summary of JICA survey records (STP, Birzai)

Unit: mg/l

Items	Inflow (Mean)
BOD_7	255.6
SS	216.5
T-N	29.5
T-P	6.1

Note: The JICA survey was carried out at the STP only of the influent.

(c) General Evaluation

As seen in the tables above, it is apparent that the existing STP can not reduce the pollutants to the required standards. The concentrations of all major parameters shown are higher than the standards; approximately 1.5 times for T-P, approximately 2 times for SS and T-N, and approximately 13 times for BOD7.

Although the JICA survey does not include testing the effluent from the STP, the test results of inflow are almost at the same level as those monitored by the MOE. Only the mean concentration of BOD, is nearly a half that monitored by the MOE. The test results vary remarkably depending on the conditions at the time of sampling. Accordingly, it would be reasonable that the results of the MOE's monitoring with relatively long-term records are used for the basic parameters in design of the STP.

(2) Factories

The evaluation was to be made using the "Waste Water Pollution Standards (LAND 10-96)" as discussed in Section 1.3.

(a) Comparison of the existing records with the standards

Summary of Existing records
(Effluent to the sewerage system from Factories, Birzai)

Unit: mg/l

Item	Brewery	Canned Food	Diary	Standard (Lithuania)	Standard (Japan)
BOD_7	*715*	231	*702*	-	600
SS	251	83	163	-	600

(b) Comparison of the JICA survey results with the standards

Summary of JICA survey records
(Effluent to the sewerage system from Factories , Birzai)

unit: mg/l

	Brewery	Diary	Standard, (Lithuania)	Standard (Japan)
BOD_7	*2,918*	*989*	-	600
COD	8,712	2380	-	-
COD/BOD	*2.98*	2.40	< 2.5	-
pH	*5.9*	8.5	6.5 – 9.0	5.0 – 9.0
SS	*821*	394	-	600

(c) General Evaluation

As the data from the Water Company is limited in number and the concentrations are less than those of the JICA surveys. The evaluation was made on the basis of the results of the JICA survey.

The Lithuanian standards are only available for the ratio of COD/BOD and pH. Effluent from the brewery exceeds the limit of the standards for both the COD/BOD ratio and pH. Effluent from the dairy factory is within the limit based on evaluation of the mean concentration.

The effluent concentration from the dairy factory is comparatively less than that from the brewery. It is however noted that effluent flow is remarkably high from the dairy factory. The annual effluent volume is approximately 100,000 m^3 from the dairy factory compared to approximately 27,000 m^3 from the brewery. Therefore, the total volume of pollutants is higher from the dairy factory.

(3) River

The evaluation was made using the " River Water Quality Standards" currently applied and the "River Water Classification" as presented in Section 1.3.

(a) Comparison of the existing records with the standards

Summary of Existing records (River, Birzai)

unit: mg/l

Item	Tatula 1.8 km	Tatula 17.5 km	Tatula 18.8 km	Standard
DO	7.3	***5.7***	22.4	> 6
BOD_7	***2.53***	***17.20***	***4.70***	2.3
NH_4-N	***3.02***	***6.92***	***0.83***	0.39
NO_2-N	***0.19***	***17.03***	0.02	0.02
T-N	***3.46***	***8.29***	***4.17***	2.0
PO_4-P	***1.40***	***2.79***	***0.19***	0.08
T-P	***0.34***	***1.09***	***0.20***	0.2
River Water Index (BOD range)	Clean	Very contaminated	Slightly Contaminated	-

Note: Values in italic and bold exceed the standard.

(b) Comparison of the JICA survey results with the standards

Summary of JICA survey records (River, Birzai)

Unit: mg/l

Item	Roveja	Apascia	Agluona	Tatula Up.	Tatula Down.	Juodupe Up.	Juodupe Down	Standards
DO	6.38	6.9	***4.93***	6.93	***5.62***	7.39	***1.08***	> 6
BOD_7	1.84	***3.15***	2.21	2.07	***4.22***	0.62	***8.50***	2.3
NH_4-N	2.05	***0.58***	***0.46***	0.33	***0.95***	0.16	***26***	0.39
NO_2-N	0.008	***0.022***	***0.05***	0.015	***0.83***	0.01	0.01	0.02
T-N	***3.8***	***2.55***	***3.78***	***6.13***	***5.44***	***9.4***	***36.2***	2.0
PO_4-P	0.02	0.03	0.02	0.03	***0.22***	0.05	***0.29***	0.08
T-P	0.076	0.09	0.098	0.115	***0.31***	0.06	***2.4***	0.2
River Water Index (BOD)	Very clean	Clean	Very clean	Very clean	Slightly Contaminated	Very clean	Medium contaminated	-

Note: Values in italic and bold exceed the standard.

(c) General Evaluation

The existing records of the MOE for the Tatula River only show the following:

1) The stretch upstream (18.8 km) of the confluence with the Juodupe River is slightly polluted and the values of BOD, NH_4-N, T-N, PO_4-P and T-P exceed the allowable standards. The pollution possibly comes from the towns and villages located upstream.
2) The downstream stretch (17.5 km) after the confluence with the Juodupe River is very polluted and all parameters exceed the limits. The change in water quality caused by contamination is very clear.
3) In the further downstream stretch (1.8 km), near the confluence to the Musa River, the river is still polluted and the values of BOD, NH_4-N, NO_2-N, T-N, PO_4-P and T-P still exceed the limits. The contamination level, however, is remarkably improved due to the natural dilution especially from additional flow from the tributaries along the way and is classified as a "clean" river..

The JICA survey results show the following:

1) The Roveja River is not polluted while only the T-N exceeds the allowable limits.
2) The Apascia and Agluona Rivers are classified as clean rivers, however the values of BOD, NH_4-N, NO_2-N and T-N exceed the limit in the Apascia River and the values of DO, NH_4-N, NO_2-N and T-N exceed the limits in the Agluona River.
3) In the Tatula River, the downstream stretch of the confluence with the Juodupe River is polluted and all the parameters exceed the limits. The upstream stretch is still clean and only the parameter of T-N exceeds the limit.
4) In the Juodupe River, the change of contamination is more apparent. The downstream stretch from the discharge point of effluent is polluted and all the parameters, except NO_2-N, exceed the standards. It is probable that the actual NO_2-N is also over the limit as the sampling in the Juodupe River was carried out only once. In the upstream stretch, only T-N exceeds the limit.

(4) Groundwater

The evaluation was made on the basis of the draft standards for drinking water presented in Section 1.3. Groundwater is the source of drinking water. Only iron removal is provided for water supply.

(a) Comparison of the existing records with the standards

Summary of Existing records (Groundwater, Birzai)

Unit: mg/l

Item	Range of the test results	Standard		
		Excellent	Good	Satis-factory
NH_4+	0 --- ***2.985***	0.5	1.0	2.0
Cl^-	4.97 --- 30.17	25	100	250
$SO4^{2-}$	51--- ***1,283.85***	150	250	450
NO_3^-	0 --- 15.983	50		
NO_2^-	0 --- ***1.36***	0.1		

Note: Values with italic and bold exceed the (Satisfactory level) standard

(b) Comparison of the JICA survey results with the standards

Summary of JICA survey records (Groundwater, Birzai)

Unit: mg/l

	GW1	GW2	GW3	GW4	GW5	Standard		
						Exce-llent	Good	Satis-factory
NH_4+	0.41	1.14	0.47	0.16	0.17	0.5	1.0	2.0
Cl-	39.8	13.62	29.76	34.23	71.93	25	100	250
pH	7.99	7.95	8.01	7.74	7.92	7.0-8.2	6.5-9.0	6.0-9.0
NO_3^-	0.53	0.15	0.93	1.09	17.1	50		
NO_2^-	0.001	0.003	0.001	0.011	0.013	0.1		

(c) General Evaluation

Groundwater is used for drinking water and has three allowable limit classes.

According to the records from the Geological Survey (MOE), some cases show the values of NH_4^+, NO_2^-, and SO_4^{2-} exceeding the specified limits. There are three cases for NH_4+, two cases for NO_2^- and 10 cases for $SO4^{2-}$ among the 16 cases in total.

In the JICA survey, all the test results are within the limit of allowable standards.

In case of NH_4+, four locations are classified as excellent while one location is satisfactory. In case of Cl^-, one location is excellent; and four locations are good. For pH, all the locations are within the excellent level.

Water quality of the groundwater varies remarkably during the year as well as by location. Long-term records by the Geological Survey has indicated that the groundwater in the area is not always safe for drinking.

(5) Lake

An evaluation was made on the basis of the standards currently applied for river water (shown in Section 1.3), as no separate standards are set for lake water.

(a) Comparison of the existing records with the standards

As seen from Table 2.18, it is difficult to show the mean results.

The results are shown as follows:

Summary of Existing records (the Sirvenos Lake, Birzai)

Unit: Coli-index number

Year	Monitoring Frequency	Maximum (Coliform)		Frequency of the cases exceeding the limit (10,000)	
		Central Beach	Near Youth Park		
1993	14	13,000	260,000	2	3
1994	11	20,000	324,000	1	2
1995	10	> 2400	> 2400	-	-
1996	11	> 2400	2,400	-	-
1997	9	> 2400	1,600	-	-
1998 (Mid. Aug)	9	> 2400	> 2400	-	-

Note: Frequency exceeding the limit is not clear since 1995 as the maximum records show only > 2400.

(b) Comparison of the JICA survey results with the standards

Summary of JICA survey records (the Sirvenos Lake, Birzai)

Unit: mg/l

Item	At LW1	At LW2	Standard Lithuania	Standard Japan (Class A)
DO	6.61	***5.02***	> 6.0	7.5
BOD_7	***3.72***	***3.41***	2.3	-
NH_4-N	***0.47***	***0.47***	0.39	-
NO_2-N	***0.04***	***0.03***	0.02	-
T-N	1.51	***2.1***	2.0	0.2
PO_4-P	0.05	0.01	0.08	-
T-P	0.12	0.07	0.2	0.01
Total coliform (MPN./100ml)	70,000	430,400	-	1,000

Note: Values in italic and bold exceed the Lithuanian standard.

(c) General Evaluation

The records from the MOH are as follows:

1) Coliform index varies depending upon the time the sampling is conducted.

2) The lake water is generally within the allowable level in regard to the coliform parameter although high index values occur occasionally.

The results of the JICA survey show the following matters:

1) At the location of LW1, the values of BOD, NH_4-N , NO_2-N and Total-coliform exceed the allowable limit.

2) At the location of LW2, the values of DO, BOD, NH_4-N, NO_2-N, T-N and Total-coliform exceed the limit of the standards.
3) Although the levels are not yet high (except for total coliform), the lake has signs of pollution.

Note: The results of total coliform seems too high. It is not clear whether the results happened due to the sampling method or the test analysis. It would be reasonable that the records from the MOH with long-term sampling are more reliable for the evaluation of total coliform.

3 RECOMMENDATION FOR IMPROVING WATER ENVIRONMENT

Water quality in the rivers receiving effluent from the existing treatment plant will be improved after completion of the new sewage treatment plants. The concentration of the effluent from the new treatment plant will be better than the allowable limits required in the "Waste Water Pollution Standards (LAND 10-96)". Some suggestions and recommendations, which are not described in the main report, are presented herein to ascertain the improvement as follows:

(1) Reduction of Pollutants at the Pollution Sources

The types of pollution sources in the future will be basically the same as the present sources, although some changes will occur because of human and economic activities. The potential pollution sources are generally categorized as follows:

(a) Residential houses

The BOD level of sewage from residences is high when people use many kinds of high BOD consumables such as cooking oils, fat meats, and washing detergent. Although the population may not increase in the town, the concentration of pollutants in the effluent from individual house may sometime increase according to the improvement of living standards.

(b) Factories

The concentrations of BOD, COD, total solids, SS, dissolved solids, P, and N are generally high in the wastewater from factories. Toxic substances are occasionally discharged.

(c) Commercial/public facilities

Commercial wastes from offices, stores/shops, hospitals, hotels, markets, etc occasionally cause high concentration of water pollutants. In addition, toxic substances are occasionally included in the discharge from hospitals, clinics, petrol stations and a research center, if not properly controlled.

(d) Live-stock farm waste

The concentrations of BOD, COD, SS, P and N from pigs, cows, horses, chickens, etc. are generally high, although the number of live stock breeding farms are not high in, and around, the project areas.

(e) Agriculture activities

Farms generally use many kinds of agricultural chemicals such as fertilizers, weed killer and pesticides (Herbicides, insecticides, etc.), which generally contain toxic chemicals. Although it is understood that the use of these chemicals has decreased over the years due to strict regulation and control of their use.

(f) Others

- Forest (decaying debris from the forest/trees contain many substances such as P, K , Ca, Mg, Na, Cl, and N)

- Atmospheric fallout and rain (Fallout contains various kinds of substances such as acid chemicals, pesticides, heavy metals and radioactive substances.)
- Construction waste
- Landfills and trash dumps
- Liquid waste ponds
- Road surface dust (from traffic)

Among the above, attention should be paid primarily to the discharges from industry (factories) and commercial/public facilities. The following is suggested:

(a) Regular monitoring of water quality from potential pollution sources.
(b) An inventory survey of pollution sources
(c) Guidance for pollution sources to reduce the contaminants
(d) Assisting in construction of pre-treatment facilities for the major industries
(e) Promptly determining penalties and collecting fines when discharges exceed the allowable standards.

As seen from the test results, the wastewater concentrations discharged from the factories to the sewerage system exceed the standards. The high biological concentration of these discharges coming into the STP is one of the major problems.

(2) Treatment at Pollutant Sources without connecting to the Sewage System

There are some areas, in which industries, other facilities and houses will remain without a connection to the sewerage system after the completion of the project. It would be a significant cost to connect them to the network or take counter-measures to correct these situations. Water quality improvement should be considered on the same level for the whole town area. A comprehensive study will be required to identify and remedy these conditions. For example, the existing sludge/liquid waste ponds located outside of Birzai town should be eliminated as early as possible.

(3) Monitoring of Water Quality

To assure the positive effects of the project, it is essential to continue regular monitoring of water quality, as follows:

(a) Daily monitoring

<u>At STP</u> (See the main report.)

(b) Periodical/Monthly monitoring

<u>At STP</u> (See the main report.)

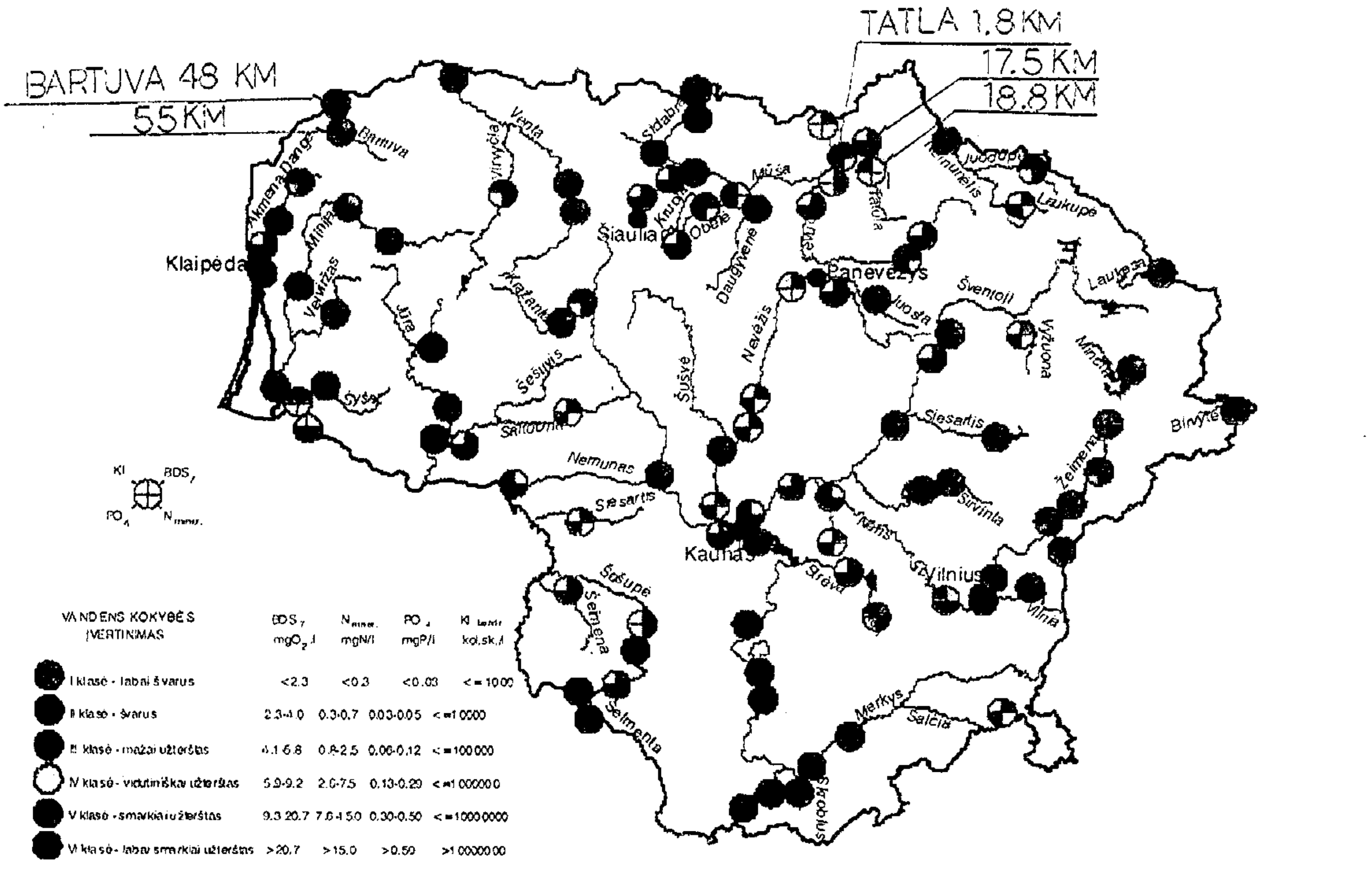
At Major Pollution Sources (Outflow to the sewerage system or the surface water)
Item: (More parameters in addition to the currently tested ones, depending on the characteristics of the sources)

At Rivers (At up-and-downstream locations from the effluent discharge points in the Juodupe River for Birzai as well as in the Bartuva River for Skuodas)
Item: (The same items currently used by the MOE, but additional parameters be required and a review is suggested)

Note: Monitoring at the Tatula River should be continued by the MOE. The locations for the Bartuva River can be adjusted to those used in the MOE monitoring.

(4) Monitoring of Fishes in the Rivers

It is recommended that the number and variety of fish in the rivers receiving effluent from the sewage treatment plants be monitored. For example, clear evidence of improvement is certain if the number of crayfish increases after the new STP starts operation.



4 pav. Lietuvos upių vandens kokybė 1996 m.

Figure 1.1 Location Map of Water Sampling Sdtations by MOE

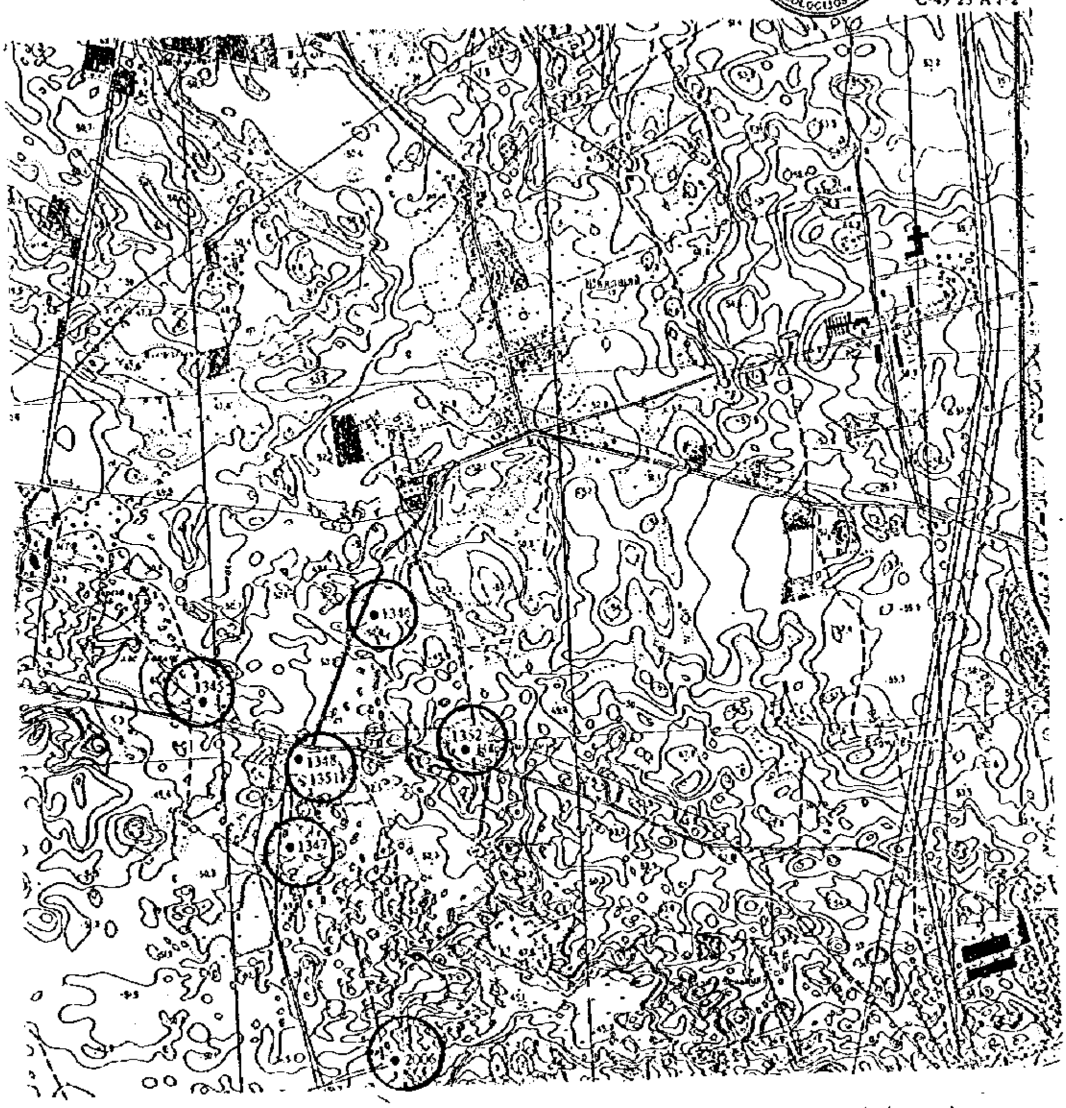
.../25

"TVIRTINU"
Lietuvos geologijos tarnyba
Direktorius
...G. Motuza
...m. 02 mėn. 15 d.

VALSTYBINIS POŽEMINIO VANDENS
MONITORINGAS

KARAIMIŠKIŲ POSTAS

C-49-23-Б-в-1
C-49-23-A-г-2



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Požeminio vandens monitoringo grupė
Atsakingas grupės vadovas A. Domaševičius

Figure 1 . 2 Location Map of Monitoring Wells of Geological Survey in Birzai

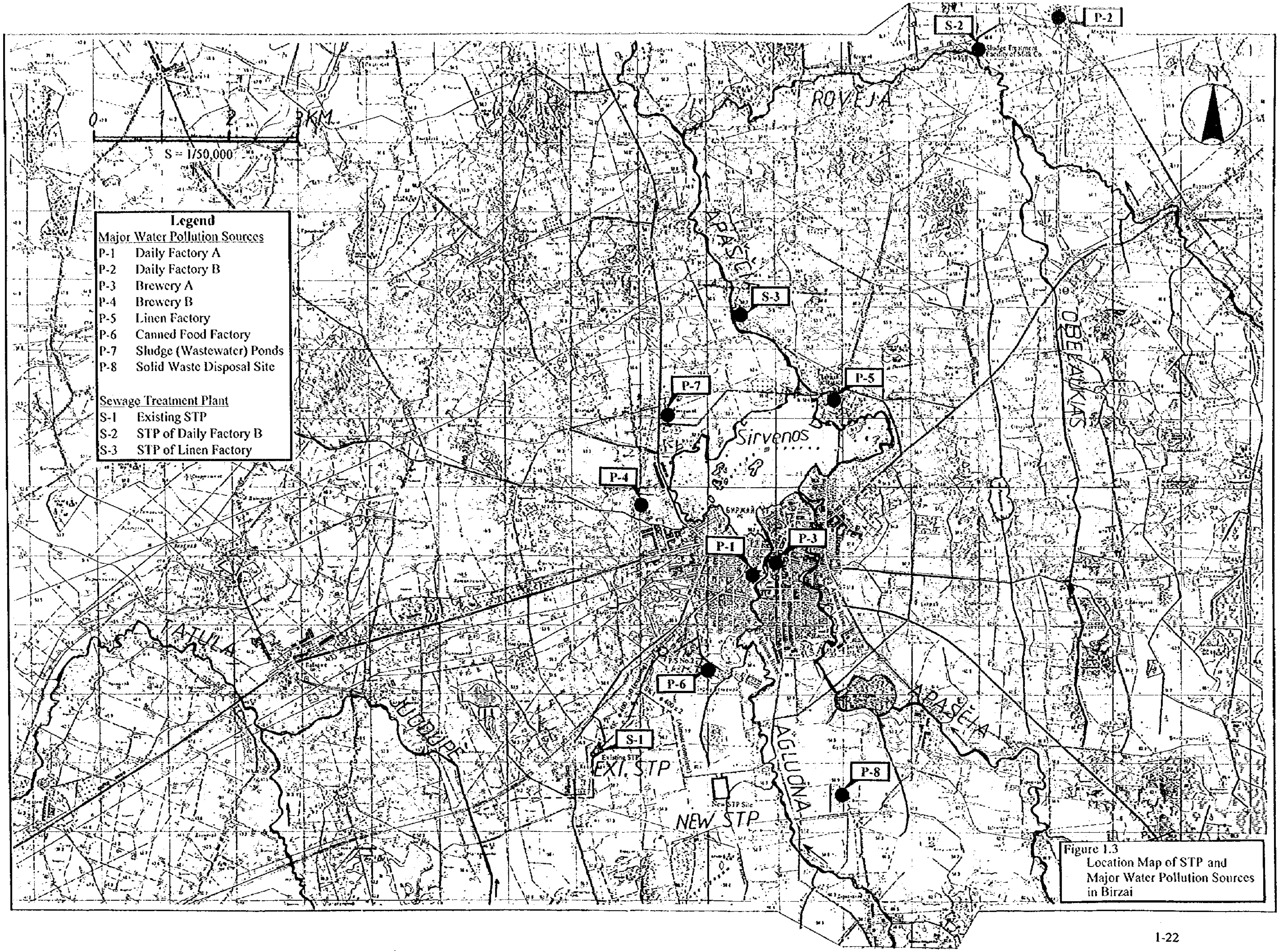


Figure 1.3
Location Map of STP and Major Water Pollution Sources in Birzai

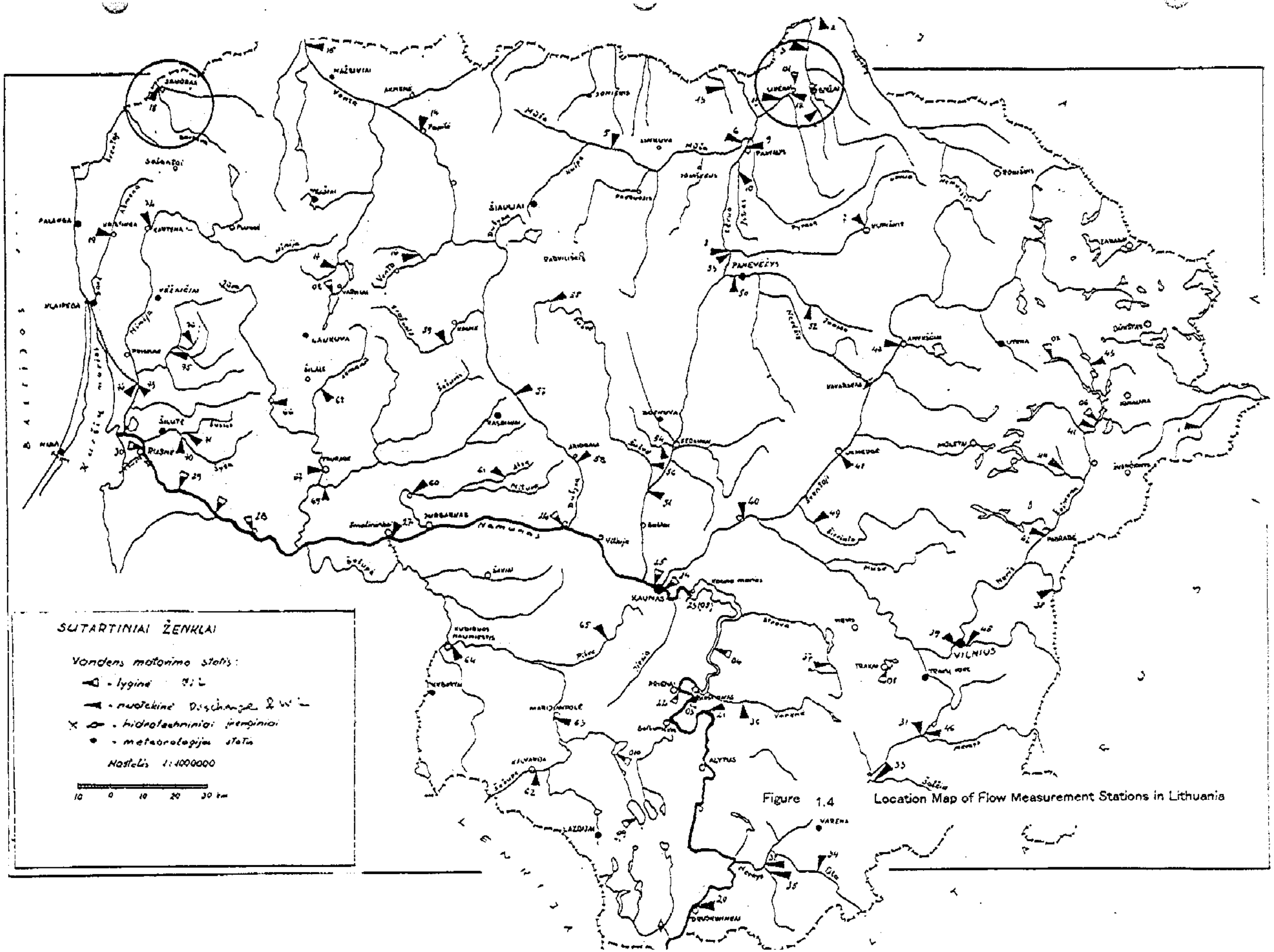


Figure 1.4 Location Map of Flow Measurement Stations in Lithuania

Figure 1.5 Flow Measurement Period

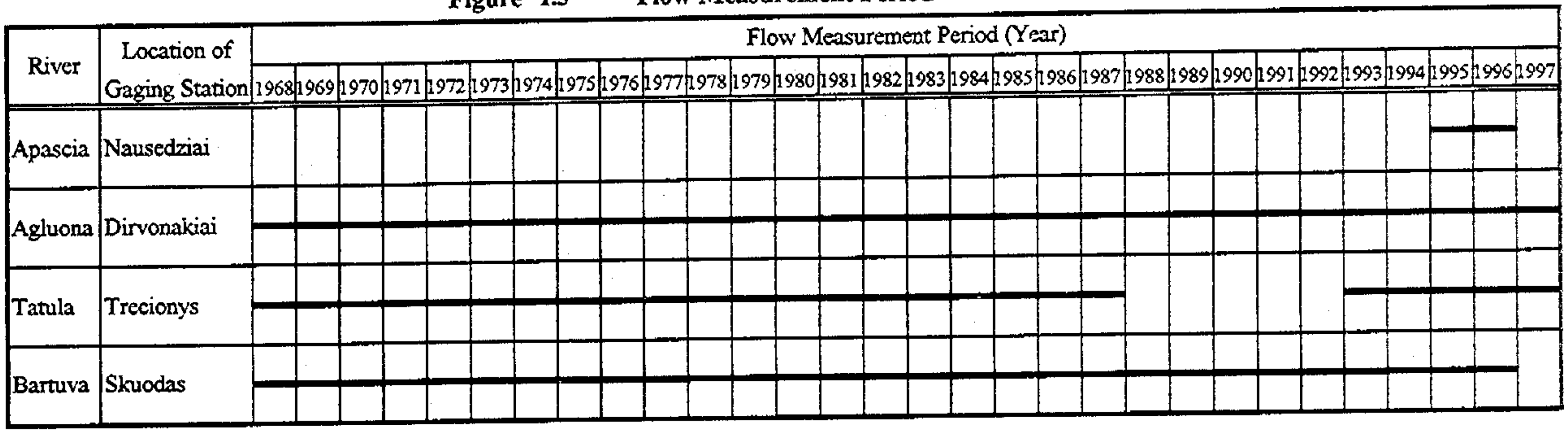


Table 1.1 (1/4) Effluent Standards in Lithuania

(Discharged into surface water reservoir)

Pollutants Item	Permissible rate	
	Mean	Maximum
	mg/l	mg/l
BOD7		
< $5m^3/d$	30	50
$5m^3/d$ < and < 5,000people	25	40
5,000 - 10,000 people	20	30
10,000 people <	15	25
COD		
< 10,000 people	100	150
10,000 people <	75	120
Total P		
10,000 people <	1.5	2.5
Total N		
10,000 - 100,000 people	20	35
100,000 people <	15	25
SS		
< 100,000 people	30	45
100,000 people <	25	35

(Discharged into surface water reservoir 2/2)

Pollutants Item	Permissible rate mg/l	Remarks
Biogenic Item		
Nitrites-N	1	Average
Ammonium-N	5	Average
Non-organic item		
Cd	0.04	Maximum
Cr	0.5	Maximum
Cr (6+)	0.1	Maximum
Cu	0.1	Maximum
Hg	0.002	Maximum
Ni	0.2	Maximum
Pb	0.1	Maximum
Mn	1	Maximum
(Tin)	1	Maximum
V (Vanadium)	2	Maximum
Zn	0.3	Maximum
Al	0.5	Maximum
Cyanides	0.1	Maximum
Active Chlorine	0.6	Maximum
Chlorides	500	Maximum
Fluorides	8	Maximum
Sulphides	0.5	Maximum
Sulphates	300	Maximum
As (Arsenic)	0.05	Maximum
Organic item (Detergents)		
Anionic	1.5	Maximum
Non-ionic	2	Maximum
Oil products	1	Maximum
Phenols	0.2	Maximum
Fats	1	Maximum

Table 1.1(3/4) Effluent Standard in Lithuania
(Discharged into Sewerage System 1/1)

Pollutants Item	Permissible rate mg/l	Remarks
General item		
COD/BOD7	< 2.5	
PH	6.5 - 9	
Non-organic item		
Cd	0.1	Maximum
Cr	1	Maximum
Cr (6+)	0.2	Maximum
Cu	1	Maximum
Hg	0.01	Maximum
Ni	0.5	Maximum
Pb	0.6	Maximum
Mn	10	Maximum
(Tin)	2	Maximum
V (Vanadium)		
Zn	1	Maximum
Al		
Cyanides	0.5	Maximum
Active Chlorine	0.6	Maximum
Chlorides		
Fluorides	10	Maximum
Sulphides	2	Maximum
Sulphates		
As (Arsenic)	0.1	Maximum
Organic item (Detergents)		
Anionic	10	Maximum
Non-ionic	15	Maximum
Oil products	5	Maximum
Phenols	3	Maximum
Fats		

Table 1.1 (4/4) Effluent Standards in Lithuania

No.	Item	No.	Item	No.	Item	No.	Item
A.	Organic materials (substances)					B.	Metals and the non-organic compounds thereof
A-1	Organic halogen compounds:	A-2	Organic phosphor compounds	A-4	Pesticides:	1	Mercury and the compounds thereof
1	Carbon tetrachloride	1	Azinphosetil	1	Aldrine	2	Cadmium and the compounds thereof
2	Chloroform	2	Dichlorphos	2	Dieldrine	3	Lead and the compounds thereof
3	1,2-Dibromethane	3	Phenitrotion	3	Endosulphane	4	Arsenic
4	Dichoraniline (A,3-2,4-;-2,5-2,6;3,4-dichloraniline)	4	Malation	4	Endrine		
5	1,2-Dichlorethane	5	Paration	5	DDT and compounds (p,p' - DDE and p,p' -DDD)		
6	Hexachlorbensol	6	Parationetil				
7	Hexachlorciklohexane (γ-HCH)	7	Parationmethyl	A-6	Other organic materials		
8	Isodrine			1	Acrylonitrile		
9	Pentachlorphenol	A-3	Organic tin compounds:	2	Atrazine		
10	Polichlorterpeniles	1	Tin tetrabutil	3	Benzene		
11	Tetrachlorethylene	2	Tributil tin compounds	4	Dinitrobenzene (1,2-; 2,5-; 2,6-dinitrotoluole)		
12	2,4,6-Trichloranilin	3	Triphenyl tin compounds	5	Isobenzen		
13	Xylol			6	Simazine		
14	Nonylphenolethoxilat			7	Trifluraline		
15	Dioxines						

Table 1.2 (1/3) Drinking Water Standards (Draft) in Lithuania

LST : 1997

Table 3. Toxic analytes in potable water, their allowable values and requirements of analysis methods

Analytes	Allowable value of analyte	Unit of measure	Requirements of analysis methods		
			Accuracy, %	Precision, %	Determination limits of analyte values, %
1. Arsenic, As	10	μg/l	10	10	10
2. Cyanide, CN^- (a)	50	μg/l	10	10	10
3. Chrome, Cr	50	μg/l	10	10	10
4. Fluorine, F^-	1.5	mg/l	10	10	10
5. Mercury, Hg	1	μg/l	10	10	10
6. Cadmium, Cd	5	μg/l	10	10	10
7. Nickel. Ni	20	μg/l	10	10	10
8. Nitrate, NO_3^-	50 (b,c)	mg/l	10	10	10
9. Nitrite, NO_2^-	0.1 (b,c)	mg/l	10	10	10
10. Lead, Pb	25 (c)	μg/l	10	10	10
11. Copper, Cu	2000 (c)	μg/l	10	10	10
12. Polycyclic aromatic hydrocarbons (d)	0.2	μg/l	25	25	25
Benzo-a-pyrene	0.01	μg/l	25	25	25
13. 1,2-dichloroethane, $C_2H_4Cl_2$	3	μg/l	25	25	10
14. Tetrachloroethene, C_2Cl_4	40	μg/l	25	25	10
15. Trichloroethene, C_2HCl_3	70	μg/l	25	25	10

Continuation of Table 3.

Analytes	Allowable value of analyte	Unit of measure	Requirements of analysis methods		
			Accuracy, %	Precision, %	Determination limits of analyte values, %
16. Boron, B	300	μg/l	10	10	10
17. Selenium, Se	10	μg/l	10	10	10
18. Stibium, Sb	3	μg/l	10	10	10
19. Benzene, C_6H_6	1	μg/l	25	25	10
20. Epichlorohydrin, C_3H_5OCl (e)	0.5	μg/l			
21. Pesticides (f)	0.1	μg/l	25	25	25
22. Vinyl chloride, C_2H_3Cl (g)	0.5	μg/l	25	25	10

NOTES:

a - this method should be used to determine total amount of cyanides;

b - allowable values of analytes may be changed, i.e.: increased up to 0.5 mg/l for nitrite provided that [nitrate]/50 + [nitrite]/3 ≤ 1 (unit of analyte value : mg/l);

c - for packaged drinking water intended for baby food allowable analyte values are reduced, i.e.: for nitrate down to 10 mg/l, for nitrite down to 0.02 mg/l, for lead down to 10 μg/l, for copper down to 100 μg/l;

d - allowable value of analyte is the total value of benzo-a-pyrene, fluoranthene, benzo-b-fluoranthene, benzo-k-fluoranthene, benzo-ghi-perylene, indene-1,2,3-cd-pyrene. Concentration of benzo-a-pyrene should not exceed 0.01 μg/l;

e - analyte should be tested only in materials in which it may be present. It may be tested also in a polymeric material according to its allowable value. Allowable value of epichlorohydrin in ionite resins is 1 mg/kg;

f - allowable value of analyte is applied to each individual pesticide;

g - allowable value of monomeric vinyl chloride in polyvinyl chloride water supply pipes and polyvinyl chloride commercial packing is 1 mg/kg.

LST : 1997

Table 5. Indicator analytes in potable water, their allowable values and test requirements (a, b)

Analyte	Value of analyte allowable for drinking water quality class			Unit of measure	Requirements of testing methods		
	Excellent	Good	Satisfactory		Accuracy, %	Precision, %	Test limits of analyte values, %
1. Ammonium, NH_4 (c)	0.5	1.0	2.0	mg/l	10	10	10
2. Basic organic carbon, C_0 (d)	1.5	4.0	5.0	mg/l	10	10	10
3. Chloride, Cl^-	25	100	250	mg/l	10	10	10
4. Turbidity	1.0 0.58	1.5 0.87	3.0 1.74	Turbidity according to formazine, mg/l	10	10	10
5. Electric conductivity	1000	2000	2500	$\mu S\ cm^{-1}$ at 20°C	10	10	10
6. Basic iron, Fe	0.1	0.2	1.0	mg/l	10	10	10
7. Dissolved oxygen, O_2	≥ 50	-	-	Saturation %	10	10	10
8. Smell threshold value	Acceptable to users and has no unnatural changes						
9. Manganese, Mn	0.05	0.1	0.2	mg/l	10	10	10
10. Permanganate oxidation (e)	2.0	5.0	6.5	O_2, mg/l	25	25	10
11. Taste threshold value	Acceptable to users and has no unnatural changes						
12. Color	15	30	40	mg/l Pt-Co (λ=436nm)	20	10	5
13. Sulfate, SO_4^{2-}	150	250	450	mg/l	10	10	10
14. Hydrogen ion concentration pH (f)	7.0-8.2	6.5-9.0	6.0-9.0	pH			

NOTES: a - drinking water used in food industry inclusive of frozen water should be in conformity with excellent or good quality class requirements;
b - bottled drinking water should comply with requirements of the excellent quality class;
c - conception of "ammonium" covers non-ionized (NH_3) and ionized (NH_4^+) forms;
d - value of this analyte shall not be determined if amount of supplied water is lower than 10 000 m^3/24 hours;
e - analyte value is not determined if basic organic carbon is determined;
f - Accuracy and precision of hydrogen ion concentration measurement should be 0.2 pH.

Table 1.3 River Water Quality Standards In Lithuania

Maximum allowable concentrations (MAC) of matter in river water

Matter	MAC
1	*2*
Dissolved oxygen	≥ 6 mg/l
BOC_7 (Biochemical oxygen consumption in 7 days)	2.3 mgO_2/l
Ammonia nitrogen	0.39 mgN/l
Nitrites	0.02 mgN/l
Basic nitrogen	2 mg/l
Phosphates	0.08 mgP/l
Basic phosphorus	0.2 mg/l
Calcium	180 mg/l
Magnum	40 mg/l
Sodium	120 mg/l
Potassium	50 mg/l
Sulphates	100 mg/l
Chlorides	300 mg/l
Iron	0.1 mg/l
Copper	1+background value µg/l
Zinc	10 µg/l
Lead	100 µg/l
Manganese	0.01 mg/l
Chrome	5 µg/l
Cadmium	5 µg/l
Nickel	10 µg/l
Oil products	0.05 mg/l
Anionic detergents	0.1 mg/l
Phenols	0.001 mg/l

Table 1 . 4 River Water Classification In Lithuania

River water classification according to general contamination indexes

Quality grade	I	II	III	IV	V	VI
Characteristics	Very clean	Clean	Slightly contaminated	Medium contaminated	Very contaminated	Super contaminated
Indexes: BOC_7, mgO_2/l	<2.3	2.3-4.0	4.1-5.8	5.9-9.2	9.3-20.7	>20.7
Mineral nitrogen, mgN/l	<0.3					>15.0
Phosphates, mgP/l	<0.03					>0.50
CI, coli/l	≤1000	≤10000	≤100000	≤1000000	≤10000000	>10000000

DOBRIŠ+3,	<25	25-50	50-125	125-250	250-500	>500

Table 1.5 Water Quality Standard, Japanese Standard for River and Lake/Pond

Type of Water			River water						Lake / Pond			
Type/Class (for Water use)			AA	A	B	C	D	E	AA	A	B	C
Description for Type/class			Simple treatment for water supply	Ordinary treatment for water supply	Advanced treatment for water supply	Not used for water supply, but for industrial water with ordinary treatment	Not used for water supply, but for industrial water with advanced treatment	Not used for water supply, but for industrial water with special advanced	Simple treatment for water supply	Ordinary/advanced treatment for water supply	Advanced treatment for water supply,but for industrial water with ordinary	Not used for water supply, but for industrial water with advanced treatment
Test Item	Water Temperature	°C										
	Color	N.A.										
	Odor	N.A.										
	PH	N.A.	6.5≦PH≦8.5	6.5≦PH≦8.5	6.5≦PH≦8.5	6.5≦PH≦8.5	6.0≦PH≦8.5	6.0≦PH≦8.5	6.5≦PH≦8.5	6.5≦PH≦8.5	6.5≦PH≦8.5	6.0≦PH≦8.5
	Transparency	N.A.										
	EC	umhos/cm										
	SS	mg/l	≦25mg	≦25mg	≦25mg	≦50mg	≦100mg	No floats are seen.	≦1mg	≦5mg	≦15mg	No floats are seen.
	BOD	mg/l	≦1mg	≦2mg	≦3mg	≦5mg	≦8mg	≦10mg	≦1mg	≦2mg	≦3mg	≦5mg
	Soluble BOD	mg/l										
	COD	mg/l							≦1mg	≦1mg	≦1mg	≦1mg
	TN	mg/l							≦0.1mg*	≦0.2mg*	≦0.4/0.6mg*	≦1mg*
	TP	mg/l							≦0.005mg*	≦0.01mg*	≦0.03/0.05mg*	≦0.1mg*
	PO4	mg/l										
	Discharge	Cu.m/s										
	NH_4-N	mg/l										
	NO_2-N	mg/l										
	NO_3-N	mg/l										
	Cl-	mg/l										
	ABS	mg/l										
	DO	mg/l	7.5mg≦	7.5mg≦	5mg≦	5mg≦	2mg≦	2mg≦	7.5mg≦	7.5mg≦	5mg≦	2mg≦
	Oil	mg/l										
	Total coliform	MPN/100ml	≦50MPN/100ml	≦1,000MPN/100ml	≦5,000MPN/100ml				≦50MPN/100ml	≦1,000MPN/100ml	—	—
	Alkalinity(as $CaCO_3$)	mg/l										

*: Approximate figures. (Definition of Types for TN & TP is different.)

Note: The detailed conditions are omitted in this table.

Table 1 . 6 Effluent Standards to Sewege System (Japaneso Srandards)

Items			Unit	Common limit	For manufactur
Central government standards	Harmful Substance	Cadmium	mg/l	0.1	
		Cyanogen	mg/l	1	
		Organophosphorous	mg/l	1	
		Pb	mg/l	1	
		Hexavalent chromium	mg/l	0.5	
		Arsenic (As)	mg/l	0.5	
		Total mercury	mg/l	0.005	
		Alkyl mercury	mg/l	0	
		PCB	mg/l	0.003	
	Other pollutants	Total chromium	mg/l	2	
		Cu	mg/l	3	
		Zn	mg/l	5	
		Phenols	mg/l	5	
		Fe	mg/l	10	
		Mn	mg/l	10	
		Fluorine (F)	mg/l	15	
Local government standards		BOD	mg/l	600	300
		SS	mg/l	600	300
		Normal-hexane extracts (Mineral oils)	mg/l	5	
		Normal-hexane extracts (Fauna-flora fats & oils)	mg/l	30	
		PH		5.0 - 9.0	5.7 - 8.7
		Temperature	°C	45	40
		Iodine (I) consumption	mg/l	220	

Note: The detailed classification and conditions are omitted in this table.

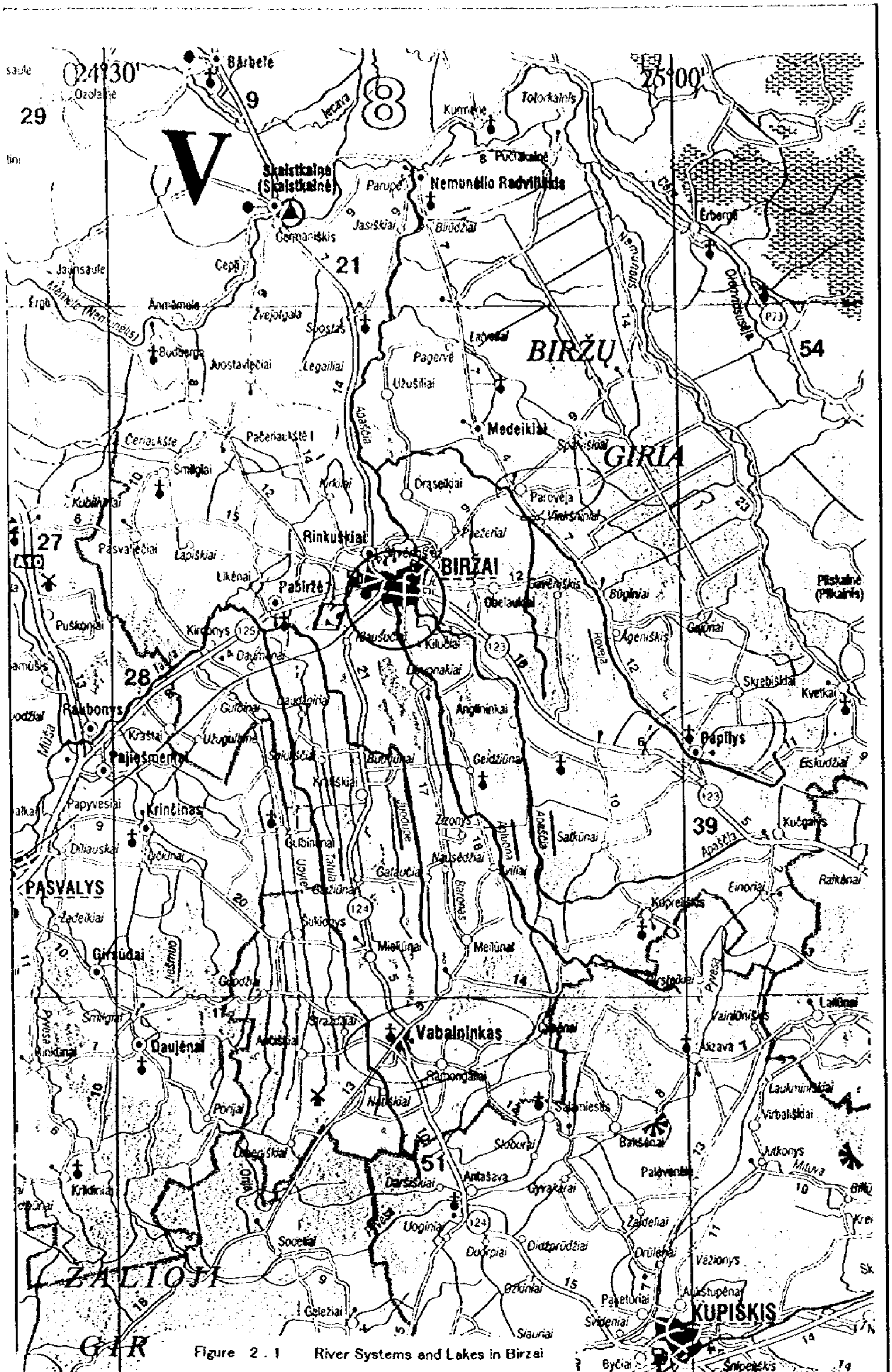
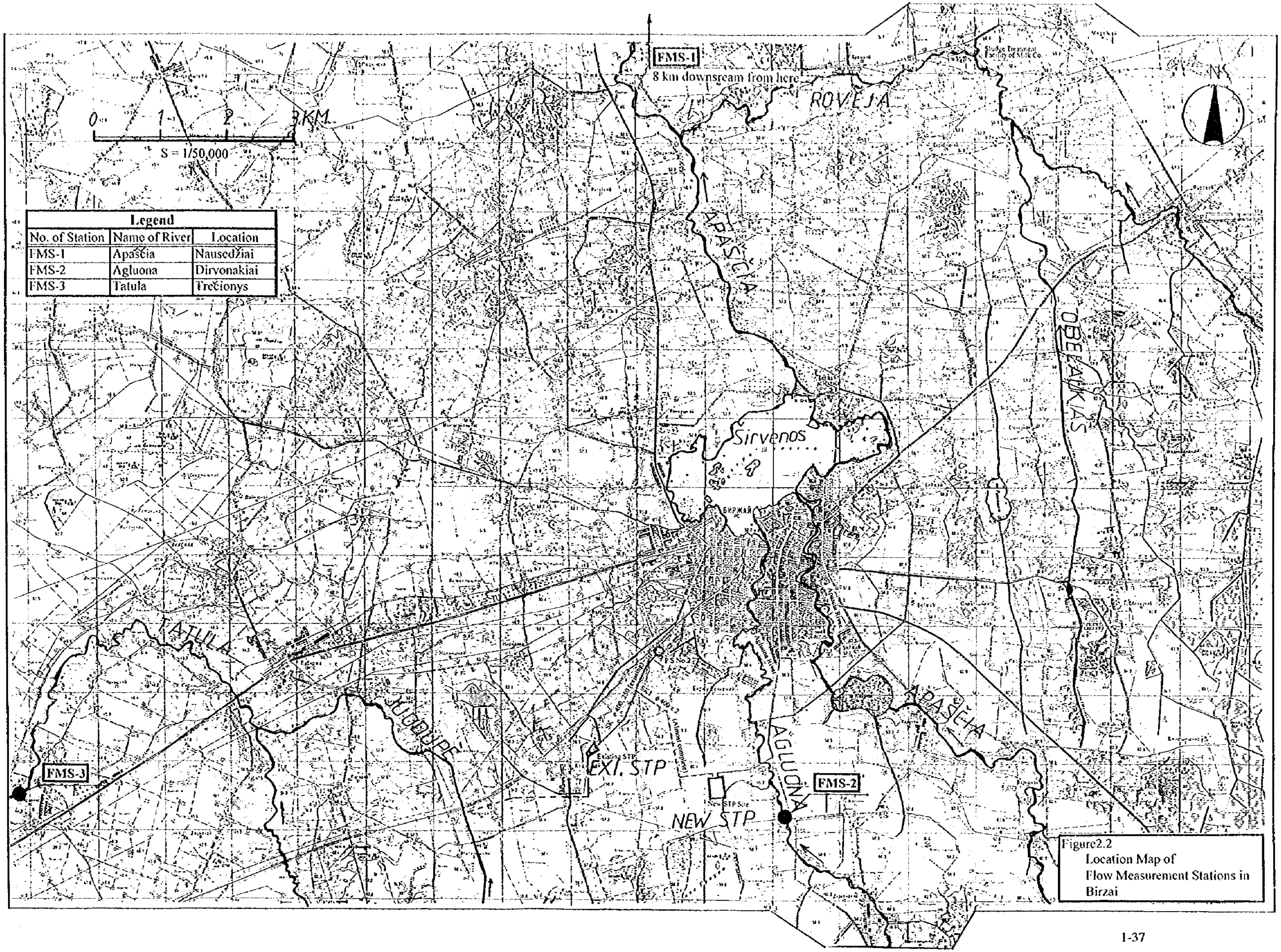


Figure 2.1 River Systems and Lakes in Birzai



Legend		
No. of Station	Name of River	Location
FMS-1	Apaščia	Nausedžiai
FMS-2	Agluona	Dirvonakiai
FMS-3	Tatula	Trečionys

Figure2.2
Location Map of
Flow Measurement Stations in
Birzai

Table 2.1 Summary of Runoff Records (Apascia, Agluona, Tatula and Bartuva Rivers)

Data Source : Meteo - Meteoroggcal Service

Name of Rivers	Measurement Period (Years)		Jan.	Feb.	March	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Mean	Max.	Min.
Apascia	2	Mean	2.58	11.97	10.23	14.87	4.91	2.24	0.70	0.27	0.22	0.47	0.86	1.25	4.21	65.3	0.10
		Max.	17.00	36.40	31.80	65.30	11.50	5.91	1.44	0.69	0.45	0.80	1.72	2.20			
		Min.	0.63	0.58	0.48	0.46	1.76	1.03	0.31	0.10	0.10	0.18	0.37	0.73			
Agluona	30	Mean	0.521	0.421	1.107	1.307	0.314	0.171	0.067	0.059	0.128	0.276	0.370	0.519	0.439	15.70	N.A.
		Max.	6.38	4.44	17.10	15.70	3.62	4.00	1.03	2.17	2.79	5.24	2.75	6.83			
		Min.	0.003	0.006	0.014	0.037	0.021	0.013	0.005	N.A.	N.A.	N.A.	0.003	0.006			
Tatula	25	Mean	1.96	2.38	6.35	8.52	2.53	1.19	0.82	0.65	0.96	1.81	2.31	2.94	2.70	67.2	0.11
		Max.	29.1	19.6	49.4	67.2	18.6	15.8	5.03	9.73	15.4	24.3	17.8	38.2			
		Min.	0.14	0.14	0.11	0.34	0.57	0.41	0.35	0.30	0.27	0.23	0.20	0.15			
Bartuva	29	Mean	10.66	8.22	12.99	13.58	3.02	1.68	1.66	2.93	4.67	8.41	14.85	13.73	8.03	153.0	0.20
		Max.	86.6	81.2	122.0	153.0	25.4	45.5	89.7	95.2	89.3	83.0	144.0	120.0			
		Min.	0.21	0.33	0.32	1.09	0.67	0.47	0.26	0.20	0.24	0.46	0.60	0.79			

Unit : m^3/sec

Table 2. 2 Length, Catchment Area and Mean Discharge of Rivers in Birzai and Skoudas

Town	Name of River	Total Length (km)	Total Catchment Area (km^2)	Catchment Area (km^2)			Annual Mean Discharge (m^3/s)			Annual Specific Discharge ($m^3/s/km^2$)	Remarks
				F.M.S.	D.P.E*	W.S.P.*	F.M.S.	D.P.E**	W.S.P.**		
Birzai	Roveja	38.1	190.8	-	-	173.4	-	-	1.2	0.007***	
	Obelaukias	9.3	14	-	4.4	-	-	0.03	-	0.007***	
	Apascia	90.7	894.1	785.0	697.7	681.9	4.21	3.67	3.68	0.0054	
	Agluona	21.1	82.9	63.0	77.6	82.2	0.439	0.54	0.58	0.0070	
	Juodupe	11.6	63.3	-	54.4	54.4	-	0.38	0.38	0.007***	
	Tatula	64.7	453.4	404.0	372.7	374.0(D) 371.4(U)	2.70	2.50	2.51(D) 2.49(U)	0.0067	
Skuodas	Bartuva	101.3	2,020.0	612.0	613.0	612.5(D) 257.3(M) 256.5(U)	8.03	8.03	8.02(D) 3.37(M) 3.36(U)	0.0131	
	Luova	52.2	353.9	-	-		-	-	-	0.00131****	4.64m3/s at the confluence

Note) F.M.S. : Flow Measurement Station (by MOE)

D.P.E. : Discharge Point of Effluent (Proposed/Alternative

W.S.P. : Water Sampling Point (by JICA Study Team)

(D): Downstream point

(M): Middle-stream point

(U): Upstream point

C.A. and Discharge at FMS: From Meteo-hydrological Service

* : Roughly measured on a map of 1/50,000

** : Calculated based on the assumed specific discharge(S.D.).

*** : The same S.D. of the Agluona River (Assumed)

**** : The same S.D. of the Bartuva River (Assumed)

Table 2.3 River Water Quality Records, Tatela River (1.8km from the mouth)
(Birzai)
(Year: 1991)

Item	Unit	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Frequency	Mini.	Max.	Mean
Velocity	m/s	0.64	0.58	0.28	0.65	0.42	0.16	0.13	0.09	0.12	0.12	0.21	0.6	12	0.09	0.65	0.33
Discharge	cu m/s	5.01	3.93	2.43	5.64	2.81	1.02	0.79	0.41	0.57	0.51	1.2	5.86	12	0.41	5.86	2.515
Temperature	°C	6	2	6	8	10	17	18	25	18	11	5	5	12	2	25	10.9
Odour	.-	Scent less	Scent less	Scent less	Scent less	Scent less	Scent less	Scent l ess	Scent less	Scent less	Scent less	Scent less	Scent less				
Transparancy	cm	20	20	19	20	20	20	20	20	20	20	20	20	12	19	20	19
Colour	.-	Yello wish	Yello wish	Yello wish	Yello wish	Yellowis h	Yello wish	Yello wish	Yello wish	Yellow ish	Yello wish	Yello wish	Yello wish				
Suspeded solid	mg/l																
PH	.-	8	8	4	6	14	7	7	10	5	5	8	6	12	4	14	7.3
O_2	mg/l	8.2	8.3	8.5	8.8	8.7	8.9	8.4	8.4	8.2	8.4	8.2	8.4	12	8.2	8.9	8.45
O_2	%	6.4	7.9	5.2	9.8	9.6	9.7	9.7	3.7	6.4	7.5	7.6	7.4	12	3.7	9.8	7.5
BOD_5	mgO_2/l	51.4	57	41.7	82.8	85.1	101	103	45.2	68.1	68.2	59.4	57.9	12	41.7	103.2	68.4
BOD_7	mgO_2/l	2.7	1.2	3.8	1.4	3.4	1.5	2	3.1	1.9	2.7	1.7	2.2	12	1.2	3.8	2.3
COD, Cr	mgO_2/l																
COD, Mn	mgO_2/l																
NH_4-N	mgN/l	12.000	12.000	7.600	11.000	11.000	9.000	7.700	6.000	8.000	4.200	6.000	7.000	12	4.200	12.000	8.400
NO_2-N	mgN/l	0.8	0.06	0.2	0.25	0.62	1.2		0.52	0.4	2.1	0.95	0.6	11	0.06	2.10	0.70
NO_3-N	mgN/l	0.05	0.04	0.07	0.03	0.05	0.09	0.02	0.02	0.07	0.07	0.12	0.05	12	0.02	0.12	0.056
Inorganic N	mgN/l	4.400	3.600	5.600	4.800	3.000	1.000	2.600	0.200	2.000	0.900	2.200	4.200	12	0.200	5.600	2.870
N total	mg/l	5.25	3.7	5.87	5.08	3.67	2.29		0.74	2.47	3.07	3.27	4.85	11	0.74	5.87	3.66
PO_4-P	mgP/l	6	8.3	8.2	7	4.3	2.5	3.2	1.8	3.2	3.6	4.6	6.5	12	1.8	8.3	4.9
P total	mg/l	0.15	0.08	0.16	0.06	0.14	0.34	0.2	0.36	0.4	0.38	0.3	0.13	12	0.06	0.4	0.225
Ca	mg/l	0.2	0.1	0.18	0.09	0.14	0.36	0.31	0.42	0.8	0.52	0.42	0.16	12	0.09	0.8	0.308
Mg	mg/l																
Na	mg/l					41.0		44.0			40.0			3	40.0	44.0	41.6
K	mg/l					14.0		14.0			14.0			3	14.0	14.0	14.0
Si	mg/l							3.2			4.1			2	3.2	4.1	3.6
HCO_3	mg/l																
SO_4	mg/l																
Cl	mg/l					725								1	725	725	725
Mineralization	mg/l	52.0	49.0	71.0	38.0	38.0	41.0	41.0	53.0	51.0	38.0	40.0	32.0	12	32.0	71.0	45.3
Total hardness	mgekv/l					15.0		9.5			7.4			3	7.4	15	10.6
Fe	mg/l						0.10				0.20			2	0.10	0.20	0.15
Mn	mg/l		0.030								0.030			2	0.03	0.030	0.030
Cu	micro g/l		10.03								4.96			2	4.96	10.03	7.49
Zn	micro g/l		11.72								5.12			2	5.12	11.72	8.42
Cr	micro g/l		8.04								2.02			2	2.02	8.04	5.03
Ni	micro g/l		0.71								1.99			2	0.71	1.99	1.35
Pb	micro g/l		0.40								2.30			2	0.40	2.30	1.35
Cd	micro g/l		0.03								0.42			2	0.03	0.42	0.22
Detergent	mg/l																
Oil prod.	mg/l																
alfa HCH	micro g/l					0.000					0.000			2	0.000	0.000	0.000
beta HCH	micro g/l					0.000					0.000			2	0.000	0.000	0.000
gama HCH	micro g/l					0.000					0.000			2	0.000	0.000	0.000
DDE	micro g/l					0.000					0.000			2	0.000	0.000	0.000
DDT	micro g/l					0.000					0.000			2	0.000	0.000	0.000
PCHB	micro g/l																
KI total	col/l					100000								1	100000	100000	100000
KI fresh	col/l					<10000								1	10000	10000	10000
E	col/ml					1								1	1	1	1
HP	col/ml					96000								1	96000	96000	96000
HM	col/ml					600								1	600	600	600
3,4-dichlor benzaine	mg/l																
penta chlor fenol	mg/l																
2-chlor fenol	mg/l																
2,4-dichlor fenol	mg/l																
2,4,6 trichlor fenol	mg/l																
2,3-dimetil fenol	mg/l																
3,4-dimetil fenol	mg/l																
4-chlor 3-metil fenol	mg/l																

Table 2.4 River Water Quality Records, Tatula River (1.8km from the mouth)
(Birzai)
(Year: 1995)

Item	Unit	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Frequency	Mini	Max.	Mean
Velocity	m/s	0.80	0.81	0.66	0.62	0.36	0.18	0.13	0.10	0.08	0.30	0.15	0.19	12	0.08	0.81	0.36
Discharge	cu m/s	3.390	10.600	5.480	3.790	2.020	1.140	0.640	0.490	0.390	1.050	0.600	0.680	12	0.390	10.600	2.522
Temperature	°C	4	4	6	8	6	15	18	22	17	12	6	4	12	4	22	10.1
Odour	-	Scent less	Scent less	Scent less	Scent less	Scent less	Scent less	Scentl ess	Scent less	Scent less	Scent less	Scent less	Scent less				
Transparancy	cm	20	8	20	20	20	20	20	19	18	20	18	20	12	8	20	18
Colour	-	Yello wish	Yellowi sh	Yello wish	Yello wish	Yello wish	Yellow ish	Yello wish	Yello wish	Yellowi sh	Yellow ish	Yellow ish	Yello wish				
Suspeded solid	mg/l	6.0	30.0	5.0	24.0	7.0	6.0	6.0	4.0	24.0	13.0	19.0	9.0	12	4.0	30.0	12.7
PH	-	7.70	7.90	8.20	8.10	8.20	8.00	8.10	7.80	8.00	7.50	7.70	7.60	12	7.50	8.20	7.90
O_2	mg/l	7.5	9.8	10.1	8.4	5.8	4.8	3.8	4.7	3.9	4.1	5.6	4.4	12	3.8	10.1	6.0
O_2	%	57.1	74.6	81.1	70.9	46.5	47.9	40.4	54.2	40.6	38.1	44.9	33.5	12	33.5	81.1	52.4
BOD_5	mgO_2/l	2.0	3.0	2.6	1.5	2.7	1.5	1.7	2.6	2.2	3.1	3.2	2.1	12	1.5	3.2	2.3
BOD_7	mgO_2/l																
COD, Cr	mgO_2/l	31	82	28	34	48	47	61	14	31	57	44	53	12	14	82	44
COD, Mn	mgO_2/l	10.0	20.0	12.0	12.0	16.0	11.0	14.0	10.0	5.0	8.0	10.0	5.0	12	5.0	20.0	11.0
NH_4-N	mgN/l	1.50	0.95	0.75	0.10	2.00	0.40	0.40		11.00	0.40	1.80	1.25	11	0.10	11.00	1.86
NO_2-N	mgN/l	0.050	0.060	0.018	0.025	0.033	0.190	0.220	0.032	0.050	0.045	0.025	0.030	12	0.018	0.220	
NO_3-N	mgN/l	7.20	3.00	0.60	4.40	0.90	1.50	1.50	0.85	1.85	1.30	1.35	1.95	12	0.60	7.20	2.00
Inorganic N	mgN/l	8.750	4.010	1.368	4.525	2.933	2.090	2.120	0.882	12.900	1.745	3.175	3.230	12	0.882	12.900	3.977
N total	mg/l		4.2			3.7			1.2		1.9			4	1.2	4.2	2.7
PO_4-P	mgP/l	0.146	0.190	0.040	0.040	0.160	0.150	0.260	0.260	0.380	0.640	0.600	0.360	12	0.040	0.640	0.268
P total	mg/l		0.210			0.180			0.300		0.960	0.640	0.380	6	0.180	0.960	0.445
Ca	mg/l					92.0			100.0		457.0			3	92.0	457.0	216.3
Mg	mg/l					36.0			23.0		38.0			3	23.0	38.0	32.3
Na	mg/l		35.0			29.0			10.0		19.0			4	10.0	35.0	23.2
K	mg/l		12.0			8.0			3.3		8.2			4	3.3	12.0	7.8
Si	mg/l		6.5			6.0			6.0		3.5			4	3.5	6.5	5.5
HCO_3	mg/l					317			262		289			3	262	317	289
SO_4	mg/l					154			127		108			3	108	154	129
Cl	mg/l	32.0	21.0	35.0	35.0	26.0	35.0	33.0	47.0	53.0	45.0	40.0	38.0	12	21.0	53.0	36.6
Mineralization	mg/l					662.0			572.7		965.0			3	572.7	965.0	733.2
Total hardness	mgekv/l		7.0			8.6			6.9		27.0			4	6.9	27.0	12.3
Fe	mg/l		0.97			0.37			0.42		0.52			4	0.37	0.97	0.57
Mn	mg/l		0.058			0.174			0.154		0.109			4	0.058	0.174	0.123
Cu	micro g/l		3.80			3.22			3.10		3.54			4	3.10	3.80	3.41
Zn	micro g/l		7.93			3.29			9.64		4.39			4	3.29	9.64	6.31
Cr	micro g/l		5.93			0.45			4.92		4.26			4	0.45	5.93	3.89
Ni	micro g/l		1.84			1.56			2.63		2.15			4	1.56	2.63	2.04
Pb	micro g/l		0.40			0.60			0.70		0.45			4	0.40	0.70	0.53
Cd	micro g/l		0.02			0.03			0.05		0.07			4	0.02	0.07	0.04
Detergent	mg/l																
Oil prod.	mg/l																
alfa HCH	micro g/l					0.000					0.000			2	0.000	0.000	0.000
beta HCH	micro g/l					0.000					0.000			2	0.000	0.000	0.000
gama HCH	micro g/l					0.000					0.000			2	0.000	0.000	0.000
DDE	micro g/l					0.000					0.000			2	0.000	0.000	0.000
DDT	micro g/l					0.000					0.000			2	0.000	0.000	0.000
PCHB	micro g/l																
Kl total	col/l								1000000					1	1000000	1000000	1000000
Kl fresh	col/l								<10000					1	10000	10000	10000
E	col/ml								<1					1	1	1	1
HP	col/ml								31000					1	31000	31000	31000
HM	col/ml								9400					1	9400	9400	9400
3,4-dichlor benzaine	mg/l																
penta chlor fenol	mg/l																
2-chlor fenol	mg/l																
2,4-dichlor fenol	mg/l																
2,4,6 trichlor fenol	mg/l																
2,3-dimetil fenol	mg/l																
3,4-dimetil fenol	mg/l																
4-chlor 3-metil fenol	mg/l																

Table 2.5 River Water Quality Records, Tatola River (1.8km from the mouth)
(Birzai)
(Year: 1996)

Item	Unit	Jan.	Feb.	Mar.	Apr	May	June	July	Aug	Sept.	Oct.	Nov.	Dec.	Frequency	Mini	Max	Mean
Velocity	m/s	0.11	0.13	0.21	0.3	0.41	0.3	0.28	0.1	0.07	0.1	0.14	0.16	12	0.07	0.41	0.19
Discharge	cu m/s	0.340	0.210	0.220	1.050	2.850	1.000	0.830	0.440	0.320	0.350	0.560	0.820	12	0.210	2.850	0.749
Temperature	°C	4.0	4.0	4.0	6.0	15.0	19.0	17.0	19.0	10.0	7.0	5.0	4.0	12	4.0	19.0	9.5
Odour	-	Scentless	Scentless	Scentless	Scentless	Scentless	Scentless	Scentless	Scentless	Scentless	Scentless	Scentless	Scentless				
Transparancy	cm	17	20	19	19	20	20	20	19	20	20	20	20	12	17	20	19
Colour	-	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish				
Suspeded solid	mg/l	8.0	14.0	3.0	19.0	15.0	26.0	4.0	12.0	4.0	7.0	6.0	8.0	12	3.0	26.0	10.5
PH	-	7.60	7.30	7.30	7.50	8.00	7.80	7.90	7.80	7.90	8.10	8.20	7.80	12	7.30	8.20	7.76
O_2	mg/l	5.7		4.3	7.4	7.9	9.3	8.0	3.4	5.1	10.2	6.7	8.3	11	3.4	10.2	6.9
O_2	%	43.4		32.7	59.3	78.7	100.9	83.2	36.9	45.2	84.0	52.3	63.2	11	32.7	100.9	61.8
BOD_5	mgO_2/l																
BOD_7	mgO_2/l	3.6	3.3	1.7	14.0	1.8	4.1	1.9	3.0	2.2	1.5	1.5	1.6	12	1.5	14.0	3.3
COD, Cr	mgO_2/l	76.0	24.0	16.0	66.0	48.0	28.0	26.0	95.0	24.0	53.0	18.0	18.0	12	16.0	95.0	41.0
COD, Mn	mgO_2/l	7.0	5.0	7.0	16.0	15.0	10.0	15.0	14.0	9.0	9.0	11.0	7.0	12	5.0	16.0	10.4
NH_4-N	mgN/l	0.90	2.80	0.50	4.10	0.58	1.20	0.98	0.23	1.15	0.47	1.50	0.50	12	0.23	4.10	1.24
NO_2-N	mgN/l	0.060	0.020	0.013	0.064	0.044	0.095	0.038	0.010	0.200	0.090	0.014	0.014	12	0.010	0.200	0.055
NO_3-N	mgN/l	2.30	1.50	0.80	1.95	2.90	0.60	2.40	0.60	0.70	1.15	0.60	2.40	12	0.60	2.90	1.49
Inorganic N	mgN/l	3.260	4.320	1.313	5.114	3.524	1.895	3.418	0.840	2.050	1.710	2.114	2.914	12	0.840	6.114	2.789
N total	mg/l		4.0			3.9			1.1		1.8			4	1.1	4.0	2.7
PO_4-P	mgP/l	0.640	0.680	0.070	0.520	0.080	0.200	0.080	0.160	0.440	1.080	0.030	0.090	12	0.030	1.080	0.339
P total	mg/l	0.800	0.720			0.110			0.200		1.160			5	0.110	1.160	0.598
Ca	mg/l		301.0			140.0			400.0		144.0			4	140.0	400.0	246.2
Mg	mg/l		24.0			15.0			24.0		15.0			4	15.0	24.0	19.5
Na	mg/l					15.0			5.5		104.8			3	5.5	104.8	41.7
K	mg/l					4.1			4.4		11.1			3	4.1	11.1	6.5
Si	mg/l		4.0			2.2			2.0		1.0			4	1.0	4.0	2.3
HOO_3	mg/l		286			262			244		244			4	244	286	259
SO_4	mg/l		121			96			70		140			4	70	140	106
Cl	mg/l	38.0	57.0	31.0	36.0	33.0	31.0	38.0	63.0	127.0	190.0	63.0	21.0	12	21.0	190.0	60.6
Mineralization	mg/l					565.1			810.9		848.9			3	565.1	848.9	741.6
Total hardness	mgekv/l					8.2			22.0		8.4			3	8.2	22.0	12.8
Fe	mg/l		0.17			0.30			0.10		0.10			4	0.10	0.30	0.16
Mn	mg/l		0.15			0.02					0.02			3	0.02	0.15	0.06
Cu	micro g/l		1.42			2.53					1.65			3	1.42	2.53	1.86
Zn	micro g/l		12.30			11.24					6.85			3	6.85	12.30	10.13
Cr	micro g/l		8.24			10.66					0.68			3	0.68	10.66	6.52
Ni	micro g/l		1.44			1.69					1.21			3	1.21	1.69	1.44
Pb	micro g/l		0.70			1.80					1.90			3	0.70	1.90	1.46
Cd	micro g/l		0.05			0.17					0.20			3	0.05	0.20	0.14
Detergent	mg/l																
Oil prod.	mg/l																
alfa HCH	micro g/l					0.000					0.000			2	0.000	0.000	0.000
beta HCH	micro g/l					0.000					0.000			2	0.000	0.000	0.000
gama HCH	micro g/l					0.000					0.000			2	0.000	0.000	0.000
DDE	micro g/l					0.000					0.000			2	0.000	0.000	0.000
DDT	micro g/l					0.000					0.000			2	0.000	0.000	0.000
PCHB	micro g/l					0.000					0.000			2	0.000	0.000	0.000
Kl total	col/l					40000			50000		<1000			3	1000	50000	30333
Kl fresh	col/l					<10000			30000		<1000			3	1000	30000	13666
E	col/ml					10			<1		<1			3	1	10	4
HP	col/ml					8600			14000		14000			3	8600	14000	12200
HM	col/ml					10			970		10			3	10	970	330
3,4-dichlor benzaine	mg/l																
penta chlor fenol	mg/l																
2-chlor fenol	mg/l																
2,4-dichlor fenol	mg/l																
2,4,6 trichlor fenol	mg/l																
2,3-dimetil fenol	mg/l																
3,4-dimetil fenol	mg/l																
4-chlor 3-metil fenol	mg/l																

Table 2.6 River Water Quality Records, Tatula River (1.8km from the mouth)
(Birzai)
(Year: 1997)

Item	Unit	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Frequency	Mini.	Max.	Mean
Velocity	m/s	0.12	0.31	0.61	0.8	0.61	0.45	0.3	0.13		0.12	0.45	0.45	11	0.12	0.8	0.39
Discharge	cu m/s	0.38	0.63	4.13	6.5	3.65	2.76	1.52	0.48	0.55	0.41	1.81	2.52	12	0.38	6.5	2.111
Temperature	°C	4.0	4.0	6.0	5.0	5.0	17.0	22.0	19.0	18.0	17.0	6.0	5.0	12	4.0	22.0	10.6
Odour	.-	Scent less	Scent less	Scent less	Scent less	Scent less	Scent less	Scentl ess	Scent less	Scent less	Scent less	Scent less	Scent less				
Transparancy	cm	20	20	20	20	20	20	20	16	19	20	20	20	12	16	20	19
Colour	.-	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish				
Suspeded solid	mg/l	7.0	5.0	4.0	6.0	5.0	27.0	7.0	28.0	11.0	6.0	5.0	8.0	12	4.0	28.0	9.9
PH	.-	7.6	7.4	7.7	8.1	8.1	7.9	7.9	8.2	8.0	8.0	8.0	7.6	12	7.4	8.2	7.9
O_2	mg/l	8.4	8.7	8.5	9.2	8.5	7.3	7.2	6.8	7.0	6.3	7.8	7.3	12	6.3	9.2	7.7
O_2	%	63.9	66.2	68.2	71.9	66.4	75.9	83.0	73.8	74.4	65.5	62.6	57.0	12	57.0	83.0	69.1
BOD_5	mgO_2/l																
BOD_7	mgO_2/l	2.0	2.6	1.2	1.4	2.0	2.4	1.9	5.3	1.3	1.6	1.6	1.2	12	1.2	5.3	2.0
COD, Cr	mgO_2/l	15.0	11.0	16.0	16.0	38.0	21.0	25.0	38.0	32.0	28.0	18.0	19.0	12	11.0	38.0	23.0
COD, Mn	mgO_2/l	11.0	11.0	10.0	10.0	16.0	13.0	17.0	21.0	13.0	12.0	8.0	11.0	12	8.0	21.0	12.7
NH_4-N	mgN/l	0.6	1.2	0.5	0.4	0.8	0.7	0.4	0.4	0.6	0.6	0.4	0.6	12	0.4	1.2	0.6
NO_2-N	mgN/l	0.044	0.008	0.018	0.016	0.016	0.022	0.065	0.000	0.000	0.000	0.016	0.020	12	0.000	0.065	0.018
NO_3-N	mgN/l	0.6	2.3	5.5	5.5	4.4	3.4	0.75	0.3	0.4	0.5	8.9	6.2	12	0.3	8.9	3.22
Inorganic N	mgN/l	1.244	3.508	5.968	5.916	5.216	4.072	1.215	0.700	1.000	1.120	9.316	6.770	12	0.700	9.316	3.837
N total	mg/l		3.6	6.7	6.4	5.3	4.7	1.6	1.0	3.4	1.2	12.0	7.5	11	1.0	12.0	4.8
PO_4-P	mgP/l	0.120	0.280	0.040	0.060	0.050	0.180	0.050	0.050	0.050	0.060	0.050	0.015	12	0.015	0.280	0.083
P total	mg/l		0.370	0.050	0.070	0.060	0.190	0.060	0.060	0.060	0.070	0.060	0.020	11	0.020	0.370	0.097
Ca	mg/l		312.0			124.0			156.0		120.0			4	120.0	312.0	178.0
Mg	mg/l		84.0			38.0			29.0		43.0			4	29.0	84.0	48.5
Na	mg/l		19.4			9.2			14.0		13.0			4	9.2	19.4	13.9
K	mg/l		6.4			3.9			6.6		9.2			4	3.9	9.2	6.5
Si	mg/l		7.0			2.0			4.0		5.0			4	2.0	7.0	4.5
HCO_3	mg/l		235			211			244		272			4	211	272	240
SO_4	mg/l		180			150			100		168			4	100	180	149
Cl	mg/l	61.0	34.0	41.0	55.0	55.0	34.0	34.0	34.0	36.0	36.0	30.0	42.0	12	30.0	61.0	41.0
Mineralization	mg/l		870.8			591.1			583.6		661.2			4	583.6	870.8	676.6
Total hardness	mgekv/l		17.0			9.3			10.0		9.5			4	9.3	17.0	11.4
Fe	mg/l		0.20			0.20			0.10		0.20			4	0.10	0.20	0.17
Mn	mg/l		0.029						0.035					2	0.029	0.035	0.032
Cu	micro g/l		0.93			1.07								2	0.93	1.07	1.00
Zn	micro g/l		3.94			5.65								2	3.94	5.65	4.79
Cr	micro g/l		0.33			0.27								2	0.27	0.33	0.30
Ni	micro g/l		0.21			0.41								2	0.21	0.41	0.31
Pb	micro g/l		0.42			0.40								2	0.40	0.42	0.41
Cd	micro g/l		0.08			0.05								2	0.05	0.08	0.06
Detergent	mg/l																
Oil prod.	mg/l		0.08			0.07			0.09		0.08			4	0.07	0.09	0.08
alfa HCH	micro g/l					0.000					0.000			2	0.000	0.000	0.000
beta HCH	micro g/l					0.000					0.000			2	0.000	0.000	0.000
gama HCH	micro g/l					0.000					0.000			2	0.000	0.000	0.000
DDE	micro g/l					0.000					0.000			2	0.000	0.000	0.000
DDT	micro g/l					0.000					0.000			2	0.000	0.000	0.000
PCHB	micro g/l					0.000					0.000			2	0.000	0.000	0.000
Kl total	col/l					<1000			4E+05		30000			3	1000	4E+05	1E+05
Kl fresh	col/l					<1001			80000		30000			3	1000	80000	37000
E	col/ml					<1			60		1			3	1	60	20
HP	col/ml					1900			40350		13300			3	1900	40350	18516
HM	col/ml					17			8230		200			3	10	970	330
3,4-dichlor benzsine	mg/l					0.000								1	0.000	0.000	0.000
penta chlor fenol	mg/l					0.000								1	0.000	0.000	0.000
2-chlor fenol	mg/l					0 000								1	0.000	0.000	0.000
2,4-dichlor fenol	mg/l					0.000								1	0.000	0.000	0.000
2,4,6 trichlor fenol	mg/l					0.000								1	0.000	0.000	0.000
2,3-dimetil fenol	mg/l																
3,4-dimetil fenol	mg/l					0.000								1	0.000	0.000	0.000
4-chlor 3-metil fenol	mg/l					0.000								1			

Table 2.7 River Water Quality Records, Tatula River (17.5 km from the mouth)
(Below Birzai, at the left bank)
(Year: 1994)

Item	Unit	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Frequency	Mini.	Max	Mean
Velocity	m/s	0.35	0.55	0.25	0.5	0.32	0.1	0.12	0.07	0.1	0.13	0.2	0.55	12	0.07	0.55	0.27
Discharge	cu m/s	2.800	3.180	1.940	3.720	1.950	0.670	0.550	0.270	0.380	0.350	0.800	3.860	12	0.270	3.860	1.705
Temperature	°C	6.0	2.0	6.0	8.0	10.0	17.0	16.0	25.0	17.0	11.0	5.0	5.0	12	2.0	25.0	10.6
Odour	.-	Scent less	Weak	Scent less	Scent less	Scent less	Scent less	Scent less	Scent less	Scent less	Scent less	Scent less	Scent less				
Transparancy	cm	20	20	12	20	17	20	20	20	18	18	17	18	11	9	19	16
Colour	.-	Yellowish	Yellowish	Colourness	Yellowish	Yellowish	Yellowish	Yellowish	Colourness	Yellowish	Yellowish	Yellowish	Yellowish				
Suspeded solid	mg/l																
PH	.-	6.0	7.0	10.0	6.0	14.0	11.0	14.0	10.0	10.0	3.0	5.0	12.0	12	3.0	14.0	9.0
O_2	mg/l	8.1	8.1	8.4	8.7	8.7	8.7	8.7	8.4	8.1	8.3	8.1	8.3	12	8.1	8.7	8.4
O_2	%	5.6	7.7	2.0	10.9	11.3	6.8	1.9	3.5	1.9	5.1	7.0	7.0	12	1.9	11.3	5.8
BOD_5	mgO_2/l	44.9	55.6	16.1	92.1	100.2	70.7	19.3	42.8	19.8	464.4	54.7	54.7	12	16.1	100.2	51.4
BOD_7	mgO_2/l	3.6	1.4	29.0	1.9	6.5	4.0	4.8	14.4	4.6	4.2	4.7	2.3	12	1.4	29.0	6.7
COD, Cr	mgO_2/l																
COD, Mn	mgO_2/l																
NH_4-N	mgN/l	14.0	13.0	10.0	14.0	11.0	16.0	16.0	13.0	14.0	7.4	9.0	5.0	12	5.0	16.0	11.8
NO_2-N	mgN/l	2.10	1.20	12.00	1.25	2.20	3.00	1.30	10.00	11.00	8.70	4.90	1.20	12	1.20	12.00	4.90
NO_3-N	mgN/l	0.040	0.080	0.040	0.050	0.075	0.020		0.090		0.100	0.045	0.050	10	0.020	0.100	0.059
Inorganic N	mgN/l	3.80	6.80		5.40	2.50	0.03	0.70	0.20		0.25	1.90	4.80	10	0.20	6.80	2.66
N total	mg/l	5.940	8.080		6.700	4.775	3.270		10.290		9.050	6.845	6.050	9	3.270	10.290	6.777
PO_4-P	mgP/l	6.1	9.2	13.0	8.5	6.0	5.5	2.6	13.0	12.0	9.2	8.0	6.5	12	2.6	13.0	8.3
P total	mg/l	0.120	0.120	1.750	0.130	0.450	1.100	1.100	1.700	4.200	1.400	0.540	0.130	12	0.120	4.200	1.061
Ca	mg/l	0.180	0.200	1.900	0.180	0.510	1.140	1.140	1.900	4.500	1.600	0.630	0.150	12	0.150	4.500	1.169
Mg	mg/l																
Na	mg/l																
K	mg/l					37.0		41.0			39.0			3	37.0	41.0	39.0
Si	mg/l					11.0		15.0			14.0			3	11.0	15.0	13.3
HCO_3	mg/l							2.8			1.3			2	1.3	2.8	2.0
SO_4	mg/l																
Cl	mg/l							480.0						1	480	480	480
Mineralization	mg/l	34.0	41.0	43.0	35.0	33.0	38.0	25.0	53.0	63.0	51.0	40.0	37.0	12	25.0	63.0	41.0
Total hadness	mgekv/l					13.0		10.0			7.2			3	7.2	13.0	10.0
Fe	mg/l						0.00				0.20			2	0.00	0.20	0.10
Mn	mg/l																
Cu	micro g/l																
Zn	micro g/l																
Cr	micro g/l																
Ni	micro g/l																
Pb	micro g/l																
Cd	micro g/l																
Detergent	mg/l																
Oil prod.	mg/l																
alfa HCH	micro g/l																
beta HCH	micro g/l																
gama HCH	micro g/l																
DDE	micro g/l																
DDT	micro g/l																
PCHB	micro g/l																
KI total	col/l					600000								1	600000	600000	600000
KI fresh	col/l					<10000								1	10000	10000	10000
E	col/ml					10								1	10	10	10
HP	col/ml					14000								1	14000	14000	14000
HM	col/ml					60			4200		1000			1	300	300	300
3,4-dichlor benzaine	mg/l																
penta chlor fenol	mg/l																
2-chlor fenol	mg/l																
2,4-dichlor fenol	mg/l																
2,4,6 trichlor fenol	mg/l																
2,3-dimetil fenol	mg/l																
3,4-dimetil fenol	mg/l																
4-chlor 3-metil fenol	mg/l																

Table 2.8 River Water Quality Records, Tatula River (17.5 km from the mouth)
(Below Birzai, at the left bank)
(Year. 1995)

Item	Unit	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Frequency	Mini.	Max.	Mean
Velocity	m/s	0.65	0.72	0.6	0.54	0.3	0.2	0.12	0.08	0.08	0.14	0.13	0.15	12	0.08	0.72	0.30
Discharge	cu m/s	2.400	7.000	3.850	3.960	1.350	0.850	0.450	0.310	0.260	0.700	0.480	0.450	12	0.260	7.000	1.838
Temperature	°C	4.0	4.0	6.0	8.0	6.0	14.0	19.0	23.0	17.0	12.0	6.0	4.0	12	4.0	23.0	10.2
Odour	-	No	No	No	No	No	No	No	No	Weak	No	No	No				
Transparancy	cm	19	8	20	20	20	20	18	18	13	17	14	19	12	8.0	20.0	17.0
Colour	-	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish	Grey	Yellowish	Yellowish	Yellowish				
Suspeded solid	mg/l	6.0	24.0	19.0	13.0	6.0	7.0	8.0	6.0	18.0	6.0	9.0	10.0	12	6.0	24.0	11.0
PH	-	7.70	7.80	8.00	8.00	8.20	7.80	7.90	7.70	7.70	7.10	7.50	7.50	12	7.10	8.20	7.74
O_2	mg/l	6.0	8.9	9.9	10.3	5.2	2.6	2.7	1.6	0.5	3.1	4.1	4.3	12	0.5	10.3	4.9
O_2	%	45.70	67.80	79.50	87.00	41.70	25.30	29.30	18.80	5.20	28.80	32.90	32.70	12	5.20	87.00	41.20
BOD_5	mgO_2/l	2.8	3.0	1.5	1.6	3.4	7.7	3.5	6.4	14.0	12.0	11.0	5.2	12	1.0	14.0	6.0
BOD_7	mgO_2/l																
COD, Cr	mgO_2/l	42	70	46	42	53	59	63	36	63	103	98	82	12	36	103	63
COD, Mn	mgO_2/l	11.0	14.0	13.0	13.0	18.0	17.0	16.0	16.0	25.0	15.0	12.0	11.0	12	11.0	25.0	15.0
NH_4-N	mgN/l	2.50	0.90	0.50	1.00	3.50	2.80	4.60	7.10	12.20	3.70	5.30	3.30	12	0.50	12.20	3.95
NO_2-N	mgN/l	0.200	0.050	0.037	0.035	0.060	0.120	0.050	0.037	0.045	0.025	0.040	0.060	12	0.025	0.200	63.000
NO_3-N	mgN/l	4.40	2.80	5.90	6.20	1.60	1.35	0.60	1.15	1.00	0.00	0.85	1.75	12	0.00	6.20	2.30
Inorganic N	mgN/l	7.100	3.750	6.437	7.235	5.160	4.270	5.250	8.287	13.245	3.725	6.190	5.110	12	3.725	13.245	6.313
N total	mg/l		4.0			6.5			9.5		4.0			4	4.0	9.5	6.0
PO_4-P	mgP/l	0.250	0.210	0.070	0.120	0.060	0.700	0.830	1.400	2.200	1.800	1.040	0.740	12	0.060	2.200	0.785
P total	mg/l		0.270			0.060			1.600		2.820	1.120	0.800	6	0.060	2.820	1.111
Ca	mg/l					100.0			128.0		232.0			3	100.0	232.0	153.3
Mg	mg/l					36.0			35.0		25.0			3	25.0	36.0	32.0
Na	mg/l		39.0			29.0			27.0		30.0			4	27.0	39.0	31.2
K	mg/l		11.0			11.0			9.5		12.0			4	9.5	12.0	10.8
Si	mg/l		6.5			6.5			6.5		10.0			4	6.5	10.0	7.3
HCO_3	mg/l					295			314		305			3	295	314	304
SO_4	mg/l					31			32		69			3	31	69	44
Cl	mg/l	27.0	16.0	32.0	39.0	30.0	31.0	24.0	40.0	47.0	66.0	42.0	38.0	12	16.0	66.0	36.0
Mineralization	mg/l					532.0			585.8		739.1			3	532.0	739.1	618.9
Total hardness	mgekv/l		4.7			8.0			9.3		14.0			4	4.7	14.0	9.0
Fe	mg/l		0.75			0.40			0.36		0.53			4	0.36	0.75	0.51
Mn	mg/l																
Cu	micro g/l																
Zn	micro g/l																
Cr	micro g/l																
Ni	micro g/l																
Pb	micro g/l																
Cd	micro g/l																
Detergent	mg/l																
Oil prod	mg/l																
alfa HCH	micro g/l																
beta HCH	micro g/l																
gama HCH	micro g/l																
DDE	micro g/l																
DDT	micro g/l																
PCHB	micro g/l																
KI total	col/l								1E+06					1	1000000	1000000	1000000
KI fresh	col/l								<10000					1	10000	10000	10000
E	col/ml								24					1	24	24	24
HP	col/ml								14300					1	14300	14300	14300
HM	col/ml								1500					1	1500	1500	1500
3,4-dichlor benzaine	mg/l																
penta chlor fenol	mg/l																
2-chlor fenol	mg/l																
2,4-dichlor fenol	mg/l																
2,4,6 trichlor fenol	mg/l																
2,3-dimetil fenol	mg/l																
3,4 dimetil fenol	mg/l																
4-chlor 3-metil fenol	mg/l																

Table 2.9 River Water Quality Records, Tatula River (17.5 km from the mouth)
(Below Birzai, at the left bank)
(Year: 1996)

Item	Unit	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Frequency	Mini.	Max.	Mean
Velocity	m/s	0.1	0.12		0.28	0.4	0.28	0.2	0.1	0.06	0.09	0.13	0.14	11	0.06	0.4	0.17
Discharge	cu.m/s	0.27	0.15		0.7	2	0.75	0.58	0.33	0.2	0.2	0.4	0.64	11	0.15	2	0.565
Temperature	°C	4.0	4.0		6.0	15.0	19.0	17.0	19.0	14.0	9.0	6.5	6.0	11	4.0	19.0	10.8
Odour	.-	Scentless	Weak		Weak	Scentless	Scentless	Scentless	Scentless	Scentless	Scentless	Scentless	Scentless				
Transparancy	cm	15	9		9	18	19	19	17	18	18	17	18	11	9	19	16
Colour	.-	Yellowish	grey		grey	Yellowish	Yellowish	Yellowish	grey	Yellowish	grey	Yellowish	Yellowish				
Suspeded solid	mg/l	10.0	5.0		31.0	15.0	15.0	6.0	35.0	5.0	17.0	11.0	13.0	11	5.0	35.0	14.8
PH	.-	7.5	7.4		7.2	7.9	7.5	7.4	7.6	7.6	8.0	8.0	7.5	11	7.2	8.0	7.6
O_2	mg/l	1.0	1.2		5.9	5.8	8.6	4.3	2.9	3.8	1.3	3.8	4.5	11	1.0	8.6	3.9
O_2	%	7.6	9.1		47.3	57.8	93.3	44.7	31.4	37.0	11.2	30.8	36.1	11	7.6	93.3	36.9
BOD_5	mgO_2/l																
BOD_7	mgO_2/l	13.0	47.0		45.0	6.3	13.0	16.0	38.0	5.6	11.0	6.2	8.5	11	5.6	47	19
COD, Cr	mgO_2/l	164	46		96	68	32	164	116	98	126	26	26	11	26	164	87
COD, Mn	mgO_2/l	22.0	16.0		20.0	21.0	13.0	17.0	16.0	15.0	17.0	18.0	12.0	11	12.0	22.0	17.0
NH_4-N	mgN/l	5.20	8.75		9.50	2.26	3.50	7.70	7.40	11.60	16.50	1.80	5.50	11	1.80	16.50	7.19
NO_2-N	mgN/l	0.030	0.170		0.290	0.190	0.140	0.200	0.060	0.018	0.034	0.026	0.036	11	0.018	0.290	0.108
NO_3-N	mgN/l	0.60	5.20		1.20	3.70	0.60	2.90	0.25	0.60	0.25	0.45	1.20	11	0.25	5.20	1.54
Inorganic N	mgN/l	5.830	14.120		10.990	6.150	4.240	10.800	7.710	11.618	16.784	2.276	6.736	11	2.276	16.784	8.841
N total	mg/l		15.0			7.0			9.6		17.0			4	7.0	17.0	12.1
PO_4-P	mgP/l	0.860	1.470		1.600	0.160	0.320	0.900	1.200	1.900	2.600	0.140	2.000	11	0.140	2.600	1.195
P total	mg/l	0.880	2.000			0.230			1.550		2.700			5	0.230	2.700	1.472
Ca	mg/l		120.0			148.0			168.0		120.0			4	120.0	168.0	139.0
Mg	mg/l		29.0			19.0			17.0		19.0			4	17.0	29.0	21.0
Na	mg/l					12.0			9.2		54.5			3	9.2	54.5	25.2
K	mg/l					5.0			8.2		20.5			3	5.0	20.5	11.2
Si	mg/l		4.5			2.0			2.0		4.0			4	2.0	4.5	3.1
HCO_3	mg/l		302			262			275		314			4	262	314	288
SO_4	mg/l		56			70			35		113			4	35	113	68
Cl	mg/l	56.0	51.0		46.0	26.0	33.0	44.0	38.0	284.0	177.0	127.0	51.0	11	26.0	284.0	84.8
Mineralization	mg/l					542.0			550.4		818.0			3	542.0	818.0	636.8
Total hardness	mgekv/l		8.4			9.0			9.8		7.6			4	7.6	9.8	8.7
Fe	mg/l		0.18			0.30			0.30		0.60			4	0.18	0.6	0.31
Mn	mg/l																
Cu	micro g/l																
Zn	micro g/l																
Cr	micro g/l																
Ni	micro g/l																
Pb	micro g/l																
Cd	micro g/l																
Detergent	mg/l																
Oil prod.	mg/l																
alfa HCH	micro g/l																
beta HCH	micro g/l																
gama HCH	micro g/l																
DDE	micro g/l																
DDT	micro g/l																
PCHB	micro g/l																
KI total	col/l					70000			100000		500000			3	70000	500000	223333
KI fresh	col/l					30000			100000		500000			3	30000	500000	210000
E	col/ml					10			10		30			3	10	30	16
HP	col/ml					14000			17000		28000			3	14000	28000	19666
HM	col/ml					60			4200		1000			3	60	4200	1753
3,4-dichlor benzaine	mg/l																
penta chlor fenol	mg/l																
2-chlor fenol	mg/l																
2,4-dichlor fenol	mg/l																
2,4,6 trichlor fenol	mg/l																
2,3-dimetil fenol	mg/l																
3,4-dimetil fenol	mg/l																
4-chlor 3-metil fenol	mg/l																

Table 2.10 River Water Quality Records, Tatula River (17.5 km from the mouth)
(Below Birzai, at the left bank)
(Year: 1997)

Item	Unit	Jan.	Feb.	Mar	Apr.	May	June	July	Aug	Sept.	Oct.	Nov.	Dec	Frequency	Mini.	Max.	Mean
Velocity	m/s	0.10	0.20	0.50	0.68	0.54	0.40				0.18	0.32	0.40	9	0.10	0.68	0.36
Discharge	cu m/s	0.260	0.420	2.660	4300	2.410	1.820	1.000	0.300	0.350	0.270	1.200	1.700	12	0.260	4300	1390
Temperature	°C	4.0	4.0	7.0	7.0	5.0	15.0	22.0	19.0	19.0	19.0	7.0	7.0	12	4.0	22.0	113
Odour	-	Weak	Scentless	Scentless	Scentless	Scentless	Scentless	Scentless	Scentless	Weak	Weak	Weak	Scentless				
Transparancy	cm	17	19	18	20	19	16	18	11	13	15	16	18	12	11	20	16
Colour	-	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish	grey	Yellowish				
Suspeded solid	mg/l	14.0	4.0	4.0	10.0	5.0	9.0	5.0	15.0	13.0	5.0	6.0	10.0	12	4.0	15.0	8.3
PH	-	7.50	7.30	7.10	8.00	8.00	7.40	7.70	8.10	7.80	7.80	7.90	7.50	12	7.10	8.10	7.67
O_2	mg/l	5.8	6.1	6.7	7.4	7.0	6.8	7.1	3.1	2.1	3.1	5.3	6.6	12	21	7.4	5.5
O_2	%	44.1	46.4	55.1	60.9	54.7	69.2	81.8	33.6	22.8	33.6	43.6	543	12	228	81.8	50.0
BOD_5	mgO_2/l																
BOD_7	mgO_2/l	33.0	4.5	1.7	2.8	3.3	5.0	14.0	15.0	10.0	8.5	3.1	3.4	12	1.7	33.0	8.7
COD, Cr	mgO_2/l	42	30	17	27	33	25	21	46	41	38	29	25	12	17	46	31
COD, Mn	mgO_2/l	16.0	19.0	9.0	13.0	16.0	15.0	16.0	30.0	120	15.0	20.0	16.0	12	9.0	30.0	16.4
NH_4-N	mgN/l	14.00	4.00	2.67	0.60	0.80	1.85	2.00	11.00	1125	5.80	2.20	1.02	12	0.60	14.00	4.76
NO_2-N	mgN/l	0.006	0.320	0.040	0.340	0.044	0.180	0.420	0.000	0.000	0.000	0.050	0.046	12	0.000	0.420	0.120
NO_3-N	mgN/l	0.00	1.90	6.40	6.20	4.60	2.40	1.85	0.20	0.30	0.30	8.50	6.60	12	0.00	8.50	3.27
Inorganic N	mgN/l	14.006	6.220	9.110	7.140	5.444	4.430	4.270	11.200	11.550	6.100	10.750	7.666	12	4.270	14.006	8.157
N total	mg/l		6.8	10.0	7.6	5.5	4.7	4.4	11.5	12.0	7.6	13.0	8.2	11	4.4	13	8.3
PO_4-P	mgP/l	3.800	0.670	0.100	1.200	0.070	0.200	0.420	1.400	1.440	1.120	0.170	0.110	12	0.070	3.800	0.891
P total	mg/l		0.700	0.140	1.400	0.100	0.240	0.460	2.000	1.560	1.200	0.180	0.120	11	0.100	2.000	0.736
Ca	mg/l		188.0			154.0			144.0		152.0			4	144.0	188.0	159.5
Mg	mg/l		44.0			32.0			89.0		17.0			4	17.0	89.0	45.5
Na	mg/l		16.6			10.0			41.0		40.0			4	10.0	41.0	26.9
K	mg/l		5.5			4.1			9.7		12.0			4	4.1	12.0	7.8
Si	mg/l		8.0			2.0			5.0		8.0			4	2.0	8.0	5.7
HCO_3	mg/l		253			226			287		317			4	226	317	270
SO_4	mg/l		140			140			100		120			4	100	140	125
Cl	mg/l	89.0	41.0	48.0	55.0	68.0	41.0	48.0	55.0	60.0	42.0	60.0	54.0	12	41.0	89.0	55.0
Mineralization	mg/l		688.1			634.1			725.7		700.0			4	634.1	725.7	686.9
Total hardness	mgekv/l		13.0			103			15.0		9.0			4	9.0	15.0	11.8
Fe	mg/l		0.20			0.20			0.30		0.50			4	0.20	0.50	0.30
Mn	mg/l																
Cu	micro g/l																
Zn	micro g/l																
Cr	micro g/l																
Ni	micro g/l																
Pb	micro g/l																
Cd	micro g/l																
Detergent	mg/l																
Oil prod.	mg/l																
alfa HCH	micro g/l																
beta HCH	micro g/l																
gama HCH	micro g/l																
DDE	micro g/l																
DDT	micro g/l																
PCHB	micro g/l																
KI total	col/l					50000			700000		500000			3	50000	700000	416666
KI fresh	col/l					6000			300000		500000			3	6000	500000	268666
E	col/ml					2			150		98			3	2	150	83
HP	col/ml					5800			130700		119500			3	5800	130700	85333
HM	col/ml					30			9520		730			3	30	9520	3426
3,4-dichlor benzaine	mg/l																
penta chlor fenol	mg/l																
2-chlor fenol	mg/l																
2,4-dichlor fenol	mg/l																
2,4,6 trichlor fenol	mg/l																
2,3-dimetil fenol	mg/l																
3,4-dimetil fenol	mg/l																
4-chlor 3-metil fenol	mg/l																

Table 2.11 River Water Quality Records, Tatula River (18.8 km from the mouth)
(Above Birzai, at the left bank)
(Year: 1994)

Item	Unit	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Frequency	Mini.	Max.	Mean
Velocity	m/s	0.35		0.25	0.45	0.3	0.1	0.1	0.06	0.1	0.15	0.18	0.5	11	0.06	0.5	0.23
Discharge	cu m/s	2.15		1.75	2.6	1.4	0.46	0.36	0.2	0.26	0.24	0.54	2.63	11	0.2	2.63	1.14
Temperature	°C	6		6	8	10	17	19	25	17	11	5	5	11	5	25	11.7
Odour	-	Scentless		Scentless	Scentless	Scentless	Scentless	Scentless	Scentless	Scentless	Scentless	Scentless	Scentless				
Transparancy	cm	20		20	20	20	20	20	20	20	20	20	20	11	9	20	19
Colour	-	Greenish		Greenish	Greenish	Greenish	Greenish	Greenish	Greenish	Greenish	Greenish	Greenish	Greenish				
Suspeded solid	mg/l	5.0		8.0	4.0	10.0	8.0	9.0	7.0	4.0	5.0	5.0	28.0	11	4.0	28.0	8.4
PH	-	7.90		8.40	8.80	8.60	8.80	8.10	8.40	8.30	8.30	8.10	8.20	11	7.90	8.80	8.35
O_2	mg/l	55.4		40.9	95.4	102.0	88.4	79.3	52.6	68.7	52.7	64.9	59.4	11	40.9	102.0	69.0
O_2	%	6.9		5.1	11.3	11.5	8.5	7.3	4.3	6.6	5.8	8.3	7.6	11	4.3	11.5	7.5
BOD_5	mgO_2/l	2.3		4.0	1.4	1.8	2.8	1.9	1.7	1.5	1.1	1.6	1.7	11	1.1	4.0	1.9
BOD_7	mgO_2/l																
COD, Cr	mgO_2/l																
COD, Mn	mgO_2/l	11.0		7.7	15.0	14.0	15.0	12.0	13.0	13.0	8.2	9.0	8.0	11	7.7	15.0	11.4
NH_4-N	mgN/l	3.30		0.40	0.35	0.38	0.10	4.00	0.30	0.10		0.30	0.60	10	0.10	4.00	0.98
NO_2-N	mgN/l	0.040		0.010	0.012	0.015	0.013	0.010	0.015			0.020	0.015	9	0.010	0.040	0.016
NO_3-N	mgN/l	4.40		5.60	6.00	2.90	0.10	0.25	0.25	0.55	0.20	3.00	4.70	11	0.10	6.00	2.54
Inorganic N	mgN/l	7.740		6.010	6.362	3.295	0.213	4.260	0.565			3.320	5.315	9	0.213	7.740	4.120
N total	mg/l	8.2		7.0	8.5	4.3	1.6	4.5	1.5	1.9	0.6	3.8	6.5	11	0.6	8.5	4.4
PO_4-P	mgP/l	0.140		0.130	0.030	0.190		0.330	0.070	0.066	0.060	0.060	0.065	10	0.030	0.330	0.114
P total	mg/l	0.200		0.150	0.050	0.210		0.360	0.150	0.100	0.110	0.080	0.080	10	0.050	0.360	0.149
Ca	mg/l																
Mg	mg/l																
Na	mg/l					26.0		30.0			27.0			3	26.0	30.0	27.6
K	mg/l					7.0		9.0			8.0			3	7.0	9.0	8.0
Si	mg/l							1.6			1.6			2	1.6	1.6	1.6
HCO_3	mg/l																
SO_4	mg/l							260						1	260	260	260
Cl	mg/l	52		30	25	25	30	38	46	25	28	27	32	11	25	52	32.5
Mineralization	mg/l																
Total hardness	mgekv/l					13.0		12.2			6.0			3	6.0	13.0	10.4
Fe	mg/l						0.00				0.20			2	0.00	0.20	0.10
Mn	mg/l																
Cu	micro g/l																
Zn	micro g/l																
Cr	micro g/l																
Ni	micro g/l																
Pb	micro g/l																
Cd	micro g/l																
Detergent	mg/l																
Oil prod.	mg/l																
alfa HCH	micro g/l																
beta HCH	micro g/l																
gama HCH	micro g/l																
DDE	micro g/l																
DDT	micro g/l																
PCHB	micro g/l																
Kl total	col/l					4000								1	4000	4000	4000
Kl fresh	col/l					<1000								1	1000	1000	1000
E	col/ml					<1								1	3000	3000	3000
HP	col/ml					40								1	40	40	40
HM	col/ml																
3,4-dichlor benzaine	mg/l																
penta chlor fenol	mg/l																
2-chlor fenol	mg/l																
2,4-dichlor fenol	mg/l																
2,4,6 trichlor fenol	mg/l																
2,3-dimetil fenol	mg/l																
3,4-dimetil fenol	mg/l																
4-chlor 3-metil fenol	mg/l																

Table 2.12 River Water Quality Records, Tatula River (18.8 km from the mouth)
(Above Birzai, at the left bank)
(Year: 1995)

Item	Unit	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug	Sept.	Oct	Nov.	Dec.	Frequency	Mini	Max	Mean
Velocity	m/s	0.55	0.55	0.55	0.48	0.25	0.15	0.1	0.08	0.06	0.12	0.12	0.11	12	0.06	0.55	0.26
Discharge	cu m/s	1.52	4.80	2.52	2.05	1.01	0.60	0.36	0.20	0.18	0.50	0.30	0.31	12	0.18	4.80	1.20
Temperature	°C	4.0	4.0	6.0	8.0	6.0	14.0	18.0	23.0	17.0	12.0	6.0	4.0	12	4.0	23.0	10.1
Odour	-	Scent less	Scent less	Scent less	Scent less	Scent less	Scent less	Scent less	Scent less	Scent less	Scent less	Scent less	Scent less				
Transparancy	cm	20	9	20	20	20	20	20	20	19	20	1	20	12	9	20	18
Colour	-	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish				
Suspeded solid	mg/l	4.0	18.0	18.0	6.0	5.0	5.0	5.5	2.0	20.0	5.0	25.0	9.0	12	2.0	25.0	10.2
PH	-	7.60	7.80	7.90	8.10	8.00	8.10	8.00	7.70	7.90	7.40	7.80	7.50	12	7.40	8.10	7.81
O_2	mg/l	7.4	9.9	10.2	12.1	4.8	4.3	4.5	4.7	3.7	4.9	6.3	3.7	12	3.7	12.1	6.3
O_2	%	56.4	75.4	81.9	102.2	38.5	41.9	47.9	55.2	38.5	45.6	50.6	28.2	12	28.2	102.2	55.1
BOD_5	mgO_2/l	1.3	2.9	1.0	1.1	1.3	2.3	1.2	2.4	1.8	1.2	2.5	1.5	12	1.0	2.9	1.7
BOD_7	mgO_2/l																
COD, Cr	mgO_2/l	41	53	30	40	47	57	59	23	61	64	86	32	12	23	86	49
COD, Mn	mgO_2/l	9.0	17.0	12.0	13.0	13.0	16.0	13.0	16.0	17.0	10.0	14.0	8.0	12	8.0	17.0	13.1
NH_4-N	mgN/l	0.35	1	0.25	0.55	1.6	0.3	0.15	0	0.5	0.15	0.55	0.1	12	0	1.6	0.45
NO_2-N	mgN/l	0.030	0.055	0.017	0.025	0.020	0.010	0.017	0.000	0.025	0.000	0.000	0.020	12	0.000	0.055	0.018
NO_3-N	mgN/l	5.20	2.80	5.30	6.00	1.00	0.80	0.00	0.25	0.00	0.20	1.30	1.50	12	0.00	6.00	2.02
Inorganic N	mgN/l	5.580	3.855	5.567	6.575	2.620	1.110	0.167	0.250	0.525	0.350	1.850	1.620	12	0.167	6.575	2.505
N total	mg/l		4.0			4.5			1.7		0.8			4	0.8	4.5	2.7
PO_4-P	mgP/l	0.050	0.250	0.020	0.030	0.600	0.080	0.062	0.070	0.040	0.060	0.060	0.065	12	0.020	0.250	0.070
P total	mg/l		0.260			0.060			0.080		0.250	0.080	6.075	6	0.060	0.260	0.134
Ca	mg/l					88.0			132.0		160.0			3	88.0	160.0	126.6
Mg	mg/l					34.0			29.0		25.0			3	25.0	34.0	29.3
Na	mg/l		18.0			18.0			11.0		12.0			4	11.0	18.0	14.7
K	mg/l		6.0			6.0			4.5		9.2			4	4.5	9.2	6.4
Si	mg/l	2.0	4.8			4.5			6.2		3.0			4	3.0	6.2	4.6
HCO_3	mg/l					274			262		207			3	207	274	247
SO_4	mg/l					21			22		57			3	21	57	33
Cl	mg/l	40.0	13.0	27.0	27.0	28.0	28.0	19.0	21.0	71.0	16.0	26.0	68.0	12	13.0	71.0	32.0
Mineralization	mg/l					469.0			481.9		486.7			3	469.0	486.7	479.2
Total hardness	mgekv/l		2.8			7.2			9.0		10.0			4	2.8	10.0	7.2
Fe	mg/l		0.66			0.32			0.33		0.28			4	0.28	0.66	0.39
Mn	mg/l																
Cu	micro g/l																
Zn	micro g/l																
Cr	micro g/l																
Ni	micro g/l																
Pb	micro g/l																
Cd	micro g/l																
Detergent	mg/l																
Oil prod.	mg/l																
alfa HCH	micro g/l																
beta HCH	micro g/l																
gama HCH	micro g/l																
DDE	micro g/l																
DDT	micro g/l																
PCHB	micro g/l																
Kl total	col/l								400000					1	400000	400000	400000
Kl fresh	col/l								<10000					1	10000	10000	10000
E	col/ml								1					1	1	1	1
HP	col/ml								11000					1	11000	11000	11000
HM	col/ml								1200					1	1200	1200	1200
3,4-dichlor benzaine	mg/l																
penta chlor fenol	mg/l																
2-chlor fenol	mg/l																
2,4-dichlor fenol	mg/l																
2,4,6 trichlor fenol	mg/l																
2,3-dimetil fenol	mg/l																
3,4-dimetil fenol	mg/l																
4 chlor 3-metil fenol	mg/l																