

A decorative graphic consisting of several overlapping, wavy blue shapes that flow from the top left towards the bottom right, creating a sense of movement and depth. The colors range from a deep navy blue to a lighter sky blue.

Second River Basin Management Plan for Seman River Basin 2027 - 2032

Main Report

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DOCUMENT OVERVIEW

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LIST OF ACRONYMS AND ABBREVIATIONS

ADA/ADC	Austrian Development Agency / Austrian Development Cooperation
AGS	Albanian Geological Survey
AKUK	National Agency for Water Supply and Sewerage
AKUM	Agency for Water Supply, Sewerage and Waste Management
ASPT	Average Score Per Taxon
AWB	Artificial Waterbody
AWRM / AMBU	Agency for Water Resources Management
BGL	Background Level
BOD5	Biochemical Oxygen demand, five days
BQE	Biological Quality Element
CA	Competent Authority
CEMSA	Consolidation of the Environmental Monitoring System in Albania
CEN	European Committee for Standardization
CODCR	Chemical Oxygen Demand, dichromate method
CWB	Coastal Waterbody
DCM	Decision of the Council of Ministers
DSIP	Directive Specific Implementation Plan
DWD	Drinking Water Directive
DWPA	Drinking Water Protected Area
EC	European Commission
EF	Environmental Flow
EO	Environmental Objective
EQR	Environmental Quality Ratio
EQS	Environmental Quality Standard
EQSD	EU Environmental Quality Standards Directive
EU	European Union
EU4RIVERS	Austrian Development Agency (ADA), as the Operational Unit of the Austrian Development Cooperation (ADC), has been delegated by the European Union (EU) to implement the "EU4Rivers" project in Albania from October 2023 to September 2028. The lead Beneficiary is the Albanian Water Resources Management Agency (AMBU).
EUSIWM	European Union Support to Integrated Water Management
FD	EU Floods Directive
FDC	Flow Duration Curve
FWD	Flood Water Directive
GC/MS	gas chromatograph / mass spectrometer
GD	EU Groundwater Directive
GEP	Good Ecological Potential
GES	Good Ecological Status
GMD	Groundwater Directive
GMU	Groundwater Management Unit
GWB	Ground Waterbody
GWDTES	Groundwater Dependent Terrestrial Ecosystem
HMWB	Heavily Modified Waterbody
IBA	Important Bird and Biodiversity Area
IGEO	Institute of Geosciences
IPH	Institute for Public Health
ISO	International Organization for Standardization
IWRM	Integrated Water Resources Management
KBA	Key Biodiversity Area
LGU	Local Government Unit
LHCU	Local Health Care Unit
LIWRM	Law on Integrated Water Resources Management – Law N° 111/2012
MARD	Ministry of Agriculture and Rural Development

MD	Ministry of Defence
MFE	Ministry of Finance and Economy
MHSP	Ministry of Health and Social Protection
MIE	Ministry of Infrastructure and Energy
MOTE	Ministry of Tourism and Environment
MSFD	Marine Strategy Framework Directive
NAPA	National Agency of Protected Areas
NCTW	National Council of Territory and Water
ND	Nitrates Directive
NEA	National Environment Agency
NH4	Ammonium (NH ₄ ⁺)
NO2	Nitrite (NO ₂ ⁻)
NO3	Nitrate (NO ₃ ⁻)
NSIWRM	National Strategy for Integrated Water Resources Management
NSPA	Nutrient Sensitive Protection Area
NVZ	Nitrate Vulnerable Zone
NWRC	National Water Resources Cadastre
PA	Environmental Protected Areas
PMO	Prime Ministers Office
PO4	Ortho-Phosphate (PO ₄ ³⁻)
POM	Programme of Measures
PTOT	Total Phosphorus
RB	River Basin
RBC	River Basin Council
RBD(A)	River Basin District (Authority)
RBM	River Basin Management
RBMP	River Basin Management Plan
RBPA	Recreational or Bathing Water Protected Area
STPS	Standard Technical Procedures
SUDS	Sustainable Urban Drainage System
SWB	Surface Waterbody
UWWTD	EU Urban Wastewater Treatment Directive
WAFU	Water Availability for Use (by operators)
WBMO	Water Basin Management Office
WFD	EU Water Framework Directive
WRA	Water Regulatory Authority
WTW	Water Treatment Plant (for public water supply)
WWTP	Wastewater Treatment Plant

GLOSSARY OF SELECTED TERMS

- **Aquifer** means a subsurface layer or layers of rock or other geological strata of sufficient porosity and permeability to allow either a significant flow of groundwater or the abstraction of significant quantities of groundwater.
- **Background Levels (BGLs)** represent the natural concentration of substances in groundwater that are not, or only minimally, influenced by human activities.
- **Body of groundwater** means a distinct volume of groundwater within an aquifer or aquifers.
- **Body of surface water** means a discrete and significant element of surface water such as a lake, a reservoir, a stream, river or canal, part of a stream, river or canal, a transitional water or a stretch of coastal water.
- **Ecological status** is an expression of the quality of the structure and functioning of aquatic ecosystems associated with surface waters.
- **Emission controls** are controls requiring a specific emission limitation, for instance an emission limit value, or otherwise specifying limits or conditions on the effects, nature or other characteristics of an emission or operating conditions which affect emissions.
- **Emission limit values** means the mass, expressed in terms of certain specific parameters, concentration and/or level of an emission, which may not be exceeded during any one or more periods of time.
- **Environmental Quality Standard (EQS)** defines the concentration threshold for a specific pollutant in water, sediment or biota that must not be exceeded in order to protect human health and the aquatic environment. EQS are used for the assessment of chemical status.
- **Ecological Quality Ratio (EQR)** expresses the deviation of observed biological conditions from the relevant type-specific reference conditions on a scale from 0 to 1. EQRs are used for the assessment of ecological status on the basis of biological quality elements. In summary, EQS relates to chemical compliance, whereas EQR relates to ecological condition.
- **Good groundwater status** means the status achieved by a groundwater body when both its quantitative status and its chemical status are at least 'good'.
- **Good surface water status** means the status achieved by a surface water body when both its ecological status and its chemical status are at least 'good'.
- **Groundwater** means all water which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil.
- **Groundwater status** is the general expression of the status of a body of groundwater, determined by the poorer of its quantitative status and its chemical status.
- **Hazardous substances** means substances or groups of substances that are toxic, persistent and liable to bio-accumulate, and other substances or groups of substances which give rise to an equivalent level of concern.
- **Heavily modified water body** means a body of surface water which as a result of physical alterations by human activity is substantially changed in character.
- **Inland water** means all standing or flowing water on the surface of the land, and all groundwater on the landward side of the baseline from which the breadth of territorial waters is measured.
- **Lake** means a body of standing inland surface water.
- **Pollution** means the direct or indirect introduction, as a result of human activity, of substances or heat into the air, water or land which may be harmful to human health or the quality of aquatic ecosystems or terrestrial ecosystems directly depending on aquatic ecosystems, which result in damage to material property, or which impair or interfere with amenities and other legitimate uses of the environment.
- **Priority hazardous substances (PHS)** are the most dangerous subset of Priority Substances recognized for properties such as being toxic, persistent, and bioaccumulative (PBT), or very persistent and very bioaccumulative (vPvB).
- **Priority substances** are a list of chemical substances that pose a significant risk to aquatic ecosystems and human health.
- **River basin district** means the area of land and sea, made up of one or more neighbouring river basins together with their associated groundwaters and coastal waters as the main unit for management of river basins.
- **River basin** means the area of land from which all surface run-off flows through a sequence of streams, rivers and, possibly, lakes into the sea at a single river mouth, estuary or delta

- **River** means a body of inland water flowing for the most part on the surface of the land but which may flow underground for part of its course.
- **Sub-basin** means the area of land from which all surface run-off flows through a series of streams, rivers and, possibly, lakes to a particular point in a water course (normally a lake or a river confluence).
- **Surface water** means inland waters, except groundwater; transitional waters and coastal waters, except in respect of chemical status for which it shall also include territorial waters
- **Surface water status** is the general expression of the status of a body of surface water, determined by the poorer of its ecological status and its chemical status.
- **Transitional waters** are bodies of surface water in the vicinity of river mouths which are partly saline in character as a result of their proximity to coastal waters but which are substantially influenced by freshwater flows.

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Task Report	Name
1	Delineation of water bodies
2	Register of Protected Areas
3	RBMP Objectives & Overview of SWMIs
4a – 4f	Monitoring Network, data collection & data analysis of existing conditions
5	Environmental objectives, EQS and establishment of provisional reference conditions
6	Drivers, Pressures & Impact assessment
7	Program of Measures (PoM)
8	Initial Economic Analysis of Water Uses, Revenue Analysis and Cost Recovery
9	Hydrological Analysis (water Balance surface & groundwater)
10	Reports of the technical workshops for developing the RBM plan and the PoM
11	Atlas of Maps of the Basin
12	Collected RBM Data

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CONCEPT

CONCEPT

1 Integrated Water Management at Basin Level

This chapter defines the strategic purpose and administrative foundation of the Seman River Basin Management Plan. It explains the objectives of the plan in line with the EU Water Framework Directive (WFD) and Albania's national water legislation. The section outlines the legal status and mandates of the competent authorities responsible for implementing the RBMP, and describes how institutional coordination is organised between AMBU, the River Basin Councils, and other relevant stakeholders. It also clarifies the structure of the RBMP documentation and how it aligns with the broader framework of integrated water resources management (IWRM) at basin and national levels.

1.1 EU Water Framework Directive (EU WFD)

1.1.1 Overview

The WFD sets out rules to halt deterioration of the status of surface water and groundwater bodies and achieve good status for Europe's rivers, lakes, and groundwater. Citizens, nature, and industry all need healthy rivers and lakes, groundwater, and bathing waters. The WFD focuses on ensuring good qualitative and quantitative health, i.e., on reducing and removing pollution and on ensuring that there is enough water to support ecosystems at the same time as human needs.

Since 2000, the WFD has been the main law for water protection in Europe. It applies to inland, transitional, and coastal surface waters as well as groundwater. It ensures an integrated approach to water management, respecting the integrity of whole ecosystems, including by regulating individual pollutants and setting corresponding regulatory standards. It is based on a river basin district approach to make sure that neighbouring countries cooperate to manage the rivers and other bodies of water they share.

As in Albania, many European river basins are international, crossing administrative and territorial borders. Therefore, a common understanding and approach is crucial to the successful and effective implementation of the Directive.

1.1.2 European Objectives & Laws

The key objectives of the WFD are set out in Article 4 of the Directive. It requires Member States to use their River Basin Management Plans (RBMPs) and Programmes of Measures (PoMs) to protect and, where necessary, restore water bodies to reach good status, and to prevent deterioration. Good status for surface water comprises good ecological status and good chemical status; ecological status is assessed using biological quality elements supported by physico-chemical and hydro morphological conditions. For groundwater the objectives are good quantitative and good chemical status. The Water Framework Directive (WFD) is the primary legislation. It is supported by two so-called *daughter directives* on the quality and quantity of groundwater and on the quality of surface water.

The *Environmental Quality Standards Directive (2008/105/EC, amended by 2013/39/EU¹)* focuses on the protection of surface water quality by setting environmental quality standards (EQS) for priority substances. The WFD also requires Member States to set and meet Environmental Quality Standards (EQS) for substances of national concern, i.e. river basin specific pollutants; the monitoring of which currently contributes to the assessment of ecological status. This list of priority substances needs to be reviewed and updated, if necessary, every 6 years. The directive is an essential instrument for safeguarding surface water quality under the Water Framework Directive.

¹ Directive 2013/39/EU of the European Parliament and of the Council of 12 August 2013 amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy.

The *Groundwater Directive (2006/118/EC)*² specifically targets the protection of groundwater against pollution and deterioration. It establishes criteria for assessing the chemical status of groundwater and requires Member States to define threshold values for key pollutants, such as nitrates and pesticides. Furthermore, it obliges Member States to develop and implement programs of measures aimed at preventing and limiting the input of contaminants into groundwater bodies. The directive is an essential instrument for safeguarding groundwater quality under the Water Framework Directive. The list of pollutants and standards must also be reviewed every 6 years; these contribute to the assessment of chemical status in groundwater. The Directive also complements the WFD by including requirements as regards pollutant trends and quantitative status.

The WFD contains provisions regarding the deadlines for meeting the objectives of the Directive, as well as provisions on exemptions. The Annexes to the WFD specify details as regards, for example, monitoring requirements, the criteria for assessing water body status, and the contents of the RBMPs. The WFD is supported and integrates more targeted directives, i.e., the Water Directive³, the Bathing Water Directive⁴, the Nitrates Directive⁵, the Urban Waste Water Treatment Directive⁶, including the recent adjustments⁷ and finally the Floods Directive⁸.

1.1.3 WFD review 2019

Following that Fitness Check, the Commission tabled a revision of Directive 2008/105/EC and Directive 2006/118/EC in 2022; the recast was formally adopted in April 2024 and will enter into force in 2026. Main conclusion was that the water legislation is broadly fit for purpose, with room for improvement related to investments, implementation, integrating water into other policies, chemical pollution, administrative simplification and digitalization. The key findings show that the directives have led to a higher level of protection for water bodies and flood risk management than could have been expected without them. The objectives of the directives are as relevant now as they were at the time of the adoption, if not more.

This is certainly the case for Albania, which is in its initial phase of Integrated River Basin Management and Planning (RBMP). The methodology of the WFD offers good opportunities for an integral and efficient implementation of RBMPs. An advantage for Albania is that it can make use of previous experiences and lessons learned during the WFD implementation process in Europe.

1.1.4 Recent and forthcoming developments in EU water policy

The recent and forthcoming developments in EU water policy provide an important policy context for Albania's alignment with the EU water acquis and the implementation of the Water Framework Directive.

The *European Water Resilience Strategy*, adopted by the European Commission in June 2025, places water resilience, restoration of the water cycle, water efficiency and access to clean and affordable water at the centre of EU policy⁹. It promotes the 'Water Efficiency First' principle, sets a voluntary EU-wide target of 10% improvement in water efficiency by 2030 and links water resilience to investment, innovation, skills development and ecosystem restoration.

In parallel, the *revised Urban Wastewater Treatment Directive*¹⁰ introduces stricter requirements for wastewater collection and treatment, including obligations for smaller agglomerations above 1,000 population equivalent, advanced treatment for micropollutants at large treatment plants, improved management of stormwater and combined sewer overflows, energy neutrality of the wastewater sector

² Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration.

³ Council Directive 75/440/EEC of 16 June 1975 concerning the quality required of surface water intended for the abstraction of drinking water in the Member States.

⁴ Council Directive 76/160/EEC of 8 December 1975 concerning the quality of bathing water

⁵ European Parliament resolution on implementation of Directive 91/676/EEC on nitrates (2000/2110(INI)).

⁶ Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment

⁷ Decision (EU) 2022/591 of the European Parliament and of the Council of 6 April 2022 on a General Union Environment Action Programme to 2030.

⁸ Council Directive 2007/60/EEC concerning floods and flood mapping.

⁹ [https://ec.europa.eu/commission/presscorner/detail/en/ "European Water Resilience Strategy - European Commission"](https://ec.europa.eu/commission/presscorner/detail/en/).

¹⁰ European Commission (2024). *Revision of the Urban Wastewater Treatment Directive (recast)*.

and expanded monitoring of microplastics, antimicrobial resistance and emerging pollutants. It also aligns wastewater management with broader EU objectives on zero pollution¹¹, climate neutrality and circular economy.

Amendments to the WFD, the Environmental Quality Standards Directive and the Groundwater Directive¹² further strengthen the EU framework for addressing chemical pollution in surface water and groundwater. They update the list of priority substances, introduce stricter environmental quality standards for several substances, strengthen the approach to persistent and mobile contaminants such as PFAS, selected pharmaceuticals and pesticides, and improve monitoring and data collection through watch-list mechanisms.

In addition, the announced broader review of the WFD in 2026 may clarify the application of EU environmental legislation in permitting procedures, including for strategic investments such as mining and other industrial activities, while maintaining the core objectives of protecting aquatic ecosystems and human health. This initiative was announced in the context of the *RESourceEU Action Plan*¹³, which forms part of the EU strategy to strengthen the Union's economic resilience and secure access to critical raw materials.

For Albania, these developments are highly relevant. They confirm that future WFD implementation will require stronger integration between river basin planning, pollution control, wastewater investment, monitoring, data management and economic development. Alignment with the revised wastewater legislation will be a major implementation challenge, given the current limitations in sewerage coverage, wastewater treatment capacity, monitoring systems and institutional resources, but it also offers a clear opportunity to modernise infrastructure, improve water quality in rivers and coastal areas, and support tourism, public health and sustainable urban development.

The strengthened chemical water legislation will require Albania to progressively expand monitoring networks, laboratory capacity, analytical scope and data management, especially for emerging pollutants such as PFAS, pharmaceuticals, pesticides, microplastics and antimicrobial resistance. This will be essential for robust chemical status assessments, targeted Programmes of Measures and credible River Basin Management Plans. The Water Resilience Strategy also reinforces the need to address water scarcity, efficiency, climate resilience and ecosystem restoration as integral parts of basin planning. For Albania's WFD implementation trajectory, the combined impact is that river basin management plans cannot be limited to formal compliance documents. They should increasingly function as strategic investment and coordination frameworks, linking environmental objectives, infrastructure priorities, monitoring development, institutional capacity building and EU accession requirements. Gradual alignment with these EU policy and legislative developments will therefore be important for achieving good status of water bodies, prioritising measures, mobilising finance and strengthening Albania's credibility in the EU accession process.

1.1.5 River Basin Management Plans (RBMPs)

The River Basin Management Plans (RBMPs) are the key tools for implementing the WFD. They are drawn up after stakeholder and public consultation and produced on a six-year planning cycle. These plans provide a comprehensive approach to water management, incorporating various aspects such as water quality, quantity, ecological status, prevention of pollution, and economic aspects. RBMPs aim to achieve and maintain good water status in all water bodies, including rivers, lakes, groundwater, and coastal areas. In essence, RBMPs serve as the practical implementation of the WFD at the river basin level, ensuring coordinated and integrated management of water resources to achieve sustainable water outcomes.

¹¹ European Commission. *Zero Pollution Action Plan for Water, Air and Soil*.

¹² European Commission (2022). Proposal for a Directive amending the Water Framework Directive, the Groundwater Directive and the Environmental Quality Standards Directive.

¹³ European Commission (2025). *RESourceEU Action Plan for securing critical raw materials and strengthening EU economic resilience*.

1.1.6 Common Implementation Strategy (CIS), Working Groups and Guidance Documents

The implementation of the WFD raises several shared technical challenges for the Member States, the Commission, the Candidate and EEA Countries as well as stakeholders and NGOs. In order to address these challenges in a co-operative and coordinated manner, the Commission agreed on a Common Implementation Strategy (CIS) for the Water Framework Directive only five months after the directive came into force. The CIS aims to ensure the coherent and harmonious implementation of the WFD and its daughter directives. Within this framework, several technical Working Groups operate, for example by producing Guidance Documents on technical aspects, key events, and additional thematic documents¹⁴.

For the development of the Drin Buna RBM plan and its Task Reports, mainly the following CIS Guidance Documents were used:

- Guidance No 01 - Economics - WATECO (WG 2.6)
- Guidance No 02 - Identification of water bodies
- Guidance No 03 - Pressures and impacts - IMPRESS (WG 2.1)
- Guidance No 04 - Heavily modified water bodies - HMWB (WG 2.2)
- Guidance No 07 - Monitoring (WG 2.7)
- Guidance No 09 - GIS (WG 3.1)
- Guidance No 10 - References conditions inland waters - REFCOND (WG 2.3)
- Guidance No 13 - Classification of Ecological Status (WG A)
- Guidance No 15 - Groundwater Monitoring Guidance Nov-2006_FINAL-2
- Guidance No 16 - Groundwater in DWPAs
- Guidance No 18 - Groundwater Status-Trend assessment
- Guidance No 19 - Surface water chemical monitoring
- Guidance No 26 - GW risk assessment and conceptual models
- Guidance No 27 - Deriving Environmental Quality Standards - version 2018-1
- Guidance No 34 - Climate change & adaptation
- Guidance No 37 – Derogations & Exemptions.

1.2 Integrated Water Resources Management in Albania

1.2.1 Introduction

Water is fundamental for life. Clean and sufficient water in ponds, lakes, reservoirs, and rivers is part of the quality of the living environment and an important condition for economic progress. Good quality and quantity of groundwater and surface water are important for agriculture, the cost-effective preparation of drinking water and process water for the industry. Good water quality in villages and towns ensures a pleasant quality of life; it is good for health and is a condition for recreational use. Last but not least, good water quality is essential for a healthy water environment. In short, clean, and sufficient groundwater and surface water are essential for economic and social interests. In a nutshell, this is the essence of Integrated Water Resources Management (IWRM).

As a natural resource, water is an essential part of society that contributes significantly to sustain socio-economies, livelihoods, water security and ecosystem services. Hence, water resources are in demand by multiple stakeholders including water users from various sectors. The protection, improvement and management of water quantity and quality of all waters in river basins including the ecosystems that depend on these are essential to ensure long-term, sustainable use of water resources as well as to prevent further deterioration. The achievement of these aims can be ensured by River Basin Planning and Management (RBM), which should be supported by legal frameworks (in force through the National Strategy of Water Resources Integrated Management 2018-2027¹⁵), implementation of structural and non-structural measures and monitoring and control. In addition, implementation of IWRM through river basin planning and management supports global frameworks and commitments like the achievement of

¹⁴ Library on Guidance Documents

¹⁵ The National Strategy of Water Resources Integrated Management 2018-2027 was approved by Regulation No. 73 dated 7 February 2018.

the UN Sustainable Development Goals (SDG's)¹⁶ and the resilience of water resources in relation to climate change.

1.2.2 General topographical and geographical characteristics of river basins in Albania¹⁷

Albania has abundant water resources, divided into seven river basins (Drin-Buna, Vjosa, Seman, Shkumbini, Mati, Ishëm, Erzeni), of which two are transboundary: Drin-Buna is shared with Greece, Montenegro, Republic of North Macedonia, and Kosovo; Vjosa is shared with Greece. Albania is also home of three major natural lakes (Ohrid, Prespa and Skadar), 247 small natural lakes, and 650 artificial reservoirs. The country has access to the Adriatic and Ionian Seas with a coastline of 427 km, of which 273 km on the Adriatic Sea and 154 km on the Ionian Sea. The coast also hosts several major protected lagoons: Kune-Vain in the North, Karavasta and Narta, and Butrinti in the South.

Groundwater resources are abundant, between 9 billion m³/year and 13 billion m³/year. Albania has approximately 9,000 –10,000 m³ per capita per year (EEA, 2023), placing Albania among the ten most water-abundant countries in Europe. However, the available quantity of surface water (and to a lesser extent, of groundwater) drastically decreases during the summer dry season (July-September), with only 6-9% of annual runoff.

Albania's diverse topography, characterized by rugged mountains, expansive valleys, and a narrow coastal plain, significantly influences the formation and behaviour of its river basins. The country's hydrographic network comprises numerous rivers that primarily drain into the Adriatic and Ionian Seas, with a minor portion flowing toward the Black Sea.

1.2.3 The Seman River Basin

The Seman River is one of Albania's principal rivers, located in the central part of the country. It originates from the confluence of two major tributaries: the Devoll and Osumi Rivers. The Seman River Basin, comprising the Seman, Osumi, Devoll, and Gjanica rivers, covers an area of 5,649 km² with an average elevation of 863 metres. The basin is bordered by the Aliakmon (Vistrica) River Basin in Greece, which drains into the Aegean Sea and Prespa Lake to the east; the Vjosa River Basin to the south; the Adriatic Sea to the west; and the Shkumbin River Basin and Lake Ohrid to the north.

Annual precipitation averages 1,084 mm, sustaining a perennial flow of 95.7 m³/s. The Devoll catchment contributes approximately 60% of this flow. River waters show relatively high mineralization levels, averaging 440 mg/l. Water temperatures range from 6°C in January to 26°C in August. Land cover in the basin is dominated by sparsely vegetated agricultural areas, which are highly prone to erosion.

The Seman River itself stretches 281 km, supported by a hydrographic network density of 1.9 km/km². At its mouth, the Seman discharges into the southern section of the Karavasta Lagoon, the largest coastal lagoon in Albania. The lagoon plays a crucial role in regulating sediment transport, tidal exchange, and ecological connectivity between inland and marine ecosystems.

The Devoll River, originating from the southeastern slopes of the Morava mountain range, forms one of the two main tributaries of the Seman. It extends 196 km, drains an area of 3,139 km², and lies at an average elevation of 960 metres. Its average discharge is 49.5 m³/s, predominantly supplied by surface runoff.

The Osumi River, the second major tributary of the Seman, runs 161 km with a catchment of 2,150 km² and an average elevation of 828 metres. Its perennial flow averages 32.5 m³/s, with low-flow conditions equivalent to 17.5 litres/s/km².

¹⁶ UN Sustainable Development Goals (SDG's)

¹⁷ Several sources: (i) AP News. (2023, March 15). Albania declares Vjosa River a national park in Europe-first; (ii) INWEB – International Network of Water-Environment Centres for the Balkans. (n.d.). Drin River Sub-Basin; (iii) Wikipedia contributors. (2023, November 17). List of rivers of Albania; (iv) European Commission & Albanian Ministry of Tourism and Environment. (2021). River Basin Management Plan for the Drin-Buna and Seman Basins 2020–2026; Annex I, Description of Action: EU for Water - Component 1: EU4Rivers, 2024.

Although not considered a main tributary, the Gjanica River is the most polluted river in Albania. Pollution originates from crude oil extraction in the Patos-Marinza field and discharges from the oil refinery in Ballsh. In addition, untreated urban and industrial wastewater from Fier is directly released into the river. Each month, an estimated 12,000 – 18,000 m³ of wastewater containing hydrocarbons and industrial oils (including benzene, toluene, ethylbenzene, and xylene) is discharged. This pollution severely damages aquatic ecosystems and compromises the use of surface water for both irrigation and livestock.

1.2.4 Main challenges related to Water Resources Management in Albania

Water resources management in Albania faces persistent systemic, technical, and environmental challenges that hinder the sustainable use and protection of water across sectors. One of the central issues is the fragmentation of institutional responsibilities among various ministries and agencies, resulting in overlapping mandates, limited coordination, and weak enforcement. Despite the existence of a legal framework aligned with the EU Water Framework Directive (WFD), implementation suffers from insufficient water management related human and financial capacities, particularly at the regional and basin levels.

The country's water infrastructure is outdated and inadequately maintained. Irrigation and drainage systems operate inefficiently, while wastewater treatment facilities lack sufficient coverage and functionality, leading to untreated discharges into rivers and coastal areas. Water quality is further degraded by diffuse agricultural pollution, including nutrients, pesticides, and sediments.

Water quantity management is also constrained. Many users, particularly in agriculture and industry, abstract water without permits or monitoring, contributing to overexploitation, especially in vulnerable sub-basins. Groundwater resources remain poorly understood due to limited hydrogeological data and sparse monitoring.

Climate change intensifies these issues by increasing hydrological variability and the frequency of extreme weather events such as floods and droughts. At the same time, rapid urbanisation and tourism-driven infrastructure expansion, particularly in coastal zones, are placing growing pressure on water bodies and ecosystems. Environmental degradation is compounded by deforestation, the proliferation of small hydropower plants, and unsustainable gravel extraction.

Institutional instability and political interference in tariff setting and investment prioritisation further weaken the sector's performance. The absence of harmonised data systems and integrated planning and monitoring, coupled with inconsistent investment planning, underscores the need for a more coherent, basin-based management approach.

Addressing these challenges requires robust governance, comprehensive river basin planning, targeted investments in infrastructure and monitoring, and the operationalisation of key regulatory instruments such as permitting, pollution control, and economic incentives for efficient water use.

1.3 Institutional and Strategic Context of Water Resources Management in Albania

Despite the above-mentioned challenges, Albania has committed to an integrated water management approach aligned with the European Union's legal and policy framework. Since 2014, the Government of Albania has adopted a vision rooted in the principles of sustainability, equitable access, economic prioritisation, and the long-term protection of ecosystems. The 'Integrated Water Resources Management (IWRM) Strategy 2018–2027' articulates this vision: *"By 2027, Albania shall ensure efficient use of water through integrated and operational water resources management, supported by a complete monitoring system and effective management of flood risks and water scarcity. This will be guided by the principles of equity, sustainability, and environmental justice for present and future generations."*

The Albanian Government has also formulated 'The National Sectoral Program for Integrated Water Management 2018-2030', which aims to orient investments towards national objectives, improve the planning process, increase investments in the sector, increase the revenues generated by the sector, continuous and effective monitoring, and protect environmental objectives.

To lead this agenda, the Integrated Policy and Management Group for Integrated Water Management (IPMG-IWM), chaired by the Council of Ministers, a central executive body oversees policy development, implementation, and evaluation. The National Agency for Water Resources Management (AMBU), established in 2018, plays a central role in steering water policy and serves as the NWC's secretariat. The IPMG-IWM operates through two thematic working groups: one on water and wastewater reform (led by the Ministry of Infrastructure and Energy), and the other on water resource management (led by AMBU). This integrated framework is also embedded in the National European Integration Plan (NEIP) 2022–2024, further aligning Albania's water governance with EU accession priorities.

Administration and management structures for water management are provided at national, basin and local level. Albania is divided into seven river basins, each one having a River Basin Council (RBC).. This structure is favourable, in principle, to counteract the current fragmentation of water resources management and promote an effective administration at basin and local level.
More about institution and legislation enforce

1.4 Development of the Seman RBMP

1.4.1 River Basin Management Cycle

The methodology will involve harmonizing the RBM approach across the river basin, based on the existing RBMP framework developed for other basins, fully by the requirements of WFD and Law on Water Resources 29/2024, as amended and the DCM 1015. This approach is consistent with the RBM cycle outlined in the WFD.

The River Basin Management (RBM) Cycle provides a structured framework for the planning and management of entire river basins, extending beyond administrative boundaries to cover the full hydrological drainage area. The product of each RBM Cycle is a River Basin Management Plan (RBMP), developed collaboratively by responsible water authorities and key stakeholders.



Figure xx - The River Basin Management Cycle based on the implementation requirements of the WFD.

Each RBMP is specific to an individual river basin and follows a systematic planning process that includes:

1. *Setting Environmental Objectives*: establishing environmental goals for all groundwater and surface waters within the river basin.
2. *Identifying Significant Water Management Issues (SWMIs)*: recognizing the critical challenges and issues within the basin that need to be addressed.
3. *Conducting Pressure/Impact Analyses*: performing qualitative and quantitative assessments of the basin's status and risks, focusing on pressures and impacts affecting water quality and availability.
4. *Proposing a Programme of Measures (PoM)*: developing a set of concrete actions designed to improve the condition of the basin's water bodies, aligned with the agreed-upon environmental objectives. The PoM is the central component of any RBMP, outlining the steps necessary to achieve the desired outcomes.

In addition to addressing water management issues, the implementation of the Water Framework Directive (WFD) requires the integration of other environmental priorities, economic considerations, and social concerns when setting water management objectives.

1.4.2 Methodology and approach for preparing the River Basin Management Plan

The DPSIR (Drivers, Pressures, State, Impact, and Response) model is the theoretical framework used to develop RBMPs. This methodology describes the interactions between society and the environment, guiding the identification of key factors (drivers and pressures) that influence the state of water bodies, the impacts of these factors, and the appropriate responses needed to address them effectively.

This approach ensures a comprehensive understanding of the river basin's dynamics, enabling the development of robust and effective management plans that promote sustainable water resource management across the entire basin.

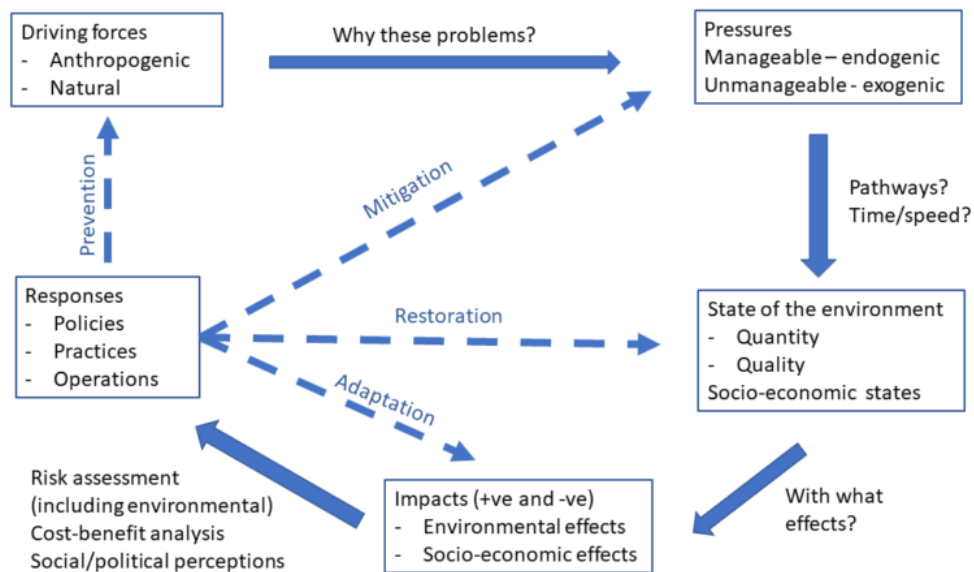


Figure xx - The DPSIR framework (source: Guidance Document No. 3)

The RBMP development process follows the DPSIR model, which is used to understand the interactions between societal activities and environmental conditions. The framework includes:

- ◆ **Driving Forces:** social, demographic, and economic developments that influence human activities impacting the environment.
- ◆ **Pressures:** the direct consequences of these driving forces on the environment.
- ◆ **State:** the current physical, chemical, and biological conditions of the environment.
- ◆ **Impact:** the effects of changes in the environmental state, leading to environmental degradation.
- ◆ **Responses:** actions taken to mitigate issues identified in the earlier stages, aiming to reduce pressures, restore environmental conditions, and address impacts.

The following steps and main activities were conducted, partly in parallel, based on the WFD requirements for developing the RBMP (reference is made to the most important WFD Articles and Annexes):

1. Mutual understanding on the purpose, definitions and steps of the RBM Cycle based on WFD approach (WFD, Article 1 and 2);
2. Setting up of the institutional framework to develop and implement the RBMP by the dedicated competent authorities at National level and at basin level by the RBCs with all responsible water authorities and relevant stakeholders (WFD, Article 3);
3. Prepare a basic outline of the RBM plan (WFD, Article 13 and Annex VII);
4. **Drivers & Pressures:** Identification of Significant Water Management Issues (SWMIs) and definition of vision and management objectives for each SWMI (WFD, Article 5 and Annex II);
5. Delineation of Surface Water Bodies, Groundwater bodies and Protected areas (WFD, Article 5, Annex II and Annex IV for protected areas);
6. Environmental Objectives, Environmental Quality Standards and Establishment of Provisional Reference Conditions for both surface- and groundwater bodies (WFD, Article 4 (objectives); Article 16 (EQS) and Annex V (classification & reference conditions);
7. **State & Impact:** Groundwater and Surface water monitoring analysis (WFD, Article 8 and Annex V) and the qualitative and quantitative pressure & risk analysis and status assessment (WFD, Article 5 and Annex II, V);

8. **Response:** Development of the Programme of Measures (PoM, WFD, Article 11 and Annex VI) and the RBM Plan (WFD, Article 13 and Annex VII);
9. Methodological analysis on developing Groundwater and Surface water monitoring programs and analysis following the EU guidance (WFD, Article 8 and Annex V);
10. Economic Analysis of Water Uses, Revenue Analysis and Cost Recovery (WFD, Article 9 and Annex III).

All above steps / activities are described in detail in several Technical Task Reports attached as Annexes to the RBMP.

Table xx - Overview of all technical Task Reports prepared for the RBMP

Task Report	Name	Main activities
1	Delineation of water bodies	5
2	Register of Protected Areas	4, 5
3	RBMP Objectives & Overview of SWMIs	4
4	Monitoring Network, data collection & data analysis of existing conditions	7, 9
5	Environmental objectives, EQS and establishment of provisional reference conditions	6
6	Drivers, Pressures & Impact assessment	7
7	Program of Measures (PoM)	8
8	Initial Economic Analysis of Water Uses, Revenue Analysis and Cost Recovery	10
9	Hydrological Analysis (water Balance surface & groundwater)	4, 5, 7
10	Reports of the technical workshops for developing the RBM plan and the PoM	2, 3, 7
11	Atlas of Maps of the Basin	-
12	Collected RBM Data	4, 5, 7 & 10

1.4.3 Implementation timeline of the Seman RBM Plan

The RBM process is based on multi-year planning and implementation cycles that are to be repeated at a certain frequency to enable a revision process, adjustment to new conditions in the basin, and addressing new challenges. The RBM Plan cycle is planned to be repeated every 6 years with an updated pressure/impact analyses and risk assessments in between to estimate improvements and the achievement of the overall aims and objectives of the River Basin.

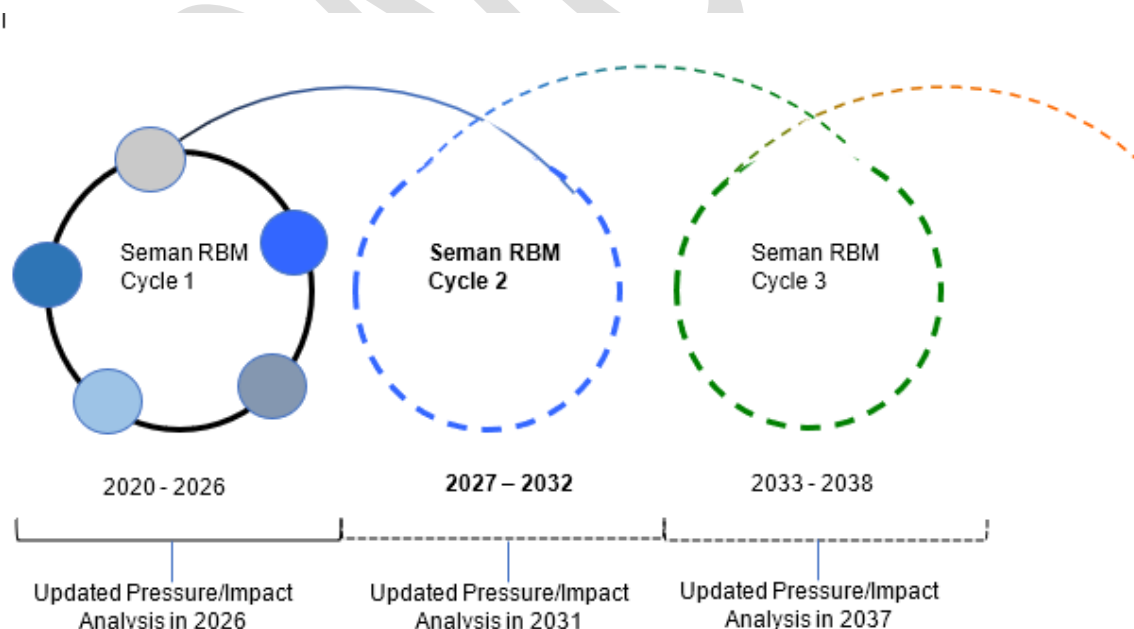


Figure xx - Timeline and review frequencies for the Seman RBM Plan

In the above context, the 2nd Seman RBM Plan, developed within the RBM Cycle (see Figure xx -), will last from 2027 - 2032. It will be followed by consecutive cycles in order to achieve the overall Seman river basin aims and objectives. The initial work towards the first Seman RBM

Plan started in 2019, with approval of the first RBM plan in 2020 by the Council of Ministers and with an implementation period until end of 2026.

1.5 Changes and updates of the first RBMP of the Seman River Basin

CONCEPT

2 Stakeholder Involvement and Public Consultation

This chapter presents the legal context and participatory mechanisms guiding stakeholder involvement in RBMP development. It describes how the principles of transparency, inclusiveness, and public participation, central to the WFD, are applied in the Seman River Basin. The section summarises the main consultation activities conducted during plan preparation, including basin-level workshops, institutional meetings, and public disclosure processes. It highlights how feedback from stakeholders has been integrated into the plan to ensure legitimacy, ownership, and practical implementation.

- *Reference is made to Task Report 10 (Reports of the technical workshops for developing the RBM plan and the PoM) and meetings held as part of public consultation etc;*
- *Annex VII of WFD point 9 says: a summary of the public information and consultation measures taken, pictures of the events, their results and the changes to the plan made as a consequence; → separate Annex or part of this chapter?*

2.1 Legal Context

- 2.1.1 Albania
- 2.1.2 WFD requirements for stakeholder involvement and public participation
- 2.1.3 Stakeholder identification
- 2.1.4 Transboundary context

2.2 Main Consultation Measures for the Seman River Basin

- 2.2.1 Statement of Consultation
- 2.2.2 Overview of Significant Water Management Issues
- 2.2.3 Draft River Basin Management Plan
- 2.2.4 Public Meetings, Workshops and Field visits
- 2.2.5 Final River Basin Management Plan

3 SEMAN RIVER BASIN OVERVIEW

This chapter provides a WFD-oriented overview of the Seman River Basin and establishes the baseline for river basin management planning. It describes the basin's geographical extent and major sub-basins. It summarises the basin's physical, ecological, and socio-economic characteristics, including topography, land use, demography, economic activities, geology, soils, hydromorphology, biodiversity, and protected areas.

Additional background, technical information and data are presented in the Task Reports 1, 2, 8, 9 and 12.

3.1 Introduction of the Seman River Basin

3.1.1 Geographical extent

The Seman River Basin is one of Albania's largest and most significant river basins, with a drainage area of approximately 5,649 km², representing nearly 20% of the country's territory. The river system is formed by the confluence of the Devoll and Osum rivers near Kuçovë and flows westward across the Myzeqe plain before discharging into the Adriatic Sea south of the Divjakë–Karavasta National Park. With a total river length of around 281 km (measured from its longest headwater), Seman River has an average discharge at the mouth of 95–96 m³/s. The basin's physiography includes mountainous headwaters, narrow valleys, and wide alluvial plains, creating diverse hydrological and ecological conditions. The Seman Basin is of strategic national importance due to its role in hydropower production, irrigation, and agriculture, as well as for the biodiversity values associated with the Karavasta Lagoon and delta.

The Seman River Basin is located in central Albania, stretching from the mountainous ranges of Grammos, Tomorr, and Ostrovicë in the east to the Adriatic coast in the west. It is bounded to the north by the Shkumbini River Basin and the watershed of Lake Ohrid, while to the east and southeast it borders the Aliakmon (Vistrica) and Prespa Lake basins, which extend across Albania's frontiers with Greece and North Macedonia. To the south, the basin adjoins the Vjosa River Basin, and to the west, it reaches the Adriatic Sea, where the Seman River forms a delta just south of the Karavasta Lagoon.

3.1.2 Major sub-basins and administrative regions

The Seman River Basin is primarily composed of two major sub-basins: the Devoll and the Osum. The *Devoll River sub-basin* (approximately 3 130 km²) drains the Korçë plateau and the surrounding eastern highlands, receiving flow from significant tributaries such as the Tomorrica and Holtë rivers. The *Osum River sub-basin* (around 2 150 km²) extends across the Tomorr massif and the Skrapar uplands, exhibiting a hydrological regime influenced by both rainfall and snowmelt. The two rivers converge near Kuçovë, forming the main stem of the Seman River, which then flows for about 85 km across the fertile Myzeqe plain before discharging into the Adriatic Sea. Among its additional tributaries, the most notable is the Gjanica River (approximately 234 km²), joining the Seman near Fier.

The Seman River Basin spans several administrative regions and municipalities, reflecting its central position in Albania:

- Korçë County (Qarku i Korçës) – upper Devoll basin and headwaters,
- Berat County (Qarku i Beratit) – Osum valley and Tomorr slopes,
- Elbasan County (Qarku i Elbasanit) – upper tributary catchments,
- Fier County (Qarku i Fierit) – lower Seman and Myzeqe plain, including the delta,
- Dibër and Gramsh areas – smaller portions of the eastern uplands.

Key municipalities include Korçë, Maliq, Gramsh, Skrapar, Berat, Kuçovë, Ura Vajgurore, Fier, Lushnjë, Divjakë, and Patos. This wide administrative coverage underscores the basin's socio-economic importance, as it supports major agricultural zones, urban centres, and hydropower installations.

Key dimensions

- Drainage area: 5,649 km²
- Total fluvial length: 281 km (longest source to sea)
- Main stem length: 85 km (confluence to sea)
- Average discharge at mouth: 95–96 m³/s
- Main outlet: delta south of Divjakë–Karavasta National Park

Table xx - Main sub-basins of the Seman River Basin

Sub-basin / Tributary	Area (km ²)	Main municipalities covered	Notes
Devoll River	3,130	Korçë, Maliq, Gramsh	Includes tributaries Tomorrica (~376 km ²) and Holtë (~227 km ²); major hydropower cascade.
Osum River	2,150	Berat, Skrapar, Kuçovë, Poliçan	Drains Tomorr massif and Skrapar highlands; joins Devoll near Kuçovë.
Gjanica River	234	Fier, Patos, Roskovec	Enters Seman near Fier; receives urban/industrial discharges.
Lower Seman (main stem)	105 (floodplain & deltaic zone)	Fier, Divjakë, Lushnjë	Extends ~85 km across the Myzeqe plain to the Adriatic; high flood risk.

3.2 River Basin Baseline Characterization

3.2.1 Topography

The Seman River Basin is characterised by a highly diverse topography, extending from high mountains in the east to wide coastal plains and lagoonal systems in the west. This relief complexity strongly shapes surface water flow patterns, runoff generation, erosion dynamics, and flood risk.

Elevation ranges and distribution

The Seman basin (5,649 km², mean elevation 863 m a.s.l.) shows a dominantly mountainous character. Altitudes between 0–800 m cover 41.2% of the basin, 800–1000 m cover 20%, 1000–1600 m 31.4%, and 1600–2400 m 7.4%. The most representative elevation class is 800–1000 m, highlighting the predominance of rugged relief.

In the Osum sub-basin (2,150 km², mean elevation 828 m), the dominant altitudes are 200–1200 m (56.1%), with additional shares of 1200–1400 m (10.8%), 1400–2000 m (14.8%), and 1600–2600 m (10.2%). The Osum originates at 1,700 m in the Vithkuq and Gramoz mountains, flowing through narrow valleys and deeply incised gorges, including the notable Çorovoda canyon¹⁸.

In the Devoll sub-basin (3,130 km², mean elevation 959 m), altitudes between 800–1400 m dominate (55.2%), while 0–800 m cover 29.1%, 1400–1800 m 12.8%, and 1800–2400 m 2.9%. The Devoll rises at 1,900 m in the Badaresha massif, passing through successive mountain gorges and the alluvial plain of Maliq. Its tributaries, such as Tomorrica (376 km², mean altitude 378 m) and Holta (227 km², mean altitude 899 m), flow in steep valleys with gradients exceeding 30–40 m/km, reflecting intense erosional processes.

Relief forms and land units

The Seman basin covers nearly all tectonic zones of central Albania, with highly varied lithology and fragmented relief. Mountain ranges such as Tomorr, Trebeshina, Shpiragu, Gramoz, and Ostrovica frame a dense hydrographic network. The valleys of Devoll and Osum alternate between wide plains (Bilisht, Maliq) and narrow gorges, while downstream the Seman enters the extensive Myzeqe plain. This alluvial lowland, historically flood-prone, has been regulated through levees from Kuç to the Adriatic Sea to reduce flood hazards.

Plains, floodplains, and coastal systems

¹⁸ Hidrologjia e Shqipërisë / red. Niko Pano. 1984, Tiranë: Akademia e Shkencave. 1-437.

After the confluence of the Osum and Devoll at Kozara, the Seman continues westward through a narrow valley before opening into the Myzeqe plain. The lower Seman crosses this flat alluvial area before discharging into the Adriatic south of the Karavasta Lagoon. The coastal topography here is marked by a complex of floodplains, levees, and lagoonal systems.

Karavasta Lagoon system

The Karavasta Lagoon is the largest lagoon on the Albanian Adriatic coast and forms an integral part of the Seman's deltaic and coastal system. Located between the mouths of the Seman (south) and Shkumbin (north), the lagoon covers 43.3 km², with a length of 10.6 km, width of 4.3 km, and a maximum depth of -1.5 m. It is connected to the Adriatic Sea through three channels (southern, central, and northern) of varying width and depth. To its east lies the Godulla of Karavasta (8.5 km², up to -3.5 m deep), also linked to the sea through a wide channel cutting across the littoral barrier.

These coastal depressions and barrier-lagoon systems represent a major lowland landform unit, shaped by fluvial and marine interactions. The Karavasta system is topographically very shallow and highly sensitive to hydrological balance, sediment dynamics, and sea-level fluctuations. Its presence at the river mouth illustrates the transition from the steep erosional landscapes upstream to depositional coastal environments downstream^{19 20}.

Topographical implications

The contrast between steep mountainous areas upstream and low-lying plains and lagoonal systems downstream defines the hydrological behaviour of the Seman basin. Strong gradients in the Devoll and Osum sub-basins promote rapid runoff, high erosion, and sediment transport. These materials accumulate in the Myzeqe plain and the Karavasta coastal system, shaping floodplains, levees, and lagoonal basins. The result is both high erosion potential in uplands and high flood risk in the lowlands, requiring careful water management planning.

3.2.2 Land Use

Overview and spatial pattern

Land use in the river basin is heterogeneous, following the strong orography-to-coast gradient. The upper catchments (Devoll–Osum headwaters and upland tributaries) are dominated by forests, natural shrublands and sparsely vegetated slopes on steeper terrain. The central piedmont and alluvial plains (Berat–Kuçovë–Lushnjë–Fier) transition to intensive agricultural mosaics (arable, permanent crops, mixed farming), interspersed with settlements, industrial sites and transport corridors. The coastal lowlands host extensive wetlands and dunes associated with the Seman delta and the Divjakë–Karavasta complex, alongside irrigated agriculture and tourism uses.

For classification consistency and change-tracking, land cover/land use is referenced to the Copernicus CORINE Land Cover (CLC) inventory (44 classes; minimum mapping unit 25 ha; 6-year updates; latest full status layer 2018). CLC is the EEA-standard dataset underpinning RBMP land-use screening across Europe and is the reference layer for maps and statistics in this Plan^{21 22 23}.

Key land-use categories

- *Forests, shrublands and semi-natural areas (upper and mid-basins)*. Predominant on steeper slopes and higher elevations; important for infiltration, baseflow regulation and erosion control. Conversion or degradation (e.g., fuelwood cutting, fires, grazing pressure) increases fine sediment supply and flashiness in tributaries.
- *Agriculture (piedmont and plains)*. Large contiguous blocks of arable land and permanent crops (olive groves, vineyards, orchards) dominate the Berat–Kuçovë–Lushnjë–Fier corridor. Irrigated fields and drainage networks alter seasonal runoff, while fertilizer/manure and plant-protection

¹⁹ Gjebreja, A., Balanca ujore dhe veçoritë limnologjike të lagunës së Karavastës. Buletini i Shkencave Natyrore, 2001(1-2): p. 25–34.

²⁰ Pano, N., Pasuritë ujore të Shqipërisë. 2015, Tiranë: Akademia e Shkencave e Shqipërisë. 1-634.

²¹ E.E.A., CORINE Land Cover (CLC) 2018, version 2020_20u1 — vector data. 2018: Copenhagen.

²² European Environment, A., Land cover and change accounts 2000-2018 (dashboard). 2019.

²³ European Environment, A. and S. Copernicus Land Monitoring, CORINE Land Cover (CLC) 2018. 2018.

products are the main sources of diffuse nitrogen and phosphorus pressures to both surface waters and shallow groundwater. Older irrigation/drainage schemes channel quickflow to rivers, raising peak loads during storm events. National evidence identifies this area among basins where agriculture and wastewater discharges are significant pollution sources²⁴.

- **Urban areas and transport infrastructure.** The principal urban nodes are Fier, Berat, Kuçovë, Lushnjë and a denser peri-urban ribbon along national roads. Urban fabric, industrial zones and road networks increase imperviousness and generate urban runoff with hydrocarbons, heavy metals and suspended solids; combined sewer overflows during intense rainfall create high short-duration pollutant pulses.
- **Industrial and energy sites.** The Patos–Marinza onshore oil field (among the largest in Europe) and associated facilities in Ballsh and Kuçovë constitute a major point-and-diffuse pressure cluster. Multiple studies and reports document hydrocarbon pollution reaching the Gjanica River, affecting sediments and water quality (oil residues, phenols, sulphides, COD/BOD, nutrients). These impacts are recurrent risk drivers for the Seman mainstream via the Gjanica^{25 26 27 28}.
- **Wetlands, dunes and protected areas.** The Divjakë–Karavasta National Park (Ramsar site) anchors the coastal wetland system; Karavasta Lagoon itself spans ~4,100 ha and is separated from the sea by the Divjakë pine forest. The lagoonal–deltaic complex is hydrologically connected to the Seman system and is sensitive to land-use change upstream (sediment/nutrient loads) and locally (tourism, aquaculture, agriculture). Coastal morphology has been highly dynamic over the last century due to delta changes and sediment supply.
- **Linear energy infrastructure.** The Trans-Adriatic Pipeline (TAP) crosses the basin from the Greece border to the Adriatic landfall near Fier (with above-ground installations and access roads). Construction included temporary land-take with reinstatement and livelihood restoration; while operational impacts are limited, the corridor intersects drainage and agricultural lands and should be shown in land-use/constraint mapping^{29 30}.

Land-use change and trends

National-level CLC change analysis (2000–2018) shows continuing urbanization and agricultural intensification in lowlands, and shifts among forest/shrub classes in uplands. These patterns are consistent with observed development along the Berat–Fier axis and peri-urban growth around municipal centres in the basin. Use the EEA country dashboards to extract Albania-specific trends and document increases in artificial surfaces, conversions within agricultural classes, and forest dynamics to contextualize basin statistics³¹.

Implications for water quality and quantity

- **Diffuse agricultural pollution.** Nutrient surpluses and soil erosion from tilled fields and orchards drive *N* and *P* loads via field drains and open channels; irrigation return flows concentrate salts and agrochemicals late in the season. Risk hotspots include intensive farming belts on alluvial plains and areas with shallow groundwater.
- **Urban and industrial runoff.** Impervious growth increases quickflow, short-lived flood peaks and contaminant pulses. Industrial estates and logistics corridors add hydrocarbons and fine particulates; maintenance of oil separators and street sweeping is often decisive for load reduction.
- **Hydrocarbon contamination cluster (Gjanica–Patos/Marinza–Ballsh/Kuçovë).** Chronic leakage/spills and legacy contamination lead to sediment-bound hydrocarbons and episodic

²⁴ Duli, M., Instruments for the regional sustainable development in Albania - Instruments for supporting the implementation of regional development policy. Academic Journal of Business, Administration, Law and Social Sciences, 2016. 2(2).

²⁵ Bankwatch and D. Hoffman, Oil casts long shadow over local people in Albania. 2014.

²⁶ Damo, R. and P. Icka, Environmental impact assessment generated by ALBANIAN petroleum industry into Gjanica rIveR. Romanian Biotechnological Letters, 2015. 20(1): p. 10151-10161.

²⁷ Kuqi, E. and M. Ina, Gjanica, the most polluted river in the country, oil and olive companies receive minimal penalties. 2023.

²⁸ Zeqo, E., Oil Pollution Analysis of Gjanica River from Petroleum Refinery and Production Industry in Albania. Current Journal of Applied Science and Technology, 2021. 40(14): p. 64-75.

²⁹ Trans Adriatic Pipeline, A.G., Trans Adriatic Pipeline: Environmental and Social Impact Assessment (ESIA) – Albania (English). 2013.

³⁰ Internet, A., The Trans Adriatic Pipeline project (TAP) in Albania. 2025.

³¹ European Environment, A., Land cover country fact sheets 2000-2018. 2021. Service. 1995.

dissolved plumes reaching the Gjanica and, downstream, the Seman; these pressures compromise WFD chemical status and ecological potential if not contained³².

- *Habitat fragmentation and riparian pressures.* Channelization, agricultural encroachment into floodplains and road embankments break off wetland connectivity and narrow riparian buffers, reducing self-purification and increasing bank erosion.
- *Coastal wetland sensitivity.* Changes in upstream sediment/nutrient delivery and local land take (tourism, agriculture) affect lagoonal flushing and eutrophication risk in Divjakë–Karavasta, with implications for Natura 2000/Ramsar conservation objectives³³.

Priority zones

One of the most pressing priority areas within the Seman basin is the *belt of diffuse agricultural pollution* that stretches across the intensively farmed alluvial plains of Lushnjë and Fier, as well as the irrigated perimeters that drain towards the lower courses of the Seman, Osum and Devoll rivers. These agricultural lands are characterized by high inputs of fertilizers, pesticides and irrigation water, which contribute to nutrient surpluses, soil erosion, and increased salinity in return flows. The cumulative effect of these pressures is a significant risk of diffuse nitrogen and phosphorus loads reaching both surface watercourses and shallow aquifers, thereby undermining the attainment of good water quality status. Addressing this zone requires the prioritisation of agri-environmental measures such as buffer strips, nutrient management plans, and controlled irrigation techniques.

A second critical zone is the *industrial hotspot cluster in the Gjanica sub-basin*, which includes the Patos–Marinza oil field, the Ballsh refinery, and the Kuçovë oil facilities. This area has long been associated with hydrocarbon contamination, both from ongoing production and from legacy pollution that remains in soils and sediments. Hydrocarbons, phenols, and sulphides have been repeatedly detected in water and sediment samples, and the risk of continued seepage or accidental discharges remains high. For this reason, the Gjanica sub-basin must be considered a top priority for containment measures, remediation of contaminated sites, and intensified monitoring programmes covering both the water column and bottom sediments. Without intervention, these pollution sources threaten to compromise not only the chemical status of the Gjanica but also the downstream ecological potential of the Seman River.

The *peri-urban growth rings around Fier and Berat*, particularly those aligned with primary highways and transport corridors, represent another priority zone due to their increasing contribution to urban runoff. Expanding residential areas, industrial estates, and transport infrastructure increase impervious surfaces and therefore accelerate stormwater runoff carrying hydrocarbons, heavy metals, suspended solids, and other contaminants. This urbanisation trend amplifies flood risks and reduces natural infiltration. Tackling these impacts requires the integration of sustainable drainage systems (SuDS), effective wastewater management, and urban planning controls to mitigate pollutant discharges into adjacent rivers and drainage channels.

Another zone of concern is the *lower Seman and Gjanica reaches*, where rivers have been straightened, floodplains disconnected, and agricultural fields extend directly to the riverbank. This has resulted in the loss of riparian buffers, reduced self-purification capacity, and increased vulnerability to erosion and flooding. Restoring these riparian areas and reconnecting the floodplains would enhance habitat quality, improve sediment retention, and restore natural hydrological dynamics. Such restoration is not only important for ecological reasons but also for strengthening resilience against extreme hydrological events, which are projected to intensify under climate change.

Finally, the *coastal wetlands buffer zone around Divjakë–Karavasta* represents a unique ecological hotspot of both national and international significance. The lagoon and its surrounding forests and dunes are recognised under the Ramsar Convention and form part of the Natura 2000 network. However, they are under growing pressure from expanding agriculture, tourism development, and unsustainable water abstractions. These activities threaten the delicate balance of sediment and nutrient inputs that sustain the lagoon's ecological character. To safeguard this zone, it is crucial to maintain and expand protective

³² Damo, R. and P. Icka, Environmental impact assessment generated by ALBANIAN petroleum industry into Gjanica rIveR (ResearchGate copy). 2015.

³³ Ramsar Convention, S., Karavasta Lagoon (Ramsar Site no. 781) – Ramsar Sites Information.

buffer areas, regulate agricultural and tourism-related discharges, and ensure that upstream water management decisions are consistent with the conservation objectives established under Ramsar and Natura 2000.

3.2.3 Demography, Municipal Districts and Population Distribution

Administrative context and units

Water governance in the Seman River Basin is exercised through 17 municipalities together with the Regional Directorates of Irrigation and Drainage in Korçë and Fier (main network), while municipal departments manage secondary/tertiary irrigation–drainage and the water utilities (WS/MW). The municipalities involved include (fully or partly) Belsh, Berat, Cërrik, Çorovodë (Skrapar), Devoll, Divjakë, Elbasan, Fier, Gramsh, Kolonjë, Korçë, Kuçovë, Lushnjë, Maliq, Mallakastër, Patos, Poliçan, Roskovec and Ura Vajgurore (now Dimal). Albania's 2014 territorial reform consolidated former LGUs into 61 municipalities and aligned WS/MW service areas accordingly.

Population size, density and spatial distribution

The Seman River Basin spans four prefectures: Fier, Berat, Korçë and a smaller northern portion of Elbasan, with population concentrated in the main urban centres of Fier, Berat–Kuçovë, Lushnjë–Patos–Roskovec and Korçë–Maliq, and lower densities in upland municipalities (Skrapar/Çorovodë, Kolonjë, Gramsh). According to the latest INSTAT census profiles (reference date 18 Sept 2023)³⁴:

- Fier prefecture: 240,377 residents; population density 127.2 inhabitants/km².
- Berat prefecture: 140,956 residents; population density 78.4 inhabitants/km².
- Korçë prefecture: 173,091 residents; population density 46.6 inhabitants/km².

While basin boundaries do not coincide exactly with prefecture limits, these figures corroborate the dominance of the Fier–Lushnjë coastal plain and the Korçë–Maliq plateau as the main population nodes, with markedly sparser settlement in the mountainous headwaters.

For historical comparison within the RBMP evidence base, the basin's resident population was estimated at 916,255 people at the 2011 census.

Urban–rural pattern and recent demographic trends

Urban settlement is concentrated in county seats and oil–agro-industrial towns (Fier, Lushnjë, Patos, Kuçovë, Korçë, Berat), while rural populations dominate irrigation districts of the Myzeqe plain and the Korçë–Maliq polje, as well as scattered mountain villages upstream (Skrapar, Gramsh, Kolonjë). RBMP service data compiled by municipality show heterogeneous WS/MW coverage, close to universal in Korçë and high in several county seats, but substantially lower in some municipalities and peri-urban/rural areas, reflecting legacy networks prior to the 2014 reform.

INSTAT's 2023 prefecture profiles indicate continued population redistribution: relatively higher densities and absolute populations in the lowland Fier–Lushnjë belt, moderate densities in Berat, and the lowest average densities in Korçë due to sustained out-migration and ageing in uplands, patterns that translate into uneven service demand and infrastructure load across the basin.

Implications for water demand, sanitation and pressures on water bodies

- *Public water supply & sanitation (WSS)*: Municipal utilities operate at the scale of the new local government units (LGUs). Coverage is variable, with several cities showing high (often >80–100%) connection rates, contrasted by lower service levels in parts of peri-urban/rural municipalities; improving coverage in these areas remains a priority under the post-reform model.
- *Seasonal demand peaks*: Demand rises during irrigation season and summer tourism on the coast/lagoon fringe (Divjakë–Karavasta), overlapping with urban peaks in Fier–Lushnjë and Korçë, increasing abstraction and stressing older supply systems [18]. (See also the 2019

³⁴ Instat, Population of Fier Prefecture, Berat Prefecture and Korçë Prefecture (18 September 2023 Census Profile).

RBMP's inventory of 211 agricultural reservoirs and extensive irrigation areas that co-locate with rural populations.)

- *Wastewater loads and quality:* Towns such as Fier, Lushnjë, Patos and Kuçovë contribute significant point-source loads to the Seman and tributaries where WWTP capacity or sewerage coverage is incomplete; RBMP figures highlight municipal-scale differences in service coverage that translate into differing pollution pressures.
- *Institutional interfaces:* Basin-level governance is mediated by the Administration Office of Basin Water and the river-basin councils, but day-to-day service delivery and network expansion depend on municipal utilities and the drainage/irrigation boards (Fier, Korçë), requiring coordinated planning to manage abstractions, leakage reduction, storm overflows and nutrient loads.

3.2.4 Socio-economic Features

Describe the key economic sectors active in the basin, such as agriculture, industry, mining, tourism, hydropower, and other services, and describe their interactions with water resources.

3.2.5 Geology and Soils

The geology and soils of the Seman River Basin strongly influence groundwater recharge, runoff, erosion and pollution risks. The basin contains a mix of permeable alluvial and gravelly-sandy deposits in the river valleys and lower plains, and less permeable flysch, molasse, clayey and silty formations in the hilly and mountainous areas^{35 36}. Locally, limestone, karst, ultrabasic/ophiolitic rocks and gypsum also occur. The Devoll and Osum rivers drain steep uplands and transport large volumes of sediment towards the lower Seman plain and the coastal zone. In the lower basin, sandy, silty and clayey deposits form floodplains, riverbanks, wetlands, lagoons and coastal dunes³⁷.

These physical conditions are directly relevant for water management. Coarse alluvial and gravel deposits can store and transmit groundwater and support exchange between rivers and aquifers. Clay-rich, flysch and molasse areas have lower permeability, generate faster surface runoff and limit local groundwater recharge. The main soil groups in Albania include Cambisols, Luvisols, Regosols, Leptosols and Phaeozems, while Fluvisols are common in western alluvial and coastal areas. In the Seman Basin, shallow soils, steep slopes and weak clay and flysch formations make parts of the Devoll and Osum sub-basins highly sensitive to erosion. This increases suspended sediment loads, bank instability, sedimentation and flood risks, and reduces the basin's natural water retention capacity.

The same characteristics also affect contaminant transport. Permeable alluvial aquifers can rapidly spread dissolved pollutants, while fine sediments can bind and later release nutrients, hydrocarbons and metals. This is particularly important in the Gjanica sub-basin, where oil extraction, industrial activities and urban pressures have affected water and sediment quality³⁸.

3.2.6 River and Coastal Morphology

The Seman River Basin has a dynamic river and coastal morphology, shaped by steep mountain tributaries, high sediment production, wide alluvial valleys, reservoirs, floodplains and an active deltaic coastline. The Devoll and Osum rivers drain erodible uplands and transport large volumes of sediment towards the lower Seman plain and the Adriatic Sea^{39 40}. In the upper and middle basin, high sediment loads have created braided river sections, shifting channels, gravel bars, bank erosion and unstable riverbanks, especially along the Devoll and its tributaries. In the lower basin, the Seman develops a wider alluvial channel, with stronger interaction between the river, floodplain, agricultural drainage systems, wetlands, lagoons and coastal waters.

³⁵ Eftimi, R., Hydrogeological Characteristics of Albania, 2014 - ResearchGate

³⁶ https://esdac.jrc.ec.europa.eu/esbn/Esbn_Zagreb/Presentations/Overview_SoilInfo/Albania_Zagreb.pdf

³⁷ https://akad.gov.al/wp-content/uploads/2024/10/1_Muceku-Y-Lamaj-MMilushi-I-Onuzi-K-Avxhiu-A-Albanian-Journal-of-Natural-and-Technical-Sciences-20191-XXIV48.pdf

³⁸ <https://www.anglisticum.org.mk/index.php/IJLLIS/article/view/1625>

³⁹ Doko, A., Bronstert, A., Francke, T. (2023): Hydrological and Sediment Transport Regime on Rivers in the Balkans: The Case of the Seman River (Central & South-east Albania), XXVIII General Assembly of the International Union of Geodesy and Geophysics (IUGG) (Berlin 2023) - <https://doi.org/10.57757/IUGG23-4780>

⁴⁰ <https://www.hydropower.org/sediment-management-case-studies/albania-devoll>

Human interventions have substantially modified this natural system. The Banjë and Moglicë hydropower plants on the Devoll River regulate flow, interrupt river continuity and trap sediment, while reservoir sedimentation reduces storage capacity and affects downstream sediment supply⁴¹. Embankments, drainage and irrigation infrastructure, gravel extraction, bank protection and local river training works further constrain natural channel migration and reduce floodplain connectivity. These pressures alter flow variability, sediment transport, bank dynamics and habitat diversity. They can reduce spawning and nursery habitats, simplify riparian zones, increase incision or aggradation, and weaken the natural link between rivers, wetlands and coastal waters.

The coastal zone near the Seman mouth and the Karavasta lagoon system remains highly dynamic. River-mouth migration, delta development, longshore sediment transport and coastal erosion have repeatedly changed the shoreline position⁴². Reduced or redistributed sediment supply from upstream regulation and extraction can increase erosion risks, while high sediment pulses from eroding catchments can increase turbidity and siltation in downstream reaches, lagoons and coastal waters.

Overall, the Seman Basin shows a moderate to high degree of hydromorphological alteration, with strongest impacts in regulated, embanked, extracted and reservoir-influenced reaches.

3.2.7 Ecoregions and Biodiversity

According to the WFD Annex XI System A typology for rivers and lakes, the Seman River Basin falls within *Ecoregion 6: Hellenic Western Balkan*. This ecoregion combines mountainous catchments, steep river systems, Mediterranean and continental climatic influences, complex geology and high ecological diversity. The transitional and coastal waters connected to the Seman mouth, the Adriatic coastal zone and the wider Seman–Shkumbin deltaic system belong to the Mediterranean Sea ecoregion for coastal and transitional water typology. This ecoregional setting is important for defining water body types, reference conditions and ecological assessment methods under the WFD⁴³.

The Seman Basin has high biodiversity value because it connects mountain streams, the Devoll and Osum river systems, reservoirs, riparian corridors, alluvial floodplains, agricultural lowlands, wetlands, lagoons and coastal waters. The upper and middle parts of the basin support riverine habitats with stony beds, fast-flowing tributaries and species adapted to variable flow and sediment conditions. The lower basin and coastal zone provide shallow-water, reedbed, wetland, lagoon, dune and riparian habitats. The Karavasta Lagoon and Divjaka-Karavasta National Park, located in the wider lower Seman–Shkumbin coastal plain, form one of Albania's most important wetland and bird areas and are designated as a Ramsar site⁴⁴.

The basin also contributes to Albania's freshwater biodiversity. Albanian freshwater fish fauna has a high degree of endemism, linked to the country's complex geological, climatic and biogeographical setting⁴⁵. The Seman drainage is particularly relevant because endemic fish species have been described from the upper Osum and Devoll systems, including *Alburnoides fangfangae* and *Alburnoides devolli*⁴⁶. The ecological value of the basin therefore depends on maintaining longitudinal connectivity between headwaters, tributaries, reservoirs, lowland rivers and coastal waters, as well as lateral connectivity with floodplains, wetlands and riparian zones.

⁴¹ <https://www.statkraft.al/en-al/projects2/devoll-hydropower-project/>

⁴²

https://www.researchgate.net/publication/227203814_Coastal_Zone_Geomorphological_Mapping_Using_Landsat_TM_Imagery_An_Application_in_Central_Albania

⁴³ WFD Annex XI lists Ecoregion 6 as "Hellenic Western Balkan" for rivers and lakes and identifies the Mediterranean Sea as an ecoregion for transitional and coastal waters under System A. (EUR-Lex)

⁴⁴ Divjaka-Karavasta National Park is described as a major migratory bird site, with about 260 bird species, more than 85 species listed in Annex I of the EU Birds Directive, and Albania's only breeding colony of Dalmatian pelican. (Mediterranean Biodiversity Consortium)

⁴⁵ Shumka et al., 2022 -

https://ribarstvo.agr.hr/articles/1402_RECENT_DATA_ON_THE_DISTRIBUTION_OF_FRESHWATER_ICHTHYOFAUNA_IN_ALBANIA_en.pdf

⁴⁶

https://www.researchgate.net/publication/259266992_Two_new_species_of_freshwater_fishes_of_the_genus_Alburnoides_A_fangfangae_and_A_devolli_Actinopterygii_Cyprinidae_from_the_Adriatic_Sea_Basin_in_Albania

The main biodiversity values of the Seman Basin are sensitive to hydromorphological change, pollution, water abstraction, sediment imbalance, agricultural pressures and disturbance in coastal wetlands. These pressures can affect aquatic habitats, fish migration, spawning areas, wetland vegetation and migratory and wintering birds.

3.2.8 Protected Areas

Protected areas in the Seman River Basin are regulated under Law No. 29/2024 on Water Resources and align with WFD Article 6 and Annex IV. They encompass zones for water supply protection, fisheries, nature conservation, and other areas of special ecological or socio-economic value.

Their designation and management ensure the alignment of Albania's river basin planning with EU water and biodiversity policies. The register includes five categories as follows:

- Drinking water abstraction zones
- Areas designated for the protection of economically significant aquatic species
- Recreational (bathing) waters
- Nutrient-sensitive zones (e.g. nitrate vulnerable zones)
- Natura 2000 sites and nationally designated nature protection areas

Task Report 2 contains the full Register of Protected Areas, also summarized in **Chapter 12**.

4 Hydrological Baseline Characterization

This chapter provides the hydrological baseline, covering climate, hydrometeorology, surface water and groundwater systems, floods, droughts, and observed and projected climate change impacts. A further focus lies on water use and water services, including drinking water supply, agriculture, irrigation and drainage, industrial water use, hydropower, dams, reservoirs, and wastewater infrastructure.

Additional background, technical information and data are presented in the Task Reports 1, 2, 8, 9 and 12.

4.1 Climate and Meteorology

Albania lies within the subtropical belt of the Mediterranean, where climate conditions are strongly influenced by its position along the Adriatic and Ionian Seas and by the country's rugged relief. The Mediterranean climate is characterized by mild, wet winters and hot, dry summers, with most of the annual precipitation concentrated between October and May. The spatial variability of precipitation and temperature across the country is controlled primarily by altitude and exposure to maritime air masses.

In Köppen terms this is the dry-summer temperate (Cs) regime, predominantly Csa/Csb, occurring on the western flanks of continents between 30°–45° latitude^{47 48 49}. Summer dryness reflects the poleward expansion of subtropical highs; winter wetness is linked to the passage of frontal cyclones.

Given its altitudinal gradient, from coastal plains through hilly and mountainous areas, the Seman River Basin (comprising the Osum, Devoll, and Seman rivers) spans several Mediterranean climatic regions. Based on the national climatic classification, the basin extends across four main Mediterranean climate sub-zones:

- I. Lowland Mediterranean Zone — Central Sub-zone
- II. Hilly Mediterranean Zone — Central and South-Eastern Sub-zones
- III. Sub-mountain Mediterranean Zone — Southern Sub-zone
- IV. Mountain Mediterranean Zone — South-Eastern Sub-zone

4.1.1 Lowland Mediterranean Zone — Central Sub-zone

This sub-zone covers the Central Albanian Coastal Plain along the Adriatic, including the lower reaches of the Devoll and Osum rivers, their confluence forming the Seman, and the adjacent estuarine and coastal areas. The climate is distinctly maritime, with mild winters and hot summers. Average annual precipitation varies between 950 and 1200 millimetres, while the number of rainy days ranges from 85 to 100 per year. The maximum 24-hour rainfall with a 100-year recurrence interval lies between 120 and 200 millimetres⁵⁰.

Air temperature is uniformly high throughout the zone, with mean annual values of 15–16 °C and January means of 6.7–7.8 °C. Frost is rare, occurring on only 15 to 30 days per year. The area experiences the strongest winds in the country, a factor that intensifies evaporation and contributes to the formation of storm waves which at times impede the discharge of river waters to the sea during flood peaks. Snow cover is negligible and very short-lived. Overall, the regime is typically Mediterranean, with

⁴⁷ Encyclopedia, B. Mediterranean climate | Definition, Region, Map, & Facts. 2009 2009/08/28; Available from: <https://www.britannica.com/science/Mediterranean-climate>.

⁴⁸ Kottek, M., et al., World Map of the Köppen-Geiger climate classification updated. Meteorologische Zeitschrift, 2006. 15(3): p. 259-263.

⁴⁹ Peel, M.C., B.L. Finlayson, and T.A. McMahon, Updated world map of the Köppen-Geiger climate classification. Hydrology and Earth System Sciences, 2007. 11: p. 1633-1644.

⁵⁰ Mici, A., et al., Klima e Shqipërisë. 1975, Tiranë: [s.n.]. 1-295.

rainfall concentrated in winter and early spring and clear seasonal alternation between wet and dry periods.

4.1.2 Hilly Mediterranean Zone — Central and South-Eastern Sub-zones

Central Sub-zone

The central hilly sub-zone includes the middle courses of the Osum and Devoll rivers and the surrounding uplands that border the coastal plain. Mean annual air temperature ranges from 11 to 13 °C, while January averages are between 4 and 6 °C. Absolute minima usually fall to –7 or –8 °C, occasionally to –12 or –13 °C in cold winters, and exceptionally to –15 or –17 °C in sheltered valleys. The number of frost days decreases southwards and averages 20 to 30 per year⁵¹.

Precipitation is moderate to high, generally 1100–1300 millimetres per year and locally 1600–1800 millimetres in the northern and southern fringes. Rainfall distribution shows a degree of spatial uniformity within the zone. Winter rainfall exceeds that of autumn, and because of the south-western exposure and moderate elevation most precipitation falls as rain. Snow cover is infrequent, lasting only 7–10 days per year. The maximum 24-hour rainfall with a 100-year return period ranges from 200 to 350 millimetres⁵².

South-Eastern Sub-zone

The south-eastern hilly sub-zone embraces the upper parts of the Osum basin near the Vjosa divide; nationally it also includes sectors of the Vjosë and Drinos rivers and the Shushica valley. Relief is predominantly valley-type with a general north-west to south-east orientation and is relatively uniform. Owing to its configuration, the area is exposed to the influence of both the Adriatic and, to a lesser extent, the Ionian Sea.

Mean annual temperature lies between 14 and 15 °C, decreasing to 11–13 °C in the higher parts. The average temperature of January exceeds 5 °C, while absolute minima are typically between –3 and –5 °C. The period with negative temperatures lasts about 30 to 45 days per year. Rainfall is abundant but spatially variable. Rain events are often intense and accompanied by thunderstorms. The number of rainy days varies between 100 and 120 per year, and the maximum 24-hour rainfall with a 100-year recurrence interval ranges from 200 to 250 millimetres⁵³. Snow is an uncommon phenomenon in the lowlands and remains on the ground only for a few days.

4.1.3 Sub-mountain Mediterranean Zone — Southern Sub-zone

The sub-mountain belt forms a transition between the hilly interiors and the mountain ranges. Within the Seman Basin it corresponds to the upper parts of the Osum and Devoll catchments, while at the national scale it also includes the upper Shkumbin and Vjosë basins and parts of the Drin system.

Here the climate becomes distinctly cooler and more continental. Average annual precipitation is about 700 millimetres, considerably lower than in the northern submontane regions, and roughly one-third of this total falls as snow owing to lower air temperatures. The number of freezing days is high, averaging 100 to 110 per year, and the maximum 24-hour rainfall with a 100-year recurrence interval ranges from 90 to 180 millimetres. Altitude and valley orientation exert strong control over seasonal contrasts: winters are cold with frequent and persistent snow cover, whereas summers are relatively warm and dry.

4.1.4 Mountain Mediterranean Zone — South-Eastern Sub-zone

The mountain Mediterranean sub-zone occupies the highest parts of the Seman Basin, specifically the ranges situated between the Vjosa valley to the south and the Shkumbin valley to the north, encompassing the source areas of the Osum and Devoll rivers. It represents one of Albania's drier high-mountain climates.

Annual precipitation varies from 900 to 1 200 millimetres, and the number of days with sub-zero temperatures is smaller than in the northern Alpine regions, although winters remain cold with regular

⁵¹ Mici, A., et al., *Klima e Shqipërisë*. 1975, Tiranë: [s.n.]. 1-295.

⁵² Pano, N., *Pasuritë ujore të Shqipërisë*. 2015, Tiranë: Akademia e Shkencave e Shqipërisë. 1-634.

⁵³ Pano, N., *Pasuritë ujore të Shqipërisë*. 2015, Tiranë: Akademia e Shkencave e Shqipërisë. 1-634.

but moderate snowfall. Despite the higher altitude, the seasonal rhythm retains its Mediterranean character, with precipitation concentrated in winter and spring and warm, dry summers.

Table xx - Characteristics of Mediterranean climatic sub-zones within the Seman River Basin

Climate Zone / Sub-zone	Spatial Coverage in Seman Basin	Mean Annual Temperature (°C)	Precipitation (mm / year)	Rainy Days (per year)	Snow / Frost Characteristics	Other Key Climatic Features
I. Lowland Mediterranean – Central sub-zone	Lower Devoll and Osum; Seman main river and coastal plain near Adriatic	15 – 16	950 – 1200	85 – 100	Snow negligible; 15 – 30 frost days	Strongest winds nationally; high evaporation; storm waves can impede river outflow during floods
II. Hilly Mediterranean – Central sub-zone	Middle Osum and Devoll valleys and adjacent uplands	11 - 13	1100 - 1300 (locally 1600 - 1800)		20 - 30 frost days; 7 - 10 snow-cover days	Winter > autumn rainfall; mostly rain (SW exposure); moderate spatial uniformity of annual rain
II. Hilly Mediterranean - South-Eastern sub-zone	Upper Osum basin near Vjosa divide (also Vjosë, Drinos, Shushica nationally)	14 - 15 (11 - 13 high areas)	1500 - 2000	100 - 120	30 - 45 frost days; snow rare in lowlands	Intense convective storms; strong Adriatic and Ionian influence; relief uniform
III. Sub-mountain Mediterranean - Southern sub-zone	Upper Osum and Devoll; transition hills-mountains	?? (cooler / continental)	~ 700-800 (≈ ⅓ as snow)		100 - 110 freezing days	Cold snowy winters, warm dry summers; strong influence of altitude and valley orientation
IV. Mountain Mediterranean - South-Eastern sub-zone	High ranges between Vjosa (S) and Shkumbin (N); Osum & Devoll headwaters	?? (cold)	900 - 1200		Regular but moderate snowfall	Among Albania's drier mountain regions; retains Mediterranean seasonality but more continental

4.2 Climatic elements controlling the hydrological regime in the Seman Basin

4.2.1 Precipitation

Within the Seman Basin, the precipitation regime reflects a Mediterranean pattern shaped by the interplay of synoptic cyclones and anticyclones, the advection paths of moist maritime air masses from the Adriatic (and locally the Ionian), and strong orographic contrasts between the coastal plain, hilly interiors and mountain headwaters. Spatial variability follows the “vertical zonation” law: precipitation generally increases with elevation through the hills and lower mountains, and the share falling as snow grows with altitude. In the coastal lowland (Lowland Mediterranean – Central sub-zone) annual totals are typically 950–1200 mm and occur almost entirely as rain, whereas the hilly belts receive 1100–1300 mm on average (locally 1,600–1800 mm in the northern/southern fringes of the central hilly zone and up to 2000mm. In the southern submountain belt of the upper Osum–Devoll, annual precipitation averages around 700 mm and roughly one-third falls as snow; the south-eastern mountain sub-zone above the headwaters receives about 900–1200 mm per year⁵⁴.

⁵⁴ Pano, N., *Pasuritë ujore të Shqipërisë*. 2015, Tiranë: Akademia e Shkencave e Shqipërisë. 1-634.

Seasonality is strongly Mediterranean. Across the basin, the wet period of October–May typically contributes about 72% of the annual total, while the dry period of July–November contributes about 28%. Winter is the wettest season, accounting for roughly 33–44% of annual precipitation; spring is transitional, with totals that decrease from March to May and contribute about 21–27% of the annual amount. Summer is generally dry over the plain and hills, with intense convective storms more frequent in the south-eastern hilly sector. Daily 24-hour extremes ($T = 100$ years) span approximately 120–200 mm in the coastal lowland, 200–350 mm in the central hilly zone, 200–250 mm in the south-eastern hilly zone, and 90–180 mm in the southern submountain belt.

4.2.2 Air temperature

Air temperature is a key control on the basin water balance, particularly via evaporation and the phase of precipitation. Temperature decreases with elevation across the Seman Basin, consistent with national vertical gradients on the order of about 0.30–0.70 °C per 100 m (depending on region). Mean annual temperatures are about 15–16 °C on the coastal plain, 11–13 °C in the central hilly interiors and 14–15 °C (11–13 °C at higher sites) in the south-eastern hilly zone. The upper Osum–Devoll submountain belt is markedly cooler and more continental, with frequent wintertime sub-zero conditions; the south-eastern mountain zone is coldest. January means range from 6.7–7.8 °C on the plain to 4–6 °C in the central hills and above 5 °C in the south-eastern hills, while the submountain and mountain belts experience prolonged freezing periods and regular winter snow cover⁵⁵.

4.2.3 Air humidity

Humidity fields modulate both precipitation potential and evapotranspiration demand. Absolute humidity generally decreases from the maritime plain toward the interior and from south toward north, and also decreases with altitude because vapour pressure falls with height by roughly 0.5 mb per 100 m. Relative humidity tends to be higher during the cool season and lower in summer. The coastal lowland exhibits smaller annual amplitudes of relative humidity than interior continental areas, where summer deficits are larger. The seasonal deficit of atmospheric humidity increases from winter to summer and from the coast toward inland valleys, enhancing evapotranspiration particularly across the plain and lower hills.

4.2.4 Wind regime

The wind regime affects both moisture transport and open-water/soil evaporation. Over the Seman lowland and adjacent coast, mean wind speeds are among the highest nationally, which favours high evaporation rates and can generate coastal storm waves that occasionally impede river outflow during major floods. Regionally, northerly winds are most frequent, followed by winds from the southern quadrants; easterly and westerly winds occur less often. Within the interior valleys, local topographic controls channel airflow and can intensify valley–slope circulations during clear-sky periods.

4.3 Hydrology and the Surface Water System

The Seman River Basin has a surface area of 5,649 km² and an average elevation of 863 m above sea level. The main course of the Seman River is 281 km long, and the hydrographic network has a density of 1.9 km/km². The basin is formed by the confluence of the Devoll and Osum rivers at Kozara, and it later receives the waters of the Gjanica River (234 km²) from the left bank near Fier.

Hydrological regime of the Seman River

The Seman River has a multiannual mean discharge of $Q_0 = 95.7$ m³/s, corresponding to a specific discharge of $q_0 = 16.9$ l/s·km². Approximately 60% of this flow originates from the Devoll sub-basin and 40% from the Osum. The minimum discharge during the driest month is $Q_{\min} = 18.7$ m³/s. The river exhibits strong seasonal variability: during the wet period (October–June) 90% of annual flow occurs, while in the dry season (July–September) only 5% of flow is registered, with June representing a transitional month (5% of the annual total).

⁵⁵ Pano, N., *Pasuritë ujore të Shqipërisë*. 2015, Tiranë: Akademia e Shkencave e Shqipërisë. 1-634.

Floods in the Seman basin are mainly rainfall-driven, with limited snow influence. The maximum discharge with a 100-year return period is estimated at 2,870 m³/s. Due to its mountainous relief and erodible soils, the basin produces high suspended sediment loads. Before the construction of the two dams on the Devoll River (Banja and Moglica), the average turbidity was 4,370 g/m³, and annual suspended sediment transport reached $W = 13.2$ million tonnes, representing about 23% of the total suspended sediment yield of Albania's river network. Sediment transport was seasonally uneven, with 82% of the annual suspended load carried in the wet period (October–June) and only 18% in the dry season (July–September). November alone contributed 15% of the annual sediment transport, while August only 3%.

The construction of the Moglicë and Banjë dams has significantly altered this regime by trapping most of the sediment within their reservoirs, reducing sediment continuity downstream. This interruption has led to sediment deficit in the lower Devoll and Seman reaches, promoting channel incision, bank erosion, and reduced sediment delivery to the coastal zone. The effects of these two dams are difficult to quantify since there is a lack of sediment measurements in the downstream areas.

Osum River

The Osum sub-basin covers 2,150 km², with a mean elevation of 828 m and a main channel length of 161 km. The hydrographic density is 1.9 km/km². The river has a multiannual average discharge of $Q_0 = 32.5$ m³/s, equivalent to a specific discharge of $q_0 = 15.7$ l/s·km². Groundwater contributes 13% of total annual runoff, while 87% is surface runoff. The overall runoff coefficient is $\alpha = 0.45$.

Devoll River

The Devoll sub-basin covers 3,130 km², with a mean elevation of 959 m. The river is 196 km long, with a hydrographic density of 2.0 km/km² and a mean channel slope of 6.2 m/km. Its mean annual discharge is $Q_0 = 49.5$ m³/s, corresponding to a specific discharge of $q_0 = 15.9$ l/s·km². The minimum groundwater contribution is 11%, while surface runoff accounts for 89% of the annual flow. The runoff coefficient is $\alpha = 0.47$. The maximum discharge with a 100-year return period is 1,630 m³/s. The annual suspended sediment transport is $W = 8.7$ million tonnes.

Tomorrica tributary

The Tomorrica River, with a catchment of 376 km², has a mean elevation of 378 m and a length of 41.7 km. It has a multiannual mean discharge of $Q_0 = 8.21$ m³/s, equivalent to a specific discharge of $q_0 = 21.8$ l/s·km². Its steep slopes (31 m/km) and wide alluvial valley with meandering planform make it a significant tributary of the Devoll.

Holta tributary

The Holta River drains 227 km², with a mean elevation of 899 m and a length of 30.7 km. It has a multiannual mean discharge of $Q_0 = 6.75$ m³/s, corresponding to $q_0 = 25.3$ l/s·km². Its steep longitudinal profile (40 m/km) and karstic sections contribute to flashy hydrological responses.

Water balance and precipitation-runoff characteristics

The Seman basin receives relatively low average precipitation compared to other Albanian river basins, with a long-term mean of $x_0 = 1084$ mm. The mean annual runoff depth is only $y_0 = 532$ mm, with a high evapotranspiration deficit of $z_0 = 552$ mm. The annual runoff coefficient is low ($\alpha_0 = 0.49$), reflecting the dominance of low-permeability formations and high evaporative losses.

Hydrological implications

The Seman is one of the most turbid rivers of Albania due to its erodible soils, sparse vegetation, and steep topography. Its flow regime is strongly seasonal, with pronounced winter-spring floods and extended summer low flows. The high sediment yield, coupled with intense flood peaks, creates significant flood risks in the Myzeqe plain and influences the morphology and ecological balance of the downstream Karavasta Lagoon and adjacent Adriatic coastal system.

Karavasta Lagoon hydrology

At the river mouth, the Seman interacts with the Karavasta Lagoon, the largest lagoon in Albania (43.3 km²). The lagoon is shallow (average depth around –1.5 m) and communicates with the Adriatic through

three channels. Its hydrological regime is shaped by a delicate balance between rainfall, continental inflow from its 155.2 km² watershed, evaporation, and tidal exchanges with the sea.

The mean annual precipitation over the lagoon area is $X_0 = 931.6$ mm, equivalent to a volume of $40.2 \cdot 10^6$ m³/year. Continental runoff from the catchment contributes $28.1 \cdot 10^6$ m³/year, while annual evaporation losses are higher, estimated at $Z_0 = 1040$ mm or $44.9 \cdot 10^6$ m³/year. This results in a typical negative water balance during dry periods, with summer deficits reaching up to $2.6 \cdot 10^6$ m³. In winter, due to high rainfall and reduced evaporation, the lagoon records a surplus of $+1.7 \cdot 10^6$ m³.

Tidal exchange with the Adriatic, though constrained by the limited capacity of the connecting channels, contributes to the lagoon's hydrological dynamics, with typical exchange flows of 10-30 m³/s. However, reduced tidal penetration makes the lagoon highly sensitive to freshwater inflows, evaporation, and sea-level rise. This balance is critical for maintaining the lagoon's ecological character and highlights its direct link to the Seman River's hydrological regime.

4.4 Hydrogeology and the Groundwater System

The Seman basin includes a wide variety of geological and hydrogeological formations. In order to produce technical material suitable for quantitative and qualitative characterization, the water-bearing units are treated according to water-bearing complexes, taking into account lithology, hydraulic conditions, water-bearing potential, role in supply and representation in the monitoring network.

In this basin, four main groups are distinguished: the alluvial-Quaternary water-bearing complex, the magmatic water-bearing complexes, the carbonate water-bearing complex and practically non-aquiferous formations. The hydrogeological map of the basin at the scale 1:100 000 shows a significant distribution of magmatic formations and confirms the need to treat them separately according to their real water-bearing potential.

Main aquifers according to water-bearing complexes:

Korça alluvial-Quaternary water-bearing complex

The Korça alluvial-Quaternary water-bearing complex is related to Quaternary alluvial and lacustrine deposits, formed mainly by the deposits of the Devoll and Dunavec rivers. This complex is recharged by rainfall infiltration, by rivers and by surrounding water-bearing complexes, including carbonate and fractured magmatic sectors.

The system consists of several gravelly and sandy horizons separated by clayey deposits and peat. The hydrogeological data mention 3-5 up to 7 gravel layers, while the waters of the main horizons are under pressure and in some boreholes show artesian flow. This complex represents the main water-supply unit for the city of Korça and the surrounding villages.

Table xx - Main hydrogeological indicators of the Korça alluvial-Quaternary water-bearing complex

Indicator	Value / description
Hydraulic type	Confined; in some cases, artesian flow
Main lithology	Gravels, coarse gravels, sands, alluvial and lacustrine deposits
Number of water-bearing horizons	4-8 main horizons
Thickness of alluvial deposits	10-15 m according to borehole data
Thickness of water-bearing horizons	12-22 m in different sectors
Piezometric level	2-22 m above ground surface
Absolute elevation of levels	820-880 m
Main direction of groundwater flow	From south to north
Yield of artesian boreholes	0.5-5 l/s up to 20-57 l/s

Table xx - Hydraulic parameters by sector within the Korça alluvial-Quaternary complex

Sector	Filtration coefficient k	Specific capacity q	Technical assessment
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Southern sectors	about 4 m/day	about 0.3 l/s/m	More limited potential; recharge area
Central part of the plain	15-64 m/day	2-5 l/s/m	Better water-bearing potential
Northern part	3-28 m/day	0.3-1.4 l/s/m	Decrease of hydraulic parameters toward the drainage area

Magmatic water-bearing complexes

Magmatic formations in the Seman basin have wide distribution and must be treated as a separate element of the hydrogeological characterization. They do not provide high regional discharges. Their water-bearing potential depends on fracturing, lithological contacts, tectonic zones and geomorphological position.

In this report, magmatic formations are divided into complexes with medium potential, complexes with low potential, complexes with very low potential and formations that are practically non-aquiferous. This division is necessary to avoid the incorrect generalization of all magmatic formations as aquifers of the same type.

Table xx - Classification of magmatic formations according to water-bearing potential

Subdivision	Description	Role in supply
Magmatic with medium potential	Sectors with more developed fractures, tectonic contacts and more stable local springs	Local supply for villages or small points
Magmatic with low potential	Compact rocks with limited fractures; usually low discharges	Small springs, mainly local
Magmatic with very low potential	Few fractures and very limited circulation	Very limited practical importance
Magmatic formations practically non-aquiferous	Massive, compact rocks, without effective fractures for significant circulation	No importance for regional supply

In the Morava area and at the contacts with Quaternary deposits, the springs generally have low discharge. Discharges usually range from 0.1 to 3 l/s, while in Morava springs from 0.01 to 5 l/s are mentioned. Springs smaller than 1 l/s are more common. These data show that magmatic complexes have mainly local importance.

Carbonate water-bearing complex

The carbonate water-bearing complex is related to limestone and dolomitic formations of Triassic, Jurassic, Cretaceous, Paleocene and Eocene age. In sectors where karst is developed, these formations have high water-bearing potential, but at the same time high vulnerability to surface pollution.

The Mali i Thatë-Rakickë sector represents one of the most important units. Hydraulic connections with Lake Prespa and drainage toward the Ohrid/Tushemisht area indicate fast circulation and major karst development. The term karstic is used only where it is important for explaining circulation, discharge and vulnerability to pollution.

Table xx - Main indicators of the carbonate water-bearing complex

Indicator	Value / description
Lithology	Limestones and dolomites
Main recharge source	Atmospheric precipitation and infiltration from Lake Prespa
Useful infiltration coefficient	0.6-0.7 in karstic areas
Total spring discharge	$Q_p \approx 2.5 \text{ m}^3/\text{s}$
Wider Mali i Thatë-Galicicë balance	about 10 m ³ /s
Discharge of individual springs	30-100 l/s in some sectors
Water temperature	9-15°C
Mineralization	0.205-0.423 g/l
Hardness	6-14° German degrees

Hydrochemical type	HCO ₃ -Ca and, less frequently, HCO ₃ -Ca-Mg
Vulnerability	High in sectors with karst development

Practically non-aquiferous formations

This group includes formations that do not have sufficient porosity or effective fractures for significant groundwater circulation. They do not have practical importance for regional supply, but may show very local discharge with low flow. In GWB delineation, these formations should be clearly distinguished from functional water-bearing complexes.

4.5 Flood occurrence and flood risk in the Seman River Basin

The Seman River Basin is one of Albania's flood-prone basins. Flood risk is mainly driven by intense rainfall, rapid runoff from the Devoll and Osum sub-basins, high sediment loads, limited channel capacity in lowland reaches, drainage constraints in the western plain and exposure of settlements, roads, agricultural land and infrastructure.

The basin experiences three main flood types: riverine floods along the Seman, Devoll, Osum and Gjanica rivers; flash floods and erosion-related floods in steeper upland tributaries; and coastal-lowland flooding near the Seman mouth, the Myzeqe plain and the Divjaka–Karavasta coastal zone, where high river levels, drainage congestion, sea-level rise and storm surges can interact. The National Disaster Risk Reduction Strategy includes Seman-specific work on water balance and sediment transport modelling, and links flood risk reduction to hydrological/hydraulic analysis and early warning⁵⁶.

Albania's National Adaptation Plan (NAP) notes repeated major floods in 1962–1963, 1970–1971, 2003, 2005, 2009, 2010, 2013, February 2015 and January 2016, and reports that floods and flash floods are a major share of disaster events, with substantial agricultural damage⁵⁷. Albania's NAP also states that climate change will increase flood frequency and magnitude and that sea-level rise and storm surges are expected to increase coastal flooding.

For the Seman Basin, the most clearly documented recent events include the February 2015 floods, when heavy rainfall raised the Vjosa, Devoll, Osum and Seman rivers above bankfull levels and affected Fier, Berat and other southern districts⁵⁸. The same year, October 2015 floods again affected southern Albania, including Fier and Berat, with flooding linked to the Gjanica and Osum rivers⁵⁹. More recent flood episodes in November 2025 and January 2026 again involved high Seman water levels, inundation of agricultural land and local damage in the Fier, Lushnje and Divjaka areas⁶⁰.

The social and economic impacts are significant. The February 2015 event affected about 42,000 people across the flooded districts, including around 20,000 people in Fier; about 850 families were evacuated, around 2,000 houses were surrounded by water or flooded, livestock was lost, bridges and roads were damaged, and about 17,000 acres of agricultural land were inundated, including about 7,000 acres in Fier. The main recurring impacts in the Seman Basin are damage to agricultural production, livestock, rural housing, local roads, bridges, embankments, drainage infrastructure, electricity supply, drinking water supply and public health conditions. These impacts are concentrated in the lowland floodplain and agricultural areas, but steep tributaries also contribute through flash runoff, landslides, erosion and sediment delivery.

Flood hazard and risk mapping has progressed under Albania's alignment with the EU Floods Directive. The Floods Directive requires a preliminary flood risk assessment, flood hazard maps, flood risk maps

⁵⁶ https://www.undp.org/sites/g/files/zskgke326/files/2024-01/national_drr_strategy.pdf

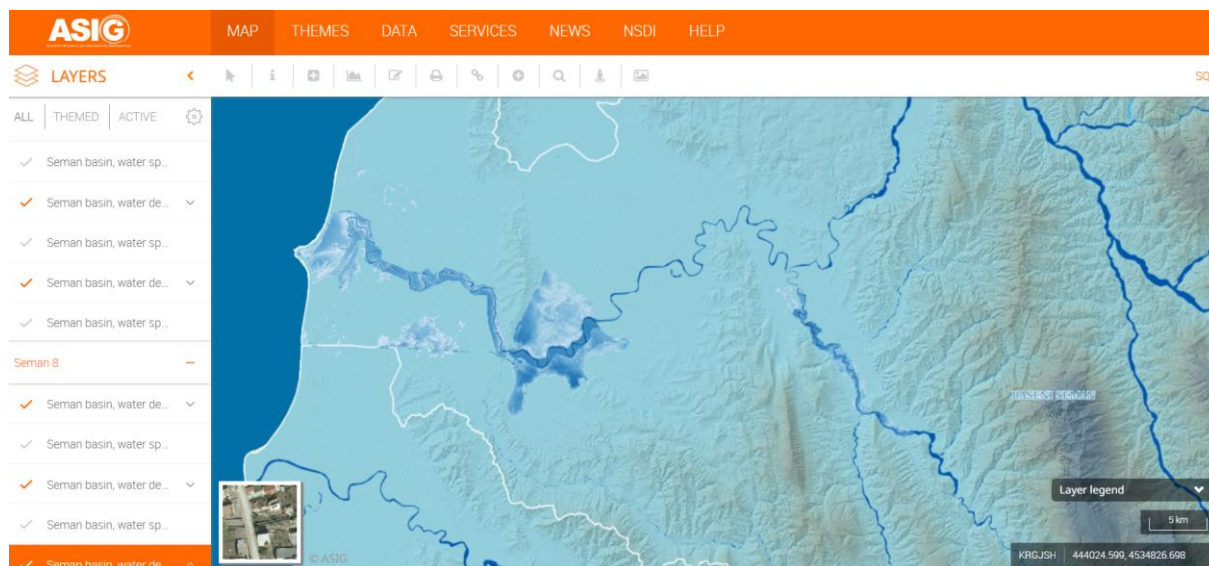
⁵⁷ https://unfccc.int/sites/default/files/resource/National_Adaptation_Plan_Albania.pdf

⁵⁸ The IFRC reported the February 2015 flood event, with 160–200 mm rainfall in three days, rising Vjosa, Devoll, Osum and Seman levels, 42,000 people affected, 850 families evacuated, damage to houses, livestock, farmland, roads and bridges.

⁵⁹ The Observatory for Children's Rights reported that southern Albania experienced two flood episodes in 2015, affecting Fier and Berat, with flooding linked to the Gjanica and Osum rivers and earlier February flooding linked to Vjosa, Seman and Gjanica flows in Fier - [observator.org.al](https://www.observator.org.al)

⁶⁰ AP reported November 2025 flooding after torrential rain, including the Seman River bursting its banks and flooding agricultural land in the low-lying Myzeqeja plain - [AP News](#) / Balkanweb reported January 2026 Seman flooding in Lushnje/Divjaka, including 130 ha of agricultural land inundated near Ngurrëz and Imshtë and additional planted land affected in Grabjan, Divjaka and Dushk - [Balkanweb](#)

and Flood Risk Management Plans (FRMP), with hazard maps showing inundation areas and risk maps showing potential adverse consequences for people, the environment, cultural heritage and economic activity. Under the PRO NEWS process⁶¹, Albania identified Areas of Potential Significant Flood Risk (APSFRs) and developed flood hazard maps for high-risk river stretches, including the Seman, using high-resolution terrain data, field surveys, bridge reconstruction, meteorological data and hydraulic modelling [9]. ASIG⁶² now provides flood hazard and risk layers for the Seman Basin through the national geoportal, including water depth and flow velocity layers for different return-period scenarios.



Map xx – Flood-prone areas in the Seman basin (source: <https://geoportal.asig.gov.al/map/?auto=true>).

The Seman FRMP process is directly used in the RBMP process. The key findings relevant for the RBMP are that flood risk is concentrated in the alluvial and coastal lowlands, that agricultural and rural communities are highly exposed, that embankments and drainage infrastructure require systematic maintenance, and that upstream erosion and sediment transport influence downstream channel capacity and flood hazard. The RBMP integrates these findings based on the work done developing the Albania FRMPs, covering Erzen, Ishëm, Shkumbin, Seman and Vjosa, with 36 APSFRs, hydrological and hydraulic models, flood zone mapping, risk maps, damage estimation, feasibility studies, cost-benefit analysis and an FRMP for each river basin⁶³.

4.6 Drought occurrence and water scarcity in the Seman River Basin

The Seman River Basin is vulnerable to recurrent summer droughts and seasonal water scarcity. Drought pressure is strongest during dry and hot periods, when river flows in the Devoll, Osum, Gjanica and lower Seman decrease while irrigation demand increases. Albania has experienced several severe drought episodes, including the 1989–1991 drought and the droughts of 2003, 2007 and 2017^{64 65}.

⁶¹ CIMA/PRO NEWS reports that Albania's flood hazard mapping identified APSFRs and produced hazard maps for high-risk stretches of the Ishëm, Erzen, Seman, Shkumbin and Vjosa rivers, based on high-resolution DEMs, field surveys, bridge reconstruction, meteorological data and hydraulic modelling - CIMA Research Foundation.

⁶² ASIG Geoportal metadata shows flood hazard/risk layers, including depth and velocity information for return-period scenarios, developed in line with the EU Floods Directive.

⁶³ <https://www.tyasa.com/en/projects/flood-risk-management-plans-in-albania/>

⁶⁴ The World Bank reports increasing drought intensity and frequency in Albania, with the 1989–1991 drought affecting more than 3 million people and causing about USD 24 million in losses; it also identifies severe drought impacts in 2003 and 2007 – <https://documents1.worldbank.org/curated/en/099745002162237184/pdf/P1724700fec9280650aad201dde94af7777.pdf>

⁶⁵ The Drought Management Centre for Southeastern Europe reported that the 2017 spring–summer drought spread across the Balkans, including Albania, and became severe to extreme in parts of the western Balkans - <https://dmcsee.org/data/files/bulletins/2017-season.pdf>.

These events show that drought is not an exceptional hazard but a recurring water management risk. National climate projections indicate increasing temperatures, higher evapotranspiration, reduced summer water availability and more severe drought conditions, especially in central and southern Albania⁶⁶. This trend is directly relevant for the Seman Basin.

Droughts affect the basin through reduced surface water availability, lower reservoir inflows, increased pressure on groundwater, higher irrigation deficits and poorer dilution of pollutants. Agriculture is particularly exposed because the lower Seman plain depends strongly on irrigation for crops, vegetables, orchards and livestock. Field observations in the Seman Basin confirm seasonal scarcity of surface water and a strong influence of agricultural abstraction on river flows. During dry years, competition may increase between irrigation, domestic supply, hydropower, ecological flows and water quality objectives. Low flows also affect ecosystems by reducing habitat availability, increasing water temperatures, concentrating pollutants and weakening the connection between rivers, wetlands, lagoons and coastal waters. In the coastal and deltaic areas, drought can combine with sea-level rise and high irrigation demand, increasing the risk of salinisation of soils and shallow aquifers⁶⁷.

The basin's resilience depends on the condition and operation of reservoirs, irrigation and drainage systems, groundwater resources, monitoring networks and early warning capacity. Albania has improved irrigation and drainage infrastructure, but water efficiency, equitable allocation and maintenance remain critical. There is no available Seman specific drought management plan. However, Albania's national water and disaster-risk policies recognise drought and water scarcity as strategic risks. The National Strategy for Integrated Water Resources Management includes disaster risk reduction and management for drought and floods, while the National DRR Strategy foresees drought risk assessment and stronger early warning systems^{68 69}.

4.7 Global Climate Change and Impacts for Albania

4.7.1 Current state and projections

The latest assessments confirm rapid warming across Europe, fastest of all continents, with the Mediterranean sub-region, which includes Albania, projected to experience hotter, drier summers, wetter winters, and more frequent extremes (heatwaves, droughts, intense rainfall) as warming increases. Europe's first Climate Risk Assessment identifies water resources, energy, food systems, ecosystems/biodiversity, and infrastructure as high-priority risk clusters already reaching critical levels in parts of Southern Europe^{70 71}.

Temperature

Albania is expected to warm substantially this century under all emissions pathways. IPCC's AR6 regional material for Europe reports continued increases in mean temperature and heat extremes, with the Mediterranean showing strong summer warming and longer, more intense heatwaves; these trends intensify with higher global warming levels⁷². Albania's Revised Nationally Determined Contribution⁷³ (NDC, 2021) projects an increase in mean annual temperature of +1.3 to +2.2 °C by 2050, and +1.2 to +4.4 °C by 2100 relative to 1986–2005. Summer warming is strongest, with maximum temperatures on

⁶⁶ The World Bank Climate Risk Country Profile projects increasing water stress in Albania by the 2050s, with the most severe drought conditions expected in central and southern areas - <https://climateknowledgeportal.worldbank.org/sites/default/files/country-profiles/15812-Albania%20Country%20Profile-WEB.pdf>.

⁶⁷ The Adaptation Fund proposal for the Shkumbini and Semani basins identifies summer drought and heat stress, increased irrigation demand, and salinisation risks in deltaic and coastal agricultural areas - https://www.adaptation-fund.org/wp-content/uploads/2024/03/AFB.PPRC_33.Inf_8-Proposal-for-Albania.pdf.

⁶⁸ Albania's National Strategy for Integrated Water Resources Management includes disaster risk reduction and management for drought and floods among its strategic objectives - https://eu4green.eu/wp-content/uploads/2025/02/Study-on-Climate-Change-Adaptation_Volume-I.pdf.

⁶⁹ Albania's National DRR Strategy includes drought risk assessment and strengthening of early warning systems as strategic actions - https://www.undp.org/sites/g/files/zskgke326/files/2024-01/national_drr_strategy.pdf.

⁷⁰ European Environment, A., European Climate Risk Assessment. 2024, European Environment Agency.

⁷¹ Horizon Europe, N.C.P.P., European Climate Risk Assessment - Executive summary. 2024, Horizon Europe NCP Portal.

⁷² IPCC, Regional fact sheet - Europe. 2022, Intergovernmental Panel on Climate Change.

⁷³ Albania's Revised Nationally Determined Contribution (NDC), 2021 - <https://unfccc.int/sites/default/files/2022-08/Albania%20Revised%20NDC.pdf>.

the coast projected to rise by +1.5 °C (RCP2.6) to +6.4 °C (RCP8.5) by 2100, accompanied by many more tropical nights and longer warm spells.

Precipitation

Projections indicate a seasonal redistribution of precipitation: decreases in summer precipitation and increases in heavy precipitation events (especially cool-season) are likely for the Mediterranean, heightening both drought risk (in summer) and flood hazard (from short-duration extremes). Mean annual precipitation is projected to decline by –2% to –4% by 2050 and by up to –12% by 2100 in a high-emissions scenario. The most robust signal is a marked summer drying trend, particularly in southern Albania, with drought indices like the Standardised Precipitation–Evapotranspiration Index SPEI showing a worsening water balance throughout the century.

Sea level rise (SLR)

Global mean sea level has risen ~21 cm since 1900 and reached a record in 2023; by 2100, it is likely to rise ~0.28–0.55 m (very low emissions) to ~0.63–1.02 m (very high emissions), with local variations for the Adriatic/Mediterranean. Such changes will result in more frequent extreme sea levels and increased risk of coastal inundation and erosion⁷⁴. For the Adriatic specifically, recent studies highlight steric (thermal) expansion as a dominant driver to mid-century, with local vertical land motion modulating relative SLR at the coast⁷⁵.

Observed and extreme events in the Western Balkans

In summer 2025, the Western Balkans, including Albania experienced severe drought and heat (up to ~40 °C in Albania), drying rivers, constraining irrigation and hydropower, and prompting energy imports, consistent with the expected rise in compound heat-drought events⁷⁶. Europe also saw its most widespread river flooding in over a decade in 2024, underscoring the increasing volatility of the hydrologic cycle⁷⁷. Heatwaves are projected to intensify, while signals for heavy precipitation remain mixed. However, risks such as short-duration storms, urban pluvial flooding and flash floods in steep catchments are expected to remain significant even with declining summer averages. Fire weather conditions will also become more frequent and severe at ≥ 2 °C of global warming.

4.7.2 Expected implications for Albania

Climate change in Albania is expected to affect the availability of water resources, increase the frequency of floods and droughts, impact the hydropower-dominated energy system, and threaten agriculture, food security, coastal areas through sea-level rise and storm surges, as well as biodiversity and ecosystems.

Water resources & floods/droughts

Hotter, drier summers and greater evaporative demand will intensify hydrological droughts and low flows; conversely, heavier downpours increase flash-flood and river-flood risk, especially in steep catchments. These risks are prominent in EUCRA and IPCC regional findings for Southern Europe^{78 79}. Climate vulnerability profiles for Albania emphasize frequent floods, storms and droughts as key hazards.

Energy sector

Albania's power system depends largely on hydropower, yielding low carbon intensity but high climate exposure. Drought years already force costly electricity imports; climate change is expected to increase power supply volatility and adequacy risks without diversification, storage and demand-side measures⁸⁰. The 2025 heat-drought event again reduced hydropower output and triggered emergency imports, illustrating systemic sensitivity to prolonged dry spells.

⁷⁴ World Climate Research, P., New high-end estimate of sea-level rise projections. 2022, WCRP (wcrp-climate.org).

⁷⁵ Verri, G., Climate projections of the Adriatic Sea: role of river release. *Frontiers*, 2024.

⁷⁶ Associated, P., Western Balkans region faces severe drought and water restrictions during heat wave. 2025, AP News.

⁷⁷ Reuters, Europe had most widespread floods for more than a decade in 2024, scientists say. 2025, Reuters.

⁷⁸ European Environment, A., *European Climate Risk Assessment*. 2024, European Environment Agency.

⁷⁹ Ipcc, *Regional fact sheet - Europe*. 2022, Intergovernmental Panel on Climate Change.

⁸⁰ Emissions Trading, E., THE WESTERN BALKAN POWER SECTOR. 2022, Emissions Trading Extra.

⁸¹ Balkan Green Energy, N., Albania forced to import 80 percent of electricity due to. 2017, Balkan Green Energy News.

Agriculture & food security

Higher temperatures, heat extremes, and summer rainfall deficits will stress rain-fed crops and irrigation demand. Albania's development and climate diagnostics call for climate-smart agriculture, irrigation efficiency, and drought risk management to safeguard yields and rural livelihoods. Coastal salinisation, especially in deltaic and lagoon areas (e.g. the Myzeqe plain near Divjaka–Karavasta), threatens soil productivity and crop viability.

Coasts, wetlands and sea level rise (SLR)

Albania's low-lying Adriatic coast, sandy beaches, deltas and lagoons are vulnerable to relative SLR, storm surge, coastal inundation and erosion. Long-term coastal studies and recent adaptation proposals highlight dynamic shoreline change around river mouths op Shkumbin and Seman and lagoon systems, driven by sediment budgets and rising seas⁸².

Biodiversity & ecosystems

MedECC and EUCRA flag accelerating risks to Mediterranean biodiversity from warming, drought, wildfire, invasive species and coastal squeeze. The Mediterranean hotspot status implies high risks for ecosystems. Coastal wetlands such as Divjaka–Karavasta Lagoon are exposed to combined pressures from sea level rise, erosion, and altered salinity regimes, threatening habitats for flagship species such as the Dalmatian pelican and associated fisheries. Albania's conservation steps, such as declaring the Vjosa River a National Park, support resilience but will need to be paired with basin-scale adaptation to changing hydrology⁸³.

4.7.3 National strategies, commitments and alignment with EU policy

In its pursuit of a resilient and sustainable future, Albania has progressively aligned its national climate policies with European Union frameworks and global climate governance. Through strengthened commitments, updated legislative instruments, and strategic planning across sectors, the country is seeking to translate these goals into coherent action. There is a need to coordinate national action with regional alignment, which is important not only for meeting greenhouse gas reduction targets, but also for ensuring adaptive capacity across vulnerable communities and ecosystems.

To embed this commitment in law, *Law No. 155/2020 on Climate Change* establishes a national legal framework fully in line with EU regulations, providing a backbone for climate governance. Complementing this is the *National Climate Change Strategy (2019)* and the *National Adaptation Plan (NAP)* process, which together steer cross-sectoral adaptation planning across water, agriculture, energy, infrastructure, health, and ecosystems.

Supporting these instruments are several sectoral and reporting mechanisms. The *Fourth National Communication (2022)* delivers updated vulnerability and adaptation assessments in areas such as water resources, agriculture, biodiversity, forestry, soils, public health, disaster risk reduction, tourism, and human settlements. Meanwhile, the *National Energy and Climate Plan (NECP, 2021)* articulate Albania's pathways toward 2030 by having a mitigation ambition the level 20.9% below business-as-usual emissions by 2030, expanded coverage to all main sectors, and set priority adaptation measures for coasts, agriculture, forestry and land use with a focus on energy security⁸⁴. The *Fourth National Communication (2022)* presents updated vulnerability and adaptation assessments for water, agriculture, biodiversity, forestry, soils, health, disaster risk reduction, tourism and settlements⁸⁵.

Table xx - Projected Climate Changes for Albania (IPCC AR6 / MedECC / EEA)

Variable	Historical (1981–2010)	Mid-Century (2041–2070)	End-Century (2071–2100)	Notes
Mean annual temperature	~12–13 °C	+1.5 to +2.5 °C	+3.5 to +5 °C	Strongest warming in summer

⁸² Adaptation Fund / Project, P., Proposal for Albania (Karavasta lagoon coastal morphology). 2024, Adaptation Fund.

⁸³ MedECC: Mediterranean Experts on Climate and environmental Change - Homepage. 2024, MedECC.

⁸⁴ Unfccc, Nationally Determined Contributions Registry. 2024, United Nations Framework Convention on Climate Change (UNFCCC).

⁸⁵ Ministry of, T., Environment, N.A.P.G. Network, and Undp, Albania's National Adaptation Plan: First progress report. 2023, NAP Global Network / Government of Albania.

Variable	Historical (1981–2010)	Mid-Century (2041–2070)	End-Century (2071–2100)	Notes
Summer precipitation	130 mm	–10 to –20 %	–15 to –30 %	Dry season deficits intensify
Heavy rainfall events	Baseline	+10 to +30 % freq.	+20 to +40 % freq.	More flash-flood risk
Sea level rise (Adriatic)	+21 cm since 1900	+0.28–0.55 m	+0.63–1.02 m	Higher if ice-sheet instability

4.8 Water Use and Water Infrastructure

4.8.1 Overview and Summary of Water Services

Provide an overview of the key water services within the river basin, as defined in Article 2(38) of the WFD. This overview supports the identification of pressures, economic analysis, and the application of the cost-recovery principle (Article 9 WFD).

4.8.2 Drinking Water Use and Supply from Surface and Groundwater

Summarise the abstraction and supply of drinking water from both surface water and groundwater sources. Include data on abstraction volumes, supply zones, infrastructure (e.g. intake points, treatment plants, pipelines), and service coverage.

4.8.3 Industrial Water Use and Supply from Surface and Groundwater

Summarise industrial water demands, including the main sectors (e.g. manufacturing, mining, food production) and their sources of supply.

4.8.4 Agricultural Water Use and Supply from Surface and Groundwater

Summarise water use for agriculture, including livestock watering, irrigation, and other rural practices.

4.8.5 Irrigation and Drainage Systems

Irrigated agriculture in Albania

Albania's agricultural sector is a key pillar of its rural economy, contributing approximately 21% to employment and around 18% to GDP⁸⁶ (including agro processing), which is approximately USD 5,3 billion (2025). Given the country's Mediterranean climate and seasonal rainfall, irrigation is essential for ensuring stable and productive agriculture, particularly in the fertile lowland and coastal plains. However, Albania's irrigation infrastructure has suffered from years of underinvestment and institutional reform.

Historically, Albania had one of the most extensive irrigation networks in the Balkans. At its peak in the 1980s, the country had approximately 435,000 hectares of irrigable land. However, after the transition from a centrally planned economy in the early 1990s, much of the infrastructure deteriorated. Today, Albania has an estimated 320,000 hectares of irrigable land, of which only approximately 140,000 hectares are regularly irrigated. The irrigation systems are typically classified into three categories:

- *Gravity-fed systems*: these dominate the landscape and are based on diversion from rivers and streams via weirs and canal distribution systems. Examples include the systems in the Myzeqe plain (around Fier) located in the downstream part of the Seman and Vjose river basins, the upstream part of the Seman river basin and the Drin river basin.
- *Pumping systems*: Located mainly in coastal and low-lying areas where water must be lifted, such as in parts of the regions of Fier, Lezhë, and Durrës.
- *Reservoir-based systems*: Supplied by small and medium-sized reservoirs (over 640 nationwide), primarily in hilly or mountainous areas. These systems help regulate seasonal flows but often suffer from sedimentation and lack of maintenance.

⁸⁶ GDP of Albania: USD 29,27 billion (nominal, 2025), World Economic Outlook Database, October 2024 and International Monetary Fund, March 2025.

Albania has invested substantially in rehabilitation and modernisation of irrigation and drainage systems. Nationally, more than 183,000 ha of irrigation and drainage systems and 44 dams have been rehabilitated, while the Water Resources and Irrigation Project improved 40,000 ha of irrigation and drainage services, rehabilitated 13 dams and supported an Irrigation and Drainage Management Information System for agriculturally intensive municipalities⁸⁷ ⁸⁸. Several investments under this programme were located in the Drin-Buna and Seman River Basins, including schemes in agricultural districts such as Berat and Fier.

Since 2015–2016, Albania has decentralised much of the operation and maintenance of irrigation and drainage infrastructure to municipalities and municipal Irrigation and Drainage Units:

- **Municipalities:** Since the 2015 administrative reform, municipalities are legally responsible for the operation and maintenance of primary and secondary irrigation and drainage systems within their authority. However, their technical and financial capacity is often limited.
- **Water Drainage Boards (WDBs):** Reforms in December 2015 consolidated 13 previous irrigation and drainage boards into four Regional Drainage Boards, each covering major agricultural lowland areas: Lezhë, Durrës, Fier and Korçë. These are regional public bodies tasked with managing large-scale drainage infrastructure and some primary irrigation canals, especially in agriculturally important lowland areas like Fier and Vlora. The WDB of Fier, for example, plays a key role in maintaining the functionality of the vast drainage and irrigation network in the Myzeqe plain, one of Albania's most productive agricultural areas.

The table below provides an overview of key irrigation systems across Albania, highlighting the type of system, the command area in hectares, and the average flow rate during the peak irrigation season (in cubic meters per second).

Table xx - Overview of key irrigation systems across Albania.

Irrigation Region	System /	Irrigation Type	Command Area (ha) regularly irrigated	Average Flow Rate in Peak Season (m³/s)
Myzeqe Plain (Fier)		Gravity-fed (main canals + pumping)	80,000	22.5
Drin Basin (Shkodra/Lezhë)		Gravity-fed + pumping	25,000	7.2
Seman Basin (Berat/Kuçova)		Gravity-fed from reservoirs	18,000	4.8
Korça Plateau		Reservoir-based (gravity)	12,000	3.1
Vjosa Delta (Vlora)		Pumping & gravity (mixed)	10,000	2.5
Durrës Coastal Area		Pumping (lowland/coastal)	8,000	2.0
Devoll Valley		Reservoir-fed (mountain runoff)	7,000	1.8
Lushnja Hills Systems	Reservoir	Reservoir-fed (seasonal creeks)	5,000	1.2

Irrigation supports a wide range of crops in Albania, with variations across regions:

- **Field crops:** Such as wheat, maize, and barley are irrigated to improve yields, especially during dry spring periods.
- **Vegetables:** Including tomatoes, peppers, cucumbers, and onions, mostly grown in the western plains and under greenhouse conditions.
- **Fruit orchards:** Such as apples, plums, and citrus require supplementary irrigation, especially in the summer months.
- **Vineyards and olives:** Increasingly irrigated to boost quality and resilience to climate change.

High-value crops like greenhouse vegetables and fruits are becoming more dominant in irrigated areas, driven by market demand and export potential.

⁸⁷ <https://ewdata.rightsindevelopment.org/files/documents/86/WB-P162786.pdf>

⁸⁸ <https://documents1.worldbank.org/curated/en/099164002202339212/pdf/P1787150025b3e080b06a05a4e240dc694.pdf>

Irrigation & Drainage in the Seman Basin

Irrigation and drainage play a central role in water management in the Seman River Basin. The lower Seman plain, including the agricultural areas around Fier, Lushnjë, Divjakë and Roskovec, depends strongly on regulated surface water supply, reservoirs, irrigation canals, drainage canals and pumping infrastructure. Agriculture uses water mainly during the dry summer period, when natural river flows are lowest and ecological flow needs are most sensitive. This creates a direct WFD-relevant pressure on the quantitative status of surface waters and groundwater, and on the ecological status of rivers, wetlands, lagoons and coastal waters.

The main irrigated crops in and around the Seman Basin include vegetables, forage crops and maize, which are among the most water-dependent crops in Albania. In the Seman irrigation schemes in Fier, Berat and Korçë, important crops include wheat, maize, potatoes, tomatoes, cucumbers, cabbage, carrots and onions. In Fier and Berat, greenhouse production of early vegetables has expanded strongly, increasing the demand for reliable irrigation water and, in some areas, groundwater or pumped drainage water. The lower Seman and Myzeqe plain also support high-value horticulture, including tomatoes, cucumbers, peppers, melons and watermelons, alongside cereals, fodder crops and livestock-related forage production⁸⁹.

Myzeqe Plain has a total command area of 80,000 ha, of which 40,000 ha is part of the I&D system around Fier. Gravity-fed type of irrigation with main canals, secondary and tertiary distribution network and parts are pumped irrigation. Average flow rate in peak season of the Myzeqe Plain is around 22,5 m³/s.

Within this RBMP, irrigation and drainage is treated both as essential socio-economic water user and as significant water pressures. Key management issues include seasonal abstraction, reservoir operation, water losses in canals, drainage of lowland and wetland areas, diffuse nutrient and pesticide pollution, sedimentation of reservoirs and canals, and salinity risks in coastal and deltaic areas.

Climate projections increase the urgency: the Seman RBMP reported an expected 170% rise in water demand between 2019 and 2027, while runoff may decrease by 13.5% due to lower precipitation and higher temperatures⁹⁰.



Discussion in the Fier Drainage Board Office.



Maps and overviews of the drainage and irrigation system around Fier.



Visit at the downstream part of the main outfall drain, close to the sea.

⁸⁹ https://www.adaptation-fund.org/wp-content/uploads/2024/03/AFB.PPRC_33.Inf_8-Proposal-for-Albania.pdf

⁹⁰ https://www.adaptation-fund.org/wp-content/uploads/2024/03/AFB.PPRC_33.Inf_8-Proposal-for-Albania.pdf



Pumping station with a maximum capacity of 4 x 5 m³/s, serving the lower part of the Seman basin. The average water level in this area is around 0,5m below MSL and needs to be drained by pumping. At the moment of our visit, the pumps were not functioning.



Old maps of the irrigation system dated from the '60's.

Secondary canal and distribution box.

Tertiary off take towards a tertiary field canal.

4.8.6 Hydropower, Dams and Reservoirs

Hydropower and artificial storage infrastructure plays a key role in shaping the hydrological and morphological regime of the Seman River Basin, which encompasses the large Devoll and Osum tributary systems. The basin contains a combination of major storage reservoirs (Devoll cascade and Thana complex) and numerous small run-of-river schemes developed since 2008 under concessionary licences. These structures have contributed to national renewable-energy production and agricultural water supply but also introduced significant flow regulation, sediment retention, and ecological fragmentation.

Classification of hydropower installations

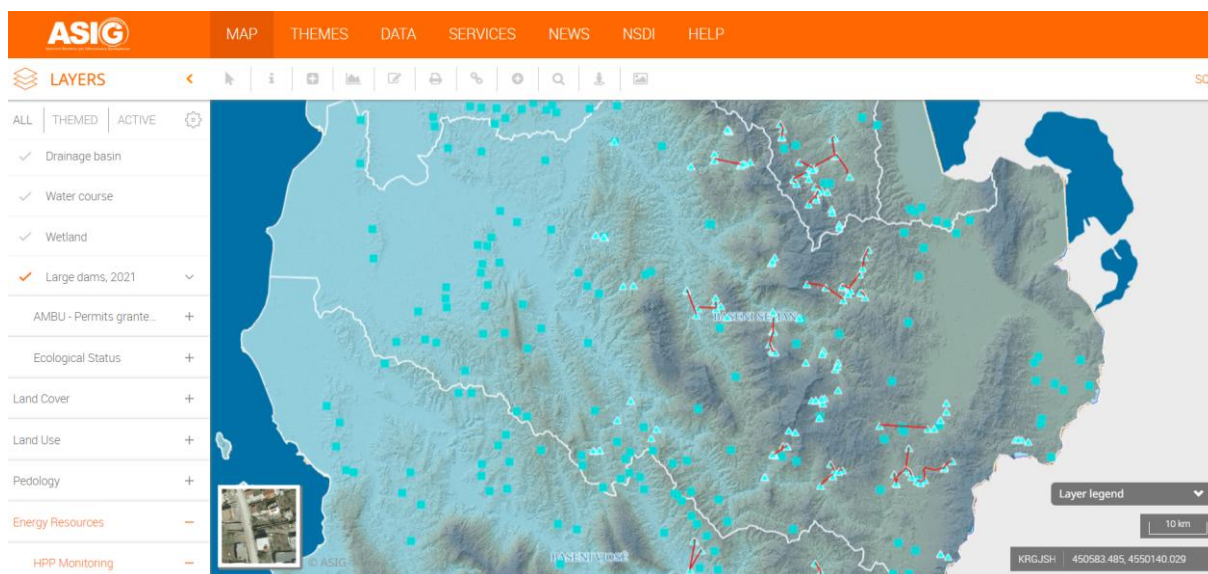
As of 2025, over 90 hydropower plants are licensed or operational in the Seman Basin. Based on their design discharge they can be classified into four groups:

Table xx - Classification of the hydropower plants based on size and configuration (AMBU register, 2025)

Class	Design discharge (l/s)	Typical capacity (MW)	Share of total
Micro	≤ 500	< 1	≈ 25 %
Small	500 – 2 000	1–5	≈ 40 %
Medium	2 000 – 5 000	5–10	≈ 20 %
Large	> 5 000	> 10	≈ 15 %

Most stations belong to the small-hydro class, with short penstocks (1–3 km) and heads of 100–400 m, located mainly in the Gramsh, Skrapar, Kolonjë, and Maliq municipalities. Examples include *HEC Sotira* (64 l/s), *HEC Dobrenji* (80 l/s), *HEC Nishan* (100 l/s) and *HEC Majlindi 2–3* (55–74 l/s).

Larger abstractions exceeding 5,000 l/s include *Kebela*, *Bleteza*, *Blineta*, *Tervoll*, *Vlushë*, *Vokopola 2–3*, and *Denas*, which together represent the basin's main hydromorphological pressures. Predominately most of schemes are of the run-of-river type and 10 % involve multi-intake layouts (two or more water-diversion structures). The multi-intake schemes, common in the Devoll and upper Osum tributaries create sequential dewatered segments.



Map xx – HPPs and (large) dams in the Seman basin (source: <https://geoportal.asig.gov.al/map/?auto=true>).

Administratively, most hydropower schemes fall within Gramsh, Skrapar, and Kolonjë municipalities, which together account for more than half of all concessions in the basin. The licensing pattern shows two development waves: the first (2008–2012) linked to the initial hydropower liberalisation and the second (2018–2024) corresponding to renewed concession rounds and cascade developments. The cumulative effect is a dense network of intakes and conveyance canals in headwater tributaries that collectively modify the flow regime of the Seman's main rivers.

Table xx - Ten largest hydropower installations (AMBU register, 2025)

No.	Hydropower Plant	River / Tributary	Sub-basin	Design Discharge (l/s)	Approx. Capacity (MW)	Type	Year of Licence
1	Banjë HPP (Statkraft)	Devoll River	Devoll	47 100	≈ 70	Storage / Regulating Dam	2016
2	Moglicë HPP (Statkraft)	Devoll River	Devoll	22 000	≈ 172	Storage / Regulating Dam	2020
3	KEBELA HPP	Devoll River	Devoll	30 000	≈ 25	Run-of-river	2023
4	BLETEZA HPP	Devoll River	Devoll	30 000	≈ 25	Run-of-river	2023
5	DENAS HPP	Çemicë / Devoll	Devoll	9 000	≈ 15	Run-of-river	2024
6	BLINETA HPP	Tomorrica	Devoll	7 500	≈ 10	Run-of-river	2022
7	TERVOLL HPP	Holta / Devoll	Devoll	7 500	≈ 10	Run-of-river	2008
8	VLUSHË HPP	Vlushë / Osum	Osum	4 200	≈ 6	Run-of-river	2021
9	VOKOPOLA 3 HPP	Vokopolë / Osum	Osum	4 500	≈ 6	Run-of-river	2020
10	MOLLAJ HPP	Dunavec / Devoll	Devoll	2 600	≈ 4	Run-of-river	2010

Major storage and cascade hydropower plants

Banjë Hydropower Plant

The Banjë HPP on the middle Devoll River near Gramsh was commissioned in 2016 as part of the Devoll Hydropower Cascade operated by Statkraft. The clay-core rockfill dam is 80 m high, impounding a reservoir of 391 million m³ with a surface area of about 14 km². The installed capacity is ≈ 70 MW, producing around 242 GWh yr⁻¹.

Banjë ensures a minimum ecological flow of 4 m³/s, with design floods of 1 812 m³/s (1 in 1 000 years) and ≈ 3 000 m³/s (PMF). The dam provides seasonal storage and daily peaking capability but traps

sediment and modifies downstream hydro-morphodynamics. Monitoring shows local bank erosion and channel incision below the dam, confirming sediment starvation effects.

Moglicë Hydropower Plant

Located upstream, the Moglicë HPP (commissioned 2020) is a 150 m-high asphalt-core dam, one of the largest in the Balkans. It creates a 360 million m³ reservoir (7.2 km²) with 172–177 MW installed capacity and ≈ 475 GWh yr⁻¹ generation. Together, Moglicë and Banjë form the Devoll Cascade (≈ 240 MW total), providing hydropower and flood-control benefits but altering the natural seasonal flow regime and sediment continuity along the Devoll main stem.

Thana Reservoir and its diversion weir

The Thana Reservoir is the largest irrigation reservoir in Albania, built during 1959–1960 in the Lushnjë area. It stores approximately 65 million m³ of water and processes an additional 132 million m³ transferred from the Devoll River via the Vlashuk diversion dam and a conveyance canal with a capacity of 30 m³/s. The main earth embankment dam at Thana is 11 m high, 2 500 m long, with a fill volume of about 13 million m³. The reservoir enables the irrigation of 31 825 ha of agricultural land in the Myzeqe plain, especially around Lushnjë, and supports aquaculture and local fisheries.

The Vlashuk Dam functions as a diversion weir on the Devoll River, directing water through a supply canal to the Thana Reservoir. Together, these structures form an integrated irrigation system that stabilizes downstream flows toward the Myzeqe agricultural plain. Although primarily designed for irrigation and not power generation, their hydraulic operation influences seasonal discharge patterns and sediment flux in the lower Devoll and Seman systems.

The information on the box to be put on annex

Visit to the Thana Reservoir (March, 2025)

- The largest artificial reservoir in Albania, with an estimated capacity of 65 million m³ (Mm³), is primarily used for irrigation.
- The reservoir is supplied via a channel from the Devoll River, which has a watershed of 3,122 km².
- It irrigates the Myzeqe Plain, one of the most fertile regions in Albania, covering a potential irrigated area of nearly 30,000 hectares. The Myzeqe Plain represents 25% of the country's total agricultural production¹.
- Currently, the total irrigated area is less than 30,000 hectares, mainly because there are fewer farmers now than when the reservoir and irrigation system were originally constructed.
- About half of the irrigated area is used for fodder crops, while the other half is cultivated with cereals (wheat and maize), vegetables, and fruit trees. Vegetables and maize are typically irrigated three to five times per year.
- Farmers report a gradual decline in soil fertility and an increase in soil salinity over the years. A water quality analysis conducted in 2010¹ found sodium concentrations up to 2.5 times higher than acceptable standards for irrigation water. Elevated levels of magnesium, phosphates, and potassium were also detected.
- The Irrigation Board, operating under the Ministry of Agriculture, is responsible for the management and maintenance of the dam, intake structures, and primary canals.
- During the irrigation season, daily decisions are made regarding the volume of water to be released from the reservoir. This operational management is done manually, and records are kept of the released water volumes.
- Municipalities are responsible for the secondary and tertiary irrigation infrastructure. Farmers pay a water fee to the municipalities, calculated based on the number of hectares and type of crop.
- In the 1990s, there were attempts to establish Water User Associations (WUAs) to manage and maintain the system collectively. However, these efforts were unsuccessful, as farmers prefer to operate independently and resist collective management structures.
- Maintenance of the irrigation infrastructure remains limited, affecting the efficiency and reliability of the system.



Thana Reservoir: the largest artificial reservoir in Albania.



Main irrigation channel downstream of the dam.

The combination of large storage dams (Moglicë, Banjë, Thana) and numerous small hydropower diversions has significantly altered the natural hydrology of the Seman Basin. Barriers fragment fish-migration routes, reduce flood peaks, and limit sediment delivery to the delta. Reservoirs capture nearly all coarse and fine sediment, intensifying coastal erosion near the Seman estuary.

Under the EU Water Framework Directive, the Devoll main stem (Moglicë–Banjë), Holta, Grabovë, Vokopolë, Gribës, Vlushë, and Thana system are now considered as Heavily Modified Water Body (HMWB). For these water bodies, achieving Good Ecological Potential (GEP) requires:

- Establishing and enforcing ecological-flow releases with seasonal variability;
- Applying ramping-rate limits to avoid abrupt stage changes;
- Installing fish-passage systems and intake screens;
- Implementing sediment-management and bypass procedures.

For smaller diversion plants, monitoring of residual flows and coordination with drought-management protocols is necessary. Cumulative-effects assessments at sub-basin scale, particularly for the Devoll and Osum systems should guide future licensing, mitigation, and restoration measures.

4.9 Summary Water Balance of the Seman River Basin

This paragraph presents the hydrological analysis of the Seman River Basin across five interconnected domains: the general hydrological setting, water body identification, the Devolli Cascade's operational hydrology, the flow regime characterisation of individual water bodies, and the basin-wide water balance under current and projected future climate. Taken together, these analyses reveal a coherent picture of a basin whose water resources are modest by Albanian standards and increasingly under pressure from the combined effects of climate change, intensive hydropower development, agricultural water demand, and industrial pollution. The following cross-cutting findings synthesise the key messages for the River Basin Management Plan.

1. **A basin of inherent hydrological vulnerability.** The Seman has the lowest specific discharge ($16.9 \text{ l/s} \cdot \text{km}^2$) and lowest precipitation ($1,084 \text{ mm/yr}$) among Albania's major rivers. Its runoff coefficients ($0.42\text{--}0.63$) are substantially lower than those in the Drin–Buna ($0.46\text{--}0.93$), indicating that the basin is inherently more sensitive to changes in the water balance. From the water resources perspective, this is the single most important finding: the Seman operates much closer to its “hydrological margin” than other river basins in Albania. For example, where the Drin has “water to spare” (high runoff coefficients meaning that ET increases have a proportionally smaller impact), the Seman does not. The range of vulnerability across sub-basins is wide: the high-altitude Devolli headwaters (Miras, $\alpha = 0.62$) are more resilient (projected worst-case decline of -44%), while the interior Osumi at Çorovodë ($\alpha = 0.42$) faces a potentially catastrophic -78% decline. Water management strategies must be spatially differentiated accordingly.

2. **The Devolli Cascade: a system designed for a wetter climate.** The Moglicë–Banjë cascade (269 MW, 700 GWh/yr) was designed with inflow assumptions of 21.8 m³/s at Moglicë and 47.1 m³/s at Banjë. The 2020–2025 observations already show mean inflows of only 15.5 m³/s and 32.4 m³/s respectively, 29% and 31% below design. Whether this reflects the short record period or an early manifestation of climate change cannot yet be determined, but the water balance projections suggest that design inflows will be increasingly unrealistic. Under SSP2-4.5 mid-century, Banjë inflows would fall to approximately 22 m³/s; under SSP5-8.5 end-century, to approximately 10 m³/s. The cascade simultaneously traps ~1.9 Mt/yr of sediment, interrupting supply to the lower Seman and the Karavasta Lagoon coast. The RBMP should require: (a) seasonally variable environmental flow releases (not a fixed 2 m³/s); (b) sediment bypass or flushing protocols; and (c) revised operating rules that account for declining inflows.
3. **Climate change will produce a “double squeeze” on water resources.** The water balance analysis reveals a particularly insidious mechanism: rising temperatures increase evapotranspiration (+8.3% observed, $p < 0.001$), which consumes a larger share of a precipitation resource that is itself projected to decline (–3 to –18% depending on scenario). The current near-neutral net effect (+0.8% runoff change) is misleading, it reflects the coincidental fact that a statistically non-significant precipitation increase (+4.6%) has temporarily offset the significant ET increase. If, as most models project, precipitation declines in the future while ET continues to rise, runoff will decline from both sides simultaneously. At the basin outlet, runoff declines range from –11% (near-term) to –66% (SSP5-8.5 end-century). The volume lost under the worst case (1,905 Mm³/yr) exceeds the combined cascade storage (793 Mm³) by a factor of 2.4, meaning that the basin’s storage infrastructure cannot compensate for the lost water even if it were operated solely for conservation purposes.

Table xx summarises the projected water balance at the basin outlet (Seman at Mbrostar, A = 5,389 km²) across all scenarios. Colour coding progresses from green (current baseline) through yellow and orange (near-term and mid-century) to red (worst-case end-century), reflecting increasing severity of projected impacts.

Table xx – Summary of the Seman water balance at the basin outlet under climate change scenarios.

Scenario	GWL	Horizon	ΔP (%)	ΔET (%)	Runoff (mm)	Q (m ³ /s)	Vr (Mm ³)	ΔR (%)
Current baseline (2003–2024)	+1.2°C	2003–2024	—	—	536	92	2,890	—
Near-term 2030s	+1.5°C	2021–2040	-3	+4	478	82	2,578	-10.8
Paris 2°C / SSP1-2.6	+2.0°C	2041–2060	-5	+6	444	76	2,391	-17.3
SSP2-4.5 Mid-century	+2.5°C	2041–2060	-8	+10	386	66	2,079	-28.1
SSP5-8.5 Mid-century	+3.0°C	2041–2060	-12	+15	311	53	1,673	-42.1
SSP2-4.5 End-century	+3.0°C	2081–2100	-10	+12	351	60	1,892	-34.5
SSP5-8.5 End-century	+4.5°C	2081–2100	-18	+25	183	31	985	-65.9
B. Sub-basin Vulnerability Ranking (SSP5-8.5 End-century: worst case)								
1	OSUMI - Çorovode	974	0.4	474	106	-77.7	-358	CRITICAL
2	OSUMI - Ura Vajgurore	2,073	0.4	494	119	-75.9	-778	CRITICAL
3	DEVOLLI - Kozare	3,122	0.5	503	152	-69.8	-1095	CRITICAL
4	SEMAN - Ura e Kuçit	5,358	0.5	521	164	-68.6	-1915	CRITICAL

Scenario	GWL	Horizon	ΔP (%)	ΔET (%)	Runoff (mm)	Q (m ³ /s)	Vr (Mm ³)	ΔR (%)
5	SEMAN - Mbrostar	5,389	0.5	536	183	-65.9	-1905	CRITICAL
6	OSUMI - Qafzez	187	0.5	627	241	-61.6	-72	CRITICAL
7	DEVOLLI - Kokel	1,884	0.5	510	230	-55	-528	CRITICAL
8	DEVOLLI - Sheqeras	431	0.6	470	224	-52.2	-106	CRITICAL
9	DEVOLLI - Miras	89.1	0.6	580	323	-44.2	-23	CRITICAL

4. **The vulnerability cascade.** From meteorology through hydrology to livelihoods. The chain of causation runs clearly through the analysis: rising temperatures (Task Report 9, Section 2) increase evapotranspiration and shift the rain/snow ratio; reduced precipitation and increased ET decrease mean runoff (Task Report 9, Section 3.5); lower mean inflows reduce the cascade's generation capacity and operational flexibility (Task Report 9, Section 3.3); declining low flows stress the aquatic ecosystems of individual water bodies (Task Report 9, Section 3.4), particularly the flysch-dominated Devolli tributaries where dry-month flows already approach zero; the Myzeqe irrigation system loses its water supply as Devolli flows decline; and the Karavasta Lagoon's ecological character is degraded by reduced freshwater inputs, higher salinity, and diminished sediment delivery. This interconnected vulnerability underscores the need for an integrated, basin-wide approach to water management rather than sector-by-sector responses.
5. **Priorities for the programme of measures.** Based on the analysis presented in this chapter, the following priorities emerge: (a) establish mandatory seasonal environmental flow releases at each dam of the Devolli Cascade, informed by the Q95 and seasonal FDC data presented in Task Report 9, Section 3.3, with rigorous compliance monitoring; (b) develop climate-adapted reservoir operating rules that account for projected inflow reductions under at least the SSP2-4.5 mid-century planning scenario (–28% runoff); (c) prioritise monitoring and protection of the most vulnerable sub-basins (Osumi at Çorovodë and Ura Vajgurore) where runoff declines of 76–78% are projected under worst-case conditions; (d) modernise the Myzeqe irrigation system, transitioning from flood to pressurised irrigation to reduce water consumption per hectare; (e) establish a comprehensive downstream monitoring programme below the Banjë dam covering flow, sediment, temperature, and ecological parameters; (f) develop and implement sediment management protocols for the Devolli Cascade to restore at least partial sediment continuity to the lower Seman and the Karavasta coastal system; and (g) diversify Albania's energy mix to reduce national dependence on a hydropower system whose inflows are projected to decline by 15–70% within the current century.

5 RIVER BASIN AIMS, SIGNIFICANT WATER MANAGEMENT ISSUES, DRIVERS AND PRESSURES

This chapter defines the overall management aims for the Seman Basin and summarises the main drivers and pressures affecting water resources. It identifies the Significant Water Management Issues (SWMIs), such as hydromorphological alterations, nutrient pollution, water abstraction, and urban wastewater discharges. The chapter links these pressures to their socio-economic drivers (e.g., agriculture, hydropower, tourism) and assesses their relevance across sub-basins. It provides the analytical foundation for later chapters on status assessment, objectives, and measures.

The detailed analysis on the River Basin aims, drivers and pressures and the Significant Water Management Issues (SWMIs), visions and management objectives can be found in Task Report 3. This Task Report was published for a 6 months public consultation period (May 2025 – October 2025), in compliance with the requirements of the Law on Public Consultation, Article 15 and Article 17 and the EU Directive 2000/60/EC – Article 14 – Public Consultation on the development of River Basin Management Plans.

5.1 Overall Seman River Basin aims

The SWMI analysis for the Seman River Basin was carried out in line with the requirements of the EU WFD and based on the DPSIR (Drivers–Pressures–State–Impact–Response) framework. The process combined analysis of available data, national and regional reports, and basin-specific monitoring results. All the identified issues were validated and further informed during a workshop and technical field visit to the Seman River Basin in Berat, February 25, which brought together representatives from various stakeholders, including academia, universities, NGOs, regional and national agencies, and local government authorities.

The Overall River Basin Aims

To ensure sustainable water resources management in the Seman River Basin enabling the protection of the aquatic environment as well as a sustainable socio-economic development and water supply security. In detail, it is aimed for:

- to ensure good quality of surface waters and groundwaters by reducing relevant pressure;
- to ensure good/sufficient water quantity in surface waters and groundwaters through efficient water use.

The Overall River Basin Aims will be backed-up by more detailed *vision & objectives* to be achieved for each Significant Water Management Issue (SWMI):

1. *Climate Change and Impact on Water Resources*
2. *Hydro-meteorological Data & Monitoring*
3. *Protected Areas and Aquatic Ecosystems*
4. *Floods and Droughts*
5. *Pressures on the Hydro Morphology of Surface Waters (dams, hydropower, channel continuity, environmental flows and river morphology)*
6. *Pressures on Surface Water Quantity (water use, abstraction, and permitting)*
7. *Pollution from Urban Settlements and Industries (point sources pollution)*
8. *Pollution from Agriculture and other diffuse sources (diffuse sources pollution)*
9. *Pressures on Groundwater Quality & Quantity*

10. Pressures on Coastal Waters (Quality, Bathing, Habitats and Erosion)

The SWMI visions reflect shared values regarding the jointly identified SWMI that are shared by the River Basin Committee and the involved stakeholders. The visions for the 10 SWMIs describe the principal objectives for the River Basin with a long-term perspective (20+ years).

5.2 Significant Water Management Issues, visions and management objectives

A total of 10 key SWMIs, have been analysed in the basin. These SWMIs represent the primary pressures and threats impacting the Seman River Basin and serve as a foundation for guiding water management planning in line with the EU Water Framework Directive.

5.2.1 SWMI 1 - Climate Change and impact on Water Resources

Climate change is expected to significantly alter the hydrological regime of the Seman River Basin, with reduced precipitation (–3 to –12%, depending on scenario) and increased temperatures (+1.2 –+3.0°C, depending on scenario) by 2060. These changes will intensify seasonal water scarcity, reduce groundwater recharge, and decrease river runoff (–10 to – 42%, depending on scenario) by 2060, affecting irrigation, hydropower, and ecological flows. Higher evaporation and shifting rainfall patterns will further exacerbate water shortages, particularly in the Myzeqe Plain.

Additional risks include droughts, wildfires, and increased eutrophication in lakes and reservoirs. Sea level rise (up to 61 cm by 2100) threatens coastal areas with flooding, salinisation, and habitat loss, notably in Karavasta National Park. Increased climate variability will raise the frequency of floods, flash floods, and landslides in mountainous areas. These developments will negatively impact agricultural productivity and water security. Overall, these pressures pose significant risks to achieving WFD objectives, including good status and no deterioration. The RBMP should integrate climate adaptation measures aligned with national strategies. Strengthened coordination and sustainable financing are essential to enhance climate resilience.

Overall pressure intensity: ●●● (Moderate)

Table xx – SWMI 1: Climate Change and impact on Water Resources (Pressures, Drivers, Impact).

Pressures	Main Driver(s)	Impact
Expected reduction in precipitation: –3 to –12%, depending on scenario by 2060.	Global climate change, regional atmospheric shifts.	- Seasonal water scarcity impacting irrigation, especially in Myzeqe plain. - Reduction in groundwater recharge linked also to change in seasonality of rainfall and type (snow or rain). - Water supply insecurity.
Expected increase of temperature: (+1.2 – +3.0°C, depending on scenario by 2060.	Global climate change, regional atmospheric shifts.	- Higher evaporation rates. - Seasonal water scarcity impacting irrigation, especially in Myzeqe plain. - Increased energy demand for cooling. - Water quality problems (water algae blooms). - Increased droughts and fire risks in forests. - Higher risk of eutrophication especially for the enclosed Belshi lakes and the big reservoirs in the basin.
Expected reduction in river runoff (both annual and seasonal): –10 to – 42%, depending on scenario by 2060.	Global climate change, regional atmospheric shifts.	- Reduced reservoir capacity for irrigation, energy production and water supply. - Inability to provide the expected water volume when most needed (late spring, summer) inability secure the ecological flow, especially for rivers used for hydropower production. - Issues with the engineering network. - Reduction of fish stock and aquaculture potential.

Pressures	Main Driver(s)	Impact
Expected sea level rise by 2050: 20-24 cm / by 2100: 48-61 cm.	Global climate change, regional atmospheric shifts.	- Sea level rise: inundations of wetlands and coastal lowlands; coastal erosion; flooding; salinity in estuaries and coastal aquifers and rising coastal water tables. - Raise in river delta level and potential of stagnant water in floodplain. - Change in biodiversity and aquatic ecosystems. Land loss significantly important for the NP Karavasta.
Increased variability in precipitation / shifts in seasonal rainfall patterns.	Global climate change, regional atmospheric shifts.	- Increased flood frequency and intensity, particularly in downstream areas like Darezeze. - Increased potential for urban floods. - Increased soil humidity impacting agricultural production.
Increase in the frequency of extreme weather events (heavy rains, potential flood risk, strong winds, droughts).	Global climate change, regional atmospheric shifts. Deforestation	- Periods of drought spells in summer and flooding in winter are expected to increase. - Increased risk of flash floods and landslides in mountainous areas of Prrenjas and Gramsh.

Vision: Addressing climate change in water management

Climate change scenarios for Southern Europe project declining precipitation and rising air temperatures, leading to reduced water availability across the country. To tackle this challenge, the RBM plan will integrate adaptation strategies aligned with key national policies, including:

- The Third National Communication on Climate Change
- The National Strategy for Integrated Water Resources Management
- The National Sectoral Program

By proactively incorporating these strategies, we can mitigate climate impacts and ensure sustainable water management for the future.

Management Objectives

- Integrate adaptation measures into the Program of Measures (PoM) within the RBM plan to enhance climate resilience.
- Assess and quantify the basin-specific impacts of climate change, focusing on precipitation, temperature, and variability, using the latest climate scenarios.
- Strengthen meteorological and hydrological monitoring at the basin level to develop accurate water balances for both surface and groundwater at the sub-basin level.
- Secure adequate funding and staffing to support improved monitoring efforts.
- Ensure real-time access and transparency in reservoir operations by sharing up-to-date data on water releases.

5.2.2 SWMI 2 - Hydro-meteorological Data & Monitoring

Effective water management in the Seman Basin is constrained by insufficient hydrological, meteorological, and water quality monitoring. Limited precipitation and flow data reduce flood forecasting capacity, particularly in high-risk areas such as Fier and Divjakë. Inadequate flood risk mapping and unreliable flow data hinder spatial planning and risk management. Water quality monitoring is incomplete, limiting robust status classification under WFD Annex V. Groundwater monitoring is weak, leaving contamination risks in areas such as Patos-Marinzë and the Myzeqe Plain insufficiently assessed. These gaps create uncertainty in Article 5 assessments and policy implementation. Institutional constraints further limit effective coordination and data use. Strengthening real-time monitoring, flood mapping, and reporting systems is essential. Long-term investment in monitoring networks is required to ensure sustainable management and WFD compliance.

Overall pressure intensity: ●●●● (Very High Impact)

Table xx – SWMI 2: Hydro-meteorological Data & Monitoring (Pressures, Drivers, Impact).

Pressures	Main Driver(s)	Impact
Inadequate hydrological monitoring (precipitation, flow data).	Lack of monitoring infrastructure, maintenance, funding, and technical capacity.	- Delayed flood warnings and ineffective risk mitigation in flood-prone areas like Fier and Divjake. - Economic damage especially in greenhouses and rural settlements. - Inadequacy in spatial planning.
Gaps in meteorological stations.	Poor integration of monitoring systems.	Inconsistent flood risk mapping and emergency preparedness. Different probability flows with low statistical confidence.
Inadequate water quality monitoring (chemical status).	Lack of monitoring infrastructure, maintenance, funding, and technical capacity.	- Insufficient data for effective water quality management and EU WFD compliance. - Uncertainty in status designation. - Reporting not in compliance with EU standards.
Inadequate water quality monitoring (biological status).	Lack of monitoring infrastructure, maintenance, funding, and technical capacity.	- Insufficient data for effective water quality management and EU WFD compliance. - Uncertainty in status designation. - Reporting not in compliance with EU standards.
Fragmented data sharing among institutions.	Institutional challenges (poor coordination among NEA, ZABU, and local municipalities).	- Delay in flood response. - Lack of transparency. - Inability for proper measures related to water status improving.
Insufficient groundwater monitoring (quantity and quality).	Lack of monitoring infrastructure, maintenance, funding, and technical capacity.	- Insufficient data for effective water quality and quantity management and EU WFD compliance. - Unidentified risks of groundwater contamination in Patos-Marinzë areas - important for petroleum extraction, and Myzeqe plain area - for nutrients and pesticides in agriculture. - Risk of irreversible damage in groundwater contamination.

Vision: Strengthening water monitoring for effective water resources management

Reliable hydrological, meteorological, and water quality data for both groundwater and surface water are essential for sustainable water resources management. To address this, the RBM plan will emphasize the need for a robust monitoring network and program. A well-functioning monitoring system will:

- Assess climate change impacts on water resources.
- Support effective water allocation.
- Enhance flood forecasting capabilities.
- Strengthen drought management strategies.
- Improve water quality management and environmental flow regulation.
- Ensure compliance with the EU Water Framework Directive (WFD).

By prioritizing data-driven decision-making, we can safeguard water resources and enhance resilience to climate change.

Management Objectives

- Establish a cooperation mechanism among relevant institutions for water resources data exchange, formalized through a Memorandum of Understanding (MoU).
- Develop a *national water resources database* consolidating all relevant water resources monitoring data, ensuring transparent and accessible information.
- Enhance meteorological and hydrological monitoring across the basin to generate reliable water balances at the sub-basin level for both surface and groundwater.
- Secure adequate funding and staffing to strengthen monitoring programs.
- Ensure real-time sharing of reservoir operation data, including water release volumes.
- Reinstate and operate critical flow measurement stations as a priority, under the responsibility of a competent State Agency.

5.2.3 SWMI 3 - Protected Areas and Aquatic Ecosystems

The Seman Basin faces significant challenges in the designation and protection of water-dependent ecosystems (Article 6, Annex IV WFD). Many drinking water sources lack adequate protection zones, increasing risks to public health and chemical status. Incomplete mapping of nitrate-sensitive zones and aquatic protected areas weakens conservation and preventive measures. Hydromorphological pressures, including dam construction (e.g. Banjë), may alter sediment transport and ecosystem connectivity. Habitat degradation from urbanisation, hydropower, and deforestation threatens biodiversity and fish stocks. Additional pressures include overfishing, invasive species, and pollution from diffuse and point sources. These impacts contribute to eutrophication and ecological deterioration of water bodies. Strengthening protection, monitoring, and integration into RBMPs is essential to achieve WFD objectives.

Overall pressure intensity: ●●●● (Moderate to High Impact)

Table xx – SWMI 3: Protected Areas and Aquatic Ecosystems (Pressures, Drivers, Impact).

Pressures	Main Driver(s)	Impact
Lack of Protected Areas designation and mapping.	Institutional challenges for the National Agency for Protected Areas (NAPA). Incomplete registers of Protected Areas for Nitrates Sensitive Areas, designated Zones for Economically Important Species.	• Increased risks to water quality and public health. • Degradation of protected habitats and/or species. • Incompliance with EU legislation.
Protected habitat degradation.	Urbanization / Deforestation / Hydropower development.	• Degradation of riparian habitats.
Overfishing and invasive species.	Lack of regulation and enforcement.	• Overfishing in reservoirs and Karavasta lagoon affecting fish populations. • Degradation of protected habitats and/or species. • The presence (from 2010) of the Blu Crab (<i>Callinectes sapidus</i>), in the Karavasta lagoon as an alien invasive species. • High fish stock impact and changing patterns of existing food webs and ecological niches.
Pollution from upstream sources.	Industrial discharges. Agricultural drainage runoff.	• Increased nutrient loads in artificial reservoirs, leading to eutrophication. • Degradation of protected habitats and/or species.

Pressures	Main Driver(s)	Impact
	Discharging of untreated wastewater. Solid waste	
Riparian zone degradation.	Unregulated land use(urbanization). Tourism development.	- Decreased sedimentation in Devoll river, due to the Banje dam, Vlashuk dam affecting aquatic habitats and water quality. - Degradation of protected habitats and/or species.

Vision: Integrating EU protected area objectives into the RBM Plan

The RBM plan aligns with EU legislation to safeguard Protected Areas and Aquatic Ecosystems, as outlined in the EU Water Framework Directive (Annex IV). These Protected Areas include:

- Drinking water sources – areas designated for the abstraction of water for human consumption.
- Economically significant aquatic ecosystems – habitats supporting commercial fisheries and aquaculture.
- Recreational waters – including bathing waters and other designated leisure water bodies.
- Nutrient-sensitive zones – including vulnerable areas affected by nutrient pollution.
- Biodiversity protection zones – habitats and species conservation areas, including Natura 2000 sites.

The long-term protection of these critical areas will be ensured through the implementation of the Program of Measures (PoM) within the RBM plan, securing their ecological and economic value for future generations.

Management Objectives

- Map and officially designate Protected Areas for both surface water and groundwater.
- Define clear objectives and assess the status of Protected Areas in alignment with EU regulations.
- Secure sufficient funding and staffing to establish a dedicated monitoring program for Protected Areas.
- Enforce regulations and strengthen compliance to protect designated areas and meet conservation objectives.

5.2.4 SWMI 4 - Floods and Droughts

Flooding in the Seman Basin is addressed as a single, integrated risk, focusing on events causing significant damage. Flood risk has decreased following the construction of the Banjë Hydropower Plant, though residual risks remain. Droughts pose increasing challenges, contributing to soil degradation, erosion, and elevated flood risks during extreme rainfall. Climate variability requires integrated management of both floods and droughts under the RBMP. Key priorities include improved hydrological monitoring and real-time data for decision-making. Strengthening early warning systems, risk assessments, and spatial planning is essential. Adequate funding and institutional capacity are critical for effective implementation. These measures support climate resilience and alignment with WFD and Floods Directive objectives.

Pressure Intensity: ●●● (Moderate)

Table xx – SWMI 4: Floods and Droughts (Pressures, Drivers, Impact).

Pressures	Main Driver(s)	Impact
Increase of frequency of flooding events.	Impact of climate change. Deforestation Urbanization in flood-prone areas. Poorly managed reservoirs. Reduced capacity in reservoirs	- Loss of lives - Socioeconomic impacts - Coastal erosion - Habitat loss

Pressures	Main Driver(s)	Impact
Increase of seasonal drought spells.	Impact of climate change. Over-abstraction of water resources (surface water and ground water).	- Seasonal water scarcity impacting irrigation. - Reduced reservoir capacity for irrigation, energy production and water supply. - Groundwater depletion during droughts. - The Kurian Reservoir remains completely dry during the dry season. - Regulating human activities on river terraces is essential to mitigate environmental impacts. - Long droughts dry out the soil, causing more sediment to wash into the river when it rains.
floodplain management.	Unregulated construction in flood planes.	- Increased flood risks in urban areas due to unregulated construction - Loss of agricultural land.

Vision: Stronger action to prepare for floods and droughts

We must take stronger action to prepare for floods and droughts. Climate change is intensifying these extreme events, increasing risks to agricultural lands, drinking water supplies, and critical infrastructure. The River Basin Management Plan will integrate targeted strategies to improve flood protection, ensure water availability during droughts, and enhance preparedness for a changing climate. The RBM plan will integrate targeted adaptation strategies and essential measures to tackle these challenges both now and in the future.

Management Objectives

- Integrate adaptation measures into the Program of Measures (PoM) within the RBM plan to ensure climate resilience.
- Ensure data-driven decision-making for water resource management through enhanced meteorological and hydrological monitoring.
- Improve flood and drought preparedness through transparent and accessible real-time water management data.
- Enhance flood risk reduction through comprehensive planning and risk assessments.
- Implement a Flood Early Warning System to provide timely alerts to populations at risk.
- Establish dedicated spatial planning strategies tailored to flood-prone regions.

5.2.5 SWMI 5 - Pressures on the Hydro Morphology of Surface Waters

Strengthening local authorities and Drainage and Irrigation Boards is key to protecting embankments. With 50% of reservoirs unused, particularly in abandoned areas like Devoll, their removal from inventory and rehabilitation is needed to reduce flooding risks. Hydropower permits should undergo strict review and enforcement to prevent environmental damage. Core objectives include ensuring sustainable river management, restoring natural flow dynamics, minimizing hydro morphological impacts, regulating sand and gravel extraction, and improving river infrastructure to support biodiversity and ecosystem health.

Overall pressure Intensity: ●●●● (Moderate to High Impact)

Table xx – SWMI 5: Pressures on the Hydro Morphology of Surface Waters (Pressures, Drivers, Impact).

Pressures	Main Driver(s)	Impact
Channel and floodplain alterations: the diversion of the Seman River	Flood protection Inappropriate gravel mining. Channelization of rivers because of urbanization.	- Destruction of aquatic habitats. - Separation of natural floodplains from the river because of flood protection schemes. - Significant impact on the hydro-morphological characteristics. The diversion of the Seman River has caused significant damage by altering the morphology of soil layers.

Pressures	Main Driver(s)	Impact
Dams, reservoirs, weirs, locks.	Hydropower development / Irrigation / Flood protection / Urban development / Agriculture. Stricter monitoring of permit conditions and enhanced cooperation with inspection authorities. Unregulated construction on river terraces. Lack of monitoring of river flows. Unused reservoirs.	- Barriers to fish and other species spawning and migrating following the construction of barrages, dams and weirs. - Impact on the sediment balance of a river system, causing erosion/sedimentation. - Nearly 50% of the reservoirs are not in use anymore. Mainly this is the case in abandoned areas caused by migration or lack of local communities. Remove or rehabilitate these structure's, as they contribute to flooding, particularly in the Devoll area.
Hydrological alteration of the natural flow regime.	Hydropower development / Irrigation / Flood protection / Urban development / Agriculture.	- The changed flow regime is likely to have significant damaging impacts on the aquatic ecosystem. - Destruction of aquatic habitats. - Impact on the sediment balance of a river system, causing erosion/sedimentation.
Physical loss / dry riverbeds.	Impact of climate change. Flood protection.	Destruction of aquatic habitats.

Vision: Sustainable management of river systems

Rivers and their natural resources are managed sustainably to support the development of self-sustaining ecosystems and maintain natural flow dynamics, and adapt to climate variability.

Through effective water management and spatial development, river resources are safeguarded to ensure long-term ecological balance and resilience.

Management Objectives

- Ensure the protection and sustainable management of river ecosystems through national policies and regulations.
- Maintain and restore natural flow dynamics to support biodiversity and ecosystem resilience.
- Establish flow regulations that balance ecosystem needs and water use.
- Minimize the negative impacts of hydromorphological alterations to ensure river continuity and habitat connectivity.
- Ensure the sustainable management of river morphology by implementing regulations for sand and gravel extraction, maintaining hydrological continuity, and minimizing environmental impacts to protect aquatic ecosystems and water resources

5.2.6 SWMI 6 - Pressures on Surface Water Quantity (water use, abstraction, and permitting)

The Thana Reservoir fully meets the needs of agriculture. The coordination between the hydropower plant (HEC) and the drainage board ensures a continuous water supply for agriculture. Water use is prioritized for agriculture, and drought management is critical. Collaboration with the HEC prevents water shortages during the summer, maintaining balance.

However, waste deposition in the reservoir is rendering some water distribution channels non-functional. Additionally, there is no water balance register, and one should be established. Participants suggested creating Water User Associations to improve water management. To improve water abstraction management, it is essential to standardize permitting processes, enforce compliance, and ensure regular reporting. Updating and enforcing the Register of Abstractions will help ensure all operators accurately register and report their water usage. Additionally, addressing illegal and non-permitted abstractions through stricter enforcement and licensing can prevent unauthorized water withdrawals and promote sustainable water use.

Overall pressure intensity: ●●● (Moderate Impact)

Table xx – SWMI 6: Pressures on Surface Water Quantity (Pressures, Drivers, Impact).

Pressures	Main Driver(s)	Impact
Abstraction and/or flow diversion for irrigation.	Agriculture.	- It is not a significant issue in the basin. In general, water abstraction points for agriculture are identified. - The volumes of water abstracted from rivers and streams (i.e. not via reservoirs) and used in agriculture for irrigation purposes are not monitored nor reported.
Abstraction and/or flow diversion for industrial water use.	Industrial development.	It is not a significant issue in the basin, only one location in Kukes.
Illegal abstractions (not permitted or regulated).	Institutional challenges. Agriculture / Urban development / Industrial development.	- The lack of formalization makes it impossible to accurately measure the impact on water availability, quality, and ecosystems. - Lack of control is not sustainable from a regulatory perspective.
Losses (up to 60%) in the municipal water supply systems.	Urban development. Lack of operation & maintenance.	Avoidable losses cause significant pressure and impacts on the natural sources.
Operation of reservoirs & hydropower plants.	Flood control, water supply & energy. Institutional challenges.	The water level in reservoirs is managed and regulated in a way that meets all needs. However, challenges remain in the formalization of users and the weak coordination between responsible institutions for water governance.

Vision: Ensure the sustainable use of surface waters

To ensure the sustainable use of surface waters, guaranteeing water security and availability while addressing the impacts of climate variability. Through responsible management and adaptive strategies, we aim to maintain balanced water distribution, support ecosystem resilience, and safeguard long-term water resources for all users.

Management Objectives

- Strengthen inter-institutional cooperation and data exchange to improve decision-making and water governance.
- Ensure balanced water allocation by maintaining water availability at the sub-basin level and preserving ecological flow requirements.
- Enhance meteorological and hydrological monitoring system to improve water resource assessments.

- Improve transparency in reservoir management and planning by enabling real-time data sharing on storage levels and water releases.
- Regulate and monitor water abstractions by standardizing permitting processes and enforcing compliance.
- Reduce municipal water supply losses to a maximum of 10% through improved infrastructure and efficiency measures.
- Increase water storage capacity by upgrading existing infrastructure and developing new ones.
- Improve drainage and water retention systems to enhance resilience against seasonal variability and extreme weather events.

5.2.7 SWMI 7 - Pollution from Urban Settlements and Industries (point sources pollution)

Untreated industrial wastewater discharge is a critical pressure and should be strictly prohibited to prevent further ecological and chemical deterioration. Urban waste accumulation along riverbanks and insufficient wastewater treatment contribute significantly to water pollution. Aquaculture activities introduce additional pressures through chemicals, feed, and antibiotic use, affecting coastal and lagoon ecosystems. These pressures pose risks to achieving good ecological and chemical status under the WFD. Flood risks are addressed under national frameworks, while stormwater overflow is not a major concern. Priority measures include expanding WWTP capacity, improving sewerage infrastructure, and reducing diffuse and point-source pollution. Strengthening monitoring, enforcement, and regulatory frameworks is essential. Promoting wastewater reuse and public awareness supports sustainable and efficient water management.

Overall pressure intensity: ●●●● (Very High Impact)

Table xx – SWMI 7: Pollution from Urban Settlements and Industries (Pressures, Drivers, Impact).

Pressures	Main Driver(s)	Impact
Urban wastewater (treated / untreated).	Urban development.	• Pollution of natural waters by untreated urban and industrial wastewater is one of the most problematic issues in Albania. • Significant environmental impact for aquatic species and reducing the ecological status of waterbodies. • Endangering of public health care. • Impact in Tourism.
Industrial wastewater (treated / untreated).	Industrial development.	• Heavy rainfall often leads to peak pollution events, as runoff washes contaminants from urban, agricultural, and industrial areas into water bodies. • Significantly impact water quality, increasing levels of sediments, nutrients, heavy metals, and pathogens. • Significant environmental impact for aquatic species.
Storm water overflow.	Urban development.	• Leakages of toxic substances, heavy metals, and pathogens can severely degrade water quality, posing significant risks to public health, aquatic ecosystems, and water supply systems. • Downstream part of the Seman RB hosts active oil extraction sites, with many small-scale oil production facilities still in operation. Severe soil contamination is visible around these oil production locations.
Contaminated sites / abandoned industrial sites.	Industrial development.	• Excessive nutrient pollution and the introduction of invasive species and waterborne diseases pose severe risks to water quality and biodiversity.
Urban or industrial waste disposal sites.	Urban development / Industrial development.	
Aquaculture. ●●●	Aquaculture.	

Vision: Minimizing untreated sewage discharge and reducing contamination risk

The goal is to achieve close-to-zero discharge of untreated sewage water from urban and industrial sources by implementing cost-effective technologies, including the safe reuse of treated wastewater.

Additionally, it is essential to minimize contamination from abandoned industrial sites, waste disposal areas, and mining sites.

Management Objectives

- Reduce untreated wastewater discharge from urban, industrial, and agricultural sources.
- Enhance wastewater treatment infrastructure through strategic investment and expansion of treatment capacity.
- Minimize pollution from contaminated sites, including industrial waste areas, mining zones, and landfills.
- Improve sewerage networks to prevent leaks, overflows, and groundwater contamination.
- Promote wastewater reuse in agriculture, industry, and urban applications.
- Strengthen regulatory frameworks for wastewater management, monitoring, and enforcement.
- Increase public awareness and engagement to prevent riverine pollution and promote sustainable water management.

5.2.8 SWMI 8 - Pollution from Agriculture and other Diffuse Sources (diffuse sources pollution)

Agriculture is one of the most important sectors in the region but also one of the highest pressures on water quality due to nutrient runoff and pesticide contamination. Pollution from nitrogen, phosphorus, and pesticides must be managed effectively to prevent the degradation of groundwater and surface water, safeguarding aquatic ecosystems, biodiversity, and human health. In addition to agricultural runoff, contamination from urban areas and roads and atmospheric deposition are present but not at an alarming level.

A robust regulatory framework is essential for effectively managing diffuse pollution from agriculture and ensuring long-term compliance with environmental standards. Strengthening regulations should focus on monitoring, enforcement, and policy integration while providing incentives for sustainable farming practices. Providing training for farmers on proper pesticide storage, handling, and disposal can further reduce contamination risks. Additionally, strengthening safety measures will help prevent and mitigate accidental pollution.

Overall pressure intensity: ●●●● (Moderate to High Impact)

Table xx – SWMI 8: Pollution from Agriculture and other Diffuse Sources (Pressures, Drivers, Impact).

Pressures	Main Driver(s)	Impact
Contamination by agriculture (nutrients and pesticides). <i>Pollutants originate primarily from fertilizer runoff and improper pesticide use.</i>	Agriculture.	• Excessive nutrients and agricultural pesticides in groundwater and surface water pose a serious threat to aquatic ecosystems and reducing biodiversity. • Eutrophication and harmful algal blooms, leading to oxygen depletion and fish dying. • Contamination of drinking water sources. • Accumulation of toxic pesticides, affecting both aquatic life and food safety.
Contamination from urban areas and roads.	Urban development. Transport system.	• Leakages of toxic substances and heavy metals can severely degrade water quality.
Atmospheric deposition.	Agriculture / Industry / Energy production (not hydropower) / Transportation & Traffic / Urban development.	• Acidification of water bodies. • Nutrient overload (eutrophication). • Contamination with heavy metals and toxic substances. • Introduction of Persistent Organic Pollutants (POPs). • Groundwater Contamination.

Vision: Reducing diffuse agricultural pollution

Diffuse source pollution from agriculture, caused by nitrogen, phosphorus, and pesticides should be managed to prevent degradation of groundwater and surface water quality that could pose risks or threats to the aquatic ecosystems, the biodiversity and human health.

Management objectives

- Reach nitrogen and phosphorus (N and P) concentrations in all water bodies as defined in the Albanian standards.
- Promote sustainable agricultural practices to limit the discharge of nutrients and pesticides into surface and groundwater.
- Establish advice and training programs to farmers in proper storage, handling and disposal of pesticide substances.
- Implement safety measures to prevent and mitigate accidental pollution from agricultural activities.
- Strengthen regulatory frameworks for monitoring and enforcing agricultural pollution control measures.

5.2.9 SWMI 9 - Pressures on Groundwater Quality & Quantity

Groundwater is a critical resource in Albania and the Seman Basin, supplying ~90% of drinking water and supporting agriculture. Key aquifers (e.g. Berati, Korça, Rrogozhina) are essential for water security and require protection of both quality and quantity. Groundwater significantly contributes to river flows (30–40% annually; >90% in low-flow periods), sustaining ecosystems. Deterioration of groundwater status directly affects surface waters and dependent ecosystems under the WFD. Groundwater in the Seman Basin is under pressure from over-abstraction, declining levels, and diffuse pollution from agriculture. Excessive fertiliser and pesticide use contribute to groundwater quality deterioration, while waste disposal poses local risks. Illegal and unregistered abstractions hinder effective management and control of groundwater resources.

Groundwater quality

Overall pressure intensity: ●●● (Moderate Impact)

Table xx – SWMI 9a: Pressures on Groundwater Quality (Pressures, Drivers, Impact).

Pressures	Main Driver(s)	Impact
Contamination by agriculture (nutrients and pesticides). <i>Pollutants originate primarily from fertilizer runoff and improper pesticide use.</i>	Agriculture.	Excessive nutrients and agricultural pesticides in groundwater cause contamination of drinking water sources.
Urban or industrial waste disposal sites.	Urban development / Industrial development.	Seepage of toxic substances, heavy metals, and pathogens can severely degrade the groundwater quality, posing significant risks to public health and water supply systems.
Leakage from urban sewer systems.	Urban development / Industrial development.	
Atmospheric deposition. <i>Transfer of pollutants from the atmosphere to land and water bodies through rainfall and dust.</i>	Agriculture / Industry / Energy production (not hydropower) / Transportation & Traffic / Urban development.	- Nutrient overload (eutrophication). - Contamination with heavy metals and toxic substances. - Introduction of Persistent Organic Pollutants (POPs). - Groundwater Contamination.

Vision: Ensuring and restoring groundwater quality for sustainable use and environmental protection

Maintain groundwater quality at levels suitable for all legitimate uses, ensuring it poses no risk to human health or ecosystems. Where groundwater has already been degraded due to human activities, the goal is to restore it to good quality, aligning with environmental standards. Groundwater should not only be viewed simply as a drinking water source but also as a vital component of ecosystems, requiring protection and sustainable management.

Management objectives – Groundwater quality

- Align with the objectives of SWMI 7 and 8 to enhance integrated water resource management.
- Establish groundwater protection zones for drinking water abstraction areas to ensure long-term water security.
- Strengthen groundwater quality monitoring system to accurately assess status and trends (see also SWMI 2).
- Strengthen governance, funding, and institutional capacity to ensure effective groundwater monitoring, enforcement, and management. Prevent contamination from key pollution sources, including agriculture, industry, and urban wastewater, by enforcing strict water quality regulations.

Groundwater quantity

Overall pressure intensity: ●● (Low Impact)

Table xx – SWMI 9b: Pressures on Groundwater Quantity (Pressures, Drivers, Impact).

Pressures	Main Driver(s)	Impact
Increase of seasonal drought spells.	Impact of climate change. Over-abstraction of water resources (ground water).	• Groundwater depletion during droughts. • Depletion of groundwater in Kukes region, affecting drinking water supply.
Groundwater abstraction for municipal water supply.	Urban development / Increasing population / Tourism development.	• Uncontrolled or excessive abstraction has significantly damaging impacts on groundwater resources (water availability).
Groundwater abstraction for industrial water use.	Industrial development.	• The volumes of water abstracted from groundwater resources and used in agriculture for irrigation purposes are not monitored nor reported.
Illegal abstractions (not permitted or regulated).	Institutional challenges. Agriculture / Urban development / Industrial development.	• Lack of control is not sustainable from a regulatory perspective.
Losses (up to 60%) in the municipal water supply systems.	Urban development. Lack of operation & maintenance.	• Avoidable losses cause significant pressure and impacts on the natural sources.
Water intrusion into groundwater		• Increased water quantity causes flooding mostly in urban areas, area of Nen-Shkoder.

Vision: Ensure long-term sustainable use of groundwater resources

Groundwater must be managed to ensure sustainable availability for all legitimate uses while maintaining resilience against climate change and human pressures. By implementing integrated groundwater management strategies, we will balance abstractions with natural replenishment, safeguarding groundwater as a critical resource for future generations.

Management objectives – Groundwater quantity

- Maintain groundwater availability at sustainable, ensuring no risk to human health or ecosystems.
- Balance abstractions with natural replenishment preventing over-extraction and long-term depletion.
- Strengthen groundwater quantity monitoring system to accurately assess status and trends (see also SWMI 2).
- Strengthen governance, funding, and institutional capacity to ensure effective groundwater monitoring, enforcement, and management.
- Regulate and monitor water abstractions by standardizing permitting processes and enforcing compliance.
- Develop a scientific understanding of groundwater systems, including transboundary aquifers, to enable coordinated management.
- Promote conjunctive use of groundwater and groundwater recharge.
- Reduce municipal water supply losses to a maximum of 10% through improved infrastructure and efficiency measures.

5.2.10 SWMI 10 - Pressures on Coastal Waters

Coastal waters in the Seman River Basin, including the Karavasta Lagoon and Seman Delta, are of high ecological, social, and economic importance and fall under WFD and MSFD objectives. They support protected ecosystems (e.g. Divjakë-Karavasta National Park), fisheries, and tourism, but are increasingly under pressure.

Key pressures include riverine pollution from industrial discharges (oil fields), agricultural runoff, and untreated wastewater, leading to eutrophication and declining water quality. Hydromorphological alterations, including dams and uncontrolled gravel extraction, disrupt sediment transport, causing coastal erosion and instability of the delta. Irrigation and drainage canals further intensify nutrient and pollutant loads to coastal waters. Bathing water monitoring is limited, with indications of declining quality, constraining compliance with the Bathing Water Directive.

These combined pressures threaten ecological status, biodiversity, and ecosystem services. Clear delineation and assessment of coastal and transitional waters are required within the RBMP. Strengthened monitoring, pollution control, and integrated coastal management are essential to achieve WFD and MSFD objectives and ensure climate resilience.

Table xx – SWMI 10: Pressures on Coastal Waters (Quality, Bathing, Habitats and Erosion) (Pressures, Drivers, Impact).

Pressures	Main Driver(s)	Impact
Coastal water quality degradation.	Urban development Agriculture	• Untreated wastewater discharge and agricultural runoff causes water pollution in Velipoje and Shengjin; risks to bathing water quality.
Coastal erosion.	Dams and reservoirs for agriculture / industry / energy production.	• Reduced sediment transport due to upstream dams. • Loss of coastal habitats, increased flood risks. • Socio-economical losses.
Expected sea level rise by 2050: 20-24 cm / by 2100: 48-61 cm.	Global climate change, regional atmospheric shifts.	• Sea level rise: inundations of wetlands and coastal lowlands; coastal erosion; flooding; salinity in estuaries and coastal aquifers and rising coastal water tables.
Unregulated coastal tourism development.	Institutional challenges (lack of environmental planning) Tourism development Urban development	• Untreated wastewater discharge causes pollution of coastal waters poses a serious threat to aquatic ecosystems and reducing biodiversity. • Disturbances of coastal ecosystems (noise, shipping).
Insufficient marine water monitoring.	Institutional challenges (limited resources).	• Reduced ability to enforce water quality standards, lack of early detection for contamination.

Vision: Sustainable coastal management in Albania

We are committed to implementing the Cross-Sectoral Coastline Management Plan (2017-2030) to protect and sustain Albania's coastal regions. Our approach directly addresses major threats such as erosion, overfishing, pollution, and the potential impacts of climate change, including sea level rise.

Albania's pristine and undisturbed coastal areas are among its most valuable natural assets. These regions include scientifically and ecologically significant wetlands, while the country's beaches and resorts serve as key drivers of tourism revenue. We are dedicated to preserving these natural treasures by ensuring high-quality bathing water along the entire coastline, safeguarding both the environment and the economic potential of our coastal zones.

Management Objectives

- Review the existing Cross-Sectorial Coastline Management Plan and align its ambition and strategy with the vision and ambitions of the River Basin Management Plan.
- Protect and restore coastal ecosystems to combat erosion with nature-based solutions, establish and maintain protected coastal areas and preserve wetlands and biodiversity.
- Improve water quality and reduce pollution (see also SWMI 3, 7 and 8).
- Ensure sustainable fisheries and maritime management by implementing quotas and eco-friendly fishing practices and establish marine protected areas and restoration plans.
- Adapt to climate change and rising sea levels (see SWMI 1).
- Promote responsible and sustainable tourism, to encourage eco-tourism, regulate coastal development to prevent environmental damage and raise awareness among tourists and local communities.
- Strengthen governance and collaboration to enforce coastal management and environmental laws.
- Construction of coast-parallel dikes

5.3 Main findings and priority actions

Main Findings

The SWMI analysis shows that the Seman basin faces increasing pressures, especially in its lowland areas and coastal zone:

- **Monitoring gaps:** In 2023, water quality was monitored at 8 stations across the basin. Nitrite, nitrate, and total phosphorus levels placed these stations in Class I (high status), but orthophosphates downgraded them to Class II (good status), showing early signs of nutrient pressure. Pesticides and other diffuse pollutants are not systematically monitored, leaving key risks under-assessed.
- **Hydro-morphological alterations:** The basin is affected by channelization, gravel extraction, and deteriorated flood protection structures, which have reduced natural river dynamics and habitat quality. These alterations increase flood risk in some stretches and degrade ecological status.
- **Point source pollution:** Wastewater from urban centers such as Kuçova and Berat is discharged without full treatment, contributing organic loads, nutrients, and bacteriological contamination. Industrial activities in the basin (e.g. oil extraction in Kuçova) add further pressures on both soil and water resources.
- **Diffuse agricultural pollution:** The fertile lowlands are characterized by intensive farming, with high use of fertilizers and pesticides. The lack of buffer zones along rivers accelerates runoff, creating risks of eutrophication and microbiological contamination downstream.
- **Groundwater pressures:** Shallow aquifers are widely used for irrigation, with increasing abstraction in summer months. At the same time, risks of contamination from agriculture and settlements threaten their long-term suitability for drinking water and ecosystem needs.
- **Bathing and coastal waters:** Microbiological monitoring at Seman, Darëzezë, and Divjakë beaches in 2023 showed a decline compared with previous years: while earlier monitoring classified all stations as excellent, recent results show only three excellent, three good, and two sufficient. This trend signals a deterioration in recreational water quality, raising concerns for both tourism and public health.
- **Climate change risks:** The basin is prone to droughts and flash floods, which intensify pressures on irrigation, urban supply, and flood protection infrastructure.

Priority Actions

To respond to these pressures, basin management should prioritize:

- Strengthening monitoring programmes, particularly for pesticides, nutrients, and groundwater, supported by transparent reporting.
- Rehabilitating river morphology and floodplains by regulating gravel extraction, upgrading flood protection infrastructure, and restoring degraded stretches.
- Improving wastewater management, especially in Kuçova, Berat, and other urban areas, by upgrading collection and treatment systems.
- Promoting sustainable agriculture through nutrient management planning, buffer strips, and farmer training to reduce runoff of fertilizers and pesticides.
- Safeguarding groundwater by enforcing abstraction limits during summer, protecting recharge areas, and reducing contamination risks.
- Protecting bathing waters through stricter controls of upstream discharges and continuous microbiological monitoring at Seman, Darëzezë, and Divjakë.
- Integrating climate adaptation into basin planning, including water-saving irrigation, drought response measures, and improved flood resilience.

5.4 Results of the Public Consultation

Task Report 3 was published for a 6 months public consultation period (May 2025 – October 2025), in compliance with the requirements of the Law on Public Consultation, Article 15 and Article 17 and the EU Directive 2000/60/EC – Article 14 – Public Consultation on the development of River Basin Management Plans.

Main results:

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6 CHARACTERISATION AND DELINEATION OF WATER BODIES

In line with Article 5 and Annex II of the WFD, this chapter describes the typology, delineation, and characterisation of surface and groundwater bodies in the Seman River Basin. It explains the criteria and datasets used to define homogeneous units for assessment and management. The section also includes an overview of the delineated Protected Areas, such as drinking water zones, Natura 2000 equivalent sites, and bathing waters. This characterisation provides the spatial and ecological framework for risk and status evaluation, monitoring, and the development of the Programme of Measures.

Detailed analyses of the delineation, and characterisation of surface and groundwater bodies in the Seman River Basin has been prepared and reported in Task Report 1.

6.1 Introduction

The delineation of surface water bodies, groundwater bodies and protected areas forms a fundamental step in the implementation of the Water Framework Directive (WFD)⁹¹ and in the preparation of the Seman River Basin Management Plan. By defining these management units, the competent authorities establish the spatial basis for monitoring, risk assessment, status classification and the development of targeted programmes of measures.

Surface water bodies include rivers, lakes, transitional waters and coastal waters. They are identified and delineated according to their natural characteristics, typology, hydrological continuity, hydromorphological conditions and significant pressures. This enables the application of type-specific reference conditions and ecological quality ratios, as required under WFD Annexes II and V.

Groundwater bodies are delineated on the basis of hydrogeological boundaries, aquifer characteristics, groundwater flow systems and their interaction with surface waters and groundwater-dependent terrestrial ecosystems. Their delineation supports the assessment of both quantitative and chemical status and allows pressures such as over-abstraction, pollution and saline intrusion to be addressed at the appropriate management scale⁹².

Protected areas, including drinking water protection zones, bathing waters, nitrate vulnerable zones, areas important for habitats and species, and areas supporting economically significant aquatic species, are integrated into the WFD framework through Article 6 and Annex IV. Their identification ensures that objectives beyond general good status are also addressed where relevant.

Together, the delineation of water bodies and protected areas provides the operational structure for river basin management. It clarifies where status must be assessed, where objectives apply, where pressures need to be managed, and where measures must be implemented. Without this spatial framework, monitoring, assessment and programme of measures would lack coherence, traceability and accountability.

⁹¹ European Commission (2003). Common Implementation Strategy for the WFD: Guidance Document No. 2 – Identification of Water Bodies. Luxembourg: Office for Official Publications of the European Communities.

⁹² European Commission (2007). CIS Guidance Document No. 15 – Guidance on groundwater monitoring. Luxembourg: Office for Official Publications of the European Communities.

6.2 Characterisation of Surface Water Bodies

6.2.1 Methodological basis

The WFD defines a surface water body as a distinct and significant element of surface water, such as a river, stream, lake, reservoir, canal, transitional water or coastal water. Within the Seman River Basin, surface water bodies are used as the primary management units for assessing ecological and chemical status and for setting environmental objectives.

Each surface water body must be clearly delineated by its geographical location and boundaries. The delineation must be detailed enough to allow a reliable comparison between observed conditions and the environmental objectives of the WFD. At the same time, unnecessary fragmentation must be avoided. The delineation should therefore strike a balance between technical accuracy and practical manageability: water bodies should be sufficiently homogeneous for assessment and management, but not divided into units that add no value for implementing the RBMP.

The delineation process considers three main factors:

1. **Surface water category and typology**
Water bodies are first assigned to the relevant WFD category: rivers, lakes, transitional waters, coastal waters, artificial water bodies or heavily modified water bodies. They are then differentiated into types using descriptors such as altitude, catchment size and geology.
2. **Natural boundaries and hydromorphological characteristics**
Changes in river size, altitude class, geology, hydrological regime, lake or reservoir character, and river continuity may require delineation into separate water bodies.
3. **Significant pressures and expected status changes**
Major pressures, such as wastewater discharges, mining impacts, hydropower installations, abstractions, flood protection works or urban areas, may require upstream and downstream sections to be delineated separately where different status conditions are expected.

This approach ensures that each delineated water body represents a meaningful and coherent management unit for monitoring, classification and the programme of measures.

6.2.2 Surface water categories and typology

Under the WFD, all surface waters must be assigned to one of the following categories: rivers, lakes, transitional waters or coastal waters. Water bodies may also be designated as artificial water bodies (AWB) or heavily modified water bodies (HMWB)⁹³, where the conditions set out in WFD Article 4(3) are met.

Transitional waters are located near river mouths and are partly saline because of their proximity to coastal waters, while still being substantially influenced by freshwater flows. Coastal waters extend one nautical mile from the landward baseline. In Albania, transitional and coastal waters fall within *Ecoregion 6: Hellenic Western Balkan*.

Artificial water bodies are surface waters created by human activity. Heavily modified water bodies are natural water bodies that have been substantially changed in character as a result of physical alterations caused by human use. These designations are relevant for the environmental objectives of the RBMP. Natural water bodies aim to achieve Good Ecological Status and good chemical status, whereas AWBs and HMWBs aim to achieve Good Ecological Potential and good chemical status. Such designations must be justified transparently in the RBMP and cannot be used simply to legitimise existing pressures.

For typology, the WFD allows the use of System A or System B. System A applies a fixed set of descriptors, including ecoregion, altitude, size and geology. System B allows additional or alternative descriptors where sufficient data are available. In Albania, and therefore also for the Seman River Basin,

⁹³ Annex II, CIS Guidance No. 4 on HMWB/AWB

System A provides the most appropriate basis at this stage, because biological, hydrological and ecological datasets remain incomplete.

Typology is essential because ecological status is assessed by comparing observed conditions with type-specific reference conditions. Different river or lake types have different natural characteristics and therefore different reference conditions. A high-altitude mountain stream, for example, cannot be assessed against the same ecological expectations as a lowland river. The main descriptors used for typology are:

- **Altitude**, which influences temperature regimes and biological communities.
- **Size**, which affects flow magnitude, habitat extent, river continuity and ecological functioning.
- **Geology**, which determines natural water chemistry and supports different aquatic communities.

Typology therefore forms the conceptual link between natural conditions, monitoring, status assessment and environmental objectives.

6.2.3 Delineation principles for the Seman River Basin

In the Seman River Basin, delineation follows the WFD principle that one water body should not cross a major typological boundary. Where a river changes from one altitude class to another, where catchment size changes significantly, or where geological conditions differ, a separate water body may need to be defined. This ensures that reference conditions and status assessment remain internally consistent.

Delineation must also reflect significant pressures and impacts. A river reach upstream of a major discharge, abstraction, hydropower installation or mining-affected tributary may have different ecological or chemical status from the reach downstream. In such cases, separate water bodies should be delineated to ensure that monitoring results, risk assessment and measures are correctly linked to the affected section.

The same principle applies to hydromorphological pressures. Dams, reservoirs, flow diversions, flood protection structures and channel modifications can alter river continuity, flow regime, sediment transport and habitat conditions. Where such pressures substantially change the character or functioning of a river reach, the delineation should capture these changes. Where relevant, the water body may be assessed for possible HMWB designation, subject to the full WFD Article 4(3) test.

The delineation must also be forward-looking. Future developments, such as urban expansion, new wastewater treatment infrastructure, water supply abstractions, hydropower development, irrigation schemes or flood protection measures, may change pressures and status. For this reason, long river sections should not be over-aggregated where future status differences are likely. A stable delineation framework reduces the need for repeated changes to water body identifiers and improves continuity between RBMP cycles.

At the same time, the current monitoring network in Albania does not yet provide status information for all delineated water bodies. The delineation for the Seman RBMP therefore combines available data with expert judgement. This is a pragmatic and WFD-consistent approach for this planning cycle, provided that uncertainties are clearly documented and progressively reduced through improved monitoring.

6.3 Surface Water Bodies in the Seman River Basin

Surface water bodies are defined as distinct and significant units of surface water, including rivers, lakes, transitional waters and coastal waters. Artificial Water Bodies (AWBs) and Heavily Modified Water Bodies (HMWBs) are identified separately where physical alterations or artificial origin require a different ecological objective.

6.3.1 River water bodies

For rivers, the WFD-based delineation applies both catchment size and length criteria. As a general rule, rivers with a contributing catchment larger than 10 km² or a river length exceeding 10 km are delineated as separate water bodies. Smaller watercourses are normally not delineated unless they have specific ecological, management or policy relevance, for example where they affect protected areas, drinking water abstractions, bathing waters, Natura 2000-related values, or are subject to significant pressures. All river and lake water bodies in Albania, including those in the Seman River Basin, fall within *Ecoregion 6: Hellenic Western Balkan*.

The Seman River Basin includes **46 river water bodies**. Their characterisation follows System A of WFD Annex II, using altitude, catchment size and geology as key typology descriptors. The delineation also considers hydrological regime, hydromorphological pressures, ecological relevance and likely differences in status. The river water body codes follow the Pfafstetter system⁹⁴. See Tabel xx for a total overview.

River flow regime is a key element for understanding reference conditions and ecological functioning. Where data are available, the flow regime is described using Q10, Q50 and Q90 values, representing high, median and low-flow conditions. Q50 provides a representative measure of average flow, while Q90 is particularly relevant for low-flow and environmental-flow assessment. The ratio Q90/Q50 is used as an indicator of groundwater contribution to river discharge, known as the Base Flow Index (BFI). In Albanian river basins, groundwater commonly contributes at least 30% of annual river flow⁹⁵ and may dominate discharge during summer low-flow periods. Protecting this groundwater-supported baseflow is therefore essential for maintaining environmental flows and aquatic ecosystem functioning.

6.3.2 Lake water bodies

The Seman River Basin also includes **10 lake water bodies**, characterised under System A of WFD Annex II. Lake typology uses altitude, geology, size and depth. Because many Albanian lakes function as reservoirs, the typology also includes the typical annual water-level fluctuation, which directly affects shoreline habitats, littoral zones and ecological status. Most lake water bodies in the basin are artificial or strongly regulated reservoirs created for irrigation and/or hydropower. See Tabel xx for a total overview.

The basin's most significant reservoirs are Banjë, Moglicë and Thana. The Banjë and Moglicë reservoirs form part of the Devoll Hydropower Cascade, with an installed capacity of approximately 240 MW and average annual electricity production above 700 GWh. These reservoirs provide substantial seasonal storage and flow regulation, but they also alter the natural seasonal discharge regime, interrupt sediment transport and create downstream hydromorphological impacts. The Thana Reservoir is the largest irrigation reservoir in Albania. With a storage volume of about 65 million m³ and additional water transfer from the Devoll River, it supports irrigation across approximately 32,000 ha in the Myzeqe plain and also contributes to aquaculture and fisheries.

Several smaller reservoirs, including Pajallia, Kasharaj, Kurjani, Gjanci and Çestijë, play an important local role in agricultural water supply, especially during dry summers. In addition, the basin includes smaller natural and semi-natural lakes, particularly in the Belsh area, such as Vahut i Shkozës and Merhoja. These shallow lowland lakes contribute to biodiversity, landscape value and potential recreation, although they may be exposed to pressures from land-use change and diffuse agricultural pollution.

A major limitation for the current RBMP cycle is that most lake water bodies in the Seman River Basin are ungauged and unmonitored. Their inflow regimes, natural water balances and ecological conditions are therefore not yet quantified. The main exceptions are the Moglicë and Banjë reservoirs, which are monitored for hydropower operation and dam safety, and the Thana Reservoir, which is monitored mainly for irrigation management and transfer flows.

⁹⁴ The RBMP has defaulted to the European-wide river basin numbering system derived from the EC JRC "Catchment Characterisation and Modelling (CCM) coding system. For river waterbodies, the Pfafstetter coding system has been applied.

⁹⁵ Science Academy of Albania, Institute of Hydro-meteorology – "The Hydrology of Albania", Tirana, 1984

6.3.3 Transitional water bodies

The Seman River Basin also includes **5 transitional water bodies**. Transitional waters are located near river mouths, are partly saline due to their proximity to coastal waters, and remain substantially influenced by freshwater flows. In Albania, transitional waters have not previously been systematically delineated in RBMPs and no specific national reference conditions have yet been established. For the Seman River Basin, the downstream transition from river water to transitional water was approximated using a mean tidal range of ± 30 cm. This resulted in the identification of the lowest 2.2 km of the Seman River as a transitional water body. The transitional water bodies are characterised using System A of WFD Annex II and are shown in the relevant RBMP maps. See Tabel xx for a total overview.

6.3.4 Coastal water bodies

For coastal waters, the main objective is to assign coastal stretches to the most appropriate river basin management unit while avoiding unnecessary subdivision. Coastal lagoons may be classified either as coastal or transitional waters, depending on their salinity regime and freshwater influence. In the Seman River Basin, **3 coastal water bodies** have been delineated and characterised using System A of WFD Annex II. See Tabel xx for a total overview.

6.3.5 Artificial- and heavily modified water bodies

Finally, **21 water bodies** in the Seman River Basin have been designated as Artificial Water Bodies or Heavily Modified Water Bodies. AWBs are man-made water bodies, such as canals or artificial reservoirs created where no natural water body previously existed. HMWBs are originally natural water bodies that have been substantially changed in character by physical modifications such as dams, reservoirs, flow regulation, flood protection works, canalisation or water diversions. For both AWBs and HMWBs, the environmental objective is Good Ecological Potential (GEP) and good chemical status, rather than Good Ecological Status. See Tabel xx for a total overview.

The designation of HMWBs must be justified under WFD Article 4(3). This means that the physical modifications must be necessary for important uses, such as hydropower, irrigation, flood protection or water supply, and that the benefits of these uses cannot reasonably be achieved by technically feasible and significantly better environmental alternatives without disproportionate cost. HMWB and AWB designation must therefore remain evidence-based and transparent. For consistency, AWBs and HMWBs are assessed using the typology, quality elements and assessment tools of the natural water category they most closely resemble.

Table xx – Seman River Basin - Waterbody Characterisation – Category RIVERS⁹⁶

River name	Subbasin	EU Code	Altitude (abs)	Area (km ²)	Geology	Typology	River Form	Length (km)	Width (m)	Ecoregion	Q10	Q50	Q90	BFI
Beçi	Devoll	3520766	1060.1	43	Calcareous/mixed	R-11b	NWB	7.6	150	Hellenic western Balkan	0.8	0.5	0.65	0.8
Çëmerica	Devoll	3520764	1006.5	118.5	Calcareous/mixed	R-10b	NWB	6.5	105	Hellenic western Balkan	2	1.2	0.57	2
Devoll	Devoll	352051	198.6	155.9	Calcareous/mixed	R-04	HMWB	33.1	850	Hellenic western Balkan	49	30.6	0.63	49
Devoll	Devoll	352053	198.6	28.4	Calcareous/mixed	R-05	HMWB	7.7	716	Hellenic western Balkan	44.4	27.8	0.63	44.4
Devoll	Devoll	352055	267.9	55.9	Calcareous/mixed	R-11b	HMWB	5	542	Hellenic western Balkan	38.9	26.2	0.67	38.9
Devoll	Devoll	352071	1189.9	26.3	Calcareous/mixed	R-11b	HMWB	8.1	632	Hellenic western Balkan	32.2	21.7	0.67	32.2
Devoll	Devoll	352073	1189.9	44.6	Calcareous/mixed	R-11b	HMWB	10.4	576	Hellenic western Balkan	29.7	20	0.67	29.7
Devoll	Devoll	352075	1189.9	117.8	Calcareous/mixed	R-10b	HMWB	14.1	188	Hellenic western Balkan	28	18.8	0.67	28
Devoll	Devoll	352077	975	29.2	Siliceous	R-14a	NWB	3.1	50	Hellenic western Balkan	19.1	11	0.57	19.1
Devoll	Devoll	3520791	975	157.7	Calcareous/mixed	R-10b	HMWB	20.8	42	Hellenic western Balkan	17.2	9.8	0.57	17.2

⁹⁶ In compliance with WFD Annex II, 1.2 System A – includes AWBs and HMWBs appropriate to the classification. For clarity, AWBs and HMWBs are also summarised under Table 2.9.

Devoll	Devoll	3520793	975	0	Organic/siliceous	R-08a	HMWB	0.7	34	Hellenic western Balkan	15	8.6	0.57	15
Devoll	Devoll	35209-1	948.6	411	Calcareous/mixed	R-10b	NWB	49.7	101	Hellenic western Balkan	7.2	4.7	0.65	7.2
Devoll	Devoll	35209-2	820	226	Calcareous/mixed	R-10b	HMWB	15.6	41	Hellenic western Balkan	15	8.6	0.57	15
Dunaveci	Devoll	35208	838.7	425	Calcareous/mixed	R-10b	HMWB	39.7	69	Hellenic western Balkan	6.5	3.8	0.57	6.5
Grabova	Devoll	352074	801.1	78.4	Calcareous/mixed	R-11b	NWB	16.1	108	Hellenic western Balkan	1.4	0.9	0.67	1.4
Hillli	Devoll	3520543	283.5	174.2	Calcareous/mixed	R-10	NWB	19	300	Hellenic western Balkan	2.9	1.8	0.63	2.9
Novosella	Devoll	3520792	837.5	26	Calcareous/mixed	R-11b	NWB	8.5	13	Hellenic western Balkan	0.5	0.3	0.57	0.5
Osoja	Devoll	3520762	1284.4	89.8	Calcareous/mixed	R-11b	NWB	29.5	32	Hellenic western Balkan	1.6	0.9	0.57	1.6
Pashtreshi	Devoll	3520542	288.9	47.5	Calcareous/mixed	R-11	NWB	17.9	135	Hellenic western Balkan	0.9	0.6	0.67	0.9
Selca	Devoll	352078	980.4	107.1	Calcareous/mixed	R-10b	NWB	53.5	37	Hellenic western Balkan	1.8	1.1	0.57	1.8
Tomorrica	Devoll	35206	576.5	374.7	Calcareous/mixed	R-10	NWB	44.2	380	Hellenic western Balkan	5.8	3.6	0.63	5.8
Vërça	Devoll	352072	503.9	134.8	Calcareous/mixed	R-10	NWB	29.5	410	Hellenic western Balkan	2.3	1.5	0.67	2.3

Zalli Gostimës	Devoll	352052	312	68.2	Calcareous/mixed	R-11	NWB	22.8	220	Hellenic western Balkan	1.2	0.8	0.63	1.2
Çorovoda	Osum	352048	1156.6	135.3	Calcareous/mixed	R-10b	NWB	29.2	239	Hellenic western Balkan	4	3	2.2	0.73
Lapardha	Osum	352042	102.8	156.1	Calcareous/mixed	R-04	NWB	31.8	115	Hellenic western Balkan	5.4	3.5	2	0.58
Osum	Osum	352041	106.4	40.3	Calcareous/mixed	R-05	NWB	13.9	144	Hellenic western Balkan	45.1	29.1	17	0.58
Osum	Osum	352043	106.4	44	Calcareous/mixed	R-05	NWB	8.4	385	Hellenic western Balkan	43.4	28	16.3	0.58
Osum	Osum	352047	473.8	142.3	Calcareous/mixed	R-10	NWB	21.7	212	Hellenic western Balkan	24.4	18.3	13.5	0.73
Osum	Osum	3520451	218.2	7.8	Calcareous/mixed	R-11	NWB	3.5	186	Hellenic western Balkan	39.7	25.6	14.9	0.58
Osum	Osum	3520453	218.2	36.1	Calcareous/mixed	R-11	NWB	7.1	530	Hellenic western Balkan	38.7	24.9	14.6	0.58
Osum	Osum	3520455	218.2	34.6	Calcareous/mixed	R-11	NWB	8	431	Hellenic western Balkan	36.2	23.4	13.6	0.58
Osum	Osum	3520457	473.8	72.8	Calcareous/mixed	R-11	NWB	11	221	Hellenic western Balkan	28.7	21.6	15.9	0.73
Osum	Osum	3520491	514.9	240	Calcareous/mixed	R-10	NWB	21.6	358	Hellenic western Balkan	18.9	14.3	10.5	0.73
Osum	Osum	3520493	1087.6	348.3	Calcareous/mixed	R-10b	NWB	32.5	214	Hellenic western Balkan	16.1	13.4	10.9	0.81

Osum	Osum	3520496	900.5	243	Siliceous	R-14b	NWB	41.8	164	Hellenic western Balkan	5.7	4.8	3.9	0.81
Staravecka	Osum	3520492	726.2	49.5	Calcareous/mixed	R-11	NWB	22.8	254	Hellenic western Balkan	1.4	1.1	0.8	0.73
Velabisht	Osum	352044	397.4	184.8	Calcareous/mixed	R-10	NWB	36.9	260	Hellenic western Balkan	5.4	4.1	3	0.73
Vërtopi	Osum	3520456	495.3	46.3	Calcareous/mixed	R-11	NWB	13.2	56	Hellenic western Balkan	1.6	1	0.6	0.58
Vodica	Osum	3520454	255.1	63.3	Calcareous/mixed	R-11	NWB	19.3	110	Hellenic western Balkan	1.8	1.4	1	0.73
Vodica e sipërme	Osum	3520494	1041.3	54.1	Calcareous/mixed	R-11b	NWB	14.2	217	Hellenic western Balkan	1.4	1.2	0.9	0.81
Vokopola	Osum	352046	616.6	151.6	Calcareous/mixed	R-10	NWB	32.4	164	Hellenic western Balkan	4.5	3.4	2.5	0.73
Zagora	Osum	3520452	162.3	33.8	Calcareous/mixed	R-05	NWB	18.7	34	Hellenic western Balkan	1.1	0.7	0.4	0.58
Gjanica	Seman	35202-1	158	232	Calcareous/mixed	R-04	NWB	63.5	113	Hellenic western Balkan	6.87	5.17	3.8	0.73
Gjanica	Seman	35202-2	158	1.4	Calcareous/mixed	R-05	HMWB	6.2	59	Hellenic western Balkan	6.92	5.21	3.82	0.73
Seman	Seman	35201	3.8	44.4	Calcareous/mixed	R-05	HMWB	33.9	131	Hellenic western Balkan	152.9	101.1	63.1	0.62
Seman	Seman	35203	13.8	815.4	Calcareous/mixed	R-04	HMWB	55.7	197	Hellenic western Balkan	141.4	93.8	58.6	0.63

More detailed calculations on the environmental flows, including exceedance probabilities of 50%, 75%, 80%, 85%, 90%, 95%, 97%, and 99% are analysed and presented in Task Report 1. Recommended values to be used for environmental flow are between 90% and 99%.

River Name	Subbasin	Brief description of the river
Beçi	Devoll	The Beçi River is a steep, headwater tributary of the upper Devoll River, draining a 43 km ² catchment at an average elevation of 1,060 m. With a channel length of 7.6 km, it discharges directly into the Moglicë Reservoir, contributing to its inflow regime.
Çemërica	Devoll	The Çemërica River is a mountainous tributary of the upper Devoll, draining a 118.5 km ² catchment at an average elevation of 1,006 m within the Hellenic Western Balkan ecoregion. With a channel length of 6.5 km, it flows directly into the Moglicë Reservoir, contributing to both inflow and sediment dynamics of the Devoll hydropower scheme
Devoll	Devoll	The Devolli River, the largest tributary of the Seman, drains a rugged basin of 3 220 km² in southeastern Albania, with an average altitude of 959 m and a river length of 196 km. Originating at 1,900 m elevation near the Albanian-Greek border, it flows through the Bilisht plain and the former Maliq marsh before entering a series of narrow gorges. The basin is largely mountainous, with over 55 % of its area between 800–1400 m, and features diverse lithologies ranging from karstic limestones in its headwaters to flysch and Quaternary deposits downstream. Hydrographic density is high (2.0 km/km²), and the river is characterized by moderate annual flow ($Q_0 \approx 49.5 \text{ m}^3/\text{s}$) with a low runoff coefficient ($\alpha = 0.47$) due to limited groundwater contribution (11 %). The Devolli is heavily regulated by two large hydropower reservoirs, Banjë and Moglicë, operated under a single concession. It contributes nearly 60 % of the total discharge of the Seman River and provides vital irrigation water to the Myzeqe plain via the Thana reservoir and 37 km of main canals. The sub-basin includes key tributaries such as the Tomorrica River and Holta Stream and shows high erosion rates, yielding about 8.7 Mt/yr of suspended sediment. Seasonal flow variability is pronounced, with peak discharges during winter and early spring. The Devolli's basin faces growing challenges from sedimentation, hydrological alteration, and climate-induced reductions in summer flow.
Dunaveci	Devoll	The Dunaveci River is a tributary of the Devoll River, draining a 425 km ² basin at an average elevation of 839 m. Extending 39.7 km, it flows through a region influenced by irrigation infrastructure and contributes significantly to the regulated inflows of the Devoll system downstream of the Moglicë dam. Its lower course is classified as HMWB due to altered morphology and flow regime from water abstractions and channel modifications.
Grabova	Devoll	The Grabova River is a natural water body (NWB) in the middle Devoll basin, draining a 78.4 km ² mountainous catchment at an average elevation of. Its 16.1 km course is shaped by steep terrain and a south-eastern mountainous Mediterranean climate, with cold winters and significant snowfall contributing to a snowmelt-dominated flow regime. Seasonal runoff is typically high in spring due to snowmelt from surrounding elevations, making it a key contributor to the seasonal flow variability of the Devoll River.
Hillli	Devoll	The Hilli River is a natural water body (NWB) draining a 174.2 km ² catchment in the lower Devoll basin, at an average elevation of 284 m. With a channel length of 19 km, it flows westward and discharges directly into the Banjë Reservoir, contributing to its regulated inflows and sediment load.

River Name	Subbasin	Brief description of the river
Novosella	Devoll	The Novosella River is a small natural tributary of the Devoll. With an average elevation of 838 m and a channel length of 8.5 km, it flows through the Maliq plain, where it collects agricultural drainage from intensively irrigated fields, particularly wheat and maize, potatoes, vegetables, and fruits. As a result, it plays a role in conveying both surface runoff and agrochemical residues into the Devoll River. Maliq plain is a major agricultural area with extensive irrigation systems on former wetlands that were drained to create fertile farmland. The reclaimed land supports cultivation of grains such as wheat and maize, potatoes, vegetables, and fruits using irrigation water from Devoll and local drainage networks. The plain is agriculturally important and relies on irrigation to sustain crop production
Osoja	Devoll	The Osoja River is a mountainous natural tributary of the Devoll, draining an 89.8 km ² catchment at an average elevation of 1,284 m within the Hellenic Western Balkan ecoregion. Its 29.5 km channel flows into the Moglicë Reservoir, contributing snow-fed runoff and sediment to the upper Devoll hydropower system.
Pashtreshi	Devoll	The Pashtreshi River is a natural tributary of the lower Devoll, draining a 47.5 km ² catchment at an average elevation of 289 m within the Hellenic Western Balkan ecoregion. With a channel length of 17.9 km, it discharges directly into the Banjë Reservoir, contributing to the regulated inflow of the Devoll hydropower system.
Selca	Devoll	The Selca River is a natural tributary of the Devoll, draining a 107.1 km ² catchment at an average elevation of 980 m in the Hellenic Western Balkan ecoregion. With a channel length of 53.5 km, it originates from mountainous terrain and contributes seasonally variable flow and sediment to the middle Devoll basin.
Tomorrica	Devoll	The Tomorrica River is the largest tributary of the Devoll, draining a 374.7 km ² basin at an average elevation of 577 m in the Hellenic Western Balkan ecoregion. Its 44.2 km course flows northwest from the limestone slopes of Mount Tomorr, forming a wide alluvial valley before joining the Devoll near Gramsh. With a steep upper gradient (31 m/km), the river displays strong seasonal variation and contributes significantly to sediment and surface runoff in the middle Devoll basin.
Vërça	Devoll	The Vërça River flows into the Devoll from the southeast, draining a 134.8 km ² catchment at an average elevation of 504 m within the Hellenic Western Balkan ecoregion. Located in the southeastern mountainous Mediterranean climate zone, the basin experiences cold winters with substantial snowfall above 600–700 m, resulting in a nival-pluvial flow regime with pronounced spring runoff from snowmelt, similar to the nearby Grabova River.
Zalli Gostimës	Devoll	The Zalli Gostimës stream drains a 68.2 km ² catchment at an average elevation of 312 m. Its 22.8 km course joins the Devoll River approximately 6 km downstream of the Banjë Dam, contributing unregulated surface runoff and sediments to the post-dam section of the river.
Çorovoda	Osum	The Çorovoda stream drains a 135.3 km ² mountainous catchment at an average elevation of 1,157 m. Its 29.2 km course flows through rugged limestone terrain before joining the Osum River upstream of the Osum Canyon, contributing cold, fast-flowing runoff with seasonal snowmelt influence.
Lapardha	Osum	The Lapardha stream is a 31.8 km tributary of the Osum River, draining a 102.8 km ² catchment at an average elevation of 156 m. Its flow regime is driven by seasonal rainfall, with limited regulation and no major hydraulic infrastructure. The basin overlies porous alluvial formations linked to the Berat–Lapardha aquifer, which supports local baseflow. Despite the presence of irrigation channels, water availability remains unreliable, and runoff is highly sensitive to seasonal variability due to the area's dependence on precipitation and shallow groundwater reserves.
Osum	Osum	The Osumi River is the second major tributary of the Seman River, draining a mountainous basin of 1,931 km ² in south-central Albania, with an average elevation of 828 m and a total river length of 161 km. It originates at about 1,700 m elevation in the Vithkuq highlands and flows northwest through deep valleys and gorges, including the Osum Canyon near Çorovodë. The basin is dominated by elevations between 200–1400 m, accounting for over 66 % of its area, and is characterized

River Name	Subbasin	Brief description of the river
		by flysch formations, karstic limestones, and ultrabasic rocks. The hydrographic network is dense (1.9 km/km²), and surface runoff dominates the hydrology, contributing 87 % of annual discharge ($Q_0 \approx 32.5 \text{ m}^3/\text{s}$), while groundwater input is limited (13 %). Key tributaries such as the Velabisht and Lapardha streams drain into the Osumi, which converges with the Devolli near Kozarë to form the Seman River. The basin shows moderate to high sediment transport due to steep slopes, poor vegetation cover, and highly erodible formations. The Osumi's runoff coefficient is relatively low ($\alpha = 0.45$), and its seasonal flow regime is typical of Mediterranean mountain rivers, with pronounced winter–spring discharge peaks and summer low flows. Though hydrologically less regulated than the Devolli, the Osumi basin plays a crucial ecological and hydrological role in sustaining the Seman system and supporting agricultural and domestic water use in the municipalities of Berat, Poliçan, and Skrapar.
Staravecka	Osum	The Staravecka stream drains a 49.5 km ² catchment in the Osum basin, with a mean elevation of approximately 726 m. Its flow regime is primarily rainfall-driven, characterized by steep gradients and rapid hydrological responses to precipitation. Due to limited baseflow buffering and moderately permeable terrain, runoff is highly seasonal, with significant variation between wet and dry periods. Groundwater storage is relatively low, and no major hydraulic infrastructure exists within the catchment, resulting in minimal flow regulation.
Velabisht	Osum	The Velabisht stream is a 36.9 km-long tributary of the Osum River, draining a 184.8 km ² catchment at an average elevation of 397 m within the Hellenic Western Balkan ecoregion. It flows through the peri-urban and agricultural areas of Berat, where runoff is influenced by rainfall and shallow alluvial groundwater. The basin includes parts of the porous Berat–Lapardha aquifer, known for moderate to high hardness and increasing nitrate concentrations due to agricultural pressures. Flow in Velabisht is unregulated and responds rapidly to precipitation, with limited seasonal baseflow support.
Vërtopi	Osum	The Vërtopi stream is a 13.2 km-long tributary of the Osum River, draining a 46.3 km ² catchment at an average elevation of 495 m within the Hellenic Western Balkan ecoregion. It exhibits a rainfall-driven regime with limited baseflow, and its runoff responds rapidly to seasonal precipitation events.
Vodica	Osum	The Vodica stream is a 19.3 km tributary of the Osum River, draining a 63.3 km ² catchment at a low mean elevation of 255 m. Its hydrology is dominated by seasonal rainfall, with flashy runoff patterns and limited groundwater storage due to shallow, low-permeability soils.
Vodica e sipërme	Osum	The Vodica e Sipërme stream drains a 54.1 km ² mountainous catchment at an average elevation of 1,041 m in the Osum basin. With a 14.2 km course, it exhibits a steep gradient and a nival-pluvial regime, with spring peak flows influenced by snowmelt and limited baseflow during dry periods.
Vokopola	Osum	The Vokopola stream drains a 151.6 km ² sub-catchment in the Osum River basin, with a mean elevation of 617 m. Its flow regime is predominantly rainfall-driven, characterized by flashy hydrological responses and limited baseflow buffering due to moderately permeable flysch and limestone formations. Seasonal variability is high, with pronounced contrasts between wet-season runoff and dry-season low flows.
Zagora	Osum	The Zagora stream drains a 33.8 km ² sub-catchment in the Osum River basin, with a mean elevation of 162 m. Characterized by a short 18.7 km course, its flow regime is shaped by seasonal precipitation, rapid runoff, and limited groundwater storage due to the basin's low elevation and generally permeable alluvial deposits.
Gjanica	Seman	The Gjanica River is a left-bank tributary of the Seman River, flowing through the city of Fier in southwestern Albania. It drains a relatively small sub-basin of 234 km ² , with a total river length of approximately 63.5 km and two distinct water bodies: an upstream natural section (NWB) and a downstream heavily modified water body (HMWB) spanning 6.2 km through the urban and industrial zones of Fier. The river originates in the Mallakastër hills at around 400 m elevation and descends rapidly towards the coastal plain, contributing directly to the Seman River just before its confluence with the Adriatic Sea. Though modest in size, Gjanica plays a significant role in the hydrology and water quality of the lower Seman system.

River Name	Subbasin	Brief description of the river
		The Gjanica River is one of the most polluted rivers in Albania, largely due to untreated industrial and urban wastewater discharges. It receives effluents from the Patos-Marinza oilfield, the largest onshore oilfield in Europe, as well as from the Ballsh oil refinery. These inputs include hydrocarbons, heavy metals, and organic pollutants. Repeated spills have been documented, and enforcement of environmental standards has been minimal. The degraded physico-chemical quality of Gjanica significantly affects the downstream Seman, contributing to its classification as "Poor" under CCME-WQI criteria for 2015–2019. Efforts to rehabilitate the river and reduce pollution remain limited, making Gjanica a critical hotspot in Albania's river basin management planning.
Seman	Seman	The Seman River is one of Albania's major rivers, formed at the confluence of the Devolli and Osumi Rivers near the village of Kozarë. It flows westward for 281 km across central Albania, ultimately discharging into the Adriatic Sea at the southern edge of the Karavasta Lagoon. The Seman drains a basin of 6,247 km², with an average elevation of 863 m and a hydrographic density of 1.9 km/km². The river traverses a transition from steep mountain valleys to the flat and fertile Myzeqe plain. Major tributaries include the Gjanica River (234 km²), which joins from the left near Fier. Flow regulation is significant, especially due to the Devoll Hydropower Project, which traps sediment and alters seasonal flows downstream. The Seman basin is geologically complex, dominated by flysch, with only 21 % of its area under permeable formations. As a result, groundwater contributes just 12 % to the river's annual discharge, while surface runoff dominates. The average annual flow at the river mouth is 95.7 m³/s, with a low runoff coefficient ($\alpha = 0.49$) and high sediment loads (≈ 13 Mt/year), making the Seman one of Albania's most turbid rivers. Floods are mainly rain-induced, with a 100-year peak discharge estimated at 2,870 m³/s. Water from the Seman system, particularly from the Devoll, supports large-scale irrigation in the Myzeqe plain. However, the river is increasingly impacted by pollution, especially from the Gjanica tributary, and faces challenges from erosion, sedimentation, and climate-induced changes to its flow regime.

Table xx – Seman River Basin - Waterbody Characterisation – Category LAKES

Lake Name	Subbasin	EU Code	Altitude (abs)	Area (km ²)	Geology	Typology	Depth (m)	Lake form	Length (km)	Ecoregion	Δ level (m)
Banja lake	Devoll	LW35205301	116.4	13.76	Calcareous/mixed	L-01c	80	AWB	49.4	Hellenic western Balkan	15
Moglica lake	Devoll	LW35207801	534.86	7.3	Calcareous/mixed	L-02b	160	AWB	76.5	Hellenic western Balkan	25
Gjanci reservoir	Osum	LW352049601	1064.61	1.22	Calcareous/mixed	L-03b	3	AWB	5.3	Hellenic western Balkan	2
Cestijë lake	Seman	LW3520303	110.4	0.98	Calcareous/mixed	L-01a	7	AWB	3.5	Hellenic western Balkan	5
Kasharaj reservoir	Seman	LW3520306	41.77	0.61	Calcareous/mixed	L-01a	24	AWB	14.6	Hellenic western Balkan	17
Kurjani reservoir	Seman	LW3520307	37.56	2.23	Calcareous/mixed	L-01b	16	AWB	5.8	Hellenic western Balkan	7
Merhoja lake	Seman	LW3520302	120.7	0.59	Calcareous/mixed	L-01a	3.5	NWB	6.1	Hellenic western Balkan	3
Pajallia reservoir	Seman	LW3520305	78.57	0.59	Calcareous/mixed	L-01a	18	AWB	7.4	Hellenic western Balkan	8
Thana reservoir	Seman	LW3520304	25.6	7.36	Calcareous/mixed	L-01b	11	AWB	12.2	Hellenic western Balkan	8
Vahut i Shkozës lake	Seman	LW3520301	127.9	0.88	Calcareous/mixed	L-01a	4	NWB	6	Hellenic western Balkan	3.5

Lake Name	Subbasin	Brief description of the lake
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Banja lake	Devoll	Lake Banja is an artificial reservoir on the Devoll River, located at an elevation of 116 m above sea level in central Albania. Commissioned in 2016 as part of the Devoll Hydropower Project, the reservoir is impounded by an 80 m high dam and has a surface area of approximately 13.76 km². With a total storage capacity of 415 million cubic metres, it plays a critical role in energy production (72 MW installed capacity), flood control, and water regulation within the Seman River Basin. The reservoir significantly alters the downstream flow regime, especially during dry seasons, and traps an estimated 1.9 million tonnes of sediment annually. Despite concession requirements for minimum ecological flows of 2 m³/s, monitoring has documented sub-daily drops to below 1 m³/s during weekdays, raising concerns about aquatic habitat degradation and fish migration. Lake Banja is a key water body within the Albanian hydropower network and contributes both to regional energy supply and sediment retention in the Devoll sub-basin.
Moglica lake	Devoll	Lake Moglicë is an artificial man-made reservoir on the Devoll River in southeastern Albania, created by the Moglicë Dam—the highest dam in the country at 166.5 m. The reservoir lies at an elevation of 535 m a.s.l., covering a surface area of 7.3 km² and reaching a maximum depth of 76.5 m. It was completed in 2020 as part of the Devoll Hydropower Project and contributes to a 197 MW installed capacity. The reservoir has a total storage capacity of 378 million m³ and plays a vital role in Albania's hydropower generation and energy security. Although smaller in area compared to Lake Banja, Lake Moglicë impounds water from a catchment of 1,671 km² and alters the natural flow regime of the Devoll River. With a projected average inflow of 21.8 m³/s and measured maximum daily inflows reaching 600 m³/s, it significantly contributes to downstream flow regulation. However, it also traps large volumes of sediment, impacting the sediment balance and downstream ecological conditions of the Seman River system.
Gjanci reservoir	Osum	Gjanci Reservoir is an artificial reservoir located in Gjanç village, Korçë, at 1,065 m a.s.l., with a surface area of 1.22 km ² and a maximum depth of 5.3 m. It is primarily used for irrigation purposes.
Cestijë lake	Seman	Cestijë lake is an artificial irrigation reservoir located in Çestijë village, Belsh municipality (Elbasan), created by a 9 m high earth-fill dam constructed in 1977. It has a surface area of 0.98 km ² , a maximum depth of 3.5 m, and stores approximately 3 million m ³ of water, primarily for agricultural use.
Kasharaj reservoir	Seman	Kasharaj reservoir is an artificial irrigation reservoir located in Kasharaj village, Lushnje municipality. Constructed in 1985 with a 25 m high homogeneous earth dam, it covers 0.61 km ² and stores up to 9.6 million m ³ of water, serving an irrigated area of 1,200 ha.
Kurjani reservoir	Seman	Kurjani reservoir is an artificial irrigation reservoir located in Kurjan village, Roskovec municipality (Fier), constructed in 1961 with a 17 m high homogeneous earth dam. It spans a surface area of 2.23 km ² , with a storage volume of 30.5 million m ³ , and supports irrigation over 6,500 ha.
Merhoja lake	Seman	Merhoja lake is a small natural lake located at 121 m a.s.l. in the Seman basin, with a surface area of 0.59 km ² and a maximum depth of 6.1 m. It is considered part of the Bleshi lake group and lies within the Hellenic western Balkan ecoregion.
Pajallia reservoir	Seman	Pajallia reservoir is an artificial irrigation reservoir located in Pajalli village, Lushnje municipality, created in 1969 by a 20 m high homogeneous earth dam. It has a surface area of 0.59 km ² , a storage volume of 5.4 million m ³ , and supplies water for the irrigation of approximately 2,500 ha.

Thana reservoir	Seman	Thana reservoir is a major irrigation reservoir on the Devoll River, created by an earth-fill dam completed in 1962. Located at 31.7 m a.s.l., it covers a surface area of approximately 8.1 km² and stores up to 60 million m³ of water. It receives inflows averaging 7.71 m³/s from a 30.3 km² catchment and is designed to irrigate around 25,000 ha of agricultural land downstream. The reservoir is hydraulically linked to the Vlashuk concrete gravity dam and canal system, forming part of a larger mid-20th century irrigation scheme for the Myzeqe plain. Although it has no hydropower function, the reservoir plays a key role in seasonal water retention and controlled releases. Its ecological character is heavily artificial, with seasonal drawdown and fluctuating water levels (24.5–31.7 m a.s.l.).
Vahut i Shkozës lake	Seman	Vahut i Shkozës Lake is a natural lake located at 128 m a.s.l. in the Seman basin, with a surface area of 0.88 km² and a maximum depth of 6.0 m. It is considered part of the Belshi lakes group and lies within the Hellenic western Balkan ecoregion.

Table xx - Seman River Basin - Waterbody Characterisation – Category TRANSITIONAL WATERS

N	S	E	F	L	A	A	E	M	M	E	T
a	u	U	o	e	r	n	l	e	e	c	u
m	b	C	r	n	e	n	e	a	a	a	o
e	b	o	m	g	a	u	c	n	n	r	b
a	d	t	(	a	t	t	w	e	i		
s	e		h	k	l	r	i	a	g	d	
i		(	m	S	i	d	t	i	i		
n		k	²	a	c	a	e	o	t		
		m	)	l	a	l	r	n	y		
		)	i	l	r	t	(				
			n	c	a	e	g				
			i	o	n	m	/				
			t	n	g	p	m				
			y	d	e	e	³				
			(	u	(	r	)				
			%	c	m	a					
			)	t	)	t					
			i	u							
			v	r							
			i	e							
			t	(							
			y	°							
			(	C							
			m	)							
			S								

/ c m)											
K	S	T	N	1	4	3	5	<	2	H	
a	e	W	W	0	1	0	7	2	0	e	
r	m	3	B	0	.	-	.	m		l	
a	a	5		.	6	4	6	i		l	
v	n	1		7	5	0		c		e	
a		7	9			%		r		n	
s		0				e		o		i	
t		1				u		t		c	
a						h		i		w	
L						a		d		e	
a						l		a		s	
g						i				t	
o						n				e	
o										r	
n										n	
										B	
										a	
										l	
										k	
										a	
										n	
P	S	T	N	6	1	3	5	<	1	H	
e	e	W	W	.	.	0	7	2	8	e	
t	m	3	B	8	0	-	.	m		l	
r	a	5		7	7	4	6	i		l	
i	n	2				0		c		e	
t		1				%		r		n	
i		0				e		o		i	
l		1				u		t		c	
a						h		i		w	
k						a		d		e	
e						i		a		s	
										t	

CONCEPT

a	0			u	t	c
r	3			h	i	w
a				a	d	e
v				l	a	s
a				i		t
s				n		e
t				e		r
a						n
L						B
a						a
g						l
o						k
o						a
n						n
W	S	T	N	1	0	3
e	e	W	W	5	.	0
s	m	3	B	.	5	-
t	a	5		1	8	4
-	n	1	4	0	6	i
K		7		%		c
a		0		e		r
r		2		u		o
a				h		t
v				a		i
a				l		d
s				i		a
t				n		l
a				e		
L						
a						
g						
o						
o						
n						

Table xx - Seman River Basin - Waterbody Characterisation – Category COASTAL WATERS

N	S	E	F	L	A	M	M	M	T	E
a	u	U	o	e	n	e	e	e	u	c
m	b	C	r	n	n	a	a	a	r	o
e	b	o	m	g	u	n	n	n	b	r
a	d		t	a	d	t	w	i	e	
s	e		h	l	e	i	a	d	g	
i			(	S	p	d	t	i	i	
n			k	a	t	a	e	t	o	
			m	l	h	l	r	y	n	
			)	i	(	r	t	(		
				n	m	a	e	g		
				i	)	n	m	/		
				t		g	p	m		
				y		e	e	³		
				(		(	r	)		
				%		m	a			
				)		)	t			
							u			
							r			
							e			
							(			
							°			
							C			
							)			
C	S	C	N	2	3	4	<	1	1	M
W	e	W	W	2	0		2	7	5	e
K	m	3	B	.	t		m	.		d
a	a	5		6	o		:	8		i
r	n	1		4	<		m			t
a		9			4		i			e
v		0			0		c			r
a		1			%		r			r
s					:		o			a
t					e		t			n
a					u		i			e
					h		d			a
					a					n

CONCEPT

					l i n e		a l		S e a	
C W L o w e r S e m a n	S e m a n	C W 3 5 2 1 0 1	N W B	9 . 5 8	3 0 t < 4 0 % : e u h a l i n e	6	< 2 m : m i c r o t i d a l	1 7 . 8	1 5	M e d i t e r r a n e a n S e a
C W R i v e r d e l t a	S e m a n	C W 3 5 2 0 0 1	N W B	3 . 1 9	3 0 t < 4 0 % : e u h a l i	7	< 2 m : m i c r o t i d a l	1 7 . 8	1 5	M e d i t e r r a n e a n S e a

s		3				a	w
e		0				m	e
r		1				s	r
v						-	
o						R	
i						e	
r						s	
						e	
						r	
						v	
						o	
						i	
D	D	3	R	H	3	1	F
e	e	5	W	M	3	5	I
v	v	2		W	.	5	l
o	o	0		B	1	.	o
l	l	5				9	w
l	l	1					r
i							e
R							p
i							g
v							r
e							o
r							m
							e
							c
							t
							i
							o
							n
D	D	3	R	H	7	2	D
e	e	5	W	M	.	8	H
v	v	2		W	7	.	a
o	o	0		B		4	y
l	l	5					m
l	l	3					d
i							s
R							r
i							/
							o
							p
							r
							e
							w
							e

CONCEPT

v e r							r e v o i r s		
D e v o l l i R i v e r	D e v o l l i	3 5 2 0 5 5	R W W B	H M W B	5 5 0 9	5 5 0 9	F l o o r d r e p r o g r a m m e c t i o n	F l o o r d r e p r o g r a m m e c t i o n	
D e v o l l i R i v e r	D e v o l l i	3 5 2 0 7 1	R W W B	H M W B	8 1 3	2 6 3	F l o o r d r e p r o g r a m m e c t i o n	F l o o r d r e p r o g r a m m e c t i o n	

CONCEPT

D e v o l l i R i v e r	D e v o l l i R i v e r	3 5 2 0 7 3	R W B	H M W B	1 0 4	4 4 6	F l o o d r e p r o g r a m t e c h n i c a l i z a t i o n
D e v o l l i R i v e r	D e v o l l i R i v e r	3 5 2 0 7 5	R W B	H M W B	1 4 1 1	1 1 7 8	D H a y m s r o p e a n r e s o u r c e s
D e v o l l i	D e v o l l i	3 5 2 0 7 9 1	R W B	H M W B	2 0 8	1 5 7 7	F l o o d r e p r o g r a m

CONCEPT

								e m e n t	
M o g l i c a r e s e r v o i r	D e v l o p m e n t	L W 3 5 2 0 7 8 0 1	L W B	A W B		7 6 . 5	7 . 3	W e y d i r s - D o w n - R e s e r v o i r	H y d r o p o w e r
G j a n c i r e s e r v	O s m	L W 3 5 2 0 4 9 6 0 1	L W B	A W B		5 . 3	1 . 2 2	W e g i r s - D l a t m s - R	A g r i c u l t u r e

CONCEPT

o i r								e i r r v g o a i r i o n
C e s t i j ë l a k e	S e m a n	L W 3 5 2 0 3 0 3	L W B	A W B	3 . 5	0 . 9 8	W A e g i r i s c - D l a t m s r - R - e i s r e r i v g o a i r i o n	
G j a n i	S e m a n	3 5 2 0 2	R W B	H M W B	6 . 2	1 . 4	C F h l a o n d	

CONCEPT

c	-					e
a	2					p
s						r
t						i
r						s
e						t
a						c
m						t
						i
						o
						s
						t
						i
						o
						n
						-
						R
						e
						i
						n
						f
						o
						r
						c
						e
						m
						e
						n
						t
K	S	L	L	A	1	0
a	e	W	W	W	4	.
s	m	3		B	.	6
h	a	5			6	1
a	n	2				
r		0				
a		3				
j		0				
r		6				
e						
s						
e						
r						
v						
						W
						A
						e
						g
						i
						r
						s
						c
						u
						-
						D
						a
						t
						m
						u
						s
						r
						-
						R
						e
						i
						s

CONCEPT

o i r								e r v o i r	i o n
K u r j a n i r e s e r v o i r	S e m j a n	L W 3 5 2 0 3 0 7	L W	A W B		5 .8	2 .2 3	W e g i r s c u - D l a t m s r - R e i s e r v o i r	A g i r s c u - D l
P a j a l l i	S e m j a n	L W 3 5 2 0 3	L W	A W B		7 .4	0 .5 9	W e g i r s c u - D l	A g i r s c u - D l

CONCEPT

s	0					a	t
ë	5					m	u
r						s	r
e						-	e
s						R	-
e						e	r
r						s	r
v						e	r
o						r	i
i						v	g
r						o	a
						i	t
						r	i
						o	n
S	S	3	R	H	3	4	F
e	e	5	W	M	3	4	I
m	m	2		W	.	.	l
a	a	0	B		9	4	w
n	n	1					r
R							e
i							p
v							g
e							r
r							i
							m
							t
							e
							/
							E
							t
							m
							i
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							n
							a
							n
							k
							m
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							t
							s

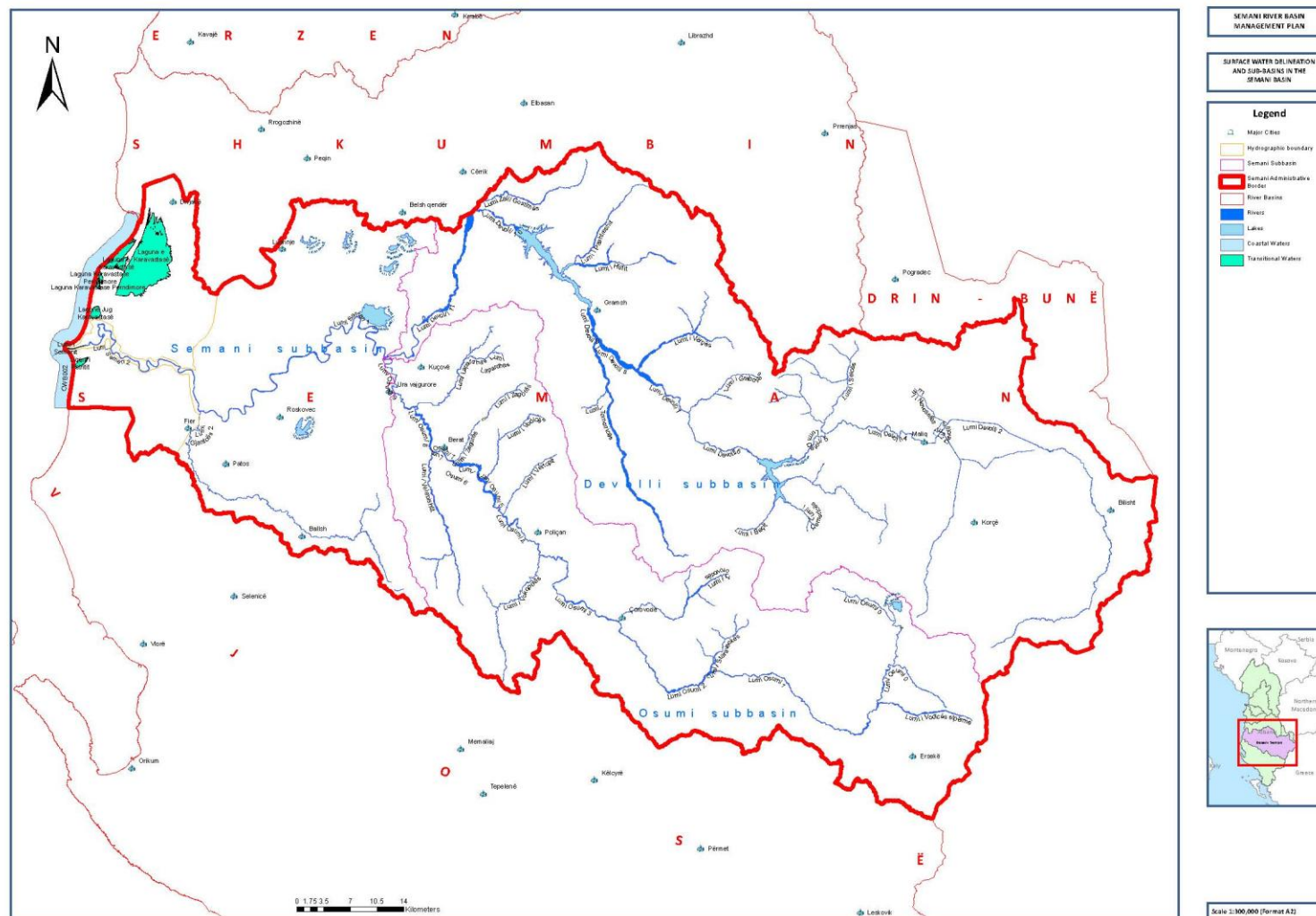
CONCEPT

S	S	3	R	H	5	8	F	F
e	e	5	W	M	5	1	I	I
m	m	2		W	.	5	o	o
a	a	0	B		7	.	w	w
n	n	3				4	r	r
R							e	p
i							g	r
v							i	o
e							m	t
r							e	e
							/	c
							E	t
							m	i
							b	o
							a	n
							n	k
							m	e
							n	t
							s	
T	S	L	L	A	1	7	W	A
h	e	W	W	W	2	.	e	g
a	m	3		B	.	3	i	r
n	a	5			2	6	r	i
a	n	2					s	c
r		0					-	u
e		3					D	a
s		0					a	t
e		4					m	u
r							s	r
v							-	e
o							R	i
i							e	s
r							r	e

CONCEPT

							r	i
							v	g
							o	a
							i	t
							r	i
								o
								n

Map xx – Seman River Basin - Surface Waterbody Category and Delineation.



6.4 Characterisation and Delineation of Groundwater Bodies

6.4.1 Overview

This section describes the delineation, characterisation and assessment of groundwater bodies (GWBs) in the Seman River Basin. It follows the requirements of the EU Water Framework Directive (WFD 2000/60/EC), the Groundwater Directive (2006/118/EC), the Nitrates Directive (91/676/EEC), and the relevant CIS Guidance Documents No. 2, No. 15 and No. 18.

Groundwater bodies form the basic management units for characterising groundwater resources and reporting groundwater status under the WFD. The delineation approach aims to define each groundwater body as a coherent hydrogeological unit in terms of natural characteristics, pressures and impacts. This supports effective monitoring, risk assessment and the identification of management measures within the RBMP cycle.

The RBMP must provide an initial characterisation of all groundwater bodies. This characterisation assesses current uses and determines whether groundwater bodies are at risk of failing the WFD environmental objectives. These objectives are good quantitative status and good chemical status. Groundwater bodies identified as being at risk require further characterisation, including more detailed assessment of pressures, pathways and receptors. This enables a more precise assessment of risk and supports the identification of measures needed to achieve compliance with WFD objectives.

In Albania, the Albanian Geological Survey (AGS) is the main competent authority for identifying, assessing and reporting on groundwater resources, trends and impacts. AGS implements the annual national groundwater surveillance monitoring programme on behalf of the National Environment Agency (NEA). AGS activities are therefore closely linked to NEA through monitoring and reporting obligations, and to the Albanian Water Resources Management Agency (AWRM/AMBU) through groundwater permitting and resource allocation. This institutional cooperation is essential for meeting monitoring requirements and supporting water allocation policies.

The WFD aims to prevent further deterioration and progressively improve the status of aquatic ecosystems. This includes safeguarding the water needs of terrestrial ecosystems that depend directly on groundwater. Protecting and restoring groundwater status is therefore an integral part of achieving the wider ecological objectives of the Directive.

6.4.2 Categorisation and Typology of Groundwater Bodies

Unlike surface waters, groundwater is not classified into multiple ecological categories. The WFD distinguishes between groundwater, aquifers and groundwater bodies. Groundwater includes all water located beneath the land surface. Aquifers are geological strata with sufficient porosity and permeability to allow significant abstraction. Groundwater bodies are distinct volumes or zones of groundwater within recognised aquifers, delineated for management under the Directive.

The WFD applies a functional test to determine whether a groundwater resource qualifies as an aquifer for management purposes. The resource must be able to yield more than 10 m³ per day or supply at least 50 persons, or abstraction from the resource must have a significant impact on the ecological status of a surface water body or a groundwater-dependent terrestrial ecosystem.

For reporting and management, the minimum size of a groundwater body is normally 10 km², in line with the minimum catchment area used for surface water bodies under WFD Annex II. Smaller units may be delineated where specific management is required, for example to protect groundwater-dependent ecosystems or drinking water supplies for more than 50 persons.

Groundwater typology is based mainly on hydrogeological and geochemical characteristics. Unlike surface water typology, it does not rely on altitude or size descriptors. Instead, it reflects the geological formation and hydraulic behaviour of aquifer systems. The main hydrogeological types are porous aquifers, karstic aquifers and fissured aquifers. Porous aquifers usually consist of unconsolidated alluvial or fluvio-glacial sediments with intergranular flow. Karstic aquifers occur in carbonate formations, such

as limestone and dolomite, and show conduit and fissure flow with high variability and high vulnerability to pollution. Fissured aquifers occur in consolidated rocks where groundwater storage and movement take place mainly through fractures.

From a geochemical perspective, aquifers may be calcareous, siliceous or organic/humic. These characteristics influence natural groundwater chemistry, buffering capacity, vulnerability to pressures and the natural background levels of substances. They are therefore important for defining reference conditions and assessing pressures and impacts.

Albania applies groundwater types that correspond broadly with EU WISE reporting categories. These include intergranular aquifers with high or medium productivity, fissured aquifers with medium to low productivity, fissured or karstified aquifers with high productivity, porous/fissured formations with medium or medium-low productivity, practically non-aquiferous rocks and unknown formations.

Table xx – Principal Groundwater Types in Albania Reporting

ALBANIA CODE	ALBANIA GEOLOGICAL FORMATION ⁹⁸	REPORTING	EQUIVALENT GEOLOGICAL FORMATION ⁹⁹	WISE REPORTING
1	Intergranular porosity – high productivity		Porous – highly productive	
2	Intergranular porosity – medium productivity		Porous - moderately productive	
3	Fissured porosity – medium to low productivity		Fissured aquifers – moderately productive	
4	Fissured/karstified porosity – high productivity		Fissured aquifers including karst – highly productive	
5	Porous/fissured porosity – medium productivity		Unclassified ¹⁰⁰	
6	Practically non-aquiferous rocks		Insignificant aquifers – limited groundwater	
7	Porous/fissured porosity - medium to low productivity		Unclassified	
8	Not available or Unknown		Unknown	

As with surface water bodies, a groundwater body must function as a coherent sub-unit within the river basin. The WFD objectives must be applicable to the groundwater body in a consistent way. In some cases, an entire aquifer may be designated as one groundwater body, but only where it is sufficiently homogeneous in hydraulic properties, natural chemistry, pressures and impacts.

Further delineation of aquifers into discrete groundwater bodies must take account of groundwater flow divides and natural chemistry. Where hydrogeological data are limited, surface water catchments and geological boundaries may be used as proxies. Natural geochemical differences are relevant where they influence suitability for drinking water abstraction, vulnerability to pressures or the design of management measures.

The delineation of groundwater bodies in Albania therefore relies on identifying hydrogeological units, such as alluvial plains, karst systems and fractured bedrock aquifers, assigning these units to the relevant typological classes, and establishing their relationship with dependent surface waters and terrestrial ecosystems. In GIS, groundwater body classification is implemented through a structured system that combines geological, hydrogeological and morphological characteristics.

6.4.3 Delineation Principles

Aquifers with significantly different water-bearing properties must be separated by delineation boundaries. The main criteria are porosity, permeability and resource potential. This process is relatively straightforward for homogeneous, unconfined aquifers, but more complex for three-dimensional geological formations with variable structure and lithology.

⁹⁸ Albanian Geological Service – 1:200 000 Hydrogeological Map of Albania, 2015. Tabulations of aquifer Types in Albania reporting is inconsistent between the 1:200 000 map and the GIS .shp files. The GIS .shp Type definitions have been used as the delineation type.

⁹⁹ WFD – WISE GIS Reporting Guidance 2016 – schema GWB – schema element – *Geological Formation*

¹⁰⁰ The Albania definition of “porous/fissured porosity” does not coincide with EU WISE categories.

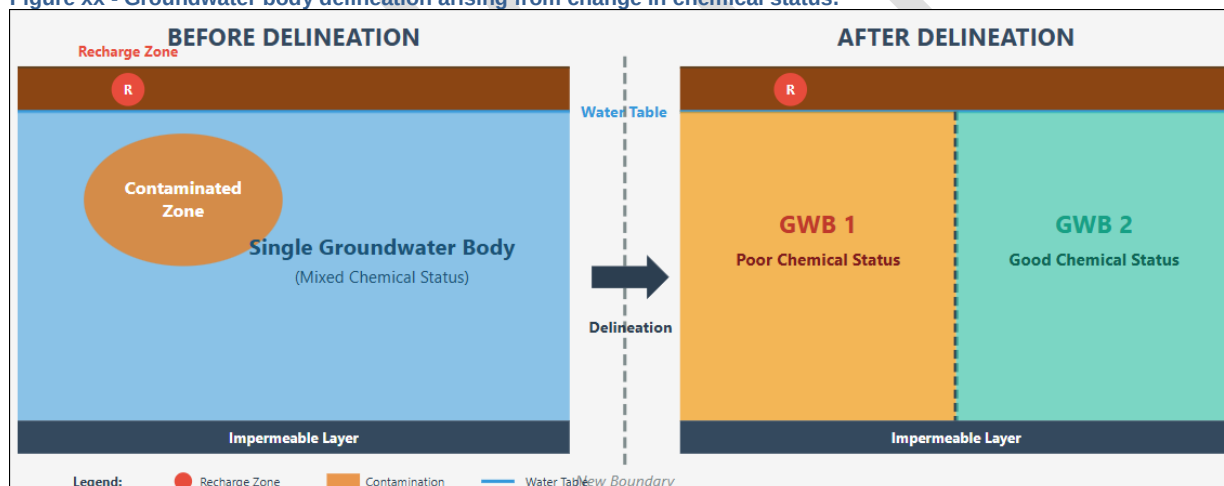
These geological complexities influence the yield capacity of groundwater bodies, their vulnerability to pollution and their hydraulic connectivity with associated surface water systems. Delineation must therefore reflect both the natural hydrogeological setting and the pressures and impacts acting on the groundwater system.

As for surface waters, the delineation of groundwater bodies must support accurate assessment of quantitative and chemical status. Where a single aquifer shows significant localised pollution, it may need to be subdivided into separate groundwater bodies to reflect different chemical status. The same principle applies where intensive abstraction creates local pressure on groundwater levels. Pumping can form a cone of depression and change the quantitative status of part of an aquifer. The affected area may therefore need to be delineated as a separate groundwater body, even where it forms part of a larger contiguous aquifer.

Delineation must also consider interactions with surface waters and dependent ecosystems. Where abstraction reduces groundwater discharge to rivers, weakens hydraulic connection, reduces spring flow, or changes interaction with wetlands or lakes, the groundwater body may need to be subdivided. In line with CIS Guidance No. 2, a groundwater body should be subdivided where a significant change in quantitative status alters flow patterns or impairs dependent ecosystems.

The final stage of groundwater body delineation is therefore iterative. It assesses anthropogenic pressures and impacts across aquifers in order to distinguish different degrees of status within the same hydrogeological unit. This is necessary to ensure that groundwater quality does not deteriorate and remains suitable for drinking water abstraction, dependent ecosystems, agricultural and industrial uses, and the maintenance of good ecological status in connected surface waters.

Figure xx - Groundwater body delineation arising from change in chemical status.



6.4.4 Assessment of Groundwater Bodies

The principal hydrogeological formations in Albania are based on data from the Albanian Geological Service and published through the ASIG portal and NEA sources. Groundwater occurs in formations ranging from the Quaternary to the Paleozoic. In the Albanian mountains, the geological structure typically includes carbonate and karstic formations, such as limestone. Highly permeable gravel aquifers also occur in lowland areas. Both carbonate karst systems and permeable gravel aquifers form highly productive aquifers and are widely present in the Seman River Basin.

A preliminary identification of groundwater bodies in Albania was carried out by AGS and international experts in 2008. This work identified five major hydrogeological formations and delineated 55 groundwater bodies across Albania. However, the CEMSA 2008 characterisation had several limitations. It did not sufficiently subdivide major regional aquifers into smaller groundwater bodies based

on abstraction pressures, pollution status or groundwater-dependent terrestrial ecosystems. These are fundamental tests for distinguishing a specific groundwater body from a wider aquifer.

The previous groundwater body numbering system was also coarse in scale and based on an arbitrary national sequence. It did not refer to the river basin in which the groundwater body occurs. Although many groundwater bodies are transboundary, hydrogeological boundaries often follow surface topographic divides. For management purposes, it is useful to apply a numbering system that recognises the river basin in which a groundwater body predominantly occurs, while still acknowledging the need for consistent management of transboundary groundwater bodies.

The 2008 work has been superseded by more detailed information from the 1:200,000 Hydrogeological Map of Albania, published in 2015. This map provides the basis for a more detailed identification of potential groundwater bodies within the new Albanian RBMP reporting framework. In the current RBMP phase, identification and reporting of groundwater body attributes aim to align more closely with the EU WISE reporting schema. The principal hydrogeological types used in this RBMP therefore follow the updated reporting framework rather than the earlier CEMSA 2008 classification.

6.4.5 Groundwater Bodies in the Seman River Basin

Reliable data on groundwater quality, quantitative status, pressures and impacts remain limited for many groundwater bodies in Albania. The first-pass delineation for the 2022–2027 planning cycle therefore relies substantially on expert judgement. Nevertheless, the breakdown into smaller groundwater body units based on anticipated abstraction pressures, pollution levels and dependent terrestrial ecosystems represents a significant step towards a more structured and analytical approach to groundwater management.

In the Seman River Basin, a total of **153 groundwater bodies** have been classified and categorised. Of these, **45 groundwater bodies** belong to intergranular formations and **108 groundwater bodies** belong to compact rocks. They are reported in separate tables according to formation type, either intergranular or compact, and according to water-bearing capacity: high, moderate, low or very low. Several groundwater bodies are transboundary between adjacent river basins. Groundwater management regimes must therefore take these transboundary connections into account. This is necessary to ensure coherent monitoring, consistent assessment and effective management across river basin boundaries.

Table xx - Aquifers in intergranular formations with high productivity

No.	District	Aquifer type	Rock type	Lithology	Age	GWB Location	Code	Surface - km ²
1	Korçe	Intergranular	Sedimentary	Sand, gravel, clay	Qp-h	Gostima	GWB017	0.000556
2	Fier	Intergranular	Sedimentary	Sand, gravel, clay	Qh	Topoja	GWB010	10.87471
3	Fier	Intergranular	Sedimentary	Sand, gravel, clay	Qp-h	Plugu	GWB015	0.612856
4	Korçe	Intergranular	Sedimentary	Clay, sand, gravel	Qh	Sheqerasi	GWB004	62.67552
5	Korçe	Intergranular	Sedimentary	Clay, sand, gravel	Qp	Pulaha	GWB007	36.38422
6	Korçe	Intergranular	Sedimentary	Clay, sand, gravel	Qh	Voskop	GWB001	129.5622
7	Korçe	Intergranular	Sedimentary	Clay, sand, gravel	Qh	Hocishti_Babani	GWB009	11.41567
8	Berati	Intergranular	Sedimentary	Sand, gravel, clay	Qp-h	Uznova	GWB012	5.246807
9	Berati	Intergranular	Sedimentary	Sand, gravel, clay	Qp-h	Berati-Otllaku	GWB016	0.000602
10	Berati	Intergranular	Sedimentary	Sand, gravel, clay	Qp-h	Lapardhaja	GWB013	4.034313
11	Korçe	Intergranular	Sedimentary	Sand, gravel, clay	Qh	Kuci	GWB005	48.33924
12	Fier	Intergranular	Sedimentary	Sand, gravel, clay	Qh	Banaj	GWB011	9.463202
13	Korçe	Intergranular	Sedimentary	Clay, sand, gravel	Qp-h	Gostima	GWB006	38.73782
14	Korçe	Intergranular	Sedimentary	Sand, gravel, clay	Qh	Remanca_Starova	GWB014	0.704325

Table xx - Aquifers in intergranular formations with moderate productivity

No.	District	Aquifer type	Rock type	Lithology	Age	GWB Location	Code	Surface - km ²
1	Fier	Intergranular	Sedimentary	Sand, gravel, clay	Qh	Kemishtaj-Krutje	GWB002	86.506388
2	Korce	Intergranular	Sedimentary	Sand, gravel, clay	Qh	Arreza-Veterrik	GWB003	66.205574
3	Fier	Intergranular	Sedimentary	Clay, alevrolite, sand	Qh	Adriatiku	GWB019	27.928792
4	Fier	Intergranular	Sedimentary	Clay, alevrolite, sand	Qp-h	Hamil-Balteza	GWB038	3.323815
5	Fier	Intergranular	Sedimentary	Clay, alevrolite, sand	Qh	Mullaj-Grecallia	GWB023	14.902213
6	Fier	Intergranular	Sedimentary	Clay, alevrolite, sand	Qh	Imshta-Kallmi_Madh	GWB024	13.695316
7	Korçe	Intergranular	Sedimentary	Clay, sand, gravel	Qp-h	Zvirina_Sovjari	GWB025	13.063191
8	Korçe	Intergranular	Sedimentary	Clay, sand, gravel	Qp-h	Vashtemija	GWB035	4.626702

9	Korçe	Intergranular	Sedimentary	Clay, sand, gravel	Qp	Podgorica_Korita	GWB022	15.650428
10	Korçe	Intergranular	Sedimentary	Clay, sand, gravel	Qp-h	Zemblaki_Dishnica	GWB026	9.993269
11	Korçe	Intergranular	Sedimentary	Clay, sand, gravel	Qh	Romeniu	GWB042	1.754554
12	Korçe	Intergranular	Sedimentary	Clay, sand, gravel	Qp-h	Qyteza	GWB043	1.722663
13	Korçe	Intergranular	Sedimentary	Clay, sand, gravel	Qp-h	Gjanc-Vithkuq	GWB030	6.284328
14	Korçe	Intergranular	Sedimentary	Clay, sand, gravel	Qp-h	Lubonja_Roshani	GWB027	9.930105
15	Korçe	Intergranular	Sedimentary	Clay, sand, gravel	Qp-h	Voskopja	GWB044	1.59909
16	Korçe	Intergranular	Sedimentary	Clay, sand, gravel	Qp-h	Mborja	GWB032	5.449204
17	Korçe	Intergranular	Sedimentary	Clay, sand, gravel	Qp-h	Erseka	GWB018	43.045471
18	Korçe	Intergranular	Sedimentary	Clay, sand, gravel	Qp	Floqi	GWB037	3.887378
19	Korçe	Intergranular	Sedimentary	Clay, sand, gravel	Qp-h	Melcani-Voskopje	GWB029	7.039599
20	Korçe	Intergranular	Sedimentary	Clay, sand, gravel	Qp-h	Tresteniku	GWB045	1.39954
21	Korçe	Intergranular	Sedimentary	Clay, sand, gravel	Qp	Polaska	GWB020	19.961456
22	Berat	Intergranular	Sedimentary	Clay, sand, gravel	Qp-h	Lybesha_Nishova	GWB021	19.417255
23	Berat	Intergranular	Sedimentary	Clay, sand, gravel	Qp-h	Ujaniku	GWB036	4.394158
24	Berat	Intergranular	Sedimentary	Clay, sand, gravel	Qh	Fushe_Peshtan-Vertop	GWB028	7.534859

Table xx - Aquifers in intergranular formations with low productivity

No.	District	Aquifer type	Rock type	Lithology	Age	GW label	Code	Surface - km ²
1	Berati	Intergranular	Sedimentary	Sand, gravel, clay	Qp-h	Lapardhaja	GWB008	20.24101
2	Korçe	Intergranular	Sedimentary	Clay, sand, gravel	Qh	Gjyralla	GWB031	5.728921
3	Berati	Intergranular	Sedimentary	Clay, sand, gravel	Qp-h	Velabishti	GWB040	2.731137
4	Berati	Intergranular	Sedimentary	Clay, sand, gravel	Qh	Bersniku	GWB039	2.760336

Table xx - Aquifers in intergranular formations with very low productivity

No.	District	Aquifer type	Rock type	Lithology	Age	GWB location	Code	Surface - km ²
	Korçe	Intergranular	Sedimentary	Clay, sand, gravel	Qp-h	Mollasi-Selita	GWB033	5.312008
2	Fier	Intergranular	Sedimentary	Clay, sand, gravel	Qp-h	Lavdari	GWB041	2.700957
3	Berati	Intergranular	Sedimentary	Clay, sand, gravel	Qp-h	Mbijeshova	GWB034	4.645846

Table xx - Aquifers in compact formations with high productivity

No.	District	Aquifer type	Rocks type	Lithology	Age	GWB location	Code	Surface - km ²
1	Berati	Compact	Sedimentary	Limestone	Pg ₂	Kroreza-Gradeci	GWB058	62.065348
2	Korçe	Compact	Sedimentary	Limestone	CR1	Vithkuqi	GWB102	26.111101

Table xx - Aquifers in compact formations with moderate productivity

No.	District	Aquifer type	Rocks type	Lithology	Age	GWB location	Code	Surface - km ²
1	Korçe	Compact	Magmatic& metamorphic	Ultrabasic	sJ2	Grabova	GWB047	51.53186
2	Korçe	Compact	Magmatic& metamorphic	Ultrabasic	sJ2	Kullollasi	GWB048	105.2859
3	Korçe	Compact	Magmatic& metamorphic	Vulcanite	msJ2	Osoja	GWB049	106.7379
4	Korçe	Compact	Magmatic& metamorphic	Ultrabasic	sJ2	Treni_Biticka_Verniku	GWB050	6.915839
5	Korçe	Compact	Magmatic& metamorphic	Basic	sJ2	Novosela_Kagjina si	GWB051	3.660986
6	Korçe	Compact	Magmatic& metamorphic	Ultrabasic	sJ2	Drenova_Kozeli	GWB052	54.5485
7	Korçe	Compact	Magmatic& metamorphic	Ultrabasic	nJ2	Maneza-Clirimi	GWB054	67.77263
8	Korçe	Compact	Magmatic& metamorphic	Ultrabasic	sJ2	Kuci	GWB055	3.107848
9	Korçe	Compact	Magmatic& metamorphic	Ultrabasic	sJ2	Zvezda	GWB056	0.451171
10	Korçe	Compact	Magmatic& metamorphic	Vulcanite	bj2	Zavalina	GWB118	3.629866

11	Korçe	Compact	Magmatic& metamorphic	Vulcanite	bT2-J1	Derstila-Myrtallare	GWB126	0.381188
12	Korçe	Compact	Magmatic& metamorphic	Vulcanite	bT2-J1	Zereci	GWB115	4.120017
13	Korçe	Compact	Magmatic& metamorphic	Vulcanite	T1-2	Kukuri	GWB124	1.041846
14	Korçe	Compact	Sedimentary	Clay, sandstone, conglomerate	N1a	Shilbatra	GWB105	20.85959
15	Korçe	Compact	Sedimentary	Clay, sandstone, conglomerate	N1a	Vina	GWB123	1.301964
16	Fier	Compact	Sedimentary	Clay, sandstone, conglomerate	N1-3m	Karbunara Sipërme	GWB097	51.58533
17	Fier	Compact	Sedimentary	Clay, sandstone, conglomerate	N1-3t	Patos-Ballsh	GWB093	122.8302
18	Fier	Compact	Sedimentary	Clay, sandstone, conglomerate	N1a	Lofkendi-Panahori	GWB112	6.011103
19	Fier	Compact	Sedimentary	Clay, sandstone, conglomerate	N1b	Lofkendi	GWB104	24.42055
20	Fier	Compact	Sedimentary	Clay, sandstone, conglomerate	N1a	Cfiri	GWB114	4.208216
21	Fier	Compact	Sedimentary	Clay, sandstone, conglomerate	N1b	Allkomemaj	GWB111	6.067531
22	Korçe	Compact	sedimentar	Sandstone, mergele, conglomerate, clays and terrigjene	J3	Strelca	GWB110	7.486917
23	Korçe	Compact	Magmatic& metamorphic	Vulcanite	bJ2	Shipoka	GWB121	2.472779
24	Korçe	Compact	Sedimentary	Sandstone, conglomerate	Pg3-N1a	Kolanec	GWB094	115.6467
25	Korçe	Compact	Sedimentary	Clay, sandstone, conglomerate	N1a	Novosela_Kloca_Biranji	GWB096	61.71824
26	Korçe	Compact	Sedimentary	Clay, sandstone, conglomerate	N1b	Progri	GWB125	0.536154

27	Korçe	Compact	Sedimentary	Sandstone, mergele, conglomerate, clays and terrigjene	J3	Zemblaku	GWB116	4.084921
28	Korçe	Compact	Sedimentary	Sandstone, conglomerate	Pg3-2	Dishnica	GWB101	27.84741
29	Korçe	Compact	Sedimentary	Clay, sandstone, conglomerate	N1b	Vranishti_Vidohova	GWB092	169.1374
30	Korçe	Compact	Sedimentary	Clay, sandstone, conglomerate	N1b	Boboshtica	GWB119	3.051024
31	Korçe	Compact	Sedimentary	Clay, sandstone, conglomerate	N2	Boshanji	GWB098	46.22901
32	Korçe	Compact	Magmatic& metamorphic	Vulcanite	bJ2	Dersniku	GWB113	5.324545
33	Korçe	Compact	Sedimentary	Clay, sandstone, conglomerate	N1b	Barci_Korca	GWB120	2.534698
34	Korçe	Compact	Sedimentary	Clay, sandstone, conglomerate	N2	Qafzeze_Vodica	GWB095	61.9712
35	Korçe	Compact	Sedimentary	Clay, sandstone, conglomerate	N2	Bilishti	GWB099	39.12257
36	Berati	Compact	Sedimentary	Clay, sandstone, conglomerate	N1-3m	Pashallia	GWB127	0.282013
37	Berati	Compact	Sedimentary	Clay, sandstone, conglomerate	N1b	Poshnja	GWB117	3.832511
38	Berati	Compact	Sedimentary	Clay, sandstone, conglomerate	N1b	Goricani_Allambrezhi	GWB100	31.58511
39	Berati	Compact	Sedimentary	Clay, sandstone, conglomerate	N1a	Kutallia_Cukalati	GWB128	26.00747
40	Fier	Compact	Sedimentary	Clay, sandstone, conglomerate	N1a	Levani	GWB106	13.08796
41	Fier	Compact	Sedimentary	Clays, alevrolite, sands	Qp-h	Roskovec-Marinez	GWB145	46.16245
42	Fier	Compact	Sedimentary	Sandstone, conglomerate	N2-2rr	Velmishti	GWB137	2.898482

43	Fier	Compact	Sedimentary	Sandstone, conglomerate	N2-2rr	Guri_Babunje	GWB133	9.145077
44	Fier	Compact	Sedimentary	Sandstone, conglomerate	N2-2rr	Kryekuqi-Kamenica	GWB134	5.558514
45	Fier	Compact	Sedimentary	Sandstone, conglomerate	N2-2rr	Kumani	GWB138	1.689576
46	Fier	Compact	Sedimentary	Sandstone, conglomerate	N2-2rr	Kurjani	GWB139	0.963575
47	Fier	Compact	Sedimentary	Sandstone, conglomerate	N2-2rr	Zharneci-Kryekuqi	GWB136	2.722017

Table xx - Aquifers in compact formations with low productivity

No.	District	Aquifer type	Rocks type	Lithology	Age	GWB location	Code	Surface - km ²
1	Elbasan	Compact	Magmatic& metamorphic	Ultrabasic	slpJ2	Gjinar	GWB046	70.48024
2	Korçe	Compact	Magmatic& metamorphic	Basic	sJ2	Pepellashi_Helmesi	GWB053	10.74494
3	Korçe	Compact	Sedimentary	Limestone	Cr1	Lleshani_Pobrat	GWB083	4.02844
4	Korçe	Compact	Sedimentary	Limestone	Pg2-2	Gopeshi	GWB080	5.518009
5	Korçe	Compact	Sedimentary	Limestone	T3-J1	Holtasi-Rashtani	GWB086	2.966026
6	Korçe	Compact	Sedimentary	Limestone	T2-J2	Kukuri_Griba	GWB091	6.580653
7	Korçe	Compact	Sedimentary	Limestone	Cr2	Grabova_Kurata	GWB088	1.281907
8	Korçe	Compact	Sedimentary	Limestone	Pg2	Qafa_Luzhaj	GWB076	10.89925
9	Korçe	Compact	Sedimentary	Limestone	Pg2	Tervoli	GWB067	19.32229
10	Fier	Compact	Sedimentary	Limestone	Pg2	Aranitasi	GWB085	3.74283
11	Korçe	Compact	Sedimentary	Limestone	T3-J1	Podgorica-Shengjergji	GWB059	51.08184
12	Korçe	Compact	Sedimentary	Limestone	T3-J1	Mancurisht-Progi	GWB064	24.34462
13	Korçe	Compact	Sedimentary	Limestone	T3-J1	Verniku	GWB062	31.58312
14	Korçe	Compact	Sedimentary	Limestone	Cr2	Dushar-Faqekuqi	GWB066	20.22655
15	Korçe	Compact	Sedimentary	Limestone	T3-J1	Luarasi	GWB084	3.755001
16	Korçe	Compact	Sedimentary	Limestone	Cr2	Helmesi	GWB089	0.485576

17	Korçe	Compact	Sedimentary	Limestone	Cr2	Bezhani	GWB075	11.57587
18	Korçe	Compact	Sedimentary	Limestone	T3-J1	Floqi	GWB073	11.77467
19	Korçe	Compact	Sedimentary	Limestone	J1-2	Gjanc-Ujebardhi	GWB079	5.875538
20	Korçe	Compact	Sedimentary	Limestone	J3	Strelca	GWB068	18.8473
21	Korçe	Compact	Sedimentary	Limestone	J3	Gjonmadhi-Lavdari_Korces	GWB060	36.25156
22	Korçe	Compact	Sedimentary	Limestone	T3-J1	Kagjinasi_Borova	GWB063	28.59544
23	Korçe	Compact	Sedimentary	Limestone	J3	Shtylla_Vithkuqi	GWB061	35.91432
24	Korçe	Compact	Sedimentary	Limestone	Pg2	Starova	GWB070	16.15987
25	Berati	Compact	Sedimentary	Limestone	Cr2	Mbreshtani	GWB069	17.64226
26	Berati	Compact	Sedimentary	Limestone	Pg2	Tomorr-Kapinova	GWB057	82.63299
27	Berati	Compact	Sedimentary	Limestone	Pg2	Berat-Zhitomi Vogel	GWB082	4.153516
28	Berati	Compact	Sedimentary	Limestone	Pg2	Veleshnja-Molishti	GWB065	23.96569
29	Berati	Compact	Sedimentary	Limestone	Pg1	Bistrovica	GWB078	9.626329
30	Berati	Compact	Sedimentary	Limestone	Pg2	Grepcka	GWB072	12.81564
31	Gjirokaster	Compact	Sedimentary	Limestone	Pg1	Arreza_e_Vogel	GWB087	1.352654
32	Gjirokaster	Compact	Sedimentary	Limestone	Pg1	Komari	GWB081	4.682719
33	Gjirokaster	Compact	Sedimentary	Limestone	Pg1	Shalesi	GWB071	14.07045
34	Gjirokaster	Compact	Sedimentary	Limestone	Pg1	Panariti	GWB077	10.77435
35	Gjirokaster	Compact	Sedimentary	Limestone	Pg1	Terpan_Paraspuar	GWB074	11.63377
36	Korçe	Compact	Sedimentary	Sandstone, marls, conglomerate, clays and different terrigenous	J3	Rehova	GWB107	11.33253
37	Berati	Compact	Sedimentary	Clays, sandstone, conglomerate	N1a	Velcani-Osmenzeza	GWB108	11.17789
38	Fier	Compact	Sedimentary	Clays, sandstone, conglomerate	N1-3t	Velcani-Malas	GWB122	2.065519
39	Fier	Compact	Sedimentary	Sandstone, conglomerate	N2-2rr	Vajkani-Ardenica	GWB130	23.83269

40	Fier	Compact	Sedimentary	Sandstone, conglomerate	N2-2rr	Miza	GWB140	0.491694
41	Fier	Compact	Sedimentary	Sandstone, conglomerate	N2-2rr	Kryegjata-Zhupani	GWB132	15.60718
42	Fier	Compact	Sedimentary	Sandstone, conglomerate	N2-2rr	Drize-Kraps-Kreshpan	GWB135	4.141446

Table xx - Aquifers in compact formations with very low productivity

No.	District	Aquifer type	Rocks type	Lithology	Age	GWB location	Code	Surface - km ²
1	Fier	Compact	Sedimentary	Clays, sandstone, conglomerate	Clays, sandstone, conglomerate	Aranitas-Osmenzeza	GWB109	8.287727
2		Compact	Sedimentary	Sandstone, marls, conglomerate, clays and different terrigenous	J3t-Cr1v	Kamican - Kukur	GWB149	68.65112
3		Compact	Sedimentary	Flysch	Pg1-2	Lleshan	GWB147	6.563741
4		Compact	Sedimentary	Flysch	Pg3-2	Gramsh-Skrapar	GWB150	302.159
5		Compact	Sedimentary	Flysch	Pg3-1	Bregasi	GWB154	53.28431
6	Fier	Compact	Sedimentary	Clays, alevrolite, conglomerate	Qp-h	Kolonj-Bubullime	GWB148	140.5278
7	Fier	Compact	Sedimentary	Clays, alevrolite, conglomerate	Qp-h	Afrim-Verbas	GWB145	57.03567
8	Korçe	Compact	Sedimentary	Sandstone, marls, conglomerate, clays and different terrigenous	Pg2-2	Cemerica_Graboc ka	GWB153	355.8122
9	Korçe	Compact	Sedimentary	Flish	Pg3-3	Dardhe_Nikolice	GWB151	50.09994
10	Korçe	Compact	Sedimentary	Sandstone, marls, conglomerate, clays and different terrigenous	J3t-Cr1v	Novosej	GWB146	5.375408
11	Korçe	Compact	Sedimentary	Sandstone, marls, conglomerate, clays and different terrigenous	J3t-Cr1v	Skorovoti_Gjonci	GWB144	90.78025

12		Compact	Sedimentary	Flysch	Pg3-1	Zhitom_Vokoploka	GWB143	211.7485
13		Compact	Sedimentary	Flysch	Pg3-1	Corovoda	GWB152	298.4995
14		Compact	Sedimentary	Sandstone, conglomerate	N2-2rr	Kurtina	GWB142	0.390612
15	Fier	Compact	Sedimentary	Sandstone, conglomerate	N2-2rr	Mbyet-Margellic	GWB131	18.6323
16	Fier	Compact	Sedimentary	Sandstone, conglomerate	N2-2rr	Garunjasi_Lekaj	GWB129	26.62739
17		Compact	Sedimentary	Sandstone, conglomerate	N2-2rr	Havalesi	GWB141	0.907093

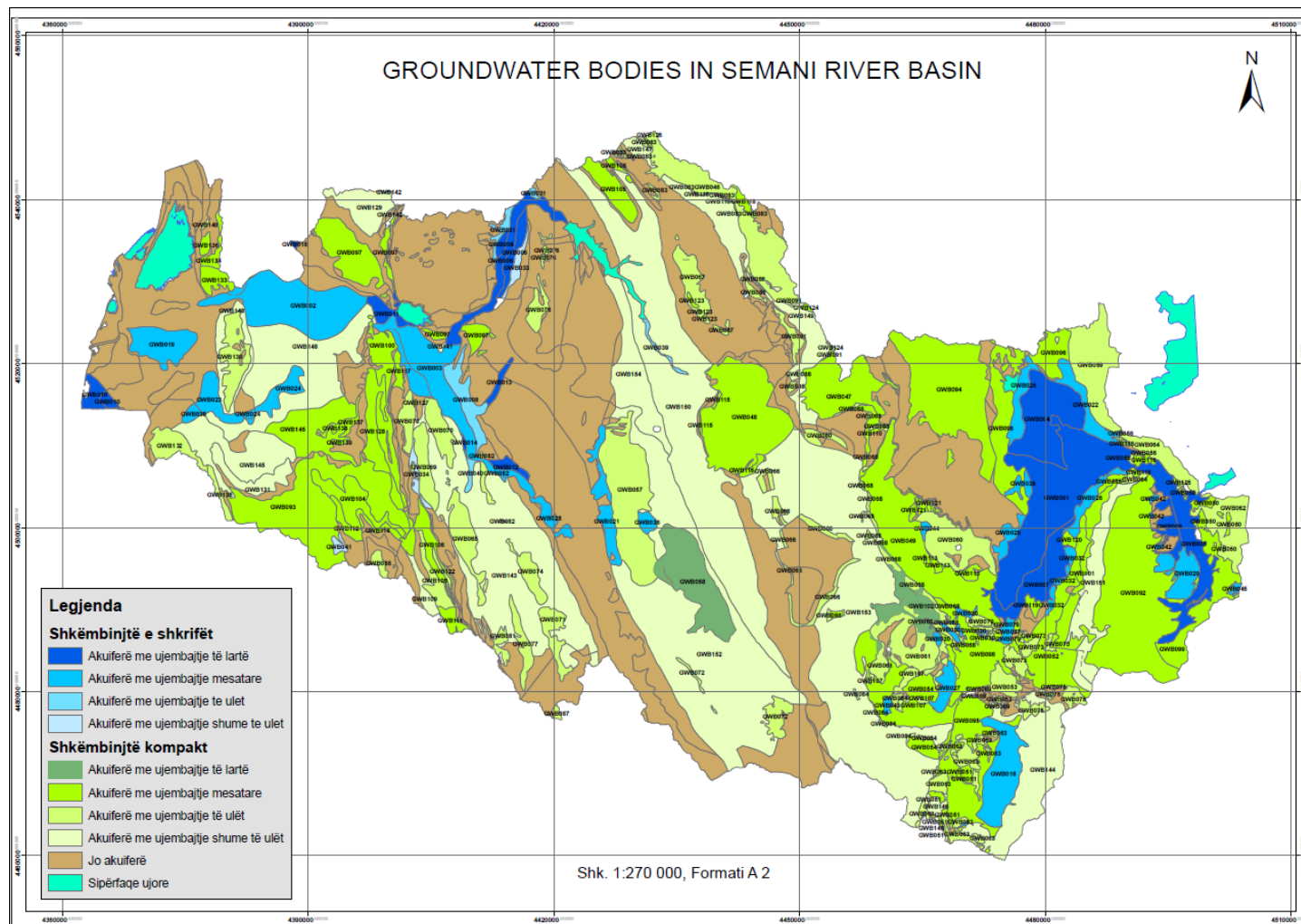
Notes to the inventory:

1. Parent geology is derived from the Albanian Geological Survey.
2. Waterbody code and type code are derived from the Hydrogeologist Expert.
3. Horizon determines level of groundwater within the parent aquifer.
4. Aquifer type follows EU WISE standard types.
5. Hb - Depth is hydraulic property average saturated depth of aquifer.
6. Sv - is hydraulic property - Specific yield.
7. Hk - is hydraulic property - Hydraulic conductivity, K - Coefficient of permeability.
8. Ht - is hydraulic property - Transmissivity, K x b.
9. *Transboundary* indicates that the groundwater waterbody extends beyond the surface topographical divide of an adjacent river basin.
10. *Dependent ecosystem* (GWDTE) definition complies with WISE 2016 reporting schema:
 - a) Dependent ecosystem (GWDTE) - "Groundwater-dependent terrestrial ecosystems (GWDTE) are terrestrial ecosystems that rely partially or fully on the groundwater body (GWB) to sustain their ecological functions, habitat structure and biological communities. They depend on groundwater level, pressure, discharge or subsurface moisture conditions. According to the WISE 2016 reporting schema, the relationship between a groundwater body and its dependent ecosystems is reported through the 'Link Terrestrial/Ecosystem(s)' schema element, which identifies the presence of dependent ecosystems, describes their type, and assesses potential risks arising from changes in groundwater conditions."
 - b) Link Terrestrial/Ecosystem(s) (WISE 2016 schema element) - "A reporting element within the WISE 2016 Groundwater Body (GWB) schema used to indicate whether a groundwater body supports groundwater-dependent terrestrial ecosystems (GWDTE).

The element records:

- (i) the existence of linked ecosystems (Yes/No);
- (ii) the identification or description of the ecosystem, and;
- (iii) the risk assessment related to groundwater pressures and impacts. This element forms part of the characterization and risk assessment of each GWB."

Map xx - Seman River Basin: Groundwater Body Category and Delineation



6.5 Characterisation and Delineation of Protected Areas

6.5.1 European Union Context

Under Article 6 and Annex IV of the Water Framework Directive (WFD), each River Basin must establish a Register of Protected Areas. This register includes all areas that require special protection for surface water, groundwater, or habitats and species directly dependent on aquatic ecosystems. Competent authorities must also prepare maps showing the location and extent of each protected area and describe the national or EU legislation under which each area has been designated.

Protected areas form an integral part of river basin management planning. They link WFD objectives with the objectives of other water-related and biodiversity legislation. Where protected area objectives are more specific or more stringent than the general WFD objective of good status, the RBMP must take these requirements into account.

6.5.2 Protected Areas in the Seman River Basin

Protected areas in the Seman River Basin are regulated under Law No. 29/2024 on Water Resources and are aligned with WFD Article 6 and Annex IV. They include areas for drinking water supply, fisheries, recreation, nutrient protection and nature conservation. Their designation and management support the alignment of Albanian river basin planning with EU water and biodiversity policy. The protected area register includes five main categories.

Drinking Water Protected Areas

Under Article 7 of the WFD, all water bodies used for the abstraction of more than 10 m³/day, or serving more than 50 persons, must be identified as Drinking Water Protected Areas (DWPAs). For groundwater, the DWPA must cover the entire delineated groundwater body, rather than only the immediate abstraction point. Where a contiguous aquifer provides drinking water and is not subdivided into smaller groundwater bodies, the full aquifer must therefore be designated as a DWPA.

DWPAs must be distinguished from safeguard or protection zones under WFD Article 7(3). These zones define where restrictions are needed to protect the drinking water source. International practice commonly applies three concentric protection zones: an outer source catchment zone, an intermediate buffer zone and an inner security zone. The outer zone corresponds to the DWPA itself and supports general land-use and pollution-control measures. The intermediate zone controls risk from priority hazardous substances and river basin specific pollutants. The inner zone protects the immediate well-head or abstraction point against direct contamination.

In the Seman River Basin, the main drinking water supply comes from groundwater wells and springs in Fier, Berat, Kuçovë and surrounding municipalities. Some abstraction sources have designated protection perimeters, measured in metres around the abstraction points. However, the infrastructure and enforcement needed to secure these zones are often missing or inadequate. Information on these protection areas has not yet been included in a consolidated register, and systematic mapping is lacking. Private wells, widely used in rural areas, remain outside the formal system.

Drinking water zones are intended to secure clean water for human consumption and directly support the WFD objective of good chemical status. Without reliable mapping, monitoring and effective protection infrastructure, drinking water sources remain vulnerable to pollution.

Areas for the Protection of Economically Significant Aquatic Species

Areas for the protection of economically significant aquatic species are designated under Article 6 and Annex IV of the WFD. These areas protect surface waters that support species of economic value, such as fish, shellfish or crustaceans. They require water quality that supports the health, reproduction and sustainable exploitation of the species concerned.

In the Seman River Basin, the Ministry of Agriculture and Rural Development has established one area under Decision No. 238, dated 23 April 2014, which declares the Karavasta Lagoon as a protected fisheries area. This designation reflects the protected status of the lagoon as part of Divjakë-Karavasta

National Park, its classification as a specially protected natural area and its importance as habitat for waterbirds listed under the Ramsar Convention.

The area operates through a local fishery organisation and co-management plans that regulate fishing methods, vessel use and catch limits. These arrangements aim to support sustainable exploitation and ecosystem balance and therefore contribute to the WFD ecological objectives. At present, information on limited fishing areas or other protected fishing areas in the basin remains incomplete. This highlights the need for improved monitoring, transparency and reporting to support fish stock sustainability.

Recreational and Bathing Waters

Bathing waters are designated under Article 6 and Annex IV of the WFD and in line with the Bathing Water Directive. They include surface waters regularly used for bathing and therefore require protection to safeguard human health and maintain suitable recreational water quality.

In Albania, bathing waters are formally designated each year through a Decision of the Council of Ministers, which approves the list of permitted beaches and their typologies. Within the Seman River Basin, Divjakë, Pirgu and Seman beach are included as official bathing waters. Despite this legal framework, monitoring remains limited. Albania has not yet established a comprehensive programme fully aligned with the EU Bathing Water Directive.

The 2023 State of the Environment Report shows that coastal bathing waters in the basin are under increasing pressure. Microbiological monitoring for Intestinal Enterococci and Escherichia coli indicates a decline in bathing water quality. At Seman and Darëzezë beaches, monitoring in 2023 classified three stations as good, one as sufficient and three as excellent. This represents a decline compared with 2020–2022, when all stations were consistently rated excellent. At Divjakë Beach, 2023 results showed one station with excellent quality, one good and one sufficient, also indicating deterioration compared with previous years.

Overall, the limited number of monitoring sites and the lack of systematic public reporting mean that objectives for safe recreation and public health protection are not yet fully met. Alignment with WFD requirements remains incomplete, particularly in areas where tourism and recreation are significant.

Nutrient-Sensitive Zones

EU legislation requires the designation of areas that need protection against nutrient pollution from diffuse and point sources. Under the Nitrates Directive, Nitrate Vulnerable Zones must be designated where agricultural practices may cause nitrate concentrations to exceed 50 mg/l in waters used, or potentially used, for drinking water abstraction. Under the Urban Waste Water Treatment Directive, nutrient-sensitive areas must be designated where waters are eutrophic, at risk of becoming eutrophic, or require additional wastewater treatment to protect aquatic habitats and species.

No Nitrate Vulnerable Zones or nutrient-sensitive areas have yet been designated in the Seman River Basin, although the Water Resources Law provides for their designation. Monitoring carried out in 2023 at eight stations across the basin shows that, based on nitrites, nitrates and total phosphorus, waters are classified as Class I, or High Status. Based on orthophosphate concentrations, waters fall into Class II, or Good Status. This indicates that nutrient pollution is not yet a significant issue at the monitored sites.

However, because nutrient-sensitive zones have not been officially declared, the preventive measures that normally apply under EU law are not yet in place. These include stricter wastewater treatment requirements and Codes of Good Agricultural Practice for farmers. This creates a gap between current good status and long-term protection, particularly if agriculture expands or intensifies in the future. Designating these zones would support the WFD no-deterioration principle and help protect water quality against future risks from agricultural pollution and nutrient enrichment.

Nature Protection Areas for Habitats and Species

Nature protection areas are designated under Article 6 and Annex IV of the WFD for the protection of habitats and species directly dependent on water. They include areas linked to the Birds Directive and the Habitats Directive and, in the EU context, form part of the Natura 2000 network. These areas require water status and management measures that maintain or restore the ecological conditions needed to achieve conservation objectives.

The Seman River Basin contains a wide network of nationally and internationally protected areas. These include national parks, such as Divjakë-Karavasta, Mali i Tomorrit, Prespa and Bredhi i Hotovës-Dangëlli; nature reserves, including Balloll, Bogovë, Lugina e Gjergjevicës and Cangonji; and protected landscapes, such as Guri i Nikës-Valamarë-Lenie, Bredhi i Drenovës-Sinicë and Liqeni i Pogradecit. The basin also includes Ramsar wetlands, Emerald sites, Important Bird Areas and UNESCO World Heritage sites.

These areas protect wetlands, rivers, lakes, forests and mountain ecosystems, many of which are directly water-dependent. They contribute to biodiversity conservation and support the WFD objective of good ecological status. However, several protected areas still lack approved management plans. In addition, protected area management plans are not yet fully integrated into territorial development planning and river basin management planning. This leads to fragmented planning and reduces the effectiveness of conservation measures. Weak enforcement further limits the capacity of protected areas to address pressures effectively.

6.5.3 Register of Protected Areas

The Register of Protected Areas provides the formal overview of all protected areas in the Seman River Basin that are relevant for WFD implementation. It identifies the protected area category, location, legal basis and relationship with surface water bodies and groundwater bodies. The register also supports the preparation of maps and the integration of protected area objectives into monitoring, status assessment and the Programme of Measures.

For the Seman River Basin, the register includes drinking water protected areas, areas for economically significant aquatic species, bathing waters, nutrient-sensitive zones where designated, and nature protection areas for habitats and species. The register must be maintained and updated as new information becomes available, including improved mapping of drinking water protection zones, updated bathing water classifications, future designation of nutrient-sensitive areas and further clarification of water-dependent nature protection objectives.

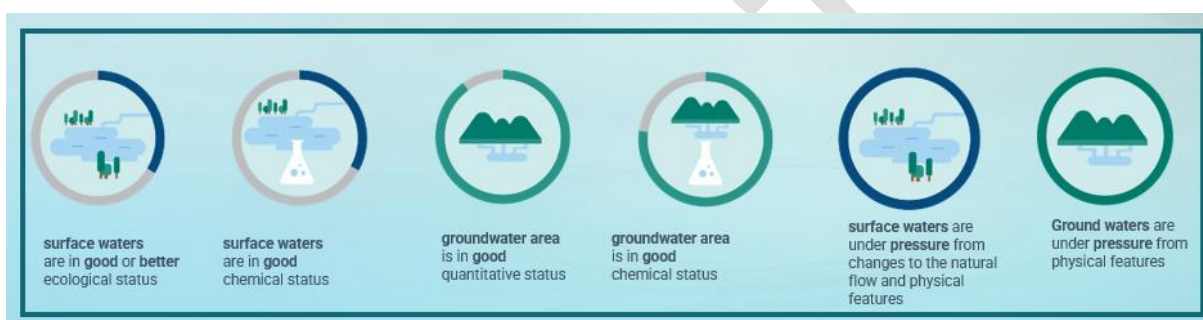
A summary of the Register of Protected Areas is included in **Chapter 11 of this RBMP**. That chapter presents the relevant protected areas for the Seman River Basin and provides the basis for linking their specific protection requirements with the environmental objectives and measures of this plan.



7 ENVIRONMENTAL OBJECTIVES FOR THE RIVER BASIN

This chapter summarises the environmental objectives applied in this River Basin Management Plan (RBMP). It translates the technical framework developed in the Task Report 5, Environmental Objectives for Surface and Groundwater, into a policy-oriented description. The detailed definitions, assessment methods, proposed standards, quality elements, threshold values and methodological references are presented in the Task Report 5.

The chapter explains what the objectives mean for surface water bodies, groundwater bodies and water-related protected areas. It also clarifies how Albania will progressively strengthen the technical basis for WFD-compliant status assessment, including reference conditions, monitoring programmes, environmental quality standards and class boundaries.



7.1 Purpose of environmental objectives in the RBMP

Environmental objectives define what the RBMP aims to achieve for each water body and for each water-dependent protected area. They provide the link between water body characterisation, pressure analysis, monitoring, status assessment and the Programme of Measures. They therefore guide public investment, permitting, inspection, restoration planning and institutional cooperation.

This RBMP applies the objective framework of the EU Water Framework Directive (WFD) and the Albanian Water Resources Law No. 29/2024. The objectives focus on preventing deterioration, improving water status where needed, and securing the water conditions required for protected areas and legitimate water uses. The RBMP treats water quality, water quantity, hydromorphology and ecosystem functioning as connected parts of one river basin management system.

For surface waters, the RBMP aims to achieve good surface water status. This requires both good ecological status, or good ecological potential for heavily modified and artificial water bodies, and good chemical status. For groundwater, the RBMP aims to achieve good groundwater status. This requires both good quantitative status and good chemical status. For protected areas, the RBMP also applies the standards and objectives of the legislation under which the areas have been designated. Where these objectives are more stringent than the general WFD objective of good status, the more stringent objective applies.

Table x - Purpose of environmental objectives in the RBMP.

Water category	Main environmental objective	What this means for RBMP implementation
Surface water bodies	Prevent deterioration and achieve good ecological status/potential and good chemical status.	Set type-specific objectives, assess biological, physico-chemical and hydromorphological quality elements, control priority substances and implement measures where status is below objective.

Groundwater bodies	Prevent or limit pollutant inputs, prevent deterioration and achieve good quantitative and chemical status.	Balance abstraction with long-term recharge, protect connected surface waters and dependent ecosystems, apply groundwater quality standards and reverse significant upward pollution trends.
Protected areas	Meet the standards and objectives of the relevant protected area legislation in addition to WFD objectives.	Maintain a protected area register, align monitoring and measures with drinking water, bathing water, nutrient-sensitive, habitat and species protection requirements.

7.2 Policy and legal basis

Albania is aligning its water management system with the EU environmental acquis under Chapter 27. The WFD provides the core framework for integrated river basin management. Law No. 29/2024 on Water Resources establishes the national basis for setting environmental objectives for surface water bodies, groundwater bodies and water-related protected areas through river basin management planning. It requires AMBU and the responsible authorities to protect, improve and restore water bodies and to implement Programmes of Measures that support good status, good ecological potential and protected area compliance.

The RBMP uses the WFD Article 4 objective structure. This means that competent authorities must prevent deterioration in the status of all water bodies, protect and enhance aquatic ecosystems, progressively reduce pollution, protect groundwater resources, and ensure that measures deliver the required status improvements. The RBMP also recognises that Albania is still building the technical and institutional system needed to demonstrate full compliance. Current limitations in monitoring coverage, data availability, laboratory capacity, biological assessment and classification methods reduce the confidence of some status assessments. The RBMP therefore combines immediate environmental objectives with a stepwise programme to strengthen the evidence base.

The Task Report 5 explains how the assessment system should develop. It highlights the need to establish national ecological reference conditions, expand WFD-compliant monitoring, define type-specific class boundaries, apply EU standards for priority substances, identify river basin specific pollutants, and improve groundwater quantity and quality assessment. The RBMP uses these technical steps as part of its implementation process.

7.3 Environmental objectives for surface water bodies

7.3.1 Overall objective

The RBMP sets the following overall objective for surface water bodies: prevent deterioration and achieve good surface water status. Good surface water status requires good ecological status and good chemical status. Where a water body has been properly designated as heavily modified or artificial, the ecological objective becomes good ecological potential, while the requirement for good chemical status remains unchanged.

Ecological status describes the quality of the structure and functioning of aquatic ecosystems. It reflects how biological communities respond to pressures such as urban waste water, agricultural nutrient losses, hydropower, abstraction, flow regulation, river continuity barriers, channel modification and habitat degradation. The RBMP therefore uses ecological status not only as a monitoring result, but also as a management signal: where biology, water quality, flow or morphology show deterioration, measures must address the underlying pressure.

7.3.2 Ecological status and ecological potential

The WFD classifies ecological status into five classes: high, good, moderate, poor and bad. The classification compares observed conditions with type-specific reference conditions. Reference conditions represent high ecological status and describe conditions with no, or only very minor, human alteration. Good status allows only slight deviation from these conditions. Moderate, poor and bad status indicate increasing ecological alteration.

Table x - Surface water status assessment.

High Status		No, or only very minor, anthropogenic alteration of biological, physico-chemical and hydromorphological quality elements.
Good Status		Slight deviation from reference conditions in the composition and abundance of biological quality elements; supporting physico-chemical and hydromorphological conditions are consistent with good ecological functioning.
Moderate Status		Moderate deviation from reference conditions; supporting physico-chemical and hydromorphological conditions are consistent with moderate ecological functioning.
Poor Status		Major alteration of biological quality elements.
Bad Status		Severe alteration of biological quality elements.

For natural surface water bodies, the RBMP aims for good ecological status. For heavily modified water bodies (HMWBs) and artificial water bodies (AWBs), the RBMP aims for good ecological potential. This objective recognises that some physical modifications support specified uses such as hydropower, flood protection, navigation, water supply or irrigation & drainage. However, HMWB or AWB designation does not legitimise avoidable impacts. It requires a transparent water body-specific test and must be accompanied by all mitigation measures that can be implemented without significant adverse effects on the specified use.

7.3.3 Biological quality elements and reference conditions

The RBMP assesses ecological status through biological quality elements supported by physico-chemical and hydromorphological quality elements. The relevant biological quality elements include Fish, Benthic Invertebrates (macrofauna), Phytobenthos and Macrophytes:

- Fish communities indicate the ecological condition of rivers and lakes. Their species composition, abundance and age structure reflect pressures such as barriers, altered flow, habitat degradation and pollution.
- Invertebrates (macrofauna) are small animals living on or near the river or lake bed. They respond quickly to organic pollution, oxygen stress, habitat quality and hydromorphological changes.
- Phytobenthos are algae and microorganisms attached to stones, sediment or plants. They are mainly used to assess nutrient enrichment, light conditions and general water quality. Benthic diatoms form a specific and widely used component of the phytobenthos, because they provide sensitive indicators for nutrient enrichment and pollution.
- Macrophytes are larger aquatic plants, including submerged, floating and emergent species. Their presence, abundance and composition reflect nutrient levels, water depth, flow conditions and habitat structure.



Figure x - Biological quality elements.

The RBMP recognizes biological quality elements as the core evidence for ecological status. Biological communities integrate the effects of multiple pressures over time and therefore provide a stronger indication of ecosystem health than individual chemical measurements alone. The Task 5 Report identifies benthic diatoms, benthic macroinvertebrates and other biological groups as key elements for developing Albania's ecological assessment system.

For benthic diatoms, the assessment can use indices that respond to nutrient enrichment, organic pollution and general pollution sensitivity, including the Trophic Diatom Index, Saprobic Index, Specific Pollution Sensitivity Index and community diversity metrics. For benthic macroinvertebrates, the assessment can use multimetric approaches consistent with the AQEM concept, including EPT taxa, BMWP, ASPT, Shannon-Wiener diversity, Margalef diversity and saprobic indices.

These metrics should not be interpreted in isolation. Albania should normalise and combine them into type-specific multimetric assessment methods and express results as Ecological Quality Ratios (EQRs).

At this stage, Albania has not yet established a complete set of national biological reference conditions and class boundaries for all surface water types. The RBMP therefore treats current ecological classifications as provisional where the data basis remains limited. During this planning cycle, the competent authorities should use the expanding biological monitoring data from the basins to identify low-pressure reference sites, develop pressure-response relationships, establish preliminary class boundaries and prepare future intercalibration or alignment with comparable European methods.

7.3.4 General physico-chemical conditions

General physico-chemical conditions support biological status and help explain the pressures affecting aquatic ecosystems. The analysis uses parameters such as dissolved oxygen, BOD5, nutrients, pH, conductivity, temperature, suspended solids, salinity and transparency to identify pressure patterns and to support ecological classification.

Nutrient enrichment, organic pollution and oxygen depletion are particularly relevant pressures in Albanian river basins, especially where untreated or insufficiently treated waste water and agricultural run-off affect rivers and lakes.

The analysis applies a stepwise approach. In the short term, existing NEA classification schemes and available monitoring data provide an interim basis for assessment. In parallel, Albania should develop WFD-compliant type-specific ranges for general physico-chemical elements. These ranges must be stringent enough to support good biological status and must reflect natural differences between water body types, altitude, geology, climate and hydrological regime.

7.3.5 Chemical status

EU water legislation addresses chemical pollution in surface waters through two complementary components:

- EU-wide substances: *priority substances* (including *priority hazardous substances*) are identified and regulated at EU level under the WFD, with Environmental Quality Standards (EQS) set in the EQS Directive 2008/105/EC, as amended by Directive 2013/39/EU¹⁰¹.
- River basin specific pollutants (RBSPs): additional pollutants of national or local concern are identified by Member States (or competent authorities) and controlled at the appropriate river basin level.

Surface water bodies are classified into 5 water quality categories of regulatory compliance:

1. **High Status:** No or very minor anthropogenic impacts; meets natural background levels.
2. **Good Status:** Meets all European Environmental Quality Standards (EQS).
3. **Moderate Status:** Certain chemical concentrations exceed baseline levels but have not triggered widespread ecological collapse.
4. **Poor Status:** Chemical pollutants (such as nitrates or pesticides) are consistently failing safety thresholds.
5. **Bad Status:** Severe chemical degradation that results in the loss of biological communities.

Good chemical status for surface water requires compliance with the Environmental Quality Standards for all EU priority substances and certain other pollutants. The RBMP recognises that routine monitoring for the full priority substance list is not yet in place. This creates uncertainty in chemical status classification. The Programme of Measures therefore needs to prioritise the establishment of a WFD-compliant chemical monitoring programme, including priority substances, relevant matrices such as water, sediment or biota, and quality-assured laboratory procedures.

The RBMP also recognises the need to identify river basin specific pollutants. These are pollutants of national, regional or local concern that are discharged in significant quantities and that may affect ecological status. Albania should use pressure analysis, emission inventories, monitoring results, industrial and mining information, agricultural pesticide use, waste water data and expert judgement to compile the first basin-specific pollutant lists.

7.3.6 Environmental flow, hydromorphology and hydropower

Flow regime and hydromorphology strongly influence ecological status. Rivers require not only a minimum flow during dry periods, but a seasonal flow regime that supports habitat diversity, sediment transport, migration, reproduction, oxygen dynamics and ecosystem resilience. The RBMP therefore treats environmental flow as a regime, not only as a single fixed low-flow threshold.

Current Albanian practice often relies on a single minimum-flow value such as Q97 or Q355. This approach provides a simple interim safeguard but does not fully protect ecological functioning across seasons and hydrological conditions. The RBMP therefore sets a medium-term objective to move towards environmental flow requirements based on flow-duration curves and ecological flow-response relationships. This transition requires reliable hydrometric data, naturalised flow series, improved abstraction and return-flow records, and stronger monitoring of ecological responses.

Hydromorphological pressures are especially relevant where hydropower plants, dams, weirs, diversions and depleted reaches alter flow, continuity and habitat conditions. The RBMP requires a transparent assessment of these pressures. Where hydropower or other physical modifications substantially change the character of a water body, the competent authorities may consider HMWB designation only after applying the full WFD Article 4(3) test. They must demonstrate that restoration to good ecological status would significantly affect the specified use and that no technically feasible, significantly better environmental alternative exists at proportionate cost. Even where designation is justified, the RBMP must define good ecological potential and require feasible mitigation measures, including environmental flow regimes, fish migration measures, continuity restoration and operational improvements where relevant.

¹⁰¹ European Commission – Water Framework Directive, Article 16, and Annex X replaced by EQSD, Annex II.

7.3.7 Overall surface water status assessment

The RBMP determines overall surface water status through the one-out-all-out principle. A water body achieves good surface water status only when ecological status or potential and chemical status are both good. Within ecological status, the lowest classed relevant quality element determines the outcome. This principle prevents strong performance in one element from masking failure in another. It also helps decision-makers identify the pressure that constrains objective achievement.

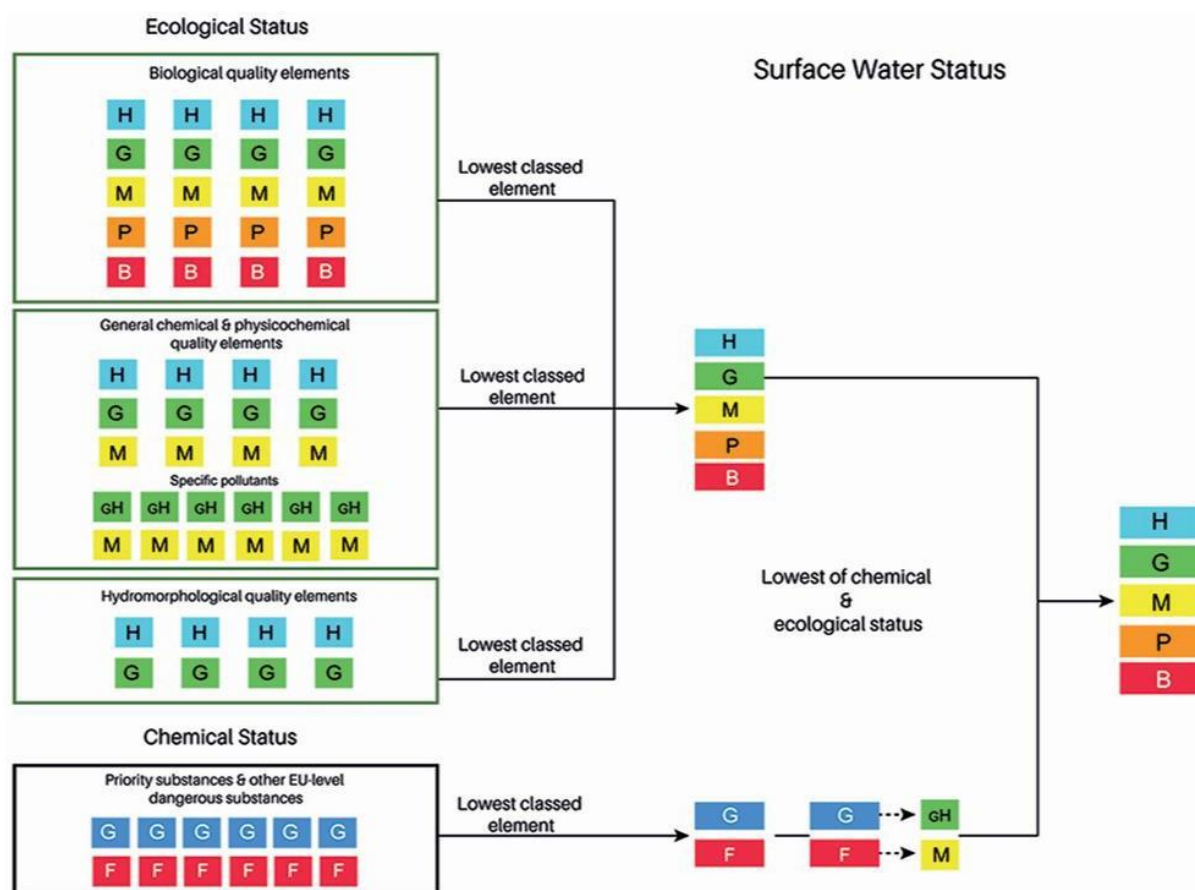


Figure xx – Procedure for Overall Status Assessment of Surface Waterbodies.

7.4 Environmental objectives for groundwater bodies

7.4.1 Overall objective

The RBMP sets the following objective for groundwater bodies: prevent deterioration and achieve good groundwater status. Good groundwater status requires both good quantitative status and good chemical status. The RBMP also protects groundwater functions, including drinking water supply, baseflow to rivers, support for groundwater-dependent terrestrial ecosystems and long-term availability for legitimate water uses.

7.4.2 Quantitative status

Good quantitative status requires a sustainable long-term balance between groundwater recharge and abstraction. The available groundwater resource must not be exceeded by long-term annual average abstraction. Groundwater abstraction must also not prevent associated surface waters from achieving their ecological objectives and must not damage groundwater-dependent terrestrial ecosystems. The RBMP recognises that groundwater and surface water form one connected resource. Excessive groundwater abstraction can lower groundwater levels, reduce spring discharge, reduce river baseflow, alter the hyporheic zone and increase ecological stress during low-flow periods. Spring capture for water

supply may have limited impact on the groundwater body at the point of discharge, but it can reduce baseflow in the receiving surface water body and therefore affect surface water ecological status.

Current groundwater-level monitoring and hydrometric data are not yet sufficient to quantify recharge, abstraction pressure and groundwater-surface water interactions with high confidence in all groundwater bodies. The RBMP therefore treats the current groundwater quantitative assessment as indicative where data are limited. It sets a clear implementation priority to strengthen groundwater-level monitoring, abstraction registration, spring-flow monitoring, water-balance assessment and, where necessary, groundwater modelling.

7.4.3 Chemical status and trend reversal

Good groundwater chemical status requires pollutant concentrations to remain below groundwater quality standards and threshold values. It also requires that pollution does not cause saline or other intrusion, does not compromise associated surface water objectives, does not damage groundwater-dependent terrestrial ecosystems, and does not increase treatment needs for drinking water production.

The RBMP applies the Groundwater Directive logic. Nitrate and pesticides have EU groundwater quality standards. For other pollutants and indicators, competent authorities must establish threshold values that reflect natural background levels, groundwater uses, interactions with surface waters and groundwater-dependent ecosystems, and the hydrogeological characteristics of each groundwater body. Relevant parameters include arsenic, cadmium, lead, mercury, ammonium, chloride, sulphate, conductivity, trichloroethylene and tetrachloroethylene, among others.

The RBMP also requires the identification and reversal of significant and sustained upward trends in pollutant concentrations in groundwater bodies at risk. Trend assessment requires long-term monitoring datasets. Because such datasets are currently limited in Albania, this RBMP prioritises the development of groundwater quality monitoring time series and the definition of starting points for trend reversal, normally based on a percentage of the relevant quality standard or threshold value.

7.4.4 Groundwater-dependent ecosystems

Groundwater-dependent terrestrial ecosystems and associated surface waters require specific attention because they may fail their ecological objectives when groundwater quantity or quality deteriorates. The RBMP uses groundwater body characterisation and risk assessment to identify ecosystems that may depend on groundwater discharge. Where the Baseflow Index indicates a high groundwater contribution to river flow, or where wetlands, springs or protected habitats depend directly on groundwater, the Programme of Measures should protect both groundwater levels and groundwater quality.

Specialist ecological and hydrogeological surveys may be required to confirm groundwater dependency and define the conditions needed to protect these ecosystems. The RBMP therefore links groundwater objectives to protected area management, environmental flow assessment, abstraction control and land-use measures in recharge zones.

7.4.5 Overall groundwater status assessment

For groundwater, overall status is determined by the poorer of quantitative status and chemical status and is therefore classified as either:

Table x – Groundwater status assessment.

Good		xxx
Fail		xxx

7.5 Environmental objectives for protected areas

The WFD requires each river basin to maintain a register of protected areas. Protected areas include water bodies used for drinking water abstraction, areas designated for economically significant aquatic

species, bathing and recreational waters, nutrient-sensitive areas and areas designated for the protection of habitats and species where water status forms an important protection factor.

Protected areas are subject to the general WFD objectives and to the specific objectives of the legislation under which they were designated. Where a protected area coincides with a surface water body or groundwater body, both objective frameworks apply. In practice, this means that good status may not be sufficient where the protected area requires more stringent water quality, quantity, habitat or health-related conditions.

7.5.1 Drinking water protected areas

For waters used for drinking water abstraction, the RBMP aims to protect raw water quality and to avoid deterioration. The objective is to ensure that drinking water can be produced under the treatment regime applied and that authorities reduce, where possible, the level of purification treatment needed. Measures may include protection zones, abstraction control, pollution prevention, monitoring of raw water quality, land-use restrictions and stronger enforcement against contamination risks.

7.5.2 Bathing and recreational waters

For bathing and recreational waters, the RBMP supports the objectives of the Bathing Water Directive: protect human health, prevent and reduce pollution, classify bathing water quality and inform the public. Albania already monitors some recreational waters, but the RBMP recognises that identification, characterisation, profiling and classification need further alignment with EU requirements. Measures should address pollution sources that may affect bathing waters, including waste water discharges, stormwater overflows, diffuse pollution and poor sanitation infrastructure.

7.5.3 Nutrient-sensitive areas and nitrate vulnerable zones

Nutrient enrichment remains a key pressure for many surface waters. The RBMP therefore links WFD ecological objectives with the Nitrates Directive and the Urban Waste Water Treatment Directive. The objective is to reduce and prevent water pollution caused by nitrates from agricultural sources and to control nutrient discharges from agglomerations and waste water treatment plants. Where water bodies show eutrophication risk, the Programme of Measures should include agricultural nutrient management, improved waste water treatment, sensitive area designation where appropriate, and targeted monitoring of nitrogen, phosphorus and biological responses.

7.5.4 Habitats, species and wetlands

Water-dependent habitats and species require water conditions that support favourable conservation status. The RBMP therefore protects and, where necessary, improves the water environment to the extent needed for habitat and species conservation objectives. This is particularly important for wetlands, floodplains, deltas, lakes, springs and river reaches with high biodiversity value. Measures may include restoring hydrological regimes, reducing pollution, improving continuity, protecting groundwater discharge, managing sediment and limiting physical disturbance.

Albania is still developing the Natura 2000 framework and related protected area information systems. The RBMP should therefore progressively improve the protected area register, map water-dependent habitats and species, and align water management measures with protected area management plans.

7.6 How the RBMP applies the objectives in this planning cycle

This RBMP applies environmental objectives in a pragmatic but WFD-consistent way. It sets the direction of travel towards full WFD implementation while recognising current data and capacity constraints. The objectives are already binding as planning objectives, but the assessment methods, monitoring coverage and classification confidence will improve during implementation.

For this planning cycle, the RBMP applies the following implementation approach:

- use the current delineation of surface water bodies and groundwater bodies as the management units for objectives, monitoring, status assessment and measures;
- apply the non-deterioration objective to all water bodies and protected areas;
- use available monitoring and expert judgement to identify pressures and provisional status where data remain incomplete;
- prioritise measures where pressures clearly prevent objective achievement, especially waste water pollution, nutrient enrichment, hydromorphological alteration, abstraction pressure and priority pollution risks;
- develop national reference conditions and class boundaries progressively, using new monitoring data, low-pressure sites, pressure-response analysis and regional comparison;
- strengthen surface water monitoring for biological quality elements, general physico-chemical elements, hydromorphology, priority substances and river basin specific pollutants;
- strengthen groundwater monitoring for levels, abstraction, springs, chemical status, threshold values and trend assessment;
- develop environmental flow methods based on flow regimes and ecological needs, supported by re-established hydrometric data;
- complete and maintain the protected area register and align RBMP measures with protected area objectives;
- document uncertainties transparently and update classifications when new evidence becomes available.

7.7 Main priorities for the Programme of Measures

The environmental objectives only become effective when they guide concrete measures. The Programme of Measures should therefore focus on the pressures that most directly prevent objective achievement and on the system improvements needed to demonstrate progress. The following priorities follow from the Task Report 5 framework and should guide implementation during this RBMP cycle.

Table xx - Main priorities for the Programme of Measures.

Priority	RBMP relevance
Complete the WFD assessment system	Establish national reference conditions, type-specific class boundaries and EQR-based biological assessment methods for Albanian water body types.
Strengthen monitoring and data management	Expand surveillance, operational and investigative monitoring; harmonise field methods; quality-assure laboratory results; store all monitoring data in a structured national database.
Control organic pollution and nutrients	Reduce untreated and insufficiently treated waste water discharges, improve waste water treatment and address agricultural nutrient losses in eutrophication-sensitive catchments.
Address hydromorphological pressures	Assess hydropower, depleted reaches, barriers, channel modification and sediment disruption; apply HMWB tests transparently; implement feasible mitigation.
Protect environmental flows	Move from single minimum-flow thresholds towards flow-regime-based environmental flow requirements supported by hydrometric monitoring and ecological evidence.
Protect groundwater resources	Improve abstraction registration, groundwater-level monitoring, chemical monitoring, threshold values and trend assessment; protect recharge zones and connected ecosystems.
Integrate protected areas	Maintain a protected area register and ensure that drinking water, bathing water, nutrient-sensitive, habitat and species objectives are reflected in monitoring and measures.

7.8 Conclusion

The RBMP sets a clear environmental ambition: Albania must prevent deterioration, restore and protect water bodies, achieve good status or good ecological potential, protect groundwater resources and meet

the objectives of water-dependent protected areas. These objectives provide the policy anchor for monitoring, permitting, investment, restoration and enforcement.

The current planning cycle should deliver two parallel results. First, it should implement practical measures that reduce the main pressures on surface waters, groundwater and protected areas. Second, it should build the WFD-compliant technical system needed for future planning cycles: reference conditions, class boundaries, monitoring networks, priority substance monitoring, groundwater thresholds, environmental flow methods, protected area registers and transparent status classification.

By combining immediate action with systematic capacity building, the RBMP can move Albania from strategic alignment with the WFD towards operational implementation in each river basin.

CONCEPT

8 MONITORING NETWORK AND DATA

This chapter presents the design, scope, and implementation of the basin's monitoring network in accordance with Annex V of the WFD. It describes monitoring programmes for surface water quantity and quality, groundwater, and protected areas. The chapter explains the selection of parameters, sampling frequencies and station coverage. It also highlights data gaps and priorities for improvement, ensuring that monitoring results support reliable status classification, risk assessment, and adaptive management.

This chapter translates the technical framework, data collection and analysis presented and outlined in detail in the Task Reports 4a to 4f.

8.1 Legal Context

8.1.1 Albania

Water monitoring responsibilities in Albania are currently distributed across several institutions, including the Agency for Water Resources Management (AMBU), River Basin Administration Offices (ZABU), National Environmental Agency (NEA), Institute of GeoSciences (IGEO), Albanian Geological Survey (AGS), Institute of Public Health (IPH), Local Health Care Units (LHCU), municipalities, water utilities, and universities. While sectoral mandates exist, responsibilities remain only partially aligned with the integrated monitoring and assessment system required under the Water Framework Directive (WFD).

Albania has progressively shifted from traditional river-basin administration toward the WFD concept of water body-based management, under which rivers, lakes, transitional waters, coastal waters, groundwater bodies, and protected areas become the principal planning, monitoring, and reporting elements. This transition requires monitoring systems that are explicitly designed to assess ecological and chemical status at water body scale rather than only through traditional station networks.

For groundwater bodies, monitoring and assessment must address two distinct status components:

- chemical status, in accordance with the Groundwater Directive (2006/118/EC);
- quantitative status, in accordance with the WFD.

For surface waters, monitoring must address:

- ecological status or ecological potential;
- chemical status;
- hydrological and hydro morphological supporting conditions;
- protected area objectives (drinking water, bathing water, Natura-type ecosystems where relevant).
- Inter-institutional data sharing obligations.

Under the WFD, monitoring is not a stand-alone technical exercise. It is the evidence base for pressure analysis, status classification, exemptions, Programmes of Measures, and compliance reporting. Strengthening the legal integration between monitoring institutions and planning authorities therefore remains a strategic priority for Albania.

Albania has advanced in water monitoring, but fragmented responsibilities hinder full Water Framework Directive (WFD) implementation and integrated river basin management. Mandates and reporting remain divided, leading to inefficiency.

Monitoring programs need consolidation to meet WFD standards—risk-based, water body-focused, and organized by surveillance, operational, and investigative goals. Lack of coordination in network design and data selection keeps systems sector-focused instead of prioritizing ecological status.

Institutional ownership is essential for accurate water assessments. Integration of datasets and standard methods is needed to avoid inconsistent or delayed results. Biological monitoring requires clearer roles

for evaluating indicators such as phytoplankton and fish; effective monitoring depends on collaboration across institutions.

Hydro morphological monitoring must be legally defined, with mandates covering river continuity, flow changes, channel modification, habitat diversity, and floodplain connectivity. Assessing groundwater–surface water interactions remain challenging due to institutional divides.

Data exchange and interoperability are governance challenges, as varied formats and reporting timelines impede information sharing. Quality assurance is crucial, with inconsistencies affecting comparability.

Integrated GIS platforms and shared databases support spatial analysis and planning, but separate systems slow progress and reduce transparency. Clear institutional responsibilities are vital for river basin reporting and ensuring monitoring informs management plans.

Legal frameworks require clarification, especially for hydro morphological and ecological monitoring, abstraction data collection, and reporting. Groundwater threshold values should be scientifically based, and pollution trend analysis systematically included. Protection of groundwater-dependent ecosystems is necessary.

Collaboration with utilities, irrigation agencies, and hydropower operators is essential, as their data strengthens national monitoring and basin management.

8.1.2 European Union

Under the WFD, monitoring programmes are designed to assess the status of water bodies and support river basin planning. This requires:

- designated competent authorities;
- quality-assured monitoring systems;
- representative monitoring networks;
- harmonised assessment methodologies;
- coordinated river basin reporting.

For groundwater, EU legislation requires monitoring to support assessment of:

- chemical status (including nitrates, pesticides and nationally relevant pollutants);
- quantitative status (groundwater levels and abstraction balance);
- significant and sustained upward pollution trends;
- impacts on groundwater associated surface waters;
- impacts on groundwater-dependent terrestrial ecosystems.

8.2 Surface Water Quantity Monitoring Programme

8.2.1 Competent Authority

The primary institution responsible for surface water quantity monitoring in Albania is the **Institute of Geosciences (IGEO)**. IGEO operates the national hydrological and meteorological observation systems and provides the main data used for hydrological assessments, water resources planning, drought management, and flood risk management. Its monitoring responsibilities include:

- River water levels;
- River discharge;
- Precipitation;
- Snow and climate-related inputs where relevant;
- Drought indicators;
- Flood-related hydrological parameters;
- Lake and reservoir water levels;
- Coastal sea-level observations.

IGEO is Albania's main institution for monitoring water resources, crucial for river basin planning, infrastructure management, and EU-compliant water policies. Its capacity falls short of modern Water Framework Directive (WFD) standards, especially in monitoring, forecasting, and digital data

management. Limitations include outdated equipment, insufficient funding, unreliable data, restricted telemetry, and a shortage of skilled personnel—resulting in incomplete hydrological records and reduced network representativeness.

These issues hinder WFD implementation, as reliable, time-series data are vital for assessing water pressures, ecological flow needs, drought risk, and climate impacts. Improving IGEO is essential for effective governance. Previous river basin plans used hydrological modelling to supplement direct monitoring, which is costly and impractical everywhere. Targeted measurements combined with models and remote sensing can ensure national coverage efficiently.

Hydrology alone doesn't capture river ecological status, which also depends on continuity, sediment, habitat diversity, channel morphology, and floodplain connectivity, often managed by multiple institutions. Activities like damming, channel modification, and urban engineering impact ecology regardless of water quantity; thus, broader collaboration and clear legal definitions are needed. Effective management requires coordinated efforts among IGEO, NEA, AGS, basin authorities, hydropower operators, and government ministries, using shared data and unified standards. Modernizing the hydrological system involves upgrading sites, expanding telemetry, maintaining databases, updating models, hiring specialists, and integrating hydro morphological assessments for comprehensive River Basin Management Plans.

8.2.2 Relevance of the Surface Water Quantity Monitoring Network

An effective quantity monitoring network is essential for implementing the Water Framework Directive (WFD), Floods Directive, drought resilience strategies, and basin-scale water allocation planning. It supplies the necessary hydrological data for sustainable management, risk mitigation, regulatory compliance, and adapting to climate change.

In the Seman River Basin, quantity monitoring has particularly high strategic importance due to the basin's hydrological complexity, economic significance, and exposure to increasing climate variability. This importance is driven by several key factors:

- The Devoll–Osum–Seman river system is a key network in Albania, merging tributaries with differing flow patterns. Monitoring helps track runoff, tributary input, seasonal changes, and downstream impacts.
- Hydropower and reservoir management in the upper and middle basin change natural flow patterns through controlled releases, storage, and generation. These actions affect downstream discharge, ecology, sediment movement, and water supply. Monitoring helps evaluate impacts and improve reservoir operations.
- High irrigation demand in the Myzeqe plain puts seasonal stress on water resources, especially during dry summers with low river flows. Accurate data is needed to balance agriculture, environmental flows, and other uses.
- Flood-prone downstream areas in the lower basin face frequent inundation from high flows, sediment buildup, low channel slopes, and poor drainage. Ongoing monitoring aids flood prediction, warning, modelling, and emergency planning.
- Water uses such as agriculture, hydropower, ecosystems, industry, and municipal supply need transparent allocation based on measurable resources. Monitoring helps ensure fair and efficient distribution during both regular and deficit periods.
- Greater climate variability and drought risk are causing more severe hydrological extremes. Longer dry spells, unpredictable rainfall, and changing runoff patterns demand improved observation systems for trend detection and adaptive management.

The monitoring network should provide reliable, continuous data on key hydrological parameters for effective management and planning. Tracking discharge trends helps evaluate changes in runoff due to abstractions, regulation, land-use, or climate, and supports basin water balance assessments. Water availability data enables accurate resource estimates and informed allocation during all seasons.

Monitoring low- flow is vital for identifying critical stress periods impacting aquatic ecosystems, irrigation, and water supplies. Effective drought tracking should cover early warning signals, streamflow shortages, groundwater changes, and event duration. This data is increasingly important with climate change.

The network should deliver precise flood data to enhance forecasting, modelling, infrastructure design, and emergency planning in vulnerable areas. In regulated zones, monitoring reservoir operations helps track water flow and storage, enabling better coordination of hydropower, flood prevention, and water supply.

Monitoring ecological flow is essential to maintain river habitats, biodiversity, and meet Water Framework Directive goals. Sediment dynamics data are also important since changes impact reservoir siltation, river shape, erosion, channel capacity, and flood management.

The network supports climate impact assessment by enabling trend analysis, hydrological model calibration, and scenario development. This helps planners and authorities predict changes in runoff, droughts, floods, and water reliability throughout the basin.

8.2.3 Status of the Surface Water Quantity Monitoring Network

The Albanian hydrometric network is crucial for tracking water in the Seman River Basin but requires significant upgrades to align with European standards and modern management. Existing systems fall short in supporting comprehensive assessment, integrated planning, climate resilience, and real-time operations.

The network's extensive hydrometric records enable trend analysis, flood and drought assessment, reservoir inflow estimation, and climate impact evaluation. This long-term data is vital for national monitoring.

IGEO retains institutional responsibility for hydrological data collection, preserving expertise, procedures, and national oversight. Standardized methods and efficient archiving support basin-wide coordination. Albania has practical experience in flood monitoring, especially along major rivers threatening settlements and infrastructure. Hydrometric stations are vital for managing reservoirs, irrigation, and water resources.

While the system has strengths, its effectiveness is hampered by structural issues like delayed data digitisation. Many records remain on paper or fragmented in electronic files, making them less accessible, slowing analysis, raising data loss risk, and hindering reporting. Systematic digitalisation is needed to maximize the value of past monitoring efforts.

Outdated rating curves can cause inaccurate discharge estimates due to changes in river channels from erosion, sediment, human impact, or altered flow. This makes hydrological data unreliable, especially during extreme events. Regular field recalibration is essential.

Ageing infrastructure creates difficulties, as many stations require repairs or upgrades to gauges, sensors, telemetry, power systems, and access. Poor conditions disrupt monitoring, lower data quality, and raise maintenance costs. Vandalism, theft, and floods also impact reliability.

Most of the basin has limited real-time data, with only partial automated observations and no full telemetry. This hampers flood alerts, reservoir coordination, drought management, and responses to extreme events, as modern basin management needs timely hydrological information. Spatial coverage is limited, as most stations are on main rivers and rarely in tributaries, reservoirs, irrigation zones, or floodplains. This underrepresentation can lead to hydrological assessments overlooking local pressures, water deficits, or tributary contributions.

A partial discrepancy exists between historical station networks and Water Framework Directive management units. Numerous legacy monitoring sites were established for engineering or flood control purposes and may not accurately represent present-day river water bodies, thereby restricting their effectiveness for evaluating ecological status, managing environmental flows, or integrated reporting.

A strategic modernization program should focus on digitizing and verifying hydrological records in a secure national database. Regular flow measurements and hydraulic reviews are necessary to recalibrate rating curves at key stations. Install or upgrade automatic telemetry stations at key sites to enhance real-time flood, drought, and reservoir monitoring. Address both low-flow and flood extremes

for better climate variability management. Modernisation should combine hydrological, ecological, meteorological, groundwater, and water quality data for effective basin management. Basin-wide databases, forecasting, and modelling tools will enable analysis, planning, operations, and adaptation.

8.3 Surface Water Quality Monitoring Programme

8.3.1 Competent Authority

The **National Environment Agency (NEA)** is the lead competent authority for surface water quality monitoring in Albania. The National Environmental Monitoring Programme remains the formal legal basis for much of the current operational monitoring network. NEA is responsible for:

- design and implementation of monitoring programmes;
- field sampling and laboratory analysis;
- quality assurance, data validation and reporting;
- assessment of ecological and chemical status;
- reporting under national legislation and eu approximation processes;
- coordination with river basin authorities and other relevant institutions.

Supporting institutions include:

- Albanian geological survey;
- IGEO (hydrology, meteorology and water levels);
- Institute of public health;
- Universities and research institutes (biology, taxonomy, ecology);
- Local authorities and utilities;
- Donor-funded technical assistance projects.

NEA's monitoring framework broadly follows the principles of the EU Water Framework Directive (WFD), but still largely reflects a historical station-based system rather than a fully waterbody-based WFD monitoring design.

8.3.2 Capacity Constraints

Albania encounters significant institutional and technical obstacles that impede advancement toward establishing a monitoring and assessment system compliant with the Water Framework Directive (WFD). Despite challenging circumstances, the National Environmental Agency (NEA) carries out essential monitoring activities, although structural pressures continue to impact the existing framework.

Chronic underfunding limits monitoring activities by reducing field campaigns, sampling fewer stations, limiting equipment routinary maintenance, and restricting investment. Consequently, basic parameters are prioritized, with more complex analyses occurring only sporadically or when project funding allows. A major constraint is the lack of specialised staff. Assessing surface water for the WFD requires expertise in hydrobiology, ecology, chemistry, ecotoxicology, statistics, and data management. Currently, there are too few experts to support a strong national programme, resulting in reliance on a small group, weaker institutional resilience, and limited capacity to expand monitoring.

Laboratory capacity remains a major bottleneck, as current analysis cannot cover all WFD priority substances, especially trace organic pollutants like pesticides, PAHs, PFAS, and various emerging contaminants. As a result, chemical status assessments are often incomplete, with some years marked as "Not assessed" due to missing data. This weakens risk management and delays compliance with EU reporting requirements.

Accreditation for modern analytical methods is still incomplete. While routine parameters follow established procedures, accreditation for trace metals, organic micropollutants, and biological methods remains limited. This lack of full accreditation affects data comparability, legal defensibility, and international recognition, especially regarding EU accession and cross-border water management.

Poor long-term staff retention is a problem, as trained specialists often leave because of limited career growth, low pay, and unstable institutions. This results in frequent loss of expertise, gaps in datasets,

and ongoing training needs. In fields like taxonomy or advanced chemistry, it can take years to rebuild lost capacity.

Data systems are fragmented, with monitoring data stored in separate databases and formats that lack interoperability across chemistry, biology, hydrology, and GIS systems. This hinders integrated assessment, delays reporting, and complicates long-term trend analysis.

The most critical gap concerns biological monitoring capacity, which is the cornerstone of ecological status assessment under the WFD. Current in-house expertise remains insufficient for regular and standardised monitoring of key Biological Quality Elements, including:

- benthic macroinvertebrates;
- benthic diatoms;
- macrophytes;
- phytoplankton;
- fish fauna.

This is particularly significant because ecological status under the WFD is fundamentally biology-driven, while physico-chemical data serve mainly as supporting evidence. Where biological monitoring is weak or absent, ecological classification becomes provisional and cannot fully reflect ecosystem condition.

Recent assessments, such as those in the Seman river basin, show progress in Albania but highlight its reliance on physico-chemical indicators over complete WFD ecological evaluations. To fully align with EU standards, Albania needs ongoing investment in labs, skilled personnel, biological expertise, accreditation, digital data systems, and institutional capacity. Without these improvements, waterbody status assessments will remain only partly accurate.

8.3.3 Relevance of the Surface Water Quality Surveillance Monitoring Network

Surveillance monitoring is essential under the Water Framework Directive (WFD), offering a scientific overview of surface water status at the river basin scale. It describes current conditions, validates risk assessments, identifies long-term trends, enables annual comparisons, and informs future measures. As a foundation of river basin planning, it ensures decisions rely on representative data rather than isolated local information.

Surveillance monitoring is especially critical for the Seman River Basin due to its complex hydrology and multiple pressures. The Devoll–Osum–Seman river system's upstream conditions affect downstream water quality and ecosystems. Major reservoirs like Banja Reservoir alter flow, sediment, and nutrient patterns, needing focused monitoring since impounded waters react differently to pollution than natural rivers.

The basin includes the productive Myzeqe agricultural plain, a major farming area in Albania. This increases the risk of diffuse pollution from nutrients, pesticides, sediment runoff, and irrigation return flows. It also has urban and industrial zones where untreated wastewater, solid waste leakage, and industrial discharges may impact water quality.

The Seman Basin is characterised by the Kuçovë–Patos–Marinza–Ballsh hydrocarbon corridor, one of Albania's most industrialised zones. Oil extraction, infrastructure, and processing activities contribute heavy metals, hydrocarbons, and altered wastewaters to the area. Elevated levels of cadmium, lead, and nickel in lower basin stations highlight the ongoing environmental impact. The lower Seman River is ecologically sensitive, absorbing nutrients, solids, and toxins from upstream. Its condition shows both local impacts and cumulative effects from the entire basin.

Effective surveillance monitoring requires capturing the spatial dynamics of the river system, including upstream reference areas to establish ecological benchmarks and major tributary entry points like the Devoll, Osum, and Gjanica to assess each sub-basin's contribution.

Monitoring cumulative downstream pressure zones is essential, as these are areas where pollutants from different sources meet. Reservoirs should be monitored because they affect water residence time,

oxygen levels, sedimentation, and nutrient cycling. Surveillance points are needed at pollution hot spots with ongoing ecological issues. Long-term surveillance is important for tracking changes in water quality over time.

Recent field campaigns and historical datasets indicate that a representative surveillance network for the Seman Basin should include the following key locations:

Table xx – Key monitoring locations in the Seman basin.

ID	STATION	STRATEGIC ROLE
S1	Devoll upstream	Reference / upper basin control site
S2	Devoll Kozarë	Middle basin pressure zone
S3	Devoll Miras	Agricultural influence reach
S4	Osum Uznovë	Urban/agricultural pressure
S5	Ura Vajgurore	Transitional middle basin station
S6	Lapan	Confirmed chemical hot-spot
S7	Gjanicë	Major polluted tributary
S8	Kuç Bridge	Lower basin metal pressure zone
S9	Mbrostar Fier	Principal cumulative pressure station
S10	Mujalli	Final downstream accumulation zone

Each of these stations fulfils a different diagnostic function. Upstream stations help distinguish natural background conditions from anthropogenic influence. Middle basin stations reveal where pressures intensify. Tributary stations identify major pollutant contributors. Lower basin stations measure the cumulative response of the river system as a whole.

Without a structured surveillance network, reliable WFD classification cannot be achieved. Ecological and chemical assessments become fragmented, pressure pathways unclear, and measures reactive rather than strategic. For the Seman River Basin, surveillance monitoring is key for understanding basin dynamics, efficient investment targeting, and progress toward Good Status.

8.3.4 Results of Chemical Water Quality Surveys

Table below gives the status assessment based on monitoring data series during the period 2019-2025 along the Seman river basin. The monitoring stations include the existing sampling points periodically monitored by NEA and the additional monitoring stations monitored by the expert project team. The parameters used for the chemical status assessment of the water bodies are limited to physic-chemical and some heavy metals. The priority substances have not been monitored so far.

Table xx - Water Quality Status Assessment (category 1-5) - Monitoring Period 2019-2025

Waterbody name	SWB Code	Sampling Station	Status P-CHEM	Status ANNEX X PSs	Status Heavy Metals	Overall STATUS
Banja lake	LW35205301	Banja Lake, Devoll River	3		5	4
Seman river	TW3520101		3		5	4
CW Lower Seman	CW352101		3		5	4
Çemërica	3520764		3		5	4
Devoll	352051		3		5	4
Devoll	352053		3		5	4
Devoll	352055		3		5	4
Devoll	352071		3		5	4
Devoll	352073		3		5	4
Devoll	352075		3		5	4
Devoll	352077		3		5	4
Devoll	3520791		3		5	4
Devoll	3520793		3		5	4
Devoll	35209-1		3		5	4
Devoll	35209-2		3		5	4
Çorovoda	352048		3		5	4
Osum	352041		4		5	5
Osum	352043		4		5	5
Osum	352047		4		5	5
Osum	3520451		4		5	5

Waterbody name	SWB Code	Sampling Station	Status P-CHEM	Status ANNEX X PSS	Status Heavy Metals	Overall STATUS
Osum	3520453		4		5	5
Osum	3520455		4		5	5
Osum	3520457		4		5	5
Osum	3520491		4		5	5
Osum	3520493		4		5	5
Osum	3520496		4		5	5
Seman	35201		4		5	5
Seman	35203		4		5	5

The table shows, indicatively that the surface waterbodies fall under 4th and 5th status category, showing “poor” waterbody status.

8.3.5 Results of Biological Water Quality Surveys

Recent biological surveys constitute a practical initial step toward achieving Water Framework Directive (WFD)-compliant ecological assessments within Albanian river basins, such as the Seman River Basin. Despite limitations in coverage, scope, taxonomic completeness, and methodological consistency, these surveys yield valuable data on ecological gradients, pressure–response relationships, and basin-scale environmental conditions. Notably, the 2025 autumn field surveys in the frame of EU4River Project, conducted across the Devolli, Osumi, and Seman rivers provide the latest comprehensive biological overview of habitat conditions and benthic macroinvertebrate communities, although laboratory identification, final ecological indices, and formal classification are still underway.

Biological data indicate a consistent longitudinal decline in integrity from upstream to downstream throughout the basin. The upper reaches exhibit superior biological quality, characterized by greater diversity, including pollution-sensitive taxa, which corresponds to reduced human impact, improved oxygenation, and increased habitat complexity. This trend was particularly evident in the upstream segments of the Devolli River, where benthic communities featured elevated proportions of *Trichoptera*, *Ephemeroptera*, and *Plecoptera*, signifying stable substrates and optimal ecological conditions, notwithstanding occasional turbidity related to rainfall events.

In comparison, the midstream and downstream sections exhibit increasingly simplified and disrupted biological communities, reflecting cumulative exposure to a range of stressors. Ecological quality in both the Devolli and Osumi rivers diminishes under the combined influences of agriculture, urban development, wastewater discharge, infrastructure projects, hydropower regulation—particularly the Moglicë and Banjë dams on the Devolli—quarrying, gravel extraction, and historic industrial activity. In these reaches, biological communities transition toward taxa with greater pollution tolerance, such as *Hydropsyche* spp., *Diptera*, *Oligochaeta*, *Gastropoda*, and *Crustacea*, accompanied by a marked reduction in overall diversity. Elevated turbidity, unstable substrates, and accumulation of fine sediments are identified as principal factors driving these changes.

The Osumi River exemplifies the significance of hydro morphological pressures. Pronounced sediment dynamics, including bank erosion and fine sediment deposition, limit the establishment of diverse benthic communities, even when chemical water quality appears satisfactory. This highlights that ecological status is influenced not solely by nutrient or organic pollution, but also by habitat structure, sediment regime, and channel stability.

The physical characteristics of the Seman main river present notable constraints to habitat availability. Factors such as depth, steep eroding banks, elevated turbidity, and fine alluvial substrates rendered the standard AQEM Multi-Habitat Sampling (MHS) methodology largely impractical for much of the channel, necessitating adapted shore-based sampling methods. Biological communities observed within the Seman River were consistently characterized by low species richness and predominance of a limited subset of tolerant taxa, including *Atyaephyra* sp., *Oligochaeta*, and *Diptera*. These results indicate both cumulative basin-wide pressures and intrinsic habitat limitations that adversely affect the diversity of benthic assemblages.

At the basin level, the Seman River serves as an integrator of pressures from its principal tributaries, the Devolli and Osumi, along with localized effects in the lower basin. Downstream, cumulative impacts from agricultural runoff, nutrient loading, wastewater discharges, industrial pollution, water abstraction, hydrological modifications, infrastructure development, and prolonged erosion processes result in increased turbidity, deposition of fine sediments, altered flow patterns, and diminished biological integrity. Biological assessments indicate pronounced sensitivity to organic contaminants and eutrophication, particularly in areas with elevated levels of BOD₅, ammonium, and phosphorus. Ecological evaluation in the Seman Basin has so far relied predominantly on two Biological Quality Elements (BQEs):

- Benthic diatoms, which are effective indicators of trophic status, nutrient enrichment, and eutrophication;
- Benthic macroinvertebrates, which integrate responses to organic pollution, habitat quality, substrate condition, and ecological continuity.

Collectively, these groups offer valuable insights into ecological status; however, they address only a portion of the biological response required by the WFD. The lack of systematic monitoring for macrophytes, phytoplankton, and fish fauna considerably limits the scope of assessments and diminishes diagnostic capacity. This is particularly significant when identifying hydromorphological pressures, including flow alteration, channel modification, barriers, and habitat fragmentation and evaluating higher trophic-level impacts on food-web dynamics and ecological resilience.

The 2025 surveys nevertheless confirm pronounced spatial differentiation within the basin and reinforce earlier trends. Reservoir systems displayed comparatively stronger ecological performance:

Table xx - Ecological condition at the monitoring stations within Seman River basin during 2025 Survey.

Water Body / Reach	2025 Condition	Ecological	Interpretation
Banjë Reservoir	Good		Stable trophic conditions; limited acute nutrient enrichment
Thana Reservoir	High		One of the best-preserved systems; quasi-reference lentic site
Middle / Lower pressured river reaches	Moderate to Poor		Strong influence of local pollution, altered flow, and habitat degradation

These findings suggest that reservoirs may temporarily buffer ecological responses through sediment retention and hydraulic stabilization, whereas downstream river sections exposed to urban, agricultural, and industrial pressures show markedly reduced ecological integrity. Longer-term ecological status trends remain concerning.

Tables below show a summary of status assessment per monitoring station based on indices calculated respectively for diatoms and macroinvertebrates.

Table xx - Indicative Ecological status assessment based on BQEs (diatoms) during 2025 (EU4Rivers monitoring campaign).

Surface Waterbody	SWB Code	Monitoring Station	Status BQE - Diatoms	OVERALL SATUS
Rezervuari i Thanës	LW3520304	Rezervuari i Thanës	1	1
Liqeni i Banjës	LW35205301	Liqeni i Banjës	1	1

Status assessment of the surface waterbodies under category “Lakes” has been performed considering monitoring of diatoms for the year 2025 in the frame of EU4Rivers Project. Number of the sampling sites within a lake waterbody, and the monitoring of diatoms remain still limited and not sufficient for a proper waterbody status assessment as required by the WFD. However, indicatively the status of Thana Reservoir and Banja Lake fall under 1-2 category, representing a good status.

Table xxx. Status assessment based on macroinvertebrates per surface waterbody at Seman River Basin

Surface Waterbody	SWB Code	Monitoring Station	Status BQE- Macroinvertebrates	OVERALL SATUS
		Kozarë		

		Lozhan		
		Miras - Çetë		
		Dimal		
		Ura e Bilçës		
		Lopan		
		Banaj		
		Mbrostar		

Table below shows a general water quality assessment based on BQEs during 2019-2025 per monitoring stations along the Seman river Basin.

Table xx - Ecological Status of Seman River Basin according to BQEs assessment.

Year	Ecological Status
2019	Bad
2020	Bad
2021	Bad
2022	Poor
2023	Poor
2024	Poor
2025	Poor

This sequence indicates no sustained recovery trend and continuing basin-wide stress conditions. While conditions appear to have improved from Bad to Poor after 2021, progress has stagnated at substandard ecological levels.

Three consistently impacted ecological zones emerge within the basin:

- **Middle Basin Transition Reaches** – environmentally unstable but important zones where agricultural runoff, wastewater, hydro morphological alteration, and seasonal flow variability interact to produce fluctuating Moderate to Poor conditions. These reaches are sensitive to changes in discharge and land-use intensity.
- **Lower Seman Reach (Mbrostar–Mujalli corridor)** – a cumulative impact zone receiving combined pollutant and hydrological loads from the Devolli, Osumi, and Gjanica systems. Ecological condition is persistently poor, with limited recovery capacity. This reach serves as a key indicator of whole-basin stress.
- **Gjanica Tributary** – the most degraded subsystem in the basin, characterized by chronic organic pollution, eutrophication, and habitat disturbance. Its strategic significance lies in its disproportionate contribution of pressures to the main Seman channel and downstream reaches.

While current surveys offer valuable insights, several structural limitations hinder full compliance with the Water Framework Directive (WFD). Albania does not yet have nationally established river typologies, biological reference conditions, or Ecological Quality Ratio (EQR) class boundaries required for formal ecological status classification. Consequently, contemporary assessments predominantly depend on proxy interpretations and supporting physico-chemical indicators, rather than comprehensive biology-based classification. Additionally, hydro morphological quality elements remain insufficiently incorporated within the existing framework.

From a methodological standpoint, the 2025 surveys provide greater clarity regarding monitoring requirements. AQEM-based strategies continue to be appropriate for wadable and morphologically complex upstream and midstream sections, notably within the Devolli and Osumi catchments. Conversely, alternative protocols are necessary for deep, non-wadable, turbid, and fine-sediment rivers,

such as the lower Seman. Consequently, future monitoring programs should integrate standardized WFD methodologies alongside adaptations tailored to specific river types.

The Seman Basin demonstrates a marked upstream–downstream ecological gradient resulting from the combined effects of organic pollution, nutrient enrichment, sediment stress, hydro morphological changes, habitat simplification, and localized toxic pressures. Biological data indicate that ecological integrity is contingent upon the collective status of water chemistry, habitat structure, and hydrological regime. Therefore, restoration strategies should address multiple stressors concurrently rather than treating individual pressures separately.

The processed 2025 dataset, comprising finalized taxonomy, computed indices, EQRs, and ecological class assignments, will serve as a robust foundation for management decisions, River Basin Management Plans, and the ongoing harmonization of Albania's river monitoring system with the EU Water Framework Directive objectives.

8.3.6 Results of Hydro-Morphological assessment

Hydro morphological monitoring is still underdeveloped in Albania's Water Framework Directive (WFD) implementation, yet it is crucial for assessing river basin degradation like in Seman River Basin. Unlike chemical monitoring, which has improved recently, hydro morphological assessment remains fragmented and incomplete.

Responsibilities are divided among several institutions: IGEO retains the mandate for hydrology and water-level monitoring, while other bodies hold partial competencies related to river engineering, flood protection, and infrastructure management. However, no single authority currently possesses a consolidated mandate for integrated hydro morphological assessment, creating a major structural gap in WFD implementation.

Hydro morphological pressures are the main factors affecting ecological status in the Seman River Basin, interacting with organic pollution, eutrophication, and chemical contaminants. The area exhibits physical changes from its headwaters to downstream floodplains, with large dams—especially the Banjë hydropower system—significantly altering flow, sediment continuity, and temperature.

Flow regulation in the Devoll and Osum rivers reduces hydrological variability and weakens ecological resilience. Sediment trapped by hydraulic structures causes downstream channel incision and habitat simplification. Channel straightening, gravel extraction, bank erosion, floodplain disconnection, and loss of riparian zones due to agriculture and urban growth place further strain on the area. As a result, the lower basin consistently shows Poor to Bad ecological status, despite occasional improvements in physico-chemical indicators.

From a basin-scale perspective, the Seman can be divided into three hydro morphological response zones:

- The upper basin, encompassing the Devoll and Osum upper streams, largely maintains natural flow patterns, demonstrates higher morphological integrity, and retains partially functional sediment continuity. However, localized effects from small hydropower installations are evident.
- The middle basin serves as a controlled transition area, significantly impacted by reservoirs such as Banjë. This influence has resulted in modified sediment transport, diminished peak flows, simplified channel structures, reduced habitat diversity, and an increasing separation between the river and its floodplain.
- The lower basin of the Seman floodplain is the catchment's most altered area, facing upstream regulation, sediment deficits, channel instability, erosion, urban and agricultural encroachment, and pollution from tributaries like the Gjanica. Due to these issues, the lower Seman has limited capacity for ecological recovery, so improved water quality may not lead to biological restoration.

Restoration priorities in the Seman Basin target environmental pressures with specific interventions recommended for regulated sections of Middle Devoll to address flow and sediment issues impacting downstream connectivity. The Middle Osum requires actions to reduce effects from regulation, water abstraction, and channel simplification, while the Gjanica urban corridor needs major rehabilitation due

to channelisation, habitat loss, and urban impacts. The Lower Seman floodplain system, especially the Fier–Mbrostar–Mujalli corridor, is prioritized because of severe floodplain disconnection and sediment depletion.

Hydro morphological degradation is a key factor behind ecological decline in the basin's middle and lower sections. While chemical pollution causes toxic and eutrophication stress, habitat recovery must accompany chemical improvements for effective restoration. Physical changes to sediment and flow influence biological communities and resilience, worsening pollutant impacts, particularly in areas like Mbrostar–Mujalli where multiple stressors converge.

Albania lacks a national hydro morphological monitoring program, leading to gaps such as incomplete barrier inventories, limited flow alteration data, insufficient sediment transport tracking, and no standardized ecological flow methodology. Hydrology, morphology, and ecology are not well integrated, and hydro morphological data rarely inform River Basin Management Plan classifications, making Water Framework Directive (WFD) assessments largely descriptive.

To meet WFD standards, Albania—particularly the Seman Basin—needs an advanced monitoring system with automated telemetry, a centralized database, barrier inventories, flow regime analysis, sediment and channel studies, riparian mapping, and GIS/remote sensing for river corridor and floodplain dynamics. Ecological integration requires environmental flow methods and stronger links between hydro morphology and Biological Quality Elements in classification processes.

Without this system, Albania will not fully comply with WFD, and ecological status assessments will remain incomplete. In the Seman Basin, hydro morphology should be treated as a co-determinant alongside chemical and biological monitoring in future RBMP cycles.

8.3.7 Analysis and Assessment of the Surface Water Quality

The Seman River Basin's monitoring network has produced valuable data, identifying pressure zones, water quality gradients, and problem areas. However, it does not yet meet Water Framework Directive (WFD) standards, remaining in transition from station-based to integrated waterbody-based assessment.

Analysis of the available monitoring data for the period 2019–2025 (NEA and EU4RIVERS monitoring campaigns) reveals a clear spatial differentiation of environmental pressures across the basin. In hydrological and management terms, the Seman River Basin can be interpreted through three principal zones: the upper basin, middle basin and lower basin. Each of these zones exhibits distinct ecological and chemical characteristics, namely:

- **Upper Basin** of the Devoll and Osum catchments generally display the most favourable conditions in the basin. These areas are characterised by stronger flow dynamics, lower population density, lower industrial pressure and greater dilution capacity. As a result, ecological status is typically assessed as Good to Moderate, depending on season, hydrology and local pressures. Where deterioration occurs, it is usually linked to temporary organic pollution, local wastewater discharges, agricultural runoff or seasonal low-flow conditions rather than persistent basin-scale contamination. Chemical status in this zone remains uncertain in many years because priority substances were not systematically monitored. Nevertheless, based on available evidence, upper basin waters appear substantially less impacted than downstream sections. October 2025 surveys confirmed relatively unimpacted conditions in upper Osum reaches and Tomorr tributaries.
- **Middle Basin** represents a transition zone, where pressures become more visible and cumulative effects begin to emerge. Here, the river receives increasing inputs from settlements, agriculture, transport corridors and local industries. Ecological conditions are commonly classified as Moderate to Poor, largely driven by elevated nutrients, increased BOD₅, ammonium peaks and episodic phosphorus enrichment. This zone is particularly important because it often marks the shift from relatively resilient upstream systems to more stressed downstream waters. Recent chemical monitoring also indicates the emergence of heavy metal

pressures in several middle basin locations, including repeated exceedances during 2023 and 2025, repeated BOD₅, NH₄⁺ and phosphorus impacts. Chemical exceedances emerged at stations such as Lapan and Ura Vajgurore. This suggests that the middle basin is not only ecologically vulnerable but also increasingly relevant for toxic pressure management.

- **Lower Basin (Kuç – Fier – Mbrostar – Mujalli)** consistently shows the most problematic conditions and functions as the principal accumulation zone for the entire catchment. By the time the river reaches the lower plain, it integrates upstream loads from the Devoll, Osum and polluted tributaries such as the Gjanica. Ecological status in this zone is typically “Poor” to “Bad”, driven by high organic loading, eutrophication pressures, suspended solids, conductivity increases and hydromorphological stress. Chemical status was clearly classified as Bad in 2023 and 2025, following repeated exceedances of cadmium, lead and nickel. These findings confirm that the lower basin is the dominant determinant of overall WFD status for the Seman River Basin.

Table xx - Indicative Seman Basin Status (2019–2025)

Basin Zone	Typical Ecological Status	Typical Chemical Status
Upper Devoll / Upper Osum	Good–Moderate	Not assessed / locally uncertain
Middle Basin	Moderate–Poor	Failures in 2023 / 2025
Lower Seman	Poor–Bad	Bad (2023, 2025)

Although useful, present status assessments remain transitional rather than fully WFD-compliant. This is because ecological classification still depends heavily on supporting physico-chemical indicators such as dissolved oxygen, BOD₅, nutrients and suspended solids. While these parameters are valuable indicators of pressure, they do not replace the central WFD requirement for biology-based ecological assessment.

Routine monitoring of Biological Quality Elements (BQEs)—including macroinvertebrates, diatoms, macrophytes, phytoplankton and fish—remains limited or project-based. Consequently, many ecological classifications should be understood as provisional assessments of pressure rather than complete determinations of ecological status *sensu* WFD.

8.4 Groundwater Monitoring Programme

8.4.1 Competent Authority

The Albanian Geological Survey (AGS) is the principal national institution responsible for groundwater monitoring and assessment in Albania. It carries out the technical functions required to identify, characterise, and monitor groundwater bodies in line with European water policy obligations, particularly those established under the Water Framework Directive (WFD) and the Groundwater Directive (2006/118/EC). Through this role, AGS provides the scientific and technical foundation necessary for integrating groundwater management into River Basin Management Plans.

AGS is responsible for mapping groundwater bodies, investigating aquifer systems, monitoring groundwater levels, evaluating quantitative and chemical status, and supporting river basin planning processes. These activities are essential for understanding groundwater availability, vulnerability, contamination risks, and long-term sustainability across Albania.

Groundwater monitoring is crucial in the Seman River Basin due to its diverse hydrogeological conditions. The basin includes various groundwater systems, such as alluvial aquifers for agriculture, river valley aquifers linked to surface water, vulnerable karst aquifers, potable spring systems, shallow resources exposed to chemicals, and coastal aquifers at risk from seawater intrusion.

The WFD emphasises integrated monitoring because changes in groundwater quality or levels directly impact ecosystems and human water supply. Poor quality threatens drinking and irrigation sources, while low levels can reduce river flow and worsen drought, especially in areas with high agricultural demand and strong groundwater–surface water interactions.

AGS therefore plays a critical role in groundwater regulation and basin management. Strengthening monitoring systems, improving data management, enhancing trend analysis, and better integrating groundwater assessments with surface water status evaluations are all essential steps for Albania to meet WFD requirements and ensure sustainable water management in river basins such as the Seman.

The AGS laboratory currently has analytical capacity for a broad range of standard physico-chemical parameters, including pH, electrical conductivity, major ions, nitrates, ammonium, hardness, and selected trace elements. However, analytical capacity remains limited for several pollutant groups that are increasingly relevant under the Groundwater Directive and wider EU environmental legislation. These include pesticides, polycyclic aromatic hydrocarbons (PAHs), chlorinated hydrocarbons, solvents, PFAS and other emerging contaminants, as well as additional organic micropollutants. Consequently, groundwater chemistry assessments often focus on conventional indicators, while diffuse agricultural pollution and industrial organic contaminants may remain insufficiently characterised.

Despite the technical expertise available within AGS, a number of institutional and operational constraints remain significant. These include ageing monitoring infrastructure, low monitoring frequency at many sites, limited staffing resources, insufficient automation of groundwater level measurements, fragmented abstraction records, incomplete pollutant screening programmes, and delays in developing threshold values for nationally relevant pollutants.

Recent groundwater assessments indicate that Albania now needs to move from a traditional point-based hydrogeological monitoring model toward a groundwater body-based WFD assessment framework. Such a system should integrate quantitative status, chemical status, pressure analysis, and groundwater-dependent ecosystems within a single coherent management approach.

8.4.2 Role of Water Utilities and Other Operators

Water utilities, irrigation agencies and private well operators also generate operational data that are highly relevant for groundwater status assessment, including:

- abstraction volumes
- pumping rates
- operational well water levels
- source water quality
- seasonal supply stress
- borehole performance

At present, these datasets are not always systematically integrated into AGS monitoring systems. Establishing formal data-sharing mechanisms would therefore significantly strengthen groundwater body assessments, trend analysis, and quantitative status evaluations.

8.4.3 Relevance of the Groundwater Quantity Monitoring Network

Groundwater quantity monitoring is essential for determining whether groundwater bodies achieve good quantitative status, meaning that groundwater abstraction does not exceed long-term available recharge and that groundwater levels remain sufficient to protect connected surface waters and groundwater-dependent ecosystems.

In the Seman River Basin, quantity monitoring is particularly important for assessing long-term groundwater level trends, recharge variability under changing climate conditions, drought response and aquifer resilience, abstraction impacts from irrigation and public water supply, maintenance of river baseflow during dry seasons, sustainability of spring discharges, the water needs of wetlands and groundwater-dependent ecosystems, the risk of saline intrusion in lowland and coastal aquifers, and hydraulic interactions between rivers and aquifers in alluvial plains.

These issues are especially significant in the lower Seman plain, where groundwater is a critical resource for agriculture, drinking water supply, and maintaining water availability during summer and drought periods.

Current monitoring frequencies of only two to four site visits per year at many locations are generally insufficient for robust quantitative assessment and long-term trend analysis. Low-frequency measurements may fail to capture important seasonal fluctuations, groundwater drawdown during irrigation periods, drought-related stress, rapid recharge following rainfall events, and peak abstraction pressures.

To comply with Water Framework Directive (WFD) requirements, groundwater quantity monitoring should progressively move toward continuous or higher-frequency measurements at representative strategic monitoring sites. This would improve understanding of aquifer dynamics, strengthen quantitative status assessments, and support more sustainable groundwater management in the Seman River Basin.

8.4.4 Status of the Groundwater Quantity Monitoring Network and Data

The existing groundwater monitoring network in the Seman Basin serves as an essential historical and operational resource; nevertheless, it remains fragmented and insufficiently aligned with management requirements at the groundwater body scale under the Water Framework Directive (European Union Water Framework Directive) and the Groundwater Directive. Many observation points were initially established for local hydrogeological investigations rather than systematic status assessment, resulting in current spatial coverage that does not consistently reflect contemporary pressures, risks, or management needs.

The quantity monitoring system is hampered by several structural limitations. Monitoring wells are unevenly distributed across aquifers, and many sites are either inactive or monitored only intermittently. Limited implementation of automatic data loggers reduces the temporal resolution of groundwater level data. Furthermore, abstraction data are not systematically integrated, and linkages between groundwater monitoring and river discharge records are weak. These constraints impede the comprehensive assessment of drought impacts, recharge variability, long-term groundwater trends, and interactions with surface water systems. Consequently, critical issues—including declining groundwater levels, diminished baseflow to rivers, and saline intrusion risks—cannot be reliably evaluated at basin scale.

Enhancing the system requires prioritizing groundwater quantity monitoring at major abstraction wells, public water supply sources, springs designated for drinking water, vulnerable shallow aquifers, and alluvial aquifers within intensively cultivated areas—particularly in the lower basin, where industrial and agricultural pressures are most pronounced. Monitoring programmes should also be designed to detect sustained and significant trends in groundwater depletion or recovery, consistent with Groundwater Directive requirements.

Key recommended actions for the Seman Basin include installing automatic groundwater level loggers, deploying telemetry systems for real-time data transmission, and rehabilitating or upgrading observation boreholes. Integrating abstraction metering fully with permitting systems will help ensure consistency between licensed usage and observed groundwater dynamics. Additional priorities encompass analysis of recharge variability and drought response, improved integration of groundwater and surface water monitoring, systematic evaluation of groundwater–river interactions, and designation of representative control sites for long-term trend analysis.

8.4.5 Status of the Groundwater Quality Monitoring Network and Data

Groundwater quality monitoring within the Seman Basin is currently centred on conventional physico-chemical parameters and major ions, offering an overview of salinity, mineralisation, nitrate concentrations, and general water suitability for various applications. Nevertheless, the existing system does not fully comply with the requirements outlined in the Groundwater Directive, particularly regarding the evaluation of priority pollutants and emerging contaminants.

A primary limitation is the narrow scope of chemical monitoring, as substances such as pesticides, industrial organic micropollutants, and polyfluoroalkyl substances (PFAS), pharmaceutical residues, and other emerging contaminants are not systematically evaluated or are only addressed in isolated studies. This gap is significant considering the diverse pressures impacting groundwater in the basin, including

agricultural activities, urban wastewater discharge, petroleum extraction, industrial contamination, and unmanaged waste disposal. Without comprehensive chemical screening, ongoing groundwater degradation may go undetected until it becomes severe or irreversible.

To enhance representativeness, groundwater quality monitoring should focus on major abstraction wells, public drinking water supplies, springs, and vulnerable aquifers—particularly shallow alluvial systems and areas affected by intensive land use or industrial activity. Monitoring programmes must also be structured to identify statistically significant and sustained upward trends in pollutant concentrations, as mandated by the Groundwater Directive.

An additional structural deficiency is the lack of nationally defined threshold values for key groundwater pollutants calibrated to Albanian hydrogeological conditions. These thresholds should cover indicators such as chlorides, sulphates, ammonium, salinity parameters, selected heavy metals, hydrocarbons, pesticides, and other locally relevant contaminants. In the absence of such standards, chemical status assessments remain partial and lack a regulatory framework.

Priority actions for improving groundwater quality monitoring include broadening pollutant screening initiatives, establishing national threshold values consistent with EU requirements, and integrating groundwater quality data with pressure indicators such as land use, abstraction rates, and contamination sources. Furthermore, enhancing analytical laboratory capabilities and ensuring consistent, long-term datasets will be essential for achieving robust assessments of groundwater chemical status at the basin level.

8.5 Protected Areas Monitoring Programmes

8.5.1 Competent Authorities

Article 8 of the Water Framework Directive (WFD) requires monitoring programmes for water bodies to ensure a comprehensive overview within each river basin district. In the Seman River Basin, this is crucial due to various protected zones such as drinking water sources, bathing areas, fisheries, Ramsar wetlands, national protected sites, and sensitive ecosystems.

Law No. 29/2024 on Water Resources aligns Albania's legal framework with WFD Article 6 and Annex IV, enabling the creation of a Protected Areas Register and integration of environmental goals into River Basin Management Plans (RBMPs). Despite legal progress, monitoring systems remain fragmented and underdeveloped.

Protected areas in the Seman Basin include:

- Drinking Water Protected Areas;
- Aquatic Species Protection Areas;
- Recreational/Bathing Waters;
- Nutrient and Wastewater Sensitive Areas;
- Nature Protection Areas (Habitats and Species).

The management and monitoring of protected areas in the Seman River Basin involves several national institutions with shared and overlapping responsibilities:

- **Agency for Water Resources Management (AMBU)** is the lead authority responsible for implementation of the Water Resources Law, river basin planning, establishment of the Register of Protected Water Areas, and coordination of WFD-related monitoring.
- **National Environment Agency (NEA)** is responsible for environmental monitoring programmes, including surface water quality, groundwater quality, and reporting on environmental status indicators.
- **National Agency of Protected Areas (NAPA)** manages national parks, protected landscapes, Ramsar sites, and other biodiversity conservation areas where water status is essential for ecological objectives.

- **Ministry of Agriculture and Rural Development (MARD)** is responsible for fisheries management, designation of aquatic species protection areas, nitrate vulnerable zones, and agricultural pollution control measures.
- **Institute of Public Health (IPH)** undertakes microbiological monitoring of bathing waters and public health parameters related to recreational waters.

Although institutional mandates exist, coordination remains weak and monitoring responsibilities are dispersed among multiple agencies with limited data integration.

8.5.2 National Monitoring and Reporting to the European Commission

Under the WFD, monitoring data help classify ecological and chemical status, assess risks, check compliance in protected areas, and track progress toward environmental goals. Albania, as an EU candidate, is gradually aligning its systems with European Commission standards.

Nationally, Albania reports environmental data through annual reports, EU accession screenings, river basin planning, and sectoral reporting for bathing water, biodiversity, and wastewater.

Protected area reporting includes drinking water zones, bathing water quality, habitat and species conditions, nitrate area monitoring, and effectiveness of measures. Currently, Albania lacks a fully integrated WFD-compliant platform, and data are fragmented and project-based.

For the Seman Basin, reporting relies mainly on general water quality stations, occasional bathing water assessments, protected area biodiversity checks, and targeted surveys like EU4Rivers. Thus, protected area reporting is incomplete and does not yet fully meet WFD Article 8 and Annex V requirements.

8.5.3 Operational Status of the Protected Areas Monitoring Networks in Seman Basin

Currently, a dedicated operational monitoring network tailored specifically for Protected Areas in the Seman River Basin does not exist. Monitoring activities are conducted through distinct sectoral systems, rather than under a unified Water Framework Directive (WFD) protected areas programme. Consequently, surveillance remains fragmented, lacks consistent coordination, and is only partially compliant with the requirements outlined in Article 8 and Annex V of the Directive.

Drinking Water Protected Areas

Groundwater sources used for public supply are subject to different levels of sanitary control and water quality monitoring. However, monitoring is not harmonized across the basin. Privately owned wells are largely outside systematic control, abstraction protection zones remain incompletely mapped, and available results are not integrated into a formal protected areas register. These shortcomings are particularly relevant in the Fier, Lushnjë, Kuçovë, and Berat areas, where groundwater plays an important role in public water supply.

Areas for Economically Significant Aquatic Species

Karavasta Lagoon serves as the primary protected fisheries area within the basin, officially designated as a co-managed fisheries zone. Partial monitoring is carried out through established fisheries management structures, conservation efforts, and protected area administration. However, there is currently no formal WFD ecological monitoring network in place to evaluate fish population dynamics, nursery habitat conditions, hydrological exchanges, eutrophication risks, or sediment contamination. Considering the lagoon's ecological and economic significance, this constitutes a substantial monitoring shortfall.

Bathing Waters

The principal bathing areas within the basin include Divjakë–Pirgu Beach and Seman Beach. Seasonal bacteriological monitoring is conducted at designated stations, with recent data showing deterioration at multiple sites. Nonetheless, the extent of monitoring remains constrained, sampling frequency does not fully meet Bathing Water Directive standards, public reporting lacks consistency, and inland recreational waters are not routinely monitored. These limitations impede comprehensive assessment of risks to public health and environmental quality associated with tourism.

Nutrient-Sensitive Areas

To date, no Nitrate Vulnerable Zones or Urban Wastewater Sensitive Areas have been officially designated within the basin. As a result, there is currently no dedicated compliance monitoring network, notwithstanding the existence of clear pressure hotspots such as the Gjanica River in the Fier urban-industrial zone, the lower Seman reaches, the Mbrostar–Mujalli corridor, and the intensively cultivated agricultural areas of the Myzeqe plain. The lack of formal designation and monitoring infrastructure restricts Albania's capacity to effectively address eutrophication and diffuse agricultural pollution in one of its most sensitive basins.

Habitat and Species Protection Areas

Protected areas such as Divjakë–Karavasta National Park, the Karavasta Ramsar Site, and mountain protected catchments are subject to some biodiversity monitoring; however, ecological surveillance related to water resources remains incomplete. In many instances, management plans are either outdated or lacking altogether, hydrological and water quality indicators are inadequately monitored. These shortcomings undermine the integration of water management and nature conservation objectives required under the Water Framework Directive (WFD).

Protected areas monitoring in the Seman Basin is only partially implemented for most categories, with incomplete and uncoordinated systems. Nutrient-sensitive areas lack monitoring due to absent formal designations. No basin-level integrated WFD Protected Areas Monitoring Network exists.

To meet WFD compliance, the Seman River Basin Management Plan should create a unified Protected Areas Monitoring Network, integrating all institutional datasets into a GIS-supported register. Nutrient-sensitive zones must be designated and monitored, bathing water surveillance expanded in coastal areas, groundwater monitoring strengthened near drinking water sources, and ecological monitoring improved in Karavasta Lagoon and related wetlands. Annual reporting should directly support the programme of measures.

Despite numerous important protected areas, current monitoring is fragmented and only partially effective. Achieving full WFD Article 8 compliance requires a coordinated, risk-based network to assess progress on environmental objectives and identify needs for restoration or pollution controls.

8.6 Monitoring in Albania: way forward

8.6.1 Current Strengths of the Monitoring Network

Despite some limitations in the monitoring framework (financial limitations, staff shortages, logistics and laboratory constraints often reduce actual monitoring intensity below planned levels), the current system offers solid strengths for future development. Key features include multi-year datasets on nutrients, BOD₅, and oxygen parameters, which help track water quality trends and assess pollution risks. Routine physico-chemical monitoring continues across parts of the basin, maintaining consistency for core indicators and supporting regulatory controls. The programme has improved identification of pollution hot-spots, allowing authorities to target resources effectively.

Recent screening for heavy metals has broadened chemical assessments, addressing ecological and health risks beyond organic pollution. Pilot biological surveys show that monitoring Biological Quality Elements is feasible, aligning with Water Framework Directive standards and reflecting true ecological conditions. Enhanced understanding of pressure pathways highlights cumulative downstream effects, supporting coordinated basin-wide management.

Overall, the existing system contains valuable data, experience, and methodological advances. With targeted investment in network redesign, biological expansion, chemical updates, and data integration, these foundations can evolve into a robust, WFD-compliant monitoring system for long-term improvement.

8.6.2 Main Gaps in the Current Monitoring System

Despite the progress achieved in recent years, the present monitoring framework for the Seman River Basin still contains several structural gaps that limit the reliability, completeness and WFD-compliance of status assessments. These weaknesses affect ecological classification, chemical risk diagnosis and the ability to design effective management measures, namely:

1. **Limited Biological Monitoring:** Biological Quality Elements (BQEs) like macroinvertebrates, fish, macrophytes, and phytoplankton are monitored infrequently, undermining ecological status assessments under the Water Framework Directive. Physico-chemical measurements alone can't capture ecosystem health, meaning rivers may appear healthy by oxygen standards but have degraded biological communities.
2. **Incomplete Chemical Monitoring:** Chemical checks mostly cover basic parameters and some metals, often resulting in "Not assessed" statuses and missing pollution risks. Targeted analyses reveal issues such as cadmium, lead, and nickel contamination, highlighting gaps that hinder EU compliance and pollution management.
3. **Insufficient Hydro morphological Monitoring:** Hydro morphological factors like flow changes, river regulation, channel modifications, sediment disruption, and habitat degradation are rarely assessed, particularly in the Seman Basin. This leaves significant impacts on ecological status poorly understood.
4. **Weak Data Integration and Information Management:** Data is scattered across platforms without integration of chemistry, biology, hydrology, or spatial information. Lack of unified GIS and QA/QC makes it difficult to track trends, link pressures, compare stations, map basins, support planning, and report under WFD requirements.
5. **Institutional Capacity Constraints:** Technical deficiencies stem from limited staff, expertise, and lab facilities. Shortages in hydrobiologists, taxonomists, environmental chemists, ecotoxicologists, GIS/data specialists, and field staff lead to disrupted monitoring and reliance on individual experts, making institutional improvement as crucial as technical upgrades.

8.6.3 Priority Actions for Strengthening the Monitoring System

In analytical terms, the Seman monitoring network already captures the most important basin pattern: a progressive deterioration from upstream to downstream, intensified by tributary inputs and industrial/agricultural pressures. This is a strong basis for WFD implementation. However, to move from broad diagnosis to a robust WFD-compliant system, the following strategic actions should be prioritised:

1. **Expand Station Coverage and Seasonal Frequency:** The present network should be strengthened through improved spatial representativeness and more regular sampling throughout the hydrological year. Seasonal monitoring is particularly important in the Seman Basin, where flow variation strongly influences pollutant concentrations and ecological response.
2. **Institutionalise Biological Quality Element Monitoring:** Routine national programmes should be established for:
 - benthic macroinvertebrates;
 - benthic diatoms;
 - macrophytes;
 - phytoplankton;
 - fish fauna.These programmes should replace project-based surveys and become the core of ecological classification.
3. **Broaden Priority Substance Screening:** Chemical monitoring should progressively cover the full WFD priority substances list, relevant river basin pollutants and emerging contaminants. Sediment monitoring should also be considered, especially in lower basin accumulation zones such as Mbrostar and Mujalli.
4. **Strengthen Hydro morphological Assessment:** A dedicated programme is needed for:
 - flow alteration analysis;
 - habitat surveys;

- continuity/barrier inventories;
- sediment transport monitoring;
- riparian condition assessment;
- environmental flow evaluation.

This would greatly improve understanding of ecological pressures.

5. Develop Integrated Databases and GIS Tools: A unified digital monitoring platform should combine water chemistry, biology, hydrology and spatial data. GIS tools are essential for river basin planning, pressure mapping, trend analysis and efficient reporting.

6. Establish Albanian Ecological Classification Systems: Type-specific ecological classification schemes must be developed in line with WFD principles, including:

- reference conditions;
- class boundaries;
- ecological quality ratios;
- intercalibration approaches.

Without this step, ecological assessments will remain transitional.

7. Estimate Natural Background Levels for Metals: For metals such as cadmium, nickel and lead, assessments should consider natural geochemical background concentrations and bioavailability factors, as foreseen under Directive 2013/39/EU. This is particularly relevant in Albania, where geology may influence baseline concentrations. Without this refinement, there is a risk of overestimating anthropogenic pollution or misclassifying chemical status.

8.6.4 Strategic Surface Water Monitoring Development Priorities (2026–2033)

Recent evaluations under the Water Framework Directive (WFD) highlight Albania's need for integrated river basin management, focusing on three pillars: chemical integrity, ecological functionality, and hydro morphological structure. The Seman River Basin is identified as the central case for WFD implementation due to its persistent environmental challenges and multiple pressures.

Albania's main priority is improving chemical status by modernizing monitoring systems, especially in the National Environment Agency's laboratory. Insufficient data and frequent exceedances of WFD priority substances—like cadmium, lead, and nickel—are most acute in the lower Seman Basin. Upgrading instrumentation, accrediting methods, and ensuring comprehensive monitoring of all priority substances, including sediment contaminants, are critical steps.

Ecological status also needs strengthening. Current assessments rely mainly on physico-chemical indicators, lacking robust Biological Quality Element (BQE) systems. Establishing national ecological classification, surveying reference conditions, and investing in biological expertise and routine BQE monitoring are essential for compliance and accurate degradation detection. Integrating hydro morphological data will improve ecological assessment.

The lower Seman corridor presents significant chemical, ecological, and hydro morphological issues and should be prioritized for intervention. Recent data confirm chronic pollution with metals and ongoing organic contamination, resulting in consistently poor ecological status and limited recovery.

To advance WFD implementation, Albania must coordinate chemical, ecological, and hydro morphological restoration within a unified program. The Seman River Basin, particularly its lower segment, should serve as both a demonstration site and a diagnostic case for national water policy and future river management planning.

9 PRESSURES, STATUS AND IMPACT ASSESSMENT

This chapter integrates pressure data, monitoring results, and expert judgement to assess the ecological and chemical status of water bodies. It explains the methodology used to link pressures with impacts, following WFD Guidance No. 3 and related EU approaches. The chapter presents basin-wide assessments for surface water, groundwater, and protected areas, identifying at-risk water bodies. It concludes with a discussion of key uncertainties and outlines the next steps toward achieving good status by 2033.

Additional background, technical information and data are presented in the Task Reports 1, 2, 3, 4a - 4f, 5, 6, 9 and 12.

9.1 Introduction

This chapter presents the assessment of pressures, environmental status, and associated impacts on surface water, groundwater, and protected areas within the Seman River Basin. The analysis is carried out in line with the EU Water Framework Directive (WFD) and applies a DPSIR-based approach to link human activities with ecological and chemical conditions.

The assessment integrates available monitoring data, spatial analysis, and expert judgement to identify key pressure types, evaluate current water body status, and determine the risk of failing to achieve Good Ecological Status or Potential. It provides the analytical basis for prioritising measures within the River Basin Management Plan.

9.2 Summary Overview of Pressures and Impacts in the Basin

The Seman River Basin contains a pronounced upstream–downstream gradient extending from mountainous and karstic headwaters in the Devoll and Osum sub-basins to intensively cultivated alluvial plains, irrigation and drainage canal systems, transitional lagoons, wetlands, and coastal waters in the lower basin. This hydrological and geomorphological configuration is highly significant for WFD Article 5 pressure and risk screening because pressures generated in upstream and middle catchments are progressively transferred downstream, where they accumulate, interact, and may intensify within low-gradient river reaches, irrigation and drainage systems, transitional waters, and coastal receiving environments. The basin therefore functions as a strongly interconnected river–plain–lagoon–coastal system in which hydrological, chemical, ecological, and hydro morphological processes are closely coupled.

The assessment demonstrates that the Seman River Basin operates under a complex and cumulative multi-pressure regime in which hydrological alteration, industrial contamination, diffuse agricultural pollution, wastewater discharges, sediment imbalance, channel modification, groundwater pressures, and climate-related stressors interact spatially and temporally across the basin. Pressures rarely occur independently. Instead, they reinforce one another through cumulative downstream propagation and feedback mechanisms. Reservoir sediment retention increases downstream sensitivity to gravel extraction and channel instability; urban and industrial discharges intensify oxygen depletion and chemical degradation in low-flow river sections; diffuse agricultural nutrient loading amplifies eutrophication risks in rivers, lagoons, and coastal waters; while hydro morphological alteration reduces ecological resilience and habitat recovery capacity throughout the basin.

The most heavily impacted areas include:

- the regulated Devoll hydropower system;
- the Osum–Seman confluence corridor;
- the Gjanica industrial and oil-contaminated tributary;

- the Myzeqe agricultural lowlands;
- the lower Seman River and associated irrigation and drainage network;
- the Divjakë–Karavasta lagoon system; and
- adjacent Adriatic coastal waters influenced by river-borne nutrient, sediment, hydrocarbon, and contaminant loads.

As outlined in *Task Report 3* and summarised in *Chapter 5*, the Seman River Basin faces multiple and cumulative pressures that affect surface water bodies, groundwater bodies, protected areas, transitional waters and coastal waters. Climate change acts as an overarching pressure. It alters hydrological patterns, increases the frequency and severity of floods and droughts, reduces ecological resilience, and increases the risk of not achieving WFD environmental objectives.

Water management is further constrained by incomplete hydrological, meteorological, groundwater and water quality monitoring. Limited discharge, precipitation, groundwater and biological data reduce confidence in status assessment, flood forecasting, drought management, water allocation and pressure-impact analysis. This weak evidence base also limits the effective planning and prioritisation of measures.

Hydromorphological pressures are significant across the basin. Hydropower, dams, reservoirs, channelisation, flood protection works, gravel extraction and sediment disruption affect river continuity, ecological flows, habitat diversity and sediment transport. The Devoll system and several irrigation reservoirs play an important role in water management, but they also alter natural flow regimes and downstream morphology.

Water abstraction and allocation create growing pressure, particularly during dry periods. Agriculture, especially in the Myzeqe irrigation system, accounts for most water use. Incomplete abstraction records, illegal abstractions, weak reporting, deteriorated irrigation infrastructure and blocked canals hamper sustainable allocation. Groundwater is also under pressure from over-abstraction, illegal withdrawals, nitrate and pesticide pollution, industrial contamination and weak surveillance.

Urban wastewater, industrial pollution and diffuse agricultural pollution remain major drivers of ecological and chemical deterioration. Untreated wastewater, legacy industrial pollution in the Gjanica–Patos–Ballsh corridor, hydrocarbons, heavy metals, nutrients, pesticides, livestock waste and irrigation return flows contribute to organic pollution, eutrophication, oxygen depletion, groundwater contamination and biodiversity loss.

The basin's wetlands, lagoons, river habitats, coastal waters and transitional waters, including Karavasta Lagoon and the Seman Delta, are vulnerable to pollution, hydrological alteration, erosion, sediment imbalance, habitat fragmentation, overfishing, invasive species and declining bathing water quality. Many protected areas and drinking water zones remain insufficiently mapped, monitored or enforced. Overall, the pressures assessment confirms widespread ecological vulnerability and a high degree of cumulative environmental stress across the Seman River Basin.

A substantial proportion of assessed water bodies are classified as either *At Risk*; or *Possibly at Risk* of failing to achieve WFD environmental objectives, including Good Ecological Status, Good Ecological Potential, and Good Chemical Status.

The assessment therefore establishes the basis for the River Basin Management Plan and future Programme of Measures. It demonstrates that achievement of WFD objectives within the Seman River Basin will require coordinated basin-scale interventions focused on:

- restoration of ecological flows and sediment continuity;
- reduction of industrial and oil-sector pollution;
- modernisation of wastewater collection and treatment infrastructure;
- reduction of diffuse agricultural pollution;
- sustainable sediment and gravel extraction management;
- groundwater protection and abstraction control;
- strengthening of monitoring and data management systems;

- climate adaptation and flood resilience;
- enhanced permitting, compliance, and enforcement mechanisms; and
- integrated management of transitional and coastal waters.

Without implementation of an integrated, adequately financed, and long-term Programme of Measures, a majority of water bodies within the Seman River Basin are unlikely to achieve Good Ecological Status, Good Ecological Potential, or Good Chemical Status in accordance with the requirements of the Water Framework Directive.

9.3 Methodology of Pressures and Status Assessment

9.3.1 Introduction

The methodology applied for the identification of pressures, assessment of water status, and screening of risks within the Seman River Basin is based on the requirements of the EU Water Framework Directive (WFD 2000/60/EC), the Groundwater Directive (2006/118/EC), associated Common Implementation Strategy (CIS) Guidance Documents, and the Water Information System for Europe (WISE) reporting framework.

The assessment follows the conceptual structure established under:

- WFD Article 5 (River Basin Characterisation and Pressure–Impact Analysis);
- Annex II (Characterisation of River Basin Districts);
- Annex V (Status Assessment and Monitoring), and
- WISE pressure, impact, and status reporting requirements.

The methodology applies an integrated pressure–state–risk approach consistent with the DPSIR (Driver–Pressure–State–Impact–Response) framework. Under this concept:

- Drivers represent socioeconomic activities generating pressures;
- Pressures represent direct anthropogenic stressors acting upon water bodies;
- State describes the observed ecological, chemical, quantitative, or hydro morphological condition of waters;
- Impacts represent the resulting effects on aquatic ecosystems, ecological functions, groundwater resources, and water uses; and
- Responses comprise the policy measures and Programme of Measures (PoM) developed to achieve WFD environmental objectives.

The assessment combines:

- pressure inventories,
- WISE-coded pressure screening,
- monitoring information,
- hydro morphological interpretation,
- hydrogeological analysis,
- spatial and GIS-based evaluation,
- risk assessment procedures, and
- expert judgement.

Given the current limitations in monitoring coverage and data completeness within the Seman River Basin, the methodology applies a precautionary and weight-of-evidence approach consistent with WFD CIS Guidance principles.

9.3.2 Identification and Quantification of Pressures and Indicators

Under the WFD theoretical framework, pressure assessment constitutes the “Pressure” component of the DPSIR analytical chain and forms the basis for identifying water bodies potentially at risk of failing environmental objectives under WFD Article 4.

According to WFD Annex II and CIS Guidance Document No. 3 (“Analysis of Pressures and Impacts”), Member States are required to identify:

- significant anthropogenic pressures,
- their magnitude and spatial extent,
- the pathways through which pressures affect water bodies, and
- the likely impacts on ecological, chemical, hydro morphological, and quantitative status.

The WISE reporting framework operationalises this requirement through a harmonised pressure typology and coding structure, enabling consistent classification of pressures across European river basin districts. WISE pressure categories distinguish among the following principal categories:

- **Point source pollution**, including discharges from urban wastewater systems, untreated settlements, industrial facilities, mining activities, landfills, and other permitted or non-permitted discharge sources;
- **Diffuse pollution**, primarily associated with agricultural runoff, nutrient enrichment, pesticide use, erosion, sediment transport, and atmospheric deposition;
- **Water abstraction and hydrological alteration**, including surface water abstraction, groundwater abstraction, irrigation withdrawals, hydropower regulation, reservoir operation, and flow modification;
- **Hydro morphological alterations**, including dams, barriers, river regulation, channelization, embankments, sediment interruption, gravel extraction, hydropoising, bank modification, and habitat fragmentation.
- **Groundwater-specific pressures**, and **Other anthropogenic** or legacy pressures. Climate change was assessed as a cross-cutting pressure multiplier influencing hydrology, flood and drought frequency, water temperature, ecological resilience, sediment transport, and groundwater recharge dynamics.

The pressure analysis considered both current pressures and future risks associated with climate change, socioeconomic development, hydropower expansion, urbanisation, agricultural intensification, and increasing water demand.

The pressure assessment methodology integrates WISE pressure coding, pressure significance screening, source–pathway–receptor analysis, and spatial aggregation techniques to systematically evaluate the interplay between human activities and water body conditions throughout the basin. This approach acknowledges that pressures rarely function independently; instead, ecological and chemical degradation often arises from the combined effects of multiple stressors, whether acting concurrently or in succession within a single hydrological system. Each pressure's significance is assessed based on magnitude, persistence, spatial distribution, reversibility, connectivity to sensitive receptors, and its capacity to intensify the impact of other pressures. Special attention is devoted to cumulative pressure pathways, where hydrological alterations, pollutant inputs, abstraction pressures, and hydro morphological changes collectively contribute to increased risks of not meeting WFD environmental standards.

Pressure quantification is therefore undertaken using:

- direct monitoring evidence where available;
- proxy indicators;
- land-use interpretation;
- hydrological and hydrogeological analysis;
- infrastructure inventories;
- inventory of permits issued for surface- and groundwater abstraction;
- pollution source inventories, and
- expert judgement interpretation.

Pressure assessment indicators were applied using both:

- qualitative screening approaches; and
- quantitative indicators where reliable datasets existed.

Due to incomplete monitoring systems and fragmented datasets, confidence levels were assigned to pressure assessments in accordance with WFD CIS Guidance principles:

- **High confidence** — strong monitoring and supporting datasets;

- **Medium confidence** — partial monitoring with supporting evidence;
- **Low confidence** — limited monitoring and reliance on expert judgement; and
- **No confidence** — insufficient information available.

This confidence-based approach supports prioritisation of enhanced monitoring and investigative assessments under the Programme of Measures.

Where empirical evidence is incomplete, the WFD precautionary principle is applied. Water bodies may therefore be screened as “Possibly at Risk” where a plausible pressure–impact relationship exists despite limited monitoring confirmation.

9.3.3 Methodology of Pressures and Status Assessment for Surface waterbodies

The status assessment constitutes the “State” element of the DPSIR (Drivers–Pressures–State–Impact–Response) framework and serves as the primary analytical process for determining the condition of surface water and groundwater bodies within the River Basin Management Plan (RBMP). This approach adheres to the requirements set forth by the EU Water Framework Directive (WFD) Annex V, related Common Implementation Strategy (CIS) Guidance Documents, hydro morphological assessment standards, and the WISE ecological and chemical status reporting requirements.

Under the WFD, surface water assessment is based on the principle that aquatic ecosystems should achieve:

- Good Ecological Status (GES), and
- Good Chemical Status (GCS).

For Artificial Water Bodies (AWBs) and Heavily Modified Water Bodies (HMWBs), the objective is:

- Good Ecological Potential (GEP).

The surface water body assessment methodology was developed in accordance with the requirements of the Water Framework Directive for ecological status assessment, supporting hydro morphological quality element evaluation, and chemical status classification. The methodology applies to all principal surface water categories, including rivers, lakes and reservoirs, transitional waters, and coastal waters, ensuring a consistent and integrated assessment framework across different aquatic environments.

Delineation and typology (see Task Report 1 and Chapter 6)

Surface water bodies are delineated according to:

- hydrological characteristics;
- catchment structure;
- waterbody type;
- hydro morphological conditions;
- ecological relevance; and
- significant pressure boundaries.

Artificial Water Bodies (AWBs) and Heavily Modified Water Bodies (HMWBs) were identified in accordance with WFD Article 4 and WISE reporting requirements. Hydropower reservoirs within the regulated Devoll hydropower system were assessed as HMWBs due to substantial hydrological and morphological alteration associated with energy production and flow regulation.

Ecological status assessment (see Task Report 4a – 4f and 5; Chapter 7 and 8)

The ecological status assessment follows the theoretical framework established under WFD Annex V, where ecological status is defined as the degree of deviation of aquatic biological communities from reference or near-natural conditions. Under this concept, ecological status represents the integrated response of river, transitional, and coastal ecosystems to the combined influence of pollution pressures, hydrological alteration, hydro morphological modification, and habitat degradation. The assessment therefore interprets ecological condition not as an isolated water-quality measurement, but as the cumulative ecological expression of multiple interacting pressures acting within the river basin system.

In accordance with the WFD ecological classification system, the assessment integrates:

- Biological Quality Elements (BQEs),

- supporting physicochemical quality elements,
- hydro morphological supporting conditions, and
- pressure–impact relationships.

The ecological status assessment was based on the evaluation of Biological Quality Elements (BQEs) required under the Water Framework Directive, including benthic macroinvertebrates, macrophytes, and Phyto benthos. These biological elements were assessed in conjunction with supporting physicochemical parameters reflecting the overall functioning and ecological condition of aquatic ecosystems.

Supporting parameters included nutrient concentrations, oxygen balance, temperature regime, salinity, suspended solids, and indicators of organic pollution, which were used to evaluate the influence of anthropogenic pressures and to support ecological status classification where biological datasets were limited or incomplete.

Hydro morphological supporting conditions were also considered as part of the ecological status assessment, particularly factors influencing habitat structure and ecosystem functioning. The assessment included evaluation of hydrological continuity, ecological flow alteration, river continuity interruption, channel modification, habitat simplification, and floodplain connectivity, with emphasis on the extent to which hydro morphological pressures may affect biological communities and ecological processes within the assessed water bodies.

Ecological status classification follows the five WFD ecological status classes:

1. **High Status:** The water body shows no or only very minor human alterations. It serves as an undisturbed, natural reference condition with pristine biological communities and high-water quality.
2. **Good Status:** There are slight deviations from the natural condition, but the ecosystem remains healthy and fully functioning. The European Water Framework Directive (WFD) mandates that all water bodies must achieve at least this status.
3. **Moderate Status:** The ecosystem is showing moderate signs of stress or pollution, with noticeable deviations from natural conditions. Certain species may be missing or negatively affected.
4. **Poor Status:** The water body is significantly impacted by human activities or pollution. Biological communities are heavily altered, and the ecosystem is impaired.
5. **Bad Status:** Severe impairment. The natural ecosystem is severely degraded, and key biological quality elements are largely absent or destroyed.

The assessment also applies the WFD “one-out-all-out” principle, whereby deterioration of a single relevant quality element may determine the overall ecological classification of a water body.

The assessment methodology is based on the understanding that ecological degradation frequently results from the cumulative interaction of multiple pressures rather than isolated stressors. Accordingly, the analysis incorporates pressure–response relationships linking pollution loads, abstraction pressures, hydrological alteration, sediment transport disruption, habitat fragmentation, and hydro morphological modification with likely ecological impacts on aquatic biological communities.

However, the assessment remains constrained by the limited development of Albania's biological monitoring systems. Systematic monitoring of BQEs across the basin is not yet fully established, ecological reference conditions remain only partially defined, and long-term biological datasets are fragmented or unavailable for many water bodies. Consequently, direct ecological classification based exclusively on biological monitoring could not be consistently applied throughout the basin.

Where biological monitoring data were absent, incomplete, or insufficiently representative, indicative ecological conditions were inferred through an integrated evaluation of supporting quality elements, documented pressures, and available hydro morphological evidence. In accordance with the precautionary and risk-based principles of the WFD assessment framework, water bodies subject to significant nutrient enrichment, persistent chemical pollution, ecological flow alteration, sediment imbalance, abstraction pressure, or major hydro morphological modification were considered likely to experience ecological impairment even where direct biological confirmation was unavailable.

This approach reflects the provisions of the WFD Common Implementation Strategy (CIS) Guidance, which recognises that, in situations where biological monitoring systems remain incomplete or datasets are spatially or temporally insufficient, ecological status assessment may be supported by:

- supporting physico-chemical and hydro morphological quality elements;
- pressure-impact relationships and pressure-based inference;
- expert judgement; and
- precautionary ecological screening.

Accordingly, the assessment applied a weight-of-evidence methodology combining available monitoring results with identified anthropogenic pressures and known ecological responses. This enabled the identification of water bodies potentially failing to achieve Good Ecological Status despite limitations in biological datasets, while ensuring consistency with WFD Article 5 risk assessment principles and Annex V ecological classification requirements.

Hydro morphological assessment (see Task Report 4a – 4f and 5; Chapter 7 and 8)

A hydro morphological assessment was undertaken as a supporting component of the ecological status classification in accordance with the requirements of the Water Framework Directive. The assessment focused on the extent to which hydrological alteration and physical modification influence aquatic habitats, ecological processes, and the condition of biological communities within surface water bodies.

The evaluation considered key hydro morphological parameters including:

- alteration of ecological flows;
- river continuity interruption;
- hydropoising effects;
- disruption of sediment transport processes;
- channel modification and river engineering;
- floodplain connectivity; and
- changes in habitat structure and morphological diversity.

Particular attention was given to the impacts of dams, hydropower operations, abstraction pressures, channelisation, bank reinforcement, gravel extraction, and other hydro morphological pressures capable of altering natural flow regimes and habitat conditions. Where direct hydro morphological monitoring data were limited, the assessment applied pressure-based analysis, spatial interpretation, and expert judgement to identify water bodies potentially affected by significant hydro morphological alteration.

Chemical status assessment (see Task Report 4a – 4f and 5; Chapter 7 and 8)

Chemical status assessment was undertaken in accordance with the requirements of the Water Framework Directive and associated daughter directives, based on compliance with:

- Environmental Quality Standards (EQS),
- priority substances,
- river basin specific pollutants, and
- other hazardous substances identified under WFD daughter directives.

The assessment was carried out based on data series available from related monitoring institutions and project monitoring for the period 2019-2025. The evaluation covered assessment of physico-chemical parameters, including nutrients and some heavy metals.

Surface water bodies were classified into 5 water quality categories of regulatory compliance:

1. **High Status:** No or very minor anthropogenic impacts; meets natural background levels.
2. **Good Status:** Meets all European Environmental Quality Standards (EQS).
3. **Moderate Status:** Certain chemical concentrations exceed baseline levels but have not triggered widespread ecological collapse.
4. **Poor Status:** Chemical pollutants (such as nitrates or pesticides) are consistently failing safety thresholds.
5. **Bad Status:** Severe chemical degradation that results in the loss of biological communities.

This assessment was grounded in an integrated pressure–monitoring framework that merged quantitative chemical analyses with spatial and sectoral information on pollutant pressures. Core analytical components included:

- Laboratory monitoring of chemical concentrations in surface waters;
- Identification of pollution hotspots, including industrial areas, mining sites, urban centres, and wastewater discharge zones;
- Evaluation of wastewater treatment performance and discharge loads;
- Screening of industrial, IPPC, and non-IPPC activities with potential hazardous releases;
- Assessment of agricultural pressures, including nutrient and pesticide pathways; and
- Documentation of observed or inferred exceedances where data were available.

Where monitoring datasets were incomplete, spatially limited, or temporally inconsistent, a precautionary source–pathway–receptor approach was applied. Known pollution sources, land-use pressures, and hydrological connectivity were used to identify water bodies potentially at risk of chemical status failure, even where direct exceedance evidence was unavailable. Particular attention was given to legacy mining areas, industrial discharge zones, urban wastewater impacts, and intensive agricultural areas as potential contributors to chemical contamination.

The assessment also recognised significant uncertainties associated with limited laboratory capacity, insufficient monitoring frequency, missing coverage of priority substances and emerging contaminants, and uneven spatial monitoring distribution. Consequently, chemical status classifications for some water bodies remain subject to moderate to high uncertainty, highlighting the need for strengthened monitoring infrastructure, expanded analytical capacity, and improved temporal and spatial monitoring coverage to support future WFD compliance assessments.

Risk Assessment and WFD Objective Screening (see Task Report 5; Chapter 7)

Risk assessment was undertaken to evaluate the likelihood of water bodies failing to achieve the environmental objectives established under Article 4 of the Water Framework Directive. The assessment followed a precautionary, evidence-based approach integrating monitoring results, pressure analysis, hydro morphological conditions, and expert evaluation within the broader River Basin Management Planning (RBMP) framework.

Surface Water bodies are classified into three principal risk categories:

- **Not at Risk**, where available evidence indicated that environmental objectives are likely to be achieved and no significant pressures or impacts were identified;
- **Possibly at Risk**, where pressures were present but monitoring data, status assessments, or pressure quantification remained insufficient to confirm objective failure with adequate confidence; and
- **At Risk**, where significant pressures and documented impacts indicated a high likelihood of failing to achieve good ecological, chemical, quantitative, or hydro morphological conditions.

The assessment integrated the magnitude, spatial extent, and cumulative effects of pressures together with the ecological sensitivity and hydro morphological vulnerability of affected water bodies. Particular consideration was given to exceedances of environmental quality standards, groundwater vulnerability, abstraction pressures, hydrological alteration, ecological flow disruption, and evidence of ecological or chemical deterioration derived from monitoring programmes and trend analysis.

Where monitoring coverage, biological datasets, or pressure quantification remained incomplete, expert judgement and precautionary screening were applied to address uncertainty. In such cases, water bodies were conservatively classified as “Possibly at Risk” pending further monitoring, data refinement, and improved status assessment. This approach ensured that uncertainty did not result in underestimation of environmental risks or omission of potentially significant pressures within the RBMP process.

The methodology was also aligned with the WISE reporting framework, linking pressures and impacts to ecological and chemical status assessment through pressure coding, risk screening, ecological classification, chemical status reporting, and confidence level evaluation.

9.3.4 Methodology of Pressures and Status Assessment for Groundwater bodies

Groundwater assessment is undertaken in accordance with the principles of the Water Framework Directive and the Groundwater Directive (2006/118/EC), supported by CIS Guidance documents and WISE reporting requirements.

Groundwater body characterisation under Annex II combines:

- pressure identification and classification;
- hydrogeological vulnerability assessment;
- receptor sensitivity analysis; and
- conceptual source–pathway–receptor modelling.

This integrated framework ensures that groundwater bodies are consistently evaluated for both **chemical and quantitative risk**, even where monitoring data are limited, in line with precautionary principles of the Water Framework Directive (see *Task Report 4a – 4f and 5; Chapter 7 and 8*).

Groundwater Vulnerability

Groundwater vulnerability in the Seman River Basin varies according to the hydrogeological setting of each groundwater body (see **Table xx**). The vulnerability characterisation supports the implementation of WFD Annex II by linking aquifer typology to the risk of chemical and quantitative pressures. It applies a source–pathway–receptor approach and helps to screen risks, interpret pressures, and prioritise monitoring and management actions.

The classification distinguishes between lowland alluvial aquifers, coastal aquifers, fractured and karst systems, mining and industrial aquifers, and upland aquifers. Each setting has different recharge conditions, attenuation capacity, permeability, flow behaviour and exposure to human pressures. Vulnerability therefore ranges from low to very high. Karst and coastal aquifers are particularly vulnerable because they allow rapid contaminant transport, have limited natural attenuation, and are sensitive to saline intrusion and abstraction-induced impacts. Upland aquifers generally show lower vulnerability, although local sensitivity may increase where recharge is seasonal or abstraction pressures are concentrated.

The main pathways for pressure transmission include vertical infiltration from land use, drainage network connectivity, conduit flow in karst systems, contaminant plume migration from industrial or mining sources, and lateral seawater intrusion in coastal aquifers. The sensitivity of each groundwater system depends on factors such as hydraulic head balance, recharge variability, aquifer protection, source persistence and abstraction intensity.

This vulnerability classification provides a conceptual basis for assessing groundwater risk under the WFD. It supports WISE-compliant reporting and helps integrate hydrogeological understanding in the Seman basin, particularly for identifying groundwater bodies that require targeted monitoring, further characterisation or management measures.

Table xx - Hydrogeological Setting and Vulnerability Characterisation

Hydrogeological Setting	Vulnerability Level	Key Characteristics	Dominant Pathways	Sensitivity Controls
Lowland alluvial aquifers	High	Shallow groundwater, high permeability, intensive land use	Vertical infiltration, drainage networks	Agricultural loading, abstraction intensity
Coastal aquifers	High	Saline interface, strong human pressure	Lateral seawater intrusion, abstraction cones	Hydraulic head balance, recharge deficit
Fractured/karst aquifers	Very High	Rapid flow, low attenuation capacity	Conduit flow, preferential pathways	Recharge events, spring response sensitivity
Mining/industrial aquifers	High (localized extreme)	Legacy contamination, heterogeneous geology	Plume migration, fracture flow	Source persistence, contaminant mobility
Upland aquifers	Low–Moderate	Higher recharge stability, lower pollution intensity	Local infiltration, spring discharge	Seasonal recharge variability, abstraction points

Receptor Characterisation

The receptor characterisation framework for groundwater in the Seman River Basin applies a source–pathway–receptor approach, in line with WFD Article 5, Annex II, WISE reporting logic and the risk assessment principles of the Groundwater Directive (see Tabel xx). It assesses pressures not only at their source, but also in terms of location, magnitude, intensity and their potential to move through hydrogeological pathways towards sensitive receptors.

The framework focuses on groundwater-dependent receptors, including groundwater bodies, public water-supply abstraction points, tapped springs, baseflow-dependent rivers, wetlands, riparian habitats and coastal ecosystems. This makes it possible to assess vulnerability and risk in a spatially explicit way, taking account of hydrogeological connectivity and the ecological or socio-economic importance of each receptor.

Drinking water abstractions are high-dependency and high-sensitivity receptors. They are mainly affected by chemical pressures such as nitrate, pesticides, microbiological contamination and salinity, with direct implications for human health protection. Springs and wetlands are very high-sensitivity receptors because they respond rapidly to changes in groundwater quantity and quality. They therefore provide important indicators of ecosystem condition and water availability.

Rivers sustained by baseflow form transitional receptors between groundwater and surface water systems. Abstraction, recharge variation and nutrient loading can directly affect their ecological status. Coastal ecosystems are also highly sensitive, particularly where saline intrusion, abstraction pressure and climate-related stressors affect groundwater quality and ecological integrity.

This receptor classification provides a structured basis for linking groundwater pressures to ecological and socio-economic impacts. It supports groundwater risk assessment, prioritisation of monitoring and the selection of management measures within the Seman River Basin Management Plan.

Table xx - Groundwater Receptor Characterisation

Receptor Type	Dependency	Sensitivity	Main Pressures	Risk Role
Drinking water abstractions	High	High	Nitrate, pesticides, microbiological pollution, salinity	Human health protection
Springs	High	Very High	Abstraction, recharge reduction, contamination pulses	Ecosystem & supply indicator
Rivers (baseflow dependent)	High	High	Abstraction, recharge change, nutrient loading	Ecological status linkage
Wetlands	High	Very High	Groundwater level decline, nutrient enrichment	Biodiversity indicator
Coastal ecosystems	High	Very High	Saline intrusion, abstraction, climate change	Transitional system integrity

Pressures–Receptors Linkage (Risk Screening)

The pressures–receptors linkage framework is structured in accordance with WISE groundwater reporting categories and the conceptual requirements of the Water Framework Directive Annex II risk assessment approach. It provides a systematic screening tool for evaluating how groundwater pressure categories propagate through hydrogeological pathways and affect sensitive receptors.

Pressures are grouped into five principal categories: point-source pollution, diffuse pollution, abstraction pressures, recharge and hydrological alteration, and legacy or uncertain sources. These represent the main anthropogenic drivers affecting groundwater quantity and quality across the basin.

The linkage analysis identifies affected receptors, including wells, springs, rivers, wetlands, and coastal aquifers, and describes dominant impact mechanisms such as contaminant infiltration, plume migration, reduction of baseflow, depletion of groundwater storage, and saline intrusion.

Risk levels are assigned in indicative terms for comparative screening and prioritisation. Diffuse pollution and recharge alteration are generally associated with medium to high risk due to their spatial extent and system-wide influence. Point-source contamination and abstraction pressures typically present high localised risk due to their direct and rapid impacts on groundwater systems. Saline intrusion in coastal aquifers is classified as high risk given its potential irreversibility, while legacy or uncertain sources are treated as medium to high uncertainty risk due to limited data availability.

Table xx summarises this groundwater pressure–receptor linkage framework, providing a structured basis for initial risk screening in line with WFD Annex II and WISE reporting requirements. It links each pressure category to the most relevant receptors, the dominant mechanisms of impact, and indicative risk levels based on pressure intensity, receptor sensitivity, and expected impact magnitude and reversibility.

Overall, the framework supports identification of priority pressures, vulnerable receptors, and areas requiring further monitoring, investigation, and management within River Basin Management Planning.

Table xx - Pressure-receptor linkage

Pressure Category	Affected Receptors	Likely Impact Mechanism	Risk Level (Typical)
Diffuse pollution	Wells, rivers, wetlands	Gradual contamination via infiltration	Medium–High
Point-source contamination	Local wells, springs	Localised plume formation	High
Abstraction pressures	Springs, rivers, wetlands	Reduced discharge, ecological flow deficit	High
Recharge alteration	All receptors	System-wide storage reduction	Medium–High
Saline intrusion	Coastal wells, aquifers	Irreversible salinisation risk	High
Legacy contamination	Local receptors	Persistent uncertain contamination	Medium–High (uncertain)

Quantitative status assessment (see Task Report 4a – 4f and 5; Chapter 7 and 8)

Quantitative status is evaluated based on the balance between abstraction and recharge, considering groundwater level behaviour, spring discharge variability, aquifer storage conditions, recharge resilience under climatic variability, and saline intrusion risk in coastal aquifers.

Where monitoring data are limited, a structured screening approach is applied, combining abstraction intensity relative to estimated recharge, hydrogeological vulnerability, receptor dependency, and expert judgement. This ensures that groundwater bodies with limited observation data are still assessed within a precautionary WFD-compliant framework.

Chemical status assessment (see Task Report 4a – 4f and 5; Chapter 7 and 8)

Chemical status is assessed using available hydro - chemical data supported by pressure–pathway analysis, focusing on key indicators including nitrate and ammonium, conductivity and salinity parameters (chlorides and sulphates), pesticides, hydrocarbons, heavy metals, and other locally relevant pollutants.

Classification is based on compliance with environmental quality standards and, where data are insufficient, inferred risk derived from pressure intensity, land-use patterns, and hydrogeological vulnerability. Typical pressure–impact patterns include diffuse agricultural nitrate contamination in lowland aquifers, wastewater-related pollution in peri-urban areas, mining-related metal contamination in selected sub-basins, and saline intrusion in coastal aquifers linked to abstraction stress.

Risk Assessment and WFD Objective Screening (see Task Report 5; Chapter 7)

Groundwater bodies are screened for risk of failing to achieve good chemical or quantitative status in accordance with the WFD Annex II characterisation framework. The assessment integrates key determinants including abstraction pressure, contamination vulnerability, recharge conditions, land-use intensity, ecosystem dependency, hydrogeological sensitivity, and available monitoring evidence.

Given limitations in monitoring coverage and data completeness, a precautionary approach is applied where uncertainty affects confidence in classification outcomes. The resulting classification provides a simplified but consistent basis for categorising groundwater bodies according to their likelihood of failing WFD environmental objectives.

Groundwater bodies are classified into three principal risk categories:

- **Not at Risk**, low pressure conditions with no evidence of significant impact;
- **Possibly at Risk**, pressures identified, but monitoring evidence is insufficient or uncertain to confirm status deterioration; and
- **At Risk**, significant pressures present with confirmed or highly probable impacts on chemical or quantitative status.

This classification supports harmonised RBMP reporting, enables comparability across groundwater bodies, and provides a basis for prioritising monitoring, investigation, and management measures.

9.3.5 Methodology of Pressures and Status Assessment for Protected Areas

The methodology for protected areas assessment is derived from the requirements of the Water Framework Directive, particularly Article 6 and Annex IV, and is aligned with related EU environmental acquis, including the Habitats and Birds Directives, bathing water protection provisions, groundwater protection obligations, and WISE protected area reporting procedures (see *Task Report 4a – 4f and 5; Chapter 7 and 8*).

Within the WFD framework, protected areas are defined as water-dependent ecosystems or water uses requiring enhanced protection due to their ecological sensitivity, biodiversity importance, public health relevance, drinking water abstraction function, or broader socio-economic value. Accordingly, the assessment integrates ecological condition, hydrological integrity, water quality status, vulnerability, and pressure analysis into a unified analytical framework.

The methodological approach follows a pressure–state–vulnerability–risk logic consistent with River Basin Management Planning (RBMP) principles, combining monitoring evidence, spatial analysis, and expert judgement to address variability and gaps in available data.

Assessment Framework

The assessment is structured around two interlinked dimensions:

Status of water-dependent ecosystems:

- Ecological condition (habitat quality and biodiversity integrity);
- Physic-chemical status (nutrients, pollutants, salinity indicators); and
- Hydrological integrity (flow regime, groundwater levels, and connectivity).

Pressure analysis affecting protection objectives:

- Identification and characterisation of anthropogenic pressures;
- Spatial overlap between pressures and protected area boundaries; and
- Intensity, persistence, and cumulative effects of stressors.

This dual structure enables differentiation between formal designation and actual environmental performance, particularly relevant in contexts where protection frameworks exist but implementation and enforcement remain uneven.

Pressure–Impact Analysis

Protected areas were assessed through key Water Framework Directive (WFD)-relevant pressure categories in order to identify and characterise the main stressors affecting their environmental objectives. The analysis considered nutrient enrichment arising from agricultural activities and wastewater discharges, as well as organic and microbiological pollution associated with inadequate sanitation systems.

Hydro morphological pressures were also a central component of the assessment, including alterations driven by hydropower regulation, river engineering, and infrastructure development, which may affect flow regimes, habitat structure, and ecological continuity. These were complemented by pressures related to habitat fragmentation and the resulting loss of ecological connectivity across aquatic and riparian systems.

In coastal and lowland groundwater systems, the assessment accounted for saline intrusion processes, while seasonal tourism activities were considered as additional sources of localised pressure. Abstraction impacts on groundwater bodies and spring systems were also evaluated, particularly where they influence ecological flow conditions and ecosystem dependency.

Further attention was given to sediment transport disruption affecting deltaic and lacustrine environments, as well as broader climate-related stressors, including increased drought frequency and temperature-driven ecosystem shifts, which act as amplifying pressures on water-dependent ecosystems.

Ecological Vulnerability

Ecological vulnerability is assessed using a receptor-based approach that focuses on the sensitivity of ecosystems and their capacity to absorb and recover from pressures. The analysis evaluates intrinsic ecological sensitivity and resilience, together with the degree of habitat connectivity and the integrity of ecological corridors that support species movement and ecosystem functioning.

It also considers the biodiversity value of the system, including internationally and nationally designated sites such as Ramsar wetlands and Emerald Network areas, as well as the level of dependence on surface water–groundwater interactions that sustain ecological processes. Exposure to diffuse and point-source pollution is assessed as a key determinant of vulnerability, alongside sensitivity to climate variability and extreme events, which may amplify existing environmental stresses and reduce ecosystem adaptive capacity.

Particular attention is given to high-sensitivity receptors, including migratory fish habitats, wetlands, bathing waters, coastal ecosystems affected by eutrophication and salinity gradients, and drinking water abstraction zones dependent on stable recharge conditions. Even relatively low-intensity pressures may therefore result in significant ecological or public health risks in these systems.

Monitoring Constraints and Uncertainty

The assessment is constrained by a range of limitations related to monitoring coverage and institutional integration, which affect the completeness and certainty of the results. These include incomplete spatial and temporal ecological monitoring networks, as well as limited availability of Biological Quality Element datasets, which reduce the ability to fully characterise ecological status trends across water-dependent ecosystems.

Additional constraints arise from fragmented groundwater and spring monitoring systems, which limit the understanding of surface water–groundwater interactions and system-wide hydrological responses. Weak inter-institutional coordination further reduces data integration across water management, environmental protection, and spatial planning authorities.

In addition, incomplete integration of protected area registers with spatial planning and water management systems limits the ability to fully align environmental objectives with territorial development and conservation measures. As a result, the assessment necessarily combines available empirical evidence with expert judgement, applying a precautionary approach where data gaps or uncertainties are significant.

9.4 Surface Waterbody Pressures and Status Assessment

9.4.1 General overview

The assessment of surface waterbody pressures and status within the Seman River Basin constitutes one of the core analytical components of the River Basin Management Plan (RBMP) and provides the technical basis for implementation of the EU Water Framework Directive (WFD). The assessment applies the WFD Annex II pressure–impact framework, linking significant anthropogenic activities and hydro morphological alterations to their likely impacts on rivers, reservoirs, transitional waters, lagoons, and coastal waters in order to support the identification of water bodies at risk of failing environmental objectives.

The assessment confirms that the Seman River Basin is exposed to a highly interconnected and cumulative pressure regime dominated by hydropower regulation, hydro morphological alteration, industrial and oil-sector pollution, urban wastewater discharges, diffuse agricultural pollution, gravel extraction, abstraction pressures, channel modification, and climate-related hydrological variability. These pressures affect surface waters throughout the basin and frequently interact synergistically, amplifying ecological degradation beyond the effects of individual stressors alone.

Due to the strong upstream–downstream connectivity of the Seman system, pressures originating in mountainous and regulated river reaches of the Devoll and Osum sub-basins are progressively transferred downstream through hydrological alteration, sediment transport processes, irrigation and drainage networks, and pollutant mobilisation pathways toward the lower Seman River, the Myzeqe plain, the Divjakë–Karavasta lagoon complex, transitional waters, and the Adriatic coastal zone. The basin therefore functions as an interconnected river–floodplain–lagoon–coastal continuum in which hydrological alteration, sediment imbalance, nutrient enrichment, hydrocarbon contamination, and diffuse pollution pressures are cumulatively expressed within downstream receiving environments. The assessment demonstrates strong spatial differentiation of pressures across the basin.

Hydrological alteration and sediment continuity disruption associated with the Banjë and Moglicë hydropower reservoirs represent the dominant pressures affecting regulated reaches of the Devoll River system. These pressures modify ecological flow conditions, reduce downstream sediment delivery, alter channel morphology, and contribute to long-term hydro morphological instability within downstream reaches of the Seman basin.

Industrial contamination and legacy oil-sector pollution pressures are particularly significant within the Gjanica–Patos–Ballsh–Kuçovë corridor, where active and historical hydrocarbon extraction, industrial discharges, contaminated sediments, and legacy pollution sites generate severe chemical and ecological pressures affecting both surface waters and downstream receiving systems. The Gjanica tributary represents one of the most environmentally degraded river systems within Albania and functions as a major pollutant transfer pathway toward the lower Seman River.

Within the lower basin and Myzeqe plain, diffuse agricultural pollution, irrigation return flows, urban wastewater discharges, drainage canal networks, floodplain modification, and hydro morphological degradation constitute the principal pressures affecting rivers, canals, groundwater-dependent wetlands, transitional waters, and coastal ecosystems. Intensive agricultural activity generates widespread nutrient, pesticide, organic matter, and sediment loading, while low-gradient hydraulic conditions favour pollutant retention, eutrophication processes, and oxygen depletion within downstream water bodies and lagoon systems.

Hydro morphological pressures associated with channelisation, flood embankments, bank reinforcement, gravel extraction, sediment disturbance, and drainage infrastructure are widespread throughout the basin and interact cumulatively with upstream sediment retention caused by hydropower reservoirs. These pressures reduce lateral connectivity between rivers and floodplains, simplify aquatic habitats, destabilise river morphology, weaken ecological resilience, and contribute to downstream coastal erosion and transitional water degradation.

Climate-related hydrological variability further amplifies existing pressures throughout the basin. Increasing drought frequency, reduced summer runoff, higher temperatures, extreme rainfall events, saline intrusion within coastal aquifers, and increased eutrophication risk intensify hydrological stress and reduce the adaptive capacity of aquatic ecosystems. Climate change therefore functions both as an independent pressure and as a multiplier of existing anthropogenic impacts.

The cumulative downstream propagation of hydrological alteration, industrial contamination, nutrient enrichment, sediment imbalance, and pollution pressures highlights the strong interconnectivity of hydrological and ecological processes throughout the Seman River Basin. Downstream transitional waters and coastal ecosystems are particularly vulnerable due to their role as receiving environments for upstream pollutant and sediment loads.

Overall, the widespread occurrence of industrial pollution, urban wastewater discharges, hydrological alteration, diffuse agricultural pollution, sediment disruption, and hydro morphological modification indicates that a substantial proportion of surface water bodies within the basin are at risk of failing WFD environmental objectives. On a basin-wide pressure-based assessment, the prevailing pressure regime is considered incompatible with the achievement of Good Ecological Status or Good Ecological Potential without the implementation of coordinated basin-scale management measures, strengthened monitoring systems, improved regulatory enforcement, enhanced abstraction and pollution control, and targeted pressure reduction interventions.

The pressure assessment distinguishes between the following principal pressure categories:

1. point-source pollution pressures;
2. diffuse pollution pressures;
3. abstraction and hydrological pressures;
4. hydro morphological pressures; and
5. climate-related and other cross-cutting pressures.

These pressure categories are assessed through a combination of monitoring information, industrial and wastewater infrastructure inventories, hydrological and hydro morphological analyses, land-use assessments, abstraction and permit registers, remote sensing interpretation, pressure screening methodologies, and expert judgement in accordance with WFD Annex II assessment principles.

9.4.2 Point-source pollution pressures

Urban and industrial wastewater discharges represent one of the most significant point-source pressures within the Seman River Basin and constitute a major threat to the ecological integrity, chemical status, and long-term sustainability of both surface water and groundwater resources. Wastewater originating from urban settlements, untreated or insufficiently treated sewage, industrial activities, oil extraction infrastructure, agro-industrial facilities, and diffuse urban runoff contains nutrients, organic matter, hydrocarbons, suspended solids, pathogens, heavy metals, and hazardous substances that are discharged directly or indirectly into rivers, canals, floodplains, groundwater bodies, transitional waters, and coastal ecosystems.

Within the Seman River Basin, inadequate wastewater treatment infrastructure, incomplete sewerage systems, ageing industrial installations, and weak environmental enforcement mechanisms continue to generate substantial pollution pressures across the basin. These pressures contribute to eutrophication, oxygen depletion, toxic contamination, habitat degradation, sediment pollution, and declining ecological resilience in rivers, lagoons, wetlands, and coastal receiving waters. Point-source pollution therefore represents one of the principal barriers to achieving the environmental objectives of the EU Water Framework Directive (WFD), including Good Ecological Status, Good Ecological Potential, and Good Chemical Status.

Urban wastewater pressures are particularly significant within the Berat–Kuçovë–Dimal corridor, the Fier–Patos–Ballsh industrial zone, the Lushnjë–Divjakë lowlands, and the lower Seman drainage network. Untreated or partially treated municipal wastewater, combined sewer overflows, septic leakage, stormwater discharges, and informal outfalls contribute elevated loads of Biochemical Oxygen Demand (BOD), nutrients (nitrogen and phosphorus), suspended solids, microbiological contaminants, hydrocarbons, and solid waste to receiving water bodies.

Despite the recent progress, only approximately 27% of generated wastewater currently receives treatment, indicating that the majority of wastewater generated within the basin continues to enter the environment untreated or insufficiently treated.

In rural areas, septic systems remain the dominant wastewater management solution. However, inadequate design standards, limited maintenance, uncontrolled infiltration, and poor sludge management create additional risks for groundwater contamination and localised pollution of rivers, drainage canals, and shallow aquifers.

Wastewater management challenges are further compounded by operational and institutional weaknesses affecting water supply and sanitation utilities throughout Albania. Limited technical capacity, insufficient maintenance of infrastructure, weak asset management systems, inadequate financial sustainability, and limited regulatory enforcement reduce the efficiency and reliability of wastewater collection and treatment systems. These institutional constraints significantly limit the basin's capacity to reduce point-source pollution pressures in the short and medium term.

Industrial wastewater discharges represent a particularly severe pressure category within the Seman Basin due to the concentration of oil extraction, petroleum processing, and associated industrial activity within the Patos–Marinzë–Ballsh–Kuçovë corridor. The basin represents one of the most

environmentally impacted industrial regions in Albania. More than 2,400 oil wells, together with ageing extraction and transport infrastructure, contribute to chronic hydrocarbon leakage, accidental spills, untreated industrial discharges, and contaminated runoff pathways.

The Gjanica tributary represents the most heavily impacted industrial water body within the basin and functions as a major conduit transporting pollutants from the Ballsh and Patos industrial areas toward the lower Seman River. Hydrocarbon contamination, oil residues, suspended solids, and elevated concentrations of heavy metals—including cadmium (Cd), lead (Pb), chromium (Cr), and nickel (Ni)—have been identified within surface waters, sediments, soils, and adjacent agricultural areas. Historical contamination associated with industrial and oil-sector activities has resulted in long-term degradation of aquatic ecosystems, groundwater vulnerability, reduced agricultural productivity, and potential human health risks within downstream communities.

Industrial and oil-sector pollution pressures are additionally amplified during storm events and high-flow periods, when contaminated sediments and floodplain deposits are remobilised and transported downstream. These event-driven pollution pulses frequently remain underrepresented within routine monitoring datasets but may generate severe short-term ecological impacts and persistent downstream contamination.

The info box in annex

Visit to Arrëz (February, 2025)

- Observation of the confluence of the Devoll and Osum Rivers, which together form the Seman River.
- The area hosts active oil extraction sites, with many small-scale oil production facilities still in operation. Severe soil contamination is visible around these oil production locations.
- Significant amounts of solid waste are present in and around the river. The water emits a strong odor, indicative of untreated wastewater pollution.
- The outer riverbanks are reinforced to prevent erosion (recently constructed bank protection works), while the inner bends are covered with clayey sediment deposits.



Near Arrëz: oil extraction sites, with many small-scale oil production facilities still in operation.



Oil pollution in the main outfall drain near Fier due to oil spill of the nearby Patos-Marinza oil field.



Confluence of the Devoll and Osum Rivers, which together form the Seman River.

Additional localised point-source pressures arise from agro-industrial facilities, slaughterhouses, food-processing industries, aquaculture operations, and urban stormwater systems. Aquaculture activities within lagoon and coastal areas may contribute nutrient enrichment, organic loading, veterinary chemical residues, and localised oxygen depletion within sensitive transitional waters and slow-flowing aquatic systems.

Urban solid waste accumulation along riverbanks, drainage canals, and floodplain areas further contributes to physical habitat degradation, organic pollution, and secondary contamination through mobilisation during rainfall and flood events. In several locations, illegal dumping and uncontrolled waste disposal remain significant local pressures.

Monitoring data confirm the significance of point-source pollution pressures throughout the basin. According to the 2023 environmental monitoring results, the Seman River Basin overall is classified within Class IV ("Poor Status"), primarily due to the severe degradation observed within the Gjanica River at the Fier urban monitoring station. Elevated BOD concentrations, nutrient enrichment, and metal contamination indicate substantial influence from urban and industrial discharges.

Although several monitored river sections remain within acceptable physicochemical ranges for dissolved oxygen and nutrient concentrations, exceedances of cadmium (Cd) and lead (Pb) concentrations within the Osum and Gjanica tributaries indicate failure to achieve WFD chemical status objectives. The Gjanica River exhibits the most degraded conditions, reflecting the cumulative impact of industrial discharges, oil-sector contamination, untreated wastewater, and urban runoff.

Within transitional and coastal waters, the Divjakë–Karavasta lagoon complex represents a particularly sensitive downstream receptor for cumulative basin-wide pollution pressures. River-borne nutrients, sediments, hydrocarbons, industrial contaminants, and agricultural runoff transported through the Seman and Shkumbin systems contribute to eutrophication, sediment contamination, and ecological degradation within lagoon ecosystems.

Monitoring of Karavasta Lagoon has identified elevated concentrations of cadmium (Cd) and lead (Pb), significantly exceeding recommended EU environmental quality thresholds. Potential contamination pathways include:

- historical industrial discharges;
- oil-sector contamination associated with the Seman system;
- agricultural runoff containing phosphate fertilisers and copper-based pesticides;
- contaminated sediment transport; and
- urban and solid waste runoff.

The persistence of elevated metal concentrations across multiple monitoring seasons indicates chronic contamination pressure affecting lagoon ecological quality and potentially creating risks for aquatic organisms, fisheries, and human health through food-chain exposure pathways.

The lower Seman basin therefore functions as a cumulative receiving environment where pollutant retention, low hydraulic gradients, sediment deposition, and hydrological connectivity between rivers,

canals, lagoons, wetlands, and coastal waters favour long-term persistence and recirculation of contaminants.

Due to incomplete wastewater discharge inventories, insufficient industrial monitoring coverage, limited combined sewer overflow datasets, and weak coastal water quality monitoring within the Seman coastal zone, uncertainty remains regarding the full magnitude and spatial distribution of point-source pollution pressures. Consequently, the assessment integrates monitoring data, wastewater infrastructure records, permit information, industrial inventories, field observations, hydro morphological interpretation, and expert judgement in accordance with WFD Annex II screening principles.

Overall, the widespread occurrence of untreated or insufficiently treated municipal wastewater, industrial and oil-sector pollution, hydrocarbon contamination, nutrient enrichment, sediment-associated contamination, and inadequate wastewater management infrastructure represents one of the most significant and persistent threats to water quality, ecological integrity, groundwater protection, and ecosystem resilience within the Seman River Basin.

The implications for future river basin management are substantial. Without major long-term investment in wastewater infrastructure, stricter industrial regulation, improved permitting and compliance systems, enhanced monitoring capacity, and targeted remediation of contaminated sites, a substantial proportion of water bodies within the basin are unlikely to achieve WFD environmental objectives.

Table xx summarises the principal point-source pollution categories, indicators, pathways, receptors, and data sources considered within the Seman River Basin pressure assessment framework.

Table xx - Point Source Pollution Pressures, Indicators and Data Sources

Point-Source Driving Force	Pressure Category	Key Indicators	Dominant Pathways / Mechanisms	Potential Receptors	Data Sources
Municipal wastewater systems	Urban wastewater discharges, CSOs, WWTP effluents	Population connected; treatment level; discharge volumes; overflow frequency; BOD, COD, TN, TP; permit compliance	Direct discharge; sewer overflow; canal transport; sediment accumulation; low-flow concentration effects	Rivers, canals, groundwater, lagoons, coastal waters	Utility records; municipal inventories; environmental monitoring
Industrial facilities and oil-sector infrastructure	Industrial effluents and hydrocarbon contamination	Hydrocarbon loads; hazardous substances; heavy metals; permit exceedances; spill frequency	Direct effluent discharge; contaminated runoff; accidental releases; sediment contamination	Rivers, sediments, groundwater, lagoons, coastal ecosystems	Permit registers; inspections; industrial inventories; monitoring
Oil extraction and legacy contamination sites	Hydrocarbon pollution and contaminated sediments	Oil residues; contaminated soils; Cd, Pb, Cr, Ni concentrations; spill occurrence	Floodplain mobilisation; sediment-bound contaminant transfer; runoff transport	Gjanica tributary, Seman River, floodplains, groundwater	Environmental monitoring; field investigations; contaminated-site records
Urban drainage systems	Stormwater and first-flush pollution	Runoff intensity; hydrocarbon loads; suspended solids; flood frequency	Event-driven runoff; urban wash-off; rapid pollutant transport	Rivers, canals, lagoons, coastal waters	Municipal infrastructure datasets; monitoring
Agro-industrial facilities and slaughterhouses	Organic and nutrient pollution	Organic load; nutrient release; wastewater treatment efficiency	Direct discharge; canal transfer; infiltration	Rivers, drainage canals, groundwater	Permit records; inspections; monitoring
Fish farming and aquaculture	Nutrient enrichment and oxygen depletion	Production intensity; feed inputs; dissolved oxygen depletion; veterinary chemicals	Direct discharge; sediment accumulation; water-column enrichment	Lagoons, reservoirs, slow-flow rivers	Permits; field observations; monitoring
Landfills and waste disposal sites	Leachate and diffuse contamination	Leachate generation; ammonium; heavy	Groundwater infiltration; runoff; drainage transfer	Groundwater, rivers, canals	Municipal records; landfill inventories;

Point-Source Driving Force	Pressure Category	Key Indicators	Dominant Pathways / Mechanisms	Potential Receptors	Data Sources
		metals; containment condition			groundwater monitoring
River engineering and dredging works	Sediment disturbance and pollutant remobilisation	Turbidity; sediment disturbance; dredging frequency	Sediment resuspension; physical habitat alteration	Rivers, floodplains, lagoons, aquatic habitats	Engineering records; hydromorphological surveys

9.4.3 Diffuse Pollution Pressures

Diffuse pollution from agriculture and broader land-use activities represents one of the most widespread and structurally persistent pressures affecting the ecological and chemical status of water bodies throughout the Seman River Basin. Unlike point-source pollution, diffuse pollution originates from spatially distributed activities and is transferred to surface waters and groundwater through multiple hydrological pathways, including surface runoff, irrigation return flows, infiltration, soil erosion, drainage canal conveyance, and shallow groundwater transport. The diffuse nature of these pressures creates high spatial and temporal variability and complicates both quantitative assessment and regulatory control under conventional permitting systems.

Within the Seman River Basin, diffuse pollution pressures are strongly associated with the intensive agricultural systems of the Myzeqe plain, the cultivated valleys of the Devoll and Osum sub-basins, and the extensive irrigation and drainage infrastructure that hydraulically connects agricultural land with rivers, canals, lagoons, wetlands, and coastal waters. The basin therefore functions as a highly connected agro-hydrological system in which nutrients, sediments, pesticides, and organic pollutants are efficiently mobilised and transferred toward downstream receiving environments.

Agriculture constitutes one of the most important economic sectors within the basin but simultaneously represents one of the dominant pressures on water quality and aquatic ecosystem integrity. The transition from traditional agricultural practices toward more intensive cultivation systems has resulted in significantly increased use of chemical fertilisers, pesticides, herbicides, and irrigation water. Nationally, Albania experienced substantial increases in fertiliser and pesticide imports between 2013 and 2015, while the Fier region alone accounts for approximately one quarter of national fertiliser consumption. In the absence of sufficiently developed nutrient management systems, soil-specific fertilisation guidance, and systematic agricultural monitoring programmes, the risk of uncontrolled nutrient mobilisation remains high throughout the basin.

Diffuse agricultural pollution primarily consists of excessive nitrogen and phosphorus loading, pesticide residues, organic matter, pathogens, and suspended sediments transported from cultivated land, livestock areas, irrigation systems, and degraded soils. Nutrient enrichment contributes to eutrophication, algal blooms, oxygen depletion, and ecological degradation in rivers, reservoirs, transitional waters, lagoons, and coastal ecosystems. These impacts are particularly pronounced within low-gradient drainage systems and the lower Seman floodplain, where hydraulic residence times are longer and pollutant retention processes are enhanced.

The extensive irrigation and drainage canal network of the Myzeqe plain significantly increases hydrological connectivity between agricultural land and receiving water bodies. Irrigation return flows mobilise dissolved nutrients, fine sediments, salts, pesticides, and organic contaminants from fields into canals and rivers, accelerating pollutant transfer toward the lower Seman River, Karavasta Lagoon, and adjacent Adriatic coastal waters. Artificial drainage systems therefore act as efficient pollutant transport corridors that amplify downstream eutrophication risks and reduce the natural attenuation capacity of the landscape.

The degradation or absence of vegetated riparian buffer zones further intensifies diffuse pollution pressures. In many agricultural areas, riparian vegetation has been removed or reduced, diminishing the capacity of floodplains and river margins to intercept sediments, nutrients, and agrochemicals before they reach water bodies. Combined with intensive cultivation, soil compaction, and inadequate manure

management practices, these conditions accelerate nutrient and sediment delivery to both surface waters and shallow groundwater systems.

Diffuse sediment pressures are additionally exacerbated by deforestation, land degradation, erosion-prone slopes, and poorly managed land-use practices throughout parts of the basin. Only approximately 30% of the basin area remains covered by vegetation, contributing to elevated erosion rates estimated at up to 180 tonnes per hectare annually in some areas. During intense rainfall events, large quantities of sediment are mobilised and transported downstream together with adsorbed nutrients, hydrocarbons, pesticides, and metals. These processes contribute to increased turbidity, substrate alteration, sediment accumulation, reservoir siltation, and habitat degradation throughout the river network and downstream transitional waters.

Diffuse pollution pressures also arise from mixed agricultural–urban landscapes, road runoff, dispersed settlements, uncontrolled waste disposal, and atmospheric deposition. Pollutants mobilised from roads and urban surfaces include hydrocarbons, heavy metals, suspended solids, plastics, and other contaminants transported through stormwater runoff and drainage systems. Atmospheric deposition associated with agriculture, industry, transport, and energy production contributes additional nitrogen compounds, heavy metals, and persistent organic pollutants to terrestrial and aquatic ecosystems.

Although current monitoring results indicate that concentrations of nitrates, nitrites, and total phosphorus at monitored stations are generally classified within High or Good Status according to Albanian standards, these findings should be interpreted cautiously. Existing monitoring networks remain spatially limited and may not fully capture episodic runoff events, seasonal variability, localised hotspots, groundwater contamination pathways, or cumulative downstream nutrient accumulation processes. Furthermore, nutrient-sensitive zones and vulnerable nitrate areas have not yet been formally designated within the Seman Basin District, limiting implementation of targeted control measures required under the EU Nitrates Directive and Water Framework Directive.

The long-term implications of uncontrolled diffuse pollution include progressive eutrophication of rivers, reservoirs, lagoons, and coastal waters; degradation of aquatic biodiversity and habitats; oxygen depletion and fish mortality; deterioration of groundwater resources; increased drinking water treatment costs; declining soil productivity; contamination of food chains; and reduced resilience of aquatic ecosystems to climate-related hydrological stress.

Diffuse pollution pressures are further amplified by climate change. Projected reductions in summer runoff, increased drought frequency, higher temperatures, and more intense rainfall events are expected to increase both pollutant concentration effects during low-flow periods and pollutant mobilisation during storm-driven runoff events. Climate change therefore acts as a multiplier of existing agricultural and land-use pressures throughout the basin.

Overall, diffuse agricultural and land-use pressures represent a basin-scale environmental challenge requiring integrated catchment management approaches, strengthened regulatory enforcement, improved agricultural practices, enhanced nutrient management systems, restoration of riparian buffer zones, sustainable irrigation management, erosion control measures, and expanded monitoring programmes throughout the Seman River Basin.

Without substantial reductions in diffuse nutrient, sediment, and pesticide loading, many water bodies within the Seman River Basin will remain “At Risk” or “Possibly at Risk” of failing to achieve Good Ecological Status, Good Chemical Status, and associated environmental objectives under the Water Framework Directive.

Table xx summarises the principal diffuse-source pollution categories, indicators, pathways, receptors, and data sources considered within the Seman River Basin pressure assessment framework.

Table xx - Diffuse pollution pressures, indicators and data sources

Driving force	Pressure category	Key indicators	Dominant pathways / mechanisms	Potential receptors	Data sources
Intensive agricultural cultivation and irrigation systems	Nutrient runoff; pesticide contamination; irrigation return flows	Fertiliser application rates; irrigation intensity; drainage canal density; crop intensity; proximity to vulnerable waters	Surface runoff during rainfall events; irrigation return flows; drainage canal conveyance; leaching to groundwater	Rivers, canals, lagoons, coastal waters, shallow aquifers	Agricultural statistics; irrigation authority records; land-use maps; monitoring data; field observations
Livestock production and manure management	Nutrient loading; pathogen transport; organic pollution	Livestock density; manure storage conditions; drainage connectivity; proximity to watercourses	Runoff from grazing areas; manure wash-off; faecal contamination during storms	Rivers, streams, wetlands, groundwater	Veterinary records; agricultural databases; monitoring programmes; field inspections
Mixed agricultural–urban landscapes	Combined nutrient, sediment, hydrocarbon and contaminant runoff	Land-use intensity; settlement density; road density; runoff connectivity	Stormwater runoff; overland flow; drainage channel transport	Rivers, canals, transitional waters, coastal ecosystems	GIS analysis; municipal records; monitoring programmes
Irrigation and drainage infrastructure	Accelerated pollutant transport and salinisation risk	Irrigation coverage; drainage density; return-flow volumes; groundwater vulnerability	Rapid hydraulic transfer through drainage canals; infiltration to shallow aquifers	Rivers, lagoons, groundwater, coastal waters	Irrigation management plans; hydrological datasets; field surveys
Deforestation and degraded riparian zones	Soil erosion and sediment mobilisation	Vegetation cover; erosion susceptibility; riparian buffer condition	Increased runoff; bank erosion; sediment transfer through tributaries	Rivers, reservoirs, wetlands, coastal systems	Land-cover datasets; forestry records; erosion studies
Erosion-prone slopes and unstable catchments	Sediment delivery and turbidity	Catchment slope; erosion indices; rainfall intensity; sediment yield	Hillslope erosion; gully formation; mass wasting during storms	Rivers, reservoirs, transitional waters	Geological surveys; sediment monitoring; hydrological studies
Diffuse pesticide and agrochemical use	Chemical contamination	Pesticide application rates; storage practices; groundwater vulnerability	Surface runoff; infiltration; adsorption to sediments	Surface waters, groundwater, aquatic ecosystems	Agricultural records; groundwater monitoring; environmental inspections
Solid waste and rural dumping	Litter and secondary contaminant mobilisation	Waste accumulation hotspots; flood exposure; proximity to drainage systems	Storm-driven mobilisation; canal transport; floodplain deposition	Rivers, lagoons, coastal waters	Municipal waste records; field inspections; remote sensing

9.4.4 Abstraction of surface water and hydrological pressures

Surface water quantity within the Seman River Basin is subject to increasing pressure arising from water abstraction, hydropower regulation, reservoir operation, irrigation demand, weak permitting systems, and deficiencies in hydrological monitoring and water allocation management. These pressures affect both the quantitative status and ecological functioning of rivers, reservoirs, canals, wetlands, groundwater-dependent ecosystems, and downstream transitional and coastal waters.

Pressures on surface water quantity are of particular importance within the basin because excessive or poorly regulated abstraction reduces ecological flows, depletes groundwater resources, alters seasonal hydrological dynamics, and weakens the ecological resilience of aquatic ecosystems.

Inadequate permitting, incomplete abstraction registration, and limited monitoring capacity further constrain the ability of authorities to manage water resources sustainably or to maintain compliance with the requirements of the EU Water Framework Directive (WFD), which requires the achievement of good quantitative and ecological status and the prevention of further deterioration of water bodies.

The assessment confirms that the Seman River Basin operates under a highly interconnected hydrological regime in which water quantity pressures propagate throughout the river continuum. Upstream hydropower regulation, irrigation withdrawals, groundwater abstraction, and river regulation schemes interact cumulatively with climate variability and increasing seasonal water demand, particularly within the lower Seman basin and the Myzeqe agricultural plain.

One of the most significant quantitative pressures within the basin is associated with hydropower regulation in the Devoll sub-basin, particularly the operation of the Banja and Moglica hydropower reservoirs. Reservoir operation substantially modifies the natural hydrological regime through:

- flow regulation;
- seasonal storage and release cycles;
- alteration of ecological flow conditions;
- sediment retention;
- modification of downstream hydraulic conditions; and
- disruption of longitudinal hydrological continuity.

Hydrological alteration associated with reservoir operation contributes to:

- attenuation and re-timing of natural flood pulses;
- altered seasonal discharge variability;
- downstream channel adjustment and sediment imbalance;
- reduced floodplain inundation;
- reduced habitat diversity and ecological connectivity; and
- increased vulnerability of downstream reaches to low-flow stress.

In annex

Visit to the Valshuku Hydrotechnical Structure (February, 2025)

- A cross regulator on the Devoll River diverts water into a side channel, which subsequently supplies the Thana Reservoir.
- At the time of our visit, no water was diverted to the side channel. The system operates primarily during the summer season, when water levels in the Thana Reservoir decline.
- Old remnants of pumping stations used for irrigating nearby agricultural lands are still present in the area. Some of these stations are no longer operational or are only partially functioning.



Cross regulator on the Devoll River.



Side channel & old remnants of pumping stations.

The cumulative effects of these pressures extend beyond the regulated Devoll reaches and influence downstream sections of the Seman River, associated irrigation systems, wetlands, transitional waters, and coastal ecosystems. Reservoir sediment retention additionally contributes to downstream sediment deficits, increasing the sensitivity of river channels and coastal areas to erosion and morphological instability.

Surface water abstraction pressures are strongly associated with agricultural irrigation demand, particularly within the Myzeqe plain and intensively cultivated lowland areas. Although official abstraction statistics indicate that hydropower accounts for approximately 33% of formally permitted water use within the basin, the actual significance of irrigation abstraction is substantially underestimated due to incomplete abstraction registration, weak enforcement, and widespread informal or unregulated withdrawals from rivers, canals, reservoirs, and groundwater bodies.

Agricultural abstraction exerts particularly strong seasonal pressure during summer low-flow periods, when irrigation demand peaks and ecological flow conditions are already naturally reduced. Large irrigation and drainage networks increase hydrological connectivity between rivers, canals, agricultural land, and groundwater systems, intensifying water losses and altering natural flow distribution throughout the lower basin.

Stakeholder consultations and field investigations indicate that coordinated operation between hydropower infrastructure and irrigation authorities currently plays an important role in maintaining agricultural water supply, particularly within the Thana Reservoir system. Water releases from reservoirs are coordinated with irrigation demand and hydropower production requirements in order to maintain seasonal agricultural supply. However, the efficiency of these systems is increasingly constrained by ageing infrastructure, sediment accumulation, waste deposition, blocked canals, and insufficient maintenance of secondary distribution networks.

More than 250 irrigation reservoirs are currently managed by irrigation authorities and associated institutions within the basin. Many of these systems suffer from operational inefficiencies, sedimentation, structural degradation, and poor maintenance, reducing the effectiveness of water distribution and increasing conveyance losses. Waste accumulation within canals and pumping infrastructure further reduces hydraulic efficiency and contributes to localised flooding and operational disruption.

Additional quantitative pressures arise from:

- public water supply abstractions;
- industrial water use;
- groundwater pumping;
- localised hydropower diversions;
- fisheries and aquaculture-related water management; and
- increasing seasonal demand associated with tourism and economic development.

Groundwater abstraction additionally affects hydraulic connectivity between aquifers, springs, wetlands, and connected river systems, contributing locally to groundwater level decline and reduced baseflow contributions during dry periods. These interactions are particularly important because groundwater contributes significantly to river discharge during low-flow conditions and therefore supports ecological flow maintenance throughout the basin.

The assessment also identifies severe deficiencies in hydrological monitoring and water accounting systems. Since the late 1990s, significant parts of the hydro-meteorological monitoring network have deteriorated or ceased functioning effectively. As a result, many hydrological assessments continue to rely partially on historical datasets from the 1960–1990 reference period, despite substantial changes in climate variability, land use, abstraction intensity, and hydrological regulation.

The absence of reliable real-time hydrological data severely constrains:

- annual water balance assessments;
- drought management;
- ecological flow assessment;
- flood forecasting;
- abstraction control;
- climate adaptation planning; and
- evidence-based allocation of water resources.

Additional uncertainty arises from inconsistent reporting by permitted users and the absence of systematic monitoring of irrigation withdrawals, private abstractions, and seasonally variable water uses. Many industrial and agricultural operators either do not report abstraction volumes regularly or operate outside fully formalised permitting systems. Consequently, the actual scale of abstraction pressure within the basin is likely substantially higher than indicated by official records.

Climate change further amplifies existing quantitative pressures. Projected reductions in summer precipitation, increasing temperatures, higher evapotranspiration rates, and declining summer runoff are expected to intensify seasonal water scarcity throughout the basin. These changes are likely to increase competition among hydropower production, irrigation demand, ecological flow requirements, and public water supply, particularly during prolonged drought periods.

The combined effects of hydropower regulation, abstraction pressures, infrastructure inefficiencies, inadequate monitoring systems, incomplete abstraction control, and climate-related hydrological variability therefore represent a major constraint on the achievement of sustainable water resource management and Good Ecological Status within the Seman River Basin.

Table xx summarises the principal hydrological and abstraction pressures affecting the basin, together with corresponding indicators and key data sources. These pressures primarily influence quantitative status and hydro morphological condition through flow alteration, abstraction-induced depletion, reservoir regulation, ecological flow reduction, and disruption of natural hydrological dynamics.

Table xx - Hydrological and abstraction pressures, indicators and data sources — Seman River Basin

Hydrological driving force	Pressure category	Key indicators	Dominant pathways / mechanisms	Potential receptors	Data sources
Hydropower infrastructure and reservoir regulation	Reservoir operation; flow regulation; ecological flow alteration; sediment retention	Regulated flow share; ecological flow deficit; seasonal flow alteration; reservoir storage dynamics; continuity disruption	Flow regulation; seasonal storage and release; sediment trapping; modification of downstream hydraulic conditions	Devoll River; Seman River; downstream floodplains; wetlands; transitional and coastal waters	Hydropower operational records; reservoir management plans; hydrological monitoring; field observations
Irrigation systems and agricultural abstraction	Surface water abstraction for irrigation	Irrigation demand; seasonal abstraction rates; canal diversion volumes; depleted reach length	Surface water diversion through canals; seasonal abstraction during low-flow periods; irrigation return flow alteration	Rivers; canals; agricultural lowlands; groundwater-dependent ecosystems	Irrigation authority records; agricultural statistics; abstraction permits; field inspections
Public water supply abstractions	Municipal surface and groundwater abstraction	Abstraction volumes; network losses; ecological flow deficits	Direct abstraction from rivers and aquifers; reduction of downstream flows; leakage losses	Rivers; groundwater bodies; springs; downstream users	Utility operational data; abstraction registers; groundwater monitoring
Groundwater abstraction	Groundwater extraction for agriculture, industry, and domestic use	Groundwater level trends; abstraction volumes; reduced baseflow contribution	Aquifer depletion; reduced groundwater recharge; altered hydraulic connectivity	Aquifers; wetlands; springs; rivers (baseflow-dependent reaches)	Hydrogeological studies; piezometric monitoring; groundwater registers
River regulation and channel engineering	Artificial flow alteration and drainage modification	Regulated channel length; altered floodplain connectivity; drainage density	Channelisation; embankments; drainage canal operation; floodplain isolation	Rivers; wetlands; floodplains; lagoons	Engineering inventories; GIS analysis; hydromorphological surveys
Multi-purpose reservoir management	Storage-driven flow modification	Storage-release dynamics; seasonal regulation intensity; operational coordination efficiency	Reservoir buffering; controlled releases; modification of natural hydrograph	Entire regulated river system; irrigation systems; downstream receiving waters	Reservoir operation plans; irrigation management records; hydrological datasets
Ageing irrigation and	Water losses and reduced	Canal blockage frequency;	Leakage; sediment	Irrigation systems;	Irrigation board records; field

Hydrological driving force	Pressure category	Key indicators	Dominant pathways / mechanisms	Potential receptors	Data sources
distribution infrastructure	conveyance efficiency	conveyance loss rates; maintenance condition	accumulation; waste blockage; reduced hydraulic efficiency	agricultural areas; connected river systems	observations; infrastructure inspections
Weak permitting and incomplete abstraction control	Unregulated abstraction and water-use uncertainty	Number of unregistered users; reporting compliance; abstraction monitoring coverage	Illegal abstraction; incomplete reporting; unmonitored withdrawals	Entire basin hydrological system	AWRM permit registers; compliance records; stakeholder consultations
Climate change and hydrological variability	Drought pressure and reduced water availability	Summer runoff reduction; drought frequency; precipitation variability; evapotranspiration increase	Reduced recharge; increased water demand; prolonged low-flow conditions	Rivers; reservoirs; groundwater bodies; wetlands; coastal ecosystems	Climate projections; hydrological studies; RBMP assessments

9.4.5 Hydro morphological pressures

Hydro morphological pressures are defined as anthropogenic physical modifications to the shape, structure, continuity, and flow regime of river and stream systems. These pressures arise from activities such as hydropower development, dam construction, channel regulation, flood protection infrastructure, water abstraction, urban river modification, and unregulated gravel extraction.

Within the Seman River Basin, hydro morphological pressures constitute a structurally dominant driver of ecological degradation. The basin is characterised by strong upstream–downstream connectivity linking mountainous catchments, agricultural lowlands, transitional waters, and coastal systems. However, increasing physical modification of river systems is progressively disrupting this continuum, reducing ecosystem resilience and undermining compliance with Water Framework Directive (WFD) ecological objectives.

The Seman River Basin is inherently sensitive to hydro morphological disturbance due to a combination of natural and anthropogenic factors:

- high natural erosion rates and sediment yields;
- steep mountainous catchments with rapid runoff response;
- large sediment transport loads in the Devoll–Osum–Seman system;
- extensive floodplain modification in the Myzeqe lowlands;
- reliance on groundwater-fed irrigation and potable supply systems;
- exposure of downstream coastal and lagoon systems to sediment deficits;
- cumulative hydropower development in the upper basin.

These characteristics amplify the sensitivity of the basin to flow regulation, sediment disruption, and morphological alteration, resulting in system-wide propagation of impacts from upstream to downstream reaches.

Major hydropower infrastructure in the Devoll sub-basin, including the Banja and Moglicë hydropower plants, has significantly altered natural hydrological regimes through flow regulation, storage operations, and sediment retention. Additional expansion through small hydropower plants (SHPPs) on tributaries further fragments river continuity.

River engineering works, including channelisation, river straightening, bank reinforcement, embankments, levees, and urban river modifications, have significantly altered natural channel dynamics and reduced floodplain connectivity, particularly in lowland areas.

Extensive drainage networks and irrigation systems in the Myzeqe plain have transformed natural floodplain environments into hydraulically controlled agricultural landscapes, reducing wetland extent and hydrological connectivity.

Unregulated in-channel gravel extraction in the Osum, Devoll, and Seman rivers has intensified channel instability, altered sediment balance, and contributed to riverbed incision and bank erosion.

Hydropower regulation modifies the natural seasonal variability of river flows, reducing the magnitude, timing, and frequency of high- and low-flow events. This leads to homogenised discharge patterns and reduced ecological flow variability.

Reservoir sediment trapping and gravel extraction interrupt downstream sediment transport, causing sediment deficits that result in riverbed incision, channel instability, and reduced sediment delivery to floodplains and coastal systems.

Dams, weirs, and diversion structures fragment river systems, restricting the movement of water, sediment, nutrients, and aquatic organisms along the river continuum. Embankments, levees, and drainage systems reduce lateral connectivity between rivers and floodplains, limiting natural inundation processes and altering flood dynamics.

Combined flow regulation and sediment disruption promote channel deepening, bank erosion, morphological simplification, and reduced habitat diversity. Hydropower infrastructure represents one of the most significant hydro morphological pressures in the basin. Flow regulation and reservoir operation modify:

- seasonal discharge variability;
- ecological flow conditions;
- sediment transport continuity;
- flood pulse dynamics;
- channel morphology downstream of dams;
- longitudinal river connectivity; and
- aquatic habitat continuity.

Reservoirs trap large sediment fractions, while regulated releases alter natural flood peaks and reduce the ecological function of high-flow events. These changes contribute to river incision, habitat homogenisation, and reduced ecological resilience in downstream reaches. In addition, SHPPs operating via diversion schemes create extended dewatered river stretches, particularly during dry periods, intensifying localised ecological stress.

The Myzeqe lowland and lower Seman floodplain represent the most heavily modified hydro morphological zones within the basin. Here, drainage systems, embankments, and agricultural reclamation have fundamentally altered natural river–floodplain interactions. The reduction in lateral connectivity has led to:

- reduced floodwater retention capacity;
- diminished groundwater recharge;
- loss of nutrient retention and denitrification processes;
- reduced sediment deposition on floodplains;
- degradation of wetland habitats; and
- increased downstream flood conveyance.

These changes have transformed formerly dynamic floodplain systems into hydraulically constrained agricultural landscapes with reduced ecological functionality.

Disruption of sediment continuity represents a basin-wide structural issue. Natural sediment transport from mountainous catchments toward lowland floodplains and coastal zones is increasingly interrupted by reservoirs and in-channel extraction. Observed and expected consequences include:

- riverbed incision and channel instability;
- bank erosion and infrastructure vulnerability;
- loss of spawning and benthic habitats;
- reduced sediment supply to the lower Seman and Adriatic coast;
- coastal erosion and shoreline retreat; and
- degradation of deltaic and lagoon systems.

Empirical evidence indicates a marked decline in sediment delivery to the former Seman delta, significantly increasing coastal vulnerability under conditions of sea-level rise.

Hydro morphological changes directly affect groundwater systems through reduced floodplain recharge, river incision, and altered surface–groundwater connectivity. Declining baseflows and channel deepening contribute to:

- lowered groundwater tables in adjacent aquifers;
- reduced well and pumping station reliability;
- decreased irrigation water availability;
- reduced aquifer recharge during flood events.

These impacts are particularly pronounced in lowland agricultural zones where groundwater represents a key water supply source.

Hydro morphological degradation reduces habitat diversity, ecological connectivity, and ecosystem resilience. The simplification of channel structure and loss of floodplain habitats results in:

- reduced aquatic and riparian biodiversity;
- loss of spawning and nursery habitats;
- degradation of wetland ecosystems;
- increased water temperature and eutrophication risk in low-flow conditions;
- reduced pollutant dilution capacity; and
- increased sediment-bound contaminant transport.

These pressures collectively contribute to declining ecological status across river, transitional, and coastal water bodies.

Effective assessment and management of hydro morphological pressures is constrained by:

- limited hydro morphological and sediment monitoring networks;
- discontinuity of long-term hydrological datasets;
- weak enforcement of gravel extraction regulations;
- insufficient ecological flow monitoring;
- fragmented institutional responsibilities; and
- limited integration of hydro morphology into basin planning.

These limitations reduce the capacity to fully assess cumulative impacts and implement adaptive river basin management.

Hydro morphological pressures in the Seman River Basin operate as interconnected system drivers affecting flow regimes, sediment transport, channel morphology, floodplain connectivity, groundwater dynamics, and coastal processes. Their cumulative effect is not localised but propagated throughout the entire upstream–downstream continuum.

Table xx summarises the principal hydro morphological pressures affecting the basin, together with corresponding indicators and key data sources. These pressures significantly reduce the ecological and hydrological resilience of the basin, increasing vulnerability to climate variability, water scarcity, flood risk, and coastal degradation. In combination, they represent one of the principal constraints to achieving good ecological status under the Water Framework Directive.

Table xx - Hydro morphological pressures, indicators and data sources – Seman River Basin

Driving force	Pressure category	Key indicators	Dominant pathways / mechanisms	Potential receptors	Data sources
Hydropower dams and reservoirs	Dams, reservoirs, sediment interruption	River continuity interruption; sediment deficit; extent of regulated river reaches; flow regulation intensity	Flow regulation and hydropeaking; sediment trapping in reservoirs; interruption of sediment continuity; alteration of seasonal flow regimes and flood pulses	Devoll and Osum rivers; Seman River; floodplains; transitional and coastal systems	Hydropower concession data; infrastructure inventories; GIS analysis; continuity assessments; field verification

Driving force	Pressure category	Key indicators	Dominant pathways / mechanisms	Potential receptors	Data sources
Small hydropower plants (SHPPs) and diversion systems	Flow diversion and reduced ecological flow	Extent of derivation reaches; ecological flow alteration; continuity disruption	Water diversion through pipelines/tunnels; reduced downstream discharge; habitat fragmentation; cumulative hydrological alteration	Tributaries; downstream aquatic ecosystems; irrigation systems; groundwater recharge zones	Water permits; concession databases; EIA reports; GIS analysis; field surveys
Flood protection infrastructure	Embankments, levees, flood control structures	Floodplain disconnection; degree of channel confinement/modification	Physical separation of river–floodplain systems; restriction of natural inundation dynamics; reduction of lateral connectivity	Floodplains; wetlands; agricultural lowlands; riparian habitats	Infrastructure inventories; satellite imagery; GIS analysis; field observations
River engineering and channel modification	Channelisation, river straightening, bank reinforcement	Channel modification intensity; habitat simplification; regulated reach extent	River confinement and channel straightening; alteration of hydraulic geometry; reduction of morphological diversity	River corridors; aquatic habitats; riparian ecosystems	GIS analysis; satellite imagery; engineering records; field surveys
Drainage and irrigation infrastructure	Agricultural drainage canals and flow control systems	Hydrological modification intensity; altered connectivity; extent of artificial drainage systems	Modification of natural flow pathways; wetland drainage; altered retention and recharge processes	Agricultural floodplains; wetlands; downstream receiving waters	Irrigation and drainage authority records; GIS datasets; field observations
Gravel extraction and dredging	In-channel extraction activities	Sediment deficit; riverbed lowering; channel incision risk; morphological disturbance	Removal of bed material; disruption of sediment transport balance; increased erosion and instability	Riverbeds; downstream reaches; floodplains; aquifers; estuarine/coastal systems	Field surveys; permits; hydro morphological assessments; satellite imagery
Sediment regime alteration (system-wide)	Sediment transport disruption	Basin-scale sediment deficit; continuity of sediment transport	Combined effects of reservoirs, erosion, extraction, and channel regulation reducing downstream sediment delivery	River systems; transitional waters; coastal and lagoon systems	Hydrological and sediment studies; erosion assessments; modelling outputs
Urban and agricultural river modifications	Artificial bank structures and confined channels	Habitat simplification; channel alteration degree	Channel lining, bank reinforcement, infrastructure encroachment, reduction of natural river dynamics	Urban and agricultural river sections; downstream floodplains	Municipal infrastructure inventories; satellite imagery; field verification
Regulated river reaches and diversion systems	Flow regulation infrastructure	Extent of regulated reaches; continuity disruption	Controlled releases and diversions; altered hydrological routing; interruption of longitudinal connectivity	Mainstem rivers; tributaries; wetlands; transitional waters	Hydropower operation data; GIS analysis; river basin datasets
Coastal and deltaic sediment deficit	Reduced sediment delivery to coastal systems	Shoreline retreat; coastal erosion intensity; sediment supply reduction	Reservoir trapping; altered river hydrodynamics; reduced sediment replenishment	Coastal zones; lagoons; deltaic habitats; Adriatic shoreline	Coastal monitoring; sediment studies; remote sensing; modelling outputs

9.4.6 Climate-related and other cross-cutting pressures

Climate change is a significant cross-cutting factor within the Seman River Basin, serving to intensify pre-existing hydrological, hydro morphological, ecological, quantitative, and coastal challenges. Instead of introducing entirely new issues, climate change escalates the severity, frequency, and cumulative effects of pressures already contributing to ecological degradation and increased vulnerability of water resources across the basin.

Long-term climate projections for Southern Europe and Albania consistently forecast rising air temperatures, decreased summer precipitation, elevated evapotranspiration rates, diminished summer runoff, and greater hydrological variability. Collectively, these developments are expected to progressively diminish water availability and heighten climate-related vulnerabilities throughout the Seman Basin.

The Seman River Basin is highly sensitive to climate change because of its intensive irrigated agriculture, reliance on hydropower generation, naturally high erosion rates, modified floodplains, groundwater-dependent irrigation systems, widespread hydromorphological alterations and vulnerable coastal areas. Climate change is expected to intensify water scarcity, ecological flow deficits, saline intrusion, groundwater depletion, ecosystem degradation, sediment instability, flood risk and competition between water users.

By 2060, climate projections indicate lower precipitation, estimated at -3% to -12% depending on the scenario, and higher temperatures, estimated at +1.2°C to +3.0°C. These changes are expected to reduce river runoff by 10% to 42%, reduce groundwater recharge and increase seasonal water shortages. This will directly affect irrigation supply, hydropower generation, drinking water reliability, wetland hydrology and the maintenance of ecological flows. Reduced summer runoff is particularly important in the Devoll and Osum systems, where river flows support hydropower, irrigation, groundwater replenishment and downstream ecological processes.

Higher temperatures will increase evapotranspiration, reduce soil moisture, increase irrigation demand and place additional thermal stress on aquatic ecosystems. Lower summer moisture may also reduce vegetation resilience and increase the risk of erosion, wildfires and land degradation in vulnerable catchments. In lakes and reservoirs, higher temperatures and lower flows may increase eutrophication risks.

Sea level along the Albanian Adriatic coast is expected to increase by approximately 20–24 cm by 2050, with projections indicating a potential rise of up to 61 cm by 2100. These changes present considerable risks, including increased coastal flooding, salinisation of aquifers and estuaries, wetland degradation, loss of agricultural land, damage to tourism infrastructure, and adverse impacts on sensitive ecological systems such as Karavasta National Park and its associated lagoon complexes. Research indicates that significant segments of the Seman coastal zone may be lost by mid-century due to the combined effects of erosion and sea-level rise, posing threats to local livelihoods and ecosystem resilience.

Hydropower systems are particularly susceptible to hydrological changes driven by climate conditions. Decreased inflows and increased evaporation may steadily lower reservoir storage capacity and reduce hydropower generation, especially during extended droughts. Given Albania's substantial reliance on hydropower, diminishing water resources could heighten vulnerability to energy shortages and increase the need for imported electricity during dry periods.

Although an overall decrease in annual precipitation is anticipated, climate models also predict greater precipitation intensity and more frequent extreme weather events. As a result, the basin is expected to experience both intensified droughts and heightened flooding. The Seman Basin already demonstrates dynamic hydrological activity due to steep terrain, rapid runoff, and highly erosive catchment characteristics. Future climate scenarios suggest that more intense rainfall will likely exacerbate flash floods, floodplain inundation, riverbank erosion, sediment movement, landslides, damage to hydraulic infrastructure, and channel stability issues.

The Seman River Basin is recognised as one of Albania's most erosion-prone watersheds, distinguished by high sediment yields and pronounced geomorphological instability. Climate change is projected to further these processes via increased rainfall intensity, enhanced runoff erosivity, reduced vegetation resilience during droughts, wildfire-related land degradation, ongoing deforestation, and rising riverbank instability. Such developments may aggravate channel incision, floodplain degradation, and sediment transport imbalances already resulting from hydropower management, gravel extraction, and channel engineering.

Hydro morphological pressures are projected to intensify under evolving climatic conditions. Greater hydrological variability, prolonged droughts, more frequent extreme rainfall events, heightened flood risk, and accelerated erosion processes may further destabilise already modified river systems. Current hydro morphological changes due to dams, channelisation, embankments, and sediment trapping limit the natural adaptive capacity of river systems to respond effectively to climate variability.

Groundwater resources are particularly vulnerable to climate-related impacts. Reduced recharge rates coupled with increased abstraction demand may progressively lower groundwater availability, especially in lowland irrigation zones. Coastal aquifers are notably exposed to saline intrusion resulting from declining groundwater levels and sea-level rise, affecting both irrigation supply and drinking water quality.

Although Albania's total national water availability currently exceeds aggregate drinking water demand, notable local imbalances persist. These are attributed to seasonal shortages, uneven spatial distribution of resources, significant non-revenue water losses, insufficient storage and distribution infrastructure, and limited resilience of water supply systems. Climate change is anticipated to amplify these structural weaknesses.

The lower Seman River and adjacent Adriatic coastal zone constitute some of the most climate-sensitive environments within the basin. Coastal and transitional waters serve as cumulative downstream recipients of upstream pressures, including nutrients, suspended solids, hydrocarbons, diffuse agricultural pollutants, fine sediments, organic matter, and floatable waste transported through the river system. Consequently, climate change interacts cumulatively with existing pollution sources, sediment deficits, and hydro morphological modifications, thereby increasing ecological vulnerability and morpho dynamic instability across the coastal zone.

Reduced sediment delivery due to upstream hydropower regulation and sediment retention by reservoirs is already contributing to shoreline instability and coastal erosion. These challenges are anticipated to intensify with projected sea-level rise, changing coastal hydrodynamics, storm surges, saline intrusion, and the acceleration of coastal erosion.

At the institutional level, climate vulnerability is exacerbated by fragmented governance, inadequate enforcement capacity, incomplete hydrological records, insufficient monitoring of groundwater and sediments, limited biological assessment resources, and poor integration of climate adaptation within water management planning. Additionally, weak coordination among relevant agencies further hampers the development of comprehensive climate-risk management strategies.

The near - collapse of Albania's surface water flow monitoring network since around 2000 has critically constrained the capacity of institutions to reliably evaluate long-term hydrological patterns, climate influences, water resource availability, and drought frequency trends. Enhanced collaboration among AMBU, the Ministry of Tourism and Environment, IGEO, hydrometeorological agencies, and river basin authorities is therefore vital for robust climate-risk assessments, adaptive management strategies, and sustainable basin governance.

Climate change amplifies existing environmental challenges across the Seman River Basin, heightening ecological sensitivity, exacerbating water shortages, promoting hydro morphological instability, accelerating coastal erosion, and increasing socio-economic risks to agriculture, infrastructure, hydropower generation, tourism, ecosystems, and public water supply systems.

Table xx summarises the principal climate-related pressures considered in the Seman River Basin assessment, together with corresponding indicators and key data sources. Climate change is treated as a cross-cutting driver that amplifies hydrological, ecological, quantitative, hydro morphological, and coastal pressures across the basin rather than as an isolated pressure category.

Table xx - Climate-related pressures, indicators and data sources – Seman River Basin

Climate-related driving force	Pressure category	Key indicators	Dominant pathways mechanisms /	Potential receptors	Data sources
Rising air temperatures and changing climate patterns	Temperature increase and hydrological variability	Projected temperature increase; evapotranspiration trends; hydrological variability indices	Increased evapotranspiration; reduced soil moisture; altered seasonal runoff; thermal stress in aquatic systems	Rivers; groundwater; wetlands; irrigation systems; aquatic ecosystems	Climate projections; meteorological datasets; regional climate models; hydrological monitoring
Altered precipitation regimes and reduced summer runoff	Drought and low-flow conditions	Declining summer runoff; drought frequency; low-flow indicators; ecological flow deficits	Reduced recharge and runoff generation; prolonged dry periods; reduced baseflow contribution; increasing water scarcity	Rivers; groundwater-dependent ecosystems; wetlands; irrigation systems; abstraction-dependent users	Hydrological records; drought assessments; climate scenarios; river flow monitoring
Extreme rainfall events and hydrological instability	Flood risk and variability	Flood frequency; flood magnitude; hydrological variability; erosion intensity	Increased surface runoff; flash flooding; peak discharge amplification; sediment mobilisation; reduced infiltration	Floodplains; river corridors; agricultural areas; urban settlements; infrastructure	Flood risk assessments; hydrometeorological datasets; GIS flood mapping; erosion studies
Climate-driven erosion and sediment instability	Sediment mobilisation and channel instability	Erosion rates; sediment transport intensity; channel instability indicators	Increased rainfall erosivity; accelerated sediment mobilisation; riverbank erosion; floodplain degradation	River systems; reservoirs; agricultural land; downstream ecosystems	Sediment studies; erosion monitoring; GIS analysis; hydrological modelling
Sea-level rise and coastal dynamics	Coastal inundation and saline intrusion	Sea-level rise trends; shoreline retreat; saline intrusion risk; coastal erosion vulnerability	Saltwater intrusion into aquifers; coastal inundation; shoreline erosion; delta destabilisation	Coastal aquifers; estuaries; transitional waters; agricultural lowlands; lagoons	Coastal monitoring; hydrogeological studies; satellite imagery; adaptation assessments
Combined climate–hydrology interactions	Intensification of hydrological extremes	Drought–flood co-occurrence; inter-annual hydrological variability	Amplification of hydrological extremes; cascading basin-scale impacts; increasing climate uncertainty	Entire river basin system; ecosystems; water infrastructure; agriculture	Integrated climate-risk assessments; basin modelling; monitoring programmes
Climate impacts on water resources management	Water availability and ecological flow stress	Seasonal water availability; ecological flow deficits; abstraction pressure	Increased competition among water users; reduced ecological resilience; pressure on irrigation and hydropower systems	Rivers; abstraction systems; groundwater bodies; dependent ecosystems	Water resource assessments; abstraction datasets; climate adaptation studies
Climate impacts on coastal and transitional ecosystems	Coastal ecosystem vulnerability	Sediment supply reduction; coastal habitat degradation; saline intrusion trends	Reduced sediment delivery combined with sea-level rise and altered hydrodynamics	Coastal ecosystems; lagoons; estuaries; wetlands; deltaic habitats	Coastal monitoring; sediment transport studies; remote sensing; ecological assessments
Institutional and monitoring vulnerability under climate change	Adaptive capacity limitations	Monitoring coverage; continuity of hydrological datasets; institutional	Weak monitoring systems; insufficient climate data; limited adaptive planning capacity	Water management institutions; RBMP implementation; climate	WRMA datasets; institutional assessments; climate adaptation reports; monitoring programmes

Climate-related driving force	Pressure category	Key indicators	Dominant pathways mechanisms /	Potential receptors	Data sources
		coordination indicators		adaptation planning	

9.4.7 Status Assessment at Subbasin and Regional Level

This section identifies the significant anthropogenic pressures and associated impacts affecting surface waters within the Seman River Basin District, structured according to the principal hydrological and functional sub-basins of the system. The assessment provides the analytical basis for the pressure-driven evaluation of ecological status and risk under the EU Water Framework Directive (WFD) Annex II methodology.

The assessment follows the WFD DPSIR framework and Annex II screening approach, linking anthropogenic activities, hydrological modifications, and land-use pressures to their likely ecological consequences on river, transitional, and coastal water bodies. The objective is to support the identification of water bodies at risk of failing to achieve WFD environmental objectives.

Where monitoring information remains incomplete or spatially limited, risk interpretation has been supported through pressure-based expert judgement consistent with WFD Annex II principles, including:

- hydro morphological interpretation;
- land-use analysis;
- pressure-pathway assessment;
- field verification,;
- and known pollutant transport mechanisms.

The pressure coding framework applied throughout the assessment follows the basin-wide classification system and includes:

- Urban wastewater discharges and point sources (Pressure Code: 1.1)
- Industrial and oil-related contamination (Pressure Code: 1.3 / 1.4)
- Diffuse agricultural pollution and pesticides (Pressure Code: 2.1 / 2.5)
- Urban runoff and stormwater pressures (Pressure Code: 2.3)
- Hydrological alteration and flow regulation (Pressure Code: 3.1 / 3.5)
- Morphological alteration and sediment continuity disruption (Pressure Code: 3.3)
- Longitudinal continuity interruption (Pressure Code: 3.4)
- Litter and solid waste pressures (Pressure Code: 2.10)
- Contaminated floodplains and seepage pathways (Pressure Code: 4.1)

Due to the strong longitudinal connectivity of the Osum–Devoll–Seman river system, pressures propagate downstream through:

- regulated flow regimes;
- sediment deficits;
- nutrient transport;
- contaminated runoff;
- groundwater interaction;
- and cumulative pollutant mobilisation.

As a result, upstream interventions progressively influence downstream river reaches, the Myzeqe lowlands, and ultimately the Divjakë–Karavasta transitional and coastal systems.

Basin Pressure Regime Overview

The Seman River Basin is characterised by a highly interconnected multi-pressure system dominated by seven principal drivers:

1. Hydropower regulation and altered flow regimes in the Devoll system (Pressure Code: 3.1 / 3.5);
2. Sediment continuity disruption and channel instability (Pressure Code: 3.3);
3. Urban wastewater discharges and insufficient sanitation infrastructure (Pressure Code: 1.1);
4. Diffuse agricultural pollution from intensive cultivation in the Myzeqe plain (Pressure Code: 2.1 / 2.5);

5. Oil extraction, industrial contamination, and hydrocarbon legacy pressures (Pressure Code: 1.3 / 1.4);
6. Morphological alteration through gravel extraction and channel confinement (Pressure Code: 3.3 / 3.4);
7. Solid waste accumulation and stormwater-driven pollution transport (Pressure Code: 2.10 / 2.3).

These pressures act cumulatively and synergistically, producing basin-wide impacts on:

- hydrological dynamics;
- sediment transport;
- oxygen balance;
- habitat heterogeneity;
- ecological connectivity;
- and biological quality elements.

The cumulative effects are most pronounced in lowland reaches and transitional waters where pollutants, nutrients, and sediments accumulate under low-gradient hydraulic conditions.

Upper Osum Sub-basin

The upper Osum sub-basin is characterised by karstic hydrology, relatively stable spring-fed baseflows, and carbonate geology supporting naturally mineralised waters with comparatively good ecological conditions. Despite the relatively high natural quality of the system, localized anthropogenic pressures are increasing along populated corridors and tourism-accessible reaches.

Dominant Pressures

- Urban wastewater discharges from settlements (Pressure Code: 1.1)
- Localised agricultural runoff (Pressure Code: 2.1)
- Riverbank modification and tourism-related disturbance (Pressure Code: 4.1.4)
- Gravel extraction and channel disturbance (Pressure Code: 3.3)

Pressure Mechanisms

Untreated wastewater and runoff from settlements enter tributaries and karst-connected drainage systems, particularly during storm events. Gravel extraction and local channel modifications alter sediment dynamics and destabilize shallow habitats.

Environmental Impacts

- Localised nutrient enrichment
- Increased turbidity during storm events
- Disturbance of shallow gravel habitats
- Reduced habitat heterogeneity in modified reaches
- Episodic bacteriological contamination

Risk Classification

Most upper Osum water bodies remain classified as “Possibly at Risk” due to increasing anthropogenic influence and insufficient monitoring coverage.

Devoll Sub-basin

The Devoll sub-basin is strongly influenced by hydropower infrastructure and associated flow regulation systems. Reservoir operation has substantially altered the natural hydrological regime inherited by downstream reaches.

Dominant Pressures

- Hydrological alteration and flow regulation (Pressure Code: 3.1 / 3.5)
- Hydropeaking effects (Pressure Code: 4.3.6)
- Sediment trapping within reservoirs (Pressure Code: 3.3)
- Longitudinal continuity interruption (Pressure Code: 3.4)

Pressure Mechanisms

Reservoirs attenuate flood peaks, alter seasonal discharge timing, and interrupt sediment continuity. Reduced sediment supply and modified hydraulic variability progressively simplify downstream geomorphological processes.

Environmental Impacts

- Reduced ecological flow variability
- Channel armouring and incision
- Sediment starvation downstream
- Simplification of riffle–pool structure
- Reduced spawning and migration cues for fish
- Decline of habitat diversity

Risk Classification

Water bodies influenced by the Devoll hydropower system are assessed as “At Risk” or “Possibly at Risk” due to significant hydro morphological alteration and sediment regime modification.

Gjanica Tributary

The Gjanica tributary constitutes one of the most environmentally stressed systems within the basin due to the combined legacy of oil extraction, refining, industrial activity, and contaminated floodplain deposits.

Dominant Pressures

- Industrial contamination and oil-related pressures (Pressure Code: 1.3 / 1.4)
- Contaminated floodplain seepage (Pressure Code: 4.1)
- Urban wastewater discharges (Pressure Code: 1.1)
- Stormwater mobilisation of hydrocarbons and sediments (Pressure Code: 2.3)

Pressure Mechanisms

Hydrocarbon-contaminated soils, sediments, and floodplain deposits are mobilised during rainfall and flood events, generating episodic pollution pulses characterized by: elevated suspended solids, dissolved hydrocarbons, oxygen-demanding substances, and contaminated fine sediments. Simultaneously, contaminated groundwater and floodplain seepage maintain a chronic background organic load.

Environmental Impacts

- Recurrent oxygen depletion
- Reduced water clarity
- Chronic ecological stress
- Hydrocarbon contamination
- Degraded macroinvertebrate assemblages
- Reduced fish recruitment
- Dominance of pollution-tolerant taxa

Risk Classification

The Gjanica corridor is classified as “at Risk” due to the persistence of industrial contamination, hydrocarbon mobilisation, and cumulative ecological degradation.

Myzeqe plain

The Myzeqe plain is an important agricultural hotspot within the Seman Basin. Highly intensive irrigated agriculture, greenhouse cultivation, and extensive drainage infrastructure generate strong nutrient and pesticide transport pathways toward rivers, canals, and shallow groundwater systems.

Dominant Pressures

- Diffuse agricultural nutrient pollution (Pressure Code: 2.1)
- Pesticide and plant protection product runoff (Pressure Code: 2.5)
- Irrigation return flows (Pressure Code: 1.9)
- Canalized sediment transport (Pressure Code: 4.1)

- Organic agricultural waste accumulation (Pressure Code: 2.10)

Pressure Mechanisms

Frequent fertigation and irrigation practices generate: nitrate leaching to groundwater, phosphorus mobilisation through fine sediments, pesticide runoff, and rapid contaminant transfer through dense canal systems. Shallow groundwater later reintroduces nutrients and mobile contaminants to rivers through summer baseflow discharge.

Environmental Impacts

- Persistent eutrophication pressure
- Excessive macrophyte and periphyton growth
- Diel oxygen fluctuations
- Sediment deposition and habitat smothering
- Chronic nutrient enrichment
- Elevated chemical-status risk
- Fine-sediment accumulation in canals and low-energy reaches

Risk Classification

Due to the spatial extent and persistence of diffuse pollution, lowland agricultural water bodies are classified as “At Risk” of failing to achieve good ecological status.

Middle and Lower Seman basin

The middle and lower Seman are heavily affected by morphological alteration associated with:

- gravel extraction;
- flood protection infrastructure;
- bank armoring;
- and channel confinement.

Dominant Pressures

- Morphological alteration and sediment disruption (Pressure Code: 3.3)
- Floodplain disconnection (Pressure Code: 4.1)
- Channel narrowing and stabilization (Pressure Code: 4.1)
- Longitudinal continuity alteration (Pressure Code: 3.4)

Pressure Mechanisms

In-channel aggregate extraction lowers riverbed elevations and promotes incision, while hard engineering structures reduce lateral channel mobility and disconnect floodplains and side channels.

Environmental Impacts

- Loss of shallow vegetated margins
- Simplification of channel morphology
- Reduced spawning habitat availability
- Increased hydraulic uniformity
- Floodplain habitat loss
- Reduced natural nutrient attenuation capacity
- Increased downstream sediment transfer instability

Risk Classification

Water bodies within the middle and lower Seman corridor are assessed as “At Risk” due to cumulative hydro morphological degradation and habitat simplification.

Urban Lowland Settlements and Drainage Networks

The lowland urban and semi-urban corridor between Berat, Kuçovë, Fier, and Divjakë is strongly affected by insufficient wastewater collection and drainage management.

Dominant Pressures

- Urban wastewater discharges (Pressure Code: 1.1)

- Stormwater runoff and first-flush pollution (Pressure Code: 2.3)
- Solid waste and litter accumulation (Pressure Code: 2.10)

Pressure Mechanisms

Combined sewer overflows, roadside drainage systems, and uncontrolled discharges transport: nutrients, pathogens, suspended solids, hydrocarbons, and urban litter into canals and rivers during rainfall events.

Environmental Impacts

- Oxygen depletion
- Bacteriological contamination
- Canal eutrophication
- Accumulation of plastics and organic debris
- Turbidity and odour problems
- Reduced ecological quality in low-energy reaches

Risk Classification

Urban lowland drainage systems and associated receiving water bodies are classified as “At Risk” due to chronic nutrient and organic pollution pressures.

Divjakë–Karavasta Transitional and Coastal Waters

The Divjakë–Karavasta system represents the terminal receiving environment for cumulative basin-wide pressures.

Dominant Pressures

- Nutrient and sediment loading from upstream catchments
- Reduced sediment delivery due to regulation and extraction (Pressure Code: 3.3)
- Diffuse agricultural pollution (Pressure Code: 2.1 / 2.5)
- Salinity intrusion and coastal instability (Pressure Code: 2.10)

Pressure Mechanisms

Riverine transport processes convey nutrients, sediments, pesticides, hydrocarbons, and suspended solids toward lagoons and coastal wetlands. Reduced coarse-sediment supply weakens geomorphological resilience of coastal barriers and distributary systems.

Environmental Impacts

- Eutrophication and algal proliferation
- Episodic hypoxia
- Fine-sediment accumulation
- Habitat degradation in lagoons and marshes
- Increased coastal erosion sensitivity
- Salinity intrusion into wetlands and distributaries
- Accumulation of contaminants within transitional sediments

Risk Classification

Transitional and coastal waters are currently assessed as “Possibly at Risk” or “Unknown”, although pressure analysis indicates vulnerability to cumulative upstream impacts.

9.4.8 Status Assessment at Surface Water body Level

Ecological status

Ecological status under the Water Framework Directive (WFD) reflects the overall health of aquatic ecosystems based on biological quality elements, hydro morphological conditions, and supporting physico-chemical parameters. There is currently insufficient ecological monitoring data available to determine the ecological status of water bodies in the Seman River Basin.

This situation reflects significant monitoring and data availability limitations across the basin, particularly regarding biological quality elements such as benthic macroinvertebrates, fish communities,

phytobenthic, and aquatic flora, which are essential for a compliant ecological status assessment under the WFD framework. In many cases, available monitoring programmes remain focused primarily on physic-chemical parameters, while biological monitoring coverage remains spatially limited and temporally inconsistent.

The lack of sufficient ecological data creates substantial uncertainty in evaluating the true condition of aquatic ecosystems and limits the ability to accurately identify water bodies at risk of failing environmental objectives. This data gap is particularly important in the Seman Basin, where multiple pressures are already known to affect river systems, including hydro morphological alteration, urban wastewater discharges, agricultural runoff, sediment transport, and hydropower regulation.

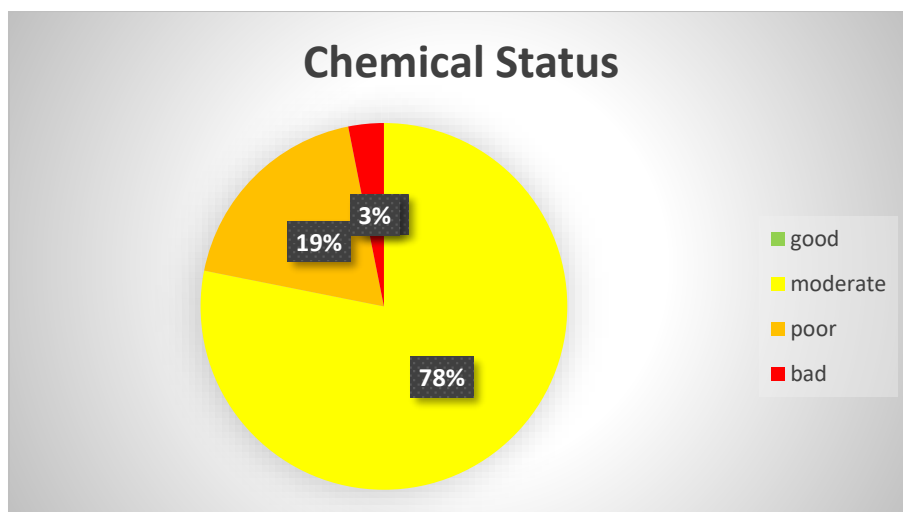


Figure xx – Overall Ecological Status classification of surface water bodies in the Seman River Basin

Chemical status

The chart below presents the chemical status classification of surface water bodies in the Seman River Basin, based on the standard Water Framework Directive (WFD) assessment categories. It provides a basin-wide snapshot of chemical water quality conditions, reflecting the cumulative influence of urban wastewater discharges, agricultural runoff, industrial pressures, and legacy pollution sources.

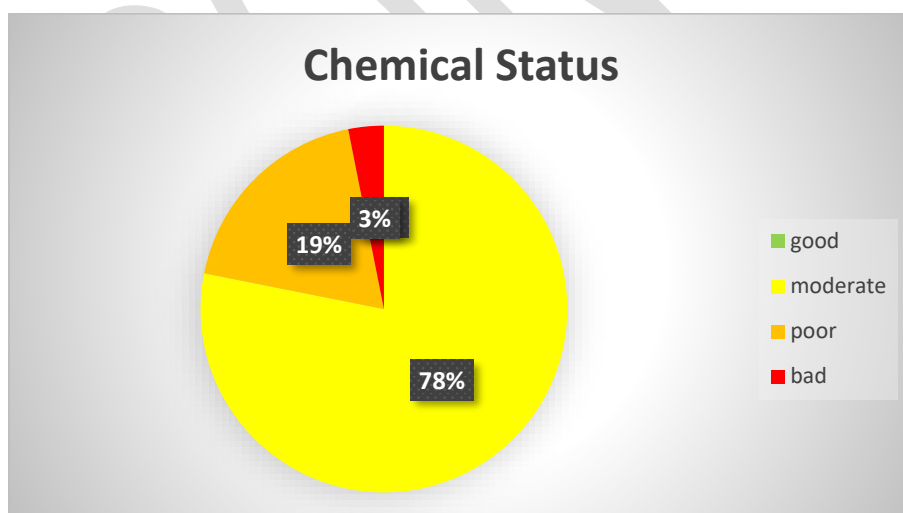


Figure xx – Overall Chemical Status classification of surface water bodies in the Seman River Basin

The results indicate a dominant deviation from good chemical status across the basin. The largest proportion of water bodies (78%) are classified as moderate, suggesting widespread presence of pollutants that exceed natural background levels but are not yet at severely degraded conditions. This class typically reflects diffuse nutrient enrichment, intermittent wastewater inputs, and moderate concentrations of priority substances.

A significant share (19%) is classified as poor, indicating more pronounced chemical degradation. These water bodies are likely affected by persistent point-source discharges, inadequate wastewater treatment coverage, and localized industrial or mining impacts, leading to exceedances of environmental quality standards for key pollutants.

A smaller but critical fraction (3%) is in bad chemical status, representing severely impacted reaches where pollutant concentrations are consistently high and ecological functioning is strongly compromised. These areas typically correspond to hotspots of untreated wastewater discharge or heavily impacted downstream sections with cumulative pressure effects.

Notably, no water bodies are classified as “good”, highlighting a basin-wide failure to achieve WFD chemical objectives. This pattern indicates that chemical pollution is not isolated but rather systemic and spatially widespread, requiring coordinated basin-level interventions rather than site-specific measures alone.

Hydro morphological status

The chart below presents the distribution of the morphological status of surface water bodies within the Seman River Basin. Morphological status reflects the degree to which river systems maintain their natural physical characteristics, including river continuity, channel structure, flow dynamics, riverbank condition, and floodplain connectivity. The assessment provides an important indication of the extent of hydro morphological alteration caused by pressures such as hydropower development, river regulation, gravel extraction, bank modification, and infrastructure construction.

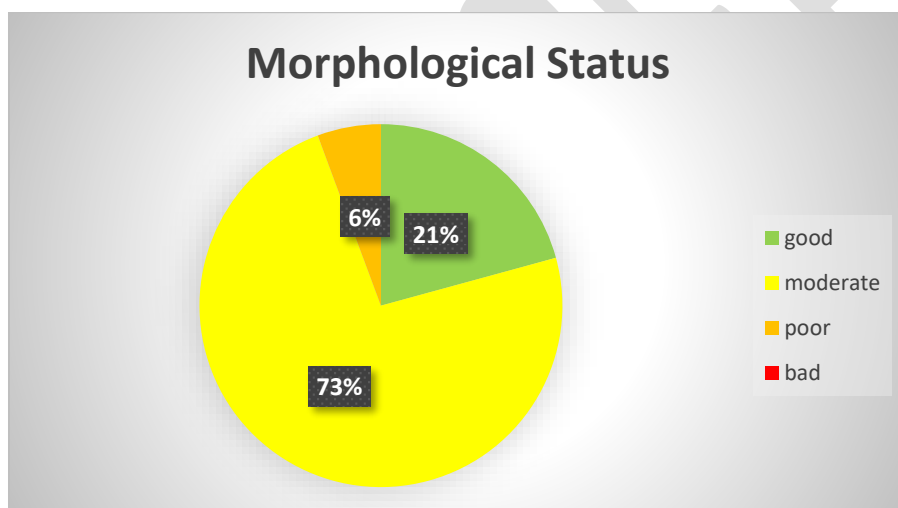


Figure xx - Distribution of the morphological status of surface water bodies within the Seman River Basin

The results indicate that the majority of water bodies in the Seman Basin are affected by varying degrees of hydro morphological alteration. Only 21% of assessed water bodies are classified as having Good morphological status, suggesting that relatively few river stretches retain near-natural physical conditions and ecological functionality.

The dominant category is Moderate status, accounting for 73% of water bodies. This indicates widespread physical modification across the basin, where river morphology has been altered but not yet severely degraded. Moderate conditions are typically associated with pressures such as flow regulation from hydropower infrastructure, local channel modifications, sediment disruption, riverbank reinforcement, and agricultural encroachment within floodplain areas. The high proportion of moderately altered water bodies demonstrates that hydro morphological pressures are extensive and cumulative throughout the basin.

A further 6% of water bodies are classified as Bad status, representing heavily modified river sections where substantial alterations to channel structure, hydrological continuity, and sediment transport

processes have significantly impaired natural river functions. These areas are likely associated with intensive regulation, major infrastructure works, severe channelization, or persistent extraction activities. Overall, the assessment highlights that hydro morphological pressures remain one of the key environmental challenges in the Seman River Basin. The predominance of Moderate status suggests that many water bodies remain potentially recoverable through targeted restoration measures, improved ecological flow management, river corridor protection, and stricter control of physical modifications.

The chart below presents the **overall status classification of water bodies** within the Seman River Basin, differentiated by Natural Water Bodies (NWB), Artificial Water Bodies (AWB), and Heavily Modified Water Bodies (HMWB). The overall status assessment combines ecological and chemical status elements in accordance with the Water Framework Directive (WFD) methodology and provides an integrated indication of the environmental condition of river systems across the basin.

The classification illustrates the extent to which water bodies achieve environmental objectives and reflects the cumulative effects of hydro morphological pressures, pollution, flow alteration, wastewater discharges, agricultural runoff, and other anthropogenic impacts.

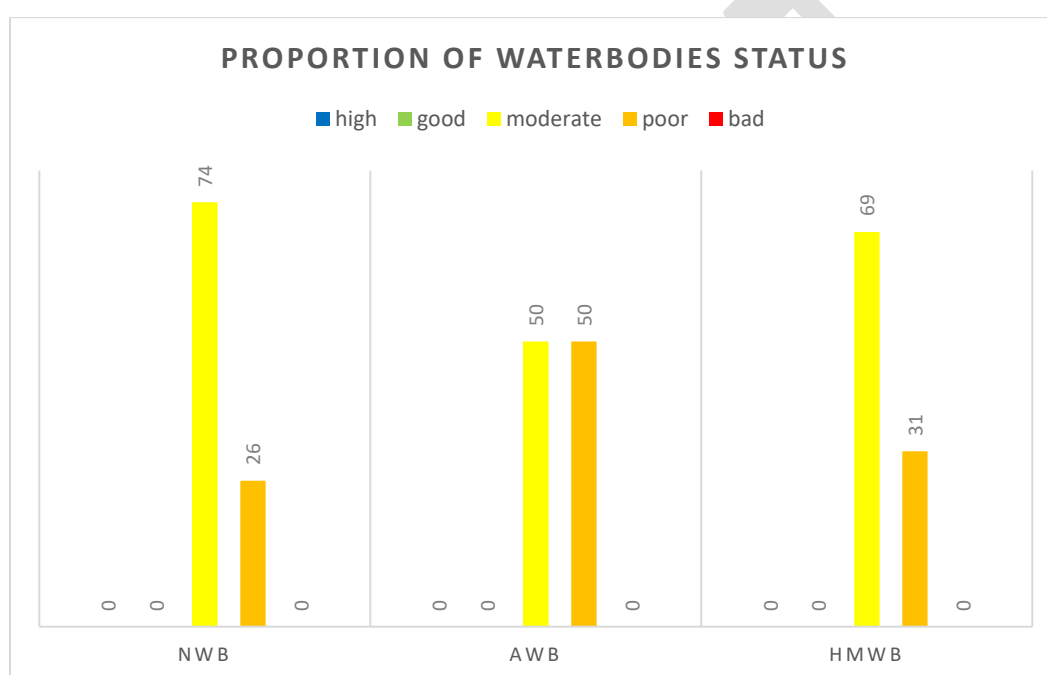


Figure xx - Proportion of water body status within the Seman River Basin

The assessment shows that none of the assessed water bodies within the Seman Basin achieve High or Good overall status, indicating widespread environmental pressures throughout the basin.

- Among Natural Water Bodies (NWB), 74% are classified as Moderate status, while the remaining 26% fall under Poor status. The absence of “Good” status water bodies suggests that even relatively natural river systems are affected by significant pressures that impair ecological functioning and water quality. Moderate status indicates substantial but potentially reversible alterations, whereas Poor status reflects more severe degradation and ecosystem disturbance.
- Artificial Water Bodies (AWB) show a more critical condition, with 50% classified as Moderate and 50% as Poor status. These systems are typically highly influenced by human activities and engineered modifications, including drainage canals, irrigation infrastructure, and regulated hydraulic systems. The equal distribution between Moderate and Poor status demonstrates the significant environmental challenges associated with maintaining ecological functionality in artificial systems.
- Heavily Modified Water Bodies (HMWB) also display considerable environmental degradation, with 69% classified as Moderate and 31% as Poor status. These water bodies are strongly affected by hydropower infrastructure, flow regulation, channel modification, and other physical

alterations necessary for economic or societal uses. Although HMWBs are assessed against ecological potential rather than natural ecological status, the results indicate that hydro morphological pressures remain substantial and continue to limit ecological performance.

Overall, the status assessment confirms that the Seman River Basin is under significant cumulative pressure from multiple anthropogenic activities. The complete absence of High and Good status water bodies highlights the need for strengthened River Basin Management measures, including improved wastewater treatment, reduction of diffuse agricultural pollution, restoration of river morphology and continuity, implementation of ecological flows, and expansion of ecological monitoring programmes.

The predominance of Moderate status suggests that many water bodies remain recoverable if targeted mitigation and restoration measures are implemented effectively. The screening assessment identifies water bodies at risk of failing WFD environmental objectives based on pressure analysis, available monitoring data, hydro morphological assessment, and expert judgement.

9.4.9 Surface Water bodies classified as At Risk

The table below shows the surface water bodies identified as “At Risk” under the WFD Annex II pressure–impact screening. These systems represent priority water bodies for Programme of Measures (PoM) development, operational monitoring design, and further investigative assessment, particularly where confidence levels are low (1–2), indicating limited supporting evidence or data gaps.

Table xx – Surface Water bodies classified as At Risk – Seman River Basin

IDENTIFICATION			RISK ASSESSMENT	
WB name	WB Code	Form	Risk Level	Confidence Level
Kasharaj reservoir	LW3520306	AWB	At Risk	2
Kurjani reservoir	LW3520307	AWB	At Risk	1
Banja lake	LW35205301	AWB	At Risk	2
Moglica lake	LW35207801	AWB	At Risk	2
Devoll	352053	HMWB	At Risk	1
Osum	352041	NWB	At Risk	1
Osum	352043	NWB	At Risk	2
Osum	352047	NWB	At Risk	2
Osum	3520451	NWB	At Risk	2
Osum	3520453	NWB	At Risk	2
Osum	3520455	NWB	At Risk	2
Osum	3520457	NWB	At Risk	2
Osum	3520491	NWB	At Risk	2
Osum	3520493	NWB	At Risk	1
Osum	3520496	NWB	At Risk	2
Gjanica	35202-1	NWB	At Risk	2
Gjanica	35202-2	HMWB	At Risk	2
Seman	35201	HMWB	At Risk	1
Seman	35203	HMWB	At Risk	1

The Osum River system dominates the risk profile, with multiple river stretches classified separately, indicating longitudinal cumulative pressures rather than isolated impacts. While the Seman mainstem (HMWB) is consistently classified as At Risk with low confidence (1), reflecting:

- aggregated upstream impacts;
- limited monitoring density, and
- uncertainty in pressure attribution.

Key regulated or modified systems include:

- Devoll River (HMWB) – influenced by hydropower cascade operations and flow regulation.
- Seman River (HMWB segments) – downstream integration of hydropower, agriculture, and urban wastewater pressures.
- Gjanica (HMWB section) – strongly impacted by industrial/urban discharges and morphological alteration.

These systems indicate structural modification and flow regulation as dominant pressure types, rather than purely chemical stressors.

Reservoir and lake systems include:

- Banja Lake and Moglicë Lake (Devoll hydropower system);
- Kasharaj and Kurjani reservoirs.

These show consistent “At Risk” classification with moderate confidence (1–2), typically linked to:

- hydrological alteration (regulated inflows/outflows);
- sediment trapping and morphological simplification;
- potential eutrophication risk under stagnant conditions.

9.4.10 Surface Water Bodies Classified as Possibly at Risk

The “Possibly at Risk” classification in the Seman River Basin reflects water bodies where available evidence indicates the potential failure to achieve environmental objectives, but where monitoring data, pressure quantification, or impact verification remain insufficient to support a definitive “At Risk” classification. The predominance of confidence levels 1 and 2 demonstrates significant uncertainty related to monitoring density, ecological assessment coverage, hydro morphological data availability, and pressure attribution.

The assessment shows that the “Possibly at Risk” category includes a broad range of water body types (see Table below):

- natural rivers (NWB),
- heavily modified water bodies (HMWB),
- artificial water bodies (AWB),
- lakes and reservoirs,
- lagoons and transitional waters,
- and coastal water bodies.

Table xx – Surface Water bodies classified as Possibly at Risk – Seman River Basin

IDENTIFICATION			RISK ASSESSMENT	
WB name	WB Code	Form	Risk Level	Confidence Level
Vahut i Shkozës lake	LW3520301	NWB	Possibly at Risk	2
Merhoja lake	LW3520302	NWB	Possibly at Risk	1
Cestijë lake	LW3520303	AWB	Possibly at Risk	1
Thana reservoir	LW3520304	AWB	Possibly at risk	2
Pajallia reservoir	LW3520305	AWB	Possibly at Risk	1
Gjanci reservoir	LW352049601	AWB	Possibly at Risk	1
Karavasta Lagoon	TW351701	NWB	Possibly at Risk	1
West-Karavasta Lagoon	TW351702	NWB	Possibly at Risk	1
CW River delta	CW352001	NWB	Possibly at Risk	1
Beçi	3520766	NWB	Possibly at Risk	2
Çemërica	3520764	NWB	Possibly at Risk	2
Devoll	352051	HMWB	Possibly at Risk	1
Devoll	352055	HMWB	Possibly at Risk	1
Devoll	352071	HMWB	Possibly at Risk	1
Devoll	352073	HMWB	Possibly at Risk	2
Devoll	352075	HMWB	Possibly at Risk	2
Devoll	352077	NWB	Possibly at Risk	1
Devoll	3520791	HMWB	Possibly at Risk	2
Devoll	3520793	HMWB	Possibly at Risk	1
Devoll	35209-1	NWB	Possibly at Risk	2
Devoll	35209-2	HMWB	Possibly at Risk	1
Dunaveci	35208	HMWB	Possibly at Risk	2
Grabova	352074	NWB	Possibly at Risk	1
Hilli	3520543	NWB	Possibly at Risk	1
Novosela	3520792	NWB	Possibly at Risk	1
Osoja	3520762	NWB	Possibly at Risk	1
Pashtrash	3520542	NWB	Possibly at Risk	2
Selca	352078	NWB	Possibly at Risk	2
Tomorrica	35206	NWB	Possibly at Risk	1
Vërça	352072	NWB	Possibly at Risk	2
Zalli Gostimës	352052	NWB	Possibly at Risk	1
Çorovoda	352048	NWB	Possibly at Risk	2
Lapardha	352042	NWB	Possibly at Risk	1
Staravecka	3520492	NWB	Possibly at Risk	2

Velabisht	352044	NWB	Possibly at Risk	1
Vërtopi	3520456	NWB	Possibly at Risk	1
Vodica	3520454	NWB	Possibly at Risk	1
Vodica e sipërme	3520494	NWB	Possibly at Risk	1
Vokopola	352046	NWB	Possibly at Risk	1
Zagora	3520452	NWB	Possibly at Risk	1

A significant concentration of “Possibly at Risk” classifications occurs within the Devoll River system, where numerous river stretches are designated as HMWB due to hydropower development, flow regulation, abstraction pressures, and channel modifications. These classifications indicate uncertainty regarding the extent to which hydro morphological alterations, altered flow regimes, sediment retention, and cumulative upstream pressures are affecting ecological conditions. The repeated occurrence of low confidence levels within the Devoll system highlights the need for improved hydrological, biological, and hydro morphological monitoring.

Several tributaries and smaller river systems, including Beçi, Çemerica, Selca, Vërça, Çorovoda, Staravecka, and Lapardha, are also classified as “Possibly at Risk.” In these systems, the uncertainty is primarily associated with:

- insufficient biological monitoring;
- limited chemical datasets;
- diffuse agricultural pressures;
- local wastewater discharges;
- erosion and sediment transport;
- and hydro morphological alterations from gravel extraction and channel interventions.

The classification of reservoirs and artificial lakes such as Thana, Pajallia, Gjanci, and Cestijë reflects uncertainty regarding eutrophication risks, seasonal water quality variation, nutrient accumulation, and operational water-level fluctuations. These systems are particularly sensitive to agricultural runoff and sediment inflow from upstream catchments.

Transitional and coastal systems, including Karavasta Lagoon, West-Karavasta Lagoon, the river delta coastal water body, and associated wetlands, are also classified as “Possibly at Risk,” reflecting concerns related to:

- nutrient enrichment;
- reduced freshwater inflows;
- salinity alterations;
- sediment dynamics;
- coastal ecosystem degradation;
- and insufficient ecological monitoring data.

The widespread occurrence of confidence level 1 indicates that many assessments rely primarily on expert judgement, pressure screening, and limited monitoring evidence rather than robust ecological datasets. Confidence level 2 classifications suggest moderate supporting evidence but still indicate important data gaps and uncertainty.

Overall, the “Possibly at Risk” classification highlights the need for:

- expanded biological and chemical monitoring programmes;
- improved hydromorphological assessment;
- enhanced pressure-impact analysis;
- better ecological status classification methodologies;
- and strengthened surveillance in hydropower-affected, agricultural, and transitional water systems.

These water bodies should be prioritised for further investigation and operational monitoring in future River Basin Management Plan implementation cycles to reduce uncertainty and support more reliable WFD risk classification.

9.4.11 Surface Water Bodies Classified as Unknown Status

The “Unknown Risk” classification applies to water bodies for which the available information is insufficient to determine whether they are achieving, or are likely to fail achieving, the environmental objectives established under the Water Framework Directive (WFD). In the Seman River Basin, this category is primarily associated with transitional, coastal, and lagoon systems where monitoring coverage, ecological datasets, and pressure-impact relationships remain particularly limited.

Table xx – Surface Water bodies classified as Unknown Status – Seman River Basin

IDENTIFICATION			RISK ASSESSMENT	
WB name	WB Code	Form	Risk Level	Confidence Level
South- Karavasta Lagoon	TW351703	NWB	Unknown	1
Seman river	TW3520101	NWB	Unknown	1
Petriti lake	TW352101	NWB	Unknown	1
CW Karavasta	CW351901	NWB	Unknown	1
CW Lower Seman	CW352101	NWB	Unknown	1

The water bodies classified as “Unknown” include (see Table above):

- South Karavasta Lagoon;
- Seman transitional water body;
- Petriti Lake;
- Karavasta coastal waters;
- and the Lower Seman coastal water body.

These systems are environmentally complex and highly dynamic, influenced simultaneously by:

- river inflows;
- marine interactions;
- salinity gradients;
- sediment transport;
- seasonal hydrological variability;
- and coastal ecosystem processes.

The assignment of confidence level 1 to all “Unknown” classifications indicates very limited supporting evidence and a high degree of uncertainty. In most cases, the classification reflects:

- insufficient ecological monitoring data;
- incomplete biological quality element assessment;
- limited chemical monitoring;
- lack of long-term hydrological and salinity datasets;
- and inadequate understanding of cumulative pressures.

For the Karavasta lagoon and coastal systems, uncertainty is further amplified by the interaction between freshwater inflows from the Seman River and marine processes in the Adriatic coastal zone. Potential pressures likely include:

- nutrient enrichment from agricultural runoff;
- urban wastewater discharges;
- hydro morphological alteration;
- sediment deposition;
- fisheries and aquaculture activities;
- and climate-related coastal changes.

However, due to the absence of sufficiently robust monitoring and assessment data, these pressures could not be conclusively linked to ecological status deterioration during the assessment process.

The classification of the Seman transitional and Lower Seman coastal water bodies as “Unknown” also reflects the current limitations in transitional and coastal monitoring methodologies, including:

- low sampling frequency;
- limited spatial coverage;
- insufficient biological indicators;
- and weak integration between river basin and marine monitoring programmes.

Petriti Lake similarly remains insufficiently characterised, with limited ecological and chemical assessment information available to support reliable risk determination.

Overall, the “Unknown Risk” category highlights critical monitoring and knowledge gaps within the Seman Basin, particularly in transitional and coastal environments. These water bodies should be considered priority areas for:

- expanded surveillance and operational monitoring;
- integrated coastal and river basin assessment;
- improved ecological status methodologies;
- hydrological and salinity regime analysis;
- and enhanced data collection on nutrient dynamics and biodiversity indicators.

Reducing uncertainty in these systems is essential for achieving reliable WFD classification and for supporting the long-term protection of ecologically sensitive lagoon and coastal ecosystems in the Seman River Basin.

9.5 Summary status assessment of Surface Waterbodies

Under prevailing conditions, the Seman River Basin faces widespread moderate to high ecological risks, with a considerable proportion of water bodies unlikely to attain Good Ecological Status (GES) within the current RBMP planning cycle. For several heavily modified and hydrologically regulated systems, management efforts will realistically focus on achieving Good Ecological Potential (GEP) instead of restoring them to completely natural states.

The basin constitutes a highly interconnected multi-pressure environment where hydrological regulation, diffuse agricultural intensification, industrial and oil-related contamination, urban wastewater discharges, sediment disruption, and hydro morphological degradation collectively exert cumulative impacts across the river basin.

Key ecological responses observed throughout the basin include:

- diminished habitat heterogeneity and structural complexity;
- persistent nutrient enrichment and ongoing eutrophication;
- elevated turbidity and increased transport of suspended sediment;
- episodes of oxygen stress during low-flow and post-storm periods;
- sediment accumulation in spawning and benthic habitats;
- impaired floodplain functionality and reduced lateral connectivity;
- and biological communities increasingly dominated by pollution-tolerant taxa.

These compounding pressures have progressively undermined ecological resilience, particularly within regulated river corridors, lowland agricultural areas, and transitional waters.

Absent integrated, basin-wide interventions, many river, transitional, and coastal water bodies are expected to fall short of WFD environmental targets. Achieving GES and GEP will necessitate a coordinated Programme of Measures directed toward:

- enhancement and expansion of wastewater collection and treatment facilities;
- improvement of collecting, handling and processing solid waste disposal;
- reduction of diffuse agricultural nutrient and pesticide inputs;
- remediation and stabilization of contaminated industrial and oil-affected locations;
- reconnection of floodplains and restoration of hydro morphological processes;
- restoration of sediment continuity and environmental flow regimes;
- tighter control of gravel extraction and channel modification;
- and reinforcement of ecological, chemical, hydrological, and groundwater monitoring throughout the basin.

Table xx - Risk, Pressures and Status Assessment of Surface Water Bodies (Categories: Rivers, Lakes, Reservoirs, Transitional) within the Seman River Basin

IDENTIFICATION			PRESSURE ANALYSIS ¹⁰²								STATUS AND OVERALL STATUS or POTENTIAL						RISK ASSESSMENT	
WATERBODY NAME	WATER BODY EU CODE	FORM	POINT PRESSURE 1	POINT PRESSURE 2	DIFUSE PRESSURE 1	DIFUSE PRESSURE 2	ABSTRACTI ON PRESSURE 1	ABSTRACTI ON PRESSURE 2	MORPHOLO GY PRESSURE	HYDRO MORPH PRESSURE	BOES EQ ¹⁰³	P-CHEM ¹⁰⁴	H-MORPH ¹⁰⁵	ANNEX X PSS ¹⁰⁶	ANNEX VIII Rbsp Heavy Metals	OVERALL STATUS	RISK LEVEL ¹⁰⁷	CL ¹⁰⁸
Vahuti Shkozës lake	LW35203 01	NWB	1.3;1.4	1.5;1.6								3	3		5	3	Possibly at Risk	2
Merhoja lake	LW35203 02	NWB										3	3		5	3	Possibly at Risk	1
Cestijë lake	LW35203 03	AWB										3	3		5	3	Possibly at Risk	1
Thana reservoir	LW35203 04	AWB						3.5	4.1.2; 4.1.3; 4.2.2	4.3.3	1	3	3		5	3	Possibly at risk	2
Pajallia reservoir	LW35203 05	AWB										3	3		5	3	Possibly at Risk	1
Kasharaj reservoir	LW35203 06	AWB	1.3;1.4	1.7	2.2;2.3				4.1.3;4.2.2	4.4;4.5		3	3		5	4	At Risk	2
Kurjani reservoir	LW35203 07	AWB	1.3;1.4	1.7	2.2;2.3							3	3		5	4	At Risk	1
Gjanci reservoir	LW35204 9601	AWB										3	2		5	3	Possibly at Risk	1
Banja lake	LW35205 301	AWB		1.7				3.5	4.1.3;4.2.2	4.4;4.5	1	3	3		5	4	At Risk	2
Moglica lake	LW35207 801	AWB	1.3;1.4	1.7				3.5	4.1.3;4.2.2	4.4;4.5		3	3		5	4	At Risk	2
Karavasta Lagoon	TW3517 01	NWB	1.1;1.2; 1.3;1.4			2.5;2.6						3			5	3	Possibly at Risk	1
West-Karavast	TW3517 02	NWB	1.3;1.4		2.2;2.3							3			5	3	Possibly at Risk	1

¹⁰² Pressure Types align with WISE GIS Reporting Guidance 2016 – Annex 1a

¹⁰³ Comment on BQE method

¹⁰⁴ Comment on P-CHEM data – P-CHEM status assessment based principally on spot sampling of July 2019, utilising BOD₅ and/or NH₄ values as indicator values.

¹⁰⁵ Comment on H-MORPH methodology – MORPHOLOGY indicates significant obstruction of watercourses or changes in river morphology due to physical or mining alterations; HYDROMORPH indicates significant change in flow regime due to municipal, irrigation or hydropower abstractions;

¹⁰⁶ Priority Substances if monitored

¹⁰⁷ Enumeration List for Risk = Not at Risk; At Risk; Possibly at Risk; Unknown;

¹⁰⁸ Enumeration List for Confidence Level = '0' = no information; '1' = low confidence; '2' = medium confidence; '3' = high confidence. Low = no monitoring data, expert judgement only; Medium = some supporting quality element (QE) data and limited data on one BQE; High = good data on 1+ BQE and supporting most relevant QEs.

a Lagoon																		
South-Karavast a Lagoon	TW3517 03	NWB									3				5	3	Unknown	1
Seman river	TW3520 101	NWB									3				5	3	Unknown	1
Petriti lake	TW3521 01	NWB									3				5	3	Unknown	1
CW Karavast a	CW3519 01	NWB									3				5	3	Unknown	1
CW River delta	CW3520 01	NWB							4.4;4.5		3				5	3	Possibly at Risk	1
CW Lower Seman	CW3521 01	NWB									3				5	3	Unknown	1
Beçi	3520766	NWB					3.5	4.1.3;4.2. 2	4.3.3		3	2			5	3	Possibly at Risk	2
Çemic a	3520764	NWB					3.5	4.1.3;4.2. 2	4.3.3		3	3			5	3	Possibly at Risk	2
Devoll	352051	HMWB									3	3			5	3	Possibly at Risk	1
Devoll	352053	HMWB		1.7; 1.8;1.9				4.2.3;4.2. 5			3	4			5	4	At Risk	1
Devoll	352055	HMWB									3	2			5	3	Possibly at Risk	1
Devoll	352071	HMWB		1.7							3	3			5	3	Possibly at Risk	1
Devoll	352073	HMWB	1.3;1.4	1.5;1.6; 1.7	2.2;2.3						3	1			5	3	Possibly at Risk	2
Devoll	352075	HMWB	1.3;1.4	1.5;1.6							3	4			5	3	Possibly at Risk	2
Devoll	352077	NWB									3	3			5	3	Possibly at Risk	1
Devoll	3520791	HMWB					3.5	4.1.3;4.2. 2	4.3.3		3	2			5	3	Possibly at Risk	2
Devoll	3520793	HMWB									3	2			5	3	Possibly at Risk	1
Devoll	35209-1	NWB					3.5	4.1.3;4.2. 2	4.3.3		3	3			5	3	Possibly at Risk	2
Devoll	35209-2	HMWB	1.3;1.4								3	3			5	3	Possibly at Risk	1
Dunavec i	35208	HMWB	1.1;1.2 ; 1.3;1.4	1.7	2.2;2.3						3	2			5	3	Possibly at Risk	2
Grabova	352074	NWB					3.5	4.1.3;4.2. 2	4.3.3		3	1			5	3	Possibly at Risk	1
Hillli	3520543	NWB					3.5	4.1.3;4.2. 2	4.3.3		3	3			5	3	Possibly at Risk	1
Novosel a	3520792	NWB	1.3;1.4								3	1			5	3	Possibly at Risk	1

Osoja	3520762	NWB	1.1;1.2		2.2;2.3						3	3		5	3	Possibly at Risk	1
Pashtres hi	3520542	NWB					3.5	4.1.3;4.2.2	4.3.3		3	2		5	3	Possibly at Risk	2
Selca	352078	NWB					3.5	4.1.3;4.2.2	4.3.3		3	3		5	3	Possibly at Risk	2
Tomorrica	35206	NWB		1.7							3	4		5	3	Possibly at Risk	1
Vërça	352072	NWB					3.5	4.1.3;4.2.2	4.3.3		3	3		5	3	Possibly at Risk	2
Zalli Gostimës	352052	NWB									3	2		5	3	Possibly at Risk	1
Çorovoda	352048	NWB					3.5	4.1.3;4.2.2	4.3.3		3	3		5	3	Possibly at Risk	2
Lapardha	352042	NWB									3	3		5	3	Possibly at Risk	1
Osum	352041	NWB							4.4;4.5		4	3		5	4	At Risk	1
Osum	352043	NWB					3.5	4.1.3;4.2.2	4.3.3		4	3		5	4	At Risk	2
Osum	352047	NWB					3.5	4.1.3;4.2.2	4.3.3		4	2		5	4	At Risk	2
Osum	3520451	NWB					3.5	4.1.3;4.2.2	4.3.3		4	3		5	4	At Risk	2
Osum	3520453	NWB	1.3;1.4	1.5;1.6							4	3		5	4	At Risk	2
Osum	3520455	NWB	1.3;1.4	1.5;1.6							4	3		5	4	At Risk	2
Osum	3520457	NWB	1.3;1.4								4	3		5	4	At Risk	2
Osum	3520491	NWB	1.1;1.2	1.5;1.6	2.2;2.3						4	3		5	4	At Risk	2
Osum	3520493	NWB							4.4;4.5		4	3		5	4	At Risk	1
Osum	3520496	NWB	1.1;1.2;1.3;1.4								4	3		5	4	At Risk	2
Staravëcka	3520492	NWB					3.5	4.1.3;4.2.2	4.3.3		3	3		5	3	Possibly at Risk	2
Velabishit	352044	NWB			2.2;2.3						3	3		5	3	Possibly at Risk	1
Vërtopi	3520456	NWB					3.5	4.1.3;4.2.2	4.3.3		3	2		5	3	Possibly at Risk	1
Vodica	3520454	NWB							4.4;4.5		3	3		5	3	Possibly at Risk	1
Vodica e sipërme	3520494	NWB					3.5	4.1.3;4.2.2	4.3.3		3	3		5	3	Possibly at Risk	1
Vokopola	352046	NWB									3	3		5	3	Possibly at Risk	1
Zagora	3520452	NWB									3	2		5	3	Possibly at Risk	1
Gjanica	35202-1	NWB	1.1;1.2;1.3;1.4	1.5;1.6	2.2;2.3						5	3		5	4	At Risk	2
Gjanica	35202-2	HMWB	1.1;1.2;1.3;1.4		2.2;2.3						5	3		5	4	At Risk	2
Seman	35201	HMWB									4	3		5	4	At Risk	1
Seman	35203	HMWB									4	3		5	4	At Risk	1

9.6 Groundwater body Pressures and Status Assessment

9.6.1 General overview

This paragraph presents the pressure and impact analysis for groundwater bodies and associated springs within the Seman River Basin. The assessment considers the hydrogeological characteristics of the basin's principal aquifer systems, including intergranular alluvial aquifers and compact, fractured, and karstic groundwater bodies, as well as the functional role of springs as major groundwater discharge zones and sensitive receptors of both quantitative and qualitative pressures.

The analysis is undertaken in accordance with the requirements of the EU Water Framework Directive (WFD 2000/60/EC), particularly Annex II and Article 5, and applies a pressure-based screening methodology to identify groundwater bodies potentially at risk of failing to achieve environmental objectives.

The assessment integrates:

- hydrogeological characteristics and aquifer vulnerability;
- groundwater abstraction pressures;
- diffuse agricultural pollution pathways;
- urban and industrial contamination sources;
- groundwater–surface water interactions;
- saline intrusion susceptibility in coastal systems;
- and the ecological significance of major spring systems.

Given the current limitations in groundwater monitoring coverage, chemical surveillance, abstraction control, and long-term quantitative datasets, the assessment relies substantially on pressure-pathway analysis, conceptual hydrogeological interpretation, existing institutional datasets, and expert judgement consistent with WFD risk assessment principles. Particular attention is given to:

- the highly permeable alluvial aquifers of the Myzeqe plain;
- karstic spring systems connected to carbonate mountain massifs;
- groundwater-dependent ecosystems;
- and hydraulically connected river–aquifer systems where groundwater contributes significantly to ecological baseflow conditions.

Under conditions of incomplete monitoring data, the assessment evaluates the likelihood that groundwater bodies and associated springs may fail to achieve:

- Good Quantitative Status;
- Good Chemical Status;
- and the protection objectives for groundwater-dependent ecosystems and connected surface waters.

The resulting pressure and risk analysis therefore provides the technical basis for groundwater status classification, identification of bodies at risk, and definition of groundwater-related measures within the Seman River Basin Management Plan.

9.6.2 Pressure Identification and classification for Groundwater Bodies

Table xx presents the initial groundwater body characterisation in accordance with the logic of the Water Framework Directive Annex II requirements and WISE reporting structure. It summarises the principal categories of pressures affecting groundwater systems, together with their indicative WISE codes, pressure type classification, dominant drivers, migration pathways, potential receptors, and expected status signals.

The table is based on a source–pathway–receptor conceptual framework and is intended to support the initial screening of groundwater bodies for risk of failing good quantitative or chemical status. It integrates both anthropogenic drivers and hydrogeological transmission mechanisms, thereby linking land-use activities and abstraction patterns to observed or potential impacts on groundwater quality and quantity.

The pressure categories include diffuse pollution, point-source contamination, abstraction pressures, recharge alteration, saline intrusion in coastal systems, and legacy or uncertain pressures. Each category reflects a distinct pathway of impact propagation through the aquifer system and is associated with specific receptor sensitivities, such as drinking water abstractions, springs, baseflow-dependent rivers, wetlands, and coastal aquifers.

The “Status Signal” column provides an indicative interpretation of typical groundwater responses associated with each pressure type, supporting subsequent risk screening, vulnerability assessment, and prioritisation of monitoring and management measures within the River Basin Management Planning process.

Table xx - Pressure Identification and Classification for Groundwater Bodies

WISE Pressure Group	Pressure Codes	Pressure Type	Key Drivers	Pathways	Potential Receptors	Status Signal (Indicative)
Diffuse pollution pressures	2.1, 2.2, 2.5, 2.6	Chemical	Agriculture, urban runoff, sanitation deficits	Infiltration through soil and vadose zone	Shallow aquifers, wells, springs, baseflow systems	Nitrate increase, pesticide risk, microbial contamination
Point-source contamination	1.1, 1.5, 1.7	Chemical	Wastewater plants, industry, mining, landfills	Direct leakage, infiltration, plume migration	Public supply wells, springs, downstream aquifers	Localised high concentrations, contaminant plumes
Abstraction pressures	3.1, 3.2, 3.3	Quantitative	Irrigation, public supply, industry	Groundwater withdrawal, spring capture	Aquifer storage, springs, connected rivers/wetlands	Declining groundwater levels, reduced discharge
Recharge alteration	6.1, 6.2	Quantitative	Land-use change, sealing, drainage, climate variability	Reduced infiltration, altered recharge distribution	Aquifer recharge zones, connected ecosystems	Reduced recharge rates, seasonal deficits
Saline intrusion (coastal systems)	7.1 (regional adaptation)	Chemical/Quantitative	Over-abstraction, sea level pressure	Hydraulic gradient reversal	Coastal aquifers, wells, wetlands	Increasing chloride, EC rise, seawater intrusion
Legacy/uncertain pressures	9.1, 9.2, 9.3	Mixed	Abandoned industry, historical mining	Residual contamination, diffuse migration	Local aquifers, springs, downstream systems	Uncertain plumes, sporadic contamination signals

9.6.3 Status Assessment at Groundwater Management Unit Level

Devoll Groundwater Management Unit

The Devoll sub-basin is dominated by compact and fractured aquifers, including karstified carbonate formations that support numerous springs used for drinking water supply and local uses. These systems are characterised by strong hydraulic connectivity between recharge areas, groundwater bodies, springs, and surface waters, with rapid groundwater flow pathways increasing vulnerability to contamination where pressures occur within recharge zones.

Groundwater pressures within the Devoll GMU are spatially variable and include:

- abstractions for public water supply, frequently directly at spring sources;
- hydropower-related alteration of groundwater–surface water interactions;
- localised mining and industrial pressures;
- diffuse agricultural activities affecting valley-floor intergranular deposits;
- urban wastewater infiltration near settlements lacking complete sewerage systems.

Hydropower regulation along the Devoll corridor locally modifies recharge conditions, baseflow contribution, and seasonal groundwater dynamics. In karst and fractured systems, even localised contamination sources may rapidly propagate toward springs and shallow groundwater receptors.

The majority of groundwater bodies within the Devoll GMU are classified as “**Possibly at Risk**”, reflecting:

- moderate but spatially concentrated pressure intensity;
- high hydrogeological sensitivity of karst aquifers and springs;
- abstraction pressures affecting spring discharge;
- uncertainty associated with limited groundwater quality and quantity monitoring.

However, selected groundwater bodies exhibit higher cumulative pressure intensity and are classified as **At Risk**, particularly where abstraction, diffuse pollution, and physical pressures coincide within vulnerable recharge zones. These include groundwater bodies such as:

- **GWB_002_Kemishtaj-Krutje**
- **GWB_067_Tervoli**

Overall, the Devoll GMU is assessed as:

- **Possibly at Risk**, with localised “**At Risk**” groundwater bodies associated with vulnerable karst systems and cumulative abstraction–pollution pressures.

Osum Groundwater Management Unit

The Osum sub-basin comprises a combination of intergranular aquifers within alluvial valleys and fractured aquifers in surrounding uplands. Numerous springs contribute to local water supply and sustain river baseflows throughout the sub-basin.

Groundwater and spring pressures in the Osum GMU are primarily associated with:

- urban wastewater infiltration from settlements without complete sewerage systems;
- diffuse agricultural nutrient and pesticide pollution;
- groundwater abstraction for irrigation and drinking-water supply;
- localised land-use and morphological changes affecting recharge zones;
- physical pressures linked to river corridor modification and floodplain alteration.

Pressures are concentrated mainly within cultivated valley systems and shallow alluvial aquifers, while upland fractured aquifers are generally less affected. Agricultural pressures are widespread throughout recharge areas, particularly in intensively cultivated zones where nutrient and pesticide infiltration may affect both shallow groundwater bodies and connected springs.

Most groundwater bodies in the Osum GMU are assessed as “**Possibly at Risk**”, reflecting:

- moderate but spatially heterogeneous pressure intensity;
- vulnerability of shallow intergranular aquifers;
- localised abstraction stress;
- incomplete monitoring evidence regarding groundwater quality trends and spring responses.

Groundwater bodies located downstream of urban centres or within intensively farmed recharge areas demonstrate elevated risk levels due to combined wastewater infiltration and diffuse agricultural loading.

Overall, the Osum GMU is classified as:

- “**Possibly At Risk**”, with pressure hotspots requiring targeted investigation and monitoring.

Seman Groundwater Management Unit (Lower Basin and Myzeqe Plain)

The Seman lower basin contains extensive high-productivity intergranular aquifers hydraulically connected to shallow groundwater systems, irrigation networks, drainage canals, springs, and surface waters across the Myzeqe plain. These aquifers are of major importance for:

- public water supply;
- irrigation abstraction;
- agricultural production;
- maintenance of groundwater-dependent ecosystems.

Compared to upland groundwater systems, aquifers within the lower basin are more exposed to anthropogenic pressures due to intensive land use, shallow groundwater conditions, and extensive hydraulic modification.

The principal pressures affecting groundwater bodies and associated springs include:

- diffuse agricultural nutrient and pesticide pollution;
- urban wastewater infiltration from towns and dispersed settlements;
- intensive groundwater abstraction for irrigation and water supply;
- industrial and oil-related contamination;
- contaminated soils and legacy industrial sites;
- hydro morphological modification and floodplain alteration.

Pressure intensity is highest within:

- intensively cultivated agricultural zones;
- shallow alluvial aquifers;
- irrigation and drainage systems;
- urbanised lowland corridors;
- areas influenced by historical oil extraction and industrial activities.

Groundwater bodies within the lower basin exhibit widespread combinations of diffuse pollution, abstraction pressure, and physical alteration. However, pressure distribution remains heterogeneous, with higher vulnerability concentrated in shallow and intensively utilised aquifers.

Although pressure intensity is elevated in parts of the Myzeqe plain and lower Seman corridor, the screening assessment indicates that most groundwater bodies remain classified as Possibly at Risk rather than At Risk, reflecting:

- widespread but uneven pressure distribution;
- cumulative pressures affecting vulnerable intergranular aquifers;
- groundwater dependence of irrigation and water supply systems;
- uncertainty linked to limited groundwater monitoring coverage.

The assessment supports prioritised investigation and management measures focused on identified hotspots rather than uniform basin-wide intervention across all groundwater bodies.

9.6.4 Status Assessment at Groundwater Body Level

Quantitative status

Quantitative status assessment evaluates whether groundwater abstraction, hydrological alteration, and groundwater-level changes within the Seman River Basin are causing, or are likely to cause, long-term deterioration of groundwater quantity, groundwater-dependent ecosystems, spring discharge regimes, and groundwater–surface water interactions.

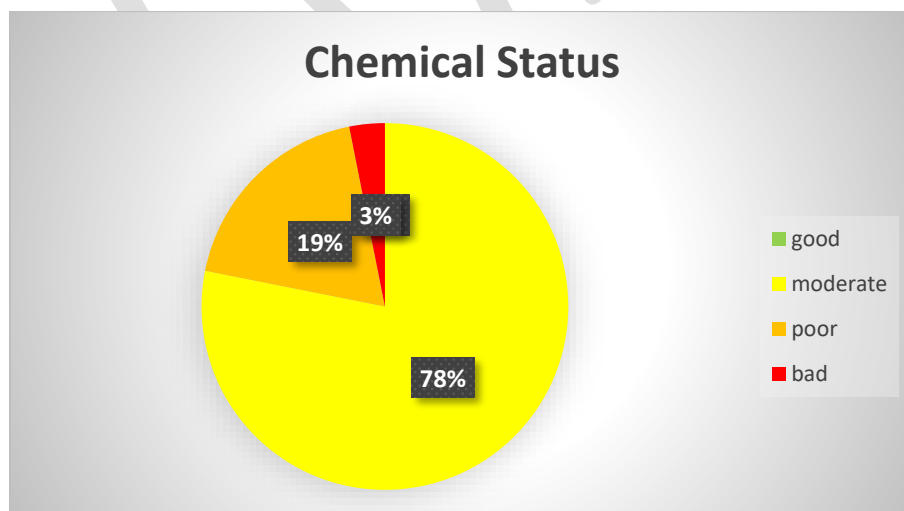


Figure xx – Overall Quantitative Status classification of groundwater bodies in the Seman River Basin

The assessment considers:

- the balance between recharge and abstraction;
- groundwater-level alteration;
- reductions in spring discharge;
- alteration of river baseflow support;
- hydrological connectivity with wetlands, irrigation systems, and surface waters;
- and the long-term resilience of aquifers under increasing climatic and water-demand pressures.

Particular attention is given to lowland intergranular aquifers of the Myzeqe plain, intensively used irrigation areas, karst spring systems within the Devoll and Osum sub-basins, and groundwater bodies where abstraction pressures coincide with vulnerable recharge zones or shallow groundwater conditions.

Quantitative pressures are most significant within the lower Seman Basin and intensively cultivated lowland systems, where groundwater is extensively abstracted for:

- irrigation;
- public water supply;
- industrial and agricultural activities.

In these systems, cumulative abstraction pressures may alter groundwater gradients, reduce groundwater storage, and increase seasonal groundwater drawdown, particularly during summer irrigation periods and prolonged dry conditions.

The lower basin intergranular aquifers are additionally sensitive because of:

- shallow groundwater tables;
- strong hydraulic connectivity with rivers and drainage canals;
- dependence of irrigation systems on groundwater abstraction;
- and reduced recharge efficiency under altered hydrological conditions.

Karst and fractured aquifers within the Devoll and Osum sub-basins are also vulnerable to quantitative alteration. Due to rapid groundwater flow and direct recharge mechanisms, intensive abstraction or prolonged drought conditions may reduce spring discharge, alter seasonal flow variability, and decrease groundwater contribution to river baseflows.

Hydropower regulation along the Devoll system may further influence groundwater–surface water interactions locally by modifying recharge dynamics, river stage conditions, and downstream hydrological connectivity.

Groundwater bodies where abstraction-related pressures have been identified through the screening assessment include:

- | | |
|------------------------------|---------------------------------|
| • GWB001_Voskopi | • GWB034_Mbjeshtova |
| • GWB002_Kemishtaj-Krutje | • GWB035_Vashtemija |
| • GWB003_Arreza_Veterrik | • GWB036_Ujaniku |
| • GWB005_Kuci | • GWB038_Hamili_Balteza |
| • GWB006_Gostima | • GWB039_Bersniku |
| • GWB009_Hocishti_Babani | • GWB040_Velabishti |
| • GWB010_Topoja | • GWB041_Lavdari |
| • GWB013_Lapardhaja | • GWB045_Tresteniku |
| • GWB014_Remanca_Starova | • GWB050_Treni_Bitincka_Verniku |
| • GWB015_Plugu | • GWB052_Drenova_Kozeli |
| • GWB017_Gostima | • GWB055_Kuci |
| • GWB020_Polaska | • GWB057_Tomorr_Kapinova |
| • GWB021_Lybesha_Nishova | • GWB058_Kroreza_Gradeci |
| • GWB024_Imshita_kallmi_madh | • GWB061_Shtylla_Vithkuqi |
| • GWB026_Zemblaki_Dishnica | • GWB063_Kagjinasi_Borova |
| • GWB031_Gjyrala | • GWB067_Tervoli |
| • GWB033_Mollasi_Selita | • GWB069_Mbreshtani |

- | | |
|-------------------------------|-------------------------------|
| • GWB079_Gjanc_Ujebardhi | • GWB124_Kukuri |
| • GWB080_Gopeshi | • GWB126_Derstila_Myrtallare |
| • GWB081_Komari | • GWB127_Pashallia |
| • GWB083_Lleshani_Pobrat | • GWB132_Kryegjata_Zhupani |
| • GWB084_Luarasi | • GWB133_Guri_Babunje |
| • GWB085_Aranitasi | • GWB134_Kryekuqi_Kamenica |
| • GWB086_Holtasi-Rashtani | • GWB135_Drize_Kraps_Kreshpan |
| • GWB087_Arreza_e_Vogel | • GWB136_Zharneci_Kryekuqi |
| • GWB093_Patos_Ballsh | • GWB137_Velmishti |
| • GWB097_Karburnara_e_Siperme | • GWB142_Kurtina |
| • GWB105_Shilbatra | • GWB143_Zhitom_Vokopoka |
| • GWB107_Rehova | • GWB144_Skorovoti_Gjonci |
| • GWB108_Velcani_Osmenzeza | • GWB145_Roskovec_Marinez |
| • GWB109_Aranitas_Osmenzeza | • GWB146_Novosej |
| • GWB113_Dersniku | • GWB147_Lleshan |
| • GWB114_Cfiri | • GWB149_Kamican-Kukur |
| • GWB115_Zereci | • GWB150_Gramsh_Skrapar |
| • GWB121_Shipoka | • GWB153_Cemerica_Graboeka |
| • GWB122_Velcani_Malas | • GWB154_Bregasi |
| • GWB123_Vina | • GWB155_Afrim_Verbas |

Key quantitative risks identified across the basin include:

- seasonal groundwater drawdown;
- reduction of spring discharge;
- altered groundwater contribution to river baseflow;
- increased vulnerability of groundwater-dependent ecosystems;
- reduced resilience during prolonged drought periods;
- local groundwater-level decline in intensively abstracted irrigation zones;
- altered groundwater–surface water interaction in hydrologically modified systems.

Although saline intrusion risk is less pronounced than in major coastal aquifer systems elsewhere in Albania, shallow lowland aquifers near the coastal plain remain potentially vulnerable where intensive abstraction coincides with reduced recharge conditions.

Due to limited groundwater-level monitoring, incomplete abstraction datasets, weak long-term piezometric records, and limited spring-discharge monitoring, confidence in quantitative status assessment remains generally low to medium across much of the Seman River Basin.

Chemical status

Chemical status assessment evaluates whether human activities are causing deterioration of groundwater quality or creating risks to drinking-water resources, connected surface waters, springs, and groundwater-dependent ecosystems within the Seman River Basin. The assessment considers point-source and diffuse pollution pathways, pollutant persistence, hydrogeological vulnerability, groundwater–surface water connectivity, and the capacity of aquifer systems to attenuate or recover from contamination pressures.

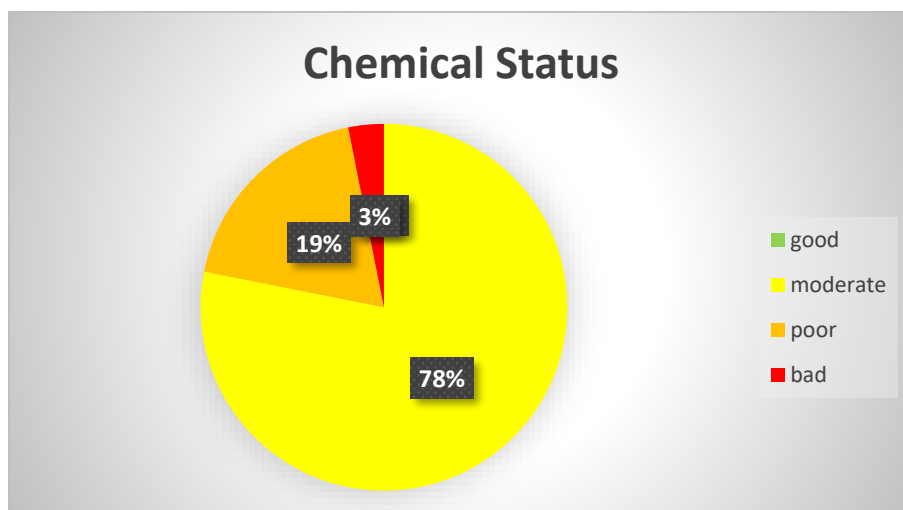


Figure xx – Overall Qualitative Status classification of groundwater bodies in the Seman River Basin

The principal chemical pressures affecting groundwater bodies and associated springs in the Seman River Basin are linked to:

- urban wastewater infiltration from settlements lacking adequate sewerage systems;
- diffuse agricultural nutrient and pesticide pollution;
- industrial and oil-related contamination;
- contaminated sites and legacy pollution;
- solid waste disposal and uncontrolled dumping;
- irrigation return flows;
- groundwater abstraction and groundwater-level alteration.

These environmental pressures introduce nutrients, pathogens, pesticides, hydrocarbons, chlorides, heavy metals, organic pollutants, and suspended contaminants into groundwater systems, especially where aquifers are shallow, highly permeable, fractured, or hydraulically connected to rivers and springs.

Diffuse agricultural pollution constitutes one of the most widespread influences within the basin, notably across the Myzeqe plain and intensively cultivated alluvial valleys of the Seman and Osum river systems. Fertilizer applications, livestock operations, pesticide usage, and irrigation return flows contribute to nitrate enrichment, nutrient build-up, and heightened groundwater vulnerability in shallow intergranular aquifers and interconnected spring systems.

Urban wastewater presents significant pressures in regions where sewerage infrastructure is incomplete, leaking, or absent. Untreated or inadequately treated effluent infiltrates shallow groundwater, adversely affecting spring quality—particularly in peri-urban communities and valley-floor aquifers with hydraulic connections to surface water and drainage networks.

Industrial and oil-related contamination is especially prevalent within the lower Seman and Gjanica corridors, where historical petroleum extraction, refining processes, industrial activity, and contaminated soils serve as persistent sources of groundwater pollution. Hydrocarbon leakage, contaminated sediments, and legacy industrial sites may continue to release pollutants into groundwater through gradual infiltration and remobilization.

Mining and quarrying activities exert localized impacts on fractured and karst aquifers in the Devoll and upland areas, where rapid groundwater flow paths and minimal natural attenuation elevate the risk of pollutant transport to springs and shallow groundwater bodies.

The most vulnerable groundwater settings within the basin include:

- shallow alluvial intergranular aquifers;
- karst and fractured carbonate aquifers;
- spring recharge zones;
- lowland irrigation aquifers;

- hydraulically connected river–aquifer systems.

Shallow alluvial aquifers are particularly exposed due to their high permeability, intensive agricultural use, limited natural protection, and direct interaction with surface activities. Karst and fractured aquifers are highly sensitive because rapid groundwater flow pathways permit rapid pollutant migration with minimal filtration or attenuation, increasing the vulnerability of springs used for public water supply.

Groundwater abstraction and groundwater-level alteration may further aggravate chemical pressures by reducing dilution capacity, modifying groundwater flow directions, increasing contaminant concentration, and altering groundwater–surface water interactions. In lowland systems, prolonged abstraction combined with diffuse pollution may increase salinity and conductivity risks in shallow aquifers.

The assessment therefore integrates:

- pressure inventories;
- hydrogeological vulnerability;
- groundwater abstraction patterns;
- spring sensitivity;
- land-use pressures;
- monitoring evidence;
- and groundwater-flow characteristics

to evaluate the likelihood of failing to achieve or maintain Good Chemical Status under current and future pressure conditions.

The groundwater bodies with relatively elevated cumulative pressure scores within the Seman River Basin include:

- | | |
|-------------------------------|----------------------------|
| • GWB002 Kemishtaj–Krutje; | • GWB129 Garunjasi–Lekaj; |
| • GWB067 Tervoli; | • GWB143 Zhitom–Vokopoka; |
| • GWB093 Patos–Ballsh; | • GWB144 Skorovoti–Gjonci; |
| • GWB097 Karbunara e Sipërme; | • GWB150 Gramsh–Skrapar; |
| • GWB107 Rehova; | • GWB155 Afrim–Verbas. |

However, the screening assessment identifies GWB002_Kemishtaj-Krutje and GWB067_Tervoli as the only groundwater bodies classified as “At Risk”. Several additional groundwater bodies, including GWB093, GWB097, GWB107, GWB129, GWB143, GWB144, GWB150 and GWB155, exhibit multiple pressures and warrant further investigation, but remain classified as “Possibly at Risk”. These groundwater bodies are affected by multiple interacting pressures including:

- diffuse agricultural pollution;
- wastewater infiltration;
- abstraction pressures;
- industrial and oil-related contamination;
- contaminated-site pressures;
- groundwater-level alteration;
- and hydromorphological disturbance.

The cumulative interaction of these pressures substantially increases the likelihood of groundwater deterioration, particularly where vulnerable aquifers coincide with intensive agriculture, urban development, industrial activity, or groundwater-dependent ecosystems. The most likely chemical impacts associated with these combined pressures include:

- elevated nitrate concentrations;
- increased nutrient loading;
- hydrocarbon contamination;
- elevated conductivity and salinity;
- localized heavy metal contamination;
- deterioration of spring-water quality;
- and degradation of groundwater-dependent ecosystems and connected surface waters.

Karst and fractured aquifers are particularly vulnerable because contaminants may bypass natural filtration mechanisms and spread rapidly through hydraulically connected groundwater pathways toward springs and river systems.

Lowland intergranular aquifers within the Myzeqe plain and lower Seman system remain especially vulnerable due to:

- intensive agriculture;
- irrigation return flows;
- unsewered settlements;
- industrial legacy contamination;
- extensive abstraction;
- and strong hydraulic connectivity with rivers, drainage canals, wetlands, and shallow groundwater systems.

Chemical status confidence remains constrained by:

- limited groundwater-quality monitoring frequency;
- insufficient pesticide and hydrocarbon analysis;
- incomplete monitoring of priority substances and emerging pollutants;
- weak integration of groundwater and surface-water monitoring;
- incomplete abstraction records;
- limited event-based monitoring;
- and fragmented groundwater information systems.

As a result, episodic pollution events, hydrocarbon releases, nitrate pulses, and seasonal groundwater-quality deterioration are likely underrepresented within current monitoring datasets. The assessment indicates that the majority groundwater bodies within the Seman River Basin are all classified as “Possibly at Risk”. Two groundwater bodies, GWB002_Kemishtaj-Krutje and GWB067_Tervoli, are classified as “At Risk” due to the cumulative occurrence of multiple pressures within hydro geologically vulnerable settings.

9.7 Summary status assessment of Groundwater Bodies

The groundwater system of the Seman River Basin consists of intergranular alluvial aquifers, compact fractured formations and karst groundwater systems. These systems support public water supply, irrigation, spring discharge, river baseflow and groundwater-dependent ecosystems. Across much of the basin, groundwater bodies and springs are hydraulically connected to surface waters, particularly in lowland alluvial areas and karstified upland regions.

The WFD Annex II pressure-based assessment shows that groundwater pressures are widespread but spatially uneven. The highest pressure intensity occurs in intensively cultivated lowland aquifers, urban and semi-urban groundwater systems, oil-affected and industrial corridors, vulnerable karst recharge areas and heavily abstracted irrigation zones. The dominant pressures include urban wastewater infiltration, diffuse agricultural pollution, pesticide use, groundwater abstraction, groundwater-level alteration, contaminated industrial and oil-related sites, drainage-related modifications and solid waste disposal.

Diffuse agricultural pollution is the most extensive pressure, especially in the Myzeqe plain and lower Seman alluvial systems, where irrigation agriculture contributes to nutrient enrichment, pesticide loading, salinisation risk and groundwater-quality deterioration. Urban wastewater infiltration is also widespread due to incomplete sewerage and dispersed settlements without effective treatment. Karst and fractured aquifers in the Devoll and upland Osum systems remain highly vulnerable because rapid flow pathways can transport contaminants towards springs and connected groundwater bodies with limited natural attenuation.

Most groundwater bodies in the Seman River Basin are classified as “**Possibly at Risk**”, reflecting moderate but spatially concentrated pressures, heterogeneous vulnerability, incomplete monitoring

evidence and uncertainty about the extent and severity of impacts. Two groundwater bodies, **GWB002 Kemishtaj–Krutje** and **GWB067 Tervoli**, are classified as “**At Risk**”. Other groundwater bodies with high combined pressure intensity include GWB093 Patos–Ballsh, GWB097 Karbunara e Sipërme, GWB107 Rehova, GWB129 Garunjasi–Lekaj, GWB143 Zhitom–Vokopoka, GWB144 Skorovoti–Gjonci, GWB150 Gramsh–Skrapar and GWB155 Afrim–Verbas, all classified as “**Possibly at Risk**”.

The basin-wide assessment confirms that groundwater risk is driven mainly by local hotspots rather than uniform basin-wide deterioration. However, confidence in the classification remains low because groundwater-quality monitoring, pesticide, hydrocarbon and priority-substance analysis, groundwater-level monitoring, abstraction records, spring-discharge monitoring and groundwater information systems remain limited or fragmented.

CONCEPT

Table xx - Risk, Pressures and Status Assessment for Groundwater bodies (GWB) within the Seman River Basin

CL	RISK LEVEL	OVERALL STATUS	ANNEX VIII RBSP	ANNEX X PSS	H-MORPH	P-CHEM	QUANTITY	PHYSICAL	PHYSICAL PRESSURE 1	ABSTRACTION PRESSURE 2	ABSTRACTION PRESSURE 1	DIFUSE PRESSURE 2	DIFUSE PRESSURE 1	POINT	GWB CODE	GROUNDWATER BODY NAME
1	Possible	3							4	6	1	3	2		GWB 001	Voskopi
1	At Risk	4							4	6	3	3	2		GWB 002	Kemishaj

[illegible]

u c i						4													t R i s k	
GWB-006-Gostima	GWB-006	1 1		2 1	2 2	3 1		4 2 3 4 2 4		2	1							2 0 r 3	P o s s i b l y a t R i s k	1
GWB-007-Mollaj-Pulah	GWB-007	1 1		2 1	2 2			4 2 3 4 2 4	6 2	1	1							2 0 r 3	P o s s i b l y a t R i s k	1
GWB-008-Berati	GWB-008			2 2		3 2		4 2 3		1	1							2 0 r 3	P o s s i b l y a t R i s k	1

i m a																					s k	
GWB-018-Ersekaja	GWB-018	1		2	2	3	4	1	1											203	Possibylat Risk	1
GWB-019-Adriatiku	GWB-019	1		2	2	4	4	1	1											203	Possibylat Risk	1
GWB-020-Polaska	GWB-020	1		2	3	4	6	1	1											203	Possibylat Risk	1
GWB-021	GWB-021	1		2	3	4	6	1	1											203	Possibylat Risk	1

i k u																			s k	
GWB-040-Velabishi	GWB-040		2 .1	3 .1	4 .2 .4	6 .2	1	1										2 or 3	P o s s i b l y a t R i s k	1
GWB-041-Lavdari	GWB-041		2 .1	3 .1	4 .2 .4	6 .2	1	1										2 or 3	P o s s i b l y a t R i s k	1
GWB-042-Remenji	GWB-042	1 .1	2 .1	3 .1	4 .2 .3 .4 .2 .4	6 .2	1	1										2 or 3	P o s s i b l y a t R i s k	1
GWB-0	GWB-0			3 .2	4 .2 .2 .2		1	1										2 or 3	P o s s i b l y a t R i s k	1

n													i	s	k	1
GWB-047-Grabova	GWBB047	1. 1		2. 1				4. 2 .4		1	1				2 or 3	Possibility at Risk
GWB-048-Kullola si	GWBB048	1. 1		2. 1				4. 2 .4		1	1				2 or 3	Possibility at Risk
GWB-049-Osoja	GWBB049	1. 1		2. 1				4. 2 .4		1	1				2 or 3	Possibility at Risk
GWB-0	GWBB0	1. 1		2. 1	2. 5	3. 1		4. 2 .4	6. 2	2	1				2 or 3	Possibility at Risk

e z a - C l i r i m i																					i s k
GWB - 055 - Kuci	GWB 055	1 .1	2 .1	3 .1	4 .2 .4	6 .2	1	1											2 or 3	P o s s i b l y a t R i s k	1
GWB - 056 - Zvezda	GWB 056	1 .1	2 .2	3 .1	4 .2 .4	6 .2	1	1											2 or 3	P o s s i b l y a t R i s k	1
GWB - 057 - Tomorr - K	GWB 057	1 .1	2 .1	3 .1	4 .2 .4		1	1											2 or 3	P o s s i b l y a t R i s k	1

GWB-070-S tarova	GWB-070	1	2		4	6	1	3			3	Possibly at Risk	1
GWB-071-Shalesi	GWB-071	1	2	3	4	1	2				2	Possibly at Risk	1
GWB-072-Grepcaka	GWB-072	1	2		4	1	2				2	Possibly at Risk	1
GWB-073-FI	GWB-073	1	2	3	4	1	2				2	Possibly at Risk	1

o q i																				R i s k	
G W B - 0 7 4 - T e r p a n - P a r a s p u a r	G W B 0 7 4	1 . 1		2 . 1				4 . 2 . 4		1	2								2 o r 3	P o s s i b l y a t R i s k	1
G W B - 0 7 5 - B e z h a n i	G W B 0 7 5	1 . 1		2 . 1				4 . 2 . 4	6 . 2 .	1	2								2 o r 3	P o s s i b l y a t R i s k	1
G W B - 0 7 6 - Q a f a	G W B 0 7 6	1 . 1		2 . 1				4 . 2 . 4		1	3								3	P o s s i b l y a t R i s k	1

[illegible]

s h n i c a							4											R i s k	
G W B _1 0 2 _V i t h k u q i	G W B _1 0 2					3 1	3 2	4 2 4	1	1							2 0 3	P o s s i b l y a t R i s k	1
G W B _1 0 4 _L o f k e n d i	G W B _1 0 4	1 1		2 1				4 2 4	6 2	1	2						0 2 - M a r	P o s s i b l y a t R i s k	1
G W B _1 0 5 _S h i l b a t r a	G W B _1 0 5	1 1		2 1		3 1		4 2 4	6 2	1	3						3	P o s s i b l y a t R i s k	1

GWB-109-Aranitas-Osmenezza	GWB-109	1 1	2 1	3 1	4 2 4	6 2	2 3				3	Possibly at Risk	1
GWB-110-Strica	GWB-110	1 1	2 1	3 1	4 2 4	1	1				2 3	Possibly at Risk	1
GWB-111-Alikom	GWB-111	1 1	2 1	3 1	4 2 4	1	2				2 3	Possibly at Risk	1

i r i																					R i s k	
GWB-115-Zerreci	GWB-115	1 1	2 1	3 1	4 2 4	1	3													3	P o s s i b l y a t R i s k	1
GWB-116-Zembla ku	GWB-116		2 2	3 1	4 2 4	1	1													2 o r 3	P o s s i b l y a t R i s k	1
GWB-117-Poshnja	GWB-117		2 2		4 2 4	6 2	1	1												2 o r 3	P o s s i b l y a t R i s k	1
GWB-118	GWB-118	1 1	2 2		4 2 4	6 2	1	2												2 o r 3	P o s s i b	1

GWB - 130 - Vajkani - Ardencia	GWB 130		2 2			4 2 4	6 2	1	2				2 3	Possibly at Risk	1
GWB - 131 - Mbyet - Margellia	GWB 131		2 2			4 2 4	6 2	1	1				2 3	Possibly at Risk	1
GWB - 132 -	GWB 132		2 1	3 1		4 2 4	6 2	1	3				3	Possibly	1

[illegible]

G W B - 1 5 4 - B r e g a s i	G W B - 1 5 4	1 . 1				3 . 1		4 . 2 . 4	6 . 2	1	3					3	P o s s i b l y a t R i s k	1
	G W B - 1 5 5	1 . 1	1 . 5	2 . 2	2 . 5	3 . 1		4 . 2 . 4	6 . 2	1	3					3	P o s s i b l y a t R i s k	1
G W B - 1 5 5 - A f r i m - V e r b a s	G W B - 1 5 5	1 . 1	1 . 5	2 . 2	2 . 5	3 . 1		4 . 2 . 4	6 . 2	1	3					3	P o s s i b l y a t R i s k	1

9.8 Protected Areas Pressures and Status Assessment

9.8.1 General overview

The establishment of a Register of Protected Areas (RoPA) under Article 6 of the EU Water Framework Directive (WFD) represents a core requirement for ensuring coordinated protection of water-dependent ecosystems, drinking water sources, and environmentally sensitive areas (see Task Report 2 and Chapter 12). In the Seman River Basin, although a wide range of protected areas exist under national legislation and international conventions, the system remains fragmented. The main limitation is not the absence of designations, but the lack of consolidation, geospatial integration, and operational accessibility within a unified basin-level register.

Under Law No. 29/2024 on Water Resources, the Water Resources Management Agency (AWRM) is mandated to establish a GIS-based Register of Protected Water Areas within four years. However, implementation is still at an early stage, with significant gaps in data harmonisation, inter-institutional coordination, and spatial integration.

9.8.2 Drinking Water Protected Areas

Drinking water protection zones in the Seman River Basin are primarily associated with groundwater abstraction systems, including springs and wells supplying urban and rural settlements. Hygienic-sanitary protection zones (Zone I–III) are legally defined and applied for utility-managed abstraction points, under coordination between AWRM, health authorities, hydrogeological services, and local government units.

Despite this regulatory framework, implementation remains incomplete:

- Protection zones exist mainly for utility-managed abstraction points only.
- No consolidated dataset exists for privately operated wells and small abstractions.
- Spatial delineation of protection zones is incomplete or inconsistent across basin datasets.

Fragmentation between utilities, AWRM, and basin-level GIS systems limits integration.

Status assessment: Partially implemented but not GIS-complete or fully WFD-compliant due to incomplete spatial coverage and data fragmentation.

9.8.3 Areas for Protection of Economically Significant Aquatic Species

Protection of economically important aquatic species is regulated under Law No. 64/2012 on Fisheries (as amended), including spawning zones, seasonal bans, and co-management fisheries areas.

Within the Seman River Basin, the most significant designated protected area is the Karavasta Lagoon co-management zone, which forms part of the wider Divjakë–Karavasta ecosystem and is internationally recognised under the Ramsar Convention due to its high ecological value and importance for migratory bird species, coastal wetland functioning, and biodiversity conservation.

This designation provides a relatively strong and well-established protection framework for coastal lagoon systems, particularly in the Karavasta area, where management arrangements, monitoring activities, and conservation objectives are more consistently applied compared to other parts of the basin. As a result, the lagoon represents the most functionally operational and institutionally consolidated protected aquatic environment within the Seman Basin.

In contrast, inland river systems, including the Seman mainstem and its major tributaries (Osum, Devoll, and Gjanica rivers), remain significantly underdeveloped in terms of spatially defined aquatic protection measures. While fisheries legislation provides for general provisions such as seasonal restrictions and spawning protection principles, there is no comprehensive or systematically mapped network of spawning grounds, refuge zones, or riverine protection areas integrated into a basin-wide GIS register. This results in a clear implementation gap, where ecological protection in inland waters relies largely on general regulatory measures rather than spatially explicit conservation zoning.

Fisheries restrictions are applied in an operational manner but are not consolidated spatially within a basin GIS register.

Status assessment: Functionally active in coastal zone, but incomplete spatial coverage and weak integration for inland aquatic ecosystems.

9.8.4 Recreational (Bathing) Waters

Bathing waters are designated annually through Council of Ministers decisions, with key sites including Divjakë–Pirgu and Seman beaches. Monitoring is undertaken by the Institute of Public Health, focusing primarily on microbiological indicators.

However, several limitations persist:

- Monitoring is seasonal and not fully aligned with EU Bathing Water Directive requirements.
- Lack of long-term, continuous datasets limits trend analysis.
- Spatial coverage remains limited to selected coastal points.
- Some stations show signs of deterioration in water quality trends.

Status assessment: Formally designated but operationally constrained due to limited monitoring continuity and incomplete EU-aligned compliance system.

9.8.5 Nutrient-Sensitive Zones

Nutrient-sensitive and eutrophication-risk areas have not yet been formally designated within the Seman River Basin, and similarly, nitrate vulnerable zones in line with EU-equivalent WFD requirements are currently absent. This represents a significant gap in the implementation of nutrient management instruments foreseen under the Water Framework Directive.

In the absence of designated nitrate vulnerable zones, there is no spatially targeted regulatory framework to address diffuse agricultural pollution pressures, particularly those originating from the Myzeqe plain, which remains one of the key agricultural production areas within the basin and a major pathway for nutrient runoff into both surface water and groundwater systems. This diffuse pollution load is not yet managed through zonal restrictions or reinforced agricultural nutrient control measures, limiting the effectiveness of prevention-based water quality management.

In addition, monitoring evidence indicates localized exceedances of heavy metals such as cadmium (Cd) and lead (Pb), alongside other organic pollution indicators in selected tributary systems. These findings point to emerging and spatially heterogeneous water quality risks that are not yet captured through dedicated nutrient-sensitive or pollution-sensitive zoning frameworks.

Overall, the absence of formally designated nutrient-sensitive areas constrains the ability of basin authorities to implement differentiated, risk-based regulatory measures for agriculture and wastewater discharges. This lack of spatial targeting reduces the effectiveness of nutrient load control and limits the capacity to address eutrophication risks in a proactive and preventive manner.

Status assessment: Not implemented. This represents a significant compliance gap under WFD Annex IV requirements.

9.8.6 Nature Protection Areas (Habitats and Species)

The Seman River Basin contains a dense network of nationally and internationally protected areas, including:

- **Divjakë–Karavasta National Park** (Ramsar Site, Emerald candidate, Key Biodiversity Area, or KBA, Important Bird and Biodiversity Area, or IBA)
- **Prespa and Tomorri ecosystems** (Emerald candidate areas)
- Multiple Key Biodiversity Areas (KBAs), including Osum Springs and Devoll upstream zones
- UNESCO World Heritage site: Historic Centres of Berat

The Seman River Basin includes a broad network of nationally designated protected areas, encompassing national parks, protected landscapes, and managed nature reserves established under various legal and administrative categories. This provides a relatively strong formal foundation for biodiversity and ecosystem conservation across the basin.

However, despite this extensive legal designation framework, the effectiveness of these areas is constrained by inconsistent implementation of management plans. In several cases, protected areas either lack up-to-date operational management plans or face limited enforcement capacity, reducing the practical effectiveness of their conservation objectives on the ground.

A further key limitation is the weak integration between protected areas and hydrological systems, including both surface water bodies and groundwater bodies. As a result, ecological conservation planning is not consistently aligned with water resource management boundaries or hydrological processes, which are central to the WFD approach.

In addition, protected areas have not yet been systematically incorporated into Water Framework Directive (WFD) water management planning frameworks at basin scale. This disconnect limits the ability to assess how protected area objectives interact with water quality, flow regimes, and ecological status targets.

Finally, the linkage between ecological datasets and hydrological GIS layers remains underdeveloped. The absence of a fully integrated spatial database reduces the capacity for joint analysis, coordinated planning, and evidence-based decision-making across environmental and water management institutions.

Status assessment: High ecological importance but moderate implementation effectiveness due to weak hydrological integration and incomplete operational management linkage.

9.8.7 Summary status assessment of Protected Areas

The Seman River Basin features an extensive framework of protected areas established under both national legislation and international conventions. Despite this broad legal coverage, these sites have yet to be fully integrated into a unified Register of Protected Areas compliant with the Water Framework Directive (WFD), which restricts their effectiveness within basin-wide water management.

There remain significant implementation gaps across key WFD categories. Drinking water protection zones are not consistently mapped, and abstraction points—particularly those operated privately—are incompletely documented. Furthermore, nitrate vulnerable zones and officially designated nutrient-sensitive areas have yet to be established, resulting in regulatory shortcomings regarding diffuse agricultural pollution and eutrophication risks.

In terms of fisheries protection, GIS integration is incomplete: inland spawning and restriction areas are largely unmapped on a basin scale. Bathing water management also faces challenges due to insufficient monitoring and fragmented datasets, which hinder effective trend analysis and compliance with EU-equivalent standards. Across all categories, there is an inadequate hydrological linkage between protected areas and surface or groundwater bodies, thereby diminishing the coherence of ecosystem-based water management.

Moreover, the absence of a unified, publicly accessible digital register hampers transparency, inter-institutional coordination, and data usability. While the designation of protected sites is relatively expansive, management remains fragmented, relying on sector-specific approaches rather than a coordinated, basin-wide system.

The principal challenge now lies in transitioning from legally designated yet administratively separated protected areas to a consolidated, GIS-based Register of Protected Areas that meets the requirements of WFD Article 6 and Annex IV. Key priorities include strengthening institutional coordination through an Adaptive Water Resources Management (AWRM) approach, expediting the development of integrated GIS systems, and formally designating nitrate vulnerable and nutrient-sensitive zones. These actions are essential to achieving full compliance and enhancing environmental governance throughout the basin.

9.9 Discussion and way forward

The assessment of the Seman River Basin identifies a system subject to multiple, interacting pressures that act cumulatively and reinforce one another spatially, rather than operating as isolated factors. Hydro morphological alteration, diffuse pollution, wastewater discharge, and localized industrial impacts collectively shape the basin's environmental status, resulting in notable variation between upland, midstream, and lowland-coastal segments.

Hydro morphological pressures are most pronounced in regulated and modified river reaches, particularly those affected by upstream water infrastructure, channel modifications, and disrupted sediment transport. These changes alter natural flow regimes, fragment habitat continuity, and impact sediment dynamics, leading to downstream consequences for floodplain functionality and coastal sediment equilibrium.

The primary drivers of water quality degradation include insufficient wastewater collection and treatment in urban and peri-urban areas, coupled with diffuse agricultural runoff from the Myzeqe plain and other intensively farmed regions. This situation contributes to nutrient enrichment, organic pollution, and localized chemical contamination. While overall nutrient levels may not consistently indicate severe eutrophication, the presence of local hotspots and seasonal fluctuations underscores emerging risks that systematic monitoring has yet to fully address.

Groundwater systems exhibit diverse but concerning trends. Although many aquifers remain only moderately affected, lowland alluvial systems and zones impacted by agriculture or legacy pollutants demonstrate enhanced vulnerability. The absence of comprehensive monitoring networks and limited abstraction measurement further restrict capacity to evaluate long-term and cumulative pressures amidst changing climatic and consumption patterns.

Protected areas within the basin are legally extensive but demonstrate variable effectiveness regarding water protection goals. Designated drinking water protection zones, fisheries areas, and nutrient-sensitive zones are either only partially implemented or have yet to achieve integrated spatial operation. Consequently, the contribution of protected areas towards Water Framework Directive (WFD) objectives remains limited, especially where hydrological connectivity is absent or weak.

In summary, the Seman River Basin continues its transition from a designation-based to an evidence-based, integrated river basin management approach. Despite the establishment of legal and institutional frameworks, full operational integration across sectors has not yet been realized.

Advancing progress in the Seman River Basin necessitates transitioning from fragmented surveillance and sector-specific management to a comprehensive, basin-wide water resources governance system consistent with the Water Framework Directive.

The foremost priority is fortifying monitoring and data infrastructure. This entails expanding and modernising hydrological, chemical, biological, and groundwater monitoring networks, improving sampling frequency and spatial coverage, and implementing real-time or near-real-time data collection where practicable. Concurrently, abstraction metering and groundwater observation networks should be extended to facilitate reliable water balance assessments and accurate pressure quantification.

Developing an integrated GIS-based basin information system constitutes the second priority. This platform should consolidate all water bodies, protected areas, abstraction points, pollution sources, and monitoring stations within a unified spatial framework. The operationalisation of the Register of Protected Areas must be embedded in this system, ensuring consistent mapping and continual updates for drinking water zones, bathing waters, fisheries areas, and ecological conservation sites.

Further, focused implementation of the Programme of Measures is vital for addressing principal pressure clusters. Hydromorphological interventions should emphasise restoration of ecological flow regimes, improvement of sediment continuity, and enhancement of river–floodplain connectivity within regulated stretches. Wastewater management requires expansion of collection networks and treatment capacity, especially in urban and rapidly developing sectors. Agricultural impacts should be mitigated through nutrient management planning, establishment of buffer zones, and adoption of improved land management practices in high-risk regions such as the Myzeqe plain. Groundwater protection efforts must prioritise abstraction control and pollution prevention in vulnerable aquifers.

A fourth imperative is more effective integration of protected area management into water planning frameworks. Key actions include formalising outstanding categories such as nitrate vulnerable zones and nutrient-sensitive areas, refining spatial delineation of drinking water protection zones, and explicitly linking ecological conservation objectives to hydrological units and flow regimes.

Strengthening institutional coordination and governance mechanisms is essential. The central role of AWRM should be reinforced for basin-level data integration and reporting, while collaboration among environmental, agricultural, health, and local authorities should be codified via structured data-sharing and joint planning. Enhanced transboundary cooperation will also become increasingly important for shared systems and downstream effects.

Absent these reforms, the Seman River Basin will likely persist in partial compliance with WFD criteria, with recurrent designation of several water bodies as “At Risk” or “Possibly at Risk” across successive planning cycles. Conversely, successful enactment of these measures would support the transition toward more resilient, data-driven, and ecologically harmonious basin management.

CONCEPT

10 Economic Analysis of Water Uses, Revenue Analysis and Cost Recovery

SUMMARY OF TASK 8 REPORT / NOT YET FINALIZED

Prepared in accordance with Article 5 and Annex III of the WFD, this chapter examines the economic significance of water uses in the Seman Basin. It provides an overview of key sectors (agriculture, energy, tourism, domestic water supply), analyses water service costs and revenues, and assesses cost recovery levels for each service. The section also explores economic trends influencing future water demand and highlights where financial instruments and pricing policies can improve efficiency and sustainability. Recommendations support the principle of cost recovery and the “polluter pays” approach.

10.1 Introduction of the economic analysis according to WFD

10.2 The Seman basin: economical baseline and the importance of water use

10.2.1 General socio-economic indicators

10.2.2 Population and urban/rural and household structure

10.2.3 Work force and employment

10.2.4 Socio-economic analysis of water users

- Agriculture (including livestock) and irrigated agriculture
- Industry
- Domestic water supply
- Potable (bottled) water
- Hydropower
- Gravel extraction (from rivers and/or other water bodies)
- Tourism
- Flood control and drainage
- Fish farming and leisure fishing

10.3 Current and Future Water Use and Relevant Developments

10.3.1 Agriculture (including livestock) and irrigated agriculture

10.3.2 Industry

10.3.3 Domestic water supply

10.3.4 Potable (bottled) water

10.3.5 Hydropower

10.3.6 Gravel extraction (from rivers and/or other water bodies)

10.3.7 Tourism

10.3.8 Flood control and drainage

10.3.9 Fish farming and leisure fishing

10.4 Water Services

10.4.1 Irrigation and drainage services

10.4.2 Industrials water supply services

10.4.3 Domestic water supply services, coverage and losses

10.4.4 Water Services related to Tourism

10.4.5 Wastewater collection and treatment services

10.4.6 Hydropower

10.5 Cost, revenue and cost recovery analysis

10.5.1 Mechanisms of water cost, revenue and cost recovery

10.5.2 Irrigation and drainage services

10.5.3 Industrials water supply services

10.5.4 Domestic water supply services

10.5.5 Wastewater collection and treatment services

10.5.6 Hydropower

10.6 Recommendations

11 PROGRAMME OF MEASURES FOR THE SEMAN BASIN

SUMMARY OF TASK 7 REPORT / 75% FINALIZED

This core chapter sets out the Programme of Measures required to achieve the basin's environmental objectives. It explains the rationale and prioritisation of measures, distinguishing between basic, supplementary, and additional measures in line with Articles 11 and 12 of the WFD. It details implementation timelines, responsible authorities, indicative costs, and potential funding sources. The PoM covers interventions for both surface and groundwater, integrates cross-sectoral actions, and includes a monitoring and evaluation plan to track progress and effectiveness.

11.1 Introduction

11.2 Rationale for the Development of the Program of Measures (PoM)

11.2.1 The concept of 'Measures' and 'Key Types of Measures (KTM)'

11.2.2 Systematic Approach to the Identification of Measures

11.2.3 Operational Implications for Waterbodies Failing Environmental Objectives

11.2.4 Transboundary cooperation and measures

11.3 Timeline for the Seman PoM and Prioritization of Measures

11.4 Implementation Action Plan and Monitoring

11.5 Structure of the PoM

11.5.1 Basic Measures

11.5.2 Supplementary Measures

11.5.3 Additional Measures

11.5.4 Numeric Identification and Reporting of Measures

11.5.5 Templates for Reporting

Type of measure	Legal reference	Purpose	Examples	Implementation character
Basic measures	Art. 11(3)	Ensure compliance with existing EU and national legislation	UWWTD, Nitrates Directive, abstraction and discharge controls, cost recovery	Legally mandatory – minimum baseline
Supplementary measures	Art. 11(4) & Annex VI (Part B)	Achieve WFD objectives where basic measures are insufficient	Hydromorphological restoration, irrigation efficiency, awareness, economic instruments	Discretionary but essential for achieving good status

Additional measures	Art. 11(5)	Address exemptions or failures to achieve objectives	Temporary or compensatory actions, emergency measures	Corrective exceptional /
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11.6 Basic Measures for the Seman River Basin

11.6.1 Overview

11.6.2 Legislative Compliance

11.6.3 Operational Relevance of Basic Measures

11.6.4 Prioritized list of Basic Measures for SWBs

11.6.5 Prioritized list of Basic Measures for GWBs

11.7 Supplementary Measures for SWBs in the Seman River Basin

11.7.1 Overview

11.7.2 Prioritized list of supplementary measures

11.7.3 Priority Class 1 supplementary measures for SWBs at risk

11.8 Supplementary Measures for GWBs in the Seman River Basin

11.8.1 Overview

11.8.2 Prioritized list of supplementary measures

11.8.3 Priority Class 1 supplementary measures for GWBs at risk

11.9 Definitions and Reporting of Costs and Sources of Funding

11.9.1 Overview of Costs of measures

11.9.2 Overview of Funds

11.9.3 Reporting of Costs and Funds

11.10 Summary Costs for Surface Water Measures

11.11 Summary Costs for Groundwater Measures

11.12 Proposed Monitoring and Evaluation Plan

11.12.1 Proposed monitoring parameters

11.12.2 Monitoring locations

11.12.3 Monitoring frequencies

11.12.4 Transboundary monitoring program

11.12.5 Investment, operation and maintenance costs

CONCEPT

12 Summary of the Register of Protected Areas in the Seman River Basin

This chapter presents a summary of the register of protected areas as required by Article 6 and Annex IV of the WFD. It identifies the types of protected zones within the basin, including drinking water abstraction areas, economically significant aquatic ecosystems, and areas designated for nature protection or recreation.

Additional background, technical information and data are presented in the Task Reports 2.

12.1 Need and Purpose of a Register of Protected Areas

The Register of Protected Areas is a core requirement for implementing the EU Water Framework Directive (WFD). Under WFD Article 6 and Annex IV, competent authorities must identify all areas within a River Basin that require special protection for surface water, groundwater, or water-dependent habitats and species. The register creates the formal link between river basin management planning and the specific objectives set under other EU water, nature, health and pollution-control legislation.

The register is necessary because protected areas often require objectives that go beyond the general WFD objective of achieving good status. Drinking Water Protected Areas, bathing waters, nutrient-sensitive areas, fisheries areas, and water-dependent nature conservation sites all have specific protection needs. By including these areas in one basin-wide register, the RBMP can clearly identify where stricter standards, targeted monitoring, or additional measures are required.

The register also supports transparent and accountable decision-making. It shows where protected areas are located, which water bodies they overlap with, which legislation applies, and which authority is responsible for protection and management. This enables competent authorities to integrate protected area requirements into monitoring programmes, status assessment, pressure analysis and the Programme of Measures.

For Albania, establishing a Register of Protected Areas is particularly important for aligning river basin management with the EU acquis and for strengthening implementation under Law No. 29/2024 on Water Resources. It helps close current gaps in mapping, monitoring and enforcement, especially for drinking water sources, bathing waters, nutrient-sensitive areas and water-dependent ecosystems. A complete and regularly updated register ensures that protected area objectives are not treated separately from the RBMP, but become an integral part of achieving WFD-compliant water management.

12.2 Register of protected areas of the Seman River Basin

12.2.1 Drinking Water Abstraction Zones

The main drinking water supply in the Seman basin comes from groundwater wells and springs in Fier, Berat, Kuçovë, and surrounding municipalities. According to data from the local water utility, some sources have designated protection perimeters (measured in meters) around the abstraction points. However, in practice, the infrastructure and enforcement to secure these zones is often missing or inadequate. Information on these protection areas is not yet included in a consolidated register, and systematic mapping is lacking. As a result, while some protection measures exist on paper, their effectiveness in safeguarding water sources remains uncertain. Private wells, widely used in rural areas, remain outside the formal system.

Drinking water zones are meant to guarantee clean supply for human consumption, which directly supports the WFD objective of good chemical status. Without reliable mapping, monitoring, and effective protection infrastructure, these sources remain vulnerable to pollution.

12.2.2 Areas for Protection of Economically Significant Aquatic Species

In the Seman River Basin, MARD has established one area of co-management under Decision No. 238, dated 23 April 2014, which declares the Karavasta Lagoon as a co-managed fisheries area (Table 1). This designation takes into consideration the lagoon's protected status as part of the Divjakë-Karavasta National Park, its classification as a specially protected natural area, and its significance as a habitat for waterbirds listed under the Ramsar Convention. This area operates through a local fisheries organisation, under co-management plans that regulate fishing methods, vessel use, and catch limits, with the aim of sustainable exploitation and ecosystem balance, thus contributing to the WFD's ecological objectives. At present, there is no information available regarding limited fishing areas or protected fishing areas in the basin, which highlights the need for improved monitoring, transparency, and reporting to ensure fish stock sustainability.

12.2.3 Recreational (Bathing) Waters

Bathing waters are formally designated each year through a Decision of the Council of Ministers (DCM), which approves the list of permitted beaches and their typologies. Within this basin, Divjake Pirgu, and Seman beach are included as official bathing waters. Despite this legal framework, monitoring remains limited. Albania has not yet established a comprehensive programme fully aligned with the EU Bathing Water Directive, and the impact of urban discharges on coastal water quality has been assessed only for Durrës, Vlorë, and Sarandë, leaving the Drin-Buna coast largely unexamined. According to the 2023 State of the Environment Report, water quality in the basin's coastal areas is under growing pressure. Microbiological monitoring for Intestinal Enterococci (IE) and Escherichia coli (EC), carried out by the Institute of Public Health across 123 national stations, shows a decline in bathing water quality.

At Seman and Darëzezë beaches, bacteriological monitoring in 2023 classified three stations as good quality, one as sufficient, and three as excellent. Compared with 2020–2022, when all stations were consistently rated excellent, these results indicate a clear decline, with fewer sites maintaining top water quality.

At Divjakë Beach, results for 2023 show one station with excellent quality, one good, and one sufficient. This marks a deterioration compared to previous years, when all monitored points were classified as excellent. Overall, the data reveal a downward trend in bathing water quality across the Seman basin's coastal areas.

Overall, the low number of monitoring sites and lack of systematic public reporting means that environmental objectives for safe recreation and protection of public health are not being met. As a result, alignment with the WFD requirement to safeguard water bodies used for human purposes remains incomplete, particularly in areas where tourism and recreation are most significant.

12.2.4 Nutrient-Sensitive Zones

No nitrate vulnerable zones or sensitive wastewater areas have yet been designated in the Seman basin, even though the Water Resources Law provides for them. Monitoring carried out in 2023 at eight stations across the basin shows that, based on nitrites, nitrates, and total phosphorus, the waters are classified as Class I – High Status. When evaluated against orthophosphate concentrations, they fall into Class II – Good Status. This indicates that nutrient pollution is not yet a significant issue at the monitored sites. However, because nutrient-sensitive zones have not been officially declared, the specific preventive measures that normally apply in such areas under EU law-like stricter wastewater treatment requirements or Codes of Good Agricultural Practice for farmers, are not yet in place. This creates a gap between the current good status and long-term protection, since agriculture in the basin could expand or intensify in the future. Designating these zones would therefore be essential for aligning with the WFD's "no deterioration" principle, ensuring that water quality is protected not only under current conditions but also against future risks from agricultural pollution and nutrient enrichment.

12.2.5 Nature Protection Areas (Habitats and Species)

The basin hosts a wide network of nationally and internationally protected areas: national parks (e.g., Divjake Karavasta, Mali i Tomorrit, Prespa, Bredhi i Hotoves-Dangelli), nature reserves (Balloll, Bogove, Lugina e Gjergjevices, Cangonji), protected landscapes (Guri i Nikës-Valamarë-Lenie, Bredhi i Drenovës-Sinicë, Liqeni i Pogradecit), as well as Ramsar wetlands, Emerald sites, Important Bird Areas, and UNESCO World Heritage sites. These sites safeguard wetlands, rivers, lakes, forests, and mountain ecosystems, many of which are directly water-dependent.

They aim to conserve biodiversity and protect habitats and species of European importance, which directly ties to the WFD's objective of good ecological status. Despite the existence of draft management plans for some protected areas, many remain unapproved and lack formal adoption, limiting their effectiveness in guiding conservation efforts. More critically, protected area management plans are not fully integrated into territorial development and river basin management plans, leading to fragmented planning and missed opportunities for sustainable resource management. Weak enforcement further reduces their capacity to address threats effectively.

Table xx - Areas jointly management in Seman River Basin

No.	Water Body/Area	Decision of the Council of Ministers
1	Karavasta lagoon	Decision No. 238, dated 23.04.2014 "On the declaration of the Karavasta Lagoon as a co-managed fisheries area"

Table xx - Overview of protected areas in Albania by management category

No.	National protected area category	Area (ha)	Protected areas (#)	% of country's territory
II	National Park	315,304	13	10.9
III	Nature Monument		738	
IV	Nature Park	222,134	30	7.7
V	Protected landscape	68,454	5	2.3
VI	Protected area with sustainable use of natural resources	18,245	4	0.63
	TOTAL	624,137	790	21.7

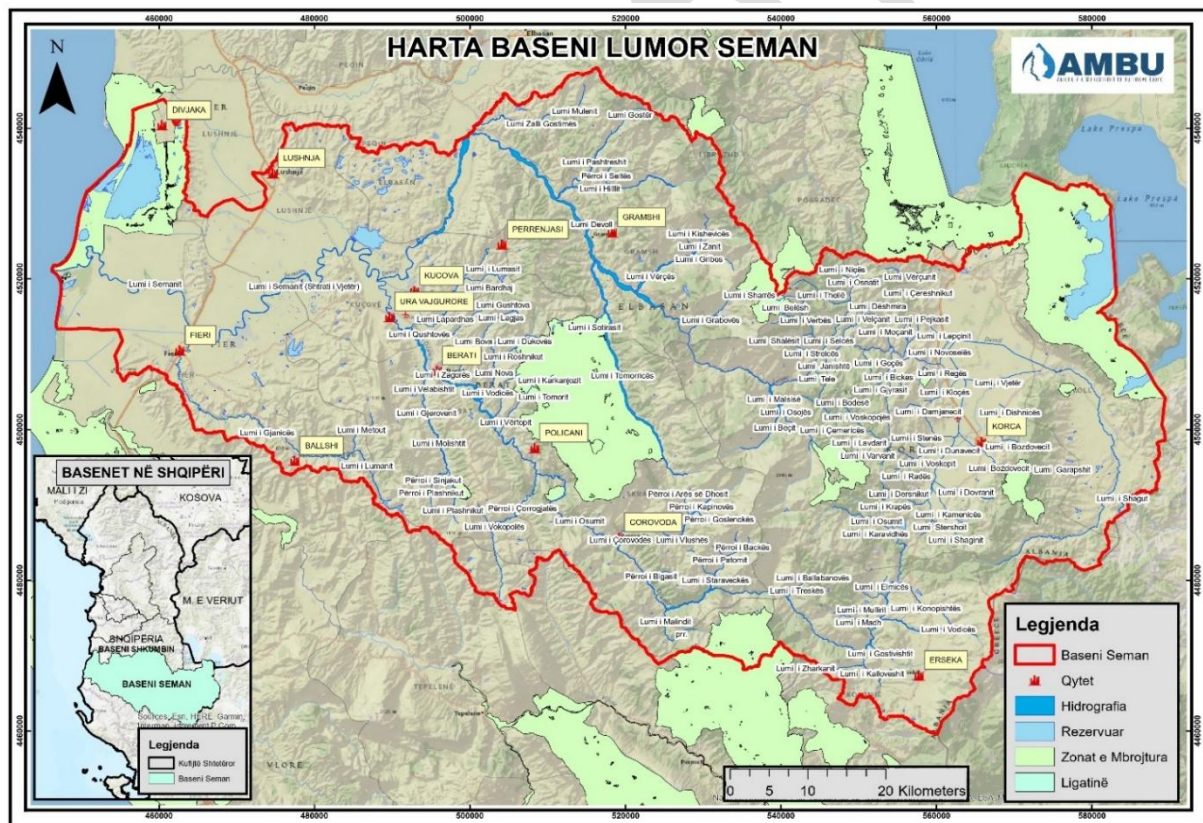
Table xx - Overview of protected areas in Seman River Basin by management category

National protected area category	Name of the PA	DCM No.	Management plan
National Park	Divjake Karavasta	59 date 26.01.2022	Yes
	Mali i Tomorrit	59 date 26.01.2022	In progress
	Prespa	59 date 26.01.2022	No
	Bredhi i Hotoves-Dangelli	59 date 26.01.2022	No
Protected landscape	Guri i Nikës-Valamarë-Lenie	591 date 25.09.2024	No
	Bredhi i Drenovës-Sinicë	594 date 25.09.2024	No
	Liqeni i Pogradecit	597 date 25.09.2024	Yes
Managed Nature Reserve	Balloll	60 date 26.01.2022	No
	Bogove	60 date 26.01.2022	No
	Lugina e Gjergjevices	60 date 26.01.2022	No
	Cangonji	60 date 26.01.2022	No

Table xx - Areas of International Importance in Seman RB

International protection categories	Name
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EMERALD network	• Candidate sites: Karavasta National Park / Parku Kombetar Karavasta¹⁰⁹ • Candidate sites: Tomorri National Park (Parku Kombetar Tomorri)¹¹⁰ • Candidate sites: Prespa National Park (Parku Kombetar i Prespes)¹¹¹ • Candidate sites: Morava
RAMSAR Site –	• Karavasta Lagoon ecosystem¹¹² • Albanian Prespa Lakes¹¹³
Key Biodiversity Areas (KBA) ¹¹⁴	• Karavasta Lagoon • Tomorri mountain • Gjergjevica • Devolli upstream • Guri i Topit - Valamarë • Liqeni i Prespes se Madhe • Osumi Spring • Boboshtica
Important Bird and Biodiversity Area (IBA)	• Karavasta Lagoon¹¹⁵ • Liqeni i Prespes se Madhe (Lake Megali Prespa)¹¹⁶
UNESCO site	• Historic Centres of Berat¹¹⁷



Map xx - Protected areas network, Seman River Basin

¹⁰⁹ <https://natura2000.eea.europa.eu/Emerald/SDF.aspx?site=AL0000016>

¹¹⁰ <https://natura2000.eea.europa.eu/Emerald/SDF.aspx?site=AL0000006>

¹¹¹ <https://natura2000.eea.europa.eu/Emerald/SDF.aspx?site=AL0000003>

¹¹² <https://rsis Ramsar.org/ris/781>

¹¹³ <https://rsis Ramsar.org/ris/2151>

¹¹⁴ <https://www.keybiodiversityareas.org/>

¹¹⁵ <https://datazone.birdlife.org/site/factsheet/karavasta-lagoon>

¹¹⁶ <https://datazone.birdlife.org/site/factsheet/lake-megali-prespa>

¹¹⁷ <https://whc.unesco.org/en/list/569/>

13 Institutional Context and Framework of Legal Acts, Policies and Plans

This chapter provides an overview of the institutional and legal framework governing water management in Albania. It describes the roles and responsibilities of key authorities and stakeholders and summarises the national and basin-level legal acts relevant to water, environment, and land use. The section situates the RBMP within broader policy frameworks, including national strategies for environment, climate, and agriculture, and identifies opportunities for policy coherence and integration. It also highlights how international commitments under the Drin MoU and other transboundary frameworks influence basin governance.

13.1 Introduction

13.2 The Transboundary river basin coordination and cooperation

13.3 Responsible water authorities and key stakeholders in water resources management in Albania

13.4 Overview of relevant legal acts

13.5 Environmental policies at National and River Basin level

13.6 Strategies and Plans at National and River Basin level

13.6.1 Water Resources Management Plan

13.6.2 Flood Risk Management Plan

13.6.3 Drought Risk Management Plan

13.6.4 Coastal Zone Management Plan

13.6.5 Strategic Environmental Assessment

1.3 Institutional and Strategic Context of Water Resources Management in Albania

Despite the above-mentioned challenges, Albania has committed to an integrated water management approach aligned with the European Union's legal and policy framework. Since 2014, the Government of Albania has adopted a vision rooted in the principles of sustainability, equitable access, economic prioritisation, and the long-term protection of ecosystems. The 'Integrated Water Resources Management (IWRM) Strategy 2018–2027' articulates this vision: “By 2027, Albania shall ensure efficient use of water through integrated and operational water resources management, supported by a complete monitoring system and effective management of flood risks and water scarcity. This will be guided by the principles of equity, sustainability, and environmental justice for present and future generations.”

The Albanian Government has also formulated 'The National Sectoral Program for Integrated Water Management 2018-2030', which aims to orient investments towards national objectives, improve the planning process, increase investments in the sector, increase the revenues generated by the sector, continuous and effective monitoring, and protect environmental objectives.

To lead this agenda, the Integrated Policy and Management Group for Integrated Water Management (IPMG-IWM), chaired by the Council of Ministers, a central executive body oversees policy development, implementation, and evaluation. The National Agency for Water Resources Management (AMBU), established in 2018, plays a central role in steering water policy and serves as the NWC's secretariat. The IPMG-IWM operates through two thematic working groups: one on water and wastewater reform (led by the Ministry of Infrastructure and Energy), and the other on water resource management (led by AMBU). This integrated framework is also embedded in the National European Integration Plan (NEIP) 2022–2024, further aligning Albania's water governance with EU accession priorities.

Administration and management structures for water management are provided at national, basin and local level. Figure xx depicts the current relationship between national ministries, basin cooperation and local agencies. Albania is divided into seven river basins, each one having a River Basin Council (RBC). This structure is favourable, in principle, to counteract the current fragmentation of water resources management and promote an effective administration at basin and local level.

CONCEPT

Figure xx - Organizational chart for institutional framework on water resources management in Albania

CONCEPT

1.4 Competent Authorities and Institutional Responsibilities for Water Resources Management in Albania

This paragraph provides an overview of the main institutions responsible for water resources management in Albania, including their mandates related to surface and groundwater, water quality and quantity, organized by national, basin, and local levels. It also outlines the key legal and regulatory framework underpinning their responsibilities.

The relevant institutions at national level involved in IWRM and the RBM process in Albania for all river basins are summarized here:

COMPETENT AUTHORITY (national level)	MAIN ACTIVITIES CONTRIBUTING TO IWRM & RBM	COORDINATION MECHANISMS
Council of Ministers	Serves as the inter-ministerial coordination body guiding policy development through the Integrated Policy and Management Group (IPMG-IWM).	Crosscutting – policy coordination
Agency for Water Resources Management (AMBU / ZABL), under the Ministry of Environment Law 29/2024 “On Water Resources” amended Law 15/2024 MSFD DCM Nr. 335 dated 2025 on “Establishment of AMBU”	- Develops water policy and aligns national legislation with the EU Water Framework Directive (WFD); - Implementation and coordination of the Law on Water Resources; - Implementation and coordination of the EU Water Framework Directive; - Preparation of IWRM Strategy; - Preparation of River Basin Management Plans and respective AP; ; - Preparation of Flood Risk Management Plans; - MSFD by the law - Issuing water use permits and authorization (surface & groundwater); - Holder of the Register of Water Abstractions (in NWRC) mainly surface water; - Secretariat of the NWTC.	- Implementation of RBMP and respective PoM. - Implementation of National IWRM Strategy - Implementation of FRMP - Implementation of MSFD - Maintenance of the register of water resources operators - Upgrading and maintenance of the National Water Resources Cadastre
Ministry of Agriculture and Rural Development (MARD)	- Plans and implements agricultural water use; - Management of the large Irrigation and Drainage (I&D) systems; - Responsible for overall policymaking, investment coordination, and donor engagement in the I&D sector; - It provides guidelines and monitors large-scale rehabilitation efforts; - It oversees the performance of Water Drainage Boards (WBDs).	...

Ministry of Infrastructure and Energy (MIE)	- Leads infrastructure development for water supply and sanitation, energy production; - Coordinates reforms in the water services sector.	...
Ministry of Environment (MoE)	- Develops water policy and aligns national legislation with the EU Water Framework Directive (WFD); - Oversees environmental standards and permitting; - Responsible for monitoring of environmental condition in permitted environmental permits.	...
Regional Water Drainage Boards Law Nr. 24/2017 on "Irrigation and drainage" DCM Nr. 437 dated 17.5.2017 on "Establishment of 4 regional directorates for irrigation and drainage"	- Reforms in December 2015 consolidated 13 previous irrigation and drainage boards into four Regional Drainage Boards, each covering major agricultural lowland areas: Lezhë, Durrës, Fier and Korçë. - Management, Operation and Maintenance (MOM) of main irrigation and drainage canals, pumping stations and flood protection infrastructure; - Flood risk management in lowland agricultural zones; - Technical support to municipalities on water infrastructure; - Emergency response in case of flooding or excessive rainfall; - Planning rehabilitation interventions in irrigation, drainage and flood protection infrastructure; - Monitoring and reporting on the functional status of the drainage network.	Uploading required data to the NWRC, necessary for AMBU in preparation of RBMP
National Environmental Agency (NEA) Law Nr. 10431 dated 9.6.2011 on "Environmental Protection" DCM Nr. 568 date 17.7.2019 on "Establishment of NEA"	- National Environmental Monitoring of River Waterbodies - National Environmental Monitoring of Lake Waterbodies - National Environmental Monitoring of Coastal Waterbodies - Environmental Permits (related to the water discharge), issued for all industrial activities in the country - EIAs and SEA assessed regularly	- Publication of the National Environmental Monitoring Programme (yearly exercise) - Maintenance of Register of Environmental Permits - Maintenance of the Register of Pollutant release and discharges

Department of Climate and Environment, Institute of GeoSciences, (IGEO) Law Nr. 8485 dated 12.5.1999 on "Code of administrative procedures" DCM Nr. 490 dated 6.7.2011 on "Establishment of IGJEUM / IGEWE (merging previous existing different institutions).	• Data collection, verification and distribution of meteorological data (precipitation monitoring) • Data collection, verification and distribution of hydrological data (flow monitoring)	• Publication of Climate Monthly Bulletin via website • Uploading required data to the NWRC, necessary for AMBU in preparation of RBMP
National Agency for Protected Areas Law Nr. 81/2017 on "Protected areas" DCM Nr. 102 dated 4.2.2015 on "Establishment of national agency for protected areas", as amended in 2016.	• Management of Protected Areas • Implementation of the EU Birds and Habitats Directives. • Approve EIA and SEIA, including those the water use	• Publication of management plans for protected areas, all types • Maintenance of register for protected areas – GIS based • Maintenance of the national Inventory of flora and fauna • Uploading required data to the NWRC, necessary for AMBU in preparation of RBMP
National Coastline Agency (NCA) Law Nr. 93/2015 on "Tourism" DCM Nr. 569 dated 17.7.2019 on "Establishment of national coastline agency"	• Protection and development of sustainable environment in coast • Monitoring and control of illegal touristic-based activities in coast (beaches)	• Maintenance of national inventory of coastline • Monitoring implementation of territorial planning instruments
National Territorial Planning Agency Law Nr. 107/2014 on "Territorial development and planning". DCM Nr. 427 dated 8.6.2016 on "Establishment of national agency for territorial planning"	• Preparation of territorial management plans in a coordinated manner – through local governments • Preparation of integrated plans thematic-wise (including infrastructure, floods, water, agriculture, urban development, etc), considering RBMP	• Publication of National Development Plan • Coordinate preparation of local governments territorial management plans • Publication of Integrated Cross-Sectorial Coastline Plan – GIS based (https://geoportal.asig.gov.al/map/?fc_name=Bregdeti_5_Sistemi_ujor&auto=true)

		• Publication of Integrated Cross-Sectorial Coastline Plan for Tirana-Durres Region – GIS based (including Tirana, Durrësi, Kamza, Vora, Shijaku and Kruja municipalities). • Maintenance of an Integrated Planning Database.
Albanian Geological Survey (AGS) Law Nr. 111/2015 dated 15.10.2015 on "Albanian geological survey"	• Study and monitoring of groundwater, aquifers, geological layers, hydrogeology. • Hydrogeology study of the rivers including geology of river bed.	• Publication of reports on groundwater quality • Maintenance of database – GIS based – on geology, hydrogeology and groundwater aquifers. • Uploading required data to the NWRC, necessary for AMBU in preparation of RBMP. • Member of EuroGeoSurveys, since 2007
National Agency for Nature Resources (NANR/AKBN) Law Nr. 7/2017 on "Use of renewable resources" DCM Nr. 547 dated 9.8.2006 on "Establishment of AKBN) as amended in 2017	• Maintenance of database – national – on Energy sector use / capacity • Monitoring and inspection of energy sector + fuels, oils, and all other natural resources • Preparation of national action plan on use of renewable resources for energy production – every 2 years • Approval of Hydropower plants design and monitoring • Analysis of minerals	• Publication of Bulletin on hydropower potential / investments in the country • Maintenance of GIS based system on energy • Uploading required data to the NWRC, necessary for AMBU in preparation of RBMP.
National Agency for Water Supply, Sewerage (AKUK) Law Nr. 8102, dated 28.3.1996 on "water supply and sewerage", as amended by law nr. 9915 dated 2008. (the new draft law is prepared – not yet adopted). DCM Nr. 431 dated 11.7.2018 "on establishment of AKUM"	• Implementation of policy and strategy on water supply and sewerage (Master plan for WSS and Waste) • Wastewater treatment • Planning infrastructure for waste • Planning investment needs for water supply / wastewater and waste management considering RBMP	• Maintenance of national GIS platform on water supply and sewerage assets • Publication of reports / statistics on performance of water utilities • Uploading required data to the NWRC, necessary for AMBU in preparation of RBMP
National Forestry Agency (NFA) Law Nr. 90/2012 on "Public administration" DCM Nr. 570 dated 17.7.2019 on "Establishment of NFA"	• Prepare inventory of forestry • Preparation of GIS based maps • Implementation of yearly monitoring programme for forestry, biodiversity, habitats, etc. • Monitoring / control / inspection	• Maintenance of integrated system on forestry (register, database, GIS system) • Publication of reports on status of forestry and other data / information related

National Agency for Civil Protection (former General Directorate for Civil Emergencies) Law Nr. 45/2019 dated 18.7.2019 on "Civil Protection"	- Preparation of national strategy for remediation of risk from disasters - Preparation of national plan for civil emergencies, considering respective RBMP. - Interventions in infrastructure in the damaged areas	- Maintenance of database of information on losses and damages - Establishment of the Fund for Solidarity
State Authority for Geo-Spatial Information (ASIG) Law Nr. 72/2012 dated 28.6.2012 on "organisation and functioning of the state infrastructure for geo-space information"	- Implementation of INSPIRE Directive requirements - Preparation of National Standards for geo-Spatial information - Preparation of all thematic-wise maps, at GIS system	- Publication of all typology / sector maps at local/region/country level - Maintenance of National GIS system for all types of information - Maintenance of the National Geo-Portal (website) with information thematic-wise and available for public
Institute of Public Health Law Nr. Nr.10 138, dated 11.5.2009 on "public health"	- Quality assessment of drinking water (analysis of surface water, groundwater and water treatment facilities) - Monitoring drinking water quality - Data analysis	- Publication of reports on health issues / status - Publication of health medical Journal - Publication of Bulletin of Health via website. Uploading required data to the NWRC, necessary for AMBU in preparation of RBMP,
National Agency for Waste Economy DCM No. 132, date 06.03.2024	Integrated waste planning, territorial planning of waste infrastructure, environmental education, prepare waste management plans, investments on treatment facilities, etc. considering RBMP.	...

The relevant institutions at basin level involved in IWRM and the RBM process in Albania for all river basins are summarized here:

COMPETENT AUTHORITY (basin level)	MAIN ACTIVITIES CONTRIBUTING TO IWRM & RBM	MEMBERS
The River Basin Council (RBC) is the key governance body responsible for ensuring sustainable water resource management within Albania's river basins. Operating under national legislation and EU Water Framework Directive (WFD) principles, RBCs apply Integrated Water Resources Management (IWRM) through	Water resources management and protection: - Ensure the conservation and sustainable use of water resources within the river basin, aligning with the River Basin Management Plan (RBMP). - Facilitate the fair allocation of water resources, balancing various uses while promoting efficiency and sustainability. - Safeguard water resources against pollution, over-extraction, and degradation.	Chaired by the Prefecture of the main region, RBCs include representatives from: - Municipalities (local governments); - Regional Environmental Agencies; - Water Supply & Sanitation Utilities; - Agricultural & Industrial Stakeholders; - Civil Society Organizations (CSOs) & Academia; - Hydropower Operators (where applicable).

the River Basin Management Plan (RBMP). The members of the Seman River Basin Council are listed in Annex A.	Regulation and decision-making: - Referring to the technical report prepared by AMBU, grant or deny authorizations and permits for activities impacting water resources, ensuring compliance with legal and environmental sustainability requirements. Monitoring, implementation, and strategic planning presented by AMBU/ZABU: - Review and approve annual implementation reports for RBMPs and Flood Risk Management Plans. - Endorse action plans for the upcoming year, ensuring alignment with national and EU water management priorities.	
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The relevant institutions at local level involved in IWRM and the RBM process in Albania for all river basins are summarized here:

COMPETENT AUTHORITY (local level)	MAIN ACTIVITIES CONTRIBUTING TO IWRM & RBM	COORDINATION MECHANISMS
Municipalities	Since the 2015 administrative reform, municipalities are legally responsible for the operation and maintenance of primary and secondary irrigation and drainage systems within their authority.	...
Public Utilities (Water and Sewerage Enterprises)	Operate and maintain municipal water supply and wastewater systems.	...
Water Users Associations (WUAs)	These used to be farmer-based organisations managing the tertiary irrigation network and water distribution at the farm level. They also should collect water fees and conduct minor maintenance works. Unfortunately, the functioning of the WUA's has collapsed in Albania. Only in Berat, a WUA is still in function. Farmers tend to operate as individual entrepreneurs and do not wish to go back to the collective farming practices of the communist era.	

The institutional roles and responsibilities are grounded in the following legal instruments:

- New Law on Water 2024.
- DCM 345, date 22.05.2019, "For Approval of National Strategy for Irrigation and Drainage and Action Plan 2019-2031".
- The National Sectoral Program for Integrated Water Management 2018-2030".

- Law No. 111/2012 “On Integrated Water Resources Management” (primary water law aligned with EU WFD).(revised 2018).
- Decision of Council of Ministers No. 267 dated 7.4.2021: Establishes the roles of AMBU and river basin agencies.
- DCM No 246, date 30.04.2014, “For the determination of environmental quality standards for surface waters”.
- Law No. 10431/2011 “On Environmental Protection”, amended.
- Law No. 8102/1996 “On Water Supply and Sanitation Sector Regulation”.
- National Water Strategy 2018–2027 and accompanying implementation plans.
- National European Integration Plan 2022–2024 (NEIP), integrating water policy under EU approximation.

The irrigation and drainage sector in Albania is governed by a decentralised and multi-level institutional framework. Key actors include:

- Ministry of Agriculture and Rural Development (MARD): Responsible for overall policymaking, investment coordination, and donor engagement. It provides guidelines and monitors large-scale rehabilitation efforts, and it oversees the performance of Water Drainage Boards.
- Water Resources Management Agency (AMBU): Oversees basin-level water resource management, licensing, and water allocation across competing uses. It also contributes to integrated planning efforts.
- Municipalities: Since the 2015 administrative reform, municipalities are legally responsible for the operation and maintenance of primary and secondary irrigation and drainage systems within their authority. However, their technical and financial capacity is often limited.
- Water Drainage Boards (WDBs): Reforms in December 2015 consolidated 13 previous irrigation and drainage boards into four Regional Drainage Boards, each covering major agricultural lowland areas: Lezhë, Durrës, Fier and Korçë. These are regional public bodies tasked with managing large-scale drainage infrastructure and some primary irrigation canals, especially in agriculturally important lowland areas like Fier and Vlora. The WDB of Fier, for example, plays a key role in maintaining the functionality of the vast drainage and irrigation network in the Myzeqe plain, one of Albania’s most productive agricultural areas. Their responsibilities include:
 - Operation and maintenance of main drainage canals, , pumping stations and flood protection infrastructure;
 - Flood risk management in lowland agricultural zones;
 - Technical support to municipalities on water infrastructure;
 - Emergency response in case of flooding or excessive rainfall;
 - Monitoring and reporting on the functional status of the drainage network.
- Water Users Associations (WUAs): These used to be farmer-based organisations managing the tertiary irrigation network and water distribution at the farm level. They also should collect water fees and conduct minor maintenance works. Unfortunately, the functioning of the WUA’s has collapsed in Albania. Only in Berat, a WUA is still in function. Farmers tend to operate as individual entrepreneurs and do not wish to go back to the collective farming practices of the communist era.

Although responsibilities are assigned, coordination among these institutions, particularly between MARD, WDBs and municipalities, remains a key challenge. Fragmentation in responsibilities, overlapping mandates, and lack of shared planning tools reduce overall system efficiency.

1.5 River Basin Council and proposed strategic actions for improved governance

1.5.1 Background

The River Basin Council (RBC) is the key governance body responsible for ensuring sustainable water resource management within Albania's river basins. Operating under national legislation and EU Water Framework Directive (WFD) principles, RBCs apply Integrated Water Resources Management (IWRM) through the River Basin Management Plan (RBMP).

Chaired by the Prefecture of the main region, RBCs include representatives from:

- Municipalities (local governments);
- Regional Environmental Agencies;
- Water Supply & Sanitation Utilities;
- Agricultural & Industrial Stakeholders;
- Civil Society Organizations (CSOs) & Academia;
- Hydropower Operators (where applicable).

Despite their mandate, RBCs face structural, procedural, and engagement challenges, limiting their effectiveness. This paragraph outlines a strategic approach to strengthen RBCs as dynamic, decision-making bodies that ensure sustainable, equitable, and climate-resilient water governance.

Key responsibilities:

Water resources management and protection

- Ensure the conservation and sustainable use of water resources within the river basin, aligning with the River Basin Management Plan (RBMP).
- Facilitate the fair allocation of water resources, balancing various uses while promoting efficiency and sustainability.
- Safeguard water resources against pollution, over-extraction, and degradation.

Regulation and decision-making

- Referring to the technical report prepared by AMBU, grant or denies authorizations and permits for activities impacting water resources, ensuring compliance with legal and environmental sustainability requirements.

Monitoring, implementation, and strategic planning presented by AMBU/ZABU

- Review and approve annual implementation reports for RBMPs and Flood Risk Management Plans.
- Review and approve water use and authorisation tariffs prepared by AMBU, based on quantity and water use sector.
- Endorse action plans for the upcoming year, ensuring alignment with national and EU water management priorities.

1.5.2 Current challenges & systemic gaps

Despite their institutional significance, RBCs face several operational challenges related to several root causes that must be addressed to avoid the impacts:

Challenge	Root Cause	Impact
Irregular participation	Lack of incentives, weak accountability	Delayed decisions, reduced legitimacy
Outdated regulatory framework	Slow legal reforms, bureaucratic inertia	Misalignment with EU WFD & 2024 national laws
Limited engagement in meetings	No acknowledgment of document circulated, no pre-meeting briefings	Superficial discussions, reactive (not strategic) decisions
Narrow focus on permits	Lack of clear strategic agenda	Missed opportunities for integrated water management
Unenforced participation fees	Budget constraints, administrative neglect	Low motivation among members
Weak inter-institutional coordination	Fragmented governance, lack of formal collaboration mechanisms	Fragmented RBMP implementation

1.5.3 Strategic actions for enhancing RBC's role

The strategic reinforcement of RBCs is essential to ensure effective river basin governance in Albania. By clarifying roles, improving operational procedures, and enhancing inter-agency cooperation, RBCs can contribute significantly to sustainable water resource management, aligning with both national priorities and EU WFD principles.

Beyond basic regulatory functions mentioned before, RBCs should evolve into proactive, data-driven governance bodies with the following adding detailed responsibilities:

A. Water resources management & protection

- Ensure sustainable water allocation among competing uses (agriculture, industry, drinking water, ecosystems).
- Implement drought & flood risk management strategies based on climate adaptation plans, in cooperation with the National Agency of Civil Protection.
- Enforce pollution control/monitoring measures, including wastewater discharge permits and industrial compliance.
- Promote nature-based solutions (NbS) for water retention, erosion control, and biodiversity protection.

B. Regulation & decision-making

- Digitize permitting processes (e.g., online water use applications tracked via a centralized platform).
- Introduce a "Water Use Impact Assessment" (WUIA) for major projects (hydropower, irrigation, mining).
- Introduce and enforce "polluter pay principle" in respective River Basin.
- Develop enforcement mechanisms against illegal water extraction and pollution, in cooperation with the State Inspectorate.
- Invite representative from main water use sectors within the River Basin in their regular meeting.

C. Monitoring, reporting & strategic planning

- Support real-time water monitoring systems for quality & quantity tracking.
- Publish annual RBMP progress reports with public access for transparency.
- Develop 5-year adaptive specific plans to adjust to climate change and socio-economic shifts.

D. Stakeholder engagement & conflict resolution

- Establish a "Water User Forum" for direct dialogue between communities, businesses, and authorities.
- Introduce facilitation mechanisms for water-related disputes (e.g., between farmers and hydropower operators).

To strengthen the effectiveness of RBCs and align them with EU Water Framework Directive (WFD) principles, the following strategic actions are proposed:

A. Legal & Institutional reform

- Update RBC bylaws (2025 revision) to align with EU WFD & national 2024 water laws.
- Clarify RBC's binding vs. advisory authority (e.g., veto power on harmful projects).
- Introduce a "Compliance Scorecard" to track member participation & decision implementation.

B. Strengthened leadership & coordination

- Define the Prefecture's role in enforcing RBC decisions (e.g., penalties for non-compliance).
- Formalize RBC-ZABU-AMBU collaboration via a Joint Technical Secretariat for data sharing.
- Enhance coordination between RBCs and national water governance institutions.

C. Operational efficiency & digital transformation

- Enhance the role of the Secretariat;
- Mandate pre-meeting technical briefings (72-hour document circulation rule).
- Develop an easy RBC digital portal/platform for:
 - Real-time water data dashboards;
 - Public consultation forums;
 - Introduce e-voting for faster decision-making and improve member engagement.
- Initiate the process for representative-based membership system to enhance efficiency.
- Assess the need for reducing the number of institutional representatives.
- Introduce "territorial" and/or "sectoral" structured meetings.

D. Simplify administrative procedures for water use applications

- Develop user-friendly templates and streamlined documentation processes.
- Establishing the most efficient and realistic communication in the exchange of information and necessary data between central institutions dealing with water quantity and quality.
- Reduce bureaucratic burdens to facilitate efficient decision-making.

E. Enhanced stakeholder engagement

- Rotating private-sector seats (e.g., hydropower, agribusiness, bottling industry, etc.) for high-impact discussions.
- Strengthen stakeholder engagement through training and awareness initiatives.
- Provide technical capacity-building to improve decision-making processes.
- CSO & youth representation to ensure inclusive governance.
- Bi-annual "River Basin Summit" for multi-stakeholder strategy alignment.

F. Financial sustainability & incentives

- Enforce member remuneration (participation fees + travel allowances).
- Work for creating an RBC Operational Fund (water permit fees, donor support) as part of the advocacy for receiving a share of income generated from water fees.
- Performance-based incentives for active members (e.g., training opportunities, field visit abroad, participation in international for a, etc.).

G. Capacity building & technical Support

- Annual RBC training programs (IWRM, climate adaptation, EU compliance).
- Peer-exchange programs with EU river basin organizations (e.g., Danube Commission).

- Technical support units for municipalities with limited expertise.

H. Climate resilience & innovation

- Ensure environmental concerns, including biodiversity conservation and pollution mitigation, are regularly addressed.
- Promote green approach (wetland restoration, rainwater harvesting).
- Pilot "Water Stewardship Programs" with industries for sustainable usage.

1.5.4 Expected outcomes

By 2028, RBCs should transition from permit-approval bodies to proactive water governance institutions, ensuring:

- Improved water security (sustainable allocation, pollution reduction).
- Stronger compliance with EU WFD (meeting at the end of 2027 RBMP targets).
- Increased stakeholder trust (transparent, participatory processes).
- Environmental protection and climate-adaptive management (resilience to droughts & floods).

14 Conclusions and Recommendations

The final chapter summarises the main findings, lessons learned, and strategic recommendations arising from RBMP preparation. It reflects on the progress made in implementing EU WFD principles in Albania and identifies the key priorities for the next planning cycle. The section highlights the importance of strengthening data quality, institutional coordination, financing mechanisms, and stakeholder engagement. It concludes with recommendations to ensure that the Seman River Basin continues advancing toward sustainable, integrated, and resilient water management.

14.1 IWRM at river basin level: lessons learned from implementing the EU WFD in Europe

14.2 Recommendations and way forward

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