Commission of European Communities, for
and on behalf of the Government of Albania,

Ref.: EuropeAid/124909/C/SER/AL

Implementation of the National Plan for Approximation of Environmental Legislation in Albania

Mati River Basin Management Plan

15 September 2010

Commission of European Communities, for and on behalf of the Government of Albania,

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Implementation of the National Plan for Approximation of Environmental Legislation in Albania

Component D: Pilot River Basin Management Plan

Acknowledgement:
The project team wishes to express its gratitude to all resource persons and experts from all institutions and stakeholders involved in the collection of data and information and to all persons and bodies that have supported the development of this Report. Special thanks are extended to the Ministry of Environment Forestry and Water Administration and its expert staff.

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List of Abbreviations

EU	European Union
LWR	Albanian Law on Water Resources
NWC	National Water Council
RBD	River Basin District
RBM	River Basin Management
RBA	River Basin Agency
RBC	River Basin Council
WFD	Water Framework Directive

SUMMARY

This summary as well as the pilot management plan for Mati river basin has been prepared with a 2-sided approach:

- To prepare a river basin management plan as far as possible in accordance with the overall requirements of the Water Framework Directive (WFD)
- To make recommendations and guidelines to the implementing authorities on how to introduce procedures and generate information needed for preparation of future river basin management plans in Albania.

This approach has been maintained both in the following summary as well as the later pilot management plan for Mati Basin

The Water Framework Directive

The purpose of the WFD is to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and ground water (Article 1). The more specific objectives can further be elaborated as:

- Protection of aquatic and terrestrial systems, and provision in the water needs of these systems
- Promotion of sustainable water use through long-term protection of water resources
- Improvement of the aquatic environment by means of specific measures for progressive reduction of discharges, emissions and losses of priority substances, and by a complete stop of emissions of priority dangerous substances
- Reduction of groundwater pollution and improvement of groundwater quality
- Mitigation of the consequences and prevention of flooding and drought.

The overall planning instrument to fulfil the objectives of the WFD is preparation and implementation of a river basin management plan for each river basin district within the national borders of each EU member state as described in Article 13 of the WFD.

The detailed content of each river basin management plan is described in Annex VII to the WFD and the main components of the plan refer to:

- Description of river basin characteristics
- Assessment of pressures on surface waters and groundwater and their impacts on the environment and natural resources
- Design of water quality monitoring systems
- Development of specific quality objectives for all water bodies types
- Economic analysis of water use, water pollution and water management
- Development of a plan for water management and mitigation of adverse environmental impacts
- Stakeholders involvement, public participation and awareness
- Establishment of an administrative structure for river basin management.

However, the pilot plan for Mati Basin District does not follow strictly the detailed content of a river basin management plan as described in Annex VII. One reason is that preparation of river basin management plans and implementation of the WFD is a complex activity, which for existing member states is scheduled for a 15 year period up to 2015. At the same time the WFD assumes that the plan shall be prepared in several separated time steps. This approach for preparing the RBM plan for Mati River Basin has not been applicable.

In the plan all separate time steps have been compressed into one and structured with the purpose to initiate a discussion of planning procedures and to raise the awareness of information required for preparation of a full river basin management plan.

Characterisation of the river basin

One of the first steps in river basin management planning is to make a description of the river basin, including an analysis of its characteristics, a review of the impacts of human activities on the status of surface waters and on groundwater and including an economic analysis of water use. (Article 3, 5, 6 and partly article 4, 7 and 8 of WFD)

In the Mati River Basin management plan the characterisation of water bodies has been made in chapter 3. A review of the impacts of human activities on the status of surface water and groundwater has been done in chapter 4, while an economic analysis of water use has been prepared in chapter 10 together with projections for the future water use. In addition chapters on flooding and protected areas are included as well as part of the characterisation of the river basin. All these chapters characterising the river basin are in a planning context considered as the baseline-description.

However, as background for characterising water bodies there are a number of basic interventions to be made.

Characterisation of water body types

Characterisation of water body types is the backbone in the whole planning process and the applied methodology for defining “good ecological status” in surface waters and “good chemical and quantitative status” for ground water. To achieve “good ecological and chemical status” for all water bodies in EU is the overall scope of the WFD. In the Mati River basin management plan only the procedures to be applied for characterisation of water bodies are described for rivers, lakes and groundwater reservoirs

Four European river types can be identified, but only one type of lake, which most correctly can be characterised as artificial lakes. For groundwater reservoirs only two magazines in the coastal plain can be delineated based on yield criteria. But there are only little knowledge concerning of the quantitative and chemical characterisation of ground water reservoirs in the major part of Mati Basin.

A part of the characterisation of water body types is to assign quality elements to each water body type. Water body types shall be characterised in relation to 4 different quality elements with regard to good status (least level of good water quality). A distinction is made between: Biological quality elements, physico-chemical quality elements, hydro morphological elements and specific pollutants with special reference to dangerous and priority substances listed in Annex IX and X of the WFD.

All the described surface water body types are in the Mati RBM plan characterised by biological and physico-chemical quality limit values for good ecological status (water quality criteria) to be achieved. Ground water reservoirs are generally characterised by quantitative criteria based on yielding capacity of sub-soils and geology.

Pressures and impacts of human activities
In accordance with requirements of the WFD pressures and impacts of human activities are described in relation to point sources and diffuse sources.

Point sources pollution
Point sources pollution is described under the headings of household pollution, industry and hydropower, gravel extraction, mining, solid waste disposal and hotspots. In this listing not all pollution sources can be described as strictly point source pollution.

The main pollution in Mati Basin arises from *households* corresponding to 290.000 people counted in 2009. The density of the population is highest in the central part and the coastal plain of the basin. There are no treatment plants. There are 8 water supply and sewerage companies operating within the basin.

There is not much industry in the basin, but a list of existing and former industries are described in addition to 2 hydropower plants.

Gravel extraction is a major problem in the lower part of Mati Basin. 35 gravel extraction companies are operating with licenses in this area and probably others are operating without licenses

Mining of especially chromium and copper is to some extent still ongoing within the basin. Chromium mining is mainly taking place in the south east part of the basin in relation to Bulquize massif. Metal processing is till taking place in Burrell and Elbasan

Random disposal of waste is a major problem within Mati Basin as elsewhere in Albania. Waste disposal might more appropriately be addressed as a source of diffuse pollution. However 6 official disposal sites for solid waste disposal exist, at Rubik, Rreshen, Burrel, Lac, Mamurras and Pilan.

A list of the 9 former and existing most polluting hot spots within the basin is described covering sources of pollution from pesticide storages, smelters for metal processing and tailing dams from mining activities

Diffuse sources pollution
Diffuse sources are described under the headings of land use, agriculture and forestry. More than 50% of the area within Mati Basin is covered with forests. Less than 10% of the area is cultivated and mainly in the coastal plain

Protected areas are not sources of pollution, but shall in accordance with the requirements of the WFD be identified and mapped as part of making the characterisation of the basin. There are 6 protected areas within the basin located mainly in the border areas of the basin. In accordance with Albanian legislation two of them are classified as national parks

Economic analysis of water use
The implementation of a river basin management plan is assumed to cost money. An essential part of RBM planning and decision-making is to make an assessment of the costs of implementing the plan and the capability of the population to finance the costs to ensure that the plan can actually implemented

The WFD requires that an economic analysis is made for a river basin as part of RBM planning (Article 5, Annex III), and that River basin management plans must contain a summary of this economic analysis and the use of economic principles to guide decisions on how to reach the objectives of the WFD. It seeks to apply economic principles in four main respects, namely:

- The estimation of the demand for and the valuation of water in its alternative uses (Article 5)
- The identification and recovery of costs associated with water services having regard for the polluter pay principle and the efficient use of water (Article 9)
- The use of economic appraisal methods to guide water resource management decisions (Article 11)
- The use of economic instruments to achieve the objectives of the WFD, including the use of incentive pricing and market mechanisms (Article 11).

In the Mati pilot RBM a comprehensive analysis has been made based on the requirements of the WFD directive. The analysis comprises a summary of the uses of water resources in the basin. Based on information from water companies the access of the public to water supply and sewerage is summarised. Water consumption of households is estimated and the proportion of billed water is applied for estimating the cash flow and available economic resources in the water sector. Finally affordability criteria are applied for estimating the capacity of households to finance future water services, assuming a considerable extension of the need for financing.

Risk assessments in RBM planning

The logic and the methodology behind characterising water bodies and introducing parameter limit values (water quality criteria) for classification of good ecological status for surface water and chemical status for ground water is among others intended for making risk assessments. The risk assessment shall be done to identify surface water bodies or groundwater reservoirs at risk of not achieving at least good environmental ecological or chemical status within a planning period (Annex II, section 1.5). The methodology is to compare measured parameter values from ongoing monitoring programmes (surveillance monitoring) with parameter limit values applied for good environmental or chemical status.

Programme of measures are hereafter implemented for those water bodies at risk of not achieving good environmental status based on the risk assessment.

Pursuant to the risk assessment specific monitoring programmes shall be established to follow the effects from having implemented the programme of measures (operational monitoring). If it is not understandable why a water body may not achieve good ecological status an investigative monitoring programme may apply.

Risk assessments, status of water bodies and monitoring

In the plan the quantitative status of rivers within the basin is described as good. The annual area specific runoff from eight sub-basins within the basin varies between 29 and 48 l/s per km^2 with an annual total discharge volume of 3.250 million m^3.

The chemical status of river water has been monitored with regard to at least 10 parameters at three stations for several years and there are not one single measurement indicating that the limit values of good chemical status is superseded. In consequence it means that river water is not at risk of not achieving at least good chemical status.

The same conclusion can be drawn from existing measurements of chemical status of groundwater

However the quantitative status of groundwater cannot be evaluated as no such data has been made available for preparing the pilot Mati RBM plan. For the Ulza and Shkopet reservoirs no recent data has been available either.

However, during preparation of the Mati RBM plan many statements on bad quantitative and chemical status of groundwater in especially the Lezhe reservoir in the coastal plain have been provided. As no comprehensive documentation exists the logic of the WFD is to initiate investigative monitoring programmes on the subject.

In the pilot plan for Mati basin a description has been made on surveillance, operational and investigative monitoring programmes and how to use them in relation to water bodies at risk of not achieving good water status in accordance with planning targets.

Programme of measures

Programme of measures in a river basin management plan is generally a main issue, as the measures to be described are those needed for achieving good ecological status in accordance with the overall objectives of the directive and the specified objectives for water bodies and protected areas. It is costly and is as such an economic controversial programme which must rely on trustworthy assumptions as background for political decision-making

It means that risk analyses of not achieving good ecological status must be verified through monitoring for at least one or two years if such risks cannot be directly verified before decision-making on programme of measures is provided.

As it cannot be shown from existing data from Mati Basin that risks of not achieving good water status exists in the water bodies then a targeted programme of measures may not need to be designed. For water bodies where uncertainties exist regarding risks, monitoring will have to await the results of investigative monitoring for at least one or two years. On that background the programme of measures shown in the pilot plan of Mati Basin is very general and will have to await the results of monitoring before it can be detailed and targeted. This is and has been the situation in all existing EU member states as it must be for this version of the Mati RBM plan. That is especially the case in Albania with regard to implementing a programme of basic measures.

Basic measures

As described in Annex VI, Part A of the WFD, programmes of measures shall at least include measures required for implementing 11 other directives as a precondition for having implemented the WFD

None of these directives have been fully implemented in Albania and they will for that reason not be addressed in this version of programme of measures for Mati river basin. It is assumed that implementation of measures related to these directives will be addressed in the general accession process and in accordance with time schedules as agreed in negotiations with the EU Commission.

However under basic measures in the pilot Mati RBM plan special attention has been made to the Urban Waste Water Directive as this directive is well defined with regard to specification of requirements and costs and it is know to be the most costly directive to implement in acceding countries. The implications of implementing this directive are in further details described in the attached Appendix: Water and sanitation.

Supplementary measures

Supplementary measures which may be taken into account if good ecological, chemical and quantitative status for surface and groundwater bodies and reservoirs are unlikely to be achieved are described in article 11.4 and Annex VI part B of the WFD.

To assign supplementary measures to programme of measures as a supplement to basic measures only make sense if data and other information indicates that specific water bodies or reservoirs are at risk of not achieving good status and that cannot be shown in existing data from Mati river basin. Before decisions can be made on a full programme of measures implementation of basic measures should take place in relation to 11 other directives and in addition monitoring should be undertaken for at least one or two years.

General programme of measures

However, based on the specific problems encountered during preparation of this plan an overall list of proposed measures can be described in outline as shown in the table below.

Category	Measures
Legal and institutional	Adjust the borders of the Mati Basin by including Kurbin and Lezhe Districts
	Adjust the digitised borders between Districts, Communes and municipalities
	Delegate clear responsibilities and allocate the necessary resources to the River Authority in Lezhe
	Clarify responsibilities between Prefecture, Districts, Municipalities and water companies
	Introduce training on river basin management to the Basin Authority in Lezhe and others
	Adopt requirements of 10 directives relevant for implementation of the WFD • The Bathing Water Directive (76/160/EEC) • The Habitats Directive (92/43/EEC) • The Birds Directive (79/409/EEC) • The Drinking Water Directive (80//778/EEC) as amended • The Major Accidents (Seveso) Directive (96/82/EC) • The Environmental Impact Assessment Directive (85/337/EEC) • The Sewage Sludge Directive (86/278/EEC) • The Urban Waste Water Treatment Directive (91/271/eEEC) • The Nitrates Directive (91/676/EEC) • The Integrated Pollution Prevention Control Directive (96/61/EC
Economic	Reorganise the water companies into major units
	Revise the tariff structure for water services
	Assess the limits of the future financing capacity for water utilities within the Mati Basin
Technical	Delineate and characterise all surface water bodies and ground water magazines
	Provide parameter limit values for quantitative, chemical and ecological status of all types of water bodies
	Continue surveillance monitoring as described in this plan
	Initiate investigative monitoring programmes as described in this plan in all types of water bodies assumed to be at risk of not achieving good ecological status
	After two years of investigative monitoring re-evaluate all assumptions on risks of not achieving good water status in water bodies
	Initiate investigative monitoring programmes for hot spots as described in this plan
	After two years of investigative monitoring reevaluate all assumptions of impacts from hot spots
	Based on new information from surveillance and investigative monitoring during a two years period make a risk analysis for all water bodies
	Provide a new set of measures required for achieving good water status in water bodies
	Initiate an operational monitoring programme in water bodies at risk after implementation of measures to follow the effects of implementing measures

INTRODUCTION

For future compliance with the requirements of the EU Water Framework Directive (WFD) Albania has to prepare management plans for the river basin districts, that have been established in the country. In accordance with EU legislation the Albanian Law on Water Resources (LWR) requests that according to Article 10 of the LWR a river basin water resources plan must be prepared for each drainage basin. Such a plan is to some extent comparable with a river basin management plan as specified by the EU WFD. However, the procedures for drafting, reviewing and approving plans, which should have been defined through a special regulation, have not been adopted yet and no river basin water resources plans have been prepared so far.

In order to support the development of the methodology for preparation of river basin management plans, a pilot management plan for the Mati river basin has been prepared as part of the ongoing project: Implementation of the National Plan for Approximation of the Environmental Legislation in Albania.

Through preparing a pilot RBM plan experience is obtained in various aspects of development of river basin management plans and integrated river basin planning. Such aspects include:

- Identification of sources of information and data ("which data can be found where")
- Establishment of an organisation and team for preparation of the plan
- Development of standards, objectives (chemical/ecological water quality, water use, flooding, protected areas, wastewater discharges and waste emissions, prevention of accidental environmental pollution, control of environmental risks)
- Economic analysis
- Involvement of stakeholders and the broader public
- Development of data interpretation methods
- Data gap analysis.

A number of information gaps exist for provision of a river basin management plan for Mati Basin in accordance with the WFD. In consequence reference to the WFD has been made continuously during the document and generally it has been prepared with an advisory approach for preparation of the next version of the plan or other upcoming plans in accordance with common European practise. As a consequence of the advisory approach the document contains a number of technical details and recommendations, which are normally not included in a river basin management plan.

1 THE WATER FRAMEWORK DIRECTIVE (2000/60/EC)

The overall intention behind the WFD is to protect or improve the ecological, chemical and physical status of surface waters and a good chemical and quantitative status of groundwater, and to ensure a sustainable water use.

The purpose of the WFD is to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and ground water (Article 1)

The more specific objectives can further be elaborated as:

- Protection of aquatic and terrestrial systems, and provision in the water needs of these systems
- Promotion of sustainable water use through long-term protection of water resources
- Improvement of the aquatic environment by means of specific measures for progressive reduction of discharges, emissions and discharges of priority substances, and by a complete stop of emissions of priority dangerous substances
- Reduction of groundwater pollution and improvement of groundwater quality
- Mitigation of the consequences and prevention of flooding and drought.

The overall planning instrument to fulfil the objectives of the WFD is preparation and implementation of a river basin management plan for each river basin district within the national territorial border of each EU member state as described in Article 13 of the WFD.

The detailed content of each river basin management plan is described in Annex VII to the WFD and the main components of the plan refer to:

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- Assessment of pressures on surface waters and groundwater and their impacts on the environment and natural resources
- Design of water quality monitoring systems
- Development of specific quality objectives for all water bodies types
- Economic analysis of water use, water pollution and water management
- Development of a plan for water management and mitigation of adverse environmental impacts
- Stakeholders involvement, public participation and awareness
- Establishment of an administrative structure for river basin management.

However, this pilot plan does not follow strictly the detailed content of a river basin management plan as described in Annex VII. It takes approximately 6 man years with experienced man-power to prepare a full scale river basin management plan and that time frame has not been available.

At the same time the WFD assumes that the plan shall be prepared in several time steps as background for decision making and communication with the public. This has not been possible either. The plan is compressed and structured with a conceptual approach to initiate a discussion of procedures and information required for preparing a full river basin management plan.

To prepare and implement the WFD is a complex activity and the member states got in year 2000 15 year up to 2015 for preparation and implementation of river basin management plans. But the planning concept behind the WFD is simple and logic.

In the first step an answer should be given to the question: Where are we? – by making a description and characterisation of the existing situation within river basins and make a projection for what will happen in the future with regard to water.(Article 3, 5, 6 and partly article 4, 7 and 8)

In the second step an answer should be given to the question: What do we want to achieve? – by setting up environmental objectives for the future development (Article 4)

In the third step an answer should be given to the question: How do we achieve what we want? – by setting up a programme of measures and by allocating the necessary economic resources for financing of the programme and at the same time see to that the programme is implemented within a proper institutional framework (Article 9, 10 and 11).

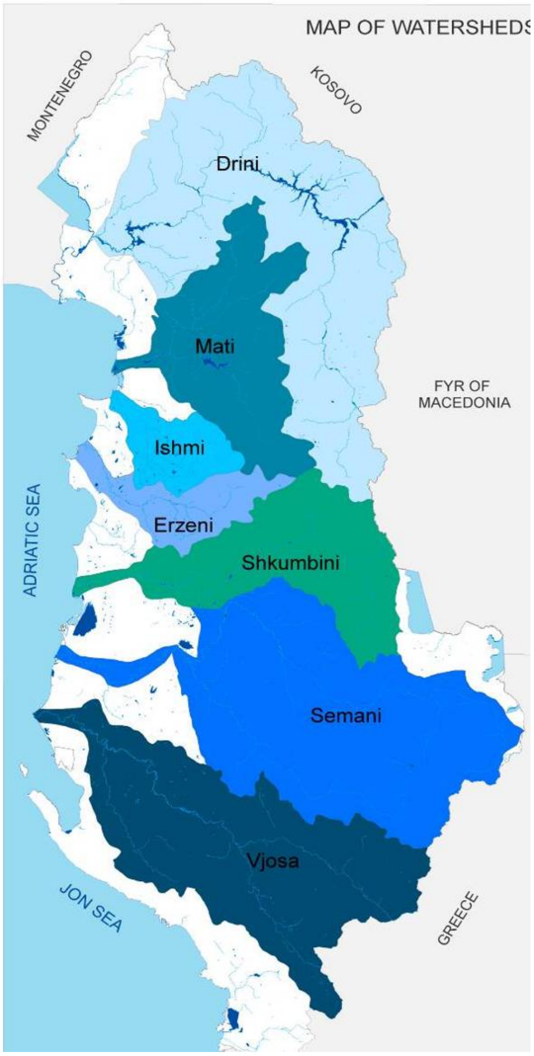
The pilot plan for Mati Basin has been prepared with this overall approach.

2 DESCRIPTION OF THE MATI RIVER BASIN

2.1 The Mati River Basin District

The Mati River Basin has been designated as one of seven River basins in Albania. The seven river basins are shown in Figure 3.1.

Figure 3.1 Designated River Basins of Albania



The Mati river basin lies in the northern part of the central mountainous region of Albania and is to the north and east separated from the Drini Basin by mountains.
Mountains are as well separating the Mati Basin from Ishmi, Erzeni and Shkumbini Basins to the south and west.

The river system of Mati Basin reaches the Adriatic Coast through a corridor of transitional waters and channelled coastal plains at Fushe Kuge.

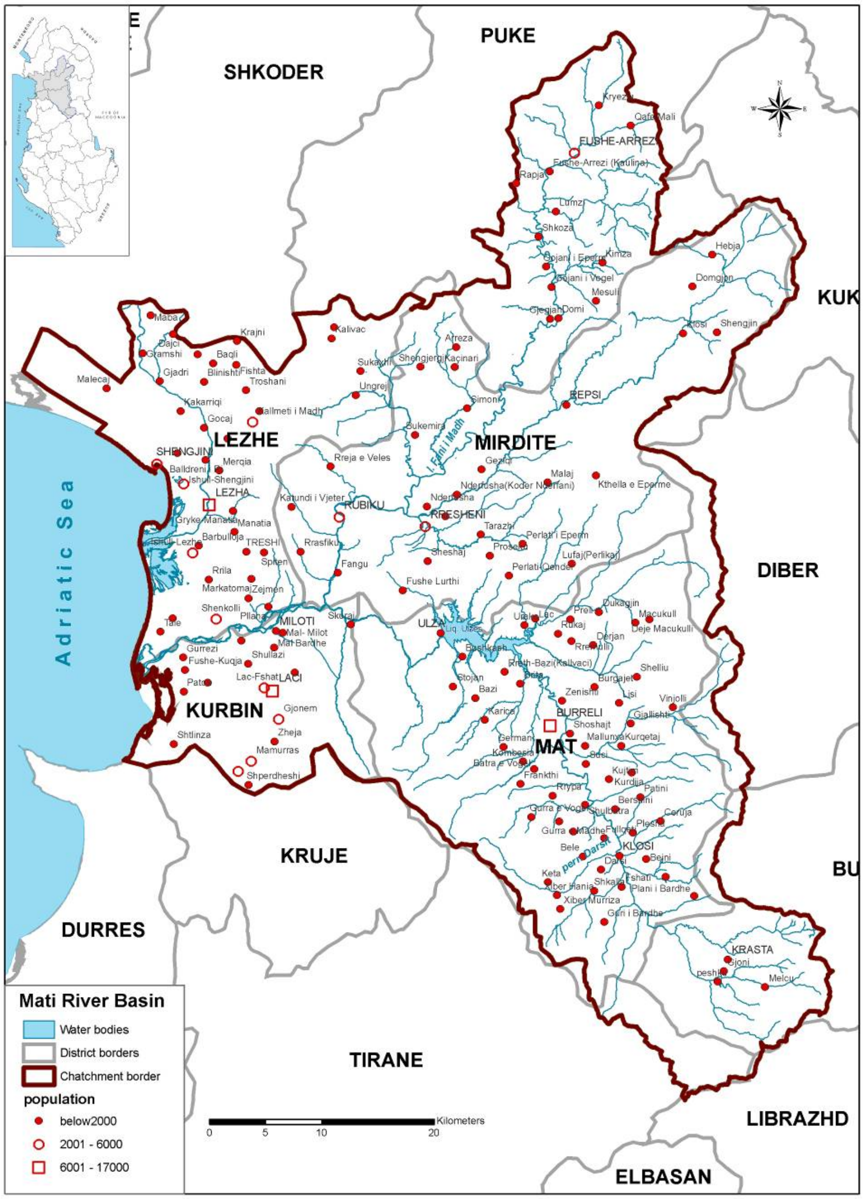
As background for preparing this plan the Mati River Basin District is assumed to cover the existing area of Mati river basin, and in addition the coastal parts of the districts of Lezhe and Kurbin. With this approach the area of the Mati River Basin District is proposed to cover the entire districts of Mat, Mirdite, Lezhe and Kurbin and parts of the district of Puke and Bulqize, and a minor part of Shkodra District.

The borders of Mati Basin and Mati Basin Discrict, main rivers and settlements with inhabitants above 400 are shown in Figure 3.2. It should be noticed that the borders of Mati Basin do not exactly follow the administrative borders of the Districts.

An argument for including Lezhe and Kurbin Districts in the Mati River Basin District is that high yielding ground water reservoirs in the coastal plain are coherent and should most appropriately be managed as one and the same resource, as the borders of the ground water reservoirs extends far beyond the watershed borders for surface water of Mati basin.

However, the inclusion of Lezhe District in the Mati River Basin District means that future RBM plans for Mati River Basin District will also include planning for Drini River Lezhe.
In this pilot river management plan for Mati Basin District the Drini River Lezhe has only been addressed superficially as further clarifications are needed concerning the borders of the Mati District

Figure 3.2 Mati River Basin District with administrative borders and settlements



2.2 Organisational structure for the management of the river basin district

An organisational structure for management of the Mati River Basin District (RBD) has not been established yet. However, under the 1996 Law on Water Resources, River Basin Councils are established as the “local authorities responsible for managing water resources in the relevant basins”. The Basin Councils have legal personality and depends on the Technical Secretariat of the National Water Council (see chapter 12 for more details).
The each basin council has its own administrative unit (referred to as an agency).

Following the establishment of the Mati River Basin Council in 2002, a Mati River Basin Agency has been assigned. The Agency is located in Lezhe and it works under the prefect of Lezhe and is supervised by a River Basin Council with 9 members.

The tasks of the Agency are unfolded in Part III of the main regulation of the Law on Water Resources (LWR).

The Mati River Basin Agency counts 2 employees, who are mainly occupied with licensing of gravel extractions and permissions on groundwater abstraction in the downstream part of the Mati Basin. But the impression is that they lack basic equipment as well as data and information and do not have any form of river basin management experience. In addition no tools are available for the long term assessments for identification of environmental risks or sound decisions making on water management (or gravel extraction for that matter).
At the moment river basin planning and management is not undertaken in the context of the WFD.

Preparation of this pilot manage plan for Mati Basin shall be seen on that background.

2.3 Climate

The Mati Basin is characterised by a varied climate with regard to temperatures and precipitation.

The coastal zone, with an altitude up to 180 m above sea level, has a Mediterranean climate with a hot, dry summer. The average summer temperature is 23-24 ^{0}C. The winter in the coastal zone is wet. Temperatures below 0 ^{0}C are possible.

The hilly zone with foot-hills and altitudes up to 600 m above sea level has an average temperature which is 3-4 °C lower than in the coastal zones, with frequent temperatures below zero during winter time.

The mountainous zone, higher than 800 m above sea level, is characterized by a continental climate with rainfall of 1 200 -1 750 mm/year. The highest temperature in July is about 25 °C; minimum temperatures in winter are down to –20 °C.

In Table 3.1 and 3.2 an overview of the average temperatures and average yearly precipitation at respectively 4 and 5 weather stations is shown.

Table 3.1: Mean temperatures (ºC) in Mati River basin

Station	Altitude (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Fshat K.	390	6	6.2	8.3	11.7	16	13	23	23	19	13	10	6.1	12.9
Bize	1200	-3.2	-2.4	0.2	4.5	10	12.5	16.4	14.3	12	6.7	2.9	-1.4	5.9
Lena M	1000	1	2.3	4	8.4	13.9	16.6	19.1	19.1	15.6	10.8	6.8	2.6	10
Burrel	150	5.5	5.9	8.3	11.7	16.1	20.3	22.7	23	19	12.7	9.5	6.2	13.4

Table 3.2 Average precipitation (mm) during the period 1951 – 1990

Station	Altitude (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Lezhe		174	148	138	121	98	78	38	54	94	152	190	175	1463
Burrel	150	142	130	116	107	86	60	42	47	78	113	161	159	1240
Fshat K.	390	159	154	128	115	108	73	47	70	95	118	185	181	1430
Bize	1200	191	170	153	147	137	79	50	67	134	185	240	194	1750
Bulqize	635	130	136	108	104	84	68	38	60	60	100	172	173	1230
Lena M	1000	178	161	140	132	117	79	43	51	88	141	226	196	1550

In the Mati basin there is correlations between river flow in sub-basins, precipitation and the size of sub-basins except during winter and in some sub-basins characterised by carstic formations. Generally the geology within the basin is dominated by calcareous and ultrabasic (magmatic) formations. The landscape in major parts of the basin can be described as mountainous, except for the coastal plain downstream Milot. For further information on climate refer to Annex 1.

3 CHARACTERISATION OF SURFACE AND GROUNDWATER BODIES

3.1 Characterisation of surface water bodies in EU

One of the key elements of preparing river basin management plans and to make the initial description of the river basin district in accordance with the requirements of the WFD is closely connected with “characterisation of water body types” (described in Annex II of the WFD).

Characterisation of water body types is the backbone in the whole planning process and the applied methodology for defining “good ecological status” in surface waters and “good chemical status” for ground water. To achieve “good ecological and chemical status” for all water bodies in EU by 2015 is the overall scope of the WFD which is required in all EU member states

In the directive the normative definition of good ecological status for surface water body types is described as a status where: “the biological quality elements show low levels of distortion resulting from human activity, and deviate only slightly from those normally associated with undisturbed conditions”. (Annex V section 1.2, table 1.2).

This definition shall be seen in the context that Annex V provides normative descriptions of 5 ecological status classifications:

- High ecological status
- Good ecological status
- Moderate ecological status
- Poor status
- Bad status

High ecological status refers to undisturbed conditions and may refer to reference conditions in water bodies (see later). Lower status than good is classified as moderate, poor or bad and will generally not be accepted after 2015 in existing EU member states. Sooner or later good ecological status will be required for water bodies in Albania if the intention of being an EU member state will remain.

For all practical purposes the key point of water management planning in EU is consequently to define the border (limit values) between good and moderate ecological status or chemical status for all national types of water bodies and to see to that a status above such limit values can be achieved or maintained. As the process of defining good ecological or good chemical status has not been done in Albania the following sections have been allocated to a description of how to do it in accordance with the requirements of the WFD.

In the Annex V it is defined that ecological status shall be described with reference to four elements:

- Biological quality elements
- Physico-chemical quality elementsHydro morphological elements
- Specific pollutants with special reference to dangerous and priority substances in Annex IX and X of the WFD

It should be noticed that the normative description of good ecological status refers only to biological elements while chemical and morphological elements are regarded as support to achieving good biological quality status in surface water bodies. In Albania this is a major problem as monitoring of biological parameters is not included in regular monitoring programmes and not with standard methods adjusted to assessment of biological quality status in accordance with the requirements of the WFD. For that reason some attention has been paid to biological monitoring methods in this pilot plan.

However, there is a long way between words in a normative description of good ecological status and empirical facts and parameters that can be monitored, controlled and assessed with a common approach by all EU member states. Characterisation of water body types is the basic first step in that approach.

In the following only the overall description for characterising water body types is taken into account and all the exemptions from the general approach will only be mentioned briefly where it is relevant. That concerns e.g. artificial and heavily modified water bodies and assessment of ecological status for such types. Artificial lake types are represented in Mati Basin: The Shkopet and Ulza reservoirs, which in addition has been modified as Chinese carps have been introduced. In the coastal plain downstream Milot there is as well a dense net of drainage channels which may be characterised as artificial, modified and transitional water bodies.

3.1.1 Mapping of surface water bodies

As a pre-accession country Albania has since 2003 been reporting on status of lakes and rivers to the European Environmental Agency in Copenhagen, but a country wide identification and mapping of all water bodies in Albania is not in place. The identification of water bodies shall be carried out according to the CIS (Common Implementation Strategy) Guidance document no. 2: Identification of water bodies.

The result of this exercise is that each water body shall be identified with a EU_CD_Code. The identification shall be supplied with a GIS map which accurately shows the location of each coded water body. The map shall be applied for characterisation of water body types and description of the ecological status and will as well be applied in the common communication and coordination with EU on river basin management planning in Albania

It has not been attempted as part of preparing this pilot river basin management plan to identify and to map all the water bodies in Mati Basin. Only the main branches of the rivers within sub-basins have been addressed and not based on mapping and coding as it will be required in the future. The coding and mapping has to be done officially by the Environmental Agency or the river basin authority through the focal point for Albania and coordinated with the European Environmental Agency in Copenhagen.

3.1.2 Surface water body types

Characterisation of water body types can be done according to two systems: System A and System B. (Annex II of the WFD).

System A is the system to be applied for reporting to EU on water body types. But in the following descriptions system B has been applied for the purpose of the pilot river Mati Basin management plan. Mainly because Greece and Italy apply system B and Albania belongs to the same eco-regions as these two countries (see Annex XI in the WFD). Albania will hereby be able to use part of the work of these two countries for setting up environmental parameter values on ecological status in water bodies – if the same future monitoring methods are adopted. In addition system B adds some flexibility in the typology descriptions and can as well include characterisations related to system A.

For characterisation of water body types Albania belongs to the eco-region: Hellenic western Balkan together with Greece for reference to inland surface water bodies like rivers and lakes. For reference to transitional and coastal waters Albania belongs to the eco-region: the Mediterranean Sea whereto obviously also Italy belongs.

The first step in defining surface water body types is to distinguish between

- Rivers
- Lakes
- Transitional waters
- Coastal waters
- Artificial and heavily modified surface water bodies

Mainly rivers as examples of water body types will be addressed in this pilot plan as major natural lakes are absent in the basin. Transitional and coastal waters represent only a minor part of the basin and should as a consequence of the hydrological complexity and lack of systematic monitoring in the area be addressed as part of a broader survey of the coastal plain areas of Albania. Two major artificial reservoirs, the Shkopet and Ulza reservoirs, exist in the basin. They are dams for hydropower production and will be addressed as an artificial modified water body type.

The coastal zones of Lezhe and Kurbin are characterised by a dense network of irrigation schemes and drainage canals which are as well characterised as both artificial and modified water bodies.

Recommendation
A recommendation is to keep the number of surface water body types low to avoid a comprehensive effort on defining reference conditions on moderate good or high ecological status. It will as well restrict the efforts of inter-calibration of parameter values with neighbouring countries within the eco-regions whereto Albania belongs.

3.1.3 River types and biological quality elements

Characterisation of surface water body types with regard to rivers in Mati Basin will in the following be done based on the EU Commission Decision[4] (2008/915/EC) on inter-calibration of ecological status as background for defining limit values on ecological status in rivers.

[4] Commission Decision of 30 October 2008 establishing pursuant to Directive 2000/60/EC of the European Parliament and of the Council the values of the member state monitoring system classification as a result of the inter-calibration exercise

The Mediterranean Rivers included in the inter-calibration was based on the shared river types shown in Table 4.1. Both Greece and Italy share the same river types and it is clear that the rivers within the Mati basin can be categorised within the same types.

For each of the four river types biological quality elements with regard to benthic invertebrate fauna have been inter-calibrated with the purpose to identify borders between good/moderate and high/good ecological status to provide a description of biological quality. In this case it has been done based on benthic invertebrate fauna in the four river types.

Table 4.1 Mediterranean River types

Type	River characterisation	Catchment km^2	Altitude m	Geology	Flow regime
R-M1	Small mid-altitude streams	10 – 100	200 – 800	Mixed	Highly seasonal
R-M2	Small/medium lowland streams	10 - 1000	<400	Mixed	Highly seasonal
R-M4	Small/medium mountain streams	10 – 1000	400 – 1500	Non-siliceous	Highly seasonal
R-M5	Small lowland temporary streams	10 – 100	< 300	Mixed	Temporary

The exercise with the inter-calibration is to calculate values for so called Ecological Quality Ratios (EQR) defined as: Boundary values / Reference values.

Reference values are the highest values to be monitored with a specific method in a reference water body type for description of high ecological status – undisturbed and without any distortion or impacts from human activities.

Boundary values are the actual values monitored with a specific method at the boundary between High/Good ecological status as well as the boundary between Good/Moderate ecological status. The last boundary refers generally to the conditions to be achieved in all surface water bodies in all EU member states up to 2015.

The method applied in both Italy and Greece for monitoring the biological quality elements is based on monitoring related to a benthic invertebrate fauna index. It means that it is based on sampling of benthic invertebrate fauna classes or species for evaluation of composition and abundance. The specific applied monitoring index for invertebrates is: STAR inter-calibration Common Metric Index. (STAR ICMi).

The results of the inter-calibration can be summarised as shown in Table 4.2 with reference to River types described in Table 4.1

Table 4.2 River types and EQR boundaries for invertebrates

River type and country	Ecological Quality Ratios EQR	
	High/Good Boundary	Good/moderate boundary
R-M1 Greece	0.95	0.71
R-M1 Italy	0.97	0.73
R-M2 Greece	0.94	0.71
R-M2 Italy	0.94	0.70
R-M4 Greece	0.96	0.72
R-M4 Italy	0.94	0.70
R M5 Italy	0.97	0.73

The results of the inter-calibration show, that the EQR values are very much the same, both between river types and between countries. It indicates that the monitored index values should be replicable also in Albania if the same index is applied and the same River types are defined

Recommendation
Based on the inter-calibration process with participation of Greece and Italy it is recommended that Albania adopt the same river types as Italy and Greece and at the same time introduce the STAR ICMi index as national standard in new monitoring programmes for characterising the environmental status of rivers with regard to biological quality.

Benthic fauna indices have for many years been the most commonly applied indices for characterising the biological quality in rivers in existing EU member states and it is now a demand in the WFD. If other indices are applied it will be time consuming to calibrate new index values with new biological quality boundaries in the WFD. The inter-calibration process referred to in the EU Commission Decision[5] (2008/915/EC) lasted four years.

Only the benthic invertebrate fauna index has been inter-calibrated in Italy and Greece until now, but the inter-calibration is ongoing and will continue for other parameters, see under recommendations.

3.1.4 Lake types and biological quality elements

Characterisation of surface water body types with regard to lakes will in the following as well be done based on the EU Commission Decision (2008/915/EC) on inter-calibration of ecological status as background for defining limit boundary values in lakes.

The Mediterranean lake of relevance to Mati Basin was based on one shared lake type shown in Table 4.3.

Table 4.3 Mediterranean lake type

Type	Lake characterisation	Altitude m	Mean depth M	Alkalinity meq/l	Lake size Km^2
L-M8	Reservoirs, deep, large, calcareous, catchment < 20 000 km^2	0 - 800	> 15	> 1	> 0,5

Both Greece and Italy shared the same lake type and it is clear that Ulza and Shkopet Reservoirs in Mati catchment can be characterised within the description of same type (see later).

The biological quality elements that were inter-calibrated were phytoplankton parameters indicative of biomass with reference to summer mean values in the euphotic zone for chlorophyll a, total bio volume and percentage of Cyanobacteria.

The result of the inter-calibration is shown Table 4.4a-c with reference to the lake type shown in Table 4.3.

[5] Commission Decision of 30 October 2008 establishing pursuant to Directive 2000/60/EC of the European Parliament and of the Council the values of the member state monitoring system classification as a result of the inter-calibration exercise

Table 4.4a: Lake type, EQR and boundary parameter values for chlorophyll a

Type	Ecological quality ratio EQR	Chlorophyll a concentration ug/l
	Good/moderate boundary	Good/moderate boundary
L-M8	0,43	4.2 – 6.0

Table 4.4b: Lake type, EQR and boundary parameter value for biovolumes

Type	Ecological quality ratio[6] EQR	Total biovolumes mm^3/l
	Good/moderate boundary	Good/moderate boundary
L-M8	0,36	2.1

Table 4.4c Lake type, EQR and boundary parameter value for % of Cyanobacteria

Type	Ecological quality ratio[7] EQR	Cyanobacteria %
	Good/moderate boundary	Good/moderate boundary
L-M8	0,72	28.5

It should be noticed that only the boundary between moderate and good ecological status has been addressed indicating that the parameter values refers to the highest values of good ecological status required in 2015.

Recommendation
Based on the inter-calibration process in Greece and Italy for the three parameters, chlorophyll a, total biovolumes of phytoplankton and % of Cyanobacteria it is recommended that Albania adopt at least the same lake type as Italy and Greece and at the same time introduce at least one of the parameters in new monitoring programmes for characterising the environmental status of lakes.

Only the three parameter values have been inter-calibrated till now in Italy and Greece, but the inter-calibration is ongoing and will for the biological quality elements also include composition and abundance of other aquatic flora as well as composition and abundance of fish fauna and composition and abundance of benthic invertebrate fauna. Adopting the same lake type Albania will benefit from further inter-calibration of these other biological quality elements in the future.

3.1.5 Quality elements, ecological status and parameter limit values in Rivers

In the WFD good ecological status shall be defined on the basis of biological parameters. Chemical, physical and hydro-morphological parameters are only considered to support the development or preservation of good biological status. However, the calibration of biological parameter values with boundary limit values for good biological status and other classifications has not yet been undertaken in Albania and it is till ongoing in existing EU member states. In this situation it is necessary to apply chemical and to some extent physical parameters to identify boundary limit values based on expert judgements. In Table 4.5 a set of frequently applied parameter limit values in Rivers have been shown with emphasis on chemical parameters. The values of the STAR ICMi index has already been discussed in relation to Table 4.2.

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[6] Calculated as EQR = (100 – boundary value/ 100 – reference value)
[7] Calculated as EQR = (100 – boundary value/ 100 – reference value)

Table 4.5 Chemical and biological parameter limit values in Rivers

Parameters	Unit	Parameter limit values				
		High Status	Good Status	Moderate Status	Poor Status	Bad Status
Chemical elements						
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
Biological elements						
Benthic invertebrate fauna						
STAR ICMi index	EQR	>0.95	>0.72	<0.72		

The most indicative parameters are dissolved O_2 and BOD_5 as they most often can be correlated with EQR values in biological indices. That is not necessarily the case for nitrogen components, but the mineralization and transformation of nitrogen components and the speed by which it takes place depends to some extent on the available oxygen concentrations in rivers and may for that reason express similar indicator susceptibility.

Nitrogen concentrations are as well indicating the level of nitrogen loads from loads and run-off. Concentrations of phosphorous components and especially Total-P are the chemical quality indicator in lakes if no biological measurements are available. But they are included in list for Rivers as well to indicate the level of phosphorous transport and risk assessments in River systems where eventually downstream lakes and reservoirs are located.

3.1.6 Quality elements, ecological status and parameter limit values in lakes

The calibration of biological parameter values with boundary limit values for good biological status in lakes has not yet been undertaken in Albania and it is still ongoing in existing EU member states. In this situation it is necessary to apply chemical and to some extent physical parameters to identify boundary limit values based on expert statements. In Table 4.6 a set of frequently applied parameter limit values in lakes have been shown. The values for chlorophyll-a, total biovolume and Cyanobacteria have already been discussed in relation to Table 4.4a-c

Total-P is the most frequently applied chemical indicator of environmental quality in lakes. The reason is that phosphorous very often is the growth limiting factor in algae populations in lakes or other stagnant water bodies with a hydraulic retention time of more than one day.

The growth and density of algae is reflected in measured chlorophyll a concentrations, the biovolume of algae and the % of the volume of Cyanobacteria.

Table 4.6 Chemical and biological parameter limit values in lakes

Parameters	Unit	Parameter limit values				
		High Status	**Good Status**	**Moderate status**	**Poor Status**	**Bad Status**
Chemical elements						
Total-P	mg/l	<0,030	<0,060	<0,4	<1	>1
Physical elements						
Transparency (Secchi depth)	m	7	>3	<3		
Biological elements						
Chlorophyll-a	ug/l		<4.2 – 6.0	>4.2 – 6.0		
Chlorophyll-a	EQR		>0.43	<0.43		
Total biovolume, algae	mm^3/l		<2.1	>2.1		
Total biovolume, algae	EQR		<0.36	>0.36		
Cyanobacteria	%		<2,85	>2,85		
Cyanobacteria	EQR		<0.72	>0.72		

They may be interdependent. It is recommended that at least one of the biological elements should be included in future monitoring programme. The least time consuming biological element to measure is chlorophyll a as it can be done with a standard procedure in a chemical laboratory, while biovolumes of algae and % of Cyanobacteria is based on time consuming counting and measuring in an expensive inverted microscope by biological specialists.

3.2 Characterisation of surface water bodies in Mati Basin

3.2.1 Characterisation of Rivers

Delineation and coding of rivers in Mati basin has not been undertaken as part of preparing this pilot plan as described in section 4.1.1. Instead an overall characterisation of rivers or segments of rivers have been done based on a characterisation of sub-basins. The terrain and main sub-basins within Mati Basin are shown in Figure 4.1. Sub-basins are defined in relation to nine existing hydrometric monitoring stations. It means that a monitoring station represents the lowest elevation point in each sub-basin. The nine sub-basins have been named after the main river branches within the sub-basin.

The main tributary of the Mati River is the Fani River that originates in the north east of the basin, while the Mati itself flows from the south east of the basin, see Figure. 4.1.

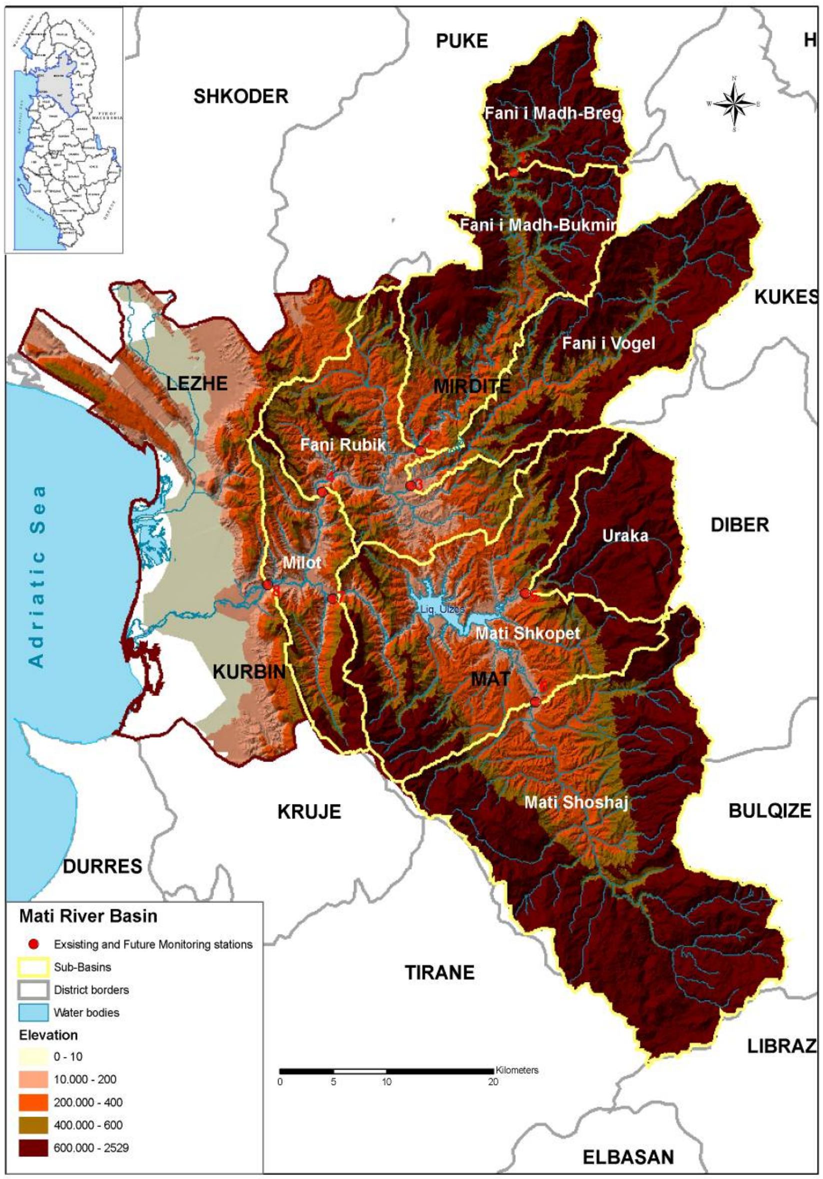
The surface area of the Mati basin upstream the confluence of the Fani River near Milot is 1330 km^2. The Fani River basin has a surface area of close to1080 km^2 and the coastal area including the part of the river after the confluence with the Fani River to the Adriatic Sea has a surface area of about 590 km^2. The entire river basin district covers an area of 2993 km^2. It should be noticed that the coastal flood plain has a relatively high population density with more intense impacts from many human activities than in the inland area. But the coastal plain area only represents approximately 15 % of the whole area of the Mati River Basin District.

The main spring of the Mati River is in the Kaptina Mountain at an altitude of approximately1870 m above sea level. The total catchment area of the Mati River has a surface area of 2445 km^2 and an average altitude of 746 m. The Mati has an overall length of 144 km.

The Fani River originates from two branches, the Fani Vogel and the Fani Madh.

The Fani Madh has a catchment area around 540 km^2 and is approximately 77 km long. The mean altitude is approximately 700 m. Its major spring area is at an altitude of around1400 m above sea level. The Fani Madh valley is about 60 km long running from north-east to the south-west. At the point of confluence with the Fani Vogel the valley is located at an altitude of 180 m above sea level.

Figure 4.1 Sub-basins and main Rivers in the Mati Basin



The Fani Vogel catchment has an area of 415 km^2 and the River has a length around 55 km. The catchment lies at an average altitude of 734 m. The springs of Fani Vogel are located around 1860 m above sea level. Fani Madh and Fani Vogel join together near Rreshen.

Based on this characterisation of sub-catchments all the Rivers and segments of Rivers upstream the Milot monitoring station can be described with reference to the Mediterranean types: R-M1, R-M2, R-M4 and R-M5 as shown in Table 4.1. It means that status of good ecological and chemical status shall be achieved in accordance with the limit values shown in Table 4.5.

3.2.2 Characterisation of lakes

Large artificial water bodies as the Ulza and Shkopet reservoirs can be seen also as lakes although their water levels fluctuate much and their littoral zones are eroded.

The major of the two is the Ulza reservoir, see figure 4.1 which is an artificial dam established for hydropower generation. In the context of the WFD they are as well biological modified lakes as Chinese carps have been introduced.

The status of the lake cannot be characterised with reference to good ecological status where “the biological quality elements show low levels of distortion resulting from human activity, and only deviate slightly from those normally associated with undisturbed conditions”.

The lake represents an exemption to the general lake types described in the WFD and for this modified lake type the expression: Good ecological potential applies. This status does not include assessments of biological status, but it is expected that it will be managed with the aim of achieving at least good chemical status, as described in article 4 (iii) and section 1.2.5 of Annex V in the WFD.

The depth of the lake varies during the year but shall be characterised as a deep lake as it may reach a depth around 60 m.
The lakes type correspond to the Mediterranean type: LM8 shown in Table 4.3 requiring good chemical and physical status in accordance with the limit values shown in Table 4.6.

3.2.3 Characterisation of artificial water bodies

In the coastal area of Lezhe and Kurbin districts a dense network of irrigation schemes, drainage canals, and reservoirs exists as well. The drainage canals generally discharge into the sea or into coastal lagoons. There are no quantitative and qualitative data on these water bodies.

Water reservoirs are distributed throughout the entire River District. The largest is the Shkopet lake, which has a reservoir with a capacity of approximately of 6 millions cubic metres.

Location and capacity of various reservoirs

Reservoir	Location	Capacity (000/m³)
Troshan	Commune of Blinisht	90
Fishta	“	433
Kallmet	Commune of Kallmet	2.044
Patalej	Commune of Kolsh	110
Kashnjet	Commune of Ungrej	428
Zheja	Municipality of Mamurras	268
Vinjoll	Commune of Milot	200
Shkopet lake	“	6.000
Malaj 1	Municipality of Rreshen	2.300
Malaj 2	“	700
Tarazh	“	200
Sheshajve	“	700
Geziq	“	245
Perlat	Commune of Kthelle	225
Prosek	“	415

Besides being used for irrigation purposes, these reservoirs serve as reservoirs for aquaculture with reference to fish production of the Chinese carps (especially silver carp big head carp and grass carp).

3.2.3 Characterisation of lagoons

Along coast there are some coastal lagoons: Merxhan (300 ha), Kune (800 ha), Vain (1500 ha), and Patok (2200 ha).

The lagoons all have similar geomorphologic characteristics with soft bottom sediments over compact clay and organic material. Their depths range between 0.3 - 1.5m, salinity 15-40°/00, temperatures range from 5-32°C and the oxygen measurements of 2.8 mg/l.

These lagoons are valuable because of their high levels of biodiversity, as well as economic interests related to tourism, fishing, hunting, etc. The Patok lagoon, between the 2 mouths of Droj and Mat rivers, in particular, serves as an important feeding area for globally endangered loggerhead turtles.

The lagoon waters are rich in fish, more prominently in mullet and eel, and aquaculture is traditionally practiced inside the coastal lagoons.

All the lagoon systems may be subject to climate change-related stress, and more or less threatened in the long term by sedimentation, siltation of channels and occasional hypertrophic anoxia, as well as domestic and industrial pollution.

3.3 Characterisation of groundwater bodies in EU

Good status in groundwater magazines is characterised by two elements: Quantitative and chemical status.

3.3.1 Quantitative characterisation

Quantitative status is in the WFD defined by the groundwater level. In good quantitative status the groundwater level is stable and the resource is not exceeded by the long term annual average rate of abstraction (Annex V, section 2.1.2). Accordingly the status shall be characterised based on monitoring continuously during the year in a sounding pipe taking into account the seasonal variation in water level and recharge. No such measurements have been made available for characterising the quantitative status of groundwater level in the Mati Basin.

But for the quantitative status only two categories exist: Good or bad, meaning that the groundwater resource in the long term perspective either recharge in response to abstraction – or not. It shall be reported in the river basin management plan and shall be addressed in programmes of measures in case the status is characterised as bad.

3.3.2 Chemical characterisation

Characterisation of groundwater magazines and setting parameter limit values for good chemical status requires an assessment of how the resource shall be applied and how it contributes to the ecological status of the surface water depending on the intensity of groundwater infiltration into the river bed.

In table 4.7 a number parameter limit values are listed and supplemented with similar Albanian norms. For implementation of the WFD it is required that a number of other directives are implemented as well. Two of them are the Ground Water Directive 2006/118/EC and the Drinking Water Directive 98/83/EC. The Ground Water Directive contains only parameter values on nitrate and pesticides, but says that a number of other parameters should be monitored if relevant (marked with * table 4.7). It means that the parameters shall be chosen and targeted if existing or former activities indicate possible impacts on the groundwater magazine. If however water shall be applied as drinking water or be applied for food-stuff processing, then the limit values in the Drinking Water directive must apply. For risk assessments in groundwater bodies of good status the parameters from the Drinking Water Directive will be applied, see section 9.1.

It should be noticed that the Albanian norms for ground water quality do not comply with the limit values in EU Directives.

Table 4.7 EU and Albanian quality objectives for drinking water and groundwater

Parameter	Unit	Ground water directive 2006/118/EC	Drinking Water directive 98/83/EC	Albanian Norms Mati Basin
Nitrate	mg/l	50	50	25
Nitrite	mg/l		0.5	5
Pesticides	µg/l	0,1	0,1	
Pesticides (total)	µg/l	0,5	0,5	
Arsenic	ug/l	*	5.0	
Cadmium	ug/l	*	5	5
Lead	ug/l	*	10	
Mercury	ug/l	*	1	
Nickel	ug/l		20	50
Zinc	ug/l		3000	100-3000
Chromium	ug/l		50	50
Copper	mg/l		2.0	0.1-1.5
Potassium	mg/l		12	
Trichloroethylene	µg/l	*	10 (sum)	
Benzene	ug/l		1.0	
PAH	ug/l		0.1(sum)	
Aluminium	ug/l		200	
Ammonium	mg/l	*	0,5	0.05
Conductivity	uS cm^{-1}		3000	
Chloride	mg/l	*	250	25
Manganese	ug/l		50	20-50
Sulphate	mg/l	*	150	25
Clostridium perfringens	no./100 ml		0	
pH				6.5-8.5
Magnesium	mg/l			20
Calcium	mg/l			75

3.4 Characterisation of groundwater bodies in Mati Basin

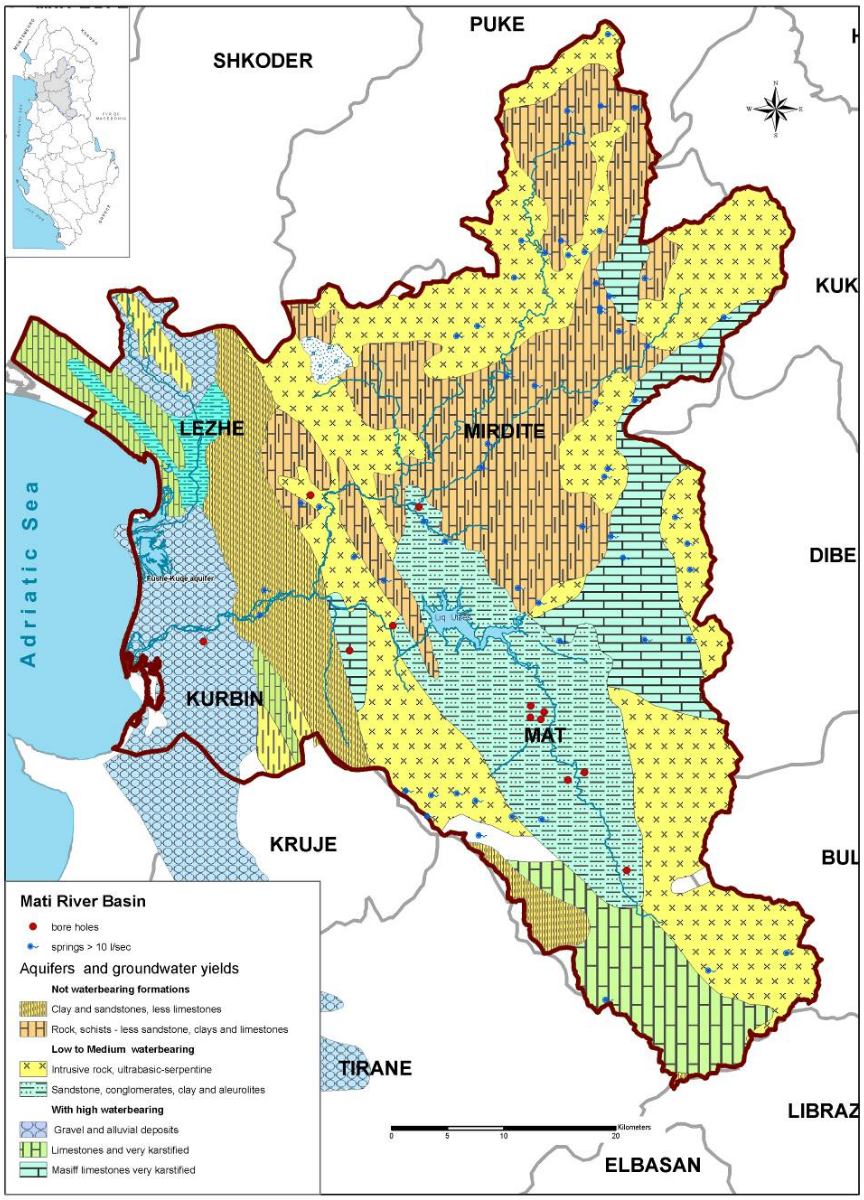
Both the quantitative and chemical characterisation of groundwater bodies within the Mati Basin are closely interrelated as the geological stratifications as well as the mineralisation of the geological formations are reflected in the transmitting and yielding capacity of aquifers and may as well give rise to chemical characterisations with potential high contents of minerals in sub-soils.

3.4.1 Quantitative characterisation

In Figure 4.2 mapping of sub-soils and an overall description and their expected yielding capacity has been undertaken. The high yielding formations are closely related with limestone and carstic formations as well as alluvial sedimentary deposits in the coastal plain. A basin wide distribution of reservoirs has not been described. But it is known that at least two groundwater reservoirs exist, respectively the Fushe Kuqe and Lezhe aquifers, both located in the coastal area and the corridor where the Mati River flows to the Adriatic Sea. Both aquifers consist of quaternary layers with a thickness of 150 to 280 m. Gravel sediments form layers that are separated by layers of clayey sediments.

The sedimentary basin in the central part of Mati Basin as well as intrusive rock areas are at least characterised by a low to medium high water bearing.

Figure 4.2 Quantitative characterisation of yielding capacity of groundwater in relation to sub-soil composition.

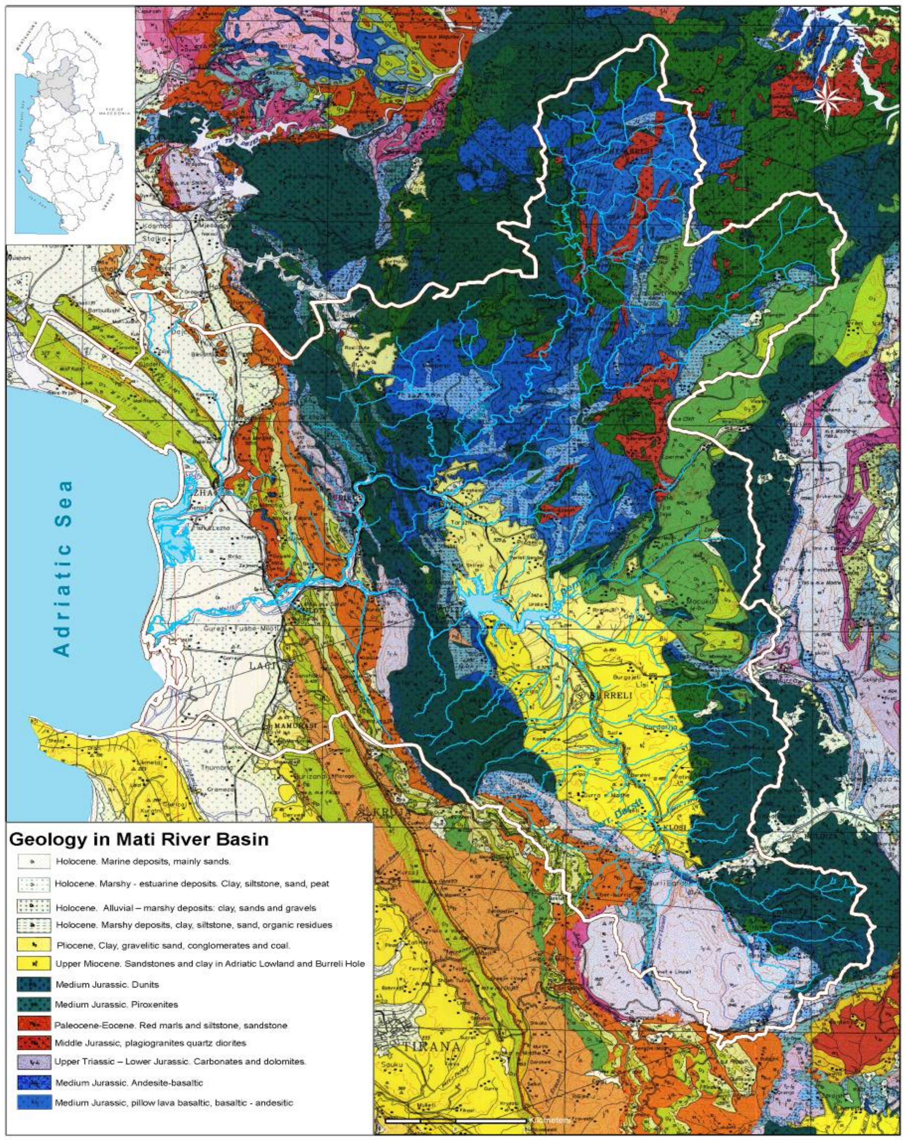


In the WFD surface water and groundwater is considered as one and the same water resource and shall be managed within the same borders. As the Fushe-Kuge and Lezhe aquifers are extending far beyond the corridor and the existing borders of the Mati Basin it should be considered to revise the border of the basin and include a major part of the coastal plain downstream Milot into the Mati Basin.

3.4.2 Chemical characterisation

In figure 4.3 the geological formations within the basin have been mapped and shown in a regional context. It can be seen that the main geological formations are reflected in the same patterns as described for sub-soils and their water bearing capacities.

Figure 4.3 Geology within the Mati River Basin



One of the main issues concerning geology related to Mati Basin concerns the Bulqiza massif[8] which in the geological map is described as the medium Jurassic pyroxenes and dunites embracing the borders of the Mati Basin. The pyroxenes and dunites are under mineralization and have a high content of chromites which is and has been the target for mining activities. It may be reflected in the chemical characterisation of both groundwater and surface water.

In the southern part of the basin the pyroxenes and dunites from the Bulqize massif is bordered by carbonates and dolomites from Upper Trias-Jura giving rise to extensive carstic areas and well buffered spring water and groundwater. In the northern part there is less carbonates in the geological formations. Instead the area is dominated by ultra basic eruptive andesitic basalts, which is compact and with less fissures and transmitting capacity as reflected in figure 4.2

The high yielding capacities are closely related to the Holocene alluvial deposits which are both of marine and freshwater origin in the transition zone of the Mati Estuary and are hereby potentially under the influence of chloride and marine electrolytes.

The lowland flood plain downstream Milot is only partly addressed in this plan as data on both the quantitative and chemical status limited. Nevertheless, the only available information on chemical status of groundwater within the basin refers to this area and will for that reason be applied in further assessments.

8 Example: H. Beshku, A. Dobi, V. Gjoni and A. Pirdeni Geology, Petrology and chromite mineralisation of the Bulquiza ultramafic Massif. Proceedings of XVII. Congress of Carpathian-Balkan. Geological Association. Bratislava, September 1st - 4th 2002

4 PRESSURES AND IMPACTS OF HUMAN ACTIVITIES

4.1 Point source pollution

Point source pollution is normally described in relation to well defined outlets either through pipes, sewer systems or other well defined waste water discharge points from industries, treatment plants, storm water systems, percolation systems from disposal sites, regulation weirs from dams and so on. As no treatment plants with sewerage systems exist and many industries and enterprises have been closed down without cleaning up, most of the pollution in Mati Basin might most correctly be characterised as diffusive pollution through infiltration from less well defined open channels and ditches and run off and seepage from former production sites.

For practical reasons this section includes less well defined pollution from point sources, even if they today most correctly might be referred to as non-point sources of pollution. A special case in that context is related to waste disposal, which today takes place everywhere and only at very few organised disposal sites. This practise is reflected in aggregation of major amounts of waste along river banks.

4.1.1 Household pollution

Population data

Districts and prefectures partially or as whole represented within the borders of the Mati River Basin District are listed in Table 5.1.

Table 5.1: Districts and prefectures

District	Prefecture	Drainage
Lezha	Lezhe	into Mati and sea
Mirdite	Lezhe	into Mati
Kurbin	Lezhe	into Mati and sea
Mat	Diber	into Mati
Bulqize (part)	Diber	into Mati
Puke (part)	Shkodra	into Mati

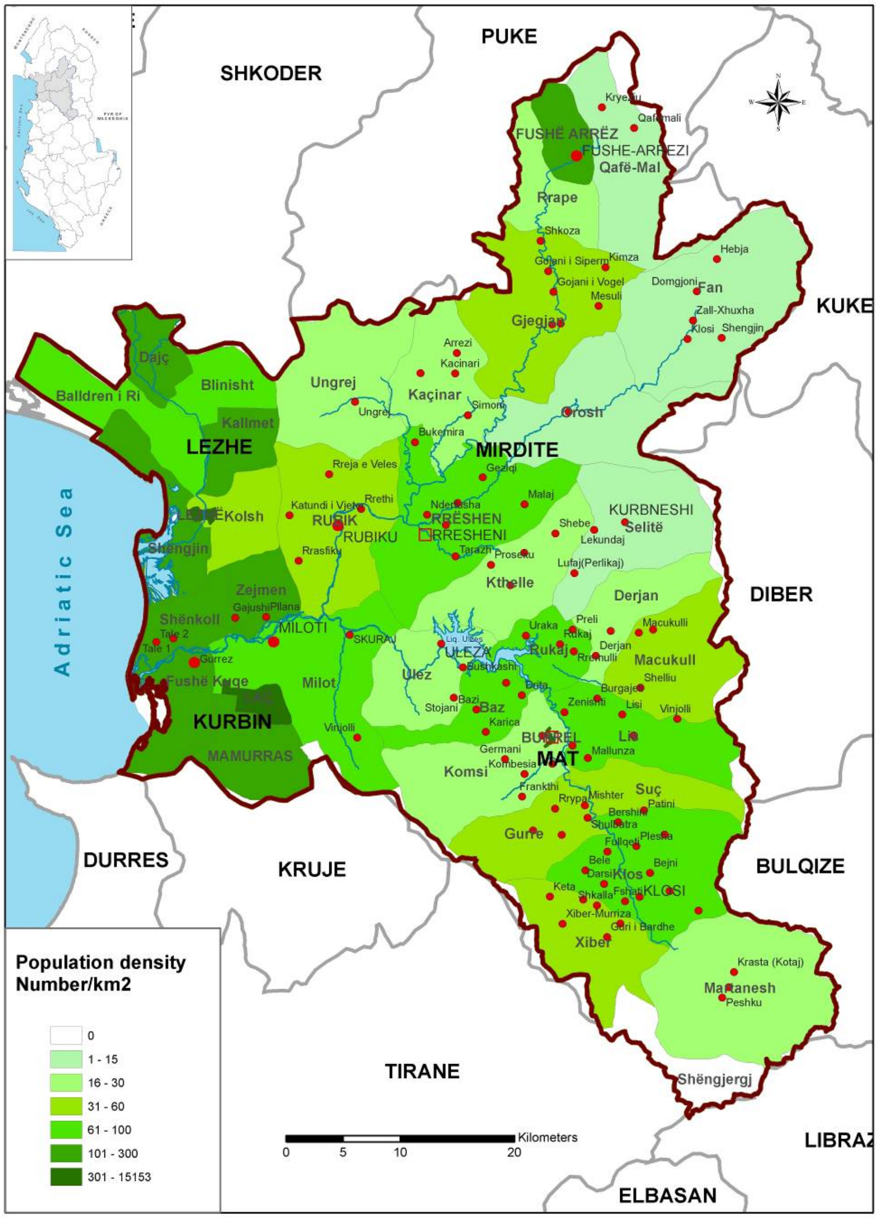
In 2001 the Mati River Basin District had 234.346 inhabitants (Census 2001). An overview of the communes and municipalities in the Mati basin is shown in Table 5.2. This table also shows data on the registered population numbers that have been provided by the Ministry of Interior for 2009.

Table 5.2: Data on population in Mati River Basin District

Name of commune or municipality			District	Area (km^2)	Census 2001	MoI 2009**)
1	Burrel	m	Mat	0.8	12123	17355
2	Klos	m	Mat	127.3	10489	10559
3	Derjan	c	Mat	57.6	2612	4459
4	Gurre	c	Mat	68.6	4373	4173
5	Baz	c	Mat	49.6	3367	3329
6	Komsi	c	Mat	109.4	6093	5285
7	Lis	c	Mat	85.6	4984	5065
8	Macukull *)	c	Mat	90.6	3453	3453
9	Rukaj	c	Mat	42.3	4293	4133
10	Suc	c	Mat	46.3	3609	3479
11	Ulez	c	Mat	74.1	2064	2151
12	Xiber	c	Mat	84.6	3727	3826
13	Martanesh	c	Bulqize	168.3	3546	2616
14	Lezhe	m	Lezhe	2,5	14420	27096
15	Balldre	c	Lezhe	72.6	7203	10804
16	Blinisht	c	Lezhe	40.8	4238	5597
17	Dajc	c	Lezhe	36.6	5183	6836
18	Kallmet	c	Lezhe	38.3	5493	6771
19	Kolsh	c	Lezhe	45.2	4943	6510
20	Shengjin	c	Lezhe	56.1	3572	11485
21	Ungrej	c	Lezhe	116.8	3840	3130
22	Shenkoll	c	Lezhe	40.4	8894	15048
23	Zejmen	c	Lezhe	34.7	6713	8919
24	Lac	m	Kurbin	14.1	19424	30080
25	Mamurras	m	Kurbin	71.8	17676	22549
26	Fushe Kuqe	c	Kurbin	60.8	6129	8622
27	Milot	c	Kurbin	143.3	11163	12072
28	Rreshen	m	Mirdite	154.1	11447	16505
29	Rubik	m	Mirdite	128.5	6842	8055
30	Fan	c	Mirdite	172.0	5702	5157
31	Kacinar *)	c	Mirdite	87.9	2916	2916
32	Kthelle	c	Mirdite	88.4	3653	5508
33	Orosh	c	Mirdite	150.9	3966	3403
34	Selite *)	c	Mirdite	106.2	2530	2530
35	Fushe Arrez	m	Puke	33.6	4090	4865
36	Qafe Mali *)	c	Puke	145.3	3762	3762
37	Gjegjan	c	Puke	147.5	5814	4830
			TOTAL	2993.5	234346	302933

Note: *) No data for 2009
**) Registered population includes migrated residents

Figure 5.1: Population density in Mati basin



4.1.2 Public water supply and sewerage

Wastewater

Currently there are no urban wastewater treatment plants in the Mati basin. It is assumed that all liquid wastes are disposed of directly into the environment, but there are no data on the specific pressures of wastewater discharge on the quality of surface water, groundwater or the soil.

Water supply
Water supply from groundwater magazines represent a pressure on ground water resources in the coastal plain, dominated by high yielding gravel and alluvial deposits see Figure 4.2. The area is densely populated and is within the borders of Mati Basin the dominating economic region. The high yielding magazines are separated by Mati river with The Fushe Kuge magazine located north of the river and the Lezhe aquifer south of the river

In the Fushe Kuqe aquifer the major well has a capacity of 800 l/s. In the Lezhe aquifer the two main wells have capacities of 600 and 160 l/s. The Fushe Kuqe aquifer is the most intensively exploited aquifer in Albania. Water from both aquifers is used for water supply in Durres, Lezha, Milot and Laç, as well as for the water supply of about 50 villages.

A number of minor boreholes are spread all over the Basin as shown in Figure 4.2. Hundreds of dug or drilled wells that are used for private water supply and for industrial and agricultural purposes. Most of these wells have low capacities (less than 1 l/s). There is no indications that there are severe pressures on ground water resources except in the coastal plain area

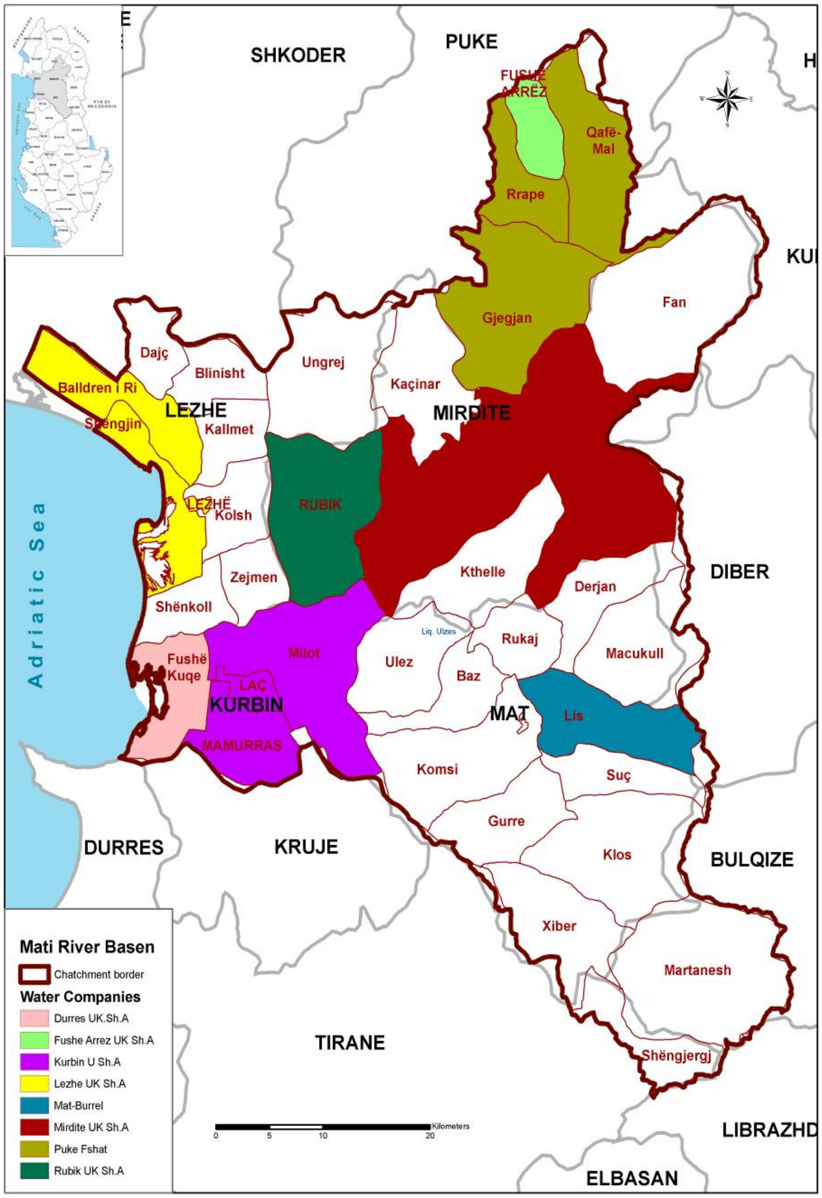
More than 400 wells are located in the coastal plain, in the communes of Shenkoll, Zejmen and Fushe Kuqe. The local authorities have 42 wells in operation for water supply, with an overall capacity of about 2116 l/s. In addition there are 14 artificial reservoirs (dams) in use for water supply, located in the districts of Lezhe and Mirdite.

The table below gives an overview of the use of groundwater in the Mati river coastal plain.

Area	Public water supply	Irrigation	Private wells
North of Mati (Rilla plain)	300 l/s	500 l/s	1100 l/s
South of Mati (Fushe Kuqe plain)	1150 l/s	-	200 l/s

Public water companies
Part of the population of the Mati basin is served by public water companies for water supply and sewerage services as shown in Figure. 5.2.

Figure 5.2: Communes and municipalities, served by water supply and sewerage companies



Data on the water supply and sewerage companies, that are active in the Mati basin, are shown in Table 5.3, 5.4 and 5.5. It should be noted that the figures in these tables refer to the entire service areas of the companies, which may be partly outside the boundaries of the Mati basin.

Table 5.3: Data on water supply and sewerage companies (1)

Company name	No. sewer connections	Communes in service areas in Mati River Basin District
Puke fshat	78	Qafe Mali, Gjegjan
Rubik UK Sh.A	484	Rubik
Mirdite UK Sh.A	1016	Rreshen, Selite, Orosh
Fushe Arrez UK Sh.A	507	Fushe Arrez
Burrel UK Sh.A	3110	Burrel, Lis
Kurbin U Sh.A	0	Milot, Mamurras, Lac
Kraste UK Sh.A.	375	Martanesh
Lezhe UK Sh A	27664	Lezhe, Balldre, Shengjin
Durres UK Sh.A		Fushe Kuqe

Table 5.4: Data on water supply and sewerage companies (2)

Company name	Services			Population	
	Water supply	Sewerage	Service area	Urban	Rural
Puke fshat	Yes	Yes	Rural	0	12000
Rubik UK Sh.A	Yes	Yes	Urban/rural	2365	166
Mirdite UK Sh.A	Yes	Yes	Urban	8276	813
Fushe Arrez UK Sh.A	Yes	Yes	Urban	3824	917
Burrel UK Sh.A	Yes	No	Urban/rural	18200	4060
Kurbin U Sh.A	Yes	No	Urban/rural	41439	23715
Kraste UK Sh.A.	Yes	Yes	Urban/rural	2150	1450
Lezhe UK Sh A	Yes	Yes	Urban/rural	34625	1600

Table 5.5: Data on water supply and sewerage companies (3)

Company name	Water Supply urban	Rural	Sewerage urban	Rural
Puke fshat	0	2350	0	250
Rubik UK Sh.A	1932	115	1920	0
Mirdite UK Sh.A	5261	813	5261	0
Fushe Arrez UK Sh.A	1681	244	1679	0
Burrel UK Sh.A	18200	4060	15162	0
Kurbin U Sh.A	39297	2148	0	0
Kraste UK Sh.A.	2150	250	2150	0
Lezhe UK Sh A	26064	1600	26064	1600

The data shown in table 5.3-5.5 will in later versions of the river basin management plan be applied for estimating point source pollution from households and as background information for assessment of costs of introducing waste water treatment facilities. It has not been attempted based on existing data to estimate the exact impacts from households or the pressures on groundwater resources within the river basin in this version of the plan.

The pollution load deriving from urban wastes can be determined using the following unit values for 1 PE[9]:

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

[9] PE: Person Equivalent. Common applied values in EU countries.

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

The amount of Tot-P, Tot-N and BOD^5 and water consumption within the basin can be calculated as shown in table 5.6.

Assuming a yearly flow of 3,250 mil. m^3/year in Mati river (see section 9.1) the impact on concentrations of N, P and BOD^5 may be calculated as shown in table 5.7.

However such assumptions are not correct as most P, N and BOD^5 from domestic sources will be retained in the soil or transformed during transport in the river system. In addition a river flow of 3,250 mil. m^3/ year can only be monitored in the downstream part of the Mati River. But in later versions of the plan such estimates will be required within sub-basins for the assessment of how to maintain or achieve good chemical water status with a programme of measures.

Table 5.6: The daily and yearly load from 1 PE and the load from 234.000 people living within the basin

1 PE	Day	Year	234,000 PE/year
Tot-P	2.8 g	1.0 kg	234 t
Tot-N	13,7 g	4,4 kg	1029 t
BOD^5	60 g	21,9 kg	5124 t
Water consumption	273 l	50 m^3	11,7 mil. m^3

Table 5.7: Calculation of contributions to concentrations

Conceptual calculation of contributions to the average concentrations in Mati river	
Tot-P	0.072 mg/l
Tot-N	0.317 mg/l
BOD^5	1.577 mg/l
Water consumption	0,4% of the yearly downstream flow

4.1.3 Industry and hydropower

Some of the main industries in Mati Basin cannot be referred to as point sources as they are no longer existing but they may still represent a pollution load. But some existing enterprises may be listed as shown in table 5.8. Pollution from mining, gravel extraction or waste disposal in the Mati basin are listed separately in later tables.

Table 5.8: Industries and locations in Mati Basin

Industry/Products	Location
Cast iron pipes	Rubik
Storage of fuels and gas	7 locations
Asphalt	Milot
Wine, raki	Rreshen
Poultry	Rreshen
Fish farming	5 locations in Fushe Kuqe and Kurbin

In the Mati river basin there are as well are 2 hydropower plants, Ulza and Shkopeti.

The Ulza hydro power plant is located close to the city of Lezha. The plant was built in 1952 and is one the oldest plants under the Korporata Elektroenergjitike Shqiptare sh.a operation which requires urgent rehabilitation.

The Shkopeti hydro power plant (HPP) is located approximately 25 km upstream the river mouth. It was put in operation in 1963, together with the hydropower plant Ulza in a cascade system.

Data on these plants are shown in Table 5.9.

Table 5.9: Hydropower plants in the Mati Basin

Name	Installed capacity (MW)	Annual production (GWh)	Storage volume (Mm^3)	Year of start-up
Ulza	25	120	240	1957
Shkopeti	24	90	15	1965

The installed capacity of the two plants amounts to 3.3% of the total installed capacity in Albania, and the production amounts to 3.8% of the total hydro-electricity production in the country.
A number of projects for construction of small/medium size hydropower stations have been recently approved. The list of these projects is given in Annex IV.

4.1.4 Gravel extraction

Large quantities of gravel are extracted in the river bed downstream the confluence of the Fani and Mati rivers. At the moment gravel extraction permissions are mainly meant for excavation of building materials for the new road from Tirana to the border with Kosovo near Kukës. The road follows the Mati and Fani I Vogel river beds. The extraction of gravel has a significant impact on the hydro-morphological characteristics of the river bed to an extent where it must be characterised as a modified river type incapable to preserve a natural biological diversity and hereby preventing a good ecological status.

In the Mati basin 35 gravel mining companies are in operation with a licence. Their combined production capacity equals about 1,200,000 m^3/year of gravel and sand. The locations of the companies are shown in table 5.10.

Table 5.10: Licensed gravel mining companies and river locations in the Mati Basin

Commune	River	Number of companies
Zejmen	Mati	5
Rubik	Fani	10
Milot	Mati	7
Milot	Fani	1
Fushe Kuqe	Mati	3
Shenkoll	Mati	3
Tale	Mati	1
Òrosh	Fani	1
Unknown, no data		4

Assumed effects of environmental impacts associated with gravel extraction is increasing. These impacts include: loss or degradation of spawning beds and juvenile fish rearing habitats; migration blockages; channel widening, shallowing, 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 downcutting; and loss or degradation of riparian habitat.

On the other hand gravel extraction is an economic important resource being the main source of material within the the building industry. When assessing a permit application for grave extraction, the River Basin Agency should ensure that extraction is undertaken on a sustainable basis not only with regard to the gravel resources (extraction rates and volumes should be closely regulated), but also with regard to environmental impacts.

A simple management scenario for gravel extraction operations, with the goal of minimizing impacts should in advance of issuing permits should be based on environmental impact assessments with emphasis on:

- Biological surveys to establish baseline environmental data as background for, evaluating possible environmental impacts, and for prescribing mitigation measures to avoid or minimize adverse environmental impacts
- Monitor permitted operations and justify environmental impacts in accordance with the permission
- Ensure as part of permissions that costs for reestablishing and implementing a long-term monitoring and restoration programme for areas applied for gravel extraction are paid by contractor

In Rasfik (Mirdite District) there is one limestone quarry, producing about 1000 m^3 per year. Locations of excavation and mining permissions are shown in Figure 5.3

4.1.5 Mining

Mining has been an important economic activity in the Mati basin, in the districts of Mat, Mirdite, Bulqize and Puke. However, the scale of operations, especially of the mining of chromium and copper ores, and the manufacture of these metals take place at a much lesser scale than before 1990. In total 215 companies are or have been in operation with licences for exploitation or exploration. Most licenses (about 162) are concerned with chromium ore mining. Other raw materials include copper ore, basalt, limestone, quartz, marble and granite. Some companies process ore into pure copper (4 companies) and pure chromium (8 companies).
The distribution of mining wastes in the Mati river basin is enormous in terms of waste volume as shown in the table below.

Table 5.10/a Mining piles and tailings ponds within Mati river basin

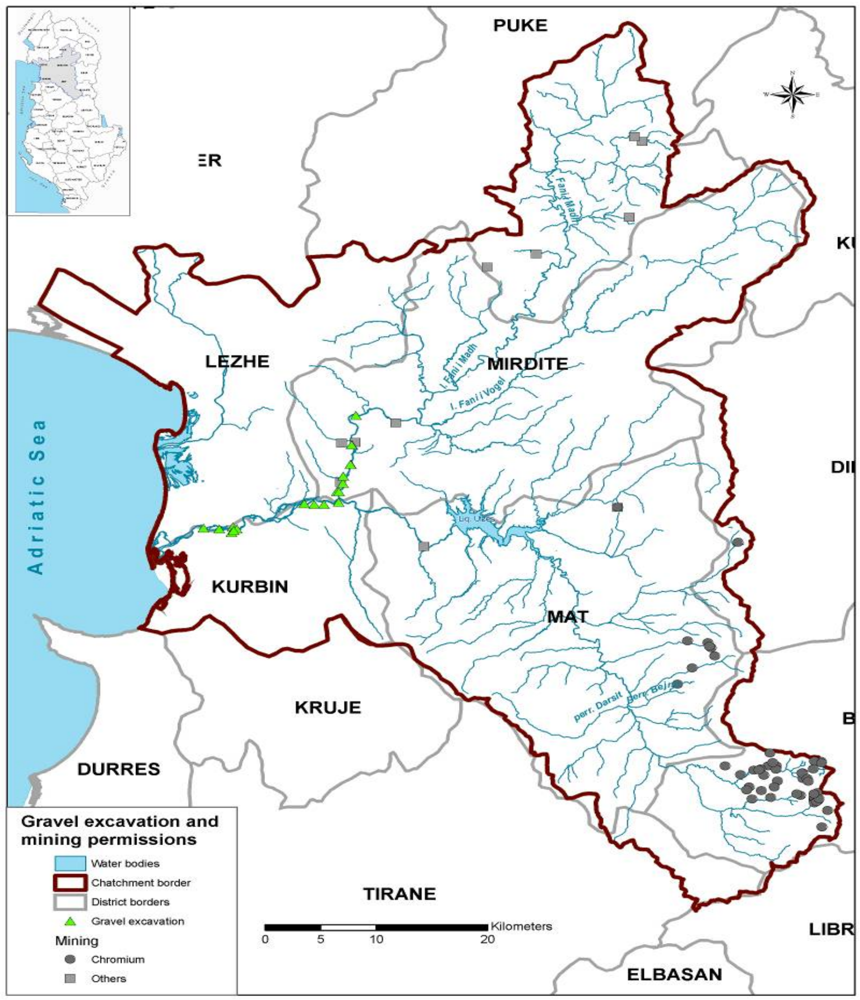
Chromium mining waste piles (m^3)	Copper mining waste piles (m^3)	Copper production tailing dams (m^3)
6,673,700	4,819,700	3,358,300

Some aspects of copper and chromium production and of the environmental threat caused by solid waste from mining activities are presented below.

Copper
Some of the mines, enrichment and refinement plants have been closed since 1990 and others are working at limited capacity. In the Mati River basin copper ore extraction takes place in Gurth, Perlati, Rubik, Spaç, Lak-Rosh, Paluca and Qafe Bari with an output of 226,000 ton/year. The enrichment factories of Fushe Arrez and Reps (both in the Mati River basin) are still in operation but with low capacity.

The plant in Fushe Arrez has a processing capacity of 110,000 tonnes of raw material per year. The process utilises extraction by flotation using pine oil extract. The process has produced mining material of approximately 200 thousand tonnes since 2004.

Figure 5.3: Locations of gravel extraction and mines in Mati basin



Most of the pollution hazard in copper mining activities comes from the enrichment factories. The wastewater only receives pre-treatment in small sedimentation basins and is normally disposed of on top of the inert material deposits, where it contributes to the leachate formation. At the Reps enrichment plant, for instance, part of the deposit has been washed into the Fani Vogel River, because of heavy flooding and the subsequently wreckage of a spillway that was supposed to divert floodwater from the deposit.

The only copper metallurgic plant still in operation is in Laç, close to the mouth of Mati River. The wastewater from this factory is led directly into the Adriatic Sea. The wastewater of the plant is partly treated (neutralisation, sedimentation). Formerly the treatment took place in combination with the wastewater from a super-phosphate plant, which is no longer in operation.

In three locations in the Mati basin with copper mining piles the risks for water contamination have been assessed as being high by national mining experts. In the case of the copper mine tailings ponds, 8 locations in the Mati basin are assessed as being high risk sites. Seven copper mining piles, all in the basin of the River Mati, have been classified as being moderate risk sites regarding water impacts. Out of the remaining mining pile locations in the Mati basin, 12 have been assessed to be low risk sites[10].

All of the mine tailings ponds have been classified as being either high risk or moderate risk locations regarding water contamination. Copper, like chromium, is a reactive transition metal and although it generally presents low risk to humans, in water bodies it is extremely toxic to fish, particularly to fingerlings. The ability of copper to complex with organic matter, used as grazing material for fish, burrowing bivalves and filter feeders, also contributes to its biomagnification in the food chain. As with ferronickel and chromium, the exact impact on surface waters of leachate and runoff from mining pits and tailings ponds in the vicinity of copper mines need to be more thoroughly investigated. The levels of copper and associated mine waste minerals measured in the water column and in inhabiting faunal and floral tissue and underlying sediments should be compared to baseline control values to measure the extent and severity of contaminants.

Copper mining solid waste is aggressive due to high sulphur contents. According to measurements and mass balance models, a total of 50 tons of copper has been released to the sea from the Mati river basin. As a consequence, high values of copper and nickel have been found in Mati river delta.[11]

Chromium

Chromite ore ($FeCr_2O_4$) is one of the most important minerals in Albania. Up until 1990 Albania was the third biggest chromate ore producer and exporter in the world.

The chromite ore is found in veins of varying thickness in ultrabasic geological formations of the Bulqiza massive of about 350 km^2, which is partly located within Mati basin and is on a world wide scale one of the largest deposits of chromium minerals.

Chromium is used in metallurgy for chrome plating, as a paint pigment, in glass staining, in tanning of leather and in chromates and dichromates as in cleaning and oxidising agents. Chromium is a reactive transition metal with a wide range of oxidation states, the most common of which are +2, +3 and +6. In oxidation state of +3 it is generally stable but in oxidation state +6 the element is very reactive and +6 salts are powerful acidic oxidising agents.

10 Source: EMISSION INVENTORY FOR EMISSIONS TO WATER IN ALBANIA. STEMA project 2008

11 Prof. Dr Genc Demi, UT Tirana, Albania

In Albania chromite ore has been mined with high intensity over several decades, using mostly out-dated technology. The chromium mining process has resulted in large amounts of solid material being amassed as piles of waste spoil.
In the Mati River basin chromium ore extraction presently takes place in Kraste-Bater and Klos (140,000 ton/year). The enrichment factories in Kraste-Bater and Klos within Mati River basin are still in operation but with low capacity. The metallurgic complex in Burrel was closed in 2008.

During 2004, all solid chromium wastes near their respective mines were inspected to determine more precisely their location, quantities, and the chemical composition of the spoil contained in the piles (Demi, 2005). Mineralogical analysis undertaken on samples taken from these wastes indicated that the piles are made up of 3-5% of olivine, rhombus pyroxene and chromium minerals. In their present form and oxidation state they are not considered to be a major environmental threat.

However each pile needs to be thoroughly investigated regarding the likely impact it may have on the surrounding environment focusing particularly on areas in close proximity to the piles of spoil. This investigation can be done by examining plants' root, stem and leaf tissue and organ tissue of animals and other bio-indicators in the vicinity of the sites and comparing with control samples to identify abnormal trends.

4.1.6 Solid waste disposal

Random disposal of waste is a major problem within Mati Basin as elsewhere in Albania. Waste disposal might more appropriately be addressed as a source of diffuse pollution

However 6 official disposal sites for solid waste disposal exist, at Rubik, Rreshen, Burrel, Lac, Mamurras and Pilan . Discharge and run-off of leachate from these dumping sites, as well as of unknown unofficial dumping sites, may contribute to pollution of surface water and groundwater. The locations of critical areas, where solid waste disposal may cause water pollution, need to be mapped in order to enhance the preparation of mitigation measures.

4.1.7 Hot spots

From going through existing information on point source pollution as referred to in this plan a number of hot spots can be identified[12]

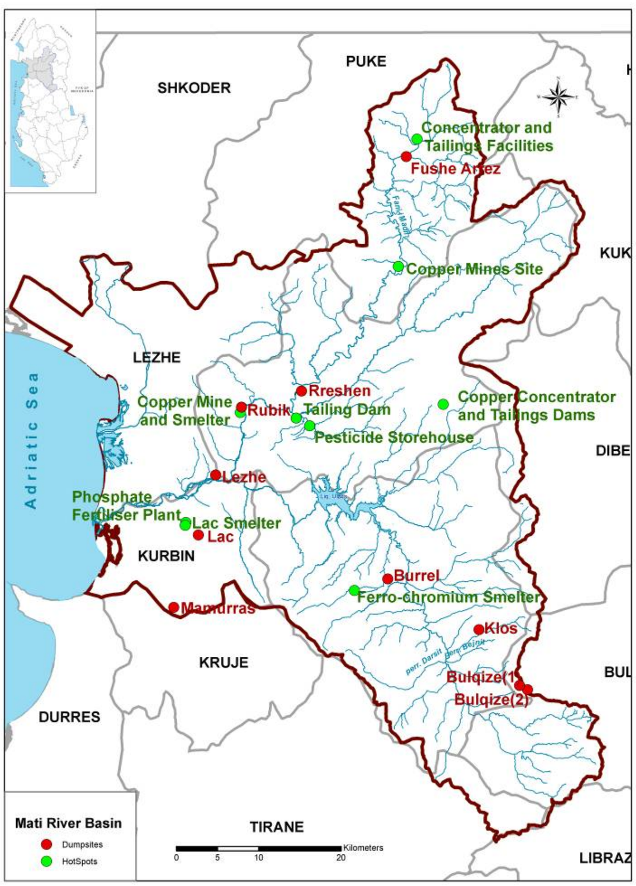
The identified hot spots are representing high pollution risks and can be listed as shown in Table 5.11. In Figure 5.4 the locations of the most important hot spots and waste dumps are shown.

12 References: Post conflict environmental assessment, Albania, UNEP, 2000, and International consultancy for preliminary site investigation of a number of environmental hotspots, Annex II, Annex III, Annex XII and Annex XVII. UNDP, 2008

Table 5.11: Waste dumps and major hot spots, activities and status

Hot spot locations	Existing an former activities	Status
Hot spots in Lezhe Prefecture		
Rubik	Copper smelter	Closed in 1998
Lac	Fertiliser manufacture	Closed in 2000
Lac	Copper smelter	Closed
Rreshen	Pesticides storage	Expired
Rheshen	Tailings Dam	
Reps	Tailings Dam	
Kurbnesh	Copper concentrator and tailings dam	
Hot spots in Diber Prefecture		
Burrel	Ferrochrome smelter	Closed in 2008
Hot spots in Shkodra Prefecture		
Fushe Arrez	Copper mining and beneficiation	
Waste dumps		
Lac, Mamurras, Pilan (north of Milot), Rubik, Rreshen, Burrel		

Figure 5.4: Hot spots of risks for environmental pollution



4.2 Diffuse sources of water pollution

4.2.1 Land use

Most of the land is grown with forest interspersed by pasture lands. Cultivation of crops takes place only in the flat lands in the coastal area. The land use map is shown in Figure 5.5.

An overview of land use data in the basins of the 8 main tributaries to the Mati River (see Figure 5.5) is given in Tables 5.12 and 5.13.

Figure 5.5: Vegetation cover and land use

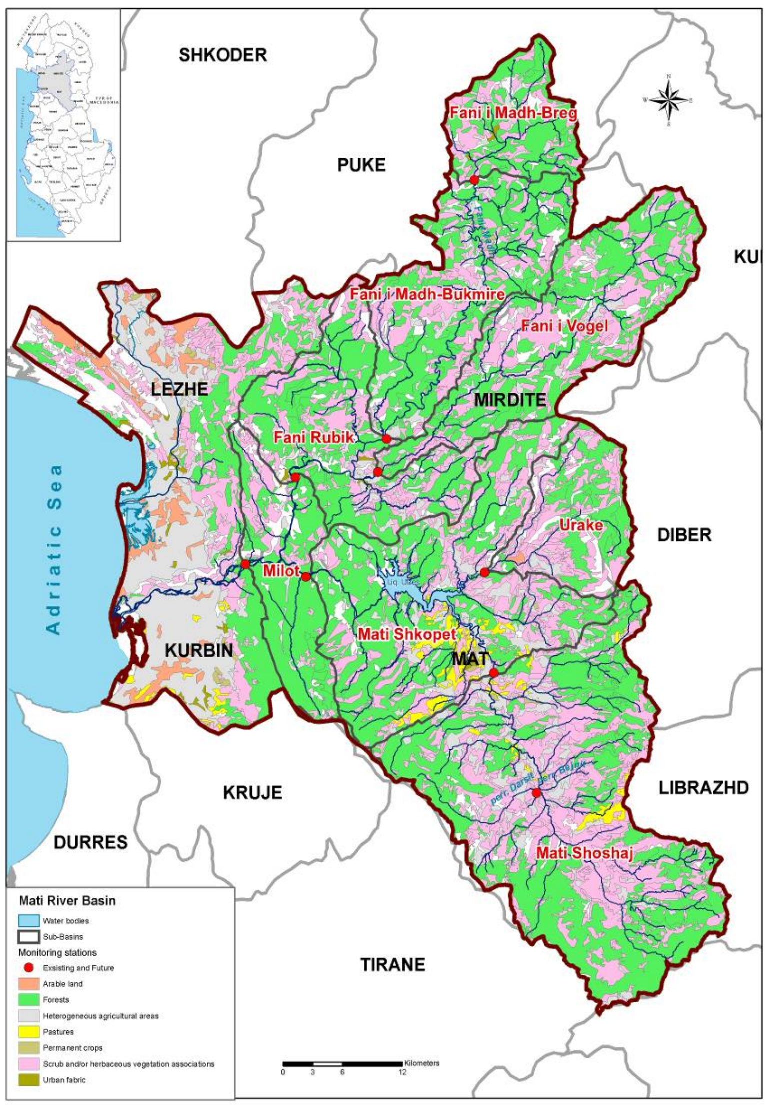
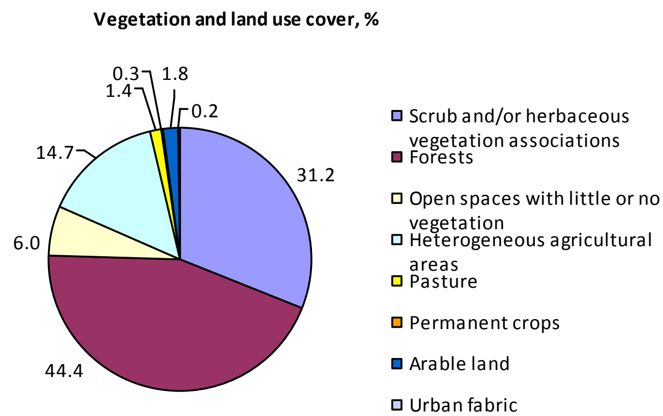


Table 5.12: Vegetation cover and land use in Mati River sub-basins

Sub-basin	Area, ha	Land use	%
Milot	0	Pastures	0,0
Milot	2918	Scrub and/or herbaceous vegetation associations	18,7
Milot	10526	Forests	67,4
Milot	1512	Open spaces with little or no vegetation	9,7
Milot	655	Heterogeneous agricultural areas	4,2
Milot Total	**15611**		**100,0**
Urake	5831	Forests	38,8
Urake	1905	Open spaces with little or no vegetation	12,7
Urake	853	Heterogeneous agricultural areas	5,7
Urake	6327	Scrub and/or herbaceous vegetation associations	42,1
Urake	119	Arable land	0,8
Urake Total	**15035**		**100,0**
Mati Shkopet	12972	Scrub and/or herbaceous vegetation associations	29,1
Mati Shkopet	21569	Forests	48,4
Mati Shkopet	1619	Open spaces with little or no vegetation	3,6
Mati Shkopet	5929	Heterogeneous agricultural areas	13,3
Mati Shkopet	2254	Pastures	5,1
Mati Shkopet	183	Permanent crops	0,4
Mati Shkopet	29	Arable land	0,1
Mati Shkopet Total	**44554**		**100,0**
Fani Rubik	2572	Heterogeneous agricultural areas	9,8
Fani Rubik	8323	Scrub and/or herbaceous vegetation associations	31,6
Fani Rubik	1569	Open spaces with little or no vegetation	6,0
Fani Rubik	36	Permanent crops	0,1
Fani Rubik	13801	Forests	52,5
Fani Rubik Total	**26302**		**100,0**
Fani i Vogel	11497	Scrub and/or herbaceous vegetation associations	35,7
Fani i Vogel	1880	Heterogeneous agricultural areas	5,8
Fani i Vogel	16462	Forests	51,2
Fani i Vogel	2335	Open spaces with little or no vegetation	7,3
Fani i Vogel Total	**32175**		**100,0**
Fani i Madh	8922	Scrub and/or herbaceous vegetation associations	30,6
Fani i Madh	2090	Open spaces with little or no vegetation	7,2
Fani i Madh	2225	Heterogeneous agricultural areas	7,6
Fani i Madh	15778	Forests	54,2
Fani i Madh	96	Permanent crops	0,3
Fani i Madh Total	**29111**		**100,0**
Breg	770	Open spaces with little or no vegetation	5,9
Breg	7749	Forests	59,4
Breg	3821	Scrub and/or herbaceous vegetation associations	29,3
Breg	713	Heterogeneous agricultural areas	5,5
Breg Total	13053		**100,0**
Mati Shoshaj	27008	Scrub and/or herbaceous vegetation associations	39,5
Mati Shoshaj	1344	Open spaces with little or no vegetation	2,0
Mati Shoshaj	6682	Heterogeneous agricultural areas	9,8
Mati Shoshaj	31955	Forests	46,8
Mati Shoshaj	1227	Pastures	1,8
Mati Shoshaj	108	Permanent crops	0,2
Mati Shoshaj Total	**68324**		**100,0**
Coastal Marine	12552	Scrub and/or herbaceous vegetation associations	21.5
Coastal Marine	5070	Open spaces with little or no vegetation	8.69
Coastal Marine	22920	Heterogeneous agricultural areas	39.28
Coastal Marine	10756	Forests	18.43
Coastal Marine	637	Pastures	1.09
Coastal Marine	618	Permanent crops	1.06
Coastal Marine	5209	Arable land	8.94
Coastal Marine	590	Urban fabric	1.01
Coastal Marine Total	**58353**		**100,0**
Grand Total	**302517**		

Table 5.13: Land use in Mati River basin - Summary

Area, ha	Land use category	% of total
94338	Scrub and/or herbaceous vegetation associations	31.2
134427	Forests	44.4
18215	Open spaces with little or no vegetation	6.0
44430	Heterogeneous agricultural areas	14.7
4119	Pastures	1.4
1041	Permanent crops	0.3
5357	Arable land	1.8
590	Urban fabric	0.2
302517	**Grand Total**	**100**



4.2.2 Agriculture, animal farming and irrigation

This section examines pressures from agriculture, horticulture animal farming within the river basin. The major threats from these activities are associated with organic and inorganic pollution from mainly BOD, nitrogen and phosphorus which may cause deoxygenation and eutrophication of surface waters and contribute to declining fish stocks, a loss of biodiversity as well as pollution of groundwater resources and prevention of water use for recreational purposes.

The table below presents a summary of the usage of different nitrogenous and phosphorus fertilisers in the Mati river basin. The information on fertilisers usage originates from Statistical Yearbook (2005).

Table 5.13/a N and P from fertilisers - Nitrogen and Phosphorus fertiliser use (tonnes of fertiliser and equivalent tonnes of N and P)

Urea nitrogen (tonnes) containing 46% N (tonnes)	2464 1133
Ammonium Nitrate (tonnes) containing 34.5% N (tonnes)	2140 738
Tonnes of Nitrogen applied	**1872**
Super Phosphate (tonnes)	1897
containing 7.07% P(tonnes)	134
Total phosphorus applied	**134**

In 2005, 4.7 thousand tonnes of nitrogenous fertilisers were used in the Mati basin containing approximately 1.8 thousand tonnes of nitrogen.

The main pollutants related to animal farming are BOD, nitrogen and phosphorus. The estimation of the pollution loads can be based of emission factors taking into account local experience and data reported in the literature[13].

Based on livestock data from Agricultural Statistics Yearbook (2000), STEMA[14] has estimated the total load for N and P from animals as follows:

Table 5.13/b

Animal Category	Total N load (in tonnes per year)	Total P load (in tonnes per year)
Cows	3.917	1.306
Pigs	391	249
Sheeps/goats	2.037	793
Poultry	1.706	1.280
Equines	508	221
Total from livestock	**8.559**	**3.849**

The total amount of nitrogen and phosphorus generated or applied from the above sources can be summarised as shown below:

Table 5.13/c

	Total N load (tonnes/year)	Total P load (tonnes/year)
Total from fertiliser (tonnes)	1.872	134
Total from livestock (tonnes)	8.559	3.849

13 Upon evaluation of the available references, the following production rates are used for the assessment of loads produced from livestock breeding:

Animal category	Total N (kg/tn A.W./day)	Total P (kg/tn A.W./day)
Sheeps/goats	0,41	0,07
Pigs	0,48	0,14
Cows	0,45	0,05
Poultry	0,33	0,22

It is assumed that for each animal category the average weight (A.W.), according to the international and local experience is: a) Sheep/goats 60 kg ; b) Pigs 80 kg; c) Cows 450 kg; and d) Poultry 2.5.

14 STEMA: Emission inventory for emissions to water in Albania

Total load (tonnes)	*10.431*	*3.981*

In addition to nitrogen originating from domestic sewage (see table 5.6), it can be estimated that approximately 10 thousand tonnes of nitrogen originate from agriculturally related activities and fertiliser application. Assuming an average diffusive loss of Nitrogen of 20% per year to water bodies the loss can be calculated to approximately 2000 tonnes/year. A figure of 20% loss has been adopted from international sources but, due to a combination of mountainous terrain in Albania and heavy rain during the wet seasons, contributing to extreme erosion. The figure for diffuse nitrogen losses may be greater than 20%.

In addition to phosphorus originating from households (see table 5.6) it ican be estimated that a total of approximately 4 thousand tonnes of phosphorus originate from agriculturally related activities and fertiliser application. Assuming an average diffusive loss of phosphorus of 10% per year to water bodies the loss can be calculated to approximately 400 tonnes year. A figure of 10% loss has been adopted from international sources but, due to a combination of mountainous terrain in Albania and heavy rain during the wet seasons, contributing to extreme erosion, the figure for diffuse phosphorus loss could be greater than 10%.

Based on these calculations and assumptions the expected increase in the yearly average nitrogen and phosphorus concentrations in water bodies can be estimated as shown in the table below. The mean, yearly downstream flow in Mati River has been monitored to 3,250 thousand m^3/year, see section 8.1

Table 5.13/d

	Nitrogen	Phosphorus
Nutrients generated from agriculture	10,000 tonnes	4,000 tonnes
Diffusive nutrient losses	20 % or 2,000 tonnes	10% or 400 tonnes
Yearly average downstream flow	3,250 thousand m^3/year	3,250 thousand m^3/year
Calculated increased concentrations	0.615 mg/l	0,123 mg/l
Monitored mean concentrations[15]	0.15 – 0.35 $N0_3$-N, mg/l	0.01 – 0.02 Tot-P, mg/l

From the table it can be seen that either the estimated amounts of nutrients generated within agriculture or the frequently applied percentage of diffusive losses are highly overestimated. Alternatively all sources generating nutrient losses are located downstream the monitoring station at Milot. The monitored mean concentrations of Nitrate-N and Phosphorus are at all stations upstreams Milot close to the natural background concentrations found in unpolluted groundwater.

Irrigation

Large scale irrigation is mainly practiced in the flat coastal zones in Lezhe and Kurbin districts, where 2 major irrigation schemes are operated, respectively: Mat-.Lezhe with a capacity of 5 m^3/s and Mat-Kurbin with a capacity of 15 m^3/s.

One major irrigation scheme exists in the upper part of the Mati basin, of Mat-Klos with a capacity of 2 m^3/s. There are many minor irrigation schemes in the higher parts of the Mati basin, but most of these are currently not functioning. The total area of irrigated lands is approximately 21,000 ha.

15 See table 9.3

In general surface water is used as a source for irrigation, with the Mati and Fani Rivers as major sources. In the upper part of the Mati basin reservoirs have been constructed for irrigation purposes.

It is estimated that the total water volume used for irrigation equals about 60 million m^3 per year.

The State of Albania is the owner of the irrigation schemes, and the operation and maintenance of the schemes is implemented by Water Use Associations (which currently are being established). The State of Albania is responsible for the issue of permits for the development of irrigation schemes. In general the users of the irrigation schemes pay only for the costs of the operation and maintenance of the schemes. They do not pay for the water supplied to them for irrigation.

4.2.3 Fishery and aquaculture

Fishing, at a commercial scale, takes place in the Ulza and Shkopeti lakes, where about 25 fishermen are active, and also in the downstream part of the Mati River at two agricultural reservoirs (Bejn and Shqefen). Carp species make up the major part of the catch (especially silver carp, big head carp, and grass carp). Stocking of the Ulza and Shkopeti lakes with fish breed occurs annually.
Trout farming takes place in the area of Fshat and Bulqize by two enterprises.

Extensive aquaculture is traditionally practiced inside the coastal lagoons. The main species found in the lagoons are mullets (M chepalus., Liza spp., Chelon labrosus).; sea bass (Dicentrarchus labrax), eel (Anguilla anguilla), sea bream (Sparus aurata) and sand smelt (Atherina hepsetus).

In general it appears that alien freshwater fish are increasing in number of species, abundance, and distribution. In general however, their impacts are not well quantified in either environmental or economic terms and current management to reduce their impacts is limited and lacking direction.

There is no information whether fishery as an economic activity or the status of the natural fish habitats in the rivers and lakes is affected by the current status of the water resources in the Mati river basin.

5 FLOODING

Flooding is a frequent problem in the Mati River District.

The areas subject to flooding are located along the coast of the Adriatic Sea, near the mouths of all the main rivers from the Drini to the Vjosa. A map of the areas affected by inundations in the winter 1962-63 shows that they include mainly cultivated land, but also the urban centres of Lezhe, Lushnje and Fier.

A review of chronicles and observations indicates that severe flooding occurred seven times in the last 150 years, in 1854, 1860, 1905, 1937, 1962-63, 1970-71 and 1992. The floods of 1962-63 rank third in this list, appearing to have a return period of approximately 50 years. During the 1962-1963 flooding an area of 8,000 ha in the Mati river basin was inundated for a period of 10 days.

Severe flooding in the coastal plain as a consequence of combination of heavy precipitation, storm surges and high tides from the sea are more frequent especially the last 15 years. The intensification of such events is evaluated as an indicator of climate changes in Albania[16]. They have brought about damages in infrastructure, in pumping and drainage systems (e.g. in September 2002), agriculture. Coastal erosion has been more aggressive. Another severe flooding in the coastal plain and the estuary of Mati Basin took place as late as January 2010. The event was a result of backwash of the river as a consequence of unfortunate coincidence of very high tides, heavy western winds in combination with high water flow in Mati River, but not beyond the occasional flow of Mati River at that time of the year.

The main causes of the extreme floods are the morphological characteristics and climatic conditions (cyclonic rains, which are preceded by frontal storms) of the area. It is worth to add that the effects of adverse climate conditions are sometimes worsted by poorly maintained high water channels and/or from non-functioning of pumping stations (as in the case of the September 2002 flooding) which do not drain the rainfall as they should.

The adoption, on basis of multi-criteria analysis and in close cooperation with ongoing programs/projects, of adequate maintenance and improvement measures may reduce the effects of the flooding. These may include but are not limited to:

- Identification of the state of dykes and improvement of the drainage systems and the channels of high water, especially the increasing of pumping station’s capacity; and eventually, building of new structures on both riverbanks;
- Reducing of the erosion by means of reforestation, building of small dams in the upper part of mountain torrents;
- Implementation of a Flood Warning Service with the purpose of alerting the populations on possible risks situation;

[16] Project “Identification and implementation of Adaptation response measures to Drini-Mati River deltas” MSP GEF/UNDP, www.ccalb.org

6 IDENTIFICATION AND MAPPING OF PROTECTED AREAS

Six protected areas assigned in accordance with Albanian law are located along the borders of the Mati Basin District.

The approach for assigning and managing protected areas in Albania is described in Law for Protected Areas[17]. The law regulates the protection of six (6) categories of protected areas.

According to the law, important or areas being at risk of degradation shall be declared protected areas, within the following management categories (IUCN, 1994):

- Category I: Strictly natural reserves/scientific reserves
- Category II: National Parks
- Category III: National Monuments
- Category IV: Nature management reserves/area of management of habitats and species
- Category V: Protected Landscapes
- Category VI: Protected areas for management of natural resources/protected area with multi-purpose utilization.

The categorization of areas, status and level of protection for each area is based on the criteria of World Center of Nature Conservation. It does not only concern nature protection and it does not comply with EU requirements on nature protection as described in The Habitats Directive, 92/43/EEC and the Birds Directive, 79/409/EEC. Implementation of among others these two directives shall be done as background for implementing the WFD.

Albanian protected areas including designated habitats and species are not represented in the common network of Natura 2000 sites for preservation of biodiversity in Europe. Albania has not made contributions to lists of species for conservation and protection in EU. Most probably Albania will be able to contribute significantly to Natura 2000 locations and the listing of rare of species needing protections in Europe in the future. In the mountainous isolated areas of the Mati Basin it is expected that numerous examples of unique nature will turn up as a consequence of implementing EU nature protection legislation.

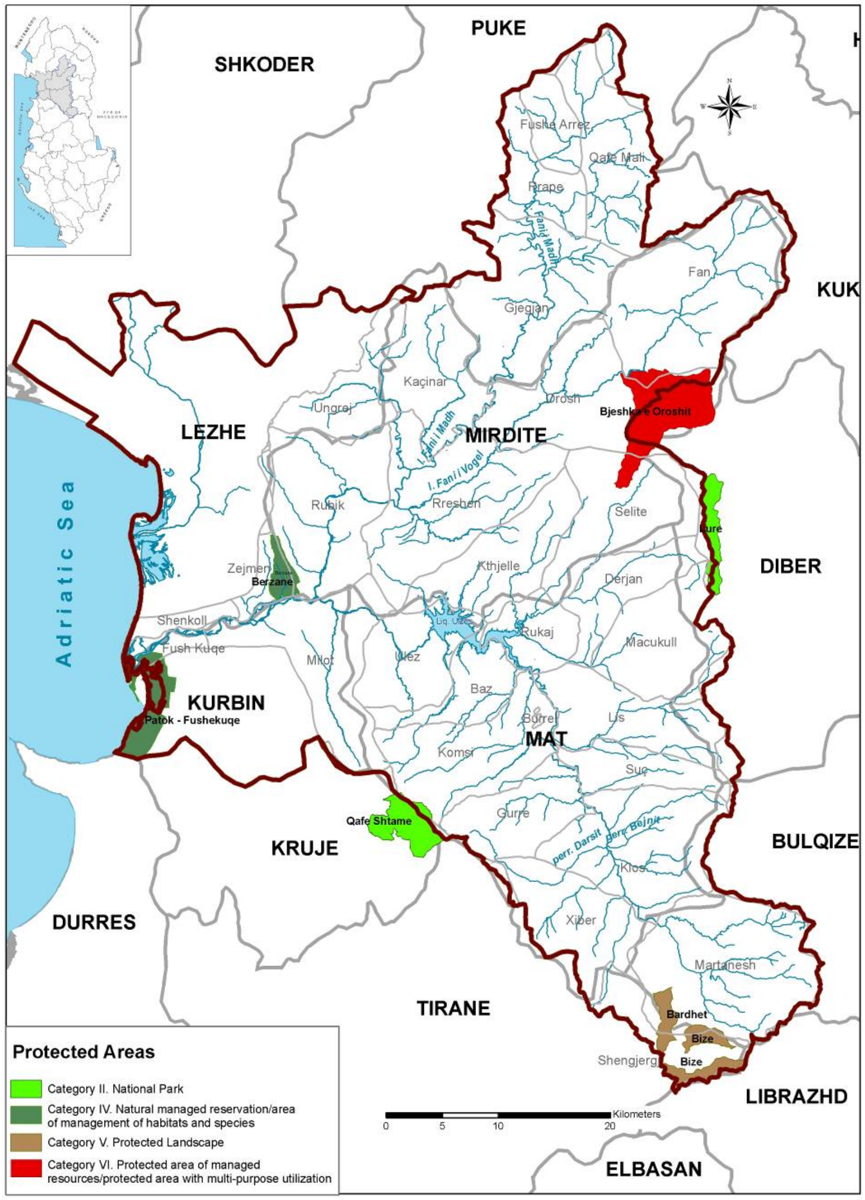
The existing protected areas at the borders of the Mati Basin district are shown in the table below.

Table 5.13/e Protected Areas

Area Name	Location (District)	Category	Surface Area (ha)
Bjeshka e Oroshit	Mirdite	VI	4.700
Lure	Diber	II	1.280
Berzane	Lezhe	IV	880
Patok-Fushe Kuge	Kurbin	IV	2.200
Qafe Shtame	Kruje	II	2.000
Kune	Lezhe	IV	800
Vain	Lezhe	IV	1.500

[17] Law no. 8906. Law for protected areas, 06.06.2002.

Figure 7.1: Protected areas in Mati River Basin District



7 RISK ASSESSMENTS IN RIVER BASIN MANAGEMENT PLANNING

The logic and the methodology behind characterising water bodies and introducing parameter limit values for classification of ecological status for surface water and chemical status for ground water is among others intended for making risk assessments. The risk assessment shall be done to identify surface water bodies or groundwater reservoirs at risk of not achieving at least good environmental ecological or chemical status within a planning period (Annex II, section 1.5). The methodology is to compare measured parameter values from ongoing monitoring programmes (surveillance monitoring) with parameter limit values applied for good environmental or chemical status. In this comparison the parameter with the lowest quality classification is decisive for classification of the whole water body.

Evaluation of risks related to impact of climate variation including extremes. These factors that influence in the surface and ground water quantity and quality have a direct impact in classification of water ecological conditions in the Mati basin according to WFD.

Measures are hereafter implemented for those water bodies at risk of not achieving good environmental status based on the risk assessment.

Pursuant to the risk assessment specific monitoring programmes shall be established to follow the effects from having implemented the programme of measures (operational monitoring). If it is not understandable why a water body may not achieve good ecological status an investigative monitoring programme may apply. For description of the purpose with surveillance, operational and investigative monitoring refer to the WFD Article 8 and Annex V point 1.3.1, point 1.3.2 and point 1.3.3 respectively).

The logic and the methodology based on risk assessments is applied for design of the necessary monitoring programmes in Mati Basin as well for specifying programme of measures, see section 12.

It is, however, as shown in the following sections difficult from existing monitoring programmes made available for this study to identify any measurements in surface water or groundwater bodies which exceed parameter values for good water status as defined in table 4.5 for rivers, table 4.6 for lakes and table 4.7 for groundwater bodies in this document. In addition the monitoring programmes made available for preparation of this plan have only been running for short or interrupted periods. It means that it is not possible to make assessments of developmental trends in the status of water bodies.

Statements on pollution and impacts on water status in the Mati Basin is not well documented and often based on assumptions and cannot and should not be applied for making costly decisions on, which measures and which investment programmes to be implemented. Instead investigative monitoring programmes with specific purposes running for at least one year (see Annex V in the WFD point 1.3.2) should be designed to have statements on pollution and other impacts declined or confirmed as described in the following sections.

How to apply the risk assessment for preparation of programme of measures is described in article 11 of the WFD. As part of this methodology a distinction is made between *basic* and *supplementary* measures.

7.1 Environmental status and basic measures

Basic measures do not necessarily have anything to do with good ecological status in water bodies, but it is not a choice to leave them out (Article 11 point 2 and Annex VI Part A). To implement basic measures is a question of compliance with the EU *acquis* to be achieved as part of the general accession process. Article 11 contains a comprehensive list of measures which refers to general water management practises. Such practises are expected to contribute to achievements on good ecological status, without addressing the status directly, and basic measures must be implemented whether good water status in water bodies have been achieved or not, see section 12.

In principle basic measures include all measures arising from implementing 11 Directives described in Annex VI. Part A of the WFD. These “background or basic” directives are not implemented in Albania at the moment and for that reason it is less evident to go through all these directives as background for preparing the programme of measures in a River Management Plan for Mati Basin - except for forecasting some overall assessment of requirements and costs connected with implementing the most expensive directives.

It is important to consider the climate change indicators for the environmental assessment of the River basin in order to implement basic/supplementary to preserve the water ecological conditions according to WFD.

7.2 Environmental status and supplementary measures

“Supplementary” measures are those which are designed in addition to basic measures with the aim of achieving the objectives of good ecological status in water bodies (the WFD article 11 point 4). A non-exclusive list of supplementary measures is shown in Annex VI, Part B of the WFD.

From a principle point of view the lack of evidence, that parameter limit values of good ecological status in water bodies are not achieved, means that there are no methodological arguments for addressing supplementary measures in the programme of measures.

It is important to consider the climate change indicators for the environmental assessment of the River basin in order to implement basic/supplementary to preserve the water ecological conditions according to WFD.

8 STATUS OF WATER BODIES AND PROTECTED AREAS

8.1 The quantitative status of surface water

The Mati river basin can be described in relation to existing and former hydrometric monitoring stations covering the discharge in 14 sub-basin areas. For water management and future monitoring purposes these sub-basin areas have been organised into 8 sub-basins. Some characteristics of the 8 sub-basins are shown in Table 9.1. The discharge from the hydrometric stations has periodic been monitored over longer time periods. The hydrometric monitoring stations and sub-basin borders are shown in Figure 9.1, which as well shows the locations of former and existing chemical river and groundwater monitoring stations.

Table 9.1 Mati river basin and characteristics of 8 sub-basins

Sub-basin	Area (km^2)	Average elevation (m)	Area specific runoff (l/s per km^2)
Mati Shoshaj	684	924	38.4
Urake	150	1229	29.0
Milot	160	784	44.3
Mati Shkopet	457	960	46.7
Fani I Vogel	322	876	41.9
Fani I Madh Bukmire	291	802	39.5
Fani I Madh Breg	132	680	44.9
Fani Rubik	265	695	44.5

During the period 1951-1985 the Mati river had a mean annual discharge of 103 m^3/s, of which 60 m^3/s originate from the Mati basin itself and 43 m^3/s from the Fani basin. Infiltration of groundwater represents 30 % of the annual flow, while the surface run-off contributes with 70 %. Its maximum flows are related to the rain fall and snow melting. Maximum flow happening once in 100 years is in the size of 3100 m^3/s.

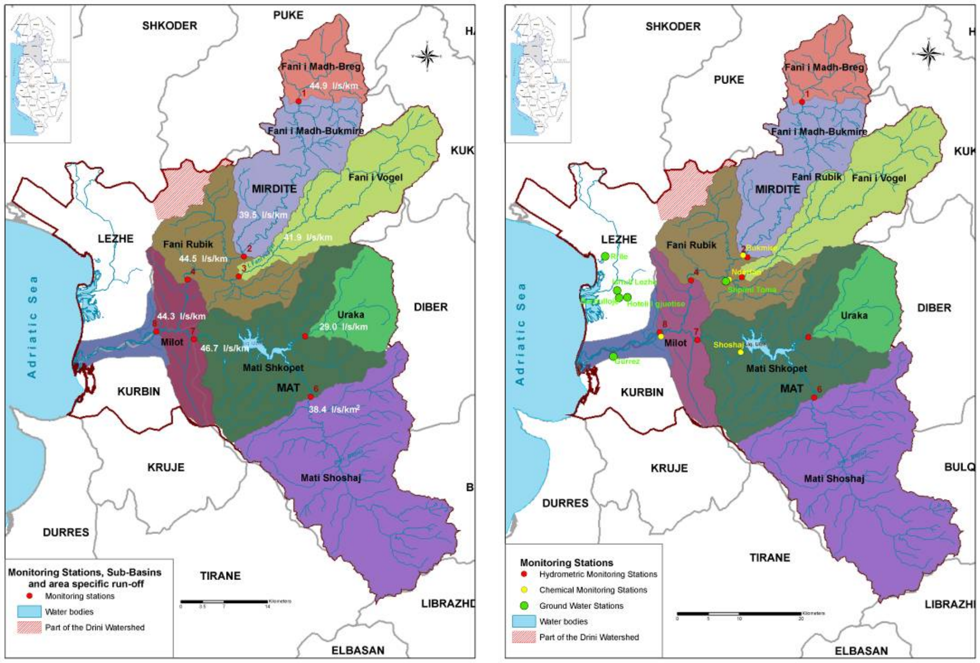
The resulting specific discharge is about 40 $l/s.km^2$ and the runoff coefficient equals 0.75. These values apply for both Mati and Fani rivers. Some of the basic characteristics can be listed as shown below:

- annual discharge volume: 3,250 million m^3 ,
- area specific run-off: 40 l/s per km^2,
- ratio between the wettest month (December) and the driest month (August) can approximately be described with a factor 10,
- once in 10 year high flows exceed the average flow with a factor of 25
- the storage capacity of the Ulza reservoir is around 240 million m^3 (about 15% of annual flow of the Mati).

Based on an assessment of the available water resources on a yearly basis reaching the coastal plain downstream Milot there does not seem to be any pressure on the available quantitative resources.

Based on a number of assumptions the maximum consumption by households can be estimated to less than 0.2 % of the measured average flow downstream Milot as described in section 5.1.2 and table 5.7.

Figure 9.1: River monitoring stations in Mati River basin for ecological status, hydrometry, and groundwater



Based on the existing information on hydropower generation the storage capacity of the Ulza reservoir only represents approximately 15% of the available resources reaching the coastal plain downstream Milot. It is unlikely that hydropower generation will represent any pressure on the available resources any time of the year as the peak storage is generated during late winter and spring where the run-off is at a maximum.

Other uses of water within e.g. industry are limited as only few major water consuming industries are located within the Mati basin.

An immediate analysis indicates that the present use of water resources does not represent a risk to the quantitative status of surface water resources even if a considerable development of the future water use is taken into account.

8.1.1 Climate change and the quantitative status of surface water

EU member states shall take into account the possible impacts of climate change on water bodies in river basin management plans from 2015[18].

18 CIS Guidance Document No. 24 on River Basin Management in a Changing Climate

Current studies carried out in the field of climate change for Albania[19] show that extreme events, intensified in the last decades, are affecting the Albanian economy. In the long perspective the climate change and its extremes may affect Albania with[20] with less precipitation, changes in the distribution of precipitation during the year, intensification of extreme events (flood, droughts) an increase in temperature and a rise in sealevel.

- Increase in the frequency of extreme weather events(heavy rains, potential flood risk, strong winds, droughts)
- Decrease in runoff, both annual and seasonal, and changes in the distribution of precipitation during the year.
- Increase in temperature and a rise in sea level.

The climate change scenarios developed for the area including the Mati basin project that the yearly precipitation will decrease with 2.6-5.4% and the average yearly temperature will be raised with 0.9-1.1 °C during the period up to 2030. The impact is assumed to increase steadily through the 21st century. A likely reduction in river runoff from 3.6 to 7.6% and from 8.5 to 16% is expected by 2030 and 2050 respectively. The impact of climate change is likely to have a significant impact on available water resources in the long perspective up to 2100. Hereby may inflict on Albania's power sector which today is more than 90% dependent on hydropower.
The possible impacts of climate change include:

- Increased energy demand for cooling.
- Reduction of water supply.
- Reduction of power generation.
- Water quality problems (salinisation and water algae blooms).

In later versions of the management plan for Mati River Basin an increasing attention should be paid to integration of climate change impacts and adaptation measures to improve the society's resilience to climate change.

Discussions of climate change and raising sea levels will most probably arise in the future in response to flooding events in the coastal flood plain around the Mati Estuary. Such events should however also be seen in the context that dykes in lower river bed is being distorted and banks are gradually being destabilised from gravel excavations without attempts to restore the impacts.

8.2 The chemical status of surface water

8.2.1 Rivers

Currently 4 water quality monitoring stations are in operation in the Mati river catchment area[21]. Information on the stations is shown in Table 9.2 and figure 9.1.

[19] Energy and Environmental Challenges to security. The NATO science for peace and security programme. Springer Verlag. ISBN 978-1-4020-9451. 2009.
[20] "Identification and implementation of Adaptation response measures to Drini-Mati River deltas" MSP GEF/UNDP, www.ccalb.org
21 Initiated by the StMA project: Strengthening of the environmental Monitoring System in Albania. EU, Cards programme, 2008

Table 9.2: Data on existing water monitoring stations in Mati river basin

Monitoring Station	Region	Longitude	Latitude	Length (km)	Altitude (m)	Catchment area (km^2)
Big Fan (Nderfan)	Rreshen	N 41° 40' 51"	EO19° 52' 54"	76,9	702	542
Little Fan (Bukmir)	Rreshen	N 41°46' 55"	EO 19° 52' 22’’	54,5	734	415
Mati (Milot)	Milot	N 41° 41' 02"	EO 19° 43' 52"	46.5		2441
Mati (Shoshaj)	Mirdite	N 41° 41' 00"	EO 19° 43' 52"	78.6	963	646

Most of the water courses in the Mati basin are natural water bodies. As such at least good ecological status should be achieved in accordance with border limit values shown in Table 4.5. But as no biological parameters have been monitored the risk of not achieving good ecological status will have to be assessed based on parameters of chemical status.

In Table 9.3 monitoring of chemical status at the 4 stations in 2007 are shown. Additional results from monitoring during the whole period from 2002 -2008 are shown. The data has been reported to the EU Environmental Protection Agency in Copenhagen as part of the pre-accession agreements between EU and Albania.

The risk analysis of not achieving good chemical status as background for identification of elements to be included in the programme of measures as described in section 8 does not add any specific information. A comparison between limit values for good chemical status shown in Table 4.5 and monitoring results in Table 9.3 as well as monitoring results of Annex 2 from 2002-2008 shows that not one single measurements out of approximately 1000 measurements are below the border limits between moderate and good chemical status and there are no developmental trends indicating that the chemical status in the river system is deteriorating.

Based on the data made available for preparation of this document the conclusion of a risk analysis will be, that there are no indication that good chemical status in Mati River cannot be achieved upstream the Milot monitoring station and for that reason no regulating measures are required.

However, one weakness combined with the existing procedures applied in connection with the monitoring programme is that the water flow is not monitored simultaneously with sampling for measurements of chemical parameters, which means that the concentrations of chemical parameters cannot be corrected in relation to dilution effects. In addition the monitoring programmes does not include monitoring of e.g. metals like chromium and copper, which might occur in concentrations above pre-defined border limits for good chemical status as a consequence of former and existing mining and metal processing activities in the basin. However, as no monitoring data exists, the logic is to provide the necessary data for this assessment by designing an investigative monitoring programme on metals as described in section 8 and as proposed in section 10.

8.2.2 Modified river sections

The downstream parts of the Mati and Fani rivers may be considered as heavily modified as a result of intensive extraction of gravel and sand. A good ecological potential should at least be the target status for these water bodies. As no specific measurements of either ecological or chemical status exists for these sections of the river system and because monitoring of biological indices are not included in monitoring programmes it is not possible to asses the extent of modification nor the ecological status.

A risk analysis must in these sections include monitoring of biological parameters as background for assessing how to achieve good ecological status.

Table 9.3 Monitoring in Mati river in 2007, see also Annex 2

Station name	Parameter	Unit	No. of samples	Mean value	Max. value	Min. value
Big Fan (Nderfan)	BOD_5	mg/l O_2	4	1,04	1,60	0,45
	CODMn	mg/l O_2	5	0,78	1,04	0,44
	Oxygen	mg/l O_2	5	8,91	9,98	8,16
	Nitrite	mg/l N	5	0,00	0,01	0,00
	Orthophosphate	mg/l P	5	0,01	0,02	0,01
	Phosphorus	mg/l P	5	0,02	0,03	0,01
	pH	pH	5	8,25	8,45	8,04
	Ammonium	mg/l N	3	0,02	0,02	0,01
	Oxygen saturation	%	5	99,72	111,50	89,10
	Nitrate	mg/l N	3	0,27	0,35	0,16
Little Fan (Bukmir)	BOD_5	mg/l O_2	4	0,67	0,95	0,33
	CODMn	mg/l O_2	5	0,80	1,44	0,48
	Oxygen	mg/l O_2	5	8,28	9,10	6,93
	Nitrite	mg/l N	5	0,00	0,00	0,00
	Orthophosphate	mg/l P	5	0,01	0,02	0,01
	Phosphorus	mg/l P	5	0,01	0,02	0,01
	pH	pH	5	8,28	8,45	7,94
	Ammonium	mg/l N	3	0,01	0,02	0,01
	Oxygen saturation	%	5	93,86	99,30	83,60
	Nitrate	mg/l N	3	0,20	0,21	0,18
Mati (Milot)	BOD_5	mg/l O_2	5	1,01	2,00	0,45
	CODMn	mg/l O_2	6	0,76	1,08	0,21
	Oxygen	mg/l O_2	6	8,64	9,50	7,84
	Nitrite	mg/l N	6	0,00	0,01	0,00
	Orthophosphate	mg/l P	6	0,01	0,02	0,01
	Phosphorus	mg/l P	6	0,02	0,02	0,01
	pH	pH	6	8,34	8,56	8,03
	Ammonium	mg/l N	4	0,02	0,02	0,01
	Oxygen saturation	%	6	94,72	120,40	72,00
	Nitrate	mg/l N	4	0,13	0,15	0,10
Mati (Shoshaj)	BOD_5	mg/l O_2	5	1,54	2,55	0,39
	CODMn	mg/l O_2	6	0,90	1,20	0,30
	Oxygen	mg/l O_2	6	7,44	9,40	0,62
	Nitrite	mg/l N	6	0,00	0,01	0,00
	Orthophosphate	mg/l P	6	0,01	0,02	0,01
	Phosphorus	mg/l P	6	0,02	0,04	0,02
	pH	pH	6	8,36	8,48	8,27
	Ammonium	mg/l N	4	0,02	0,03	0,02
	Oxygen saturation	%	6	93,27	105,60	76,79
	Nitrate	mg/l N	4	0,17	0,22	0,10

8.2.3 Lakes

The only lakes in the Mati Basin are the two artificial water bodies, the Ulza and Shkopet reservoirs. They are artificial lakes and good ecological potential should at least be the target status for these water bodies in accordance with parameter limit values for chemical parameters shown in table 4.6.

The Ulza reservoir has a surface area of 12.5 km^2, a maximum depth of approximately 61 m, and it is located 129 m above sea level.

Notwithstanding the value and importance of hydropower and irrigation reservoirs in the Mati basin, currently there is no monitoring programme in place that allows the River Basin Agency to evaluate the status of these water bodies.

Chemical analyses of samples taken from the Ulza and Shkopet reservoirs before 1990 showed a high content of metallic ions (iron, manganese and copper).

As with rivers, lakes, groundwater, transitional waters and coastal waters, the WFD stresses the importance of the inclusion of modified water bodies in the overall monitoring and management of water resources. A risk analysis of not achieving a good chemical status shall be carried out and be based on monitoring of chemical parameters in the two reservoirs as proposed in section 10. Special attention for especial Ulza and Shkopet reservoirs should be paid to sampling of sediment, with a double aimed purpose:

- To estimate the siltation rates, as the two reservoirs represent traps for suspended solids from approximately half of the Mati river basin
- In continuation of estimating siltation rates to monitor the historical development of metal contamination of suspended solids as a consequence of the development and changing intensity of mining activities during the last 40 years

8.3 Groundwater quantitative and chemical status

Monitoring of the chemical status of ground water was initiated only 5 years ago in Mati Basin. The Institute for Geological Survey is responsible for monitoring of groundwater. There are 23 monitoring locations where monitoring occasionally or regularly takes place and mainly in the coastal plain and the Fushe Kuge and Lezhe aquifers.

Information on capacity and utilisation of monitored aquifers is provided in the table 9.3/a.

Table 9.3/a Water use in the monitored aquifers

Aquifer	*Quantity of water used in 2005, l/sec*	*Coefficient of utilisation*
Lezha	*600-650*	*0.3-0.35*
Fushe Kuqe	*1250-1300*	*0.35-0.5*

Statements about problems related to the quantitative and chemical status of aquifers in the coastal plain are not easily assessed as some of them rely on old monitoring data where the criteria for identification of pressures and risks were less well defined. Criteria for assessment of status and risks is also in this plan a problem as good chemical status to be defined through chemical parameter limit values, as prescribed in the WFD, do not comply with the norms applied in Albania as shown in Table 4.7. In addition data for assessing the quantitative status of groundwater resources based on trend analysis of changes in groundwater tables have not been available for preparation of this plan. The same is the case for measurements of hygienic parameters.

However, for reporting to the Environmental Agency in Copenhagen as part of the pre-accession agreements with EU some data on chemical status of groundwater in the Fushe Kuge and Lezhe aquifers exist as shown in Annex 3. For a risk analysis the data shall be compared with the parameter limit values shown in Table 4.7.

From the available data in Annex 3 it can be seen that heavy metals concentrations do not seem to exceed the Albanian norms. Heavy metals are generally not expected to occur in major concentrations in deep groundwater magazines.

Nitrates concentrations are far below the Albanian norms. Nitrates in high concentrations in ground water normally occur in areas cultivated intensively and with application of commercial fertilizers or animal farmyard manure beyond the absorption capacity of the cultivated crops.

However, in especially the Lezhe reservoir measurements shows rather high concentrations of chloride and generally of electrolytes. In coastal areas this is normally an indication of saltwater intrusion and generally an expression of over exploitation of groundwater resources and hence of bad quantitative status - at least if the water is going to be applied for drinking water purposes or food processing. For most people the tasting of salt starts around 200–300 mg/l.

But as the risk of not maintaining good chemical and quantitative status rely on very little information further monitoring should be continued or extended , not only with the purpose to evaluate parameter limit values here and now, but also with the purpose to assess the developmental trends in both the chemical and quantitative status.
The coastal plain is densely populated and the Fushe Kuge and Lezhe reservoirs even provide water for major towns which are expected to exceed a considerable pressure on the available water drinking resources. The coastal plain is cultivated intensively, even if the density of domestic animals is limited. Major irrigations schemes and generally the major economic activities within Mati Basin are located in the coastal plain. A major number of shallow wells exist which may represent a problem as well.

It is strongly recommended that sanitary protection zones should be established around water supply wells and that gravel should not be excavated from river bottoms near water supply wells.

The risk analysis concerning the quantitative and chemical status shown in this document rely on very little information. But based on the human activities in the coastal plain it is expected that more severe problems may be revealed with a more intensive and targeted monitoring programme which in this case shall be understood as investigative monitoring with the overall purpose of confirming or rejecting statements about the status of available water resources of the Fushe Kuge and Lezhe groundwater reservoirs.

For further information of investigative monitoring as part of risk analysis refer to section 7 and for further discussion of monitoring, refer to section 9.

8.4 Status of protected areas

Seven protected areas are assigned in accordance with Albanian law and located along the borders of the Mati Basin District. The protected areas and their category of protection is described in section 6.

Law no. 8906 dated 06.06 2002 prescribes in article 15 the introduction of management plans for protected areas and in Decision no. 676 dated 20.12 2002 a list of monuments and natural sites of historical significance is presented for each district.

As such both the protection of specific sites, monuments to be preserved and plants and animals to be protected is specified. At the same time management plans shall be prepared to preserve the specified objects mentioned in the list for each district. In that sense the overall approach for at least nature protection has been adopted in Albanian Legislation with a similar management approach as described in the EU habitats Directive.

Management plans of protected area shall include at least the following:

- Objectives for management of protected areas
- Management responsibilities delegated to specific authorities or operators
- Threats and pressures on specific protected area and their surroundings
- Regulatory or administrative measures to be applied to mitigate threats and pressures;
- Permitted activities within the protected area and their surroundings;
- Regulating measures on tourism and other services;
- Information of former ownership the and the right to use biodiversity elements in combination with traditional lifestyle and interests of local communities
- Conditions to for maintaining traditional lifestyle activities within protected areas and in relation to biodiversity elements to ensure that the activities do not contradict the objectives of protected area;
- Conditions for sharing profits from the establishment and administration of protected area with local communities;
- Conditions for scientific research, inventories and monitoring;
- Financial resources for management of protected areas including income from activities within protected areas
- Amendment of the legislation for Protected Areas to consider the climate change impacts and adaptation issues.

In addition it is specified that management plans of protected areas shall be revised and elaborated periodically as required.

It has not been possible to see any examples of management plans for site specific locations within the Mati River Basin District and it is not the impression from visiting two of the protected areas that there are any ongoing management activities. But the legal framework for ensuring good status of protected areas in Albania and the Mati Basin is place at least for a transitional period until EU legislation is implemented as part of the pre-accession process.

9 ESTABLISHMENT OF MONITORING NETWORKS AND PROGRAMMES

The WFD requires that appropriate water quality monitoring networks are established and maintained (article 8, annexes V, VI). Prior to establishing a monitoring network and programme the major surface waters have to be characterised as background for establishing at least good environmental status for surface water bodies or good quantitative and chemical status for ground water as described in section 3.

The monitoring networks should address:

- For surface waters:
  - Flow measurements to monitor the quantitative status of the water body
  - Analysis of physical and chemical status of the water with respect to the quality objectives as determined by the specific category of classification of the water body
  - Analysis of ecological parameters in order to assess the ecological status and the ecological potential
- For groundwater:
  - Measurement of groundwater levels and flow characteristics in order to assess the quantitative status of the groundwater body
  - To analyse physical and chemical parameters for description of the status
- For protected areas:
  - To assess the status of the areas, depending on the specific characteristics of the protected area

Monitoring systems include surveillance, operational, and investigative monitoring, as described in the following:

- Surveillance monitoring shall be done to provide an overall assessment of the existing surface water and groundwater status and with the purpose to reveal the long term developmental trends in water status
- Operational monitoring shall be done to follow the status of water bodies at risk of not achieving good status after implementation of programme of measures
- Investigative monitoring is used to find out the reason why a water body does not fulfil requirements of good environmental status or in case monitoring data is missing to find out what the status of a water body actually is.

9.1 Surveillance monitoring

9.1.1 Surface waters

For the purpose of this plan it has not been attempted to propose an extension of the already proposed master plan for national surveillance monitoring[22] in rivers, transitional waters, lagoons, coastal waters and lakes as there are no clear indication from existing data that this is needed. In case investigative monitoring shows a need for an extension of the surveillance programme it should be done in the future based on the results from investigative monitoring

[22] Monitoring programme of physico chemical water quality and hydrobiology in Albania. Mater Plan. StEMA, October 2008

Rivers, lagoons, transitional waters and lakes
Two main aspects should be taken into account for surveillance monitoring in rivers.

Monitoring of biological parameters (ICMi index, see also section 4.1.3) are not included in standard programmes of surveillance monitoring in rivers. Biological index values are to a higher degree indicator of seasonal trends in contrast to monitoring of chemical parameters which only expresses the instantaneous status in a water sample. In consequence monitoring of biological indices can justify less frequent and more relevant monitoring.

For monitoring of hydrology and the quantitative status of water in rivers any measurements should be accompanied with sampling for monitoring of chemical parameters and visa versa. Hydrometric monitoring in combination with monitoring of chemical parameters will facilitate calculations of transport of chemical elements as background for making load estimates within sub-basins. At the same time misinterpretation of levels of concentrations of chemical components as a consequence of shifting water levels and flows and dilution effects may be avoided.

Based on these assumptions hydrological surveillance monitoring is proposed to take place at the 8 existing hydrometric monitoring stations downstream the 8 sub-basins shown I figure 9.1 and as described in table 9.1. They represent monitoring stations which have been running during long time periods. In the figure the stations 1-8 are named: Breg, Bukmir, Nderfan, Rubik, Milot, Shoshaj, Shkopet and Uraka. The frequency of hydrometric monitoring as expression of the quantitative status should be done 12 times a year or continuously as shown in tables 1 and 2 below

To avoid any confusion on proposed monitoring stations and programmes in Mati Basin the Stema approach is presented below.

4 monitoring stations have been proposed in Mati Basin by the StEMA project[23] as described in section 9.3 The location of the 4 stations are shown in figure 9.1. It is assumed that monitoring will be continued at these stations in accordance with agreements with Ministry of Environment.

The main issue in the StEMA approach is that a classification of the chemical status at the selected monitoring station serves as background for selection of the parameters to be monitored. The classification of monitoring stations is shown in the table 9.3/b.

Table 9.3/b

Classes and locations	**Average**		
	$BOD_5(O_2)$ mg/l	NH_4 mg/l	Tot-P mg/l
Class 1	<2.5	<0.03	<0.07
Class 2	2.5-4	0.03-0.1	0.07-0.15
Class 3	4-8	0.1-0.5	0.15-0.3
Class 4	8-15	0.5-1.5	0.3-0.6
Class 5	>15	>1.5	>0.6
Little Fan (Nderfan)	1.3	0.038	0.026
Mati (Milot)	1.6	0.046	0.018

[23] Strengthening of the environmental Monitoring System in Albania. EU, Cards programme, 2008

Mati (Shoshaj)	1.8	0.072	0.018
Big Fan (Bukmir)	1.2	0.038	0.022

Based on the classification of the monitoring stations the parameters to be monitored including the frequency is specified in two lists: List 1 and List 2 in accordance with the classification shown in the table 9.3/c.

Table 9.3/c

	Identification code	Location	Classification	Parameter list
Mati	AI_RV_22	Litlle Fan (Nderfan)	Extensive impacted	List 1
Mati	AI_RV_23	Mati (Milot)	Intensive representative	List 2
Mati	AI_RV_29	Mati (Shoshaj)	Extensive representative	List 1
Mati	AI_RV_4	Big Fan (Bukmir)	Extensive impacted	List 1

As shown in the table the three stations Little Fan, Mati (Shoshaj) and Big Fan (Bukmir) shall, as prescribed by the StEMA project for the national surveillance program, be monitored in accordance with the specifications of Parameter List 1 as shown in the table 9.3/d.

Table 9.3/d

Parameter List 1 Rivers	**Description/Units**	**Frequency**
Hydrometric/Staff gauge	M	Monthly
Flow	m^3/sec	Monthly
Dynamic Water Level	M	Monthly
Water temperature	ºC	Monthly
Dissolved Oxygen (DO)	% Saturation	Monthly
Dissolved Oxygen (DO)	mg/l O_2	Monthly
Biochemical Oxygen Demand (BOD)	mg/l O_2	Monthly
Conductivity	µS/cm	Monthly
pH	pH units	Monthly
Colour	Hazen	Monthly
Alkalinity	mg/l $CaCO_3$	Monthly
Total Hardness	mg/l $CaCO_3$	Monthly
Turbidity	NTU	Monthly
Silica	mg/l Si	Monthly
Total Phosphorus	mg/l P	Monthly
Ortho-Phosphate (PO_4)	mg/l P	Monthly
Nitrate (NO_3)	mg/l N	Monthly
Nitrite (NO_2)	mg/l N	Monthly
Organic Nitrogen (N)	mg/l N	Monthly
Total Nitrogen (N)	mg/l N	Monthly
Sulphate (SO_4)	mg/l SO_4	Monthly
Suspended Solids (in salmonid rivers only)	mg/l	Monthly
Chloride	mg/l Cl	Monthly
Total Ammonia (NH_4)	mg/l NH_4	Monthly
Non-ionised Ammonia (NH_3) (in salmonid rivers only)	mg/l NH_3	Monthly
Micro-biological parameters		
Total Coliforms	No./100ml	Monthly
Faecal Coliforms (or *E.coli*)	No./100ml	Monthly
Faecal Streptococci	No./100ml	Monthly
Cadmium	µg/l Cd	4 times/year

Parameter List 1 Rivers	Description/Units	Frequency
Total Chromium	µg/l Cr	4 times/year
Copper	µg/l Cu	4 times/year
Iron	µg/l Fe	4 times/year
Lead	µg/l Pb	4 times/year
Manganese	µg/l Mn	4 times/year
Mercury	µg/l Hg	4 times/year
Nickel	µg/l Ni	4 times/year
Zinc	µg/l Zn	4 times/year
Hydromorphological elements		
Hydromorphological elements		Once
Hydrobiological elements		
Phytoplankton	Amount & diversity	Once
Phytobenthos	Amount & diversity	Once
Aquatic macrophytes	Amount & diversity	Once
Benthic invertebrates	Numbers & Diversity	Once
Diatoms	Numbers & Diversity	Once
Fish fauna	Numbers & Diversity	Once

The StEMA project has not identified stations or prescribed surveillance monitoring in coastal lagoons or transitional waters related to Mati Basin. However the Mati (Milot) river station is considered as a potential impacted river station in accordance with the applied classification system. Consequently the monitoring programme for the river station Mati (Milot) is proposed by StEMA to be monitored in accordance with List 2 parameters as shown in the list below. Any future surveillance monitoring stations in the lagoons and coastal waters of Mati Basin shall as well be monitored as a whole or partly in accordance with the specifications of List 2 parameters. In this version of list 2 Organics, PAH's and various organic compounds have been left out. To see the whole list of parameters and the arguments for inclusion in the list with reference to specific directives please refer to the StEMA Master Plan[24]

Table 9.3/e

List 2 Parameters, impacted Rivers, Marine lagoons and coastal waters	CAS Number & comments	Frequency
General Parameters:		
Temperature (*In situ*)	n/a	2/yr
Hardness (mg $CaCO_3$/L)	n/a	2/yr
Conductivity	n/a	2/yr
Time of High Water	n/a - for saline stations only	2/yr
Wind conditions (*In situ*)	n/a	2/yr
Hydrometric/Staff gauge (m)	n/a	2/yr
Dynamic Water Level (m)	n/a	2/yr
pH (*In situ*)	n/a	2/yr
Salinity	n/a	2/yr
COD	n/a	2/yr
Transparency	n/a	2/yr
Composite depth profile	n/a	2/yr

[24] Monitoring programme of physico chemical water quality and hydrobiology in Albania. Mater Plan. StEMA, October 2008

List 2 Parameters, impacted Rivers, Marine lagoons and coastal waters	**CAS Number & comments**	**Frequency**
samples		
Colour	n/a	2/yr
Suspended solids	n/a	2/yr
Morphological conditions (*In situ*)	n/a	2/yr
Other parameters:		
Total Coliforms	No./100ml	2/yr + bathing water requirements
Faecal Coliforms (or *E.coli*)	No./100ml	2/yr + bathing water requirements
Faecal Streptococci	No./100ml	2/yr + bathing water requirements
Indicators of biodiversity	n/a	1/yr
Hydromorphological elements		
Hydromorphological elements	n/a	1/6-yr
Hydrobiological elements		
Phytoplankton	n/a - amount & diversity	2/yr
Other aquatic fauna	n/a - amount & diversity	1/3-yr
Macro invertebrates	n/a- nos .& diversity	1/3-yr
Fish fauna	n/a- nos .& diversity	1/6-yr
Chlorophyll-a	42617-16-3	1/6-yr
Mineral oil	n/a	1/6-yr
Inorganics		
Cadmium (Cd)	7440-43-9	1/6-yr
Arsenic (As)	7440-38-2	1/6-yr
Nickel (Ni)	7440-02-0	1/6-yr
Zinc (Zn)	14833-23-9	1/6-yr
Chromium (Cr)	14833-09-1	1/6-yr
Copper (Cu)	7440-50-8	1/6-yr
Lead (Pb)	7439-92-1	1/6-yr
Mercury (Hg)	7439-97-6	1/6-yr
Tributyltin (TBT)	688-73-3	1/6-yr
Nutrients and ions:		
Ammonium (NH_4^+)	14798-03-9	2/yr
Nitrate (NO_3^-)	(7697-37-2)	2/yr
Nitrite (NO_2^-)	(7632-00-0)	2/yr
Organic nitrogen (N)	(93037-13-9)	2/yr
Ortho-phosphate (PO_4^{3-})	(68891-72-5)	2/yr
Total phosphorus (P)	12185-10-3	2/yr
Dissolved silicate (Si) (*fresh water*)	(10006-28-7)	2/yr
Gasses:		
Dissolved O_2 (*In situ*)	(80937-33-3)	2/yr

9.1.2 Groundwater

Groundwater surveillance monitoring of the quantitative and chemical status has been ongoing for some years in relation to the Fushe Kuge and Lezhe aquifers.

There are 6 groundwater monitoring stations. They are located at Shpimi Toma (close to Nderfan), Gurrez (in Fushe Kuqe aquifer), Hoteli I Gjuetise (in Lezhe aquifer), Barbulloje (in Lezhe aquifer), Ishull Lezhe (in Lezhe aquifer) and Rrile (in Lezhe aquifer)

At the monitoring stations both the quantitative and chemical status of groundwater in the Fushe Kuge and Lezhe aquifers is monitored twice a year. The analyses are concentrated on electrolytes, chloride, alkalinity, nitrate and nitrites and sulphate. Metals including chromium, copper and manganese are monitored occasionally and it is expected that changes in groundwater tables are measured as well even if such measurements have not been available for preparation of this plan.

The stations are monitored by the Albanian Geological Survey. Unless investigative monitoring shows the need for further long term monitoring, the surveillance programme should be continued in the existing version with the purpose to be able to identify developmental trends in the status of aquifers in the coastal plain.

The StEMA project has however made proposal for a future surveillance monitoring programme for groundwater[25] which should as a whole or partly include the following parameters. The parameters to be included refer to parameter lists in in the Ground water Directive, 2006/118/EC and the Drinking Water Directive 98/83/EC as shown as well in table 4.7 in section 3.3 of this pilot plan

General parameters
Temperature, pH, Dissolved oxygen, electrical conductivity;
Major ions
Ca, Mg, Na, K, HCO_3, Cl, SO_4, PO_4, NH_4, NO_3, NO_2;
Heavy metals
Hg, Cd, Pb, Zn, Cu, Cr. More precise choice depends on local pollution sources;
Organic substances
Aromatic hydrocarbons, halogenated hydrocarbons, phenols, chlorophenols. More precise choice depends on local pollution sources;
Pesticides
Components depend in part on local usage, land-use framework and existing observed occurrences in groundwater.
Microbes
Total coliforms, faecal coliforms.

[25] Monitoring programme for groundwater, Master Plan, StEMA, April 2008

9.2 Operational monitoring

Operational monitoring is applied in water bodies at risk of not achieving good ecological status when a programme of measures has been implemented. The role of operational monitoring is to evaluate whether implemented measures are sufficient or whether additional measures are needed. As no programme of measures has been implemented within the river basin district no additional operational monitoring is needed. In the operational monitoring may include the meteorological monitoring and warning, as very important for the River Basin Management. Instead supplementary monitoring is proposed under investigative monitoring.

9.3 Investigative monitoring

9.3.1 Rivers, lagoons and coastal waters

There has not been established investigative monitoring programmes in rivers, lagoons or coastal waters at the moment, but such stations and programmes shall most appropriately as a whole or partly in the future be based on list 2 parameters as shown in the table above

Comprehensive excavation and gravel extraction activities in the river bed in the lower part of Mati River have been ongoing for years, see table 5.10 and figure 5.3. The visual impression is that the river bed in many places has been modified beyond the limits of what is needed for maintaining good ecological status in natural rivers. Most probably it can easily be verified through monitoring and application of biological indices. Monitoring should be done with the purpose to create the background for introducing conditions for re-establishing excavation sites as background for issuing permissions. As part of such permissions there should be a clear indication of the ecological parameter limit values to be achieved in succession of restoration activities.

More generally a an investigative programme for monitoring the hydromorphological conditions in support of maintaining good ecological status all through the river system should be established. Hydromorphological conditions in support of biological life has not been addressed elsewhere in this plan, but is described in the WFD, Annex V, point 1.1.1. Several indices have been developed in EU to facilitate the monitoring and assessment of the hydromorphological conditions supporting biological life. Such indices are applied in cases where changes of the physical conditions in river beds are needed as background for issuing permissions on structural changes where compensations from impacts are needed.

Investigative monitoring programmes should as well be established in relation to at least the existing and former hotspots in the basin as described in section 5.1.7 and table 5.11. The purpose of monitoring should be to describe trends in the future impacts in water bodies as background for excluding other point sources from future programmes of measures. Such investigative monitoring should be concentrated downstream Reshen, Rubik, Lac, Reps, Kurbnesh, Burrel, Fushe Arres and monitoring should first of all address dangerous substances like metals, pesticides and other parameters characterising the former or existing production at specific hot spots.

9.3.2 Lakes

Two lakes exist in Mati Basin: Ulza and Shkopet reservoirs. Both of them are artificial reservoirs for retaining water and storage capacity for hydropower production. Based on existing information the Ulza reservoir has as well been modified as Chinese carps have been introduced in the reservoir. In consequence good ecological status is not necessarily expected to be achieved, but only good ecological potential. In practise it means that the reservoirs at least should maintain a chemical environment corresponding to what is needed for maintaining biological life as required for good ecological status.

There has not been done any targeted monitoring in the reservoirs since the beginning of the nineteen nineties and it should as part of investigative monitoring be attempted to verify the characterisation of the reservoirs as a considerable amount of all water in the Mati River passes through the reservoirs. It will indicate what can be expected at downstream monitoring stations.

It is proposed that a three year monitoring programme is established for both reservoirs based on sampling three times a year, spring, mid-summer and autumn at one station located in the middle of each reservoir.

The reservoirs are stratified during the summertime. It is proposed that sampling takes places at three depths over and below the temperature stratification layer. The main parameters to be monitored includes Secchi depth, chlorophyll-a, total-phosphorous, orthophosphate, total-nitrogen, nitrate, alkalinity, and oxygen.

9.3.3 Groundwater

As there is a surveillance programme ongoing in the two main reservoirs in the coastal plain any follow-up with additional investigative monitoring should be decided continuously in response to changes in groundwater status which might represent a risk in relation to good quantitative and chemical status at specific locations.

Generally an additional investigative monitoring programme should be initiated in relation to mapping of hygienic problems related to water supply from shallow wells.

Monitoring within the protected areas should include the monitoring of climate change indicators as well (investigative monitoring).

10 ECONOMIC ANALYSIS OF WATER USE

The implementation of a river basin management plan is assumed to cost money. An essential part of RBM planning and decision-making is to make an assessment of the costs of implementing the plan and the capability of the population to finance the costs to ensure that the plan can actually implemented

The WFD requires that an economic analysis is made for each water basin district (Article 5, Annex III), and that River basin management plans must contain a summary of this economic analysis (Annex VII.A). The WFD promotes the concept of water as an economic commodity and the use of economic principles to guide decisions in reaching the objectives of the WFD. It seeks to apply economic principles in four main respects, namely:

- The estimation of the demand for and the valuation of water in its alternative uses (Article 5)
- The identification and recovery of costs associated with water services having regard for the polluter pay principle and the efficient use of water (Article 9)
- The use of economic appraisal methods to guide water resource management decisions (Article 11)
- The use of economic instruments to achieve the objectives of the WFD, including the use of incentive pricing and market mechanisms (Article 11).

More specifically, the economic analysis should include the following:

- Long-term forecasts of supply and demand for water in the river basin, taking into account the reduction of water resources (surface and ground waters) projected by the climate change scenarios developed for the area.
- Estimates of the volume, prices and costs associated with water services
- Provide information to make judgements about the most cost-effective combination of measures in respect of water uses to be included in the programme of measures
- Estimates of relevant investments, including forecasts of investments
- The calculations necessary to take account of the principle of cost recovery (Article 9).
- Allow disproportionateness of costs to be determined. (The WFD allows derogations from its requirements or extensions in implementation timescales where the costs involved would be 'disproportionate'.)

The WFD provides that a RBM plan should contain “a summary of the economic analysis of water use as required by Article 5 and Annex III”. What is required is therefore not the full economic analysis, but a summary of the main points.

10.1 Demand for water services

10.1.1 Uses of water resources in the Mati river basin

The water resources enjoy multiple uses in the Mati river basin (MRB). The main uses are:

- public supply of (drinking) water for households, commerce, hospitals, institutions, etc.;
- other abstraction of water (wells, springs, surface water) for household and similar consumption;
- process water for industry (for processing, production and cleaning);
- agriculture (irrigation, livestock);

- o sewage and industrial effluent ‘assimilation’ (dilution and transport);
- o hydroelectricity;
- o fisheries;
- o amenity;
- o nature conservation.

The first four of these are ‘consumptive’, and involve the abstraction of water from surface or ground water resources and its delayed (partial) return to the hydrological cycle.

We consider each of these uses in turn. In the case of consumptive uses, existing demand is quantified where possible, and then a projection is made of future demand, and of the capacity of the water system to meet this demand.

10.1.2 Public drinking water supply for households, commerce, industry and other institutions

It was seen earlier (section 5.1.2, and figure 5.2) that there are a number of water supply and sanitation companies operating in the MRB.

The analysis which follows makes extensive use of a database maintained by the General Directorate of Water and Sewerage (DPUK) as a means of monitoring and benchmarking the performance of the water supply and sanitation companies. The database relates to the period January to June 2009, and covers 181 days. The use of water in the home and in institutions is inseparable from the issue of waste household water (i.e. sewage), and most of the water supply companies also provide sewage networks for removal of the sewage.

The situation is summarised in table 10.1

Table 10.1 Water supply and sanitation companies operating in the Mati River Basin

Region	Company	Service area in MRB[26]		Outside MRB (all communes)
		Municipalities	Communes	
Lezhe	Sh.A. UK Lezhe	Lezhe.	Shëngjin, Balldren,	
	Sh.A. UK Kurbin	Laç, Mamurras,	Milot.	
	Sh.A. UK Mirdite	Rreshen;	Selite, Orosh	
	Sh. A. UK Rubik	Rubik		
	Outside water company service area		Fan, Kacinar, Ungrej, Fushe Kuqe, Kthjelle, Shenkoll, Blinisht, Zejmen, Kolsh, Dajc, Kallmet,	
Shkoder	UK Puke fshat		Qafe Mali, Gjegjan	Rrape, Blerim, Qelez, Fierze, Qerret, Iballe
	Sh.A. U F. Arrëz	F. Arrez		
Diber	Sh. A U Mat	Burrel	Lis	
	Outside water company service area	Klos	Selishte, Macukull, Gurre, Suc, Derjan, Komsi, Xiber, Rukaj, Ulez, Baz	

26 MRB: Mati River Basin

There are:

- Six companies – Lezhe UK Sh. A, Kurbin UK Sh. A, Rubik UK Sh. A, Mirdite UK Sh. A, Fushe Arrez UK Sh. A and Burrel UK Sh. A – supply exclusively to communities in the MRB and two companies – In the case of Puke fshat, only a minority of its customers (about 40%) are situated within in the MRB, the rest are outside.
- There are many (rural) areas which are not covered by a public water supply company at all (11 communes in Lezhe region, 10 communes in Diber region and one (Martanesh) in Bulqize).
- The water supply sector in the MRB is rather fragmented: all the supply companies are very small, those operating in MRB serving a population between 2000 and 40,000 (where the supply area straddles the boundaries of the MRB). It is generally accepted that water supply companies need to be rather larger, in terms both of optimising operating efficiency (and therefore costs), obtaining access to funds for investment, and the ability to hire specialists.

Coverage of water supply

The water supply coverage is shown in table 11.2

Table 10.2: Access to public water supply, 2008[27]

Company	% in MRB	Pop. in service area	Persons with HH water connection		Persons served by standpipe		Total population with water access	
			Total	MRB	Total	MRB	Total	MRB
Lezhe UK Sh.A	100%	36,600	27,771	27,771	1,500	1,500	29,271	29,271
Puke fshat Sh.A	40%	12,000	2,000	800	350	140	2,350	940
Rubik UK Sh.A	100%	2,532	2,026	2,026	20	20	2,046	2,046
Mirdite UK Sh.A	100%	9,089	5,906	5,906	168	168	6,074	6,074
Fush Arrez UK Sh.A	100%	4,741	1,925	1,925	0	0	1,925	1,925
Burrel UK Sh.A	100%	22,260	18,200	18,200	4,060	4,060	22,260	22,260
Kurbin U Sh.A	100%	65,154	41,446	41,446	0	0	41,446	41,446
Total		152,376	99,274	98,074	6,098	5,888	105,372	103,962

Considering that the total estimated population of the MRB is 234,000, this means that:

- proportion of population in the MRB whose home is supplied by piped water supply is 41.9%
- proportion of population with access to standpipe is 2.5%
- total proportion of population with access to public water is 44.4%

Other households presently rely on individual or shared wells, springs or surface water.

Connection to sanitation facilities

The coverage by sanitation facilities is shown in the table below.

27 Source in this and the following tables: DPUK benchmarking database

Table 10.3: Access to sewage network, 2008

Company	% in MRB	Pop. in service area	Persons connected to sewer network	
			Total	MRB
Lezhe UK Sh.A	100%	36,600	29,004	29,004
Puke fshat Sh.A	40%	12,000	250	100
Rubik UK Sh.A	100%	2,532	1,920	1,920
Mirdite UK Sh.A	100%	9,089	5,261	5,261
Fush Arrez UK Sh.A	100%	4,741	1,679	1,679
Burrel UK Sh.A	100%	22,260	15,162	15,162
Kurbin U Sh.A	100%	65,154	0	0
Total		152,376	53,276	53,126

The proportion of the population of the MRB connected to a sewage network is therefore 22.6%.

Per capita water consumption

The per capita water consumption for the different water companies and for the Mati River Basin as a whole are shown in the table below.

Table 10.4: Household water consumption in the Mati river basin, 2008

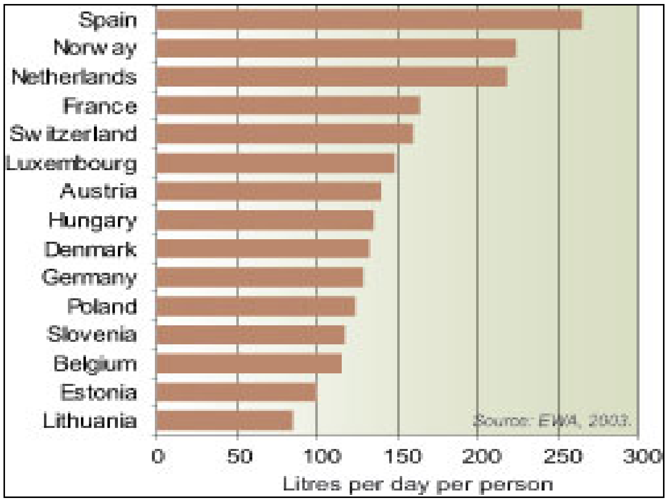
Company	Persons connected	Water sold ('000 m^3)	% in MRB	Persons in MRB connected	Water sold MRB ('000 m^3, 181 days)	Per capita. consumption (l/d)
Lezhe UK Sh.A	27,771	410	100%	27,771	410	82
Puke fshat Sh.A	2,000	61	100%	2,000	61	169
Rubik UK Sh.A	2,026	51	100%	2,026	51	140
Mirdite UK Sh.A	5,906	86	100%	5,906	86	80
Fush Arrez UK Sh.A	1,925	26	100%	1,925	26	75
Burrel UK Sh.A	18,200	213	100%	18,200	213	65
Kurbin U Sh.A	41,446	450	100%	41,446	450	60
Total	99,274	1,297		99,274	1,297	72

The mean consumption for households in the river basin connected to a public water supply is therefore 72 l/d, with a range for the different water supply companies between 60 and 170 litres/day.

Interestingly, smaller companies like Puke fshat and Rubik are the companies with the highest demand, and the largest company, Kurbin, has the lowest demand. However the figure for Puke fshat, which distributes exclusively to rural areas, may be raised by (legal or illegal) usage for irrigation purposes.

For comparison purposes, Figure 11.1 shows the mean household consumption for 2002 in a number of other European countries.

Figure 11.1: Mean household consumption in a number of European countries in 2002[28]



For the countries depicted, consumption ranges from 80 l/d for Lithuania up to nearly 270 l/d for Spain (in the latter case may be affected by the high level of irrigation in Spain). Broadly as incomes and living standards increase, so does household water consumption – at least up to a certain not predefined level but hereafter followed by a decline as a consequence of targeted savings. The present water consumption in the Mati river basin is clearly on the low side relative to other European countries, and can be expected to grow as living standards rise and supply bottlenecks are resolved.

According to the European Environment Agency, national average per capita public water supply varies widely between European countries, ranging between 50 and 150 m^3 per capita annually (96 to 288 l/d per person), reflecting the net effect of a number of drivers that can vary considerably both spatially and temporally. Household use typically accounts for 60–80 % of the public water supply across Europe with personal hygiene and toilet flushing accounting for about 60 % of this proportion[29].

Efficiency of water supply and unbilled water

An important indicator of the performance of a water supply system is the ratio of the amount of drinking water manufactured to the amount billed. The following is the situation for the MRB in 2008.

Table 10.5: Proportion of water billed to water manufactured in MRB, 2008

Company	Water produced (‘000 m^3)	Water sold (‘000 m^3)	Efficiency	Length of water pipe network (km)	% in MRB	Water prod. for MRB (‘000 m^3)	Water sold MRB (‘000 m^3)
Lezhe UK Sh.A	1,123	506	45%	63	100%	1,123	506
Puke fshat	210	65	31%	134	40%	84	26
Rubik UK Sh.A	75	60	80%	17	100%	75	60
Mirdite UK Sh.A	494	291	59%	20	100%	494	291
Fush Arrez UK Sh.A	29	28	98%	29	100%	29	28

[28] Source: UNEP Global Resource Information Database. Freshwater in Europe
29 EEA report no. 2/2009: Water resources across Europe — confronting water scarcity and drought.

Burrel UK Sh.A	1,912	267	14%	49	100%	1,912	267
Kurbin U Sh.A	1,954	514	26%	55	100%	1,954	514
Total	4,674	1,225	26%			4,548	1,186

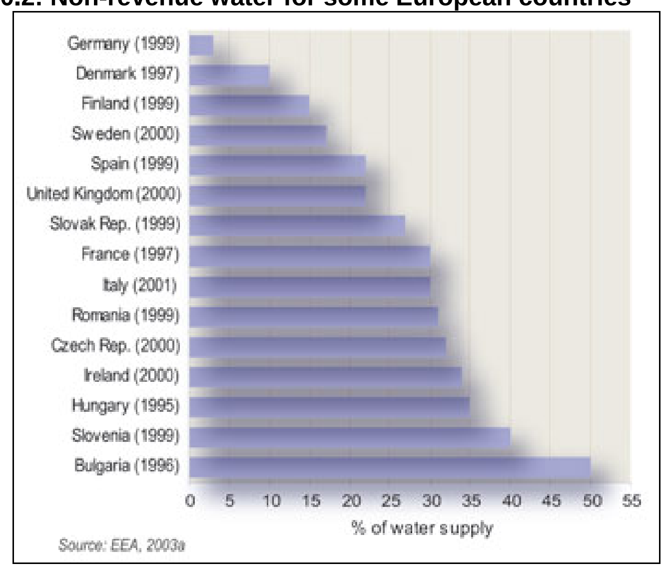
The efficiency of the water supply (measured according to that particular definition) varied strikingly, between 14% (Burrel) and 98% (Fush Arrez). The average overall for the Mati river basin was 30%. Water losses are relatively greater for the larger companies (Burrel and Kurbin) than for small companies such as Fush Arrez and Rubik. One reason for this is that the smaller companies are supplying water to a small discrete community situated close to the water supply, and therefore do not have to transport the water so far (see fifth column in above table).

However in any case water loss rates in excess of 40% are clearly wasteful, and indicate that something is seriously wrong. Non-revenue water may be caused by:

- consumption which is authorised but unbilled,
- apparent losses as illegal water connections (theft) and metering inaccuracies, and
- leakages and other losses, due to old and inefficient infrastructure (leaking pumps) or poor maintenance and failure to respond appropriately to incidents

The table below shows water loss rates for a number of other European countries.

Figure 10.2: Non-revenue water for some European countries[30]



According to an EEA report, non-revenue water in Denmark has consistently been less than 10%[31]. In Germany, according to a study commissioned by the German water industry association BGW, NRW averages only 7%. According to the same study it was 19% in England and Wales, 26% in France and 29% in Italy[32].

30EEA: Unaccounted-for water in EECCA countries 1994 – 2004)

31 EEA: Unaccounted-for water in EECCA countries 1994 - 2004.

32 Metropolitan Consulting Group: VEWA - Vergleich europaeischer Wasser- und Abwasserpreise

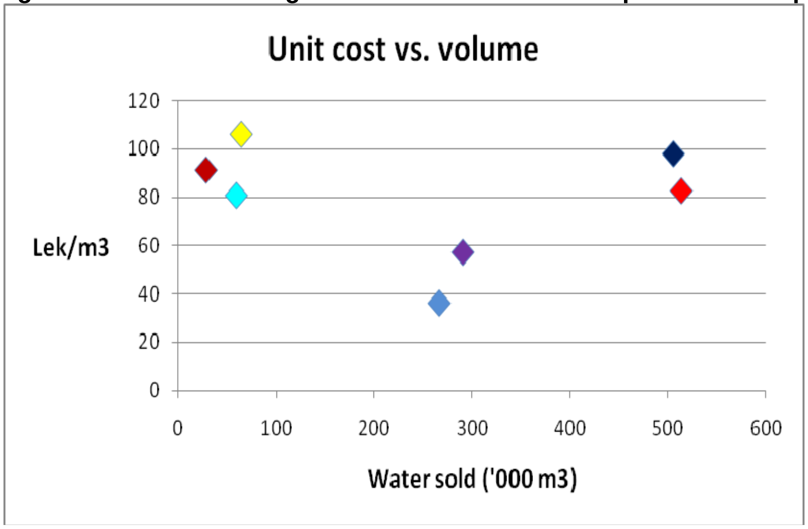
Dependency between size and unit costs
The water supply industry in the Mati river basin is rather fragmented, with 7 different water supply companies active in this relatively small area. Even between these companies there are significant differences in size. In the table below size indicators are tabulated against unit costs.

Table 10.6: Indicators of size and unit costs for MRB water supply companies, 2008

Company	Urban/ rural	No. of connect.	Total costs ('000 lek/y)	Water sold ('000 m3)	Unit cost (lek/m^3)
Puke fshat	R	524	65	6,860	106
Lezhe UK Sh.A	U + R	5,801	506	49,656	98
Fush Arrez UK Sh.A	U	571	28	2,594	91
Kurbin U Sh.A	U + R	5,288	514	42,483	83
Rubik UK Sh.A	U + R	503	60	4,817	81
Mirdite UK Sh.A	U + R	1,171	291	16,617	57
Burrel UK Sh.A	U + R	3,717	267	9,694	36
Total		17,574	1,731	132,721	77

The rows are tabulated in decreasing sequence of unit costs (lek/m^3 of water sold). Unit cost is also plotted against quantity of water sold in the scatter diagram below.

Figure 10.3: Unit costs against volume of water sold per water company



It can be seen that there is no clear correlation between size and unit cost. But the three highest-cost companies are all small companies, with water sales < 70,000 m^3 per year. In particular Puke fshat (yellow point) distributes water over a rural area only. On the other hand one of the largest companies (Lezhe, dark blue) has relatively high costs. Also playing a role is water losses and whether the company is making extensive use of pumping or has a gravity-feed system (lower energy costs).

Quite apart from the question of unit costs, streamlining of the water and sanitation sector in the MRB is necessary. Companies will need to have a greater pool of skills in the future, eventually they will become more or less autonomous, and will need to initiate their own investment programmes and attract finance. Larger utility companies will be necessary to make this possible. There are signs that the companies realise this. For example it is understood that Burrel, Rubik and Mirdite have already held preliminary discussions about the possibility of cooperating more closely or merging.

Success in terms of converting billings into payments

The table below shows the proportion of billings which are converted into payment for each of the companies operating in the MRB.

Table 10.7: Proportion of billings for which payment is received

Company	Billings	Payments collected	Coll. incl. arrears	Collection rate
(1)	(2)	(3)	(4)	(5)=(4)/(2)
Lezhe UK Sh.A	32,161	19,297	19,297	60%
Puke fshat	1,297	1,059	1,059	82%
Rubik UK Sh.A	2,630	2,844	3,034	115%
Mirdite UK Sh.A	19,530	18,140	18,140	93%
Fush Arrez UK Sh.A	865	294	415	48%
Burrel UK Sh.A	10,333	8,129	8,561	83%
Kurbin U Sh.A	12,385	6,457	6,757	55%
Total	79,201	56,220	57,263	72%

Allowance is made for the collection of arrears in the calculated collection rates, even though the sums collected as arrears may not correspond to the amounts billed (e.g. they may apply to earlier billings). In the case of Rubik the collection rate appears to exceed 100%, presumably because by the time periods for which billings and payments count does not correspond exactly. It should be noted however that Rubik states that it follows up on non-payment by house-to-house visits, and exercise sanctions against some non-payers (water supply cut off).

It can be seen that the overall collection rate for the MRB as a whole is of the order of 72%, although collection rates for some of the companies is significantly lower (Fush Arrez 48%, Kurbin 55%).

Metering

Finally the proportion of the companies' customers which have their water consumption metered is presented.

Metering (and invoices based on metered consumption) is important because it ensures that water is treated as an economic commodity, about the consumption of which consumers make economically motivated decisions. In particular, without metering it is not possible to achieve cost recovery in accordance with the polluter pays principle, as required by Article 9 of the Water Framework Directive. Metering reduces wasteful usage of water.

Table 10.8: Proportion of connections and of water sales which are metered

Company	Proportion metered			
	Households		Total	
	By connections	By vol. water	By connections	By vol. water
Lezhe UK Sh.A	54.0%	33.9%	54.1%	34.6%
Puke fshat	0.0%	0.0%	1.7%	1.0%
Rubik UK Sh.A	7.4%	4.1%	15.7%	15.2%
Mirdite UK Sh.A	3.8%	5.6%	11.6%	71.4%
Fush Arrez UK Sh.A	0.0%	0.0%	1.8%	0.0%
Burrel UK Sh.A	85.1%	87.3%	86.2%	89.9%
Kurbin U Sh.A	0.0%	0.0%	1.6%	3.2%
Total	36.3%	25.6%	37.9%	37.5%

Burrel stands out as having a high penetration of meters, both in the household sector and overall – nearly 90% of all water sold is metered. Lezhe also has a relatively high penetration of meters. None of the other companies has achieved even 10% metering in the household sector, although Mirdite achieves 71% overall water metering, presumably because a small number of heavy commercial/ institutional users are metered.

Interestingly, the mean water consumption per metered household taken over all the above-listed companies is $56m^3$/year whereas the mean consumption for unmetered households is $93m^3$, which appears to demonstrate the water-saving effect of water metering referred to earlier.

10.1.3 Cost recovery and financial sustainability of the water companies

The following table summarises the costs and revenues[33] of the water companies operating in the MRB.

Table 10.9: Costs and revenues of the water companies operating in the MRB

	Lezhe UK Sh.A	Puke fshat	Rubik UK Sh.A	Mirdite UK Sh.A	Fush Arrez UK Sh.A	Burrel UK Sh.A	Kurbin UK Sh.A	TOTAL
DOC W	37656	4,034	3,571	13,550	821	7,594	32,283	99,509
Cash W	37656	4,034	3,882	14,637	821	7,594	32,283	100,907
TOC W	49656	6,860	4,817	16,617	2,594	9,694	42,483	132,721
DOC S	4292	893	623	2,780	261	354	0	9,203
Cash S	4292	893	693	2,780	261	354	0	9,273
TOC S	7292	1,253	1,088	3,428	1,205	1,134	0	15,400
Total DOC	41,948	4,927	4,194	16,330	1,082	7,948	32,283	108,712
Total Cash	41,948	4,927	4,575	17,417	1,082	7,948	32,283	110,180
Total TOC	56,948	8,113	5,905	20,045	3,799	10,828	42,483	148,121
Tariff								
Bills W	27684	1,184	2,263	17,837	711	9,793	12,385	71,857
Bills S	4477	113	367	1,693	154	540	0	7,344
Total billings	32161	1,297	2,630	19,530	865	10,333	12,385	79,201
Collected W	16780	972	2,453	14,602	243	7,811	6,457	49,318
Collected S	2517	87	391	3,538	51	318	0	6,902
Collected other	0	0	15	0	0	35	131	181
Total collections	19,297	1,059	2,858	18,140	294	8,164	6,588	56,400
Billings/DOC	76.7%	26.3%	62.7%	119.6%	79.9%	130.0%	38.4%	72.9%

33 Notes: W = water S = sewerage DOC = direct operating costs TOC = total operating costs 'cash costs' refer to direct operating costs plus taxes plus interest plus financial expenses

TOC = cash costs + depreciation

Billings/cash costs	76.7%	26.3%	57.5%	112.1%	79.9%	130.0%	38.4%	71.9%
Billings/TOC	56.5%	16.0%	44.5%	97.4%	22.8%	95.4%	29.2%	53.5%
Collected/DOC	46.0%	21.5%	68.2%	111.1%	27.2%	102.7%	20.4%	51.9%
Collected/Cash	46.0%	21.5%	62.5%	104.2%	27.2%	102.7%	20.4%	51.2%
Collected/TOC	33.9%	13.1%	48.4%	90.5%	7.7%	75.4%	15.5%	38.1%
Subsidies	10000	4,000	3,000	612	2,000	0	34,423	54,035
As % of TOC	18%	49%	51%	3%	53%	0%	81%	36%

The following conclusions can be drawn from the above table:

1. The water supply sector as a whole is a long way from being cost recovering at present. The total amount billed to its customers only covers 53% of its total operating costs (or 72% of its cash costs or 73% of its direct operating costs).
2. This situation is being exacerbated by the fact that not all billings are actually being paid. Cash receipts from billings cover only 38% of total operating costs (or 51% of total cash costs or 52% of direct operating costs.
3. The deficit is being made up by subsidies from the Ministry of Public Works (DPUK). Subsidies in 2008 amounted on average to 36% of the total operating costs.
4. These figures referred to in points 1, 2 and 3 are average figures applying to the sector as a whole. In fact these averages cover a wide range of different financial situations for the different water supply and sanitation companies. While none of the companies is able totally to meet its costs from the revenues generated, it can be seen that some come quite close. Both Mirdite and Burrel cover all their direct costs, and cover 91% and 75% of their total operating costs respectively. These would be 97.4% and 95.4% respectively if the companies succeeded in turning all their billings into cash. Burrel did not receive an operating subsidy at all, and Mirdite received an operating subsidy of only 3% of its total operating costs.
5. At the other end of the spectrum, Fush Arrez only succeeded in covering 7.7% of its total operating costs (although this figure is significantly increased if arrears are included) from the charges collected, and Puke fshat only covered 13.1% of its TOC from cash receipts (billings were only 26% of DOC). Fushe Arrez is the smallest of the water companies, supplying a population of only 1925 persons. Puke fshat is also small, but it should be borne in mind that it supplies water exclusively to rural communities and has the largest pipeline network of any water supply company operating in the Mati river basin (134 km transport and distribution).
6. It can be seen in the above table that the tariffs for the three types of water service user (households, industry/commerce and institutions) vary greatly, being much higher (typically 3 to 4 times higher) for the latter 2 categories than for households. The difference is more than can be accounted for purely in terms of the government subsidy applying to households, in other words there is some subsidisation of households by the commercial and institutional sector.

10.1.4 Forecast future demand for publicly supplied water

Rough forecasts have been made, up to 2030, for the demand for drinking water by households, and by the commercial, industrial and institutional (CII) sector. These forecasts are presented in the tables below. The method used to make the forecasts is described below the tables.

Table 10.10: Long-term projection of demand for public water by households

	2010	2015	2020	2025	2030
Population of MRB (assume growth as national)	234,346	241,647	247,684	251,904	254,098
Connection rate to water supply	43%	48%	70%	85%	90%
Population connected to water supply	100,769	115,991	173,379	214,118	228,688
Per capita water consumption (l/d)	75	90	100	105	110
HH water demand (thousand m^3)	2,759	3,810	6,328	8,206	9,182
Ratio water sold ; water produced	27%	33%	45%	65%	70%
Water to be abstracted for HH consumption (thousand m^3)	10,217	11,546	14,063	12,625	13,117

The demand made on the water resources in regard to the public supply of drinking water will depend on population trends, on the proportion of population connected to the public water supply, on the mean per capita water consumption in the home, and on the proportion of water lost between production and consumption.

As far as the population is concerned, use was made of the projection of the population of Albania made by the United Nations Statistics Division[34]. It was assumed that the population in the Mati river basin will develop at the same rate as the national population.

As far as the proportion of the population connected to the water supply is concerned, Albania's accession to the European Union will provide a major boost to the number of connections, in accordance with the provisions of the Drinking Water Directive (Council Directive 98/83/EC). It is assumed that by 2030 90% of the population of the MRB will be connected, and this progress is assumed to be made, gradually up to the time of accession, and thereafter more rapidly when Albania has become a member of the European Union.

As far as the per capita water consumption is concerned, the present mean level in the MRB, at 72 litres/day, is on the low side by comparison with other European countries[35], see figure 11.1. It is assumed that by 2030 mean consumption will reach a level of 110 litres/day, a middle-of-the-range level for other European countries.

As far as non-revenue water is concerned, this is assumed to fall from its present very high value progressively to about 30% of the water produced (i.e. 70% of water production is delivered and billed to customers) by 2030.

It can be seen that on the assumptions made, household consumption will more than treble by 2030. But the volume of water needed to be abstracted from ground (and surface) water to meet this increased demand will only rise by some 30% in 2030, due to the anticipated improvements in diagnostics and maintenance and a clampdown on illegal connections (if relevant). The water production requirements in the intervening period may be somewhat higher, as the reduction in non-revenue water is assumed to be achieved less rapidly than the increase in connections and per capita assumption.

Obviously the many households not connected to a public water supply and without access to a standpipe have to make other arrangements for meeting their water needs. No data on this aspect have been identified. The Mati River Basin Agency has records of 443 sources of water in private use. It is not known whether these are exploited by single households, associations or small enterprises.

34 This projection is available at the website http://data.un.org/Data.aspx?d=GenderStat&f=inID%3A7

35 This is probably artificially low, since consumption is being constrained by discontinuities in supply.

Table 10.11: Long-term projection of demand for public water by CII sector, and of water needed to be abstracted to meet this demand

	2010	2015	2020	2025	2030
Assumed growth rate (p.a.) 4%					
Water consumption of CII sector	468	570	693	843	1,026
Ratio production : water sold	27%	33%	45%	65%	70%
Water to be abstracted for households	1,735	1,727	1,541	1,298	1,466

Water demand in the CII sector is assumed to grow at a rate of 4% p.a., but this growth in demand by commerce, industry and institutions will be more than offset by improvements in distribution resulting from the reduction in non-revenue water.

10.1.5 Other abstraction of water (wells, springs, surface water) for household and similar consumption

This can be either:

- abstraction from surface waters (no data available), or
- abstraction from groundwater (own well or spring): some data provided by Mati River Basin Agency, but it is not know whether this is complete

10.1.6 Process water for industry

There are details of 24 sites where groundwater from wells or springs is abstracted for operations associated with quarrying, mainly the washing of gravel. These all have a permit from the Mati River Basin Authority. For 18 of these wells, there is information on the quantity of water abstracted. The amount involved is 65 litres/second.

10.1.7 Agricultural use of water

Some data on the use of freshwater for irrigation in the Mati River basin are presented in section 4.2.2.

The Ministry of Agriculture stated that it is mainly surface water which is used for irrigation purposes in the Mati River Basin. Some years ago, however, Eftimi[36] described the use of water from uncontrolled free flowing irrigation wells of the northern part of the Rilla plain, with a total discharge is about 500 l/s, and suggested that these might be contributing to saline intrusion into the coastal aquifer. If this practice is continuing, then urgent action is needed to assess the situation and ensure that a proper balance is being struck between all needs in the area, possibly introducing charges for irrigation water which ensure that all parties are paying the full economic costs or which establishes disincentives to discourage harmful water use.

It appears that users of water for irrigation pay no charge for the water itself (although they pay for the operating and maintenance costs of the irrigation system).

10.1.8 Hydroelectric power

There are at present two hydroelectric power plants on the Mati river.

36 R. Eftimi: some considerations on seawater-freshwater relationship in the Albanian coastal area (undated)

Hydroelectricity generation is not a consumptive use of the river water, but it is a use and a valuable one and it is reasonable that part of the costs of managing the river basin should be met by the hydroelectric sector. The two power stations (Mati cascade) have a combined capacity of 52 MW and a mean annual output of 210 GWh[37].

Although the power stations do not *consume* water, the electrical output depends on the discharge of the Mati river at those points on the river (lower discharge = lower output).

Future demand

- o According to the draft National Energy Strategy there are no plans in the medium term to increase the hydroelectric capacity in the MRB (although mean output may increase somewhat as a result of the project to refurbish the Shkopeti power station).
- o If climate change in the future leads to less rainfall overall, this could reduce the output of these hydroelectric stations[38].

10.1.9 Fisheries

There appears to be some subsistence and commercial fishingat Uleza and Shkopeti lakes; and aquaculture activities, based mainly at trout farming, in Bulqiza and in Fshat village. Most of the fish produced is sold in the domestic market.

Despite abundant freshwater source the trout farm suffered from a poor feed conversion rate, low international market prices and high cost of imported feed and is not non-operational. However, there are now private initiatives in trout farming.

Table 10.11/a Fish production during the last 5 years at Uleza and Shkopet lakes

Type	Scientific name	2005	2006	2007	2008	2009	Average yearly production (quintal)	Average market price (Lek/kg)	Average yearly revenue (Million Lek)
Grass carp	*Ctenopharyngodon idella*	6.5	6	3.7	8.5	8	6.5	310	0.2
Silver carp	*Hypophthalmichthys molitrix*	53	55	48	61	48	53	255	1.4
Common bleak	*Alburnus alburnus*	5.6	7	2	4	3	4.3	160	0.1
Common carp	*C. carp*	69	73	42	63.5	43	58.1	365	2.1
Crucian carp	*C. carassius*	35	37	34	43	34	36.6	190	0.7
Common Nase	*Ch. nasus*	15.1	17	17.4	31	24	20.9	230	0.5
European Chub	*Squalius cephalus*	18	20	16	33	18	21	240	0.5
Others		22	45	16.3	9	7	19.9	210	0.4
Rainbow trout	*Oncorhynchus*	291	280	350	387.5	345	330.7	490	16.2
Total		**515.2**	**540**	**529.4**	**640.5**	**530**	**551**		**22.1**

37 Draft National Energy Strategy 2006 - 2020

38 Ermira Fida et al: Security of the energy sector in Albania in the face of climate change, 2009

10.2 Cost recovery, affordability

The preceding analysis showed that the water consumers supplied by the water companies are not at present meeting the full costs of their water supply. Table 11.12 shows that on average the total cash received from customers only covered 38% of the TOC (total operating costs). Arguably even this overstates the extent to which consumers are meeting the full costs, since TOC probably does not include the full capital costs of the infrastructure. The shortfall is being met partly by the annual operating subsidies paid by DPUK and probably partly by cutting back on non-acute maintenance and by not having the full cost of capital reflected in their balance sheets.

It should be noted that all the water companies operate a system of differential tariffs, with households paying far less per m^3 than businesses and institutions. There is no logic to this in terms of the cost structure, since unit costs of supplying water to institutions is likely to be lower than to households. This can be seen in the table below.

Table 10.12: Tariffs charged to different categories of water user

	Water tariff Households (Lek/m3)	Water tariff PE (Lek/m3)	Water tariff Institutions (Lek/m3)	Total Operating Costs /tonne
Puke fshat	15	80	60	106
Rubik UK Sh.A	30	100	70	81
Mirdite UK Sh.A	25	80	60	57
Fush Arrez UK Sh.A	20	80	80	91
Burrel UK Sh.A	23	80	60	36
Kurbin U Sh.A	18	80	60	83
Lezhe UK Sh.A.	43	110	100	98

It can be seen that, in the case of some companies, none of the categories of customer is paying the full cost of the service (Puke fshat, Fushe Arrez, Kurbin), in others most of the benefit of the subsidies accrues to households, while institutional customers are paying the full cost or a large part of it (Rubik, Mirdite, Lezhe). In Burrel it appears that institutional water users are not only meeting the full costs of their water, but are actually cross-subsidising households.

Article 9 of the Water Framework Directive requires that member states:

1. "take account of the principle of recovery of the costs of water services, including environmental and resource costs, having regard to the economic analysis ... in accordance .... with the polluter pays principle";
2. "ensure that water-pricing policies provide adequate incentives for users to use water resources efficiently, and thereby contribute to the environmental objectives of this Directive";
3. "ensure an adequate contribution of the different water uses, disaggregated into at least industry, households and agriculture, to the recovery of the costs of water services .... taking account of the polluter pays principle"

Albania therefore needs to be working towards a situation where revenues to the water companies from the sale of water not only fully cover operating costs, but also include sufficient margin that they provide for replacement of investments reaching the end of their life. While the Directive does not explicitly rule out cross-subsidisation of one category of user by another, and it may be acceptable during an intermediate period when there are affordability problems, in the longer term a tariff structure should be aimed at where all categories of users are contributing similarly to the cost of the water supply on the basis of the amount of water consumed.

Affordability is of course a rather vague concept, but international agencies have attempted to give more precise substance to it. The benchmark used is normally in the range 4-5% of disposable income.

Unfortunately there are very few data available on the incomes of individuals or of households in Albania. An indicative calculation is carried out below based on very approximate data. There are some data on incomes, for example in the regional development plans developed in 2005 with UNDP support for the 12 regions of Albania in connection with the planning for the Millennium Development Goals. Unfortunately there are few data relevant directly to the MRB, but data were available for 2003 for the Elbasan and Shkoder regions which were reasonably inter-consistent, and could be regarded as perhaps likely to be similar to the Mati river basin area in terms of household incomes. Household income here includes not only salaries or cash earnings, but also social security payments, remittances or earnings repatriated from work abroad and the imputed income from subsistence farming. The indicative calculation is set out below. Calculations are carried out for a ‘mean low’ and a ‘mean high’ salary.

Table 10.13: Indicative calculation showing possible scope for recovering real costs from households in MRB

Parameter	Amount		Units	Remarks
	Low mean	**High mean**		
Mean income, 2003	120	230	lek/person/d	Based on data for Shkoder, Elbasan regions
Mean income, 2009, daily	142	272	lek/person/d	Assuming salaries increased by inflation 2003-2009
Mean income, 2009, monthly	4253	8151	lek/person/month	
Maximum affordable for water & sanitation	*213*	*408*	*lek/person/month*	*Based on 4% criterion applied to the ‘low and high means’ respectively*
Mean water consumption	18	18	m3/person/month	Based on 50 l/d/person
Present mean water bill	46	46	lek/person/month	Based on typical present household water tariff of 30 lek/m3
Monthly water bill if HH met full unit production cost	110	110	lek/person/month	If HH were charged full present unit cost of production (=72 lek/m3)
Monthly water and sewage bill for cost recovery after implementation of EU directives	1400!	1400	lek/person/month	Very rough estimate obtained by dividing total annualised costs of water after implementation by affected population

It can be seen that, on the basis of the 4% affordability criterion there is some scope for increasing present household tariffs, for example so that households, even in the ‘low mean’ category, are meeting the costs of their water supply. However this will involve bringing about a change in people’s thinking, so that they accept that water is a valuable commodity which has to be paid for and is not provided by the ‘government’ as a right. The cost of water services for full cost recovery in the long term presents a considerable challenge and real salaries will have to rise very considerably in the long term to make this feasible.

11 PROGRAMME OF MEASURES

Programme of measures in a river basin management plan is generally a main issue, as the measures to be described are those needed for achieving good ecological, chemical and quantitative status in accordance with the overall objectives of the directive and the specified objectives for water bodies and protected areas. It is costly and is as such an economic controversial programme which must rely on trustworthy assumptions as background for political decision-making

In existing EU member states implementation of the WFD has been ongoing since year 2000 with intersected planning periods allocated for specific steps in preparing RBM plans. In article 11 point 7 in the WFD it is stipulated that programme of measures shall be established in 2009 and made operational in 2012. In Denmark as an example 23 river basin management plans including programme of measures for each plan are not yet ready and will not finally be established until late 2010 and they will not be made operational until 2012. In addition good ecological status in water bodies based on interventions described in programmes of measures shall not be achieved until 2015 in existing EU member states. It corresponds to a planning period of 15 years.

Compared to that - in this preliminary version of a river basin management plan for Mati Basin it has been attempted to compress a 10 year planning period down into 5 months knowing that water bodies have not been defined and characterised as prescribed in the WFD. Long term surveillance monitoring programmes and specific investigative monitoring programmes have not been running as assumed in the WFD as background for making assessments of developmental trends in the ecological status of water bodies. Criteria for good ecological, chemical and quantitative status have not been defined for specific water bodies as background for making risk assessments. Inter-calibration with neighbouring countries (in the same eco-region) on good ecological status has not been undertaken and last but not the least methods, resources and procedures for management in accordance with the requirements of the WFD have not sufficiently been available or are not implemented.

In addition this version of the plan has been prepared on the background that Albania is in a pre-accession position, where the main directives relevant for implementing the WFD have not been fully transposed, implemented or made operational as part of a general change of practises on environmental management.

The programme of measures has been prepared based available information, which is supposed to be changed continuously as a result of ongoing and planned monitoring and additional strengthening of the institutional capacities with the involved authorities In that context the programme of measures shall only be seen as an outline programme which has to be detailed further in the future.

Some of the most urgent basic actions to be taken as part of preparing future management plans in accordance with the of the WFD require:

- increase in the activities on general water monitoring and allocation of resources to increase the analysing capacity and accreditation of laboratories
- establishment of ecological monitoring as needed to comply with WFD

- o formal identification and characterisation of water bodies (follow-up on procedures as described in this pilot plan) including determination of the ecological status of surface waters and chemical and quantitative status of groundwater reservoirs
- o risk assessments of water abstractions from the aquifers in the coastal zone and other places where the quantitative status of groundwater may be at risk

11.1 Basic measures

As described in Annex VI, Part A of the WFD programmes of measures shall at least include measures required for implementing 11 directives as a precondition for having implemented the WFD

- The Bathing Water Directive (76/160/EEC)
- The Habitats Directive (92/43/EEC)
- The Birds Directive (79/409/EEC)
- The Drinking Water Directive (80//778/EEC) as amended
- The Major Accidents (Seveso) Directive (96/82/EC)
- The Environmental Impact Assessment Directive (85/337/EEC)
- The Sewage Sludge Directive (86/278/EEC)
- The Urban Waste Water Treatment Directive (91/271/eEEC)
- The Nitrates Directive (91/676/EEC)
- The Integrated Pollution Prevention Control Directive (96/61/EC)

None of these directives have been implemented in Albania. It is assumed that implementation of measures related to these directives will be addressed in the general accession process and time schedules as agreed in negotiations with the EU Commission.

But in the following it will in short be described how the directives may inflict on protection of water status in water bodies and a long term successful implementation of the WFD.

The bathing water directive contains a number of hygienic water quality criteria to be acceded in water bodies designated as bathing water. Hereby the directive may contribute to achievements on good ecological status.

The habitats and birds directives are the main pieces of EU legislation on nature protection with reference to habitats and animal and plant species. The WFD requires identification and mapping of protected areas and implementation of Natura 2000 management plans in designated areas as a basic condition for achieving good status of protected areas with reference to the WFD.

The major accidents directive regulates the conditions for storage, application and to some extent transport of major amounts of dangerous substances, which in case of accidents also may have serious impact on the ecological status of water bodies

The environmental impact assessment (EIA) directive is widely applied for assessment of environmental impacts from major building or infrastructure projects within all economic sectors as background for issuing permits where environmental mitigation measures shall be introduced. It also concerns projects which may cause impacts on the ecological status of water bodies. As an example it should be mentioned that e.g. gravel extraction permits like those issued in the downstream riverbed in Mati River, always, in existing EU member will be based on an EIA prescribing conditional mitigation measures for maintaining good ecological status in water bodies.

The nitrates directive regulates agricultural practises in areas vulnerable to nitrate pollution. Areas characterised by high concentrations of nitrates in surface or groundwater may be designated as vulnerable zones where good agricultural practises shall be implemented for preservation of good ecological or chemical status in surface water bodies and groundwater reservoirs

The Integrated pollution prevention and control (IPPC) directive regulates mainly permissions on industrial activities with an integrated approach addressing both potential pollution impacts on soil air and water. For permissions on major industrial activities permissions issued in accordance with the IPPC directive includes assessments in accordance with the EIA directive mentioned above

The drinking water directive is concerned with the quality of water applied for drinking water and includes parameter limit values as described in this plan.

The urban waste water treatment and the sewage sludge directive will below be given special attention as these directives are the most expensive directive to implement in accession countries where no treatment plants have been established. The waste water treatment directive specifies that all urban agglomerations representing more than 2000 PE, shall establish wastewater collection and treatment systems. 23 urban agglomerations above 2000 PE have been identified in the Mati River Basin District, see table 12.1

Table 12.1 Urban agglomerations in Mati River Basin District

Code	Agglomeration	Population Census 2001	Existing sewerage (no. persons)	Sewerage Needs (no. persons)	WWTP Capacity (PE)
3001	Burrel	12123	15162	0	20000
3002	Klos	10489	0	10489	11000
3003	Gurre	4373	0	4373	4200
3004	Baz	3367	0	3367	3400
3005	Lis	4984	0	4984	5100
3006	Macukull	3453	0	3453	3500
3007	Martanesh	3546	2450	1096	2700
3008	Lezhe	21227	14000	7227	27000
3009	Balldre	7203	0	7203	4800
3010	Blinisht	4238	0	4238	2000
3011	Dajc	5183	0	5183	2500
3012	Kallmet	5493	0	5493	5500
3013	Kolsh	4943	0	4943	2600
3014	Shenkoll	8894	0	8894	16000
3015	Zejmen	6713	0	6713	9000
3016	Rreshen	11447	5261	6186	12000
3017	Rubik	6842	1.445	5397	8100
3018	Fushe Kuqe	6129	0	6129	5400
3019	Lac	37100	0	37100	44000
3020	Milot	11163	0	11163	13000
3021	Fushe Arrez	4090	1.666	2424	5000
3022	Qafe Mali	3762	0	3762	3800
3023	Gjegjan	5814	0	5814	5000
TOTAL		192576			215600

The costs of constructing the necessary sewage infrastructure in the Mati Basin can with reference to the attached Appendix: Water and Sanitation be estimated as shown in table 12.2.

Table 12.2: Costs of constructing sewage infrastructure in Mati River Basin[39]
Notes[40]:

	Collecting systems		Wastewater treatment plant		Total	
	Capital[3] € million	Operating € '000 p.a.	Capital[3] € million	Operating € '000 p.a.	Capital[3] € million	Operating € '000 p.a.
Agglomerations with wastewater load > 20,000 PE[1,2]	32.2	487	23.0	741	55.3	1,228
Agglomerations with wastewater load > 5,000 – 20,000 PE	53.5	651	34.4	849	87.9	1,500
Agglomerations with wastewater load < 5,000 PE	27.3	324	17.5	348	44.8	672
Total	113.1	1,462	74.9	1,938	188.0	3,400

Implementation of directives as part of basic measures in relation to the WFD will not be addressed further here. But one outstanding activity for implementing e.g the Urban Waste Water Directive will be to provide affordability analysis and providing investment programmes and time periods in accordance with the financing capacity of the population within Mati River Basin. It has not been done in this case as both the tariff structure, income of the inhabitants and the organisation of water companies have to change before capital investments in the size of 188 mill € and yearly operation costs in the size of 3,4 mill. € can be adopted as indicated also in section 11.2

11.2 Summary of the basic measures related to directives

In later versions of programme of measures it is supposed that the 10 directives have been implemented as part of the general accession process as agreed with the EU Commission. For each of the 10 Directive a competent authority shall be designed to take responsibility of the implementation.

Even if the 10 additional directives shall be implemented as a precondition for implementing the WFD then it is not given that a number of the requirements of the directives can be considered as basic measures which might influence adverse impacts of the ecological and chemical status of surface and groundwater within the Mati Basin District. The 10 additional directives all address specific environmental impacts which are not necessarily met within the Mati District. However most of them will apply as part of the accession process.

In the following table the aim of the specific directives is described together with an abbreviated list of activities, which will be needed for their implementation in the future.

39 Source: INPAEL project – Directive-specific Implementation Plan for the Urban Waste Water Treatment Directive, 2009

40 1. PE = population-equivalent, 2. Agglomerations with a wastewater load > 20,000 PE include Lac, Lezhe and Burrel 3. Including contingency

Directive	Aim	General measures, and implementation tasks
The Bathing Water Directive (76/160/EEC)as amended	To ensure proper water quality in bathing areas	-Ensure laboratory capacities to carry out bathing water analyses. -Decide upon the criteria for the selection of bathing waters, and commence a survey of possible sites. -On basis of criteria in the Directive set legally binding bathing water quality standards -Designate the chosen bathing areas. -Decide on the length of the bathing season, -Establish sampling and monitoring programme with fixed sampling points in all designated waters.
The Habitats Directive (92/43/EEC) The Birds Directive (79/409/EEC)	The aim of the directive is the the conservation of natural habitats and of wild fauna and flora for the maintenance of biodiversity within the European territory	-Designate Natura 2000 sites or animal and plant species which are of impotant to EU -The competent authority shall see to that any plan or project likely to have a significanteffect on Natura 2000 sites or internationally protected species must be revised for conservation of such sites and species -As part of the Natura 2000 European network, countries are responsible for maintaining its ecological coherence. The competent authority must provide objectives for management plans and provide monitoring of the protected sites to ensure objectives for protection are maintained
The Drinking Water Directive (80//778/EEC)	To ensure that waterintended for human consumption is wholesome and clean	-Ensure laboratory capacities to carry out drinking water analyses. -Set quality standards for connsumption of water -Establish compliance monitoring procedures to ensure compliance with monitoring standards. -Establish procedures for dealing with incidents of non-compliance and the instigation of remedial action. -Establish procedures for informing the public of actions needed to address non-compliant sources of drinking water. -Establish procedures for assessing the efficiency of any disinfection treatment which is applied to water for human consurription -Develop and disseminate guidelines for actions to take to restrict use of waters posing a threat to human health.
The Major Accidents	To minimise the probability that	The directive is most often addressed in

(Seveso) Directive (96/82/EC)	unnecessary risks arise from main industrial activities involving dangerous substances in processes and in storage.	relation to industrial activities requiring permissions in relation to the Industrial Pollution and Prevention Directive. - In cooperation with industrial plan operators to identify major accident hazards –not only to the environment but also to the labour force -and to take steps to foresee and to control them and to prevent any likely effects to arise as part of emergency planning
The Environmental Impact Assessment Directive (85/337/EEC)	To ensure that all major projects are assessed with regard to environmental effect and that mitigation measures are identified and implemented accordingly	-Provide a screening to see if the project is defined in Annex 1 as a mandatory EIA project or assess in Annex 2 whether an EIA is needed -If an EIA is needed provide the assessment in relation to 12 impact areas and require mitigation measures to be implemented as a precondition before permisission is granted -Ensure public participation I decision-making
The Sewage Sludge Directive (86/278/EEC)	The aim of the directive is in countries with plenty of waste water treatment plants to control the use of sewage sludge in agriculture by establishing maximum limit values for concentrations of heavy metals in soil.	-Ensuring that laboratories with the analysing capacity are available. - Provide limit values for quantities of heavy metals (cadmium, copper, nickel, lead, zinc and mercury) which may be added to soil from applying sewage sludge within agriculture. -Through monitoring control that the limit values are not exceeded. - Set seasonal minimum time limits for separating the use of sludge on certain types of agricultural lands and their use.
The Urban Waste Water Treatment Directive (91/271/eEEC)	The aim of the directive is to control the collection, treatment and discharge of urban waste water from agglomerations; and the treatment and discharge of biodegradable waste water from certain industrial sectors	-Identify “sensitive areas” as background for establishing waste water treatment plants with technology corresponding to secondary or tertiary treatment -Provide a waste water treatment plan for establishing treatment plants for all agglomerations above 2000 PE or foodstuff facilities with loads representing more than 4000 PE - Provide a time schedule and financing capacity in 3 steps. First steps for plants above 100,000 PE. In second step for plants between 10,000-100,000 PE and third steps for plants between 2,000 – 10,000 PE -Apply for derogations in EU in case a proper investment plan cannot be justified within prescribed implementation periods
The Nitrates Directive (91/676/EEC)	To reduce water pollution caused or induced by nitrates from agricultural sources.	-Ensure that laboratory capacity is avilable for implementation of monitoring programmes - Identify waters affected by nitrates

		pollution -Designate all known areas draining into those waters as'vulnerable zones'. -For vulnerable zones establish and implement action programmes to reduce pollution. -Action programmes shall contain mandatory measures including maximum amounts of manure that can be applied to land every year -For areas outside the vulnerable zones reduction of pollution has to be promoted by (voluntary) codes of good agricultural practice.
The Integrated Pollution Prevention Control Directive (96/61/EC)	To achieve integrated prevention and control of pollution arising from a wide range of activities to prevent to reduce emissions from industrial facilities to air, water and land,	- As the coordinating competent authority see to that all emissions on water air and land is inclued in one and the same integrated permission - See to that all aspects of Best Available Technology are implemented as background for mitigating environmental impacts -Ensure public participation in decision-making

11.3 Supplementary measures

Supplementary measures which may be taken into account if good ecological, chemical and quantitative status for surface and groundwater bodies and reservoirs are unlikely to be achieved are described in article 11.4 and Annex VI part B of the WFD.

To assign supplementary measures to programme of measures as a supplement to basic measures only make sense if data and other information indicates that specific water bodies or magazines are at risk of not achieving good ecological status.

As described in section 9 it is not evident from existing data that the rivers in Mati Basin are at risk of not achieving good ecological or quantitative status. There may be problems with the status at riverbeds which have been modified from gravel extraction, but there is no data to verify this assumption. In artificial lakes there is no information except data from the former century. There are statements saying that there are major risks for not achieving good quantitative and chemical status in the aquifers in the coastal plain, but it is only partly reflected in existing data.

In consequence supplementary measures addressing these aspects is proposed first of all to include a number of investigative monitoring programmes to get a more precise impression of the actual conditions in relation to parameter limit values describing good ecological, chemical and quantitative status.

However a number of general water management measures should be taken into account under supplementary measures which not only concerns the future management of Mati River Basin, but also other Albanian basins and river basin authorities.

Management and administrative measures

The WFD directive embraces the river basin as the basic unit of water resources management and to this end the Member States must identify each individual river basin and assign them to specific river basin districts. Groundwater and coastal waters are to be assigned to the nearest or most appropriate river basin districts. Each river basin district must be subject to appropriate administrative arrangements including the identification of an appropriate competent authority.

In connection with Albania's ongoing duty to approximate its legislation with that of the EC, the entire territory Albania shall be designated to River Basin Districts.

Under the Law of Water Resources 6 river basins have been defined, and devolved river basin management structures. The borders of these 6 basins have been defined in accordance with the hydrographical boundaries of catchment areas, see Figure 3.1. But some parts of Albania do not belong to a river basin. Parts of the districts of Lezhe and Kurbin have in this plan been assigned to Mati River Basin District.

To increase the capacity on river basin management it is proposed that River Basin Council in Lezhe should be given clear, but elementary responsibilities with regard to the management of the river basin district, and be allocated resources in accordance with the responsibilities with regard to staffing, equipment, office facilities and training needs. As part of an upgrading of the responsibilities the relations with other administrative bodies, such as Prefecture, District, Commune, Municipality, Water and Sewerage Companies should be clarified. In particular the Drainage Board that is responsible for flood protection and embankments on the Mati River shall be represented in the River Basin Council.

Staffing the recommended structure

As a first estimate, meeting WFD requirements in the fields described might need a structure with at least further four technically qualified experts employed at RBA (a water resources specialist, a water quality expert, environmental engineer and a GIS/database expert).

Equipping the recommended structure

Permitting and inspection both call for site visits and transport is an essential prerequisite for good practice. Offices need to computerised with access to relevant environmental, planning and property data bases (This includes workstations/servers, local area networks, B&W and colour printers, scanners, plotters (all with A3 capability), database software, GIS software, GPS, etc., i.e. the tools needed to prepare and present digital maps of river basin districts). Basic sampling and field testing materials are important for inspection.

11.4 General programme of measures

Based on the specific problems encountered during preparation of this plan an overall list of proposed measures can be described as shown in table 12.3.

Table 12.3 General list of measures

Category	Measures
Legal and institutional	Adjust the borders of the Mati Basin by including Kurbin and Lezhe Districts
	Adjust the digitised borders between Districts, Communes and municipalities
	Delegate clear responsibilities and allocate the necessary resources to the River Authority in Lezhe
	Clarify responsibilities between Prefecture, Districts, Municipalities and water companies
	Introduce training on river basin management to the Basin Authority in Lezhe and others
	Adopt requirements of 10 directives relevant for implementation of the WFD • The Bathing Water Directive (76/160/EEC) • The Habitats Directive (92/43/EEC) • The Birds Directive (79/409/EEC) • The Drinking Water Directive (80//778/EEC) as amended • The Major Accidents (Seveso) Directive (96/82/EC) • The Environmental Impact Assessment Directive (85/337/EEC) • The Sewage Sludge Directive (86/278/EEC) • The Urban Waste Water Treatment Directive (91/271/eEEC) • The Nitrates Directive (91/676/EEC) • The Integrated Pollution Prevention Control Directive (96/61/EC
Economic	Reorganise the water companies into major units
	Revise the tariff structure for water services
	Assess the limits of the future financing capacity for water utilities within the Mati Basin
Technical	Delineate and characterise all surface water bodies and ground water magazines
	Provide parameter limit values for quantitative, chemical and ecological status of all types of water bodies
	Continue surveillance monitoring as described in this plan
	Initiate investigative monitoring programmes as described in this plan in all types of water bodies assumed to be at risk of not achieving good ecological status
	After two years of investigative monitoring re-evaluate all assumptions on risks of not achieving good water status in water bodies
	Initiate investigative monitoring programmes for hot spots as described in this plan
	After two years of investigative monitoring reevaluate all assumptions of impacts from hot spots
	Based on new information from surveillance and investigative monitoring during a two years period make a risk analysis for all water bodies
	Provide a new set of measures required for achieving good water status in water bodies
	Initiate an operational monitoring programme in water bodies at risk after implementation of measures to follow the effects of implementing measures

12 EXISTING INSTITUTIONAL ARRANGEMENT FOR WATER MANAGEMENT

According to the WFD, each river basin district must be subject to appropriate administrative arrangements including the identification of an appropriate competent authority for the application of the rules of the Directive within each River Basin District.
The “competent authority” has general responsibility to ensure that the Directive is implemented and enforced in accordance with the legal requirements. The authority also has specific responsibilities to ensure that appropriate economic analysis are carried out, as background for approving project proposals,within programmes of measures and generally contribute to the elaboration of future River Basin Management Plans within the legal framework of EU directives.

Currently, the organisational structure for management of the river basin districts has not fully been established with all the necessary competencies. However, under the 1996 Law on Water Resources, River Basin Councils were announced as the “local authorities responsible for managing water resources in the relevant basins

12.1 River Basin Councils and Agencies

The Law on Water Resources divides Albania, for water management purposes, into water basin districts, and establishes River Basin Councils (RBCs)

Six RBCs were established in 2002 respectively for the Drini-Buna, Mati, Ishmi-Erzeni, Shkumbini, Semani and Vjosa basins. But part of the coastal areas of Albania are not allocated to River Basin Districts

The RBCs are composed of officials from central and local government, and one third is coming from the business community, each being chaired by the Prefect of the Qarq (prefecture) in which the RBC is located. In other words users are largely under-represented; while a considerable number of representatives from the business community may cause a potential risk of conflict of interests; especially as the RBCs issue water use permits and concessions.

River Basin Agencies (RBA) are established as a form of executive branch of RBCs, although RBAs are not referred to in the LWR. RBAs are responsible for preparing the water resources plan, for drawing up the inventory of water resources, in terms of quantity and quality. Additionally the RBAs are involved in the issue of permissions, concessions and authorisations for water use and for discharges of wastewaters to water bodies. The administrative units have formal inspection responsibilities, but are not equipped to act accordingly

In addition to the lack of a clear legal status, the RBAs suffer from a lack of offices, insufficient staffing,as well as basic office equipment and other equipment and training . There is a need to strengthen the management capacity of the RBAs.

13 PUBLIC INFORMATION AND CONSULTATION

For the preparation of the RBM plan it is essential that local parties are involved in the process of developing the plan. Stakeholder and public participation, public awareness building, exchange and dissemination of information are key issues in the development of an optimum RBM plans, on the basis of accurate input data and adequate objectives, which have been agreed upon by all parties involved. For this purpose representatives of various stakeholders in the river basin area should be identified and mobilised in order to be informed about the scope and background of a river basin management plan and to investigate their interest. Stakeholders are: the river basin authority, water and sewerage enterprises, administrations of municipalities and communes, related NGOs, chambers of commerce, farmers/foresters associations, etc. It may be possible to form a RBM plan working group from members of the stakeholder parties.

14 FURTHER PLANNING AND RECOMMENDATIONS

This report describes the results of the first stage of the preparation of a river basin management plan for the Mati river basin. It provides a description of the Mati basin on the basis of the currently available data, extracted mainly from existing documents and reports. The report also describes requirements and criteria for characterisation of selected water bodies, objectives for development of monitoring systems and programmes, and issues for a programme of measures for protection and improvement of water resources. The report also pays attention to economic analysis of water use, appointment of a competent authority and public involvement.

In the following stages the preparation of the river basin management plan will be completed. The major activities hereto are:

- Characterisation and labelling with an EU_CD code of selected rivers and lakes
- Characterisation of groundwater bodies and delineation of their boundaries
- Identification and selection of protected areas, development of objectives for these areas and design measures to achieve the objectives
- More detailed description of the impacts by point and diffuse sources of environmental pollution and degradation on the basis of further investigations
- Development of environmental quality objectives for surface waters and groundwater bodies, including quantitative objectives
- Elaboration of monitoring network and programme for surface waters, groundwater and protected areas
- Preparation of action programme on the basis of basic and supplementary measures and the objectives
- Establishment of an organisational structure for river basin management including appointment of the competent authority
- Stakeholder analysis, public consultation, information and awareness
- Economic analysis of water use (cost recovery, polluter pays principle)
- Preparation of the draft river basin management plan, taking into account the adaptation measures to climate impact (including extreme events).

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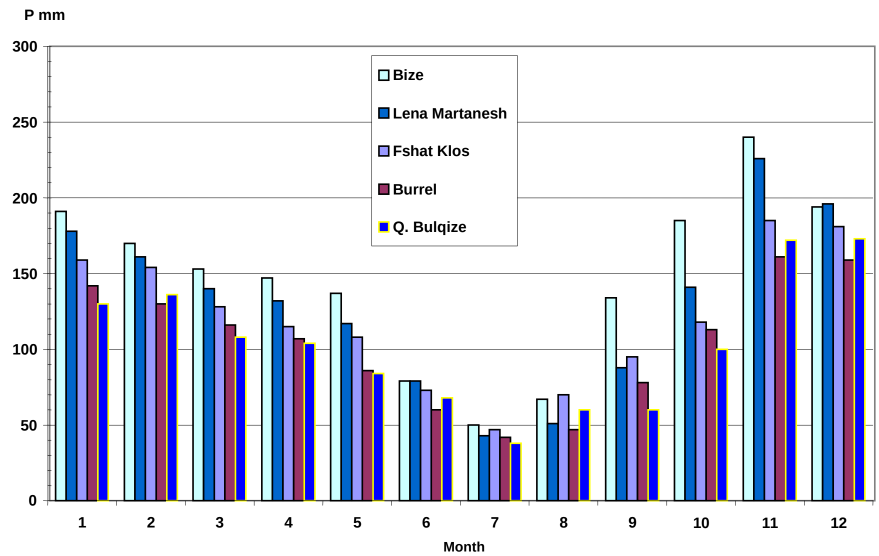
ANNEX 1: ADDITIONAL INFORMATION ON CLIMATE

The annual distribution of precipitation at 5 weather stations in Mati Basin



Measured maximum temperatures at 4 stations in Mati Basin.

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Fshat K	**17.6**	**15.7**	**25.4**	**27.3**	**31.8**	**31.3**	**38.8**	**34.9**	**32.1**	**27.8**	**22.7**	**18.6**	**38.8**
Bize	**11**	**12**	**17**	**20.8**	**29.5**	**27.5**	**31.5**	**28.5**	**27.5**	**23**	**18.5**	**14**	**31.5**
Lena M	**11.5**	**15.1**	**19.8**	**24.2**	**28.5**	**29.5**	**35.2**	**30.1**	**28.5**	**24.5**	**19.1**	**12.2**	**35.2**
Burrel	**1.5**	**25.5**	**29.9**	**27.5**	**33.8**	**35.2**	**40.9**	**40.3**	**34.4**	**30.8**	**25.4**	**22.1**	**40.9**

Measured minimum temperatures at the 4 stations in Mati Basin.

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Fshat K	**-7.9**	**-9.4**	**-7**	**0.6**	**3.3**	**7.6**	**8.7**	**11.7**	**3.8**	**-5.5**	**-12.5**	**-4.7**	**-12.5**
Bize	**-34.7**	**-28.6**	**-26.6**	**-18.6**	**-3.2**	**-1.2**	**0.6**	**0.9**	**-4.2**	**-10.8**	**-21**	**31.4**	**-34.7**
Lena M	**-17.5**	**-12.2**	**-13.7**	**-4.5**	**-0.5**	**4.0**	**5.0**	**7.1**	**1.9**	**-5.5**	**-9.8**	**-14.7**	**-17.5**
Burrel	**-14.7**	**-11.5**	**-11.0**	**-3.0**	**0.2**	**5.4**	**8.3**	**7.6**	**3.0**	**-2.5**	**-4.6**	**-13.5**	**-14.7**

Maximum precipitation (mm) during 24 hours at 5 stations in Mati Basin.

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Burrel	**91.2**	**114**	**72.3**	**46.8**	**72.8**	**52.7**	**65.8**	**77.3**	**61.2**	**172**	**125**	**64.7**	**172**
Fshat Klos	**74**	**90**	**61**	**95**	**61**	**53**	**57**	**94**	**80**	**80**	**65**	**82**	**95**
Selite Malit	**218**	**135**	**125**	**81**	**110**	**85**	**56**	**90**	**94**	**130**	**172**	**175**	**218**
Shengjergj	**154**	**112**	**108**	**65**	**118**	**75**	**59**	**62**	**98**	**128**	**135**	**96**	**154**
Bize	**83**	**106**	**79**	**61**	**80**	**56**	**31**	**49**	**54**	**118**	**112**	**185**	**155**

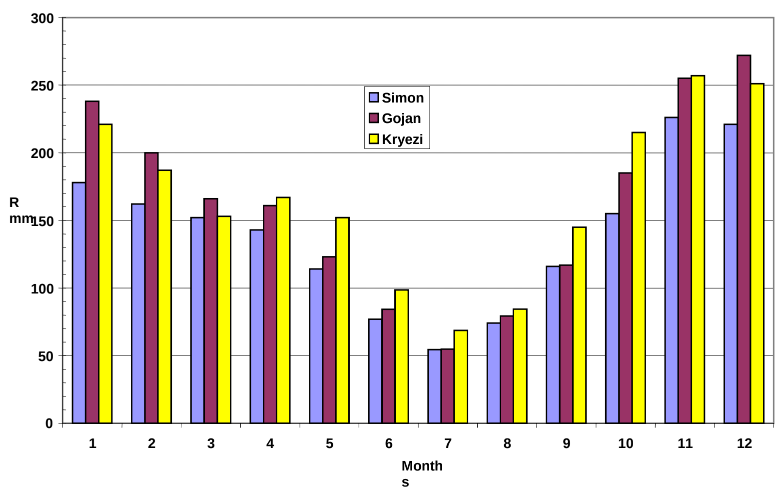
Temperatures at Gojan station in Fani Madh Basin. ^{0}C

Temperature	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Mean annual	3.9	5.6	8.0	11.2	16.0	20.0	22.2	22.2	18.4	13.4	8.8	5.1	12.9
Mean max.	7.6	9.3	13.0	16.0	21.7	26.0	28.4	28.2	23.7	18.1	13.2	9.2	17.9
Mean min.	0.2	1.8	2.9	6.3	10.4	14.0	16.1	16.3	13.0	8.6	4.4	0.9	7.9
Absolute max	18	22.5	28.4	27.7	31.7	36.8	39.6	39.0	36.5	30.2	26.1	20.0	39.6
Absolute min	-14.6	-11.5	-13.6	-2.5	-1.0	5.0	7.3	9.5	4.4	-3.5	-5.3	-14.4	-14.6

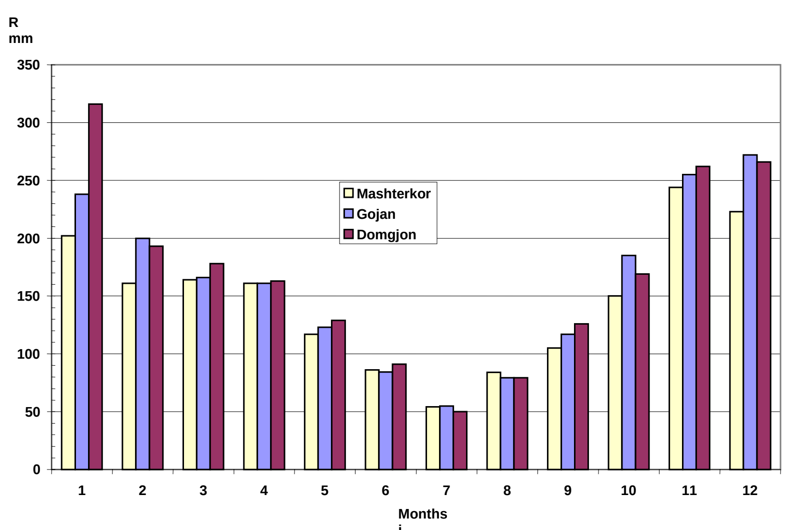
Average precipitation at 5 stations in the Fani Madh and Fani Vogel catchments

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Simon	**178**	**162**	**152**	**143**	**114**	**76.9**	**54.4**	**74.2**	**116**	**155**	**226**	**221**	**1671**
Gojan	**238**	**200**	**166**	**161**	**123**	**84.3**	**54.9**	**79.3**	**117**	**185**	**255**	**272**	**1937**
Kryezi	**221**	**187**	**153**	**167**	**152**	**98.5**	**68.6**	**84.4**	**145**	**215**	**257**	**251**	**2008**
Domgjon	**316**	**193**	**178**	**163**	**129**	**91**	**50**	**79.3**	**126**	**169**	**262**	**266**	**2022**
Mashterkore	**202**	**161**	**164**	**161**	**117**	**86**	**54**	**84**	**105**	**150**	**244**	**223**	**1751**

Annual distribution of precipitation in Fani Madh basin



Annual distribution of precipitation in Fani Vogël basin



ANNEX 2: SURFACE WATER - CHEMICAL STATUS, RIVERS

Watershed	Sample Stations	Station Code	Kilometric system	
Fan Vogel	Nderfan	Al_RV_22	4405350	4627860
Fan Madh	Bukmire	Al_RV_4	4407653	4631629
Mat	Milot	Al_RV_23	4394388	4618594
Mat	Shoshaj	Al_RV_29	4407329	4616018

Year 2002

Watershed	Sample station	Date	t ºC	pH	DO	COD	BOD	N-NH4	N-NO2	N-NO3	P total
Fan i madh	Bukmire	20.03.2002	14,2	8,40	9,54	0,6	3,2	0,010	0,0010	2,30	0,014
Fan i madh	Bukmire	20.05.2002	22,4	8,20	8,18	1,20	0,8	0,040	0,002	1,15	0,014
Fan i madh	Bukmire	20.09.2002	22,6	8,20	7,84	0,78	0,66	0,015	0,006	0,65	0,014
Fan i madh	Bukmire	14.11.2002	10,2	8,46	10,30	0,95	0,50	0,018	0,002	0,95	0,009
Fan i vogel	Nderfan	20.03.2002	12,4	8,50	9,57	1,0	3,5	0,010	0,0010	2,50	0,013
Fan i vogel	Nderfan	20.05.2002	21,6	7,60	7,63	0,64	0,7	0,035	0,002	1,40	0,014
Fan i vogel	Nderfan	20.09.2002	20,8	8,20	8,00	0,80	0,68	0,015	0,008	1,25	0,015
Fan i vogel	Nderfan	14.11.2002	10,6	8,30	9,94	0,50	0,40	0,016	0,003	1,20	0,008
Mati	Milot	20.03.2002	11,6	8,40	9,61	0,8	1,2	0,010	0,0025	2,00	0,015
Mati	Milot	20.05.2002	19,4	8,25	10,41	0,80	1,6	0,025	0,005	1,70	0,012
Mati	Milot	20.09.2002	21,6	8,35	8,13	0,80	1,05	0,015	0,012	1,00	0,016
Mati	Milot	14.11.2002	12,2	8,45	9,24	0,72	0,95	0,080	0,003	1,60	0,009

Year 2003

Watershed	Sample station	Date	t ºC	pH	DO	COD	BOD	N-NH4	N-NO2	N-NO3	P total
Fani i madh	Bukmire	15,04	9,3	8,34	9,63	1,76	2,05	0,012	0,0030	0,18	0,016
Fani i madh	Bukmire	19,06	21,0	8,45	8,05	1,20	4,80	0,016	0,0800	1,35	0,060
Fani i madh	Bukmire	22,09	24,8	8,50	8,35	0,25	0,79	0,05	0,005	0,25	0,020
Fani i vogel	Nderfan	15,04	9,1	8,35	9,80	0,64	1,12	0,013	0,0020	0,40	0,018
Fani i vogel	Nderfan	19,06	19,4	8,35	8,40	1,75	5,02	0,018	0,0750	1,20	0,070
Fani i vogel	Nderfan	22,09	24,4	8,47	8,08	0,40	0,65	0,10	0,003	0,28	0,038
Mati	Milot	15,04	9,4	8,26	9,63	0,80	1,35	0,015	0,0050	0,25	0,015
Mati	Milot	19,06	19,8	8,46	7,88	1,85	3,70	0,120	0,0055	0,66	0,008
Mati	Milot	22,09	23,2	8,44	11,03	0,30	2,76	0,06	0,005	0,30	0,012

Year 2004

Watershed	Sample station	Date	t ºC	pH	DO	COD	BOD	N-NH4	N-NO2	N-NO3	P total
Fani i madh	Bukmire	06.04.04	12,1	8,09	8,15	0,60	0,60	0,002	0,140	0,04	0,022
Fani i madh	Bukmire	26.05.04	18,8	8,30	8,22	0,56	0,55	0,005	0,240	0,04	0,025
Fani i madh	Bukmire	21.07.04	30,1	8,78	6,96	0,64		0,000		0,05	0,050
Fani i madh	Bukmire	18.08.04	24,9	8,46	8,16	0,56	1,90	0,004		0,04	0,010
Fani i madh	Bukmire	24.09.04	21,3	7,41	8,60	0,62	0,95	0,003		0,06	0,009
Fani i madh	Bukmire	19.11.04	9,4	8,12	9,73	0,40	0,80	0,002		0,03	0,011
Fani i vogel	Nderfan	06.04.04	11,6	8,29	9,10	0,64	0,58	0,002	0,200	0,04	0,025
Fani i vogel	Nderfan	26.05.04	19,2	8,23	8,32	0,50	0,40	0,004	0,270	0,04	0,030
Fani i vogel	Nderfan	21.07.04	27,4	8,70	6,80	0,40		0,000		0,04	0,048
Fani i vogel	Nderfan	18.08.04	22,7	8,38	8,50	0,45	2,15	0,005		0,05	0,011
Fani i vogel	Nderfan	24.09.04	20,6	8,40	7,90	0,68	1,95	0,004		0,04	0,012
Fani i vogel	Nderfan	19.11.04	9,9	8,09	9,67	0,32	0,40	0,002		0,03	0,011
Mati	Milot	31.03.04	13,2	8,36	9,42	0,76		0,024	0,200	0,08	0,035
Mati	Milot	26.05.04	17,8	8,10	8,50	0,80	1,30	0,004	0,061	0,04	0,013
Mati	Milot	09.07.04	22,2	8,50	7,13	0,56	0,90	0,000		0,03	0,032
Mati	Milot	18.08.04	21,3	8,25	8,85	0,72	1,80	0,005		0,05	0,012
Mati	Milot	23.09.04	20,5	8,37	8,66	0,75	2,00	0,003		0,04	0,018
Mati	Milot	03.11.04	18,0	8,61	8,41	1,12	4,80	0,005		0,06	0,050
Mati	Shoshaj	31.03.04	13,0	8,42	9,67	0,88		0,010	0,172	0,27	0,023
Mati	Shoshaj	09.07.04	23,8	8,50	8,18	0,76	3,70	0,004		0,04	0,026
Mati	Shoshaj	03.11.04	16,0	8,70	9,31	0,56	1,10	0,004		0,04	0,021

Year 2005

Watershed	Sample station	Date	t ºC	pH	DO	COD	BOD	N-NH4	N-NO2	N-NO3	P total
Fani i madh	Bukmire	07.04.05	9,2	8,09	10,55	0,38		0,004		0,068	0,018
Fani i madh	Bukmire	22.06.05	19,8	8,12	8,15	0,32	0,85	0,002		0,02	0,032
Fani i madh	Bukmire	26.07.05	25,80	8,16	6,43	0,6	0,44	0,0026	0,16	0,03	0,013
Fani i madh	Bukmire	23.08.05	24,30	6,18	6,71	0,48	1,70	0,0020	0,11	0,030	0,014
Fani i madh	Bukmire	11.10.05	14,20	7,81	8,54	0,4	0,22	0,0015	0,10	0,025	0,011
Fani i madh	Bukmire	09.12.05	9,0	8,45	10,30	0,80	0,80	0,0013	0,22	0,028	0,014
Fani i vogel	Nderfan	07.04.05	14,20	8,10		0,44		0,002		0,03	0,025
Fani i vogel	Nderfan	22.06.05	18,2	8,02	8,55	0,28	1,22	0,003		0,025	0,040
Fani i vogel	Nderfan	26.07.05	23,60	8,11	6,24	0,6	1,75	0,005	0,18	0,04	0,019
Fani i vogel	Nderfan	23.08.05	23,10	7,96	6,76	1,2	1,60	0,005	0,2	0,045	0,020
Fani i vogel	Nderfan	11.10.05	13,80	7,53	8,72	0,48	0,35	0,002	0,4	0,030	0,010
Fani i vogel	Nderfan	09.12.05	9,6	8,51	10,22	0,80	1,30	0,0013	0,30	0,040	0,014

Mati	Milot	07.04.05	10,8	8,20	10,5	0,36		0,002		0,055	0,018
Mati	Milot	22.06.05	17,6	7,98	8,30	0,52	1,20	0,005		0,025	0,035
Mati	Milot	26.07.05	23,20	8,34	7,11	0,64	0,40	0,0033	0,1	0,03	0,014
Mati	Milot	23.08.05	24,80	7,92	6,18	0,8	1,45	0,0030	0,12	0,030	0,016
Mati	Milot	12.10.05	15,20	7,84	8,44	0,36	1,43	0,0018	0,175	0,025	0,018
Mati	Milot	09.12.05	9,6	8,50	10,22	0,96	0,73	0,0013	0,17	0,160	0,015
Mati	Shoshaj	29.04.05	10,3	7,99	10,3	0,48		0,002		0,07	0,03
Mati	Shoshaj	22.06.05	21,8	8,05	8,60	0,48	1,05	0,004		0,030	0,030
Mati	Shoshaj	25.07.05	24,20	7,47	8,11	0,6	1,35	0,002	0,11	0,02	0,014
Mati	Shoshaj	23.08.05	19,80	8,39	7,46	0,6	1,50	0,002	0,18	0,018	0,016
Mati	Shoshaj	12.10.05	12,20	8,13	9,61	0,48	0,90	0,002	0,17	0,024	0,011

Year 2006

Watershed	Sample station	Date	t ºC	pH	DO	COD	BOD	N-NH4	N-NO2	N-NO3	P total
Fan Madh	Bukmire	09.02.06	0,4	8,52	13,20	0,48	1,20	0,160	0,0010	0,33	0,010
Fan Madh	Bukmire	14.04.06	10,3	8,43	9,50	0,40	0,30	0,010	0,0010	0,20	0,038
Fan Madh	Bukmire	19.05.06	22,8	8,44	7,60	1,76	0,60	0,020	0,0015	0,280	0,020
Fan Madh	Bukmire	26.07.06	26,2	8,31	7,60	1,96	2,75	0,015	0,0120	0,60	0,110
Fan Madh	Bukmire	20.10.06	17,8	8,14	8,53	0,22	0,60	0,030	0,005	0,21	0,026
Fan Madh	Bukmire	20.10.06	14,2	8,37	8,30	0,64	0,33	0,0013	0,21	0,015	0,013
Fan Vog	Nderfan	09.03.06	1,8	8,47	13,00	0,48	1,40	0,030	0,0010	0,40	0,010
Fan Vog	Nderfan	14.04.06	10,2	8,36	9,68	0,48	0,45	0,010	0,0010	0,22	0,030
Fan Vog	Nderfan	19.05.06	18,5	8,39	8,06	1,60	0,60	0,020	0,0018	0,370	0,016
Fan Vog	Nderfan	26.07.06	24,8	8,34	7,62	1,76	2,00	0,015	0,0070	0,33	0,019
Fan Vog	Nderfan	20.10.06	17,6	7,93	7,85	0,24	0,65	0,034	0,002	0,45	0,030
Fan Vog	Nderfan	20.10.06	15,0	8,45	8,70	0,72	0,45	0,0014	0,16	0,015	0,014
Mat	Milot	09.02.06	3,2	8,50	12,10	0,64	1,60	0,025	0,0010	0,45	0,012
Mat	Milot	14.04.06	11,1	8,39	9,68	0,80	0,49	0,010	0,0015	0,19	0,048
Mat	Milot	19.05.06	17,4	8,27	8,45	2,40	0,60	0,025	0,0020	0,300	0,030
Mat	Milot	26.07.06	24,4	8,41	7,99	1,12	1,50	0,015	0,0130	0,35	0,035
Mat	Milot	20.10.06	20,5	8,29	7,55	0,24	0,55	0,025	0,005	0,10	0,012
Mat	Milot	20.10.06	16,3	8,45	8,35	0,80	0,45	0,0015	0,15	0,018	0,018
Mat	Shoshaj	10.03.06	6,4	8,05	10,56	0,80	2,03	0,010	0,0012	0,30	0,008
Mat	Shoshaj	14.04.06	8,8	8,46	9,50	0,48	0,40	0,010	0,0010	0,27	0,033
Mat	Shoshaj	19.05.06	11,7	8,47	9,66	1,92	2,30	0,030	0,0015	0,350	0,015
Mat	Shoshaj	26.07.06	23,4	8,52	9,31	1,12	1,60	0,015	0,0018	0,31	0,030
Mat	Shoshaj	21.10.06	17,7	8,30	9,16	0,28	0,45	0,022	0,002	0,12	0,032
Mat	Shoshaj	21.10.06	9,2	8,27	9,40	0,96	0,72	0,0018	0,19	0,015	0,016

Year 2007

Watershed	Sample station	Date	t ºC	pH	DO	COD	BOD	N-NH4	N-NO2	N-NO3	P total
Fan Madh	Bukmire	05.07.07	30,2	8,42	6,93	0,62	0,95		0,001		0,01
Fan Madh	Bukmire	07.09.07	19,6	7,94	8,71	0,48	0,5	0,012	0,002	0,2	0,016
Fan Madh	Bukmire	02.11.07	12,7	8,23	9,1	1,44	0,9	0,014	0,002	0,18	0,022
Fan Madh	Bukmire	27.11.07	14,2	8,37	8,3	0,64	0,33	0,0013	0,21	0,015	0,013
Fan Madh	Bukmire	18.05.07	21	8,45	8,36	0,8			0,002		0,012
Fan Vog	Nderfan	18.05.07	19,6	8,33	8,16	0,8			0,003		0,018
Fan Vog	Nderfan	05.07.07	26	8,24	8,91	0,44	1,6		0,002		0,016
Fan Vog	Nderfan	07.09.07	18,5	8,04	9,98	0,88	0,9	0,018	0,006	0,35	0,02
Fan Vog	Nderfan	02.11.07	13,1	8,19	8,8	1,04	1,2	0,014	0,005	0,3	0,026
Fan Vog	Nderfan	27.11.07	15	8,45	8,7	0,72	0,45	0,0014	0,16	0,015	0,014
Mat	Milot	18.05.07	20	8,56	8,76	0,96			0,004		0,016
Mat	Milot	05.07.07	26,8	8,48	9,5	0,72	1,05		0,003		0,012
Mat	Milot	07.09.07	21,3	8,03	7,84	0,8	1,05	0,02	0,005	0,1	0,015
Mat	Milot	02.11.07	13,7	8,19	8,71	1,08	2	0,012	0,01	0,14	0,018
Mat	Milot	27.11.07	16,3	8,45	8,35	0,8	0,45	0,0015	0,15	0,018	0,018
Mat	Milot	19.12.07	5,9	8,3	8,7	0,21	0,49	0,002	0,14	0,019	0,015
Mat	Shoshaj	18.05.07	17,9	8,48	8,36	1,08			0,008		0,028
Mat	Shoshaj	04.07.07	25,4	8,44	8,51	0,76	2,25		0,002		0,016
Mat	Shoshaj	07.09.07	16,2	8,3	0,62	1,2	2,55	0,018	0,01	0,22	0,022
Mat	Shoshaj	02.11.07	12,4	8,32	8,64	1,08	1,8	0,018	0,002	0,1	0,025
Mat	Shoshaj	27.11.07	9,2	8,27	9,4	0,96	0,72	0,0018	0,19	0,015	0,016
Mat	Shoshaj	19.12.07	6,7	8,33	9,1	0,3	0,39	0,004	0,16	0,025	0,036

Year 2008

Watershed	Sample station	Date	t ºC	pH	DO	COD	BOD	N-NH4	N-NO2	N-NO3	P total
Fan Madh	Bukmire	10,08	17,7	8,62	9,74	0,48	0,8	0,012	0,002	0,18	0,012
Fan Madh	Bukmire	12,08	9	8,45	10,3	0,8	0,8	0,028	0,0013	0,22	0,014
Fan Vog	Nderfan	10,08	19	8,76	9,38	0,8	1,2	0,02	0,003	0,12	0,018
Fan Vog	Nderfan	12,08	9,6	8,51	10,22	0,8	1,3	0,04	0,0013	0,3	0,014
Fan Vog	Nderfan	1,09	9,2	7,99	9,6	1,9	2,3	0,06	0,01	0,26	0,024
Mat	Milot	10,08	18,4	8,62	9,03	1,08	1,5	0,02	0,008	0,12	0,018
Mat	Milot	12,08	9,6	8,5	10,22	0,96	0,73	0,16	0,0013	0,17	0,015
Mat	Milot	1,09	8,8	7,93	9,9	2,6	1,9	0,01	0,012	0,22	0,028
Mat	Shoshaj	10,08	15,6	8,68	9,56	1,44	3,2	0,026	0,005	0,13	0,028

ANNEX 3: GROUNDWATER. CHEMICAL STATUS

	Month	FUSHE- KUQE Aquifer Monitoring mg/l (rounded)														
		pH	Chemical components													
			Na^{+},K	Ca	Mg	Fe^{2+3}	NH^{4}	Sum	HCO_3	CO_3	Cl	SO_4	NO_3	NO_2	Sum	Overall min.	F° gj
Patok	June	8	289	16	13	0		319	159	19	351	64			593	912	5
	November		291	17	27	0,05	0,3	336	185	6	411	46	no	no	649	986	9
F.Kuqe	June	8	14	17	25	gj		56	135	12	10	29		0	187	244	8
	November		9	14	32	no	0,1	56	134	18	12	30	no	no	195	251	9
Lac	June	8	17	62	46	gj	gj	126	298		23	101	2	0	424	550	19
	November		8	38	29	gj	no	75	225	no	10	30	2	no	269	344	12
Milot	June	8	20	48	21	gj		90	248		12	30	2		292	382	12
	November		3	38	27	no	no	69	217	no	10	21	1,2	no	250	320	11
Gurrez	June	8	6	25	24	gj	gj	55	155	gj	14	28	gj		197	253	9
	November		10	22	26	no	no	58	176	no	8	26	0,8	0,05	212	217	9
Permitted norm		6,5-8,5		75	20	0	nl-0,05				25	25	25	nl-0,005			

Tests for microelements
mg/l

			Mn	Li	Cr	Ni	Cu	Zn	Co	Cd
F.Kuqe	July		0,015	-	0,005	-	-	0,005	-	-
	October		0,015	-	0,005	-	-	0,005	-	-
Permitted norm			0,02-0,05		nl-0,05	nl-0,05	0,1-1,5	0,1-5		nl-0,005

No. pricking	Site	Lezha aquifer monitoring, mg/l (rounded)															
		Ph	Full chemical														
			Na^+, K	Ca	Mg	Fe^{2+3}	NH^4	Sum	HCO_3	CO_3	Cl	SO_4	NO_3	NO_2	Sum	Overall min.	F° gj
Ishull Lezhe	June	8,11	340	26	20	0,1	0,05	386	175	gj	449	106		gj	730	1117	8
	November		336	24	26	0,05	no	386	197	no	443	106	no	0,9	749	1136	9
H. gjue-tise	June	6,88	194	3	9	gj	0,2	207	195		209	14			419	626	2
	November		194	3	13	gj	no	211	125	36	207	32	no	1,00	402	614	3
St.pom Barbull	June	8,56	183	8	5	gj	0,2	197	181	19	150	46			398	595	2
	November		149	10	14	no	no	174	213	no	136	40	no	0,8	391	566	4
Rrilë Lezhe	June	7,96	750	74	47	0,05	gj	872	92	gj	1057	428			1578	2451	21
	November		677	74	54	no	no	806	112	no	1057	290	no	gj	1460	2266	22
Permitted norm		6,5-8,5		75	20	0,05	nl-0,05				25	25	25	nl-0,005			

Tests for microelements
mg/l

			Mn	Li	Cr	Ni	Cu	Zn	Co	Cd
Barbullonje	July		T	-	0,01	-	0,005	0,005	-	-
	October		0,005	-	0,005	-	T	0,005	-	-
Permitted norm			0,02-0,05		nl-0,05	nl-0,05	0,1-1,5	0,1-5		nl-0,005

ANNEX 4: PROJECTS OF HYDROPOWER PLANTS

Date of decision	Contracted Company	River/Small River	Commune/ Municipality	M^3/year	Intake level
23.05.2007	Koka	Mat/Theknes, Lene, Blishtes	Burrel	2.4+1.8+7.8m³/s	410m
30.05.2007	Malido	Fan/Shengjin	Fan, Mirdite	1.5m³/s	635.4m
30.05.2007	Korenti	Fan/Bergjane	Fan, Mirdite	0.500m³/s	300m
30.05.2007	Betharnalte	Mat/Vinjolle	Milot	0.285m³/s	530m
30.05.2007	Komp energji	Mat/Vinjolle	Milot	0.374m³/s	504m
30.05.2007	Darsi	Mat/Darsi	Klos, Burrel	1.5m³/s	120m
07.08.2007	Velezerit shpk	Mat/Lajthize, Mullias	Martanesh	1.09m³/s, 0.49m³/s	1250m/875m
07.08.2007	Sigers	Mat/Lene		800l/s	1200m
07.08.2007	Superbeton Mati	Mat/Kanali I Zenishit	Klos, Burrel	1.2m³/s	231.11m
07.08.2007	Mak Olimpik	Mat/Vinjolle	Milot		
07.08.2007	Sigers	Mat/Thekna, Lena, Licona		4.94m³/s	840m
07.08.2007	Vili	Mat/Koxherri	Mat	0.4m³/s	970m
07.08.2007	Nesh	Mat/Shkalle,Ceruje		0.4m³/s,0.3m³/s	1200m/1195m
25.10.2007	Endi E	Mat/Urake	Urake/Burrel	3m³/s	690m
25.10.2007	Dinamik	Mat/Shkalle, Ceruje, Stavec	Burrel	11.3m³/s,23.2m³/s	600m,345m
25.10.2007	Energy Alb	Mat/Darsi,Xibri	Klos, Burrel	1.94m³/s,3.34m³/s	670m/320m
25.10.2007	Ylberi	Mat/Urake	Urake/Burrel	5.5m³/s	340m
25.10.2007	Komp energji	Mat/Lusses		4.625m³/s per hec	758m
25.10.2007	Gjoni 05	Mat/Ujvara UJE			
25.10.2007	Edi	Fan/Knelle			
18.02.2008	S."2001"shpk	Fan/Bisake	Fan, Mirdite	6.71m³/s	425m

18.02.2008	Hydro Projekt	Mat/Urake	Urake/Burrel	3m³/s	690m
18.02.2008	Dushi	Mat/Licone	Burrel	0.6m³/s	1482m
18.02.2008	Debojtron DOOEL	Zalli I Dishit, Z.Likones	Burrel	9m³/s	370m/350m
18.02.2008	OBERALD	Fan/Perroi I madh	Puke	0.4m³/s	1014m/822m
18.02.2008	Koka	Mat/Stavec 1	Bulqize	3.92m³/s	590m
09.05.2008	GENER2	Mat/Darsi	Mat	1.97,2.84,3.12;3m³/s	795m
09.05.2008	Klenis	Mat/Dars, Kete, Xiber	Mat	1.4625m³/s per4Hec	876m
09.07.2008	Hydromat Power	Mat/Perroi Hurdhe			406.54m/281.16m/126m
09.07.2008	Merga	Mat/Lene, Nene, Lajthiz		1.476m³/s;0.64m³/s;0.32m³/s	1450m/998.5m
14.11.2008	Energy Albania	Fan/Perroi I madh	Fushe Arrez	2.67m³/s	578m
14.11.2008	Shkopeti	Mat/Shkopet	Shkopet	41m³/s;80m³/s	36m/29m
14.11.2008	AS ENERGY	Fan I vogel			
14.11.2008	Betharnalte	Mat/Vinjolle, Hurdhaz	Milot	0.68,0.82,2.65m³/s	530,385,130m
14.11.2008	Univers sh.p.k	Mashterkore, Gojan	Puke	6.71m³/s,9.18m³/s,8.05m³/s	425m/421m
14.11.2008	I-AS sh.p.k	Fan I madh	Kaçinar	4.33m³/s	297m
14.11.2008	Komp Energy	Mat/Vinjolle, Hurdhaz	Milot	250l/s,600l/s,800l/s	404m,255m,133m
29.01.2009	K.E.A	Mat/P.Zallit, Lumi Luses, Mansderes		827,647,4103litra/s	1450,1104,255m
29.01.2009	GEOENERGIE Spa	Mat/P.Zallit, Lumi Luses, etj		235,536,780,503,855,1945,3475lit/s	1570,980,680,1170,830,585,490m
29.01.2009	Koka	Mat/Zalli I Dishit - Klos	Burrel	11.8m³/s	350m
29.01.2009	Nesh	P.Shkalle, Ceruje, Bejni	Diber	0.3;0.49;0.65;1.365;0.375;0.52m³/s	1550,1200,632,548m
29.01.2009	ILAR	Blishtes, Disha, Klos1, etj	Burrel	8.27;12.23;15.763;18.99;16.85;27.11;34.97m³/s	589,349,320,284,253,199,158m
31.07.2009	Piroli	Gajush, Shehu, Zheje	Milot		
31.07.2009	Arlita	Mat/Zalli I Tarit		2300litra/sek	570m