

# ENVIRONMENTAL ASSESSMENT OF THE WASTEWATER TREATMENT PLANTS IN ALBANIA, USING THE BIOLOGICAL TREATMENT AS THE SECONDARY TREATMENT DURING OPERATIONAL PHASE

## CASE STUDY: POGRADECI WWTP

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### INTRODUCTION

Wastewater treatment plants (WWTP) are built in almost all the major cities of Albania, as an urgent need for public health safety and clean environment. Nowadays, Albania has 16 WWTP in function, 5 WWTP in construction phase, 2 WWTP in reconstruction phase, and 11 WWTP in the phase of design and feasibility study. The WWTPs in operation in Albania use as main treatment method, the biological one.

### METHODOLOGY

#### Case study: Pogradeci Wastewater treatment plant

Waste Water Treatment Plant (WWTP) of Pogradeci which is a touristic city, is lying near Ohrid Lake, one of the Europe's deepest and oldest lakes, which was declared a World Heritage site by UNESCO in 1979. This WWTP is serving with waste water treatment an urban population of 50,000 residents, which is going to cover with his service also the rural area with a number of 75,000 inhabitants approximately in the III phase. (Fig. 1).

The treatment capacity of WWTP is 1,68 million m<sup>3</sup>/year. The waste water treatment process is based on biological treatment using technology of trickling filter, polyethylene construction, resistant of UV, with a diameter of 23 m and depth of 4 m (Fig.2). Flow at the inlet of WWTP is about 38 l/s, which enters in the treatment plant through a pumping station in a distance of 2 km from this plant. The current surface of WWTP is approximately 13.5 ha .

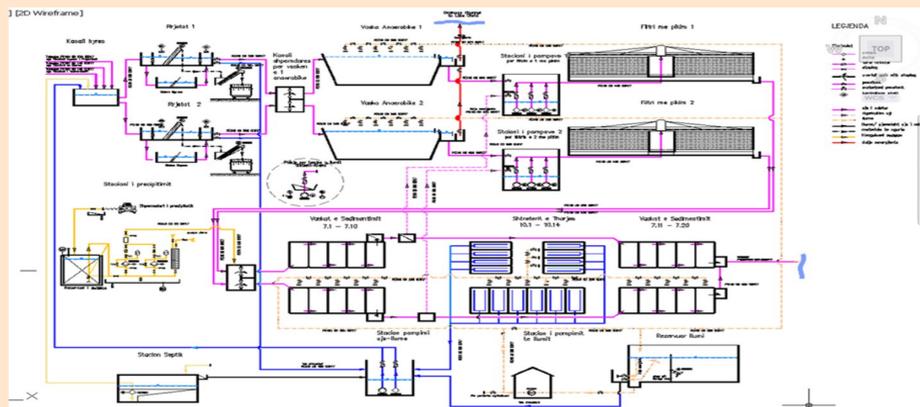


Fig. 1 Scheme of Pogradeci WWTP with the extension phase



Fig. 2 Trickling filter of Pogradeci WWTP (photo credit by author)



Fig. 3 Ponds used for sedimentation and treatments of N and P (photo credit by author)

Pogradeci WWTP is using for N removal a step by step process with ponds which occupy a total area of 8.5 ha, which before the construction of the waste water treatment plant was used for fish cultivation (Fig.3).

#### Environmental Assessment of the Wastewater Treatment Plants and sample analysis

Environmental Assessment is based on:

- the efficiency of the wastewater treatment plant
- water quality of Ohrid lake
- environmental impact of the nearby population.

Water quality is assessed based on the WWTP laboratory analyses. The WWTP laboratory is measuring these parameters: BOD, COD, SS, PO<sub>4</sub>-P, NH<sub>4</sub>-N, NO<sub>3</sub>-N, P total. BOD, COD and SS are measured once a week, while the other parameters every day. Samples are collected in the same point, at the same depth, and in the same way. Samples collection:

simple analyses: only one sample in short time.

qualify analyses: 5 samples every 2 hours and with a time distance 2 min from each other.

complex analyses: some or many samples, mixed with each other in time from 2 to 24 hours.

Ohrid Lake because of its depth is under the stratification phenomenon. The measure parameters are from two monitoring points, the first one is at a reference station 150 m depth and the samples are taken in 8 different depth from the surface to the end of the lake, respectively 0, 20, 40, 60, 80, 100, 120, 150 m, and the second station (littoral) is 200 m from the lake side, above 5 m depth.

### RESULTS AND DISCUSSION

Pogradeci WWTP is using as the secondary treatment the method of trickling filter, the biological treatment.

The advantage of this method is that the treatment efficiency is 90% compare to other methods.

Tab 1, presents the result of the laboratory analyses for water quality during the year 2021. The results show a very high efficiency of the treatment. BOD is reduced in 92.135 %, COD is reduced in 87.50%. Tab 2, presents the result of the laboratory analyses for water quality during august 2022. The results show also a very high efficiency of the treatment. BOD is reduced in 93.57 %, COD is reduced in 93.46 %. The values of water after treatment are below the standards (Tab. 3).

Tab. 1 Laboratory analyses of water quality, Year 2021. (Source: Laboratory of Pogradeci WWTP)

Average Value	Influent Flow		Concentration of WWTP Influent							Concentration of WWTP Outlet							Efficiency	
	Pump 1,2	COD	BOD	COD	BOD	COD/BOD	NH <sub>4</sub> -N	PO <sub>4</sub> -P	P <sub>total</sub>	COD	BOD	NH <sub>4</sub> -N	NO <sub>3</sub> -N	PO <sub>4</sub> -P	P <sub>total</sub>	COD	BOD	
	m <sup>3</sup> /d	kg/d	kg/d	mg/l	mg/l		mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	%	%	
January	4,262.00	1,542.48	851.65	285	156.5	1.83	17.5	2.92	3.82	28.1	15.53	4.075	8.195	3.39	3.58	86.255	89.584	
February	5,563.50	1,540.11	916.189	277	162.65	1.7	13.5	3.64	3.86	21.45	10.58	3.9	7.98	3.35	2.66	90.43	93.156	
March	6,371.50	1,849.25	896.257	290	140.67	2.06	15.25	3.19	5.58	19.98	7.93	4.05	9.54	3.83	2.53	87.05	94.15	
April	5,730.90	1,264.45	815.220	220.6	142.25	1.55	12.7	4.46	3.63	22.73	9.875	3.82	8.15	3.93	3.05	88.73	92.994	
May	5,858.80	1,277.115	589.768	218	153.50	1.42	9.55	4.64	4.06	25.06	14.60	4.55	8.56	3.17	3.87	87.48	89.84	
June	5,098.00	1,301.74	717.543	255	140.75	1.81	12.45	4.14	3.88	28.41	12.4	4.05	7.88	4.16	3.46	88.03	90.964	
July	2,994.00	1,301.97	886.774	285	194	1.46	17.75	3.64	4.59	28.1	11.27	5.215	11.65	3.02	3.97	87.17	93.728	
August	5,455.00	1,338.01	810.5411	287	171	1.67	17.15	3.44	4.51	34.68	14.63	4.60	12.75	2.87	4.77	83.70	90.053	
September	4,133.00	1,612.18	742.017	391	179	2.17	18.66	2.74	5.25	35.53	13.43	5.25	9.60	3.55	4.27	89.12	90.193	
October	4,137.00	1,204.33	887.386	291	214.5	1.35	15.55	2.66	4.47	31.15	12.1	4.07	11.25	3.02	4.09	86.98	93.995	
November	4,283.00	1,342.86	109.430	360	255.50	1.4	15.85	3.36	7.08	32.329	10.70	6	11.40	2.67	3.61	89.38	95.547	
December	3,746.00	930.881	930	383	248.5	1.54	14.5	0.96	6.97	55.6	12.5	8.65	8.765	1.82	4.05	85.75	91.41	
Average value /year	4,802.79	1,316.53	843,211	295	179.86	1.64	15.08	3.31	4.73	30.26	12.96	4.833	9.643	3.23	3.6658	87.50	92.135	

Tab 2. Laboratory analyses of water quality, August 2022. (Source: Laboratory of WWTP Pogradeci).

Average Value	Influent Flow		Parameters of WWTP Influent							Parameters of WWTP Outlet							Efficiency	
	Pump 1,2 m <sup>3</sup> /d	COD	BOD	COD	BOD	COD/BOD	NH <sub>4</sub> -N	PO <sub>4</sub> -P	P <sub>total</sub>	COD	BOD	NH <sub>4</sub> -N	NO <sub>3</sub> -N	PO <sub>4</sub> -P	P <sub>total</sub>	COD	BOD	
	kg/d	kg/d	mg/l	mg/l		mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	%	%	
August 2022	4,610	2,245.98	1,306	492	286	1.7	19.8	3.76	3.81	32.2	18.4	6.7	9.243	3.06	4.37	93.46	93.57	

Tab 3. Norms of discharges liquids to Albania (source DoCM no 177, dated 31.03.2005 "On the allowed norms of discharges of liquids and zoning criteria for the receiving water environments")

Parameters	Concentration	Efficiency
a) Parameters for water discharges to normal areas		
BOD <sub>5</sub>	25 mg/l	70-90 %
COD	125 mg/l	75%
TSS	35 mg/l ( area with >10.000 inhabitants) 60 mg/l ( 2.000-10.000 inhabitants)	90 % (WWTP for 10.000 inhabitants) 70 (WWTP for 2.000-10.000 inhabitants)
b) Parameters for water discharges to sensitive areas		
P <sub>tot</sub>	2 mg/l/1 (10.000-100.000 inhabitants ) 1 mg/l (>100.000 inhabitants)	80 %
N <sub>tot</sub>	15 mg/l (10.000-100.000 inhabitants) 10 mg/l (>100.000 inhabitants )	70-80 %

Water of Ohrid Lake is saturated with oxygen, the values are 10 – 13 mg O<sub>2</sub>/l [3], during year 2021 and 7.58 –13 mg O<sub>2</sub>/l during 2022 . The water is alkaline pH 7.2- 8.9 and with the high transparency from 5 to 11 m. Water temperature varies from 16 -26 °C. Based on the monitoring parameters from the National Environmental Agency of Albania, waters of Ohrid Lake, are classified as mesotrophic and in Class 1 – Good condition

Tab 4. Water quality of Lake Ohrid (source NEA, 2021)

Parameters	Station one (reference)	Station two (littoral)	Unit
Transparency	11	5	m
COD	4	5.3	mg O <sub>2</sub> /l
BOD <sub>5</sub>	2.6	3	mg O <sub>2</sub> /l
Nitrate	<1	<1	mg N/l
P total	11	11	µg P/l
Chlorophyll a	4.75	2.69	mg/m <sup>3</sup>
Trophic index	45.88	40.29	TSI (Carlson Index)

#### Environmental Impact of the WWTP

Pogradeci WWTP has occupied a large surface as we mention above 13.5 ha. The sludge from the WWTP is treated with ponds and there are no qualitative analyses. The large space for the setup, installation and power supply costs, pungent smell can be considered as a lack for this treatment method as well as negative environmental impact. The air pollution is minimal, but odors can be smell because of the biological treatment, especially anaerobic processes.

### Conclusions

- WWTP are necessary because they treat wastewater before the discharge to the environment. However if the wastewater treatment is inadequate, it can be a source of environmental pollution.
- The biological treatment has its advantages, mainly the low cost, and high efficiency of organic load removal.
- The results of Pogradeci WWTP show a very high efficiency of the treatment. BOD is reduced in 92.135 %, COD is reduced in 87.50%. The sensitive area as consider the Lake Ohrid should treat also the nutrient N, P. The environmental impact of WWTP to the air, soil, landscape, are minimal. The main problem is the sludge disposal.
- Maintenance of the WWTP is proposed as a key measurement to avoid negative impacts to the environment.