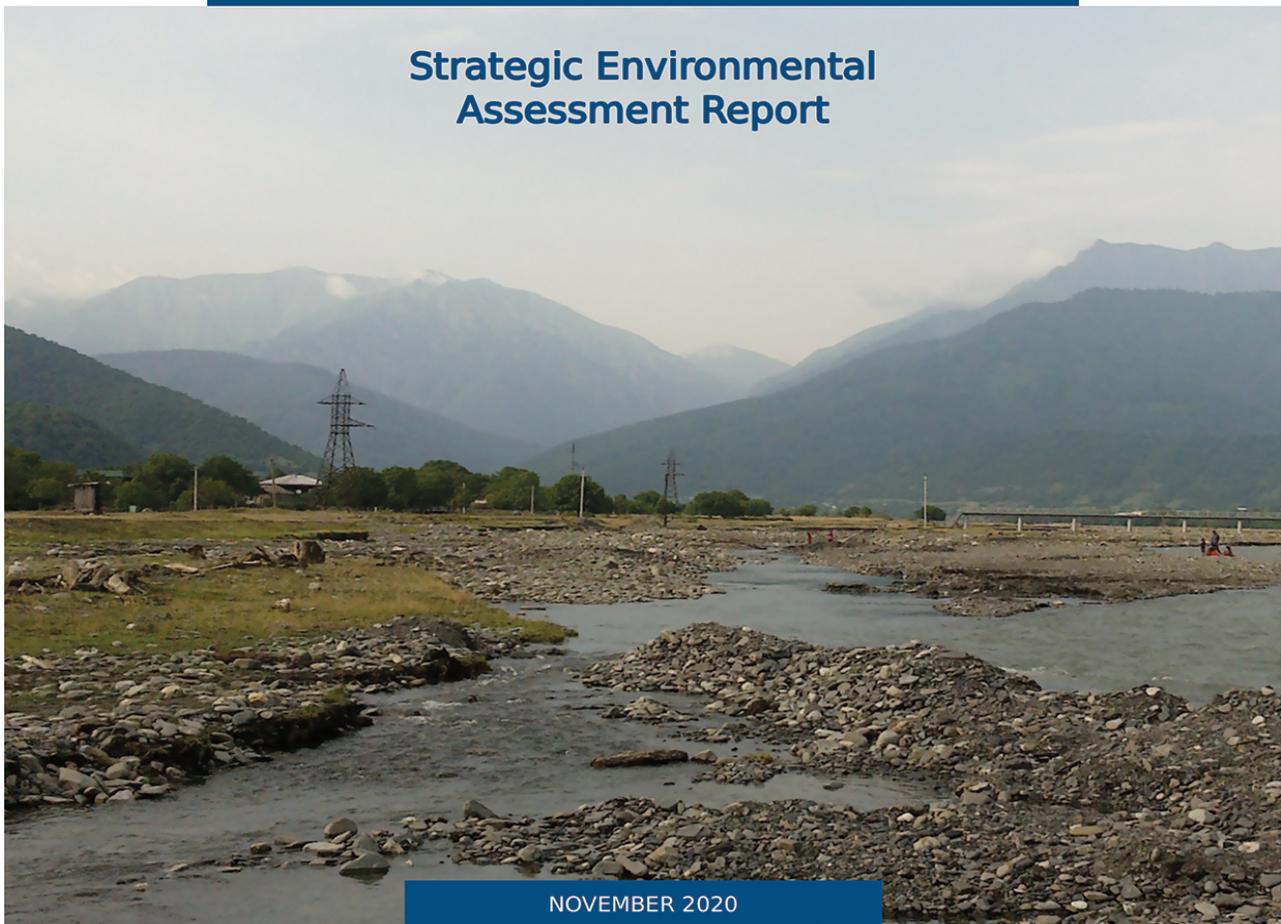




# European Union Water Initiative Plus for Eastern Partnership Countries (EUWI+)

STRATEGIC ENVIRONMENTAL ASSESSMENT (SEA) OF THE DRAFT ALAZANI-IORI RIVER BASIN MANAGEMENT PLAN

## Strategic Environmental Assessment Report



NOVEMBER 2020



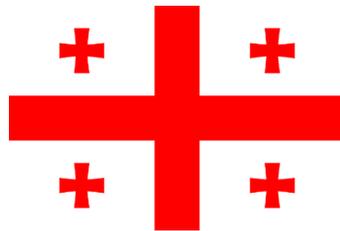


# European Union Water Initiative Plus for Eastern Partnership Countries (EUWI+)

## STRATEGIC ENVIRONMENTAL ASSESSMENT (SEA) OF THE DRAFTALAZANI-IORI RIVER BASIN MANAGEMENT PLAN

SEA Report

November 2020



This SEA report was prepared by the national SEA team established for the pilot project “The Application of a Strategic Environmental Assessment (SEA) for the Draft Alazani-lori River Basin Management Plan” (hereinafter also the SEA pilot project): Ms. Elina Bakradze (water and soil quality aspects), Ms. Anna Rukhadze (biodiversity, habitats and protected areas), Ms. Lela Serebryakova (health related aspects), Mr. Giorgi Guliashvili (hydrology and natural hazards), Mr. Davit Darsavelidze (socio-economic aspects), Mr. Irakli Kobulia (cultural heritage aspects and GIS) and the UNECE national consultant Ms. Irma Melikishvili (the team leader also covering climate change aspects), under the guidance and supervision of the UNECE international consultant Mr. Martin Smutny.

**Maps:** The thematic maps presented in the SEA Report are produced by *Mr. Irakli Kobulia* on the basis of the GIS database provided by the EUWI + programme. The SEA Report also includes maps developed in the framework of the EUWI + programme (under result 2) by the REC Caucasus, subcontractor of the EUWI+ programme.

The SEA pilot project was carried out under the supervision of Mr. Alisher Mamadzhonov, the EUWI+ programme leader from UNECE with the support provided by Ms. Christine Kitzler and Mr. Alexander Belokurov, UNECE and Ms. Eliso Barnovi, the EUWI+ Country Representative in Georgia. The overall coordination of the SEA pilot project was provided by the Georgian Environmental Outlook (GEO) and its team represented by Ms. Nino Malashkhia.

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### **Objectives of the SEA pilot project**

As Georgia has limited experience in the application of a SEA, the capacities of the main actors to apply SEA, need further development and strengthening. In view of the above, in May 2019 the Ministry of Environmental Protection and Agriculture of Georgia (MEPA), that is the key institution responsible for the administration of the SEA legislation as well as for coordination of the SEA processes in the country, requested the United Nations Economic Commission for Europe (UNECE) to provide the technical assistance within the frame of the European Union Water Initiative Plus (EUWI+) programme to carry out a pilot SEA for the draft Alazani-Iori River Basin Management Plan (RBMP).

The main objective of the UNECE's SEA pilot project is to develop capacities of the MEPA and to build national expertise in the implementation of the SEA in the context of river basin management. In the framework of the pilot projects was developed the Scoping and SEA reports of the draft Alazani-Iori RBMP.

### **European Union Water Initiative Plus (EUWI+) programme**

*With financing from the European Union, the EUWI+ programme specifically supports the Eastern Partnership countries to move towards the approximation to EU acquis in the field of water management with a focus on trans-boundary river basin management. The overall objective of the project is to improve the management of water resources in the EaP countries, which is consistent with the EU Water Framework Directive (WFD). One of the specific objectives of the EUWI+ in Georgia is the development of River Basins Management Plans (RBMPs) in line with the EU Water Framework Directive. In particular, the project is supporting developments of the RBMPs for the Alazani-Iori and Khrami-Debeda River Basins.*

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## Acronyms

AA – Association Agreement  
APA – Agency of Protected Areas  
ASCIs – Areas of Special Conservation Interest  
DRR – Disaster Risk Reduction  
EAC – Environmental Assessment Code  
EIA – Environmental Impact Assessment  
EU – European Union  
EUWI – EU Water Initiative  
GDP – Gross Domestic Product  
GEO – Georgia’s Environmental Outlook  
GIZ – The Deutsche Gesellschaft für Internationale Zusammenarbeit  
HMWBs – Heavily Modified Water Bodies  
HPP – Hydro Power Plant  
IWRM – Integrated Water Resources Management  
LEPL – Legal Entity of Public Law  
MEPA – Ministry of Environmental Protection and Agriculture  
MPC – Maximum Permissible Concentration  
NDC – Nationally Determined Contribution  
NDCC – National Disease Control Centre  
NBSAP – National Biodiversity Strategy and Action Plan of Georgia  
NDRRS – National Disaster Risk Reduction Strategy  
NEA – National Environmental Agency  
NEAP – National Environmental Action Plan  
PAs – Protected Areas  
PAH – Polycyclic Aromatic Hydrocarbons  
PCB – Polychlorinated Biphenyl  
PoM – Programme of Measures  
RBM – River Basin Management  
RBMP – River Basin Management Plans  
SEA – Strategic Environmental Assessment  
SPAs – Special Protected Areas  
SWBs – Surface Water Bodies  
UNDP – United Nations Development Programme  
UNFCCC – United National Framework Convention of Climate Change  
UNECE – United Nations Economic Commission for Europe  
UNESCO – *United Nations Educational, Scientific and Cultural Organization*  
UWSC – United Water Supply Company WASH – Water, Sanitation, and Hygiene  
WFD – Water Framework Directive  
WHO – World Health Organization  
WRM – Water Resource Management  
WWF – World Wildlife Fund  
WWTP – Waste Water Treatment Plant

## EXECUTIVE SUMMARY

### ***Introduction and background information***

In 2017, Georgia adopted a new national Code on Environment Assessment (EAC). In accordance with the EAC, strategic documents prepared for certain sectors, including the water resources management sector, are subject to the Strategic Environmental Assessment (SEA). The SEA aims to identify those environmental and health issues that may arise from the implementation of a strategic document and to recommend measures for mitigating, reducing or avoiding potential impact from the implementation of the strategic document.

In order to develop capacities of the Ministry of Environmental Protection and Agriculture of Georgia (MEPA) and to further build the national expertise in the SEA application, the United Nations Economic Commission for Europe (UNECE) within the framework of the project *EU Water Initiative Plus* assisted Georgian in piloting the SEA for the draft Alazani-lori River Basin Management Plan (RBMP).

The implementation of the pilot SEA started in December 2019 and included also consultations with relevant stakeholders on the scope of the assessment. The outcomes of the scoping consultations are considered in the final version of the SEA report.

Taking into account that the development of the RBMPs is not yet required by the national legislation (as of 2020) and its preparation is of a pilot nature, consequently the SEA for the Alazani-lori RBMP cannot be considered as a formal SEA under *the Environmental Assessment (EA) Code*. Therefore, the Ministry of Environment Protection and Agriculture (MEPA) is cannot fully perform its formal role as the SEA authority. However, it has been agreed with the MEPA that the SEA pilot should – to the extent possible – go through the SEA steps outlined in the *EA Code*.

This Executive Summary is based on the draft version of the SEA Report and provides an overview of main findings and conclusions regarding the likely effects of the Alazani-lori RBMP on the environmental and health, and outlines mitigation measures<sup>1</sup> suggested by the SEA to be considered in the final Alazani-lori RBMP during the implementation of the Plan.

### ***Introduction to the RBMP***

The draft Law on Water Resource Management (WRM) that is planned to be adopted in the course of 2020, introduces a river basin management approach in water sector and requires to develop and implement river basin management plans (RBMPs) deriving from the findings of the pressure/impact analysis and corresponding risk assessment. Therefore, RBMP aims to propose measures to address water management issues of a certain basin in accordance with the principles of the Water Framework Directive (WFD). The Alazani-lori RBMP covers the **Basic Measures**, which are obligatory minimum requirements to be included in the Programme of Measures (PoMs), which represents one of the main components of the RBMP, and the **Supplementary Measures** designed in addition to the basic measures to achieve desired results. Supplementary measures include additional legislative acts, fiscal measures, research, and educational campaigns that go beyond the basic measures.

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<sup>1</sup> The document uses the term “mitigation measures” in accordance with Art. 26.2(f) of the *Environmental Assessment Code of Georgia* the SEA report should contain “measures for preventing, reducing or mitigating the potential impact on the environment and human health resulting from the implementation of the strategic document”. Therefore, “mitigation measures” have to be distinguished from the “recommendations” of the SEA report and the draft strategic document (Art. 27.7 of the *Environmental Assessment Code of Georgia*, recommendations should be issued by the *Ministry of Environmental Protection and Agriculture* and the *Ministry of Internally Displaced Persons from the Occupied Territories, Labour, Health and Social Affairs of Georgia* at the end of the SEA procedure).

The draft Alazani-ori RBMP proposes a number of measures, however, not all measures proposed by the draft RBMP have been considered in the detailed impact assessment as they do not demonstrate a clear link to the environmental and health issues identified in the baseline analysis of the SEA (i.e. the key SEA issues). Thus, only a selected number of RBMP measures have been subjected to the detailed impact assessment for the likely effects although not all these measures are selected for the RBMP first implementation cycle covering a 6-year planning period.

***The key environmental and health issues in the Alazani-ori River Basin***

Based on the analysis of the past development and current status of the environment and health in the Alazani-ori River Basin, the SEA identified following key environmental and health issues, which are relevant to the RBMP i.e. the issues which may be affected (both positively or adversely) by the implementation of the RBMP:

Key issues	Specific concerns
<b>Water resources</b>	Industrial and urban wastewater discharges and run-offs Agriculture diffuse sources of pollution Other discharges
	Potentially contaminated groundwater
	Weak groundwater monitoring
	Insufficient hydrological monitoring network
	Dilapidated and inefficient irrigation systems
	Structural issues of dams and reservoirs
<b>Natural Hazards</b>	Hails
	Floods/flashfloods
	Riverbank erosion
	Mudflows
	Landslides
<b>Soil</b>	Soil pollution
	Soil degradation
<b>Climate change and related risks</b>	Prolonged drought and associated water deficit
	The potential increase of climate induced natural hazards
<b>Biodiversity, habitats and protected areas</b>	Population of fish, in particular endangered species
	Population of other water dependent species especially vulnerable and endangered species
	lori floodplain forests
	Alazani floodplain forests
	Protected Areas

	Emerald Sites and Biosphere Reserves
<b>Public health</b>	Quality and safety of drinking water and water used for households
	Quality and safety of water used for agricultural processes
	Undisturbed supply of water to medical and public health infrastructure
	Access to healthcare services in case of emergencies
	Knowledge, attitudes, and practices (KAP) of local communities
<b>Socio-Economic factors</b>	Economic growth & pressure on the quality of water Demographic transition & depopulation, especially in mountain areas Unemployment & low income
	Low awareness of local stakeholders/Unsustainable economic activities/ practices Inefficiency/Inadequate infrastructure and services
<b>Cultural Heritage</b>	Potential physical damage to the cultural heritage assets and its features

**Main environmental and health effects**

As a basis for evaluation of the likely environmental and health effects of the RBMP, the likely future evolution of the key environmental and health issues if the RBMP would not be implemented was outlined. Then, the possible changes of these future trends, which may be caused by implementation of the measures proposed by the RBMP, was assessed. Overall, it can be concluded that the RBMP should have mainly positive effects – it has a large potential to improve the status of certain environmental issues and thus contribute to better environmental and health situation of the population in the basin.

The main effects of the Alazani-iori RBMP on the key environmental and health issues are presented below.

**Water resources:** In overall, the RBMP provides a coordinated framework for improving the water quality and water resources management in the Alazani-iori River Basin through comprehensive measures and interventions. The implementation of the RBMP measures e.g. construction of WWTPs and sewage system and rehabilitation of wastewater network, replacement of the water supply network, wells, and collectors, as well as other indirect measures proposed by the RBMP, such as development of the Actions Plans for Nitrate Vulnerable Zones, Codes of Good Agricultural Practices for Protection of Waters against Agricultural Nitrate Pollution, etc., will indeed have direct positive effects on the quality of water. Furthermore, it provides the opportunity to improve the surface and groundwater monitoring network, which is an essential element for further assessment and planning of water resources in the basin.

The implementation of measures specified in the Alazani-iori RBMP will have a positive effect on the hydrology of the basin. The measures specified in the RBMP aim to address current and future issues related to hydrology in the river basin, including rehabilitation of irrigation systems to reduce water loss, regulation of water abstraction/impoundment, and determination and maintenance of moderate flow to ensure that sufficient water is available for water-dependent ecosystems, as well as climate change impacts on water bodies is considered. Besides, it envisages the improvement of hydrological monitoring network, which can provide additional data to assess water balance in rivers. This will serve as a basis for informed decision making on the water quantity to be released into irrigation canals, as well as to plan other water abstraction activities appropriately e.g. development of new hydropower plants. Environmental flow can be also determined on the basis of hydrological monitoring data, which is essential for maintaining the river morphology, especially considering existing and new HPPs that are planned to be built in the basin.

**Soil:** Based on the evaluation of the likely impacts of individual measures outlined in the RBMP it can be concluded that the implementation of the RBMP will have overall positive effect in terms of reduced soil pollution and degradation. The measures proposed by the RBMP directly or indirectly result in improved soil quality and structure. These measures include the establishment of organic farms, setting up vermicompost (producing bio humus), supporting good practices for applying fertilizers, and managing livestock in the Alazani-lori River Basin. All these measures will contribute to improved soil structure and quality in the basin, where the agriculture is one of the leading economic sectors.

**Natural hazards:** The rehabilitation and construction of protective hydraulic structures will contribute to the reduction of river bank scouring and inundation during floods/flash floods. Periodical removal of solid sediments from rivers and deepening-alignment of their channels will mitigate the negative effect of mudflows. Adequate hydrological monitoring network will help also to identify the areas that are prone to floods/flash floods and select proper locations for installing early warning systems. The RBMP addresses issues such as riverbank protection and other control measures, which in turn will facilitate the restoration of the river channel and its morphology to ensure the maintenance of near-natural state of rivers. Thus, the implementation of the RBMP will significantly improve the current situation; however, additional measures need to be introduced in the plan for reducing the risk of natural hazards in the basin.

**Climate change:** As it can be concluded from the baseline analysis, climate change will affect the Alazani-lori Basin in the future and there is a number of risks associated with this, including water deficit and increased frequency and magnitude of climate-induced natural hazards. Therefore, it is important that climate change impacts are well studied and climate change adaptation is addressed in the RBMP in short- and long-term perspectives. There are RBMP measures directly focused on consideration of climate change impact on water bodies, as well as other indirect measures e.g. those related to water abstraction regulation. It is obvious that the implementation of those measures will contribute to improved preparedness and adaptation of the basin regarding the consequences of climate change.

**Biodiversity, habitats and protected areas:** It is expected that RBMP implementation will have positive impacts on floodplain forests especially along the lori river. Most important measures in this regard are those related to the enhancements of environmental flow level in the river by reviewing water abstraction quantities and development of methodology for the assessment of environmental flow levels. Direct measures of floodplain forests restorations are envisaged also by the PoMs with expected significant positive impacts.

Implementation of RBMP will have indirect positive impacts on aquatic species, especially on fish fauna and other water related species through promotion of improvement water quality, restoration of ecological flow reducing fragmentation of water bodies. However, PoMs do not envisage direct measures for the improvement of conservation status of water related species, including endangered species.

Most of the supplementary measures is expected to have positive indirect effects on species and habitats conservation status through improvement of water quality and hydromorphological conditions.

Implementation of the RBMP will have positive impact on protected areas and emerald sites as well due to the nature and location of measures.

**Health:** Based on the evaluation of each measure, RBMP will have a significant positive impact on the health of population by improving the quality of water, its supply and treatment. Water is an essential aspect of human health and improved supply and quality of water would improve health of the population.

Access to water and sanitation are essential for the functioning of medical facilities, which, in turn, also play a significant role in ensuring the health of the population. Besides, water treatment and rational use of water for agricultural purposes promotes not only water conservation, but also the management of crop contamination from chemical and biological pathogens. However, there are interim risks (mainly at the local level) associated with the implementation of proposed measures.

**Socio-economic development:** The measures proposed by the draft RBMP have a potential to significantly support the sustainable socio-economic development of the Alazani-lori river basin.

The RBMP actions will considerably support the employment and revitalization of certain economic areas in the river basin, especially in mountainous areas and the places with proposed new communal services. These RBMP actions will support sustainable development of local communities, facilitating provision of proper social-economic conditions (increased employment and income as well as improved living conditions) necessary for improved life quality.

**Cultural heritage:** Construction works needed for the implementation of certain RBMP measures (e.g. construction of wastewater treatment facilities, flood defenses, channels, crossings, etc.) may potentially disturb previously undiscovered archeological remains near or within water bodies thus leading to potential negative impacts of the RBMP implementation. However, based on the assessment carried out in the SEA, it can be concluded, that the impact of these processes on water resources (and vice-versa - the impact of the state of water resources on the process of managing cultural heritage), will be minimal.

### **Proposed SEA mitigation measures**

Following the conclusions of the evaluation of the likely effects, the SEA has to formulate measures to avoid, mitigate or compensate the likely adverse effects of the analyzed plan/programme as well as measures to enhance the likely positive effects.

There are two types of mitigation measures proposed by SEA and listed below for each environmental and health issue, which may be affected by the RBMP:

1. Measures to be considered in the RBMP (i.e. before it's approval or adoption): these include the proposals for additional measures or activities to be considered when finalizing the RBMP (and in particular the PoMs with measures selected for the first implementation cycle);
2. Measures and conditions that should be followed up by a relevant agency when implementing RBMP measures. It includes also studies and research to be conducted – as a part of the RBMP implementation – to provide a solid basis for decisions on specific RBMP projects and activities. Implementation of these measures and conditions should be supervised by the MEPA.

## **WATER RESOURCES**

### ***Measures to be considered in the RBMP***

- The RBMP measures deemed / proposed for addressing the hydro-morphological alteration of rivers should include analyses of the impacts of river sand and gravel mining in specific areas. The analyses should result in determining the location and amounts of inert materials that can be mined from specific rivers to ensure proper functioning of rivers and maintenance of ecological, hydrological and morphological integrity.
- Considering the intensive mining of the sand/gravel in the basin, it is important to address the sustainable management of sand/gravel extraction. Therefore, an emphasis should be placed on setting up the monitoring plans/measures that will provide data/information on changes in sand/gravel extraction or sediment transport capacity. Such information will enable the authorities to evaluate the long-term effect of mining activities on water bodies both upstream and downstream of the sand extraction sites and propose relevant mitigation measures or management measures e.g. regulations to keep natural conditions of rivers in the basin.
- Processing of sewage sludge produced in wastewater treatment plants and using it as a secondary product (sludge management); the development of technical regulations for sewage sludge processing.
- In order to enhance efficiency of water resources use, the training and awareness-raising programs envisaged by the draft RBMP should also include best practice examples and knowledge sharing activities on how to optimize the use of irrigation water (e.g. irrigation at critical stages of crop growth, during droughts, irrigating at night, etc). Also, pilot projects on efficient use of water resources for all type of water users in the region should be supported to disseminate and increase the knowledge and strengthen skills of the local population, which will also contribute to better preparedness to mitigate or adapt to the likely consequences of climate change.

### ***Measures and conditions for the RBMP implementation***

- As a part of designing the drainage rehabilitation projects, the computational models for the drainage networks should be tested with several rainfall scenarios, including potentially dangerous scenarios (i.e. extreme situations including heavy and sudden rainfall), and the selected rehabilitation design should therefore consider the worst possible scenario.
- EIAs to be carried out for rehabilitation or construction of new drainage systems should consider suitable drainage water treatment methods and discharge points location and analyze reasonable alternatives. The alternatives may include e.g. treatment lagoons, constructed wetlands, and stabilization ponds.

## **NATURAL HAZARDS**

### ***Measures to be considered in the RBMP***

- In order to improve preparedness to natural hazards (in particular floods/flash floods), preparation of the action plan for the rehabilitation of dams/reservoirs should be proposed in the RBMP, along with a dedicated study on the technical conditions of the dams/reservoirs (especially those used for irrigation purposes) to determine the state of potential structural damage of dams/reservoirs.

### ***Measures and conditions for the RBMP implementation***

- Potential for water abstraction/impoundment (for the purpose of abstraction and impoundment regulation) should be calculated and assessed specifically for each river in the basin considering their hydrometric and morphological characteristics.
- Sediment management/sediment transport measures should be based on the results of the study of their characteristics, including volumes, velocity, etc.
- To ensure the improvement of sediments transport continuity via dam management, at the first stage, it is important to conduct research and identify the condition of dams/reservoirs e.g. conditions of spillway gates. Spillway gates of the water reservoirs shall be rehabilitated to ensure sediment transport continuity. A relevant study covering the direction and velocity of sediment transport, volumes of transported materials shall be carried out. It is also important to study and determine the near-natural conditions (velocity and amounts) of rivers based on which proper continuity of sediment transport can be ensured.
- To maintain moderate river flow, envisaged by the RBMP, the amount of moderate flow shall be determined at first stage. The amount of moderate flow required for meeting the demands of water-dependent economic activities shall be determined on the basis of hydrological monitoring data. However, the density of the hydrological network in the Alazani-Iori River Basin is not sufficient to provide adequate data for the determination of moderate river flow. Therefore, it is recommended for the RBMP to determine moderate flows for each river considering the best national and international methodologies/practice.
- Additional hydrological observation stations shall be deployed in the basin in areas that are prone to mudflows, floods, water intake-discharge points, downstream and upstream of water reservoirs of HHPs, etc. In particular, hydrological observation stations (water level measurements) should be located along the Iori river: in the upper and lower reaches of the Sion Reservoir, in the lower and upper reaches of the Paldo Reservoir, in the upper and lower reaches of the Dali Mountain Reservoir, and on the irrigation canals of the Iori river basin. Hydrological observation stations should be located in the Alazani basin: on main irrigation canal of the Alazani river, lower and upper reaches of the Samkuristskali 1 HPP, on the rivers Ilto, Stori, Turdo, Lopota, Intsoba, Chelti, Shromiskhevi, Duruj, Bursa, Chermistskali, Kabali, Ninoskhevi, and Lagodekhiskhevi. Hydrological monitoring stations in these areas will, on the one hand, allow determining the annual runoff of rivers (required to determine the moderate environmental flow) according to which the management of water resources for irrigation, drinking, and energy purposes should be decided; on the other hand, all these areas are prone to flooding and mudflows, therefore, access to proper information is necessary to manage and mitigate the adverse effect of natural hazards in these areas.

- Hydraulic engineering measures should have a comprehensive character involving the rehabilitation of all hydraulic structures including gabions, bank protection structures, mudflow control structures to contribute to the restoration of the morphology of a river channel. The Alazani River bank between the Georgian-Azerbaijan border subject of intensive erosion needs immediate attention and installation of bank protective infrastructure to avoid or mitigate the further loss and degradation the hectares of agricultural land resulting from intensive river erosion. A more detailed assessment of areas e.g. water bodies under the risk of climate-induced natural hazards is needed for setting effective adaptation measures e.g. infrastructure and bank protection measures best suitable for that particular water body. The priority should be given to a combination of structural and non-structural protection measures e.g. bioengineering, floodplain forests to mitigate risks caused by further activation of climate-induced natural hazards. Therefore, it is recommended to conduct a detailed assessment of areas under the risk e.g. those water bodies that are at risk and study the possibility of non-structural infrastructure measures in combination with structural measures where relevant.
- The Alazani-lori River Basin is prone to strong mudflow events, therefore regular geological monitoring studies shall be carried out (focused on the determination of recurrence periods of mudflows, amounts of inert materials accumulated in river gorges, the velocity of activated debris flows, potentially affected human settlements, etc.) to plan and design the measures for the rehabilitation of mudflow control structures. Mudflow control structures shall be built in the middle course of all rivers that are prone to the occurrence of mudflows to protect human settlements and infrastructure. Preference should be given to the Kherkheulidze type protection dams, that are perfectly suited for the Alazani-lori river basin. Some river channels that are prone to mudflows pose especially dangers, including Duruji, Telaviskhevi, Kabali, Lagodekhiskhevi, Shromiskhevi, Ninokhevi, Avaniskhevi, Turdo, Khodashniskhevi. The rehabilitations of mudflow control structures of Duruji and Telaviskhevi river channels is crucial.
- On the basis of the results of hydrological, meteorological and geological monitoring, the location of early warning systems should be determined. Potential locations include the areas that are most sensitive to natural hazards. Data of hydrological monitoring shall be used to build simulation models of inundation, flood, flashflood and mudflow processes and obtained results shall be used for identification of potential locations of early warning systems. Early warning systems will help avoid the negative impacts of expected natural hazards by providing timely and reliable information.
- Early warning systems shall be implemented at all respective infrastructure and settlements located in high-risk zones, to avoid the damage of infrastructure and potentially human deaths in case of natural disasters. Early warning systems shall be also implemented downstream of all water reservoirs and in the gorges of high-risk rivers including Duruji, Lagodekhiskhevi, Ninokhevi, Shromiskhevi, Chelti, Stori, Telaviskhevi, Tudro, and Khodashniskhevi.
- Hail causes serious problems in the Kakheti region and therefore, risks caused by this natural event should be further studied and relevant measures should be identified to protect the population, infrastructure, and agriculture lands of the Alazani-lori River Basin from its negative impact. For this purpose, it is recommended to establish a working group to work on this issue and improve anti-hail systems that will mitigate or avoid destructive effects of hail.

## CLIMATE CHANGE

### ***Measures to be considered in the RBMP***

- Rehabilitation of existing and setting up new irrigation systems is recommended to be implemented first in Sagarejo and Dedoplistskaro, where drought represents the most significant problem within the basin, followed by Signnagi, Akhmeta, and Gurjaani municipalities.
- Implementation of activities (i) on testing and promoting new drought-resistant crop varieties in Kakheti is advised; and (ii) to increase the awareness on such approaches among farmers respective measures should be included in the RBMP.

### ***Measures and conditions for the RBMP implementation***

- A study/research should be assigned on how to adapt agriculture sector in the basin to the likely consequences of the climate change.

## BIODIVERSITY, HABITATS AND PROTECTED AREAS

### **Measures to be considered in the RBMP**

- To increase positive impacts on biodiversity, establishment of the organic farms should be promoted in agriculture areas within the SPAs and around the Korugi and Iori Managed reserves, as well as around Alazani proposed emerald sites (rivers Inaboti, Apeni, Ole, etc.) and adjacent areas to the Alazani Natural Monument and Vashlovani National Park (villages Sabatlo, Pirosmani).
- Special studies to identify the most threatened freshwater species, as well as to assess the main impacts and threats on freshwater biodiversity within the Alazani-Iori river basin should be included among the RBMP measures for the first implementation cycle.
- Special measures are proposed by the RBMP for the Dali Reservoir that will have a positive effect on the Iori floodplain forests. However, none of these measures are selected to be implemented during the 1st implementation cycle. Considering the importance of the Dali reservoir for biodiversity composition, it is highly recommended to include measures related to the Dali reservoir in the first implementation cycle of the RBMP.

### **Measures and conditions for the RBMP implementation**

- It is recommended to identify ecological priority zones, trade-off zones, and zones with no particular restrictions or conservation interest of the floodplain forest areas along the entire length of the Iori and Alazani Rivers. This zonation scheme may serve as the basis for complying with development targets and improving the rivers' ecological status<sup>2</sup>. Zonation scheme also may set a foundation to identify priority areas for floodplain forests restoration measures.
- The EIA for the WWTP project should cover a detailed analysis of impacts on biodiversity, including the Red List species. Field surveys shall be conducted to identify flora and fauna species, especially the Red Listed species that may be affected by the construction activities.
- When setting new infrastructure (e.g. WWTPs or new sewerage systems), selection of the location of this new infrastructure including wastewater discharge points should be based on the analysis of the site alternatives (optimally to be carried out as a part of EIA), which should consider following criteria:
  - sites with already modified habitats and secondary vegetation should be preferred;
  - sites with sensitive habitats (forests, wetlands, less modified areas) should be avoided;
  - sites with the presence of Red Listed species should be avoided.
- Sagarejo city can be considered as one of the priority areas for constructing the WWTP.
- Maintenance of the environmental flow as well as lifecycle and conservation requirements of the key species and habitats should be considered in the design of the abstraction licensing /control system. Limits for the water abstraction should be defined and licenses should be issued within the limits to ensure that sufficient amount of water is maintained in the water bodies enabling a long-term survival of water dependent species and habitats.
- Special studies could be recommended to be carried out to assess the impacts of hydromorphological alteration of rivers, water abstraction and water pollution on species and habitats protected within Korugi and Iori Managed reserves, based on which appropriate conservation measures should be planned.
- EIA for development projects, which requires water abstractions/impoundments, should give a special consideration to the assessment of the potential cumulative effects of water abstraction/impoundments on biodiversity, taking into account other ongoing or planned development in the catchment area.
- Detailed studies and assessments on fish and invertebrate fauna should be carried out as a part of planning and designing the projects on sediment transport improvement. For example, such studies should be conducted before implementation of the measures related to Dali Reservoir such as restoration of the natural flooding regime and improvement of the infrastructures (for instance shield restoration).

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<sup>2</sup> The recommendation is developed based on the case study – *Hydromorphological restoration priorities in Austria* presented in the Guidance document on the requirements for hydropower in relation to EU Nature legislation, European Commission, 2018.

- Protection of spawning areas for fish species should be addressed by material removal and sediment extraction regulation. The operation of machinery for material removal and sediment extraction into the river stream must be restricted. Arrangement of protective barriers between excavation areas and water stream should be required.
- The Agency of Protected Areas, administrations of the Iori and Chachuna Managed Reserves and other stakeholders active in the field of nature protection should be involved in the planning and design of the projects on riparian habitats improvement and diversification to avoid any unexpected impact on the natural tugay forest habitats along the Iori River.
- It is recommended to avoid livestock grazing not only in water protection zones, but also in floodplain forests. Development and implementation of pastures management plans, especially within protected areas and emerald sites is highly recommended.

## HEALTH

### **Measures to be considered in the RBMP**

- In order to strengthen the positive effects of the public campaigns promoting efficient water use by domestic customers, the following topics are suggested to be included in the communication plan (preparation of which is proposed by the RBMP):
  - Information regarding the risks associated with discharging household wastewater;
  - Advantages of the use of modern appliances (such as a dishwasher, washing machine, etc.) for efficient use of water;
- Preparation of a system of monitoring and elimination of incidences (including their timely detection, reporting, etc.) should be included to the supplementary measures proposed by the RBMP "Implementation of water resources monitoring program and environmental inspection controls".

### **Measures and conditions for the RBMP implementation**

- As a part of the infrastructure project preparation, the medical emergency management plans should be prepared to address specific health hazards the workers can be exposed to. The plans should provide a scheme of actions to (i) timely detect injury or exposure, (ii) provide immediate medical assistance at the site, (iii) ensure the transport to nearest, adequately equipped and staffed healthcare facility for additional medical assistance, if needed.
- Temporary shortage of water output to household and healthcare facilities, which represents a risk during construction works, should be addressed by ensuring alternative water supply as well as proper and early communication and public information campaigns.
- Due attention and controls should be implemented in order to avoid contamination of drinking water sources during the construction works in order to avoid supply of unsafe water and avoid waterborne diseases.
- For the cases of water pollution/contamination incidence, an early warning and notification system should be established to inform the local population about the situation and ensure that contaminated water is not used for drinking, cooking, household chores or recreational purposes.

## SOCIO-ECONOMIC ASPECTS

### **Measures to be considered in the RBMP**

- Development of a system of environmental fees to cover costs related to the implementation of measures should be included among the Alazani-Iori RBMP measures gradually with a short- and long- term perspectives. Introduction of fee system is needed to sustain the measures. Maintenance of the system as well as periodic measures (technical inspection/study, etc.) requires considerable resources. In addition, without proper maintenance, amortization of certain engineering systems will be accelerated. Moreover, capital costs will not be recovered and the system will be demolished soon, with no resources left to rehabilitate the system again.

### **Measures and conditions for the RBMP implementation**

- Employment of the local community members in implementation of the RBMP-related activities (e.g. construction works, operation of WWTTPs) should be a priority. In order to enhance working

- skills and capacities of the local population, a special campaigns and capacity development activities (trainings, workshops, etc.) should be provided to the local workforce.
- Introducing fees on the water abstraction (as envisaged by the new draft Law on Water Resource Management), will considerably reduce water losses and inefficient use; however, certain recommendations should be followed:
    - Economic incentives (access to funds, technologies, etc.) will be needed to promote efficient and sustainable water use practices as well as to change current unsustainable practice and to switch to water efficient technologies.
    - Special awareness raising and knowledge transfer campaign via trainings (e.g. as a precondition for applying for the special fund), workshops, information dissemination via local TVs, web-pages, newspapers, information stands, leaflets and other means of communication should be arranged in order to reduce excessive use.
    - Efficient fee system for irrigation service needs to be introduced as soon as the system is rehabilitated or new ones become operational so that the maintenance, as well as the capital costs, is recovered and the service becomes cost-effective.
  - Trainings and information campaigns on environmental aspects for the local stakeholders should be established, which should enable to:
    - Improve decision-making process for sustainable use of water resources, as well as stakeholders' participation in the management of Alazani-iori River Basin.
    - Inform the local population about the outputs and results of improved environmental monitoring and supervision/inspection systems;
    - Inform the local population about potential future issues related to environment (e.g. likely consequences of the climate change and necessary adaption measures).

## CULTURAL HERITAGE

### **Measures and conditions for the RBMP implementation**

The legal requirements stipulated by the Law on Cultural Heritage have to be followed in the design and implementation of those RBMP measures requiring construction and earthworks. The likely impacts on the cultural heritage (in particular on previously undiscovered archeological remains near or within water bodies) should be analyzed in EIAs.

## HYDROPOWER DEVELOPMENT

*Although the RBMP does not promote further development of the hydropower in the basin, the construction of perspective HPPs, which is planned in the basin, will have significant impacts on certain environmental and health issues addressed in the SEA. Therefore, SEA formulated following mitigation measures to address selected environmental aspects of the future hydropower development in the basin:*

- Up to 5 HPPs are planned to be built in the Alazani-iori Rives Basin in 5-year period and additional HPPs are expected to be built in a long-term perspective. Therefore, in order to address likely cumulative effects, SEA should be assigned for the relevant strategic document prepared in energy sector, which will address hydropower development in the basin. The SEA should include analysis of cumulative impacts of existing and planned hydropower plants on surface water availability, considering climate change scenarios to avoid water shortage for other surface water users in the basin.
- Environmental flow is crucial for maintaining the river morphology and its habitats, as for the determination of amounts of water to be released into irrigation systems and impounded in water reservoirs. The rate of environmental flow established in the Georgian legislation (10% of average multiannual flow) does not ensure the maintenance of river morphology as the approach of calculation of environmental flow is outdated (it is based on the Soviet standards and norms, and does not meet modern requirements). Therefore, the calculation of environmental flow (carried out separately for each river) should be based on international practice/methodology and formulated as a law (the value of environmental flow should be integrated into the legislation and subjected to regulation). It is also important to strengthen the monitoring of environmental flow at upstream and downstream of water reservoirs, HPPs and irrigation systems.

- The cumulative impact of new HPPs development on environmental flow should be determined, taking into account likely consequences of the climate change including potential reduction of water flows, especially during prolonged droughts. Without understanding and setting proper environmental flow considering climate change impact on flow, the baseline planning e.g. HPPs construction and other water-dependent economic activities will not be effective in the Alazani-Iori River Basin.
- An assessment of cumulative effects of existing and planned HPPs on fish migration should be carried out to avoid further reducing or interrupting rivers continuity for fish migration.

## 1. BACKGROUND INFORMATION

### 1.1. BRIEF OVERVIEW OF THE LEGAL FRAMEWORK FOR SEA IN GEORGIA

By signing the EU Association Agreement in 2014 Georgia committed itself to fulfill a number of obligations in the field of environmental protection, including in the area of environmental impact assessment (EIA) and strategic environmental assessment (SEA). The adoption of a new national Code on Environment Assessment (EA Code or EAC) in 2017 was an important step towards establishing a modern EIA and SEA procedure in the country. The EA Code requires that strategic and policy documents prepared in certain sectors, including in the water resources management sector, are subject to the SEA. Besides, the EAC defined project-based procedures to examine potential impacts on the environment of the planned projects that fall within the scope of the activities provided by Annex I to the EAC, and of the activities provided by Annex II according to a screening decision.

According to the EA Code, the SEA is defined as a systematic process, to be undertaken to analyze likely environmental and health effects related to a strategic document<sup>3</sup> and to integrate findings into strategic planning for better decision-making.

As outlined in the EA Code, the SEA includes following main steps:

- Screening to decide whether a strategic document has to be a subject to SEA<sup>4</sup>;
- Scoping e.g. preparation of a scoping application, scoping consultations, and issuing the scoping opinion ;
- Preparation of a SEA Report;
- Carrying out of public participation and consultations with relevant public authorities and stakeholders on the draft strategic document and the SEA report;
- Preparation of recommendations by the Ministry of Environmental Protection and Agriculture and the Ministry of Internally Displaced Persons from the Occupied Territories of Georgia, Labour, Health and Social Affairs according to the Art. 27.7 of the EA Code based on the findings of the SEA process, which should be taken into account during adoption/approval of the strategic document.

The draft Law on Water Resource Management (WRM)<sup>5</sup> that is planned to be adopted in the course of 2020, introduces a river basin management approach in water sector and requires to develop and implement river basin management plans (RBMPs)<sup>6</sup> for 6 (six) basin districts. The draft Law identifies the MEPA as key planning authority for the RBMPs. Once the law is adapted, the RBMPs according to the EA Code will be subject to the SEA procedure.

### 1.2. SEA FOR THE DRAFT ALZANI-IORI RBMP

#### 1.2.1. A brief overview of the SEA pilot process

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<sup>3</sup> Strategic document – a sub-normative act of administrative body, which sets a framework for future development projects in the specific sectors as defined by the Environmental Assessment Code (EA Code) of Georgia.

<sup>4</sup> For the purpose of this pilot project the screening procedure was not carried out as RBMPs are the strategic documents that require mandatory SEA according to the EAC.

<sup>5</sup> Preparation of the draft Law on Water Resource Management was initiated by the Ministry of Environmental Protection and Agriculture of Georgia (MEPA) and was prepared through donor assistance within the different projects and initiatives including the EUWI+ programme. The draft Law on Water Resource Management shall be subject of the intergovernmental consultations with the aim to adopt the Law in 2020.

<sup>6</sup> River Basin management Plan, territorial planning document: it gives the overall orientations of water management in the basin and the objectives to be reached, the delay and the priorities in the actions to be developed for a defined period of time.

The draft RBMP for Alazani-Iori River Basin has been prepared with the assistance of the EUWI+ programme as a part of the pilot activities of the programme in Georgia aiming to support MEPA in its efforts to introduce RBM approach in the wake of adoption of the new law on WRM. The SEA pilot project on the other hand supports MEPA in preparing the SEA documentation for the Alazani-Iori RBMP to ensure smooth transition of water sector to RBM principles and implementation of the SEA procedures in respect to RBMP.

The implementation of the SEA pilot project for the draft Alazani-Iori RBMP started in December 2019. The pilot project consisted of two main stages i.e. the scoping stage (including preparation of the scoping report and scoping consultations), and the SEA report preparation, which will be followed by the consultations on the draft RBMP and the SEA report. For this purpose, the team of national experts was established to work with support of the international expert on the preparation of scoping and SEA reports for the draft Alazani-Iori RBMP. The pilot SEA project activities being completed by two training events and consultation workshops with the main national stakeholders. The scoping stage of the pilot project was carried out from December 2019 till April 2020. Comments on the Scoping Report were sought from various state agencies and other stakeholders through the scoping consultations. Comments and suggestions made by stakeholders at the scoping stage are reflected in this draft SEA report (*see Annex 1. Table of Comments*). The second stage of the pilot project was launched in April 2020 and has resulted in the draft SEA report, which together with the draft RBMP were open for consultations in October 2020. The SEA report was finalized based on the feedback sought from stakeholders.

The approach to the SEA took into consideration the very nature of the RBMP, which is an environmentally oriented document. Therefore, the major focus of the SEA was to enhance the likely positive effects of the RBMP on the environment including socio-economic and health issues relevant to the Alazani-Iori RBMP.

### 1.2.2. Major obstacles in conducting SEA pilot project

This SEA pilot project is the first attempt to conduct the SEA for RBMP in Georgia. One of the difficulties was related to the fact that national experts involved in the project had only limited or no previous experience with conducting assessments at the strategic level.

It must be noted that restrictions imposed due to COVID 19 pandemic affected the SEA pilot project implementation process. Although the project envisaged an extensive training events to be organized for the national experts and other main stakeholders, the full-scale implementation of these events was hindered due to the restrictions imposed to public life (including gatherings). Therefore, the second training for national experts was provided only in a form of the webinar that turned out to be less effective than 'face-to-face' meeting. The COVID-19 related travel restrictions also did not allow organization of the mission of national experts to the Alazani-Iori River Basin and international expert to Georgia during preparation of the SEA report and thus limited opportunity of the joint work of the entire team. Although partially replaced by online communication means, similar to the webinar, this approach did not enable a full-scale knowledge and practice sharing.

Another challenge the project faced was related to gathering data and information for the baseline analysis. In particular, following gaps in data and information has been identified:

- Biodiversity monitoring system is developing only now and data on the status of endangered and vulnerable species in the basin are very limited or not available;
- There are significant data gaps on groundwater and soil monitoring:
  - Groundwater monitoring was resumed in 2013 and since then the monitoring network is being subject to gradual extension. Currently, there are 33 monitoring stations. These monitoring stations and data are not sufficient to allow adequate assessment of the quality and quantity of groundwater in the basin.
  - Current soil monitoring in the Kakheti region is not systematic and does not allow for quantitative analysis and assessment.
- Impacts of water pollution by chemical substances on human health are generally not well studied in Georgia. The national systems to investigate and identify the source of outbreaks of common

conditions which could be caused by water pollution, such as diarrheal diseases, are not fully functioning. The National Center for Disease Control and Public Health (NCDC), which is the governmental agency responsible for outbreak investigations, is expected to improve the monitoring system by 2022.

### 1.3. PURPOSE OF THE SEA REPORT

The purpose of the Alazani-lori RBM SEA report is to provide well-readable information about the environmental and health issues relevant to the implementation of the RBMP in the Alazani-lori River Basin, including description of the likely effects of the RBMP on those issues, and formulation of measures to mitigate likely negative effects and/or to enhance likely positive impacts of the plan.

The EA Code requires following information to be provided in the SEA report (Article 26, Paragraph 2):

- a) *information on the contents and objectives of the strategic document and the relation of the strategic document to other strategic documents;*
- b) *the general assessment of the current status of environmental and human health in the area on which the implementation of the strategic document may have significant effects;*
- c) *a general analysis of the main aspects related to the environment and human health for the territory which may be subject to significant effects;*
- d) *general forecasts of the potential environmental effect resulting from the implementation of the strategic document;*
- e) *information on the potential transboundary impact resulting from the implementation of the strategic document if there exist grounds provided by this Code;*
- f) *a brief description of measures for preventing, reducing or mitigating the potential effect on the environment and human health resulting from the implementation of the strategic document;*
- g) *opinions as to the substantiation of the alternatives reviewed;*
- h) *a non-technical summary of the SEA report.*

In accordance with above requirements of the EA Code, as well as in line with the UNECE SEA Protocol and the EU SEA Directive, the Alazani-lori RBM SEA report includes following sections:

- Analysis of the environmental baseline e.g. social-economic and health aspects related to the Alazani -lori River Basin;
- Review of environmental and health policy objectives relevant for the Alazani-lori River Basin;
- Likely effects on environment, socio-economic and health aspects;
- Relevant mitigation measures to minimize likely negative effect or the measures to enhance likely positive effect resulting from the RBMP implementation;
- Environmental and health monitoring system;
- Summary of the results and the main mitigation measures to be further considered in the draft Alazani-lori RBMP.

### 1.4. INFORMATION ON THE PLANNING AUTHORITY

Currently, the development and implementation of the RBMP are not required by the national legislation in force. However, the draft law on WRM that aims to fulfil the obligations under the Association Agreement between Georgia and the European Union, introduces the river basin management approach in the water sector and puts forward a new requirement to develop and implement RBMPs. The draft Law identifies the MEPA as the planning authority for RBMPs (Paragraph 3 of Article 6). The EA Code, on the other hand defines the planning authority as *an administrative body or any other competent organisation which is responsible for preparing a strategic document*. Furthermore, the planning authority is responsible for initiating the SEA process and submitting the strategic document for its adoption and/or for its implementation.

In a view of above, the current document has been developed with the understanding that MEPA is to act as the planning authority of the Alazani-lori RBMP once the respective laws and by-laws are adopted.

## 2. INTRODUCTION TO THE ALAZANI-IORI RIVER BASIN MANAGEMENT PLAN

### 2.1. THE CONTENT OF THE DRAFT ALAZANI-IORI RBMP

According to the draft Law on Water Resource Management (Article 29, Paragraph 2) the River Basin Management Plan should contain the following elements:

- a) *General characterization of the basin territorial unit of integrated river basin/basin district;*
- b) *Description of the significant anthropogenic pressure and impact on the status of surface and groundwater bodies;*
- c) *List of risks of water-negative impact zones and risk management program;*
- d) *Map showing the boundaries of protected zones;*
- e) *A map of the monitoring network designed to determine the ecological status, which should also reflect the results of the monitoring programs based on which the water status was determined;*
- f) *List of environmental objectives set for surface and ground water bodies and for water bodies existing on the protected zones, including information which includes cases of exemptions to set environmental objectives and related information;*
- g) *Short survey of economic analysis of water use;*
- h) *Review of the program of measures for achieving environmental objectives;*
- i) *List and brief descriptions of other programs and management plans developed within the river basin management territorial units (districts) that have impact or possibly have impact on water bodies within the territorial unit;*
- j) *Information on Public Discussions and Consultations held at the stage of development of the river basin/basin district management plan and reflection on their results plan;*
- k) *Information about the competent authority of the river basin/basin district and its local representations, as well as information about the contact person, basic documents and the procedure for withdrawing these documents.*

Within the scope of the EUWI+ project, the elements of the draft Alazani-iori RBMP have been prepared in line with the requirements of the draft law on WRM.

The plan consists of following components: i) report on characteristics of the Alazani and Iori River Basins, ii) report on Pressures and Impact of Human Activities on Water Resources, iii) economic analysis of the RB, iv) programme of measures for water bodies of the Alazani-Iori RBMP) economic analysis of proposed RBMP measures and vi) environmental objectives. A brief overview of the main elements of the draft Alazani-Iori RBMP are presented below.

**A general overview** of the Alazani-Iori basin's geography, climate, hydrology, soil types, water resources, and other environmental characteristics are described in the report on **“Characteristics of the Alazani and Iori River Basins”**. Furthermore, the report provides general information on the socio-economic activities that are predominant in the basin. The report also describes the use of water and land resources and its relation with the quality of surface and ground waters. Overall, the report provides detailed information on the current environment, socio-economical and public health conditions of the Alazani-Iori River Basin, as well as anthropogenic factors influencing the quantity and quality of the natural resources.

**The “Pressures and Impact of Human Activities on Water Resources” report** assesses qualitative pressure on water resources. This includes the situation regarding water pollution from point and diffuse sources of pollution including contamination from urban and industrial wastewater, illegal landfills, agriculture, and other discharges that result in pollution of surface water resources. Quantitative pressures on surface and ground waters, such as water abstraction for irrigation purposes, industrial activities, public water supply, etc. has been analyzed as well. Besides, the report also looks at the impacts of human activities on the change of hydrological and morphological conditions and provides information on the quantitative balance between water abstractions and surface water and groundwater resources to identify which sectors are the biggest water users in the basin. In addition, based on the pressure and impact analysis and a preliminary risk assessment of the main pressures are provided for each water body.

Protected areas within the Alazani-iori River Basin were also identified and mapped with the aim to underline their distinguished importance for the conservation of water dependent habitats and/or species. Environmental objectives related to protected areas are provided in chapter 2.2.1. below.

The RBMP studies also included the socio-economic analysis of water resources and their uses. In particular, it provided information on water users covering the sectors which are the main water abstractors) and sectors, which contribute to the pollution of water and the change of the hydrological regime mostly. Such studies support informed decision making and allow decision-makers to gain a better understanding of the socio-economic value of water and define the relevant cost of water management. Besides, the draft RBMP provides economic analysis of proposed RBMP measures as well.

A programme of measures (PoM) represents one of the main components of the RBMP. and is presented in details in chapter 2.2.2.

### 2.1.1. Environmental Objectives for the Alazani-iori RBMP

Identification of environmental objectives is an important part of the river basin management plan that aims to achieve good status of water bodies, prevent deterioration of water status and ensure sustainable water management. Therefore, the draft environmental objectives for the Surface Water Bodies (SWBs), Heavily Modified Water Bodies (HMWBs) and the protected areas of the draft Alazani-iori RBMP were set out by the RBMP, which are summarized in the table below (Table 1. Draft Environmental Objectives for the draft Alazani-iori RBMP)

**TABLE 1. DRAFT ENVIRONMENTAL OBJECTIVES<sup>7</sup> FOR THE DRAFT ALAZANI-IORI RBMP**

Group of Objectives		Specific Objectives
<b>Objectives for Surface Water Bodies (SWBs) at risk</b>		<p><b>Urban waste water (sewerage) discharges:</b></p> <ul style="list-style-type: none"> <li>To improve water quality against organic matter, nitrogen, phosphorus other pollutants by reducing untreated waste water discharges from sewerage systems, having a sewerage treatment facility</li> </ul> <p><b>Industrial (sand-gravel extraction) waste water discharges:</b></p> <ul style="list-style-type: none"> <li>To improve water quality by reducing concentration of weighted portions and untreated waste water discharges from industry sector</li> </ul> <p><b>Agricultural (crop production) activities:</b></p> <ul style="list-style-type: none"> <li>To improve water quality by reducing organic matter, nitrogen, phosphorus, pesticides hazardous substances discharges in surface water bodies</li> </ul> <p><b>Agricultural (animal livestock) activities:</b></p> <ul style="list-style-type: none"> <li>To improve water quality by reducing organic matter, nitrogen, phosphorus, pesticides hazardous substances discharges in surface water bodies; improving manure management</li> </ul> <p><b>Illegal landfills waste water discharges:</b></p> <ul style="list-style-type: none"> <li>To improve water quality by regulating the illegal landfills</li> </ul> <p><b>Excessive water abstraction for irrigation; HPPs; Public water supply:</b></p> <ul style="list-style-type: none"> <li>To improve the hydromorphological status of the river such as morphology, continuity, hydrology by reducing disturbance of flow, improving the conditions of irrigation systems</li> </ul> <p><b>Hydromorphological alteration</b></p> <ul style="list-style-type: none"> <li>To improve hydromorphological status of the river such as morphology, continuity, hydrology by reducing plan form/channel pattern changes, altered riparian habitats, bed and bank fixation, protecting the environmental flow (e.g. low flow, variable flow, etc.), assuring river continuity</li> </ul>
<b>Objectives for Heavily Modified Water Bodies (HMWBs)</b>		<ul style="list-style-type: none"> <li>To improve hydromorphological state (hydrological regime changes, river continuity, morphological alterations) of a water body by maintaining environmental flow</li> </ul>
Environmental objectives related to protected areas	<b>Objectives for special areas of conservation (habitats)</b>	<ul style="list-style-type: none"> <li>To protect and where necessary improve the status of the water bodies in order to achieve the conservation objectives for the protection or improvement of the particular natural habitat type or species</li> </ul>
	<b>Objectives for special protection areas for birds</b>	<ul style="list-style-type: none"> <li>To protect and improve the water status to the level necessary to achieve the conservation objectives for the protection/improvement of the site for ensuring the survival and reproduction of birds</li> </ul>
<b>Environmental objectives for groundwater</b>		<ul style="list-style-type: none"> <li>WFD Art. 4(1)(b)(1): prevent or limit input of pollutants into GW; prevent deterioration of GWB status</li> <li>WFD Art. 4(1)(b)(2): achieve good status</li> <li>WFD Art. 4(1)(b)(2): reverse significant and sustained upward trends in pollutant concentrations due to human activity</li> </ul>

Source: Draft Environmental Objectives of the draft Alazani-Iori RBMP, the report is prepared within the RBMP.

<sup>7</sup> Environmental Objectives are defined by the WFD in Article 4, Paragraph 1

### 2.1.2. Programme of Measures

The draft Alazani-iori RBMP PoMs derives from findings of the pressure/impact analysis and corresponding risk assessment. The major water management issues in the Alazani-iori River Basin have been defined as follow:

- Point source pollution from urban wastewater discharges Point source pollution from industrial waste water discharges (sand-gravel extraction);
- Diffuse source pollution from agriculture-crop production;
- Diffuse source pollution from agriculture-animal live stocking;
- Diffuse source pollution from illegal landfills;
- Excessive water abstraction (irrigation, public water supply, hydropower plant (HPP), fish farm, and etc.);
- Hydro morphological alteration (hydrological flow changes, longitudinal river, habitat continuity interruption, morphological alterations).

The draft RBMP proposes measures to address the impacts of above-mentioned water management issues and covers **Basic Measures**, which are obligatory minimum requirements to be included in the PoMs and **Supplementary Measures** designed in addition to the basic measures to achieve the environmental objectives of the Water Framework Directive (WFD). Supplementary measures would include additional legislative acts, fiscal measures, research and educational campaigns that go beyond the basic measures.

**TABLE 2. PROPOSED BASIC AND SUPPLEMENTARY MEASURES OF THE DRAFT ALAZANI-IORI RBMP**

Group of Measures	Specific Measures
<i>Measures deemed / proposed specially for urban wastewater discharges</i>	<ul style="list-style-type: none"> <li>- Construction of new waste water treatment plants (WWTP)</li> <li>- Construction of the sewerage systems</li> <li>- Rehabilitation wastewater network, which includes replacement of the pipes, wells and collectors</li> <li>- Environmental inspection controls on wastewater discharges to the rivers</li> <li>- Monitoring of illegal landfills (to be executed by the municipalities), imposing some sanctions, improvement of waste management</li> </ul>
<i>Measures deemed / proposed specially for agriculture-crop production, live stocking</i>	<ul style="list-style-type: none"> <li>- Rehabilitation of drainage systems to reduce water induced erosion and agriculture run-off</li> <li>- Setting buffer strips and hedges (establishment of 3m buffer strip)</li> <li>- Codes of Good Agricultural Practices for Protection of Waters against Agricultural Nitrate Pollution (the reduction in the use of fertilizers in agriculture)</li> <li>- Establishment of organic farms</li> <li>- Action plans for Nitrate Vulnerable Zones</li> </ul>
<i>Measures deemed / proposed specially for water abstraction (by irrigation, HPP, drinking water supply)</i>	<ul style="list-style-type: none"> <li>- Using modern and efficient irrigation technologies to economize the water uses</li> <li>- Rehabilitation of the main canal, collectors and engineering works of the irrigation systems in the Alazani-Iori River Basin</li> <li>- Setting up sanitation zones (sanitary protection zones) to protect water quality</li> <li>- Regulations for abstractions and impoundments to prevent deterioration of water body status (the system of abstraction licensing control)</li> </ul>
<i>Measures deemed / proposed specially for hydro-morphological alteration</i>	<p><i>Measures for the pressure category-water flow changes</i>            Creation of ecologically compatible hydraulic conditions through flow control (e.g. water level regulation)            Creation of water course passability for upstream and downstream migration of location specific species and for sediment transport; management of sediments</p> <p><i>Measures for the pressure category-sediment dynamics</i>            Improvement of sediments transport continuity via dam's management            Material removal and sediments extraction regulation            Moderate watercourse maintenance            Investigation and monitoring of sand-gravel enterprises (investigation of waste water treatment plants and estimation of weighed portions)</p> <p><i>Measures for the pressure category-morphological changes</i>            Improvement and diversification of bank and bed structures, riparian and aquatic habitats (vegetalization)            Supporting hydraulic engineering measures for morphological restructuring of the water course</p>
<i>Measures deemed / proposed specially for the reduction of climate change pressure</i>	<ul style="list-style-type: none"> <li>Restoration of floodplain forests</li> <li>Considering climate change aspects in the implementation of infrastructure or bank protection projects</li> <li>Considering climate change impact when calculating water demand/supply balances for water supply companies</li> <li>Monitoring of water abstraction considering decreased precipitation, ensuring sustainable use of water</li> </ul>

From a wide range of proposed measures in the draft RBMP, altogether 28 measures have been selected (19 basic and 9 supplementary) for the 1<sup>st</sup> 6-year implementation cycle of the Alazani-iori RBMP. The selection of the measures has considered relevant issues and existing pressures in the Alazani-iori River Basin with a major focus on reducing water pollution by wastewaters from households, industrial and agriculture sectors. There is a number of measures, which have not been selected for the 1<sup>st</sup> implementation cycle due to the lack of funding and appropriate consents.

**TABLE 3.** THE MEASURES SELECTED FOR THE FIRST IMPLEMENTATION CYCLE

Basic Measures	Supplementary measures
<ul style="list-style-type: none"> <li>• <b>Rehabilitation of sewage network</b></li> <li>• <b>Construction of wastewater treatment plant</b></li> <li>• <b>Renovation of agriculture drainage system</b></li> <li>• <b>Installation of buffer strips and hedges</b></li> <li>• <b>Establishment of vermicompost</b></li> <li>• <b>Rehabilitation of main channel and engineering work</b></li> </ul>	<ul style="list-style-type: none"> <li>• Implementation of water monitoring programme</li> <li>• Monitoring of sand-gravel enterprises</li> <li>• Controlling of water volume</li> <li>• Training of farmers to use water efficiently</li> <li>• Public campaigns promoting efficient water use by domestic customers</li> <li>• Creation of sanitary protection zones</li> <li>• Monitoring of illegal landfills</li> <li>• Strengthening of hydrological monitoring system</li> <li>• Research to assess current and potential climate change impact on water bodies</li> </ul>

### 2.1.3. Competent authorities responsible for the implementation of the Alazani-lori RBMP

According to the draft RBMP, the list of competent authorities that are recommended to be involved in implementation of the Alazani-lori RBMP includes:

- LEPL National Environmental Agency
- Ltd. Georgian Amelioration
- Ministry of Regional Development and Infrastructure of Georgia
- Ltd. United Water Supply Company of Georgia
- Ministry of Economy and Sustainable Development of Georgia

as well as local authorities: basin municipalities, branches of central level water management related agencies (amelioration department, extension centers of the Ministry of Environmental Protection and Agriculture).

## 2.2. POTENTIAL ALTERNATIVE MEASURES ENVISAGED BY THE STRATEGIC DOCUMENT

The draft Alazani-lori RBMP does not elaborate on alternatives. The potential alternatives of the measures may be elaborated in follow up stages of the river basins management planning, when the details of the measures (including their locations) will be specified after the draft Alazani-lori RBMP is adopted, and before its implementation starts.

## 2.3. THE RELATION BETWEEN THE ALAZANI-IORI RBMP AND OTHER STRATEGIC DOCUMENTS

**The EU-Georgia Association Agreement (AA)**, which was signed in 2014 and entered into force in 2016, is a key document that sets certain commitments in the environmental field and shapes the environmental legal and policy framework at the national level. The government of Georgia is committed to approximate its legislation with the EU Directives in the sectors of environment including water resources management. The AA sets obligations for Georgia on the approximation of its legislation with the EU Water Framework Directive (WFD). Therefore, a new draft law on “Water Resources Management” that sets the legal base for water management at a river-basin level, aims to fulfil the obligations of the AA and WFD respectively. According to the draft law, the main priority areas for integrated water resources management is the introduction of a water resources river basin management mechanism and creation of appropriate legal and institutional basis.

The new **draft framework Law on WRM** addresses all types of water bodies and includes provisions dealing with both water quality and quantity. The law addresses water management and incorporates all aspects of integrated water resources management, including water classification system, water quality objectives and standards, water use, water resource planning, pollution prevention, monitoring and enforcement, flood risk management and public participation. Adoption of the new water law will be a significant step towards establishing internationally accepted water management practices to ensure the achievement of at least “good status” in relation to all waters.

Environmental protection objectives and the certain measures of the draft Alazani-lori RBMP are in consistence with **the Third National Environmental Action Programme of Georgia (NEAP 2017-2021)**”, approved by the Decree N1124 of the Government of Georgia on May 22, 2018. In general, the long-term goal (2030) of the NEAP is to ensure good qualitative and quantitative status of surface and groundwater bodies for human health and aquatic ecosystems. To achieve this goal, the NEAP sets the following three targets:

**Target 1.** Development of an effective system of water resources management;

**Target 2.** Reduction of water pollution from the point and diffuse sources and ensuring sustainable use of water resources;

**Target 3.** Improvement of the water quality and quantity monitoring and assessment systems.

Priority measures and objectives of the draft Alazani-lori RBMP are also relevant for:

- **the Socio-Economic Development Strategy of Georgia - “Georgia 2020”** that among others defines the water resources management related strategic objectives e.g. to ensure uninterrupted water supply to the entire population of Georgia and to rehabilitate the water supply and sanitation systems;
- **the Regional Development Program of Georgia (2018–2021)** that identifies the provision of public services e.g. modernization and development of water and sewage network, including construction and rehabilitation of treatment plants, as one of the priority measures, particularly for rural areas.
- **The Strategy for Agriculture Development (2021-2027)** that puts forward the modernization of irrigation and drainage infrastructure as one of the key strategic objectives.
- **The Kakheti Regional Development Strategy (2014-2021)** that identifies the supply of high-quality drinking water to the population and connection households to the sewage network as one of the main goals.

Detailed description of further linkages between the draft Alazani-lori RBMP and relevant environmental and health objectives (and thus other strategic documents, which stipulate these objectives) is provided in the policy analysis (see Chapter 4).

### 3. ENVIRONMENTAL AND HEALTH BASELINE<sup>8</sup>

This chapter presents the analysis of the environmental and health situation (baseline) related to the Alazani-lori River Basins. It serves as a basis for identification of the key environmental and health issues relevant to the draft Alazani-lori RBMP, and evaluation of the likely effects of the draft Alazani-lori RBMP.

The baseline analysis covers water resources including hydrology, natural hazards, soil, climate change factors focusing on adaptation issues, biodiversity, habitats and protected areas as well as public health conditions, socio-economic aspects, and cultural heritage. It uses the most recent available data and information from a wide range of sources (monitoring network, existing reports and studies, etc.). It also identifies existing gaps in data and information (for more details see sub-chapter 1.2.2.).

#### 3.1. INTRODUCTION OF THE ALAZANI-ORI RIVER BASIN<sup>9</sup>

The Alazani-lori River Basin fully covers the territory of Kakheti, as well as the territory of the Tianeti Municipality in the Mtskheta-Mtianeti region. It entails 8 administrative units – municipalities of Akhmeta, Telavi, Gurjaani, Kvareli, Signagi, Sagarejo, Lagodekhi and Dedoplistskaro in the Kakheti region and Tianeti municipality located in the Mtskheta-Mtianeti region.

Kakheti is one of the largest regions in Georgia, with a territory of 11,375 km<sup>2</sup> and a population of 312,500 as of 1 January 2019 (GeoStat), which represents approx. 8% of the entire country's population. There are 9 urban settlements and 333 villages in Kakheti. Approx. 22.6% of the population of the Kakheti region lives in urban settlements, while around 77% lives in the rural areas. As a result, the region has the lowest urbanization rate in Georgia - 22% compared to the national average - 58%.

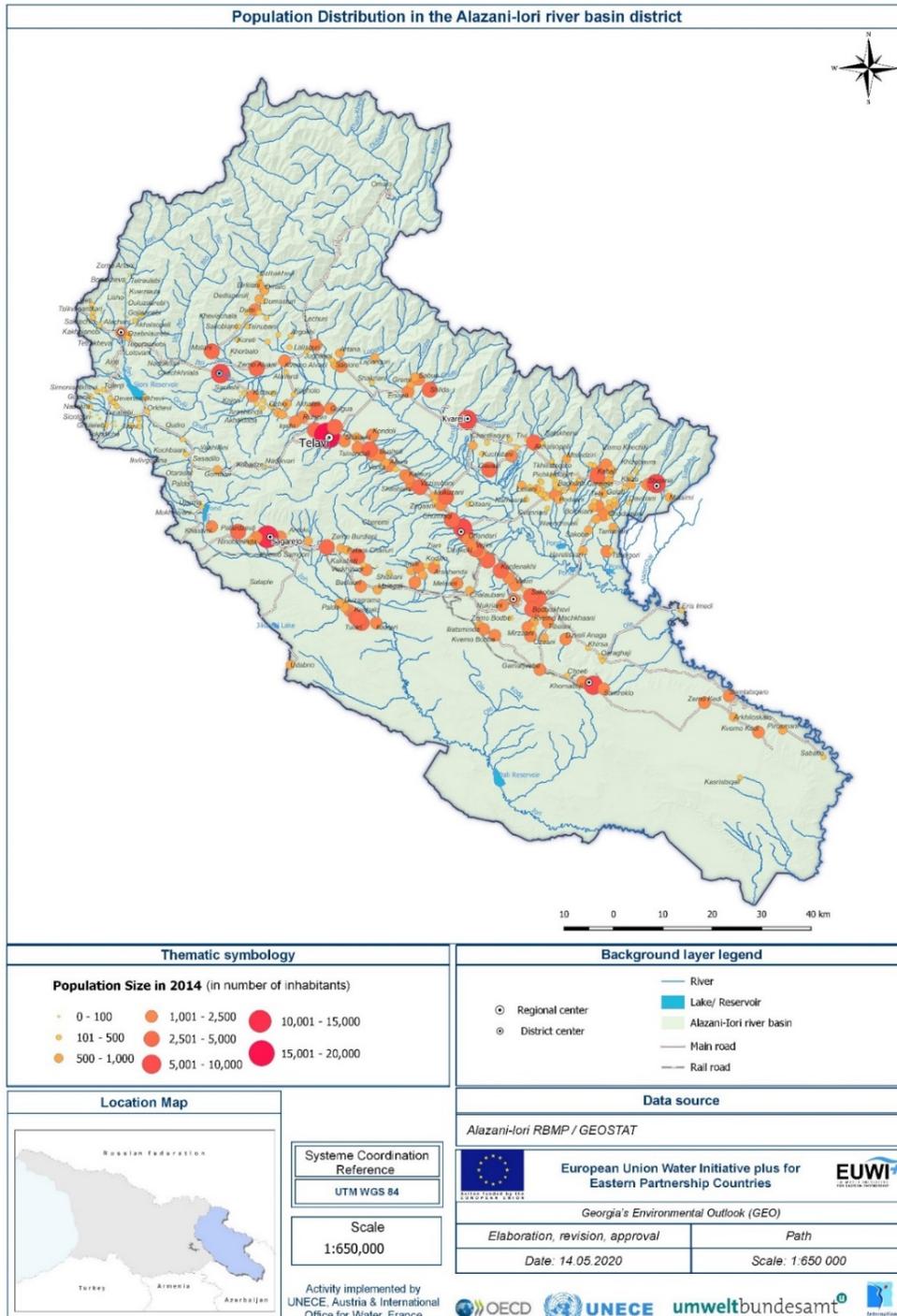
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<sup>8</sup> “Environment and Health” is used in the titles in accordance with the standard SEA practice. It is worth noting that health may be affected not only by the environment and its quality but also by socio-economic factors, therefore these are also addressed in SEA.

<sup>9</sup> Some information in the chapter was taken from the draft report ‘Characteristics of the Alazani and Iori River Basins’ (2019), prepared by the EUWI + national programming team.

Kakheti has the lowest population density and the highest share of the rural population in the country. Population density is 27.5 inhabitants per km<sup>2</sup>, which is 2.3 times lower compared to the national population average 65.1 inhabitants per km<sup>2</sup> (GeoStat, 2019).

**Map 1: Population distribution in the Alazani-Iori River Basin**



Age composition of Kakheti population is as follows: 17.8% - children and adolescents younger than 14 years; 17.4% - people older than 65 years; and 64.8% - able-bodied population.

## 3.2. WATER RESOURCES

### 3.2.1. Surface water resources

Catchment area of the Alazani basin is 11,800 km<sup>2</sup>, catchment area of the lori river is 4,700 km<sup>2</sup>).

The River Alazani originates through the confluence of the two mountain rivers - Tsiplovaniskhevi and Samkuristskali, flowing from the southern slopes (Mount Didi Borbalo) of the Main Caucasus Range at an altitude of 2,600-2,800 m above sea level (a.s.l.). The river crosses the Alazani valley, flows along Georgian-Azerbaijan border and joins the Mingachevir Reservoir in Azerbaijan. The total length of the river is about 390 km, average elevation is 850 m, average fall -745 m and average inclination - 2.12%.

The lori River originates on the southern slopes of the Main Caucasus Range at an altitude of 2,600 a.s.l. and, like the Alazani River, flows into the Mingachevir reservoir at the southern edge of the Gare-Kakhetian Plateau. The total length of the river is about 320 km, total fall - 2,520 m, average slope - 78.7%.

The Alazani river and its tributaries are fed by groundwaters – 40%, rain water – 31%, melting snow – 29%. The river is characterized by high waters in spring, stable low waters in winter, flash waters during heavy rains in spring and summer. Discharge of the Alazani river and its tributaries is not distributed evenly during a year: spring – 37%, summer – 31%, fall – 21%, winter – 11%. The river does not freeze. The average multiannual discharge of the river at the confluence is 112 m<sup>3</sup>/sec, maximum water discharge having a probability of occurrence of 1% at the confluence is 1,114 m<sup>3</sup>/sec.

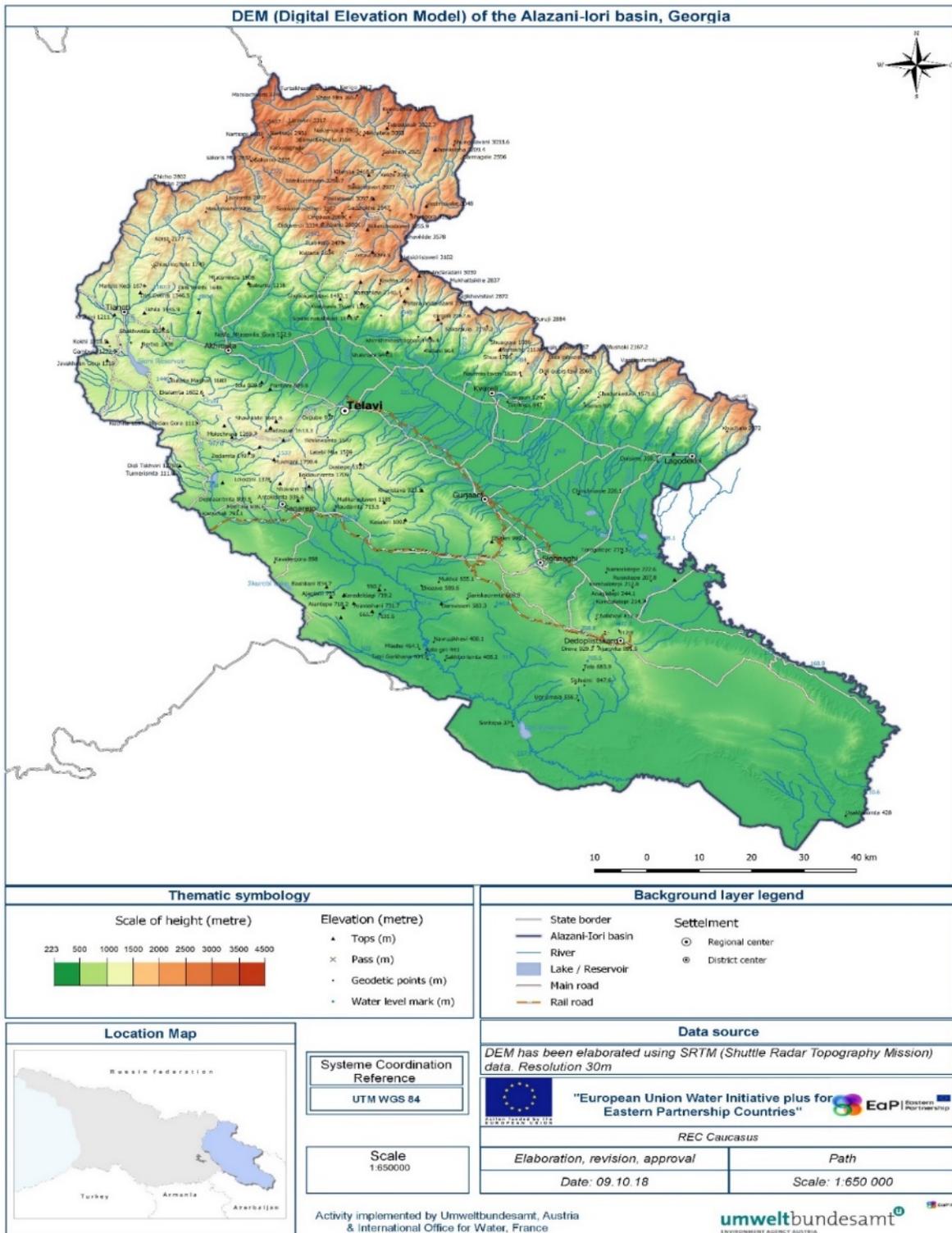
Along the length of the Alazani River, close to 1,803 tributaries of various types and sizes with a combined length of 6,851 join the river. The left tributaries of Alazani river flowing from the steep south-facing slopes of the Caucasus range are characterized by the abundance of water, narrow deep gorges, and riverbeds with rapids and waterfalls. They scour their channels, transport large amounts of sediments downstream, develop alluvial fans, create branches, and flow into the Alazani river through narrow channels. The left tributaries of the Alazani River include following main tributaries: rv. Stori, rv. Chelti, rv. Lagodekhis khevi, rv. Kabala, rv. Duruji etc. The right tributaries include rv. Batsara, rv. Ito, rv. Tudro, rv. Chermis khevi, rv. Kisiskhevi, etc.

The main tributaries of the lori are the rivers of Khashrula –12 km long; Sagome – 18 km long; Adedi – 16 km long; Gombori – 13 km long, Lapinakhevi – 10 km long; Ragolantskali – 12 km long; Lakbe – 32 km long; and Ole – 29 km long.

The Alazani-lori River Basin used to be one of the best-studied river basins of Georgia in terms of hydrology, meteorology, and geology. A number of hydrological and meteorological observation stations were in operation within the river basin; however, most of these stations were operational in 1940-1990 and only couple of them operates today.

Altogether 42 hydrological stations, measuring water flow and water level and determining annual water discharges and balance were in operation in the last century. Currently, only 4 hydrological stations are in operation, which is not sufficient to obtain required data on water balance in the basin (*See Annex 2. Hydrological stations in the Alazani-lori River Basin operating in the 20<sup>th</sup> century*).

**MAP 2: PHYSICAL MAP OF THE ALAZANI-IORI RIVER BASIN**



### 3.2.2. Groundwater resources

The Alazani-lori River Basin is one of the rich underground water resource basins on the territory of Georgia. Groundwater monitoring in Georgia was resumed in 2013 by the Geology Department of National Environmental Agency (NEA). A groundwater monitoring network currently covers 33 monitoring wells in total (See Annex 3. *Groundwater monitoring wells in the Alazani-lori Basin*).

According to the information of the NEA in 2017 and 2018, the groundwater debit remained at more or less stable level in the wells being monitored. However, it has to be noted that 2-year data does not provide sufficient information to observe the trend of groundwater debit changes.

To monitor the chemical composition and microbiological parameters of groundwater laboratory tests are performed twice a year. During 2017-2018, the temperature, chemical composition, total mineralization, and microbiological indicators of monitored groundwater wells and springs have changed insignificantly and fluctuated more or less within the permissible level. However, as in case of debit only 2-year qualitative data is not sufficient to draw any conclusions on trends. The existing groundwater resources monitoring system and available data are insufficient to allow a comprehensive assessment of the quality and quantity of groundwaters in the basin.

### 3.2.3. Surface water quality

The RBMP “Pressures and Impact of human activities on water resources” report indicates that data on water quality in the rivers of the basin are scarce and incomplete because of the lack of effective water quality monitoring network. There are four water quality monitoring stations in the Alazani river (Shakriani, Chiauri, Alaverdi, and Omalo) and 2 stations in the lori basin (Sasadilo and Sartichala) under the authority of the National Environmental Agency (NEA) of MEPA. At these stations, monitoring is not conducted systematically, making it difficult to carry out comprehensive assessment of the water quality.

The above stations measure the following physical and chemical parameters of water quality: pH, dissolved oxygen (DO), biological oxygen demand (BOD), the content of nitrite, nitrate, ammonia nitrogen, phosphates, sulphates, iron, zinc, copper, lead, and manganese, electric conductivity, and mineralization. The monitoring of specific organic substances, such as Polycyclic Aromatic Hydrocarbons (PAH), Polychlorinated Biphenyl (PCB), pesticides, and others are not conducted within the framework of the National Water Quality Monitoring Program.

The monitoring of water quality in the Alazani and lori rivers (source of information NEA) showed no significant change in water quality during the last 5 years, however, ammonia often exceeds the Maximum Permissible Concentration (MPC), which must be caused by the uncontrolled discharge of untreated wastewater into rivers.

The RBMP “Pressures and Impact of human activities on water resources” report indicates that in 2017 the amount of discharged wastewater from the sewage system into surface water bodies of the basin accounted for 7,089,475 m<sup>3</sup> in total, among which 2,005,600 m<sup>3</sup> of wastewater was accounted to the Telavi sewage network, from which wastewater is discharged to the main irrigation canal of the Upper Alazani Irrigation Network.

It is assumed that the primary sources of nutrient pollution are runoff of fertilizers, animal manure, sewage treatment plant discharges, stormwater runoff and. Other discharges into the surface water are assumed to be contaminated land nearby surface water bodies and agriculture points (slurry, silage and other feeds, sheep dip use and disposal, manure depots, etc).

The upstream areas of the Alazani-lori Basins due to the low population density do not undergo significant pressures from technogenic activities and urban development. Therefore, large areas are occupied by natural landscapes and ecosystems of high ecological and aesthetic value that make these areas attractive for tourism development and recreation.

### 3.2.4. Water resources users

In this basin the main drivers of the pressure from water abstraction are irrigation systems, hydropower plants, drinking water supply, fish farming and sand/gravel mining. The irrigation and domestic water use account for the biggest water intake after the hydropower generation.

Drinking water supply in the basin is based on groundwater sources in the Alazani-lori River Basin. As indicated in the RBMP, the water abstraction from groundwater bodies includes regulated as well as unregulated water abstraction - pumping groundwater from bore-holes, springs capping, etc.

As indicated in the draft RBMP<sup>10</sup>, which relies on the data of MEPA, in 2016, the water abstraction in the Alazani-lori River Basin reached approximately 1,177 mln m<sup>3</sup>, 25.13 mln m<sup>3</sup> from this amount was extracted from groundwater aquifers. Whereas, the total volume of used freshwater accounted for approximately 777 mln m<sup>3</sup> and 718 mln m<sup>3</sup> (92%) of it was used for hydropower generation, while 34.73 mln m<sup>3</sup> was used for irrigation and only 6.74 mln m<sup>3</sup> – for the industry.

### 3.2.5. Irrigation Systems

There are several canals in the Alazani-lori River Basin that are used mainly for irrigation. The length of the lower irrigation system of Alazani is 96 km and has carrying capacity of 20 m<sup>3</sup>/sec. – headworks of the main canal is built downstream of the confluence with the Chelta river, near the village Kondoli. It receives water from the right intake.

The length of the upper irrigation system of Alazani is 79 km and has carrying capacity of 24 m<sup>3</sup>/sec. Samgori irrigation system consists of the Upper Samgori and Lower Samgori subsystems. The total length of main canals of the Samgori irrigation system (the Sioni-Samgori-Jandara water reservoirs) is 105 km.

Altogether 6 irrigation reservoirs (including Zemo Alazani, Naurdali, Kvemo Alazani) are located in the basin. Currently, a part of the irrigation systems is out of order or in need of major rehabilitation. Accordingly, the Georgian Amelioration plans include significant rehabilitation works in these irrigation systems. Due to outdated irrigation systems, losses of water are substantial. Moreover, consumption by farmers is not as efficient as it is commonly found in developed agricultural practices. Furthermore, the loss of large amounts of water to seepage due to delapidating state of irrigation canals causes swamping and salinization of adjacent areas, making them unusable for agriculture purposes. Often the irrigation system takes large quantity of water from the river affecting the environmental flow of rivers and consequently the state of the riverine ecosystems.

### 3.2.6. Water reservoirs and Hydro Power Plants

Within the Alazani-lori River Basin are located number of water reservoirs and Hydro Power Plants (HPPs), including the Sioni, Paldo and Dalismta water reservoirs. There are also some small water reservoirs.

The Sioni water reservoir is located in Tianeti municipality, in the middle course of the lori River between the Sioni settlement and the village Lelovani. The Dalismta water reservoir is located in Dedoplistskaro municipality downstream of the lori River, at a distance of about 30 km from the city of Dedoplistskaro.

The Dalismta water reservoir is facing serious technical problems. The emergency spillway is blocked, one from the two gates of the environmental spillway is damaged and does not open. There is risk of leakage. In the lower reaches of the lori valley, the shepherds' huts, which are close to the river, are in danger. Also in danger is the village of Kessaman in Azerbaijan with 6,800 inhabitants.

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<sup>10</sup> This information is provided in the draft report Pressure and Impact of Human Activities on Water Resources dated December 2018 (RBMP). Therefore, the document relies on water use data of 2016.

There is a risk of dam failure at the Chermistskali water reservoir in the Alazani River Basin. The dam failure threatens the villages Velistsikhe and Zegaani with an estimated population of 5,000 at risk.

It was mentioned above, that hydro power generation is one of the main drivers of the water abstraction pressure in the basin and accounts for up to 92% of the total water use.

There are nine small and medium size HPPs operating in the basin.

**TABLE 4.** HPPS OPERATING IN THE ALAZANI AND IORI RIVER BASIN

#	Hydroelectric power plant	Company	Installed capacity (mw)
1	Shilda HPP	Energia LLC	5,0
2	Khadori HPP	Peri LLC	5,4
3	Akhmeta HPP	Geoenergy LLC	9,1
4	Pshavela HPP	Stori power HPP	1,95
5	Alazani HPP 2	Georgian international energy corporation LLC	6,0
6	Alazani HPP	Georgian international energy corporation LLC	6,06
7	Shilda 1 HPP	Hydroenergy LLC	1,2
8	Lopota HPP	Mg renewables LLC	2,5
9	Khadori HPP	East energy corporation LLC	24

Source: RBMP

In addition, approximately 5 new HPPs are planned to come into exploitation with the capacity ranging from 5 to 26 MW (in total up to 62 MW) within 5 years period.

**TABLE 5.** PLANED HPPS IN THE ALAZANI-IORI RIVER BASIN

#	HPP	River	Approximate Capacity	Potential Exploitation Year
1	Khadori 3	Alazani	5 MW	2022
2	Stori 1	Stori	20 MW	2023
3	Baisubani	Kabali	5 MW	2023
4	Lopota 1	Lopota	6 MW	2022
5	Samkuristskhali 2	Samkuristskhali	26 MW	2023

Source: Ministry of Economy and Sustainable Development

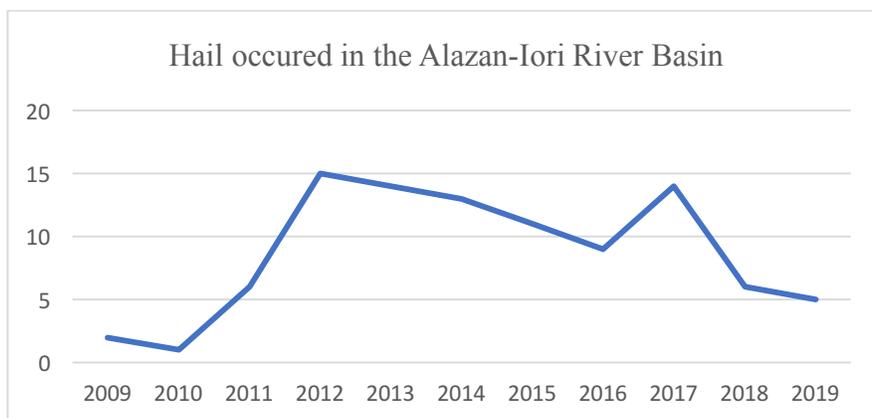
According to the information provided by the Ministry of Economy and Sustainable Development (MESD), there are nine other HPPs under the feasibility study stage with potential exploitation years between 2023-2025. In addition, it is planned to sign the memorandum of understanding for the development of the Ilto-Alazani HPP Cascade with a potential capacity of 139 MW to come into exploitation by the year of 2027.

### 3.3. NATURAL HAZARDS

The whole territory of the Alazani-Iori River Basin is exposed to natural hazards including hail, floods/flashfloods, mudflows, erosion of riverbank, landslides, etc. Some of these natural hazards have been characterized by an increasing frequency over the last 5-10 years and pose serious risks for the population, environment, and the infrastructure of the region.

**Hail** creates serious problems for the Alazani-Iori River Basin area. Usually, hail occurs during thunderstorms and heavy rains, mainly in warm periods, when air temperature exceeds 20°C (see Annex 4. *Hail recorded in the Alazani-Iori River Basin (2009-2019)*). Hail occurs in all municipalities of the Alazani-Iori River Basin and causes serious damage to agriculture. The number of hail days in the basin is 6-9 on average and occurs 2-3 times per year. In certain years hails have occurred 15-16 times (see Figure 1). The frequency of hail events is especially high in the Alazani, Iori, Lagodekhistskali, Shromiskhevi, Ninoskhevi, Chelti, Intsoba, Stori river and some others. Therefore, for effective river basin management hail events shall be considered and relevant risk reduction measures have to be planned.

**FIGURE 1. HAIL EVENTS OCCURRED IN THE ALAZANI-IORI RIVER BASIN DURING 2009 - 2019**

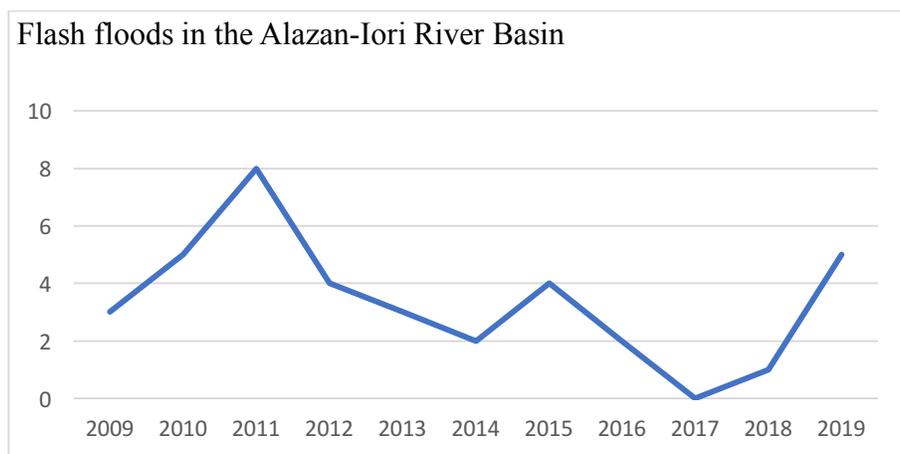


Source: National Environmental Agency (NEA)

**Floods and flash floods** are another concern in the Alazani-Iori River Basin. Flash floods are a major problem in the basin due to their frequency and the magnitude of damage caused by this hazard. Flash floods are hardly predictable, as they are not characterized by reoccurrence, unlike floods. The duration of flash flood events varies from several hours to several days. During flash floods, the average monthly discharge exceeds average annual discharge values. The analysis of floods during 2009-2019 (see Figure 2) shows, that in the basins of the Alazani and Iori Rivers basins and its small tributaries, this natural event occurs 4 -5 times a year. This natural event causes destruction of river banks, inundation of agricultural lands, villages, and roads, human injuries and deaths. Flash floods most frequently affect the villages of Gurjaani, Akhmeta, Sagarejo, Signagi, Dedoplistskaro, Lagodekhi, and Tianeti municipalities.

**Erosion of river banks** causes the loss of hundreds of ha of agricultural lands, damage of agricultural land, motor roads and bridges are serious problems in the Alazani-Iori River Basin. The process of river bank erosion has an intensive character in the villages of Tianeti municipality: Zemo Artani, Chabano, Sachure, Akhalsopeli, Zhebota, Gojianeebi and around the city of Tianeti. Protection gabions are damaged, at certain locations they are completely destroyed causing additional threats. Riverbank erosion processes are recorded in the Alazani and Khodashniskhevi river gorges near the village Kvemo Alvani and Alaverdi in Akhmeta municipality. Intensive erosion in the Alazani River is detected in the villages of Birkiani, Omalo, Jokolo and in the city of Akhmeta. In Telavi municipality, the Stori river erodes the area between the villages Lechuri and Pshavle. Turdo, Lopota and Didkhevi rivers erode the areas adjacent to the villages Lapankuri, Artana, Jugaani, Saniore, Serodani, and Vardisubani. In Kvareli municipality the Alazani River intensively erodes the territories of the villages Sakriani and Gavazi. Erosion of river banks has been observed also on the rivers Intsoba and Chelti. In Lagodekhi municipality washing of river banks occur along the rivers Baisubani, Chvartlisgele, Ninoskhevi, Lagodekhiskhevi, and Shromiskhevi. In Dedoplistskaro municipality erosion is observed on the banks of the Alazani and Iori Rivers. Bank erosion poses serious threats near the village Sabatlo, in so-called Kakliskure in Milari district. The intensive erosion processes in the Iori River basin is observed downstream of the Dalismta water reservoir, where the problem is aggravated by vertical erosion. In Signagi municipality the Alazani river washes the banks on the territory of the village Erisimedi. In Sagarejo municipality the Iori and Chailuriskhevi rivers erode their banks quite intensively. In Gurjaani municipality erosion occurs on the banks of the rivers Papriskhevi, Shromiskhevi, and Chermiskhevi.

FIGURE 2. FLASH FLOODS IN THE ALAZANI-IORI RIVER BASIN (IN PERIOD 2009 - 2019)



Source: National Environmental Agency (NEA)

It must be pointed out that the Alazani River bank serves as a border line between Azerbaijan and Georgia. Therefore, riverbank erosion raises great concerns as tens of hectares of land are lost every year due to this natural event.

**Mudflows** originating from the Kakheti Caucasus and Tsvi-Gombori ranges differ by their character and composition. Mudflows originating from the Caucasus range are characterized by large volumes (one-time deposition of 1.22 mln m<sup>3</sup> of debris by the Duruji river) and destructive power. The volumes of materials transported by mudflows triggered by the Tsvi-Gombori range varies from some tens of m<sup>3</sup> to 300-500 m<sup>3</sup>. Almost all gorges and ravines of the Tsvi-Gombori range are prone to the development of mudflows. Mudflows may occur several times during a year. Mudflows occur on the right and left tributaries of the Alazani River, as well as on the Iori River and its tributaries.

**Landslides** often occur in the Alazani-Iori River Basin, especially in highlands.

**Rockfalls** and rock avalanches are recorded mainly in Tianeti and Akhmeta municipalities. The data on geological processes for 2014-2018 is provided in *Annex 5. Information on recent landslides, mudflows, and rockfalls in the municipalities of the Alazani-Iori River Basin*.

Mudflows (Sagarejo, Telavi, Kvareli), landslides (Sagarejo, Telavi), flood/flashfloods (Akhmeta, Lagodekhi) and riverbank erosion (Akhmeta) are the issues for the many municipalities of this region (*Annex 6. Map of the settlements of the Alazani-Iori River Basin that are located in the zone of natural geological hazards*).

In Kakheti, these natural hazards mainly have an impact on agriculture and agricultural lands, as well as on the quality of water. During natural disasters, the water supply and sewage systems may break down, which might result in contamination of drinking water<sup>11</sup>. In the future, growing frequency and intensity of floods, flash floods, landslides, and mudflows are expected to increase the exposure and vulnerability of communities to disasters. There is a need to plan and implement large-scale riverbank reinforcement measures, as well other disaster risk reduction measures.

<sup>11</sup> Georgian Road Map on Climate Change Adaptation (USAID/NALAG, 2016)

## 3.4. Soil

### 3.4.1. Soil pollution

Kakheti is a major agricultural region, where mineral fertilizers and pesticides are used extensively in agriculture. Approximately 50% of applied fertilizers and 90% of pesticides are dispersed in the environment and cause pollution.

Traditionally, in the Kakheti region, main pressures on the land resources derived from the intensive use of chemicals, application of unsustainable land management practices, including soil compaction by heavy machinery, intensive irrigation and overgrazing. The post-Soviet drastic economic down-fall caused a decline in all economic activities, including agriculture activities. Farmers didn't have resources to buy agrochemicals and the central system for import and distribution for these chemicals has also diminished. Currently, among agrochemicals, the most widely used are less toxic nitrogenous fertilizers and the manure. However, their overuse can cause soil salinization and acidification. The amount of manure used is still significant and soils might be polluted by various substances, including salts of heavy metals as well as by microorganisms. Regarding the irrigation, many systems stopped functioning due to the electricity shortage or obsolescence of these systems. Those that are currently operational work at lower capacities due to the reduced irrigation water demand. Therefore, the pressures from the use of agrochemicals and irrigation have declined. However, they have already damaged vast areas of agriculture lands in the Alazani valley. Meanwhile, the state due to the lack of finances was unable to implement land reclamation activities, including erosion prevention and mitigation measures. Consequently, the total area of cultivated agriculture lands decreased, eroded land area expanded and low productivity became widespread. This trend is maintained nowadays as well. Regarding the livestock rising, sheep breeding is on rise in a number of municipalities of the region. Intensive grazing on sub-alpine and alpine meadows is a common practice.

Along with the above pressures, the quality of land resources is affected by leachates and drainage waters from waste disposal and illegal dump sites, open-pit mining operations and urban surface run-off.

### 3.4.2. Soil degradation

At present in Kakheti, 27,000 ha of agricultural lands (5% of all agricultural lands in the region), mainly pastures and grasslands, are damaged and eroded. Land degradation mostly caused by wind erosion and salinization has turned into a serious problem, especially in two municipalities – Dedoplistskaro and Signagi. Salinization often is caused by excessive use of water for irrigation, since these areas are rather arid.

Desertification also represents an important issue in the river basin, and is caused mainly by a large number of animals grazing in the pastures, especially in Sagarejo and Dedoplistskaro.

## 3.5. Climate change and related risks

According to the forecast data of climate change, it is expected that in Dedoplistskaro the average annual air temperature will increase by 1°C during 2021-2050 as compared to 1986-2010, while in other municipalities estimated increase is slightly higher and amounts 1.1-1.2°C, respectively 1.1°C in Akhmeta, Sagarejo and Kvareli and 1.2°C in Gurjaani, Telavi, Lagodekhi, and Signagi. Decreased trend in annual precipitation has been observed during the last decades (1986-2010) in most municipalities of Kakheti and with only exception in Lagodekhi (+8%). Till 2050, the greatest increase of annual precipitation is expected in Akhmeta (+11%) and Sagarejo (+8%), while the maximum decrease is expected to be observed in Lagodekhi (-6%), Telavi and Signagi (-5%), and Dedoplistskaro (-4%).

TABLE 6. CHANGES IN CLIMATE PARAMETERS BETWEEN THE PERIODS OF 2021-2050 AND 1986-2010 ACCORDING TO THE DATA PROVIDED BY 8 STATIONS IN KAKHETI<sup>12</sup>

Parameters	Winter		Spring		Summer		Autumn		Year, Average	
	T <sup>0</sup> C	P%	T <sup>0</sup> C	P%	T <sup>0</sup> C	P%	T <sup>0</sup> C	P%	T <sup>0</sup> C	P%
Akhmeta	1.1	31	1	-13	0.9	7	1.2	11	1.1	11
Gurjaani	1.3	32	1.3	-20	1.3	14	1.3	0	1.2	0
Dedoplistskaro	1.1	16	1.2	-25	0.7	14	1	-4	1	-4
Telavi	1.3	43	1.2	-14	1.1	6	1.3	-5	1.2	-5
Lagodekhi	1.2	28	1.2	-22	1.2	-16	1.4	5	1.2	-6
Sagarejo	1.1	44	1	-10	1.2	14	1.2	5	1.1	8
Kvareli	1.1	39	1.1	-11	1.1	-6	1.1	3	1.1	1
Tsnori/Signaghi	0.9	6	1.4	-24	1.3	9	1.3	2	1.2	-5
Average	1.1	+22	1.2	-17	1.1	+5	1.2	+2	1.1	0

Source: Climate Change and Agriculture in Kakheti (2014)

The number of heavy precipitation days has increased over the last decades (1986-2010) in Kakheti e.g. more than 20 mm precipitation during the day and more than 50 mm precipitation daily for 3 days. It is assumed that the daily maximum precipitation has increased by 67% during the last 25 years. The number of days when the daily total precipitation is more than 10, 20 and 25 mm will continue to increase, as forecasted<sup>13</sup>. Models suggest that the daily total precipitation exceeding 90 mm will increase in the next 30 years as well. In this regard, it is worth noting that more than 50 mm daily precipitation may lead to forming of mudflows and flash floods in the Kakheti region, increasing risk of disasters.<sup>14</sup>

Droughts in Kakheti have become more frequent during the last decade and their duration has almost doubled. The number of hot days during the year increased by 11 and projections suggest an increase to reach 40 days in coming years tending towards more prolonged droughts by 2050 (Third National Communication, 2015).

Observation of weather events revealed that drought, increased temperature (increase in the number of extremely hot days), and hail were serious problems in the Kakheti Region in the last decades. Drought significantly impacted the agriculture sector and respectively, the productivity of crops. This includes a decrease of annual, as well as perennial yield of crops and forage grasses<sup>15</sup>. Therefore, the production of some crops became impractical due to unstable weather conditions, the examples are sunflower and corn crops. Although new hybrid species were introduced in corn production, high yield are threatened due to the periodic droughts.

<sup>12</sup> This is a difference between average temperature 2021-2050 (i.e. model) and 1986-2010 (i.e. real data).

<sup>13</sup> The Third National Communication, 2015

<sup>14</sup> Climate Change and Agriculture in Kakheti (2014)

<sup>15</sup> Climate Change and Agriculture in Kakheti (2014)

The risk of heavy precipitation causing floods/flash floods still remains, as well as the risk of hail that is common for the whole region of Kakheti. In the last years, hail has significantly damaged large agricultural lands of Kakheti. Hail especially causes big losses in the districts with viticulture and fruit production such as Gurjaani, Telavi, and Kvareli. Therefore, it is Gurjaani, Telavi, and Kvareli municipalities that need hail protection technologies in the first place. Besides, arranging embankment works for reducing flash flooding and mudflow risks are needed almost in all municipalities of Kakheti but Akhmeta municipality is the most vulnerable in this respect.

During droughts rivers in most municipalities experience reduced water flow, especially in summer, when irrigation of agricultural lands and pastures, that leads to water shortages.

Groundwater is the main source of drinking water in the Kakheti Region, which is also very important for rural farms and agriculture sector, as it partially determines the level of soil moisture. According to the observations made by local residents, the groundwater levels dropped in many areas, especially in Dedoplistskaro municipality, which is quite poor in groundwater resources (Climate Change and Agriculture in Kakheti (2014)).

It can be concluded that by 2050, the temperature increase is expected during all seasons and in all municipalities of Kakheti. Prolonged droughts are expected to increase mostly in Dedoplistskaro. While annual precipitation is projected to increase in Akhmeta and Sagarejo, Signaghi and Dedoplistskaro the climate models suggest a decrease, with the highest decrease to be observed in Lagodekhi. However, total daily precipitation is forecasted to increase by more than 10, 20, 25 and 50 mm contributing to increased risks of occurrence of natural hazards. Mudflows threaten Signaghi, Sagarejo, Telavi, and Kvareli; landslides and floods are expected to pose risks for Akhmeta and Lagodekhi. Riverbank erosion is widespread problem, especially for Akhmeta. However, overall, these natural disasters more or less are problematic for all municipalities of the region. Exposure to hail risks is especially big for municipalities of Gurjaani, Telavi, and Kvareli.

## 3.6. BIODIVERSITY, HABITATS AND PROTECTED AREAS

### 3.6.1. Species diversity

The Alazani and Iori Rivers and their tributaries are among the 18 critical freshwater areas identified in the Caucasus<sup>16</sup> (*Annex 7. Map of Key Biodiversity Areas* and *Annex 8. Freshwater Key Biodiversity Areas within the Alazani-Iori River Basin*).

Within the Alazani-Iori River Basin, there are 36 flora species and 53 fauna species recorded as critically endangered, endangered or vulnerable and consequently included in the Red List of Georgia (*Annex 9. Species included in the Red List of Georgia within the Alazani-Iori River Basin*).

In addition, 19 plant species within the river basin are among 117 endangered plant species<sup>17</sup> Those species are not included in the Red List of Georgia yet (*Annex 10. Threatened plant species within the Alazani-Iori River Basin*).

Uncontrolled and illegal hunting, as well as habitats modification, have led to a drastic decrease of large mammals' populations in the Alazani-Iori River Basin, as in other parts of Georgia. However, recent years show positive trends. According to the annual reports of the Agency of Protected Areas (APA), deer population growth is being observed in the Lagodekhi Nature Reserve, nevertheless, the population of deer has not reached yet the number recorded in the last decade of 20<sup>th</sup> century.

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<sup>16</sup> Assessment of freshwater ecosystems and critical habitat identification was carried out in the framework of the Sustainable Development of Hydropower Resources and Reservoirs Project in the Caucasus with the support of the Norwegian Government and World Wildlife Fund (WWF), 2015.

<sup>17</sup> identified by the assessment carried out in 2014 with the support of the German International Cooperation (GIZ) program "Sustainable Biodiversity Management in the South Caucasus".

Restoration project<sup>18</sup> of gazelles (*Gazella subgutturosa*), implemented in recent years, resulted in reintroduction of a viable population of gazelles in Samukhi valley. *Gazella subgutturosa* has been extinct in Georgia since the last century due to intensive hunting. Currently their number reaches 100 individuals. In 2018, the third generation of gazelles was born in Georgia.

The records<sup>19</sup> of the East Caucasian Tur in Lagodekhi Protected Areas revealed an increase in the ibex population. A number of ibex individuals were first observed in the Lagodekhi Nature Reserve through a photo trap. Ibex was found only in the Tusheti and Pshav-Khevsureti Protected Areas in Georgia and its total population does not exceed 300 individuals.

It should be highlighted that data availability on populations of other species does not allow to analyze in detail the current status and trends of biodiversity in the basin, as the biodiversity monitoring system is being developed only now and data on their status is either very limited or not available.

### 3.6.2. Fish species

21 fish species are being present in the Alazani-lori River Basin, from which two species are included in the national Red List of Georgia as vulnerable populations. 6 species are endemic for Transcaucasia and 2 species are endemic for the Caucasus (*Annex 11. Fish species within the Alazani-lori River Basin*).

Information on inland water biodiversity of Georgia is very scarce, and only limited number of studies focus on identification of species composition. The description below is based on existing data provided by the National Environmental Agency.

Field research of freshwater fauna conducted by the National Environmental Agency (NEA) in 2015-2016, shows reduction of diversity of fish species in lakes and reservoirs of Georgia, including the Alazani-lori River Basin, where fish fauna is presented mainly by invasive and introduced species such as, *Carassius gibelio*, *Hypophthalmichthys nobilis*, *Cyprinus carpio*. Only three native species (shamaya, chub and Transcaucasian barb) were found in the studied reservoirs (5 artificial reservoirs and one lake within the Alazani lori River Basin (*Annex 12. Fish fauna and invertebrates of the lakes and reservoirs in Kakheti*).

Among invertebrates, the most abundant families were the Diptera *Chironomidae*, *Simuliidae* and *Blephariceridae*, the Trichoptera *Rhyncophilidae*, *Hydropsychidae*, *Sericostomatidae* and *Limnephilidae* and the Plecoptera *Perlidae*, *Perlodidae*, *Leuctridae* and *Nemouridae*, the *Ephemeroptera Heptageniidae* and *Baetidae* in Alazani River Basin (Biomonitoring data, National Environmental Agency, 2012-2016). The Dali reservoir is routinely stocked by alien species such as bighead carp and grass carp, which might be of high interest for holders of shining license but their likely impact on native species is not clear. The impact of the stocked alien species on native fish species in Dali reservoir is not assessed so far.

According to the National Biodiversity Strategy and Action Plan of Georgia (NBSAP 2014 -2020) pollution of surface waters by organic substances and heavy metals, illegal fishing, construction of infrastructure, such as dams, roads, bridges, and pipelines, invasive species are the main drivers of reducing freshwater diversity. Potential serious impacts of infrastructure development typically include: blocking of fish passages, limiting of fish breeding areas, depletion of fish food bases, decrease of water flow and water pollution, overall modification of water habitats.

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<sup>18</sup> Project is implemented by the APA with support of of the German Ministry of Cooperation and Economic Development (BMZ), and in cooperation with Azerbaijan's Ministry of Ecology and Natural Resources and the World Wildlife Fund (WWF)

<sup>19</sup> The study was carried out by the National Center for the Conservation of Species Research (CNF).

Pollution, water abstraction, alien species, and hydropower and water control dams have been identified as the main threats to freshwater biodiversity by the WWF Caucasus<sup>20</sup> as well. Many species, such as trout and number of resident species, especially crayfish, mussels, and dragonflies are sensitive to pollution. Water abstraction leads to massive habitat loss and distribution of alien species, as water is often stored in the reservoir polluted by alien species. There is no effective regulation to limit water abstraction. Commercial use of water is usually given priority over the biodiversity issues. Already existing hydropower and irrigation dams either do not have minimum outflow or minimum outflow is not sufficient. In many areas, the outflow from dams is managed by regular flood pulses (hydro-peaking) that have negative impact on the freshwater biodiversity. Most of the dams are installed without well-functioning fish ladders (WWF, 2015).

The non-native Crucian carp (*Carassius carassius*) introduced in the lakes in Georgia in the last century, is now the most common species in the inland waters. There has been no study about its impact, but it is likely that this invasive species has had a very negative impact on the native fish populations (NBSAP, 2014-2020).

#### 3.6.4. Flood plain forests<sup>21</sup>

The water environment is particularly important for the maintenance and restoration of the flood plain forests (riparian or gallery forests) along the Iori and Alazani gorges.

**Iori gallery forests** are located along the Iori river in the areas of the Korugi managed reserve (Sagarejo municipality), the Iori managed reserve (Signnagi municipality) and the Chachuna managed reserve (in Dedoplistskaro municipality). The gallery forests along the Iori gorge represent one of the most vulnerable ecosystems since they are located in lowlands and easily accessible. Timber use and grazing are the main drivers of Iori gallery forest degradation. It is also likely that the Dali reservoir, put in operation in 1980s, could have had an adverse impact on the ecosystem. The recent study<sup>22</sup> shows that over the last decade recovery of the forest area is being observed in the Chachuna managed reserve, however forested area is still smaller as compared to 1978.

Due to the change in flood regime after the reservoir became operational the Dali reservoir has affected the composition of species rather than the area of gallery forest. There is a significant difference in terms of the floristic composition between the upstream and downstream of the reservoir. Species composition analysis showed that the occurrence of pistachio trees is more frequent in Chachuna compared to upstream of the Dali reservoir. Same as the occurrence of poplar trees in upstream of the Dali reservoir is higher than in Chachuna. There are the arid ecosystem elements in the downstream area (e.g. pistachio tree and conversely, elements of the gallery forest are less), whereas, in the upstream of the Dali reservoir with less favorable conditions for the gallery forest, there are more elements of the gallery forest. In order to have a clear picture regarding the direct and indirect impact of the Dali reservoir on the ecosystem further research is needed.

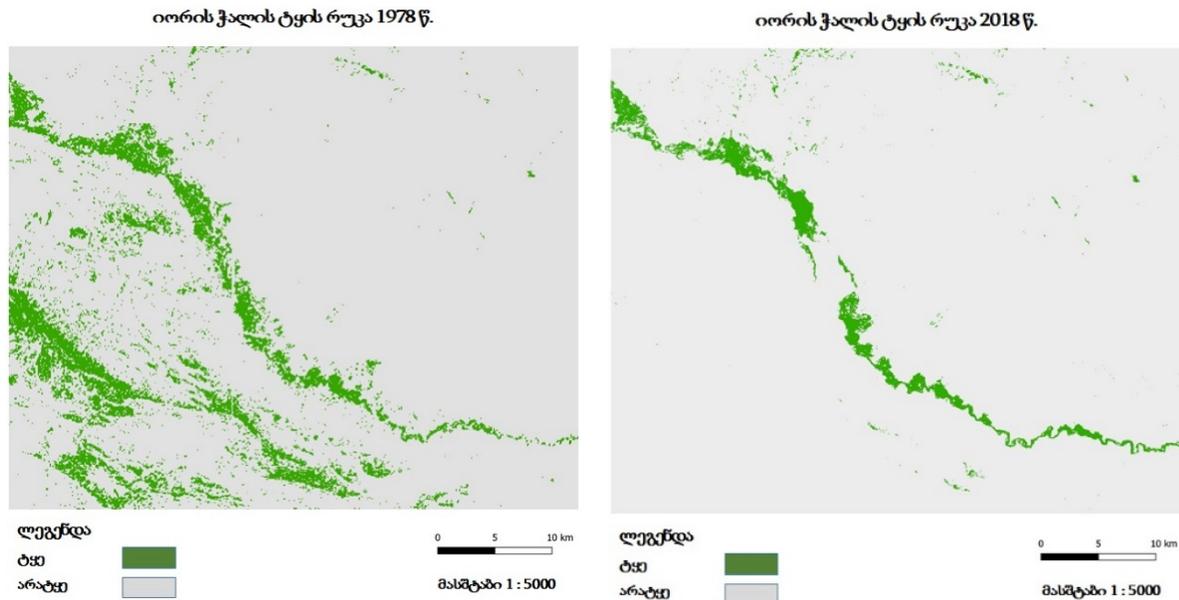
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<sup>20</sup> Assessment of freshwater ecosystems and critical habitat identification was carried out in the framework of the Sustainable Development of Hydropower Resources and Reservoirs Project in the Caucasus with the support of the Norwegian Government and World Wildlife Fund (WWF), 2015.

<sup>21</sup> The new Forest Code, which will come into force in 2021, introduces a new definition of floodplain forest, according to which floodplain forest is: forests scattered in river basins, which are periodically covered with water (during floods and/or floods). Also, according to Article 8 of the Code, "Protected Category Forest" will be automatically granted the status of a Protected Forest Category after the entry into force of the Code.

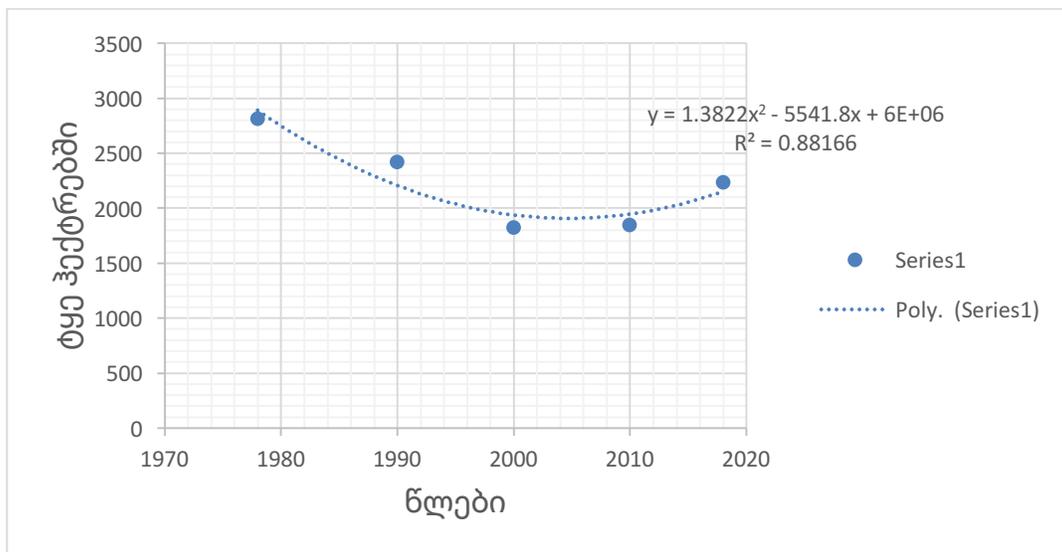
<sup>22</sup> Study was conducted by the Society for Nature Conservation (SABUKO) within the project "Restoring Gallery Forests and Grasslands in the Iori River Valley"

FIGURE 3. IORI GALLERY FOREST IN 1978 AND 2018



Source: Restoring Gallery Forest and Grasslands in the Iori River Valley, Society for Nature Conservation (SABUKO), Georgia Forest Ltd. 2019

FIGURE 4. FOREST COVER CHANGE UPSTREAM AND DOWNSTREAM OF DALI RESERVOIR



Source: Restoring Gallery Forest and Grasslands in the Iori River Valley, Society for Nature Conservation (SABUKO), Georgia Forest Ltd. 2019

**The Alazani Floodplain forests** are mostly transformed into a cultural landscape. Only along the riverbanks, some patches of natural forests are presented, including the largest and relatively better preserved Chianuri forest. Establishment of multiple-use area (IUCN category VI) was proposed by the “Georgia Protected Areas Development Project” (funded by World Bank) in 2005. However, this protected area has not been established.

### 3.6.5. Protected Areas

The Alazani-Iori River Basin has an ecologically diverse range of habitats from alpine meadows and mountain forests to arid light woodlands, riparian forests, steppes, and semi-arid landscapes. A part of the river basin area is protected by national and international designations. The national network of the Protected Areas (PAs) covers 16.6% of the basin (194,415,12 ha). There are 6 strict nature reserves, two national parks, three nature monuments, 5 Managed reserves and 1 protected landscape in the Alazani-Iori River Basin (*Annex 13. Map of Protected Areas within the Alazani-Iori River Basin* and *Annex 14. A brief characterization of biodiversity preserved in the PAs*).

### 3.6.6. Emerald sites

There are 15 **Areas of Special Conservation Interest (ASCIs)** identified within the Alazani-Iori River Basin in accordance with requirements of the AA. 10 of them are already designated as emerald sites. Other 5 sites are to be granted that status of the emerald sites after the finalization of their assessments.

All of the designated emerald sites in the Alazani-Iori River Basin are included in the national network of protected areas and managed by the Agency of Protected Areas under the MEPA, while other proposed 5 emerald sites are located outside of protected areas. (*Annex 15. Map of Emerald sites in the Alazani-Iori River Basin* and *Annex 16. A brief characterization of biodiversity preserved in the Emerald sites*).

### 3.6.7. Special Protected Areas for Birds

There are 5 **Special Protected Areas (SPAs)** for birds identified within the Alazani-Iori River Basin. At present, only part of the SPAs is included in the national network of PAs. Under the available version of the Draft Law on Biodiversity, SPAs for birds will become part of the Emerald Network and will be managed as emerald sites in accordance with the provisions of the draft law (*Annex 17. Map of SPAs for birds in the Alazani-Iori River Basin* and *Annex 18. Special Protection Areas for Birds in the Alazani-Iori River Basins - Species of Concern*).

### 3.6.8. Biosphere Reserves

The Assessment of Biosphere Reserve Development Opportunities in Georgia prioritized the Kakheti region in terms of the development of the biosphere reserve. The Vashlovani and Tusheti Protected Areas and their surrounding landscapes, which combine traditional nomadic livestock, are considered for nomination as the biosphere reserves. The establishment of the Biosphere Reserve will ensure the sustainable development of the wider landscape connecting protected areas. Currently, the preparation of documentation for the International Nomination with UNESCO for both Biosphere Reserves is underway.

## 3.7. PUBLIC HEALTH

### 3.7.1. Healthcare infrastructure

Healthcare infrastructure in Kakheti strongly depends on the proximity of certain districts to Tbilisi and its terrain. For districts in the proximity of Tbilisi, it is easier to travel for healthcare needs to Tbilisi, rather than to Telavi, or even the municipal city with the district healthcare center for specialized or complex healthcare needs. However, Kakheti also has landlocked districts, with limited to no healthcare infrastructure in place (e.g., high mountainous regions).

**TABLE 7. CORE HEALTHCARE INDICATORS, KAKHETI**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
<b>Number of doctors (in 1000)</b>	1.3	1.3	1.4	1.2	1.0	1.1	1.1	1.2	1.2	1.1	1.4
<b>Number of nurses (in 1000)</b>	1.1	1.1	1.2	0.9	0.7	0.7	0.7	0.7	0.8	0.8	0.7
<b>Hospitals</b>	21	21	22	20	18	17	16	16	16	15	15
<b>Hospital beds (in 1000)</b>	0.7	0.7	0.6	0.5	0.4	0.5	0.4	0.5	0.5	0.5	0.5
<b>Out-patient centers</b>	132	237	243	247	252	248	251	260	274	277	282
<b>Out-patient visits</b>	580	585	522	410	509	598	645	531	581	529	513

Source: GeoStat

In general, public health services and infrastructure functions well in Kakheti. However, the system faces some challenges. Hospital bed ratio is 165 per 1 000 population, which is one of the lowest in the country (after the Guria Region). Meanwhile, the bed occupancy rate in hospitals is the highest in the country with high patient turnover and higher than the average length of stay in hospital – 234.5, while the national average is 187.2. This indicates a high demand for existing hospital infrastructure.

Availability of village doctors, outpatient centers (policlinic, dental clinics, and similar), and emergency medical services is similar to the rest of the Georgia.

The use of out-patient/family medical service in Kakheti is low – 1.6 visits per population per year, while the national average is 3.3. The prevalence of rural settlements, where the access to healthcare is generally limited, is probably a contributing factor for low utilization of outpatient services.

The Kakheti region does not have any distinct epidemiological profile. Cardiovascular diseases, which are the leading cause of mortality and morbidity in Georgia, also prevail in Kakheti and at higher rates than national averages. In addition, diseases of the respiratory system are also presented at higher than the national average in Kakheti.

In 2018, there were 722 new cancer cases registered in Kakheti, the incidence rate is lower than the national average (287 vs. 321.4)

**Waterborne diseases** include parasitic, infectious and viral diseases. However, current surveillance system often does not identify the source of occurrence of these conditions, and in general the impacts of chemical water pollution on human health is not well studied in Georgia. A study carried out by the Ministry of Agriculture, where samples of drinking water were collected and tested for pollutants, identified that only 3.42% of samples collected from the Kakheti region failed to meet the national standards, mostly due to additives such as chlorine and nitrates<sup>23</sup>. Similar results were obtained by the assessment carried out during preparation of the draft Alazani-Iori RBMP.

<sup>23</sup> [http://srca.gov.ge/files/ბ ა ს მ ე ლ \\_ ნ ე ა ლ .pdf](http://srca.gov.ge/files/ბ ა ს მ ე ლ _ ნ ე ა ლ .pdf) (p.29)

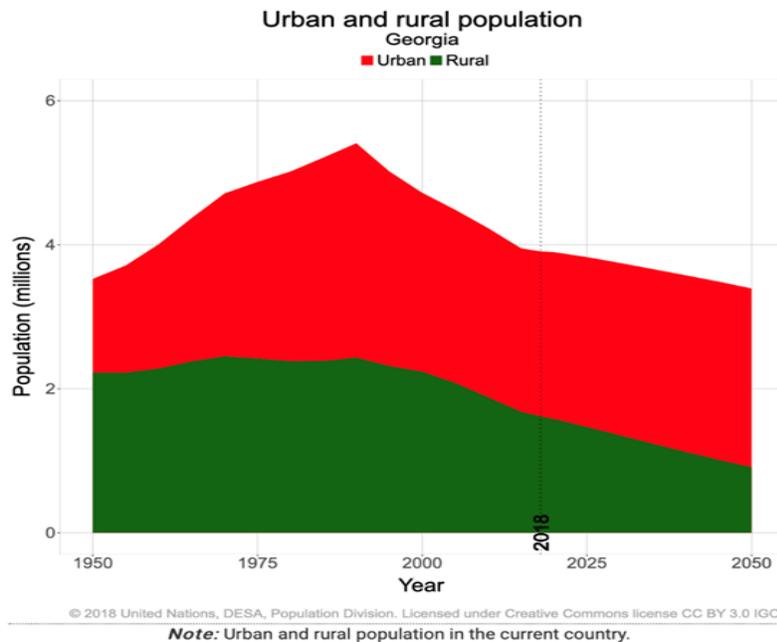
## 3.8. SOCIO-ECONOMIC FACTORS

### 3.8.1. Demography

Even though economy of Kakheti is growing, local economic development in certain territories is rather limited. Due to the lack of local economic development opportunities and inefficient economic conditions, certain rural areas in the river basin are facing depopulation due to migration to urban areas of Georgia as well as abroad.

With the aging of population and declining fertility rate, the population of Georgia, including that of Kakheti, is not expected to grow. According to UN Population Division, population of Georgia is projected to decline by 14% by 2050 compared to 2018. While decline is not projected in urban settlements given the positive in-country migration trend towards urban settlements and higher fertility rates in urban areas, the decline is fully attributable to rural population (projected decline 46%)<sup>24</sup>. Given that 77% of Kakheti population lives in rural area, this population decline would significantly challenge the current demographic profile of Kakheti.

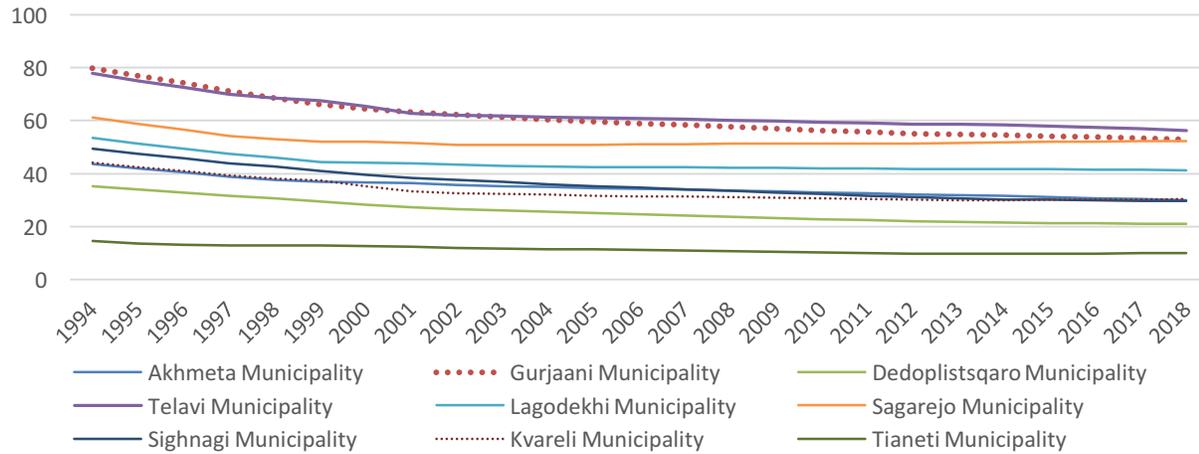
FIGURE 5. POPULATION PROJECTION FOR GEORGIA BY URBAN AND RURAL SPLIT



Most of the active youth are relocating to the big urban areas (e.g. Tbilisi), as they are looking for better opportunities in terms of employment, education, entertainment and other services. Official statistics revealed that in every municipality of the river basin, since the 90s, a population decline is considerable, varying from 14% to 40% (see Figure 6).

<sup>24</sup> United Nation, Department of Economic and Social Affairs, Population dynamics database, Georgia Profile [https://population.un.org/wup/Country-Profiles/]

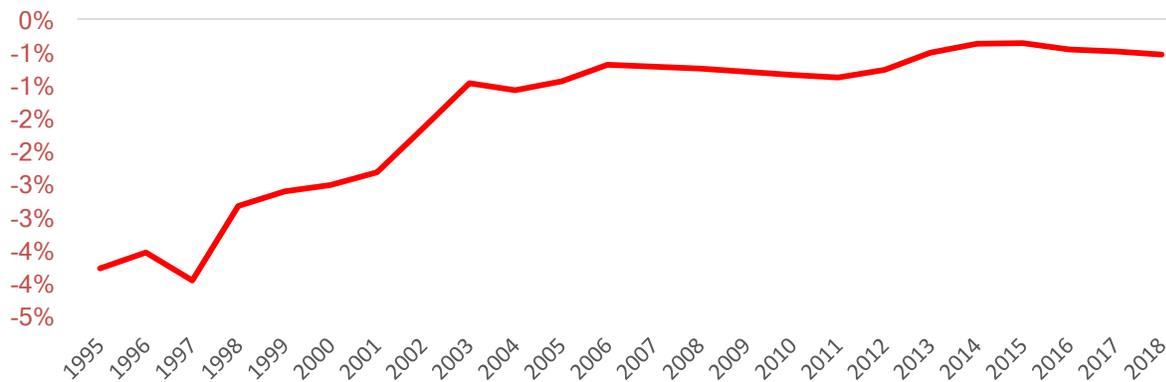
**FIGURE 6. THE NUMBER OF POPULATION BY MUNICIPALITIES IN THE ALAZANI-IORI RIVER BASIN (IN THOUSANDS, 1994-2018)**



Source: National Statistics Office of Georgia, [www.geostat.ge](http://www.geostat.ge)

In 1994-2018, population in Kakheti declined by 131 thousand persons (- 29%). In the 90s, population was declining annually at the rate of 3-4%, afterwards the rate dropped to 1-2% until 2013, and then almost to 0% (see Figure 7).

**FIGURE 7. POPULATION GROWTH RATE IN KAKHETI (% , 1995-2018)**



Source: National Statistics Office of Georgia, [www.geostat.ge](http://www.geostat.ge)

Table below describes population trend for rural and urban areas (in period 2009 - 2019)

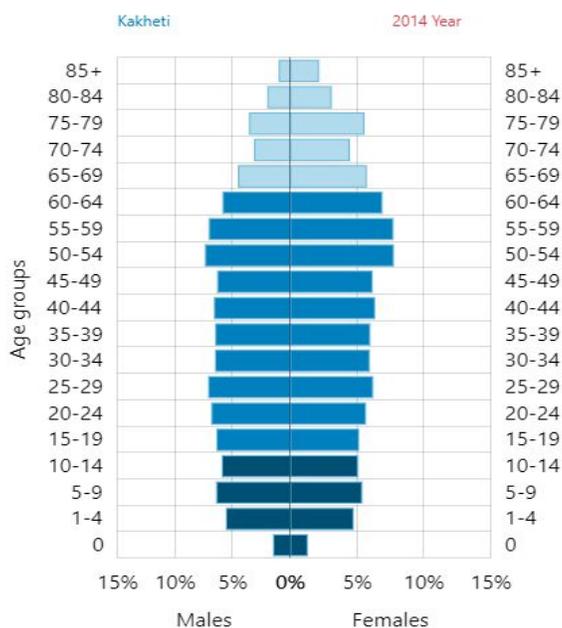
**TABLE 8. POPULATION TRENDS IN KAKHETI FOR RURAL AND URBAN AREAS**

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
<b>Total</b>	<b>331.9</b>	<b>329.2</b>	<b>326.3</b>	<b>323.4</b>	<b>321.3</b>	<b>320.1</b>	<b>318.8</b>	<b>317.8</b>	<b>315.9</b>	<b>314.7</b>	<b>312.5</b>
<i>Rate of decline (%)</i>	-0.79	-0.82	-0.88	-0.89	-0.66	-0.36	-0.40	-0.33	-0.60	-0.38	-0.71
<b>Urban</b>	<b>76.5</b>	<b>75.6</b>	<b>74.6</b>	<b>73.5</b>	<b>72.7</b>	<b>72.1</b>	<b>72.0</b>	<b>71.9</b>	<b>71.6</b>	<b>71.4</b>	<b>71.0</b>
<i>Rate of decline (%)</i>	-1.17	-1.24	-1.33	-1.37	-1.15	-0.81	-0.17	-0.09	-0.41	-0.30	-0.61
<b>Rural</b>	<b>255.4</b>	<b>253.6</b>	<b>251.7</b>	<b>249.8</b>	<b>248.6</b>	<b>248.0</b>	<b>246.9</b>	<b>245.9</b>	<b>244.3</b>	<b>243.3</b>	<b>241.5</b>
<i>Rate of decline (%)</i>	-0.67	-0.70	-0.75	-0.74	-0.51	-0.22	-0.46	-0.41	-0.65	-0.40	-0.74

Source: GeoStat

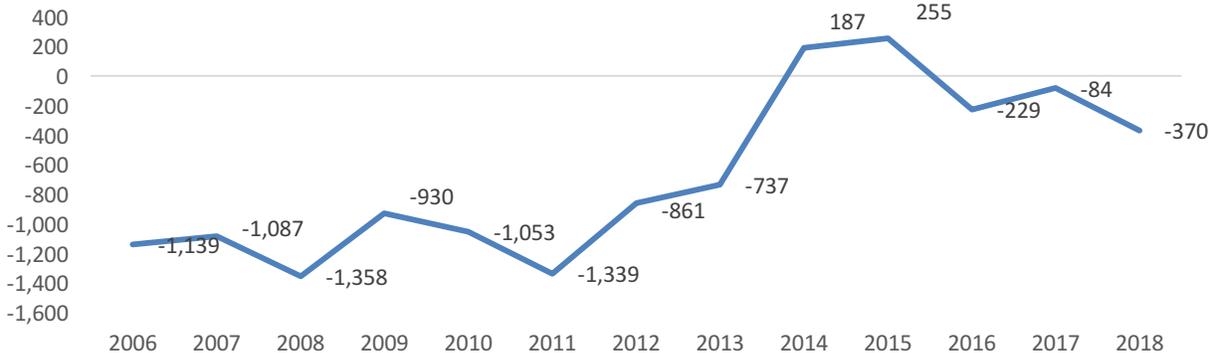
The sex-age structure of the Kakheti region based on 2014 population census data (see Figure 8 – e.g. small number of children under age group <15 (17.8 % of total population) and large number of elderly under age group 65+ (17.2%)), mostly negative natural increase of population (see Figure 9), as well as other related factors indicate population aging and demographic transition in the river basin, that actively contributes to negative trend of depopulation.

**FIGURE 8. SEX-AGE STRUCTURE OF POPULATION OF KAKHETI REGION (BY CENSUS DATA 2014Y.)**



Source: National Statistics Office of Georgia,  
<http://database.geostat.ge/pyramid/index.php?lang=en>

**FIGURE 9. NATURAL INCREASE OF THE POPULATION IN KAKHETI (IN PERIOD 2006 - 2018)**



Source: National Statistics Office of Georgia, [www.geostat.ge](http://www.geostat.ge)

The low density of population, negative growth trend, and low rate of urbanization create a specific profile for household water use in Kakheti. From a long-term perspective, the expected population growth rate should not create any additional pressure in terms of increased domestic water use and wastewater infrastructure overload. However, the low coverage of drinking water supply and sewage systems, the absence of wastewater treatment facilities, as well as the need to upgrade and rehabilitate existing supply and treatment systems, calls for development in short- and medium-term perspectives that if implemented will lead to increased use of water for drinking and sanitation purposes.

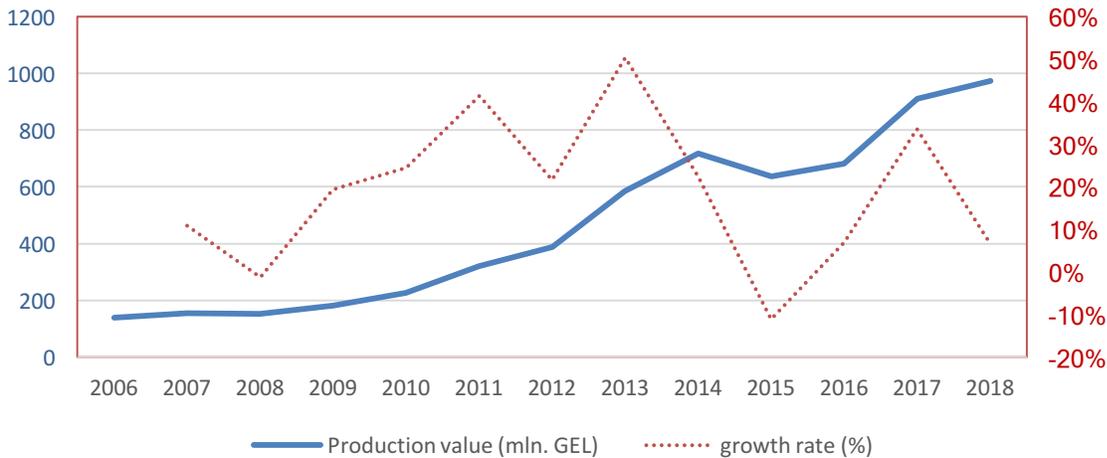
One of the best ways to fight depopulation in Kakheti, appeared to be development of the tourism sector. Attraction of domestic as well as international visitors creates a very positive trend for revitalization of local economies even in depopulated rural areas. In the Alazani-Iori River basin, an interesting example supporting this statement is Tusheti. Some years ago, Tusheti was almost depopulated but growing number of visitors to the area created demand on tourism infrastructure and services that facilitated development of the construction sector, local food production, food and tourism services. Abandoned several villages revived and since few years the economy of Tusheti has been steadily growing.

However, tourism growth is resulting in new environmental challenges for local communities. These new challenges are mostly related to modern communal services (drinking water provision, wastewater treatment, electricity demand, road infrastructure development need), locally produced agriculture (use of water, diffuse pollution, etc.), increased number of livestock (waste management, overgrazing, etc.). Currently these challenges are not large in scale, however, with the growth of the tourism sector they are expected to result more visible negative effects.

### 3.8.2. Economic development and related pressures on the river basin

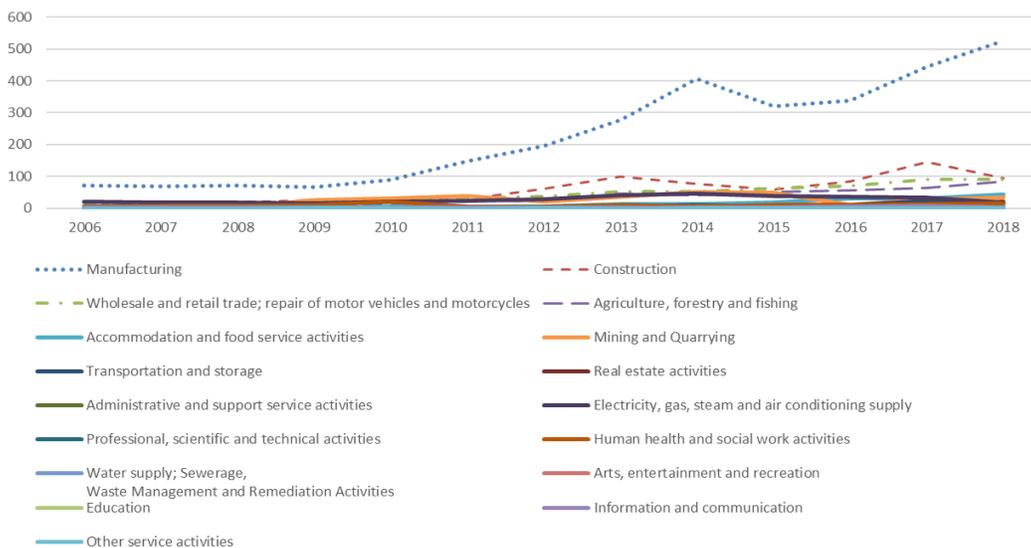
For more than a decade, economy of the Kakheti region has been growing. In 2006-2018, production value in the region has increased by 833.5 mln GEL (seven-times), with simple average annual growth rate of 19% in the same period.

**FIGURE 10. PRODUCTION VALUE IN KAKHETI (MLN. GEL, %, 2006-2018)**



In 2006-2018, 484.7 mln. GEL growth is mainly found in industry (increase by 569%), primarily driven by the development of manufacturing economic activity (additional 454.5 mln. GEL with 635% increase). Therefore, in the same period, 79.2 and 76.3 mln. GEL growth (784% and 966% increase) was also found in trade and agriculture accordingly. Significant positive change was also indicated in the construction sector with certain variation for the same period, overall, it accounted positive growth of 80.8 mln. GEL (569% increase). Significant growth has been observed also in the accommodation and food service activities with growth of 3727% (41 mln. GEL).

**FIGURE 11. PRODUCTION VALUE BY KIND OF ECONOMIC ACTIVITY IN KAKHETI (MLN. GEL, 2006-2018)**

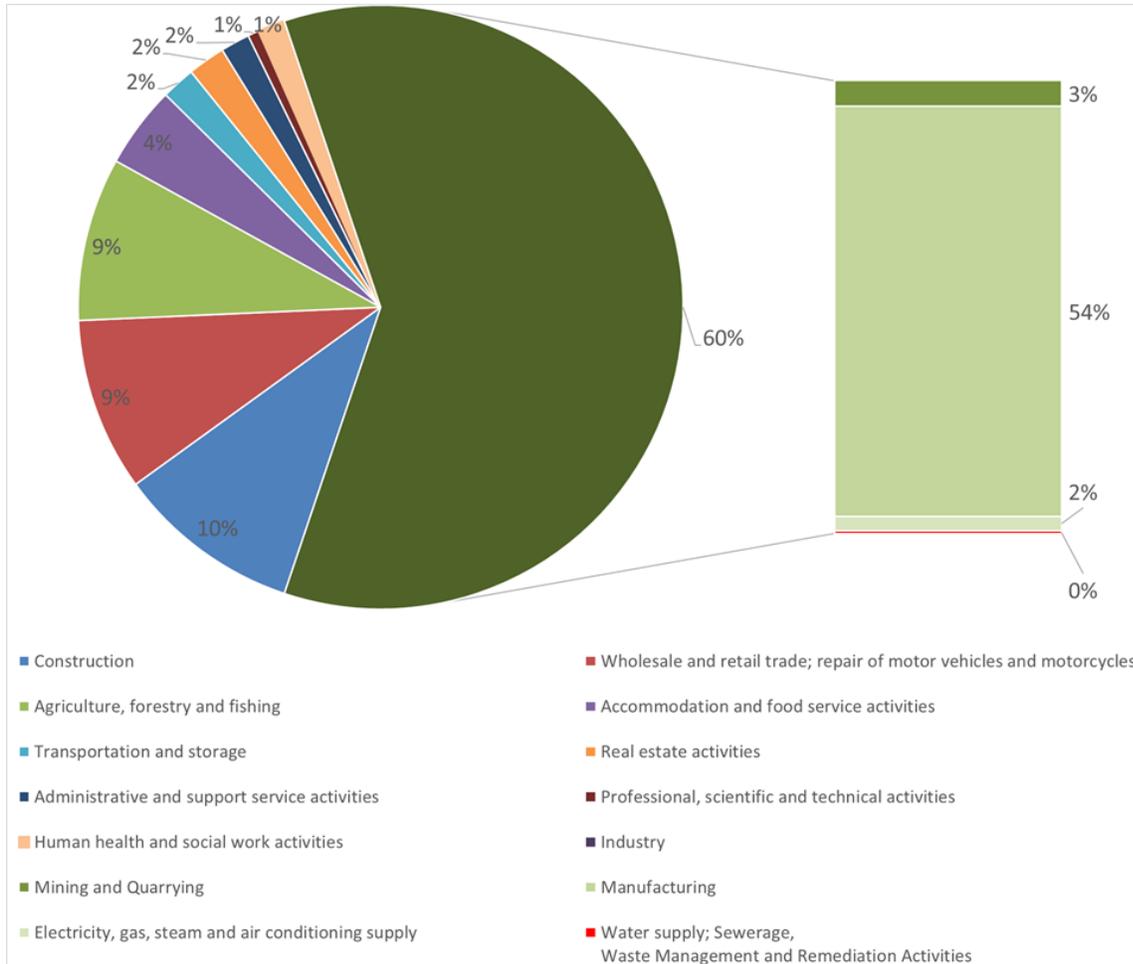


Source: National Statistics Office of Georgia, [www.geostat.ge](http://www.geostat.ge)

If we consider the value of production by economic activities for 2018, industry is leading with 60% share (580.7 mln. GEL), in which, the biggest contributor is manufacturing - 54% (526.1 mln. GEL), followed by mining and quarrying - 3% (32.6 mln. GEL) and electricity, gas, steam and air conditioning supply - 2% (18.5 mln. GEL) and relatively small share, less than 1 % for water supply, sewerage, waste management

and remediation activities (3.5 mln GEL). After industry, construction sector accounts for the largest production value 10% and –followed by trade and agriculture both with ~9% (see Figure 12).

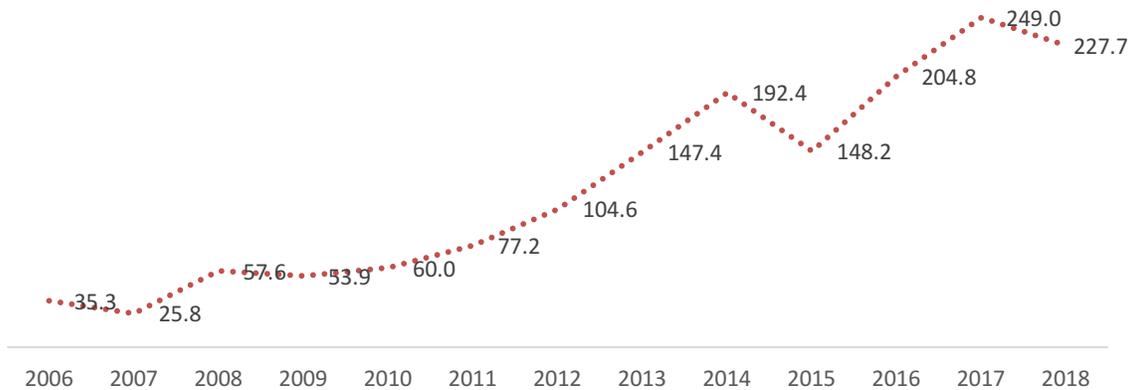
**Figure 12.** Production Value distribution share by Kind of Economic Activity in Kakheti (% , 2018)



Source: National Statistics Office of Georgia, [www.geostat.ge](http://www.geostat.ge)

Considerable growth of added value of the industry is accounted, in 2006-2018 period. It increased by 192.4 mln. GEL that corresponds to 545% growth rate (see Figure 13).

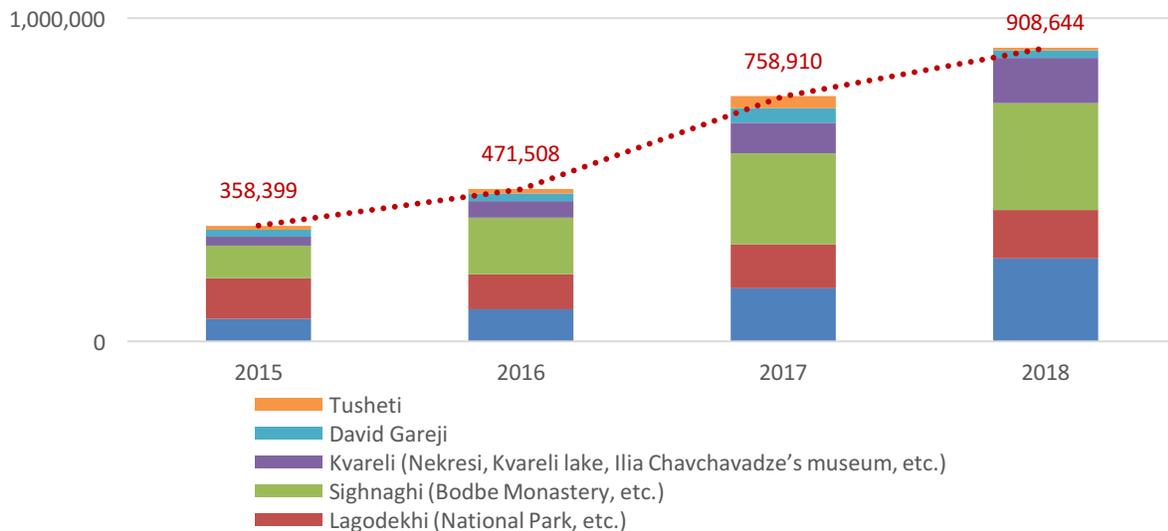
**FIGURE 13.** ADDED VALUE BY INDUSTRY IN KAKHETI REGION (MLN. GEL, 2006-2018)



Source: National Statistics Office of Georgia, [www.geostat.ge](http://www.geostat.ge)

In 2015-2018 period the number of visitors grew 2,5 times in the Kakheti region and by 2018 reached 908,000 persons (Figure 14).

**FIGURE 14.** VISITORS DISTRIBUTION ACCORDING TO DESTINATION IN KAKHETI IN 2015-2018

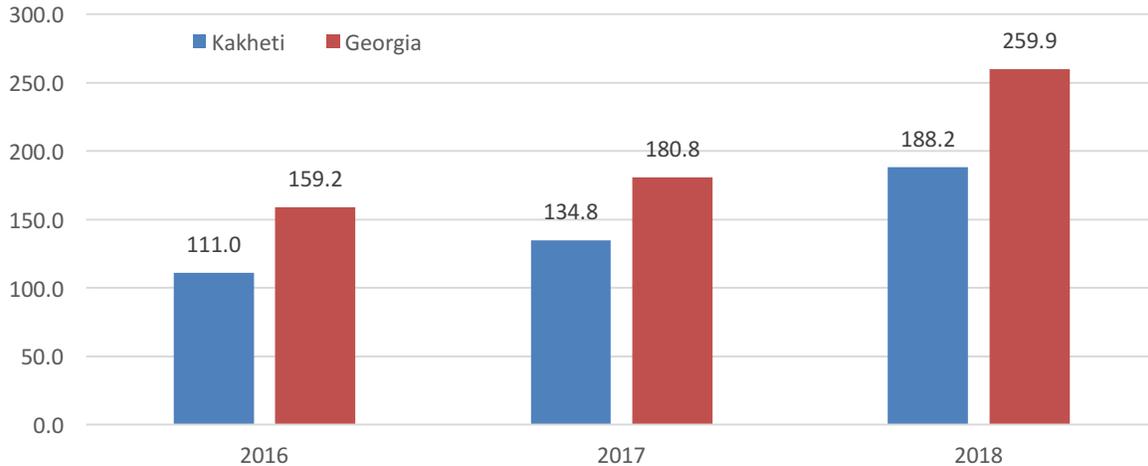


Source: Georgian National Tourism Administration, <https://gnta.ge/statistics/>

In 2016-2018 70% growth was observed in the production of grapes, as the wine production and export are developing every year (Figure 15); 86,2 million bottles (0,75 ml) were exported to 53 countries in 2018, which is 13% more than previous year<sup>25</sup>.

<sup>25</sup> Source, LEPL "National Wine Agency", report 2018, <http://georgianwine.gov.ge/En/Files/Download/9120>

**FIGURE 152.** PRODUCTION OF GRAPES IN KAKHETI (1,000 TONES)



Source: National Statistics Office of Georgia, [www.geostat.ge](http://www.geostat.ge)

It is worth to note that the pressure on water bodies in the river basin currently is not as high as it was at the end of 1980s. However, with increasing the standard of living, improved connectivity, reduced time for travel, developed communication, as well as growth of the tourism, wine industry, construction and various service sectors, economic activities in the river basin are expected to grow.

Population migration towards big urban area has no alternative so far, as the local economy in the Alazani-lori River Basin is still weak. However, with the improvement of the standard of living in urban areas, tourism development, creating economic opportunities by unfolding local cultural and agrarian potential, the attitude towards living in rural areas may change.

### 3.9. CULTURAL HERITAGE<sup>26</sup>

The Alazani-lori River Basin is extremely rich and diverse in cultural heritage. The area is well known for its historic and archeological sites, historical dwelling areas, monasteries and churches, pre-Cristian sites, fortresses, and famous wine cellars, etc. There are three museum reserves within the project area<sup>27</sup>: Gremi Museum (Village Gremi / Kvareli municipality); Niko Pirosmiani state museum (Village Mirzaani / Dedoplistskaro municipality), and Ujarma museum reserve (Sagarejo Municipality).

Below, **the map** shows, the locations of cultural heritage objects within the Alazani-lori River basin. initial (temporary) and (b) permanent protection through granting the status of the Cultural Heritage Property or the Listed Property status.

- Initial (temporary) protection is applied when the heritage object is being discovered. The Ministry of Education, Science, Culture and Sport of Georgia is responsible to assess the discovered object

<sup>26</sup> Law on Culture defines two types of cultural heritage (Article 5). Specifically:

# Material Cultural Heritage - man-made or created as a result of human impact on the natural environment, any kind of architectural, artistic, urban planning, agricultural, archaeological, anthropological, ethnographic, monumental, related to technological development movable or immovable objects of artistic, aesthetic, historic or memorial value; documentary material; as well as gardens, parks, objects of landscape architecture, historic settlements, historically formed environments related to the history, development, folklore, faith and traditions, past or present civilization of the country.

# Non material Cultural Heritage - oral traditions and verbal arts, including language, as a bearer of material cultural heritage, performing arts, customs traditions and traditional practices, knowledge and skills related to traditional arts and crafts, as well as the instruments, objects, artifacts, and cultural space related to them, which are recognized by society, groups, and, in some cases, individuals, as part of their cultural heritage.

<sup>27</sup> <https://www.heritagesites.ge/en/services/36>

and, in case the historical or cultural value, related to its antiquity, uniqueness or authenticity is confirmed, the object shall be inscribed in the List of Cultural Heritage Properties. The object can be inscribed in this list for the period up to six months. This period can be extended only once for another six months. After this period, the object is either granted the Listed Property status or taken out from the List of Cultural Heritage Properties.

- The permanent protection is granted to be object by the Minister of Education, Science, Culture and Sport of Georgia<sup>28</sup>. In this case, among other provisions the protection regime implies the establishment of the individual protection zone, corresponding areas and regulations that aim to preserve the setting of the monument which contributes to its historic, cultural, and other values.

According to the Law on Cultural Heritage, the listed property can be granted the grade of national importance if it has special artistic or aesthetic value, or if it is associated with an event or a person of special historical significance, or if it is related to a stage of national development, and if it has distinctive general and national values<sup>29</sup>. A listed property of national significance can be nominated for inclusion in the World Heritage list (by the Prime Minister of Georgia upon the recommendation of the Minister of Education, Science, Culture and Sport of Georgia, or upon his/her personal initiative). Based on the above mentioned, following steps can be distinguished in the hierarchy of properties:

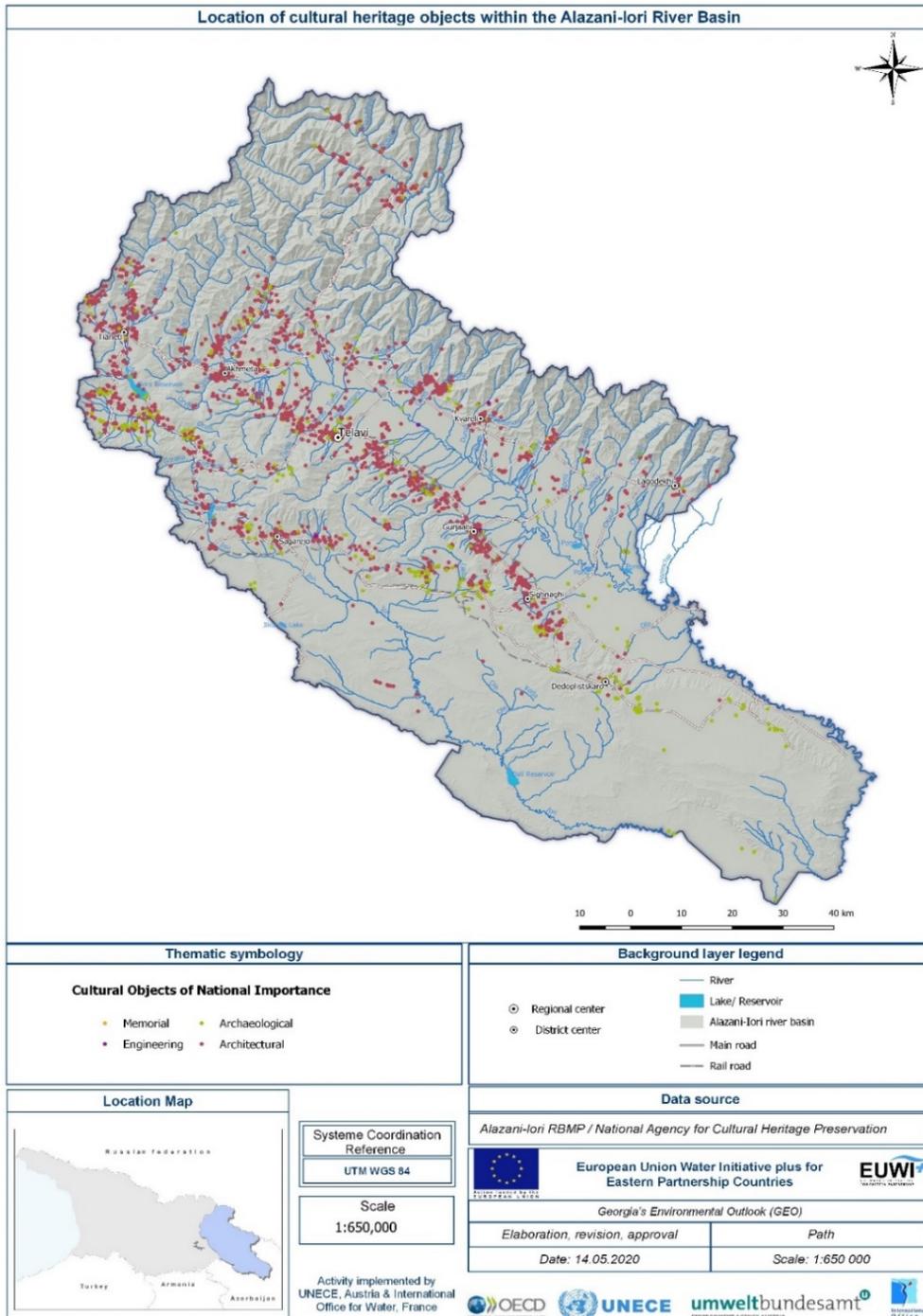
- i. Objects of cultural heritage.
- ii. Listed cultural property.
- iii. Listed cultural property of national importance (National monument).
- iv. Listed cultural property of international importance (World Heritage Site).

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<sup>28</sup> Law on Cultural Heritage. Article 15.

<sup>29</sup> Law on Cultural Heritage. Article 18

**MAP 3: LOCATIONS OF CULTURAL HERITAGE OBJECTS WITHIN THE ALAZANI-IORI RIVER BASIN**



The current national legislation<sup>30</sup> defines two mechanisms for protection of cultural heritage objects - (a)

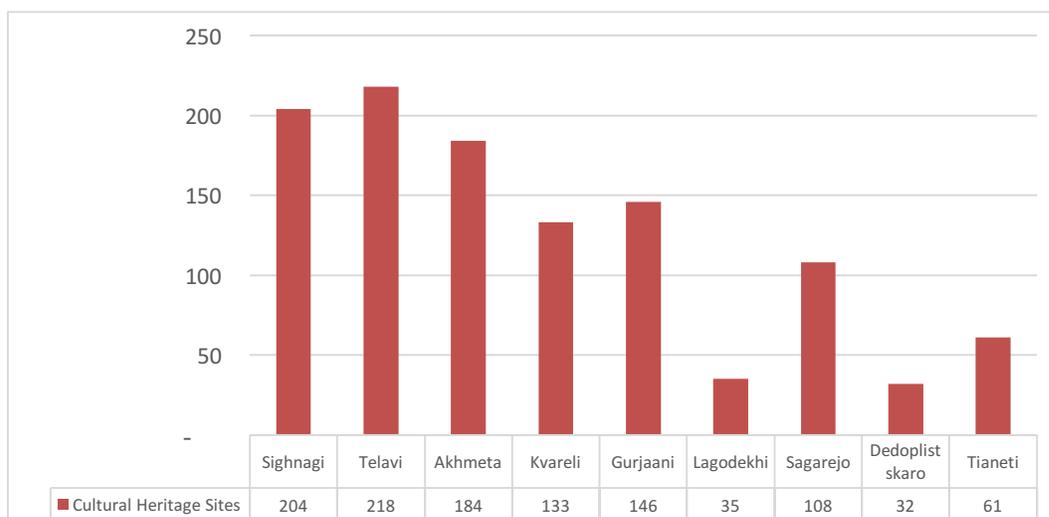
In general, the protection regulations are stricter for the listed properties of national significance and World Heritage Sites then for listed properties without such a grade.

<sup>30</sup> Law on Cultural Heritage

It should be also mentioned that any intervention on or use of the listed property, which diminishes its historic and cultural value, damages and endangers it, affects its authenticity and prevents its interpretation, is prohibited by the law.

In total, within the Alazani-Iori River Basin, there are about 1,400 immovable listed cultural properties, and 275 of them are property of national importance<sup>31</sup>. There is no cultural property of international importance within the target river basin (Figure 16 below indicates a distribution of cultural heritage among different municipalities within the target river basin).

**FIGURE 16.** IMMOVABLE CULTURAL HERITAGE SITES WITHIN THE ALAZANI-IORI RIVER BASIN (DISTRIBUTION BY MUNICIPALITIES)



Source: National Agency for Cultural Heritage Preservation of Georgia<sup>32</sup>

In addition to the above mentioned, within the target area at the time of the SEA development, there might be cultural heritage sites that have not been included in the State Register yet. Furthermore, archaeological sites that have not yet been identified can be discovered or revealed during the construction works envisaged by the RBMP.

<sup>31</sup> National importance heritage graded cultural property if such property has special artistic or aesthetic value, or if it is associated with an event or a person of special historical significance, or if it is related to a stage of national development, and if it has distinctive general and national values. *Law on Cultural Heritage. Article 1*

<sup>32</sup> <https://www.heritagesites.ge/uploads/files/5d9b295f1fa11.pdf>

### 3.10. MAIN PROBLEMS AND FACTORS AFFECTING THE PAST TRENDS AND CURRENT STATE OF ENVIRONMENTAL AND HEALTH ISSUES

**Water resources:** the main factors affecting the surface water quality in the basin can be summarized as follows: industrial and urban wastewater discharges; agriculture diffuse sources of pollution; other discharges into the surface waters e.g. leakages from illegal landfills, etc. It is likely that these factors also affect the groundwater resources, however, relevant data is not sufficient to adequately assess the quality of groundwaters in the basin.

By analysing existing water use trends in the Alazani-lori River Basin based on the information of the draft RBMP, it can be concluded that the energy sector, irrigation sector and domestic water supply are the major water users and therefore exert the main pressures on the basin.

Based on the RBMP and spatial analysis of key drivers and related pressures, 12 SWBs<sup>33</sup> were identified as undergoing significant pollution pressures from untreated municipal wastewater, which is attributable to the following rivers: The Akhtaliskhevi; the Balakhevi; the Vezrulaskhevi; the Ninoskhevi; the Shromiskhevi; the Bursa; the Anagiskhevi; the Sakoboskhevi; the Mashnaariskhevi; the Ilto; the Alazani; the Atsiviskhevi; the lor 120; and the lori.

The result of categorization pressure indicators and calculation of preliminary risks for these 12 SWB is resented on the map bellow that shows the location of categorized water bodies within the pilot basin.

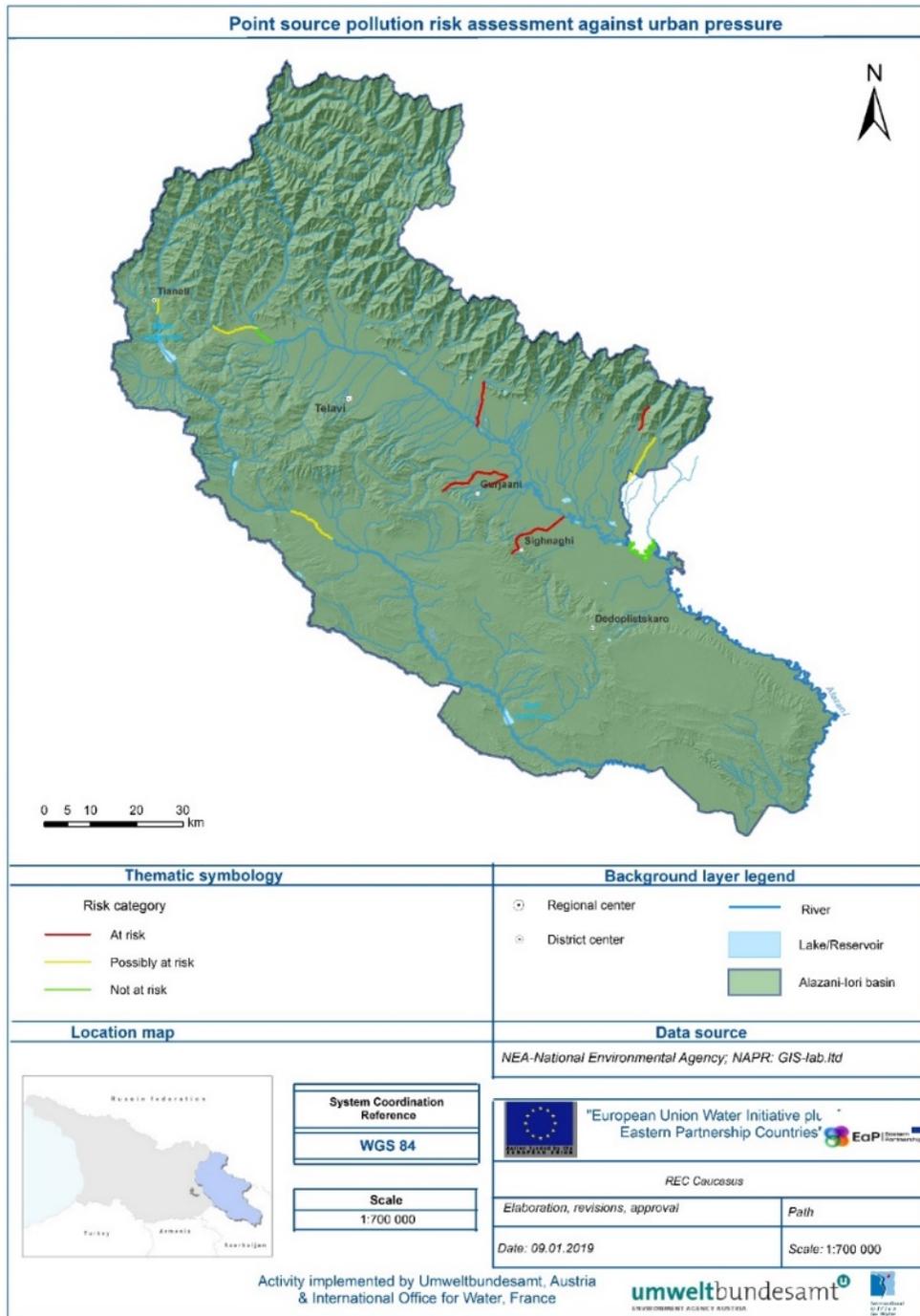
Most of the reservoirs and dams in the basin were built in the 1980s and are recently out of order. They present a risk for the population and infrastructure downstream, which would be affected in the case of the dam break. One such risk presents the Dalismta Reservoir, which is facing technical problems. The emergency spillway is blocked, one from the two gates of the environmental spillway is damaged and does not open. There is risk of leakage that might cause some risks to the population downstream.

Similar to water reservoirs, also irrigation and water intake systems are damaged and obsolete. This leads to high water losses when only approx. 50-60% of the water taken from the source reaches the end-users. There are about 15 irrigation canals in the Alazani-lori basin, which need to be rehabilitated, according to the Georgian Melioration Service.

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<sup>33</sup> Surface "water bodies" are discrete sections or parts of water bodies, which differ from each other in specific natural characteristics, the nature of the impact of human activity, or any other significant and distinguishable parameters (Sall et al, 2012)

**MAP 4: CATEGORIZATION OF SURFACE WATER BODIES UNDER POINT SOURCE POLLUTION PRESSURE**



**Natural hazards:** almost all types of natural hazards (hail, floods, flooding, mudslides, landslides, river bank erosion due to intensive washing, etc.) occur in the Alazani-Iori Basin. A growing trend of increased frequency and severity of hazards is being observed (e.g. the number of hail days and the extent of the damage caused by it have increased over the last 10-15 years, the number of floods/flashfloods days has increased as well).

There are several factors, which are affecting the situation, and for the most of the hazards it is a combination of the natural factors and human activities, including:

- Meteorological, hydrological and geological factors (e.g. contributing to the activation of mudslides processes);
- Climate change;
- Human activities in the water protection zones – agriculture, housing development, other constructions;
- Lack of flood preventive infrastructure and river bed cleaning measures (after floods, the river bed is filled with solid sedimentary material and there is a danger of spill over/flooding and causing damage downstream);
- Insufficient hydrological, meteorological, geological and hydrogeological monitoring network to efficiently assess existing conditions;
- Absence of pre-warning systems for natural disasters that would provide data on the expected natural hazards, and enable more efficient management.

**Soil:** there are two main issues concerning the soil in the river basin – soil pollution and soil degradation. Based on the information available (as it is very scarce) the key drivers and pressures of soil degradation in the Kakheti region are related to intensive use of chemicals, application of unsustainable land management practices, including soil compaction by heavy machinery, intensive irrigation and overgrazing. Currently, among agrochemicals, the most widely used are less toxic nitrogenous fertilizers and the manure. However, their excessive use can cause soil salinization and acidification as well. The amount of manure used is still significant and soils might be polluted by various substances including nutrients and microorganisms. Along with the above pressures, the quality of soils is affected by leachates from landfills, urban surface run-off, untreated wastewater run-offs, as well as open-pit mining operations.

**Climate change concerns:** climate change predictions make it clear that water quantity will be affected in the Alazani-lori Basin. As studies indicate, prolonged droughts may result in a reduction of groundwater and surface water flows. The shortage of water resources will affect the availability of water for domestic, irrigation, power generation, and other industrial purposes. In addition, the decrease in river flows will affect the water quality and biodiversity. Facing climate change consequences, efficient management of water use for maintaining enough flow in surface and ground waters is one of the issues to be addressed in the basin.

The increase of daily precipitation is likely to increase the risk of mudflows and flash floods in the region resulting in potential economic damage.

It is also important to highlight that the Alazani river is a transboundary river flowing downstream Azerbaijan. In the last 15 years, the river bank erosion degraded more than 100 ha arable land and pastures at the Georgian-Azerbaijan border. This type of loss is increasing annually, as a result of which, the local population loses an important source of income from the production of livestock and agricultural crops.

In the face of climate change and increase in daily precipitation resulting in severe floods, this issue might exacerbate leading to loss of land at increased rate. Considering above, this issue requires due attention and installation of protective infrastructure to avoid or mitigate the further loss and degradation of agricultural land resulting from river bank erosion.

**Biodiversity, habitats, and protected areas:** pollution of surface waters by organic substances and heavy metals, illegal fishing, water abstraction, hydropower and water control dams, invasive species are the main drivers of reduced freshwater diversity in the Alazani-lori River Basin. Potential serious effects of further infrastructure development (HHPs, irrigation systems) typically include: blocking of fish passages, limiting of fish breeding areas, depletion of fish food bases, a decrease of water flow and water pollution, and overall modification of water habitats. Many species, such as trout and number of species, especially crayfish, mussels, and dragonflies are sensitive to pollution. Water abstraction leads to habitat loss and distribution of alien species, as water is often stored in the reservoir polluted by alien species.

The water environment is particularly important for the maintenance and restoration of the floodplain forests (riparian or gallery forests) along with the Iori and Alazani gorges.

As it is presented on the maps below, the maintenance or improvement of water bodies status is essential for:

- Tugay floodplain forests located along with Iori river (possible at-risk water bodies) and protected within Korugi, Iori and Chachuna Managed Reserves; especially for Chachuna managed reserve located downstream of Dali Reservoir;
- Alazani Proposed Emerald site which includes floodplain forest along Alazani river (possible at-risk water body Alz 139);
- Alazani Nature Monument and part of Vashlovani National Park, located along the Alazani River.

**Map 5:** Relation of Emerald site with water bodies at risk

Water bodies at risk and Emerald network sites in the Alazani-Iori river basin district



Thematic symbology

Emerald network	Risk category
Emerald network	At risk
	Possibly at risk
	Not at risk

Background layer legend

Regional center	River
District center	Lake/ Reservoir
	Alazani-Iori river basin

Location Map



Systeme Coordination Reference
UTM WGS 84
Scale
1:650,000

Activity implemented by UNECE, Austria & International Office for Water, France

Data source

Alazani-Iori RBMP / Ministry of Environmental Protection and Agriculture



European Union Water Initiative plus for Eastern Partnership Countries



Georgia's Environmental Outlook (GEO)

Elaboration, revision, approval

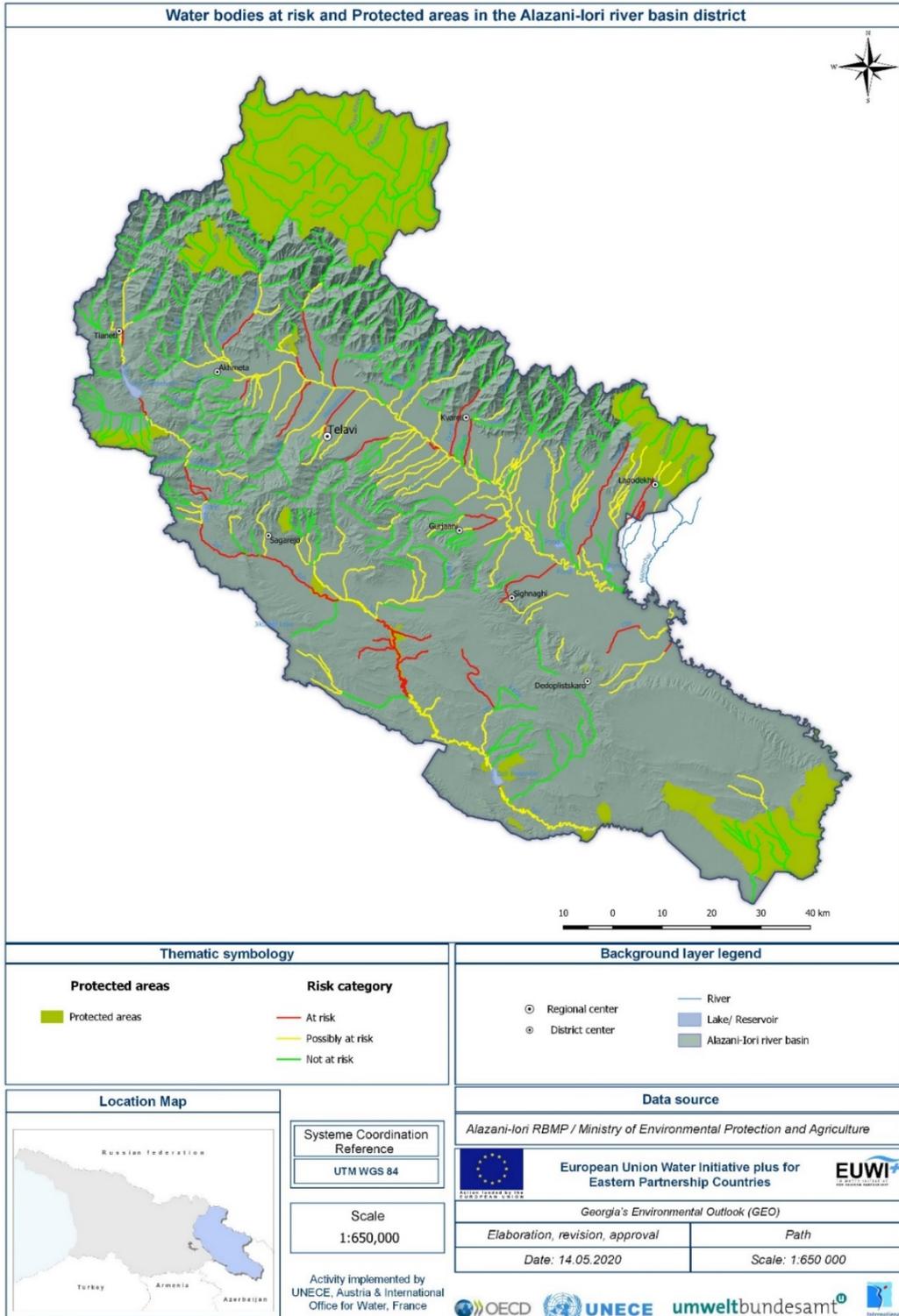
Path

Date: 14.05.2020

Scale: 1:650 000



**MAP 6: RELATION OF PROTECTED AREAS WITH WATER BODIES AT RISK**



**Health related issues:** generally, poor water quality, sanitation and hygiene belong to potential risk factors for morbidity in the basin, especially among children. However, current surveillance system does not provide enough data to identify the impact of environmental quality on the health of the Kakheti population and estimate trends.

Overall, pressures identified as part of RBMP baseline study, suggest that Alazani and Iori and their tributaries are polluted with organic and biogenic substances from untreated wastewater and agricultural activities. Therefore, it can be assumed that faecal pollution and alleviated levels of ammonia in drinking water, would represent a health risk for the local population.

Per Georgian legislation, healthcare facilities should have constant water supply and pre-defined infrastructure for wastewater treatment (based on the potential degree of contamination with in-patient facilities requiring the most advanced filtration and treatment facilities). Outpatient facilities are required to have continuous water supply, which could be a challenge for a number of rural facilities serving over half of the population living in the Kakheti region. This issue might be even worsened in short-term during the infrastructure construction processes planned in the region throughout the RBMP implementation.

Additionally, some of the current water use practices affect the quality and quantity of water in the region as well. This includes agricultural activities, which may contaminate water bodies, or abstraction of large quantities of water, as well as common household activities related to the discharge of household wastewater.

**Socio-economic aspects:** inadequate standard of life, lack of economic opportunities compared to urban areas, low income of local communities, limited or no formal employment prospects, as well as the lack of cultural events and access to basic services, and very limited basic, primary and vocational education opportunities in the rural areas of Kakheti have been the main reasons for youth to migrate to urban areas or abroad. It is less likely that they return back to villages after they settle in new areas. Besides, demographic changes in the basin i.e. aging of the local population and depopulation of certain rural areas not well-connected to urban centres (such trends can be revealed from official statistics) is a challenge as well.

A lack of resources to develop sufficient economic activities and collect revenues to sustain necessary local services (e.g. maintenance/rehabilitation of water distribution as well as sewage systems) also can be acknowledged as contributing to the trends. In addition, lack of awareness of local population to introduce sustainable economic practices (organic production, sustainable waste and chemical management, etc.) is also a big challenge for local communities in Kakheti.

It is the fact, that tourism growth creates new environmental challenges for local communities and the region itself. The challenges are mostly related to the requirement of modern communal services (drinking water provision, wastewater treatment, electricity demand, road infrastructure development need), locally produced food and drinks (use of water, diffuse pollution, etc.), increased number of livestock (waste management, overgrazing, etc.). Currently, highlighted challenges are not large in scale, however, with the growth of the tourism sector they are expected to result in more visible negative environmental effects if efficient water use, treatment of wastewater, and adequate waste management are not introduced.

**Cultural heritage aspects:** the Alazani-Iori River Basin is extremely rich and diverse in cultural heritage. The area is well known for its historic and archeological sites, historical dwelling areas, monasteries and churches, pre-Cristian sites, fortresses, and famous wine cellars, etc. In total, within the Alazani-Iori River Basin, there are more than 1,120 immovable cultural heritage sites, and about 200 of them are sites of national importance. In addition to the above mentioned, within the target area, cultural heritage sites may be presented that have not been included in the State Register at this time. Besides, there might be archaeological sites that have not yet been identified and can be revealed during any type of construction work. The current trend in terms of cultural heritage is an ongoing process of identification, documentation, and research the objects of material and intangible cultural heritage in the target area. The process mainly is driven by existing policy (Culture Strategy 2025) and legislation (Law on Cultural Heritage) and managed by Georgian Cultural Heritage Agency.

### 3.11. LIKELY FUTURE EVOLUTION OF THE ENVIRONMENTAL AND HEALTH ISSUES IF THE RBMP IS NOT IMPLEMENTED

Below, Table 9. Provides summary of existing environmental and socio-economic issues and the likely future evolution without implementation of the RBMP.

**Table 9.** existing environmental and socio-economic issues and the likely future evolution without implementation of the RBMP

Key issues	Specific concerns	Geographic areas	Relation to the RBMP e.g. business as usual “zero” scenario
Water resources	Industrial and urban wastewater discharges and run-offs	Alazani-lori River Basin	<p>Without construction of WWTPs, rehabilitation and construction of sewage systems, and improved agriculture practice (i.e. aspects addressed in the RBMP), the water quality in the basin will not improve, and may even worsen. The pollution from agriculture, industry, and urban sources will continue to deteriorate water quality and moreover, in a transboundary context, it can become an issue downstream of the Alazani River on the territory of Azerbaijan as well.</p> <p>Also, without strengthening groundwater monitoring aspects, as envisaged by the RBMP, the information and data on ground water quality will remain limited and it won't enable better assessment of quality aspects and trends in the future.</p>
	Agriculture diffuse sources of pollution		
	Other discharges into the surface waters		
	Potentially contaminated groundwater		
	Weak groundwater monitoring		
	Insufficient hydrological monitoring network	Alazani-lori River Basin	<p>Without the implementation of the RBMP which envisages measures aiming to improve the hydrological conditions of the basin directly or indirectly e.g. the rehabilitation of existing irrigation system, controlling and regulation of water abstraction and use, keeping moderate water flow, strengthening hydrological monitoring network with the purpose of improving hydrological data and assessment, the current hydrological conditions of the basin won't be improved.</p>
	Existing irrigation systems are in dilapidating state and inefficient		
	Damaged dams and reservoirs		
Natural Hazards	Hails	Tianeti, Akhmeta, Telavi, Sagarejo, Dedoplistskaro, Signaghi, Gurjaani, Kvareli, Lagodekhi municipalities	<p>It is expected that the scale of natural hazards (floods, landslides, mudflows, hail) will increase and the process might be irreversible if relevant reinforcement measures preventing or reducing the risk of natural hazards are not implemented. The frequency of natural hazards and the scale of</p>

	Floods/flashfloods	Gurjaani, Akhmeta, Sagarejo, Signagi, Dedoplistskaro, Lagodekhi, and Tianeti municipalities	<p>damage might increase along with the activation of climate-induced processes. Therefore, a significant part of the population in the basin might be at potential risk of natural hazards if preventive and mitigation measures are not taken. Without improving the monitoring network (the measures envisaged by the RBMP) and setting early warning systems, the amount of damage caused by various hazardous processes will be significant. It is important to take structural and non-structural measures for reducing the impact of natural hazards on the economic activities and population of the basin. Therefore, the role of RBMP is essential in considering such measures more prominently in the planning and implementation processes.</p>
	Riverbank erosion	Characteristic for the entire Alazani-lori River Basin	
	Mudflows	Tianeti, Akhmeta, Telavi, Sagarejo, Dedoplistskaro, Signaghi, Gurjaani, Kvareli, Lagodekhi municipalities	
	Landslides	Especially characteristic for Tianeti, Akhmeta, Kvareli, Lagodekhi municipalities	
Soil	Soil pollution	Entire region and especially Dedoplistskaro and Signagi municipalities	<p>Without the implementation of the RBMP measures, which include supporting sustainable agriculture practice e.g. regulation of the use of fertilizers, support the introduction of modern irrigation technologies, use of organic fertilizers and bio humus, supporting organic farming and livestock management, soil pollution and degradation caused by unsustainable agriculture activities will remain and even worsen over time, making the soil potentially not suitable for future agriculture purposes e.g. crop production.</p>
	Soil degradation	Especially Dedoplistskaro and Signaghi	
Climate change and related risks	Prolonged droughts and associated water deficit	The Alazani-lori River Basin	<p>Without the implementation of the RBMP measures, which focus on climate change aspects directly or indirectly, e.g. the implementation of infrastructure and bank protection projects, considering climate change impact when calculating water demand/supply balances for water supply companies, as well as measures focused on reducing climate change pressure on agriculture, the impacts of climate change will be more prominent in the region. This will impact agriculture productivity and water availability for different uses directly or indirectly that can be even more severe in this relatively dry region of the country, as well as creating ground for further activation of natural hazards.</p>
	The potential increase of climate induced natural hazards		

Biodiversity, habitats and protected areas	Population of fish, in particular endangered species	The Alazani-lori River Basin	<p>Without RBMP implementation, further exacerbation of existing pressures on biodiversity, and therefore further worsening of current status, especially for water-related species and habitats, are highly expected. For example, the increase of the water demand due to the further development of hydropower and irrigation, without assessment and control of environmental flow and with the lack of a clear definition of ecological limits of water abstraction (these are measures envisaged by the PoMs), will result in a wide range of negative effects including drying out of spawning sites for fish and/or preventing the development of fish eggs and juveniles. Inadequate flow in the original riverbed can also cause the reduction of floodplain forests areas and will have an impact on species composition of these habitats. Without the implementation of measures proposed by the draft RBMP for urban wastewater discharges, further deterioration of water quality is expected, which in turn will have a negative impact on fish and other water-related species, which are particularly sensitive to water pollution.</p> <p>Without implementation of the RBMP, improvements of water quality and hydromorphological status cannot be expected, and thus, the status of protected areas located along the river lori (Korugi, lori and Chachuna Managed Reserves) will not be enhanced either.</p>
	Population of other water dependent species especially vulnerable and endangered species		
	lori floodplain forests	The lori River Gorge	
	Alazani floodplain forests	The Alazani River Gorge	
	Protected Areas	The Alazani-lori River Basin	
	Emerald Sites and Biosphere Reserves		
Public health	Quality and safety of drinking water and water used for households	The Alazani-lori basin	<p>Without the implementation of the RBMP, the quality of water resources for safe use in households and for agriculture purposes will not be improved from a long-term perspective. Without the implementation of the RBMP that envisages the improvement of wastewater treatment measures and the construction/rehabilitation of sewage systems, the sanitation conditions might worsen and become a source of contamination and the spread of diseases.</p>

	Quality and safety of water used for agricultural processes	The Alazani-lori Basin.	<p>Although, the risk is probably very low at this stage without the implementation of the RBMP that ensures the improvement of water quality for agriculture purposes, the consumption of potentially contaminated products from agriculture sectors gradually might cause health issues to the population consuming those agricultural products.</p> <p>Knowledge, attitudes, and practices of local communities might become an issue during the RBMP implementation process as well. Addressing the complex social and behavioral practices require appropriate means of public education and awareness-raising that should become part of awareness and education programs planned in the RBMP as well. So, it can be assumed that without the implementation of the RBMP, the public health might become a concern over time.</p>
	Undisturbed supply of water to medical and public health infrastructure and maintenance		
	Access to healthcare services in case of emergencies	Specific to districts not in proximity of Tbilisi	
	Knowledge, attitudes, and practices (KAP) of local communities	The Alazani-lori basin	
Socio-Economic factors	Economic growth & pressure on the quality of water	Characteristic for the entire Kakheti Region	<p>Without the RBMP, the water pollution and water use will increase as a result of the development of economic activities such as agriculture (for example, wine industry) and food processing industry. Moreover, with increased urbanization more municipal wastewater will be generated causing additional pollution of the SWBs. Polluted environment will cause a negative environmental impact on changing ecosystems and reducing quality and the number of ecosystem services. As a result, polluted environment will worsen the standard of living of the local population, further accelerate depopulation, hinder the development of ecotourism and related industries.</p> <p>Without the introduction of sustainable agriculture practices (e.g.: organic production) the measures envisaged by the RBMP, fragmented arable landowners and small-scale producers, which create most of the employment and presents the majority of the land, will have limited or no chance to compete not only internationally, but even in Georgia.</p>
	Demographic transition & depopulation, especially in mountain areas		
	Unemployment & low income		
	Low awareness of local stakeholders/Unsustainable economic activities/practices	Characteristic for the entire Kakheti Region	
	Inefficiency/ Inadequate infrastructure and services		
Cultural Heritage	Potential physical damage to the cultural heritage assets and its features	Alazani-lori River Basin	In practical terms, non-implementation of the RBMP will not affect future trends in cultural heritage management practices.

## 4. POLICY ANALYSIS

### 4.1. IDENTIFICATION OF RELEVANT ENVIRONMENTAL AND HEALTH POLICY OBJECTIVES

This section identifies environmental and health policy objectives established in **the existing policy and strategic documents** at the national level, as well as international treaties Georgia is a party to and that are relevant to the draft Alazani-lori RBMP.

The identified environmental and health objectives serve as a basis for defining the reference framework for the policy evaluation of the draft Alazani-lori RBMP. As the hydropower development belongs to one of the main pressures on a number of the environmental and health issues in the basin, the information on the national legislative framework regarding energy development and in particular the objectives regarding the hydropower are provided as well (under 'socio-economic factors').

#### **Water resources**

**The Water Law (1997)** that sets the legal framework for the management of water resources in Georgia, defines the main goals related to the protection and use of water. These goals are as follows:

- The protection of water bodies and their rational use, consideration of the principles of sustainable use;
- Meeting the needs of the population for clean drinking water in the first place;
- Sustainability and sustainable use of aquatic species.

At present the management of water resources in Georgia derives from the principle of administrative management of water resources. The law addresses exclusively the surface waters, groundwater is regulated by the Law on Mineral Resources (1996). The Water Law defines the principles of water resources protection and use. Due to amendments introduced in 2007 the Water Law currently does not have in place a permit system for the abstraction, discharge and combined water use.

**A Draft new Law on Water Resources Management** that is ready for submission to the Parliament of Georgia and is expected to be adopted in the course of 2020, has adopted the Water Framework Directive (WFD) principles and is built around the concept of the Integrated Water Resources Management (IWRM). It addresses all types of water resources, including surface-, ground-, coastal- and transitional waters. The new Water Law also requires development and implementation of the River Basin Management Plans (RBMP) for all main rivers in the country. The new Water Law provides a legal framework for the protection of water resources by regulating the discharge of priority polluting substances, prevention of discharge of hazardous pollutants and reduction of water losses. The new law also re-introduces the permit system for the abstraction, discharge and combined water use and aims to establish the volumetric charges/fees for water abstraction in coming years

**The Third National Environmental Action Programme of Georgia (NEAP 2017-2021)**, approved by the Decree N1124 of the Government of Georgia on May 22, 2018, defines the long-term goal (2030) - to ensure good qualitative and quantitative status of surface and groundwater bodies for human health and aquatic ecosystems. To achieve this goal, the NEAP sets the following targets:

- Development of an effective system of water resources management;
- Reduction of water pollution from the point and diffuse sources and ensuring sustainable use of water resources;
- Improvement of the water quality and quantity monitoring and assessment systems.

**The Strategy for Agriculture Development 2021-2027** identifies the improvement of irrigation and drainage system as one of the priorities.

#### **Natural hazards**

**The National Disaster Risk Reduction Strategy (NDRRS) and Action Plan (2017-2020)**, approved by resolution # 4 of the Government of Georgia in 2017, defines the following priority areas:

- Establishment of Disaster Risk Reduction System at the national and local levels;
- Development/Implementation of Methodology/Approach for Post-Disaster Damages and Recovery Needs Assessment and Calculation of Economic Losses;
- Integration of Early Warning and Alarm Systems into the National Disaster Risk Reduction System;
- International Cooperation in the area of Disaster Risk Reduction;
- Implementation of Disaster Risk Reduction model into the Education System;
- Development of Geospatial Data Infrastructure for DRR, etc.

The same strategy deals with the threat of floods, landslides, mudslides, water erosion, hail, and reservoir (hydrodynamic) accidents. In order to minimize the adverse effects of different types of disasters, it is important to identify, assess and plan disaster risk mitigation measures in advance.

Some goals derived from the National Disaster Risk Reduction Strategy and Action Plan 2017-2020 that are relevant for the RBMP include:

- Study and assessment of disaster risks and the preparation of relevant response documents outlining the extent of each disaster;
- Preparedness plans for natural disasters (floods, landslides, mudslides, erosion, hail, etc.);
- Determination of flooding zones;
- Operation of disaster warning systems;
- Evaluation of reservoirs in the Alazani-Iori River Basin and development of rehabilitation project;
- Necessary qualitative and quantitative study of groundwater, and the reduction of substances that contaminate groundwater;
- Improvement of surface water hydrological status and determination of ecological cost for habitats and biodiversity.

### **Soil**

The long-term goal of the **NEAP 2017-2021** is the protection and sustainable use of land resources, which further identifies two specific targets for soil:

- Target 1. Reduction of land degradation / desertification and the restoration of degraded areas;
- Target 2. Establishment of a monitoring system for degraded/eroded and polluted soils.

**The Law of Georgia on Soil Protection** (12/05/ 1994). The goals of this law are:

- Ensure the integrity of the soil cover, increase and maintain fertility;
- Define land users, landowners, and state responsibilities to create conditions for soil protection and ecologically clean production;
- Prevent the adverse effects of the increasing use of soil that threatens the soil quality, human health, flora, and fauna;
- Maintain endemic vegetation and fertile soil layer in high mountain regions by protecting subalpine and alpine meadows;
- Facilitate the coordination of activities in the field of melioration in order to achieve a high and solid harvest from melodic lands.

### **Climate change**

Georgia ratified the Paris Agreement and submitted its Intended Nationally Determined Contribution ((I)NDC) on 8 May 2017. In the document, the country sets conditional and unconditional targets for the implementation of (I)NDC<sup>34</sup>.

Conditional climate change targets of the (I)NDC related to adaptation are as follows:

- Agriculture sector:
  - Research and development of emergency response plans for droughts and floods;

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<sup>34</sup> Georgia is actively working on its international commitments through the preparation and implementation of relevant adaptation policies, strategies, and measures on the national and sub-national levels. With this regards Georgia plans to prepare the National Adaptation Plan (NAP), which is intended to improve the country's preparedness and adaptive capacity to climate change factors. In this regard, Georgia takes steps to integrate climate risk and resilience into core development planning and implementation. The National Adaptation Plan to Climate Change for Agriculture Sector (AgriNAP) was already developed as a part of the GEF-supported project. The document identifies the adaptation measures and climate-friendly approaches for selected crops. The proposed measures will be integrated into the NAP process afterward.

- Introduction of innovative irrigation management and water application techniques;
- Implementation of anti-erosion measures;
- Establishment of information centers for farmers.
- Establishment of early warning systems for climate-related extreme events;
- Strengthening: (a) adaptation strategies; (b) policymakers' capacity for climate change adaptation planning; and (c) adaptive capacities of communities.

As indicated above, the climate change issues are mainstreamed and addressed in the number of policy documents.

**The NEAP 2017-2021** sets long-term goal and short-term targets for climate change mitigation and adaptation, mainly with regard to adaptation, its emphases the need of increasing the adaptive capacity of the country (Target 2).

**The Strategy for Agricultural Development in Georgia 2021-2027** emphasizes the need to address climate change, environment and biodiversity. It proposes the following measures to this end:

- Maintaining good agricultural practices, biodiversity, and environmental sustainability programs; and
- Promoting climate-smart agriculture practices.

**The Rural Development Strategy of Georgia 2017-2020** mentions that climate change-related issues should be considered in regional and municipal policy documents. It also emphasizes the importance of raising climate change awareness among the local authorities and population, especially in rural areas.

#### **Biodiversity, habitats and protected area**

**The National Biodiversity Strategy and Action Plan (NBSAP)** for 2014-2020 was approved by the Decree of the Government of Georgia N343 in 2014. This document represents the main document that formulates national policy in respect to biodiversity protection and identifies 21 national targets in the field of biodiversity. Targets that are relevant for the RBMP are as follows:

- Assess alien invasive species with regard to their status and impact; evaluate their pathways and set measures to prevent their introduction and establishment through the management of these pathways; no new alien species;
  - Reduce negative factors directly affecting threatened natural habitats through the sustainable management of at least 60% of these habitats, including at least 60% of forests, 80% of wetlands and 70% of grasslands;
  - Reduce the level of pollution of Inland waters to ecologically acceptable levels;
  - Improve the status of species-including 75% of "Red List" species through effective conservation measures and sustainable use;
- Restore the integrity of Inland water ecosystems and species diversity.

#### **Public health**

The Law of Georgia on Public Health (27/06/2007) aims:

- to provide a safe environment for human health and prevent the spreading of diseases.

**The National Environment and Health Action Plan of Georgia 2018-2022** (NEHAP-2) defines the improvement of access to safe water and sanitation, including for each child, as a strategic priority. Strategic interventions introduced by this NEHAP-2 regarding water are the following:

- Legislative and normative base, policy for water resources and protecting drinking-water supply - reviewed and updated by 2022;
- Establish the effective surveillance systems on waterborne diseases and drinking water (by 2022);
- Ensure public health through the improvement of access to safe and sustainable water supply according to the National and International requirements;
- Provide to Georgian population adequate sanitation and wastewater treatment plants
- Improve drinking water, sanitation, and hygiene (Water, Sanitation and Hygiene -WASH) in Educational and Medical facilities, Recreational Areas and IDP settlements.

### **Socio-economic factors**

The draft Alazani-iori RBMP is in line with all major country public policy documents related to the general development vision, specifically:

Georgia's current social-economic development vision **Social-economic Development Strategy – Georgia 2020**, which defines the following targets:

- Fast and efficient economic growth to create jobs and reduce poverty;
- Facilitate inclusive economic growth;
- Rational use of natural resources, ensuring environmental safety and sustainability and avoiding natural disasters during the process of economic development.

It, also, focuses on development of the regions and its infrastructure and harmonization with EU standards and requirements.

**The Regional Development Programme of Georgia 2018-2021** entails major public infrastructure development projects, among which one of the key targets are:

- Urban waste management, including rehabilitation as well as the construction of a new sewage system, water treatments plans, landfills, and closure of the old ones in the regions.

**The Strategy for Agricultural Development in Georgia 2021-2027:**

- Rehabilitation of old and construction of new irrigation and drainage systems;
- Introduction of sustainable agricultural practices (efficient use of water resources as well as the promotion of bio production).

**National Energy Development Strategy 2020-2030** was approved by the order of the Minister of Economy and Sustainable Development of Georgia in October 2019. Strategic directions emphasized by the document includes:

- Adequacy of generation - the ability of generation sources to continuously meet the demand of consumers for electricity, both in the event of a planned and unexpected power outage;
- Network Reliability - The ability of the transmission network to provide power to customers without limitation and deterioration of power quality in case of accidents.

The Strategy also mentions 10-year **Transmission Network Development Plan** which is updated annually. This is a strategic plan for development of stable, reliable, cost-effective and efficient transmission system, which will ensure sufficient transfer capacity for integration of renewable energy sources into the network. It also presents the main planning document outlining perspectives for HPPs constructions for 10-years period with indicated locations and envisaged capacities throughout the country.

**Renewable Energy Action Plan (REAP, 2019-2020)** outlines the following measures as part of REAP:

- the continues support for new hydropower production via agreements with power producers.

### **Cultural heritage**

The following objectives can be identified for the Cultural Heritage aspects relevant to the RBMP:

The Law of Georgia on Cultural Heritage<sup>35</sup>, *Article 22 – Fundamental Principles for the protection of cultural property*

- To preserving the features and peculiarities of the cultural property, as well as its settings in the case of an object of immovable cultural property, which ensure the preservation of its historical, cultural, memorial, ethnological, artistic, aesthetic, scientific or other values.

The Culture Strategy 2025<sup>36</sup>

- To ensure physical protection (conservation, restoration, and rehabilitation) of the tangible cultural heritage in compliance with the relevant international standards and research.
- To ensure that the conservation of cultural heritage follows an integrated conservation approach and that urban, spatial and regional development plans take into consideration the protection of

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<sup>35</sup> <http://bit.ly/2TMnWdE>

<sup>36</sup> <http://bit.ly/30Kx11u>

buildings, architectural ensembles, cultural heritage protection zones and landscapes of cultural value.

## 4.2. EVALUATION OF THE LINKAGES BETWEEN THE ALAZANI-IORI RBMP OBJECTIVES AND ENVIRONMENTAL AND HEALTH POLICY OBJECTIVES

The section provides a summary of the findings and conclusions of the policy analysis i.e. analysis of the linkages (i.e. potential synergies or conflicts) between the Alazani-Iori RBMP objectives and relevant environmental and health objectives stipulated in the international and national policy documents described in the section above (for a full analysis see *Annex 19*).

It can be concluded that no likely conflict was identified between the Alazani-Iori RBMP objectives and the environmental and health policy objectives. In most of the cases the RBMP objectives that are designed to improve the conditions of water bodies will likely have a significant positive effect on the environmental conditions of the basin e.g. the populations of water-related species, especially on fish fauna and water birds, soil and water quality, and it can be expected that meeting these objectives should prevent further degradation and deterioration of environment in the basin.

Although there is no direct linkage between the objectives of the RBMP and identified climate change adaptation objectives, it can however be concluded that the improvement of the status of surface waters (as an expected result of fulfilling the RBMP objectives), will positively contribute to higher resilience of agriculture sector to the climate change, mainly in terms of improved water quality, as well as water availability. Also, there is a synergy between the objectives of the RBMP and the objectives of the National Disaster Risk Reduction Strategy – achievement of the NDRRS objectives should also contribute to meeting the RBMP objectives regarding better protection of water resources, land, and habitats from adverse effects of natural disasters, as well as the loss of habitats for species, and damages to infrastructure and economy. The whole territory of the Alazani-Iori River Basin is exposed to natural hazards. The RBMP represents an opportunity to mitigate or adapt the consequences of natural hazards in the Alazani-Iori River Basin.

In terms of the health objectives, it can be concluded that the implementation of RBMP will improve the quality of water bodies in the Alazani-Iori River Basin, thus contributing to reaching the national health objectives.

The draft Alazani-Iori RBMP is also in line with all major policy documents related to the general socio-economic development visions and supports the harmonization of economic aspects of the basin with EU standards and requirements. As the generation of energy from renewable sources is one of the strategic directions and there are existing, ongoing and planned HPPs in the basin, the RBMP should be an opportunity to improve planning the generation of energy from hydro-resources considering existing environmental issues of the basin as well.

There is no direct link between the cultural heritage objectives and the RBMP objectives.

## 5. LIKELY ENVIRONMENTAL AND HEALTH EFFECTS AND MEASURES TO MITIGATE ADVERSE EFFECTS

### 5.1. METHODOLOGY TO EVALUATION OF LIKELY EFFECTS

The task of the SEA is to identify and evaluate likely effects on the environment including socio-economic and health issues that can be caused by the implementation of relevant plan or programme and to propose measures to reduce or mitigate any adverse effects or to enhance the positive effects.

The draft Alazani-ori RBMP proposes a long list of measures; however, not all measures proposed by the draft RBMP have a link to the environmental, health and socio-economic issues identified as a result of the baseline analysis ((see previous chapter) i.e. the key SEA issues). Thus, in order to focus only on the RBMP measures which may have significant effects on the key SEA issues, the evaluation of the RBMP measures was carried out in two sub-sequent steps:

#### ***Step 1: Screening of all the Alazani-ori RBMP measures to identify their linkages to the key SEA issues***

The purpose of the screening was to select only those proposed RBMP measures which have certain linkages to the key SEA issues to be a subject of further detailed analysis of the likely effects. **All proposed RBMP measures<sup>37</sup> including basic measures as well as supplementary measures were considered, although not all proposed measures are selected for the first implementation cycle covering 6-year planning period.** The screening was carried out using a simple screening matrix (a completed screening matrix is provided in Annex 20.), with the following legend:

1 – there is a link between a specific key SEA issue and a given RBMP measure (i.e. the RBMP measure affect the key SEA issues),

0 – there is no link between a specific key SEA issue and a given RBMP measure (i.e. no effects are expected).

As a result, following RBMP measures were selected for detailed evaluation of the likely effects on each key SEA issue. The table 10 also indicates which RBMP measures are relevant to each SEA key issue.

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<sup>37</sup> For the purpose of screening the draft Alazani-ori RBMP and Programme of Measures (PoMs) dated September 2019 were used.

**TABLE 10.** SCREENED-IN RBMP MEASURES AND THEIR RELEVANCE TO THE SEA KEY ISSUES

Water Resources	Hydrology/Natural Hazards	Soil	Climate change aspects	Biodiversity, Habitats and Protected Areas	Health	Socio-economic aspects <sup>38</sup>	Cultural Heritage
<b>Construction of new wastewater treatment plant(s) and sewage system</b>	Rehabilitation wastewater network, which includes replacement of the pipes, wells, and collectors	Setting buffer strips and hedges (establishment of 3m buffer strip)	Using modern and efficient irrigation technologies to economize the water uses	Construction of new waste water treatment plant(s)	Rehabilitation wastewater network, which includes replacement of the pipes, wells and collectors	Construction of new waste water treatment plants (WWTPs)	Construction of new wastewater treatment plant(s)
<b>Rehabilitation wastewater network, which includes replacement of the pipes, wells, and collectors</b>	Regulations for abstractions and impoundments to prevent deterioration of water body status (the system of abstraction licensing control)	Codes of Good Agricultural Practices for Protection of Waters against Agricultural Nitrate Pollution (the reduction in the use of fertilizers in agriculture)	Rehabilitation of the main canal, collectors and engineering works of the irrigation systems in the Alazani-lori River Basin	Rehabilitation of drainage systems to reduce water induced erosion and agriculture run-off	Renovation /construction of a sewerage system in Kvareli; Construction of wastewater treatment plants (WWTP) in Kvareli with capacity considering number of populations	Construction of the sewerage system	
<b>Rehabilitation of drainage systems to reduce water induced erosion and agriculture run-off</b>	Creation of water course passability for upstream and downstream migration of location specific species and for sediments transport; management of sediments	Rehabilitation of the main canal, collectors and engineering works of the irrigation systems in the Alazani-lori River Basin	Creation of ecologically compatible hydraulic conditions through flow control (e.g. water level regulation)	Setting buffer strips and hedges (establishment of 3m buffer strip)	Training of farmers to use water in an efficient way and to store water	Rehabilitation wastewater network, which includes replacement of the pipes, wells and collectors	

<sup>38</sup> This table provides only part of screened-in RBMP measures for socio-economic issues, the list of detailed screened-in RBMP measures are provided in Annex 20

<b>Setting buffer strips and hedges (establishment of 3m buffer strip)</b>	Improvement of sediments transport continuity via dam management and material removal and sediments extraction regulation	Establishment of organic farms	Restoration of floodplain forests	Codes of Good Agricultural Practices for Protection of Waters against Agricultural Nitrate Pollution (the reduction in the use of fertilizers in agriculture)	Publicity campaigns promoting efficient water use by domestic customers	Environmental inspection controls on wastewater discharges to the rivers	
<b>Codes of Good Agricultural Practices for Protection of Waters against Agricultural Nitrate Pollution (the reduction in the use of fertilizers in agriculture)</b>	Maintenance of moderate river flow	Setting up verмикompost (producing bio humus)	Considering climate change aspects in the implementation of infrastructure or bank protection projects	Establishment of organic farms	Construction and use of biogas plants (biogas digesters) for households or for a whole municipality	Rehabilitation of drainage systems to reduce water induced erosion and agriculture run-off	
<b>Actions plans for Nitrate Vulnerable Zones (this measure consists of the preparation of Actions plans for Nitrate Vulnerable Zones in the river basin and is in line with the EU-Nitrate Directive)</b>	Improvement and diversification of bank and bed structures, riparian and aquatic habitats (vegetalization)	Construction and use of biogas plants (biogas digesters) for households or for a whole municipality	Considering climate change impact when calculating water demand/supply balances for water supply companies	Actions plans for Nitrate Vulnerable Zones (this measure consists of the preparation of Actions plans for Nitrate Vulnerable Zones in the river basin and is in line with the EU-Nitrate Directive)		Setting buffer strips and hedges (establishment of 3m buffer strip)	
<b>Setting up sanitation zone (sanitary protection zones) to protect water quality</b>	Supporting hydraulic engineering measures for morphological restructuring of the watercourse	Avoidance of livestock grazing in water protection strips by providing alternative zones	Monitoring of water abstraction considering decreased precipitation, ensuring	Avoidance of livestock grazing in water protection strips by providing alternative zones		Codes of Good Agricultural Practices for Protection of Waters against Agricultural Nitrate Pollution (the reduction in	

			sustainable use of water			the use of fertilizers in agriculture)	
<b>Regulations for abstractions and impoundments to prevent deterioration of water body status (the system of abstraction licensing control)</b>	Considering climate change aspects in the implementation of infrastructure or bank protection projects	Codes of Good Practices for Livestock in the Alazani-lori River Basin	Implementation of water resources monitoring program and environmental inspection controls	Setting up sanitation zone (sanitary protection zones) to protect water quality		Establishment of organic farms	
<b>Implementation of water resources monitoring program</b>	Elaboration of a technical guideline/normative act (technical standing orders) on the management of river sand and gravel mining	Elaborations of methodologies for using a different type of fertilizers and pesticides in a proper way	Controlling the volume of water that can be abstracted and the time over which it can be abstracted (licenses, permits)	Regulations for abstractions and impoundments to prevent deterioration of water body status (the system of abstraction licensing control)		Actions plans for Nitrate Vulnerable Zones (this measure consists of the preparation of Actions plans for Nitrate Vulnerable Zones in the river basin and is in line with the EU-Nitrate Directive	
<b>Environmental inspection controls on wastewater discharge to the rivers</b>	Strengthening hydrological monitoring system	Elaboration of norms / standards for livestock grazing intensity	Training of farmers to use water in an efficient way and to store water	Creation of ecologically compatible hydraulic conditions through flow control (e.g. water level regulation)		Setting up vermikompost (producing bio humus)	
<b>Source control (reducing pollution at source reduces the costs associated with its treatment and produces</b>	Conducting research to assess current and possible climate change impacts on water bodies		Promotion of efficient and sustainable water use	Creation of water course pass ability for upstream and downstream migration of location specific		Construction and use of biogas plants (biogas digesters) for households or	

<b>environmental benefits)</b>				species and for sediments transport		for a whole municipality	
<b>Development of Normative act on a definition of ecological and chemical status of water bodies</b>			Strengthening hydrological monitoring system	Improvement of sediments transport continuity via dam management		Avoidance of livestock grazing in water protection strips by providing alternative zones	
<b>Providing training on sustainable livestock farming</b>			Conducting research to assess current and possible climate change impacts on water bodies	Material removal and sediments extraction regulation		Codes of Good Practices for Livestock in the Alazani-lori River Basin	
<b>Controlling the volume of water that can be abstracted and the time over which it can be abstracted (licenses, permits)</b>			Competitive financing of target programs in research institutes to study climate change impact on different ecosystems and economic sectors	Improvement and diversification of bank and bed structures, riparian and aquatic habitats (vegetalization)		Using modern and efficient irrigation technologies to economize the water uses	
<b>Training of farmers to use water in an efficient way and to store water</b>			Developing and implementing a long-term land management strategy in the Kakheti region, which would be the most important climate change adaptation measure after monitoring	Supporting hydraulic engineering measures for morphological restructuring of the water course  Improve the infrastructure of Dali reservoir (for instance restore the shields)		Rehabilitation of the main canal, collectors and engineering works of the irrigation systems in the Alazani-lori River Basin	
<b>Restoration of existing</b>				Restoration of floodplain forests		Setting up sanitation zone	

<b>abstraction to sustainable levels (development of alternative supplies or more efficient water use</b>				Restore the natural flooding regime in the downstream of the Iori River by opening the Dali reservoir to mimic natural floods		(sanitary protection zones) to protect water quality	
<b>Publicity campaigns promoting efficient water use by domestic customers</b>						Regulations for abstractions and impoundments to prevent deterioration of water body status (the system of abstraction licensing control)	
<b>Set up a payment system for water abstraction from the surface water courses</b>						Creation of water course passability for upstream and downstream migration of location specific species and for sediments transport; management of sediments	
<b>Elaboration of a technical guideline/normative act (technical standing orders) on the management of river sand and gravel mining</b>						Improvement of sediments transport continuity via dams' management.	

<b>Conducting research to assess current and possible climate change impacts on water bodies</b>						Material removal and sediments extraction regulation	
<b>Investigation of wastewater treatment plants and estimating weighed portions</b>						Moderate watercourse maintenance	

## **Step 2: A detailed evaluation of the likely effects of the RBMP measures,**

Further analysis of the likely effects was conducted only for those RBMP measures which were 'screened in' i.e. evaluated as '1' in Step 1 described above (Table 10).

The analysis of likely effects attempted to describe the characteristics of likely risks/opportunities related to the implementation of a given measure on the key issue i.e. what can cause risk, if any and what represents opportunity etc. including direct or indirect effects. Subsequently, a numeric value was assigned in line with the following evaluation scale:

- 2 significantly negative effect/high risk,
- 1 minor negative effect/risk,
- 0 no effect/risk expected,
- +1 moderate positive effect/opportunity and
- +2 significantly positive effect/important opportunity.

Following the results of the analysis of likely effects, relevant measures and suggestions were formulated to prevent or mitigate the identified potential negative effects<sup>39</sup> and/or to enhance the identified potential positive effects expected to be resulted from the implementation of the Alazani-lori RBMP (see Chapter 6). **For detailed evaluation of proposed RBMP measures see Annex 21.**

## **5.2. SUMMARY OF RESULTS AND CONCLUSIONS FROM THE ASSESSMENT OF THE LIKELY EFFECTS**

This section provides a summary of the main conclusions from the detailed evaluation of the likely effects i.e. from Step 2 described above. It should be noted that mainly likely positive effects are identified. There are only few RBMP measures, where potential adverse effects were identified, mainly of a local nature, for which relevant mitigation measures were proposed by the SEA. Thus, in general, it can be concluded that the implementation of the RBMP will have a predominantly positive effect on the environmental and socio-economic (including health) issues addressed in the SEA (i.e. those relevant to the Alazani-lori River Basin).

### **5.2.1 Water resources**

In overall, the **RBMP provides a coordinated framework for improving the water quality and water resources management in the Alazani-lori River Basin** through comprehensive measures and interventions. The implementation of the RBMP measures e.g. construction of WWTPs and sewage system and rehabilitation of wastewater network, replacement of water supply network, wells, and collectors, as well as other indirect measures proposed by the RBMP, such as development of the Actions Plans for Nitrate Vulnerable Zones, the Codes of Good Agricultural Practices for Protection of Waters against Agricultural Nitrate Pollution, etc., will indeed have direct positive effects on the quality of water. Furthermore, it provides the opportunity to improve the surface and groundwater monitoring network, which is an essential element for further assessment and planning of water resources in the basin.

The implementation of measures specified in the **Alazani-lori RBMP will have a positive effect on the hydrology of the basin**. The measures specified in the RBMP aim to address current and future issues related to hydrology in the river basin, including rehabilitation of irrigation systems to reduce water loss, regulation of water abstraction/impoundment, and determination and maintenance of moderate flow to ensure that sufficient water is available for water-dependent ecosystems, as well as climate change impacts on water bodies is considered. Besides, it envisages the improvement of hydrological monitoring network, which can provide additional data to assess water balance in rivers. This will serve as a basis for informed decision making on the water quantity to be released into irrigation canals, as well as to plan other water abstraction activities appropriately e.g. development of new hydropower plants. Better availability of

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<sup>39</sup> For the purpose of screening the draft Alazani-lori RBMP and Programme of Measures (PoMs) dated September 2019 were used.

hydrological monitoring data may also be used for determining the environmental flow, which is essential for maintaining the river morphology, especially considering existing and new HPPs that are planned to be built in the basin.

### 5.2.2. Natural hazards

The rehabilitation and construction of hydraulic structures in the river beds will contribute to the reduction of river bank washing and inundation during floods/flash floods. Periodical removal of solid sediments from rivers and deepening-alignment of their channels will mitigate the negative effect of mudflows. Adequate hydrological monitoring network will help also to identify the areas that are prone to floods/flash floods and select proper locations for installing early warning systems. **Therefore, the RBMP will have positive effect on natural hazards** and address issues such as riverbank protection and other control measures which in turn will facilitate the restoration of the river channel and its morphology to ensure the maintenance of near-natural state of rivers. Thus, the implementation of the RBMP will significantly improve the current situation; however, additional measures need to be introduced in the plan for reducing the risk of natural hazards in the basin.

### 5.2.3. Soil

Based on the evaluation of the likely impacts of individual measures outlined in the RBMP, it can be concluded that **the implementation of the RBMP will have overall positive effects in terms of reduced soil pollution and degradation**. The measures proposed by the RBMP directly or indirectly result in improved soil quality and structure. These measures include the establishment of organic farms, setting up vermicompost (producing bio humus), supporting good practices for applying fertilizers, and managing livestock in the Alazani-lori River Basin. All these measures will contribute to improved soil structure and quality in the basin, where the agriculture is one of the leading economic sectors.

### 5.2.4. Climate change

As it can be concluded from the baseline analysis, climate change will affect the Alazani-lori Basin in the future and there is a number of risks associated with this, including water deficit and increased frequency and magnitude of climate-induced natural hazards. Therefore, it is important that climate change is well studied and climate change adaptation is addressed in the RBMP in short- and long-term perspectives. There are RBMP measures directly focused on consideration of climate change impact on water bodies as well as other indirect measures e.g. those related to water abstraction regulation. **It is obvious that the implementation of those RBMP measures will contribute to improved preparedness and adaptation of the basin regarding the consequences of climate change.**

### 5.2.5. Protected areas, habitats and biodiversity

It is expected that **RBMP implementation will have positive impacts on floodplain forests** especially along the lori river. Most important measures in this regard are those related to the enhancements of environmental flow level in the river by reviewing water abstraction quantities and development of methodology for the assessment of environmental flow levels. Direct measures of floodplain forests restorations are envisaged also by the PoMs with expected significant positive impacts.

As it is presented on Map 5 and Map 6 the maintenance or improvement of water bodies status is essential for:

- tugay floodplain forests located along lori river (possible at risk water bodies) and protected within the Korugi, lori and Chachuna Managed Reserves; especially for the Chachuna managed reserve located downstream of Dali Reservoir;
- Alazani Proposed Emerald site, which includes floodplain forest along the Alazani river (possible at-risk water body Alz 139);
- the Alazani Nature Monument and part of the Vashlovani National Park, located along the Alazani river.

Particular attention should be paid to the Korugi and lori Managed reserves located along lor121 and lor125 Heavily Modified Water Bodies (HMWBs<sup>40</sup>). Special studies could be recommended to assess the impact

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<sup>40</sup> Surface water body that has significantly altered nature as a result of human influence

of rivers hydro morphological alterations, water abstraction and pollution on species and habitats protected within the Korugi and Iori Managed reserves, based on which appropriate conservation measures should be planned.

HMWB - Ior131 (Dali reservoir) is located in the vicinity of Iori (upstream) and Chachuna (downstream). Special measures are identified for the Dali Reservoir by the PoMs, that will have positive impact on the Iori floodplain forests. However, none of these measures are selected to be implemented during the 1<sup>st</sup> implementation cycle of the RBMP. Other measures directed on water quality and hydromorphological status improvement, to be implemented along the Iori river will promote improvement of the status of protected areas located there (the Korugi, Iori and Chachuna Managed Reserves).

Rehabilitation of the main canals, collectors and engineering works of the irrigation systems (the Zemo and Kvemo Alazani, Kvemo Samgori Irrigation systems) on one hand will promote the reduction of water abstraction for irrigation by reducing water losses in the system. However, environmental flow should be calculated carefully and cumulative effects assessed by the EIA of irrigation systems rehabilitation projects, to avoid water scarcity in the protected areas and emerald sites located down-stream areas.

Implementation of the **PoMs will have positive impact on protected areas and emerald sites** as well due to the nature and location of measures.

Implementation of **RBMP will have indirect positive impacts on aquatic species**, especially on fish fauna and other water related species through promotion of improvement water quality, restoration of environmental flow, reducing fragmentation of water bodies. However, PoMs do not envisage direct measures for the improvement of conservation status of water related species, including endangered species.

**Most of RBMP supplementary measures are expected to have positive indirect effects on species and habitats conservation status** through improvement of water quality and hydromorphological conditions.

#### 5.2.6. Health

Based on the evaluation of each measure, **RBMP will have a significant positive impact on the health of population** by improving the quality of water, its supply and treatment. Water is an essential aspect of human health and improved supply and quality of water would improve health of the population.

Access to water and sanitation are essential for the functioning of medical facilities, which, in turn, also play a significant role in ensuring the health of the population. Finally, water treatment and rational use of water for agricultural purposes promotes not only water conservation, but also the management of crop contamination from chemical and biological pathogens. However, there are interim risks (mainly at the local level) associated with the implementation of proposed measures.

It is highly advisable that in the process of implementation, each infrastructural project is accompanied by the medical emergency management plan; there are specific health hazards to which workers are exposed and those should be addressed and included in the plan. Temporary shortage of water output to household and healthcare facilities is another risk, which should be addressed by proper communication and public information campaigns. Due attention and controls should be implemented in order to avoid contamination of drinking water sources during the construction processes in order to avoid the supply of unsafe water and avoid waterborne diseases.

#### 5.2.7. Socio-economic development

The measures proposed by the draft **RBMP have a potential to significantly support the sustainable socio-economic development** of the Alazani-Iori river basin.

The RBMP actions will considerably support the employment and revitalization of certain economic areas in the river basin. Certain rural lands will be cultivated again due to new or rehabilitated irrigation systems and the introduction of good agriculture practices will support doing sustainable agricultural business in the basin. These RBMP measures will support sustainable development of local communities, facilitating

provision of proper social-economic conditions which will be reflected in increased employment and income as well as improved living conditions necessary for improved life quality.

#### 5.2.8. Cultural heritage

Construction works needed for the implementation of **certain RBMP measures (e.g. construction of wastewater treatment facilities, flood defenses, channels, crossings, etc.) may potentially disturb previously undiscovered archeological remains** near or within water bodies and thus RBMP implementation may have a potential negative effect. However, the current law on Cultural Heritage regulates such cases and requires application of certain procedures that should be considered during the RBMP implementation.

Based on the evaluation carried out in the SEA, it can be concluded, the impact of these processes on water resources (and vice-versa - the impact of the state of the water resources on the process of managing cultural heritage), will be minimal.

GIS analyses were conducted for the identification of possible correlation/impacts of measures selected by the draft RBMP with cultural heritage sites presented in a target area. A layer of cultural heritage sites and their buffer (protection) zones was overlaid by a layer of selected measures defined in the draft RBMP (basic measures actually covering construction and rehabilitation works related to the water infrastructure). The result of the analysis showed that there is no spatial conflict between those two layers. No cultural heritage site is presented in the vicinity of 1 kilometer from planned measures. Not a single object of cultural heritage is represented in the vicinity of 1 kilometer from the planned priority basic measures<sup>41</sup> (see Map 7).

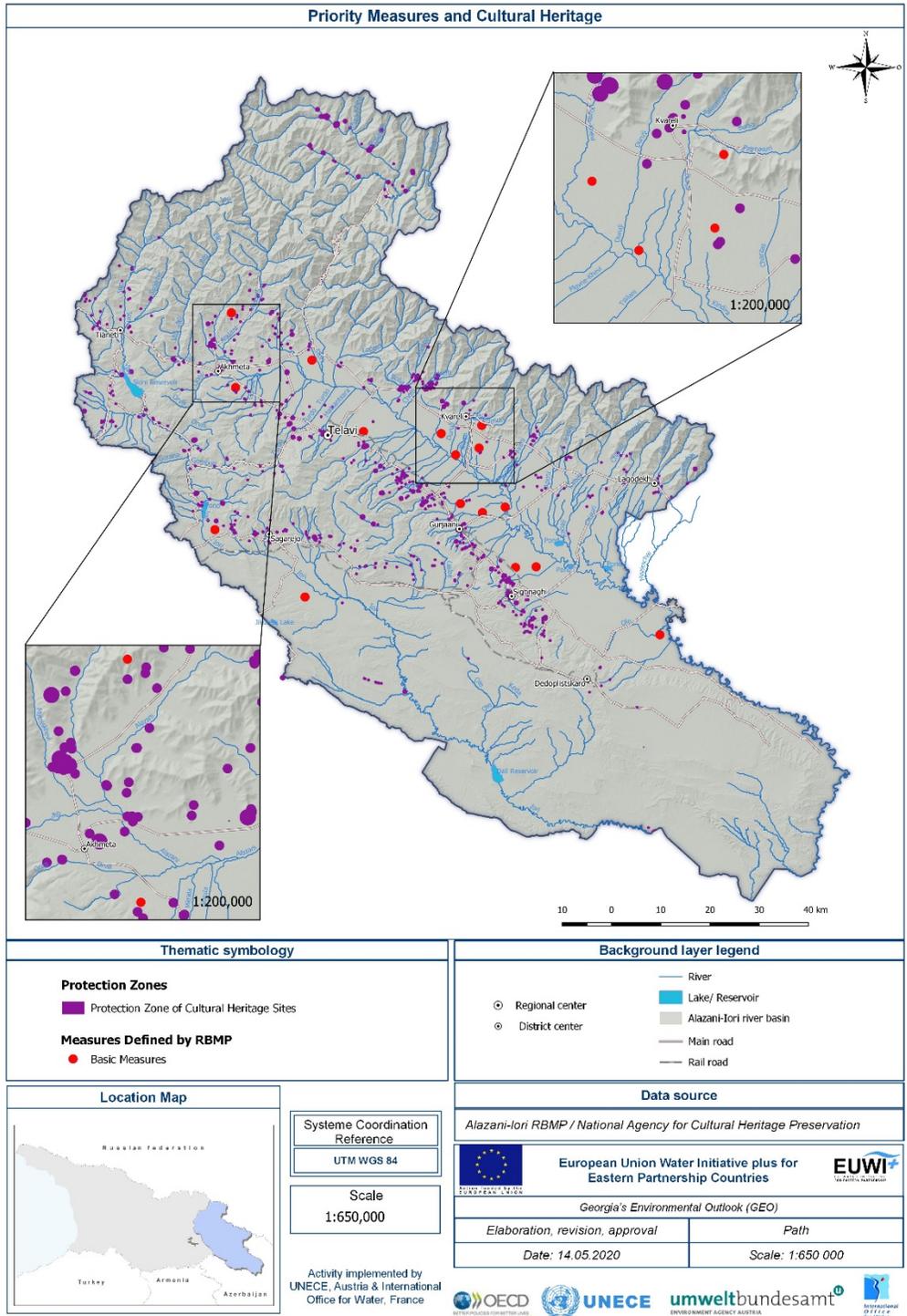
In the end, **it can be stated that there is no direct link between the planned measures (RBMP) and existing objects of cultural heritage.** Consequently, the implementation of measures does not imply any impact on existing cultural heritage sites.

Despite the above-mentioned, there is a possibility that implementation of basic measures (construction, rehabilitation, and earthworks) may affect previously undiscovered archeological remains near or within water bodies. Therefore, measures to minimize this risk have to be adopted and followed (see Chapter 6).

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<sup>41</sup> This is several times more than the protection zone of a cultural object defined by law. The protection zone of cultural heritage is - an area surrounding an immovable object of cultural heritage and/or the area within the extension or influence zone of the object of immovable cultural heritage determined in accordance with the procedures established by this Law, within which there is a special exploitation regime and which is designed to protect cultural heritage within its area from adverse impacts“ (Law on Cultural Heritage. Article 3). The territory surrounding a cultural property is defined as a primary buffer zone of the cultural property which consists of perimeters of physical and visual protection and is identified for the purposes of the physical and visual protection of the cultural property. Primary buffer zones are automatically established from the moment of listing. The statutory radius of a Physical Protection Area is defined as twice the maximum height of a monument, but no less than 50m. The statutory radius of a Visual Protection Area varies according to the category of a monument. Specifically, the monuments located in urban areas are protected with a Visual Protection Area of 150m from its outer contour, the Visual Protection Area of the monuments of national importance is 250m, these distances double in rural areas and are respectively 300m and 500m. The World Heritage Sites enjoy the greatest degree of protection with 1000m Visual Protection Area (Law on Cultural Heritage. Article 36).

**MAP 7. ANALYSIS OF LIKELY SPATIAL CONFLICTS BETWEEN ALAZANI-IORI RBMP PRIORITY MEASURES AND CULTURAL HERITAGE OBJECTS**



## 6. MITIGATION MEASURES PROPOSED BY SEA<sup>42</sup>

Following the conclusions of the evaluation of the likely effects, the SEA has to formulate measures to avoid, mitigate or compensate the likely adverse effects of the analyzed plan/programme as well as measures to enhance the likely positive effects.

There are two types of mitigation measures proposed by SEA and listed below for each environmental and health issue, which may be affected by the RBMP:

1. Measures to be considered in the RBMP (i.e. before it's approval or adoption): these include the proposals for additional measures or activities to be considered when finalizing the RBMP (and in particular the PoMs with measures selected for the first implementation cycle);
2. Measures and conditions that should followed up by a relevant agency when implementing RBMP measures. It includes also studies and research to be conducted – as a part of the RBMP implementation – to provide a solid basis for decisions on specific RBMP projects and activities. Implementation of these measures and conditions should be supervised by the MEPA.

### 6.1. WATER RESOURCES

#### ***Measures to be considered in the RBMP***

- The RBMP measures deemed/proposed for addressing the hydro-morphological alteration of rivers should include analyses of the impacts of river sand and gravel mining on specific areas. The analyses should result in determining the amounts of inert materials that can be mined from specific rivers to ensure the proper functioning of rivers and maintenance of ecological, hydrological, and morphological integrity.
- Considering the intensive mining of the sand/gravel in the basin, it is important to address the sustainable management of sand/gravel extraction. Therefore, an emphasis should be placed on setting up the monitoring plans/measures that will provide data/information on changes in sand/gravel extraction or sediment transport capacity. Such information will enable the authorities to evaluate the long-term effect of mining activities on water bodies both upstream and downstream of the sand extraction sites and propose relevant mitigation measures or management measures e.g. regulations to keep natural conditions of rivers in the basin.
- Processing of sewage sludge produced in wastewater treatment plants and using it as a secondary product (sludge management); the development of technical regulations for sewage sludge processing.
- In order to enhance the efficiency of water resources use, the training and awareness-raising programs envisaged by the draft RBMP should also include best practice examples and knowledge sharing activities on how to optimize the use of irrigation water (e.g. irrigation at critical stages of crop growth, during droughts, irrigating at night, etc). Also, pilot projects on efficient use of water resources for all type of water users in the region should be supported to disseminate and increase the knowledge and strengthen the skills of the local population, which will also contribute to better preparedness to mitigate or adapt to the likely consequences of climate change.

#### ***Measures and conditions for the RBMP implementation***

- As a part of designing the drainage rehabilitation projects, the computational models for the drainage networks should be tested with several rainfall scenarios, including potentially dangerous scenarios (i.e. extreme situations including heavy and sudden rainfall), and the selected rehabilitation design should therefore consider the worst possible scenario.

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<sup>42</sup> The document uses the term “mitigation measures” in accordance with Art. 26.2(f) of the Environmental Assessment Code of Georgia the SEA report should contain “measures for preventing, reducing or mitigating the potential impact on the environment and human health resulting from the implementation of the strategic document”. Therefore “mitigation measures” have to be distinguished from the “recommendations” regarding the SEA report and the draft strategic document (Art. 27.7 of the *Environmental Assessment Code* of Georgia, recommendations should be issued by the Ministry of Environmental Protection and Agriculture and the Ministry of Internally Displaced Persons from the Occupied Territories, Labour, Health and Social Affairs of Georgia at the end of the SEA procedure).

- EIAs to be carried out for rehabilitation or construction of new drainage systems should consider suitable drainage water treatment methods and discharge points location and analyze reasonable alternatives. The alternatives may include e.g. treatment lagoons, constructed wetlands, and stabilization ponds.

## 6.2. NATURAL HAZARDS

### ***Measures to be considered in the RBMP***

In order to improve preparedness to natural hazards (in particular floods/flash floods), preparation of the action plan for the rehabilitation of dams/reservoirs should be proposed in the RBMP, along with a dedicated study on the technical conditions of the dams/reservoirs (especially those used for irrigation purposes) to determine the state of potential structural damage of dams/reservoirs.

### ***Measures and conditions for the RBMP implementation***

- Potential for water abstraction/impoundment (for the purpose of abstraction and impoundment regulation) should be calculated and assessed specifically for each river in the basin considering their hydrometric and morphological characteristics.
- Sediment management/sediment transport measures should be based on the results of the study of their characteristics, including volumes, velocity, etc.
- To ensure the improvement of sediments transport continuity via dam management, at the first stage, it is important to conduct research and identify the condition of dams/reservoirs e.g. conditions of spillway gates. Spillway gates of the water reservoirs shall be rehabilitated to ensure sediment transport continuity. A relevant study covering the direction and velocity of sediment transport, volumes of transported materials shall be carried out. It is also important to study and determine the near-natural conditions (velocity and amounts) of rivers based on which proper continuity of sediment transport can be ensured.
- To maintain moderate river flow, envisaged by the RBMP, the amount of moderate flow shall be determined at the first stage. The amount of moderate flow required for meeting the demands of water-dependent economic activities shall be determined on the basis of hydrological monitoring data. However, the density of the hydrological network in the Alazani-lori River Basin is not sufficient to provide adequate data for the determination of moderate river flow. Therefore, it is recommended for the RBMP to determine moderate flows for each river considering the best national and international methodologies/practice. Monitoring of moderate flow shall be also ensured by relevant authorities.
- Additional hydrological observation stations shall be deployed in the basin in areas that are prone to mudflows, floods, water intake-discharge points, downstream and upstream of water reservoirs of HHPs, etc. In particular, hydrological observation stations (water level measurements) should be located along with the lori river: in the upper and lower reaches of the Sion Reservoir, in the lower and upper reaches of the Paldo Reservoir, in the upper and lower reaches of the Dali Mountain Reservoir, and on the irrigation canals of the lori river basin. Hydrological observations stations should be located in the Alazani basin: on main irrigation canal of the Alazani river, lower and upper reaches of the Samkuristskali 1 HPP, on the rivers Ilto, Stori, Turdo, Lopota, Intsoba, Chelti, Shromiskhevi, Duruj, Bursa, Chermistskali, Kabali, Ninoskhevi, and Lagodekhiskhevi. Hydrological monitoring stations in these areas will, on the one hand, allow determining the annual runoff of rivers (required to determine the moderate environmental flow) according to which the management of water resources for irrigation, drinking, and energy purposes should be decided; on the other hand, all these areas are prone to flooding and mudflows, therefore, access to proper information is necessary to manage and mitigate the adverse effect of natural hazards in these areas.
- Hydraulic engineering measures should have a comprehensive character involving the rehabilitation of all hydraulic structures including gabions, bank protection structures, mudflow control structures to contribute to the restoration of the morphology of a river channel. The Alazani River bank between the Georgian-Azerbaijan border subject of intensive erosion needs immediate attention and installation of bank protective infrastructure to avoid or mitigate the further loss and degradation of the hectares of agricultural land resulting from intensive river erosion. A more detailed assessment of areas e.g. water bodies under the risk of climate-induced natural hazards

is needed for setting effective adaptation measures e.g. infrastructure and bank protection measures best suitable for that particular water body. The priority should be given to a combination of structural and non-structural protection measures e.g. bioengineering, floodplain forests to mitigate risks caused by further activation of climate-induced natural hazards. Therefore, it is recommended to conduct a detailed assessment of areas under the risk e.g. those water bodies that are at risk and study the possibility of non-structural infrastructure measures in combination with structural measures where relevant.

- The Alazani-lori River Basin is prone to strong mudflow events, therefore regular geological monitoring studies shall be carried out (focused on the determination of recurrence periods of mudflows, amounts of inert materials accumulated in river gorges, the velocity of activated debris flows, potentially affected human settlements, etc.) to plan and design the measures for the rehabilitation of mudflow control structures. Mudflow control structures shall be built in the middle course of all rivers that are prone to the occurrence of mudflows to protect human settlements and infrastructure. Preference should be given to the Kherkheulidze type protection dams, that are perfectly suited for the Alazani-lori river basin. Some river channels that are prone to mudflows pose especially dangers, including Duruji, Telaviskhevi, Kabali, Lagodekhiskhevi, Shromiskhevi, Ninoskhevi, Avaniskhevi, Turdo, Khodashniskhevi. The rehabilitation of mudflow control structures of Duruji and Telaviskhevi river channels is crucial.
- On the basis of the results of hydrological, meteorological, and geological monitoring, the location of early warning systems should be determined. Potential locations include the areas that are most sensitive to natural hazards. Data of hydrological monitoring shall be used to build simulation models of inundation, flood, flashflood, and mudflow processes and obtained results shall be used for identification of potential locations of early warning systems. Early warning systems will help avoid the negative impacts of expected natural hazards by providing timely and reliable information.
- Early warning systems shall be implemented at all respective infrastructure and settlements located in high-risk zones, to avoid the damage of infrastructure and potentially human deaths in case of natural disasters. Early warning systems shall be also implemented downstream of all water reservoirs and in the gorges of high-risk rivers including Duruji, Lagodekhiskhevi, Ninoskhevi, Shromiskhevi, Chelti, Stori, Telaviskhevi, Tudro, and Khodashniskhevi.
- Hail causes serious problems in the Kakheti region and therefore, risks caused by this natural event should be further studied and relevant measures should be identified to protect the population, infrastructure, and agriculture lands of the Alazani-lori River Basin from its negative impact. For this purpose, it is recommended to establish a working group to work on this issue and improve anti-hail systems that will mitigate or avoid the destructive effects of hail.

### 6.3. CLIMATE CHANGE

#### ***Measures to be considered in the RBMP***

- Rehabilitation of existing and setting up new irrigation systems is recommended to be implemented first in Sagarejo and Dedoplistskaro, where drought represents the most significant problem within the basin, followed by Signnagi, Akhmeta, and Gurjaani municipalities.
- Implementation of activities (i) on testing and promoting new drought-resistant crop varieties in Kakheti is advised; and (ii) to increase the awareness on such approaches among farmers, respective measures should be included in the RBMP.

#### ***Measures and conditions for the RBMP implementation***

- A study/research should be assigned on how to adapt to the agriculture sector in the basin to the likely consequences of climate change.

### 6.4. BIODIVERSITY, HABITATS AND PROTECTED AREAS

#### ***Measures to be considered in the RBMP***

- To increase positive impacts on biodiversity, the establishment of the organic farms should be promoted in agriculture areas within the SPAs and around the Korugi and Iori Managed reserves, as well as around Alazani proposed emerald sites (rivers Inaboti, Apeni, Ole, etc.)

and adjacent areas to the Alazani Natural Monument and Vashlovani National Park (villages Sabatlo, Pirosmani).

- Special studies to identify the most threatened freshwater species, as well as to assess the main impacts and threats on freshwater biodiversity within the Alazani-lori river basin should be included among the RBMP measures for the first implementation cycle.
- Special measures are proposed by the RBMP for the Dali Reservoir that will have a positive effect on the lori floodplain forests. However, none of these measures are selected to be implemented during the 1st implementation cycle. Considering the importance of the Dali reservoir for biodiversity composition, it is highly recommended to include measures related to the Dali reservoir in the first implementation cycle of the RBMP.

### ***Measures and conditions for the RBMP implementation***

- It is recommended to identify ecologically priority zones, trade-off zones, and zones with no particular restrictions or conservation interest of the floodplain forest areas along the entire length of the lori and Alazani Rivers. This zonation scheme may serve as the basis for complying with development targets and improving the rivers' ecological status<sup>43</sup>. Zonation scheme also may set a foundation to identify priority areas for floodplain forest restoration measures.
- The EIA for the WWTP project should cover a detailed analysis of impacts on biodiversity, including the Red List species. Field surveys shall be conducted to identify flora and fauna species, especially the Red Listed species that may be affected by the construction activities.
- When setting new infrastructure (e.g. WWTPs or new sewerage systems), selection of the location of this new infrastructure including wastewater discharge points should be based on the analysis of the site alternatives (optimally to be carried out as a part of EIA), which should consider following criteria:
  - sites with already modified habitats and secondary vegetation should be preferred;
  - sites with sensitive habitats (forests, wetlands, less modified areas) should be avoided;
  - sites with the presence of Red Listed species should be avoided.
- Sagarejo city can be considered as one of the priority areas for constructing the WWTP.
- Maintenance of the environmental flow as well as lifecycle and conservation requirements of the key species and habitats should be considered in the design of the abstraction licensing /control system. Limits for the water abstraction should be defined and licenses should be issued within the limits to ensure that sufficient amount of water is maintained in the water bodies enabling a long-term survival of water dependent species and habitats.
- Special studies could be recommended to be carried out to assess the impacts of hydromorphological alteration of rivers, water abstraction and water pollution on species and habitats protected within Korugi and lori Managed reserves, based on which appropriate conservation measures should be planned.
- EIA for development projects, which requires water abstractions/impoundments should give special consideration to the assessment of the potential cumulative effects of water abstraction/impoundments on biodiversity, taking into account other ongoing or planned development in the catchment area.
- Detailed studies and assessments on fish and invertebrate fauna should be carried out as a part of the planning and designing the projects on sediment transport improvement. For example, such studies should be conducted before implementation of the measures related to Dali Reservoir such as restoration of the natural flooding regime and improvement of the infrastructures (for instance shield restoration).
- Protection of spawning areas for fish species should be addressed by material removal and sediment extraction regulation. The operation of machinery for material removal and sediment extraction into the river stream must be restricted. Arrangement of protective barriers between excavation areas and water stream should be required.

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<sup>43</sup> The recommendation is developed based on the case study – Hydromorphological restoration priorities in Austria presented in the Guidance document on the requirements for hydropower in relation to EU Nature legislation, European Commission, 2018.

- The Agency of Protected Areas, administrations of the Iori and Chachuna Managed Reserves and other stakeholders active in the field of nature protection should be involved in the planning and design of the projects on riparian habitats improvement and diversification to avoid any unexpected impact on the natural tugay forest habitats along the Iori River.
- It is recommended to avoid livestock grazing not only in water protection zones but also in floodplain forests. Development and implementation of pastures management plans, especially within protected areas and emerald sites is highly recommended.

## 6.5. HEALTH

### ***Measures to be considered in the RBMP***

- In order to strengthen the positive effects of the public campaigns promoting efficient water use by domestic customers, the following topics are suggested to be included in the communication plan (preparation of which is proposed by the RBMP):
  - Information regarding the risks associated with discharging household wastewater;
  - Advantages of the use of modern appliances (such as a dishwasher, washing machine, etc.) for efficient use of water;
- Preparation of a system of monitoring and elimination of incidences (including their timely detection, reporting, etc.) should be included in the supplementary measures proposed by the RBMP "Implementation of water resources monitoring program and environmental inspection controls".

### ***Measures and conditions for the RBMP implementation***

- As a part of the infrastructure project preparation, the medical emergency management plans should be prepared to address specific health hazards the workers can be exposed to. The plans should provide a scheme of actions to (i) timely detect injury or exposure, (ii) provide immediate medical assistance at the site, (iii) ensure the transport to the nearest, adequately equipped and staffed healthcare facility for additional medical assistance, if needed.
- A temporary shortage of water output to household and healthcare facilities, which represents a risk during construction works should be addressed by ensuring alternative water supply as well as proper and early communication and public information campaigns.
- Due attention and controls should be implemented in order to avoid contamination of drinking water sources during the construction works in order to avoid supply of unsafe water and avoid waterborne diseases.
- For the cases of water pollution/contamination incidence, an early warning and notification system should be established to inform the local population about the situation, and ensure that contaminated water is not used for drinking, cooking, household chores, or recreational purposes.

## 6.6. SOCIO-ECONOMIC ASPECTS

### ***Measures to be considered in the RBMP***

- Development of a system of environmental fees to cover costs related to the implementation of measures should be included among the Alazani-Iori RBMP measures gradually with a short- and long- term perspectives. Introduction of fee system is needed to sustain the measures. Maintenance of the system as well as periodic measures (technical inspection/study, etc.) requires considerable resources. In addition, without proper maintenance, amortization of certain engineering systems will be accelerated. Moreover, capital costs will not be recovered and the system will be demolished soon, with no resources left to rehabilitate the system again.

### ***Measures and conditions for the RBMP implementation***

- Employment of the local community members in the implementation of the RBMP-related activities (e.g. construction works, operation of WWTTPs) should be a priority. In order to enhance working skills and capacities of the local population, a special campaigns and capacity development activities (training, workshops, etc.) should be provided to the local workforce.

- Introducing fees on the water abstraction (as envisaged by the new draft Law on Water Resource Management), will considerably reduce water losses and inefficient use; however, certain recommendations should be followed:
  - Economic incentives (access to funds, technologies, etc.) will be needed to promote efficient and sustainable water use practices as well as to change current unsustainable practice and to switch to water-efficient technologies.
  - Special awareness-raising and knowledge transfer campaign via training workshops (e.g. as a precondition for applying for the special fund), workshops, information dissemination via local TVs, web-pages, newspapers, information stands, leaflets, and other means of communication should be arranged in order to reduce excessive use.
  - Efficient fee system for irrigation service needs to be introduced as soon as the system is rehabilitated or new ones become operational so that the maintenance, as well as the capital costs, is recovered and the service becomes cost-effective.
- Training and information campaigns on environmental aspects for the local stakeholders should be established, which should enable to:
  - Improve decision-making process for sustainable use of water resources, as well as stakeholders' participation in the management of the Alazani-Iori River Basin.
  - Inform the local population about the outputs and results of improved environmental monitoring and supervision/inspection systems;
  - Inform the local population about potential future issues related to the environment (e.g. likely consequences of the climate change and necessary adaptation measures).

## 6.7. CULTURAL HERITAGE

### **Measures and conditions for the RBMP implementation**

- The legal requirements stipulated by the Law on Cultural Heritage have to be followed in the design and implementation of those RBMP measures requiring construction and earthworks. The likely impacts on the cultural heritage (in particular on previously undiscovered archeological remains near or within water bodies) should be analyzed in EIAs.

## 6.8. HYDROPOWER DEVELOPMENT

*Although the RBMP does not promote further development of the hydropower in the basin, the construction of perspective HPPs, which is planned in the basin, will have significant impacts on certain environmental and health issues addressed in the SEA. Therefore, SEA formulated following recommendations to address selected environmental aspects of the future hydropower development in the basin:*

- Up to 5 HPPs are planned to come into exploitation in the Alazani-Iori Rives Basin in the 5-year period and additional HPPs are expected to be built in a long-term perspective. Therefore, in order to address likely cumulative effects, SEA should be assigned for the relevant strategic document prepared in energy sector, which will address hydropower development in the basin. The SEA should include an analysis of cumulative impacts of existing and planned hydropower plants on surface water availability, considering climate change scenarios to avoid water shortage for other surface water users in the basin.
- Environmental flow is crucial for maintaining the river morphology and its habitats, as for the determination of amounts of water to be released into irrigation systems and impounded in water reservoirs. The rate of environmental flow established in the Georgian legislation (10% of average multiannual flow) does not ensure the maintenance of river morphology as the approach of calculation of environmental flow is outdated (it is based on the Soviet standards and norms, and does not meet modern requirements<sup>44</sup>). Therefore, the calculation of

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<sup>44</sup> Many rivers of the Alazani-Iori River Basin either have never been studied from the hydrological point view, or the observation time is not sufficient. Therefore, the average annual runoffs of these rivers have to be determined using two methods. The first method is provided in "Renewable energy resources of Georgia" (Возобновляемые энергоресурсы Грузии). According to this method, the module of river runoff corresponding to the average elevation of the study river basin, which is used to determine average multiannual runoff of the river, is derived from a discharge rating curve built for the location of the study river basin.

environmental flow (carried out separately for each river) should be based on international practice/methodology and formulated as a law (the value of environmental flow should be integrated into the legislation and subjected to regulation). It is also important to strengthen the monitoring of environmental flow at upstream and downstream of water reservoirs, HPPs and irrigation systems.

- The cumulative impact of new HPPs development on environmental flow should be determined, taking into account likely consequences of climate change including potential reduction of water flows, especially during prolonged droughts. Without understanding and setting proper environmental flow considering climate change impact on flow, the baseline planning e.g. HPPs construction and other water-dependent economic activities will not be effective in the Alazani-Iori River Basin.
- An assessment of the cumulative effects of existing and planned HPPs on fish migration should be carried out to avoid further reducing or interrupting rivers continuity for fish migration.

## 7. SYSTEM OF ENVIRONMENTAL AND HEALTH MONITORING

This chapter lists the indicators to be used to monitor the environmental and health effects during implementation of the RBMP.

However, as the SEA report suggests a number of measures to be considered during implementation of the RBMP, this chapter also outlines the scheme to be established to monitor and report on how the SEA measures are implemented.

It is assumed that an overall monitoring system to oversee implementation of the RBMP will be established under coordination of the Ministry of Environment Protection and Agriculture and shall invite a wide range of other governmental agencies. Below proposed system of SEA monitoring and reporting should optimally be integrated in such overall RBMP implementation monitoring system.

### 7. 1. MONITORING OF ENVIRONMENTAL AND HEALTH EFFECTS DURING THE IMPLEMENTATION OF THE RBMP

The indicators listed below are linked to the key environmental and health issues and likely RBMP effects on these issues. Consistent monitoring of these indicators should assist to the successful implementation of the RBMP and provide early warning in case of unintentional negative side-effects.

It is recommended that the regular (e.g. annual – but the periodicity depends on overall monitoring system for the RBMP implementation) monitoring reports on below indicators should be prepared during implementation of the RBMP and published.

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The second method to determine average annual runoffs is provided in the monograph "Water balance of Georgia" ("Водный баланс Грузии", Л.А.Владимиров, Д.И.Шакаришвили, Т.И.Габричидзе, Academy of Sciences, Tbilisi, 1974). According to this method, the runoff depth corresponding to the average elevation of the study river basin, which is used to determine average multiannual runoff of the river is derived from the curve describing the relationship between the average heights of the river basin and runoff depths.

Both methods have been adopted and tested in the Caucasus. These methods are used for relevant calculations in Georgia. However, it shall be noted, that the best international methods for the calculation of average runoffs of those rivers, that have never been studied, have to be introduced along with the above-described methods.

**TABLE 11. ENVIRONMENTAL AND HEALTH INDICATORS**

Key issues	Indicators	Source of data	Responsible agencies
<b>Water Resources</b> <sup>45</sup>	Number WWTs/length of sewage system newly constructed or rehabilitated	Ministry of infrastructure and regional development of Georgia Municipalities Budget performance reports	Ministry of Infrastructure and Regional Development of Georgia Municipalities
	Length of rehabilitated/newly constructed irrigation network (km)	Georgian Amelioration. Note: in most cases Georgian Amelioration is a source of water reservoir related data, however certain water reservoirs in Georgia are owned by private companies, and therefore these companies are responsible for relevant data.	Georgian Amelioration (in case of water reservoirs, managed by Georgian Amelioration, however certain water reservoirs in Georgia are owned by private companies, and therefore these companies are responsible for their management and maintenance).
	Number of rehabilitated water reservoirs/dams	Georgian Amelioration. Note: in most cases Georgian Amelioration is a source of water reservoir related data, however certain water reservoirs in Georgia are owned by private companies, and therefore these companies are responsible for relevant data.	Georgian Amelioration (in case of water reservoirs, managed by Georgian Amelioration, however certain water reservoirs in Georgia are owned by private companies, and therefore these companies are responsible for their management and maintenance).
	Number of hydrological and groundwater monitoring stations expanded	National Environmental Agency (NEA)	National Environmental Agency (NEA)
	Number of local population/farmers involved in good practice sharing trainings/knowledge sharing and pilot projects	Reports of relevant agencies conducting the trainings	Relevant agencies conducting the trainings e.g. LEPL Environmental Information and Education Centre, local NGOs, contractors, etc.
<b>Natural Hazards</b>	Number of rehabilitated mudflows retaining structures	National Environmental Agency (NEA) Motor Roads Department of the Ministry of Regional Development and Infrastructure.	National Environmental Agency (NEA)  Motor Roads Department of the Ministry of Regional Development and Infrastructure.
	Areas of lands lost or protected from river bank erosion	Local municipalities. Roads Department of the Ministry of Regional Development and Infrastructure. ( <a href="http://www.georoad.ge/uploads/files/debuleba56.pdf">http://www.georoad.ge/uploads/files/debuleba56.pdf</a> )	National Environmental Agency (NEA) Roads Department of the Ministry of Regional Development and Infrastructure.

<sup>45</sup> This table does not include a full range of monitoring indicators regarding water resources, as water resources monitoring is already covered in the RBMP (e.g. indicators for chemical monitoring of water quality, hydrobiological monitoring, and hydromorphological monitoring).

	Rehabilitated and new river bank protection structures	Local municipalities. Roads Department of the Ministry of Regional Development and Infrastructure. ( <a href="http://www.georoad.ge/uploads/files/debuleba56.pdf">http://www.georoad.ge/uploads/files/debuleba56.pdf</a> )	National Environmental Agency (NEA) Roads Department of the Ministry of Regional Development and Infrastructure
	Early warning systems	National Environmental Agency (NEA)	National Environmental Agency (NEA)
	Surveillance monitoring system expanded	National Environmental Agency (NEA)	National Environmental Agency (NEA)
<b>Climate change and related risks</b>	Change in ground and surface water flows at observation stations	National Environmental Agency (NEA)	National Environmental Agency (NEA), MEPA
	Specific climate change impact studies on the basin	Assessments/reports prepared under donor funded projects National Environmental Agency (NEA)	Ministry of Environment Protection and Agriculture
<b>Biodiversity, habitats and protected areas</b>	Area of floodplain forests in Alazani basin (ha)	Satellite images	Ministry of Environment Protection and Agriculture, LEPL Protected Areas Agency
	Area of floodplain forests in Iori basin (ha)	Satellite images	Ministry of Environment Protection and Agriculture, LEPL Protected Areas Agency
	Species composition of floodplain forest (and in particular upstream and downstream of the Dali reservoir)	Special survey	Ministry of Environment Protection and Agriculture, LEPL Protected Areas Agency
	Population trends for selected aquatic species – <i>Lutra lutra</i> , <i>Salmo fario</i> , <i>Oxynoemachelius alasanicus</i> , and <i>Sabanejewia aurata</i> <sup>46</sup>	Special survey	Ministry of Environment Protection and Agriculture

<sup>46</sup> These species are target species for identification of freshwater KBAs in Caucasus (WWF, 2015: Promoting Sustainable Dam Development at River-Basin-Scale in the Southern Caucasus). *Lutra lutra*, *Salmo fario*, and *Sabanejewia aurata* are also included in the Red list of Georgia as vulnerable species.

<b>Soil</b>	Soil areas used for agriculture purpose (sq.m)	Donor funded projects LEPL Scientific Research Center of Agriculture	Ministry of Environment Protection and Agriculture
	Number of monitoring points for controlling soil quality (physical-chemical parameters (nutrient, heavy metals, pH, salinity, etc.), organic compounds (pesticides, etc))	LEPL National Environmental Agency (NEA)	LEPL National Environmental Agency (NEA) MEPA
<b>Public health</b>	Number of water-borne diseases in Kakheti region	Health monitoring system <sup>47</sup>	National Centre of Disease Control and Public Health
	Number of medical facilities in the districts affected by infrastructural projects within RBMP	Special survey <sup>48</sup>	Various agencies implementing the RBMP activities
	Presence of healthcare management plan at the sites of infrastructural projects within RBMP	Survey or monitoring visits to check that healthcare management plan is available at all infrastructural project sites.	Various agencies implementing the RBMP activities
<b>Socio-Economic factors</b>	Number of persons from the local population employed full or part-time in implementation of the RBMP.	Periodic assessment/fulfilment reports of the fulfilment of the measures considered under RBMP	Ministry of Environment Protection and Agriculture, Various agencies implementing the RBMP activities
	The number of populations in the river basin.	Annual Official statistics, general Population Census Data by municipalities of the River Basin	National Statistics office of Georgia
	Economic performance sectors related to Kakheti region	Annual Official statistics	National Statistics office of Georgia

<sup>47</sup> As of 2019, monitoring system was not in place; although, according to National Environmental Health Strategy, this system should become functional by 2020 (Strategic objective: MTO 1.2 – 2: Establish the effective surveillance systems on waterborne diseases and drinking water (by 2022). After the system becomes function, the data should be used to monitor impact of the quality of water on human health.

<sup>48</sup> Provided that there is no routine source of information, a dedicated survey should be carried out to get relevant data for this indicator.

<b>Cultural Heritage</b>	Number of cases of physical damage of the cultural heritage assets and its features related to RBMP activities	Post-project analysis reports	Various agencies implementing the RBMP activities
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## 7.2 MONITORING OF IMPLEMENTATION OF SEA MEASURES

It is recommended that the regular (e.g. annual – but the periodicity depends on overall monitoring system for the RBMP implementation) monitoring reports regarding implementation of SEA measures should be prepared during implementation of the RBMP and published. The reports should cover following information:

- The RBMP measures/activities implemented during the reporting period.
- The relevant SEA measures and how these have been implemented.
- Further comments and future actions.

The above information can be presented in a tabular format as shown in Table 14, which also includes several examples on the type of information to be included in the report.

**TABLE 12.** IMPLEMENTATION OF SEA MEASURES

RBMP measures/activities implemented during reporting period	Relevant SEA measures	How SEA measures have been implemented	Comments/further action required
<b>Construction of the wastewater treatment plant in location XY.</b>	The wastewater treatment plants should not be located in biodiversity sensitive areas.	Location XY is located approx. 3km from the site, where several Red list species have been observed. The detail survey was carried out as a part of EIA and the likely adverse effects on these species were not identified.	Further monitoring of Red list species population should be ensured.
<b>Rehabilitation of irrigation systems</b>	Rehabilitation of existing irrigation systems is recommended to be implemented first in Sagarejo (Udabno) and Dedoplistskaro where drought is the biggest problem, followed by Sighnagi, Akhmeta, and Gurjaani municipalities.	Irrigation systems in Sagarejo and Akhmeta were rehabilitated so far, while Dedoplistskaro and Sighnagi are in the list for the next implementing period.	Preparation of the projects on rehabilitation of irrigation systems in Akhmeta and Gurjaani municipalities should be launched next year in order to secure allocation of funds from the national budget.
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## ANNEXES

Annexes are provided in the separate document.

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