



The Quantity and Quality of Wastewater in the Municipality of Prizren-Kosova

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Abstract: The purpose of this study is the identification of the current state of sewerage network in the Prizren Municipality and investigation of the quantity and quality of wastewaters prior to discharge in Lumbardhi River. This is done in order to enable location of various points for the installation of facilities which shall be used for wastewater treatment in this municipality (Kico & Kittelberger, 2002). The definition of wastewaters, their quality, and the percentage of citizens with access to sewerage network are some of the essential parameters for projecting the quantity of facilities and proposing the adequate methods and technology for the treatment of the wastewaters. In order to achieve at the definition of these determining parameters for analyses, three sample points have been chosen for sample taking in the municipality of Prizren: Zone 1. The area of the southern basin in the new pipe installed DN 1000/DN 1200 the main collector along the main road to Landovica, Zone 2. The Old Town in the left bank of the river and Zone 3. The centre of the city in the main network on the right bank of the river Lumbardhi. The results taken from these points are compared with European standards of parameters to determine the pollution level of the wastewaters prior their discharge to the river (Kico & Kittelberger, 2002).

Key words: Wastewater, wastewater treatment, treatment facilities

Introduction

The treatment of the wastewater prior their discharge in the water of Kosovo from the aspect of pollution level, and the compliance with the national and international law obligations need to have a serious approach. The requirement for a serious approach is further enhanced by the significance and necessarily of this case for the governing and scientific institution of Kosovo.

In this phase of political development, the treatment of wastewaters in Kosovo in conformity with the requirement for a level of sanitation defined by the European Union standards and the water law of Kosovo will be one of the more serious standards to be fulfilled, as a condition for integration in regional and international levels.

Our resolve to start with the research on the quality of discharging waters from the sewerage network system, with particular emphasis in the Municipality of Prizren will be only a beginning of the contribution greatly needed in this field. The assessment of the parameters given below which are to be achieved and an assessment of the quantity and the pollution level of wastewaters in the Municipality of Prizren is a precondition to define the locations and methods of wastewater treatment. The assessments of parameters important to achieve the objectives of the study are:

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The assessment of the quantity of maximally collected external waters as well as the assessment of the locations of inflows and the identification of these waters. The calculation (assessment) of access level in the sewerage system according to the daily measures of the flow in the sewerage network and the pollution load assessment. The assessment of general physical/chemical characteristics of polluted waters in relation to the impact in the environment and the proposal for facilities and methods of treatment in conformity to the flow and the level of pollution of wastewaters prior to their discharge in the river. The estimate of the pollution level for the population, and comparison of results with the level of pollution per capita with the standards of Southeastern European countries. Analytic measurement results will be used to study the definition of necessary rehabilitation works of the existing sewerage network, and will serve as basic parameters for projecting the facilities for new sewerage and the equipment for treatment of wastewater in the Municipality of Prizren and the surrounding area.

Materials and Methods

To achieve the goal of the study, the following methodology of sample analysis is used:

The identification of 3 representative pilot zones for taking the samples and to analyze the defined parameters of the wastewaters; The implementation of continuous flow measurement for at least 48 hours in the exit point of the sewerage network of each zone.

Constant taking of water samples for analysis for 2 x 24 hours in each pilot zone with a 24 hour average preparation of proportional samples, with the measured flow of the wastewaters.

The daily total flow calculation of each pilot zone, the external water flow (based on the minimal flow during the night) and the flow of the wastewaters,

In each zone, the implementation of the measurement campaign control in the sewerage network shall be carried out in order to identify the main inflows of the external waters.

Calculation of access level according to the measured water flow and the level of pollution.

Comparison of the discharge level of pollution in municipalities per capita with the values of southeastern European countries as a basis for the quantity and projection of the wastewater treatment facilities.

The calculation of characteristic flow values

The calculation of sewage waters is made with the following formula (Buck & Bank, 1995);

$$Q_s = Q_t - Q_e \quad (1)$$

Where; Q_t is the daily total flow of wastewaters, average flow per hour, Q_e the flow of external water, minimal flow during the night and Q_s the flow of sewage water. Based on the flow measurements and their analysis, the characteristic flow values will be evaluated for each measurement point. The external water flow will be evaluated based on the minimum flow during the night according to the analysis of the samples for the minimal night flow. For this purpose the following parameters of the wastewaters are analyzed below: Ammonia (NH_4^+) and the chemical expenditure of Oxygen. The ammonia is considered as representative of water pollution in the household waters.

To achieve the measurement of the total external water flow which inflows in the sewerage network in each pilot zone, surveys have been carried out in order to locate and define the origin of the main inflow of external water.

Defining of the level of access according to the flow of sewerage

The calculated flow of wastewaters (Q_s) of each zone will be compared with theoretical estimates of polluted waters according to the consumption of drinking water, in order to calculate the level of access of the households located in the pilot zones to the sewerage network. The calculation of the population with access will be done according to the specific

consumption of the drinking water from 158 (L/p/d); (the evaluation of assets for Prizren–Final Report, July 2004, RODECO)

Areas chosen for analysis; Pilot zones

For analysis three points are chosen for sample taking in the city of Prizren.

Zone 1: The zone of southern basin (pond) in the new pipe installed DN 1000/DN 1200 the main collector along the main road to Landovica,

Zone 2: The Old City on the left bank of the river and

Zone 3: The main sewerage pipeline at the center of the city, on the right bank of the River Lumbardhi (Figure 1).

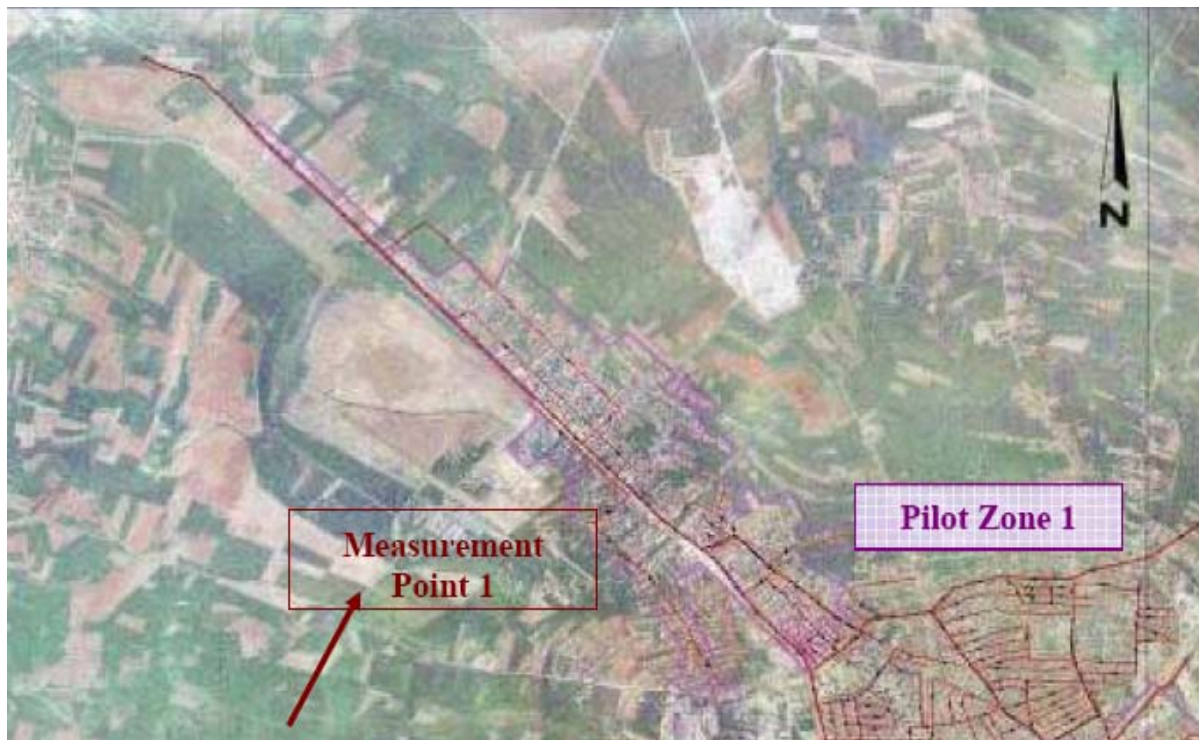


Figure 1. A view of zone 1 of Prizren where the measurement of the flow and the analysis of physical–chemical parameters have been done.

Flow measurement

The flow measurements of the wastewaters have been made using measurement equipment for water flow MAINSTREAM specially developed for continuous measurement of the flow in the open sewers and partially filled pipes. This equipment combines the measurement of the water level (sounds under pressure) and the measurement of velocity using ultrasonic waves (Doppler effect). The measurement of the water level is used for calculating the wet surface of the cross section which in combination with the velocity measurement allows obtaining directly the values of the flow. Main advantage of this kind flow measurement is that it does not require having any temporary construction work such as dams for example. The measurement equipment consists of the following components;

Measurement sounds; Two separate sounds, one for the level of the water and the other for the velocity of the water flow. The measurement sounds are fixed with a nut in a metallic circle which do not get rusted and are fixed at the end of the pipe.



Figure 2: Equipment for water flow measurement at the sewerage in zone 1

Data loader; which saves the data until they are stored to the PC

Rechargeable battery 12V:- the supply with energy of the sound and the data loader equipment is made from the rechargeable battery (Figure 2).

Results

The results of the flow measurements during all the period of measurement in each point are shown in the Figure 3.

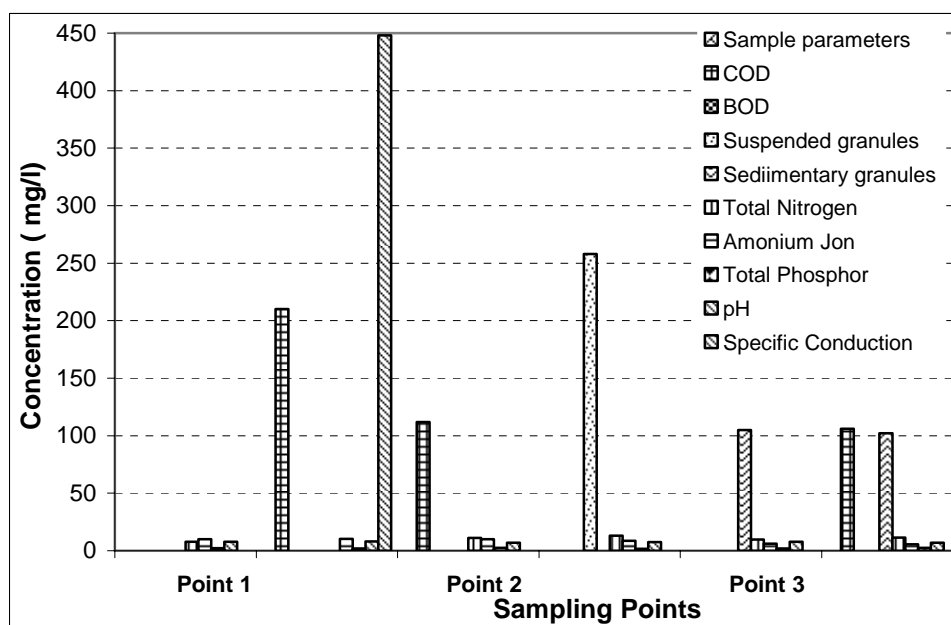


Figure 3. Graphical presentation of polluting parameters in different points for the dates 18-19.10.2005 from the Laboratory IHMK

The total flow measured is 4.034 m³/d for the first sampling with minimum night flow from 31,8 L/s and 3.076 m³/d and with the minimum night flow for the second sampling from 25,0 L/s. except for the two measured precipitations, the flow during drought changes between 28,0 (minimal night flow) and 90,0 L/s. In this measuring point it has been noticed that there was a sudden increase and decrease of flow of around 20 L/s, between 06:30 and 20:00 (during working hours) so that these extremes could be seen as industrial activities. After the survey it was noticed that a concrete factory is connected to the sewerage network. This factory takes the water from its well to wash the gravel with a flow 20 L/s. Observed flows correspond with

working hours during the time of washing the gravel. The connection of this factory in the sewerage system explains also the presence of the big concentration of floating particles in the samples taken in this measuring point.

The analysis of wastewaters in the sewerage system

Since there is lack of capacities needed, local laboratories and especially analyses of waters from the sewerage, we have contacted the Laboratory for environmental analysis in Radstatt in Germany, a certified laboratory. The samples were taken from 18 October, 20:00 to 20 October 21:00. Physical-Chemical parameters were analyzed in each 24 hour sample of the wastewaters (6 samples): The chemical expenditure of Oxygen (COD), The Biochemical expenditure of Oxygen (BOD), Suspended particles (GS), N-Kjeldahl (TKN) = $N_{org} + NH_4^+$, Ammonium Ion (NH_4^+), total phosphorus (P-tot) and the pH value.

Moreover, in each sample that corresponded to the minimal night flow, these parameters have also been analyzed: The chemical expenditure of Oxygen (COD) and Ammonium Ion (NH_4^+). The measurement of the minimal night flow has been carried out in order to assess the dilution level of external waters (Table 1 and Figure 3).

Table 1. Presentation of polluting parameters in different points for the dates 18-19.10.2006 from the Laboratory IHMK

Parameters	Symbols	Unit	Point 1 18-19 October	19-20 October	Point 2	19-20. October	Point 3 18-19 October	19-20 October
Mixed samples in 24 hours								
Chemical expenditure of Oxygen	COD	mg O ₂ /l	183.0	210.00	112.00	94.5	103.6	106.00
Biochemical expenditure of Oxygen	BOD	mg O ₂ /l	32.6	35.6	32.3	47.8	29.54	34.6
Suspended particles	GS	mg /l	242.8	320.6	245.8	258.00	282.32	311.1
Precipitated particles	GF	mg /l	84.5	81.45	65.5	99.6	105.00	102.00
Total Nitrogen	N _{tot}	mg N/l	7.85	20.34	11.20	13.20	9.82	11.50
Ammonium Ion	NH ₄ [*]	mg N/l	9.97	10.40	9.99	8.60	5.99	5.59
Total phosphor	P-tot	mg P/l	2.27	2.07	2.48	1.76	1.98	2.54
pH			7.76	8.06	6.97	7.65	7.73	6.87
Specific conductivity		μS/cm	432.32	448	532.2	487.32	457.76	505.34
The samples of minimal night flow								
Biochemical expenditure of Oxygen	BOD	mg O ₂ /l	39.4	45.4	41.4	37.7	34.6	42.2
Ammonium Ion	NH ₄ [*]	mg N ₂ /l	8.65	9.05	9.50	4.76	6.90	3.48
Report BOD/COD			0.18	0.17	0.29	0.50	0.32	0.27
Report COD/ BOD			5.61	5.87	3.40	1.99	3.16	2.93

Discussion and Conclusion

In comparison to the usual values of the concentration of defining parameters for the urban wastewaters, the values attained from the results taken during the measurement are obviously lower, as a result of reduction of the external waters: The ratio of *BOD /COD* is extremely low (0.17 to 0.50), when it is compared with the “normal” values of the *BOD /COD* ration for urban wastewaters, which oscillates around the value of 0.6. As for COD, the analyzed samples of the minimum night flow are less concentrated than the mixed 24 hour samples, which clearly show the connection of the external water to the sewerage network. Among the 24 hour samples there is no significant change in the results of defining parameters

of the pollution level. The results of analyses between German and Kosovar laboratories are quite similar.

In comparing to usual values of European Union on the concentration of determining parameters in the wastewater pollution levels in the urban sewerage network, the concentration of wastewaters in the sewerage network system of the city of Prizren is very low, as a result of collection all the waters in the same pipe of sewerage, that is, external waters.

According to the results taken, the ratio of BOD/COD; varies in the values from 0.17 to 0.50. These ratios of BOD/COD are very low for urban wastewaters when compared to normal values of the ratio of BOD/COD which is (0.6) in the developed European Union.

The analysis has been made in the laboratory of the Hydrometeorology Institute of Kosovo and the laboratory for medical analyses from the city of Radstatt in Germany.

From the results of the analyses obtained these basic conclusions can be pointed out:

Compared with usual values of concentration of defining parameters for the sewerage network of urban wastewaters, concentration of water parameters of the sewage of the municipality of Prizren are very low as a result of dilution through external waters, for example:

<i>COD</i> : Measured Values (g/L)	95.0 - 210,	Usual Values (g/L)	600 mg/l
<i>BOD</i> Measured Values (g/L)	21.2 - 476	Usual Values	300 mg/L
<i>Total N</i> : Measured Values (g/L)	6.59 - 20.50,	Usual Values	55 mg/L
<i>P-tot</i> Measured Values (g/L)	19,0 - 2.84,	Usual Values	12.5 mg/L

The report BOD/COD; (0.17 to 0.50) of our measurements is extremely low for urban waters if compared with "normal" value from (0.6). This is probably because of the conserving conditions and the delay between the sampling and the analyzing. As for COD, the samples of minimum during the night are less concentrated than mixed 24 hour samples which clearly show the connection between the external waters in the sewerage network. There is no big discrepancy between two 24 hour samples.

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