IMPLEMENTATION OF THE STRATEGIC ACTION PROGRAMME (SAP) OF THE DINARIC KARST AQUIFER SYSTEM: IMPROVING GROUNDWATER GOVERNANCE AND SUSTAINABILITY OF RELATED ECOSYSTEMS

OUTPUT 2

BILATERAL GROUNDWATER GOVERNANCE DIAGNOSTIC ANALYSIS TBA CEMI/CIJEVNA

JANUARY 2026

Content

References

Council of Ministers of Albania. (2021). *National Waste Management Strategy 2021–2027*. Tirana, Albania.

Dević, N. (2025). *Study on the Status, Protection and Valorization of Groundwater Resources of the Zeta Plain*. Geological Survey of Montenegro, Podgorica, Montenegro.

EEA – European Environment Agency. (2020). *Persistent Organic Pollutants in Europe: Environmental Risks and Management*. Copenhagen.

Environmental Protection Agency of Montenegro (EPA). (2024). *Information on the State of the Environment in Montenegro 2024*. Podgorica.

EPTISA Southeast Europe d.o.o. (Consortium leader). (2025). *Flood Risk Management Plan for the Adriatic River Basin*. Project: Support to Implementation and Monitoring of Water Management, Montenegro. Client: Capital Projects Administration of Montenegro.

EPTISA Southeast Europe d.o.o. (Consortium leader). (2025). *Flood Risk Management Plan for the Danube River Basin*. Project: Support to Implementation and Monitoring of Water Management, Montenegro. Client: Capital Projects Administration of Montenegro.

European Commission. (2023). *Albania Environmental Performance Review*. Brussels.

European Commission. (2023). *Albania: Environmental Monitoring and Assessments*. Brussels.

European Commission. (2023). *Water Resilience and Groundwater Vulnerability in Karst and Alluvial Systems*. Brussels.

FAO, UNESCO-IHP, IAH, World Bank Group & GEF. (2016). *Global Framework for Action to Achieve the Vision on Groundwater Governance*. Rome/Paris/Washington D.C.

GEF IW: LEARN. (2015). *Transboundary Diagnostic Analysis and Strategic Action Programme Development: A Manual for Practitioners*.

INSTAT – Institute of Statistics of Albania. (2023). *Environmental Statistics of Albania*. Tirana.

INSTAT – Institute of Statistics of Albania. (2023). *Sustainable Development Goals: SDG Indicator 6.3.1 – Proportion of Wastewater Safely Treated*. Tirana.

Ministry of Agriculture and Forestry and Water Management of Montenegro. (2021). *Water Management Plan for the Adriatic River Basin District*. Government of Montenegro.

Ministry of Agriculture and Forestry and Water Management of Montenegro. (2021). *Water Management Plan for the Danube River Basin District*. Government of Montenegro.

Ministry of Agriculture and Rural Development. (2017). *Water Management Strategy of Montenegro*. Podgorica.

Ministry of Agriculture and Rural Development. (2023). *Agricultural Water Use and Irrigation in Northern Albania*. Tirana.

Ministry of Ecology, Spatial Planning and Urbanism of Montenegro. (2020). *National Wastewater Management Plan of Montenegro (2020–2035)*. Podgorica.

Ministry of Infrastructure and Energy of Albania. (2022). *Water Resources Management Plan – Albania*. Tirana.

Ministry of Tourism and Environment of Albania. (2021). *Annual Report on Environmental Protection*. Tirana.

Ministry of Tourism, Ecology, Sustainable Development and Northern Development of Montenegro. (2024). *National Waste Management Plan 2024–2028*. Podgorica.

MONSTAT – Statistical Office of Montenegro. (2011). *Census of Population, Households and Dwellings in Montenegro: First Results*. Podgorica.

MONSTAT – Statistical Office of Montenegro. (2023). *Census of Population, Households and Dwellings 2023*. Podgorica.

Municipality of Tuzi. (2023). *Local Environmental Action Plan of the Municipality of Tuzi 2024–2027*. Tuzi.

Municipality of Zeta. (2024). *Local Environmental Protection Plan of the Municipality of Zeta 2024–2028*. Official Gazette of Montenegro – Municipal Regulations 28/2025.

UNDP Montenegro. (2023). *Management of PCBs in Montenegro*. Podgorica. Available at: https://www.undp.org/cnr/montenegro/projects/upravljanje-pcb-om

UNEP – United Nations Environment Programme. (2016). *Guidelines for the Environmentally Sound Management of PCBs*.

UNEP – United Nations Environment Programme. (2016). *Stockholm Convention on Persistent Organic Pollutants: Polychlorinated Biphenyls (PCBs) Guidance*.

WHO – World Health Organization. (2017). *Polychlorinated Biphenyls (PCBs) in Drinking-water*.

World Bank. (2022). *Albania Climate Risk Assessment: Impacts on Water Resources and Agriculture*. Washington, D.C.

World Bank. (2022). *Water Supply and Sanitation Sector Review: Albania*. Washington, D.C.

LIST OF TABLES

LIST OF ANNEXES

ACRONYMS

AGS- Albania Geologic Service

BGGDA - Bilateral Groundwater Governance Diagnostic Analysis

CWRB - Council of Water River Basin

EPA - Environmental Protection Agency

GGDA - Groundwater Governance Diagnostic Analysis

GSM – Geological survey of Montenegro

GWD - Groundwater Directive

GWDE - groundwater-dependent ecosystems

IHMS - Institute of Hydrometeorology and Seismology

MAFWM - Ministry of Agriculture, Forestry and Water Management

NAP - National Action Programs

NAWSW/AKUK - National Agency of Water Supply and Waste

NCTW - National Council of Territory and Water

NGO- Non-Governmental Organization

NWTC - National Water and Territory Council

REGAGEN - Energy and Regulated Utilities Agency

RB - River Basin

RBMP – River Basin Management plan

SAP - Strategic Action Programme

SDG - Sustainable Development Goal

SPZ - Sanitary Protection Zones

TBA - Transboundary Area

TDA - Transboundary Diagnostic Analysis

WRMA / AMBU - Water Resources Management Agency

WD - Water Directorate

WFD - Water Framework Directive

WAO - Water Administration Office

PREPARED BY DIKTAS II PROJECT TEAM

Neda Dević, National Expert for Legal policy, Montenegro

Halit Kamberi, National Expert for Legal policy, Albania

Nevila Koçollari Furxhiu, National Expert for Sociology, Albania

Romario Zoga, International expert for Stakeholder Involvement

Lidija Brnović, National Expert for Gender, Montenegro

Irena Topalli, National Expert for Gender, Albania

SUPPORT

Zoran Nakić, National Expert for Legal policy, Croatia

1. Introduction

1.1. Purpose and scope of the Bilateral GGDA for TBA Cemi/Cijevna

The Bilateral Groundwater Governance Diagnostic Analysis (BGGDA) for the Cemi/Cijevna Transboundary Area (TBA) aims to deliver a harmonized, evidence-based assessment of groundwater governance across the Albanian and Montenegrin components of this shared transboundary system. Its overarching objective is to identify critical governance gaps, strategic opportunities, and priority policy and management interventions that can strengthen the sustainable and coordinated management of the TBA in line with relevant regional frameworks and international best practices.

This analysis builds upon the foundational work of the DIKTAS I project, including the Transboundary Diagnostic Analysis (TDA) and the Strategic Action Programme (SAP), and is implemented under DIKTAS II to advance institutional cooperation and policy alignment. It applies the methodological principles of the Global Framework for Action to Achieve the Vision on Groundwater Governance, developed under the GEF/FAO initiative, ensuring consistency with globally recognized best practices.

The scope of the BGGDA encompasses three core dimensions of groundwater governance:

- Legal and regulatory frameworks, including compliance with EU Water Framework Directive and Groundwater Directive provisions;
- Policy and planning instruments, with emphasis on integration across sectors such as water, agriculture, energy, and spatial development;
- Socio-economic drivers and indicators, addressing pressures from tourism, agriculture, and infrastructure development in the Dinaric karst region.

The analysis will systematically review institutional arrangements, enforcement capacities, and data-sharing mechanisms, highlighting disparities and opportunities for harmonization between the two countries. It will also consider the socio-economic reliance on groundwater for drinking water supply, energy production, and biodiversity conservation.

By providing a comparative diagnostic, the BGGDA aims to establish a common understanding of governance challenges and to propose actionable recommendations for bilateral cooperation. These recommendations will serve as a basis for the future joint action program, monitoring programs, and capacity-building initiatives, contributing to the long-term resilience of the TBA Cemi/Cijevna under changing climatic and socio-economic conditions.

1.2 Methodological Approach and Alignment with DIKTAS II Framework

The Bilateral Groundwater Governance Diagnostic Analysis (BGGDA) for the Cemi/Cijevna Transboundary Aquifer (TBA) applies a structured and comparative methodology grounded in internationally recognized principles of groundwater governance. It follows the *Global Framework for Action to Achieve the Vision on Groundwater Governance*, ensuring alignment with global best practices and the objectives of DIKTAS II. The approach builds upon the outputs of DIKTAS I, in particular the Transboundary Diagnostic Analysis (TDA) and Strategic Action Programme (SAP), and integrates lessons learned from national governance diagnostic assessments conducted in Albania and Montenegro.

The methodology is based on a stepwise diagnostic process, beginning with a systematic stocktaking of legal, policy, and institutional frameworks, followed by the identification of gaps, opportunities, and

priority measures for harmonization. It applies a three-dimensional governance framework encompassing legal and regulatory instruments, policy and planning mechanisms, and socio-economic drivers, while addressing cross-cutting issues such as enforcement capacity, stakeholder engagement, and gender mainstreaming. Comparative analysis constitutes a core element of the approach, enabling the identification of governance asymmetries and areas of convergence between the two countries.

Alignment with DIKTAS II is ensured through direct linkage to Component 2 (Institutional Strengthening for Improved Groundwater Governance), particularly Output 2.1 on governance diagnostics across all project countries and Output 2.2 on the harmonization of legal and policy instruments. The BGGDA also contributes to Component 1 (Facilitating Multi-country Cooperation) by providing an evidence base to support bilateral agreements and joint management mechanisms. Methodological tools include governance indicator frameworks and participatory processes involving relevant national institutions and stakeholders.

The analysis adopts an adaptive management approach, allowing flexibility to incorporate available data, stakeholder inputs, and evolving policy contexts during implementation. It ensures coherence with the requirements of the EU Water Framework Directive (WFD) and the Groundwater Directive (GWD), while respecting national legal systems and existing bilateral arrangements. Overall, the methodological design aims to deliver actionable recommendations that are scientifically sound, institutionally feasible, and aligned with the long-term objective of sustainable and equitable management of the Cemi/Cijevna TBA under DIKTAS II.

1.3. Overview of the TBA Cemi/Cijevna: Hydrogeological, Geographical and Environmenral Context

On the north-western slopes of the Prokletije Mountains, also known as the Albanian Alps, the Cemi/Cijevna River is formed. It flows through a highly karstified area composed of Jurassic and Cretaceous limestones, following a northeast–southwest direction. Near Dinoša, the Cijevna River enters the extensive Zeta Plain, which is built of fluvioglacial sediments, where it has incised an impressive riverbed with almost vertical sides, before flowing into the Morača River.

The karst aquifer developed in the limestone formations is primarily recharged by atmospheric precipitation. During the summer period, part of the Cijevna River's flow within Montenegro sinks underground and contributes to the recharge of the confined aquifer of the Zeta Plain, while another part feeds springs located along the eastern margin of the plain (Ribnička Springs, Dinoša, Urelja, the Krvenica cave, Vitoja, etc.). This Plain provides additional water resources for the supply of three municipalities: Podgorica, Tuzi, and Golubovci.

In the upper reaches of the river, on the territories of Albania and Montenegro, the landscape is predominantly mountainous, with sparsely and irregularly distributed settlements and a relatively low population density. The Cemi/Cijevna River is a typical alpine river, and its location within a largely preserved and unaltered natural environment has contributed to a significant increase in visitor numbers in recent years, further stimulated by improvements in infrastructure. Its catchment area is formed in the mountainous regions of Albania and Montenegro, within a classic Dinaric karst terrain, which implies sensitive and highly specific ecosystems. The river is characterized by high biodiversity, and according to environmental organizations, it has been proposed that, due to its outstanding natural values, it be included among watercourses requiring protection within international nature conservation networks.

All of the above makes the Cemi/Cijevna River a natural asset of multiple importance - as a source of water, as an ecological habitat, and as a tourism and economic resource (tourism, ecotourism, fisheries, agriculture, etc.).

The hydrogeological and biodiversity characteristics indicate a high degree of sensitivity and complexity of the transboundary Cemi/Cijevna aquifer, confirming its exceptional importance for regional water resources management. At the same time, these characteristics clearly highlight the need to establish coordinated, joint monitoring and protection systems between Albania and Montenegro.

1.4 Structure of the Bilateral GGDA

The Bilateral Groundwater Governance Diagnostic Analysis (BGGDA) for the Cemi/Cijevna Transboundary Aquifer (TBA) is structured into eight chapters, systematically addressing the key dimensions of groundwater governance. Following the introductory chapter, which defines the objectives, scope, and methodology, the analysis begins with a review of the legal framework, including a comparative assessment of national legislation in both countries, relevant EU directives, and existing bilateral agreements, with the aim of identifying gaps and opportunities for harmonization.

Subsequent chapters examine policy and planning instruments, including national water strategies, river basin management plans, and relevant sectoral policies, with particular attention to alignment with EU requirements and cross-sectoral coordination. This is followed by an assessment of socio-economic drivers, resource pressures, and environmental risks, as well as a dedicated chapter on institutional arrangements, capacities, and mechanisms for transboundary cooperation between Albania and Montenegro.

Building on these analyses, the report formulates recommendations to strengthen legislation, policy frameworks, monitoring systems, and overall system resilience, supported by a set of governance indicators aligned with the objectives of DIKTAS II. The concluding chapter synthesizes the key findings, identifies priority actions, and outlines a roadmap for enhanced future cooperation, while the annexes provide supporting references and methodological documentation.

This structure ensures a logical progression from analysis to actionable recommendations and provides a practical framework for strengthening groundwater governance in the Cemi/Cijevna TBA.

2. Legal Framework Analysis – TBA Cemi/Cijevna

2.1 EU Directives and Bilateral Agreement Relevant to TBA Cemi/Cijevna

Albania and Montenegro have adopted a legal framework that largely aligns national legislation with the Water Framework Directive (2000/60/EC) and the Groundwater Directive (2006/118/EC), aiming at sustainable management and protection of water resources.

The Water Law of Montenegro establishes principles of sustainable and integrated water management based on the river basin approach, with the aim of protecting aquatic ecosystems and preserving the quality of surface and groundwater. It defines surface and groundwater bodies, ecological objectives, monitoring, and criteria for assessing chemical and quantitative status (including

Annexes II and V of the WFD and partially Annex I of the GWD), and prescribes planning, measures for rational use of water resources, pollution reduction, and mitigation of flood and drought impacts, through public participation and responsible concession management

The Albania's **Water Law No. 29/2024,** provides a robust foundation for integrated management of water resources and legal framework for groundwater management toward alignment with EU environmental standards. Effective implementation remains constrained by **regulatory gaps**, **insufficient technical guidelines**, and **limited institutional capacity**—particularly regarding **karst aquifers, artificial recharge, and remediation procedures**.

Related to the common cooperation a Memorandum of Understanding for the Drin Basin – Drin Declaration was signed in November 2011 by the countries of the Drin Basin (Montenegro, Albania, North Macedonia, Greece, and Kosovo). The aim of this document is to strengthen cross-border cooperation in integrated water management and sustainable development of the region, in accordance with the Water Convention and the Water Framework Directive.

The first agreement between countries of Montenegro and Republic of Albania concluded in 2001. In addition to the bilateral treaty on water management, the following were signed:

- Statute and Protocol on Cooperation in the Field of Water Management in 2003, adopted by both governments,
- Memorandum of Understanding between the Council of Ministers of the Republic of Albania and Montenegro for the "Cross-Border Development of Lake Skadar",
- Memorandum of Understanding between the Ministry of Agriculture and Rural Development of Montenegro and the Ministry of Environment, Forestry and Water of Albania, 14 December 2010,
- Agreement on Transboundary Water Resources Management between Montenegro and Albania, 2018,
- Cross-border cooperation on the Cijevna/Cemi River – supported by the Water Convention's Implementation Committee as part of the advisory procedure on the Cijevna/Cemi River (2023).

Although respective stats has signed a bilateral agreement on transboundary water management, including shared aquifers, its implementation is limited, and does not cover joint monitoring, data sharing, or coordinated risk assessment procedures.

2.2 National Legal Instruments Governing Groundwater (Albania and Montenegro)

The primary legislative instrument governing water management in Albania is **Law No. 29/2024 "On Water Resources."** This comprehensive law establishes the foundation for integrated water resources management, aligning Albania's framework with the principles of the EU **Water Framework Directive (WFD)** and **Groundwater Directive (GWD)**.

The law provides:

- A unified framework for the sustainable use, protection, and administration of all water resources, including groundwater.
- A protection zones around water sources.
- Regulates pollution control, discharge permits, monitoring, and authorized water use.

Albania has developed a substantial legal foundation for the protection of water resources, particularly groundwater. This includes regulations addressing **sanitary protection zones, wastewater discharge control, artificial aquifer recharge, and remediation of contaminated soil and groundwater**. However, significant gaps and inconsistencies persist—especially in **karstic regions**, where hydrogeological vulnerability is exceptionally high.

Main legal acts:

Law No. 10431 on Environmental Protection[1]. Key Principles:

- Precaution, prevention, "polluter pays", public participation.
- Requires restoration/rehabilitation for environmental damage.
- Integrates environmental goals into sector policies.

Law No. 9115/2003 on the Environmental Treatment of Polluted Waters[2]

- Regulates discharges of polluted waters (urban, industrial, etc.).
- Prohibits discharges exceeding pollutant limits into groundwater or water bodies.
- Requires environmental licensing, monitoring, and sampling.
- Shared enforcement by environmental, sanitary, and municipal inspectorates.

Law No. 9244 on Agricultural Land Protection[3].

- Protects agricultural land from degradation.
- Addresses human and environmental threats to agricultural soils.
- Imposes duty to inform authorities of harmful impacts or risks.

Regulation No. 379 (25 May 2016) — Regulation on the Quality of Drinking Water[4].

Regulation No. 177 on the Discharge of Liquid Wastes and the Criteria for Zoning Water Environments[5]

- Standards for discharges and zoning of water environments.
- Sets maximum discharge limits and hazardous substance controls.
- Establishes zoning categories for water bodies to guide permissible discharges.

Groundwater (and surface water) in Montenegro is regulated by the **Water Law** ("Official Gazette of the Republic of Montenegro", no. 027/07; "Official Gazette of Montenegro", nos. 073/10, 032/11, 047/11, 048/15, 052/16, 055/16, 002/17, 080/17, 084/18, 084/24), which governs the status of water, rules for use, protection, and monitoring. In practice, this law provides the basis for issuing permits/concessions for water use and monitoring obligations.

[1] https://faolex.fao.org/docs/pdf/alb112561E.pdf

[2] https://faolex.fao.org/docs/pdf/alb52544E.pdf

[3] https://faolex.fao.org/docs/pdf/alb66988.pdf

[4] https://faolex.fao.org/docs/pdf/alb163693.pdf

[5] https://faolex.fao.org/docs/pdf/alb67467.pdf

The **Law on Geological Research** ("Official Gazette of the Republic of Montenegro", nos. 028/93, 027/94, 042/94, 026/07; "Official Gazette of Montenegro", nos. 073/10, 028/11) (a new version is under preparation) regulates basic and detailed hydrogeological research to determine the status of groundwater, properties and characteristics of rocks and soils, as well as protection measures.

The **Environmental Protection Law** ("Official Gazette of Montenegro", nos. 52/16, 59/18, 10/23) introduces principles of pollution prevention, the "polluter pays" principle, ensures public access to information, and provides mechanisms for environmental impact assessment. It is implemented through water protection measures that include preventing or limiting the introduction of hazardous, waste, and other harmful substances into water, monitoring and testing the quality of surface and groundwater, as well as wastewater treatment.

The **Nature Protection Law** ("Official Gazette of Montenegro", nos. 054/16, 018/19, 084/24) protects biological and geological diversity, ensures the preservation of the quality, quantity, and availability of groundwater and surface water, protects habitats and ecosystems dependent on water, and regulates zoning and protection regimes in protected areas.

Funding for water management in Montenegro is provided under the **Law on Financing Water Management** ("Official Gazette of Montenegro", nos. 065/08, 074/10, 040/11, 082/20), through fees for water use and discharge, watercourse regulation, and other sources, and is used for the protection, regulation, and maintenance of water resources.

2.3 Comparative Legal Analysis: Albania vs Montenegro

2.3.1 Groundwater Ownership and Use Rights

The Water Law of both countries Albania and Montenegro defines water as a public good under administration of state institutions and regulates its use through permits, concessions, and usage rights, taking into account environmentally acceptable flows and the water balance to preserve aquatic ecosystems and associated terrestrial ecosystems.

Water resources management in Albania and Montenegro are **based on the principles respecting the integrity of river basin management plans,** based on social and economic requirements for water resources, while protecting and preserving the quality of these resources and the quality of the environment for future generations.

Table 1.1. Institutional Roles & Capacity Gaps for Cemi/Cijevna related River (Albania–Montenegro)

Institution / Country	Mandate Related to Water & Cemi/Cijevna	Strengths	Capacity Gaps	References (APA, in-table)
Ministry of Tourism & Environment (AL)	National water policy, EU approximation & environmental regulation	Coordinates national alignment with EU Water Framework Directive	Needs stronger capacity for transboundary data systems and enforcement in remote basins	(EU4Rivers project summary, 2023; EEAS, 2025)[6]

[6] EEAS. (2025, October 17). *Commission releases funds for Montenegro, Albania and North Macedonia under EU Growth Plan for Western Balkans*. https://www.eeas.europa.eu/delegations/albania/commission-releases-funds-montenegro-albania-and-north-macedonia-under-eu-growth-plan-western_en; https://euprojects.al/

Agency for Water Resources Management – AMBU (AL)	Integrated water management & basin planning	Legal authority for water cadastre and River Basin Management Plans	Limited technical monitoring in upland tributaries; needs harmonized data with Montenegro	(EEAS, 2023)[7]
National Environment Agency (AL)	Water quality monitoring	Technical expertise on water quality parameters	Sparse monitoring coverage in highland tributaries of Cem; needs more equipment	(EU4Rivers project summary, 2023)[8]
Municipality of Malësi e Madhe (AL)	Local implementation & community coordination	Local knowledge; community engagement potential	Limited technical staff for hydrological data; lacks monitoring tools	Assessed qualitatively (no direct online source)*
Ministry of Agriculture, Forestry and Water Management (ME)	Water policy coordination, basin plans	Experience with EU-aligned water planning	Lacks regular joint planning mechanisms with Albania	(UNECE, 2023)[9]
The Water Directorate (Uprava za vode) (ME)	Operational implementation of water policy: groundwater monitoring, permitting, supervision, registers	Clear operational mandate; supports transboundary cooperation	Limited leverage over upstream pressures; need for joint monitoring protocols	Water Law (Official Gazette 027/07, 073/10);
Environmental Protection Agency (EPA) (ME)	EPA reports on the status of water resources in Montenegro.	Official source of water status information in Montenegro.	Limited data coverage near Albania border; needs harmonized protocols	(EPA, 2024)
Local Municipalities (ME: Podgorica, Tuzi and Zeta)	Land-use planning, sanitation, wastewater management, local enforcement	Direct control over land use; stronger operational capacity	Vulnerable to upstream pressures; coordination with national plans can be improved	Municipality of Zeta (2024); Municipality of Tuzi (2023)
Public Water Utility (Vodovod i kanalizacija Podgorica and Vodovod i kanalizacija Tuzi)	Protection of groundwater sources, water quality monitoring, maintaining service reliability	Strong incentives for protection; medium operational capacity	Limited control over upstream land use; data sharing with Albanian authorities is ad hoc	Municipality of Zeta (2024); Municipality of Tuzi (2023)
Transboundary Cooperation (AL–ME)	Joint river governance mechanisms	Advisory process via UNECE Water Convention supports cooperation	No permanent operational working group; limited shared monitoring	(UNECE, 2023)

[7] EEAS. (2023)Integrated Water Resources Management in Albania, approaching EU standards. Retrived from: https://www.eeas.europa.eu/delegations/albania/integrated-water-resources-management-albania-approaching-eu-standards

[8] EU4Rivers project summary. (2023). *EU4Rivers / EU for Water – Component 1, Albania – Austrian Development Agency*. https://euprojects.al/euprojects/eu4rivers/ euprojects.al

[9] UNECE. (2023, April 28). *Water Convention's Implementation Committee supports Albania and Montenegro on the transboundary Cijevna/Cem River*. https://unece.org/environment/news/water-conventions-implementation-committee-supports-albania-and-montenegro-part UNECE

Western Balkans Investment Framework (WBIF)	Infrastructure financing that can touch water systems	Large EU-backed funds supporting infrastructure	Needs targeted programming for basin water infrastructure	(European Commission Growth Plan, 2025)[10]
European Investment Bank (EIB Global)	Technical & financial support for water projects	Grants/loans strengthen water infrastructure resilience	Projects not yet directly focused on Cem basin; opportunity for expansion	(EIB Global 2023[11]; EEAS, 2025)[12]

2.3.2 Licensing and Permitting Procedures

The quantity, purpose, and duration of water use are determined through permits issued by the **Water Administration of Montenegro**, while long-term or commercial uses, such as hydropower projects, irrigation, bottling, or tourism activities, are granted through concessions with clearly defined conditions and financial obligations.

The law also establishes priorities for water use, particularly for public water supply, and regulates procedures for resolving potential conflicts among users.

In Albania water management is done in two level central and local one.

The main Institution in central level is:

- Council of Ministries;
- National Council of Territory and Water (NCTW); (besides the other, responsible for transboundary issues)
- Water Resource Management Agency (WRMA) (besides the other, operate as secretariat of NCTW)

The main Institution in local level:

- Council of Water River Basin (CWRB); (issued water permits and authorisation base on RBMP)
- Water Administration Office (WAO), besides the other operate as secretariat of CWRB.

All applications for water permit addressed to the WRMA via electronic system. WRMA valuate the application file and based on RBMP condition and in cooperation with other Institution (if necessary), prepare the file for CWRB discussion and decision.

[10] European Commission. (2025). *Commission releases funds for Albania, Montenegro and North Macedonia under Western Balkans Growth Plan*. https://enlargement.ec.europa.eu/news/commission-releases-funds-albania-montenegro-and-north-macedonia-under-eu-growth-plan-western-2025-10-16_en Enlargement and Eastern Neighbourhood

[11] EIB Global. (2023). *EIB Global deploys additional support to improve water distribution system in Tirana*. https://www.eib.org/en/press/all/2023-429-albania-eib-global-deploys-additional-support-to-improve-water-distribution-system-in-tirana European Investment Bank

[12] EEAS. (2025). *Better water, healthier lives: How the EU is strengthening Albania's water infrastructure*. https://www.eeas.europa.eu/delegations/albania/better-water-healthier-lives-how-eu-strengthening-albania%E2%80%99s-water-infrastructure_en European External Action Service

2.3.3 Pollution Control and Sanitary Protection Zones

Issues of concern in Cemi/Cijevna aquifer may summarized:

- Lack of a sewage system in almost all the settlements in the TDA zone;
- A high degree of vulnerability of the karst aquifers because of the lack of vegetative cover and forests;
- Water exploitation and discharge without permits or control by the authorities;
- Lack of an appropriate drinking water system (water pipelines are local and amortized).

In Albania, **Sanitary Protection Zones (SPZs)** are legally recognized, but have been **only partially implemented**, with the first zone most consistently defined. Their delineation is primarily based on **Decision of the Council of Ministers (DCM) No. 379, dated 25 May 2016**, "On the Quality of Drinking Water."[13]

Scope:
This regulation sets technical and hygiene standards for drinking water infrastructure and includes provisions for protection zones around water sources.

Key Provisions of the regulation:

- Establishes sanitary protection requirements for water supply systems;
- Specifies standards for design, disinfection, and hydro-sanitary safety of wells, pipelines, and related facilities.

Structure of Sanitary Protection Zones:

- **Immediate Protection Zone**
    - Directly surrounds the water source.
    - Strictly controlled access, managed by the water supplier.
    - Defined by **VKM No. 379/2016**, typically with a radius of **15–100 meters**, depending on aquifer type.
    - The main objective is to **prevent infiltration of pollutants** into the water intake.
- **Adjacent (Vicinal) Protection Zone**
    - Extends beyond the immediate zone and prohibits **construction, agriculture, livestock, industrial activities, and use of fertilizers or pesticides**.
    - Calculated using hydrogeological formulas tailored to the aquifer.
    - Serves to prevent **pathogenic and chemical contaminants** from reaching the groundwater.
- **Remote Protection Zone**
    - Surrounds the second zone.

[13] https://faolex.fao.org/docs/pdf/alb163693.pdf

- Activities may be permitted but require **administrative authorization** and strict environmental oversight.
- Functions as a **buffer zone** between protected areas and the wider environment.

These zones are defined based on **health risks and water quality criteria** through cooperation between **water, health, and environmental authorities**. Although the legal framework acknowledges the specificities of **karst hydrology**, technical implementation guidelines remain insufficient.

According to Article 57 of the Montenegro Water Law ("Official Gazette of the Republic of Montenegro", no. 027/07; "Official Gazette of Montenegro", nos. 073/10, 032/11, 047/11, 048/15, 052/16, 055/16, 002/17, 080/17, 084/18, 084/24), sanitary protection zones of water supply sources, as well as the areas designated for these zones, must be incorporated into Water Management Plans and spatial plans for special purposes.

The **Rulebook on the Determination and Maintenance of Sanitary Protection Zones and Belts of Water Supply Sources and Restrictions within These Zones** ("Official Gazette of Montenegro", nos. 066/09 and 013/24), sanitary protection zones are defined; however, there are no detailed national guidelines that precisely specify the methodology for their determination, particularly in karst areas.

Groundwater monitoring is conducted in accordance with the principles of the Water Framework Directive, including the assessment of the chemical and quantitative status of waters. Monitoring elements include basic physicochemical and microbiological parameters, as well as the monitoring of heavy metals and pesticides. Monitoring points are selected based on the hydrogeological representativeness of the site. Sampling is carried out twice a year, during the hydrological maximum and minimum.

The **first protection zone (Zone I)** protects the water source, water intake structures, and the immediate surroundings, allowing only facilities directly related to water supply. The boundary of Zone I must be at least 10 meters from water intake structures.

The **second protection zone (Zone II)** is determined based on the quantity and regime of exploitation, hydrogeological characteristics, and contamination risk. Activities that could compromise water quality are strictly prohibited within Zone II, including untreated wastewater discharge, industrial construction, mining activities, use of fertilizers and pesticides, intensive livestock farming, and the construction or expansion of cemeteries.

The **third protection zone (Zone III)** covers the area from the outer boundary of Zone II to the hydrogeological watershed and the broader recharge area of the aquifer. Activities that disrupt the natural recharge regime are prohibited in Zone III, including waste disposal, untreated wastewater discharge, industrial development with pollution risk, storage of hazardous substances, and the construction or expansion of cemeteries.

For the protection of groundwater (GW) and groundwater-dependent ecosystems (GWDE), there is a legal basis in the **Water Law** (preventing deterioration, protecting and improving the status of aquatic ecosystems as well as terrestrial and wetland ecosystems directly dependent on water systems) and regulations on wastewater discharge. However, no specific guidelines exist for groundwater, and consequently for karst areas.

The **Rulebook on the Quality and Sanitary-Technical Conditions for Wastewater Discharge, the Method and Procedure for Testing Wastewater Quality, and the Content of Reports on Determined Wastewater Quality** ("Official Gazette of Montenegro", 056/19) prescribes maximum allowable

concentrations of hazardous and harmful substances in wastewater discharged into recipients (surface waters) or sewerage systems. Direct discharge of pollutants into groundwater is prohibited except in prescribed cases, as is the disposal of municipal or other waste on water bodies, high river banks, cliffs and canyon sides, natural pits, dolines, and other locations from which pollutants could reach surface or groundwater or lead to deterioration of water quality.

2.3.4 Enforcement Mechanisms and Institutional Capacities

The operational capacity for implementing water policy in Montenegro is based on the legislative framework established by the **Water Law** ("Official Gazette of Montenegro", nos. 27/07, 73/10, 32/11, 47/11, 48/15, 52/16, 55/16, 2/17, 80/17, 84/18, 84/24), which defines the competencies of the **Ministry of Agriculture, Forestry and Water Management – Directorate for Water Management**, the **Ministry of Ecology, Sustainable Development and Northern Region Development**, the **Environmental Protection Agency**, the **Ministry of Health**, the **Ministry of Energy and Mining**, and the **Water Administration**, i.e., the authority responsible for water management.

The Water Administration plays a key role in issuing water acts, supervising the use and protection of water, implementing water management plans, and maintaining records. However, operational capacity is limited due to a lack of skilled personnel, equipment, and financial resources at both the state and local levels. Most institutions and municipalities do not have a sufficient number of trained water management engineers, nor stable budgetary sources for the maintenance and development of water infrastructure.

Financial mechanisms, such as water use and protection fees, exist, but their collection and reinvestment in the sector are often inconsistently implemented. Through **IPA projects** and other international programs, Montenegro receives support to strengthen administrative and technical capacities, modernize equipment, and develop strategic plans, including the **Water Management Plans for the Danube and Adriatic River Basins (2021)** and also **Flood Risk Management Plans for the Danube and Adriatic River Basin** (EPTISA Southeast Europe d.o.o., 2025).

Supervision of the implementation of the **Water Law** ("Official Gazette of Montenegro", nos. 27/07, 73/10, 32/11, 47/11, 48/15, 52/16, 55/16, 2/17, 80/17, 84/18, 84/24) is carried out by the **Water Administration**, the inspection bodies within the **Inspectorate**, as well as the competent ministries. These authorities have the powers to conduct inspections, issue orders to remedy irregularities, temporarily suspend activities, and initiate misdemeanor proceedings in cases of non-compliance with regulations.

The water use permits and authorization including obligation to comply with sanitary protection requirements in Albania is reaffirmed in **Decision of the Council of Ministers No. 319, dated 11 June 2025**, *"On the Approval of Application Forms for the Use of Water Resources, Accompanying Documentation, Decision-Making Procedures, Permit Forms, Special Conditions, and Validity Periods."*

As is mention above in Albania, groundwater management is supported by a framework of various policies, strategies, rules and regulations that aim to protect and ensure the sustainable use of these vital resources.

Inspection and controlling for respecting of environmental condition on use of water resources are obligation of National Environmental Agency, part of Ministry of Environmental and Tourism, which is

the main state institution for controlling and protection of the environmental in general and water in particular. Important Department part of this agency, is Inspectorate of Water Resources.

Considering groundwater as part of natural water resources, its management is done based on respective River Basin Plans, compile by WRMA.

Key challenges addressed related to GW on RBMPs:

- **Identification,** maping, evaluation and registering existing illegal groundwater abstraction in respective RBs.
- **Monitoring of** *groundwater pollution***.** Industrial, agricultural, and urban activities often cause groundwater contamination through untreated discharges. Measures to improve water quality include enhanced treatment capacities and continuous monitoring[14].
- **Monitoring unsustainable exploitation**. Over-abstraction of groundwater, especially in low-recharge areas, can lower water levels and degrade quality.
- **Limited local capacity** for monitoring and management.
- **Compliance of aquafer protected area.**

2.4 Identified Legal Gaps and Opportunities for Harmonization

Even than each country has respective legal and institutional framework for water protection and management fully in line with EU acquis, still there is rooms and challenges on enforcement capacity related to common legal from work and criteria.

- **Legal mechanisms** - Acceleration of process for fully implementation WFD, especially GW Directive, focusing in bylaw formulation for complete implementation of all water related directives.
- **Administrative mechanism** - ability to enact and apply regulations;
- **Operational capacity** - availability of human and financial resources for the implementation of policies and regulations;
- **Inspection/Supervision and sanctions**: compliance monitoring and application of penal provisions of regulations.
-

2.5 Summary Table: Legal Framework Comparison – Al vs MN (TBA Cemi/Cijevna)

Table 1.2. Legal Framework Comparison – Al vs MN (TBA Cemi/Cijevna)

Aspect	Montenegro	Albania
Actors	Surface and groundwater monitoring in Montenegro carried out by the Institute of Hydrometeorology and Seismology of Montenegro.	Water Resource Management Agency WRMA: in planning and monitoring of surface and groundwater together with responsible Institutions.
Legal Framework	Water Law amended and supplemented several times, the most recent from 2024. II) the following Rulebooks adapted: Rulebook on the Method and Deadlines for Determining the Status of Surface Waters from 2019, and	i)-CMD from 2025 "On the organ & functioning of the WRMA".; ii) new Law 29/2024 "For Water Resources": part of the legal package in the framework of the full approximation of Albanian legislation in the field

[14] https://www.erru.al

	Rulebook on the Method and Deadlines for Determining the Status of Groundwater from 2019; Rulebook on the Designation and Maintenance of Sanitary Protection Zones and Belts of Water Sources and Restrictions Within These Zones amended in 2024.	of water resources management with the EU acquis in this field, iii) CMD no. 993, from 2020 "On the approval of tariffs for the use of water, cross-border waters, administrative payments for water discharge and their reuse".; iv) act "On the characterization and status of GWer" is included in CMD no. 1015, from 2020 "On the content, development and implement. of the National Strategy for WRM of RB and flood risk management plans".
Policy and Plans	Water Management Strategy of Montenegro (2017); Water Management Plan for the Danube River Basin District (2021); Water Management Plan for the Adriatic River Basin District (2021); Flood Risk Management Plan for the Adriatic River Basin (2025); Flood Risk Management Plan for the Danube River Basin (2025); Agreement on Transboundary Water Resources Management between Montenegro and Albania (2018); Transboundary Cooperation on the Cijevna/Cem River – the Water Convention's Implementation Committee Supports Albania and Montenegro as Part of the Advisory Procedure on the Cijevna/Cem River (2023); Drin Transboundary Basin Project – (2025), Phase II of the GEF-funded project "Implementing the Strategic Action Program for the Drin Basin" launched, managed by Albania, Kosovo and North Macedonia	i) DCM No345, from 2019 "On the adapting of the National Strategy for Integrated water Resource Management, 2018-2027".; ii) Five River Basin planes in implementation stage; iii) two of them started preliminary stage of second phase (Drin-Buna RB is transboundary river); iv) two River Basin started the first phase of River Basin Plan, from 2027 all rivers will have respective RBMPs.
Adherence to the WFD and GWD	Legal alignment with the WFD and the GWD has largely been achieved through the Water Law and accompanying secondary legislation; however, full implementation in practice is still ongoing.	Enter in power the new law 29/2024 "For Water Resources", started full approximation of Albanian legislation in the field of WFD and GWD.
Available Knowledge	Available knowledge and technical capacities of institutions responsible for groundwater management in Montenegro is partially sufficient to meet the obligations under WFD and the GWD: improvements are needed in terms of data availability, systematic monitoring, and inter-institutional coordination and cooperation.	Available knowledge and technical capacity of (ground)water management and respective monitoring institutions is in need for knowledge and equipment support, to fulfil all obligations under the WFD and the GWD. The key issue remain standardization and change of data between different institutions dealing with water.
Enforcement Capacity	Capacity of competent institutions to enforce regulations and measures related to groundwater limited; practical implementation is hindered by a shortage of personnel, limited financial and technical resources, and insufficiently developed monitoring and inspection mechanisms; strengthening institutional capacities and inter-institutional cooperation needed for the full implementation of the WFD and the GWD.	i) implementation of EU environmental and water acquis will request capacity development to produce and operationalize guidelines and standardization of water (surface and groundwater) monitoring procedures, in line with EU methodologies; ii) much more should be done related to the ability to enact and apply regulations availability of human and financial

3. Legal Framework Analysis- TBA Cemi/Cijevna

Groundwater policy and planning frameworks in Albania and Montenegro provide the formal basis for sustainable groundwater management; however, their operational effectiveness in the specific context of karst systems and transboundary aquifers remains limited. This chapter provides a comparative assessment of national strategies, river basin planning instruments, sectoral policies, and cross-border planning mechanisms relevant to the Cemi/Cijevna Transboundary Aquifer (TBA), highlighting policy coherence, implementation challenges, and opportunities for strengthening governance.

3.1 National Water Strategies and River Basin Management Plans

National water strategies and River Basin Management Plans (RBMPs) in both Albania and Montenegro establish the primary policy foundation for groundwater governance, addressing water abstraction, pollution control, protection of vulnerable aquifers, and integration of groundwater into broader resource management frameworks.

In **Montenegro**, the Water Management Strategy (2017) emphasizes sustainable development principles, institutional capacity strengthening, and protection of karst groundwater resources. The River Basin Management Plans adopted in 2021 define groundwater bodies, establish environmental objectives, and introduce protective measures consistent with the Water Framework Directive (WFD). However, although legal alignment is strong, detailed hydrogeological characterization of karst systems and operationalization of measures remain limited. Direct discharges into groundwater are prohibited, yet enforcement capacity and monitoring coverage require further strengthening.

In **Albania**, Integrated Water Resources Management (IWRM) principles and river basin planning frameworks provide an increasingly structured approach to groundwater protection. The policy framework formally recognizes groundwater vulnerability, particularly in karst environments, and emphasizes sustainable abstraction, pollution control, institutional strengthening, and gradual expansion of monitoring systems. Nevertheless, implementation capacity remains uneven across regions, while monitoring coverage and enforcement capacities require continued enhancement.

Although both countries demonstrate high levels of formal policy alignment with EU water governance requirements, practical implementation in karst and transboundary contexts remains constrained by limited technical detail, insufficient monitoring networks and administrative capacity.

3.2 Sectoral Policies Impacting Groundwater (Agriculture, Tourism, Energy, Spatial Planning)

Sectoral policies in agriculture, tourism, energy, and spatial planning exert direct influence on groundwater quantity and quality. Their alignment with national water management objectives is essential to ensure sustainable use of groundwater resources in TBA Cemi/Cijevna.

In **Montenegro**, agricultural policies promote irrigation development and land-use intensification, which may contribute to quantitative pressures and potential nitrate pollution in sensitive karst systems. Tourism development, particularly in the upper river valley and near populated zones, generates seasonal peaks in water demand and potential wastewater challenges. Spatial planning legislation requires the protection of sanitary protection zones; however, implementation remains uneven, particularly in areas of informal or unplanned development. Energy policy has historically

given limited attention to groundwater-related risks, particularly in karst terrains, where surface-groundwater connectivity is strong.

In **Albania**, sectoral policies increasingly acknowledge groundwater protection; however, enforcement of discharge control, regulation of agricultural practices, and monitoring of illegal abstractions remain challenging. Urban expansion, tourism growth, and agricultural intensification introduce additional pressures on groundwater resources. In karst conditions, where infiltration is rapid and contamination pathways are direct, even moderate environmental pressures may result in accelerated groundwater degradation.

Sector policies in both countries provide partial safeguards for groundwater but remain insufficiently coordinated with water authorities. Strengthening inter-sectoral coordination, compliance mechanisms, and integration of groundwater considerations into land-use and economic development planning is essential.

3.3 Integration of Groundwater in Planning Instruments

Groundwater is formally recognized and integrated within national planning frameworks in both Albania and Montenegro; however, this integration remains largely normative and insufficiently operationalized for karst and transboundary aquifers.

In Montenegro, groundwater management is legally linked to basin planning and environmental protection instruments. Nevertheless, groundwater and surface water monitoring are often addressed separately, with limited systematic integration of karst-specific dynamics. In Albania, groundwater is conceptually included within RBMPs and strategic planning frameworks, but monitoring density, data consistency, and coordination remain limited, particularly in upland and cross-border areas.

Furthermore, data standardization across institutions is incomplete in both countries, hindering consistent status assessment and complicating joint or comparative planning.

Although groundwater is institutionally present within planning instruments, more robust operational integration, standardized monitoring frameworks, and technically harmonized planning practices are required, especially for karst and transboundary contexts.

3.4 Comparative Analysis of Policy Coherence and Implementation

Despite strong formal policy alignment in both countries, a clear gap persists between policy frameworks and actual implementation capacity. Fragmented institutional coordination, uneven enforcement mechanisms, incomplete data integration, and limited human and technical capacities reduce the effectiveness of groundwater planning and policy execution.

The most significant weaknesses relate to:

- insufficiently developed and spatially limited monitoring networks,
- incomplete integration of groundwater-dependent ecosystems (GWDEs),
- inconsistent cross-sectoral coordination and data exchange,
- partial operationalization of EU-aligned policy commitments.

Both Albania and Montenegro demonstrate policy readiness but face challenges in translating policy intentions into consistent and measurable implementation outcomes.

3.4.1 Alignment with the Water Framework Directive (WFD) and Groundwater Directive (GWD)

Albania and Montenegro have achieved substantial progress in harmonizing legal and policy frameworks with the WFD and GWD. This includes defining groundwater bodies, prohibiting direct discharges, and introducing structured basin-level planning obligations. However, achieving full implementation requires:

- further standardization of methodologies,
- expansion and densification of groundwater monitoring networks,
- comprehensive integration of GWDEs,
- strengthening administrative and technical capacities.

Karst aquifers, including Cemi/Cijevna, require tailored policy approaches beyond standard WFD/GWD application, given their hydrogeological sensitivity and rapid response dynamics.

3.4.2 Cross-Sectoral Coordination Mechanisms

Institutional structures for cross-sectoral coordination exist in both countries, yet their operational functionality remains limited. Data exchange between water management, environmental, agricultural, tourism and spatial planning authorities is not systematic. Coordination platforms do not consistently ensure integration of groundwater priorities into sector policies, resulting in fragmented implementation.

Strengthening structured coordination mechanisms, establishing shared databases, and institutionalizing regular inter-sectoral planning processes are critical for achieving policy coherence.

3.4.3 Transboundary Planning Instruments for TBA Cemi/Cijevna

Existing bilateral agreements, Memoranda of Understanding, and regional cooperation initiatives provide a strong political and institutional foundation for cross-border collaboration. However, practical transboundary planning mechanisms for the Cemi/Cijevna aquifer are still insufficiently developed.

Key gaps include:

- absence of a joint groundwater monitoring system,
- lack of harmonized data-sharing protocols,
- uncoordinated delineation and management of sanitary protection zones,
- absence of common risk assessment methodologies and indicators,
- limited institutionalized technical-level cooperation platforms.

Sustainable management of TBA Cemi/Cijevna requires transition from sporadic cooperation to institutionalized, regular, and technically robust transboundary coordination supported by harmonized monitoring, shared databases, and jointly defined priorities.

Summary Conclusion of Chapter 3

National policy and planning frameworks in Albania and Montenegro demonstrate strong formal alignment with EU principles of water governance and recognize the importance of groundwater management. However, implementation remains constrained by limited monitoring capacity, fragmented inter-sectoral coordination, varying levels of data standardization, and insufficiently developed transboundary planning mechanisms. These challenges are amplified in the karst and transboundary context of the Cemi/Cijevna aquifer, where rapid hydrological responses and ecological sensitivity demand proactive, coordinated, and technically robust policy implementation.

Strengthening institutional capacity, operationalizing policy commitments, expanding monitoring systems, and institutionalizing bilateral coordination represent key prerequisites for ensuring sustainable groundwater governance in the TBA Cemi/Cijevna.

3.5. Summary table: Policy and Planning Comparison – Al vs MN (TBA Cemi/Cijevna)

Table 1.3. Policy and Planning Comparison – Al vs MN (TBA Cemi/Cijevna)

Aspect	Albania	Montenegro	Assessment / Implication for TBA Cemi/Cijevna
National policy framework	Integrated water policy framework; EU-aligned	Comprehensive national water policy framework aligned with EU directives and river basin approach	Strong formal alignment in both countries; operationalization still developing
RBMP status	RBMPs developed; implementation progressing, with variable regional capacity	RBMPs adopted (2021), WFD-aligned, with identified groundwater bodies and measures	RBMPs exist in both countries; implementation uneven and requires further operational detail
Focus on groundwater	Groundwater formally recognized; vulnerability acknowledged, especially in karst systems	Groundwater formally recognized; legal safeguards established	Recognition exists in both systems, but translation into operational measures remains limited
GWDE consideration	Increasing recognition; integration still developing	Largely underdeveloped in operational planning	GWDE inclusion insufficient; requires stronger incorporation into policy tools
Sectoral Integration (Agriculture, Tourism, Spatial Planning, Energy)	Integration progressing; coordination mechanisms exist but enforcement remains inconsistent	Formal requirement for alignment with water policies; coordination improving but uneven	Sectoral policies partially aligned; inconsistent implementation poses governance risk
Monitoring Framework	Monitoring expansion ongoing; coverage and capacity still limited, particularly in karst and upland areas	Groundwater quality monitoring established; quantitative monitoring and spatial coverage remain insufficient	Monitoring insufficiently dense and harmonized to support robust groundwater planning
Institutional coordination	Structured mechanisms exist at national and basin levels; coordination effectiveness varies	Institutional frameworks established; coordination improving, but not fully systematized	Functional coordination exists on paper; requires stronger institutionalization in practice

Data Availability and Standardization	Data improving; fragmentation and inconsistencies remain challenges	Data available; needs further standardization and integration across institutions	Lack of standardized data complicates comparative assessment and joint planning
Alignment with WFD and GWD	Strong policy alignment; full implementation ongoing	Strong legal alignment; implementation progressing, especially through RBMPs	Both systems aligned with EU framework; implementation gap remains key challenge
Transboundary Planning and Cooperation	Formal cooperation frameworks exist; operationalization limited	Formal cooperation frameworks exist; requires stabilization of practical mechanisms	Cooperation foundation exists; move needed from political commitments to operational structures

4. Socio-economic indicators and pressures - TBA Cemi/Cijevna

4.1 Demographic and Economic Overview of the TBA Cemi/Cijevna Region

From a stakeholder perspective, demographic and economic patterns within the Cemi–Cijevna basin determine who uses groundwater, who generates pressure on the aquifer system, and which groups are most exposed to risk. The basin spans two contrasting socio-economic contexts: a predominantly rural, mountainous upstream area in northern Albania and the northeastern parts of Montenegro, and a more densely populated, peri-urban downstream area-Zeta plain in Montenegro. These contrasts create clear asymmetries in stakeholder capacity, incentives, institutional presence, and exposure to groundwater-related impacts. The demographic structure of the basin is characterized by low population density upstream and increasing concentration downstream, and these differences directly influence groundwater use patterns, sanitation practices, monitoring capacity, and the distribution of environmental and social risks across the transboundary system. This chapter provides an overview of these demographic and economic characteristics, identifies key groundwater users and pressures, and analyses how different stakeholder groups are exposed to current and emerging risks.

In the Albanian part of the basin, particularly within the administrative unit of Kelmend and the municipality of Malësi e Madhe, long-term depopulation caused by emigration, low birth rates, and an aging population has resulted in very low population density and reduced availability of labor. Kelmend, located in the TBA Cemi/Cijevna, has an extremely low population density (1,464 inhabitants) with a declining and aging population, whereas Malësi e Madhe, although more populated, continues to experience a gradual decline in population below the national average (21,684 inhabitants according to the 2023 census).

The age structure in both areas indicates pronounced demographic aging, with a high proportion of residents over 65 years of age, increasing the demand for healthcare, social services, and reliable drinking water supply, while simultaneously limiting the local economic capacity.

The relatively high share of older residents and the smaller number of young people reflect the migration of the younger population to urban centers or abroad for employment and education, a widespread demographic pattern in rural Albania. Socio-economic conditions remain predominantly rural, with agriculture as the main economic activity, followed by services and limited industrial employment.

Seasonal and structural employment patterns contribute to variable water demand, particularly for irrigation and livestock needs.

Tourism has become a growing seasonal economic driver in areas such as Tamarë, Lepushë, and Vermosh, placing additional pressure on groundwater and local water sources during the summer months, when water availability is lowest. Monitoring and data disaggregation at municipal and sectoral levels remain limited, hindering precise assessment of water use patterns.

Household living standards are gradually improving, reflected in high levels of ownership of basic goods and increasing internet access, although incomes and wages remain among the lowest nationally, and dependence on pensions and social transfers is significant due to aging and emigration.

The Cijevna/Cemi River Basin in Montenegro, covering the municipalities of Podgorica, Zeta, and Tuzi, is a complex area with clear contrasts between upstream mountainous and downstream lowland zones – Zeta plain. Upstream communities are small and scattered, with declining and aging populations totaling 1,321 inhabitants (MONSTAT, 2023), creating increased demand for healthcare, social services, and reliable drinking water. Economic activities are limited, primarily consisting of livestock farming and small-scale agriculture.

Downstream areas, particularly in the Zeta Plain and peri-urban zones, are more densely populated (6,597 inhabitants, MONSTAT, 2023) and economically diversified, including public services, trade, agriculture, and infrastructure projects. Institutional frameworks are stronger here, with public water utilities and regulatory bodies overseeing water supply and spatial planning to ensure sustainable use of water resources.

Seasonal and structural employment patterns drive variable water demand for irrigation, livestock, and peri-urban consumption. Tourism and economic development increase seasonal pressures on water resources. While wastewater is not yet fully regulated, plans for systematic collection and treatment are in place, representing a priority for future water management. Urbanization continues to raise water consumption and wastewater production, but institutional capacity supports monitoring and infrastructure planning, gradually improving risk management for groundwater and surface water.

The basin demonstrates significant differences in living standards, with downstream populations benefiting from broader access to services, while upstream communities face lower incomes, dependence on social transfers, and youth outmigration. Effective water resources management, institutional support, and the preservation of cultural and natural heritage are crucial for sustainable development. Tailored strategies are needed to manage resources, infrastructure, and the protection of transboundary and local ecosystems, including groundwater and planned wastewater systems.

Transboundary Interpretation

The demographic and economic asymmetry between the upper karstic part of the basin in Albania and Montenegro and the downstream lowland area of the Zeta Plain represents a key governance challenge for the TBA Cemi–Cijevna. Upstream Albanian and Montenegrin communities exert diffuse, low-intensity pressures, with limited local management capacity, while downstream Montenegrin institutions and populations experience higher exposure and stronger consequences of groundwater degradation.

This upstream–downstream dynamic means that impacts are not spatially aligned with responsibility or capacity. Small-scale decisions and practices in the upper basin can significantly affect water quality and availability downstream, where institutional actors bear public, economic, and political consequences.

Effective governance therefore depends on coordinated risk interpretation, data sharing, and targeted collaboration that reflects these socio-economic realities. Strengthening groundwater protection in the basin requires not only technical measures but also differentiated stakeholder strategies addressing the specific demographic and economic drivers on each side of the border.

4.1.1. Gender mainstreaming baseline

The settlements located along the Cemi/Cijevna transboundary river corridor form part of a wider mountainous and karst region characterized by high water availability, but persistent socio-economic vulnerability and uneven access to services. Similar to other Dinaric karst river basins, water plays a central role in household life, agriculture, and emerging tourism, while governance, infrastructure, and investment lag behind environmental potential.

Across both Albania and Montenegro, women are key everyday water users and managers at the household and micro-economic level, yet remain largely excluded from formal decision-making related to water management. Country-level gender analyses indicate that women's livelihoods are closely tied to water-dependent activities. At the same time, their control over water-related assets and participation in water governance remain limited.

This desk-based analysis was constrained by the limited availability of sex-disaggregated and locally disaggregated data, particularly at the settlement level. The subsequent field research phase is expected to generate richer quantitative and, especially, qualitative evidence on the knowledge, attitudes, and practices of women and men related to water use, access, decision-making, livelihoods, and care responsibilities within the Cemi/Cijevna area.

Albania (Cemi/Kelmend area)

On the Albanian side, the Cemi basin lies mainly within the Kelmend administrative unit, under the Malesi e Madhe Municipality. The area is predominantly shaped by limited economic opportunities and infrastructure, driving male out-migration and increasing the responsibilities on women who remain, from managing family farms and livestock to securing water and fuel for daily needs. Livelihoods rely primarily on small-scale agriculture, livestock, and increasingly seasonal tourism (guesthouses, food services, eco-tourism), all of which are highly dependent on water availability and quality.

National gender analysis of Albania's water sector shows that women constitute roughly half of the population but only around one-third of the employed workforce, with a high concentration in agriculture and informal work. Women in the Cemi area bear primary responsibility for household water management, sanitation, food preparation, and care work. These responsibilities intensify in contexts of unreliable water services, seasonal water stress, or inadequate infrastructure, conditions common in remote rural settlements. While women are heavily involved in water-dependent economic activities such as subsistence farming, livestock care, food processing, and household-based tourism, their role remains largely confined to the informal sphere, with limited access to income security, social protection, or formal recognition.

Land ownership patterns further constrain women's access to water as an economic asset. Limited ownership and control over land reduce women's access to irrigation, water-related subsidies, and climate-resilient investments, even where water resources are locally abundant. As a result, women's

economic activities in the Cemi area are prone to water stress, while their influence over water-related decisions remains minimal.

Despite Albania's relatively progressive legal framework on gender equality, women remain underrepresented in technical, managerial, and decision-making roles within the water sector. In rural contexts such as Kelmend, water governance decisions, whether related to infrastructure maintenance, irrigation systems, or environmental protection, are typically dominated by men and institutional actors, with slight systematic inclusion of women's perspectives, needs, or experiential knowledge as primary water users.

Montenegro (Cijevna area)

On the Montenegrin side, the Cijevna river flows through predominantly rural settlements in Tuzi and Zeta municipalities, where the socio-economic profile is shaped by agriculture, family labor, commuting to urban centers, and small-scale services. As in Albania, water is central to agriculture, household functioning, and local economic activities, yet governance and investment decisions are largely detached from women's everyday water use.

A country-level gender analysis of Montenegro highlights a persistent gap between progressive legal frameworks for gender equality and their implementation in the water sector. Women remain significantly under-represented in technical and decision-making roles within water utilities and water governance bodies, while being concentrated in administrative positions or unpaid family work. Only a small share of family farm holders are women, directly limiting their control over irrigation and water-related assets.

Although official data indicate that men are more often responsible for physical water collection in households without on-premises access, women continue to carry the broader unpaid care burden linked to water use, sanitation, food preparation and care for children and elderly family members. In rural river-adjacent settlements, this unpaid work reduces women's capacity to engage in formal employment or participate in local decision-making processes related to water management.

Recent individual cases in the Cemi/Cijevna area point to a gradual shift in local gender dynamics. Women's engagement in small-scale, water-dependent economic activities, such as olive oil production, medicinal herbs, and small-batch food processing, has resulted in visible and market-validated income generation. Once women's economic contribution becomes evident, they tend to gain improved access to productive resources, including land, water and community support structures, even within traditionally male-dominated ownership and decision-making arrangements. At the same time, these economic gains often translate into an additional burden for women, who continue to shoulder the majority of unpaid household labor and care responsibilities for children, family members and older persons.

Environmental and Water-Related Risks

Environmental risks such as floods, droughts, and seasonal variability directly affect livelihoods along the Cemi/Cijevna corridor. Agriculture and tourism, both highly water-dependent, are particularly vulnerable to changes in water quantity and quality. Gender analyses from both countries indicate that during periods of water stress, women's unpaid workload increases because they are typically responsible for securing alternative water sources, maintaining household hygiene, and caring for sick or vulnerable family members.

Climate-related pressures and infrastructure gaps, therefore, have gender-differentiated impacts. While women are among those most affected by disruptions in water services and declining water quality, they remain largely absent from formal river-basin planning, municipal water management, and transboundary governance processes.

Implications for TBA Cemi/Cijevna

Existing gender analyses for Albania and Montenegro clearly demonstrate that water management in the Cemi/Cijevna basin is not gender-neutral. Women's livelihoods and daily responsibilities are closely linked to water, yet their limited access to assets, formal employment, and decision-making constrains equitable and sustainable water governance.

For the TBA Cemi/Cijevna, integrating gender considerations into socio-economic analysis and water management planning is essential. Strengthening sex-disaggregated data, recognizing unpaid and informal water-related work, and ensuring women's participation in local and transboundary water governance structures and consultations are key prerequisites for effective and inclusive management of shared water resources.

Table 1.4. Population and Gender Indicators by Administrative Unit and Settlement, 2023

Municipality / Administrative unit	Settlement	Total pop. 2023	Women (%)	Notes on women & economy
MONTENEGRO				
Tuzi	Dinoša Zeta plain	483	51.8	Rural settlement with agriculture, small trade and daily commuting to Tuzi and Podgorica. Women engaged in family farming, services and care work. The settlement provides two recent individual examples of women's entrepreneurship: one in olive growing and oil production, recognized at national level for product quality, and another in medicinal herb cultivation and nursery activities.
Tuzi	Gornji Milješ Zeta plain	402	47.5	Mixed rural economy (agriculture, commuting). Women active mainly in farming and low-paid services.
Tuzi	Kuće Rakića Zeta plain	372	47.8	It will be further examined in the next phase of the project.
Zeta	Donja Cijevna (2023) Zeta plain	435	51.7	Semi-rural settlement along the river; agriculture and small services dominate. Women economically active mostly through family-based work.
Zeta	Mahala Zeta plain	2.410	49.9	Larger settlement near Podgorica; services, trade and commuting common. Women present in the labour market, mainly in lower-paid and insecure jobs.
Zeta	Ljajkovići Zeta plain	537	49.7	Mixed economy (agriculture, services, commuting). Gender structure balanced; women concentrated in low-value sectors.
Zeta	Mitrovići Zeta plain	278	55.0	Small settlement with higher share of women; care work and informal economic activity prevalent.
Zeta	Mojanovići Zeta plain	1.680	49.3	More diversified local economy (trade, services, logistics). Women have better access to formal jobs than upstream settlements.
Tuzi	Lovka	53	49.1	Very small village; subsistence agriculture and remittances dominate. Women mainly involved in unpaid family labour and household production.

Tuzi	Pikalj	57	42.1	Aging and shrinking settlement; economy limited to small-scale farming. Women have low access to formal employment.
Tuzi	Krševo	64	48.4	Small rural community; agriculture and seasonal work prevail. Women's economic roles largely informal and family-based.
Tuzi	Drume	174	40.2	It will be further examined in the next phase of the project.
Tuzi	Spinja	83	49.4	
Tuzi	Barlaj	36	38.9	
Tuzi	Skorać	86	46.5	
Tuzi	Helmnica	64	46.9	
Tuzi	Nabon	35	42.9	
Tuzi	Traboin	37	43.2	
Tuzi	Nikmaraš	10	n/a	
Tuzi	Poprat	31	51.6	
Tuzi	Koći	46	41.3	
Tuzi	Stjepovo	30	50.0	
Tuzi	Mužeška	33	33.3	
Tuzi	Delaj	21	n/a	
Podgorica (Capital City)	Medun	87	44.8	Small rural settlement with mixed agriculture and strong links to Podgorica; women's roles largely combine unpaid household and care work with family-based agricultural activities and occasional commuting-based employment.
Podgorica	Dučići	13	n/a	Very small settlement; livelihoods typically rely on subsistence agriculture and household economy. Women's economic activity is primarily informal and family-based, alongside a high unpaid care workload (sex-disaggregated census data not published for this settlement).
Podgorica	Fundina	136	47.1	Rural Kuči-area settlement with agriculture and seasonal/commuting income patterns; women participate mainly through family farming and small-scale household production, while unpaid household and care responsibilities remain a key constraint to formal employment and participation.
Podgorica	Ubli	148	45.9	Central Kuči settlement; livelihoods linked to agriculture, livestock and seasonal use of nearby mountain plateaus, including Kučka Korita.
Podgorica	Orahovo	53	47.2	Small rural Kuči settlement; subsistence agriculture and seasonal livelihoods dominate.
Podgorica	Kržanja	24	45.8	Very small dispersed settlement; household-based and informal economic activities prevail.
Part of the Municipality of Zeta and Tuzi	**Zeta plain (Total)**	**6597**	**50.3**	A lowland settlement in the Zeta Plain with more developed, market-oriented agriculture and better connections to urban centers. Women's role is more visible and significant, with greater participation in agriculture, family businesses, and service activities, while still carrying the burden of domestic responsibilities.
Part of the Municipality of Podgorica and Tuzi	**Mountains – upper area (total)**	**1321**	**44.9**	It is a very small and dispersed mountainous settlement. The population's livelihood mainly relies on modest subsistence agriculture, livestock breeding, and household-based activities. Women's economic engagement is largely informal and family-based, with a significant burden of unpaid domestic and care work.
ALBANIA				

Kelmend	**Vermosh**	n/a	n/a	Tourism-oriented Mountain village; women active in family-run guesthouses and food services, mostly informal.
Kelmend	**Lëpushë**	n/a	n/a	Seasonal tourism and hospitality dominate; women involved in accommodation, food production and care work.
Kelmend	**Vukël**	n/a	n/a	Predominantly agricultural settlement with strong migration. Women's work mainly unpaid and household-based.
Kelmend	**Selcë**	n/a	n/a	Mixed agriculture–service economy; limited local employment opportunities, particularly for women.
Kelmend	**Tamarë**	n/a	n/a	Local service and administrative centre; women more present in trade and services than in surrounding villages.
Admin. Unit Kelmend (Malesi e Madhe Municipality)	**Kelmend (total)**	**1,464**	**50.3**	Mountainous area with agriculture, livestock and seasonal tourism. Women largely engaged in unpaid family labour and household tourism.

4.2 Groundwater Use by Sector (Drinking Water, Agriculture, Industry, Tourism)

The demographic and economic characteristics described above directly explain the observed groundwater use patterns across sectors within the TBA Cemi–Cijevna. In the upper part of the TBA Cijevna/Cemi basin, across the territories of Montenegro and Albania, the dominance of small households, livestock-based agriculture, and informal tourism results in relatively low abstraction volumes, but also in a high level of vulnerability to diffuse pollution. Groundwater use is fragmented across many individual actors, making collective management and regulation difficult despite the relatively limited intensity of use.

In contrast, the downstream Montenegrin context translates demographic concentration and economic diversification into more centralized groundwater use patterns. Public water utilities and municipal systems become dominant stakeholders, with higher abstraction volumes, structured wastewater systems, and clearer accountability. These differences underpin the sectoral analysis presented in Section 4.2 and highlight why groundwater pressures in the basin cannot be assessed solely on volumetric use, but must be interpreted through the lens of stakeholder behavior and institutional capacity.

Link to Vulnerability and Resilience (Section 4.5.2)

The socio-economic asymmetries within the basin are a key driver of both vulnerability and resilience indicators identified in Section 4.5.2. Upstream depopulation, ageing communities, and limited municipal capacity increase vulnerability by reducing the ability to maintain sanitation systems, monitor groundwater impacts, and respond to emerging risks. These conditions amplify the inherent hydrogeological sensitivity of the karst system.

At the same time, downstream population concentration and economic dependence on reliable water services increase exposure but also strengthen resilience through institutional incentives. Utilities and municipal authorities have stronger motivation and capacity to invest in protection measures, monitoring, and emergency response. However, their effectiveness remains partially constrained by upstream pressures that lie outside their direct control.

Governance Implications

Taken together, the demographic and economic profile of the TBA Cemi/Cijevna confirms that groundwater governance challenges are not evenly distributed across the basin. Pressure generation, risk exposure, and response capacity are spatially and institutionally misaligned. This reinforces the need for transboundary governance arrangements that explicitly account for upstream–downstream dependencies and tailor interventions accordingly.

Socio-economic analysis therefore provides the foundation for differentiated governance responses: upstream measures focused on awareness, sanitation improvement, and practical guidance for households and small businesses, and downstream measures centered on institutional coordination, monitoring, and risk management. These dynamics are reflected throughout the subsequent sections of this diagnostic analysis and inform the recommended cooperation mechanisms and measures.

Groundwater use within the TBA Cemi/Cijevna is shaped less by large-scale abstraction and more by the cumulative effects of sector-specific practices, spatial concentration of users, and differences in institutional oversight between upstream and downstream areas. The karstic nature of the system means that even relatively modest pressures can translate rapidly into basin-wide impacts, particularly in terms of water quality.

The sectoral analysis below focuses on how different stakeholder groups use groundwater, where pressures originate, and how these uses interact across the transboundary system.

Albania

Drinking Water

In the Albanian upstream part of the basin, drinking water supply is largely decentralized. Households rely on private wells, local springs, or small communal systems, often with limited treatment and monitoring. The primary stakeholders are individual households, small community associations, and municipal service providers with constrained technical and financial capacity.

Abstraction volumes are generally low, but governance challenges arise from the absence of systematic oversight and data collection. Water quality risks are closely linked to sanitation practices and land use rather than abstraction intensity. The lack of regular monitoring means that contamination events may go undetected until impacts are observed downstream.

Agriculture

Agricultural groundwater use is predominantly small-scale and seasonal. Irrigation demand is modest, but livestock grazing, manure storage, and animal access to karst features represent important diffuse pollution pathways. The key stakeholders are smallholder farmers and livestock owners, whose practices are shaped by tradition, limited resources, and low awareness of hydrogeological vulnerability.

While agriculture does not exert high quantitative pressure on groundwater resources, its qualitative impact is significant due to the sensitivity of karst recharge zones. These pressures are spatially dispersed and difficult to regulate through conventional permitting or enforcement mechanisms.

Industry

There is no significant industrial groundwater abstraction within the Albanian part of the basin. Localized risks may arise from small commercial activities, construction works, or informal workshops, but these remain secondary compared to household and agricultural pressures.

Tourism

Tourism is an emerging sector in the Albanian uplands, driven by landscape value, outdoor recreation, and cross-border visitor flows. Small guesthouses, restaurants, and recreational facilities create seasonal increases in water demand and wastewater generation. These operators typically rely on septic tanks and on-site systems, making them an important stakeholder group despite their limited scale. Seasonal tourism concentrates pressure in specific locations and time periods, increasing the risk of localized contamination that can propagate rapidly through the karst system.

Montenegro

Drinking Water

In the upstream Montenegrin part of the basin, water supply relies on small karst springs managed by local communities and households, without formal oversight or monitoring. As a result, risks are decentralized and difficult to control collectively. In contrast, in the downstream, lowland part-Zeta plain of the basin, groundwater use for drinking water is more centralized and institutionalized. Public water utilities supplying the municipalities of Tuzi, Zeta, and the wider Podgorica area are key stakeholders, managing abstraction points and distribution systems that serve a large and concentrated population. Abstraction volumes and service reliability are critical issues, and utilities have strong incentives to protect water sources. Monitoring, treatment, and operational control are more developed than upstream, but vulnerability remains high due to dependence on interconnected karst systems affected by upstream activities.

Agriculture

Agricultural use includes peri-urban farming, vineyards, and livestock activities. Agricultural operations are carried out by a small number of households and are generally of low intensity. In some areas, water is directly abstracted from the Cijevna River for irrigation and other uses. Livestock keeping, manure storage, and uncontrolled use of fertilizers and pesticides create diffuse pollution risks, particularly in the vulnerable karst terrain. As in Albania, groundwater abstraction volumes are generally much lower than those for public supply, but diffuse pollution remains a concern. Agricultural stakeholders engage more directly with municipal planning and regulation, although enforcement of regulations remains uneven.

Industry

Industrial groundwater use is limited compared to public supply, but peri-urban industrial and service facilities introduce potential risks through wastewater handling and accidental discharges. These pressures are spatially concentrated and more visible, making them easier to regulate but also more impactful when failures occur.

Tourism and Recreation

The Cijevna corridor is an important recreational and landscape asset. Tourism and leisure activities increase seasonal water use and wastewater loads, particularly during summer. Public expectations for environmental quality are high, increasing reputational and political pressure on authorities to maintain groundwater protection.

Transboundary Synthesis

Groundwater use pressures in the TBA Cemi/Cijevna are asymmetric but interconnected. Upstream uses are diffuse, fragmented, and weakly regulated, while downstream uses are concentrated, institutionalized, and highly dependent on reliable groundwater supply.

This creates a governance challenge where low-intensity upstream practices can generate downstream impacts with high social and economic consequences. Effective management therefore requires sector-specific measures aligned with stakeholder capacity and coordinated across the border.

***

Groundwater use in the TBA Cemi/Cijevna reflects a clear upstream–downstream asymmetry. Upstream, small households, informal agriculture, and emerging tourism dominate, producing low volumetric pressure but high vulnerability to diffuse pollution. Downstream, population concentration and institutionalized water utilities create centralized use with higher abstraction volumes and structured monitoring, increasing resilience yet maintaining dependence on upstream conditions. Sectoral pressures differ in scale and visibility: drinking water is highly regulated downstream, agriculture produces dispersed pollution, industry remains limited but concentrated, and tourism creates seasonal peaks. Effective management requires differentiated measures: awareness and sanitation upstream, institutional coordination and monitoring downstream. Transboundary coordination is essential to align pressures, exposure, and response capacity across borders.

4.3 Infrastructure Status: Water Supply, Wastewater, Waste Management

4.3.1 Drinking Water Supply

In the Albanian part of the TBA Cemi/Cijevna, drinking water supply infrastructure shows uneven development, reflecting national challenges in extending safe and reliable services to rural and mountainous areas. According to national SDG monitoring, access to safely managed drinking water services — defined as water that is accessible on premises, available when needed, and free from contamination — remains lower in non-urban areas compared to municipal centers (INSTAT, SDG Indicator 6.1.1)[15].

Urban and semi-urban settlements benefit from centralized supply networks operated by water utilities, while rural and highland communities, particularly in mountainous areas, rely more heavily on decentralized systems, springs, and small-scale networks. These systems are often characterized by intermittent supply, limited treatment capacity, and higher vulnerability to seasonal fluctuations. Due to the Ministry of Infrastructure and Energy, such disparities between urban and rural areas increase exposure to public health risks, especially during periods of low water availability or infrastructure failure.

Additional challenges include aging distribution networks, high levels of non-revenue water, and limited monitoring of water quality in decentralized systems. These factors collectively constrain service reliability and undermine the long-term sustainability of water supply infrastructure.

In the Montenegrin part of the TBA Cemi/Cijevna, drinking water supply infrastructure exhibits pronounced differences between the upper and lower parts of the basin, reflecting local demographic patterns and institutional capacity. In the upper basin, a limited number of households and isolated

[15] INSTAT (National Institute of Statistics of Albania)
SDG Indicator 6.1.1 – Percentage of population using safely managed drinking water services.
SDG Indicator 6.3.1 – Percentage of safely treated domestic and industrial wastewater.

communities rely on local intakes and small karst springs, often without formal oversight or regular monitoring. These systems are typically decentralized, with limited treatment capacity and occasional interruptions in supply, increasing vulnerability to seasonal fluctuations and unforeseen system failures.

In the lower, lowland part of the basin, drinking water supply is more centralized and institutionalized through public water utilities serving the municipalities of Tuzi, Zeta, and the wider Podgorica area. These utilities manage key abstraction and distribution points, providing more stable and reliable services. Supply reliability and water quality are high priorities, supported by more advanced monitoring and treatment compared to the upper basin.

Nevertheless, several challenges persist, including aging distribution networks in certain areas, high levels of non-revenue water, and the vulnerability of the karst system to activities occurring both in the upper and lower parts of the basin. Taken together, these factors constrain service reliability and pose potential public health risks during periods of reduced water availability or unanticipated infrastructure failures.

4.3.2 Wastewater Collection and Treatment

Albania

Wastewater collection and treatment infrastructure in the Albanian part of the Cemi River basin remains significantly underdeveloped, reflecting broader national challenges in extending sanitation services to rural and mountainous areas. Sewerage networks are primarily concentrated in larger settlements, such as Bajzë, while the majority of rural and highland communities in Malësi e Madhe lack access to centralized wastewater collection systems (INSTAT, SDG Indicator 6.3.1)[16].

As a result, on-site sanitation solutions, including septic tanks and rudimentary drainage systems, are widely used. These systems are often poorly designed, inadequately maintained, or non-compliant with environmental standards, leading to direct discharges into surface waters or infiltration into shallow groundwater aquifers. Informal discharge practices are particularly common in dispersed settlements where centralized infrastructure is technically and financially challenging to implement.

National monitoring data indicate that only a limited proportion of domestic and industrial wastewater in Albania is safely treated before discharge, with treatment coverage remaining especially low in northern and mountainous regions (INSTAT, SDG Indicator 6.3.1; European Commission, 2023)[17]. In the Cemi basin, wastewater treatment facilities are either absent or operate below required performance standards, resulting in the release of untreated or partially treated effluents into rivers and streams.

The lack of effective wastewater treatment poses significant risks to both surface and groundwater quality. Untreated effluents contribute to increased organic pollution, nutrient loads, and pathogen concentrations, which degrade aquatic ecosystems and threaten downstream water uses. These

[16] **INSTAT (National Institute of Statistics of Albania)** (2023).
SDG Indicator 6.3.1 – Proportion of domestic and industrial wastewater safely treated.
https://www.instat.gov.al

[17] **European Commission** (2023).
Albania Country Report – Environment, Water and Wastewater Management. European Commission, Brussels.

impacts are particularly critical in the Cemi basin, where groundwater and spring sources serve as primary drinking water supplies for many communities, increasing public health vulnerability (Ministry of Health and Social Protection, 2022)[18].

Recent regulatory initiatives aimed at strengthening wastewater management and extending treatment obligations to commercial and institutional facilities have experienced slow implementation and limited compliance, highlighting gaps in institutional capacity, enforcement, and financing (European Commission, 2023). Without targeted investment and strengthened governance, wastewater-related pressures are expected to persist and intensify, especially under conditions of population growth, seasonal tourism, and climate variability.

Montenegro

Wastewater collection and treatment infrastructure in the Montenegrin part of the Cijevna River basin is characterized by pronounced spatial disparities and an overall insufficient level of development, reflecting broader national challenges in aligning the municipal wastewater sector with the requirements of the EU Urban Waste Water Treatment Directive. While the Capital City of Podgorica is served by a partially developed sewerage system and existing wastewater treatment capacities, **no unified sewerage network or municipal wastewater treatment plant has been constructed in the municipalities of Tuzi and Zeta**.

In the municipalities of Tuzi and Zeta, wastewater generated by households, agricultural holdings, and economic activities is predominantly managed through individual septic tanks and other decentralized solutions. These systems are often inadequately designed, poorly maintained, and not compliant with applicable technical and environmental standards, and in many cases lack impermeable chambers. As a result, there is a high risk of wastewater infiltration into soils and groundwater aquifers, representing a significant pressure on both groundwater and surface water quality in the sensitive karst environment of the Cijevna River basin (Local Environmental Action Plan of the Municipality of Tuzi 2024–2027)[19].

In addition to domestic wastewater, further pressures arise from effluents originating from farms, livestock facilities, and small-scale production activities, which are largely discharged without prior treatment. Such practices contribute to elevated concentrations of organic matter, nutrients, and microbiological pollutants, with potentially adverse impacts on ecosystems and public health, particularly given that groundwater and spring sources within the Cijevna basin are used for drinking water supply.

In response to these challenges, the **National Wastewater Management Plan of Montenegro** (2020-2035)[20] foresees the construction of sewerage networks and wastewater treatment plants for the Tuzi and Zeta agglomerations, including a treatment facility with a design capacity of approximately 9,000 population equivalents for the Tuzi agglomeration, applying secondary treatment. However, until the planned investments are fully implemented, the absence of systematic wastewater collection and

[18] **Ministry of Health and Social Protection (Albania)** (2022). *Public health and sanitation conditions in rural and mountainous areas*.

[19] *Local Environmental Action Plan of the Municipality of Tuzi 2024–2027* (Tuzi: Municipality of Tuzi, 2023).

[20] *National Wastewater Management Plan of Montenegro (2020–2035)* (Podgorica: Ministry of Ecology, Spatial Planning and Urbanism of Montenegro, 2020).

treatment will remain one of the key drivers of water resource vulnerability in the Montenegrin part of the Cijevna River basin.

4.3.3 Solid Waste Management Practices

Solid waste management practices in the Albanian part of the Cemi River basin reflect persistent structural challenges typical of mountainous and predominantly rural regions of northern Albania. Municipal solid waste collection services are mainly available in urban and semi-urban settlements such as Bajzë, while coverage in rural and highland villages of Malësi e Madhe remains partial, irregular, or entirely absent (INSTAT[21], 2023; Council of Ministers of Albania, 2021)[22].

According to national waste management assessments, rural municipalities face constraints related to limited financial resources, difficult terrain, dispersed settlements, and insufficient infrastructure, which collectively hinder the provision of regular waste collection services (Council of Ministers of Albania, National Waste Management Strategy 2021–2027). As a result, informal and illegal waste disposal practices are widely observed in the Cemi basin, including open dumping along riverbanks, small tributaries, ravines, and unused land near settlements.

Uncontrolled disposal of household, agricultural, and construction waste constitutes a significant diffuse pressure on water resources. During rainfall events, solid waste and associated leachate are mobilized by surface runoff, facilitating the transport of organic matter, plastics, and potentially hazardous substances into the Cemi River and its tributaries. These processes contribute to localized surface water pollution and increase the risk of contamination of shallow groundwater, particularly in areas with permeable soils and karstic features (European Commission, 2023)[23].

National reporting confirms that waste separation, recycling, and environmentally sound disposal remain limited, especially in rural municipalities, with continued reliance on open dumping and informal practices (European Commission, 2023; Ministry of Tourism and Environment). In the Cemi basin, these deficiencies exacerbate environmental pressures on both surface and groundwater systems, undermining water quality objectives and posing risks to public health in communities relying on local water sources.

Addressing and improving solid waste management challenges in the Albanian part of the Cemi basin requires expansion of collection services to rural and mountainous areas, closure and rehabilitation of informal dumping sites, improved enforcement, and increased public awareness, in alignment with national waste management policy and EU environmental acquis.

In the Montenegrin part of the Cijevna River basin, solid waste management is characterized by significant spatial disparities and a lack of systematic coverage, particularly in the municipalities of Tuzi and Zeta. In Podgorica, municipal waste collection services are partially developed and operate in urban settlements, whereas in smaller peri-urban and rural areas, regular waste collection is largely absent. As a result, informal and illegal waste disposal practices are widespread, including dumping

[21] **INSTAT (National Institute of Statistics of Albania)** (2023). *Environmental and municipal services indicators; SDG-related reporting*.
https://www.instat.gov.al
[22] **Council of Ministers of Albania** (2021).*National Waste Management Strategy and Action Plan 2021–2027*.
[23] **European Commission** (2023).*Albania Country Report – Environment, Waste Management and Water Quality*. Brussels

on open land, riverbanks, ravines, and unused areas (Municipality of Tuzi, Local Environmental Protection Plan 2024–2027; Municipality of Zeta, Local Environmental Protection Plan 2024–2028)[24].

Collected mixed municipal waste from Podgorica, Tuzi, and Zeta, without prior separation, is transported to the "Livade" landfill in Podgorica, which serves as the only systematic facility for treatment and disposal of waste in this part of the basin.

Uncontrolled dumping at informal sites exerts direct pressure on both surface and groundwater quality. Additional pressures arise from agricultural farms, livestock operations, and small-scale industrial activities, which frequently discharge wastewater and by-products without treatment. These practices contribute to increased nutrient loads, organic pollution, and microbiological contamination, potentially causing long-term negative impacts on ecosystems and public health (Municipality of Tuzi, 2024; Municipality of Zeta, 2024).

To improve solid waste management, the municipalities of Podgorica, Tuzi, and Zeta plan to expand waste collection networks, close and rehabilitate informal dumping sites, establish recycling points, and strengthen enforcement of regulations, alongside raising public awareness on responsible waste disposal. These measures aim to reduce diffuse pressures on water resources and enhance the overall environmental status of the Cijevna River basin (Municipality of Tuzi, 2024; Municipality of Zeta, 2024).

4.3.4 Impacts on Surface and Groundwater

The combined effects of aging water supply networks, limited wastewater treatment, and inadequate waste management infrastructure contribute to elevated pressures on both surface and groundwater. Untreated or poorly treated wastewater discharged into rivers and lakes carries organic matter and pathogens that degrade water quality and elevate public health risks. Likewise, solid waste breakdown products can leach harmful substances into aquifers, threatening water sources used for drinking and irrigation. These infrastructure-related pressures have direct implications for public health, ecosystem integrity, and the long-term availability of water resources. Addressing these challenges requires targeted investments in network rehabilitation, expansion of wastewater collection and treatment systems, and improved waste management services, particularly in rural and mountainous areas, in line with national water and sanitation strategies and SDG commitments. Improving infrastructure performance will require targeted investments in network rehabilitation, expanded sewerage coverage, and the establishment of sustainable treatment operations, particularly in peri-urban and rural zones where current services are least developed. Strategic planning should align with national frameworks for water and sanitation service expansion and environmental protection standards. Solid waste management services in the Albanian and Montenegrin part of the TBA display clear spatial disparities. Urban centers are generally served by organized waste collection systems, whereas rural and mountainous areas experience partial coverage or irregular service provision. In the absence of adequate infrastructure, informal and illegal waste disposal practices persist. Uncontrolled dumping of household and agricultural waste near riverbanks, streams, and recharge zones increases the risk of leachate infiltration into groundwater and direct contamination of surface waters. These practices represent a diffuse but significant pressure on water resources and contribute to the cumulative degradation of environmental quality (national waste management assessments).

[24] Municipality of Zeta (2024). *Local Environmental Protection Plan of the Municipality of Zeta 2024–2028.* Adopted by decision published in the *Official Gazette of Montenegro – Municipal Regulations* 28/2025.

4.3.5 Key Infrastructure Gaps and Challenges

The assessment of water supply, wastewater, and solid waste infrastructure in the Albanian and Montenegrin parts of the TBA Cemi/Cijevna highlights several structural gaps that constrain service performance and environmental protection. The most critical challenges include insufficient coverage of sewerage networks, limited wastewater treatment capacity, and persistent disparities between urban centers and rural or mountainous communities.

Decentralized water supply and sanitation systems, which are widely used in highland areas, often operate with limited technical oversight and financial resources. This increases the risk of system failures, water quality deterioration, and environmental contamination. Furthermore, high levels of non-revenue water and aging infrastructure reduce the efficiency of existing water supply systems and place additional pressure on groundwater abstraction.

In the solid waste sector, the TBA shows clear spatial disparities. Urban centers are generally served by organized waste collection systems, whereas rural and mountainous areas experience partial coverage or irregular service provision. In the absence of adequate infrastructure, informal and illegal waste disposal practices persist. Insufficient collection coverage and the absence of environmentally compliant disposal sites in rural areas continue to drive informal and illegal dumping practices. These practices represent a long-term risk for both surface water bodies and groundwater aquifers, particularly in areas characterized by high hydrological connectivity.

4.3.6 Implications for Socio-economic Development and TDA Relevance

Deficiencies in water supply infrastructure, wastewater management, and solid waste services have direct socio-economic implications in both the Albanian and Montenegrin parts of the Cemi/Cijevna basin, particularly in the highland - upstream areas. Limited access to reliable water supply and sanitation services affects public health outcomes, increases household vulnerability, and constrains local economic activities, particularly agriculture and tourism.

From a Transboundary Diagnostic Analysis (TDA) perspective, these infrastructure deficiencies contribute to cumulative pressures on shared water resources and increase the risk of downstream impacts. The lack of adequate wastewater treatment and uncontrolled waste disposal practices heightens pollution loads entering surface and groundwater systems, with potential cross-border implications.

Addressing these challenges is therefore critical not only for improving local living conditions, but also for reducing transboundary environmental risks. Priority actions include rehabilitation of water supply networks, expansion of wastewater collection and treatment systems, and strengthening of solid waste management services, in alignment with national sector strategies and Sustainable Development Goal (SDG) commitments.

4.4 Environmental Pressures and Risks (e.g. PCB contamination, illegal waste disposal)

This section provides an overview of the main environmental pressures and risks affecting surface and groundwater in the Cemi/Cijevna transboundary basin.

4.4.1 Overview of Key Environmental Pressures

The predominantly mountainous part of the Cijevna River basin, located within the territories of Albania and Montenegro, is subject to a range of environmental pressures and risks primarily arising from inadequate infrastructure, legacy pollution sources, and diffuse human activities typical of rural and mountainous regions. These pressures affect both surface and groundwater systems and have implications for ecosystem health, water quality, and human well-being.

In the downstream part of the basin, within the Zeta Plain, environmental pressures are further intensified by higher population density, concentrated agricultural production, and the presence of key water supply and sanitation infrastructure. The strong hydrological connectivity between the Cijevna River, glaciofluvial groundwater bodies, and drinking water abstraction zones increases vulnerability to cumulative pollution loads and the downstream transfer of contaminants originating in upstream areas[25].

From a Transboundary Diagnostic Analysis (TDA) perspective, the functional linkage between upstream mountainous zones and downstream lowland areas represents a critical factor in assessing shared water resource risks. Inadequate wastewater treatment, uncontrolled solid waste disposal, and diffuse agricultural pollution in upstream sections may generate disproportionate impacts downstream, increasing the risk of transboundary effects on water quality, aquatic ecosystems, and the sustainable use of water resources[26].

4.4.2 Hazardous Substances and PCB-Related Risks

In the Cemi/Cijevna transboundary basin, legacy polychlorinated biphenyls (PCBs) and other hazardous substances present potential long-term risks to soil, surface water, and groundwater. In Albania, historical handling and limited remediation of PCB-containing equipment, such as transformers and capacitors, may cause localized contamination due to the persistent and bioaccumulative nature of these compounds (UNEP, 2016).

In Montenegro, PCB-containing electrical equipment installed before the 1990s has been identified as a priority hazardous waste issue under the Stockholm Convention. A national inventory and disposal program, supported by UNDP/GEF, addresses contaminated equipment and waste, mitigating risks to soil, surface water, and groundwater (UNDP Montenegro, 2023). While no site-specific contamination has been documented in the Cijevna basin, improper storage, handling, or accidental release could create localized long-term risks. Precautionary monitoring and management of PCB-containing waste are recommended across both countries.

4.4.3 Illegal Waste Disposal and Diffuse Pollution

Illegal and informal waste disposal represents a key environmental pressure in both the Albanian and Montenegrin parts of the Cemi/Cijevna basin. In rural and mountainous areas of Albania, limited access to organized waste collection services has led to uncontrolled dumping of household, agricultural, and construction waste near riverbanks, streams, and floodplains, particularly in Malësi

[25] European Commission (2023). *Water Resilience and Groundwater Vulnerability in Karst and Alluvial Systems.*
[26] GEF IW:LEARN (2015). *Transboundary Diagnostic Analysis and Strategic Action Programme Development: A Manual for Practitioners.*

e Madhe (Council of Ministers of Albania, 2021; European Commission, 2023). These practices increase the risk of pollutant transport downstream, with potential impacts on aquatic ecosystems and water users.

In the Montenegrin part of the basin, similar pressures occur in peri-urban and rural areas of Tuzi and Zeta, where waste collection services are limited and open dumping frequently occurs near watercourses. Combined with the absence or limited coverage of wastewater collection and treatment infrastructure, these practices contribute to elevated levels of nutrients, organic matter, and pathogens in surface and groundwater sources used for drinking and irrigation (Municipality of Tuzi, 2023; Municipality of Zeta, 2024).

Addressing these pressures requires the expansion of waste collection services, closure and rehabilitation of informal dumping sites, and improvement of wastewater treatment, particularly in rural and peri-urban areas, to reduce diffuse pollution and protect shared water resources.

4.4.4 Agricultural and Sanitation-Related Pressures

In the absence of comprehensive sewerage systems, untreated domestic wastewater is frequently discharged into the environment through on-site sanitation or informal outlets, contributing nutrients, organic matter, and pathogens to surface waters and groundwater (INSTAT, SDG Indicator 6.3.1).

Agricultural activities, although generally small-scale, exert a diffuse pressure through the use of fertilizers and pesticides. Inadequate nutrient management can increase nitrate and phosphorus loads in surface waters and groundwater, particularly in areas with high hydrological connectivity.

While these pressures are not industrial in scale, they are continuous and contribute to the cumulative environmental risk in the basin, affecting water quality and ecosystem integrity, especially in both the upland mountainous and lowland areas of the Cijevna basin.

4.4.5 Risks to Water Resources and Public Health

The combined effects of illegal waste disposal, untreated wastewater, and diffuse agricultural pollution create cumulative risks to water resources in both the Albanian and Montenegrin parts of the Cemi/Cijevna basin. Surface waters are particularly vulnerable to increased organic matter and waste accumulation, while groundwater faces long-term risks from nutrient infiltration, pathogens, and other potentially harmful substances.

In Albania, informal waste disposal and limited coverage of municipal and sewerage systems in rural and mountainous areas contribute to pollution of smaller streams and springs used for drinking water and irrigation (INSTAT, 2023; Council of Ministers of Albania, 2021; European Commission, 2023). Agricultural activities, although generally small-scale, further contribute to diffuse pressure through nutrient runoff and pesticide application.

In the Montenegrin part of the basin, particularly in the municipalities of Tuzi and Zeta, the lack of unified sewerage systems and predominant reliance on septic tanks and decentralized sanitation systems increase the risk of groundwater contamination (Municipality of Tuzi, 2023; Municipality of Zeta, 2024). Surface waters in the Zeta Plain and lowland areas of Podgorica are also under pressure

from agricultural and municipal activities, while seasonal tourism further increases the load on local water resources.

These pressures have direct implications for public health, as communities relying on untreated or partially treated water are at increased risk of waterborne diseases. The cumulative effects of these pressures represent a significant challenge for achieving water quality protection and pollution reduction targets in line with national and EU standards, as well as the Sustainable Development Goals (SDG 6).

4.4.6 Impacts on Water Resources and Public Health

The combined effects of the presence of hazardous substances, illegal waste disposal, untreated wastewater, and diffuse agricultural pollution create cumulative risks to water resources in the Albanian part of the Cemi/Cijevna basin. Surface waters are particularly vulnerable to organic pollution and the accumulation of solid waste, while groundwater resources face long-term impacts from persistent pollutants and nutrient infiltration. These pressures have direct implications for public health, particularly in communities relying on untreated or intermittently treated water. They also pose challenges to achieving national and EU-aligned water quality protection and pollution reduction objectives.

Although no site-specific PCB contamination hotspots have been formally identified within the Cemi basin, legacy hazardous substances remain a potential risk, reflecting national challenges related to obsolete electrical equipment, transformers, and inadequate disposal practices (UNEP, 2016; Ministry of Tourism and Environment, Albania, 2016). Given the persistent and bioaccumulative nature of PCBs, improper handling or accidental release of these substances in the basin could pose long-term risks to soil, surface water, and groundwater. Preventive monitoring and the careful management of hazardous waste are therefore recommended, even in areas without confirmed contamination.

In the Montenegrin part of the basin, particularly in the municipalities of Tuzi, Zeta, and the wider Podgorica area, pressures on water resources primarily stem from limited wastewater collection and treatment systems, underdeveloped solid waste management services, and decentralized septic systems in peri-urban and rural areas (Municipality of Tuzi, 2024; Municipality of Zeta, 2024). Household and small-scale industrial wastewater is often discharged directly into soil or shallow aquifers, while inadequate solid waste disposal contributes to increased mobilization of pollutants into surface and groundwater, especially during precipitation events.

These factors elevate the risk of contamination by microbial and organic matter, nutrients, and potential chemical substances, with immediate impacts on public health, particularly in communities relying on local springs and wells. Integrated measures, including the expansion of public sewerage systems, construction of wastewater treatment plants, and modernization of solid waste collection and treatment, are essential for mitigating these risks and achieving compliance with national and EU standards (Ministry of Sustainable Development and Tourism, 2023).

Key Findings – Impacts on Water Resources and Public Health

- Cumulative pressures from hazardous substances, illegal waste disposal, untreated wastewater, and diffuse agricultural pollution threaten both surface and groundwater quality in the Cemi/Cijevna basin.

- Surface waters are particularly vulnerable to organic pollution and solid waste accumulation, while groundwater faces long-term risks from persistent pollutants and nutrient infiltration.
- Communities relying on untreated or intermittently treated water are at increased risk of exposure to microbial and chemical contaminants.
- Although no site-specific PCB hotspots have been formally documented, legacy hazardous substances in obsolete electrical equipment, transformers, and improper disposal practices pose a potential long-term risk (UNEP, 2016; Ministry of Tourism and Environment, Albania, 2016).
- In the Montenegrin part of the basin (Tuzi, Zeta, Podgorica), pressures arise from limited wastewater collection and treatment, underdeveloped solid waste services, and decentralized septic systems (Municipality of Tuzi, 2024; Municipality of Zeta, 2024).
- Inadequate wastewater and solid waste management increases pollutant mobilization to surface and groundwater, especially during rainfall, with direct impacts on public health.
- Integrated interventions—including sewerage expansion, construction of wastewater treatment plants, and modernization of solid waste management—are essential to mitigate risks and achieve compliance with national and EU standards (Ministry of Sustainable Development and Tourism, 2023).

4.5. Comparative Socio-economic Analysis

4.5.1 Water Demand Projections

Water demand in the Albanian and Montenegrin parts of the Cemi/Cijevna basin is primarily driven by domestic consumption, livestock rearing, and small-scale agriculture, with limited industrial use. Current demand levels remain relatively low in absolute terms in Albania due to population decline and limited economic activity, while in Montenegro, urban centers such as Podgorica maintain relatively stable water demand due to concentrated populations and developed infrastructure. Seasonal and structural factors influence future demand trends in both parts of the basin.

Population projections for Malësi e Madhe indicate a continued gradual decline and aging trend, suggesting stable or slightly decreasing long-term domestic water demand (INSTAT, 2023). In the Montenegrin part, population growth in Podgorica and urban expansion in the municipalities of Tuzi and Zeta may temporarily increase water demand, whereas in mountainous and peri-urban areas, decentralized supply systems experience intermittent service. Seasonal peaks related to return migration, summer tourism, and agricultural activities can further increase water abstraction pressures, particularly in areas relying on small springs and wells.

Climate variability and an increasing frequency of drought periods are expected to intensify irrigation and livestock water needs, potentially offsetting demographic decline in Albania and increasing seasonal demand in the lowland areas of Montenegro, including the Zeta Plain and the Podgorica Plain (World Bank, 2022). As a result, water demand projections for the basin indicate moderate but seasonally intensified pressure, requiring improved demand management and infrastructure efficiency rather than large-scale expansion of abstraction.

Domestic Water Use

Household water consumption is influenced by population density, access to piped networks, and seasonal variations. Urban households in Podgorica and other Montenegrin centers generally benefit from higher coverage and reliability, whereas rural settlements in mountainous and peri-urban areas, including Tuzi and Zeta, face intermittent supply, limited treatment, and reliance on local springs and wells. Seasonal fluctuations, particularly during summer, can significantly affect availability in decentralized systems, increasing the risk of temporary shortages (Municipality of Tuzi, 2024; Municipality of Zeta, 2024).

Agricultural Water Use

Agriculture represents the largest water-consuming sector in the basin's rural areas, mainly through small-scale irrigation for crop cultivation and water for livestock. Irrigation demand peaks during summer, coinciding with the lowest natural flows of the Cemi River and its tributaries. In the Montenegrin part, irrigation is concentrated in the lowland areas of Zeta Plain, while smaller and seasonally variable usage prevails in the highlands of Tuzi and the upper basin. Nutrient runoff and groundwater abstraction associated with irrigation can contribute to cumulative pressures on water resources (Ministry of Agriculture and Rural Development, 2023; Municipality of Tuzi, 2023).

Industrial and Tourism Water Use

Industrial activity in the Albanian part of the basin is limited, mostly consisting of small enterprises with low water consumption, while in Montenegro, larger industrial zones in Podgorica have stable but localized demand. Seasonal tourism in both Albania and Montenegro can create localized spikes in water demand in villages and small settlements hosting guesthouses or tourist facilities, particularly during July and August. These temporary demands must be considered in water supply planning to avoid over-extraction from springs or small reservoirs.

Future Demand Projections

Based on demographic trends, urbanization, climate change projections, and planned socio-economic development, total water demand in the basin is expected to increase moderately by 2030. Key considerations include:

- Growth in population and households in municipal centers.
- Expansion of tourism and related services.
- Increasing water demand for irrigation during dry periods.
- Seasonal vulnerability of decentralized rural systems in mountainous and peri-urban areas.

If current infrastructure and management practices remain unchanged, seasonal water stress may increase, particularly in the upper and mountainous parts of the basin, as well as in the lowland zones of Zeta Plain. Integrated water resources planning, demand management, and infrastructure upgrades are essential to ensure equitable access and sustainable water use in the Cemi/Cijevna River basin (Ministry of Infrastructure and Energy, 2022; INSTAT, 2023; Municipality of Tuzi, 2023; Municipality of Zeta, 2024).

4.5.2 Vulnerability and Resilience Indicators

Vulnerability and resilience within the Transboundary Aquifer (TBA) Cemi/Cijevna are shaped by the interaction of hydrogeological sensitivity, socio-economic characteristics, and institutional capacity. In the highly connected karst system of the basin, vulnerability is not determined solely by physical exposure, but also by governance arrangements, resource-user behavior, and the degree of alignment between pressure generation and response capacity.

Key Vulnerability Indicators

Albanian part of the basin (upper reach – Malësi e Madhe)

- **Dependence on decentralized water sources.** Rural and mountainous communities largely rely on springs, small piped systems, and shallow wells. These sources are highly sensitive to seasonal variability, resulting in intermittent supply during dry periods.
- **Exposure to diffuse pollution.** Low-intensity agriculture, livestock activities, and informal waste disposal contribute to increased nutrient and microbiological loads in surface and groundwater. Limited wastewater treatment coverage further amplifies contamination risks.
- **Socio-economic factors.** Low population density, pronounced outmigration, population ageing, and limited local financial capacity reduce the ability to invest in infrastructure maintenance and resilience measures.

Montenegrin part of the basin (including the lower reach – Tuzi, Zeta and the wider Podgorica area – as well as the mountainous areas of the basin in Montenegro)

- **Unregulated sanitation systems and waste management:** A large number of households and small businesses rely on individual septic tanks without adequate oversight, while inadequate solid waste disposal practices create additional risks of soil and water contamination.
- **Agricultural pressures.** Direct abstraction from the Cijevna River and its tributaries, the use of fertilizers, pesticides, and manure, as well as livestock presence, generate diffuse pressures on the aquifer, particularly in the Zeta Plain where groundwater is shallow and highly vulnerable.
- **Peri-urban development and seasonal tourism.** Rapid expansion of peri-urban settlements, small campsites, private accommodation, and hospitality facilities increases water consumption and wastewater generation during the summer season, while infrastructure development often lags behind these pressures.
- **Strategic drinking water abstraction zones.** The TBA Cijevna basin directly influences key drinking water sources, including Ćemovsko Polje, Dinoša, Miles, Tuzi–Dečić, Karabuško Polje, and Vuksan Lekići, which supply parts of the municipalities of Podgorica, Zeta, and Tuzi. Due to strong karst connectivity, pressures within the basin may have immediate downstream impacts on drinking water security.

Basin-wide Shared Factors

- **Climate variability.** Seasonal low-flow conditions and prolonged drought periods increase system sensitivity to both abstraction and pollution, reducing natural dilution capacity.
- **Hydrogeological connectivity.** The high degree of connectivity between surface waters and intergranular and karst aquifers enables rapid transport of pollutants throughout the basin.

Key Resilience Indicators

Albanian part of the basin

- **Community-based water system management.** Households and local communities often collectively maintain small-scale water supply systems, demonstrating a basic level of adaptive capacity.
- **Existing planning and regulatory frameworks.** National water management plans aligned with SDG targets provide a foundation for infrastructure improvement and water resource protection.
- **Diversity of water supply sources.** The combination of springs, wells, and piped systems enhances resilience to temporary supply disruptions.

Montenegrin part of the basin

- **Downstream institutional capacity.** Public water utilities and local authorities have clear operational and economic incentives to protect abstraction zones, conduct monitoring, and respond rapidly to incidents.
- **Protected areas - Cijevna River Canyon.** The designation of the Cijevna River Canyon as a Natural Monument provides a framework for regulating land use, agriculture, and tourism, contributing to the protection of water resources.
- **Civil society engagement.** Local non-governmental organizations and community groups contribute to awareness raising, monitoring, and advocacy for water protection, particularly in areas with limited institutional presence.

Transboundary Resilience Dimension

Vulnerability within the TBA Cemi–Cijevna is shared but unevenly distributed. Upper basin areas generate predominantly diffuse pressures under conditions of limited response capacity, while downstream areas face higher exposure and potential consequences but benefit from stronger institutional mechanisms.

Resilience increases where institutional incentives, stakeholder awareness, and transboundary cooperation are aligned. Joint monitoring, targeted sanitation improvements, and structured communication between upstream and downstream actors represent key leverage points for reducing vulnerability and strengthening long-term system resilience.

4.5.3 Institutional and Financial Capacities

Institutional and financial capacities within the Cemi–Cijevna transboundary basin are distributed across national, regional, and municipal levels, with notable differences between the Albanian (upper) and Montenegrin (lower and upper-mountainous) parts of the basin.

Albanian part (upper basin – Malësi e Madhe). Institutional responsibilities are shared among national ministries, regional authorities, and municipal water utilities. Key actors include:

- **Municipal water utilities**, responsible for urban water supply and limited wastewater management.
- **Ministry of Infrastructure and Energy**, overseeing policy, planning, and investment.

- **Environmental and water regulatory agencies**, monitoring water quality and compliance.

Institutional and financial capacity at the municipal level remains limited, particularly in rural and mountainous areas. Municipal budgets are constrained by a narrow revenue base, high service delivery costs due to dispersed settlements, and reliance on central government transfers and donor-funded projects (World Bank, 2022). These limitations affect infrastructure planning, maintenance, monitoring, and enforcement. National strategies provide a clear policy framework, but local implementation is often delayed due to capacity gaps.

Montenegrin part (lower and mountainous basin – Tuzi, Zeta, wider Podgorica area). Institutional capacities are more centralized, with key actors including:

- **Public water utilities** (Podgorica, Zeta, Tuzi), responsible for water supply, source protection, and limited wastewater management.
- **Water Administration (Uprava za vode)**, responsible for regulation, monitoring, and planning of surface and groundwater resources.
- **Ministry of Ecology, Spatial Planning and Urbanism**, and **Ministry of Agriculture, Forestry and Water Management**, overseeing water governance and environmental policies.
- **Local municipalities**, responsible for planning, local environmental protection, and service delivery.

Lower and peri-urban areas benefit from stronger institutional capacity and technical knowledge, but the mountainous areas still face limited oversight of decentralized water supply and sanitation systems.

Key Institutional Gaps and Challenges:

- Limited technical staff and expertise, particularly in rural and highland areas.
- Fragmentation of responsibilities across agencies, leading to slow response and inefficient coordination.
- Insufficient monitoring and enforcement mechanisms for water quality, wastewater, and hazardous substances.

Financial Capacity:

- Municipal budgets cover routine maintenance and partial network expansion but are insufficient for large-scale rehabilitation or wastewater treatment.
- National programs and EU funding provide additional support but are limited and competitive.
- Household contributions are often low due to affordability constraints and reliance on decentralized systems.

Financial constraints particularly affect rural and mountainous areas where infrastructure is limited. Investment priorities include:

- Rehabilitation and expansion of water supply networks.
- Construction or upgrading of wastewater treatment facilities.
- Improvement of solid waste collection and environmentally compliant disposal sites.

Opportunities to Strengthen Capacities:

- Integrated planning combining municipal, regional, and national levels to optimize resource allocation.
- Capacity building for municipal staff and local community managers to improve operation and maintenance of decentralized systems.
- Mobilization of external funding (EU, bilateral projects, climate adaptation funds) to support infrastructure investment and environmental protection.
- Community engagement and cost-sharing mechanisms to strengthen local ownership and sustainable management of water and sanitation services.

Summary:
Strengthening institutional and financial capacities across both sides of the basin is critical to improving resilience, addressing seasonal water stress, and responding to cumulative environmental pressures identified in Sections 4.4 and 4.5.1–4.5.2. The integration of national and local actors, along with targeted investments and cross-border cooperation, forms the foundation for sustainable water management under the TDA and SAP frameworks.

4.5.4 Integrated Vulnerability-Resilience Assessment

Based on the analysis of vulnerability and resilience indicators, the following conclusions can be drawn:

Albanian part of the basin (upper reach – Malësi e Madhe)

- Urban settlements, such as Bajzë, exhibit moderate vulnerability, with higher resilience due to infrastructure coverage and institutional support.
- Rural and highland villages show high vulnerability, primarily due to reliance on decentralized water sources, limited sanitation coverage, and seasonal water stress. Resilience in these areas depends heavily on local community water management and small-scale adaptive measures.

Montenegrin part of the basin (lower reach – Tuzi, Zeta, wider Podgorica area, including upper-mountainous areas)

- Vulnerability is pronounced in peri-urban and rural settlements due to limited wastewater collection and treatment, informal solid waste disposal, and decentralized septic systems.
- Agricultural pressures, seasonal tourism, and peri-urban expansion further increase stress on water resources.
- Key drinking water sources (Ćemovsko polje, Dinoša, Miles, Tuzi–Dečić, Karabuško polje, Vuksan Lekići) supply parts of Podgorica, Zeta, and Tuzi municipalities, making local pressures especially critical.
- Resilience is higher in urban centers and protected areas (Cijevna Canyon), while civil society engagement and local community coordination provide additional adaptive capacity.

Shared basin factors

- **Climate variability:** Seasonal low flows and prolonged dry periods increase sensitivity to both abstraction and pollution.

- **Hydrogeological connectivity:** High connectivity between surface waters and shallow karst aquifers facilitates rapid pollutant transfer across the basin.
- **Cumulative pressures:** Increasing water demand, seasonal fluctuations, diffuse agricultural pollution, and inadequate infrastructure amplify vulnerabilities and stress on water resources.

Conclusion:
Vulnerability in the TBA Cemi/Cijevna is **shared but unevenly distributed**: upstream areas contribute diffuse pressures under low capacity, while downstream areas experience higher exposure but stronger institutional mechanisms and greater problem visibility. Resilience is enhanced where institutional incentives, stakeholder awareness, and cross-border cooperation are aligned. **Joint monitoring, targeted sanitation improvements, and structured communication between upstream and downstream actors** are key levers to reduce vulnerability and strengthen long-term resilience in the basin.

4.6 Summary Table: Socio-economic Indicators

ALBANIA

Table 1.5. Infrastructure Component – Current Status, Key Differences, Implications-Al

Infrastructure Component	Current Status	Key Urban–Rural Differences	Main Implications
Drinking Water Supply	Partial coverage with mixed service quality; dependence on centralized systems in urban areas and small-scale or decentralized systems in rural/mountainous settlements	Higher network coverage and continuity in municipal centers; lower coverage, intermittent supply, and seasonal variability in rural and highland areas	Public health risks from intermittent supply; higher vulnerability of rural populations (INSTAT, SDG 6.1.1)
Water Quality Control	Uneven monitoring and treatment performance	More regular monitoring in urban utilities; limited controls in decentralized systems	Increased risk of microbiological contamination and service unreliability
Wastewater Collection	Incomplete sewerage coverage; many settlements without formal systems	Urban areas more likely to be connected; rural/mountainous areas rely on on-site or informal solutions	Direct discharge into surface waters and seepage into groundwater (EC Reports; INSTAT SDG 6.3.1)
Wastewater Treatment	Limited treatment capacity; only a fraction of generated wastewater treated to standards	Treatment plants mainly serve larger urban areas	Degradation of surface water quality and downstream ecological impacts
Solid Waste Collection	Organized collection in urban centers; limited or irregular coverage in rural areas	Informal dumping more frequent in rural and mountainous zones	Leachate and diffuse pollution affecting surface and groundwater
Solid Waste Disposal	Reliance on disposal sites with variable environmental controls	Lack of compliant facilities near smaller settlements	Long-term contamination risks for aquifers and river systems

Sources: INSTAT (SDG indicators 6.1.1; 6.3.1); Ministry of Infrastructure and Energy sector assessments; European Commission country and sector reports.

Table 1.6. Socio-economic Indicators - AL

Indicator	Situation in the Cemi Basin (Albanian part)	Source
Population trend	Declining and aging population	INSTAT, 2023
Settlement pattern	Dispersed, predominantly rural	INSTAT, 2023
Main economic activities	Agriculture, livestock, remittances	INSTAT, 2023
Domestic water demand	Low–moderate, seasonal peaks	INSTAT; World Bank, 2022
Irrigation & livestock demand	Seasonal, climate-sensitive	World Bank, 2022
Access to piped water	Uneven; lower in rural/mountain areas	INSTAT, SDG 6.1.1
Wastewater treatment coverage	Very limited	INSTAT, SDG 6.3.1
Socio-economic vulnerability	High sensitivity, low adaptive capacity	European Commission, 2023
Institutional capacity	Limited at municipal level	World Bank, 2022

Table 1.7. Key Infrastructure & Socio-economic Summary-AL

Indicator	Value / Coverage	Source / Reference	Remarks / Relevance
Population	~15,000 (Malësi e Madhe, highland and rural settlements)	INSTAT, 2023	Determines domestic water demand and pressure on infrastructure
Urban vs. Rural Population	Urban: ~40%; Rural/Highland: ~60%	INSTAT, 2023	Highlights differences in access to water, sanitation, and waste management
Literacy Rate (age 15+)	97.7%	INSTAT, 2023	Socio-economic development indicator
Household Water Supply Coverage	Urban: ~85%; Rural/highland: ~45–60%	INSTAT, SDG 6.1.1	Reflects access to safely managed drinking water
Wastewater Treatment Coverage	Urban: ~25%; Rural/highland: 0–10%	INSTAT, SDG 6.3.1	Indicates vulnerability to waterborne contamination
Solid Waste Collection Coverage	Urban: ~70–80%; Rural/highland: 10–25%	National Waste Management Strategy, 2021–2027	Highlights pressure from informal/illegal dumping
Agricultural Water Use	Small-scale crop and livestock irrigation; seasonal peaks in summer	Ministry of Agriculture and Rural Development, 2023	Largest water-consuming sector in rural areas
Industrial Water Use	Limited, small enterprises; low absolute volume	Ministry of Infrastructure and Energy, 2022	Minor contributor to total demand

Tourism Water Use	Seasonal spikes in villages with guesthouses/small resorts	Ministry of Infrastructure and Energy, 2022	Temporary local pressure on water supply
Projected Water Demand (2030)	Moderate increase (domestic, irrigation, tourism)	INSTAT, 2023; Ministry of Infrastructure and Energy, 2022	Planning consideration for infrastructure development
Vulnerability Indicators	Reliance on springs/groundwater; intermittent supply; limited wastewater; low access to organized waste collection	Sections 4.5.1–4.5.2	Highlights high-risk areas, especially rural/highland
Resilience Indicators	Community-managed water systems; municipal utility support; redundancy in water sources	Sections 4.5.1–4.5.2	Indicates adaptive capacity
Institutional Capacities	National: Ministries (Infrastructure, Environment); Regional: Municipal utilities; Local: community committees	Section 4.5.3	Governance structure for water and sanitation
Financial Capacities	Municipal budgets + national/EU programs; limited local funding in rural/highland areas	Section 4.5.3	Investment needs for infrastructure, maintenance, and environmental protection

Notes: Indicators are specific to the Albanian part of the Cemi/Cijevna basin, integrating demographic, economic, infrastructure, environmental pressures, and governance aspects. Coverage percentages reflect latest available data (INSTAT, national reports) and may vary seasonally, particularly for decentralized water sources and tourism. Vulnerability and resilience indicators are qualitative, based on socio-economic analysis, infrastructure status, and institutional capacities. All are preliminary data**.

Table 1.8. Summary of Infrastructure Status in the TBA Cemi/Cijevna Region-AL

Infrastructure Component	Status / Coverage	Key Features / Notes	Key Challenges	Sources
Drinking Water Supply	Partial coverage with mixed service quality	Dependence on centralized systems in urban/semi-urban areas (e.g., Bajzë) and small-scale or decentralized systems in rural/mountainous settlements	Intermittent supply, aging networks, limited treatment, seasonal variability	INSTAT, 2023; Ministry of Infrastructure and Energy, 2022
Wastewater Collection & Treatment	Underdeveloped	Centralized sewerage in larger settlements; rural/mountain areas rely on on-site or informal systems	Lack of treatment plants, maintenance gaps, direct discharges into rivers/groundwater	INSTAT SDG 6.3.1, 2023; Ministry of Infrastructure and Energy, 2022
Solid Waste Management	Uneven / partial	Organized collection in urban centers; rural areas mostly informal	Illegal dumping along riverbanks, leachate infiltration into groundwater, lack of recycling	Council of Ministers of Albania, 2021–2027; European Commission, 2023

Surface & Groundwater Impact	High pressure	Untreated wastewater and solid waste disposal contribute to organic pollution, nutrients, and pathogens	Risks to drinking water sources and ecosystems	INSTAT SDG 6.3.1, 2023; European Commission, 2023
Key Infrastructure Gaps	Significant	Rural and highland villages lack reliable water supply and wastewater services	Insufficient financial & institutional capacity, limited monitoring	World Bank, 2022; Ministry of Tourism and Environment, 2022
Socio-economic Implications	Critical	Direct impact on public health, livelihoods, and ecosystem services	Need for investment in rehabilitation, expansion, and governance	European Commission, 2023; INSTAT, 2023

MONTENEGRO

Table 1.9. Infrastructure Component – Current Status, Key Differences, Implications-ME

Infrastructure Component	Current Status	Key Urban–Rural/Highland Differences	Main Implications
Drinking Water Supply	Partial coverage; mix of centralized municipal supply and local springs/boreholes	Urban and peri-urban (Podgorica, Tuzi, Zeta) better coverage; rural/highland intermittent, gravity-fed springs, or small networks	Intermittent supply increases public health risks; rural/highland communities more vulnerable
Water Quality Control	Monitoring coverage varies; treatment limited	Urban utilities regularly monitor; rural/highland decentralized sources rarely monitored	Microbiological and chemical contamination risk; unreliable water quality
Wastewater Collection	Incomplete; many settlements rely on septic tanks	Urban centers partially connected - Podgorica; rural/highland rely on on-site systems	Direct discharge to streams/groundwater; cumulative pollution risk
Wastewater Treatment	Limited; small plants in Podgorica and Tuzi	Treatment facilities concentrated in municipal centers; rural areas mostly untreated	Surface water degradation; contamination of aquifers
Solid Waste Collection	Organized in urban areas; informal in rural/highland	No basin-specific quantitative data were available at the time of reporting.	Diffuse pollution and leachate affecting water resources
Solid Waste Disposal	Landfills with limited compliance; illegal dumping observed	Urban centers semi-controlled; rural/highland mostly informal dumps	Long-term risk for groundwater and river systems

Table 1.10. Socio-economic and Gender Indicators-ME

Indicator	Situation in Montenegrin Part (Tuzi, Zeta, Podgorica, Highlands)	Source
Population trend	Urban/peri-urban growth (Podgorica, Zeta plain); highlands stable or declining	Monstat, 2023
Settlement pattern	Dispersed in highlands; peri-urban clusters along roads	Monstat, 2023
Main economic activities	Agriculture, livestock, remittances, small trade; services in urban/peri-urban areas	Monstat, 2023
Domestic water demand	Moderate; seasonal peaks during summer tourism	Monstat, 2023
Irrigation & livestock demand	Seasonal; climate-sensitive	Ministry of Agriculture and Rural Development. (2017)
Access to piped water	Rural and peri-urban areas: water supply available; mountainous areas: limited access.	Municipality of Zeta (2024); Municipality of Tuzi (2023)
Wastewater treatment coverage	Only Podgorica (poor); Tuzi, Zeta, and mountainous areas: none.	Municipality of Zeta (2024); Municipality of Tuzi (2023); Ministry of Agriculture and Rural Development. (2017)
Socio-economic vulnerability	Moderate–high; high seasonal exposure	Municipality of Zeta (2024); Municipality of Tuzi (2023)
Institutional capacity	Limited at municipal level; support from Water adminstration	Municipality of Zeta (2024); Municipality of Tuzi (2023)
Women's share of population	44–55% depending on settlement; lower in aging rural communities	Monstat, 2023
Women's economic engagement	Primarily family-based, unpaid, agricultural, tourism services; limited formal employment; seasonal income	Monstat, 2023
Gender-specific water responsibilities	Household water management, sanitation, food prep, care work	Monstat, 2023
Implications for resilience	Women's unpaid labor increases under water stress; limited influence on formal water governance	Section 4.1.1.

Table 1.11. Key Infrastructure & Socio-economic Summary-ME

Indicator / Component	Value / Coverage	Source / Reference	Remarks / Relevance
Population	~7,918 (Montenegrin part of the Cemi/Cijevna basin – within the watershed)	Monstat, 2023	Determines domestic water demand
Household Water Supply Coverage	No basin-specific quantitative data were available at the time of reporting.		Access to safely managed drinking water
Wastewater Treatment Coverage	No basin-specific quantitative data were available at the time of reporting.		Vulnerability to waterborne contamination
Solid Waste Collection Coverage	No basin-specific quantitative data were available at the time of reporting.	Municipality of Zeta (2024); Municipality of Tuzi (2023)	Pressure from informal/illegal dumping
Agricultural Water Use	Small-scale irrigation & livestock; seasonal peaks	Municipality of Zeta (2024); Municipality of Tuzi (2023)	Largest water-consuming sector in rural areas
Industrial Water Use	Small enterprises; low absolute volume	Municipality of Zeta (2024); Municipality of Tuzi (2023)	Minor contributor to total demand

Tourism Water Use	Seasonal peaks; villages, guesthouses	Municipality of Zeta (2024); Municipality of Tuzi (2023)	Temporary local pressure on water supply
Projected Water Demand (2030)	Moderate increase; domestic, irrigation, tourism	Municipality of Zeta (2024); Municipality of Tuzi (2023)	Planning for infrastructure expansion
Vulnerability Indicators	Dependence on springs/groundwater; intermittent supply; limited wastewater; informal waste disposal	Sections 4.5.1–4.5.2	High-risk areas: rural/highland settlements
Resilience Indicators	Community-managed water systems; municipal utility support; redundancy in water sources	Sections 4.5.1–4.5.2	Adaptive capacity
Institutional Capacities	National: Water Administration; Local: municipal authorities, community committees	Section 4.5.3	Governance structure for water and sanitation
Financial Capacities	Municipal budgets + national/EU programs; limited local funding	Section 4.5.3	Investment needs for infrastructure, maintenance, environmental protection
Gender & Social Considerations	Women heavily engaged in unpaid household, agriculture, tourism; limited decision-making	Section 4.1.1	Important for inclusive water management and resilience

Table 1.12. Summary of Infrastructure Status in the TBA Cemi/Cijevna Region – Montenegrin Part

Infrastructure Component	Status / Coverage	Key Features / Notes	Key Challenges	Sources
Drinking Water Supply	Partial coverage; mixed reliability	Centralized supply in municipal centers (Tuzi, Zeta); rural and highland villages rely on springs, small piped networks, or decentralized systems.	Intermittent supply in rural/highland areas; limited treatment; seasonal variability	Monstat, 2023
Wastewater Collection & Treatment	Underdeveloped	Centralized sewerage in larger settlements-Podgorica-city; peri-urban, rural and highland areas rely on individual septic tanks or informal solutions	Lack of treatment plants; maintenance gaps; direct discharges into rivers and groundwater	Municipality of Zeta (2024); Municipality of Tuzi (2023)
Solid Waste Management	Uneven / partial	Organized collection in urban centers (Podgorica, Zeta, Tuzi); rural and highland areas mostly informal	Illegal dumping, leachate infiltration into groundwater, lack of recycling	Municipality of Zeta (2024); Municipality of Tuzi (2023)
Surface & Groundwater Impact	Moderate–High pressure	Untreated wastewater and solid waste disposal contribute to microbial and nutrient loads; key drinking water sources (Ćemovsko polje, Dinoša, Miles, Tuzi–Dečić, Karabuško polje, Vuksan Lekići) affected	Risks to drinking water security and ecosystems; high vulnerability of rural/highland settlements	Municipality of Zeta (2024); Municipality of Tuzi (2023) Dević, N. 2025.

Key Infrastructure Gaps	Significant	Rural and mountainous villages lack reliable water supply and wastewater services	Limited municipal budgets and institutional capacity; insufficient monitoring and maintenance	Municipality of Zeta (2024); Municipality of Tuzi (2023)
Socio-economic Implications	Critical	Direct impact on public health, livelihoods, and ecosystem services	Need for targeted investment in rehabilitation, expansion, and governance; address seasonal water stress	Municipality of Zeta (2024); Municipality of Tuzi (2023)

Note: The population within the Montenegrin part of the Cijevna sub-basin is ~7,918 (6,597 lowland Zeta Plain + 1,321 mountain/highland settlements), highlighting the scale of rural and highland dependence on decentralized and small-scale water supply systems.

5. Institutional and Transboundary Cooperation – TBA Cemi/Cijevna

5.1 Institutional Roles and Capacities in Albania and Montenegro

This section outlines the institutional landscape governing groundwater management within the TBA Cemi-Cijevna, with a focus on mandates, operational capacity, coordination mechanisms, and structural gaps relevant to transboundary aquifer protection. While both countries have formal legal and institutional frameworks in place, their effectiveness differs significantly between upstream and downstream areas, and coordination remains largely project-based.

Albania

The Albanian part of the basin operates within a centralized national water governance framework, with limited implementation capacity at local level. Institutional roles are formally defined, but practical enforcement and monitoring in the upper basin remain constrained by geography, resources, and institutional reach.

Primary institutions

National Water and Territory Council (NWTC)

Acts as the highest decision-making body for water resources administration, setting strategic direction and approving key policies related to water management, River Basin Management Plan and water protection.

Water Resources Management Agency (WRMA / AMBU)

Serves as the national authority responsible for water resources management, including planning, coordination, data collection, and implementation support.

Albania Geologic Service (AGS) is the main state Institution dealling will groundwater management and monitoring based on RBM Plans. This Institution is part of Ministry of Energy and Infrastructure, which complicate coperation with other water related institutions, related to use and water monitoring.

National Agency of Water Supply and Waste (NAWSW/AKUK and related entities). Responsible for sector-level planning, oversight of water supply and wastewater services, and investment coordination. Their role in groundwater protection is indirect but relevant through service standards and infrastructure development.

Municipal governments within the basin

Hold responsibility for spatial planning, sanitation, solid waste management, and local environmental protection. In the upper Cemi basin, municipalities face significant capacity constraints, including limited budgets, large service areas, and weak technical staffing. Groundwater protection is rarely addressed explicitly in local planning instruments.

Capacity assessment

- Strong legal and policy framework at national level, with ongoing alignment to EU water governance principles.
- Weak operational capacity at local level, particularly for groundwater monitoring, septic system oversight, and diffuse pollution control.
- Limited routine data collection and public reporting on groundwater conditions in the upper basin.
- Coordination between national institutions and municipalities is formal rather than operational, reducing responsiveness to localized risks.

Montenegro

In the Montenegrin part of the basin, groundwater governance is more operationally embedded within municipal and utility systems, reflecting higher population density, stronger institutional presence, and direct dependency on reliable water supply.

Primary institutions

Ministry of Agriculture, Forestry and Water Management (MAFWM) - Directorate for Water Management
Holds responsibility for water management policy, regulation, and coordination at national level, including groundwater protection and abstraction control. While the Directorate provides the formal regulatory framework, its capacity to influence upstream pressures originating outside national borders remains limited, requiring structured transboundary cooperation mechanisms.

The Water Directorate-WD (Uprava za vode) is tasked with the operational implementation of water management policies, including issuing permits, monitoring water resources, maintaining water registers, and ensuring compliance with water use and protection measures.

Water management directorates and regulatory bodies, including the **Water Directorate (WD)**, the **Water Inspection**, and the **Energy and Regulated Utilities Agency (REGAGEN)**, provide technical oversight, permitting functions, and coordination with municipal authorities. While the Water Directorate and Water Inspection focus on operational management and compliance monitoring of water resources, REGAGEN regulates public water supply and wastewater services, including licensing, tariff approval, and performance oversight. Their combined role is most visible in downstream and

peri-urban areas, where infrastructure, population density, and water use demand active management and coordinated oversight.

Municipal governments (Tuzi, Zeta and Podgorica)

Responsible for local spatial planning, communal services, wastewater management, and environmental protection. Tuzi, in particular, has direct relevance due to its location within the basin and its role in managing land use in sensitive areas.

Public water utility (Vodovod i kanalizacija Podgorica and Vodovod i kanalizacija Tuzi)

The key operational stakeholder for drinking water supply. The utility has strong incentives to protect groundwater sources, maintain service reliability, and monitor water quality. Its operational capacity and data availability exceed those found upstream, but its control over upstream pressures is indirect.

Capacity assessment

- Stronger operational capacity and clearer accountability at utility and municipal level.
- Better integration between water supply operations, monitoring, and risk response.
- Persistent exposure to upstream pressures that fall outside national or municipal control.
- Coordination across land-use planning, wastewater management, and water protection remains imperfect, particularly under rapid peri-urban development.

Transboundary Institutional Context

There is no permanent bilateral institution dedicated specifically to groundwater governance in the TBA Cemi/Cijevna. Cooperation between Albania and Montenegro has historically occurred through international agreements, reporting obligations, and project-based initiatives rather than standing operational mechanisms.

Institutional asymmetry is evident:

- Albania exhibits strong central policy authority but weak local implementation capacity in the upper basin.
- Montenegro exhibits stronger downstream operational institutions but limited leverage over upstream drivers of risk.
- Data exchange, joint monitoring, and coordinated incident response are not yet institutionalized and rely on ad hoc communication or project platforms.
- DIKTAS II provides a practical framework for addressing these gaps by supporting harmonized monitoring, shared indicators, and structured dialogue between institutions. However, long-term effectiveness will depend on translating project-based cooperation into routine institutional practice.

Governance Implications

The institutional analysis confirms that groundwater governance challenges in the TBA Cemi/Cijevna are not rooted in the absence of institutions, but in uneven capacity, fragmented responsibilities, and limited operational coordination across borders.

Strengthening governance therefore requires:

- Clearer operational linkages between upstream and downstream institutions.

- Routine data sharing and joint interpretation mechanisms.
- Explicit recognition of upstream–downstream dependencies in institutional mandates and cooperation arrangements.
- These findings inform the assessment of stakeholder engagement, cooperation gaps, and opportunities presented in the following sections.

5.2 Bilateral Agreement and Joint Commission

A Memorandum of Understanding for the Drin Basin – Drin Declaration was signed in November 2011 by the countries of the Drin Basin (Montenegro, Albania, North Macedonia, Greece, and Kosovo). The aim of the Drin Declaration is to strengthen cross-border cooperation in integrated water management and sustainable development of the region, in accordance with the Water Convention and the Water Framework Directive. This project is of particular importance for Montenegro in terms of its impact on the Bojana River and the coastal sea.

Albania and Montenegro's interstate relations in the field of water as neighboring country are regulated by treaties between the states:

The first agreement between countries of Montenegro and Republic of Albania concluded was in 2001. In addition to the bilateral treaty on water management, the following were signed:

- Statute and Protocol on Cooperation in the Field of Water Management in 2003, adopted by both governments,
- Agreement between the Academies of Sciences and Arts of Montenegro and Albania, 2005,
- Memorandum of Understanding between the Council of Ministers of the Republic of Albania and Montenegro for the "Cross-Border Development of Lake Skadar", on 26 May 2006.
- Memorandum of Understanding between the Ministry of Agriculture and Rural Development of Montenegro and the Ministry of Environment, Forestry and Water of Albania, 14 December 2010,
- Memorandum for cooperation between 4 Hydrometeorological institutes (Montenegro, Albania, North Macedonia, and the Republic of Kosovo) Cooperation and Data Exchange for Flood warning in the Drim\Drin - Buna\Bojana River Basin (2011).
- Agreement on Transboundary Water Resources Management between Montenegro and Albania, 2018,
- Cross-border cooperation on the Cijevna/Cem River – supported by the Water Convention's Implementation Committee as part of the advisory procedure on the Cijevna/Cem River (2023).

5.3 Stakeholder Engagement and Public Awareness

This section assesses stakeholder engagement practices, communication channels, and public awareness levels related to groundwater protection within the TBA Cemi/Cijevna. The analysis focuses on how different stakeholder groups are informed, involved, and able to influence groundwater-related decisions, and where gaps in engagement contribute to governance risks.

Overall, stakeholder engagement in the basin remains fragmented and uneven, reflecting broader institutional asymmetries between upstream and downstream areas. While formal mechanisms for consultation exist in both countries, groundwater-specific engagement is limited, and transboundary stakeholder interaction is largely absent outside project-based initiatives.

Table 1.13. Stakeholder Roles, Engagement Gaps, and Sensitivities

Key Stakeholder Groups	Engagement Gaps	Stakeholder Dynamics and Sensitivities
Public Water Utilities (Montenegro): Technically capable operational institutions with strong dependency on groundwater sources and high service accountability.	No formalized mechanisms for regular communication with upstream communities and authorities. Limited public dissemination of groundwater monitoring results and risk alerts.	High sensitivity to contamination and supply disruption. Strong incentive for protection, but limited leverage over upstream drivers of risk.
Municipal Governments (Albania & Montenegro): Responsible for spatial planning, sanitation, waste management, and local enforcement.	Engagement is largely administrative and compliance-driven. Groundwater considerations are rarely addressed explicitly in local planning and public consultations.	Capacity asymmetry between upstream rural municipalities and downstream peri-urban ones. Competing development priorities weaken focus on groundwater protection.
Rural Communities (Upstream Albania): Households, farmers, and livestock owners influencing diffuse pressures.	Low awareness of karst vulnerability and upstream–downstream linkages. Limited access to practical guidance on septic maintenance, waste disposal, and land-use impacts.	Groundwater risks perceived as distant or abstract. Economic constraints and weak institutional presence reduce engagement motivation.
Tourism and Recreation Operators: Guesthouses, restaurants, and service providers along the river corridor.	No systematic environmental training or groundwater-specific guidance. Engagement is ad hoc and project-based.	Seasonal economic incentives can conflict with environmental protection. Operators benefit from environmental quality but have uneven awareness of groundwater risks.
Agricultural Users: Small-scale farmers and livestock owners in both countries.	Limited involvement in groundwater protection planning. Diffuse pollution risks are not addressed through structured engagement or advisory services.	Practices are tradition-based and resource-constrained. Low perception of cumulative impacts in a karst system.
Environmental NGOs and Civil Society: Active particularly in Montenegro, with advocacy and awareness roles.	Involvement is not systematically integrated into groundwater governance or monitoring frameworks.	Act as potential bridges between institutions and communities. Can increase accountability but depend on institutional openness.
Schools and Youth Groups: Educational institutions and informal youth networks.	Largely underutilised in groundwater awareness and long-term capacity building.	High potential for long-term behavioral change and awareness, but currently peripheral to governance processes.

5.4 Opportunities for Strengthening Cooperation

Opportunities for strengthening cooperation in the **TBA Cemi/Cijevna can be organized around four strategic pillars.** Each pillar responds directly to the institutional asymmetries, stakeholder engagement gaps, and governance vulnerabilities identified in the preceding sections. Together, they provide a practical pathway for moving from ad hoc collaboration toward more stable and effective transboundary groundwater governance.

PILLAR 1: JOINT MONITORING AND INFORMATION EXCHANGE

Establishing a harmonized and jointly agreed monitoring framework represents the most immediate and impactful opportunity for cooperation. Given the karstic connectivity of the basin, shared understanding of groundwater conditions is essential for effective risk management.

Key opportunities include:

- Agreeing on a core set of monitoring parameters for groundwater quantity and quality, including spring discharge, basic physic-chemical indicators, and microbiological parameters.
- Identifying and jointly validating priority monitoring points in upstream and downstream areas, including springs, wells, and key river–groundwater interaction zones.
- Establishing routine data exchange protocols between Albanian and Montenegrin institutions, supported by simple, shared reporting formats.
- Organizing periodic joint data interpretation meetings to build a common understanding of trends, anomalies, and emerging risks.

Outcome: A shared evidence base that supports early warning, informed decision-making, and trust between institutions.

PILLAR 2: COORDINATED RISK MANAGEMENT AND PROTECTION MEASURES

Reducing groundwater vulnerability requires coordinated approaches to risk prevention and response, particularly where upstream pressures can have downstream consequences.

Key opportunities include:

- Developing a joint incident notification and response protocol between relevant authorities and public water utilities, defining communication channels and response timelines.
- Jointly mapping high-risk sanitation and land-use zones in the upper basin and peri-urban downstream areas, using common criteria.
- Aligning minimum technical guidance for on-site sanitation systems in vulnerable karst areas, including septic tank design, maintenance, and inspection.
- Coordinating emergency preparedness for contamination events and extreme hydrological conditions, including low-flow periods.

Outcome: Faster, more coherent responses to risks and reduced exposure of sensitive recharge zones.

PILLAR 3: SUSTAINABLE LAND-USE AND TOURISM PRESSURE MANAGEMENT

Land-use change and tourism-related pressures represent growing governance challenges in the basin. Cooperation can help align standards and expectations across borders.

Key opportunities include:

- Developing shared environmental guidance for tourism and recreation operators, focusing on water efficiency, wastewater management, and waste disposal.

- Coordinating awareness messaging through visitor centers, municipal communication channels, and tourism platforms to promote responsible behavior.
- Strengthening coordination between spatial planning authorities to ensure groundwater vulnerability is considered in development decisions in sensitive areas.
- Encouraging voluntary compliance schemes or codes of practice for tourism and hospitality businesses operating along the river corridor.

Outcome: Harmonized management of seasonal pressures and stronger alignment between economic activity and groundwater protection.

PILLAR 4: INSTITUTIONAL DIALOGUE AND COMMUNITY ENGAGEMENT

Long-term cooperation depends on stable institutional relationships and meaningful stakeholder involvement beyond formal authorities.

Key opportunities include:

- Establishing a standing technical coordination group for the TBA Cemi–Cijevna, involving national water institutions, municipalities, and public water utilities from both countries.
- Creating structured channels for the participation of municipalities, NGOs, and community representatives in cross-border discussions.
- Developing bilingual, practical awareness materials tailored to upstream households, farmers, and small businesses.
- Facilitating joint training and exchange activities for inspectors, utility staff, and municipal practitioners.

Outcome: Improved institutional continuity, clearer accountability, and stronger bottom-up support for groundwater governance.

Strategic Implications. Taken together, these opportunities demonstrate that effective cooperation in the TBA Cemi–Cijevna does not require new institutions from scratch, but rather better alignment of existing mandates, data, and stakeholder engagement practices. DIKTAS II provides a suitable platform to operate these opportunities, but sustained impact will depend on integrating cooperation into routine institutional practice beyond the project lifecycle.

5.5 Summary Table: Institutional and legal Arrangements

The main required acts by both countries are almost similar as are summaries in table below.

Table 1.14. Institutional and legal Arrangements

Country	Formulation of bylaw / regulation related to GWD	Mapping and assessment of illegal water abstraction	Enforcement of water related inspection and punishment	Full implementation of polluter pays principes	Increasing financial and capacity on Management of Water Resource Institutions
Albania	✓	✓	✓	✓	✓
Montenegro	✓	✓	✓	✓	✓

Laws and regulations that incorporate societal goals, and set an enabling and regulatory framework for achieving those goals, are a fundamental component of groundwater governance. But their implementation require completion with necessary bylaws, much more financial support and technical assistance (skills & equipment).

6. Recommendations and Measures - TBA Cemi/Cijevna

6.1 Legal Harmonization Measures

Both countries should strengthen the implementation of the **National Water Reform** and advance progress towards meeting the requirements of **EU water legislation** (EU acquis/EU WFD, including the Groundwater Directive – GWD), thereby increasing institutional capacities.

Regarding the Cemi/Cijevna aquifer, as part of the Drin-Buna River Basin, it is essential that both countries cooperate at all stages of the **River Basin Management Plan (RBMP)** formulation process, including the development of the plan of measures. This approach facilitates the harmonization of actions related to groundwater monitoring, protection, permitting and authorizations, and the implementation of water management plans, ultimately enabling a **joint water protection plan**.

6.2 Policy Integration and Planning Improvements

It is clear that the protection and improved management of the Cemi/Cijevna aquifer will largely depend on each country's ability to recognize that **cooperation and alignment on legal acts and management measures** are key elements that can serve as improvement factors in the integration of water management policies, particularly regarding groundwater issues.

This should be achieved not only through **bilateral state agreements at the central level**, involving the main institutions responsible for groundwater, but also through **close cooperation at the local level**, which should be considered an important factor for effective implementation.

6.3 Socio-economic Measures for Sustainable Groundwater Use

Socioeconomic measures in the TBA Cemi/Cijevna must address the everyday practices that generate groundwater pressure while acknowledging the structural constraints faced by communities and local institutions.

In a transboundary karst system where impacts travel faster than governance responses, measures should prioritize prevention, early intervention, and practical behavior change rather than relying solely on regulatory enforcement.

A central priority is the gradual improvement of on-site sanitation systems in the upstream Albanian and Montenegrian part of the basin. Rather than large-scale infrastructure investments that are unlikely to be feasible in dispersed mountain settlements, targeted, incremental upgrades should be promoted. This includes promoting sealed septic tanks, controlled overflow systems, and regular emptying schedules adapted to local conditions. Technical guidance should be practical, visual, and delivered through local channels, including municipal staff, community leaders, and trusted local actors.

The objective is not full standardization, but meaningful risk reduction in the most vulnerable recharge areas.

Livestock management practices require specific socioeconomic attention. In many upstream areas, grazing and manure handling occur in close proximity to karst features. Simple measures such as designated livestock exclusion zones around springs, improved manure storage practices, and seasonal restrictions in sensitive areas can significantly reduce contamination risk. These measures should be introduced through advisory support and incentives rather than penalties, recognizing the limited economic margins of small farmers.

Waste management pressures, particularly illegal dumping in remote or environmentally sensitive locations, represent a persistent risk to groundwater quality. Addressing this issue requires a combination of improved service provision and social measures. Municipalities should prioritize the identification and remediation of informal dumpsites near springs and losing streams, while also ensuring that legal waste collection is accessible and reliable for rural households. Community-based monitoring, supported by NGOs or local associations, can help identify new dumping hotspots early and support local ownership of solutions.

Tourism and recreation in the Cemi/Cijevna corridor present both a risk and an opportunity. Small scale tourism operators often lack technical knowledge rather than willingness to comply with environmental standards. Tailored guidance packages for guesthouses, restaurants, and recreational businesses should focus on low-cost improvements, such as water-saving devices, improved grease traps, and basic wastewater controls. Municipalities and tourism boards can reinforce these measures by linking environmental performance to promotion, permits, or voluntary recognition schemes, creating reputational incentives for compliance.

Beyond sector specific actions, strengthening groundwater stewardship requires improved risk communication. Communities and businesses need to understand not only what actions are required, but why they matter in a karst and transboundary context. Clear communication of upstream downstream linkages, supported by simple maps and examples, can help translate abstract groundwater concepts into tangible local responsibility. This is particularly important in upstream areas where impacts are not immediately visible.

Economic support mechanisms should be designed to lower barriers to action. Small grants, co-financing schemes, or in kind technical support for sanitation upgrades, waste facilities, or water-efficient equipment can enable households and micro-enterprises to adopt better practices. These mechanisms should be modest, targeted, and linked to vulnerability priorities rather than broad eligibility.

Finally, socio economic measures should be embedded within routine local governance processes rather than treated as standalone environmental actions. Integrating groundwater considerations into municipal development decisions, local tourism planning, and community investment priorities can help ensure that protection measures are sustained over time. Regular dialogue between municipalities, utilities, and community representatives can reinforce shared responsibility and reduce the perception that groundwater protection is an external or imposed agenda.

6.4 Transboundary Cooperation and Governance Mechanisms

Effective protection of the TBA Cemi/Cijevna depends on stable and operational cross-border cooperation, that reflects the basin's strong hydrogeological connectivity and pronounced upstream–downstream dependencies.

While both Albania and Montenegro participate in regional and international water cooperation frameworks, transboundary groundwater governance in the basin remains largely informal and project driven. Strengthening cooperation therefore **requires moving from ad hoc coordination toward predictable, routine governance mechanisms.**

A first priority is the establishment of a standing bilateral technical coordination mechanism focused specifically on groundwater. This mechanism does not need to take the form of a new legal institution, **but rather a regularized platform under existing national mandates, supported initially through DIKTAS II**.

Its core function should be the joint review of groundwater-related information, coordination of monitoring activities, and alignment of protection measures in sensitive areas. Participation should include national water authorities, relevant municipalities, and public water utilities from both countries.

Harmonization of monitoring and data exchange is essential for effective cooperation. Jointly agreed monitoring parameters, sampling frequencies, and data formats would ensure comparability and reduce uncertainty in interpreting groundwater trends.

A shared digital space for data exchange, even in a simplified form, would improve transparency and support early warning of contamination or abnormal flow conditions. Equally important is the joint interpretation of data, as shared understanding builds trust and reduces the risk of unilateral or conflicting responses.

Emergency communication and response protocols represent another critical governance gap. In a karst system, contamination events can propagate rapidly across borders, leaving little time for institutional coordination.

A simple, predefined notification protocol between upstream authorities and downstream utilities would significantly improve preparedness. **Such a protocol should clarify who informs whom, within what timeframe, and through which channels, without requiring complex legal arrangements.**

Transboundary cooperation should also extend beyond technical institutions to include municipalities and key stakeholder groups. Local authorities play a central role in land-use planning, sanitation management, and enforcement, yet they are often excluded from cross-border dialogue. Structured involvement of municipalities would help align local actions with basin-wide protection objectives. Similarly, NGOs and community organizations can support awareness raising, local monitoring, and trust-building across the border.

Aligning governance approaches to land use and tourism is increasingly important. While national planning systems differ, cooperation can focus on shared principles rather than uniform rules. Exchange of good practices, joint guidance for tourism operators, and coordinated messaging in sensitive areas can help manage seasonal pressures more consistently across the basin.

Finally, cooperation mechanisms should be designed with durability in mind. Reliance on project-based funding and informal communication limits long-term effectiveness. Embedding transboundary

coordination tasks into routine institutional workflows, supported by modest but stable resources, would improve continuity beyond the DIKTAS II timeframe. Periodic joint reporting on groundwater status and cooperation outcomes can further reinforce accountability and political visibility.

Governance Implications

The proposed transboundary cooperation mechanisms recognize that effective groundwater governance in the TBA Cemi/Cijevna is not constrained by the absence of legal frameworks, but by the lack of operationalization. By focusing on practical coordination, shared information, and inclusive dialogue, Albania and Montenegro can significantly reduce groundwater vulnerability and strengthen resilience without creating unnecessary institutional complexity.

These mechanisms provide a realistic foundation for long-term cooperation, aligning technical needs, institutional capacities, and socio-economic realities across the transboundary karst system.

6.5 Indicator Framework for Water Master Plan

6.5.1 Proposed Groups of Indicators for Implementation Monitoring

Follows the approach set out in the "Global Framework for Action on Groundwater Governance", the final output of the FAO/UNESCO/IAH/World Bank/GEF "Groundwater Governance Project", which highlights that effective governance depends on setting clear indicators.

The indicators framework for the Cemi/Cijevna TBA Joint Action Program (JAP) is designed to turn governance principles into measurable signals of progress. Indicators will be grouped into four categories:

i. Institutional,

ii. Legal & Fiscal,

iii. Technical, and

iv. Policy Planning.

Proposed groups of indicators it's also aligns with the governance performance indicators presented in the Framework's annex, creating a link between global standards and the Cemi/Cijevna-specific program.

Institutional indicators will show whether the arrangements and capacities needed for joint aquifer management are in place and functioning. They will track the work of the Joint Water Management Commission, the frequency and quality of stakeholder meetings, and whether decisions reflect stakeholder input. These indicators will confirm if cooperation is moving from informal coordination to structured and transparent processes. As part of the TBA Cemi/Cijevna JAP, they will demonstrate whether joint mechanisms are operating effectively, whether stakeholder engagement is inclusive, and whether capacity for monitoring and conflict resolution is being strengthened.

Legal & Fiscal indicators will measure whether laws, regulations, and financial tools are applied and support sustainable groundwater use. They will include licensing of wells and discharges, inspection and compliance rates, sanctions for violations, and cost-recovery mechanisms. These indicators will show if legal frameworks are harmonized across borders, if permits and sanctions are reducing risks, and if financial incentives are shifting behaviour toward efficiency and protection.

Technical indicators will assess the performance of measures that directly affect the aquifer and related ecosystems. They will track adoption of water-saving technologies, recharge volumes, groundwater level trends, and water quality changes. The Cemi/Cijevna TBA is identified as the most problematic concerning available data on water resources and is proposed for the installation of a modern monitoring network for observation of climate elements, surface and groundwaters. These indicators will confirm whether technical actions are achieving intended results, such as stabilizing flows and protecting vulnerable areas, and whether monitoring systems are fully operational and integrated across both countries.

Policy Planning indicators will verify that governance principles and technical evidence are being translated into actionable plans and review processes. They will measure whether operational plans are adopted and funded, targets for quantity and quality are defined, communication strategies are implemented, and conflict resolution mechanisms work. These indicators will ensure that progress is monitored against clear objectives and that plans are updated based on results and changing conditions.

Together, these four groups will provide a complete picture of implementation. Institutional indicators confirm governance structures; Legal & Fiscal indicators track compliance and incentives; Technical indicators measure physical and chemical responses; and Policy Planning indicators ensure actions are planned, financed, and reviewed.

Applied across Chapters 8 to 12 of the TBA Cemi/Cijevna JAP, this framework will show what has been achieved and whether the foundations for effective transboundary groundwater governance are in place. It will allow the TBA Cemi/Cijevna JAP to report progress, identify gaps, and adapt measures based on evidence and stakeholder input.

6.5.2 Alignment with SAP and DIKTAS II Objectives

Protection and Sustainable Use of the Dinaric Karst Transboundary Aquifer System (DIKTAS) is a regional project aimed at improving the management of karst groundwaters in the Dinaric Karst shared by several countries in South-Eastern Europe. As such, the project is the first ever attempt to globally introduce integrated management principles in a transboundary karst freshwater aquifer system of such magnitude.

The project's main outputs include the Transboundary Diagnostic Analysis (TDA), the establishment of cooperation mechanisms at national and regional level, and the adoption of a regional Strategic Action Program (SAP) and corresponding National Action Programs (NAP) for each of the countries involved.

6.6 Summary Table: Recommended Measures

There is no legal or policy document in any of these countries which adequately defines and prescribes the integration of environmental and resource costs into development of pricing policies.

It's noted that the main shortcoming of the legislative framework in all countries is an under developed system of by-laws and insufficient implementation of present legislation due to lack of human resources and financial means for fulfilling legal and policy requirements.

National financial resources are not sufficiently developed to cope with the accumulated problems related to the groundwater management and due to its small budget, local communities, in principle, have to rely upon the assistance of the state and international donors.

Integrated Water Resources Management (IWRM) principles in groundwater governance, capacity building for public administration and strengthening the role of public participation in taking decisions.

Program of measures at the regional level should be defined on the basis of application of economic criteria (cost effectiveness) and principles of "combined approach" and "best environmental practice“.

7. Conclusions

7.1 Key Findings from the Comparative Analyses

National laws and subordinate regulations provide the necessary conditions for the transposition of the EU Water Framework Directive (WFD) and related directives in both countries. These legal instruments define procedures for assessing and monitoring the chemical and quantitative status of both surface and groundwater bodies, as well as the ecological status of associated ecosystems.

Given the current conditions and identified challenges, the sustainable development of the Cem/Cievna River Basin requires a strategic shift towards integrated, long-term management, strengthening both institutional and financial capacities while safeguarding riverine ecosystem values.

At present, there is no common legal framework or shared criteria for:

- the delineation of sanitary protection zones for water sources,
- establishing cost-effective measures for groundwater protection in the Cemi/Cijevna transboundary aquifer,
- ensuring that each country establishes sanitary zones for water sources located or used in the neighboring country.

Furthermore, coordination and a clear division of responsibilities among institutions at different levels have not been adequately defined, and law enforcement remains insufficient across the basin.

There is a pressing need for capacity building and staff training in relevant institutions, particularly in areas such as:

- characterization of water bodies,
- establishment of reference conditions,
- analysis of human impacts,
- application of the “combined approach” principle, and
- development of River Basin Management Plans and Programmes of Measures.

7.2 Strategic Priorities for Groundwater Governance in the TBA Cemi/Cijevna

The Transboundary Diagnostic Analysis (TDA) was conducted to identify the proximal, intermediate, and root causes of environmental problems and threats within the Dinaric Karst Aquifer System.

The TDA includes:

- A SWOT analysis of the regional Dinaric Karst Aquifer System,
- A comprehensive overview of the legal and institutional frameworks and policies in the region, supported by relevant national laws, regulatory documents, and international guidelines for transboundary aquifers.

The Cijevna/Cemi TBA is of particular importance as it encompasses portions of designated protected areas, karst springs, and habitats of endangered and endemic species.

Key priorities for effective groundwater governance in the TBA Cemi/Cijevna include:

- Identifying the most permeable and vulnerable zones within the basin, which represents a critical first step in designing a joint Groundwater Monitoring Network for both countries;
- Providing a common platform and establishing a sustainable compromise between competing demands and interests, in order to balance ecological, social, and economic objectives.

7.3 Next Steps

Building on the findings of the comparative analyses (7.1) and the identified strategic priorities (7.2), the following steps are recommended to advance sustainable groundwater governance in the TBA Cemi/Cijevna:

1. **Establish a Joint Technical Coordination Platform**
    - Create a standing bilateral coordination mechanism focused on groundwater monitoring, data sharing, and management of sensitive zones.
    - Include national water authorities, relevant municipalities, and public water utilities from both countries.
    - Integrate responsibilities into routine institutional workflows to ensure long-term continuity beyond project cycles.
2. **Implement a Harmonized Groundwater Monitoring Network**
    - Identify key observation points along upstream and downstream areas, including springs, wells, and critical river–groundwater interaction zones.
    - Define common monitoring parameters, sampling frequency, and reporting formats.
    - Develop a shared digital platform for data storage, visualization, and joint interpretation to improve transparency and early-warning capabilities.
3. **Strengthen Policy Integration and Legal Alignment**
    - Harmonize national bylaws, permitting procedures, and protection measures for transboundary aquifers.
    - Ensure that sanitary protection zones, groundwater permits, and risk mitigation measures are **mutually recognized** across borders.
    - Promote the adoption of EU Water Framework Directive principles, including the “combined approach” and the polluter-pays principle, in both countries.

4. **Enhance Socio-Economic Measures and Stakeholder Engagement**

    - Support incremental improvements in sanitation systems in upstream settlements and promote best livestock management practices to reduce contamination risks.
    - Engage local communities, NGOs, tourism operators, and small-scale agricultural users through awareness campaigns, advisory support, and targeted incentive schemes.
    - Integrate groundwater considerations into municipal planning, tourism development, and community investment priorities.

5. **Capacity Building and Institutional Strengthening**

    - Provide training for staff in municipalities, water utilities, and national authorities on groundwater management, monitoring, and emergency response.
    - Develop guidance materials and practical tools for local and regional actors, emphasizing karst-specific vulnerabilities and upstream–downstream interdependencies.
    - Strengthen the capacity of institutions to enforce legislation and implement River Basin Management Plans.

6. **Promote Adaptive Management and Regular Review**

    - Conduct periodic joint evaluations of monitoring data, risk mitigation effectiveness, and stakeholder engagement outcomes.
    - Adjust management measures based on emerging trends, climatic variability, and socio-economic developments.
    - Ensure that cooperation mechanisms remain flexible, inclusive, and capable of responding to unforeseen pressures on groundwater resources.

Overall Objective: These steps aim to transform ad hoc collaboration into a structured, sustainable, and integrated framework for groundwater governance, reducing vulnerability, enhancing resilience, and protecting both ecological and human water needs in the TBA Cemi/Cijevna.

8. Annexes

8.1 Legal and Policy Reference Documents (Al and MN)

This section provides a consolidated list of national and regional legal and policy documents relevant for groundwater governance, management, and protection in the TBA Cemi/Cijevna. These references support the analyses, recommendations, and proposed measures presented in this report.

Country	Type	Key Documents / Acts	Purpose / Notes
Albania	National Laws	Law No. 29/2024 “On Water Resources”	Primary law for integrated water resources

Country	Type	Key Documents / Acts	Purpose / Notes
			management; aligned with EU WFD & GWD
		Law No. 431/2011 – Environmental Protection	Environmental protection framework
		Law No. 111/2012 On integrated management of water resources	Article 34 Protected areas Article 57 Hygiene and Sanitary Protection Zones
		Law No. 44/2015 – Administrative Procedures	Defines administrative procedures for water management
		Law No. 81/2017 – Protection Areas	Establishes protected areas relevant for groundwater
		Law No. 93/2015 – Tourism	Regulates tourism impacts on environment
		Law No. 111/2015 – Agency for Territory Planning & Development	Spatial planning and land use regulation
		Law No. 7/2017 – Albanian Geological Services	Geological surveys and groundwater monitoring
		Laws on Water Supply, Sewerage, Irrigation & Drainage (Law Nos. 102/1996, 24/2017, 111/2012, 8102/1996)	Sectoral water uses and infrastructure regulation
	Council of Ministers Decisions (DCM)	DCM No. 335 / 19.06.2025 – WSMA Organization	Establishes Water and Sewerage Management Authority roles
		Decision of the Council of Ministers (DCM) No. 379, dated 25 May 2016, titled — "Regulation on Drinking Water Quality"	Aligns Albanian law with EU Drinking Water on the quality of water intended for human consumption; Establishes three sanitary protection zones; Quality standards and monitoring requirements aligned with the EU standard.
		DCM No. 1015/2020 – National Water Strategies & RBMPs	Development and implementation of RBMPs and flood risk plans

Country	Type	Key Documents / Acts	Purpose / Notes
		Other DCMs (DCM 635/2001, 568/2019, 490/2011, 102/2015, etc.)	Establish national agencies, environmental standards, irrigation strategies, permits
Montenegro	National Strategies & Plans	Water Management Strategy of Montenegro (2017)	Strategic framework for water management
		National Waste Management Plan 2024–2028 (2024)	Wastewater and solid waste planning
		Water Management Plans for Danube & Adriatic River Basins (2021)	RBMPs in Montenegro
		Flood Risk Management Plan for the Adriatic and Danube River Basin (2025)	Flood risk plans
	National Laws	Water Law (Official Gazette Nos. 027/07; 073/10; 032/11; etc.)	Primary water legislation
		Law on Geological Research (Official Gazette Nos. 028/93; 027/94; etc.)	Geological surveys and monitoring
		Environmental Protection Law (Official Gazette Nos. 52/16; 59/18; 10/23)	Environmental protection framework
		Nature Protection Law (Official Gazette Nos. 054/16; 018/19; 084/24)	Protection of ecosystems and habitats
		Law on Financing Water Management (Official Gazette Nos. 065/08; 074/10; etc.)	Funding mechanisms for water management
		Law on Environmental Liability (Official Gazette Nos. 27/2014; 55/2016)	Pollution and liability framework
		Law on Spatial Planning. Official Gazette of Montenegro, Nos. 19/2025. Montenegro. Law on Construction. Official Gazette of Montenegro, Nos. 19/2025. Montenegro.	Spatial Planning – Regulates spatial development and land use. Construction – Regulates construction and building standards.
	Rulebooks & Technical Regulations	Rulebook on Method & Deadlines for Groundwater Status (No. 52/2019)	Defines groundwater monitoring methodology
		Rulebook on the Method and Deadlines for Determining Surface Water Status. (Official	Defines surface water monitoring methodology

Country	Type	Key Documents / Acts	Purpose / Notes
		Gazette of Montenegro, No. 25/2019.). Montenegro.	
		Rulebook on the Determination and Maintenance of Sanitary Protection Zones and Belts of Water Supply Sources and Restrictions within These Zones. (Nos. 066/09; 013/24)	Defines protection zones around water sources
		Rulebook on Water Quality Monitoring (Nos. 64/18; 101/21)	Standards and methods for human-use water quality
		Rulebook on the Quality and Sanitary-Technical Conditions for Wastewater Discharge, the Method and Procedure for Testing Wastewater Quality, and the Content of Reports on Determined Wastewater Quality (No. 056/19)	Defines standards and procedures for wastewater
		Rulebook on Parameters, Compliance Verification, Methods, Scope and Implementation of Monitoring of Water Quality for Human Use (Nos. 64/18 and 101/21).	Defines standards and monitoring of drinking water quality.
	Other References	Croatian Regulation on Water Quality Standards (No. 96/19)	Relevant for transboundary water standards

8.2 Stakeholder Lists and Institutional Maps

ALBANIA			
Stakeholder Group	Key Actors	Mandates / Roles	Relevance to Groundwater
National Water Governance	National Water Council	Strategic decision-making on water resources management and protection	High – sets overall policy direction
Water Resources Management	Water Resources Management Agency (WRMA / AMBU)	Planning, coordination, data management, and support for water resources governance	High – core technical authority
Water Supply & Sanitation	AKUK; local water and sewerage operators	Sector planning, service oversight, infrastructure investments	High – indirect but critical for protection
Local Government	Municipalities in the upper Cemi basin	Spatial planning, sanitation, waste management, local enforcement	Very High – influence recharge areas
Rural Communities	Households, farmers, livestock owners	Daily water use, sanitation practices, land management	Very High – diffuse pressure generation
Agriculture Stakeholders	Smallholder farmers, pastoralists	Livestock management, manure handling, land use	Medium–High – diffuse pollution risk
Tourism Operators	Guesthouses, restaurants, small recreation services	Seasonal water use, wastewater generation	Medium – localized seasonal pressure
Civil Society	Local NGOs, community associations	Awareness raising, monitoring, advocacy	Medium – support accountability
Education Sector	Schools, youth groups	Environmental education, long-term awareness	Medium – future resilience

Montenegro			
Stakeholder Group	Key Actors	Mandates / Roles	Relevance to Groundwater
National Water Governance	Ministry of Agriculture, Forestry and Water Management	Water policy, regulation, abstraction control, groundwater protection	High – national authority
Water Management Bodies	Water management directorates / regulatory units	Technical oversight, permitting, coordination with municipalities	High – operational governance
Local Government	Municipality of Tuzi and Zeta; City of Podgorica	Spatial planning, communal services, environmental protection	Very High – downstream exposure
Public Water Utility	Vodovod i kanalizacija Podgorica; Vodovod i kanalizacija Tuzi	Drinking-water abstraction, treatment, distribution, monitoring	Very High – direct dependency
Communities & SMEs	Peri-urban residents, small businesses	Water use, wastewater generation	High – cumulative pressure
Agriculture Stakeholders	Farmers, vineyards, livestock owners	Irrigation, manure management	Medium – diffuse pollution risk
Tourism & Recreation	Recreation operators, hospitality businesses	Seasonal demand, environmental pressure	Medium–High – corridor-specific
Civil Society	Environmental NGOs, river protection groups	Awareness, advocacy, community monitoring	Medium – trust-building role
Education Sector	Schools, youth initiatives	Environmental education and outreach	Medium – long-term impact

Cross-Border Coordination Roles (Albania–Montenegro)				
Actor / Institution	Country	Mandate in National System	Role in Cross-Border Cooperation	Priority Coordination Functions
Water Resources Management Agency (WRMA / AMBU)	Albania	National water resources management, planning, data coordination	Core upstream technical counterpart	Joint monitoring design; data exchange; vulnerability mapping; incident notification
National Water Council	Albania	Strategic oversight of water governance	Strategic-level coordination	Policy alignment; endorsement of cooperation arrangements
AKUK / Water & Sanitation Sector Institutions	Albania	Oversight of water supply and wastewater services	Supporting institutional partner	Align sanitation investments with groundwater protection priorities
Municipalities (Upper Cemi Basin)	Albania	Spatial planning, sanitation, waste management	Local implementation partner	Sanitation upgrades; local risk reporting; community engagement
Ministry of Agriculture, Forestry and Water Management	Montenegro	National water policy and regulation	Core downstream policy counterpart	Regulatory alignment; abstraction control; protection measures
Water Directorate/ Units	Montenegro	Technical oversight and permitting	Technical coordination partner	Harmonization of monitoring standards; data interpretation
Municipality of Tuzi	Montenegro	Local planning and environmental management	Local partner	Land-use coordination; tourism and sanitation pressure management
Municipality of Zeta	Montenegro	Local planning and environmental management	Local partner	Land-use coordination; tourism and sanitation pressure management

City of Podgorica	Montenegro	Urban planning and communal services	Downstream coordination actor	Peri-urban development control; infrastructure alignment
Vodovod i kanalizacija Podgorica; Vodovod i kanalizacija Tuzi	Montenegro	Drinking-water abstraction, supply, monitoring	Key operational downstream and upstream, actor	Operational data sharing; early warning; emergency response coordination
Civil Society & NGOs	Both	Awareness, advocacy, community engagement	Supporting cross-border facilitator	Reporting local issues; participatory monitoring; trust-building
Research & Academic Institutions	Both	Hydrogeological research and analysis	Technical support partner	Joint studies; methodology alignment; capacity building
DIKTAS II / UNESCO Platform	International	Project coordination and facilitation	Catalytic coordination role	Supporting creation of coordination mechanisms; tools; reporting frameworks