



# QUANTITATIVE WATER MANAGEMENT PLANNING PILOT EXPERIENCE IN KASAKH RIVER BASIN, ARMENIA

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### **DESCRIPTION OF KASAKH RIVER BASIN**

- Located in the Aragatsotn, Armavir, and Kotayk regions of the Republic of Armenia.
- The length of the Kasakh river: 89 km
- The catchment area is 1480 km<sup>2</sup>.
- Number of population: ~76,000
- Water-related challenges:
- Lack of monitoring data and data management mechanisms;
  - Inadequate condition of hydrotechnical structures;
  - Lack of water saving and reuse mechanisms;
  - Inadequate quality of irrigation water;
  - Absense of wastewater treatment;
  - Quantitative management of water resources has not been set up on a basin level.

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#### ON WHAT CRITERIA KASAKH RIVER BASIN WAS CHOSEN?

- Be a clear hydrographic entity facing quantitative issues (one water table or sub-basin): the unit should be in significant deficit justifying the specific effort of the local planning.
- Ideally the need of reinforced quantitative management plan should be identified in the RBMP developed under EUWI+ project (districts Sevan, Hrazdan, Akhuryan): In a RBMP, a local QMP can be seen as one meta measure to be implemented. It can also concretely support a CC adaptation strategy implementation.
- Start with a basin where the water use issues are not or not significantly connected to the transboundary situation. However, this instrument could be used to discuss and set transboundary water use and water saving objectives.
- A basin where hydrological and water abstraction data is ideally well documented. Water accounting experience could be a good instrument to bridge the data gap and calculate water use estimates based on no water related statistics.
- Ideally, where the water users are already organized in the form of a water user group or local basin committee.





## **METHODOLOGY**

- Identifying nodal points in the basin
- Estimating water balance per nodal basin
- Estimating water use per nodal basin
- Calculating the environmental flow per nodal basin and test the use QMNA5 statistic approach
- Setting up the target minimum flows limits conditioned to certain actions by the management body
- Discriminate drought risk from scarcity management



EU4Environment in Eastern Partner Countries: Water Resources and Environmental Data (ENI/2021/425-550)

#### **Development of a Quantitative Water Resources Management Plan for** Kasakh Sub-basin of Armenia



EXECUTIVE SUMMARY







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## USING NODAL POINTS FOR THE BREAKDOWN OF THE BASIN

Nodal points or junction points have been selected based on hydrography of the basin taking into account the inflows of main tributaries into Kasakh River.

8 nodal points have been identified:

- 1. Upper flow of Kasakh River, Kasakh-Vardenis hydropost
- 2. Aparan Reservoir area, Aparan dam
- **3.** Middle flow of Kasakh River, the point of Inflow of Amberd River
- 4. Lower flow of Kasakh River, the mouth
- 5. Gegharot River mouth (inflow to Kasakh)
- 6. Apnagyugh River basin (inflow to Kasakh)

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- 7. Shahverd River basin (inflow to Kasakh)
- 8. Amberd River basin (inflow to Kasakh)



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### ESTIMATION OF ENVIRONMENTAL FLOW (ARMENIAN METHOD)

- Monthly environmental flow is being calculated using the provisions of RA Gov't Decision 57-N from January 25, 2018,
- When determining the value of the environmental flow in the areas of the currently operating hydrological observation points of the studied rivers, the average discharge of 10 consecutive days with the multi-year lowest discharge in the winter period is taken as a basis.
- Taking into account the fact that there are no hydrobiological monitoring data in the rivers of the Republic of Armenia, a 33% of the multi-year average monthly natural minimum flow is added to env. flow, which is a "safety factor",
- In the case of reservoirs with a volume of 20 million sq. m and more, the average discharge of 10 consecutive days with the lowest discharge during the winter period is taken as environmental flow.

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### ESTIMATION OF QMNA5 (STATISTIC FRENCH HYDROLOGIC METHOD)

- To better understand the situation with water availability, with the recommendation of the International Office for Water (France), an additional water scarcity assessment indicator, QMNA5, was considered in this study.
- QMNA5 corresponds to a "minimum discharge with a probability of not reoccurring more than once every 5 years" or a "flow with a probability of being exceeded 4 out of 5 years").
- The probability of not reoccurring more than once every 5 years is assimilated to the risk of drought (no more than 2 events in 10 years).

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#### ESTIMATION OF WATER USES

Water use per nodal point is calculated based on the:

- Water use permit data received from the Ministry of Environment; and
- Irrigation water abstraction data received from the Water Committee of the Ministry of Territorial Administration and Infrastructure.

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## Water use permits

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#### WUA irrigated areas





#### WATER BALANCE AT NODAL POINTS

Water balance was calculated for each nodal point based on the raster models for precipitation, evaporation, and surface natural flow built on hydrometeorological observation data from Armhydromet



Precipitation, mm – Evaporation, mm – Surface Flow, mm = Deep Flow, mm

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#### **Drought risk management proposal for Armenia**







#### DROUGHT RISK MANAGEMENT PROPOSAL FOR ARMENIA

- Vigilance flow < Environnemental Flow + 50 % Water abstraction possible
- Alert flow < Environmental Flow
- **Reinforced alert flow** ۲ order < Environmental Flow – 30 %
- Crisis flow < Environmental flow -75% ٠

- 30 % water abstraction order
- 50 % Water abstraction
- Cessation of non vital water uses order (-100 %)



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### LESSON LEARNED FOR QUANTITATIVE WATER MANAGEMENT IN KASAKH RIVER BASIN

- Delineation of basin sections (by nodal points) is crucial for more targeted assessment of the situation and quantitative water management planning
- Environmental flow at nodal point is the key tool for assessment of water deficit. The hydrobiological component with the selection of reference species needs to be introduced for more precise evaluation of environmental flow.
- Focus on the quantitative water management must be on a dry period.
- Real-time data on river flow at nodal point and mechanisms for real-time data sharing between key actors are essential for managing drought crisis.
- Continuous monitoring of the flow rates against the threshold values supports the operative and efficient water management in the basin.
- Quantitative water management plan program of measure should follow the same structure as for the RBMP in order to ease the monitoring of the measures implementation at large basin or national scale.







#### FOR MORE INFORMATION:



#### Our work by countries

The "European Union for Environment" (EU4Environment) Programme aims at greening economies in six Eastern Partnership countries :





https://www.eu4environment.org/



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