

GROUNDWATER STATUS ASSESSMENT

Training Report – Armenia



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EU4Environment
Water and Data in Eastern Partner Countries

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ABOUT THIS REPORT

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ABOUT EU4ENVIRONMENT – WATER RESOURCES AND ENVIRONMENTAL DATA

This Programme aims at improving people's wellbeing in EU's Eastern Partner Countries and enabling their green transformation in line with the European Green Deal and the Sustainable Development Goals (SDGs). The programme's activities are clustered around two specific objectives: 1) support a more sustainable use of water resources and 2) improve the use of sound environmental data and their availability for policy-makers and citizens. It ensures continuity of the Shared Environmental Information System Phase II and the EU Water Initiative Plus for Eastern Partnership programmes.

The programme is implemented by five Partner organisations: Environment Agency Austria (UBA), Austrian Development Agency (ADA), International Office for Water (OiEau) (France), Organisation for Economic Co-operation and Development (OECD), United Nations Economic Commission for Europe (UNECE). The programme is principally funded by the European Union and co-funded by the Austrian Development Cooperation and the French Artois-Picardie Water Agency based on a budget of EUR 12,75 million (EUR 12 million EU contribution). The implementation period is 2021-2024.

<https://eu4waterdata.eu>

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List of abbreviations

ADA.....	Austrian Development Agency
BQE	Biological Quality Elements
DoA.....	Description of Action
DG NEAR.....	Directorate-General for Neighbourhood and Enlargement Negotiations of the European Commission
EaP	Eastern Partners
EC.....	European Commission
EECCA	Eastern Europe, the Caucasus and Central Asia
EMBLAS.....	Environmental Monitoring in the Black Sea
EPIRB.....	Environmental Protection of International River Basins
ESCS	Ecological Status Classification Systems
EU	European Union
EUWI+.....	European Union Water Initiative Plus
GEF.....	Global Environmental Fund
ICPDR	International Commission for the Protection of the Danube River
INBO.....	International Network of Basin Organisations
IOW/OIEau	International Office for Water, France
IWRM	Integrated Water Resources Management
NESB	National Executive Steering Board
NFP	National Focal Point
NGOs.....	Non-Governmental Organisations
NPD.....	National Policy Dialogue
OECD.....	Organisation for Economic Cooperation and Development
RBD	River Basin District
RBMP	River Basin Management Plan
Reps	Representatives (the local project staff in each country)
ROM.....	Result Oriented Monitoring
ToR.....	Terms of References
UBA.....	Umweltbundesamt GmbH, Environment Agency Austria
UNDP	United Nations Development Programme
UNECE.....	United Nations Economic Commission for Europe
WFD	Water Framework Directive

Country Specific Abbreviations Armenia

EMIC	Environmental Monitoring and Information Centre (until January 2020)
HMC.....	Hydrogeological Monitoring Centre (since February 2020)
MNP.....	Ministry of Nature Protection
SCWS.....	State Committee on Water Systems
SWCIS.....	State Water Cadastre Information System of Armenia
WRMA	Water Resources Management Agency

1. Main results / outputs of the training

In the training workshop on 2 and 3 February 2023 the following aspects have been discussed and elaborated:

1. the WFD requirements for the assessment of GW quantitative and chemical status,
2. the needs of the AM policy department for drafting the governance resolution,
3. the discussion of possible approaches with experiences from EU Member States.

Within the workshop, the requirements of the WFD and GWD (groundwater directive) and the groundwater monitoring situation and the legal framework in Armenia were presented. The needs of the Armenian experts in terms of implementing the WFD requirements according to the schedule of the SEPA were discussed and the discussion of options was illustrated with implementation examples from Austria.

It was finally recommended by all participants to continue this interdisciplinary discussion of experts from the different institutions. The setup of a national groundwater working group would be favourable which meets regularly and discuss all open issues step by step. Consider the available data, link with the Ministry of Health (drinking water). Further elaborate on the establishment of national methodologies and approaches for the assessment of groundwater chemical and quantitative status and include the specifications into national legislation. UBA offered support if needed.

A translated version of the Austrian ‘Ordinance on the Monitoring of the Quality of Water Bodies’ in Russian language is provided to the AM experts. The current German version can be accessed online.

<https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20005172>

More detailed points of discussion are summarised in Annex II.

1.1. Groundwater chemical status

Armenia suffers an almost 30 year groundwater monitoring gap after the collapse of the Soviet era. Since 2017 the number of sites and parameters increased up to 54 sites but there is no assessment system for GW chemical data in Armenia – no GW standards established and no methodology for status assessment.

In 2022 the AM Water Code was substantially amended and it is still necessary to develop GW norms for the status assessment until July/August 2024.

Together with representatives from the policy department the needs for drafting the respective governance resolution were discussed as well as options for specifications, based on the existing data in Armenia and the experiences gained in Austria within the implementation of the WFD. The following aspects were recommended to be tackled by the governance resolution and discussed by national experts beforehand:

1. Quality standards;
2. Threshold values for relevant pollutants and for relevant receptors (uses, ecosystems,);
3. Natural background levels;
4. Aggregation of monitoring values at site level;
5. Aggregation of site values at GWB level (acceptable pollution in the GWB and still good status);
6. Tests for status assessment; and
7. Trend assessment.

The Armenian experts explained that in particular, the Ararat valley suffers of intensive agriculture and many areas could be in poor status. Examples from AT were requested and discussed, how pesticide and nitrate pollutions are tackled.

1.2. Groundwater quantitative status

In Armenia groundwater quantity mainly an issue in the Ararat valley where 74 % of the AM GW resources are located and the network is dense. The main problem are the abstraction permits for fish farms and irrigation and the water needs of 180 settlements. Even the legal abstraction is too high in this area.

In the 1980s for 40 wells, which were drilled, 5000 l/s of sustainable GW abstraction was calculated. In the meantime, 500-600 additional wells were drilled and the abstraction raised 30000 l/s, which is not sustainable. Last year the level declined from 40 to 60 cm in an area of 1100 km². In 2016 a detailed inventory was made with the help of USAid. At that time fish farms were using 50000 l/s. Permits are usually issued for 1.5 years but can easily be prolonged. Reducing permits is politically not desired. The Ministry is in favour to fix permits, HMC rather prefers to change the permits. It is highly recommended to effectively limit permits in terms of their duration.

Within the discussion it was highly recommended that in particular in the Ararat valley where the legal permits are almost reaching the limits, the quantity of illegal abstractions should be estimated and considered in the risk and status assessment.

The current assessment of GW quantity is oriented towards the Soviet methodology of the overall stock of GW and the definition of the usable GW resources. Such assessment

lies within the Ministry of Territory and Infrastructure. GW is covered by the law for underground which is the reason why GW is assigned to this Ministry.

Currently, there are only 'soft' measures in the RBMPs and the plans will only be used as a basis for issuing water abstraction permits.

Mr Artashes Aghinian presented the methodology for assessing available groundwater resource in mountain regions of Armenia, which he developed with support of EUWI+. The method is limited to small rivers and areas with positive water balance (precipitation exceeds evapotranspiration). The presented water balance methodology is not applicable for intermountain or artesian basins. The available groundwater resource is defined as 50 % of natural groundwater resource.

Some of the presented requirements of the WFD were found new by the audience. The legal act on GW quantity was mentioned as quite important. There are considerable gaps in GW quantity monitoring. The EU agreement SEPA requires to move towards WFD. The RBMP approach prevails and AM should no longer follow the resource approach. Within the discussion, the mandatory WFD requirements were addressed and different options considered. The following aspects were recommended to be tackled by the governance resolution and discussed by national experts beforehand:

1. How to make the water balance test
 - a. with the GW levels? / pressure heads?
 - b. With the water balance assessment?
 - c. How to deal with artesian GWBs
2. Agreement on method for estimation of available GW resource
3. Abstraction data
 - a. Reliability of abstraction data
 - b. Outlook and further development of abstraction quantities
4. Criteria for risk and good status
5. Aspects related to Measures
 - a. Nature based solutions
 - b. High water losses;

2. Detailed discussion points

2.1. Groundwater chemical status

2.1.1. Groundwater monitoring and data assessment in Armenia

Armenia operates in total 119 groundwater quantity monitoring sites where 55 are also analysed on about 40 chemical parameters twice per year. Most of the sites are springs which are used for drinking water. Since 2017 the number of sites and parameters increased but there are still no GW standards established. The monitoring results are compared with the drinking water standards (corresponding decree) of the Ministry of Health, which are not covering all monitoring parameters. For the remaining substances no assessment is made. Currently, there is no assessment system for GW chemical data in Armenia. The monitoring results are summarised in annual reports. While preparing the RBMPs, monitoring results were compared with the nitrates directive and nitrate vulnerable zones were delineated.

Monitoring sites mainly belong to the communities and some are private. An amendment is currently under preparation to transfer ownership of all community sites to HMC. For private sites it is considered to establish servitude agreements.

Drinking water monitoring data belong to the Ministry for Health (no info on number of sites). There is currently no exchange of these data, but it is the aim to transfer these data into the cadastre. Data which are gathered via contracted monitoring (e.g. mineral water or fish farms) are used within expert judgements for RBMP preparation but must not be published.

At the moment there are no contaminated sites designated. For surface water there are hot spot sites but not for GW. Industrial sites are used for soil monitoring but industrial sites directive is not part of the SEPA.

2.1.2. Policy needs for drafting a governance resolution for Armenia

In 2022 the Water Code was substantially amended, i.a. to closer harmonise with the WFD (e.g. several definitions were included). It is still necessary to develop GW norms for the status assessment until July/August 2024. The title of the governance resolution is still not clear but input from technical experts is definitely needed for drafting the decree and also experience from UBA is highly appreciated.

Information on **background concentrations** would also be needed and it was proposed to use monitoring data from the 1960s and 70s as there were almost no polluting activities. It is only questionable whether data on heavy metals are available from that time. It started with a stepwise approach and decided case by case with expert judgement whether an elevated concentration is caused by pollution or geogenic reasons.

In Armenia since 2011 natural background values (NBL) are considered for surface waters, where EQS are added to NBL. The decree was revised in 2020 but still needs further revision.

Within the discussion, the following aspects were recommended by UBA to be tackled by the governance resolution:

6. Quality standards;

The AM participants agreed that the WFD standard for nitrates of 50 mg/l is too high. In AM the drinking water standard for nitrates is 45 mg/l and it might happen that even lower standards would be needed. There is a need for further discussions. The WFD pesticide standards seem OK.

7. Threshold values for relevant pollutants and for relevant receptors (uses, ecosystems,);

The groundwater directive (GWD) requires to check the need for threshold value (TV) establishment for all substances listed in Annex II. AM experts proposed to apply 80% of the drinking water standards as TVs as a precautionary principle due to the patchy data situation.

8. Aggregation of monitoring values at site level;

Calculation of mean values per site has to be specified, the method could be linked to the GWB reaction time. AT calculates 3-years mean per site: first annual arithmetic mean per site and then mean value for the 3-years-period per site).

9. Aggregation of site values at GWB level (acceptable pollution in the GWB and still good status);

A method is needed for aggregating the results of sites to the whole GWB-level. Different options and examples were discussed. Monitoring should reflect a representative picture of the GWB. CIS guidance 15 recommends at least 3 sites per GWB. AM runs a more dense monitoring network in the first years and then reduces the network. This is in principle in line with the WFD to reduce the monitoring efforts if there is no risk but it has to be considered to repeat the denser monitoring every 6 years (surveillance monitoring). In case of risk, monitoring should be kept for at least the parameters causing risk. When monitoring happens only once a year, the monitoring period should consider the hydrology. In AT surveillance monitoring is continued the remaining 5 years as annual monitoring in the 2nd quarter of a year. Operational monitoring (in case of identified risk) happens 3x/year.

10. Tests for status assessment; and

The tests for status assessment should be defined in the decree, not only the standards.

11. Trend assessment.

A statistical method for the assessment of trends and trend reversal has to be specified as well as the starting points for trend reversal as a percentage of the TV. The percentage depends on the hydrogeological properties and the reaction time of a GWB to changes in pressures (due to measures).

It is important to consider that a RBMP is fixed for the whole 6 year plan period and has to be updated for the next period. Also GWBs are fixed for a RBMP period, but can be amended for the next period if needed. Preparatory works on that start quite early. The

EU directives are regularly checked whether they are fit for purpose. Currently the WFD and GWD are under review.

The Armenian experts explained that in particular the Ararat valley suffers of intensive agriculture and many regions could be in poor status. Examples from AT were requested and discussed, how pesticide and nitrate pollutions are tackled. The measures comprise both mandatory and voluntary measures as: Programme on sustainable pesticide use, pesticide action programme, Nitrate Action programme (nationwide mandatory with certain measures), a control system (cross compliance system, random samples of farms), education programmes etc.

2.1.3. Groundwater chemical monitoring in Austria

Monitoring sites (wells and springs) in Austria belong to communities or private owners (agreements necessary for monitoring). All monitoring results are publicly available (<https://wasser.umweltbundesamt.at/h2odb/>), but private owners of sites receive the data automatically. Chemical (~2000 sites) and quantitative networks (~3000 sites) are different, only a limited number of monitoring sites (~300) are used for both quantity and chemical monitoring. A considerable number of sites are springs.

AT has 8 neighbouring countries and transboundary harmonisation is done for all 15 transboundary GWBs. Monitoring results are discussed by the experts.

Water sampling and analysis are contracted every 3 years. The groundwater chemical monitoring requirements as well as the budget and how the costs are shared between the Federal and the provincial level are laid down in the 'Ordinance on the Monitoring of the Quality of Water Bodies'. A translated version in Russian language is provided to the AM experts. The current German version can be accessed online.

<https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20005172>

2.2. Groundwater quantitative status

2.2.1. Groundwater monitoring and data assessment in Armenia

In Armenia groundwater quantity is monitored 6 times per month and the main focus is on the Ararat valley where 74 % of the AM GW resources are located and the network is dense.. In addition to the national monitoring network of 119 sites, there is a network of private sites: about 120 fish farms with about 250 stations. The monitoring (by HMC on a contractual basis) depends on the abstraction volume (frequency from 1/month to 1/3month).

Water permits are issued by the Ministry of Environment for 5 years (except power plants with 25 years). Any applicant for a water permit has to provide a passport. HMC is asked for expert information on the possibility of a water permits and issues such permits. HMC has to be paid for this expert information.

The assessment of GW quantity is oriented towards the overall stock of GW and the assessment of GW resources and the definition of the usable GW resources lies within the Ministry of Territory and Infrastructure (also licenses for mineral water abstraction): The

resources were approved in 1984 the last time and it has to be updated. Mineral water is seen as useful mineral (not covered by drinking water directive) and GW is covered by the law for underground which is the reason why GW is assigned to the Ministry of Territory and Infrastructure.

The Ararat basin (artesian) belongs to 3 RBDs and is covered by 3 RBMPs. There are only 'soft' measures in the RBMPs and the plans will only be used as a basis for issuing water abstraction permits. It is a challenge to delineate GWBs in this basin.

The Ministry is in favour to fix permits, HMC rather prefers to change the permits. It is highly recommended to limit permits in terms of their duration.

Water users have to pay for the abstracted water and inform about the actual water abstractions. Licenses can be more or less than the real abstractions. Users will not report exceeding abstractions as they would have to pay a fine and sometimes they report less amounts to save fees. Due to the revision of the Water Code, all water users (~2000) will have to install water meters until 1.1.2024. It is still unclear where the measurements have to be reported to.

It was highly recommended that in particular in the Ararat valley where the legal permits are almost reaching the limits, the quantity of illegal abstractions should be estimated and considered in the risk and status assessment.

Mr Artashes Aghinian presented the **methodology for assessing available groundwater resource in mountain regions of Armenia**, which he developed with support of EUWI+. The method is limited to small rivers and areas with positive water balance (precipitation exceeds evapotranspiration). The available groundwater resource is defined as 50 % of natural groundwater resource.

The method used in the soviet union is called hydraulic method and forecasts are based on an empirical model (based on processed pumping data). In the Ararat valley 40 boreholes were drilled in the 1980s. The distance and interlinkages between the wells were considered and finally for these 40 wells 5000 l/s were calculated. In the meantime, 500-600 additional wells were drilled and the abstraction raised to 30000 l/s, which is not sustainable. Last year the level declined from 40 to 60 cm in an area of 1100 km²; respecting the limit of 5000 l/s would allow reaching the former GW level.

In 2016 a detailed inventory was made with the help of USAid. At that time fish farms, which were using 50000 l/s, were bankrupt and since 2018 the levels rose again by 1 m/year but since beginning of 2023 there is no longer a positive tendency.

Armenia already performed a programme like in Austria where abundant or damaged artesian wells were closed or remediated. The main problem are the abstraction permits for fish farms and irrigation and the water needs of 180 settlements. Even the legal abstraction is too high.

Permits are usually for 1.5 years but can easily prolonged. The Water Code foresees the change of fish farms to circular water use which would allow for reducing the permits. But this is politically not desired.

Finally also the water loss is an issue which amounts for up to 75%. It has to be mentioned, that when water need in the night is strongly reduced, the reservoirs are still filled and the exceeding water is also counted as water loss.

2.2.2. Policy needs for drafting a governance resolution for Armenia

Some of the presented requirements of the WFD were found new by the audience. The legal act on GW quantity was mentioned as quite important. There are considerable gaps in GW quantity monitoring. The EU agreement SEPA requires to move towards WFD. The RBMP approach prevails and AM should no longer follow the resource approach.

Within the discussion, the mandatory WFD requirements were addressed and different options considered. The presented water balance methodology is not applicable for intermountain or artesian basins. The following aspects were recommended to be tackled by the governance resolution and discussed by national experts beforehand:

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