Baltic University Urban Forum
City Status Report I

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Water Management

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Baltic University Urban Forum
Cities Status Reports

1. Water management

Introduction

The city status reports in the BUUF project address ten key areas of city management, chosen at the outset of the project. These were later group in three areas of management, while integration was kept as a separate topic.

Material flows:
1. Water,
2. Energy,
3. Waste

Urban space:
4. Traffic and transport,
5. Green structures,
6. Built structures, especially brown fields

Socio-economy:
7. Education and information,
8. Economic development,
9. Urban-rural cooperation

Integration:
10. Integration of management

The areas were all discussed by the BUUF Scientific Advisory Council, which developed indicators for each of them. These indicators were later treated by the UBC Commission for the environment into a table, a short hand, for reporting indicator values. The indicator, the tables and the comments from the SAC are all found in the BUUF indicator book.

The reports

The city Status reports were/will be collected in the BUUF project at three occasions, 2004, 2005 and 2006. The reports will for each of the ten key areas, contain the following:

1. A description of the situation (collected 2004)
2. Basis indicator data (collected 2005)
3. Updating of indicator data. Comments on the choice of indicators. (2006)

The reports are edited for each area (water, energy etc) separately consisting of about 25 pages. The status descriptions consist of one page, with occasional additional pages for data diagrams etc, per city. The basic indicator data is collected in a table (one page) including all cities.

The Scientific Advisory Council members are asked to write benchmarking statements on these reports from the cities. The collected reports and benchmarking statements will be collected in a City status book from the BUUF project.

The cities
The cities have been organised in five groups according to character to make comparisons more meaningful. In each group there are representative from both "East" and "West". The list of cities then becomes as follows:

Group 1. Large port cities
1. Hamburg, Germany
2. Kaliningrad, Russia
3. Novgorod, Russia
4. Turku/Åbo, Finland

Group 2. Fairly large inland cities, metropolis issues
5. Lodz, Poland
6. Nacka, Sweden (close to Stockholm)
7. Minsk, Belarus
8. Örebro Sweden

Group 3. Medium sized inland university cities
9. Uppsala, Sweden
10. Tartu, Estonia
11. Jelgava, Latvia
12. Kaunas, Lithuania

Group 4. Small inland/coastal cities under economic restructuring
13. Livani, Latvia
14 Hällefors, Sweden
15. Norrtälje, Sweden
16. Sopot, Poland

Group 5. Small municipalities, ecovillage character
17. Enköping, Sweden
18. Tukums, Latvia
19. Kosakowo, Poland
20. Hågaby, Sweden

The data for the cites are thus listed in this order. There is also a table, which contain basic data for each of the cities.

2. Water management indicators

Minutes from audio conference on March 28, 2005.

Participants Bengt Hultman, KTH, Stockholm, and Agrita Briede, Univ of Latvia, Riga, members of SAC

Anna Granberg and Kyösti Lempa, UBC office Turku

Lars Rydén, BUP Secretariat, Uppsala University (taking minutes)

The indicators reflects the way of water through the municipality from the source (surface or ground water) through the technical system to the recipient, as well as the fate of the residual products (nutrients, carbon and heat) picked up and carried by water through the system. For each indicator several values are asked for. The quality norms should defined by each municipality. Care has been taken to reflect both environmental, economical and social properties of the water system of the municipality.

The indicator list is in harmony with both the UBC indicator project and the European common indicators, both managed by the UBC Turku Office.

Core indicators to be reported by everyone are underlined. It should be noted that much of the detail are needed to report core indicators, and they are thus close to an instruction on how to collect data for a core indicator.

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1. Surface water

Indicator:
- Percentage of surface water in the municipality above a defined quality (Indicate parameter values used).
- Is some part of the surface water used for water provision? How much.
- Is some part of surface water used as recipient? How much.
Comment: In the Baltic Sea region, water is abundant, while pollution of surface water is a problem. The EU Water Directive request monitoring of all surface water and that the water is turned into a "natural" state or so-called "reference conditions". Thus a long-term work to improve surface water is ahead of us. For quality best refer to the list of parameters in the Directive.

2. Ground water
Indicator
- Percentage of ground water above a defined quality.
- Is some part of the ground water used for water provision? How much.
- Is some part of surface water used as recipient? How much.
Comment: The water table is a regularly checked parameter, important for sustainability monitoring. The Water Directive treats ground and surface waters in a similar way.

3. Transport system; use of water
Indicator
- How much water is used (e.g as litres/day and capita in households; use per day in industry)
- How much storm water goes through the sewer network
- Leakage of water from the system
Comment Water consumption is related to economy and e.g. the need to use or not to use additional water resources, and the cost of preparing drinking quality water. Water use also needs to stay within the long-term available resources.

4. The quality of drinking water
Indicator
- Accessibility (percent of households having access to tap water, or percent of time;)
- Percentage of water above a given quality (Indicate quality parameters used, bacteriological and chemical)
- Price of water
Comment This value should be related to public health and legal requirements.

5. Treatment of wastewater quality of
Indicator
- wastewater percent purified in a wastewater treatment plant (%)
- wastewater percent purified in mechanical step
- wastewater percent purified in biological step
- wastewater percent purified in nutrient removal (N and P removal)
Comment At present there is no request to report water quality in the effluent to the recipient, although it would be better. No difference is made between large WWTP and small, one household facilities.

6. Using the resource. sludge and energy
Indicator
- How much sludge is used, not sent to landfill (percentage for each purpose)
- How much sludge is used in agriculture (percentage for each purpose)
- How much sludge is used for soil improvements, e.g. in parks (percentage for each purpose)
- How much sludge is used for fermentation (to biogas) (percentage for each purpose)
- How much sludge is sent to landfill (percentage for each purpose)
Comment The linear flow of nitrogen and phosphorus through wastewater is a non-sustainable process in our society. Recycling sludge to agricultural land will limit the unsustainable production of N and P for fertilisation. Also energy efficiency is important.

1. Water management

Water management indicators

Numbers represent either exact or estimated values (Italic)

City	*Indicator #*	*10*	*11*	*12*	*13*	*14*	*14a*	*14b*	*15*
	Title/Values either exact or estimated (Italic)	**Annual water consumption (m^3/cap) in the whole city.**	**Annual amount of drinking water produced (m^3/cap) in the whole city**	**Percentage of waste water purified in the centralised sewage plant in the whole city.**	**How much sludge is used, not sent to landfill?**	**Effluent from urban waste water treatment plants to rural areas**	**Number of agreements with farmers**	**Amount of sludge to the rural areas (m^3)**	**Percentage of surface water in the municipality above a defined quality**
Hamburg		*150-300*		*40-60*	*<20*		*2*	*120*	*60-80*
Kaliningrad		*50-150* (2003); 88,3 (2005)	*120-150* (2003) 109 (2005)	10 (2003)	0 (2003) *<20* (2005)		0	0	
Novgorod		*50-150*	*50*	*>80*	0				*60-80*
Turku		150 (2003); 73 (2004)	90 (2004)	99 (2003); 96 (2004)	100 (2004)		0	0	
Lodz		*50-150*	*71,4*	98,5	0,80				
Nacka		81		98					
Minsk									
Örebro		91	*85*	86	*>80*		*5*	*13000*	*>80*
Uppsala		165	*200*	100	*>80*	0			
Tartu		*50-150*	0,148	*>80*	0				*>80*
Kaunas		*50-150*		*>80*					
Jelgava		28,5		84					

Livani		*47,9*	*64*	*100*	*0*		NO	0	
Hällefors									
Norrtälje		*150-300*	108	95	*>80*		0	0	
Sopot		*52*	*100*	100					5
Enköping		67,4	67,4	*>80*			10	2000	
Tukums									
Kosakowo									
Hågaby									

CITY	WATER SUPPLY	SEWAGE TREATMENT	STORM WATER	SURFACE WATER
Hamburg, Germany **Large port city 1** Total surface area of municipality 755,3 km^2 1,7 mln inhabitants The number of staff in the municipality administration - 14000	About 2 million people are daily supplied with 300.000 to 400.000 m^3 cubic metres of water by Hamburg's water works. 18 water works supply both city and surrounding localities. Hamburg's water is taken exclusively from ground water, which, due to the filtering effect of the soil because of the filtering effect of the soil, is characterised by a high grade of purity in comparison with surface water coming from reservoirs. The quality of the water is further improved by the addition of enriching minerals and gases from the ground. Metals such as iron or manganese are precipitated in an environmentally friendly way. Hamburg's water works extract a large amount of fossil ground water, thousands of years old, from the lower lignite sands. Because of its age, it is especially clean and represents a considerable value. .	The sewage works association Köhlbrandhöft / Dradenau is responsible for the recycling of ca. 440.000 cubic metres of sewage per day, which is guided via the 5.414 km long sewer net of Hamburg's drainage system. 99,98 % of the waste matter from sewage purification is almost completely recycled		

CITY	WATER SUPPLY	SEWAGE TREATMENT	STORM WATER	SURFACE WATER
Kaliningrad, Russia **Large port city 2** Total surface area of municipality 223,0 km^2 425 600 inhabitants The number of staff in the municipality administration – no data **ADDITIONAL DATA IN APPENDIX, Table 1, Figure 1-7.**	Water comes from two main sources to Kaliningrad. They are surface and ground waters: - Surface water comes from 17 artificial ponds and 2 water intakes in the Pregel river. - Ground water comes from 1 intake though there are 22 seams. In general, the part of water intake has the following form: • from the surface waterbodies - 67%; • from ground waterbodies - 33%. In 2001, the general intake of fresh water from surface and ground waterbodies is about 223.4 mln m^3. That is 5.2 mln m^3 bigger then in 2000. Such increasing of water consumption is the result of economical development of our region. However, this general water intake is still within the established water intakes from natural waterbodies for 2001 (232.2 mln m^3). As drinking water mainly (up to 2/3 of the total amount) comes from the Pregel river, the adverse environmental situation with it has a direct impact on the quality of drinking water and creates a potential threat to the citizen's health. The quality of water taken from the artificial drinking water ponds corresponds to the required standards. Ground water source is also considered as a clean. It belongs to class 1 of water quality and needs simple treatment only. However, the condition of this source can soon be changed, and there is even a probability that the distribution network would not be able to guarantee the required drinking water quality. Over the last years, there has been a tendency towards reducing sanitarian safety of the ground drinking water sources. The city of Kaliningrad often suffers from drinking water deficiency. The Pregolya River, which is an important part of the city's landscape and also the main source of drinking water, is the main watercourse in the town. It flows from east to west through the Kaliningrad region and the city of Kaliningrad into the Vistula lagoon, which in its turn opens into the Baltic Sea. The river is very shallow. During strong western winds, water flows from the bay into the mouth of the river. As a result the discharge of the waste, water reaches the water intakes. When this occurs the supply of water to the two water intakes is shifted to two emergency reservoirs, which have limited capacity of about one week. If this situation lasts for more than a week, there may be a problem with adequate drinking water supplies.	In 2002, there were 149 wastewater treatment facilities with an actual capacity of 368.5 thous. m^3/day, including 68 plants with biological treatment with capacity of 26 thous. m^3/day, 5 plants with physical-and-chemical treatment with capacity of 0.6 thous. m^3/day and 76 – with mechanical treatment of 341.9 thous. m^3/day capacity (Table 1, appendix). The system of sewerage includes pipelines and head pump stations. In pre-Soviet period of time sewerage wells and storm and household sewages were connected but the wastewater was discharged through separated outlets. Nowadays the situation is exacerbated with the absence of separation between storm water and household sewages, which leads to pollution of virtually all water bodies in the city with industrial and household wastewater.	The length of the storm water collectors in Kaliningrad is about 300 km, there are more than 12 thousand storm water street and surface inspection inlets. In 2003, the digital data base of the collectors was created and it's still being replenished with new objects. Besides, the storm water sewage system is supposed to cause pollution of the Vistula lagoon and the Baltic Sea with the oil products. Oil slicks, which appear from time to time on the surface of the Baltic waters may originate from the urban run-off, which goes through the storm water collectors directly to the natural water bodies and water courses without any treatment.	

CITY	WATER SUPPLY	SEWAGE TREATMENT	STORM WATER
Kaliningrad, Russia **Large port city 2** Total surface area of municipality 223,0 km^2 425 600 inhabitants The number of staff in the municipality administration – no data **ADDITIONAL DATA IN APPENDIX, Table 1, Figure 1-7.**	The sanitary authorities in the region have established a good system for monitoring the quality of drinking water. The quality of drinking water generally corresponds to the federal standard. However, there are some deviations from the standard (failed tests). The failed tests typically relate to: - Color; - Residual aluminium; - Residual chlorine (likely to be a result of water treatment in particular during periods where additional chlorine is used due to poor quality of raw water supply). Sometimes the central water source, which is refilled by precipitation, may substitute the missing river water. However, if the summer has been dry the source may not be able to provide sufficient quantity of water. In these cases, the city water supply faces a predicament and the Sanitary authorities authorize the use chemicals and chlorine for water treatment above standard levels. As a result, the residual concentration of aluminium and chlorine can be higher than standard. In extreme cases, use of water for drinking and cooking may be prohibited and water is then supplied to citizens in cans. One of the complaints of inhabitants is the color and the taste of delivered water. The reason can be the way, in which the system operates i.e. the fact that the water supply is cut off at night in some districts Easily oxidized organic substances of the household waste water are the main cause of heavy pollution in the upper layer of the Pregolya River. The river's bottom is covered with a massive layer of dead sediments many meters thick. Some reasons connected with pollution of the Pregolya explain the current adverse situation with concentration of hydrogen sulphide in the air of Kaliningrad. - constant over-flows and emergency discharge of municipal sewage badly pollute the Pregolya; - back-up periods in the Pregolya during long periods of dominating westerly winds; - a concrete cover of the main self-flow sewage collector near Kosmodemyanskogo settlement has been deteriorating for the last two and a half years, so the collector currently stays open.	Therefore, domestic, industrial and storm waters discharge to sewerage net of Kaliningrad. Volume of the flows is about 160 thousand m^3 per day. But sewerage collector was built before the World War II. It fits only for 70 thousand m^3 per day. This is more than 2,5 times less than existing waste water. Some parts of sewerage net are being destroyed.	

CITY	WATER SUPPLY	SEWAGE TREATMENT	STORM WATER
Kaliningrad, Russia **Large port city 2** Total surface area of municipality 223,0 km^2 425 600 inhabitants The number of staff in the municipality administration – no data **ADDITIONAL DATA IN APPENDIX, Table 1, Figure 1-7.**	The level of organic pollution in the water, especially in the summer period, exceeds the limit values and the content of dissolved oxygen in the water is often critically low. Besides, industrial discharge into the river contains salts of heavy metals. The city is supplied with the water by the monopolistic municipal unitary enterprise «Vodokanal». 90% of the city population have the in-house water services, the others either consume the water from the water taps in the streets (within "Vodokanal" water supply network) or from the private water wells. The water network comprises almost 800 km of water pipes. More than 95% of the pipes are of cast iron and about 5% are of steel. About 75% are older than 60-70 years. Those old pipe lines are the reason of the numerous leakage accidents – up to 150 cases monthly. The fault rate in Kaliningrad in 2005 was about 2-2.5 leakage flows per 1 km of the water pipelines. Another reason is the hydraulic knocking i.e. drastic rise or decrease of the water pressure in the network. In May 2005, Kaliningrad City hall and "Vodokanal" devised the program "Energy Saving", which stipulates for the installation of the frequency converters in the water supply systems. The converters let reduce the fault rate thanks to the automatic pressure maintaining and, thus, it prevents the hydraulic knocking. This work is expected to be finished by the autumn 2006. One more innovation serving as a tool for the water distribution network management and preventing of the hydraulic knocking is introducing of the geoinformation system (GIS), which collects, saves and process the information for the estimation, forecasting and efficient development of the entire Kaliningrad water-supply system. Since the summer 2004, reconstruction of the city water network started and it's being changed now for plastic pipes. In the year 2005, about 6 km of the water-supply line were changed. Stop valve with the diameters from 50 to 500 mm is being repaired and changed. The fire plugs are also being regulated and changed in the city. There are 3 types of water prices in Kaliningrad: 1. The first one is for the manufacturing firms and commercial companies, water prices for which depend on their activity. 2. Population pays for the drinking water according to another 2 categories of the tariffs.		

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Kaliningrad, Russia **Large port city 2** Total surface area of municipality 223,0 km^2 425 600 inhabitants The number of staff in the municipality administratio n – no data **ADDITIONA L DATA IN APPENDIX, Table 1, Figure 1-7.**	Above 75% of townsmen do not have water counters. Calculation of the water price for this category based on the supposition that 1 person consumes 320 liters water per day (185 l of cold water and 135 l of hot one). It means that water consumption volume is 9.6 m^3 per capita per month. This rate accepted in 1988 is a matter of constant conflicts between population and the municipal unitary enterprise «Vodokanal». Population considers this quota to be noticeably overpriced as the average water consumption in the flats with water meters is about 4,08 m^3 per capita per month. On the other hand, the «Vodokanal» objects that the citizens, whose flats are not equipped with the water meters are very wasteful about the water and consume even more resource than they pay for (monitoring of the real water consumption by the population of Kaliningrad is still in process and it will take place till August 2006, but the intermediate data demonstrated the consumption 13.6 m^3 per capita per month). However, the existing technical water leakage all over the city is included into the tariff. The price for this category of people is approximately 2.4 per month. 3. Another part of inhabitants (constantly growing one) uses water counters. They must pay for real water consumption. 1 m^3 of water costs 0.25 euro (Price dynamics are demonstrated on the Figure. 6). Projects for the year 2006: • Construction of the water purification and iron removal plant in the settlement Chkalovsk (10 mln. RUR); • Reconstruction of the water supply and sewerage system network including modernization of the water main from the Eastern water station (10 mln. RUR). Cardinal decision of the problem of the waste water discharge and treatment can be reached only through the construction of the general waste water treatment plant according to the EBRD project.		hout any treatment.

CITY	WATER SUPPLY	SEWAGE TREATMENT	STORM WATER	SURFACE WATER
Large port city 3 **Novgorod, Russia** Total surface area of municipality 89 km^2 223 000 inhabitants The number of staff in the municipality administration – 500	Municipal Unitary Enterprise (MUE) "Novgorod Vodokanal" provides water supply and wastewater services in Veliky Novgorod. The company's main customers are the population from municipal and private housing stock, as well as budget, commercial and industrial organizations and enterprises. In 2003, the volume of sold water has amounted to 34,5 mln. m^3. The volume of processed wastewater equaled 32,4 mln. m^3. The profitability rate was 1,0%. At present, about 850 employees are working in the company. MUE "Novgorod Vodokanal" has technically equipped facilities for maintenance and repair of the majority of equipment. Company's adjustment service is responsible for hydraulic calculations, commissioning and testing of steam and hot water boilers, control and measuring devices and automatic equipment. The emergency and dispatching service operates 24 hours a day. Since 2002, the enterprise has been actively involved in the implementation of institutional changes within the project financed by international financial agencies such as SIDA, NIB and NEFCO. This includes development and implementation of a corporate development plan, changes in the organizational and managerial structure of the enterprise, introduction of new forms of reporting. In April 2004, a feasibility study aimed at the development of short- and long-term investment strategies has started in the company.	Currently, the company owns about 500 km of water network and 38 booster stations. There are three water treatment plants with the total capacity of 158 000 m^3/day. All major treatment operations are carried out by Left Bank Water Treatment Plant with the capacity of 180 000 m^3/day. After the necessary reconstruction of its facilities, the plant will be able in future to treat all water in the city, while two other plants will stay as reserve plants. Collection and transportation of wastewater from customers are done through 390 km of waste collectors and 31 sewage pumping station. Collected wastewater is transported to the biological treatment plant owned by one of the biggest industrial enterprises of the City – joint stock company Akron.		

CITY	WATER SUPPLY	SEWAGE TREATMENT	STORM WATER	SURFACE WATER
Turku/Åbo, **Finland** **Large port city 4** Total surface area of municipality 306,4 km^2 175 000 inhabitants The number of staff in the municipality administration – 13695 **ADDITIONAL DATA IN APPENDIX, Figure 8**		About 96 % of wastewater of the whole city is purified in the centralised sewage plant. All environmental allowance limits are normally achieved in the sewage plant. The specific consumption of energy at the plant decreased by about 20 percent from 2003 and by 51 percent from the year 2000. The reduction in specific energy consumption was mostly effected by a new purification process, which removes nitrogen from sewage. The process attained a nitrogen removal effectiveness of 58 percent. The results were also greatly affected by the training and high motivation of the staff. The phosphorus, nitrogen and BOD load has been decreasing for several years. This was achieved by improving the treatment process and by running the plant more conscientiously. The centralized sewage plant is over 40 years old. The city of Turku has made great investments on building of a new sewage plant, which will be ready in year 2008. Big investments have been made also in drinking water production to guarantee high quality water supply in future years too.		

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Lodz, Poland **Large inland cities 1** Total surface area of municipality 294,4 km^2 770 800 inhabitants The number of staff in the municipality administration - 1935	Water consumers in Łód are supplied from three water supply systems: the Sulejów – Łód water pipeline, the Tomaszów – Łód water pipeline, and from deep subterranean water intakes. These systems supply 63 mln m^3 of water per year, of which 68,2% are deep subterranean waters. The largest consumers are households (39,5 million m^3) and local industry (6,1 mln m^3). The amount of water sold to the towns located within the water pipeline route reached 3,7 million m^3. The municipal pipeline network is 1947,6 km long. Water is also supplied via 640 street pumps and 65 wheeled water tanks. The water pipeline has been recently extended by nearly 30%, while water consumption, and, therefore, sewage disposal, were reduced by nearly 40%.	In 2003, household sewage output amounted to 37,3 thousand m^3. In Łód , the general depopulation tendency is accompanied by concurrent "diffusion" of the urban zone. Łód is located on the Vistula - Oder watershed. The water for Łód is collected from the Vistula drainage basin (Tomaszów, Sulejów) and in the form of sewage it is disposed into the Oder drainage basin, where it accounts for as much as 11%. The city's northern part is located in the Bzura (Vistula) drainage basin, the southern and central parts – in the Ner (Oder) drainage basin, while the eastern part – in the Miazga (Vistula) drainage basin.		The City of Łód used to be in charge of river management under an agreement with the Łód Region Governor. Following new legislation, this agreement has been terminated. However, due to poor technical condition of the flows and their significant role in the system of precipitation waters distribution, Łód finances river maintenance on annual basis. Additionally, the City implements investments in rainwater sewers, e.g. river regulation, or water reservoirs construction (projected are 30 impoundment lakes in the drainage basin of the Rivers Ner and Bzura).

CITY	WATER SUPPLY	SEWAGE TREATMENT	STORM WATER	SURFACE WATER
Nacka, Sweden **Large inland city 2** Total surface area of municipality 95,4 km^2 78 000 inhabitants The number of staff in the municipality administration – no data		Nacka municipality has launched a campaign to inform the inhabitants about sustainable practices in waste water management. The inhabitants have received information about how to deal with waste, such as old medicines and chemical substances, without endangering the quality of water. Another water management issue in Nacka is related to the increasing amount of leisure time houses, which have the need for drinking water. Therefore, the municipality has started to build a waste water management system in new areas.		

CITY	WATER SUPPLY	SEWAGE TREATMENT	STORM WATER	SURFACE WATER
Minsk, Belarus **Large inland city 3**	No data			

CITY	WATER SUPPLY	SEWAGE TREATMENT	STORM WATER	SURFACE WATER
Örebro, Sweden **Large inland city 4** Total surface area of municipality 1380 km^2 126 288 inhabitants The number of staff in the municipality administration – 14 000	The municipality has the following data on water management. (NB! Most appendices on water management are in paper format). Data on drinking water, the distribution of drinking water, sewage water and storm water and also the treatment sewage water can be found in the annual report of the technical department, "*Tekniska nämnden Örebro Årsredovisning 2003*", pages 29-60 and in the environmental reports from the sewage treatment plant. Below we list some examples of data. Data on drinking water:The amount of drinking water produced in the municipal water treatment plants. ("*Tekniska nämnden Örebro Årsredovisning 2003*" , pages 34,37,39-40). We constantly examine the quality of the incoming water to the water treatment plant as well as the quality of the outgoing drinking water through quite a few parameters. Data on the water distribution system: How well our distribution system works, showing leakage of drinkable water and in-leakage of water to the wastewater system. The municipality is working on a new water plan. See appendixes in the folder *Vattenplan*.	Parameters monitored by the water purification plant are specified in *"Analyse parameter for the water purification plant*". An increase in in-leakage to the wastewater system increases the amount of water that needs to be treated in the waste water plant, hence the usage of chemicals and electricity increases. *("Tekniska nämnden Örebro Årsredovisning 2003*", pages 42,46-47). Data on sewage sludge: - The level of contamination in sludge from metals and some other substances harmful to the environment. (See the environmental report of the sewage treatment plant, "*Miljörapport Avloppsverket i Örebro 2003*" page 17) - The percentage of sludge being used in growing vegetation. ("*Miljörapport Avloppsverket i Örebro 2003*" page 17) Data on treatment of sewage water: - Levels of N, P, BOD7 and more in the incoming water to the sewage treatment plants. ("*Miljörapport Avloppsverket i Örebro 2003*" page 12-13) - Levels of N, P, BOD7 and more in the outgoing water from the sewage treatment plants. ("*Tekniska nämnden Örebro Årsredovisning 2003*" , pages 51-52) and for details ("*Miljörapport Avloppsverket i Örebro 2003*" page 12-13). Parameters monitored by the water purification plant are specified in "*Kontrollprogram AVÖ – Egenkontroll*" The environmental report from the sewage treatment plant only covers the main treatment plant "Skebäck" and not the smaller ones. For all plants go *to "Tekniska nämnden Örebro Årsredovisning 2003*". New goals and new indicators, which have to be used, are included in the environmental program. See *Örebro miljömål remissversion 2004-03-25*, *pages 33, 36, 38*	We have separate networks for treating sewage water and urban drainage water (storm water). Treatment of storm water through the best management practices by gravity to remove contaminants such as heavy metals and nutrients (See map in the water management plan, "*04. Karta Dagvatten*").	General data on water quality: Nutrients in lake Hjälmaren catchment (appendix *Hjälmarens vattenvårdsförbund*)

CITY	WATER SUPPLY	SEWAGE TREATMENT	STORM WATER	SURF. WATER
Uppsala, Sweden **Medium sized university cities 1** Total surface area of municipality 2189 km^2 182 076 inhabitants The number of staff in the municipality administration – 5 688	Uppsala has good natural conditions for producing good drinking-water. The Uppsala-ridge is one of Sweden largest subsoil water magazines and contains considerable amounts of water to be used for drinking. The contents of lime are unfortunately high so the water is very hard. This is to be noticed as lime-deposit on saucepans and gives white traces of dried lime in bathrooms and kitchens. The hard water also dissolves copper from the copper pipes in the buildings. The metal mixes with the waste water and goes to the sewage treatment plant and ends up in the mud. The mud from the sewage treatment plant contains plant nutrients and mould, which is valuable for the agriculture. The high copper levels are one of the reasons why the mud is not attractive to be used in farming in Uppsala. Until further notice the sludge with high copper levels is stored in the waste establishment (Hovgården) but it is planned for the future that it will be used in restoration of closed deposit areas. Two new waterworks are being built in Uppsala. In the new waterworks, the water will be treated in columns with small sand grains to be softer. However, there will still be some levels of magnesia left, because it is known to give a good taste. During the past ten tears, the water-consumption per capita has declined by 25 %, but the total consumption is still unaltered, because the population has increased.	Almost all waste water in the city is treated in the city's sewage-treatment plant before it is let out in the Fyris-river. Some small parts of the city are not connected to the plant. The houses, which mostly lay in the outskirts of the city, have their own outflow with waste water treatment where three chamber wells in combination with infiltration are the most common. In Uppsala and Knivsta, there are about 4 000 households in rural areas with own outflows, which let out more nutrients and bacteria than it is allowed. Uppsala's treatment plant contains - except the usual cleaning-steps with mechanical purifying (where large objects, coffee grounds and heavy particles are deposited), chemical purifying (phosphorous are deposited with iron, the clusters become mud), biological purifying (reduction of organic material, addition of microorganisms, inflation of air) a newly built out nitrogen separation. In the basins, where air is inflated, the nitrogen is transformed to nitrite and then lead to an anaerobe basin. Then the bacteria take oxygen from the nitrate and nitrogen gas is evaporated to the air.	Daywater includes rain and melted snow from roofs and streets. The day water is transported in separate pipes to the Fyris-river or other watercourses without passing the treatment plant. There are contaminations in the day water from the heavily trafficked roads and industrial areas. Some local solutions are made to take care of the water in building-site grounds. The sand from the streets is swept up quickly so that the sand with its contaminations does not go along with the day water to the river.	

CITY	WATER SUPPLY	SEWAGE TREATMENT	STORM WATER	SURFACE WATER
Tartu, Estonia **Medium sized university city 2** Total surface area of municipality 38,8 km^2 100 148 inhabitants The number of staff in the municipality administration – 290	Water supply, waste water and rain water are managed by a municipal (100% of stokcs belong to city) company AS Tartu Veevärk. The company is responsible for providing consumers with drinking water, collecting and treating waste water, buiding and renovating pipes. The company has to make an annual report of financial issues, and also the prices of water and waste water have to be approved by the city council. There are 96, 000 users of communal water supply. The amount of water pumped is about 14 000- 15 000 m^3/d. Drinking water is pumped from 35-40 bored wells. 100% of ground water is used. Depending on the ground water layer, the depth of the wells varies from 20 to 400m. There are four different water layers, from wich water is collected, and the water quality is different. Since 1998, water has not been pre-treated or cleaned, because the quality met the local norms. Now, there are two water treatment plants (Sepa and Anne) that are ready to clean water (mainly iron, solid matter, hydrogen sulfide). Currently, the water treated in plants meets all the EU norms, however, in some areas (where water is not traeted), there are some problems with iron and hydrogen sulphyde.	*Waste water treatment* In 2004, tunnel collector Kesklinna-2 was ready, which now collects all the sewage water in communal waste-water supply. Water is brought to the city water treatment plant, which treats waste water mechanically, biologicaly + chemical phosphorus removal. *Local on-site techniques* are mostly used in rural areas. Modern private houses mostly have a septic tank combined with a filtration bed. There are some projects going on in smaller villages- in Kambja. There is a system of ponds, where sewage water is collected into ponds in winter and used to water willows in summer. The willow is planned to use for heating the local boiler house. In Kodijärve, there is a system consisting of a pumping station, vertical flow rock filter, horisontal flow sand filter combined with plants, tank filled with ashes to remove phosphorus.		

CITY	WATER SUPPLY	SEWAGE TREATMENT	STORM WATER	SURFACE WATER
Jelgava, Latvia **Medium sized university city 3** Total surface area of municipality 60,32 km^2 66 088 inhabitants The number of staff in the municipality administration – no data	No data			

CITY	WATER SUPPLY	SEWAGE TREATMENT	STORM WATER	SURFACE WATER
Kaunas, Lithuania **Medium sized university city 4** Total surface area of municipality 157 km^2 368 917 inhabitants The number of staff in the municipality administration – no data	Kaunas City uses the drinking water from underground waterworks. The explored capacity of water in Kaunas waterworks is 250 thousand m^3 per day. There are four waterworks in Kaunas: Eiguliai (20 th. m^3/day), Kleboniskis (15 th. m^3/day), Viciunai (40,12 th. m^3/day), Petrasiunai (32 th.m^3/day). Quality of drinking water is quite high in Kleboniskis waterwork, but it is not good enough in Petrasiunai and Viciunai waterworks, because of iron admixtures in the water, and it must be additionally cleaned. The present drinking water demand makes ca. 75 000 m^3/day, the future demand in 2020 is foreseen up to 117 000 m^3/day. The length of water supply network makes 946 km, and it is planned to build 179 km water supply pipes up to year 2010.	Kaunas has a well developed sewage network, which covers ca. 85 percent of entire city area. The length of household and industrial sewage network is 585 km, there is planned to build 195 km of such sewage pipes up to year 2010. Kaunas Water Treatment Plant, situated in the Nemunas River valley at Marvele district, is one of the largest in Lithuania. The designed capacity is 230 m^3/day. The project has been divided into two phases. The first phase was ended in 1998, the construction of the mechanical treatment facilities has been completed. Later on, during the second phase, the biological treatment facilities will be constructed. Sludge from water treatment plant is transported to the sludge fields, 10 km far, in the Ezerelis forest. It is used as a nutrient for planting of energy plants. The waste sludge is not recycled in Lithuania. There is no urine separation in Kaunas, or in Lithuania.		

CITY	WATER SUPPLY	SEWAGE TREATMENT	STORM WATER	SURFACE WATER
Livani, Latvia, **Small cities economic restructuring 1** Total surface area of municipality 306,06 km 9 500 inhabitants The number of staff in the municipality administration - 40	Livani has a centralized water supply system. Currently, only cold water is supplied. Livani has 2 rivers and 1 lake, but they are not used for getting drinking water. The central water system is served by six artesian wells. The artesian wells are concentrated around the water tower; all water protection zones are taken into account. The water supply network is 13 km in length. The row water is treated at an iron removal plant before it is supplied. The treatment facilities can cover the whole amount of water to be distributed. The treatment technology is based on using pressure filters. The water distribution network is in moderate condition. Drinking water analyses at consumers' taps correspond to the national standards. The central water supply network is used by 70% of residents. The main water consumers are private households (residents), municipal institutions, shops and small and medium enterprises. According to the official statistics, 1215 m³ water are consumed per day, from that 72% for households needs and 28% for production needs. Total capacity of water supply is 2800m³ per day.	The waste water treatment plant is old, it was constructed in 1971. The concrete structure are completely worn out, the metal structures are corroded. The wooden structures have been replaced during last years; however, they are in bad shape. Livani municipality is now participating in the project "Development of water management system in river basins of Eastern Latvia". 18 different towns take part in this project. The main object of this project is optimizing water management sector in Livani town. It is planned to finish the project in 2007. The expected results are: a new sewerage penstock, a new iron removal plant with all filters, a reconstructed water tower and a new sewage treatment plant.	One of the biggest problems in Livani municipality now is lack of rainwater collection and cleaning system. The municipality is planning to attract EU Structural Funds resources in order to solve the problem.	

CITY	WATER SUPPLY	SEWAGE TREATMENT	STORM WATER	SURFACE WATER
Hällefors, Sweden Small cities economic restructuring 2	There is one big water supply plant in the municipality. The plant supplies the population centres of Grythyttan and Hällefors. In the smallest population centres, there are also four smaller water supply plants, which take water from the ground water that is a very good quality. Water from our biggest supply plant is going out in Sweden as table water and it is very popular. On the countryside the households have their own water wells.	*Treatment plants* There are nine treatment plants in the municipality. The two biggest plants are in Grythyttan and in Hällefors, and in addition, there are smaller plants in six smallest population centres. *Ecological techniques* In Grythyttan, we fell the phosphor by chemicals and we reduce the organic materials by microorganisms. Hällefors treatment plant use also chemicals to fell the phosphor. Instead of using microorganism to reduce the organically materials they use air. There is the same technique in the treatment plant in Loka Brunn. *Local on-site techniques* In six smallest population centres, the treatment techniques such as infiltration are used. The same techniques are used by private households. Sludge is collected from the treatment wells and then the water goes away to an infiltration bed. In the infiltrations bed, there are microorganisms that take care of phosphor. A sludge truck comes once a year and take care of the sludge. The trucks deliver the sludge to our bigger treatment plant in Hällefors where the processing of the sludge continues. *Sludge management* Currently, we also work together with municipal unions such as Nora, Hällefors, Lindesberg and Ljusnarsberg regarding the technical supply issues. We are planning to close two landfills and we will use the sludge for covering the landfills. *Urine separation* The technique of urine separation and the black water to an infiltration bed are allowed in private properties near a lake.		

CITY	WATER SUPPLY	SEWAGE TREATMENT	STORM WATER	SURFACE WATER
Norrtälje, Sweden **Small cities economic restructuring 3** Total surface area of municipality 5700 km^2 16311 inhabitants The number of staff in the municipality administration – no data	In order to make right decisions on how to use the land and water, it is necessary to have access to relevant knowledge and facts. Water is a very complex matter; it is a movable resource that many people want to use. During the last 15 years, the Norrtälje municipality has collected information about our water resources, including the lakes and the archipelago. In the comprehensive plan, a great number of strategies and goals for the future have been formulated. The most important are the following: • Drinkable fresh water to the entire municipality • The water resources added values must be protected • Nutrients and contamination in lakes and sea have to be diminished successively. • The character of the archipelago as a nature conservancy area must be protected and kept. In order to obtain these goals, the comprehensive plan has recommendations for the different types of areas such as water protection areas and environmental disturbed areas.	30000 people in Norrtälje municipality are connected to the municipal water and sewer systems. There are 11 water treatment plants and some reserve water intakes. All of these are connected to greater water pipes to diminish the risks of the system. Within the municipality, there are also19 sewer disposal plants, which are very active. Polluted rainwater is taken care of locally and ecologically by three bigger constructions of ponds, which are located in the city area. At the moment, there is a project going on concerning the eco recycling of individual sewer systems.		

CITY	WATER SUPPLY	SEWAGE	STORM WATER	SURFACE WATER
Sopot, Poland, **Small city economic restructu-ring 4** Total surface area of municipality 17,31 km^2 39 587 inhabitants The number of staff in the municipality administration – 197 **ADDITIO-NAL DATA IN APPENDIX, Table 2 and 3.**	Sopot is supplied with drinking water only from underground resources. Between years 1999 to 2001 water was being supplied from 3 primary water intakes in Bitwy pod Płowcami, Brodwino and Nowe Sarnie Wzgórze. The volume of water intake in the years 1999-2001 and the amount of water transited to Gda sk is shown in Table 2 (see appendixes). Drinking water quality is continuously monitored by the Province Sanitary and Epidemiological Station and Saur Neptun Gda sk. The total balance of water supplied from water intakes to the pipe network in year 2001 shows that (concerning physicochemical parameters): - 79.4% of water complied with EU directives, - 79.3% of water complied with Polish Norm. 20.7% of water, which did not meet sanitary requirements included: - water from the intakes at Bitwy pod Płowcami and at Nowe Sarnie Wzgórze, - water purified at the purification plant at Bitwy pod Płowcami (due to excessive content of manganese compounds - result of water disinfection). Water samples were examined at least once a month (146 samples total).			In the years 1999-2001, 10 water courses (Course 1, Course 2, Course 6, Course 7, Grodowy Stream, Swelina, Haffnera Stream, Karlikowski Stream, Kamienny Stream, Babidolski Stream) were monitored for water quality, and a total number of 36 permanent testing points were established. Samples were taken twice a month for bacteriological tests, and once a month for extract determination. Flow measurements were also conducted once a month. If necessary, additional tests were carried out (e.g. in cases when pollution persisted in a specified area) On the basis of the results from all the measuring points, the sanitary condition of examined water courses can be generally estimated as fairly good. Irrespective of the degree of pollution, all the water courses are characterised by a high variation in pollution levels both in time (this applies to all water courses) and along their courses (mainly in the Babidolski and Karlikowski streams). In 2001, just as in previous years, there was periodical lack of flow in some water courses. As in previous years, the streams under observation differed as to the amount of water. The biggest flows occurred in the biggest streams: Babidolski Stream, Karlikowski Stream and Kamienny Stream. Much lower flows were recorded in the Grodowy and Haffnera streams. The average annual values of flow in the water courses mentioned above, have not changed significantly compared to previous years. There are 4.2 km of sandy beaches within the administrative boarders of Sopot. Monitoring of coastal waters has been carried out since year 1992. The aim of the tests was to determine the suitability of seawaters for bathing and recreation. The tests were carried out by the Province Sanitary and Epidemiological Station and the Institute of Maritime and Tropical Medicine in Gdynia. In year 2001, the scope of the tests and the criteria of evaluation were widened with the new Ordinance of the Ministry of Health. Water for drinking and utility purposes, and water in swimming pools have been tested, and rules for water quality control rapport by the Sanitary Inspection authorities. Due to stricter evaluation criteria and introduction of new evaluation indexes, the bathing water usability threshold has been significantly raised. Thus, it can be stated that the cleanest waters occur along the shoreline section from the Sopot-Gdynia border to the Grand Hotel beach (central Sopot), while waters in the section from Łazienki Południowe to the Sopot-Gda sk border are slightly more polluted. The waters adjacent directly to the Sopot pier are characterised by a relatively high level of pollution. In the years 1999-2001, the beach in Sopot was opened at its full length (excluding 50 m long sections at both sides of the pier).

CITY	WATER SUPPLY	SEWAGE TREATMENT	STORM WATER	SURFACE WATER
Enköping, Sweden **Small ecovillage city 1** Total surface area of municipality 1 184 km^2 38 211 inhabitants The number of staff in the municipality administration – 2 087	The drinking water comes from ground water reservoirs in the Enköping esker, natural water that is taken directly to the drinking water system without any additive or any preparation. The amount of produced drink water 2 800 000 m^3. Cost of drink water 1,87 SEK/m^3.			

CITY	WATER SUPPLY	SEWAGE TREATMENT	STORM WATER	SURFACE WATER
Tukums, Latvia **Small eco-village city 2**	The water supply system in Tukums is operated by municipality owned company "Tukuma udens". Daily water consumption is 2500 m^3/day. The total length of the water supply network is 26 000m. Town is provided with drinking water only from underground recourses, six independent local systems, 21 artesian wells, which are 50-300 m in the depth. There is drinking water iron removal plant (in 2003) in the central part of Tukums with capacity of 3900 m^3/day, reservoir volume 1000 m^3. In addition, there are two local iron removal treatments with capacity of 400 m^3/day and 600 m^3/day.	Wastewater treatment services are provided by municipality owned company "Tukuma udens". The total length of sewer network is 40 000m, of storm water network 2 200m. Construction of town wastewater treatment plant (capacity 7000m^3/day) was completed in 1999. The flow of wastewater to be treated fluctuates from 2500 to 6500 m^3/day, depending on weather conditions. Reconstruction of water and wastewater network and rehabilitation of sewage pumping stations have been done within the scope of projects of Public Investment Programme.		

CITY	WATER SUPPLY	SEWAGE TREATMENT	STORM WATER	SURFACE WATER
Kosakowo, Poland Small eco-village city 3 **ADDITIONAL TEXT IN APPEN-DIX**	One of the biggest underground waters areas in Poland (GZWP nr 110) is located within the municipality. Special protection is required because of its size, quality and exploitation conditions (the regulations are being prepared by the Ministry Council). There are 7 water intakes supplying group and individual water supply systems within the municipality. The areas of Pogorze, Debogorze Wybudowanie and sewage purification plant "Debogorze" are supplied from the water supply system in Gdynia. Industrial areas such as waste incineration landfills and liquid fuel bases are supplied from their own underground water resources. Existing water supply intakes are protected within its protection zones. Indirect protection is provided by layers of high-thickness clays. There are two areas of underground water intakes belonging to water supply system in Gdynia, which are located along the municipality borders. They are directly and indirectly protected. Existing water supply system fulfills the needs of the municipality and the water quality is good. The following water resources are being a part of the municipality fire protection system: water supply system (plus hydrants), rainfall waters retention reservoirs, melioration system, ponds and the waters of Puck Gulf.	Pressure-gravitation sewage system is currently being built in the whole municipality and is going to be connected to the sewage purification plant "Debogorze". Debogorze and Kosakowo villages and developed areas of Debogorze-Wybudowanie have already been connected to the system. The works in Mosty and Rewa villages are planned to be finished by year 2005. The works in Mechelinki village are planned to be conducted during the years 2004 – 2005. Sewage from single-family housing area in Suchy Dwor is directly transported to the sewage purification plant. Sewage from housing, service and industrial areas located along Pulkownik Dabek Street is transported to the sewage system of Gdynia city. Sewage from housing, service and production areas, which are not connected to the system, is stored in isolated vessels and transported to the sewage purification plant. Sewage from liquid fuel bases is locally purified and transported to the sewage purification plant. Municipality's future development had been taken into consideration while preparing development plan for the system, and it fulfils current and future flow requirements	The municipality has no underground drainage system for rainfall waters with the exception of Suchy Dwor, where they are transported to retention reservoirs and to green areas. The technical condition of the system is bad and modernization is required. The northern parts of the municipality (Moscie Blota and Rewa polders) are densely meliorated. However, the technical condition of the system is not good (sludge, mud). A part of Moscie Bloto peat-bog has recently been meliorated. The areas of Mechelinki village have been drained and their meliorating system has been modernized (the outlet pipeline has been protected against seawater invasion). Technical documentation of rebuilding and modernization of two collecting melioration ditches has been prepared for Reva village. Among others, the system is going to be facilitated in devices reducing seawater invasion and sand deposition. There is a military base and airport located within the municipality. Heating, energy and gas supplies in these areas are provided from separate supply systems. The information on military areas is not available.	Surface water resources are Zagorska Struga river, Cisa river and their tributaries together with Lyska and Leniwa canals are the surface waters in the municipality. The waters are classified as II and III in I – III water purity scale. Rewa beach waters are opened for public recreation use. Mechelinki beach waters are closed for public use because of pollution caused by the outlet from sewage purification plant "Debogorze".

CITY	WATER SUPPLY	SEWAGE TREATMENT	STORM WATER	SURFACE WATER
Hågaby, Sweden **Small ecovillage city 4**	The water in Hågaby is mainly derived from the Uppsala ridge district supply. Since 2006, the Calcium containing water will be less hard due to application of new municipal water treatment techniques. .	*Urine Sorting* Urine sorting is used in the quarter Hällen in Hågaby and urine is used in local farming in the area. Further use of urine is investigated. *Local Sewage Treatment* Since 1999, Hågaby has a local sewage treatment plant with 7 purification steps: 3 sludge removing compartments, 3 biological purification steps and 1 chemical step for Phosphorous removal. The Sewage plant is currently being evaluated with regard to its economical and ecological performance. *Sludge management* Hågaby produces a very clean sludge – with the exception of high copper contents. At the beginning of 2006, the copper is expected to be significantly reduced, and, thus, softer water will be introduced in Uppsala.	The whole area has an advanced local storm water treatment system, where most of the storm water is infiltrated in the local landscape.	Since 2003, an extensive use of ground water for cultivation watering was introduced in many parts of the area, which strongly reduced the use of fresh water

Appendix

Kaliningrad

Table 1. Characteristics of treatment facilities (The share of wastewater treated with different types of treatment facility has also changed during this period /Figure 2-3/.)

	Type of treatment facility (Actual capacity, thous. m^3/day)			
No of treatment facilities	Biological treatment	Physical&-chem. treatment	Mechanical treatment	Total
1999	23	5	20	48
2002	68	76	5	149
1999	6.9	0.9	260.1	267.9
2002	26.0	341.9	0.6	368.5

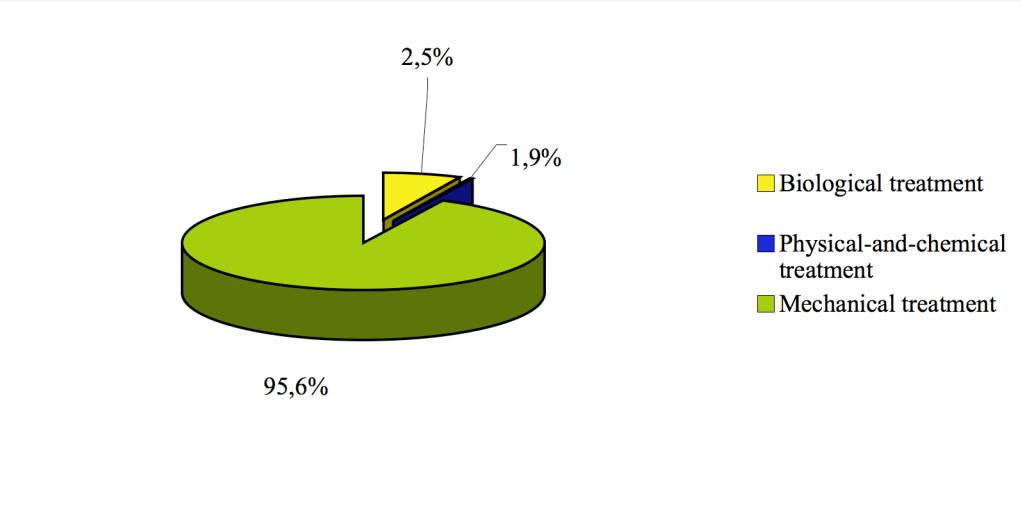


Figure 1. The share of wastewater treated with different types of treatment facility in 1999.

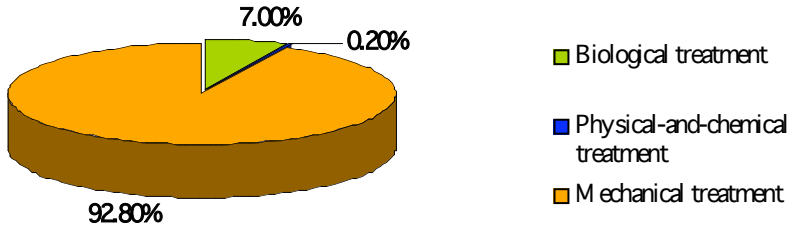


Figure 2. The share of wastewater treated with different types of treatment facility in 2002.

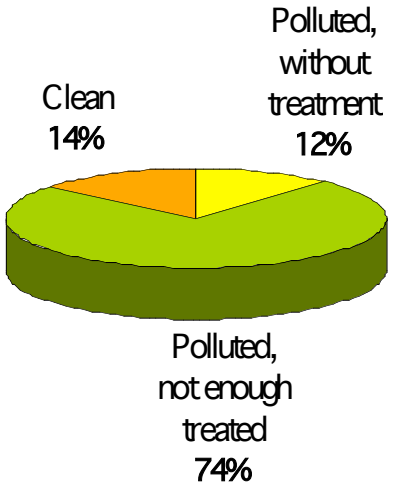


Figure 3. The structure of discharged wastewater in 2002.



Figure 4. Polluted wastewater in Kaliningrad.

The biggest share in the structure belongs to the polluted wastewaters (151.1 mln. m^3) or 86% of general discharge. The discharge without any treatment has increased on 1.6 mln. m^3 (in comparison with 2001) and the discharge of not enough treated wastewaters has not changed a lot.

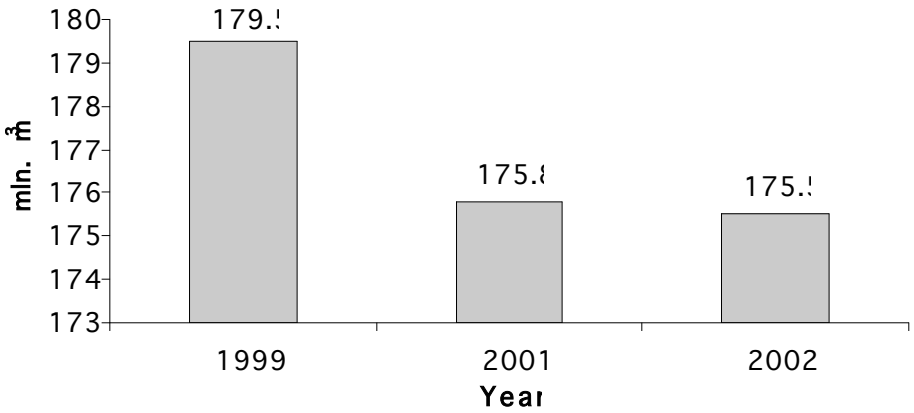


Figure 5. The volume of wastewater in Kaliningrad.

The volume of wastewater discharged into the surface waterbodies in 2002 decreased (in comparison with 1999) on 4.0 mln. m^3.

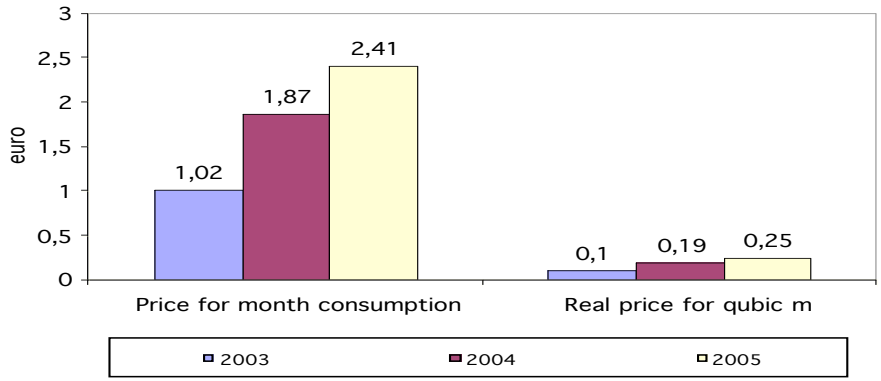
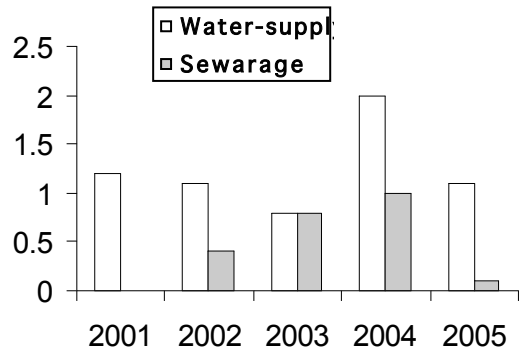


Figure 6. Dynamics of the drinking water price (Euro) for the population in Kaliningrad, 2003-2005.



During the year 2004, the through repair of some water supply and drainage system objects was organized. It took 55,8 mln. RUR (54,2 of them were subsidized by the municipal budget of Kaliningrad). At the Eastern waterworks 15 new water wells were drilled.

Figure 7. Major repairs of the water-supply and sewerage systems in Kaliningrad, km.

Turku

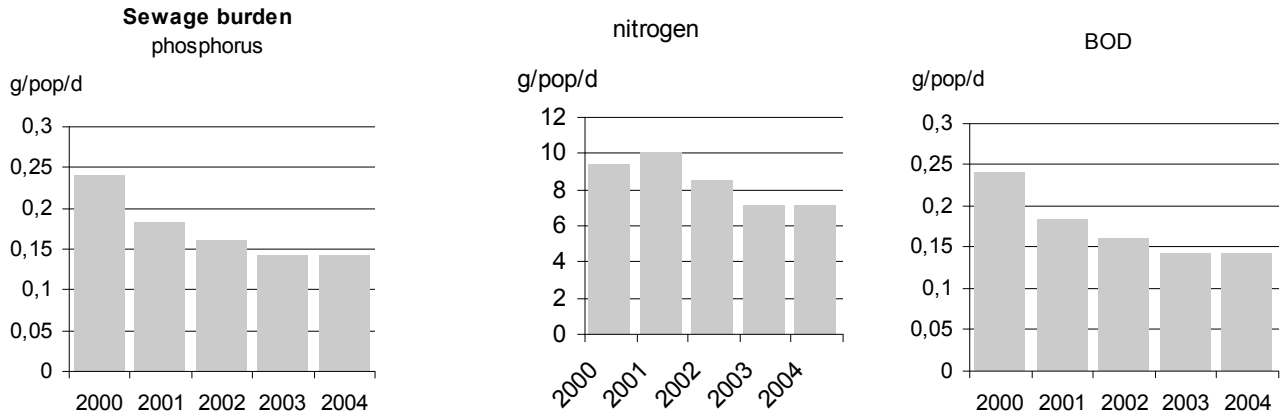


Figure 8. Phosphorus, nitrogen and BOD in sewage of Turku.

Sopot, Poland

Table 2. Water production in Sopot in the years 1999-2001.

Water intake [m^3/year]	1999	2000	2001
Bitwy pod Płowcami	3,599,250	3,548,900	3,541,750
Nowe Sarnie Wzgórze	1,274,590	1,213,800	1,191,250
Brodwino	761,730	757,880	727,760
Total	**5,635,570**	**5,520,580**	**5,460,760**

Table 3. Water production balance in Sopot in the years 1999-2001.

Water intake Water production in the years 1999-2001 [m^3/year]	1999	2000	2001
Water transit to Gda sk	1,887,750	1,883,180	1,996,620
Water pumped to the water pipe network	3,689,390	3,577,460	3,383,700
Water for internal needs (network cleaning, container washing)	28,290	39,487	35,983
Losses	322,000	456,322	412,278
Losses %	8.7%	12.7%	12.1%

Kosakowo

Hazardous factors influencing the quality of surface and underground water resources

The factors include:

- liquid fuel bases, oil supply lines, sewage purification plant “Debogorze” and its sewage outlet located within the beach area
- waste incineration landfill in Mosty village
- heating plant Elektrocieplownia Gdynia
- railway facilities in Gdynia-Leszczynki
- earth works, (e.g. elimination of organic deposits), being especially dangerous in the area of water intake in Rumia-Janowo
- devastated and choked melioration systems
- agriculture policy (using fertilizers and chemical substances).

Activities reducing environmentally hazardous factors
The activities include:

- renovation, regulation and melioration of canals
- “Coastline Protection” project (“Ochrona Brzegow Morskich”), which includes assessment of current coastline condition and specification of hazardous factors. The project specifies legal actions and regulation activities to be included while implementing long term “Coastline Protection Program”
- partial reclamation of incineration landfills (see chapter 6.4)
- prolongation of the time period for building a deep-water outlet (1 km long) for sewage purification plant “Debogorze”.