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

GROUNDWATER SURVEY 2023

Azerbaijan

Funded by
the European Union

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ABOUT THIS REPORT

AUTHORS(S)

R. Abdullayeva, AzeLab LLC

Sh. Atashov, Geological Exploration Agency PLE

IMPRINT

Owner and Editor: EU4Environment-Water and Data Consortium

Umweltbundesamt GmbH	Office International de l'Eau (IOW)
Spittelauer Lände 5	21/23 rue de Madrid
1090 Vienna, Austria	75008 Paris, FRANCE

December 2023

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 action is co-funded by the European Union, 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

CONTENTS

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 Azerbaijan

Azersu JSC..... JSC Water Supply and Sanitation of Azerbaijan

MENR..... Ministry of Ecology and Natural Resources

WRSA..... Water Resources State Agency of Ministry of Emergency Situations

Key messages

This groundwater chemical study is focused on the Kura River delta and aims to prove the extent of seawater intrusion into groundwater resources in the area and the extent of pollution due to agricultural activities and domestic waste water from villages. The study of ground water was conducted together with the study of surface water and coastal waters.

Executive Summary

17 points were selected to assess the salinity composition and to get a first impression of the geogenic background and the influence of human pressures and impacts. Samples of these groundwaters were taken and analyzed.

1. Introduction and Scope

This groundwater chemical study is focused on the Kura River delta and aims to prove the extent of seawater intrusion into groundwater resources in the area and the extent of pollution due to agricultural activities and domestic waste water from villages. The study of ground water was conducted together with the study of surface water and coastal waters.

1.1. Preparatory activities before the survey

Sampling sites were selected prior to the survey. For initial observations at the sampling site, portable devices were developed for measurement. An oximeter for measuring oxygen, a conductometer for measuring electrical conductivity, and a pH-meter for measuring pH were calibrated and sent to the field for measurement.

1.2. List of measured parameters and analysed substances

The list of parameters was selected, based on the available capacities of the laboratories of AzeLab. The field parameters are listed in Table 1 and the substances analysed in the laboratory are listed in Table 2 and 3.

Table 1: Groundwater Survey 2023 – Field parameters

Parameter/Indicator	Unit	Measurement device
Depth to groundwater table	m	
Water temperature	°C	Thermometer
Electrical conductivity	µS/cm	Conductometer
pH value	-	pH-meter
Dissolved oxygen	mg/l, %	Oximeter
Colour	-	
Turbidity	-	Turbidimeter
Odour	-	
Taste	-	

Table 2: Groundwater Survey 2023 – Substances analysed in the laboratory.

Parameter/Indicator	Unit	Sample treatment
Calcium Ca	mg/l	
Magnesium Mg	mg/l	

Parameter/Indicator	Unit	Sample treatment
Sodium Na	mg/l	
Potassium K	mg/l	
Chloride Cl	mg/l	
Nitrate NO_3	mg NO_3/l	
Sulphate SO_4	mg SO_4/l	
Hydrogen carbonate HCO_3	mg/l	
Nitrate NO_2	mg NO_2/l	
Ammonium NH_4	mg NH_4/l	
Total mineralization	mg/l	
Total hardness	mg/l	

Table 2: Metals

Parameter/Indicator	Unit	Sample treatment
Iron Fe	mg/l	Filtration and Acidification with HNO_3
Manganese Mn	mg/l	
Aluminium Al	mg/l	
Arsenic As	mg/l	
Lead Pb	mg/l	
Cadmium Cd	mg/l	
Chromium Cr	mg/l	
Copper Cu	mg/l	
Nickel Ni	mg/l	
Zinc Zn	mg/l	

1.3. Investigated monitoring sites

Table 3: Groundwater Survey 2023 –Monitored sampling sites

№	№ of station	Location of stations	Coordinates and altitude of wells	Depth of wells (m)	GW type	Height of the wellhead (m)	Variation of statistical GW levels during the year (m)	Temp. of GW (°C)
1	431/1	Sabirabad district, village of Pokrovka	39°57'53.7" 048°36'44.9" -19,54	70	pressurised	0.30	1,10-1,7	16,5
2	431/2	Sabirabad district, village of Pokrovka	39°57'53.7" 048°36'44.7" -19,73	30	ground	0.32	1,28-1,67	15,5
3	431/3	Sabirabad district, village of Pokrovka	39°57'53.7" 048°36'44.7" -19,72	8	ground	0.25	1,23-1,52	16,1
4	432/4	Sabirabad district, village of Ahmadabad	39°58'09.9" 048°36'56.2" -19,78	18	ground	0.10	0,65-1,90	16,6
5	453/3	Sabirabad district, on the right side of Osmanli St, near the Zalqaraagac road	39°55'27.9" 048°46'35.4" -19,41	9.6	ground	0.40	1,60-2,19	15,6
6	461/1	Sabirabad district, in the yard of a livestock farm in Qaraagac village	39°54'48.4" 048°53'00.7" -19,3	120	pressurised	0.40	0,17-1.29	15,6
7	461/2	Sabirabad district, in the yard of a livestock farm in Qaraagac village	39°54'48.4" 048°53'00.7" -19,3	85	pressurised	0.35	0,07-1,81	14,7
8	465/2	Salyan district, center of Salyan	39°36'11.4" 048°57'37.0" -18,96	85	pressurised	1.00	2,13-3,52	15,7
9	465/3	Salyan district, center of Salyan	39°36'11.4" 048°57'37.0" -19,03	35	ground	1.00	2,22-3,65	15,1
10	465/4	Salyan district, center of Salyan	39°36'11.4" 048°57'37.0" -19,03	5	ground	1.00	2,29-4,0	16,4

№	№ of station	Location of stations	Coordinates and altitude of wells	Depth of wells (m)	GW type	Height of the wellhead (m)	Variation of statistical GW levels during the year (m)	Temp. of GW (°C)
11	468/1	Salyan district, western part of Marishli village	39°33’59.2” 048°56’07.1” -28,0	140	pressurised	0.30	0,70-2,67	16,6
12	468/2	Salyan district, western part of Marishli village	39°33’59.2” 048°56’07.1” -23,6	85	pressurised	0.30	1,72-1,78	16,4
13	468/3	Salyan district, western part of Marishli village	39°33’59.2” 048°56’07.1” -23,6	30	ground	0.30	1,05-1,29	15,8
14	468/4	Salyan district, western part of Marishli village	39°33’59.2” 048°56’07.1” -23,6	5	ground	0.10	1,25-1,40	16,0
15	477	Neftchala district Pirebbe village	39°29’37.2” 048°59’50.2” -31,0	4	ground	0.30	1,00-1.77	16,2
16	478/1	Neftchala district Khilli village	39°25’20.9” 049°06’14.8” -23,6	5	ground	0.20	1,00-1.77	16,0
17	478/2	Neftchala district Tatarmahla village	39°28’21.1” 049°06’12.0” -31,0	5	ground	0.40	1,00-1.77	16,4

Figure 1: Groundwater Survey 2023 – Map of sampling sites.

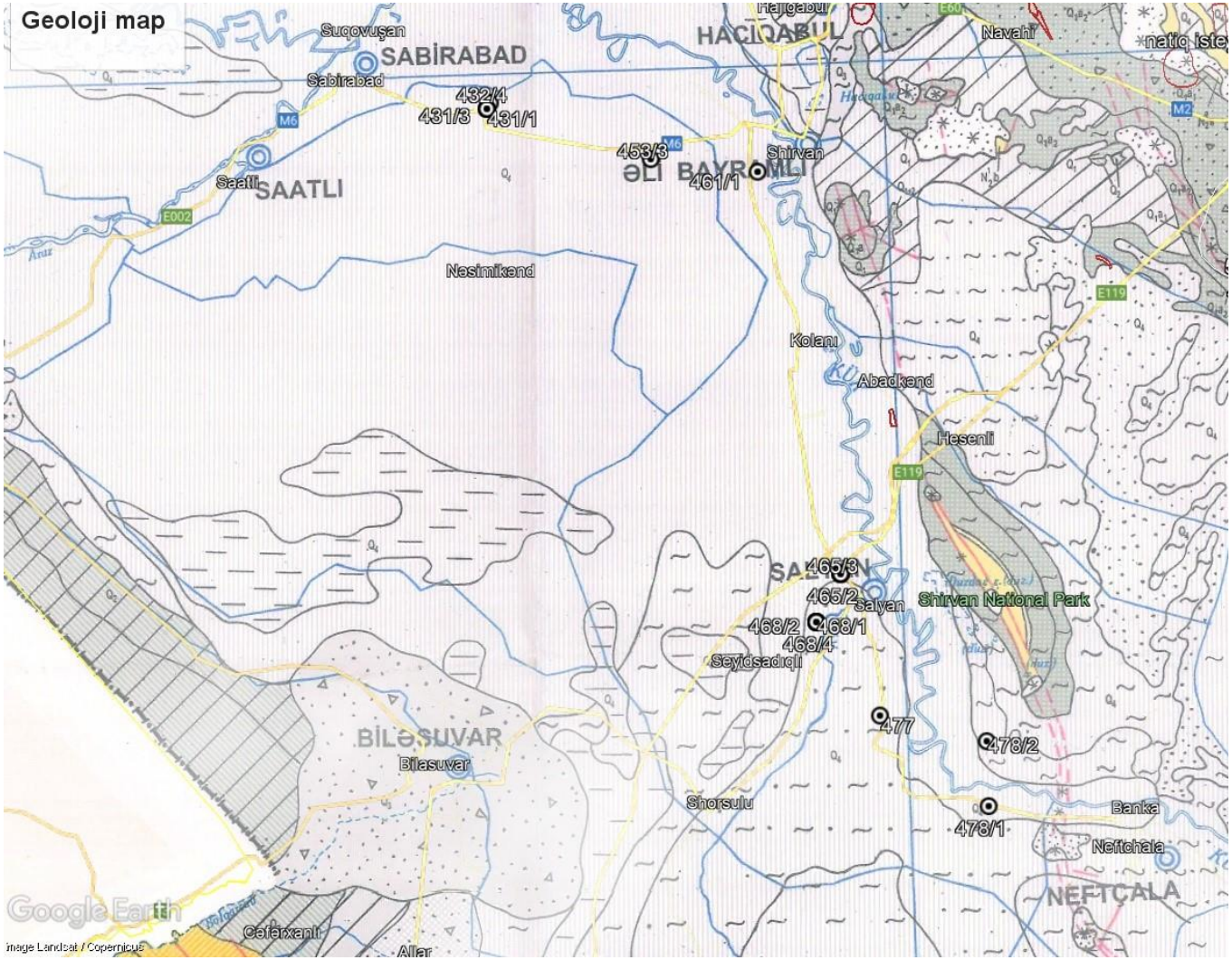

Figure 2: Groundwater Survey 2023 – Geological map of sampling sites.

2. Summary of results

Parameter		Unit	1	2	3	4	5	6
Site ID			468/2	453/3	461/2	431/3	465/3	468/1
Site name			Salyan district, western part of Marishli village	Sabirabad district, right side of Osmanli St, near Zalqaraagac road	Sabirabad district, in the yard of a livestock farm in Qaraagac village	Sabirabad district, village of Pokrovka	Salyan district, center of Salyan	Salyan district, western part of Marishli village
Location			N 39°33'59.2" E48°56'07.1"	N 39°55'27.9" E48°46'35.4"	N 39°36'11.4" E48°57'37"	N 39°57'53.7" E48°36'44.7"	N 39°36'11.4" E48°57'37"	N 39°33'59.2" E48°56'07.1"
Hydr. Carbonate	HCO_3	mg/L	18,3	463,7	73,2	274,6	225,8	12,2
Total Mineralization	TM	mg/L	9418,78	1543,54	721,93	1313,41	684,52	24884,3
Calcium	Ca	mg/L	683,2	49,5	48,3	36	36,5	1552,7
Magnesium	Mg	mg/L	177,6	12,9	12,5	9,4	9,5	403,8
Sodium	Na	mg/L	171,2	353,5	170,1	339,9	157	7315
Potassium	K	mg/L	149,5	65,8	3,9	35,2	11	285
Chloride	Cl	mg/L	7705,4	464,54	225,63	275,77	191,71	15115,9
Nitrate	NO_3	mg/L	1,00	0,24	0,33	0,83	0,48	3,83
Nitrite	NO_2	mg/L	0,02	0,18	0,02	0,08	0,01	0,07
Ammonium	NH_4	mg/L	4,6	0,08	0,04	0,05	0,33	5,37
Phosphate	PO_4	mg/L	0,06	0,07	0,05	0,09	0,05	0,07
Sulfate	SO_4	mg/L	405,1	85,8	150,52	284,62	23,74	38,6
Total hardness		mg/L	2745	176,5	172	128,5	130	5535,0
Iron	Fe	mg/L	16	0,102	<0,1	0,023	0,0590	28,60
Manganese	Mn	mg/L	3,32	0,010	0,009	0,0137	0,0363	6,680
Aluminum	Al	mg/L	0,191	0,027	0,0004	<0,0001	<0,0001	0,471
Arsenic	As	mg/L	0,006	<0,0001	<0,0001	<0,0001	<0,0001	0,0063
Lead	Pb	mg/L	0,004	0,003	0,0003	0,0007	0,0003	0,002
Cadmium	Cd	mg/L	0,003	0,001	0,0001	0,0003	0,0004	0,004
Chromium	Cr	mg/L	0,007	0,001	0,0002	0,0017	0,0017	0,028
Copper	Cu	mg/L	0,097	0,006	0,015	0,0025	0,0519	<0,001
Nickel	Ni	mg/L	0,029	0,007	0,0034	0,0019	0,0034	0,032
Zinc	Zn	mg/L	0,058	<0,001	<0,001	0,0019	<0,001	0,014

Parameter		Unit	7	8	9	10	11	12
Site ID			468/3	468/4	461/1	431/1	465/2	478/1
Site name			Salyan district, western part of Marishli village	Salyan district, western part of Marishli village	Sabirabad district, in the yard of a livestock farm in Qaraagac village	Sabirabad district, village of Pokrovka	Salyan district, center of Salyan	Neftchala region Khilli village
Location			N 39°33'59.2" E48°56'07.1"	N 39°33'59.2" E48°56'07.1"	N 39°54'48.4" E48°53'00.7"	N 39°57'53.7" E48°36'44.9"	N 39°36'11.4" E48°57'37"	N 39°25'20.9" E49°06'14.8"
Hydr. Carbonate	HCO_3	mg/L	1427,9	757,9	701,7	237,9	305,1	512,6
Total Mineralization	TM	mg/L	3373,3	2396	5919,9	15968,3	847,3	3168,8
Calcium	Ca	mg/L	133,1	248,4	481,7	384,2	50,2	136,4
Magnesium	Mg	mg/L	34,6	64,6	124,8	233,1	13	35,5
Sodium	Na	mg/L	804,8	349,5	845	5111	173,3	855,4
Potassium	K	mg/L	96,6	5	516,5	52	30	35,7
Chloride	Cl	mg/L	796,4	283,2	1695,9	5942,6	244,8	1113,4
Nitrate	NO_3	mg/L	3,87	1,24	1,82	0,49	0,45	0,51
Nitrite	NO_2	mg/L	0,58	0,04	0,12	0,03	0,04	0
Ammonium	NH_4	mg/L	1,07	0,94	0,33	3,32	1,42	0
Phosphate	PO_4	mg/L	0,05	0	0,49	0,04	0,09	0,1
Sulfate	SO_4	mg/L	57,150	580,20	1524,1	3971,0	6,53	338,2
Total hardness		mg/L	474,50	885,50	1717,0	2062,5	179,0	486,0
Iron	Fe	mg/L	0,026	0,0170	0,0560	0,0240	0,0110	0,0160
Manganese	Mn	mg/L	0,012	0,1300	0,0960	0,3090	0,0670	0,8980
Aluminum	Al	mg/L	<0,0001	0,0480	0,0890	<0,0001	0,0057	0,1400
Arsenic	As	mg/L	0,006	0,0015	0,0055	<0,0001	<0,0001	0,0006
Lead	Pb	mg/L	0,002	<0,00015	0,0051	0,0037	<0,00015	<0,00015
Cadmium	Cd	mg/L	0,001	0,0002	0,0014	0,0037	0,0001	0,0007
Chromium	Cr	mg/L	0,002	0,0001	0,0003	0,0170	0,0038	0,0021
Copper	Cu	mg/L	0,015	<0,001	0,0023	0,0093	0,0148	0,0024
Nickel	Ni	mg/L	0,010	0,0076	0,0337	0,0249	0,0045	0,0186
Zinc	Zn	mg/L	<0,001	<0,001	0,0154	0,0111	0,0050	<0,001

Parameter		Unit	13	14	15	16	17
Site ID			478/2	431/2	477	465/4	432/4
Site name			Neftchala region Tatarmahla village	Sabirabad district, village of Pokrovka	Neftchala region Pirebbe village	Salyan district, center of Salyan	Sabirabad district, village of Ahmadabad
Location			N 39°28'21.1" E 49°06'12"	N 39°57'53.7" E 48°36'44.8"	N 39°29'37.2" E48°59'50.2"	N 39°36'11.4" E 48°57'37"	N 39°58'09.9" E 48°36'56.2"
Hydrogen Carbonate	HCO_3	mg/L	659	665	524,8	390,5	286,8
Total Mineralization	TM	mg/L	3882,2	1692,3	2098,7	1293,9	3420,2
Calcium	Ca	mg/L	422,5	50,9	360,5	66,3	286
Magnesium	Mg	mg/L	109,9	13,2	93,7	17,2	74,4
Sodium	Na	mg/L	618,4	366,4	177,9	318,3	804,3
Potassium	K	mg/L	32,5	78,5	4,9	7,41	72,6
Chloride	Cl	mg/L	862,7	221,2	722,6	281,7	1747,5
Nitrate	NO_3	mg/L	0,86	1,75	0,7	1,58	1,6
Nitrite	NO_2	mg/L	0,02	0,04	0	0,04	0,08
Ammonium	NH_4	mg/L	0	0	0	1,88	0,15
Phosphate	PO_4	mg/L	0,1	0,03	0,09	0,03	0,05
Sulfate	SO_4	mg/L	1062,25	236,97	208,10	190,13	141,3
Total hardness		mg/L	1506,0	181,50	1285,0	236,5	1019,5
Iron	Fe	mg/L	0,0106	0,0637	0,0101	0,0184	0,00721
Manganese	Mn	mg/L	0,6690	0,0066	0,0169	0,0933	0,142
Aluminum	Al	mg/L	0,0860	0,0095	0,1060	0,0195	<0,0001
Arsenic	As	mg/L	0,0018	<0,0001	0,0023	<0,0001	0,00541
Lead	Pb	mg/L	0,0012	0,0003	<0,00015	0,0002	0,00207
Cadmium	Cd	mg/L	0,0005	0,0002	0,0008	0,0000	0,00139
Chromium	Cr	mg/L	0,0021	0,0012	0,0013	0,0015	0,0017
Copper	Cu	mg/L	0,0085	0,0021	0,0031	0,0116	0,00135
Nickel	Ni	mg/L	0,0296	0,0035	0,0045	0,0040	0,0161
Zinc	Zn	mg/L	0,0030	<0,001	0,1030	0,0016	<0,001

Data interpretation

Based on the results, the water salinity in some wells is high. This is related to the lithology of that area (Absheron clay - blue clay). As the depth of the wells increases and they move towards the Caspian Sea, the salinity increases. In some areas, wells with high NaCl results are shallow wells (drilled into groundwater, water that is the first impermeable layer). These waters cause saline waters to fall down as the first impervious layer (to the level of drainage systems) as a result of irrigation from the surface and lead to the formation of saline waters.

The results of the conducted monitoring are considered satisfactory. There were no errors during monitoring. According to the monitoring results, a relative decrease in mineralization was observed due to the change of climatic conditions.

Continuous monitoring will help to obtain more accurate results.

3. Annexes

Annex 1: Survey Manual

Annex 2: Chemical data (in Excel format)

Annex 3: Sampling protocols

Annex 4: Metadata (in pdf format)

Annexes are available as separate documents

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