WATER QUALITY STATUS IN THE ISHMI RIVER, ALBANIA OVER THE PERIOD 2014-2019 AND PROSPECTIVE TOWARDS THE ACHIEVEMENTS OF EU WFD OBJECTIVES IN ITS BASIN

Erjola Keci[1]
Osman Metalla[2]
Vanela Gjeci[3]

DOI: https://doi.org/10.31410/EMAN.2021.435

Abstract: *The Ishmi River basin, although it is the smallest of the seven watersheds of Albania, is by far the most polluted one. The assessment of water quality monitoring data over the period 2014 – 2019 in the river system shows annual average concentrations above limit values for ammonia, nitrogen dioxide, nitrate and phosphorus.*

The paper presents the key stages of the approach followed to identify waterbody pressures, status and impacts assessment, namely:

- *Identification of driving forces and pressures;*
- *Identification of the significant pressures;*
- *Determination of the consequent status;*
- *Assessment of the impacts; and*
- *Evaluation of the risk of failing to meet the objectives.*

Quantification of pressures, though feasible, requires significant amounts of good quality data, many of which are not currently collected in Albania. Significant improvements in data collection and coordination between competent authorities will be required as part of future measures.

Keywords: *Water quality, EU Water Framework Directive, Monitoring acquis.*

1. INTRODUCTION

The Ishëm is formed from several rivers which arise to the northeast of Tirana in the Skanderbeg Mountains beyond the Krujë range. The most important of these are:

- The Tiranë, which has its source to the northeast of Mount Dajt;
- The Lanë, which rises on the western slopes of Mount Dajt and flows through the city center of Tirana to the south of the Tiranë River in a west direction until it meets it;
- The Tërkuzë, which crosses the Tirana Plain near the Tirana Airport, before it meets the Tiranë River. Once these two rivers join, the river is referred to as the Gjole;
- The Zezë, which arises east of Krujë and meets the Gjole a few kilometers after the Tërkuza.

From the point where the Zeze joins the Gjole, the river is known as the Ishëm. It flows in a west direction until it reaches the edge of the Tirana Plain, then turns to the northwest and discharges into the Adriatic Sea to the southwest of Laç in the Rodon Bay. The total length is 74 km.

[1] Aleksander Moisiu" University, Faculty of Professional Studies, Durres, Albania
[2] Aleksander Moisiu" University, Faculty of Professional Studies, Durres, Albania
[3] National Environment Agency, Tirana, Albania

The drainage basin of the Ishëm covers a total area of 673 km2. The average discharge at the mouth of the river is 20.9 m³/s. The highest annual discharge is over six times the annual minimum.

In 2019 the population living in the basin was estimated by INSTAT – 896,275 people (31 % of the country' total) mainly divided among the Municipalities of Tiranë, Krujë, Vorë, and Kamëz.

In 2019, the annual surface water monitoring programme by the National Environment Agency identified 7 monitoring sites. Results of the monitoring are shown in the Table below (number 1 station being close to the source, number 7 being close to the mouth of the river).

Table 1. Surface monitoring results for the Ishmi River Basin in 2019

River Basin	Monitoring station	Parameter (mg/l)						EQS
		DO	BOD_5	NH_4	NO_2	NO_3	P-Tot	
Ishmi	Salmer Bridge - 7	5,9	13	1,71	0,11	0,5	0,37	V
	Gjola Bridge - 6	5,7	21	2,42	0,09	0,4	0,45	V
	Rinas Bridge - 5	5,6	23	2,7	0,08	0,5	0,59	V
	Kamza Bridge - 4	7	28	3,52	0,05	0,2	0,55	V
	Yrshek - 3	4,1	64	13,2	0,1	0,4	1,49	V
	Lanabregas - 2	8,6	5	0,32	0,04	0,85	0,12	III
	Brari Bridge - 1	8,8	3	0,14	0,011	0,5	0,04	II

Source: NEA 2019, www.akm.gov.al

Table 2 provides the scheme for classification of the physico-chemical quality of rivers applied in Albania, which although distinguishing five classes, labeled from "high" to "bad" – is not yet designed fully in accordance with the requirements of the WFD.

Table 2. The classification scheme for assessment of physico-chemical parameters in rivers

Parameters	**Unit**	**Parameter limit values**				
		High Status (I)	**Good Status (II)**	**Moderate Status (III)**	**Poor Status (IV)**	**Bad Status (V)**
Dissolved O_2	mg/l	>7	>6	>5	>4	<3
BOD_5	mg/l	< 2	< 3,5	< 7	< 18	> 18
pH (acid)			> 6,5	> 6		
pH (alkaline)			< 8,5	< 9		
NH_4	mg/l	<0,05	<0,3	<0,6	<1,5	>1,5
NO_2	mg/l	<0,01	<0,06	<0,12	<0,3	>0,3
NO_3	mg/l	<0,8	<2	<4	<10	>10
PO_4	mg/l	<0,05	<0,10	<0,2	0,5	>0,5
Total-P	mg/l	<0,1	<0,20	<0,4	<1	>1

Available monitoring data and assessment criteria do not yet allow for a comprehensive assessment of the environmental state of water bodies. However, some conclusions can already be made.

In relation to dissolved oxygen, the waters of Ishmi River Basin at the 7 stations are of moderate quality (Class III). There is barely sufficient dissolved oxygen to sustain aquatic life in the water of the Ishmi River Basin from Yrshek to Salmer Bridge. The highest concentration of DO is measured in Brari Bridge with 8.8 mg/l.

NH_4, NO_2, and P-total measured in the river basin are below the EQSs for good status in most of the stations. The levels of NH_4 are of bad quality (Class V) in five stations, namely: Yeshek, Kamza, Rinas, Gjola and Salmer, they are moderate at Lanabregas (Class III) and of good quality in Brari station. The levels of NO_2 are of moderate quality (Class III) in four stations, namely: Yeshek, Rinas, Gjola and Salmer. The levels of P-total are of poor quality (Class IV) at Kamza, Rinas, Gjola, and moderate (Class III) in Salmer.

The levels of BOD_5 concentrations in the Ishmi River exceed the limit of good quality in all stations except for the Brari station. The concentration of BOD_5 indicates chemical and biological pollution and a poor quality of the river that can be attributed to discharges from wastewater, and industrial effluents.

As for No_2, the concentrations are for good quality status in all stations.

To conclude, the measurements indicate a river with generally bad water quality, except the Brari Bridge section, where water is of good quality. **Based on the above results, the status of Ishmi river waters can be classified overall as 'bad' quality (Class V) waters**. The monitoring results indicate the presence of discharges of industrial and urban wastewater and possibly agricultural run-off.

2. METHODOLOGY

The WFD requires the systematic identification of significant pressures on rivers' water quality from point sources of pollution, diffuse sources of pollution, modifications of flow regimes through abstractions or regulation and morphological alterations, as well as any other pressures. 'Significant' means that the pressure contributes to an impact that may result in failing to meet the WFD objective of not having at least 'good status'. In some cases, the pressure from several drivers may in combination be significant.

Conventionally pressures and impacts occur either at diffuse scale or point scale. Diffuse pressures e.g. nitrate pollution from agriculture e.g. over-abstraction of groundwater – may require general environmental policies or management strategies that apply over a wider area (e.g. a sub-basin or aquifer). Conversely, point pressures such as wastewater discharges or hydropower outflows may require specific actions for individual water bodies, although correctly determined and enforced higher-level policies should in theory prevent the need for later remedial specific measures.

The pressures assessment and resultant status are central for understanding and quantifying the gaps between environmental objectives and the current state of water bodies in the river basin. The assessment is necessarily a mixture of analytical and descriptive criteria depending on the level of data available.

Whereas assessment of waterbody status can be a reasonably simple exercise by comparison against standards based on a single analytical sample, assessment of pressures is more complex, because *a)* pressures are typically more diffuse and harder to measure *b)* different pressures combine in complex ways to influence a water body's status.

Urbanization, industrial development, agriculture, energy production, the presence of hot spots, and urban and rural wastewater discharge are regarded as the main sources of pollution.

A useful interim approach is to adopt the standard reporting procedures and codified enumeration lists set out by the WISE guidance [4] [5] which provides an 'overview approach'.

The logic and the methodology behind characterizing water bodies and introducing parameter limit values for classification of ecological status for surface water and chemical status for groundwater is among others intended for making risk assessments. The risk assessment is done to identify surface water bodies at risk of not achieving at least good environmental ecological or chemical status. The methodology is to compare measured parameter values from ongoing monitoring programmes with parameter limit values applied for good environmental or chemical status. In this comparison, the parameter with the lowest quality classification is decisive for the classification of the whole water body.

3. RESULTS AND DISCUSSION

Urban development is a point source of mainly organic pollution that poses particularly intensive pressures on the water resources of the Ishmi river basin.

In 2019 about 759,370 people were connected to a centralized water supply system (84.7% of the basin's population), with a rate of population covered varying from 41% for Vore to 95% of Tirana Municipality (see Table 3). Based on a daily norm of 150 liters per capita the water demand in the basin is estimated at 39 million m^3/y, the highest in the country.

The drinking water supply comes mainly from natural springs and underground water sources, except for the Tirana metropolitan area which gets a portion of its supply from the Bovilla reservoir, which is formed by a dam of the river Tërkuzë.

None of the 4 water utilities operating in the basin manage to provide 24 hours of pressurized water supply service across their entire systems all day and throughout the year. The population compensates for the service discontinuity by purchasing and installing booster pumps and water storage tanks.

Table 3. Water Service Provision in the Ishmi Basin, 2019

Municipality	Population (2019)	WSS Company	Water Supply Coverage (%)	Sewerage Connection Coverage (%)	Population connected to a WWTP (%)
Kamëz	108.864	Kamez UK Sh.A	46,05	99,93	0,0
Krujë	63.357	Kruje UK Sh.A	63,7	37,13	0,0
Tiranë	682.863	Tirane UK Sh.A	95,49	83,8	0,0
Vorë	41.191	Vore UK Sh.A	40,82	34,97	0,0
TOTAL	**896.275**		**84,7%**	**80,2%**	**0,0**

4 The approach adopted in the new template for RBMPs in Albania is to closely align with WISE reporting requirements in terms of feature classes and attributes. This focuses data collection only on what is needed for WISE and EIONET reporting and orientates the NWRC data structures to be broadly aligned with WFD outputs.

5 Water Information System for Europe – WISE GIS Guidance – on the reporting of spatial data to WISE, v 6.0.6, 2016.

All the Municipalities of the Basin have sewerage connections, but none of them has a WWTP. This means that wastewater is collected in public sewers and/or septic tanks and then released into the environment without receiving treatment. The main municipal outfalls have been identified by AMBU (see Table 4).

Table 4. Municipal outfalls, AMBU 2019

Municipality	WSS Company	Municipal Outfall
Kamëz	Kamez UK Sh.A	4 outfall points along the Tiranë River
Krujë	Kruje UK Sh.A	2 outfall points along the Perroi Mzeze branch of the river ishem 1 outfall at Bidrit stream 3 outfall points at Bërdharit stream 1 outfall at Gjolës River
Tiranë	Tirane UK Sh.A	38 outfall points along the Lanë River 1 outfall point at Paskuqanit stream, a branch of Lane River 2 outfall points along the Gjeroskess, a branch of Lane River
Vorë	Vore UK Sh.A	2 outfall points along the Vores stream branch of Lane River

The pollution load deriving from urban wastewaters can be determined (see Table 5) using the following unit values for 1 PE[6]:

- Biochemical Oxygen Demand (BOD_5) = 60g/person/day[7],
- Total Nitrogen (TN) = 11 g/person/day,
- Total Phosphorus (TP) = 2.8 g/person/day.

The amount of Tot-P, Tot-N and BOD5 and water consumption within the basin can be calculated as shown in Table 5.

Table 5. The daily and yearly load from 1 PE and the load from 896,275 people living within the basin

1 PE	Day	Year	896,275 PE/year
Tot-P	2.8 g	1.0 kg	896 t
Tot-N	11 g	4.0 kg	3585 t
BOD^5	60 g	21.9 kg	19628 t

Industrial activities are point sources of pollution that place constant pressure on the water resources of the river basin. These mainly include the following.

- **Manufacturing industry**. The revenue leading sector and include production activities of cement and construction materials; metals (in particular iron and ferrochrome alloys); leather goods; textile goods and footwear; aluminum for construction. Five industrial installations operate with Class A permit[8], as follows.

6 PE: Person Equivalent. Common applied values in EU countries.

7 The estimated organic load of 60 g/person/day corresponds to one population equivalent (PE), as defined in the Directive 91/271/EEC.

8 The current Albanian permitting system in relation to environment protection is established by the Law on Environmental Permitting No. 10488 Dated 14.7.2011, which provides the basic principles for the environmental permitting process. The Law establishes a three-tier system for permits of installations and activities, namely: Class A, Class B, and Class C Environmental Permit. These three are distinguished from each other by the thresholds of industrial activity, production and capacity. A Class A permit shall take into account the environmental performance of the installation or the activities as a whole. The permit set emission limit values for pollutants, according to Best Available Techniques. *The Class A permit is aligned to the EU IPPC permit.*

Table 6. Large industrial installations within Ishem River Basin

Municipality	Product or processing	Activity by EU Sector
Tirana	Centre for hospital waste treatment	Waste
Tirana	Polystyrene production	Misc.
Tirana	Plant for red bricks	Mineral
Tirana	Fireworks production	Chemistry
Tirana	Storage of chemical fertilizers, products for plants processing	Misc.

In addition, 75 medium-sized enterprises (SMEs) operate under Class B permit. Industries normally discharge their wastewater into the urban sewerage system.

However, there are no official data on the amounts of water used by this sector, nor for the quantity/quality of discharged wastewater.

- **Mining.** The mining sector is a historic pillar of Albanian industrial production due to the relative abundance of minerals in the territory. There are 45 active mining permits in the Ishmi Basin (16 within the Tirana Municipality, 1 within Vore, 28 within Kruie). The mining industry in the basin mainly produces limestone and clay for the construction industry. The sector uses surface water and/or groundwater for technological processes, but there are no official data on the amounts used in Albania. The environmental impact of mining includes erosion, formation of sinkholes, loss of biodiversity, and contamination of soil, groundwater, surface water from mining processes. In some cases, additional forest logging is done in the vicinity of mines to increase the available room for the storage of the created debris and soil. Mining can have bad effects on the surrounding surface and groundwater if protective measures are not taken. Runoff of mere soil or rock debris – although non-toxic – also devastates the surrounding vegetation.
- **Sand and gravel excavations** take place in the Ishmi basins. There are 55 active gravel extraction permits in the Ishmi Basin (47 within Tirana Municipality, and 8 within Kruje). The assumed effects of environmental impacts associated with gravel extraction are increasing. These impacts include loss or degradation of spawning beds and juvenile fish rearing habitats; migration blockages; channel widening, swallowing, and ponding; loss of hydrologic and channel stability; loss of pool/riffle structure; increased turbidity and sediment transport; increased bank erosion and/or stream bed down-cutting; and loss or degradation of riparian habitat.

Contaminated sites/Abandoned industrial sites represent areas of diffuse sources of pollution that pose pressure on water resources. In many cases, termination of the activity in the early ’90s was not followed by the necessary environmental restoration; consequently, the industrial ruins still occupy the territory and can contaminate the soil and, ultimately, water bodies. Past industrial pollution hotspots in the basin include the following.

Table 7. Hot spots within the Ishmi basin

Facility	Location
Albanian Film Studio	Tirana
Auto & Tractor Factory	Tirana
Dajti Metallurgy Enterprise	Tirana
Institute for Public Health	Tirana
Workshop for regeneration of used transformer oils	Tirana
Transformer repair workshop	Tirana

Agriculture and farming activities are diffuse sources of organic and inorganic pollution (mainly BOD, nitrogen and phosphorus) that place constant pressure on the water resources of the river basin as they may cause deoxygenation and eutrophication of surface waters and contribute to declining fish stocks, and a loss of biodiversity.

Agriculture run-off also remains a challenge for river pollution as it is a major contributor to the eutrophication of freshwater bodies.

Mineral fertilizers, such as nitrogen (N) and phosphorus (P), are widely used in agriculture to optimize production. They are important nutrients that are absorbed from the soil by plants for their growth. A surplus of nitrogen and phosphorus can, however, lead to environmental pollution like the eutrophication of surface water.

Albania mineral fertilizer consumption fluctuated substantially in recent years, it tended to increase through the 2002-2019 period and was 126.14 kg/ha of arable land.[9]

The yearly fertilizer consumption in the Ishmi basin is estimated at 3,505 tons/ha.

Based on the information on fertilizers usage it is possible to estimate the usage of different nitrogenous and phosphorus fertilizers in the river basin as shown in the table below.

Table 8. N and P from fertilizers – Nitrogen and Phosphorus fertilizer use (a ton of fertilizer and an equivalent ton of N and P), 2019

Basin	Ishmi
Urea Nitrogen (tons)	1.367
containing 46% N (tons)	629
Ammonium Nitrate (tons)	1.262
containing 34.5% N (tons)	435
Tons of Nitrogen applied	**1.064**
Super Phosphate (tons)	876
containing 7.07% P(tons)	62
Total Phosphorus applied	**62**

The main pollutants related to animal farming are BOD, nitrogen and phosphorus. The estimation of the pollution loads can be made by knowing the livestock's number, based on emission factors taking into account local experience and data reported in the literature.[10]

Based on livestock structure data from the Albanian Institute of Statistic (INSTAT), the total load for N and P from animals in the Ishmi basin can be estimated as follows:

9 Source: https://data.worldbank.org/indicator/AG.CON.FERT.ZS?locations=AL

10 Data on livestock manure characteristics presented are obtained by combining a wide base of published information on livestock manure production and characterization. Actual values vary due to differences in animal diet, age, usage, productivity and management. Whenever actual sample analyses can be performed, such information should be considered in lieu of the mean values presented here.

Table. Fresh manure characteristics per 1.000 kg live animal mass per day

Parameter	**Unit**	**Animal Type**						
		Cattle	Cows	Sheep / goats	Pigs	Equines	Poultry	Turkey
Total N	Kg	0,45	0,34	0,41	0,48	0,3	0,33	0,52
Total P	Kg	0,05	0,092	0,07	0,14	0,07	0,22	0,23

The pollution by livestock in each of the basins can be calculated by considering a typical live animal masses of: cattle 450 kg; swine 150 kg; sheep/goat 50 kg; horse 200 kg; poultry 0.8 kg; turkey 3.5 kg.

Table 9. Estimate load of N and P from livestock

Animal Category	Ishmi	
	N load (ton/year)	P load (ton/year)
Cattle	2301	256
Sheep	706	121
Pigs	89	26
Equidae	80	19
Poultry	114	76
Turkey	10	5
Total	**3299**	**501**

The total amount of nitrogen and phosphorus generated or applied from the above sources can be summarized as shown in the table below.

Table 10. The total amount of nitrogen and phosphorus generated or applied within Ishmi Basin area

	Total N load (tons/year)	**Total P load (tons/year)**
Total from fertilizer (tons)	1.064	62
Total from livestock (tons)	3.229	501
Total	*4.293*	*563*

Hydropower. Due to the morphological features, Ishmi basin's rivers although with small flows, have considerable cascade which make them substantially important for the hydropower potential. Today, Albania is almost totally dependent on hydropower for electricity generation; nearly 100 percent of the country's domestically produced electricity comes from hydropower. Hydropower generation is not a consumptive use of water (i.e. water abstracted without returning it to its resource). The overall water balance remains equal, but water available for further use is partly regulated by the operation of reservoirs.

Six hydropower plants are currently installed in the basin.

Solid Waste Disposal. Random disposal of waste on land and along watercourses is common and represents a major problem in the basin. Waste disposal might more appropriately be addressed as a source of diffuse pollution.

Dumping in poorly managed landfills is the main method of municipal solid waste disposal. These sites lack the necessary infrastructure or engineering provisions to collect and contain landfill leachate and gas.

Four dumpsites exist, at Kamez (the site is located adjacent to the main trunk road through Kamez in a gravel extraction pit, where the waste is being dumped into the depressions left from the gravel extraction), at Vore (located near the village of Kuc and consists of a dump site at the side of the road resulting in the infilling of a valley to the south of Vore), at Kruje (located off the main road in a mountainous valley to the east of the city of Kruje). The site has been created by removing the brick wall which prevented traffic from going off the road, down the ravine, and then reversing the refuse vehicles, completely blocking the main road and tipping directly over the edge of the road and down into the ravine), and at Fushe Kruje (located to the east of the city, as a more organized dumpsite relying on the infilling of a relatively narrow valley).

4. CONCLUSIONS AND RECOMMENDATIONS

Tables below present a final register of the identified pressures, an estimation of the waterbody's status, and an estimation of the water bodies at risk of failing the environmental objectives.

Available monitoring data and assessment criteria do not yet allow for a comprehensive assessment of the environmental state of water bodies in the Ishmi basin. Generally, Ishmi is polluted largely due to the discharges of untreated wastewater. This implies that the river will not comply with the WFD criteria for "good" status.

Reservoirs – used for irrigation, hydropower and/or drinking water supply – impose hydro morphological pressures. However, there are no monitoring data for substantiating the state and impacts of reservoirs.

Water Body Name	POINT							DIF-FUSE		
				Dams, barriers and locks			Hydrological alteration			
	1.1 Urban waste water	1.2 Storm overflows	1.3 IED plants	1.4 Non IED plants	1.5 Contaminated sites or abandoned industrial sites	1.6 Waste disposal sites	1.8 Aquaculture	2.2 Agricultural	2.6 Discharges not connected to sewerage network	2.8 Mining
Ishem				x		x	x	x	x	x
Zeze	x	x		x		x			x	
Terkuza				x		x			x	
Tirana	x	x	x	x		x	x		x	
Lana	x	x		x	x	x			x	

Water Body Name	ABSTRACTION		PHYSICAL ALTERATION					
	3.1 Agriculture	3.5 Hydropower	4.2.1 Hydropower	4.2.3 Drinking water	4.2.4 Irrigation	4.3.3 Hydropower	4.3.4 Public water supply	4.3.6 Gravel Extraction
Ishem	x	x	x		x	x		x
Zeze		x	x			x		x
Terkuza	x			x	x		x	x
Tirana	x	x	x			x		x
Lana	x	x			x	x		

WATER-BODY NAME	PRESSURE ANALYSIS				STATUS AND OVERALL STATUS or POTENTIAL						RISK ASSESSMENT	
	POINT PRESSURE	DIFFUSE PRESSURE	ABSTRACTION PRESSURE	PHYSICAL PRESSURE	BQES EQR	P-CHEM	H-MORPH	ANNEX X PSs	ANNEX VIII RBSP	OVERALL STATUS	RISK LEVEL	CL
Ishem	1.4 Non IED plants	2.2 Agricultural	3.1 Agriculture	4.2.1 Hydro-power		poor					At-risk	2
	1.6 Waste disposal sites	2.6 Discharges not connected to sewerage network	3.5 Hydropower	4.2.4 Irrigation								
	1.8 Aquaculture	2.8 Mining		4.3.3 Hydro-power								
				4.3.4 Public water supply								
				4.3.6 Gravel Extraction								
Zeze	1.1 Urban waste-water	2.6 Discharges not connected to the sewerage network	3.1 Agriculture	4.2.1 Hydro-power							Probably	1
	1.2 Storm overflows		3.5 Hydropower	4.2.5 Recreation								
	1.4 Non IED plants			4.3.3 Hydro-power								
	1.6 Waste disposal sites			4.3.4 Public water supply								
				4.3.6 Gravel Extraction								
Terkuza	1.4 Non IED plants	2.6 Discharges not connected to the sewerage network	3.1 Agriculture	4.2.3 Drinking water							Probably	1
	1.6 Waste disposal sites			4.2.4 Irrigation								
				4.2.5 Recreation								
				4.3.4 Public water supply								
				4.3.6 Gravel Extraction								

Tirana	1.1 Urban waste-water	2.6 Discharges not connected to the sewerage network	3.1 Agriculture	4.2.4 Irrigation		poor					At-risk	2
	1.2 Storm over-flows			4.2.4 Irrigation								
	1.3 IED plants			4.3.4 Public wa-ter supply								
	1.4 Non IED plants			4.3.6 Gravel Extraction								
	1.6 Waste dis-posal sites											
	1.8 Aquaculture											
Lana	1.1 Urban waste-water	2.6 Discharges not connected to the sewerage network	3.1 Agriculture	4.2.1 Hydro-power		poor					At-risk	2
	1.2 Storm over-flows		3.5 Hydropower	4.2.4 Irrigation								
	1.4 Non IED plants			4.3.3 Hydro-power								
	1.5 Contaminat-ed sites or aban-doned industrial sites -											
	1.6 Waste dis-posal sites											

REFERENCES

Directive 2000/60/EC of the European Parliament and of the Council of 23rd October 2000 establishing a framework for Community action in the field of water policy. European Commission PE-CONS 3639/1/100 Rev 1, Luxembourg.

Directive 2008/105/EC of The European Parliament and of the Council on environmental quality standards in the field of water policy, amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC and amending Directive 2000/60/EC of the European Parliament and of the Council.

Directive 91/271/EEC on urban wastewater treatment

EU Directive 2000/60/EC 2004-2006. (2005): Common implementation strategy for the Water Framework Directive (2000/60/EC). Guidance on the intercalibration process 2004-2006. 2005: 14: 31.

Directive 2008/1/EC concerning integrated pollution prevention and control (the IPPC Directive)-EU IPPC Permit.

Law on Environmental Permitting No. 10488 Dated 14.7.2011, Albania.

National Environment Agency 2019; www.akm.gov.al

Statistical yearbook, 2019 Director of the Publication: PhD Elsa Dhuli, prepared by INSTAT-Institute of Statistics; info@instat.gov.al ; www.instat.gov.al

Water Framework Directive – Integrated River Basin Management for Europe - 2000/60/EC.

Water Information System for Europe – WISE GIS Guidance – on the reporting of spatial data to WISE, v 6.0.6, 2016

Water Framework Directive Reporting Guidance – WISE Reporting Guide, 2016; http://cdr.eionet.europa.eu/help/WFD/WFD_521_2016

World Bank, 2003. Water resources management in South Eastern Europe. Vol. II: Country water notes and water fact sheets. World Bank, Washington; https://data.worldbank.org/indicator/AG.CON.FERT.ZS?locations=AL.