European Union Water Initiative Plus
for the Eastern Partnership (EUWI+): Results 2 and 3

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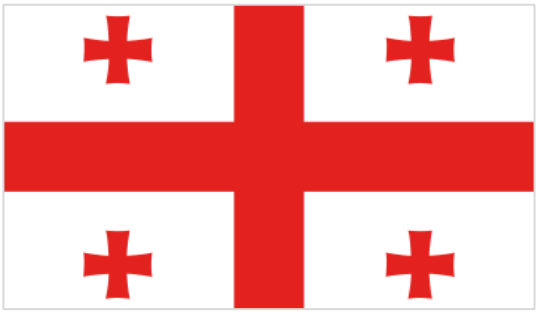
THEMATIC SUMMARY

DEVELOPMENT OF DRAFT RIVER BASIN MANAGEMENT PLAN FOR KHRAMI-DEBEDA RIVER BASIN IN GEORGIA



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1 KHRAMI-DEBEDA RIVER BASIN CHARACTERISATION

1.1 Socio-Economic Conditions in the River Basin

Geographic Overview: Khrami-Debeda river basin fully covers the districts of Bolnisi, Dmanisi, Tetritskaro, Tsalka and the district of Marneuli - only partially. It also cover a small part of Borjomi Municipality (Samtskhe-Javakheti Region), where the river Khrami originates from. The survey area of the Khrami-Debeda within Georgia is 5,186 km^2. The River Khrami with its water source from the stream located on the southern slope of the Trialeti ridge, represents the right tributary of the Mtkvari river. It is called “Qtsia” In the upper part. The river Debeda with its water source on the eastern slope of the Javakheti ridge at 2091 m altitude, represents the left tributary of the river Khrami. In the upper part, the basin is represented by the high ridges and volcanic valleys, while in the lower part - by the Marneuli alluvial plain.

Climate: The Khrami-Debeda river basin has continental climate. There is mountain steppe climate in the uplands with short summer and cold winter. In the lowland winter is cold, while summer is warm and long. Precipitation deficit is typical here. Average annual precipitation ranges from 377,7 mm (Bolnisi) to 954,2 mm (Bakuriani). Average temberature varies from 0,3°C to 20,3°C.

Vegetation: The high mountain areas of the Khrami-Debeda river basin (> 2000-2300 m) are covered with subalpine meadows and steppe elements, while the rest of the basin, including the heads of the Khrami and its tributaries, are covered with alpine steppe vegetation with the lower limits passing by the towns of Tsalka and Dmanisi. A significant part of the middle reaches of the Khrami-Debeda river basin is covered with spruce, oak and hornbeam forests. Downstream, the forests become thinner and in the lower part of the middle reaches change to thorny shrubs with forest elements. The lower section of the basin, including the Khrami and its tributaries, is mainly covered with steppe vegetation in combination with Tkhmeli floodplain forests.

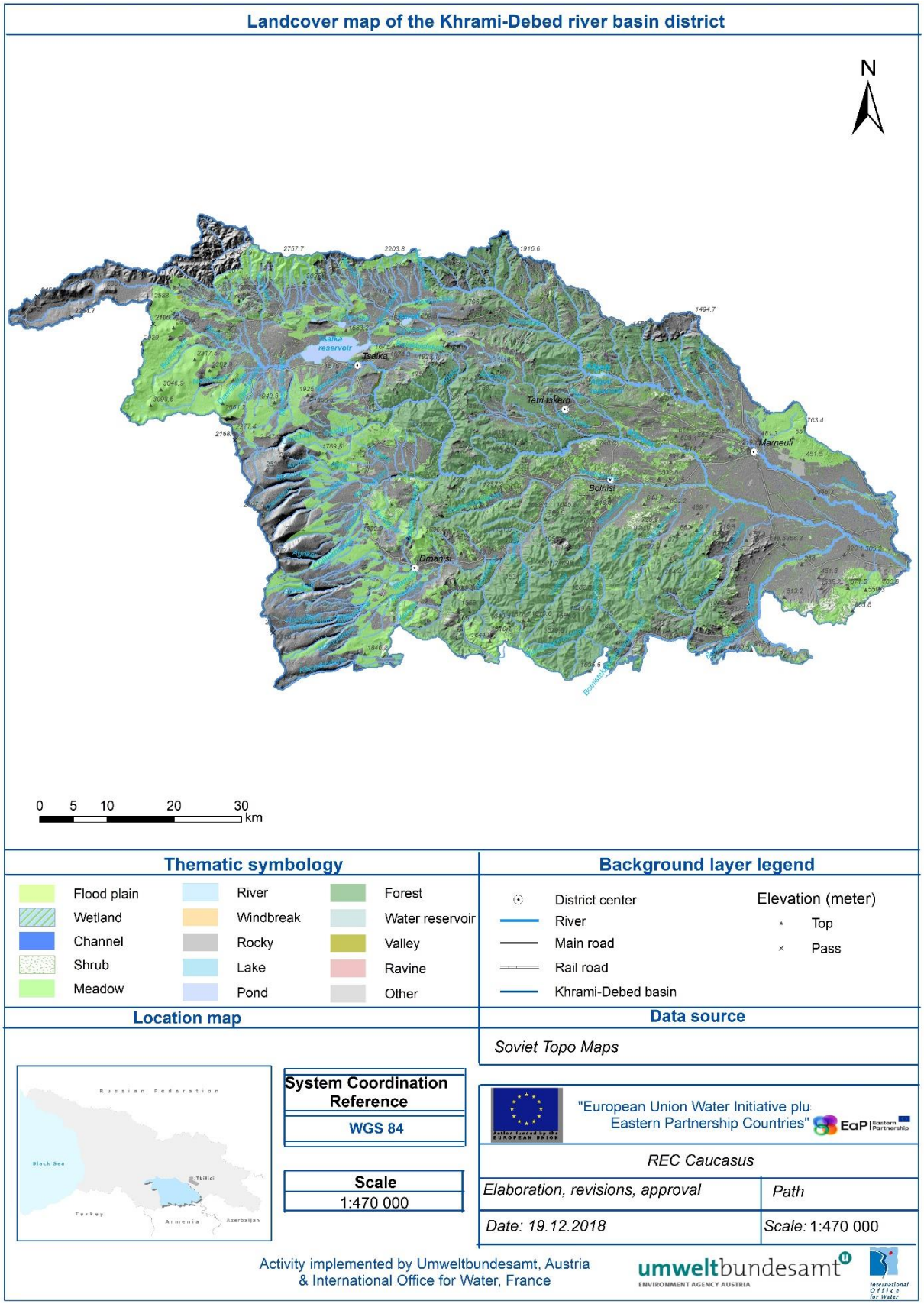
Ichthyofauna: There are 23 fish species found there, including CiscaucaIsian spined loach and trout, red-listed in Georgia.

Land Cover: 25,4% of the Khrami-Debeda river basin consists of forests, 20,2% - meadows and steppes, which are used as mowing lands and pastures. In the table below is given data on land cover in the Khrami-Debeda river basin.

Table 1. Land cover in the Khrami-Debeda River Basin

Land cover type	Area, km^2	Percentage, %
Forests	1316,8	25,4
Meadows	1046,4	20,2
Bushland	187,5	3,6
Floodplains	0,07	0,001
Rivers	23,5	0,4
Lakes	24,4	0,5
Reservours	1,97	0,04
Wetlands	5,2	0,10
Ponds	0,69	0,01
Windbreaks	2,18	0,04
Ravines	20,1	0,4
Rocks	5,5	0,10
Chasms	5,8	0,11
Channels	4,2	0,08
River Banks	4,4	0,08
Other	22,6	0,4

Map 1. Land cover in the Khrami-Debeda River Basin



Disaster Risks:

Unlike many other regions of Georgia, Kvemo Kartli belongs to the low and medium risk category in terms of development, reactivation and emergence of hazardous geological processes. Topographic features of territory, frequent heavy rainfalls, strong wind, and sometimes inappropriate agricultural practices trigger different types of soil erosion. Soils are mostly depleted because of insufficient application of organic and non-organic fertilizers, lack of crop rotation, damaged irrigation system and windbelts.

Hydrographic Network

The study area of the Khrami-Debeda basin is 5,186.6 km^2, the total lengths of the rivers is 2,373.2 km. There are several small lakes and the Tsalka reservoir in the river basin.

Maximum water discharge of the river Khrami is observed during spring period, specifically in April and May. The flow of the river is the smallest in winter. Average annual discharge of the river Khrami is 53,5m^3/sec, water discharge – 1,047 mill m^3.

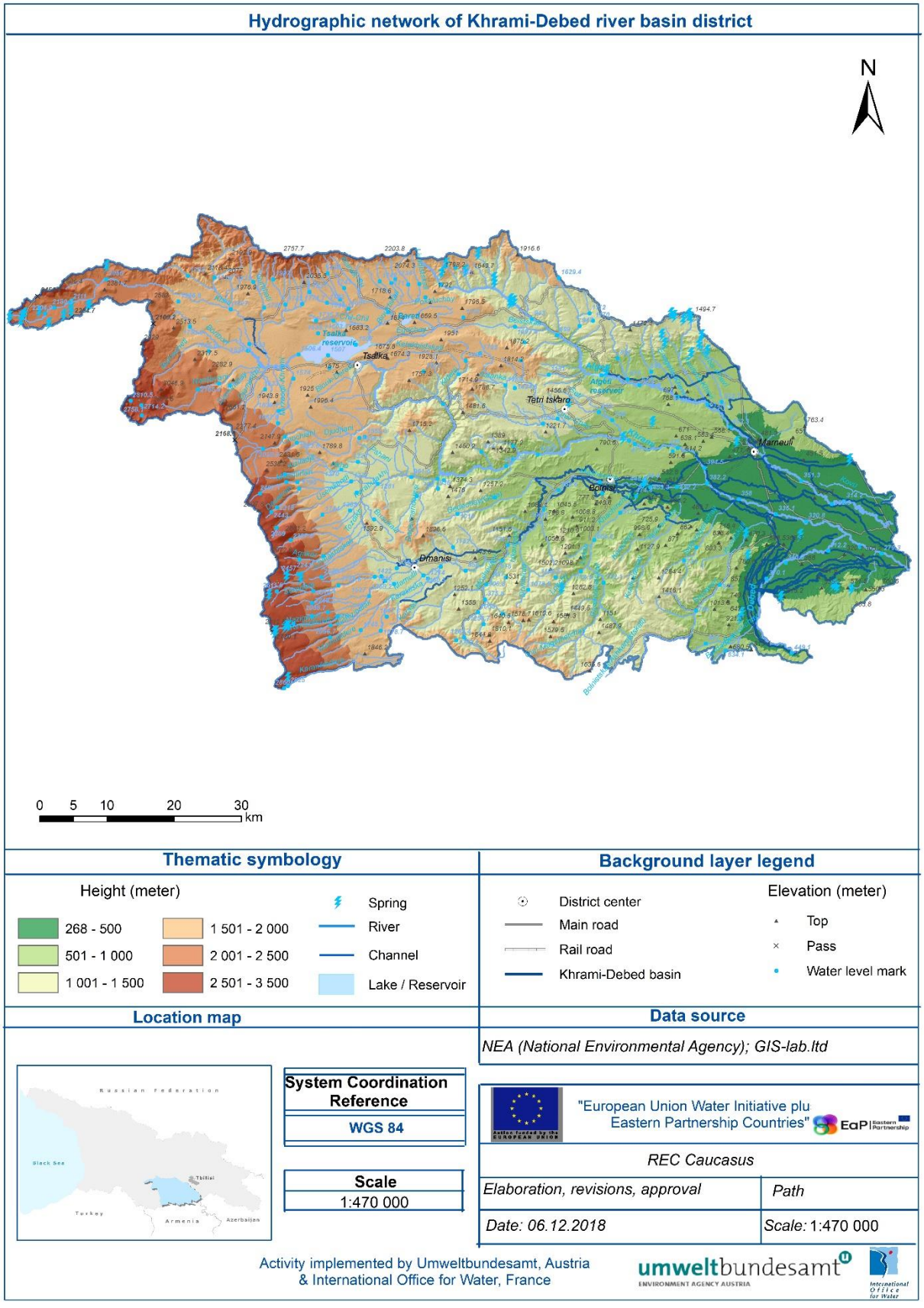
Filling source of Tsalka reservoir is river Khrami and other small rivers. Dam height is 33 m, the length of the reservoir – 14 km, the longest width is 3.5 km, average width is 2.4 km, the deepest width – 25 m; The water surface area is 33.6 km^2, the total water amount is 312 mill m^3; useful amount – 293 mill m^3.

Major tributaries of the river Khrami are: the river Korsuchai, the river Karabulakhi, the river Aslanka, the river Chivchava, the river Mashavera, the river Moshevani, the river Bolnisi, the river Talaverchai, the river Shulaverchai, the river Debeda, the river Algeti.

Algeti Reservoir is located in the Kvemo Kartli side of Tetri Tskaro municipality in 60 km from Tbilisi lake. The water area of the reservoir is 65 mill m_3, useful area – 60 mill m^3, length – 3.7 km, width – 0.4 km.

Hydrogeological structure of the region is responsible for the high saturation of young lava sheets on the basis of which there are strong streams of fractured groundwater water in the contact with the crystal rocks and sedimentary deposits of Mezo-cainozoic age. The discharge rate of mentioned waters reaches several m^3/sec. By chemical composition waters are hydrocarbonate-calcium type and suitable for drinking. According to the hydrogeological zoning, on the territory of Khrami-Debeda river we observe: Porous-fractured waters of the west part of Marneuli-Gardabani artesian basin; Fractured groundwater of the east part of Akhalqalaqi lava Plato; Fractured groundwater of East slope of Javakheti Range.

Map. 2 Hydrographic network of the Khrami-Debeda river basin



Population: Population of Kvemo Kartli numbered 423,986 people of whom 39% lived in cities and settlements, while 61% lived in villages. Population density was 67 people per km^2. Population density is the highest in Marneuli Municipality. Natural population increase was observed in all the municipalities except Tetritskaro. We can assume that the decline in Tetritskaro is caused by migration. However, because of the migration, total population of the region decreased in 2002-2016. As compared to other regions, natural population increase is observed in Kvemo Kartli, meaning in the long run that the region will have to meet increasing demands for social infrastructure, social services and new jobs. Ethnic composition of the Kvemo Kartli region population is as follows: Georgians – 44.7%, Azerbaijanis – 45.1%, Armenians – 6.4%, Abkhazians, Ossetians, Russians, Greeks, Ukrainians and Kurds – 3.8%. Unemployment level is 14,1%.

Agriculture: Agriculture plays an important role in Kvemo Kartli's economy, its share in the region's gross value added (GVA) being 19%. 122,316 ha of agricultural land is operated by farms, out of which 50,087 ha is cropland, 2,098 ha is land under permanent crops and 70,043 ha is mowing lands and pastures. Average area of agricultural land operated by farms in Kvemo Kartli exceeds the average nationwide figure (1.37 ha) and makes 3.7 ha. The leading agricultural sectors are potato growing, vegetable farming and beef stock farming. There are 148,800 heads of cattle in Kvemo Kartli. The region produces 2,100 tons of meat and 103,200 tons of milk. In 2017, the region produced 3,641,900 heads of poultry and 13,800 tons of poultry meat.

Fish Farms: Fish farms are developed rather well in Kvemo Kartli region: there are 22 fish farms there, including 9 operating farms, producing altogether 35.5 tons of fish. Tsalka reservoir is used for fish farming according to a special licence. About 10-80 tons of fish is produced every year, mostly Prussian carp (Carassius gibelio) and smaller quantity of Caucasian scraper (Capoeta capoeta).

Hydro Power Generation: There are 9 small and medium-sized HPPs operating in the Khrami-Debeda river basin. Construction of 13 hydroelectric power plants is being planned, of which 3 are already under construction.

Table 2. Planned and operating HPPs in the Khrami-Debeda river basin

HPP	Design capacity (MW)	Planned and Ongoing Hydro Power Generation Projects	Design capacity (MW)
Khrami 1	112.80	Chapala HPP	0.43
Khrami 2	110.00	Oro HPP (former Zemo Orozmani HPP)	1.12
Dashbashi	1.26	Khrami HPP	1.13
Algeti HPP	1.25	Kizilaglo HPP	4.10
Mashavera HPP	1.25	Nakhidura HPP	9.04
Debeda HPP	3.20	Kvemo Orozmani HPP	0.63
Marneuli 1931	0.25	Kvemo Orozmani HPP	4.20
Mekvle HPP	1.00	Kvemo Orozmani HPP	4.02
Kazreti HPP	2.00	Zemo Karabulakhi HPP	1.03
		Khrami HPP 3	16.07
		Khrami HPP 4	14.97
		Khrami HPP 5	19.89
		Mashavera HPP	4.15

Mining: The region is rich in mineral resources and has a developed mining industry, producing ferrous and non-ferrous metals, ferroalloys and industrial minerals. Madneuli mine produces gold, copper, barite and complex ore. The mine uses open-pit production method. Its annual estimated output capacity is 12,000 tons of ore. There are more than 200 mostly unexploited deposits of ferrous, non-ferrous and precious metals, chemical and ceramic raw materials, hydro-mineral and fuel resources there.

Tourism: Natural and geographic conditions, cultural, historical and natural monuments of Kvemo Kartli make it rather attractive for tourists. Tourists can visit settlements dated by the 1st millennium BC, such as the famous ancient settlement in Dmanisi. Bolnisis Sioni (5th century AD – Middle Ages), Tsugrugasheni (Middle Ages), Pitareti church (13th century AD), Manglisis Sioni (14th century AD), the ancient fortress of ruins of Samshvilde and Birtvisi fortress are the main tourist attractions. The quality of service and tourist infrastructure fails to meet the current standards and needs improvement.

Future Needs: The Regional Deelopment Strategy of Kvemo Kartli (2014-2021) covers the following priorities:

- Uninterrupted centralized supply of high-quality drinking water to the population;
- Rehabilitation of the sewer system and construction of domestic wastewater treatment facilities in municipal centres, settlements and resorts;
- Support of small HPP development;
- Utilization of unused landfills and soil fertility improvement and rehabilitation of internal roads and irrigation systems accessible to the arable lands;
- Development and implementation of the bank protection measures plan;
- Implimentation of measures for partial solving of contamination problems and water quality indicators.

Protected Areas: The Khrami-Debeda river basin includes the following protected areas: Algeti National Park, the natural monuments of Dashbashi, Samshvilde and Birtvisi canyons, and Ktsia-Tabatskuri Managed Reserve, located in the upper reaches of the Khrami (where the River Khrami is called Ktsia). The area of Algeti national Park is 6,822 ha, the area of Ktsia-Tabatskuri Managed Reserve – 22,000 ha. The abovementioned protected areas (excluding Birtvisi) incorporated in Emerald Network.

1.2 Impact of Human Activities

Water Abstraction: HPPs are major water users in the Khrami-Debeda river basin. Iirrigation, municipal water abstraction and industry also considerable water users. As of 2016, 1623.74 mln m^3 of water were extracted from natural water bodies, including 35.48 mln m^3 from underground sources. The total volume of consumed fresh water was 1567.84 mln m^3, of which 68.8% were used for power generation. Average annual water intake of the irrigation systems is 256 mln m^3, while projected irrigation area is 35,683 ha.

Water Pollutants: In 2017, consumptive water users discharged 1,669,218 m^3 wastewater directly into surface waters of the Khrami/Debeda river basin. Out of total volume of wastewater discharged, 1,281,198 m^3 (about 90%) was untreated wastewater and only 388,020m^3 was treated.

Untreated wastewater discharges mostly were accounted to the sewage networks of small towns of the Khrami/Debeda river basin. Within the pilot basin, centralized sewerage systems are developed in the

municipal centres of Bolnisi, Dmanisi, Marneuli, Tetritskaro, Tsalka. None of the village settlements are served by centralized sanitation systems. In 2017 amount of discharged wastewater from the Sanitation sector in to the surface water bodies of the basin amounted to 1,120,598 m^3 in total. None of the sewerage in the basin has operational treatment plant, however construction of a completely new and modern wastewater treatment plant is planned in Marneuli, this treatment plant will receive municipal wastewater from Bolisi and Marneuli. Wastewater mainly consists the following pollutants: BOD, COD, nitrates, phosphates.

Main pollution problem in the Khrami-Debeda river basin comes from industrial wastewater discharge of copper and gold mining companies. According to the assessment carried out by the Georgian Technical University in 2011, the content of Copper, Zinc, Cadmium, Lead, Cobalt and Nickel in the soil of Kazreti area, the Kazretula and Mashavera riverbed soil, exceeded by several times the limited permissible concentrations. Despite some recent measures taken in this regard, the pollutionof the Kazretula, Mashavera and Pholadauri rivers remains an acute issue, which must have been caused by the perennial pollutionfrom Madneuli enterprises. The concentration of toxic elements in the surface waters of the Mashavera lower stream catchment basin sometimes was more than thousand times the maximum permissible limits.

Table 3. Microcomponent content of Kazreti area soils and riverbed soils, Georgian Technical University, 2011

Kazreti area soils											
		Cu	**Zn**	**Cd**	**Pb**	**Fe**	**Mn**	**Co**	**Ni**	**Li**	**Sr**
Element concen-tration, mg/kg	**Maximum**	10,153	11,168.3	223.1	89.10	7,633.83	105.0	3,133.64	213.75	8.0	100.0
	Minimum	6	6.6	0.13	0.05	4.51	5.0	1,85	0.13	2.0	20.0
	Maximum permissible concen-tration	3.0	23.0	1.5	20.0		85.0	4.0	2.0	3.5	150.0
The Kazretula riverbed soils											
Element concen-tration, mg/kg		2,000	313.0	18.9	0.3	1333	170.0	-	-	2.0	

The study also revealed a high concentration of Copper, Zinc, Iron, Manganese and, partially, Cadmium in the waters of the Mashavera and Pholadauri river basins. In particular, the concentration of copper in the river Kazretula water amounted to 162 mg/l, iron - 135 mg/lg/l, zinc - 43,78 g/l mg/l, manganese - 3 mg/lg/l. The source of pollution is the ore mining and processing enterprise, which was observed for several times as a source of accidental discharges of industrial solutions to the Mashavera river, quarry, dams for storing byproducts of mining operations (tailings dams), cyanidation sites. Since 2012, RMG companies have been implementing new environmental policies and measures to minimize the pollution of the Kazretula and Mashavera with industrial wastewater. Wastewater discharge is carried out in accordance with environmental impact permits and maximum permissible concentrations agreed with the Ministry of Environment Protection and Agriculture. Nevertheless, the pollution of the Kazretula, Mashavera and Poladauri rivers remains a significant problem, which is due to the perennial pollution from RMG enterprises.

Diffuse Source Pollution: Agriculture is the main diffuse pollution source in the Khrami-Debeda river basin. The main issue for the assessment of the impact of pesticides, fertilizers and other chemical substances is the absence of detailed data on the use of these substances. In total, during 2014-2017, from 2,3 to 4,8 tons of mineral fertilizers, including 2,0-4,7 tons of nitrogenous fertilizers were used annually in Kvemo Kartli region. This constitutes 8,6 - 4,9 % of mineral fertilizers used in the same period in Georgia (in 2014 and 2017 years, accordingly). Mineral fertilizers were mainly used in arable lands. The amount of annual crops fertilized with mineral fertilizers varied from 5,1 thousand ha (2017) to 9,2 thousand ha (2016).

The average annual use of mineral fertilizers on arable land is estimated at 0,45-0,80 tons per hectare (according to the data for 2014-2017), which approximately equals the average annual use of mineral fertilizers in the same period throughout the country.

In 2014-2017, pesticides were annually used for 4,7-6,7 thousand ha of annual crops in Kvemo Kartli, however, there exists no data with regards to the amount of the pesticides used.

The analysis of available data has shown that 111,399 ha area of Khrami-Debeda basin is under the impact of agriculture (crop production) diffuse pollution, whereas 63,959 ha of the territory is possibly polluted.

Landfills are one of the sources of diffuse pollution in the Khrami-Debeda basin. There operate 3 landfills in the Khrami-Debeda basin - Marneuli (village Kizilajlo), Bolnisi (village Andreevka) and Dmanisi nearby territory. Landfills closed in Tetritskaro and Tsalka. More than 40% of household waste is an organic faction that causes a large number of leakage and gas emissions. None of the landfills are equipped with collecting and treatment systems for leakage and drainage waters. Apart from that, the landfills have no specific points of discharge in the surface waters.

According to the Waste Inventory Report 2007, the industrial waste in the region amounted to 3 million tons, out of which 3% were toxic waste. The waste is accumulated in adjacent territories of the metallurgical and mining combinations from the Soviet period. The one and only hazardous waste landfill (2700 tons of expired pesticides, agrochemicals, etc.) throughout the country, located in Kvemo Kartli region, on the Ialghuja mountain (Marneuli Municipality), is officially closed. Pesticides containing up to 250 tons of POPs were safely removed, taken out of the country and placed safely. There is no information available on the existence and condition of agricultural waste and pesticide bankers (whether functional or abandoned) in the region.

Due to the scarcity of data and lack of methodology in this regard, further research will be needed to categorize specific water bodies " at risk" because of significant pressures from landfills.

Water Quality: Up-to-date data on water quality in the rivers of this basin are scarce and incomplete because of the lack of effective water quality monitoring network. In 2013-2017, the monitoring of water quality in the rivers showed that the biochemical Oxygen demand often exceeded MPC. Ammonia nitrogen often exceeded MPC. DO concentration significantly exceeded allowed limits and was equal to 7,30-13,10 mg in the Debeda river and 5,3-13,5 in the Khrami river (MPC: 4-6 mg/l). The average mineralization and salt content of the Khrami water ranges within 146,38 - 608,7 mg/l. The average mineralization and salt content of the Debeda water ranges within 205,44 - 603,3 mg/l.

The pollution of the rivers Kazretul, Mashavera and Pholadauri due to industrial wastewater discharge in mining remains a significant problem. The studies of the Kazretula water near Madneuli copper mine showed that concentrations of copper, zinc, cadmium and sulfate ions exceeded by many times the limited permissible concentrations. According to the biological monitoring and ecological status assessment of n water facilities carried out in 2011-2016 witihn the framework of EPIRB, the ecological status of the Mashavera (near Kazreti) and Debeda (near Sadakhlo) rivers was estimated as very bad.

1.3 Status of Water Bodies and Delineation

Identification, delineation and typology of water objects within the Khrami-Debeda river basin have been implemented according to the analysis of the selected rivers as well as based on identification, delineation and classification methodology for surface water bodies, elaborated for EU Water Framework Directive.

Surface “water bodies" are discrete sections or parts of water bodies, which differ from each other in specific natural characteristics (Sall et al, 2012). The process of delineation and definition surface water bodies consists of the division of water bodies into sections and parts according to the (agreed) parameters and criteria.

306 water bodies (SWB) are identified in the Khrami-Debeda basin, all of which have a unique code. Also, each surface water object was differentiated according to the types accordance to the System-A typological classification of WFD.

Delineation of catchment areas has been implemented by means of the geo-informational technologies, where only two variables have been applied - digital elevation model (STRM 30) and digital hydrological network with the 1:25,000 resolution original scale data-sheets, based on the Soviet topographical maps and geo-rectified and corrected images on the basis of most recent satellite imagery of a high intelligibility.

Using the abovelisted methods and parameters, 288 units of different types of rivers, have been identified in the Khrami-Debeda basin.

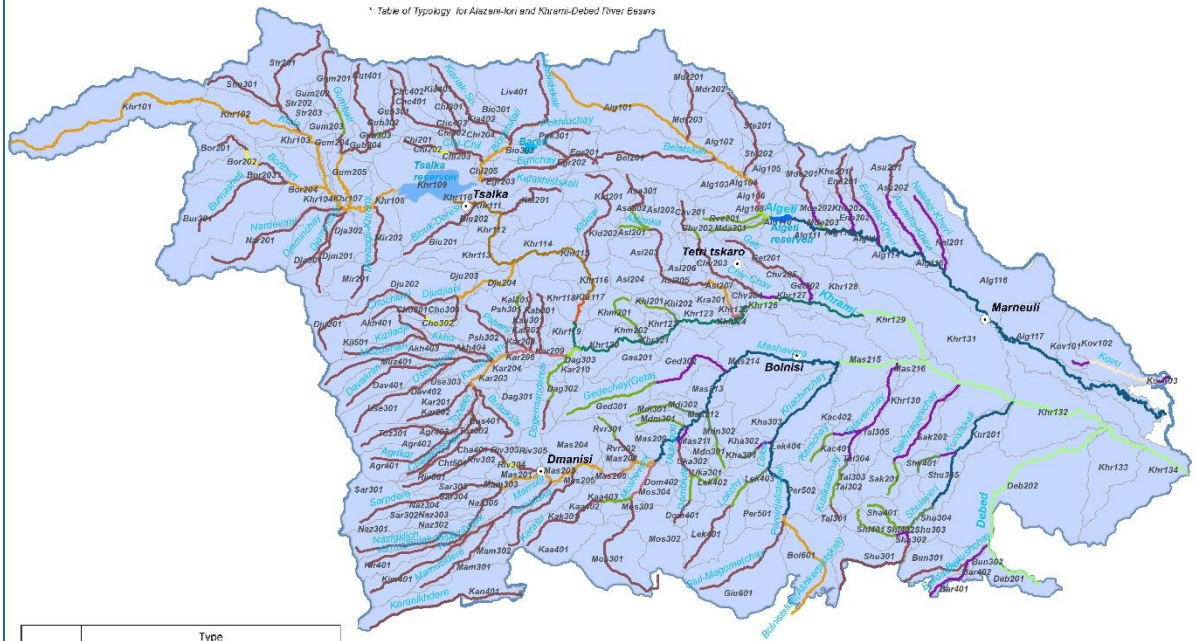
Except for rivers, 2 reservoirs have been also typologically marked out in the Khrami-Debeda basin (Tsalka Reservoir – type V and Algeti reservoir - type I) and 1 lake (Bareti Lake – type Ш).

Map 3. River and Lake Typology in the Khrami-Debeda River Basin

River and Lake typology map of the Khrami-Debed river basin district

Descriptor	Type																
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII
Ecoregion	24																	
Catchment size, km²	Small: <100 km²							Medium: 100 to 1000 km²					Large: >1000 to 10 000 km²					Very large: > 10 000km²
Geology	Organic		calcareous		Siliceous			calcareous		Siliceous			calcareous		Siliceous			Siliceous
Altitude	200-800	>800	200-800	>800	<200	200-800	>800	200-800	>800	<200	200-800	>800	200-800	>800	<200	200-800	>800	<200

* Table of Typology for Alazani-Iori and Khrami-Debed River Basins



Descriptor	Type				
	I	II	III	IV	V
Ecoregion	24				
Catchment size, km²	Small: 0.5 to 1 km2	Medium: 1 to 10 km2			Large: 10 to 100 km2
Mean depth	<3	<3	<3	>15	3 to 15
Geology	Siliceous				
Altitude	200 800	200 800	>800	>800	>800

0 5 10 20 30 km

N

Thematic symbology

River typology: I, II, III, IV, IX, VI, VII, VIII, XI, XII, XIII, XIV, XVI, XVII

Lake typology: I, III, V

Background layer legend

District center

Khrami-Debed basin

Location map

Data source

NEA (National Environmental Agency); GIS-lab.ltd

System Coordination Reference
WGS 84

Scale
1:470 000

"European Union Water Initiative plu Eastern Partnership Countries"

REC Caucasus

Elaboration, revisions, approval	*Path*
Date: 06.12.2018	*Scale:* 1:470 000

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

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12 aquifers were identified, which are in direct contact with surface ecosystems.

Under three types of underground water types were assigned three groups: porous -P; Karst-k; Fractured-F;

In the first group with Index - GP, the following groundwater bodies of Khrami and Debeda basin: the Aquifer of modern alluvial deposits of floodplain and valley-side of rivers Khrami, Mashavera and Debeda, (temporary code GPK0024); Artesian aquifer of modern and upper quaternary age aluvial-proluvial and lake sediments (temporary code GPK0025); Sporadically saturated deposits of modern aluvial-deluvial, deluvial-proluvial and proluvial-deluvial sediments, (temporary code GPK0026) and Aquifer of lower Miocene-upper Pliocene age sediments (temporary code GPK0028).

They are characterized by similar lithology (pebble-boulders, sandstones, clays, loams, conglomerates and etc.) and hydraulically connected with each other. We observe similarities in the chemical composition of the water (hydrocarbonate-sulfate-sodium-calcium-magnesium). Their total mineralization does not exceed 1 g/l and is suitable for drinking. In contrast to the lower deep pressurized aquifers of these groundwater bodies that are ecologically relatively pure, the upper active circulation zones are chemically and microbiologically polluted (tens of meters) from the agricultural activities and wastewater in the area.

The second group of karstic groundwater bodies – GK, is represented by sporadically saturated carbonate stratum of upper Cretaceous sediments (temporary code GKK0031). It is characterized by intensive saturation and low mineralized, suitable for drinking waters.

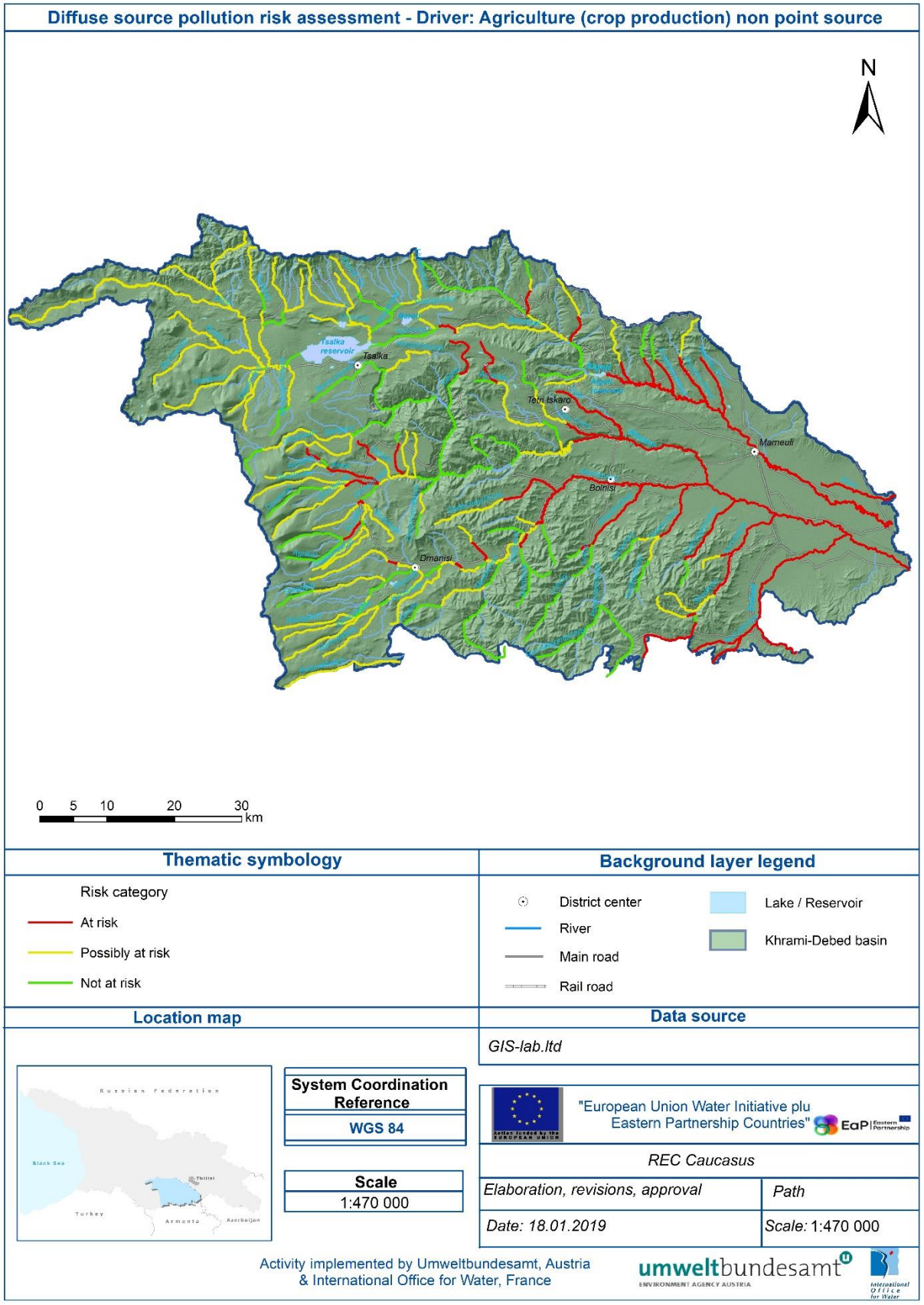
The third, the biggest group of fractured groundwaters (F) united the following groundwater bodies of similar hydrochemical and pressure properties: Sporadically saturated lava formations of upper Pliocene-Quaternary age (temporary code GFK0027); Sporadically saturated volcanic deposits of lower Miocene-upper Pliocene sediments, (temporary code GFK0029); Sporadically saturated massive and coarst grained piroclastolices of middle Eocene sediments (temporary code GFK0030); Aquifer of volcanic stratum of upper Cretaceous, (temporary code GFK0032); Aquifer volcanogenic stratum of the Bayosian stage (temporary code GFK0033) and Sporadically saturated sediments of Leyas deposits (temporary code GFK0034). They, in the upper active circulation zone, contain low mineralization, suitable for drinking waters.

Status of the Waterbodies: For assessment of pressure indicator and preliminary risks for untreated wastewater was used “Analysis of Pressures and Impacts” and “Assessment of Risks”. The water objects were graded into risk categories “Not at risk” (Dww1<1), “Possibly at risk” (1< Dww <1.5) and “At risk” (Dww>1.5). 9 SWBs were identified as undergoing pollution pressures from untreated municipal wastewater and drainage wastewater from RMG mining company: Algeti (Alg 117, Get201), Mashavera (Mash 202, Mas2014, Mas211), Khrami (Khr 111), Kazretula.

Since the crop production is the leading sector in the Khrami-Debeda river basin and all types of mineral fertilizers are used in this sector, it has significant impact on water bodies in this basin. 72 water bodies have been graded into risk category “At risk”, while 112 water bodies are classified as “Possibly at risk”.

[1] Dilution indicator, Dww = L/Qmin,r, where L is load equivalent originating from wastewater discharge into the rive and Qmin,r - Minimum annual flow of the river [l/s]

Map 4. Diffuse source pollution risk assessment – Driver Ariculture



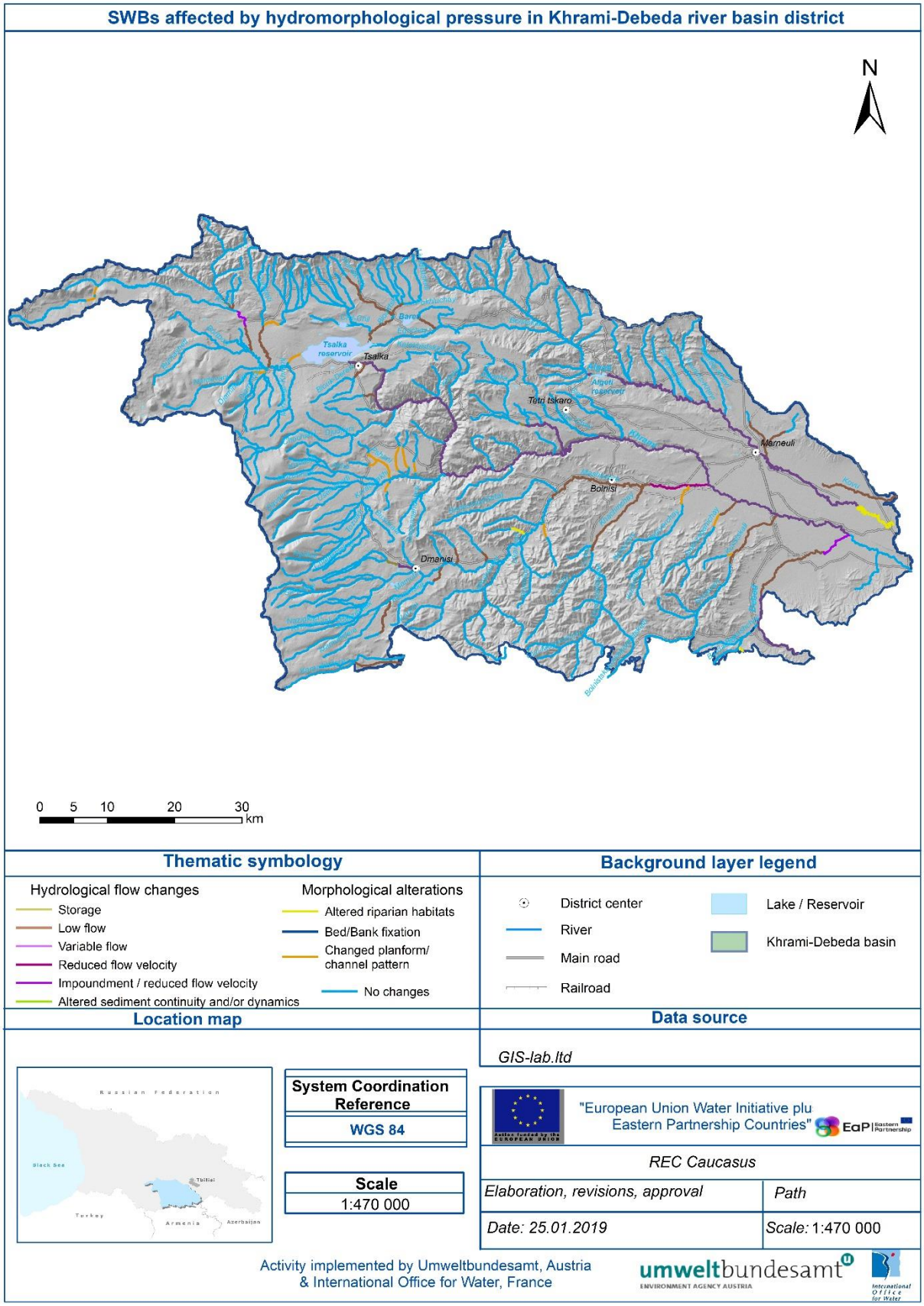
After calculation of animal livestock diffused source pollution pressure indicator the preliminary risk assessment has been performed. 12 water bodies have been specified as “At risk”, while 31 water bodies have been rated as “Possibly at risk”.

16 water bodies under significant abstraction pressure have been identified in the Khrami-Debeda river basin: Khachinchay (Kha303), Mashavera (Mas213), Khrami (Khr119, Khr114, Khr110, Khr129, Khr129, Khr134, Khr111), Debeda (Deb201, Deb202), Mashavera (Mas215, Mas213), Djaminchay (Dja301), Bortborti (Bor204).

The evaluation/identification of hydro-morphological changes have been made by means of the high-resolution satellite images and photo-interpretations. 15 water bodies under significant hydro-morphological pressure were identified in the Khrami-Debeda river basin: Algeti (Alg117), Debeda (Deb202), Gub304, Khrami (Khr108, Khr110, Khr111, Khr112, Khr113, Khr129, Khr130, Khr131, Khr132), Mashavera (Mas215, Mas216), Sachure (Shv402).

According to monitoring data, parameters of artesian wells is stable, debits do not change or vary in a small interval. The underground waters of the wells and sources of water, temperature, chemical composition, general mineralization and microbiological indicators of underground waters of wells have changed insignificantly within the permissible norms in recent years.

Map 5. Hydromorphological alteration in Khrami-Debeda River Basin



Monitoring System: There are only 4 water quality monitoring stations in the Khrami basin (TsiteliKhidi, Imiri, Nakhiduri, and Khramhesi), and only 1 station (Sadakhlo) in the Debeda river basin, which operate under the National Environmental Agency of the Ministry of Environmental Protection and Agriculture. The monitoring is not systematic therefore it is difficult to get a full picture of water quality.

On the above-mentioned stations are monitored the following physical and chemical parameters: pH, oxygen dissolved in water (DO)), *Biochemical Oxygen Demand (BOD),* nitrite, nitrate, ammonium nitrogen, phosphates, sulphates, iron, zinc, copper, lead and manganese content, electro conductivity and mineralization. Monitoring of specific organic substances (for instance HAP, PCB, pesticides, etc.) are not covered under the National Quality Monitoring Program.

Only one hydrological station operates in the Khrami-Debeda river basin right now, on the Mashavera river near Kazreti. In various years hydrological observations were carried out at the following stations: the river Qtsia - Kuschi (1946-1987), Edikilisa (1946-1993), Chatakhi (1956 – 1987), Dagheti (1938-1998), Imiri (1983-2006), Tsiteli Khidi (1956- 1993), the river Bolnisistskali - Samtsverisi (1941-1998), the river Shulaverdi – Shaumiani (1949-1993), the river Debeda - sadakhlo (1954-1993).

There are two groundwater monitoring stations in the Khrami-Debeda river basin: well #41 in Marneuli Municipality, village Kvemo Bolnisi (X-460252, Y-4581157) and well # 42 in vil. Azizkendshi, Marneuli Mniciaplity. In December 2017, the National Environmental Agency installed an up-to-date equipment on the wells, allowing continuous monitoring of groundwater quality

1.4 Governance

Legal amendments necessary for implementation of river basin Management: Georgia has committed to the harmonization of its national legislation with the EU Acquis, including the Water Framework Directive.

The draft law on Integrated Water Resources Management is developed and currently under consultation process with different ministries and other stakeholders.

Six by-laws (draft Governmental Decrees) have been also prepared to ensure proper enforcement of the water code:

- On Approval of the Procedure of the Development, Consideration and Endorsement of River Basin Management Plans;
- On Approval of Procedure for Identifying Water Bodies and Establishing Boundaries;
- On the rules on composition and functioning of River Basin Council;
- On Approval of Technical Regulation on Calculation of Maximum Admissible Discharge (MAD) Norms of Pollutants Discharged with Wastewater into Surface Water Bodies;
- On identification and delineation of river basins;
- On the Rules for planning and implementation of water resources monitoring.

The draft law on Integrated Water Resources Management is aligned to the principles and provisions of the EU WFD as well as the IWRM principles.

According to the draft law on Intergrated Water Resources Management Georgia has to introduce the river basin management and prepare river basin management plans for main rivers, conduct consultations with the public and publish these plans (art. 13 and 14 of EU–Georgia AA).

According to the AA, Georgia has obligation to develop river basin management plans based on the requirements of the Water Framework Directive by 2024.

Key stakeholders: Development of the state policy in the sphere of water protection and use as well as the adoption of legislative acts concerning water use and protection and control is the responsibility of the Ministry oif Enviroment Protection and Agriculture of Georgia. Implementation of water monitoring and assessment of the water quality of inland and coastal waters, as well as provision of meteorological and geo-morphological observations, and maintenance of respective records is responsibility of National Enviroment Agency of the Ministry of Environment Protection and Agriculture.

2 MAIN ISSUES

A number of challenges were identified during the development of Draft River Basin Management Plan for Khrami-Debeda River Basin which lead to deterioration of water quality and water scarcity problem. The main issues identified are presented below:

2.1 Deterioration of surface and groundwater quality

- Only municipal centres (Bolnisi, Dmanisi, Marneuli, Tetritskaro, Tsalka) in the Khrami/Debeda river basin have a sewage system. Rural areas are not covered by centralized sewerage systems at all. There is no sewerage treatment facility in the river basin. It is planned to build a sewerage treatment facility in Marneuli which will receive sewage waters from Marneuli and Bolnisi. 1,281,198 m^3 untreated sewage water was directly discharged into the river basin in 2017.
- The main issue of the Khrami/Debeda river basin is the water contamination caused by the release of industrial wastewater from Madneuli ore mining and processing enterprise. The content of Copper, Zinc, Cadmium, Lead, Cobalt and Nickel in the soil of Kazreti area, grounds of the Kazretula and Mashavera rivers, also, waters in the Mashavera and Pholadauri river basins exceeded by many times the limited permissible concentrations. Despite some recent measures taken in this regard, the contamination of the Kazretula, Mashavera and Pholadauri rivers remains an acute issue, which must have been caused by the perennial contamination from Madneuli enterprises.
- Diffuse pollution caused by mineral fertilizers, pesticides and manure from the agricultural sector. For impact assessment of diffuse source pollution, there is no available data on the usage of these substances, which is the issue in this regard. In the Khrami/Debeda river basin, the area affected by diffuse agricultural (crop production) pollution source constitutes 111399 ha. Whereas 63 959 ha is possibly polluted.
- Disposal of municipal/solid waste directly into the streams due to weak waste collection and disposal management system (especially plastic waste)
- Absence of drainage water management systems on the existing landfill. At present, there is no sanitary regional landfill within the Khrami/Debeda basin, which meets the standard of EU Landfill directive with the system of leachate water collection and treatment in place.

2.2 Disturbance of Ecological Flow and Geo-Morphological Modifications

- Poor condition of the irrigation systems resulting in huge water losses from the system (50%); The poor quality and insufficiency of internal irrigation systems of internal irrigation systems (the lack of dripping irrigation, windbreaks).
- Increasing water consumption for hydropower generation (69% of water taken in 2016). In total, there are 9 small and medium-sized HPPs and the construction of 14 HPPs is planned.

- 15 water-facilities are threatened due to hydro-morphological modifications in the Khrami / Debeda basin. Hydromomorphological modifications are mainly caused by disturbance of flow.

2.3 Incomplete System of Rational Use and Protection of Water Resources

- Incomplete legislative framework, institutional arrangement and basin management legislation – the new Framework Law on Integrated Management of Water Resources has not been adopted, there are no river basin boards.
- The absence of surface- and groundwater quality control and hydrological monitoring networks. Out of 9 hydrological stations existing in the 90s, only 1 of them operations. As for the water quality monitoring, there are only 4 stations in the Khrami basin and 1 station in the Debeda basin.
- Water scarcity - According to water use planning, there is an increasing trend of water demand from energy, irrigation and water supply systems) and there is no forecast and water distribution system for the cumulative loading on the river basin
- Weak water quality control/monitoring system, including Biological monitoring (A biological monitoring system is currently being developed; The restoration of ground water monitoring system started several years ago; There exists no data detailed data on the use of pesticides and fertilisers; There is no monitoring of water facilities pollution with pesticides).
- Lack of data on water resource utilization. There is no complete annual data on water collection and water discharge, which is significant to assess the impact and implement priority measure.
- The absence of modern standards and methods of designing hydro technical structures (unclear norms for maintaining ecological consumption in the rivers, which can cause conflict between water major water consumers and endanger ecosystems).

3 TIMETABLE AND WORK PLAN TILL THE ADOPTION OF THE DRAFT RBMP

N⁰	Activities	2019									
		Months									
		Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
1	Economic Analyses (part 1)										FINALIZATION
2	Objectives										
3	Program of Measures										
4	Economic Analyses (part 2)										
5	draft River Basin Management plan										
6	Second Technical Report										

4 TECHNICAL REPORTS

First Technical Report: Presents the initial results of development of Khrami-Debeda River Basin Managemnt plan: Delineation of water bodies and characterization of the Khrami-Debeda River Basin.

Second Technical Report: Presents Economic analysis (part 1 and part 2), Objectives, Programme of measure and draft Khrami-Debeda River Basin Managemnt plan.

5 GLOSSARY

Water bodies	Homogeneous natural hydrological basic unit or volume of groundwater within an aquifer.
Hydromorphology	The physical characteristics of the shape, the boundaries and the content of a waterbody.
Pressures	The direct effect of the driver (for example, an effect that causes a change in flow or a change in the water chemistry on water bodies). A significant pressure, on its own, or in combination with other pressures, would be liable to cause a failure to achieve the environmental objectives.
RBMP	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.
Status	Condition of a water body resulting from natural and anthropogenic factors (= potential). Can be High, good, moderate, poor, or bad.
Status	The condition of the water body resulting from both natural and anthropogenic factors (i.e. physical, chemical and biological characteristics). Reference conditions - near natural conditions that reflect the status of the environment in the absence or with minimal human impact.
Water Allocation	The planning process using regulatory tools which consists in supplying all users with water volumes according to the legal framework in order to meet the demand. Water allocation refers to sectorial share but also to individual water permits.
Water balance	It is the gap between existing water supplies and water demand (including ecological flow). As both waters demand and supply facilities (dams' storage, water table…) fluctuate on a seasonal and daily basis, water balance must enable to account for these variations in fluctuations.

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