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Governing for Growth in Georgia

REPORT ON PRESENTATION OF FINAL GUIDACE DOCUMENTS AND TRAINING WORKSHOPS

SUMMARY OF MEETINGS

USAID GOVERNING FOR GROWTH (G4G) IN GEORGIA

25 September 2017

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USAID GOVERNING FOR GROWTH (G4G) IN GEORGIA

CONTRACT NUMBER: AID-114-C-14-00007

DELOITTE CONSULTING LLP

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WORK PLANNING: WATER RESOURCE MANAGEMENT 3600

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DATA

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Project Component:	Water Resource Management Component
Practice Area:	Water Resource Management
Key Words:	Mashavera River Basin, Kazretula, Guidance Documents, WFD

ACRONYMS

AA	EU-Georgia Association Agreement
GEO	Georgia's Environmental Outlook
G4G	Governing for Growth in Georgia
GoG	Government of Georgia
MENRP	Ministry of Environment and Natural Resources Protection of Georgia
NEA	National Environmental Agency
NGO	Non-Governmental Organization
USAID	United States Agency for International Development
WFD	Water Framework Directive

INTRODUCTION

G4G is a five-year USAID funded project implemented by Deloitte Consulting LLP since 2014. G4G aims to support Government of Georgia (GoG) in sustainable management of freshwater resources across multiple competing interests. Within its mandate, G4G implements number of the activities which facilitates improving of regulatory and legal framework for the effective management of river basins in Georgia.

On June 27, 2014 Georgia and the European Union signed Association Agreement (AA). With signing of the Association Agreement, the GoG has made a commitment to bring its laws and practices closer to those of the European Community, including the water protection/management requirements.

Following the signing of AA agreement, the Ministry of Environment and Natural Resources Protection of Georgia (MENRP) has developed a Road Map for the implementation of the EU-Georgia Association Agreement (AA) in the field of environment and climate action. The roadmap enables the MENRP to implement legal approximation, policy making and similar activities in line with the specific requirements of the AA (including water resources management). To support the sound implementation of WFD, the AA Roadmap recommends to GoG to develop guidance documents, providing an overall methodological approach and at the same time being tailored to specific circumstances of Georgia.

G4G awarded a competitive grant to NGO Georgia's Environmental Outlook (GEO) to develop 'Water Resource Management Guidance Documents Applicable for Georgia'. The main objective of this grant is to provide support to GoG in developing the non-legally binding and practical guidance documents on technical issues of the Water Framework Directive (WFD) as well as raise awareness on water management.

The non-governmental organization (NGO) "Georgia's Environmental Outlook - GEO" is implementing this project in close consultations with G4G team, relevant governmental institutions (Water Unit of the MENRP, the National Environmental Agency (NEA) under the MENRP), G4G grantees and other related projects.

Expected results of the grant are as follows: 1. Two selected non-legally binding practical Guidance Documents developed, as technical tools for the implementation of particular provisions of the WFD at national level; 2. Understanding on technical aspects of the WFD raised and capacity of relevant staff of the MENRP in practical application of developed Guidance Documents strengthened; and 3. Information on existing practice as well as international expertize shared among national stakeholders.

The main grant activities are: 1. Selection of Guidance Documents; 2. Preparation of the Guidance Documents applicable for Georgia in close cooperation with the MENRP and in consultation with other key stakeholders; and 3. Organization of stakeholder workshops and trainings.

The grant activity milestones are listed below:

1. Inception Phase (selection of Guidance documents, detailed planning, etc.)
2. Development of Draft Guidance Document I;
3. Development of Draft Guidance Document II and Stakeholder Discussion;
4. Finalization of Guidance Documents;
5. Presentation of Final Guidance Documents and Trainings;
6. Final Phase (Develop a report on project implementation).

This report presents report on presentation of the final Guidance Documents and trainings (5th milestone of the project).

CONTENTS

1. PRESENTATION MEETING AND TRAININGS

1.1 PRESENTATION OF GUIDANCE DOCUMENTS

Final drafts of the Guidance Document I ("Analysis of Pressures and Impacts and Assessment of Risks Applicable for Georgia") and Guidance Document II ("Classification of Ecological Status and Ecological Potential Applicable for Georgia") were presented and discussed with stakeholders on 19 September, 2017. Representatives of the MENRP, NEA, Environmental Supervision Department of the MENRP, other donor supported related projects and academic sector attended the meeting. In total 24 participants were presented. Meeting Agenda, the list of participants and photos are attached in Annexes I.

After the opening remarks by Ms. Mariam Makarova – Head of the Water Unit if the MENRP and Ms. Khatuna Gogaladze - Project Manager (GEO), the international and national Experts presented the final Guidance Documents to the audience. The presentations were followed by live discussions and remarks.

1.2 TRAININGS

After a half day presentation meeting, the theoretical part of 2 day training started for the representatives of the National Environmental Agency, Water Unit, Environmental Supervision Department, Environmental Permit Department and others. The training was based on the prepared training module on practical application of the Guidance Documents (Annex II).

The 2-day training was designed in the following way: the half day theoretical part of training was conducted on 19 September, 2017 back to Guidance document presentation meeting as mentioned above. Theoretical part aimed at working on desk exercises and explaining/preparing the targeted audience for the field visit. Specifically, training participants were split in 3 groups and were requested to make calculations using the formulas provided in the Guidance Documents. They were provided by maps and some descriptions of the situation. Based on provided information, participants were tasked to delineate river basin boundaries, identify main pressures, define water status, etc.

Theoretical part of the training was followed by the one-day practical training on 20 September, 2017 in the Mashavera River basin. This basin was selected because of existing diverse pressure sources. The purpose of the practical part of the training was to contribute testing and checking the results that were obtained during the theoretical part of training workshop (on 19 September). Specifically, 5 sites were identified and visited. The sites were selected by taking into account reference condition and existing pressures on the river.

The following observation sites and sampling locations were visited:

1. The Mashavera River, upstream of Dmainisi to assess reference condition regarding to biological (macroinvertebrates) and hydromorphological elements.
2. Section of the Mashavera River near Didi Dmanisi to assess impact from untreated wastewater and agricultural activities.
3. Section of the Mashavera River below Didi Dmanisi to assess impact caused by hydrological regime change.
4. The Kazretula River near Kazreti to assess the impact of mining industry on the Kazretula River and also on the Mashavera River after confluence with Kazretula River.

5. The Mashavera River near village Khidiskuri to assess pressure and impact from dredging materials.

During the filed visits biological sample (macroinvertebrates) was taken and hydromotphplogical observation conducted by using Hydromorphological assessment Protocols. Visual observation of pressures and impacts on the river was also carried out.

After the field visit, a half-day training was conducted on 21 September, 2017. The purpose of this part of training was to summarize and present the field trip findings and debriefing the project beneficiaries.

In total 17 people were trained out of which 5 were men and 12 women. The List of participants, agenda and photos of both theoretical and practical parts of the training are attached in the Annex III.

ANNEX 1. GUIDANCE DOCUMENTS PRESENTATION MEETING AGENDA, REGISTRATION FORM AND PHOTOS

Date | Time: 19 September, 2017 | 10:30
Location: Hotel "Holiday Inn"
#1 26 May Square
Tbilisi, Georgia

AGENDA

Develop Water Framework Directive (WFD) Implementation Guidance Documents for Georgia

19 September

PRESENTATION OF THE GUIDANCE DOCUMENTS AND TEORETICAL PREPARATION FOR FIELD TRAINING

10:30 – 11:00 **Welcome coffee**

11:00 - 11:15 **Opening remarks**

Gizo Chelidze, Head of the Integrated Management Department (MENRP) TBC

Ketevan Skhireli, Environmental Specialist (G4G) TBC

Khatuna Gogaladze, Project Manager (GEO)

Presentations of the Draft Guidance Document I and II

11:15 - 11:45 Presentation of the final Draft Guidance Document on Analysis of Pressures and Impacts and Assessment of Risks applicable for Georgia

Peter Roncak – International Expert

Eliso Barnovi – National Expert

11:45 – 12:00 Discussion/Q&A

12:00 – 12:30 Presentation of the final Draft Guidance document on Classification of Ecological Status and Ecological Potential applicable for Georgia

Peter Roncak – International Expert

Eliso Barnovi – National Expert

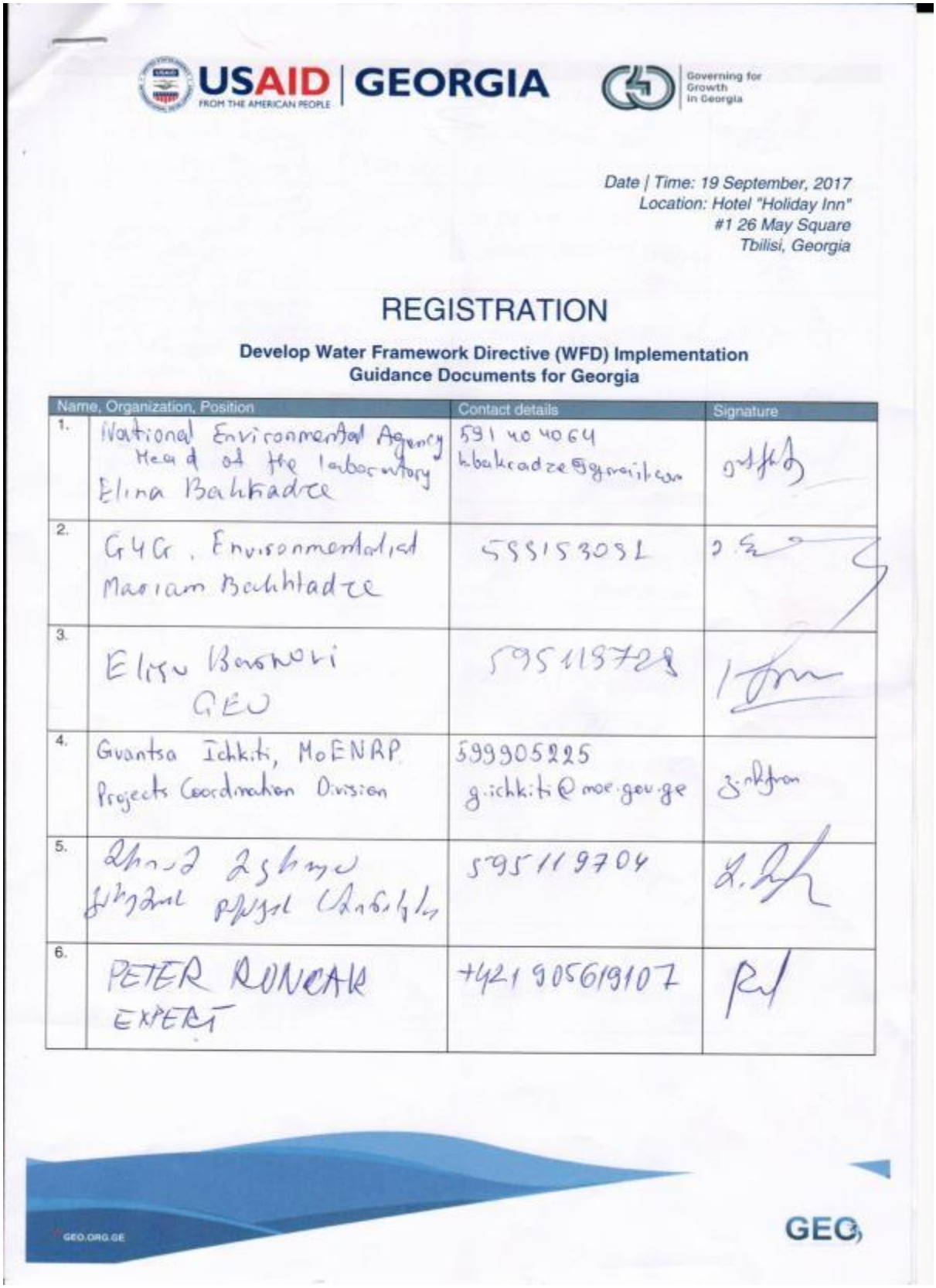
12:30 – 12:45 Discussion/Q&A

12:45 – 13:00 **Final remarks**

Closing of the meeting

13:00 – 14:00 **Lunch**

Registration Form



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Date | Time: 19 September, 2017
Location: Hotel "Holiday Inn"
#1 26 May Square
Tbilisi, Georgia

REGISTRATION

Develop Water Framework Directive (WFD) Implementation Guidance Documents for Georgia

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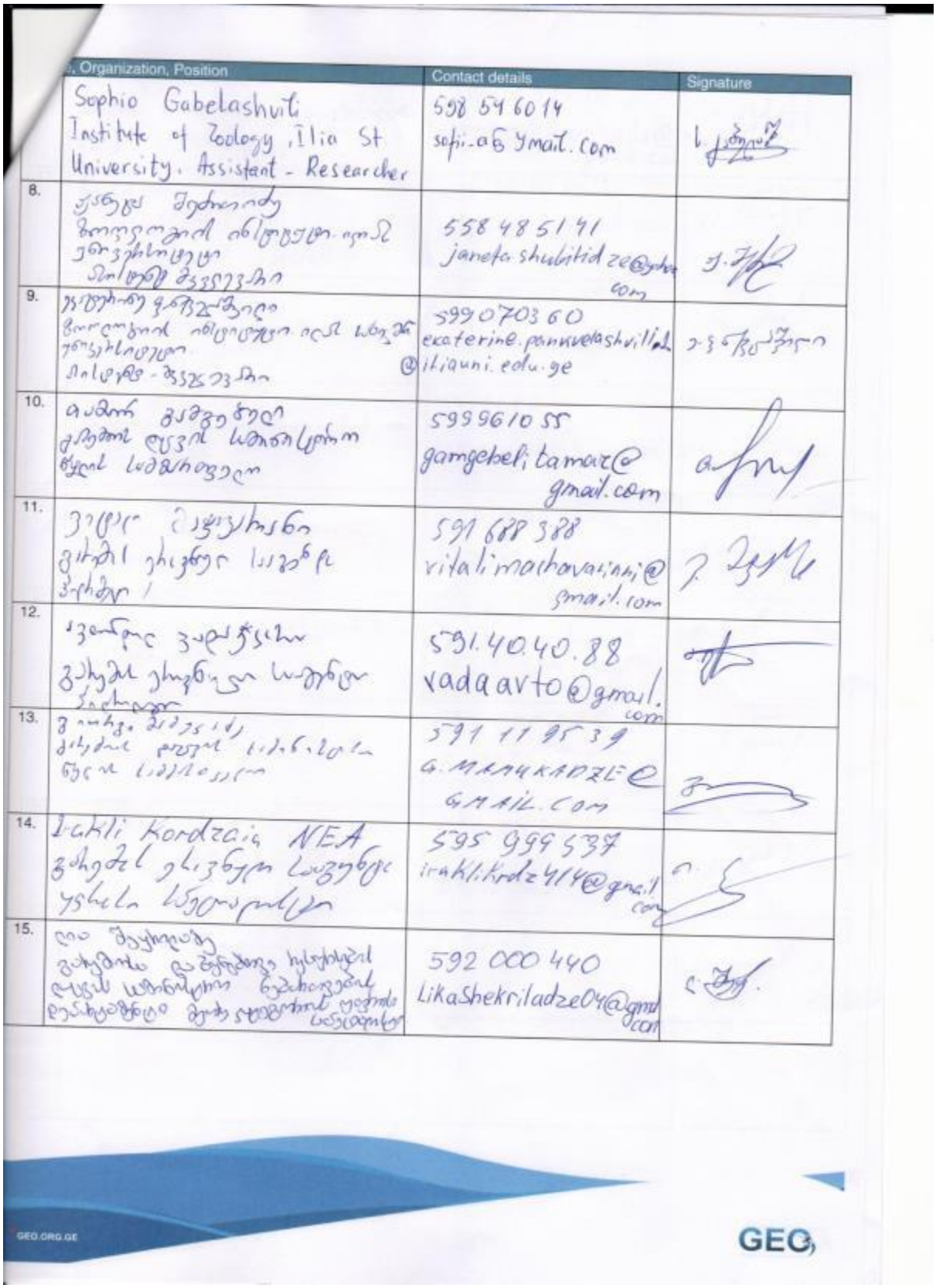

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Photos


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Implementation Guidance Documents
for Georgia
KHATUNA GOGALADZE
PETER RONCAK


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ANNEX 2. TRAINING MODULE FOR THE TRAINING WORKSHOP ON PRACTICAL APPLICATION OF TWO GUIDANCE DOCUMENTS

ACRONYMS

BOD	Biological Oxygen Demand
COD	Chemical Oxygen Demand
EQR	*Ecological Quality Ratio*
EQS	Environmental Quality Standard
GIS	Geographic Information System
G4G	Governing for Growth in Georgia
EPIRB	Environmental Protection of International River Basins, EU Project
EU	European Union
HMWB	Heavily Modified Water Body
IMPRESS	CIS Guidance for the analysis of Pressures and Impacts In accordance with the Water Framework Directive.
REFCOND	Guidance Document No. 10 River and lakes – Typology, reference conditions and classification systems (2003).

CONCEPT OF TRAINING WORKSHOP

ON PRACTICAL USE OF

DRAFT GUIDANCE DOCUMENT ON ANALYSIS OF PRESSURES AND IMPACTS AND ASSESSMENT OF RISKS APPLICABLE FOR GEORGIA AND DRAFT GUIDANCE DOCUMENT ON THE CLASSIFICATION OF ECOLOGICAL STATUS AND ECOLOGICAL POTENTIAL APPLICABLE FOR GEORGIA

Objectives and tasks

This activity will contribute to the implementation of the activities defined by the Project ,,Develop Water Framework Directive (WFD) Implementation Guidance Documents for Georgia“ (USAID - G4G - RFA#2017 - 001).
Main objective of these tasks will be increasing capacities of the respective national authorities for Pressure and Impact Analysis and Risk Assessment of the water bodies failing environmental objectives and also to assess the Ecological status of the surface water bodies as required by EU Water Framework Directive.
This specific objective of the training workshop will be to conduct practical testing of Draft Guidance Document (DG) on Analysis of Pressures and Impacts and assessment of Risks applicable for Georgia and Draft Guidance document on the Classification of Ecological Status and Ecological Potential applicable for Georgia.

Based on the objectives the following tasks of the training workshops are established:

1. Presentation of two Draft GDs for participants to be familiar with the approaches and methods used for both Pressure and Impact Analysis and Risk Assessment and Ecological Status Classification of Surface Water Bodies.
2. Field training on the use Draft Guidance Document on Analysis of Pressures and Impacts and assessment of Risks applicable for Georgia and Draft Guidance document on the Classification of Ecological Status and Ecological Potential applicable for Georgia.
   The Mashavera River basin was selected based on fact that there are potential pressures both hydromorphological and sources of pollution on water bodies and there are data available from national monitoring programmes and field surveys.
3. Evaluation of both theoretical part of the training workshop and field testing of two Draft GDs.

Results from the training workshop will be used to update the two Draft GDs.

Training workshop timeline, locations and institutional arrangement

Training workshop will be provided in Tbilisi, 19 – 21, September.
Thistraining workshop is organized for the beneficiary institutes that are responsible for the implementation of the EU WFD in the field of River Basin Management Plans development in Georgia

Training worshop equipment and materials

Equipment/Item	Quantity	Confirmation
Car (minibus)	1 – 2 depending on the number of participants	
Projector	1	

- **Data from the JFS Kura in the Mashavera River basin** - **Mean annual flow and minimum flow the Mashavera River (Bolnisi), also historical data can be used** - **Maps on land use (agriculture)** - **Statistical data on population and agriculture activities (plant crops, livestock)** - **Statistical data on water abstraction, hydromorphological alterations, point sources of pollution,** - **The river basin area (km2)**	2 set of Maps printed A3	
Markers (to draw the line for different risk areas)	4 sets	
Hydromorphological assessment Protocols	10	

Instructions for testing the Draft Guidance Document on Analysis of Pressures and Impacts and assessment of Risks applicable for Georgia are in **Annex 1** and Instructions for testing the Draft Guidance Document Classification of Ecological Status and Ecological Potential applicable for Georgia are in **Annex 2** of this document.

ANNEX 1

Instructions for testing the Draft Guidance Document on Analysis of Pressures and Impacts and assessment of Risks applicable for Georgia

During the training workshop of this Draft GD both hydromorphological pressures and pressures from pollution sources on the Mashavera River basin will be tested.

Testing of the Draft GD on Ecological Status and Potential Classification system (ESCS) consists of two stages and several steps that are described below.

Stage 1 Desk work. During this stage data and information available from national monitoring programme and EU projects (EU Kura II, EU Kura III and EU EPRIRB) will be used for analysis, whether due to significant pressures the water bodies in the Mashavera River basin are at risk to fail environmental objectives.

Stage 2 Field survey in the Mashavera River basin will be conducted to check the results from the desk work part.

Some assumption

Significant pressures were identified in the Mashavera River basin as follows:

- Hydromorphological alterations (impoundment and flow regulations were not recognized as significant pressures)
- Urban waste water (partly treated, untreated waste water)
- Agriculture (both plant and livestock production)

Note: Rural development was not found as significant pressure (household clusters=septic tanks).

Risk categories due to hydromorphological pressures are used as described in table below.

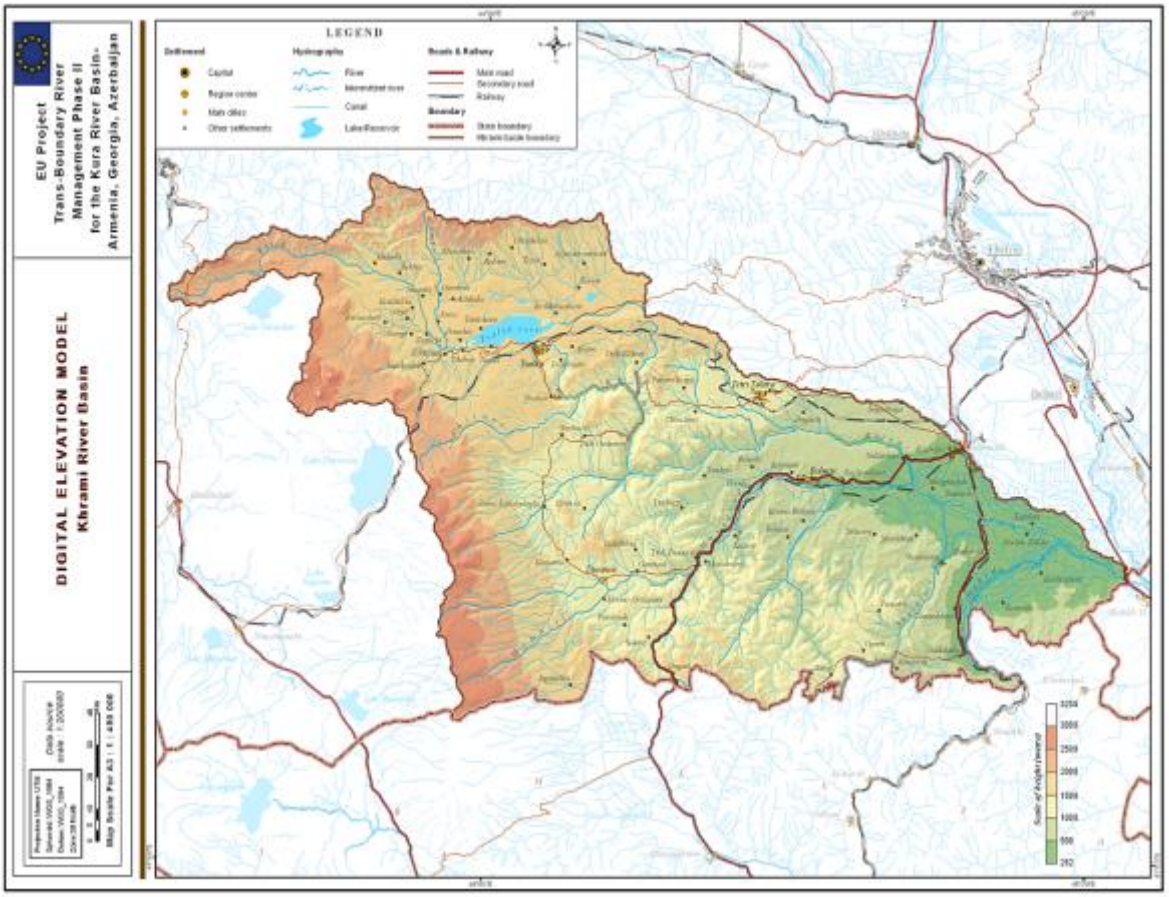
Risk Category #	Risk Category Name
1	**Water body <u>at risk</u> to fail the EU WFD environmental objective** One or more significant (see risk criteria in Tables below in Chapers 3.2 and 3.3) hydromorphological alterations are assessed (barriers, impoundments, water abstraction, hydropeaking) River morphology (if available) is “extensively modified or severely modified’. Water bodies of this group should be considered as heavily modified (HMWB).
2	**Water body <u>possibly at risk</u> to fail the EU WFD environmental objective** Data sets are insufficient to apply criteria and gaps need to be filled. OR No significant (see **risk criteria**) hydromorphological alterations (barriers, impoundments, water abstraction, hydropeaking) are assessed. However, river morphology (if available) is “moderately modified”. This group is temporary, because decision whether these water bodies should belong to category “provisional HMWB” cannot be done and needs additional data and investigation.

3	**Water body <u>not at risk</u> to fail the EU WFD environmental objective** No significant (see **risk criteria**) hydromorphological alterations (barriers, impoundments, water abstraction, hydropeaking) are assessed. River morphology is “near-natural” or “slightly modified”. Water bodies of this group should be considered as natural river water bodies regarding hydromorphology. However, other pressures may be assessed.

Step 1 Make sub-division of the Mashavera River basin up to Khidiskuri cross section into river size categories based on the Tab. 1. For this purpose used Map 1.

Table 1. River size categories

River size category	Channel width	Catchment Area Sizes	Description of River Type
Small	< 10 m	10 km^2 – 100 km^2	Mountain ‘gravel’ river type
Medium	10 – 30 m	100 km^2 – 1000 km^2	Semi-Mountain ‘gravel’ river type
Large	> 30 m	> 1000 km^2	Lowland/Plain river type

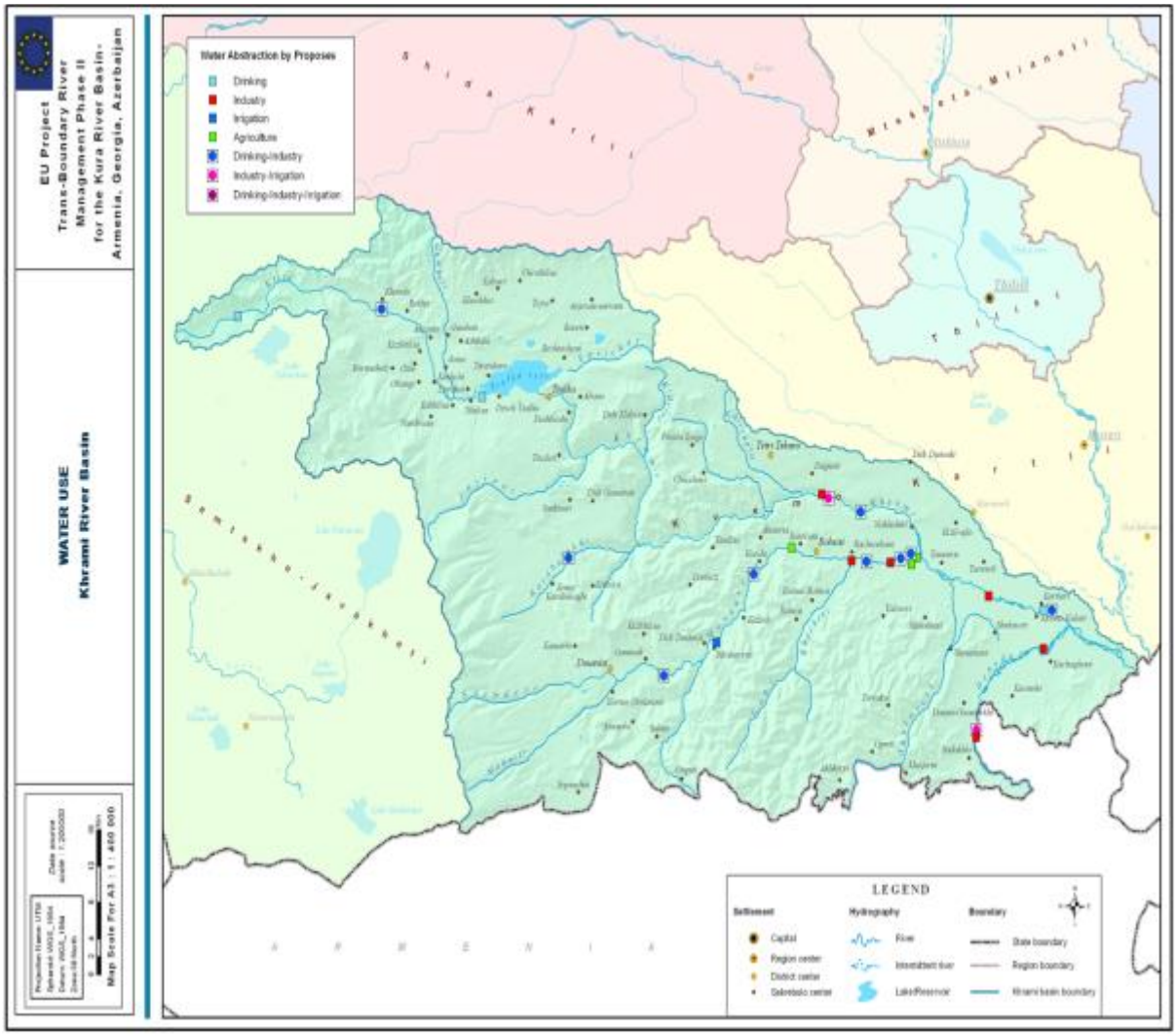


Map 1. Topographic map of Mashavera/Khrami River basin

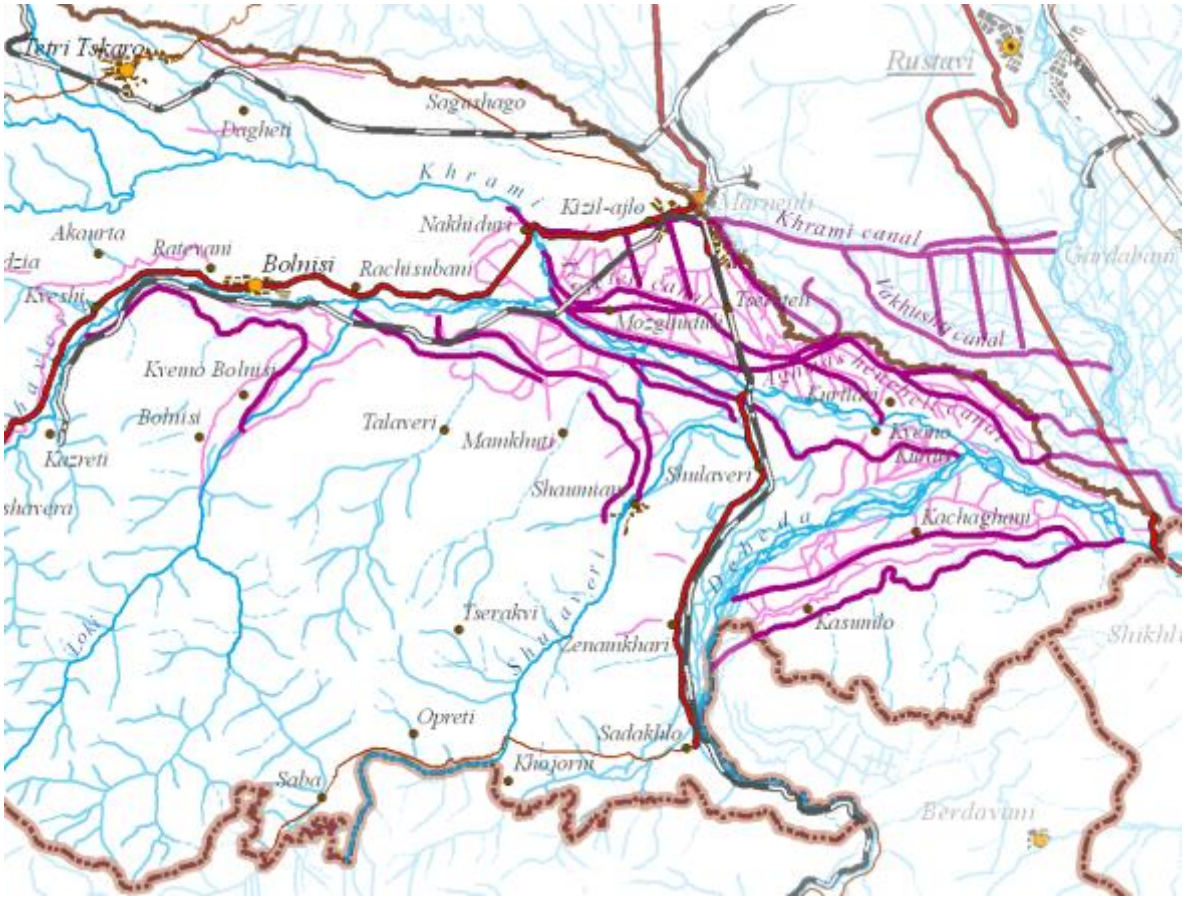
HYDROMORPHOLOGICAL PRESSURES

Hydrological flow changes

Step 2. For assessing the hydrological flow changes use Map 2 and 3 and also data from Tab. 3. From Table 3 is visible that after Didi Dmanisi where the weir is constructed for irrigation water abstraction, river flow discharges are decreased. Naturally, river flow values would be increased due to contributions from the basin tributaries. Based on the data, calculate % decreased in downstream sites and put these data into Tab. 3.



Map 2. Water Abstraction in the Mashavera/Khrami River basin



Map 3. Main irrigation canals in the Mashavera/Khrami River basins

Table 2 Hydrological characteristics for Kazreti hydrological station

Hydrological characteristics	***Value***
Mean annual flow (m^3/s)	5,27
Long-term mean minimum flow (m^3/s)	1,64
Specific runoff coefficient ($l/s/km^2$)	7,64

Table 2. Hydromorphological data for the Mashavera River basin

Sampling site number	**River**	**Location of sampling site**	**Q (m3/s)**	**v (m/s)**	**width (m)**	**depth (m)**	**HMQ Score**
1	Mashavera	Dmanisi	4,1	1,0	12,0	0,32	**1,05**
2	Mashavera	Didi Dmanisi	6,0	1,15	17,5	0,4	**1,15**
4	Mashavera	Kianeti	5,2	1.10	12	0.37	**1,22**

5	Mashavera	Khidiskuri	5,4	1,1	21	0,45	**3,65**

Table 3. % of flow changes between Didi Dmanisi site and downstream locations

Sampling site number	River	Location of sampling site	% of flow change	Risk category
1	Mashavera	Dmanisi	_	
2	Mashavera	Didi Dmanisi		
3	Mashavera	Kianeti		
4	Mashavera	Khidiskuri		

Step 3. Use thresholds values from Tab. 4 to classify risk categories for locations as indicated in Tab. 3 and insert data into the last column in Tab. 3 and marked them on the Map 1 by using colours (green "not at risk", yellow "possibly at risk" and red "at risk"). **An assumption is that natural flow conditions are those in Didi Dmanisi site (6,0 m^3/s.)**

Table 4. Thresholds for hydrological pressures on water body

Water Body	Threshold (provisional)	When	Note
	Thresholds for where pressures do not present a Risk		
	Combined abstraction and flow regulation pressures		
River	Hydrological change relative to natural mean annual flow conditions is for example <10% (However, different % value can be used. Hydrologists will make decision).	At all times	Expert opinion
	Thresholds for where pressures place a waterbody at Risk		
	Combined abstraction and flow regulation pressures		
River	Percentage of hydrological change relative to natural low flow conditions (e.g. >40% from natural mean annual flow)	Crossed defined percentiles*	Based on Risk Assessment method**

Hydromorphological Alterations

Step 4. A) There is one weir below Didi Dmanisi to abstract water for irrigation purposes in the Mashavera River basin. The weir is functioning mainly

during the vegetation season that can partly cover also spawning time for some species of fish (trout). To assess the River and Habitat Continuity Interruption use thresholds from Tab. 5 and marked them on the Map 1 by using colours (green "not at risk", yellow "possibly at risk" and red "at risk").

Table 5. Thresholds regarding the pressure "River and Habitat Continuity Interruption" (adopted from EU EPIRB, 2013)

River Size	Not At Risk	Possibly At Risk	At Risk
Small & Medium	No artificial barrier Or barrier that is equipped with a functioning fish bypass facility/fish migration aid	No sufficient information is available if fish bypass facility/fish migration aid is functioning;	One or several artificial barrier in place that hinder fish migration and interrupt habitats
Large	No artificial barrier Or barrier that is equipped with a functioning fish bypass facility/fish migration aid	No sufficient information is available if fish bypass facility/fish migration aid is functioning;	One or several artificial barrier in place that hinder fish migration and interrupt habitats

B) During the field surveys in previous two years, it was found that there are two locations were materials from the Mashavera River are dredged. It was in Kianeti location where around 10 % of investigated area was affected and Khidiskuri where it was more that 50 % of overall investigated area affected

Note: investigated area (in such type of the river as the Mashavera River) is 200 m length and up to 30 m width.

Take the thresholds values from Tab. 6 for risk assessment of the presuure from "dredging and removal of natural material" on the river morphology and marked them on the Map 1 by using colours (green "not at risk", yellow "possibly at risk" and red "at risk").

Table 6 Thresholds regarding the pressure "dredging and removal of natural material"

River Size	Not At Risk	Possibly At Risk	At Risk
Small & Medium & Large	No dredging	<15% of surveyed river reach affected	>30% of surveyed river reach affected

C) For assessment pressures on overall "river morphology" used data from Tab. 7. (Hydromorphological Quality Score values (HMQS) and compare than with threshold classes values from Tab. 8 to classify the locations. After that use threshold values from Tab. 9 to assess the risk categories for the locations and marked them on the Map 1 by using colours (green "not at risk", yellow "possibly at risk" and red "at risk").

Table 7 Hydromorphological data for the Mashavera River basin

Sampling site number	River	Location of sampling site	Q (m3/s)	v (m/s)	width (m)	depth (m)	HMQ Score

1	Mashavera	Dmanisi	4,1	1,0	12,0	0,32	**1,05**
2	Mashavera	Didi Dmanisi	6,0	1,15	17,5	0,4	**1,15**
3	Mashavera	0.5 km below Kazreti	5,2	1.09	11	0.38	**1,22**
4	Mashavera	Kianeti	5,2	1.10	12	0.37	**1,22**
5	Mashavera	Khidiskuri	5,4	1,1	21	0,45	**3,65**
6	Poladauri	0,2 km from mouth	0,25	0,7	4,5	0,2	**1,21**

Table 8 Preliminary boundaries of the hydromorphological quality classes to assess river morphology alterations

Hydromorphological quality class		**HMQS theshold values**	**Colour**
1	High	1,0 – 1,7	High
2	Good	1,8 – 2,5	Good
3	Moderate	2,6 – 3,4	Moderate
4	Poor	3,5 – 4,2	Poor
5	Bad	4,3 – 5,0	Bad

Table 9 Thresholds regarding the pressure on “River Morphology”

River Size	Not At Risk	Possibly At Risk	At Risk
Small & Medium & Large	The surveyed river reach is assessed with ‘high quality’: Morphological Quality Class 1 **OR** <30% of overall water body length is allocated to Morphological Quality Class 3-5	No sufficient information is available; **OR** <70% of overall water body length is allocated to Morphological Quality Class 3-5 **and** <30% of WB length Morphological Quality Class 4-5	>70% of overall water body length is allocated to Morphological Quality Class 3-5 **OR** >30% of overall water body length is allocated to Morphological Quality Class 4-5

PRESSURES FROM THE POLLUTION SOURCES

This chapter focuses on the analysis pressures and impacts that may put a water body at risk of failing environmental objectives due to pollution from point and diffuse sources.

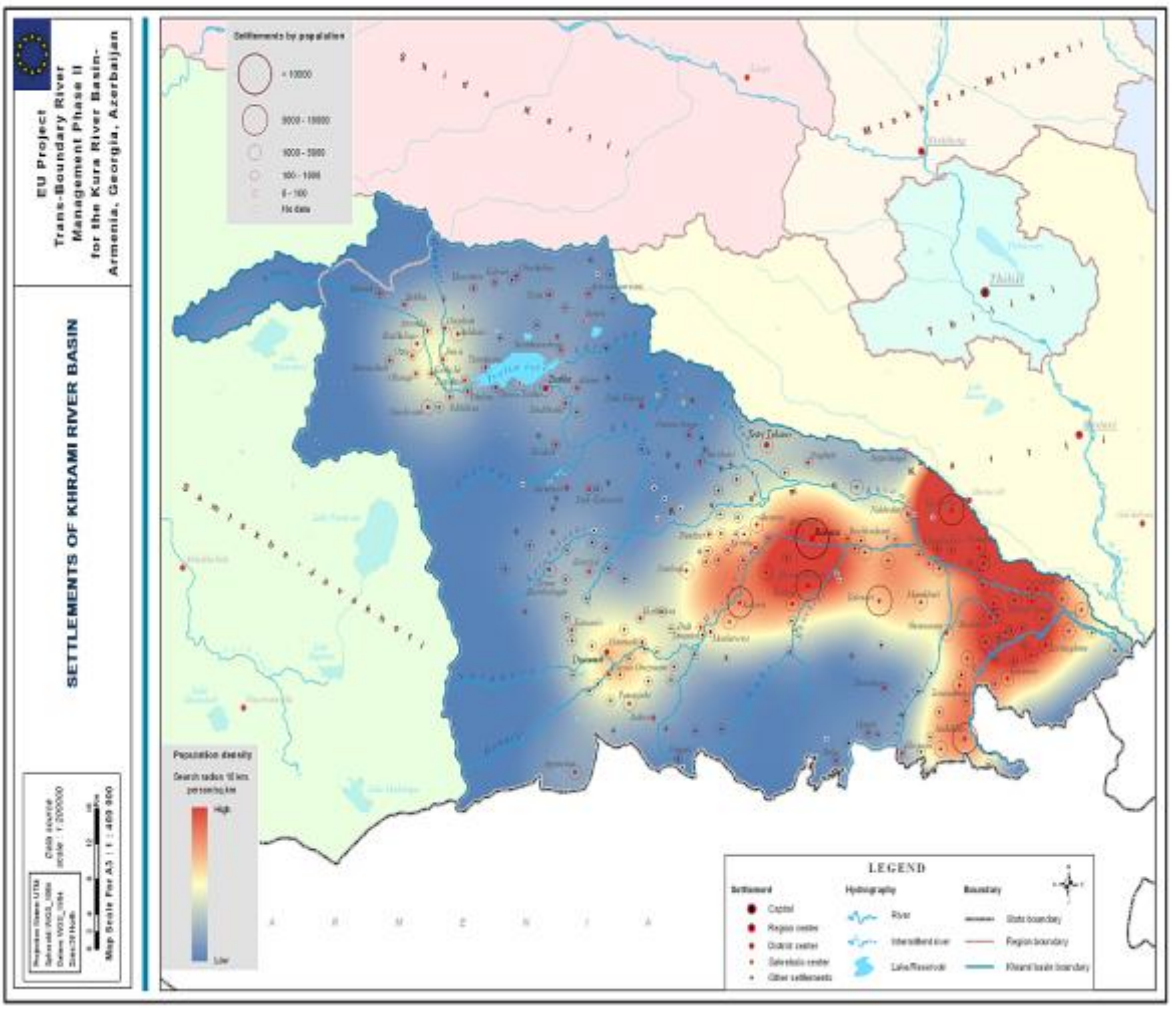
Note: There are no functional waste water treatment plants in the Mashavera River basin. Therefore, pressures from both urban and industrials waste water treatment plants are not assessed in this exercise.

Pressures from urban waste water

Only the bigger towns in the Mashavera River basin have sewage systems. People in the villages mainly use septic tanks and pit latrines. The following towns have sewage systems:

1) Dmanisi
2) Kazreti
3) Bolnisi

Not all people living in the towns listed above are connected to the sewage systems; the connection rate is approximately 70 %. The Map 4 presents the population density in the Mashavera/Khrami River basin.



Map 4. Population density in the Mashavera/Khrami River basin

Partly treated and untreated urban waste water

Step 5 Partly treated urban waste waters. There is sewer system (canalisation) with primary treatment (mechanical) constructed in Dmanisi, Kazreti and Bolnisi. Use data from Tab. 10 (if possible estimate the number of inhabitants connected in Kazreti on canalisation and use formula below where **η will be "0")** and formula below to calculate the Load Equivalent discharged from these two agglomerations into the Mashavera River.

$D_{ww} = (L*(1-\eta))/ Q_{min,r}$

L: Load equivalents (either for organic matter, nutrients or quantity);

η: Treatment efficiency. Treatment efficiency can be selected according to the knowledge on the performance of the treatment plant. Usually the following figures in Tab. 11 can be assumed as an approximation.

Qmin,r: Minimum annual flow of the river [L/s].

Calculated Load Equivalent values fill into the Tab. 12 for sampling locations below town Dmanisi and Bolnisi.

Table 10 The distribution of population for urban and rural areas for the Mashavera River basin region (year 2008)

District	Urban	Rural	Total
Dmanisi	3,500	24,700	28,200
Bolnisi	18,700	57,300	76,000
Hydrological characteristics	**Value**		
Mean annual flow (m^3/s)	5,27		
Long-term mean minimum flow (m^3/s)	1,64		

Table 11 Values for the treatment efficiency of different wastewater treatment schemes.

		η [-] : Treatment Efficiency (%)		
	Settling Tank	**Primary**	**Secondary**	**Advanced (nutrient removal)**
Organic matter BOD	20	85	90	95
Organic matter COD		70	75	80
TSS	50	>90	>90-	>90
NH_4		<25	>90	
N_{tot}				75
P_{tot}				80

Table 12 Calculated Load Equivalent values and risk categories

District	Load Equivalent	Risk Category	Discharged volume of waste water (m^3/s)

Dmanisi

Bolnisi

Kazreti

Sww: Total share of waste water/risk level

Step 6. After calculation load equivalent, use risk criteria values from Tab. 13 to assess the risk categories for the locations and these risk categories fill into the Tab. 12 and later mark them on the Map 1 by using colours (green "not at risk", yellow "possibly at risk" and red "at risk").

Table 13. Criteria to assess the risk regarding an identified pressure untreated (or partly treated) waste water

Risk Category	Risk Criteria
At Risk	D_{ww}>1,5
Possibly at Risk	1< D_{ww} <1,5
Not at Risk	D_{ww}<1

Total Share Of Waste Water In The River

This indicator describes the total share of waste water that has been discharged to river from its source. It does not specifically show the expected impact on general physico-chemical parameters, but before all it indicates the likelihood of contamination with conservative substances and substances that tend to accumulate in sediment and biota.

Step 7. If not measured calculate the waste water discharges from the Dmanisi, Kazreti and Bolnisi by using following formula:

Qww (m^3/s) = number of inhabitants connected on the sewer (canalisation) (in our case it is 70 %)*0,7* *unit discharge of 120 l/(inhabitant per day)/24/60/60.*

Calculated data fill into the Tab. 12.

Calculate the indicator Total share of waste water in a river by using the following equation:

Sww = ∑Qww/MQr

Description of equation:

- Sww: Total share of waste water in a river at a given cross section along the river (dimensionless)
- Qww: Total of all (current/future) upstream waste water discharges into the river (m^3/s) (use sum of discharged volumes from Tab. 12)
- MQr: Mean annual flow of the river (m^3/s) (use data from Tab. 10)

Insert calculated value of Sww into Tab. 12.

Step 8. Use criteria from Tab. 14 to assess the risk regarding an identified pressure Total share of waste water in the Mashavera River basin and assign risk category (in Tab. 12)

Table 14. Criteria to assess the risk regarding an identified pressure from Total share of waste water

Risk Category	Risk Criteria
At Risk	$S_{ww} > 0,1$
Possibly at Risk	$0,05 < S_{ww} < 0,1$
Not at Risk	$S_{ww} < 0,05$

Pressures from diffuse pollution sources

Agriculture

Lack of data to represent many pressures and impacts of the diffuse source of pollution is an issue in many countries. Therefore, different models are used to evaluate pressures from diffuse agricultural pollution sources and to grade the water bodies into risk categories "Not at risk", "Possibly at risk" and "At risk". In this case, two indicators are proposed for this purpose.

Step 9. Use data from the Tab. 15 on the agricultural land and total area for Dmanisi and Bolnisi Municipalities and calculate indicator for assessment of the pressure from agricultural crop (plant) production by using following formula and insert values into Tab. 16:
Sagri = Aagri/AWB

Description of equation:

- Sagri : Share of agricultural area in a given water body catchment [-]
- AWB: Catchment area of the respective water body [km^2]
- Aagri: Area used for intensive/industrial agriculture in the respective catchment [km^2]. For example, Aagri can cover arable, intensive grassland and also urban area.

Table 15. Total area and agricultural land area in the Mashavera River basin

Municipality	Total area, hectares	Total agricultural land, hectares	% not in use	Reasons for not used agricultural land
Dmanisi			60	High fuel prices and lack of equipment
Bolnisi		17156	60	High fuel prices and lack of equipment

Table 16. Indicators and risk assessment values for diffuse sources of pollution

District	Indicator agricultural crop Sagri	Risk category	Indicator of live stocking Ihus	Risk category
Dmanisi				
Bolnisi				

Step 10. Use calculated values **(Sagri)** from step 9 and compare with criteria in Tab. 17 to assess the risk from plant production and insert risk categories into Tab. 16.

Table 17. Criteria to assess the risk regarding an identified pressure agriculture crop production

Risk Category	Risk Criteria
At Risk	$S_{agri} > 0,4$
Possibly at Risk	$0,2 < S_{agri} < 0,4$
Not at Risk	$S_{agri} < 0,2$

Step 11. Use data from Tab. 18 and 19 to calculate the indicator to assess the pressure from animal live stocking. Indicator calculate by using following formula:
Ihus = Ue/AWB

Description of equation:

- **Ihus:** Indicator for animal livestock [LU/ha]
- **Ue:** Animal livestock unit for grazing livestock and others (e.g. pigs, different poultry species), that is calculated as livestock unit (LU) multiplied by animals number averaged over the whole year for the water body.
- AWB: Catchment area of the respective water body [ha]

*Example: If water body has area **(AWB)** 1000 ha, estimated number of beef cows is 1000, **Ue** is calculated as **LU unit** for cows is 0,75 and multiplied by number of cows. The **Ihus** (indicator of animal live stocking)the ration of Ue and AWB is 0,75..*

Table 18. Livestock number over the regions in the Mashavera River basin

Municipality	No. of Cows	No. of Sheep	No. of Pigs	Total catchment area, hectares
Dmanisi	24000	22000	4000	

Bolnisi	42000	34000	4500	

Table 19. Livestock unit values (source: http://adlib.everysite.co.uk/adlib/defra)

	Cows	Sheep	Pig
LU/ha	0,75	0,08	0,2

Step 12. Use calculated values **(Ihus)** from step 11 and compare with criteria in Tab. 20 to assess the risk from livestock production and insert risk categories into Tab. 16.

Table 20. Criteria to assess the risk regarding an identified pressure animal live stocking

Risk Category	Risk Criteria
At Risk	I_{hus} >1
Possibly at Risk	0,3 < I_{hus} < 1
Not at Risk	0 < I_{hus} < 0,3

FINAL STEP

Summarize the results of risk categories for hydromorphological and pollution sources pressures, use “One Out All Out” principle (the worst case) and mark the final risk category for selected locations in the Mashavera River basin by using three colours (green “Not At Risk”, yellow Possibly At Risk” and red “At risk”) into the Map 1.

ANNEX 2

Instructions for testing the Draft Guidance Document Classification of Ecological Status and Ecological Potential applicable for Georgia

Testing of the Draft GD on Ecological Status and Potential Classification system (ESCS) consists of two stages and several steps that are described below.

Stage 1 Desk work. During this stage data from the national monitoring programme of NEA and EU EPIRB project will be used to estimate the ecological state classes of the selected sampling location in the Mashavera River basin.

Stage 2 Sampling locations in the Mashavera River basin will be visually observed.

Some assumption

- It is assumed that Reference Conditions locations were selected and also reference conditions values were established.
- The ESCS for small size mountainous and middle size mountainous river categories are used to classify the river stretches in the Mashavera River basin.
- Classification scheme for Physico-chemical parameters from the EU EPIRB is used to support biological assessment.
- Hydromorphological Quality Score scheme from the EU EPIRB is used to support biological assessment.

The river size categories are as presented in Table below:

River size category	Channel width	Catchment Area Sizes	Description of River Type
Small	< 10 m	10 km^2 – 100 km^2	Mountain 'gravel' river type
Medium	10 – 30 m	100 km^2 – 1000 km^2	Semi-Mountain 'gravel' river type
Large	> 30 m	> 1000 km^2	Lowland/Plain river type

During the stage 1, these steps will be done during the testing exercise:

Step 1. Use the data from Tab. 1 to calculate Ecological Quality Elements (EQR) for each metrics and Multimetric Index (by averaging of the 4 metrics) in the Tab.1. EQR is calculated as ratio of Observed biological value/Reference biological value, for each sampling location and fill up the Tab. 2

Table 1 Metrics for macroinvertebrates in the Mashavera River basin (spring 2015)

	Metrics				
	Observed biological values				
Sampling location	***BMWP***	***BBI***	***IBE***	***EPT***	***Margalef´s Diversity***
Dmanisi	145	10	10,6	18	4,3
Didi Dmanisi	82	7	7,6	8	3,1
Kazretula (mouth)	12	2	2,3	2	0,4
Kianeti	24	4	5,4	3	1,8
Poladauri	94	9	9,6	13	3,8
Khidiskuri	35	4	6	2	1,8
	Reference condition values				
Middle river	145	10	12	16	4,5
Small river	112	9	10	14	4,1

Table 2 Ecological Quality Ratios for metrics and sampling locations in the Mashavera River basin

	EQR					
Sampling location	***BMWP***	***BBI***	***IBE***	***EPT***	***Margalef´s Diversity***	***MMI***
Dmanisi						
Didi Dmanisi						
Kazretula (mouth)						
Kianeti						
Poladauri (mouth)						

Khidiskuri						

Step 2. Use data on EQR from Tab. 2 for each metrics, MMI and each sampling location and assign for them ecological class by using Ecological State Classification Scheme in Tab. 3 and 4. Fill up these classes to the Tab. 5 by using colours as defined by the EU WFD.

Table 3 Classification scheme for the middle gravel mountainous river type in the Mashavera/Khrami River basin

	Middle gravel mountainous type				
Class	I	II	III	IV	V
EQR	>0,83	>0,6	>0,4	>0,2	≤0,2
BMWP Score	>120	>90	>62	>31	≤31
EQR	>0,9	>0,6	>0,4	>0,2	≤0,2
BBI	>9	>6	>4	>2	≤2
EQR	>0,9	>0,6	>0,4	>0,2	≤0,2
IBE	>10	>6,6	>4,4	>2,2	≤2,2
EQR	>0,88	>0,6	>0,4	>0,2	≤0,2
EPT	>16	>11	>7	>4	≤4
EQR	>0,78	>0,6	>0,4	>0,2	≤0,2
Margalef's Diversity Index	>3,68	>3,06	>2,04	>1,02	≤1,02
Multimetrics Index (MMI) EQR	>0,86	>0,6	>0,4	>0,2	≤0,2

Table 4 Classification scheme for the small gravel mountainous river type in the Khrami River basin

	Small gravel mountainous type				
Class	I	II	III	IV	V
EQR	>0,88	>0,6	>0,4	>0,2	≤0,2
BMWP Score	>108	>74	>49	>25	≤25
EQR	>0,88	>0,6	>0,4	>0,2	≤0,2

BBI	>8	>5,4	>3,6	>1,8	≤1,8
EQR	>0,98	>0,6	>0,4	>0,2	≤0,2
IBE	>8,9	>5,4	>3,6	>1,8	≤1,8
EQR	>0,73	>0,6	>0,4	>0,2	≤0,2
EPT	>11	>9	>6	>3	≤3
EQR	>0,77	>0,6	>0,4	>0,2	≤0,2
Margalef's Diversity Index	>3,3	>2,58	>1,72	>0,86	≤0,86
Multimetrics Index (MMI) EQR	>0,85	>0,6	>0,4	>0,2	≤0,2

Table 5 Classes of the sampling location based on the biological assessment

	Classes					
Sampling location	***BMWP***	***BBI***	***IBE***	***EPT***	***Margalef´s Diversity***	***MMI***
Dmanisi						
Didi Dmanisi						
Kazretula (mouth)						
Kianeti						
Poladauri (mouth)						
Khidiskuri						

Step 5 Use scheme below to support biological assessment with physicochemical and hydromorphological quality elements. For this purpose use data from Tab. 6 and 7. For classification of physico-chemical parameters use scheme presented in Tab. 8 and for hydromorphological quality elements use scheme presenred in Tab. 9.

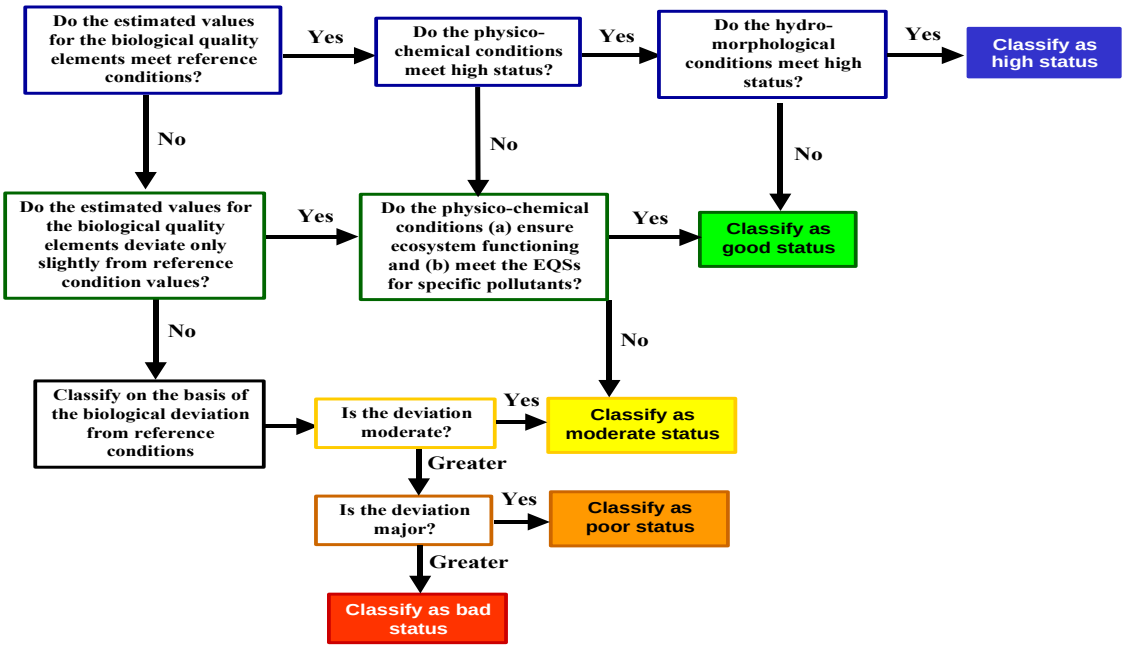


Table 8 Classification scheme for general physico-chemical parameters for Middle mountainous and river types (EU EPIRB project, 2016)

Parameter		unit	I	II	III
Temperature	Mean	°C	<20	<23	≥23
Conductivity		µS/cm			
pH		-	(7,0; 8,5)	(6,0; 7,0> or <8,5; 9)	≤ 6,0 or ≥ 9,0
Dissolved oxygen	Min	mg/l	>7,0	>6,0	≤6,0
BOD_5	Mean	mg/l	<3,0	<5,0	≥5,0
COD-Cr	Mean	mg/l	<7,0	<15,0	≥15,0
$N\text{-}NH_4$	Mean	mg/l	<0,2	<0,5	≥0,5
$N\text{-}NO_3$	Mean	mg/l	<2,0	<3,0	≥3,0
$P\text{-}PO_4$	Mean	mg/l	<0,04	<0,08	≥0,08

Table 9 Preliminary boundaries of the hydromorphological quality classes (SHMI, 2004)

Hydromorphological quality class		HMQ Score values	Colour
1	High	1,0 – 1,7	
2	Good	1,8 – 2,5	
3	Moderate	2,6 – 3,4	
4	Poor	3,5 – 4,2	
5	Bad	4,3 – 5,0	

Step 6. Filled up the Tab. 10 with final Ecological Status classes for the sampling locations by using principle "One Out All Out" (by using colour as defined by the WFD).

Table 10 Final ecological classes for the sampling locations in the Mashavera River basin

	Sampling locations					
	Dmanisi	*Didi Dmanisi*	*Kazretula (mouth)*	*Kianeti*	*Poladauri (mouth)*	*Khidiskuri*
Class						

FINAL STEP

Outline the ecological status into the Map 1 of the Mashavera River basin by using colour as defined by the WFD.

Exercise on Relationship stressors and biological quality elements

Step A. For testing relationship between stressors and macroinvertebrates metrics please used data from Tab. 6 and data on arable land (% of agricultural land) and MD means morphological alterations expressed from 0 (no alterations) to 1 (maximum alterations). In this case use 0,1 for Dmanisi and 0,3 for Bolnisi.

Note: in case of Bolnisi sampling site the area of arable land has to be calculated as sum for both Municipalities (Dmanisi and Bolnisi).

Step B. Calculate the EPT and Margalef´s Diversity Index metrics for macroinvertebrates by using following formulas:

General model: Number of EPT families = 4.91 – 0.52*BOD5 – 0.026*ARABLE + 7.73*MD;

Slovak model: Number of EPT families = 2.67 – 0.22*BOD5 + 0.003*ARABLE + 9.26*MD;

MI=DO*(T+2*DO)*(T+EC+BOD5)

Where:

MI: Margalef´s Diversity Index,

DO: dissolved oxygen (mg/l),

T: water temperature (°C),

EC: Electrical Conductivity of the water (µmS/cm), and

BOD_5: 5 days biological oxygen demand (mg/l).

FINAL STEP

Compare calculated values of metrics with observed data in Tab. 11.

Type of data	General EPT	Slovak EPT	Margalef´s DI
Calculated			
Observed	10	10	3,1

Table 6 Physico-chemical parameters
(annual mean values)

Sampling site	River	Location of sampling site	Temperature, °C	Dissolved oxygen, mg/L	Oxygen saturation, %	pH	Conductivity	Total Suspended solids, mg/L	BOD5, mg/l	COD ($Cr_2O_7^{2-}$), mg O_2/l	Ammonium mg/L	Nitrate, mg/L	Phosphates, mg/L	Cu microg/L	Ni microg/L	Zn, mg/L
1	Mashavera	Kazreti upstream														
2	Mashavera	Bolnisi downstream														
3	Kazretula	Mouth														
4	Poladauri	Mouth														

Table 7 Hydromorphological data for the Mashavera River basin

Sampling site number	River	Location of sampling site	Q (m3/s)	v (m/s)	width (m)	depth (m)	HMQ Score
1	Mashavera	Dmanisi	4,1	1,0	12,0	0,32	**1,05**
2	Mashavera	Didi Dmanisi	6,0	1,15	17,5	0,4	**1,15**

3	Mashavera	0.5 km below Kazreti	5,2	1.09	11	0.38	**1,22**
4	Mashavera	Kianeti	5,2	1.10	12	0.37	**1,22**
5	Mashavera	Khidiskuri	5,4	1,1	21	0,45	**3,65**
6	Poladauri	0,2 km from mouth	0,25	0,7	4,5	0,2	**1,21**

ANNEX III. TRAINING AGENDA, REGISTRATION FORM AND PHOTOS

Training Agenda

Date | Time: 19 September, 2017 | 14:00
Location: Hotel "Holiday Inn"
#1 26 May Square
Tbilisi, Georgia

AGENDA

Develop Water Framework Directive (WFD) Implementation Guidance Documents for Georgia

19 September

Theoretical preparation for field training

14:00 – 15:00	**Theoretical application of the Draft Guidance Document I - Analysis of Pressures and Impacts and Assessment of Risks on the Mashavera River basin (desk work)** Peter Roncak – International Expert Eliso Barnovi – National Expert
15:00- 15:30	**Discussion/Q&A**
15:30-16:00	**Coffee Break**
16:00 – 17:00	**Theoretical application of the Draft Guidance Document II - Classification of Ecological Status and Ecological Potential on the Mashavera River basin (desk work)** Peter Roncak – International Expert Eliso Barnovi – National Expert
17:00-17:30	**Discussion/Q&A**
17:00-17:45	**Closing of the theoretical part of the training workshop**

20 September

PRACTICAL TRAINING (continued)

This activity will contribute to testing and checking the results that were obtained during the theoretical part (the first day) of the training workshop. Field surveys will concentrate on the direct reconnaissance sites and location having pressure on the surface water bodies and visiting monitoring sites used for the ecological status assessment in the first day of the training workshop.

Location of the training course: *Mashavera River basin*

9:30 -10:00	**Meeting of training participants** *(Radisson Blu Iveria Hotel, 1 Rose Revolution Square)*
10:00	**Departure from Tbilisi**
11:40	**Arrival to the field (Mashavera River)**
	Practical assignments:
11:40-12:30	Reconnaissance of the sampling location upstream Dmanisi as candidate on the reference condition location (macroinvertebrates) for ecological status classification. Overall physical habitat and micro habitat conditions will be assessed.
12:30-13:00	Reconnaissance of the sampling location near Didi Dmanisi will be assessed to present the impact from untreated waste water (Dmanisi) and agricultural activities.
13:00-13:30	Reconnaissance of the water abstraction point below Didi Dmanisi to assess the pressure on hydrological regime change.
13:30 -14:30	**Lunch**
14:30-15:30	Reconnaissance of the sampling location Kazreti to assess the impact of mining industry on river Kazretula and also on the Mashavera River after confluence with the Kazretula River.
15:30-16:30	Reconnaissance of the sampling location Khidiskuri due to assessment

pressure from dredging material

16:30-17:00 **Debriefing on the field surveys**

17:00 **Departure from the field**

18:30 **Arrival to Tbilisi**

21 September

Date | Time: 21 September, 2017 | 10:00
Location: Hotel "Holiday Inn"
#1 26 May Square
Tbilisi, Georgia

SUMMARIZATION OF THE FIELD SURVEY RESULTS

The purpose of this part is to discuss and incorporate the findings from field surveys into two Draft Guidance Documents.

10:00 – 10:30 **Welcome coffee**

10:30 – 11:30 **Presentation of findings from the field surveys**

Experts and training participants

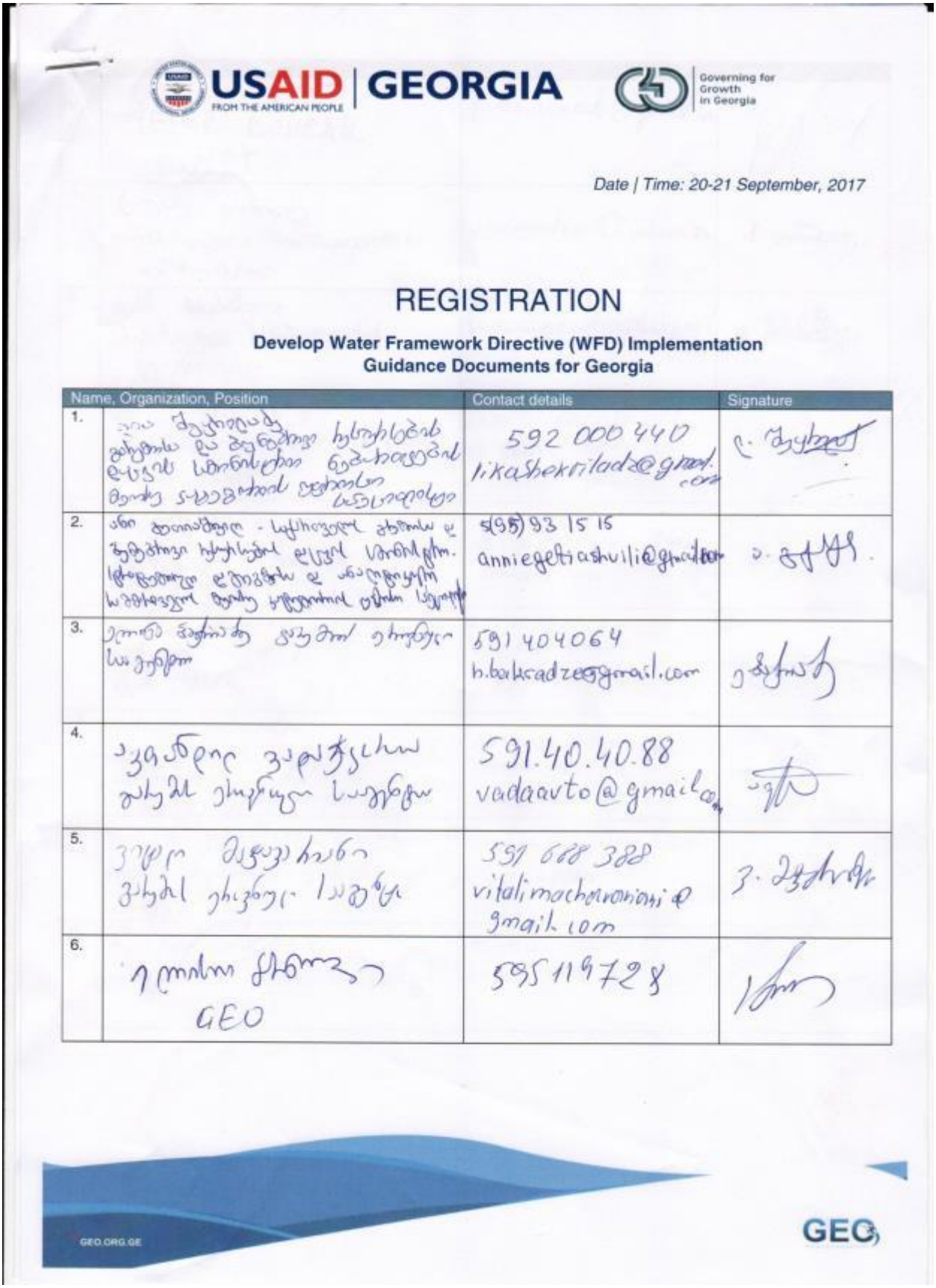
11:30 - 12:30 **Discussion/Q&A**

12:30 – 12:45 **Final remarks**

Closing of the meeting

12:45 – 13:00 **Lunch**

Registration Form



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FROM THE AMERICAN PEOPLE

Governing for Growth in Georgia

Date | Time: 20-21 September, 2017

REGISTRATION

Develop Water Framework Directive (WFD) Implementation Guidance Documents for Georgia

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19.			
20.			

Photos

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