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THE USE OF POLISH WATER RESOURCES IN 1998 IN THE CONTEXT OF STATISTICAL SURVEY

Paper submitted by the Central Statistical Office of Poland [1]

Abstract

The main purpose of this paper is to present and characterise the most recent statistics (as of 1998) on use of water resources, especially on an aspect of water withdrawal and waste water discharges, which is obtained from the statistical surveys conducted by Central Statistical Office of Poland (CSO). At the beginning of this paper, scope of subject matter of statistical surveys and general structure of carrying out them were outlined. In addition to that, the state of adjustment of Polish statistical surveys in the field of water use to the European Union standards was also discussed in general.

The results and statistical analysis of the materials contained in the statistical surveys on water and waste water for 1998 present a comprehensive and accurate picture of Polish water use in this year.

The above paper provides only an extract from the most actual statistics on water use in Poland from the point of view of pressure on water resources according to the scheme: pressure – state – response.

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I. Background

1. Poland is one of the relatively small number countries which have for decades collected huge amounts of statistical data and measured results, covering the most important environmental quality parameters.

2. In attempting to meet the information users' expectations, the studies which assess the state of the environment more and more often apply methods of presentation based on the scheme of pressure - state - response. In laying out this paper, the first element of this scheme - pressure was only discussed and characterised in detail. In other words, a good deal of attention was paid on presentation of water use both in the context of the economic activity conducted (water withdrawal) and the media receiving pollutant releases into the environment (waste water discharges).

3. Presented paper has a form of statistical report which is based on the 1998 data obtained from CSO statistical surveys on water and waste water management.

4. The discussed report is mainly based on analyses of numerical data with high degree of reliability, comprehensiveness and representativeness which have been acquired in the public statistical system.

II. Water resources

5. Poland lies in Central Europe, almost entirely in the catchment area of the Baltic Sea (99,7 %). The predominant part of the Polish territory lies within the borders of the basins of its two largest rivers: the Vistula (54% of the country's territory) and the Order (33,9% of it). The hydrological network of Poland also encompasses the Pomeranian rivers which discharge directly into the Baltic Sea. Aquatic ecosystems (flowing and standing waters including reservoirs) occupy about 3 % of the country.

6. However, Poland is one of countries with poor water resources. They include:

- surface water resources the quantity of which, defined as the mean long-term runoff, is about 63,1 billion m^3/year (i.e., 1600 m3/year per capita on average, whereas in European countries the average surface water resources are estimated at 4560 m^3/year per capita);

- underground water resources the operating volume of which was estimated at 15,6 km^3 in 1997, including 35% from deep geological strata;

- inland and territorial sea water resources.

7. The quantity of surface water resources varies in time, both over a long-term period and within a given year. In dry years the per capita index of the resources falls to 1100 m^3/year (data for 1991), whereas in wet years the maximum levels of 2600 m^3/year were observed (data for 1975). Thus, the large variability makes it difficult to manage surface waters in a rational way and the relatively low retention capacity of artificial water reservoirs (about 6 % of the mean annual runoff) prevents the result from periodic water redundancies and shortages in rivers.

8. In 1998 the balanced resources of surface waters amounted to 73,2 billion m^3, i.e., 1893 m^3 per capita. Waters from the basins situated as a whole within the country account for about 87 % of total surface waters.

III. Statistical surveys on the use of water resources and their harmonisation with EUROSTAT standards

9. Statistics on environment protection, of which on water use, because of a transborder and global character of many phenomena and ecological processes, is conducted by the Central Statistical Office (CSO) from the very beginning, i.e. since the 70s, in a close international co-operation, mainly within the UN Statistical Commission and an ECE/UN Conference of European Statisticians. In the 90s the above co-operation has been extended by Eurostat and OECD. This provides possibility to make use (directly and through adaptation) of the achievements of those Organisations as well as helps the CSO to consider the information needs resulting from the program co-operation and the international comparisons made.

10. In Poland the main source of information on water and waste water management (of which on use of water resources) are CSO statistical surveys based on the following annual statistical reports:

- water management, waste waters and loads of pollution in industrial enterprises (OS-3),
- water abstraction for irrigation in agriculture and forestry and filling fish ponds (OS-4),
- municipal and rural waste water treatment plants (OS-5),
- water supply systems and public sewage systems (M-06),
- collective water supply systems and collective sewage systems of voivodeship water services plants, housing co-operatives and working places (M-07),
- gminas' statistics; a part - housing and municipal management related to, i.a., water supply systems and sewage systems of gminas (SG-01).

11. In 1998 the subject matters of the reports comprised:

- sources of water abstraction and water consumption in the national economy and for the population needs,
- quantity and management of saline mine waters and salt loads contained in them,
- closed water cycles in industrial enterprises,
- irrigated areas and water-filled fish ponds (area and water consumption), the quantitative state and maintenance of irrigation equipment,
- waste waters discharged to surface waters, treatment methods and basic loads of pollution
in waste waters,
- quantity, size and types of industrial waste water treatment and pre-treatment plants, their effectiveness and management of generated sludge,
- quantity, size and types of municipal and rural waste water treatment plants, their effectiveness and management of generated sludge,
- population connected to municipal and rural waste water treatment plants.

12. All the above surveys are obligatory, which results from "The official statistics programme of statistical surveys" (approved annually by the

Council of Ministers) precisely defining the entities of statistical observation (the so-called survey frame) which are under an obligation to participate in the survey, its scope, forms and deadlines for submitting statistical data as well as methodological principles of surveys.

13. All the surveys are conducted using the most of data carriers which are in form of reporting forms. Most of the statistical surveys are full (cover entirely the examined phenomenon), some of them are based on special criteria, e.g. OS-3 concerns population of units determined according to the criteria of their environmental hazard.

14. Data carriers (reporting forms symboled: OS-3, OS-4, OS-5, M-06, M-07, SG-01) are the basic sources of data which as a result of appropriate control and processing procedures, become an information base for all kinds of work and analyses in this field.

15. Taking into account a data users's needs, every year author and the unit, which conduct and bear responsibility for the realisation of the given survey in the organisational structure of the Central Statistical Office (CSO), can verify and modify the information scope of the reporting form. It is done after consultations with experts from the Ministry of Environmental Protection, Natural Resources and Forestry, the Institute of Environment Protection and the Institute of Meteorology and Water Management. The above institutions assist the Central Statistical Office (CSO) in the realisation of the surveys in question.

16. It should be noted that CSO makes use of the categories and definitions of the ECE Standard Statistical Classification of Water Use while elaborating projects of their statistical surveys on water.

17. While introducing some changes or improvement on the reporting form it must be done in such a way in order to maintain the continuity of the data gathered in the reporting form in a given year with regard to previous years in order to be able to compare them.

18. It should be borne in mind that since the year 1998 data have been collected by making use of amended reporting forms OS-3 and OS-5. Among other things, the information scope of the reporting form OS-3 was extended with new chapter concerning data on quantity and quality of saline mine waters as well as kinds of their management.

19. Taking into account all those limitations and some assumptions of statistical surveys, information obtained from those surveys regarding: water withdrawal, industrial quantity and quality of waste water concerns:

- organisational entities making payments for the annual withdrawal of 5000 m^3 or more of underground water, or 20000 m^3 or more of surface water from their own sources, or discharging 20000 m^3 or more of waste water annually;

- agriculture and forest organisational entities consuming water for irrigating agriculture or forest land of 20 ha or more in area, and for the purpose of exploiting fishponds of 10 ha or more in area;

- companies and plants supply water established by the voivod and managed by local self-governments.

20. As a country which is a member of the OECD and which has a real chance to join the European Union, it is very important for Poland to meet the requirements and standards of environmental protection which are mandatory in this community. In that context an adjustment of Polish statistics to international standards and requirements of the European Union has appeared to be an extremely important and urgent task.

21. The basic and primary document including the tasks and obligations in the field of statistics is EUROSTAT'S guidelines "Statistical Requirements Compendium". According to the last edition of this document issued in 1998, "1998 Joint OECD/EUROSTAT Questionnaire on the State of the Environment" constitutes the basic tool of ecological information and establishes standard information source of the domain discussed. Within the framework of this questionnaire, data on freshwater resources, their use and pollution are collected in the section "Inland waters". This section contains about 467 statistical variables. Level of the possibility of filling in this questionnaire for Poland in 1998 has been estimated at about 70 %, which is comparable to indices defined for the OECD and EU countries.

22. The legal basis for conducting of Polish statistics are defined in the Law on official statistics issued in June 1995. This legal act is fully consistent with the statistical standards binding in the European Union. Screening in the area of statistics, which was held in Brussels in July 1998, indicated a high level of adaptation of Polish statistics to the EU rules.

23. In the light of the last assessments and analyses, statistical surveys concerning water use conducted in Poland are classified among a group of surveys adjusted to the EU demands in general. The information base which characterises water and waste water management is extensive and comparable to the statistical data of the OECD and EU countries. They only require supplements and improvements in the scope of statistical variables specified in the mentioned questionnaire. For example, some kinds of modification and harmonisation in the Polish statistics on water pertaining degree of waste water treatment will be required.

24. Taking into account this aspects, CSO has still been working on adjusting this component of environment statistics to the requirements and directives of the OECD and EUROSTAT.

IV. Pressure on water resources

25. According to assumptions of the above paper, presentation of the most recent statistics on water use was organised under the five main topics:

- water abstraction,
- sources of surface water pollution,
- waste waters,
- waste water treatment plants,
- mine waters.

IV.1. Water abstraction

26. Surface water resources are of basic significance for water supplies to the national economy in Poland. Water withdrawn from rivers and lakes covers more than 80 % of the needs of the national economy.

27. Underground water resources are allocated above all for good quality drinking water supplies to the population. The law requires that their consumption should be rationalised and bans its use for industrial purposes unless it is warranted by technological requirements (e.g., the pharmaceutical industry, food production etc.).

28. The registered water withdrawal to meet the needs of the national economy in 1998 was 11,3 billion m^3, including 9,6 billion m^3 of withdrawn surface waters 1,6 billion m^3 of underground waters and more than 0,1 billion m^3 of recovered waters from mine drainage systems.

29. The withdrawn water was used by:

- industry 8125 million m^3 (71,8%),
- municipal economy 2189 million m^3 (19,4%),
- agriculture and forestry 999 million m^3 (8,8%).

30. The demand of the municipal and domestic sector is covered to the extent of at least 57 % by underground waters. In fact, this share is much greater, since it is also necessary to consider the water withdrawal from individual wells which is not covered by public statistics.

31. Compared with the situation in 1990 the now registered water consumption in the economy is much lower. The water consumption drop has been observed in all the sectors of the economy, including:

- in industry by 15 %,
- in municipal economy by 27 %,
- for irrigation in agriculture and forestry and for filling up fish ponds by 41 %.

32. The reduction in water consumption was significantly affected by changes in the volume and structure of industrial production, the closing of water cycle systems, the adjustment of water withdrawal charges and operating rates in the municipal economy, in parallel with the mass-scale introduction of water meters for individual users, and the liquidation of large state-owned farming complexes. It should be noted, however, that following a period of a radical reduction in water demand, to be observed at the turn of the past and present decades, since 1995 the withdrawal for industrial purposes has again been noted to grow, although its rate is distinctly lower than the production growth rate.

Table 1. Water withdrawal in 1998 by source and by sector

Specification	Quantity of waters	
	(million m^3)	**(%)**
Total	11313,4	100,0
Surface water	9612,5	85,0
Underground water	1557,0	13,7
Mine waters	143,7	1,3
• Industry (for manufacturing processes)	8125,2	100,0
• Surface waters	7665,4	94,3
• Underground waters	316,1	3,9
• Mine waters	143,7	1,8
• Irrigation in agriculture, forestry and filling fish ponds	999,2	100,0
• Surface waters	999,2	100,0
• Water supply systems	2189,0	100,0
• Surface waters	948,0	43,3
• Underground waters	1240,9	56,7

33. In the field of rationalisation of water consumption, a substantial progress has been achieved, although the situation is unsatisfactory yet. E.g., a very loss is registered in municipal water supply systems, reaching 1/4 of total water distribution. It is very likely that in fact this indicator is even higher. Considerable water losses also occur in households, where general habits of saving water are still absent, water-consuming household appliances are used or so are leaking sanitary systems. The increasingly meters helps prepare the balance of the real level of water use, and thus identify and reduce losses.

34. Examples of irrational water use can also be found in industry. Slightly more than 43 % plants which use water for production purposes have closed cycles (mostly of cooling water) holding about 4,5 % of water withdrawn.

35. Industry is by far the largest water user, particularly the production of electricity sector. In 1998, water used by electricity production facilities accounted for 86 % of the total national water withdrawal for industrial purposes. It was above all water withdrawn for supplying open cooling cycles.

IV.2. Sources of surface water pollution

36. The economic development, especially: the growth of industrial production, intensification of agriculture and concentration of population in large urban agglomerations brought new types of pressure on aqueous ecosystems, of purely anthropogenic nature. At present the quality of surface waters is above all determined by very often specific chemical and microbiological pollutants coming from point, area and linear sources related to man’s economic activity and living.

37. Pollutants released from point sources should be understood to mean waste water discharged in an organised way through sewage systems. The major point waste water sources include:

- municipal sources, i.e., urban and rural sewage systems discharging as a rule a mixture of waste water from households and industrial plants connected to the urban sewage systems,

- industrial sources, i.e., plants discharging waste water directly into waters through their own sewage systems.

38. In Poland the basic point sources of man-made surface water pollution still remain industrial plants and larger concentration of population which discharge waste water into receiving bodies through sewage systems.

IV.3. Waste waters

39. In 1998 the quantity of waste water registered in the public statistical system as discharged into surface waters from point pollution sources was 9,8 billion m^3, including 2,8 billion m^3 of waste water requiring treatment. Total waste water quantity accounted for more than 87 % of water withdrawn for economic purposes. Direct discharges from industrial plants (including cooling waters and polluted mine waters) accounted for 83,2 % of total waste water, i.e., 8,2 billion m^3, and sewage systems represented 16,8 %, i.e., 1,7 billion m^3.

40. In industrial waste water there is a significant share (about 86 %) of so-called „arbitrarily clean" cooling water, which for the substantial part does not need to be treated by biological methods, although they may contain some amounts of suspended solids, mineral oils and even sometimes biocides. The other waste waters discharged from industrial sources and practically the whole of sewage from municipal management belong to the category of waste water requiring treatment. This means that about 59,1 % of total waste water requiring treatment comes from municipal systems, with the other 40,9 % discharged from industrial plants.

41. In 1990-1998 the quantity of municipal sewage discharged into surface waters fell from 2,3 billion m^3/year in 1990 to 1,7 billion m^3/year in 1998, i.e., by 28,4 % while the quantity of industrial waste waters requiring treatment dropped from 1,8 billion m^3/year in 1990 to 1,2 billion m^3/year in 1998, i.e., by 36,4 %. This was above all a result of rationalisation of water use both for production purposes and in households as induced by legal and economic instruments applied (fees, fines and more efficient inspections). It was especially the adjustment of charge levels that made water users more interested in applying water-saving technological solutions and sometimes in simply reducing water squandering. Rationalisation of water consumption is also favoured by the expansion of measurements of its consumption, the introduction closed cycles etc.

42. At the same time, the quantity of treated waste water grows systematically. Out of the total quantity of waste water requiring treatment (without cooling water), almost 85 % already goes to treatment plants. 79 % municipal waste water undergoes treatment and so does 93 % of industrial wastewater. In 1998 about 35 % waste waters requiring treatment were treated by biological methods and about 12 % underwent treatment by advanced technology, i.e. with increased biogen removal[2] system. Share of treated waste waters by mechanical methods is still significant – 33 %. It should be emphasised that not all industrial sewage requires to be treated by

[2] Occurs in treatment plants with highly efficient treatment technologies (mostly biological, and also chemical) allowing for an increased reduction in nitrogen and phosphorus content. According to ECE Standard Statistical Classification of Water Use, this type of waste water treatment belongs to the category of advanced treatment technology (including waste waters treated by chemical methods).

biological methods. An example of this may be polluted waters from drained mine workings which account for about 30 % of all industrial sewage requiring treatment.

Table 2. Consolidated balance of municipal and industrial waste waters discharged into surface waters in 1998

Specification	Quantity of waste waters	
	(million m^3)	**(%)**
Total including:	9843,5	100,0
• municipal waste water	1655,5	16,8
• industrial waste water	8188,0	83,2
• including cooling water (arbitrarily clean)	7041,8	71,5
Waste water requiring treatment	2801,9	100,0
including:		
waste water treated:	2377,7	84,9
• mechanically	926,6	33,1
• chemically	142,5	5,1
• biologically	980,3	35,0
• with increased biogen removal	328,2	11,7
untreated waste water	424,2	15,1
• from industrial plants	80,1	2,9
• from sewage systems	344,1	12,3

IV.4. Waste water treatment plants

43. According to the 1998 statistical surveys 3621 municipal and industrial waste water treatment plants were in operation in Poland, including:

- 1923 municipal waste water treatment plants covered by the public statistical system as treatment plants managed by enterprises and waterworks, water companies, local governments, housing co-operatives and work places provided that they treated municipal sewage supplied from sewage systems,

- 1698 industrial waste water treatment plants.

In addition to that, about 1300 small waste water treatment plants at farms were also in operation this year.

44. The facilities in operation in 1998 (1923) which were assigned to the category of municipal sewage treatment plants in the public statistical system had the total capacity of about 9,1 million m^3/day. Almost 79 % of

municipal waste water treatment plants apply biological methods and another 13 % are equipped with increased biogen removal systems.

45. The treatment capacity of more than 56 % of these facilities fall within the range of 50-1000 m^3/day and of another 20 % within 1000-10 000 m^3/day. Thus, they are small and medium-sized facilities, which are able at their maximum capacities to serve settlements with an equivalent number of inhabitants (inhabitant equivalents - I.E.) not exceeding 40 000-50 000 I.E.

46. As of 1998 there are waste water treatment plants in 745 towns (with the total number of 913 facilities). Since 1990 the number of facilities of this type in operation in towns has grown by more than 61 %. This is significant progress, although still 130 towns discharge practically untreated waste waters, including 3 with more than 100 000 inhabitants: Grudzi¹dz, Kalisz and Zielona Góra.

47. It should be borne in mind that a number of cities (with more than 100 000 inhabitants) treat only part of their waste waters. A spectacular example in this respect is Warsaw which treated 81,2 million m^3/year of waste water out of the total quantity of 173,9 million m^3/year (as of 1998). This means that about 54 % municipal waste waters are not treated in Warsaw (92,7 million m^3). The number of waste water treatment plants in cities (≥100000) has not grown significantly in recent years.

48. 1759 industrial plants had industrial waste water plants with the total capacity of 7,7 million m^3/day. The majority of industrial waste water (about 67 %) is treated mechanically; almost 19 % - biologically, 13 % - chemically and 1 % with increased biogen removal.

49. The growing number of municipal and industrial treatment plants which use biological and advanced technology ensures better effects of sewage treatment. It is estimated that at present about 52 % of treated waste water is characterised by BOD and COD reduction indicators greater than 60 %.

50. In order to better illustrate use of water resources in Poland it might be interesting to present indicators on national population connected to waste water treatment plants. In 1998 about 49 % of total population was served by waste water treatment plants (in town - 75 %, in the country, where live 38 % of total population, only – 7 %).

51. The emergence of sewage sludge in the course of sewage treatment is an important problem which has not been fully solved to date. In 1998, about 1282 thous. tons of sludge (dry mass) were generated in municipal and industrial waste water treatment plants, out of which 42 % was used for economic purposes and 55 % was stored, in most cases on the site of the treatment plant.

IV.5. Mine waters – water salinity

52. The mining sector, especially mines of power raw materials, non ferrous metal ores and minerals used in the chemical industry, is a source of mine waters, part of which are badly polluted. In addition to suspended solids, they contain large loads of chlorides and sulphates. It should be emphasised that in Poland more than 70 % of electric energy demand is covered by hard and brown coal.

53. River water salinity, particularly in Oder and Vistula Rivers, and in some their tributaries, is an essential, characteristic in Poland, element of

environmental pollution, limiting or even making impossible the economic use of these resources in some regions of the country, and also causing damage in both the environment and technical infrastructure.

54. Water salinity results primarily from mining, mainly from hard-cool mines, where water from dewatering of mine workings is pumped out to the surface. The drainage water is discharged to receiving bodies by almost 70 hard coal mines. Difficult situation in this regard is additionally intensified by the fact, that salinity sources are situated in Oder and Vistula upper watercourse sections, and that the present deficit in coal extraction, even apart from the cost of counteraction against water salinity, does not indicate any soon solution of this problem.

55. Salinity condition of main rivers in Poland can be improved only in case of applying of desalination (pumping out) technology of saline waters, or by means of closing down of the part of mines, those which discharge the largest chloride and sulphate loads, including also operation shutdown of their dewatering systems.

56. According to results of the statistical surveys, in 1998 about 150 million m^3 saline mine waters were pumped out from mines and quarries. About 10 million m^3 out of those waters are strong-saline waters, and 140 million m^3 out of those waters are mean-saline waters.

57. Saline mine waters are understood as waters with concentration of chlorides and sulphates more than 1800 mg/dm^3. They can be mean-saline waters with $Cl^- + SO_4^{2-}$ concentration between 1800 mg/dm^3 – 42000 mg/dm^3 or strong-saline waters with $Cl^- + SO_4^{2-}$ concentration exceeded 42000 mg/dm^3.

58. Saline mine waters in 1998 account for about 13 % of industrial waste waters requiring treatment. During this year about 118,5 million m^3 of saline mine waters was discharged directly from mines into receiving bodies, causing locally a substantial increase in salinity of surface waters. About 6,5 % of those waters are strong-saline waters with degree of salinity more than 42000 mg/dm^3.

59. Total loads of chlorides and sulphates discharged into Polish surface waters in 1998 was estimated at 1171 thousand tons.

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